UCRL-20000 NN August 1970



NN AND ND INTERACTIONS (ABOVE 0.5 GeV/c) – A COMPILATION

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N N Kinematics

P _{lab} (MeV/c)	T _{lab} (MeV)	E _{c.m.} (MeV)	P _{c.m.} (MeV/c)	4π X ² (mb)	P _{lab} (MeV/c)	Tlab (MeV)	E _{c.m.} (MeV)	P _{c.m.} (MeV/c)	4π X ² (mb)	Plab (GeV/c)	T _{lab} (GeV)	E _{c.m.} (GeV)	P _{c.m.} (GeV/c)	4π x ² (mb)
0 20	0 0	1877 1877	0 10	48908.14	1380	730	2212	585	14.27	3.0	2.2	2.77	1.02	4.73
40 60	1 2	1877	20 30	12231.20 5439.17	1400 1420	747 764	2219 2226	592 599	13.95 13.65	3.2	2.4	2.83	1.06	4.35
80	3	1878	40	3061.96	1440	780	2233	605	13.36	3.6	2.8	2.96	1.14	3.75
100	5	1879	50 50	1961.64 1363.94	1460	797 814	2240	612 618	13.08	3.8	3.0	3.02	1.18	3.50
140	10	1882	70	1003.54	1500	831	2254	624	12.54	4.2	3.4	3.14	1.26	3.10
160	14	1883	80 90	769.62	1520	848 865	2261	631 637	12.29	4.4	3.6	3.19	1.29	2.93
200	21	1887	99	494.52	1560	882	2275	643	11.82	4.8	4.0	3.31	1.36	2.64
220	25	1889	109	409.63 345.07	1580	899 917	2282	650 656	11.59	5.0	4.1	3.36	1.40	2.51
260	35	1894	129	294.82	1620	934	2296	662	11.16	5.4	4.5	3.47	1.46	2.29
280	41 47	1897	138 148	254.94 222.76	1640	951 969	2304	668 674	10.96	5.6	4.7	3.52	1.49	2.20
320	53	1903	158	196.43	1680	986	2318	680	10.57	6.0	5.1	3.63	1.55	2.03
340	60 67	1906	157	174.60	1700	1003	2325	686	10.39	6.2	5.3	3.68	1.58	1.95
380	74	1913	136	140.81	1740	1039	2339	698	10.04	6.6	5.7	3.78	1.64	1.82
400	82 90	1917	196	127.58	1760	1056	2346	704	9.87	6.8	5.9	3.83	1.67	1.76
440	9.8	1925	214	106.32	1800	1092	2360	716	9.55	7.2	6.3	3.92	1.72	1.65
460	107	1929	224	97.70	1820	1109	2367	721	9.40	7.4	6.5	3.97	1.75	1.60
500	125	1938	242	83.45	1860	1145	2381	733	9.10	7.8	6.9	4.06	1.80	1.51
520 540	134	1943	251	77.52	1880	1163	2388	739 744	8.96	8.0	7.1	4.11	1.83	1.46
560	154	1952	259	67.51	1920	1199	2402	750	8.70	8.4	7.5	4.20	1.88	1.39
580	165	1957	278	63.25	1940	1217	2409	756	8.57	8.6	7.7	4.24	1.90	1.35
620	186	1967	296	55.94	1980	1253	2423	767	8.32	9.0	8.1	4.33	1.95	1.29
640	197	1973	304	52.78	2000	1271	2430	772	8.20	9.2	8.3	4.37	1.97	1.25
680	221	1984	322	47.27	2040	1307	2444	783	7.97	9.6	8.7	4.41	2.02	1.20
700	232	1989	330	44.86	2060	1325	2451	789	7.87	9.8	8.9	4.50	2.04	1.17
740	257	2001	347	40.61	2100	1362	2465	799	7.65	10.0	9.6	4.64	2.12	1.09
760	269	2007	355	38.72	2120	1380	2472	805	7.55	11.0	10.1	4.74	2.18	1.03
800	295	2019	372	35.37	2160	1417	2486	815	7.36	12.0	11.1	4.93	2.28	.94
820	308	2025	380	33.86	2180	1435	2493	821	7.26	12.5	11.6	5.03	2.33	.90
860	335	2037	396	31.16	2220	1472	2507	831	7.08	13.5	12.6	5.21	2.43	.83
880	348	2043	404	29.95	2240	1490	2514	836	6.99	14.0	13.1	5.30	2.48	.80
920	376	2056	420	27.74	2280	1527	2527	846	6.83	14.5	14.1	5.47	2.57	.74
940	390	2062	428	26.74	2300	1546	2534	852	6.74	16.0	15.1	5.64	2.66	.69
980	418	2075	443	24.91	2340	1583	2548	862	6.59	18.0	17.1	5.97	2.83	.61
1000	433	2082	451	24.07	2360	1601	2555	867	6.51	19.0	18.1	6.12	2.91	.58
1040	462	2095	466	22.54	2400	1639	2568	877	6.36	22.0	21.1	6.56	3.14	.49
1060	477	2102	473	21.84	2420	1657	2575	882	6.29	24.0	23.1	6.84	3.29	-45
1100	508	2115	488	20.54	2460	1695	2589	892	6.15	28.0	27.1	7.37	3.56	.38
1120	523	2122	495	19.94	2480	1713	2595	897	6.08	30.0	29.1	7.62	3.69	.36
1160	554	2135	510	18.83	2520	1751	2609	906	5.95	34.0	33.1	8.10	3.94	.32
1180	569 585	2142	517	18.31	2540	1769	2616	911	5.89	36.0	35.1	8.33	4.06	.30
1220	601	2156	531	17.35	2580	1807	2629	921	5.77	40.0	39.1	8.77	4.28	.28
1240	617	2163	538 545	16.90 16.48	2600	1826	2636	926	5.71	42.0	41.1	8.98	4.39	.25
1280	649	2177	552	16.07	2640	1864	2649	935	5.59	44.0	45.1	9.39	4.60	.23
1300	665 681	2184	559 565	15.68	2660	1882	2656	940	5.54	48.0	47.1	9.58	4.70	- 22
1340	698	2198	572	14.94	2700	1920	2669	949	5.43	55.0	54.1	10.25	5.04	.19
1360	714	2205	579	14.60	2720	1939	2676	954 958	5.38	60.0	59.1	10.69	5.26	.18
					2760	1977	2689	963	5.27	70.0	69.1	11.12	5.69	.15
					2780	1996	2696	040	5.22					

PREFACE TO THE SERIES

This is the third in a <u>new series</u> of reports produced by the Particle Data Group. In this series we will collect and display total and differential cross sections, polarizations, mass spectra, and other similar data. Each report will cover one input channel. This one is NN (the first one was on K^+N^+ and the second on YN^{\S}). In the next few months we hope to bring out π^+N and $\overline{N}N$. Following later will be π^-N , K^-N , etc. All reports will be complete from January 1968, and will also contain selected results before that date. The reports will be updated periodically, as necessary.

At present there are many physicists in the Particle Data Group who are working on one or more phases of these reports. They are:

- I. <u>System Development (LRL)</u> Art Rosenfeld
 - LeRoy Price Odette Benary Naomi Schmidt[†]
- II. Encoding and Verifying Data, Editing Reports, Fitting Data (LRL) Odette Benary
 - LeRoy Price

III. <u>Reading and Evaluating Articles, and</u> <u>Analyzing Compiled Data in:</u>

- $\underline{K^{T}N}$ Interactions
 - Odette Benary (LRL)

Roger Bland (Ecole Polytechnique)

- LeRoy Price (LRL)
- Naomi Schmidt (Brandeis)
- *Charles Wohl (Oxford)
- Victor Henri (CERN)
- K N Interactions below 2.0 GeV/c
 - *Claude Bricman (CERN)
- K N Interactions above 2.0 GeV/c

J. Badier (Ecole Polytechnique) *Enzo Flaminio (BNL)

- G. Kayas (Ecole Polytechnique)
- Brian Musgrave (ANL)

Fred Winkelmann (SLAC) James Wolfson (M. I. T.) π N Interactions *Alan Thorndike (BNL) Frank Turkot (BNL) YN and NN Interactions Gideon Alexander (Tel-Aviv) *Odette Benary (LRL) **NN** Interactions Pierre Bastien (Univ. of Wash.) *Tom Ferbel (Rochester) David Miller (M. I. T.) Paul Slattery (Rochester) Yoshio Sumi (Osaka) Toshihiro Yoshida (Kyoto) If you have any suggestions for improving these reports, please let us know. Our address is: Particle Data Center Lawrence Radiation Laboratory Berkeley, California 94720 (415) 843-2740, Ext. 6301; nights, weekends, and holidays call 642-0466

*Henry Lubatti (Univ. of Wash.)

*'' Chairman. ''

[†]Now at Brandeis Univ., Waltham, Massachusetts.

 $\pi^{\dagger}N$ Interactions

[‡]Particle Data Group (L. R. Price, N. Barash-Schmidt, O. Benary, R. W. Bland, A. H. Rosenfeld, C. G. Wohl), "A Compilation of K⁺N Reactions," UCRL-20000 K⁺N (Sept. 1969). The supply of this first report has now been exhausted. [§]Particle Data Group (O. Benary, N. Barash-Schmidt, L. R. Price, A. H. Rosenfeld, and G. Alexander, "A Compilation of YN Reactions," UCRJ.-20000 YN (Jan, 1970). These are available from LRL-Berkeley and CERN.

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pp →	total	26 - 29 (11)				
• •	elastic	26 - 29 (11)	30 -55 (11)	56 -57 (13)	58 -70 (14)
	ΝΝπ	72 -73 (15)				
	ΝΝππ	80 - 81 (15)				
	ΝΝπππ	82(15)				
	dπ ⁺	74 -75 (15)	76 -79 (15)			
	dp ⁺	83(19)	110(19)			
	NΔ	84 - 85 (16)	86 -90 (16)			
	NN*	92 -93,	94 -97,			
		98 - 99 (17)	100-101(17)			
	$\Delta\Delta$	106-107(18)			~	
	N [*] Δ	106-107(18)				
	$N\pi\Delta$	104-105(18)				
	pp(ω, η, ρ)	108-109(19)				
	additional					
	nonstrange					
	reactions	83(15)				
	strange-particle	2				
	production	112-122(19)				
	n-prongs	122(19)				
nn →	total	125(19)				
	elastic	126(19)				
np, pi	n + total	128-130(20)				
• •	elastic (includin	g	132-142, (20)	142/24	444 4524243	454 457/241
	charge exchan	ge) ¹³¹⁽²⁰⁾	144-145 (20)	143(21)	146-153(21)	154-157(21)
	inelastic	158(20)				
NN(I:	=0)-> total	160-161(22)				
pd, n	d→total	164-165(22)				
•	elastic	168(22)	166-169(22)			

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	2.	Fits Ir D	s to nteg: niffe:	the I rated renti	Data <u>C</u> r al C	oss ; ross	Sect 3 Se	ion ctic	s.	•	. •	•	•	•	•	•	•	•	•	•	•	•	•	•	÷	22
:		F	F F orw	op El op Ine ard	asti elas np [°] J	c . tic . Elasi	• • • • • • tic.		• • •	•	•		.• •	•	•	•	•	•	•	• •	•	•	• •	•	42 91	,103 ,102 140
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NN AND ND INTERACTIONS (ABOVE 0.5 GeV/c)-A COMPILATION

Particle Data Group

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and

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ABSTRACT – We compile 165 papers reporting pp, np, nn, pd, and nd interactions from 0.5 to 70 GeV/c. We display cross sections, angular distributions, and polarizations as well as our fits to some of the data. Included are indices to the papers, as well as a complete listing of the selected data. The cutoff date for this report was 1 July 1970.

^{*}The Berkeley Particle Data Group is jointly supported by the U.S. Atomic Energy Commission, the National Science Foundation, and the office of Standard Reference Data of the National Bureau of Standards.

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Section I.

GENERAL PROCEDURES

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Introduction

It has been known for some time that a comprehensive, evaluated compilation of experimental high energy physics results is essential. In the past there have been numerous collections of data, generally covering rather narrow fields. But because they were not computerized, the authors became "exhausted" on the first edition, and updated versions were never published.

Encouraged by the success of the Particle Data Group's computerized "Particle Properties Tables," * we have started also to compile cross-sectional data. Our system is completely computer based, so that we will be able to answer specific user requests, in addition to periodically publishing the collected data.

During the last three years, we have had two full-time physicists here at LRL developing and coding the system programs.

During the last year we have been feeding data into the system—and this report on NN is our third result. (We consider these first few reports to be more or less "debug" versions—we are still trying to figure out the best ways to organize the reports and present the data.)

We plan to continue our program development and would appreciate any comments you may have on the way the data are displayed, the types of data collected, etc. In the next few months we hope to go to a form of photocomposition. This means essentially that we will have an unlimited character set and can print Greek letters instead of having to spell them out, for example.

Scope of the Compilation

1. We will collect all experimental high energy physics results that can be represented by simple tables or graphs, i.e., σ , $d\sigma/d\omega$, polarizations, angular distributions, density matrices, etc.

We leave it to Data Summary Type Libraries to store Dalitz plots or other ≥ 2 -dimensional displays (although the presence of such data is indicated in our KEY WORDS). In any case our printed compilations should serve as a necessary "table of contents" to a DST library.

2. The data come primarily from published journals, e.g., Physical Review, Physical Review Letters, Nuclear Physics, Physics Letters, Nuovo Cimento, etc.

We do <u>also compile</u> unpublished theses and conference reports—if the reports give enough information to permit a valid evaluation of the experiment and analysis.

We do <u>not record</u> data that appear in abstract form only, nor do we generally accept preprints unless the article has already been accepted for publication.

3. The compilation is to be <u>complete</u> from January 1968. Before that time we will enter data that are particularly important. But the bulk of the pre-1968 papers will not be put into our system.

4. To reduce the number of errors to the very minimum, all punched information is checked by the physicist who read the article and by another physicist as well.

Data Handling

In order to make this compilation as accurate and complete as possible, many physicists are involved. These physicists fall into two general categories:

a) Those who read and evaluate the data. These physicists (referred to as "readers") are generally experimentalists chosen for their "expertise" in a particular field. In

^{*}Particle Data Group, Rev. Mod. Phys. <u>42</u>, 87 (1970).

general they are not from LRL. They are organized into small groups, each group being responsible for a different input channel.

b) Those physicsts who encode the data, run the programs, write system programs, etc. These are all at LRL.

The list below indicates the most important steps that every article must go through in order to have its information entered onto the DATA TAPE (the magnetic tape that contains all of our data). This list is summarized in the "Flow Diagram" in Fig. A.

a) The "reader" (physicist) finds a relevant article, reads it, marks it, fills out a form, and mails a copy of the article plus the form to us.

b) Our secretary assigns it a number and it is logged in.

c) The LRL physicist responsible for this initial state quickly scans it, writes out the standard KEY WORDS, etc., to help in the next step.

d) Our secretary transcribes bibliographic information, putting abstract, citations, comments, beam information, and KEY WORDS, onto coding sheets.

e) The LRL physicist transcribes the data that the reader has selected onto coding sheets (this is much more laborious than you might suspect).

f) Key-punch operators punch the data.

g) The LRL physicist puts the cards for a particular article into the correct order.

h) Cards are put onto the DATA TAPE with the DATAPE program.

i) If any cards are out of order, essential information missing, etc., the article is rejected by DATAPE. The physicist repairs the deck, and it is again put through DATAPE.

j) The output DATA TAPE is read by the SKELM program, which makes a listing of all the data stored for each article. k) The SKELM is looked over by the LRL physicist for obvious errors.

 SKELM output is mailed to the original physicist "reader," who checks all entries carefully and returns SKELM plus corrections (if any) to us.

m) If any errors are found, stepse) through 1) are repeated as many times as necessary.

n) When the reader has no more corrections or changes to make, the LRL physicist gives the article its final verification (i. e., he rechecks all data with the original article). The name of this physicist is put on the tape, and the article is then ready to be used by any one of a number of programs.

Steps b) through n) take, on the average, about 1-3/4 hours per article (1-1/4) hour physicist + 1/2 hour secretary).

Even after being verified, an article can have its contents slightly increased, e.g., if renormalized data are added. In this case only steps e) through k) are repeated.

Again, all the above is just to get the data onto the DATA TAPE. When preparing a report such as this, many additional tasks are involved. A few typical ones are:

a) Collecting all the data on a particular set of reactions—plotting them, looking at systematic errors, removing obviously bad data from the graphs (but loaving it in the tables).

b) Ironing out normalization differences between experiments.

c) Worrying about the various ways in which different authors make resonance cuts and subtractions.

d) Deciding what types of curves (if any) should be fit to certain classes of data.



Fig. A.

XBL 701-132

Collaboration with Other Groups Some physicists in Europe have formed a group called HERA (High Energy Reactions Analysis)^{*} to also compile cross-section data. We are trying to keep in close contact with one another in order to minimize duplication of effort both in programming and data collection. Their first reports[†] were published last year and more reports are expected soon. *See B. Sadoulet, "An Example of an Organization of Compilation of Data, " Preprint CERN/D. Ph. II/PHYSICS 68-21. [†]G. Giacomelli, P. Pini, and S. Stagni, "A Compilation of Pion-Nucleon Scattering Data, " CERN-HERA 69-1 (1960). B. Sadoulet, "Data Compilation of Antiproton-Proton Reactions into Antihyperon-Hyperon," CERN-HERA 69-2 (1969). We also cooperate with HERA on report distribution: LRL prints and distributes both HERA and our reports for the Western Hemisphere and Japan, and CERN does the same for the rest of the world.

We originally planned to collaborate closely with John Hornbostel of BNL. He had been compiling cross-section information for a number of years and was going to bring out a series of reports covering the data appearing before January 1968. Sadly, however, he died early last year, with the project incompleted. We wish to thank BNL for sending all of his files to us. We also thank the Michigan Cross Section Group for sending us all of their files. Their report is referred to in the next section under Williams et al.

Other Cross-Section Compilations

We present below (in chronological order) all of the previous large cross-section compilations that we know of. In addition to just listing data, some of them have nice reviews, perform various fits to the data, etc.

• V. S. Barashenkov and V. M. Maltsev, Cross Sections for <u>Elementary Particle In-</u> teractions, Fortsch. Physik <u>9</u>, 549 (1961).

• V. S. Barashenkov and J. Patera, Cross Sections for <u>Antinucleon Production</u>, Fortsch. Physik <u>11</u>, 469 (1963).

• V. S. Barashenkov and J. Patera, <u>Strange Particle Production</u>, Fortsch. Physik 11, 479 (1963).

• M. N. Focacci and G. Giacomelli, <u>Pion-</u> Proton Elastic Scattering, CERN 66-18 (1966)

• J. T. Beale, S. D. Ecklund, and R. L. Walker, <u>Pion Photoproduction</u> Data Below 1.5 GeV, CALT-68-108 (1966).

• H. Yukawa, ed., Experimental Data on <u>Hadron Interactions</u> in GeV Region, Supplement of the Progress of Theoretical Physics (Kyoto), Extra Number (1967).

• P. K. Williams, D. M. Levine, J. A. Koschik, References and Some <u>Two-Body</u> Data for High Energy Reactions, University of Michigan, 1967 (unpublished).

• G. Alexander, O. Benary, and U. Maor, Data Compilation of <u>Proton-Proton Interactions</u> Between 1 and 32 GeV/c, Nucl. Phys. <u>B5</u>, 1 (1968).

• G. Alexander, O. Benary, and U. Maor, Data Compilation of Baryon-Baryon Interactions. (II) <u>Proton-Neutron</u> Collisions Between 1 and 27 GeV/c, Nucl. Phys. <u>B7</u>, 281 (1968).

• G. Alexander, O. Benary, U. Karshon, and U. Maor, Data Compilation of Baryon-Baryon Interactions. (III) Hyperon-Proton Collisions, Nucl. Phys. <u>B10</u>, 554 (1969).

• B. Sadoulet, Data Compilation of <u>Anti-</u> proton-Proton Reactions into Antihyperon-Hyperon, CERN-HERA 69-2 (1969).

• G. Giacomelli, P. Pini, and S. Stagni, A Compilation of <u>Pion-Nucleon Scattering</u> Data, CERN-HERA 69-1 (1969).

Particle Data Group (L. R. Price, N. Barash-Schmidt, O. Benary, R. W. Bland,
A. H. Rosenfeld, C. G. Wohl), A Compilation of <u>K⁺N Reactions</u>, UCRL-20000 K⁺N (1969).

Particle Data Group (D. J. Herndon, A. Barbaro-Galtieri, A. Η. Rosenfeld), <u>«N</u>
Partial Wave Amplitudes; A Compilation,
UCRL-20030 πN(1970).

Particle Data Group (O. Benary, N.
Barash-Schmidt, L. R. Price, A. H. Rosenfeld,
G. Alexander), A Compilation of <u>YN Reactions</u>,
UCRL-20 000 YN (1970).

Acknowledgments

We thank Prof. Arthur Rosenfeld for his constant interest, support, and advice. We are also grateful for his many suggestions on ways to significantly improve these reports We also wish to thank Dr. Naomi Barash-Schmidt for her significant contributions to our system development. We also thank Arlene Wells for her general help in handling the data and Marjorie Hutchinson for her assistance with some of the programming.

Section II.

NN AND ND INTERACTIONS (ABOVE 0.5 GeV/c)

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Scope of This Compilation

This compilation of NN interactions covers the range of beam momenta from 0.5 to 70 GeV/c. We do not include any cosmic ray data or data obtained from emulsions.

Our lower limit of 0.5 GeV/c was selected to coincide approximately with the uppermost energy at which reliable NN phase shift analyses have been performed. Data below 0.5 GeV/c will be the topic of a later report. For already available information on this lowenergy range see:

1) V. S. Barashenkov and V. M. Maltsev, Cross Sections for Elementary Particle Interactions, Fortschr. Physik 9, 549 (1961);

2) M. H. McGregor, R. A. Arndt, and R. M. Wright, (p, p) and (n, p) Data Listing $0 \rightarrow 750 \text{ MeV/c}$, UCRL-50426 (1968).

For continuity we have in a few places presented data below our cutoff of 0.5 GeV/c; in these cases we have taken the data from the compilation of Barashenkov and Maltsev (above).

In this report we have included all articles reporting NN data in our energy range published since 1 January 1968. In addition we have included many important works before that date. In particular we have included most of the papers used in two earlier compilations on high-energy NN interactions. ^{*} Our final cutoff date for inclusion in this report is 15 June 1970.

pp Interactions

It is not surprising that most of the data on NN interactions above 0.5 GeV/c are on the pp interaction. Not only is it easier to form well-defined proton beams than neutron beams, but one can also use a pure hydrogen target thus eliminating the subtractions and corrections which must be applied in order to extract neutron data when using proton beams on complex targets. Also, the art of building highenergy proton beams is much older and more highly developed than it is for neutron beams. Total pp Cross Section

Although there is a huge dip in the $\sigma^{T}(pp)$ below 2 GeV/c (in the vicinity of the 1π and 2π thresholds), above 2 GeV/c there is no appreciable structure (see Figs. 1a, b, c). For most purposes this cross section can be considered to be a constant 40 mb from 5 GeV/c up to the highest momentum yet reported (30 GeV/c). Elastic pp Cross Section[†]

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From Fig. 1 we see that below about 1 GeV/c, $\sigma^{el}(pp)$ is equal to $\sigma^{T}(pp)$. Above 2 GeV/c there is no appreciable structure in σ^{el} . From 7 to 30 GeV/c, $\sigma^{el}/\sigma^{T} \approx 1/4$. Elastic pp Angular Distributions

In contrast to many other elastic processes (e.g., $\pi^{\pm}N$ scattering), there are no known resonances in the pp system. Thus the angular distributions for pp elastic scattering are somewhat simpler than those of the other processes.

Empirically, however, the pp angular distributions do divide into two regions:

1) The forward region (where the shape is expressible as a diffraction peak), and

2) The large-angle region (i. e., outside the diffraction-peak region).

Let us first consider the forward region where the cross section decreases approximately exponentially in t . As the energy increases this region extends out to higher t values. Around $P_{beam} = 1 \text{ GeV/c}$, the diffraction

^{*}G. Alexander, O. Benary, and U. Maor, Data Compilation of Proton-Proton Interactions Between 1 and 32 GeV/c, Nucl. Phys. <u>B5</u>, 1 (1968); G. Alexander, O. Benary, and U. Maor, Data Compilation of Baryon-Baryon Interactions. II Proton-Neutron Collisions Between 1 and 27 GeV/c. Nucl. Phys. <u>B7</u>, 281 (1968).

[†]For a good discussion of NN elastic scattering see: Yoshio Sumi and Toshihiro Yoshida, Suppl. Prog. Teor. Phys. (Kyoto) Extra Number, p. 53 (1967). This is a special edition devoted entirely to "Experimental Data on Hadron Interactions in GeV Region."

region extends out to about $|t| = 0.5 (\text{GeV/c})^2$ (i. e., to $\theta_{\text{c.m.}} = 90 \text{ deg}$). At the highest energies it extends out to $|t| \approx 1 (\text{GeV/c})^2$ (e. g., $\theta_{\text{c.m.}} = 17 \text{ deg at 26 GeV/c}$). In Fig. 2 we display the log of $d\sigma/dt$ vs. |t|. In this figure we have also plotted out best fits (solid lines) to the data of the formula

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$$\frac{\mathrm{d}\sigma}{\mathrm{d}t} = \frac{\mathrm{d}\sigma}{\mathrm{d}t}\Big|_{t=0} \mathrm{e}^{\mathrm{b}t},$$

using only data in the interval $0.03 \le |t| \le 0.3$ (GeV/c². This interval was arbitrarily selected to be a compromise that would permit us to use the <u>same</u> interval to fit <u>all</u> of the data. A word of caution: the results of fits of this nature are extremely cutoff dependent. We have plotted our best-fit parameters in Figs.

3a and 3b. In Table I we give the values of the parameters reported by the experimenters to their own data. Figure 3 is the same as 3b except that we have added the slope fits done by the Serpukov group. The vertical discontinunity between these fits and ours is not meaningful since they use a different fitting interval, etc.

It is easy to see from Fig. 3b that the diffraction peak for pp elastic scattering shrinks rapidly—particularly up to a P-beam of about 6 GeV/c. * From 6 to 22 GeV/c the slope appears to be roughly constant at about 9 $(GeV/c)^{-2}$. The Serpukov data perhaps show a slow additional shrinkage from 30 to 70 GeV/c.

In Fig. 3a we see that our fitted values of the intercept $d\sigma/dt_{t=0}$ are generally larger than the optical lower limit (represented by the smooth curve in Fig. 3a), showing that the forward elastic amplitude is not purely imaginary.

We now turn to the "large angles" region, [†] i. e., the region outside of the diffraction peak and extending up to $\theta_{c.m.} = 90 \text{ deg}$ (there is always a symmetry about 90 deg for identical particles in the initial or final state). Here we find the two general features (Figs. 2, 4, and 5):

1) At fixed P_{beam} , $d\sigma/dt$ varies in general rather slowly with t (in the large angle region), and

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2) At fixed t, $d\sigma/dt$ decreases very rapidly with increasing P_{beam}. The larger the value of t, the faster the fall-off.

In 1964 Orear[‡] fitted these features [of the Cornell-BNL wide angle data of Cocconi et al. Phys. Rev. <u>138</u>, B165 (1965)] with the simple formula

$$S\left(\frac{d\sigma}{d\omega}\right)_{c.m.} = Ae^{-\frac{P_{\perp}}{b}}$$

where S is the c.m. energy squared, P_{\perp} is the transverse momentum, and b is a "universal" constant.

However, as higher-energy data became available, it became clear that the value of b was in fact energy dependent. In addition various "breaks" and "wiggles" began to be discovered. In 1967 Krisch^{**} proposed an empirical formula that has had outstanding qualitative success. In Fig. 6 we reproduce one of Krisch's plots. It is easy to see that his formula of the type



where β is the c.m. velocity of the proton,

^{*} Carrigan has recently proposed that there is a "break" in the diffraction peak at $|t| = 0.15 (GeV/c)^2$ at energies around 20 GeV/c. See R. A. Carrigan, Jr., Phys. Rev. Letters 24, 168 (1969) for his full discussion.

[†]See Charles B. Chiu, Rev. Mod. Phys. <u>41</u>, 640 (1969) for an excellent discussion of large-angle scattering including various models.

[‡]J. Orear, Phys. Letters <u>13</u>, 190 (1964).

^{**} For the exact form of his formula and details of the fitting, the reader is referred to A. D. Krisch, Phys. Rev. Letters <u>19</u>, 1149 (1967).

does an admirable job of fitting the data over 12 orders of magnitude (both small angles and large angles).

Neither the significance of the dependence upon the variable $\beta^2 P_{\perp}^2$ nor the reason for the breaks in the curve in Fig. 6 is yet clear. It has been suggested that the breaks might be associated with the openings of various inelastic processes.

Although Krisch's fit explains the general features of the elastic pp data, there is some "fine structure" that it does not explain. This oscillatory structure is nicely displayed in Fig. 7 [taken from J. V. Allaby et al., in Proceedings of Topical Conference on High Energy Collisions of Hadrons (CERN, Geneva, 1968), p. 580]. Allaby et al. point out that: "Such an oscillation is reminiscent of similar phenomena seen in πp , Kp and $\overline{p}p$ scattering. A simple-minded interpretation of such behaviour is in terms of diffraction scattering. There, as well as here, the first diffraction minimum reveals itself when the cross section has fallen below a level of about $10^{-28} \text{cm}^2/(\text{GeV})^2$. Equating the dips of the oscillation to the zeros of the first order Bessel function, $J_{1}(R \sqrt{t})$ results in an obsorbing disc radius of R = 0.6 f, an anomalously small value. In any case, it seems premature to conlude that large angle protonproton scattering is dynamically nothing else than the tail of diffraction scattering."

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There are two experiments (Diddens et al., Ref. 53, and Cocconi et al., Ref. 161) that report results on pp elastic angular distributions at <u>fixed angle</u> rather than <u>fixed energy</u>. We have not reproduced their data in this section, but it is tabulated in Sec. III of this report.

Re/Im Ratio of the Forward pp Elastic Amplitude

The real part of the forward elastic amplitude is of great interest. Its magnitude can be estimated by extrapolating $d\sigma^{el}/dt$ to

t = 0 and then using the optical theorem to evaluate the imaginary part from the total cross section. *

If one looks at $d\sigma/dt$ at extremely forward angles {in the Coulomb interference region [e.g., $|t| < 0.01 (GeV/c)^2$]} one can presumable measure not only the magnitude but also the sign of the real part. As a matter of fact, this is exactly what is generally done (see, e.g., Fig. 8).

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In reality, of course the determination of $\operatorname{Re}(f)/\operatorname{Im}(f)$ at zero degrees is considerably more complicated than suggested by the above simple prescription. For instance, $\operatorname{Re}(f)$ means only the total <u>nuclear</u> contribution; i. e., the Coulomb scattering contributions must be removed. This subtraction is somewhat model dependent.

In addition, if all of the forward amplitude cannot be explained by the imaginary spinindependent part, the discrepancy can be due to either:

1) A real part of the forward spin-<u>indepen-</u> dent amplitude, and/or

2) The existence of a spin-<u>dependent</u> part of the forward amplitude.

The separation of these effects is not easy, and it seems probable that other data, in addition to precise $d\sigma/dt$'s, are going to have to be employed to finally resolve the ambiguities.

In reporting their results, authors usually give the <u>ratio</u> of the Real part to the Imaginary part of the spin-independent forward amplitude (defined as α_{pp}). In Fig. 9 we have plotted most of the measurements of α_{pp} done recently (i. e., since 1964). The agreement above 2 GeV/c with the curve calculated from forward dispersion relations by

^{*}See the discussion by H. A. Bethe, Ann. Phys. (N. Y.) $\underline{3}$, 190 (1958).

Söding^{**} is quite striking. However, below 2 GeV/c they appear to disagree completely. It is interesting to note that 2 GeV/c is also the place where the total cross section levels off and begins to assume a relatively constant value. A possible connection between these two effects is speculated upon by Bellettini et al.[†]

Actually, Söding's calculation is based upon the assumption that the spin-dependent part of the forward amplitude is zero (i.e., $\beta_{pp} = 0$). As Fig. 9 shows, the experimental points do agree with the calculation at high energies, suggesting that β_{pp} is indeed consistent with 0.

However, below ~2 GeV/c the experimental values for $\alpha_{\rm pp}$ are much smaller than the calculated ones, suggesting that $\beta_{\rm pp}$ might become important at low energies. This is confirmed by the values of $\beta_{\rm pp}$ reported by Dutton et al. (Refs. 51 and 52).

Plab	Ppp	
1.29	0.75 ± 0.27	
1.54	0.50 ± 0.10	two separate
1.54	0.25 ± 0.36	experiments
1.69	0.50 ± 0.13	

Thus it seems that the spin-dependent part of the elastic scattering amplitude decreases with increasing momentum. Polarization in Elastic pp Scattering

Good polarization measurements on pp elastic scattering are vital to the pp phase shift analyses. In Fig. 10 we plot the polarizations at various momenta. The distributions are presented for $0 \le \cos \theta_{c.m.} \le 1$ because the symmetry of the identical protons requires that the distributions be <u>antisymmetric</u> about

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 $\cos \theta_{\rm c.m.} = 0.$

In Fig. 11 we have plotted [after Grannis **11** et al., Phys. Rev. <u>148</u>, 1297 (1966)] the maximum polarization vs. beam momentum. It is easy to see that there is a maximum at about 1.4 GeV/c.

Elastic pp Partial-Wave Analyses

A partial-wave analysis is the most complete description we have of an elementary particle reaction. All possible information is contained in it. However, such analyses are in practice feasible only for the low-energy regions where only a few partial waves need be considered, and only a very few inclastic channels are open. MacGregor et al. have managed to extend the pp elastic partial-wave analysis up to 1.4 GeV/c. ^{*} However, they point out that above 1 GeV/c these analyses are really only qualitative so far.

As a matter of fact, it is because the low-energy data is well described by partialwave analyses and the high-energy (about ~ 1 GeV/c) data are not, that we decided to bring out our NN compilation in two parts: this first section covering 0.5 GeV/c and above, and a second section (some time in the future) below 0.5 GeV/c.

Although we are going to leave all the partial-wave results for our later report, in. this section we would just like to indicate the general "state-ot-the-art."

In March 1967 the University of Florida hosted the International Conference on the Nucleon-Nucleon Interaction. A rather complete report of this conference is the subject of the special issue of the July 1967 <u>Reviews of</u> <u>Modern Physics</u>. In their introductory paper to this issue Green, MacGregor, and Wilson make the following comments: "Our knowledge of the N-N interaction around 1960 might be

^{*}P. Söding, Real Part of the Proton-Proton and Proton-Antiproton Forward Scattering Amplitude at High Energies, Phys. Letters 8, 285 (64).

Bellettini et al., Phys. Letters $\underline{14}$, 164 (1965).

^{*}MacGregor et al., Determination of the Nucleon-Nucleon Scattering Matrix. VIII. (p,p) Analysis from 350 to 750 MeV, Phys. Rev. 169, 1149 (1968).

summarized by the succinct statement of Professor M. L. Goldberger: ' There are few problems in modern theoretical physics which have attracted more attention than that of trying to determine the fundamental interaction between two nucleons. It is also true that scarcely ever has the world of physics owed so little to so many. In general, in surveying the field, one is oppressed by the unbelievable confusion and conflict that exists. It is hard to believe that many of the authors are talking about the same problem or, in fact, that they know what the problem is. ' After three days of presentations and discussions at the 1967 N-N Interaction Conference at the University of Florida in Gainesville, it would appear that our view has improved considerably from the bleak picture of 1960. Indeed several relatively simple and accurate descriptions of the nucleon-nucleon interaction based upon meson field theory have emerged. While the formalisms used differ greatly, it appears now that these theories have about the same physical substance and that the various authors are not only talking about the same problem but that correspondences between the various languages are being established. " Inelastic pp Reactions*

The total pp inelastic cross section can be easily estimated by eye from Fig. 1b or 1c. It is virtually zero below 1 GeV/c; it quickly increases to about 30 mb by 2 GeV/c and remains relatively constant up to the highest energies yet reported (30 GeV/c). As we will see in the next section, the inelastic reactions are dominated by Δ and N^{*} productions.

12

In Fig. 12 we present the single-pion production cross sections (which include

resonance contributions). Because of the importance of Δ (1236) production, the pn π^+ cross section is considerably larger than the pp π^0 cross section. We will shortly see that those single-pion production cross sections follow rather closely the shapes of the pp $\rightarrow N\Delta$ (1236) cross sections.

We next present a plot of the cross section for $pp \rightarrow d\pi^{+}$ (Figs. 13a and 13b). Note that the steep decrease of σ with P_{beam} is reasonably well fit by the form $\sigma = KP^{-n}_{beam}$ (the dashed line in Fig. 13b). The significance of this fit and the fitted value of $n = 4.29 \pm 0.04$ will be discussed in a later section.

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We present in Fig. 14 the differential **14** cross sections for the reaction $pp \rightarrow d\pi^+$. Since the initial-state particles are identical, these distributions are symmetric about $\cos \theta_{c.m.} = 0$. It is clear that the distributions are peaked in the forward (backward) direction, and this peaking increases as the energy increases from 1.7 to 3.6 GeV/c.

Next we turn to double-pion production and in particular to $pp \rightarrow pp\pi^+\pi^-$, as the other three possible double-pion processes

$$p \rightarrow pp\pi^{0}\pi^{0}$$
$$pn\pi^{+}\pi^{0}$$
$$nn\pi^{+}\pi^{+}$$

p

each involve two missing neutrals and are therefore considerably harder to detect (and are underconstrained in the bubble chamber). In Fig. 15 we see that the double-pion cross, **15** section displays the same general features as the single-pion production: a peak near threshold (neither as high nor as sharp as for the single-pion case, however), tapering off to a rather constant value at higher beam momenta. When we look at resonance production shortly we will see that most of this distribution is due to quasi-two-body reactions involving N^* 's and Δ 's.

In Fig. 16 we see that the triple-pion production cross sections have the same

^{*}For further information on NN inelastic processes, see the excellent review talk by E. Lillenthun, Lund Conference, 1969. Also see Kimio Fujimura, Suppl. Prog. Theor. Phys. (Kyoto), Extra Number, (1967), p. 282.

general shape as the single- and double-pion productions. Again this plot contains a large smount of resonance contributions.

Finally in Table II we present the available data on 4- and 5-pion production, as well as deuteron+ 3π and deuteron+ 4π reactions. These data are not plotted because there are too few points available.

N^* and Δ Resonances

The most thoroughly investigated phenomena in the pp inelastic final states are the nucleon resonances—and for good reason. They make up generally from 50 to 80% of the inelastic cross section.

Before proceeding to look at the data, it is <u>essential</u> to understand a couple of basic facts about how these experiments are performed. Briefly, there are two basic methods of gathering data on resonance production in inelastic reactions, and each type has its advantages and disadvantages that must be understood before the data can be properly interprotud:

1) <u>The "missing mass" experiments.</u> In these one usually measures only the mass recoiling against the detected particle (neutral or charged). Thus these experiments are able to measure the total production cross sections for all decay modes of the produced resonance. However, they generally must measure

$$\frac{\mathrm{d}\sigma}{\mathrm{d}t} \ (\mathrm{pp} \rightarrow \mathrm{pN}^*)$$

over some limited t range, and then assume a dependence like

$$\frac{\mathrm{d}\sigma}{\mathrm{d}t} = \mathrm{A} \mathrm{e}^{\mathrm{B}t}$$

in order to evaluate the integrated cross section.

2) The "bubble chamber-like" experiments. These have the advantage of being able to detect all angular regions equally. However, only part of the decay modes are generally detected. This latter point brings us to the question of how to correct for unmeasured decay modes. Where possible we have used isospin relations. For resonances that have both $N\pi$ and $N\pi\pi$ decay modes and only the $N\pi$ mode has been reported, we have used the factor

$$c \equiv \frac{\Gamma(N^* \rightarrow N\pi)}{\Gamma(N^* \rightarrow all)}$$

as given by the most recent "Reviews of Particle Properties."^{*} The error in x has boon included in our quoted cross=sectional errors.

Another problem that affects any type of detector is the separation of "signal" from "background." Frequently these resonances sit on top of large backgrounds so the subtractions become complicated. See for example the mass plots in Fujimura's review article.[†]

With these preliminaries understood, we now turn to the data, taking the baryon resonances in roughly increasing mass order.

<u>∆(1236)</u>

The cross sections for the reactions $pp \rightarrow n\Delta^{++}$ and $pp \rightarrow p\Delta^{+}$ and plotted in Fig. 17. **17** From isospin the ratio of $\sigma(n\Delta^{++})/(p\Delta^{+})$ should he 3. and the data is consistent with thin. The dashed line in Fig. 17b represents our best fit of $\sigma(n\Delta^{++})$, above 10 GeV/c, to the formula

(with best-fit value of $n = 2.20 \pm 0.16$). The significance of this parameterization will be explained in a later section. We did not fit $\sigma(p\Delta^+)$ because as yet there are too few data above 10 GeV/c.

In Fig. 18 we present the differential cross sections for (a) $pp \rightarrow n\Delta(1236)^{++}$ and (b) $pp \rightarrow p\Delta(1236)^{+}$. In Figs. 18a and 18b we have also displayed the results of our fits to the data of the form $d\sigma/dt = Ae^{bt}$. In Fig. 18c

^{*}Particle Data Group, Review of Particle Properties, Rev. Mod. Phys. <u>42</u>, 87 (1970). K. Fujimura, <u>op. cit</u>.

we have plotted our best-fit values of b. We see that the diffraction peak is shrinking for the $p\Delta^+$ processes, but it is not clear whether the $pp \rightarrow n\Delta^{++}$ peak is shrinking or not. One should not put too much faith into the actual numbers plotted in Fig. 18c. As we have said before, the data (Figs. 18a and 18b) are sensitive to background subtractions, etc.

 $\frac{N^{*}(1470, 1/2^{+}), N^{*}(1520, 3/2^{-})}{N^{*}(2190, 7/2^{-})},$

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Next we look at the "elastic-like" pp interactions, i.e., $pp \rightarrow p N_{1/2}^*$. In Fig. 19a is $\sigma [pN^*(1470)^{\dagger}]$; Fig. 19b, $\sigma [pN^*(1520)^{\dagger}]$ and Fig. 19c shows $\sigma [pN^*(2190)^{\dagger}]$ in addition to the previous two. We see that although the productions of $N^*(1470)^{\dagger}$ and $N^*(1520)^{\dagger}$ are essentially of the same magnitude around 4 GeV/c, by 10 GeV/c the $N^*(1520)^{\dagger}$ has dropped by a factor of 3, whereas the $N^*(1470)$ has remained relatively constant (and does so all the way up to 30 GeV/c).

The energy dependence of these " elasticlike" reactions is in marked contrast to the Δ (1236) production, which continues to decrease as a function of energy (see Fig. 17b). They are, however, quite similar to the pp elastic scattering, which also is about constant above 10 GeV/c.

The $\Delta(1236)$ cross section falls so fast that although at ~ 4 GeV/c the p Δ (1236) production is considerably greater than pN^{*}(1470 or 1520), by 10 GeV/c it is less than that for N^{*}(1470) and by 15 GeV/c it is less than for N^{*}(1520).

Figures 20 and 21 show the differential cross sections for the processes $pp \rightarrow pN^*(1470)^+$ and $pp \rightarrow pN^*(1520)^+$ respectively. From the data we have displayed it is not easy to tell whether these diffraction peaks are shrinking or not. In Table III we have plotted the parameters that various experimenters have obtained in fitting to their own data. Although the fits were not done in a completely consistent manner from one experiment to another (i. e., various |t| cuts, different background subtractions), it does appear that neither the N^{*}(1470), the N^{*}(1520), nor the N^{*}(2190) peaks are in fact shrinking. Notice also that the N^{*}(1470) peak is considerably sharper than that of the N^{*}(1520) and N^{*}(2190). Also, notice by comparing Table III with Fig. 3 (the coefficients for the pp elastic scattering) that the N^{*}(1470) [as well as the Δ (1236)] are about twice as steep as the elastic, where the N^{*}(1520) and N^{*}(2190) [as well as the composite '' N^{*}(1688)''] are only about half as steep.

In the "large angle" $[|t| > 1 (GeV/c)^2]$ region we have no data on $pp \rightarrow pN^{*}(1470)^{+}$. However, for the $pN^{*}(1520)^{\dagger}$ final state (Fig. 21) we do have some information for large [t]. The data below 49 GeV/c show a very flat dependence on t. We can also see that the $d\sigma/dt$ values in this region decrease as P increases. These two characteristics are also found in the elastic pp scattering, and thus the reaction pp \rightarrow pN^{*}(1520)⁺ is sometimes said to exhibit "elastic-like behavior in the region |t| > 1.'' If we look at the data at 19.2 GeV/c, however, we see that the cross section in this region is still rather t dependent. More data above 8 GeV/c would be most helpful in understanding this reaction.

'' N^{*}(1688)'' Bump

•Next we look at the "N^{*}(1688)". Actually πN phase shift analyses have shown that this region contains a number of resonances with differing J^P and I-spin [e.g., N(1670, 5/2⁻), N(1688, 5/2⁺), N" (1700, 1/2⁻), Δ (1650, 1/2⁻), Δ (1670, 3/2⁻)]. Thus it is impossible at present to correct for unseen decay modes. Therefore, in Fig. 22 we have plotted only those experiments (mostly counters) that reported all decay modes. In this figure we see that the composite "N^{*}(1688)⁺" production cross section is roughly constant from 4 to 30 GeV/c.

In Fig. 23 we plot the available differenti- **23** al cross sections for $pp \rightarrow p'' N^* (1688)^+$. "

Again in Table III we present the fitted parameters for this distribution. They show that the " $N^{*}(1688)$," like the other $N^{*}(1470)$, 1520, and 2190), does not have a shrinking diffraction peak.

In the large-angle region $[|t| > 1 (GeV/c)^2]$ we find a behavior quite analogous to that found in the reaction $pp \rightarrow pN(1520)^{\dagger}$; i. e., below 19 GeV/c the d σ /dt is quite constant in |t| but falls with increasing beam momentum ("elastic-like"). Again, however, the data at 19.2 GeV/c does not show this behavior, but rather continues to decrease as |t| increases.

A Parameterization of the $d\sigma/dt's$

Ankenbrandt et al. [Phys. Rev. <u>170</u>, 1223 (1968)] have introduced an interesting parameterization of the inelastic channels we have been considering. Probably stimulated by the success that plotting the elastic $d\sigma/dt$ vs. P_{\perp}^2 has shown, they introduce the kinematic variable

$$\mathbf{v} \equiv -\left[\frac{tn}{(t+1)}\right],$$

where t and u are the familiar Mandelstam variables:

$$t = (P_1 \cdot P_3)^2$$
;
 $u = (P_1 - P_4)^2$.

As they point out, v has some of the desirable properties that P_{\perp}^2 manifests for elastic scattering (v is identically P_{\perp}^2 for elastic scattering). It is symmetric under interchange of the initial state protons; it takes the same value for the inverse process; and it reduces to (-t) for small |v|.

In Fig. 24 we display the results of our fits of the form

$$\frac{\mathrm{d}\sigma}{\mathrm{d}t} = \mathrm{b}e^{-\mathrm{v}/\mathrm{v}_0}$$

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to the pp $\rightarrow p\Delta^{\dagger}$, pN^{*}(1520)[†], p''N^{*}(1688)[†]'', and pp elastic scattering data. The results of such fits are of course dependent somewhat upon the range of v values chosen. Following Ankenbrandt et al. we fitted the reactions to the above formula for v values just outside of the diffraction peak. Thus, this figure is essentially identical to that presented by Ankenbrandt et al., except that we have extended the plot above their 7 GeV/c upper limit,

As already noted by Ankenbrandt et al., the most striking feature of Fig. 24 is the tendency of all the slopes toward the same value $(1/v_0 \approx 2.5)$ around 7 GeV/c. We see that above 7 GeV/c, the elastic points are slowly falling. The points at 19 GeV/c are interesting but may not be very significant since the experiment covers a somewhat different t range than do the lower-momentum experiments. Additional experiments above 7 GeV/c would be most useful.

Baryon Resonances in Other Final States

So far we have been considering the production of baryon resonances in the simplest manner, i. e., in quasi-two-body final states, where one particle is a nucleon. However, there are a few bubble chamber experiments which also look at baryon production in more complicated situations. In Fig. 25 we see single-resonance production: (a) $pp \rightarrow p\pi^{-}\Delta^{++}$ and (b) $pp \rightarrow p\pi^{+}\Delta^{0}$. In Fig. 26 is displayed the double-resonance production: (a) $pp \rightarrow \Delta^{++}\Delta^{0}$ and (b) $pp \rightarrow \Delta^{++}N^{*}(1520)^{0}$.

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26

a) $pp \rightarrow \Delta \Delta^{\circ}$ and (b) $pp \rightarrow \Delta N$ (1520). In addition there have been numerous

results published on various other final states containing N^* 's and Δ 's. Such data may be found in the following articles (in Sec. III).

First author	Reference no.
Alexander	57
Almeida	153
Bodini	139
Boggild	96
Boggild	159
Caso	120
Connolly	93
Connolly	97
Ginestet	131
Kayas	82
Kinsey	126
Klein	122
Yekutieli	83

Boson Resonances

In contrast to πN and KN interactions, the NN initial state has no bosons. Thus the lack of boson resonances in NN final states is not too surprising. In general, boson resonance production seems to be only about 1% as probable as nucleon resonance production in pp reactions.

27

In Fig. 27 we present the cross sections for (a) $pp \rightarrow pp\omega$ and (b) $pp \rightarrow pp\eta$.

In Table II we give the only cross section measurement (at 21.1 GeV/c) for the

28 process $pp \rightarrow d\rho^{\dagger}$. In Fig. 28 is shown the $d\rho^{\dagger}$ production angular distribution corresponding to this point.

Strange-Particle Production in pp Interactions The production of strange-particle final states accounts for only about 1% of the total inelastic cross section in the energy range measured so far (up to ~ 10 GeV/c). Many of these reactions are dominated by strong N^* , Y^* , Σ^* , or K^* production.

29 30 The three-body final states are displayed in Fig. 29 (pp \rightarrow pAK), Fig. 30a (pp \rightarrow p $\Sigma^{+}K^{0}$), and Fig. 30b (pp \rightarrow p $\Sigma^{0}K^{+}$). (The only other possible strange three-body final state is nK⁺ Σ^{+} and no data has yet been reported for this reaction.) We see from Figs. 30a and 30b that the cross sections for p $\Sigma^{0}K^{+}$ and p $\Sigma^{+}K^{0}$ are about equal. We also note that the pAK⁺ cross section is about 2 1/2 times as great as either of the Σ cross sections.

Next we display the four-body final states. In Fig. 31 are all possible reactions of the type pp → NAK^{II}. We see that in tho energy interval measured (~ 5 to 10 GeV/c) all three reactions have about equal cross sections.

32

In Fig. 32 are plotted all possible reactions of the type $N\Sigma K^0\,\pi.$

3 Figure 33 shows the reactions (a) $pp K^0 \overline{K}^0$ and (b) $pnK^+\overline{K}^0$. These have about the same cross sections as the other strange four-body processes in Figs. 31 and 32.

In Table IV are listed various strangeparticle production cross sections from 4-, 5-, and 6-body final states. These data are not plotted because they are too sparse.

For cross sections involving Y^{*} productions see Klein et al. (Ref. 122). $pp \rightarrow n$ -prongs

Table V displays the cross sections for the reactions $pp \rightarrow n$ -prongs.

nn Interactions

By isospin invariance the nn interactions should be identical to the pp interactions reported in the previous section (as long as one stays out of the Coulomb-force region).

In Fig. 34 we have plotted the values of $\sigma^{T}(nn)$ along with a smooth curve for $\sigma^{T}(pp)$ taken from Fig. 1. Considering the difficulties associated with nn experiments (with we shall enumerate in the next section on np and pn interactions) the agreement seems quite good.

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In Fig. 35 is displayed the most recent (1956!) differential cross-section measurement for elastic nn scattering. It appears to be quite consistent with pp elastic scattering at the same energy.

np and pn Interactions

By "np" interactions we mean those interactions where the n is the beam particle and the p is the target; "pn" obviously then means the reverse situation. We know that as far as the basic interactions are concerned the np and pn interactions must be identical. However, due to the differences in <u>experi-</u> <u>mental</u> techniques and setup, it is worthwhile keeping the np and pn reactions somewhat separate. The major experimental differences (and problems) are:

1) <u>np</u>. Although deuteron beams are occasionally used, one ordinarily uses free neutrons on a hydrogen target. This is a most desirable situation except that, at present, high-energy monoenergetic neutral beams are hard to construct. Thus the data are sometimes "smeared out" over a large region of center-of-mass energy. Also the calculation of the absolute beam normalization is frequently rather difficult.

2) <u>pn</u>. Here one usually uses a conventional proton beam, but the target is deuterium (or something even more complex). This then calls for various "deuteron corrections" to be applied, including those for screening, spectator momentum, Fermi motion, and rescattering. These various corrections are not too well known and thus introduce uncertainties.

Because of the difficulties involved, the np and pn interactions have not been measured as well as the pp interactions, as will be obvious from the data we have reproduced in this section.

pn and np Total Cross Sections

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In Fig. 36 we have plotted the np and pn total cross sections (a) on a log-log plot and (b) on a linear scale. The data below 0.5 GeV/c are from the compilation of Barashenkov et al. We have plotted only those pn data that have had Glauber-type corrections applied. The solid curve is a smooth curve drawn through the pp total cross section of Fig. 1.

The following observations may be made: 1) The pn data seem to fall consistently higher than the np data;

2) Although σ^{T} (np) is considerably less than σ^{T} (pp) below about 4 GeV/c, they cross at about 4.5 GeV/c and then again at about 10 GeV/c. Above about 10 GeV/c they are very close together and for most practical purposes may be considered to be identical. np and pn Elastic Scattering (Including Charge Exchange)

The $\sigma^{el}(np)$ and $\sigma^{el}(pn)$ data are displayed in Fig. 37a. The solid curve is the $\sigma^{el}(pp)$, taken from the data of Fig. 1.

Although there are only very few data, we see that the np and pn data appear to agree with one another, and that above 1 GeV/c they are very close to the $\sigma^{el}(pp)$.

In Fig. 37b we present the np "charge exchange" cross sections. These are just those elastic events in which the beam particle is scattered backwards in the center of mass, thus the data in Fig. 37a includes these data. Even though there are only three data points, we fitted them to the equation

The solid line shows our best-fit curve $(n = 3.0 \pm 0.6)$. The possible significance of this parameterization is explained in a later section.

np and pn Elastic Angular Distributions (Including Charge Exchange)

The elastic np (or pn) differential cross section may be divided into three regions:

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1) In the <u>forward direction</u> (Fig. 38) there is a diffraction peak similar to that found in pp elastic scattering. The straight lines are our fits of the forward peaks to the formula

$$d\sigma/dt = \left. \frac{d\sigma}{dt} \right|_{t=0} e^{bt}$$

In Fig. 39 we display our fitted slopes. ^{*} We **39** see that the peak shrinks as P_{beam} increases from threshold up to ~ 10 GeV/c. For comparison we have also plotted the results of our fits (from Fig. 36) for pp elastic scattering. We see that the np and pp slopes are about equal up to 6 GeV/c. Above 6 GeV/c there <u>seems</u> to be a difference between the np and pp data [the pp has a constant slope of ~ 9 (GeV/c)⁻²;np of ~ 7 (GeV/c)⁻²]. However,

^{*}All experiments represented in Fig. 39, except Dzhelepov (Ref.137) have normalized their data, using the optical theorem and taking various amounts of real parts. Thus a plot of the intercept $d\sigma/dt |_{t=0}$ is in this case relatively meaningless and we do not give it.

this difference is due only to the fact that the pp data were fit over a smaller t range than were the np. As a matter of fact, if one uses the same t range for pp that is used for np, the two sets of slopes are perfectly consistent.

The results of various author's fits to their own data are given in Table VI.

So far we have been considering only the np elastic scattering. We also have one experiment on pn elastic scattering, and present it in Fig. 40. The only reason for separating this one pn experiment from the numerous np experiments is that (as discussed earlier) the experimental techniques (and biases) are quite different in the two processes.

Just as is done for the elastic pp scattering, one can deduce the Re/Im part of the forward np (or pn) amplitude from the elastic scattering (plus total cross section) data. This difficult task has been done at only four momenta so far, and the results are displayed in Fig. 41.

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2) In the large-angle region (see Fig. 42) the np differential cross section is fairly flat and decreases rapidly with beam energy-in strong analogy to pp elastic scattering (the elastic pp drops slightly faster). There is also generally a minimum near $\theta_{c.m.} = 90 \deg$. 43 3) In the backwards direction (Fig. 43) there exists a "charge exchange" peak. Unlike the forward np scattering, in backward np scattering experimenters have been able to measure much closer to the kinematical limit (u = 0), because it is easier to detect a forward-going particle if it is of a type different from the beam particle. Experimenters have succeeded in measuring very close to the 180 deg (u = 0) point, and they have uncovered a very interesting effect: below $\sim 1 \text{ GeV/c a}$ very sharp peak appears for |u| < 0.01 $(GeV/c)^2$. We have fitted these $d\sigma/du's$ to the form $\frac{d\sigma}{du} = \frac{d\sigma}{du}\Big|_{u=0} e^{bu}$ ($|u| \le 0.01$). Our

fitted parameters appear in Fig. 44. We can see the precipitous decrease in intercept as the beam momentum increases from 0.6 to 1.0 GeV/c in Fig. 44a. The dotted line represents our best fit to the form

$$\frac{\mathrm{d}\sigma}{\mathrm{d}u}\Big|_{u=0} = \mathrm{KP}_{\mathrm{beam}}^{-n}$$

with a best fit of $n = 2.02 \pm 0.02$.

In Fig. 44b we see that the slope appears to go through some sort of maximum around 0.8 GeV/c and then begins to decrease (i. e., the peak shrinks as the beam momentum is increased to ~ 0.8 GeV/c, and then it beings to expand).

A recent article by Mishke et al.[†] points out that this maximum in the slope is near the one-pion threshold. Possible explanations of this structure suggested by those authors are: (a) threshold effects, (b) a possible two-baryon particle or resonant state, and (c) the influence of t-channel resonances on the back scattering cross section. It is not yet clear what mechanism is involved in the np charge exchange process. For a review of many of the various proposed mechanisms and their criticisms, see for example Shepard et al. (Ref. 94). Polarization in Elastic np and pn Scattering

In Fig. 45 we present data from a recent 45 experiment on (backwards) np elastic scattering. In Fig. 46 are displayed data on polarization in 46 pn elastic scattering. In contrast to the pp elastic data (where the polarization must be antisymmetric about $\cos \theta_{c.m.} = 0$) the np data is displayed in $\cos \theta$ from -1 to +1. It is interesting that over the entire energy range covered from $P_{beam} = 0.8$ to 1.3 GeV/c, there is a pronounced dip at $\cos \theta \approx -0.2$ and the

^{*}The only authors who give fits to these distributions are Shepard et al. (Ref. 94 in Sec. III). Thus we have not separately tabulated them here.

^TR. E. Mishke, P. F. Shepard, and T. Y. Devlin, Structure in np Charge Exchange, Phys. Rev. Letters 23, 542 (1969).

polarization reaches its maximum values at $\cos \theta \approx +0.8$. ($|\cos \theta| \approx 0.8$ is also where the pp elastic polarization reaches its maximum.)

Inelastic np and pn Reactions ·

Data on np and pn inelastic reactions are very sparse. In Table VII we list all of the data on these reactions picked up in our compilation.

NN Reactions in the I = 0 State

Since the pp (and nn) are in pure I = 1, we need not make special mention of the I = 1reactions. The I = 0 part of the NN interactions must, however, be determined by subtraction.

From isospin we have

$$\sigma_{I=0} = 2\sigma_{np} - \sigma_{pp}$$

So far np data has been so sparse that this formula can be applied meaningfully only to the total cross section. In Fig. 47 we see the NN(I=0) total cross section, along with a curve of the NN(I=1) total cross section [i. e., σ^{T} (pp), taken from Fig. 1]. From this figure we see that although the I=1 interaction dominates from 1.25 to 4 GeV/c, the I=0 part becomes the larger around 4 GeV/c and remains so at least up to 10 GeV/c. This tendency for the lower I-spin to predominate seems to be a general property of high-energy cross sections.

Interactions with Deuterons: pd, nd, and dp

In order to get information on pn, nn, or np reactions, one frequently uses deuterium as the neutron source and then "corrects" the deuterium data appropriately to extract the neutron data.

In this section we present some of these deuterium data, which are interesting in their own right.

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Figure 48 shows pd and nd total cross sections. Since the deuteron has I=0, isospin invariance requires that both of these processes be identical. Although the nd data are scanty they do in fact agree.

In Table IX we list the only available data on $\sigma^{el}(pd)$.

Figure 49 displays a very forward region in **49** pd elastic scattering (in the Coulomb interference region). The purpose of this experiment was to measure α_{np} (i. e., the ratio of the Re/Im parts of the np forward elastis scattering amplitude).

Finally in Fig. 50 we present various pd elastic differential cross sections. <u>A Parameterization of the Integrated Cross</u> Sections

For two-body and quasi-two-body final states, Morrison^{*} has proposed a parameterization of the high-energy cross sections as a function of the incident momentum:

$$\sigma = \operatorname{const} \cdot \operatorname{P}_{\operatorname{heam}}^{-n}, \qquad (1)$$

50

suggesting that the value of the exponent n might indicate what mechanism is involved in a particular reaction. He proposes the following:

n ≈	Suggested exchange mechanism
0	"Elastic-like"
1.5	Non strange meson exchange
2.0	Strange meson exchange
4	Baryon exchange

^{*}D. R. O. Morrison, Interpretation of the Variation of Cross Section with Incident Momentum for Inelastic Two Body Reactions, Phys. Letters 22, 528 (1966).

Reaction	Energy interval	Restrictions on experiments	Fitted value of n	n. Morrison
$pp \rightarrow d\pi^+$	All data	· None	4.29±0.04	4
$\rightarrow n\Delta^{++}$	Above 10 GeV/c	None	2.2 ± 0.16	1.5
→ pN [*] (1470) ⁺ (''Roper'')	Above 10 GeV/c	Only experiments reporting production cross section for all decay modes of N	-0.09±0.27	Ó.
$\rightarrow pN^{*}(1520)^{+}$	Above 10 GeV/c	11	0.10±0.33	0
Elastic	Above 10 GeV/c	None	-0.22 ± 0.06	0
np → pn (charge exchange)	All data	None	3.0 ±0.6	1.5 or 4

We have fitted to formula (1) the following reactions:

Except for the last entry, agreements between Morrison's predictions and what one might reasonably expect in each of these reactions is really quite good.

2q² Table

P	2 P ²	Plan	$2 P^2$	P _{lab}	2 P ²
(MeV/c)	$(MeV/c)^2$	(MeV/c)	$(MeV/c)^2$	(GeV/c)	$(GeV/c)^2$
0	0	1380	685389	3.0	2.07
20	199	1400	700943	3.2	2.25
40	799	1420	716565	3.4	2.43
60	1798	1440	732254	3.6	2.61
100	3194	1460	763826	3.8	2.79
120	7170	1500	779705	4.2	3-16
140	9746	1520	795644	4.4	3.34
160	12708	1540	811641	4.6	3.52
180	16053	1560	· 827694	4.8	3.71
220	23876	1,500	859963	. 5.0 5.2	3.89
- 240	28343	1620	876176	5.4	4.26
260	33174	1640	892439	5.6	4.45
280	38364	1660	908751	5.8	4.63
300	43905	1680	925111	6.0	4.82
340	49791	1720	941517	0•2 5-4	5.00
360	62575	1740	974464	6.6	5.37
380	69459	1760	991002	6.8	5.56
400	76661	1780	1007582	7.0	5.75
420	84175	1800	1024202	7.2	5.93
440	91993	1820	1040862	7.6	6.12
480	108512	1860	1074296	7.8	6.49
500	117198	1880	1091068	8.0	6.68
520	126159	1900	1107876	8.2	6.86
540	135388	1920	1124718	8.4	7.05
560	144878	1940	1158504	8.0	1.24
600	164609	1980	1175446	9.0	7.61
620	174838	2000	1192419	9.2	7.80
640	185298	2020	1209423	9•1	7.98
660	195984	2040	1226457	9.6	8.17
700	218006	2080	1243520	10.0	8.30 8.54
720	229329	2100	1277730	10.5	9.01
740	240852	2120	1294876	11.0	9.48
760	252560	2140	1312049	11.5	9.95
780	264472	2160	1329248	12.0	10.41
820	288821	2200	1363721	12.5	10.88
840	301254	2220	1380994	13.5	11.82
860	313852	2240	1398290	14.0	12.28
880	326611	2260	1415610	14.5	12.75
900	339525	2280	1432952	15.0	13.22
940	365799	2320	1467702	17.0	14.10
960	379150	2340	1485108	18.0	16.03
980	392638	2360	1502536	19.0	16.97
1000	406258	2380	1519983	20.0	17.91
1020	420006	2400	1554937	22.0	19.78
1040	447871	2440	1572443	26.0	23.53
1080	461980	2460	1589967	28.0	25.41
1100	476201	2480	1607509	30.0	27.28
1120	490532	2500	1625069	32.0	29.16
1140	504970 519500	2520	1660240	36.0	11+03 32.91
1180	534148	2560	1677851	38.0	34.78
1200	548884	2580	1695478	40.0	36.66
1220	563713	2600	1713121	42.0	38.54
1240	578633	2620	1730780	44.0	40.41
1280	593641 608722	2660	1766143	40.0 48.0	42.29
1300	623909	2680	1783847	50.0	46.04
1320	639165	2700	1801565	55.0	50.73
1340	654498	2720	1819298	60.0	55.42
1360	669907	2740	1837044	65.0	60.11
		2780	1872577	70.0	04•8U
		2100	1912211	ł	

pp Total and Elastic Cross Sections

For elastic scattering the expression for t in the c.m. is $t = -2q^2 (1 - \cos \theta_{c.m.})$. We give in the tables for elastic differential cross section $2q^2$ in $(GeV/c)^2$ and call it 2Q SQUARE.

On the facing page we have tabulated $2q^2$ vs incident nucleon momentum.

$pp \rightarrow \begin{cases} total \\ elastic \end{cases}$

Pbeam (GeV/c)	o _{total} (mb)	σ _{elastic} (mb)	References	P _{beam} (GeV/c)	^o total (mb)	^o elastic (mb)	References
.14	314.00 ± 13.00		BARASHENKO 61 X	3.67	42.10 ± 1.20		HART 62
-19 -24	155.00 2.00 92.00 1.00		BARASHENKO 61 X BARASHENKO 61 X	3.73 3.91	42.68 .04 42.32 .04		BUGG 66 BUGG 66
.28	70.00 1.00		BARASHENKO 61 X	4.00	41.60 .62	12 50 5 20	LONGO 62
-31 -35	52.80 .60 42.50 .40		BARASHENKU 61 X BARASHENKO 61 X	4.04	42.14 .04	13.30 1 .30	BUGG 66
.37	37.40 2.30		BARASHENKO 61 X	4.26	41.76 .04		BUGG 66 DLODENS 62
.43	28.50 1.30		BARASHENKO 61 X	4.55	41.46 .04		BUGG 66
-44	27.70 1.30		BARASHENKO 61 X BARASHENKO 61 X	4.78	41.38 .04 41.16 .04		BUGG 66 BUGG 66
-54	25.20 1.20		BARASHENKO 61 X	5.00	44.00 1.00		VON DARDEL 60
.59	23.20 1.90		BARASHENKO 61 X	5.52	41.60 1.40	11.99 .25	ALEXANDER 67
.69	22.40 .90		BARASHENKO 61 X BARASHENKO 61 X	5.53	40.88 .04		BUGG 00 BUGG 66
.75	22.60 1.30		BARASHENKO 61 X	5.83	41.60 .60		DIDDENS 62
-83 -85	24.30 1.00 23.40 .90		BARASHENKO 61 X	6.00	40.60 .60		GALBRAITH 65
.88	23.20 .30		BARASHENKO 61 X	6.60 6.80		10.20 50	COLTON 60 FOLEY 63
.97	24.00 1.00		BARASHENKO 61 X	6-92	42.60 1.30	11.40 .50	ALEXANDER UU
1.11	34.03 .17		BUGG 66	7.75	41.60 1.10		DIDDENS 62
1.29	43.23 .11		BUGG 66 BUGG 66	7.82	40.34 .12 40.07 .05		FOLEY 67 BUGG 66
1.42	46.20 + .50		LONGO 62	7.85	40-00 -60		TAYLOR 65
1.48	45.00 6.00		MORRIS 56	8.00	40.00 .60		GALBRAITH 65
1.60	47.50 +1.02		LONGO 62	8.10	40.10 .20	10.80 .40	GINESTET 69 HARTING 65
1.61	47.48 .06		BUGG 66	8.80		11.71 .74	FOLEY 63
1.66	47.55 .06	24.80 ± .90	BUGG 64	9.90	39.40 1.50		ASHMORE 60
1.66		26.80 2.30	MCFARLANE 63	10.00	42.00 .50		VON DARDEL 60
1.73	46.20 + .82	20120 2110	LONGO 62	10.01	41.10 1.70	10.20 .60	ALMEIDA 68
1.78	46		BUGG 66	10.11 10.70	40.00 .30		VON DARDEL 60
1.86	47.45 .04		BUGG 66	10.80	10.62 12	11.04 .70	FOLEY 63
1.89	46.80 +1.51		LUNGU 62	12.00	39.40 .60		GALBRAITH 65
1.94	47.36 .05		BUGG 66 BUGG 66	12.10	39.00 1.50	10.40 1.70	DIODENS 62 ASHMORE 60
2.05	45.30 +1.12		LONGO 62	12.40		8.90 .87	HARTING 65
2.08	47.22 .04		BUGG 66	14.00	39.10 .60	10.09 .72	GALBRAITH 65
2.21	46.98 .05	19.86 + 73	BUGG 66	14.01	39.42 .12	10-48 -71	FOLEY 67 FOLEY 63
2.23		64	ET SMER 05	15.50		9.20 1.40	DIDDENS 62
2.25	35.00 +8.00	20.00	FOWLER 56	15.80 16.00	38.70 1.50 38.70 .60		GALBRAITH 65
2.28	46.67 .04		BUGG 66	16.03	39.23 .12	9.74 .69	FOLEY 67
2.45	45.83 .04		BUGG 66	17.70	39.70 1.50		ASHMORE 60
2.47	45.10 + .83		LONGO 62	17.91 18.00	39.18 .12 38.70 .60		GALDRAITH 65
2-59	45.53 .04		BUGG 66	18.40		8.80 .95	HARTING 65
2.68	45.33 .04 45.17 .04		BUGG 66	19.00		8.70 .50	BOGGILD 69
2.81	45-01 -04	19.21 .48	FICKINGER 62 BUGG 66	19.33	38.90 .30 39.70 1.50		BELLETTINI 65 ASHMORE 60
2.86	44.93 .04		BUGG 66	19.60		9.64 .73	FOLEY 63
2.96 2.97	44.65 .04 44.50 + .46		LONGO 62	20.22	39.05 .12		FOLEY 67
2.00	42		BUIGG 66	20.46	39.09 .12 39.40 1.50		FOLEY 67 ASHMORE 60
3.00	44.33 .32		ABRAMS 69	21.40	22.22	8.00 1.60	DIDDENS 62
3.05 3.11	44.40 .04 44.19 .04		BUGG 66	22.00	38.30 .60		GALBRAITH 65
3.13	44.16 .04		BUGG 66	24.00	38.89 .12 38.70 1.50		FOLEY 67 ASHMORE 60
3.27	47.10 .90		DI DDENS 62	24.50	39.30 .80	8.80 .30	BREITENLOH 63
3.28 3.30	43.61 .04 43.67 .04		BUGG 66 BUGG 66	26.20	30.90 .12	9.80 2.20	DIDDENS 62
3.44	43.14 .04		BUGG 66	26.42	38.80 .30 39.90 1.50		BELLETTINI 65 ASHMORE 60
3.57	35.00 +8.00	15.00	BLOCK 56				
3.58	-5.00		LONGO 62	* DATA WAS READ	FROM A GRAPH		
3.67		15.32 .76	SMITH 61	X DATA TAKEN FR	OM A REVUE ARTICLE		
				Second Strategy (Second			
		REFER	NCES 56	103 1484	cc		
		2 FOWLEB	56PR	103 1175	LL		
		3 MORRIS 4 ASHMORE	56PR 60PRL	103 1472 5 576	CNTR		
		5 VON DAR	TEL 60	5 333	LNIR		
		7 SMITH	61PR	123 2160	HBC		
		8 DIDDENS 9 DIDDENS	62PRL 62PRI	9 32 9 108	CNTR		
		10 FICK ING	R 62PR	125 2082	HBC		
		12 LUNGO	62PR	125 701	CNTR		
		13 BREITEN	OH 63PL	7 73	HRC		
		15 MCFARLA	IE 63NC	28 943	CNTR		
		16 BUGG 17 BELLETT	64PR NI 65PL	13381017 14 164	HBC		
		18 ETSNER	05FR	138 8670	HBC		
		20 HARTING	65NC	38 60	SPRK		
		21 TAYLOR 22 BUGG	65PL 66PR	14 54 146 980	SPRK		
		23 ALEXAND	R 67PR	154 1284	HBC		
		24 COLETTI 25 FOLEY	67PRL	19 857	CNTR		
		26 MURRAY 27 ALEXAND	67NC R 68PR	49A 261 173 1322	C NTR HBC		
		28 ALMEIDA	68PR	174 1638	HBC		
		30 FIREBAU	68PR	172 1354	HBC		
		31 ABRAMS 32 BOGGLLD	69BNL 14	4125 308 369	C NTR HBC		
		33 GINESTE	69NP	813 283	HBC		



Fig. 1a. pp total and elastic cross sections from 0.1 GeV/c up to the highest reported momentum. Data below our cutoff of 0.5 GeV/c are from the review article of Barashenkov (Ref. 56). For a linear representation of this same data see Figs. 1b and 1c.



Fig. 1b. Same as Fig. 1a but now on linear scales.

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dđ

elastic

total


Fig. 1c. Same as Fig. 1b but only for $\rm P_{beam}$ from 0.5 to 5.5 GeV/c.

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUR	ICENTRAL V	ALUE)= .849 0	EV/C	BEAM MOMENT	UMICENTRAL VA	LUE)= .949	GEV/C
BEAM MOMENTUN	A RANGES FR	DM .800 TO	.899 GEV/C	BEAM MOMENT	UM RANGES FRO	M .900 TO	.999 GEV/C
MOM 1	rr			MOM	TR		
MINIMUM	MAXIMUM	SIGMA (- DSIGMA ARNS/(GEV/C)**2)	MINIMUM	MAXIMUM	SIGMA (MILLI	+- DSIGMA BARNS/(GEV/C)**2
.050	.099	89.500	4.000	.050	•099	76.100	3.800
.100	.149	80.700	4.500	.100	•149	67.800	5.300
.150	.199	76.600	3.200	.150	•199	71.200	4-200
.200	.249	84.300	3.700	-200	.249	63.900	3.900
.250	.299	81.800	4.900	- 250	• 299	66.600	2.800
				•300	.349	66.300	3.200
20 SOUARE	307						
				2Q SQUAR	E= .372		
RYAN	PPPA	PPAR-11 (1	.969) SPRK	PLUS POSSIBL	E SYSTEMATIC	ERROR OF +-	1PER CENT
				RYAN	PPPA	PPAR-11 (1969) SPRK

BEAM MOMENT	UMICENTRAL VA	LUE)= 1.049 G	EV/C	BEAM MOME	NTUM(CENTRAL VA	LUE)= 1.149	GEV/C
BEAM MOMENT	UM RANGES FRO	M 1.000 TO 1	.099 GEV/C	BEAM MOME	NTUM RANGES FRO	M 1.100 TO	1.199 GEV/C
MOM	TR			N	ION TR		
MINIMUM	MAXIMUN	SIGMÁ + (MILLIB	- DSIGMA ARNS/(GEV/C)**	MINIMUM 2)	MAXIMUM	SIGMA (MILLI	+- DSIGMA BARNS/(GEV/C)*#2)
.050	.099	58.100	2,900	.050	.099	53.300	2.800
.100	.149	63.600	3.300	.100	.149	52.700	2.800
.150	.197	56.590	3.500	. 150	.199	43.700	2,800
200	.249	58.600	3.700	,200	.249	45.100	3.600
250	.244	54.400	2.400	. 250	. 244	48.100	2.500
.300	.349	46.900	2.300	. 300	.349	41.400	2.100
.350	.399	49.500	2.600	.350	.399	36.300	2.000
400	.449	50.900	3.000	. 400	.449	33.600	2.000
				.450	.499	40.400	2.400
20 SQUAR	E= .441			. 500	. 549	38.900	2.900
PLUS POSSIBL	E SYSTEMATIC	ERRUR DF +-	ZPER CENT				
		•		20 501	ARE= .512		•
RYAN	PPPA	PPAR-11 (1	969) SPRK	PLUS POSSI	BLE SYSTEMATIC	ERROR OF +-	2PER CÊNT
				RYAN	PPPA	PPAR-11 (1969) SPRK

нвс

BEAM MOMENTUM= 1.168 GEV/C

.

****THIS DATA WAS READ FROM A GRAPH****

млм	τо	ANCE	STONA	*	DSTGMA	
non			(MILLI	BAR	NS/(GEV	//C)**2)
		.126	53.812		3.587	
		.179	48.431		4.185	
		.231	47.833		4.185	
		.284	50.225		4.783	
		.336	46.637		4.783	
		.389	41.854		4.185	
		.441	41.854		4.185	
		•494	37.071		3.587	
i	29	SQUARE=	.525			
BAL	DON	r	NC		26	1376(1962)

.

BEAM MOMENTUM(CENTRAL VALUE)= 1.249 GEV/C

BEAM MOMENTUM RANGES FROM 1.200 TO 1.299 GEV/C

.

~.

	MOM TR		,
MINIMUM	MAXIMUM	SIGMA	+- USIGMA
		(NILLI	BARNS/(GEV/C)**2)
.050	• 099	62.200	3.700
.100	•149	54.100	3.300
.150	.199	47.200	3.200
.200	.249	39.700	3.100
.250	.299	33,900	3.400
.300	.349	36.000	4.200
.350	. 399	26:400	4.600
.400	.449	25.500	1.700
.450	.499	22.400	1.700
.500	.549	25.200	1.800
.550	.599	24.000	1.900
.600	.649	24.100	1.400
20 50	UARE= .586		
PLUS POSS	IBLE SYSTEMATIC	ERROR OF +-	2PER CENT

RYAN PPPA PPAR-11 (1969) SPRK



Fig. 2. pp elastic differential cross sections. For experiments measuring especially small angles or very large angles, see the following figures. Since the two particles are identical the angular distributions are symmetric about 90 deg. So as not to mask possible structures, systematic errors have not been included, even though they may have been given by the authors. Some distributions given originally as $d\sigma/d\omega$ vs. $\theta_{c.m.}$ have been transformed to $d\sigma/dt$ vs. t. We have not included Connolly <u>et al.</u> (Ref. 93), which reports numbers of events, rather than $d\sigma/dt$ (and does not give a factor that would enable us to convert to σ). The solid lines are the results of our least-squares fit to

 $d\sigma/dt = \frac{d\sigma}{dt}\Big|_{t=0^2}$. e^{bt}, using data in the interval 0.03 $\leq |t| \leq 0.3 \text{ (GeV/c)}^2$. This interval was arbitrarily selected to be a compromise that would allow us to use the same interval to fit all the data. Author's extrapolated values for $d\sigma/dt$ at t = 0 were not used in our fits. WARNING—the fit is very cutoff dependent. The fitted parameters are plotted in Fig. 3. The vertical arrows represent the values of t at $\theta_{c.m.} = 90 \text{ deg}$. In those cases where the beam has a very wide momentum spread (see facing table), we have placed the arrow at the position corresponding to the middle of the momentum range (i. e., at the value appearing on the figure).

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUM(CENTRAL VALUE)= 1.450 GEV/C

MU	M TR			MQM	ŢR		
MINIMUM	MAXIMUM	SIGMA +-	- DSIGMA	MINIMUM	MAXIMUM	SIGMA	+- DSIGMA
		(MILLIBA	ARNS/(GEV/C)**2)			(MILLI	BARNS/(GEV/C)**
.050	.099	80.600	3.900	.050	•099	89.100	5.000
.100	.149	63.800	3.700	.100	. 149	68.500	4.300
.150	.199	46.600	3.200	.150	.199	54.600	4.000
-200	.249	38.600	3.200	•200	.249	42.700	3.600
.250	.299	40.800	3.700	.250	.299	32.100	3.600
.300	• 349	28.000	4.100	.300	.349	22.600	3.300
.350	.399	23.000	1.700	.350	.399	19.800	4.500
.400	.449	18.800	1.500	.400	.449	19.300	1.700
• 450	.499	15.300	1.400	- 450	.499	16.400	1.500
• 500	.549	15.100	1.400	.500	.549	12.700	1.400
.550	.599	13.500	1.400	. 550	.599	10.500	1.300
• 600	.649	14.000	1.500	• 600	.649	8.500	1.200
.650	.699	11.800	1.400	.650	-699	10.400	1.400
			•	.700	.749	5,500	1.100
20 SOUA	RE= .662						
LUS POSSIB	LE SYSTEMATIC E	RROR OF +- 3	BPER CENT	20 SQUAR	E= .740		
				PLUS POSSIBL	E SYSTEMATIC	ERROR OF +-	2PER CENT
RYAN	PPPA	PPAR-11 (19	69) SPRK				
				RYAN	PPPA	PPAR-11 (1969) SPRK

BEAM MOMENT	UM(CENTRAL_VAL	_UE)= 1.549 GE	v/c	BEAN MOMENTU	MICENTRAL VA	LUE)= 1.649 G	EV/C
BEAM MOMENT	UM RANGES FROM	4 1.500 TO 1.	599 GEV/C	BEAM MOMENTU	M RANGES FRO	M 1.600 TO 1	.699 GEV/C
MOM	1 TR			MOM	TR		
MINIMUM	MAXIMUM	SIGMA +- (MILLIBA	DSIGMA RNS/(GEV/C)**2)	MINIMUM	MAXIMUM	SIGMA + (millib	- DSIGMA JARNS/(GEV/C)**2)
- (151)	*U4A	93.500	5.500	.050	.077	23.000	6.200
.100	.199	55.300	4.900	-100	.199	58,500	6.100
.200	.299	31.600	3.100	.200	.299	28.800	4.700
.300	. 344	19.300	2.900	• 3ÚÚ	. 399	19.700	3.500
.400	.499	14.000	1.300	.500	.599	8.300	1.200
.500	.599	8.800	1.100	.600	.699	5.800	1.300
.600	.699	7.000	1.100	.700	.799	4.600	1.000
.700	.799	6.800	1.100	.800	.899	4.600	.900
.800	.899	7.100	.900	.900	• 909	5.600	1.100
.900	.999	6.600	1.100				
				20 SQUARE	900		
20 SQUAR	E= .819			PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	1PER CENT
PLUS POSSIBL	E SYSTEMATIC I	ERROR OF +- 1	PER CENT				
A FAN	рррд	PPAR 11 (17	69) SPAK	RYAN	PPPA	PPAR-11 (1	969) SPRK

BEAM MOMENTUMICENTRAL VALUE) = 1.749 GEV/C

BEAM MOMENTUM(CENTRAL VALUE) = 1.349 GEV/C

BEAM MOMENTUM RANGES FROM 1.700 TO 1.799 GEV/C Mom Tr

MINIMUM	MAXIMUM	SIGMA	+- DSIGMA
		(MILL)	[BARNS/(GEV/C)**2)
.050	• 099	98.500	9.100
.100	.199	46.000	8.900
-200	. 299	27.200	8.700
.300	.399	16.900	7.700
.500	.599	6.800	1.300
.600	.699	4.200	1.200
.700	.799	6.500	1.300
.800	.899	4.800	1.500
-900	.999	5.000	1.600
20 SQUARE	982		
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	1PER CENT
RYAN	PPPA	PPAR-11	(1969) SPRK

BEAN MOMENTUM= 2.230 GEV/C

****THIS DATA WAS READ FROM A GRAPH****

		0414		NLA		NOR	~	UNAF	
MOM	TRANS	ŠF	SIG	MA	+	DSL	GMA		
			- (M I	LLI	BAR	NS/	(GE	V/C)	*#Z)
	• 01	10	8.1	39		4.	069)	
	.02	20	47.4	75		9.	947	,	
	•03	32	76.8	65		9.	043		
	-04	¥8	92.6	90		13.	564	,	
	+06	58	85-9	07		13.	564	•	
	•09	90	72.3	43		9.	043		
	.11	16	49.7	36		4.	521		
	.14		38,4	37		۵.,	۹? <u>۱</u>		
	- 13	76	36.1	72		4.	521		
	•21	12	29.3	89		4.	521		
	•25	50	21.2	51		4.	521		
	.29	90	21.2	51		4.	521		
	.34	•0	14.0	16		3.0	617		
	.39	90	15.8	25		2.	261		
	. 44	0	12.2	80		2.	261		
	.49	90	7.6	86		1.	356		
	.55	50	4.5	21		1.	356		
	.64	0	5.8	78		- •	904		
	.71	0	4.0	69	•	•	904		
2	a sai	JARE=	1.3	90					

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EISNER





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MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (Gev/C)++2

BEAM MUMENTUMW 2	2.980 GEV/C			BEAN NONENTUN	4.000 GEV	vc	
MOM TRANSF	SIGMA +- DSI [millibarns/	GNA (GEV/C)++2)		****THIS DATA	WAS READ F	ROM A GRAPH***	•
.270 10	4.	000		NDM TRANSF	SIGNA +-	OS EGNA	
-580	3.200	200		.025	80.000	8.000	
.680 .790	2.100 .	200		.040	70.000	8.000	
-940	.060 -	050		.075	50.000	7.000	
1.340	.630 .	030		.130	32.000	6.000	
1.750	.470 .	030		-150	28.000	5.000	
				. 230	20.000	3.000	
PLUS POSSIBLE SYS	STEMATIC ERR	UR OF +- /PEF	CENT	.270	8.000	3.000	
		170 1223119681	CNTR	-650	1.300	.400	
			•	1.300	.020	.050	
BEAM MOMENTUP	4= 5.520 GEV	/C		1.600	.080	.003	
****THIS DATA	WAS READ F	ROM & GRAPH®®®	•	20 5011485+	2 075		
NON 1	re				2		
				COLETTI	NC	494 479119	571 HBC
MININUM	MAXIAUM	IMILLIBA	RNS/1GEV/C1++21				
010	.020	25.920	3.527	BEAM MUMENT	UM# 6.000	55476	
.030	- 040	61.920	5.452	****THIS DA	TA WAS REA	O FROM A GRAPH	
.050	.060	62.880	5.494	NUM	I TR		
-070	.010	43.920	4.591	MIN INUM	MAXINUM	SIGHA	← DSIGHA
.080	.070	44.880	4.641	0.	.020	16.500	2+031
.100	.110	36.000	4.157	-020	.040	62.000	3.937
.110	.130	32.680	3.973	.060	.080	53.000	3.640
-130	-140	26.880	3.592	.080	.100	40.000	3.162
.150	.160	24.960	3.461	-120	.140	38.000	3.062
.150	.180	18.960	3.017	. 160	.180	24.000	2.449
.180	. 190	18.000	2.939	.180	.200	21.000	2.062
- 200	.210	18.480	2.978	. 220	- 240	14.000	1.871
-210	.230	10.560	2.251	. 260	.280	11.000	1.058
.230	. 740	11.040	2.302	.280	. 300	6.000	1.225
.250	. 260	10.560	2.251	. 320	.340	5.500	1.173
.260	.280	14.880	2.200	.360	.380	4.500	1.061
-280	- 290	6.960	1.828	.380	.400	3.000	.866
.300	.310	12.000	2.400	.420	- 440	3.750	. 968
.310	.330	4.120	2.092	.460	.480	2.000	. 707
- 330	. 340	9.600	2.147	-480	.500	2.750	.829
.350	.360	5.520	1.628	. 520	- 540	1.500	.612
.360	. 380	7.920	1.950				
.380	- 390	4.080	1.399	20 5004	E* 5.374		
.+00	.410	4.080	1.399	COL TON	UCLA	1025	11968) HBC
. 420	.430	5.040	1.555				
430 - 440	.440	6.000	1 687	UCAN RUNCH	UMP 8.920	UEV/L	
-450	.460	4.030	1.399	****THIS O	TA WAS REA	O FROM A GRAPH	••••
-460	.480	2.880	1.176	802	1.18		
-480	.500	. 1.920	.960				
.500	-510	2.880	1.176	ATALING	0841000	14111	104043/10CV/C)++L1
.520	.530	2.880	1.176	.010	-020 -020	14.000	21040
. 530	.550	L.440 2.850	.071 .	. 030	.040	50.000	5.000
. 550	. 580	****	.674	. 050	.060	50.000	5.000
. >60	. 510	••	- 0.	.060	-070	54.000	5.196
.570	.580	2.400	-960 L.073	-080	.090	43.000	4.637
- 590	-600	2.400	1.073	.100	.110	40.000	4.472
.610	.620	1.440	.831	.120	.120	24.000	3.464
.630	-640	.960	.679	.130	.140	29.000	3.808
:040	-660	.900	. 519	.150	.160	18.000	3.000
		•	~ 01	.170	.180	27.000	3.674
. 560	.070	0.	- 0.	.180	.190	20.000	3.162
.670	.680	0.	+ .480 - 0.	- 200	.210	15.000	2.739
.680	.690	0.	+ .480	. 220	.230	14.000	2.040
- 69D	. 700	1.920	.960	.230	.240	13.000	2.550
.700	. 720	0. 400	+ .480	- 250	- 260	13.500	2.598
. 120	. 730	o.	- 0.	. 270	. 280	12.000	2.449
			- 0.	.260	. 290	17.000	2.291 2.915
. 750	.740	1.920	.960	.300	.310	13.500	2.598
20 500485	4.373			. 320	.330	10.000	2.236
		164 1384414		.340	.350	5.000	1.581
ALEAANDER	PR	134 1284114		.350	.360	4.000	1.414
				. 370	.390	5.000	1.581
BEAM MOMENTU	M= 6.800 GEV	VC		.390	.400	2.000	1.000
NON	TR			.400	.410	. 3.000	1.225
HENEMIN	MAX [NUN	51 GHA	- DSIGMA	. 420	.430	2.000	1.000
		INILLA	DNS/1064/614+21		450	5.000	1. 201
. 021	.025	86.800	3.400	.460	-460 -470	4.500	1.500
-031 -042	.037	76.700	3.000 2.500	. 4 70	-480	1.000	. 101
.058	.068	. 57.100	2.100	. 500	.510	1.000	. 707
.093	.109	41.600	1.800	.510	.520	.500	. 500 .
.228	.268	10.880	.440	. 530	.540	- 500	. 500
.363	.427	3.830	.210	.550	.560	1.500	.866
.519	.609	1.222	.092	.560	.570	1.000	.500
- 605	.711	.717	-066 -047	.580	. 590	1.500	- 866 - 500
. 794	.932	.234	.033	. 600	-610	1.500	-866
29 SQUARE	5.560			. 510	.020	1.500	.000
PLUS PUSSIBLE	STSTERATIC	CKRUN UF.+- 6	FCR LENI	29 SQUAR	E= 5.672		
FOLEY	PRL	11 425(19	1631 CNTR	ALEXANDER	PR	173 1322	1966) HBC

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Fig. 2 (continued)

NOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM IGEV/C1*+2

BEAM MONE	NTUM= 8.100	GEV/C			E	EAM MOMENTUM	= 0.500 GEV	/c		
н	DM TR				,	UM TRANSE	SIGMA +-	DSIGNA		
N 1 N T MEIN	MAYEND		\$16HA +-	DSIGHA		1.30	CHILLIBAR	NS/(GEV/C)	**2)	
6191006	1144 1104		IMILLIBA	RNS/(GEV/C)**2)		.150	20.650	.610		
060	D. JEXTRAP	DLATED PC)INT (7'	9.650+-3.279)		-170	17.780	.570		
.080	.100	3	7.260	2.243		.220	11.800	.330		
.100	.120	1	9.835	2.160		.260	8.740	.280		
+140	. 160	2	7.675	1.933		.340	4.770	.200		
-160	-180	4	7.550	1.111		.380	3.390	1110		
. 200	. 220	i	6.875	1.509		.420	1.790	.120		
. 220	- 240	1	3.500	1.350		.500	1.370	.110		
+ 260	. 300	i	1.340	1.237		.5 80	.800	.085		
-280	.300		9.180	1.113		-650	.485	.041		
.320	.340		6.075	.906		.850	-123	.021		
• 340 • 360	.360		5.940	.895		.950	- 059	.016		
. 380	.400		3.645	. 701		11050				
.400	.420		4.455	.776	PI	20 SQUARE=	7.143 SYSTEMATIC	ERROR UF +	- 7966	CENT
20 500	APE= 6 770							30 4	0410461	5004
GINESTET	NP	813	283119	59) HBC	,	ARTINO		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	0117027	J. K.
					*					
BEAM MOMEN	ITUM= 8.800	GEV/C				BEAM MOMEN	TUM=10.800	GEV/C		
мо	IM TR					мо	M TR			
			C1 CMA +	DSIGNA						DSIGNA
MININUM	De JEXTRAP	DLATED PO	INT CLO	RNS/(GEV/C1++2)		- DI 1004	. JEXTRAP	נ ULATED POI	MILLIBA NT 110	RNS/(GEV/C)++2) 2.800+-3.100)
- 036	-042	7	4.700	2.500		.053	.063	59	.400	1.700
.052	.062	۵ 4	9.900	1.700		.107	.125	32	. 700	1.100
. 097	.113	3	8.900	1.200		.144	-170	23	- 730	.760
•155	.181	2	2.510	.920		.230	.270	10	.260	.450
.242	-284		9.500	.360		.247	.289	8	.100	.320
. 385	. 453		2.840	.160		. 393	.461	2	.380	.130
• 464	.544		1.554	.102		. 474	.556	1	.148	.075
.641	. 753		.402	.040		. 656	.770		. 295	.027
- 739	.867		.192	.026		.758	. 890		.138	.018
. 20 5000	95- 7 423					20 5004	RE= 9.291		F +- 6	PER CENT
PLUS PDSSIE	LE SYSTEMAT	IC ERROR	0F +- 6F	ER CENT						
FOLEY	PRL		425(196	3) CNTR		FOLEY	PRL	11	422114	CATE
BEAM MOMENTU	N=10.940 GEV	/C				BEAM MOMEN	ITUM=12.800	GEV/C		
.200	(NILL(84R	N\$7(GEV7(1++21			M(ы тр 			
.263	8.100	.230				AININUM	MAXINUN	· · · · ·	.IGMA ↔ .M11.1.[B/	• USIGHA SRNS/(GEV/C)++21
.333	4.660	.160					.) EX TR AP	DLATED POI	NT (10	4-000+-4.3001
. 493	1.411	.076				.045	.079	46	.700	4.600
•582 •679	.641	.048				-110	-130	33	.900	1.400
.782	.178	.026				.206	.242	13	.930	.780
.841	.094	.018				.256	.300	6	-880	.280
20 2011755	• 9 677					179	186	2	640	170
00.07	TAL.	13	+3115031	CHTR		.408	.478	1	.920	.110
						. 583	.685		.420	.036
•						.788	.000		.229	+025
						20 30UA	RE= 11.16Z			
						PLUS POSSIB	LE SYSTEMAT	IC ERROR O	F +- 6	PER CENT
						FOLEY	PRL	· 11	425(19	63) CNTR
										.,
				BEAR RUMENTU		024/6				
			•	MOM TRANSF	SIGMA (MILLI	+- DSIGMA BARNS/(GEV/C	1**21			
				-130	23.430	.770				
				.150	18.400	.650				
				.190	12.440	.490				
				.220	7.150	.320				
				.300	5.360	- 220				
				.380	2.960	.160				
				.420	2.100	-140				
				.500	1.280	.110				
				.540	.815	.091				
				.650	.370	.038				
				.750	.178	.026				
				.950	.034	.011				
				1.100	.020	.006				
				1.500	.012	.005				
				2.000	.004	.002				

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20 SOUARE= 10.787 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7PER CENT HARTING NC 38 60(1965) SPRK

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MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)++2

BEAN NOMEN	ITUM=14.800 GEV/	c	BEAM MOMENTS	JM=14.930 GEV	/C
NO	IN TR		MOM TRANSF	SIGMA +-	DSIGNA
MININUM (0 .061 .110 .147 .203 .270 .274 .346	NAX[HUM). IEXTRAPOLAT .071 .130 .173 .234 .318 .322 .406	SIGHA +- DSIGHA (AILLIBARNS/(GEV/C)++2) ED PDINT (103.200+4.800) 49,400 1.900 35,200 1.300 20,00 1.300 20,00 1.300 20,500 1.300 5,830 .250 5,830 .470 2,930 .150	.216 .284 .360 .444 .534 .631 .736 20 SQUARI	(HILLIBAF 11.400 6.670 3.400 1.752 .886 402 .189 5- 13.155	105/165/2()**2) -230 -240 -160 -064 -039 -024 -016
.355 .431 .519 .615 .719 20 SQUA PLUS POSS18	.417 .505 .609 .721 .843 RE= 13.034 See Systematic Ei	2.400 .280 1.489 .089 .663 .050 .317 .030 .128 .017 RROR OF +- 6PER CENT	FOLEY	PRL	15 4511965) CNTR
FULEY	PRL	11 425(1963) CNIR			
BEAM MONENTUM	=15.500 GEV/C		864M MON		GEV/C
MOM TRANSF	SIGMA +- DSIG (MILLIBARNS/()	MA GEV/C)**2)		NON TR	
.019 .085 .196 .364 .564	15.735 13.6 34.893 5.2 12.393 1.8 2.938 .4 .505 .10	32 32 59 70 06	MINIAUA - 039 - 077	HAXIMUM 0. JEXTRAP .045	A SIGNA +- USIGNA (MILLIBARNS/(GEV/C)+2) OLATED PDINT (92-200+-5-500) 56-000 4-300 (22-00 3-800
20 JOUARC-	13.007	•	.130	.152	24.420 .980
DIDOENS	PRL	9 108(1962) CNTR	.259 .283 .350 .362 .449 .452 .542 .642	.303 .333 .410 .424 .527 .530 .636 .754	7.030 .430 5.060 .220 2.810 .260 2.430 .130 1.114 .072 1.090 .170 .471 .038 .214 .023
BEAM MOMENTUM	■18.400 GEV/C		PLUS POSSI	BLE SYSTEMAT	IC ERROR OF +- 6PER CENT
NOM TRANSF .190 .200 .260 .300 .340 .380 .420 .500 .f(9 .500 .f(9 .500	SIGHA +- OSIG (HILLIBARNS/(C 12.510 - 84 10.260 - 64 7.350 - 4 4.800 - 22 2.360 - 1 1.710 - 1 1.100 - 1 1.106 - 10 4.07 - 0 387 - 0 2.77 - 0	NA 50 GV/C ++2 50 70 70 70 70 70 70 70 70 70 70 70 70 70	FOLEY	PRL	11 425(1963) CNTR
.750	.092 .0	18	BEAM MOMENTU	IM=18.600 GEV	/C
.950 1.100 1.300 1.500 2.000 3.600 20 SQUARE=	.050 .01 .013 .00 .005 .00 .000 .00 .000 .00 .000 .00	14 05 03 02 00 00 00 00 00 00 00	MOM TRANSF .U31 .134 .289 .521 .194	SIGNA +- (MILLIBAR 19.139 24.991 4.771 .606 .095	USIGMA NS/IGEV/C)**21 17-*11 4.998 .954 .145 .020
HARTING	NC	38 60(1965) SPRK	0 IDDENS	001	9 108/19621 CNTR
			0100243		

BEAM MOMENTUM=19.200 GEV/C

MOM	TRAN SF	S E GMA	+- DSIGMA
		INICRO	BARNS/(GEV/C)**2)
	-058	48500.000	2910.000
	.147	21400-000	1284.000
	, 7 79	10300.000	618-000
	.329	4170.000	250.200
	.446	1600.000	96.000
	• 5 1 1	965.000	57.900
	.581	546.000	32.760
	+654	295.000	17.700
	100	147.000	0.740
	-813	76.000	4.560
	+899	31.000	2.220
	• 989	18.200	1.092
	1.082	10.300	.618
	1.180	6.160	.370
	1.281	4.320	.259
	1.385	3.850	. 231
	1.494	3.400	.204
	1.606	3.060	.184
	1.721	2.330	.140
	1.840	2.270	-136
	1.962	1.940	.116
	2.088	1.600	.096
	2.216	1.250	.075
	2.348	.947	.057
	2.483	.685	.041
	2.620	.604	.036
	2.761	.517	-031
	3.050	- 257	-015
	3.349	. 159	.010
	3.658	.085	.005
	3.976	.054	.003
	4.302	-032	.002
	4.636	.016	.001
	4.776	.011	.001
	5.323	- 009	.000
	5.676	.005	.000
	0.033	.004	.000

20 SQUARE= 17.156 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 8PER CENT ALLABY 288 67(1968) CNTR

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Fig. 2 (continued)

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (Gev/c)**2

BEAM MON	IENTUM=19.6	00 GEV/C			BEAM MOMENTU	M=19.840 G	EV/C		
	MOM TR				MOM TRANSF	SIGMA + (MILLIB)	- DSIGMA ARNS/(GEV/C]**2]	
MINTMUM	ΜΔΧΤ	MELM	SIGMA +- I	SIGNA	.230	9.290	.280		
n in in inon	100.1		JUSTI LIDADI	103400M	200	5 140	. 190		
	10 1577		901NT (04	5004-7 0001	- 5 4 A - 7 0 7	2 440	120		
	10. 7221	KAPULATEU	PUINI (90.	500+-7.0001	• 3 8 3	2.040	.120		
.106	•	124	29.400	1.200	• • / •	1.209	.070		
•177	•	207	14.080	•410	• 569	• 552	.042		
.256	•	300	6.390	.260	.674	.291	.030		
.278	•	326	5.010	.240	.787	.100	.018		
• 353	• '	415	2.260	.130					
.357	•	419	2.400	.130	20 SQUARE	= 17.755			
. 444	- 1	522	1.089	.076					
476		558	.710	.073		0.01	15	45(1965)	
674	•	430	446	.0.5	FULLI	T AL			
• 220	•	550	• 405	.043					
. 637	•	141	.150	.023					
. 746	• •	876	.113	.018					
20 SC PLUS POSS FOLEY	DUARE= 17.5 IBLE SYSTE	31 Matic Erro	R DF +- 6PE 11 425(1963	R CENT					
10227			11 4251170.						
BEAM MOMENT	FUM=21.120	GEV/C			BEAM MOMENTU	M=21.400 G	EV/C		
MOM TRANSF	SIGMA	+- DSIGMA			MOM TRANSE	SIGMA +	- DSIGMA		
	(MICRO	BARNS/(GEV	/C)**2)			(MILLIB	ARNS/(GEV/C]**2)	
070	20200 000	1572 000			.032	59 505	17 494		
.070	39300.000	1912.000			.0.52	14 050	12.470		
•178	14400.000	576.000			.156	14.059	2.531		
.277	6000.000	240.000			.365	2.092	• 398		
. 398	2150.000	86.000			.681	.170	.034		
.539	690.000	27.600			1.047	.015	.005		
• 337	212 000	9 480							
./01	212.000	3 544			20 5011485	- 10 210			
•790	88,600	3.344			ZU SUUAKE	= 19.218			
.883	40.100	1.604							
.982	18.200	.728			DIDDENS	PRL	91	08(1962)	CNTR
L.uá9	10.100								
1 1 0 2	5.230	. 209							
1 4 1 7 4	6 060	147							
1.300	4.040	102							
1.423	3.120	.125							
1.544	2.740	_110							
1.670	2.510	.100							
1.800	5.110	- 984							
1 024	1 760	.070							
1.934	1.700	•010							
2Q SQUA PLUS POSSIB	RE= 18.955 Le systemat	IC ERROR O)F +- 8PER	CENT					
ALLABY	PL	288	67(1968)	CNTR					
BEAM MOMEN	TUM=21.880	GEV/L			BEAM MOMENTU	IM=24.630 G	EV/C		
MOM TRANSF	SIGMA (HILLI	+- DSIGMA BARNS/(GEV	/()**2)		MOM TRANSF	SIGMA + (MILLIB	- DSIGMA ARNS/(GEV/(.)##2)	
.235	8.980	.280			.254	7.560	.340		
309	4.820	.180			.334	3.740	.210		
302	2.250	.100			-474	1.712	.122		
• 3 7 2	1 100	043			575	034	074		
.485	1.100	.005			• 223	.024	•014		
.583	.494	.038			.632	.203	.036		
.691	.209	•024			.748	.110	.028		
, 807	.096	.016							
					ZO SQUARE	= 22.246			
20 50114	RE= 19.668								
					FOLEY	PRL	15	45(1965)	CNTR
FOLEY	PRL	15	45(1965)	CNTR	,		•-		

BEAM, MUMENTUM#26.200 GEV/C

MOM	TRANSF	SIGMA +	- DSIGMA		
		(MILLIBARNS/(GEV/C)**2			
	.064	50.069	11.015		
	.267	5.934	1.246		
	.597	.328	.072		
	1.040	.020	.006		

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20 SQUARE= 23.718

DIDDENS PRL	· 9	108(1962)	CNTR
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Fits to the pp elastic scattering data.

P _{beam} (GeV/c)	dø/dt [mb/(Ge	t = 0] V/c) ²	SLOF (GeV	РЕ /с) ⁻²	x²/N
.849	87.47	\$ 5.07	.35	£ .32	1.90
. 94 9	78.27	4.98	.66	. 31	.64
1.049	62.87	3.93	. 46	. 31	1.05
1.149	56.38	3.77	. 87	.35	1.25
1.249	78.43	6.40	3.01	.46	· .03
1.349	105.92	7.88	4.10	.43	2.50
1.450	126.86	10.44	4.98	.50	.04
1.549	147.51	13.84	6.27	.64	. 34
4.000	86.94	8.07	6.59	.67	- 40
5.520	86.53	4.90	8.05	. 39	1.22
6.600	89.52	5.06	7.68	.39	.60
6.800	102.07	6.87	9.05	.24	. 62
6.920	83.94	4.72	7.58	.38	2.21
8.100	74.90	4.14	7.20	.34	.84
8.500	62.88	5.16	7.45	. 21	1.60
8.800	101.10	6.88	8.91	.23	1.27
10.800	98.50	6.55	9.11	.18	1.89
10,100	40 72	6.00	8.65	.25	1+42
12.800	98.52	7.05	9.22	. 21	3.74
14.800	98.73	7.20	9.62	. 22	2.52
16.700	85.54	7.29	8.96	. 34	.54
19.600	85.56	8.00	9.36	.35	- 14
21.120	73.30	7.03	9.07	.27	- 26

Table I. Fits reported by authors to their own pp elastic scattering data. For our fits to these data see Fig. 3.

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P _{beam} (GeV/c)	t m	in t max	FORMULA				PA	RAMETE	RS				Referenc	es
-80			Y=4+EXP[-BT+CT++2]		87.10	5.10	8	96 1	. 55	c	2.91 5	: 1.81	RYAN	69
.90			Y=A+EXP(-BT+CT++2)		78.80	4.70	в	-1.17	. 57	с	1.89	1.69	RYAN	69
1.00			Y=4*EXP[-8T+CT**2]		64.70	3.60	8	-1.00	. 52	c	.72	1.31	RYAN	69
1-10			Y=4+EXP[-BT+CT++2]	۸	60.40	3.40	8	-2.01	.47	с	2.10	.99	RYAN	69
1.20			¥=4*EXP(-81+C1**2)	۸	79.60	4.70	8	-4.38	. 44	с	3.96	. 72	RYAN	69
1.30			T#A*EXP[-BT+CT++2]	۵	107.40	5.00	в	-3.16	. 11	¢	4.00		BYAN	A 9
1.40			Y-4+EXP[-01+CT++2]		116.10	7.10	8	-5.45	. 44	c.	2.04	. 79	RYAN	69
1.50			Y=A+EXP[-BT+CT++2]	A	126.20	9.60	в	-6.51	. 34	с	3.56	.39	RYAN	69
1.60			Y=A+EXP[-BT+CT++2]	۰ م	137.00	11.70	в	-7.20	.49	c	3.80	.57	RYAN	69
1.70			Y=4+EXP[-8T+CT++2]	۸	140.90	15.70	в	~7.65	. 59	c	4.39	. 72	RYAN	69
4.00	.02	.40	X=A*EX*(8[T])	A	91.00	5.00	8	6.70	. 50				COLETTI	67
5.52	.03	.75	X=EXP(4+BET)	A	4.39	.04	8	7.17	.18				ALEXANDER	67
5.52	.03	. 75	X=EXP(A+B[T]+C[T++2])	A	4.45	.05	8	7.96	.41	с	1.50	. 75	ALEXANDER	67
6-60	-06	.60	Y =EXP(A+B+T)	A	4.49	.09	8	-7.71	. 24				COLTON	68
6.60	. 06	.60	¥ =EXP[A+BT+CT++2]	۸	4.54	. 11	8	-8.25	.92	с	1.05	1.72	COLTON	68
6.92	.04	.50	X=A+EXP(B[T]+C[T++2])-	Å	94.00	2.50	ø	9.83	.15	ι	3.68	.80	ALEXANUER	88
0.72	.U4	112	H-AMERPIBET33		00 10	6 70		7 TA	50				AT FXANDER	68
8.10	.06	.50	Y =A*EXP[LAMBDA*T]	A	80.00	3.00	LAME	0 7.50	. 20				GINESTET	69
8.50	.13	50	X=EXP[A+BT]	۸	4.20	.03	8	7.75	.11				HAR T1 NG	65
8.50	.13	. 95	X#EXP[A+BT+CT##2]	۸	4.24	. 04	в	8.16	. 28	с	- 84	.36	HARTING	65
8.50	.13	1.05	¥#FXPf &+AT+CT++21	A	4.27	.04	8	8.35	. 25	с	i.i4	.31	HARTING	65
10.94			A = EXPIA + DETS + C(T+12)		1.25	.09	a	0.66	.47	c	1 70	54	FULEY	••
12.40	.13	.95	X=EXP[A+BT+CT++2]		4.26	.05	8	9.05	. 34	с	1.41	. 44	HARTING	65
12.40	.13	.50	X=EXP(A+BT)	۸	4.15	.03	в	8.19	.13				HARTING	65
12.40	.13	2.00	X=EXP[A+BT+CT++2]	۸	4.35	. 03	8	9.71	.16	с	2.33	.14	HARTING	65
13.00	.01	.12	Y=EXP[-8+485(T)]	8	9.61	. 35							BEZNOGIKH	69
14.93			X = EXP(A + B[T] + C[T++2])	۸	4.32	. 10	8	8.89	. 52	с	.98	- 62	FOLEY	65
15.71	.01	.12	Y=EXP[-844851111	в	9.98	. 12							00010011414	6 T
18.40	.19	3.60	x=ExP[&+BT+CT++2]	٨	4.42	.01	в	4.46	. 21	ι	1.10	. 10	ITAŘ T ENÚ	63
18.40	.19	.50	X=EXPLA+811	A	4.18	. 08	Ð	0.50	. 24				HAPTING	65
18.40	- 19	.95	X=EXP[A+BT+CT++2]	۸	4.39	.13	в	9.79	.63	c	1.53	- 69	HARTING	65
18.81	. 01	.12	Y=EXP(-B+ABS(T))	в	10.46	. 12							BEZNOGIKH	69
19.84			X = EXP(A + B(T) + C(T++2))	۸	4.19	. 15	8	8.68	. 79	c	. 70	. 92	FOLEY	65
21-82	.01	.12	Y=EXP(-8+A85(T))	в	10.58	. 12							BEZNOGIKH	69
21.88			X = EXP(A + B[T] + C[T++2])	۵	4.38	. 16	в	9.63	.78	c	1.56	. 89	FOLEY	65
25.50			V=A4EYDFR&T1	R	9.00	• 30							BREITENLOH	63
24.63			¥ = EXPLA + BET1 + CET++21)	A	4.09	. 30	- B	7.97	1.56	C	. 82	1.83	FOLEY	65
24.72	.01	.12	Y=EXP[-8+48\$(T]]	8	10.59	.11							BEZNOGIKH	69
27.62	.01	.12	Y=E XP[-8*AB\$[1]]	6	10.77	.11							BEZNOGIKH	69
28-50			Y =EXP[A-8+T+C+T++2]	A	7.34	• 11	8	- 10.91	1.05	с	4.18	2.11	CONNOLLY	67
30.62	.01	.12	Y=EXP[-8+AB5[1]]	в	10.68	.11							BEZNOGIKH	69
33.53	.01	-12	Y=EXP[-8+A85(T)]	в	10.66	.11						•	BEZNOGIKH	69
36.43	.01	-12	Y=EXP[-B+AB5(T]]	в	10.77	.11							BEZNUGINM	87
39.53	.01	-12	¥*EXP1-8+485(T1)	в	10.89	. 10							BEZNOGIKH	69
41-63	.01	.12	Y=EXP(-8+485(T))	в	10.87	. 14							BEZNDG1KH	69
45.13	- 01	.12	Y=EXP(-8+A85(T))	в	10.95	. 10							BEZNOGIKH	69
46.93	.01	-12	Y=EXP[-8+485(T)]	ė	11.19	. 11						•	BEZNOGIKH	69
52.13	. 01	.12	Y=EXP(-8+ABS(T)]	в	11.31	. 11							BEZNOGIKH	69
54.33	.01	.12	Y=EXP[-8+ABS(T)]	в	11.24	- 12							BEZNOGIKH	69
57.03	.01	-12	Y=EXP[-B+ABS(T)]	8	11.16	- 10							BEZNOGIKH	69
60.23	.01	.12	Y=EXP(-B+ABS(T)]	в	11.40	- 09							BEZNOGIKH	. 69
63.53	. 01	.12	Y+E XPI-B+ABSITI	В	11.76	. 12							BEZNÓGIKH	69
66-13	. 01	.12	Y=EXP(-B+ABS(T))	в	11.52	- 12	·						BEZNOGIKH	69
69.93	.01	.12	Y=EXP(-8+A85(T))	в	11.38	• 11							BEZNOGIKH	69



Fig. 3. Coefficients from our least-squares fit of the pp elastic scattering $d\sigma/dt$ to the form $d\sigma/dt = \frac{d\sigma}{dt}\Big|_{t=0}$. e^{bt} over the interval $0.03 \le |t| \le 0.3 (\text{GeV/c})^2$. Systematic scaling errors in the data have been folded into the errors of $\frac{d\sigma}{dt}\Big|_{t=0}$. In the table χ^2/N is the chi-square of the fit divided by the number of degrees of freedom. We have tabulated and plotted values only from those distributions giving $\chi^2/N \le 5$ and a relative error in $\frac{d\sigma}{dt}\Big|_{t=0} \le 10\%$. The solid line in (a) is the optical lower limit calculated from $\sigma_{total}(pp)$, Fig. 1. The two points falling below this line (represented by \diamondsuit) are from an experiment that starts at a relatively high |t| value of ~ 0.15 (GeV/c)². The fitted values of these parameters whenever given by the authors are shown in Table I. For convenience we have plotted the Serpukov results in Fig. 3c together with ours. The vertical discontinuity between these fits and ours is not meaningful since they use a different cutoff, etc.

pp elastic $d\sigma/dt$ (large |t|)

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUM=	4.000 GE	v/c		
MOM TRANSF	SIGMA +-	DSIGMA		
	(MILLIBAN	RNS/(GEV/	C1++2)	
.480	4.900	.300		
.490	4.500	.300		
.540	3.200	.200		
.690	1.600	.100		•
1.180	.320	.100		
1.610	.188	.007		
2.230	.087	.004		
2.850	.059	.002		۰,
20 SQUARE=	2.975			
PLUS POSSIBLE S	STENATIC	ERROR OF	+- 7PE	RCENT
ANKENBRAND	PR	170 1	223(1968) CNTR

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BEAM	MOMENTUM≓	5.020	GEV/C	

MOM	TRANSF	SIGMA	+- DSEGMA	
		ENELLI	BARNS/IGEV	/C)**2)
	.730	.950	•060	
	.750	1.050	.080	
	.750	1.070	.080	
	.830	.630	•040	
	.840	.710	.050	
	1.030	.320	.030	
	1.040	.330	.020	
	1.520	.100	.010	
	1.760	.064	.005	
	1.800	.060	.003	
	2.800	.021	.001	
	3+080	•020	.991	
	3.230	.017	.000	
	1.590	.015	.001	
	3.640	.016	.000	
	3.640	.015	.001	
	3.800	.019	•002	

2Q SQUARE= 3.911 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7PER CENT

ANKENBRANU PR

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BEAM MOMENTUM= 6.070 GEV/C

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NOM TRANSE	S'EGMA +-	DSIGNA	
	(NILLIBA	RNS/(GEV/C)**	•2)
1.090	.200	.020	
1.230	.123	.009	
1.510	.057	.003	
1.830	.029	.002	
2.180	,017	.001	
2.180	.017	. 002	
2.189	.017	• 002	
2.510	.012	-001	
2.850	.009	.001	
3.320	.006	+000	
3.900	• 005	•000	
4.440	.003	.000	
4.660	.úů3	.000	
4.000	.003	•000	
4.670	.003	-000	
20 SQUARE=	4.883		
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	7PER CENT

170 1223(1968)

CNTR

BEAM MOMENTUM= 7.100 GEV/C

	MOM TR		
MINIMUM	HAXIMUM	SIGMA +-	DSIGMA
		(MICROBAR	NS/(GEV/C)**2)
2.902	2.937	4.401	.176
3.080	3.116	3.766	.151
3.353	3.390	2.733	.109
3.633	3.671	2.152	.086
3.919	3.957	1.666	.067
4.308	4.348	1.263	.051
4.805	4.845	.894	.036
5,819	5.860	.673	.027
20 50	UAPE= 5.839		
PLUS POS	IDLE SYSTEMATIC	ERROR OF - 70	ER CENT
ALLABY	CERN	68-7 580(196	A) CNTR

BEAM MOMENTUM= 7.120 GEV/C

ANKENBRAND

PR

 MOM
 TRANSF
 SIGMA
 ← DSIGMA

 (HIL, IBARNS/(GEV/C)**2)
 1.420
 .053
 .006

 1.580
 .034
 .004
 .014

 1.810
 .021
 .001
 .011

 2.370
 .006
 .001
 .014

 3.160
 .004
 .001
 .001

 4.360
 .001
 .000
 .000

 4.630
 .001
 .000
 .630

 5.670
 .001
 .000
 .000

 2Q SQUARE=
 5.858
 .001
 .000

 PLUS POSSIBLE SYSTEMATIC ERROR DF
 + 7PER CENT

 ANKENBRAND
 PR
 .170
 .1223(1968)
 CNTR

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BEAM MUMENTUM= 8.100 GEV/C

	MOM TR		
MINIMUM	MAXIMUM	SIGMA	+- DSIGNA
		(MICRO	BARNS/(GEV/C)**2)
1.562	1.500	26.728	. 669
1.803	1.835	11.239	.450
2.050	2.084	8.399	.336
2-311	2.346	5,912	.236
2.584	2.621	4.464	.179
2.868	2.906	3.081	.123
3.163	3.203	2.199	.088
3,365	3-406	1.852	.074
3.571	3.613	1.470	.059
3.888	. 3,931	1.012	.040
4.212	4.256	.721	.029
4.544	4.589	.544	.022
4.995	5.041	.349	.014
5.571	5.618	.276	-011
6.747	6.794	.184	.007
20 50	MARE= 6.770		
	TOLE CVETEMATIC	50000 OF A-	TREP CENT
LO2 6022	IDLE STATEMANIC	CANON OF T-	TER GUNT

ALLABY CERN 68-7 580(1968) CNTR

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(large It)





pp elastic $d\sigma/dt$ (large |t|)

NOMENTUM TRANSFER.BETWEEN BEAM AND SCATT BEAM . (GEV/C)**2

BEAM MOMEN	TUM= 9.200 GE	v/c		BEAM MOMEN	TUM=1
MO	N TR			MO	N TR
MINIMUM	MAXENUM	SIGMA -	- DSIGMA	MINIMUM	м
		(MICROE	ARNS/(GEV/C)**2)		
1.807	1.842	7.084	.283	2.001	
2.076	2.113	5.392	.216	2.198	
2.361	2.400	4.142	·166	2.403	
2.661	2.702	3.135	.125	2.616	
2.975	3.018	1.950	.078	2.835	
3.302	3.347	1.365	•055	3.062	
3.642	3.688	.923	.037	3.296	
3.875	3.922	.681	.027	3.536	
4.112	4.160	.496	.020	3.782	
4,477	4.526	.315	.013	4.034	
4.851	4.901	.213	.009	4.292	
5.232	5.284	.161	•006 ·	4.555	•
5.752	5.805	.117	.005	4.959	
6.416	6.469	.090	.004	5.373	
7.769	7.824	.085	.003	5.796	
			•	6.372	
20 SQUA	RE= 7.796			7.107	
PLUS POSSIB	LE SYSTEMATIC	ERROR OF +-	7PER CENT	8.607	
ALLABY	CERN	68-7 580(1	968) CNTR	20 5004	₹Ę≠ i
	•	,		01.00 000510	C CU

JM=10.100 GEV/C

MINI	MUM	MAXIMUM	SIGMA	
			IMICRO	BARNS/ (GEV/C) **2)
2.	.001	2.040	4.343	.174
2.	198	2.239	4.059	.162
2.	403	2.445	3.266	.131
2.	616	2.659	2.481	.099
2.	835	2.880	1.826	.073
3.	062	3.108	1.357	.054
3.	296	3.343	• 95 8	.038
3.	536	3.585	-719	.029
3.	782	3.832	.468	.019
4.	034	4.086	•350	.014
4.	292	4.345	• 251	.010
4.	555	4.609	.186	.007
4.	959	5.014	.123	.005
5.	373	5.429	.093	.004
5.	796	5.853	.068	.003
6.	372	6.431	.053	.002
7.	107	7.167	.044	.002
8.	607	8.667	•038	.002
2	9 SQUARE	= 8.637		
PLUS	POSSIBLE	SYSTEMATIC	ERROR OF +	7PER CENT

68-7 580(1968)

CNTR

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BEAM MOMENTUM=11.100 GEV/C

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BEAM MOMENTUM=12.100 GEV/C

CERN

ALLABY

MO	M TR			MOM	4 TR		
MINIMUM	MAXIMUM	SIGMA +- (MICROBA	DSIGMA RNS/(GEV/C)**2	MINIMUM	MAXIMUM	SIGMA +- (NICROBA	- DSIGMA ARNS/(GEV/C)**2)
2.218	2.261	3.368	•135	2.435	2.482	2.105	.084
2.517	3.604	2.170	.087	2.798	2.848	1.166	.047
2.899	2.947	1.319	.053	3.182	3.235	.624	.025
3.267	3.317	.783	.031	3.586	3.641	.331	.013
3.652	3.705	.437	.017	4.009	4.067	.177	.007
4.054	4.109	.236	.009	4.450	4.510	.096	.004
4.471	4.528	:140	. +006	4.908	4.970	.055	.002
4.757	4.815	.103	.004	5.222	5.285	.043	.002
5.048	5.107	.012	.003	5.54Z	5.000	+034	.001
5.496	5.557	.051	.002	6.033	6.100	.021	.001
5.955	6.017	.038	.002	6.537	6.605	.018	.001
6.424	6.487	.031	.001	7.051	7.121	.015	.001
7.062	7.126	.025	.001	7.752	7.823	.011	.001
7.876	7.942	.022	.001	8.646	8.718	.010	.001
9.538	9.605	.020	-001	10.470	10.543	.010	.001
29 SQUA	RE= 9.571			24 SUUAK	E= 10.507		
PLUS POSSIB	LE SYSTEMATIC E	RROR OF +- 7	PER CENT	PLUS POSSIBL	E SYSTEMATIC E	RROR DF +- 7	PER CENT
ALLABY	CERN	68-7 580(19	68) CNTR	ALLABY	CERN	68-7 580(19	68) CNTR



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-MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUM=16.900 GEV/C BEAM MOMENTUM=14.250 GEV/C SIGMA +- DSIGMA (NANDBARNS/(GEV/C)**2) .901 .017 .708 .025 .641 .021 .540 .017 .461 .013 .410 .017 .385 .013 .364 .017 .335 .021 SIGMA +- DSIGMA (NANDBARNS/(GEV/C)**2) 4.070 .125 3.147 .100 2.344 .075 MOM TRANSE MOM TRANSE 9.139 7.627 9.139 9.870 10.365 11.118 11.626 12.396 12.913 8.443 12.519 1.777 .050 . 2Q SQUARE= 12.519 PLUS POSSIBLE SYSTEMATIC ERROR OF →- 7PER CENT 13.693 258 156(1967) CNTR PL ALLABY 2Q SQUARE= 15.001 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7PER CENT

ALLABY	PL	258	156(1967)	CNTR

BEAM MOMENTUM=21.300 GEV/C

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BEAM MOMENTUM=19.300 GEV/C

PL

ALLABY

MOM	TRANSF	SIGMA ← {NANOBAR	DSIGMA NS/(GEV/C)++2)
	9.688	.263	.011
	11.068	.153	.010
	12.785	.106	.008
	17.249	.072	.007

20 30UARE™ 17.249 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7PER CENT

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258 156(1967)

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CNTR

мом	TRAN SF	SIGMA +-	DSIGMA
		(NANOBAK	N\$/(GEV/C)**2)
	11.345	.076	.006
	12.583	.047	.004
	14.174	.035	.003
	18.123	• 02 1	.003
	24 SQUARE	≞ 19.124	
PLUS	POSSIBLE	SYSTĘMAŢĮÇ	ERROR OF +- 7PER CENT
ALL	ABY	PL	258 156(1967) CNTR

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Fig. 4 (continued)

pp elastic $d\sigma/d\omega$ at $\theta_{c.m.} = 90^{\circ}$

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BEAM MOMENTUM

MINEMUM	MAXIMUM	SIGMA +- DS	IGMA
37)	V/C)	(MICROBARNS	/STERADIAN)
4.975	5.025	8.51000	.24679
5.095	5.105	. 7.90000	.26070
5.195	5.205	7.09000	•21979
5.295	5.305	6.49000	.23364
5.395	5.405	5.53000	.17143
5.495	5.505	4.90000	.16660
5,595	5.605	4.47000	.13857
5.695	5.705	3.72000	.12276
5.795	5.805	3.37000	.11121
5,895	5.905	2.74000	.09590
5.995	6.005	2.44000	•07564
6.095	6.105	2.19000	.08103
6.195	6.205	1.83000	.06771
6.395	6.405	1.50000	.05550
6.595	6.605	1.07000	.05029
6.795	6.805	. 79600	.03741
6.995	7.005	.64500	.07644
7.195	7.205	• 51500	.02060
7.395	7.405	.38600	.01853
7.595	7.605	.30500	.01647
7.795	7.805	.25300	.01138
7.995	8.005	.21700	.00976
8.095	8.105	.16900	.00659
8.195	8.205	.17200	.00757
8.295	8.305	.15400	-00585
8.395	8,405	.15300	.00704
8.595	8.605	.12700	.00584
8.795	8,805	.10300	.00494
8.995	9.005	.08090	.00372
9,195	9.205	.07800	.00335
9.395	9.405	•06760	.00358
9.595	9.605	.05890	.00289
9.795	9.805	.05360	.00252
9.995	10.005	.04680	.00229
10.195	10.205	+04400	+00211
10.395	10.405	.03860	-00181
10.595	10.605	.03560	.00171
10.795	10.805	.03030	.00148
10.995	11.005	.02840	.00156
11.195	11.205	•02550	.00100
11.395	11.405	.02020	.00109
11.595	11.605	.01900	•00099
11.795	11.805	.01530	.00083
11.995	12.005	•01430	.00077
12.195	12.205	.01180	.00063
12.395	12.405	.01160	.00063
12.595	12.605	.00953	■00060
12.795	12,805	,00867	.00049
12.995	13.005	.00739	.00044
13.195	13.205	.00722	.00051
13.395	13.405	.00525	•00030

2Q SOUARE= 83.567 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2PER CENT -

AKERLOF	PR	159	1138(1967)	CNTR

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pp elastic $d\sigma/d\omega$ at $\theta_{c.m.}=90^{\circ}$



Fig. 5. pp elastic $d\sigma/d\omega$ at $\theta_{c.m.} = 90 \text{ deg from P}_{\text{beam}} = 5 \text{ to } 14 \text{ GeV/c.}$





Note the fine oscillatory pat-The lines of fixed t are also indicated (from Allaby et al., 1968, Ref. 143). Fig. 7. The pp differential cross section in $d\sigma/dt$ versus sin θ . tern.

elastic $d\sigma/d\omega$ (very forward angles) pp

DISTRIBUTION IN THE ANGLE OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE LAB SYSTEM

BEAM MOMENTUN	4= 1.290	GEV/C			BEAM MOMENTL	JM= 1.390	GEV/C		
THETA(DEG)	S I GMA	← DSIGMA			THE TA(DEG)	SEGNA	+- DSIGMA		
	EMELL	IBARNS/STER	ADIAN }			(MILL	IBARNS/STEP	ADIAN)	
1.175	892.000	100.000			1.003	1039.000	135.000		
1.289	697.000	85.000			1.117	535.000	73.000		
1.404	608.000	73.000			1.232	524.000	40.000		
1.518	306.000	60.000			1.346	430.000	31.000		
1.633	292.000	33.000			1.461	384.000	28.000		
1.748	263.000	30.000			1.576	324.000	24.000		
1.862	244.000	21.000			i.ù90	207:000	££.688		
1.977	214.000	24.000			1.805	212.000	20.000		
2.091	162.000	22.000			1.919	175.000	19.000		
2.206	164.000	20.000			2.034	130.000	17.000		
2.320	167.000	19.000			2.149	146.000	16.000		
2.435	154.000	18.000	•		2.263	129.000	14.000		
2.550	142.000	17.000			2.378	75.000	13.000		
2.664	163.000	17.000			2.492	106.000	13.000		
2.779	136.000	16.000			2.607	99.000	13.000		
2.893	132.000	16.000			2.722	121.000	13.000		
3.008	137.000	15.000			2.836	94.000	12.000		
3.237	132.000	20.000			2.951	95.000	12.000	•	
3.352	97.000	20.000			3.065	99.000	12.000		
3.466	101.000	20.000			3.180	94.000	11-000		
3,581	94 - 000	20.000			3.295	97.000	11.000		
3.696	81.000	19.000			3.409	71.000	11.000		
3.810	69.000	18.000			3.524	81.000	11.000	•	
3.925	78.000	16.000			3.638	96.000	11.000		
4.039	71.000	16.000			3.753	80.000	10.000		
4.154	59.000	14.000			3.867	73.000	9.000		
					3.982	62.000	9.000		
20 SQUARE=	• • • • • • • • • • • • • • • • • • • •				4.097	56.000	7.000		
DUT TON	PL	268	679(1968)	SPRK	20 SQUARE	= .693			
					DUTTON.	PL	26B	679(1968)	SPRK

BEAM MOMENTUM= 1.540 GEV/C

SIGMA +- USIGMA (MILLIBARNS/STERADIAN) 1014-000 243-000 590-000 76-000 532-000 58-000 THETALDEG) .945 1.060 1.175 1.289 1.404 1.518 1.633 1.748 1.862 1.977 2.091 2.206 58.000 36.000 31.000 27.000 24.000 22.000 337.000 326.000 278.000 228.000 228.000 220.000 147.000 183.000 146.000 192.000 136.000 135.000 19.000 21.000 20.000 18.000 18.000 17.000 2.208 2.320 2.435 2.550 2.664 2.779 17.000 16.000 15.000 14.000 14.000 14.000 14.000 14.000 13.000 135.000 144.000 144.000 101.000 2.893 3.008 3.123 3.237 3.352 3.466 3.581 3.696 3.810 3.925 4.039 4.154 128.000 91.000 126.000 . 75.000 123.000 13.000 12.000 12.000 11.000 106.000 105.000 96.000 86.000 10.000 2Q SQUARE=

.812

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DUTTON

BEAM MOMENTUM= 1.540 GEV/C

	;)						
MINIMU	и н	NUMIXAN	S 1 (M	GMA	+- 1 1848	DSIGM NS/ST	A ERADIAN}
1.00	3	1.117	533.	000		53.00	0
1.11	7	1.232	472.	000	4	47.00	0
1.23	12	1.346	431.	000	4	41.00	0
1.34	6	1.461	321.	000	3	34.000	υ
1.44	1	1.576	259.	000		30.00	0
1.57	16	1.690	219.	000		27.00	0
1.69	90	1.805	176.	000		25.000	0
180	15	1.919	144,	000		22.00	0
1.91	9	2.034	176.	000	:	22.00	0
2.02	4	2-149	100.	000	1	20.00	0
2.14	9	2.263	122.	000	:	14-00	0
2.20	53	2.378	114.	000		19-00	0
2.37	78	2.492	127.	000		19.00	0
2.49	92	2.607	114.	000		16.00	0
2.60)7	2.722	129.	000		17.00	0
2.72	22	2.836	111.	000		17.00	0
29	SQUARE=	.812					
DUTTO	1	PL	258	245	196	7)	SPRK

BEAM MOMENTUM= 1.690 GEV/C

SPRK

THETA(DEG)

268 679(1968)

MENIMUM	MAXIMUM	SIGMA +-	DSIGMA
		(MILLIBA	RNS/STERADIAN)
1.060	1.1/5	372.000	50.000
1.289	1.404	253.000	39.000
1.518	1.633	194.000	32.000
1.748	1.862	142.000	26.000
1.977	2.091	137.000	23.000
2.206	2.320	121.000	20.000
2.435	2.550	142.000	19.000
2.664	2.779	154.000	19.000
2.893	3.008	133.000	17.000
2Q SQUARE=	.933		
DUTTON	PL	258 245(19	167) SPRK

54





Fig. 8. pp elastic differential cross sections at very forward angles. The main purpose of such experiments (in the Coulomb-nuclear interference region) is to accurately measure parameters related to the forward nuclear elastic amplitudes.

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pp Re $f^{el}(0)/Im f^{el}(0)$

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CNTR CNTR EMUL SPRK

ŠPRK SPRK SPRK

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P _{beam} (GeV/c)	E _{c.m.} (GeV)	α	SOL	Reference	es
1.29	2.18	76	.13	DUTTON	68
1.39	2.22	58	.06	DUTTON	68
1.54	2.27	30	.09	DUTTON	67
1.54	2.27	32	.07	DUTTON	68
1.69	2.32	50	•15	DUTTON	67
1.69	2.32	.10	.16	DUTTON	67
1.70	2.32	007	.07	DOWELL	64
2.78	2.70	17	•08	KIRILLOVA	64
7.85 ± .02	4.07	29	.03	TAYLUR	65
10,11	4.56	43	•04	BELLETTIN	I 65
10.90	4.72	25	.07	KIKILLUVA	64
19.33	6.17	33	.03	BELLETTIN	I 65
24.00	6.84	19	•09	LOHRMANN	64
26.42	7.17	32	.03	BELLETTIN	I 65
REFERI	ENCES				
1 DOWELL	64	PL		12 252	
2 KIRILLO	VA 64	•••PL		13 93	
3 LOHRMANI	N 64.	•••PL		13 78	
4 BELLETT	INI 65	PL		14 164	
5 TAYLOR	65	•••PL		14 54	
6 DUTTON	67.	•••PL		25B 245	
7 DUTTON	68	•••PL		26B 679	

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Fig. 9. Ratio of real to imaginary parts of the pp forward nuclear elastic scattering amplitude. The smooth curve is the dispersion relation calculation by Söding (see text).

DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAM MOMENTUN= .823 GEV/C

SEAM MUMENTUM= .850 GEV/C

COSC	THETAI			COS	(HETA)		
MINIMUM	MAXIMUM	POLARIZ+	OPQL	WĮŅĮMŪM	MAXIMUM	PULARIZ	-DPOL
- 04 7	.172	.035	.008	-,201	167	094	.027
. 124	244	.117	.007	131	096	054	.024
. 342	.460	.217	.008	063	028	008	.025
413	- 512	.276	.007	-002	.037	.016	.027
- 605	.677	- 362	.011	- 065	.099	.163	.035
641	.713	.374	.007	.247	.281	.187	.023
. 809	.855	.402	.025	- 302	.335	.165	.023
				.357	.389	.191	.024
20 50114	RF= .291			- 410	.442	256	.027
PLUS POSSIB	LE SYSTEMATIC EF	ROR OF +- 3	PER CENT	-460	. 491	.255	.020
205 00010				-509	.539	.317	.022
CHENG	PR .	163 1470(19	67) CNTR	.555	.584	. 324	.025
			••••	. 599	.627	.349	.031
	• * •			.641	.668	. 389	.045
				20 SOUA	RE= .308		
				PLUS POSSIBI	E SYSTEMATIC	ERROR OF +- 6	PER CENT
				BETZ	PR	148 1289(19	966) CNTR
BEAM MOMEN	TUM≖ .954 GEV/C			BEAM MOMEN	TUM= 1.090 GEV	7/0	
cosi	THE TA)			COSt	THETA)		
MINIMUM	MAXIMUM	POLARIZ+	-OPOL	MINIMUM	MAXIMUM	POLARIZ	+-DPOL
- 066	.194	.084	.009	. 082	.203	.113	.016
-103	.223	.105	.008	- 089	.213	.107	.015
. 360	.477	.272	.010	.376	.480	.313	.025
. 394	.497	.275	.008	.379	. 492	.270	.010
- 621	.714	.419	.011	.618	.700	.452	.014
631	.711	.419	.008	.636	.728	.461	.018
1000	.053	.442	.014	.799	. 911	.510	.059
				.809	.854	.490	.011
20 SQUA	RE= .375						
PLUS POSSIB	LE SYSTEMATIC ER	ROR OF +- 3	PER CENT	20 5004	RE= .469		
	 	142 1470410	47) ČNŤO	PLUS PUSSIB	LE SYSTEMATIC	ERRUR UF 🕶	SPER CENT
CHENG	PK	103 14/0(19	OFF CNIK	CHENG	PR	163 1470(1	967) CNTR

BEAM MOMENTUM= 1.090 GEV/C

созатн	FTAL	POLARIZ	-0201
-	.063	070	.005
-	.007	031	.013
	.049	.015	.016
	.110	.060	.010
	.163	.094	.005
	.177	.095	•009
	.225	.087	-019
	.242	.125	.013
	.286	.141	.017
	.302	.190	.020
	.365	.230	.020
	.426	.260	.020
	.447	.295	•020
	.485	.300	.020
	.500	. 330 .	.020
	.542	.340	.032
	.559	.345	.022
	.610	.435	.040
	.620	.375	.022
	.667	.454	.030
	.674	.420	.032
	.722	.490	.034
	.729	.430	.022
	.771	.440	•054
	.823	.490	.035
20	SQUARE=	.469	

BEAM	MOMENTUM=	1.213	GEV/C			
COSCI	[HETA]	POLARI	IZ+-DPOL			
	240	235	•()14		
	105	084	•0	11		
	021	018	•0	010		
	.037	•040	•0	11		
	.106	.106	•••	11		
	.179	.160	•(13		
	.249	.231	.0	13		
	.391	.297	•0	15		
	.456	.380	•(20		
	.585	.425	• •	22		
	.645	.459	•0	20		
	.702	.488	• (25		
	.755	.488	•0	126		
	.804	•526	• (27		
	.848	.473	• 1	.17		
	•921	•445	•0	74		
20	SQUARE=	• 558				
COIGN	NET	NC	4	3A	708(1966)	CNTR

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COZZIKA PR 164 1

164 1672(1967) CNTR



Fig. 10. Polarization in ppelastic scattering. Whenever a distribution was given in $\theta_{c.m.}$ or t, we transfored it to $\cos(\theta_{c.m.})$. Due to the indistinguishability of the protons, the polarization is antisymmetric about $\theta_{c.m.} = 90$ deg.

59

Polarization in pp elastic scattering

DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

				COCLEMETAN		
ços(THETAI			COSCINEIAI	PULARIZ	+-DPUL
INTRUM	MAXIMUM	POLARIZ+	-DPOL	.007	006	.020
				•068	.029	.015
.065	+184	.114	.025	•129	.122	.010
.108	.232	.168	.010	-143	.160	.019
358	.466	.361	.038	•257	.210	.020
. 396	.508	.399	.019	.276	.290	.070
.606	•691	.484	.010	•319	.265	.020
. 647	.737	.516	.010	.337	.320	.019
.809	.839	.595	.035	•384	.345	.020
.808	.856	.513	.010	-400	.380	.018
	-,			.466	.400	.036
20 5004	RE= .563			• 52 4	.465	.025
US POSSIB	E SYSTEMATIC	ERROR OF +- 3	PER CENT	• 540	.410	.025
05 105510				•585	.500	.024
HENG	PR	163 1470(19	67) CNTR	•600	.455	.024
				.628	.410	.045
				643	500	023
				• • • • •		+ 4 2 3
				.660	.450	.019
				•660	.450	.019
				.660 .682 .718	.450 .476 .450	.019 .029 .026
				.660 .682 .718 .736	.450 .476 .450 .480	.019 .029 .026 .027
. •				.660 .682 .718 .736 .768	.450 .476 .450 .480 .415	.019 .029 .026 .027 .027
				.6660 .682 .718 .736 .768 .790	.450 .476 .450 .480 .415 .440	.019 .029 .026 .027 .029 .029
. .				.6660 .682 .718 .736 .768 .790 .817	.450 .476 .450 .480 .415 .440 .415	.019 .029 .026 .027 .029 .026 .029
	• .			.660 .682 .718 .736 .768 .790 .817 .857	.450 .476 .450 .480 .415 .440 .415	.029 .029 .026 .027 .029 .026 .026 .043 .091
•	· .			- 660 - 682 - 718 - 736 - 768 - 790 - 817 - 859 - 863	.450 .476 .450 .480 .415 .440 .415 .360 .440	.029 .029 .026 .027 .029 .026 .043 .041 .080
	· .			.660 .682 .718 .736 .768 .790 .817 .059 .863 20 SQUARE=	.450 .476 .450 .480 .415 .440 .415 .260 .440 .571	.029 .029 .026 .027 .029 .026 .043 .043 .091 .080

BEAM MOMENTUM= 1.237 GEV/C

BEAM MOMENTUM= 1.303 GEV/C

COS(THETA)

-667

.884 .932 .960 .978 .984 .992 .996 .997

2Q SQUARE≈

AZHGIREI

POLARIZ+-DPOL

.046

.046 .016 .028 .019 .017 .026 .029 .024

.028

1

2 636(1966)

CNTR

.580

.580 .506 .448 .357 .272 .242 .140 .051 .012

.626

SJNP

۰,

COS(THETA)

• .

MENIMUM	MAXIMUM	POL AR I Z+-DPOL		
.078	.148	• 091	.015	
.181	.249	.238	.016	
. 271	.337	.357	.019	
.277	.344	. 325	.018	
.760	.415	.463	.019	
.371	.435	+413	.020	
.426	.488	. 492	.019	
- 500	. 559	• 505	.019	
ສດ້ ເດເເລຍ	576			

PLUS POSSIBLE	SYSTEMATIC	ERROR OF	+-	19PER	CËNÎ
BETZ	PR	148 12	2891	1966)	CNTR

COS(THE	(A)			
MINIMUM	MAXIMUN	F	POLARIZ+-DPOL	
017	.027		.012	.009
.154	.197		.181	.016
. 292	.333		.296	.014
•433	.473		- 405	-021
.469	.507		.395	.014
. 4 9 9	. 167		+455	.016
.532	.569		.419	.014
.563	.598		.445	.014
. 594	.627		.482	.014
.609	.643		. 497	.014
. 625	.098		492	.014
.639	.672		.482	.016
.655	•688		. 485	.009
.670	.702		.501	.014
.684	.715		.508	.014
.698	.728		.513	.016
.711	.741		.511	.014
.738	.767		.518	.014
.764	.792		.522	.019
.789	.815		.522	.019
.813	.831		.490	.025
-03 h	858		. 499	.021
.876	.896		.475	.024
29 SQUARE=	.596			
KAZARINOV	RMP	39	509(19)	67) CNTR

BEAM MOMENTUM= 1.263 GEV/C

CNTR

F	BEAM	NOMENTUM=	1.317	GEV/C
		CUSTINET	A.	

.

MINIMUM	MAXIMUM	POLARIZ+-DPOL	
.111	.146	.073	.044
.163	.198	.151	.036
.213	.247	. 247	.031
.264	.297	.274	.027
.312	.345	. 293	.030
.379	.412	. 363	.019
.427	.459	.399	.018
.477	.508	.430	.017
.524	.553	.484	.018
.569	.598	.529	.013
.613	.640	.570	.013
.655	.681	.596	.017
. 695	.719	.583	.017
.733	.756	.578	.019
.768	.790	.578	.028

2Q SQUARE≕ •637 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 6PER CENT

PR

В	ET	z	
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148 1289(1966) CNTR



Fig. 10 (continued)

DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM -

COSCI	THETAI			COSC	THETA) .		
INIMUM	MAXIMUM	POLARIZ+-1	DPOL	MINIMUM	MAXEMUM	POLARIZ+	-DPOL
007	- 129	. 109	.038	.269	.269	.268	.015
.163	.286	.255	.015	.335	.335	.296	.050
- 41192	. 410	-355	.039	. 606	.404	.364	•030
443	. 552	.474	.011	.463	.463	.404	•030
. 566	- 652	4527	.022	. 527	,527	.460	.020
- 686	.769	.558	.016	.585	.585	.486	.030
.794	.829	.522	.012	.669	.669	.500	.030
. 843	.874	.555	.019	.724	.724	.550	.030
	•••			.777	.777	.570	.030
20 501148	F= .657			.827	.827	.530	.040
IS POSSIBI	E SYSTEMATIC	ERROR OF +- 3PE	ER CENT	.868	.868	.520	•040
05 1055100				.903	.903	.490	.030
HENG	PR	163 1470(196)	7) CNTR	. 938	.960	.367	•032
include in the second sec				.988	.997	.118	.160
				29 SQUA	RE= .690		
				COLLINA	PA	164 1677/19	167)

BEAM MOMENTU	JM= 1.387 GEV	/C	
COSCT	HETAI		
MENINUM	MAXEMUM	POLARI	Z+-DPOL
.101	.136	.144	.023
.153	.187	.180	.018
.204	.239	.231	.018
.254	.287	.304	.018
. 302	.335	.342	.018 .
. 352	.384	.365	.017
.399	.431	.419	. Ö 18
. 471	.502	.473	.014
. 520	.549	.498	.013
.565	.593	.497	.013
1610	.637	.520	.011
. 652	.678	.528	.011
.673	.718	.559	.015
.731	.755	.560	+014
.768	.790	.553	.017
- 803	. 823	.579	.028
.834	.853	.579	•049
ZQ SQUAR	E= .691		
PLUS POSSIBL	E SYSTEMATLG	ERROR OF .	APER GENT
8ET Z	PR	148 12890	1966) CNTR

COS(THETA)	POLARIZ+-OPOL			
.065	.097	.078		
.439	.470	.067		
.598	.530	.029		
.680	.513	.044		
.721	•541	.075		
20 SQUARE≠	.704			
PLUS POSSIBLE S	SYSTEMATIC	ERROR OF	+-	5 PER

BEAN MOMENTUM= 1.404 GEV/C

PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	SPER	CENT
NEAL	PR	161 1374(1967)	CNTR+SPRK

BEAN MOMENTUM=	1.487	GEV/C
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COSITH	ETA)	POLARIZ+	-090L
	.059	.056	.085
	.124	.100	.036
	.187	.155	.016
	.252	.225	.017
	• 322	.300	.011
	. 335	-315	.035
	.384	.335	•025
	.400	.355	.017
	.445	.330	.017
	.463	.392	.012
	.524	.410	.017
	. 593	.445	.016
	.605	.465	.016
	•652	.455	.015
	.667	. 435	•022
	•691	.410	.040
	.710	.450	.017
	.722	.475	•016
	.743	.476	.030
	.773	.455	.012
	.797	.484	.025
	.823	.443	.016
	.842	.470	.025
	.866	.443	.029
	.883	.465	.035
	.919	.435	.035
20	SOLIARE=	. 769	

FR

164 1672(1967)

CNTR

COZZIKA

COS(THETA)	POL AR I Z +	- DPOL
.624	.370	.018
.682	.385	.024
.738	.385	.024
.794	. 445	.024
.841	.435	.021
.883	.400	.017
.918	. 340	.018

BEAM MOMENIUM= 1.609 GEV/C

COZZIKA	PR	164 1672(1967)	CNTR
20 SQUARE=	.867		
• 918	- 340	.018	

62



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Fig. 10 (continued)

.63

DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAN MOMENTUM=	1.729 GE	v/c		BEAN MOMENTU	M= 1.730 GE	V/C		
COS(THETA)	POLARIZ+	-DPOL		COS(THETA)	PULARIZ+	-DPOL		
.052	017	.046		.031	021	.034		
.118	.090	.020		.221	• 0 9 5	.029		
.184	.092	.013		.319	• 265	.037		
.249	.080	.035		.366	-245	.033		
.316	.210	.020		.418	.258	.073		
,363	.210	.060		.475	.325	.033		
.388	.287	.050		.533	.417	.038		
.429	.265	.030		.593	-481	.023		
.500	.285	.020		.738	.464	.040		
.568	.330	.020		.767	•419	.031		
.627	.330	.020						
.643	.345	.021		20 SQUARE=	• 966			
.687	.360	.025		PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	SPER	CENT
.702	.370	.020					<i></i>	
.743	.405	.027		NEAL	PR	161 1374/	19671	C (
.759	.385	.030						
.813	.370	.030						
.858	.355	.020						
.900	.345	.040						
20 SQUARE=	.965							
COZZIKA	PR	164 1672(1967)	CNTR					

BEAM	MOMENTUM=	1.915	GEV/C	
	COSCTHET			

MINIMUM	MAXIMUM	POLARIZ+-D	POL
.080	.080	016	.070
.146	.146	083	.025
.211	.211	.035	.017
.281	.281	.020	+035
.349	.349	.080	•028
.367	.367	.085	.030
.418	.418	.085	•024
.432	.432	.105	•019
.503	.503	.190	.020
.511	. 371	.275	.034
.588	.588	.245	•020
.591	. 591	:520	.025
.635	.635	.305	•024
.656	.656	.330	•019
.656	.656	.337	•040
.698	.698	.310	.036
.717	.717	وەد.	+017
.721	.721	.385	.037
.775	.775	.375	•015
.777	.777	.392	•060
.827	.827	.405	•016
.829	.829	.370	•044
.875	.875	.390	•025
.876	.876	.355	• 034
.914	.914	.350	•090
.916	.941	.224	.030
.962	.979	.124	.033
ZQ SQUARE=	1.120		
COZZIKA	PR	164 1672(1967) CNTR

BEAM MOMENTUM= 2.	054 GEV/C
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COSTHEIA PULAR [Z+-DPOI,

.031	.034	.029
•142	• 059	.034
.263	• 06 Z	.032
.370	•034	.030
.482	•190	.025
.600	.266	-020
.646	•339.	.022
.687	•407	.025
.776	• 343	.045
.821	• 403	.030
.845	.361	.036

20 SQUARE= 1.238 PLUS POSSIBLE SYSTEMATIC ERONE OF +- SPER CENT

NEAL	PR	161 1374(1967)	CNTR+SPRK

CNTR+SPRK

BEAM MOMENTU	M= 2.391 GF	v/r		BEAM MOMENTU	M= 2.466 GE	v/c	
COS(THETA)	POLARIZ+	-DPOL		CÚSITH	ETA)		
.164	0. .025	•031 •030		MININUM	MUMIXAM	POL AR I Z+-D	POL
•390	.025	.028		•791	-812	.362	.020
.559	.151	.053		• 844	.858	• 396	.017
.718	.369	•020		-869 -891	.885	• 423 • 389	.015
.782 .841	.335 .352	•025 •032		•911	.925	.431	.021
.876	.228	.029		20 SQUARE	= 1.595		
20 SQUARE	= 1.529			PLUS PUSSIBLE	STSTEMATIC	ERRUR OF +- 12PE	CENT
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +- 5PER	CENT	GRANNIS	PR	148 1297(1966)	CNTR
NEAL	PR	161 1374(1967)	CNTR+SPRK				


Fig. 10 (continued)

DISTRIBUTION IN COSITHETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAN DIRECTION IN THE C.M. SYSTEM

BEAM MOMENTUM	= 3.037	GEV/C	
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BEAM MOMENTUM=	3.037 GE	ev /C	BEAM MOMENTUM=	3.660 GE	V/C		
COS(THETA)	POLARIZ	- DPOL	COS(THETA)	POLARIZ	-DPOL		
.083	.006	.061	.297	•043	.059		
.353	.093	.050	.499	.115	.055		
.466	.020	.041	.680	.142	.071		,
.544	•048	.075	.750	.175	.037		
•588	.147	.032	-810	.199	.057		
.612	.134	.036	.851	.237	.039		
.634	.163	.037	.915	188	-054		
•680	.182	.033	.976	. 193	- 026		
.726	.178	.027					
. 761	205	.025	20 SOUAR E=	2.665			
. 780	.229	.052	PLUS POSSIBLE ST	STEMATIC		5050	CENT
.808	. 292	.030	205 (0551622 0	51014110		<i>)</i> , en	ULAT .
862	.252	.026	NEAL	0 P	141 1374	10471	CNTOLCOOK
.890	.315	.026	HEAL		101 1514	1,211	UNI AT JE KA
.701	, 377	.031					

20 SQUARE= 2.102 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5PER CENT

NEAL PR 161 1374(1967) CNTR+SPRK

BEAM MOMENTU	M= 3.670 GEV	//C	
COSITH	ETA)		
MINIMUM	MUMIXAM	POLAR	Z+-DPOL
.605	.632	•104	.092
.633	.660	.171	.055
.667	.695	•130	.042
.690	.714	.156	.040
. 717	•741	.218	.036
.743	.766	.142	.031
.768	.790	.196	.027
. 793	.814	.225	.023
815	.835	.242	.022
. 826	.845	.283	.028
039	. 967	• 2 70	.019
. 848	. 866	.221	.022
. 86 9	. 886	.260	.020
- 889	905	. 255	.017
.907	-921	. 245	.015
. 974	.937	.237	.015
. 94.0	. 951	. 188	.020
.953	.963	.151	.085
20 SOLLAR F	= 2.674		
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	12PER CENT

148 1297(1966) CNTR

BEAN NOMENT	UM= 4.338 GEV	/C	
CÓS(T	HETAI		
MINIMUM	MAXIMUM	POLARIZ+-	-090L
.774	.795	.127	.063
. 794	.815	.083	.054
. 814	.834	.123	.044
.833	.852	.131	.046
. 851	.869	• 224	.035
. 868	.885	.207	.030
.885	.900	.218	.028
. 900	.915	.203	.024
915	. 92.8	. 203	.021
. 928	.941	.171	.019
20 50044	E≅ 3.284		
PLUS POSSIBL	E SYSTEMATIC	ERROR OF +- 12	PER CENT

GRANNIS	PR	148	1297(1966)	CNTR
OKAINT J				

BEAM MOMENTUM= 4.848 GEV/C

PR

COSCTHEIAL

GRANNIS

MINIMUM	MAXIMUN	POLARIZ+	-DPOL
.878	.894	.194	.026
. 894	· 909	.181	.022
. 909	.022	.217	.020
923	.935	.193	.017
. 935	.947	.211	.015
.948	.958	.191	.016
.958	.968	.144	.025

GRANNI S	PR	140	1297(1966)	CNTR

BEAM MOMENTUN- 5.150 GEV/C

****THIS DATA WAS READ FROM A GRAPH****

COS(THETA)	POLARIZ+	- DPOL
.566	.320	.130
.611	.180	•130
.635	.250	-100
.663	. LŚÚ	-100
.695	.260	-080
.722	.240	.070
.747	.200	•050
.772	.140	-050
.794	.130	.030
.814	.150	.030
.834	.120	.020
.861	.120	.020
.881	.170	+010
.901	.180	.010
.916	.190	+010
.931	.210	.010
.945	. 220	.010

2Q SQUARE= 4.031 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

21 651(1968) CNTR PRL BOOTH



Fig. 10 (continued)

DISTRIBUTION IN COSITHETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAM MOMENTUM= 5.914 GEV/C

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COSC	THE TA }		
MINIMUM	MAXIMUM	PULAR	LT€≓DPUL
.797	.81/	.041	.138
.818	.838	.100	.121
.835	.854	.206	.100
.851	.869	.231	.087
.867	.884	.008	.062
.881	.897	.145	.055
.890 .899 .909	.911 .914 .923 .925	.138 .226	.034 .034 .054
.924	.937	•185	.027
.935	.947	•178	.022
.946	.956	•153	.019
• 956	.965	.166	.019
• 965	.973	.152	.024
• 972	.980	.089	.100
2Q SQUA PLUS POSSIB	RE= 4.738 LE SYSTEMATIC	ERROR OF +-	12PER CENT

148 1297(1966) CNTR

COS(THETA)	POLARIZ+-DPOL		
.850	.U92	·104	
.862	.062	.080	
.874	.135	.041	
.886	.063	.029	
.896	.108	.023	
.907	.083	.019	
.917	.117	.018	
.926	.141	.017	
.935	.095	.015	
.944	.117	.014	
.952	.101	.014	
.959	.138	.016	
.966	.122	.025	
.972	.041	.034	
.977	.124	.069	
20 SQUARE=	4.818		

BEAM MOMENTUM= 6.000 GEV/C

PLUS POSSIBLE SYSTEMATIC ERROR OF -- SPER CENT

BORGHINI	PL	248	77(1967)	(CNTR

BEAM MOMENTUM= 6.000 GEV/C

PR

GRANNES

,

COS(1	HETA)			
MINIMUM	MAXIMUM	POLARIZ	-DPOL	
481	.564	.060	.092	
. 564	.606	.086	.102	
.606	.647	.120	.127	
.647	.689	.074	.086	
.689	.730	.154	.069	
.730	.751	.244	.083	
.751	, 772	.217	.073	
. 172	. 792	.131	.062	
.792	803	.100	.068	
.803	.813	.034	.056	
.813	.824	.039	.045	
874	.834	.064	+042	
.834	. 844	.107	.037	
.844	. 855	. 097	.030	
. 855	.865	.107	.029	
. 865	.819	. 112	•023	
.875	.886	. 052	.019	4
.886	.896	• 090	.017	-
. 896	.907	.099	-015	
.907	.917	.113	.013	
.917	.927	.124	.011	
.927	.938	.112	.009	
.938	.948	•142	.009	
.948	.950	.131	-007	
.958	• 96 9	.137	.007	
.969	.979	.129	.008	
979	. •990	.108	,032	
20 SQUAR	LE= 4.818			
PLUS POSSIBL	E SYSTEMATIC	ERROR OF +- 5	PER CENT	
BORGHINI	PL	318 405(19	970) CNTR	
BEAM MOMENT	FUM=10.000 GE	//C ·		
COS(THETA)	POLARIZ+-	- DPOL		
.913	.080	•045		
.920	.117	046		
.927	.077	•037		
.934	.067	•028		
.941	.024	.023		
.947	.067	.019		
.953	.081	.018		
.959	.093	.017		
.964	.082	•014		
.969	.071	.013		
.973	.093	-013		
•978	.097	.015		

BEAM MOMENTUM= 7.026 GEV/C

COSL	(HETA)		
MINIMUM	MAXIMUM	POLARIZ+	-OPOL
. 860	.877	.002	.074
.874	.890	.142	.053
. 888	.903	.085	.042
897	-912	.077	.064
- 901	.916	.117	.032
.910	.924	.157	.053
. 913	.927	.169	.027
072	. 9 4 9	.100	-092
033	- 945	. 262	.037
	954	.111	.031
053	- 963	- 196	.028
.955	.970	.177	.031
• 701	677		
.969	.977	•112	.049

20 SQUARE= 5.770 PLUS POSSIBLE SYSTEMATIC BROD OF += 12PER GENT

GRANNIS	PR	148 1297(1966)	CNER

BEAM MOMENTUM=12.000 GEV/C

COS(THETA) POLARIZ+-DPOL .002 .927 .056 .940 .948 .954 .959 .964 .969 .973 .977 .981 .984 .026 .023 .020 .019 .017 .014 .013 .066 .046 .031 .055 .081 .064 •066 •042 •036 .012 .013 .018 .987 .990 .032 .034 .023

20 SQUARE: PLUS POSSIBLE	= 10.413 Systematic	ERROR	OF	+-	5PER	CENT
BORGHINI	PL	240	в	77 (1967)	CNTR

2Q SQUARE= PLUS POSSIBLE	8.543 SYSTEMATIC	ERROR OF	F +-	5PER	CENT
BORGHINI	PL	24B	77(1967)	CNTR

.023 .030

.072

BORGHINI	PL	24B	77(1967)

.067 .024 .067 .081 .093 .082 .071 .093 .097 .058 .059

.074

.981

.988



Polarization in pp elastic scattering

Fig. 10 (continued)



 P_{beam}^{lab} (GeV/c)

P _{beam} (GeV/c)	E _{c.m.} (GeV)	Polariz	ation	Referenc	es .
.55	1.95	•23 ±	•02	GRANNTS	66 X
.66	1.98	- 33	. 02	GRANNIS	66 x
. 82	2.02	• 40	•03	GRANNIS	66 x
. 92	3.03	. 27	.00	GILATOTO	66 11
.82	2.02	•40	.03	CHENG	67
.82	2.03	•39	.05	GRANNIS	66 X
. 95	2.07	.44	.02	CHENG	67
• 95	2.07	.44	.01	GRANNIS	66 X
.97	2.07	•43	.03	GRANNIS	66 X
1.09	2.11	.49	.02	CHENG	67
1.09	2.11	•51	.05	GRANNIS	66 X
1.10	2.12	•40	.06	GRANNIS	66 X
1.21	2.15	• 50	•02	COLGNET	66
1.23	2.16	.47	• 02	COZZIRA	67
1.26	2.17	• 52	• 02	KAZARINOV	67
1.32	2,19	• 57	.04	BETZ	66
1.34	2.20	• 55	.03	CHENG	67
1.39	Z.22	.56	• OZ	COZZIKA	Ğ7
1.39	2.22	•57	•04	BETZ	66
1.49	2.25	• 48	. 02	COZZIKA	67
1.61	2.29	•44	.02	COZZIKA	67
1.73	2.34	•40	.02	COZZIKA	67
1.92	2.40	• 40	. 02	COZZINA	67
2.05	2.45	• 40	.03	NBAL	67
2.39	2.56	• 36	• 04	NEAL	67
2.47	2.99	- 47	-05	GRAEN LS	66
3.04	2.78	.30	.03	NEAL	67
3.66	2.98	•23	.04	NEAL	67 .
3.67	2.98	• 27	.04	GRANNIS	66
4.34	3.18	•22	.05	GRANNIS	66
5.90	3.60	•22	.06	GRANNIS	66
6.00	3.63	•21	.07	BORGHINI	70
X DATA TAKEN I	FROM A REV	UE ARTICL	.e		1-

Fig. 11. The maximum polarization in pr elastic scattering as a function of beam momentum [after Grannis et al., Phys. Rev. <u>148</u>, 1297 (1966)]. The points represented by diamonds are from the compilation by Grannis et al. The squares are our estimates from the distributions in Fig. 10.

Maximum polarization in pp elas

pp elastic scattering.

pp Inelastic Interactions-Non-Strange Particle Production

P _{beam} (GeV/c)	$\sigma_{\mathrm{pp}\pi^0}$ (mb)		$\sigma_{pn\pi^+}$ (mb)	References
1.17	.91 ± .15		5.21 ± .44	BALDONI 62
1.39	3.46 .25			CENCE 63
1.66	3.70 .30		18.30 .70	BUGG 64
2.23	3.98 + .27		17.22 + .66	EISNER 65
	26		57	
2.81	3.85 .22		16.06 .44	FICKINGER 62
3.67	2.90 .31		11.44 .65	SMITH 61
4.00	2.60 .30		9.70.40	COLETTI 67
5.52	2.77 .11		8.03 .19	ALEXANDER 67
6.07	2.80 .30		6.70 .50	TAN 68
6.60			5.73 .35	MA 69
6.60	2.06 .19		4.89 .28	COLTON 68
6.92	2.00 .20		5.20 .40	ALEXANDER 68
8.10	1.75 .20		4.50 .40	GINESTET 69
10.01	1.40 .30		4.10 .40	ALMEIDA 68
19.00	1.10 .20		1.90 .20	BOGGILD 69
28.50			1.50 .10	CONNOLLY 67
REFERENC	FS			
1 SMITH	61 and PR	123 2160	HBC	
2 BALDONI	62 NC	26 1376	HBC	
3 FICKINGER	62 PR	125 2082	HBC	
4 CENCE	63 PR	131 2713	CNTR	
5 BUGG	64 PR	13361017	HBC	
6 EISNER	65 PR	138 B670	HBC	
7 ALEXANDER	67 PR	154 1284	HBC	
8 COLETTI	67 NC	49A 479	HBC	
9 CONNOLLY	67 BNL	11980	HBC	
10 ALEXANDER	68 PR	173 1322	HBC	
11 ALMEIDA	68 PR	174 1638	НВС	
12 COLTON	68 UCLA	1025	HBC	
13 TAN	68 PL	28B 195	НВС	
14 BOGGILD	69 PL	30B 369	HBC	
15 GINESTET	69 NP	813 283	HBC	
16 MA	69 PRL	23 342	НВС	

 $PP \rightarrow \begin{cases} pn\pi^+ \\ pp\pi^\circ \end{cases}$



Fig. 12. Single-pion production in pp collisions including contributions from resonances.

73

pp→

 $pn\pi^+$

ppπ°

P _{beam}	(GeV/c)	E _{c.m.} (GeV)	^σ dπ ⁻	+ (mb)	Referenc	es		
1.17	± .10	2.14	2.75	±.29	BALDONI	62		
1.66	.17	2.31	•48	•08	BUGG	64		
1.68	•	2.32	• 5-5	•03	CHAPMAN	64		
1.70		2.32	• 45	•05	HEINZ	68		
2.03		2.44	•22	•02	HEINZ	68		
2.23	•06	2.51	•13	•05	EISNER	65		
2.25		2.52	•12	.01	HEINZ	68		
2.47		2.59	•03	.01	HEINZ	68		
2.78		2.70	• 05	•01	HEINZ	68		
3.31		2.87	•03	• 003	HEINZ	68		
3.62		2.96	• 03	. 003	HEINZ	68		
3.67	•11	2.98	.11	•06	SMITH	61		
4.00	•04	3.08	•03	•01	COLETTI	67		
6.60	.01	3.78	.01		COLTON	68		
21.10	• 42	6.43	(15.1 ±	1.5) x 10 °	ALLABY	69		
	REFER	ENCES						
1	SMITH	61.	•••PR		123 2160			HBC.
2	BALDONI	62	NC		26 1376			нвс
3	BUGG	64	PR		133B1017			HBC
4	CHAPMAN	64.	PL		11 253			CNTR
5	EISNER	65.	PR		138 8670		•	HBC
6	COLETTI	67	•••NC		49A 479			HBC
7	COLTON	68.	UCL	Α	1025			HBC
8	HEINZ	68.	PR		167 1232			CNTR
9	ALLABY	69.	•••PL		298 198			CNTR

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Cross section for $pp→d π^+$

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Fig. 13. Cross section for $pp \rightarrow d\pi^+$. (a) Linear representation; (b) log-log display. The dashed line represents our best fit to these data, using $\sigma = Kp_{beam}^{-n}$, $n = 4.29 \pm 0.04$ (see text).

Differential Cross section for $pp \rightarrow d\pi^+$

DISTRIBUTION IN COS(THETA) OF THE DEUTERON WITH RESPECT TO THE BEAM DIRECTION IN THE C.H. SYSTEM . • .

· · · · · · · • • •

BEAM MOMENTUM= 1.168 GEV/C

****THIS DATA WAS READ FROM A GRAPH****

COS(THETA)

MINIMUM	MAXIMUN	SIGMA +-	DSIGMA
		(NUMBER	OF EVENTS)
800	700	8.000	2.828
700	600	5.000	2.236
600	500	4.000	2.000
500	400	6.000	2.449
400	300	5.000	2.236
300	200	2.000	1.414
200	100	1.000	1.000
100	0.	5.000	2.236
0.	.100	5.000	2.236
.100	.200	5.000	2.236
.200	.300	9.000	3.000
.300	.400	4.000	2.000
.400	.500	3.000	1.732
.500	.600	4.000	2.000
.600	.700	5.000	2.236
.700	.800	12.000	3.464
ZQ SQUARE=	• 525		
BALDONI	NC	26 1376(19	62) HBC

.

BEAM MONENTUM= 1.696 GEV/C

COSITHETAL	SIGMA +	- DSIGMA	
	(MICROB.	ARNS/STERADIAN	0
960	50.100	2.500	
930	49.900	2.700	
900	52.100	2.000	
800	51.200	2.400	
700	45.900	2.200	•
600	42.100	1.500	
500	33.400	1.700	• •
400	31.900	1.600	
300	24.400	1.200	
200	23.500	1.100	
100	21.000	.900	
0.	20.300	.900	

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20 SQUARE= · .938 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

HEINZ	PR	167	1232(1968)	CNTR

. . .

BEAN MOMENTUM= 2.251 GEV/C

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COS(THETA)	SIGMA +	- DSIGMA	
	(HICROB	ARNS/STERADI	ANT
965	9.900	.800	
950	12.100	. 700	
925	14.600	1.000	
900	15.900	.600	•
850	16.400	.600	
800	13.300	- 800	
700	13.100	.700	
600	10.200	.500	
500	9.700	.500	
400	7.600	.300	•
300	8.600	•500	
200	6.900	.500	
100	6.200	.400	
0.	6.300	•400	

29 SQUARE= 1.407 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

HEINZ	PR	167 1232(1968)	CNTR

-.950 17.500 1.300 -.925 22.000 .800 -.920 21.000 .800 -.900 21.000 .800 24.200 -.850 1.100 -.800 .900 23.800 .800 .700 -.600 20.100 11.000 -.400 14.500 .700 -.100 .700 13.600 .600 .700 13.000

12.200

SIGMA +- DSIGMA

BEAM MOMENTUM= 2.032 GEV/C

COS(THETA)

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2Q SQUARE= 1.220 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

167 1232(1968) CNTR PR HEINZ

.600



Fig. 14. Differential cross sections for $pp \rightarrow d\pi^+$. Because of the identity of the particles in the initial state, these distributions are symmetric about $\theta_{c.m.} = 90$ deg.

Differential Cross section for $pp \rightarrow d\pi^+$

DISTRIBUTION IN COS(THETA) OF THE DEUTERON WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAM MOMENTUM= 2.466 GEV/C

BEAN MOMENTUM= 2.784 GEV/C

COS(THETA)	SIGMA +-	- DSIGMA	COS(THETA)	SIGMA +-	DSIGMA
	(MECROB/	RNS/STERADIAN)		INICROBA	RNS/STERADIAN)
965	10.600	.900	965	9.500	.700
950	12.500	.900	940	8.300	.600
925	14.600	.700	920	10.200	.700
900	16.100	.800	900	10.000	. 500
850	12.900	.900	850	8.400	.500
800	11.900	.800	800	7.300	. 400
700	9.400	.500	700	6.200	.300
600	6.000	.400	600	4.700	.300
500	5.000	.300	500	2.900	-200
400	4.400	.200	≠. 400	2.400	.100
-:300	3.000	.200	.200	1.300	-199
200	3.100	.200	100	1.200	-100
100	3.000	.200	0.	1,100	-100
0.	2.900	.200	•••		
			20 SOUARE	- 1.877	
20 SQUARE	= 1.595		PLUS POSSIBLE	SYSTEMATIC	ERROR OF +- LOPER CENT
PLUS POSSIBLE	SYSTEMATIC	; ERROR OF +- LOPER CENT			
			HEIN7	PR	167 1232(1968) CNTR
HEINZ	PR	167 1232(1968) C	NTR	• ••	

BEAM MOMENTUM= 3.308 GEV/C

SIGMA +- DSIGMA COS(THETA) co (MICROBARNS/STERADIAN) -.970 12.300 1.200 -.950 -.925 -.900 10.600 6.400 5.700 .800 1.000 +00 200 300 3.500 2.700 -.800 • 200 • 100 • 100 -.600 1.900 -.500 -.300 -.100 1.400 .700 .000 .100 . 20 SQUARE= 2.346 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT HEINZ 167 1232(1968) CNTR PR HEINZ

BEAM MOMENTUM= 3.619 GEV/C

PR

DS(THETA)	SIGMA +	⊷ DSIGMA	
	(MICRO	BARNS/STERADIAN)	
970	12.800	2.300	
950	8.300	.500	
900	5.100	•400	
850	3.700	.300	
800	3.300	.300	
700	2.200	.200	
600	1.700	.200	
-,500	1.200	.100	
400	1.000	.100	
30 - C111 - 60 - C -			

20 SQUARE= 2.627 Plus possible systematic error of +- 10per cent

167 1232(1968)

CNTR



Fig. 14 (continued)

 $pp \rightarrow pp \pi^+ \pi^-$

P _{beam} (0	GeV/c)	E _{c.m.} (GeV)	$^{\sigma}\mathrm{pp}\pi^{+}$	π- (mb)	Referenc	es	
2.23	± .06	2.51	1.22	± .14	EI SNER	 65	
2.81		2.70	2.51	•14	PICKUP	62	
3.67	•06	2.98	2.67	.13	HART	62	
4.00		3.08	2.95	.15	BODINI	68	
4.95	.03	3.35	2.96	.12	COLLERAINE	67	
5.52	.01	3.50	2.84	.08	ALEXANDER	67	
5.97	•05	3.62	2.80	.10	CASO	68	
6.04	.03	3.64	3.20	.30	CHINOWSKY	68	
6+60	.01	3.18	2.10	.16	COLTON	68	
6.90		3.85	3.00	.30	YEKUTIELI	69	· . · · ·
7.87	•04	4.08	2.54	.13	GRETHER	68	
3.11	•08	4.13	2.46	.10	KAYAS	68	
10.01	.01	4.54	2.40	.20	ALMEIDA	68	
16.00		5.64	1.66	+ .13	RUSHBROOKE	69	
				06			
19.00		6.12	1.50	•20	BOGGILD	68	
21.80		6.54	1.36	.16	JESPERSEN	68	
24.80		6.95	1.50	.20	EHRLICH	68	
28.50		7.43	1.10	•20	CONNOLLY	67	
•	REFE	RENCES					
1	HART	62	•••PR		126 747		HBC
2	PICKUP	62	•••PR		125 2091		HBC
. 3	EISNER	65	•••PR		138 B670		нвс
4	ALEXAND	DER 67	•••PR		154 1284		HBC
5 .	COLLER	AINE 67	•••PR		161 1387		HBC
6	CONNOLI	Y 67	BNL		11980		HBC
7	ALMEIDA	A 68	•••PR		174 1638		HBC
8	BODINI	68	• • • NC		58A 175		HBC
9	BOGGIL	0 68	•••SUB	VNA			HBC
10	CASO	68	•••NC		55A 66		HBC
11	CHINOWS	SK.Y 68	•••PR		171 1421		HBC
12	COLTON	68	•••UÇLA		1025		HBC
13	EHRLICH	1 68	•••PRL		21 1839		HBC
14	GRETHER	68	ILL		C001195125		HBC
15	JESPERS	5EN 68	•••PRL		21 1368		HBC
16	KAYAS	68	•••NP		B5 169		нвс
17	RUSHBRO	DOKE 69	•••PRL		22 248		HBC
18	YEKUTIE	LI 69	REHO	1			HBC



Fig. 15. Cross sections for $pp \rightarrow pp\pi^+\pi^-$ including any contributions from resonances.



 P_{beam}^{lab} (CcV/c)

Fig. 16. Cross section for $pp \rightarrow pn \pi^+\pi^+\pi^-$ and $pp \rightarrow pp \pi^+\pi^-\pi^0$, including contributions from resonances.

P _{beam} (G	eV/c)	^σ ppπ+π-πο	(mb)			$\sigma_{pn\pi}^{+} \pi^{+} \pi^{+}$,- (mb)	Reference	s
2.23 2.81 3.67 4.00 4.95 5.52 5.97 6.04		.02 ± .22 .74 1.10 1.76 1.84 2.20 2.40	.02 .03 .07 .10 .07 .07 .20 .10			-02 -40 1-15 1-60 2-19 2-85 2-30 3-10	* -02 -04 -09 -10 -09 -08 -20 -50	EISNER PICKUP HART BODINI COLLERAINE ALEXANDEP CASO CHINUNKY	65 62 68 67 68 68 68
6.60 6.90 10.01 19.00 28.50		2.15 2.60 2.30 1.70	.13 .30 .20 .30			2.47 2.60 2.40 1.70 1.60	•15 •30 •20 •30 •30	COLTON YEKUTIELI Almeida Boggild Connolly	68 69 68 68 67
	REFERENC	ES							
1 2 3 4 5 6 7 8 9 10 11 12 13	HART PICKUP EISNER ALEXANDER COLLERAINE CONNOLLY ALMEIDA BOGGILD CASD CHINOWSKY COLTON YEKUTIELI	62PR 65PR 65PR 67PR 67PR 67BNL 68PR 68NC 68NC 68NC 68NC 68REHO	VNA	126 125 138 154 161 11980 174 58A 55A 171 1025	747 2091 8670 1284 1387 1638 175 66 1421		HBC HBC HBC HBC HBC HBC HBC HBC HBC HBC		

^P beam (C	GeV/c)	$\sigma_{pn\pi}^{+}\pi^{o}$ (1	mb)	$\sigma_{nn\pi}^{+}+(mb)$) σ _{ppπ} ο _π ο (m	$\sigma_{\mathrm{pn}\pi} + \sigma_{\pi} o_{\pi} o \ (\mathrm{mb})$	References
2.23 4.00		2.37 ± .: 3.80 .:	20 30	.25 ± .06	-41 ± .OA	1.80 ± .20	EISNEŘ 65 BODINI 68
1 2	REFERENC EISNER BODINI	:ES 65PR 68NC	138 584	8 B670 A 175	нвс Нвс		
P _{beam} (C	GeV/c)	^σ ppπ ^ι π ⁺ π ⁻ π	. (mb)	^σ ppπ ⁺ π ⁺ π		$o_{pn\pi^+\pi^+\pi^+\pi^-\pi^-}$ (mb)	References
5.52 10.00 28.50		•23 ± •0 •46 •0 •38)2)4	•09 •69	± .01 .05	.10 ± .01 .54 .04	ALEXANDER 67 HOLMGREN 68 CONNOLLY 69
1 2	REFERENC ALEXANDER HOLMGREN	ES 67PR 68NC	154 574	1284 20	HBC HBC		
3	CONNOLLY	69BNL	13694	•	HBC .		
3	CONNOLLY	69ΒΝL	13694 (mb)		нвс	 mb)	References
3 beam (G 3.67	connolly GeV/c)	69ΒΝL σ _d π+π+π- .06 ± .0	13694 (mb) 02		нвс	'mb)	References Hart 62
3 beam (G 3.67 4.00 4.95	connolly GeV/c)	69BNL $\sigma_{d\pi^+\pi^+\pi^-}$.06 ± .0 .04 .0 .02 .0	1 36 94 (mb) 22 21		HBC 	 mb) 1	References Hart 62 COLETTI 67 COLLERAINE 67
3 beam (G 3.67 4.00 4.95 6.00 1 2 3 4	CONNOLLY REFERENC HART COLETTI COLLETAINE KINSEY	69BNL σdπ+π+π- .06 ± .0 .04 .0 .02 .0 .04 .0 ES 67PR 67PR 68UCRL	13694 (mb))1)1)1)1)1)1)1)1)1)1)1)1)1	747 479 1387	нвс 	'mb) 1 3 3	References Hart 62 Coletti 67 Colleraine 67 Kinsey 68
3 beam (G 3.67 4.95 6.00 1 2 3 4	REFERENC HART COLETTI COLLERAINE KINSEY	69BNL σdπ+π+π- .06 ± .0 .04 .0 .04 .0 62PR 67NC 67PR 68UCRL	13694 (mb) 22 21 21 21 21 21 21 22 49A 161 17707	747 479 1387	HBC σ _d π+π+π-πο (.08 + .0 0 .16 ± .0 HBC HBC HBC HBC HBC		References Mart 62 Coletti 67 Colleraine 67 Kinsey 68
3 beam (G 4.00 4.95 6.00 1 2 3 4	CONNOLLY REFERENC HART COLETTI COLLERAINE KINSEY	69BNL σdπ+π+π- .06 ± .0 .04 .0 .04 .0 62PR 67NC 67PR 68UCRL Pbeam (Ge	(mb) (mb) 126 11 126 49A 161 17707 E _{c.m} V/c) (GeV	747 479 1387	$\sigma_{d\pi} + \pi + \pi - \pi \sigma$	(mb)	References Mart 62 COLETTI 67 COLLERAINE 67 KINSEY 68
3 beam (G 3.67 4.00 4.95 6.00 1 2 3 4	CONNOLLY REFERENC HART COLETTI COLLERAINE KINSEY		(mb) (mb) 126 126 126 126 126 126 126 126	747 479 1387) $\sigma_{d\rho} + (mt)$ (15.9 ± 2.4) x	HBC $\sigma_{d\pi^+\pi^+\pi^-\pi^0}$ (08 + .0 -08 + .0 -00 $16 \pm .0$ HBC HBC HBC HBC HBC HBC HBC HBC	mb)	References Hart 62 Coletti 67 Colleraine 67 Kinsey 68

Table II. Some nonstrange inelastic reactions in pp scattering.

P _{beam}				$\sigma_{p\Delta^+}$	(mb)				$\sigma_{n\Delta^{++}}$	(mb)		Referenc	es
(GeV/c)	·Δ ⁺ →	<u>p</u> π ⁰	Δ^+ -	+ nπ ⁺	$\Delta^+ \rightarrow al$	l modes						
2.800									10.630 :	± .290		BACON	67
2.850						3.800 ±	£ .600					BLAIR	69
4.000		1.170 ±	•293	.970 1	.294	2.140	.415		4.350	.279		COLETTI	67
4.550						1.500	•200					BLAIR	69
5.520		.720	.050	.750	•080	1.470	•094		3.250	.160		ALEXANDER	67
6.000		I				.376	.076					ANDERSON	66
6.060						. 6C0	.100					BLAIR	69
6.070		•520	•130	•280	•080	.800	.153					TAN	68
8.920								F	1.900	.300		ALEXANDER	68
7.880		150	0.70	(0.0		•410	.060					BLAIR	69
10,000		-100	•070	• 40 0	-100	-5:0	•122		1,350	• 300		GINESTET	69
10.000						-154	.050					ANDERSON	66
13 000									1.180	•140		ALMEIDA	68
15,000						1.00	100		• 550	• 099		MA	70
18,100						+ 1 + C	•100		201	05.2		ANDERSUN	66
19.000									• 501	• 052		MA	10
21,100									+210	•050		BUGGILU	59
24.200									-217	047		MA	70
28,500									.115	.015		ELLIS	69
	REEPENC	-						•			ſ		
1		-5 66PRI		16	855			CORK					
2	ALEXANDER	67PR		154	1284			HRC					
3	BACON	67PR		162	1320			HBC					
4	COLETTI	67NC		494	479			HBC					
5	ALEXANDER	68PR		175	1322			HBC					
6	ALMEIDA	68PR		174	1638			HBC			•		
7	TAN	68PL		28£	195			HBC					
8	BLAIR	69NC		634	529			CNTR					
9	BOGGILD	69PL		306	369			HBC					
10	ELLIS	69BNL		13671				HBC					
11	GINESTET	69NP		B13	283			нвс					
12	MA	70PRL		. 24	1031			HBC					

pp→n∆(1236)

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data above 10 GeV/c. See discussion in text concerning background subtractions and differences cross section (above 10 GeV/c) to the for-Fig. 17. Cross sections for $pp \rightarrow N\Delta(1236)$. (a) Linear display; (b) log-log display. From because there are too few The and the data are consistent with this. We did not fit the $p\Delta^+$ dashed line in (b) represents our best fit of the $n \Delta^{++}$ ŝ isospin, the ratio of $\sigma(n\Delta^{++})/\sigma(p\Delta^{+})$ should be = 2.20±0.16 (see text). in data from various detectors. Ħ mula $\sigma = Kp_{beam}^{-u}$

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1.1

P^{lab}_{beam} (GeV/c)

$d\sigma/dt$ for $pp \rightarrow n\Delta(1236)^{++}$

MOMENTUM TRANSFER BETWEEN BEAM AND OELTA++ (GEV/C)++2

BEAN MOMENTUR=	2.800 GE	v/c	
****THIS DATA	WAS READ	FROM A GRAPH****	
MOM TR			
M IN INUM	MAXENUN	SIGMA +- DSI	GNA
06.8	. 017	69 63866	5 78042
.048	.017	54 52149	5-15180
	.040	36. 26652	4.20173
141		32.128/4	3.95477
171	141	18.25496	2.98102
202	171	16.06437	2.79645
233	. 20.2	10-22278	2,23079
266	. 233	10.22278	2.23079
.295	.264	7.30198	1.88536
. 326	. 295	6.32839	1.75518
. 157	.326	6.32839	1.75518
.388	.357	5.59819	1.65082
.412	.388	8.03218	1.97739
.450	.419	4.86799	1.53939
.481	.450	7.30198	1.88536
.512	.481	3.16419	1.24110
.543	.512	3.89439	1.37688
.574	.543	4.86799	1.53939
.605	.574	5.59819	1.65082
.636	.605	3,16419	1.24110
. 667	.636	3.89439	1.37688
.698	.667	1.94720	.97360
.729	.698	1.94720	.97360
.760	.729	3.89439	1.37688
.791	.760	4.86799	1.53939
ZQ SQUARE=	1.890		
BACON	PR	162 1320(1967)	HBC

****THIS DATA	WAS READ	FROM A GRAPH***
МОМ Т	R	
MINIMUM	MAX.[MUN	SIGMA ↔ DSIGMA (MILLIBARNS/(GEV/CI**2)
.044	.004	10.87499
.085	.044	6.83571
.125	- 085	4.35000
-166	.125	2.95178
206	. 166	1.55357
.247	.206	1 - 24286
.287	.247	1.08750
. 327	. 287	1.55357
.368	.327	1.08750
.408	.368	.77679
.449	. 408	.77679
489	. 449	. 62143
. 530	489	46607
.570	530	46607
.611	.570	. 46607
. 651	.611	.31071
29 SQUARE=	4.373	
ALEXANDER	PR	154 L284(1967) HBC

.

BEAN MOMENTUM= 6.600 GEV/C

NOM

.

MOM T	R		
MINIMUM	MAXEMUM	SIGMA ← DSI [MILLIBARNS/	GMA (GEV/C)**2)
.002	.010	11.80000	1.12000
.010	.020	15.00000	1.13000
.020	.030	12.40000	1.03000
.030	.040	12.25000	1.02000
.040	.060	11.10000	.69000
.060	.080	7.44000	.57000
.080	.100	6.80000	.54000
.100	+120	1=45888	. 4 40.00
.120	.140	3.64000	.40000
.140	.168	3,04000	- 6 1.000
.160	.180	2.22000	• 31000
.180	.200	2.27000	.31000
.200	.220	2.27000	.31000
.220		1.67000	.27000
.240	.260	1.75000	.28000
. Z 60	.280	1,41000	.25000
.280	.300	1.37000	.24000
ZQ SQUARE*	5.374		
MA	PRL	23 342(1969)	HBC

BEAM MOMENTUM= 6.920 GEV/C

BEAN NOMENTUM= 5.520 GEV/C

****THIS DATA WAS READ FROM A GRAPH****

HON TR	R Contraction of the second se	
MENTAUN	MAXIMUM	SIGHA +- DSIGMA (NILLIBARNS/(GEV/C)**2)
0.	.025	11.00000
.025	.050	13.00000
.050	.075	13.50000
.075	-100	7-00000
.100	.125	3.70000
.125	.150	4.70000
.150	.175	1.70000
.175	.200	4.00000
.200	.229	3+00000
.225	.250	. 1.40000
.250	.275	2.00000
,275	.300	1.60000
.300	.325	2.40000
.325	.350	0.
.350	.375	1.00000
.375	.400	-40000
.400	.425	0.
.425	.450	1.00000
.450	. 175	.50000
.475	.500	.30000
.500	.525	.60000
.525	.550	.40000
.550	.575	.60000
.575	.600	.40000
29 SQUARE=	5.672	
AL EXANDER	PR	173 1322(1968) HBC

BEAM HOMENTUM- 8.100 GEV/C

NON TR

0. .020 .040 .060 .100 .120 .140 .160 .200 .220 .240 .240 .280 .300

GINESTET

NP

MINIMUM

MON T	R		
INUN	MAX EMUN	SIĞHA ← DS	16MA
		(MICCIONANA	/1001/01++2/
).	.020	6.48000	.93531
.020	.040	3.84500	.70148
.040	.060	3.64500	.70148
.060	.080	2.56500	.58045
.080	.100	2.02500	.52285
.100	.120	2.10000	.54000
.120	.140	1.62000	.46765
.140	-160	.81000	.33068
• 160 ·	.180	1.21500	.40500
.180	.200	.67500	.30187
.200	.220	.81000	.33068
. 220	.240	1.21500	.40500
.240	. 260	.27000	.19092
.260	. 280	. 27000	.19092
. 280	. 300	.27000	.19092
- 300	.320	0. +	.135
•		- 0	
. 320	.340	-13500	.13500
340	.360	-13500	.13500
360	.380	0. +	.135
		- 0	
380	. 400	. 27000	. 19092
	470	0	.135
		- 0	
		- 0	•
20 501148 F	6.770		

B13 283(1969)

HBC

BEAM NOMENTUN=10.010 GEV/C

****THES NATA WAS READ FROM A GRAPH****

	DUA IA	•			
MENING	л	мах і ним	S	IGMA +- DSI	GMA (GEV/C1++2)
0.		. 020		- 70000	1.70000
	20	040	š	. 00000	1.60000
	50	060	3	30000	1.10000
		000	5	50000	1.00000
	30	.100		50000	1.00000
. 14	10	-120	ĩ	. 70000	.85000
. 13	20	-140	•	. 80000	.55000
	50	-140	1	. 70000	.85000
	50	180	2	30000	70000
. 24	10	. 220		- 85000	.60000
. 2	20	.240		42000	- 42000
.2		- 260		42000	+ 2000
	50	. 280		. 85000	.60000
. 2	80	. 300		. 42000	.42000
20	SQUARE=	8.553			
DEHNE		NC	534	232(1968)	нвс



Fig. 18. Differential cross sections for $pp \rightarrow M\Delta(1236)$. (a) $pp \rightarrow n\Delta(1236)^{++}$. (b) $pp \rightarrow p\Delta(1236)^{+}$ from counter experiments (i.e., all decay modes included). The distributions given originally as $d\sigma/d\omega$ vs. $\cos \theta_{c.m.}$ were

transformed to $d\sigma/dt$ vs. t [taking m(Δ) = 1.236 GeV]. In (c) we display our best-fit values of b (the slope) obtained by fitting the data in (a) and (b) to $d\sigma/dt = Ae^{bt}$ in the range 0.03 $\leq |t| \leq 0.3 (GeV/c)^2$.

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$d\sigma/dt$ for $p\Delta(1236)^+$

SIGMA ← DSIGMA (MILLIBARNS/(GEV/C)**2)

.20000 .10000

.10000 .04000 .04000 .03000 .02000 .02000

170 1223(1968) CNIK

MOMENTUM TRANSFER BETWEEN BEAM AND PROTON (GEV/C)**2

(MILLIB/ 1-50000 .90000 .39000 .39000 .39000 .31000 .10000 .15000

PR

SEAM MOMENTUM= 5.020 GEV/C

.

20 SQUARE= 2.051 PLUS POSSIBLE SYSTEMATIC ERROR OF ← 12PER CENT

BEAM MOMENTUM= 2.980 GEV/C

MOM TRANSE

ANKENBRAND

.260 .290 .370 .640 .740 .880 1.260 1.630

HOM TRANSF SIGMA ← DSIGMA (HILLIBARNS/(GEV/C)**2) (.31 .031 13.10000 .39300 .034 12.80000 .38400 .039 16.7000 .50100 .048 9.05000 .2150 .052 7.40000 .22800 .058 8.30000 .224900 .065 11.30000 .33900 .078 10.90000 .32700 .085 10.90000 .32700 .092 7.30000 .22800 .102 7.60000 .22800
.031 13.10000 .39300 .034 12.80000 .38400 .039 16.70000 .50100 .048 9.05000 .27150 .049 9.60000 .28800 .052 7.40000 .22200 .055 8.30000 .224900 .065 11.30000 .33900 .078 10.90000 .32700 .085 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.6000 .19800
.034 12.80000 .38400 .039 16.70000 .50100 .048 9.05000 .27150 .049 9.60000 .228800 .052 7.40000 .22200 .058 8.3000 .224900 .065 11.30000 .33900 .072 7.5000 .22500 .076 10.9000 .32700 .085 10.9000 .32700 .092 7.3000 .21900 .102 7.60000 .22800 .102 6.0000 .22800
.039 16.70000 .50100 .048 9.05000 .27150 .049 9.60000 .28000 .052 7.40000 .22200 .058 8.3000 .24900 .078 10.9000 .33900 .078 10.90000 .32700 .085 10.9000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.6000 .19800
.048 9.05000 .27150 .049 9.60000 .28800 .052 7.40000 .22200 .058 8.30000 .224900 .065 11.30000 .224900 .078 10.9000 .22500 .078 10.90000 .32700 .085 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.6000 .18800
.049 9.60000 .28800 .052 7.40000 .22200 .058 8.30000 .24900 .057 11.30000 .33900 .072 7.50000 .32700 .078 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.60000 .12800
.052 7.40000 .22200 .058 8.30000 .224900 .065 11.30000 .33900 .072 7.50000 .22500 .078 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .102 6.6000 .22800
.058 8,30000 .24900 .065 11,30000 .33900 .072 7.50000 .22500 .078 10,90000 .32700 .085 10,9000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.60000 .19800
.065 11.30000 .33900 .072 7.50000 .22500 .078 10.90000 .32700 .085 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.6000 .19800
.072 7.50000 .22500 .078 10.90000 .32700 .085 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.6000 .19800
.078 10,90000 .32700 .085 10,9000 .32700 .092 7,30000 .21900 .102 7.60000 .22800 .110 6.6000 .19800
.085 10.90000 .32700 .092 7.30000 .21900 .102 7.60000 .22800 .110 6.60000 .19800
.092 7.30000 .21900 .102 7.60000 .22800 .110 6.60000 .19800
.102 7.60000 .22800 .110 6.60000 .19800
.110 6.60000 .19800
.119 6.80000 .20400
.128 5.60000 .16800
.138 5.60000 .16800
.148 5.45000 .16350
.160 5.48000 .16440

20 SQUARE: PLUS POSSIBLE	1.935 SYSTEMATIC	ERROR	OF	+-	LOPER	CENT
BLAIR	NC	6 3 A		5291	1969)	CNTR

REAM MOMENTUN= 4.550 GEV/C

NOM

TRANSF	SIGMA +- D	SIGMA
	(MILLIBARN)	\$/{GEV/C}**2}
.034	4.65000	.13950
.035	5.30000	.15900
.042	5.60000	.16800
.043	4.70000	.14100
.053	5.05000	.15150
.053	3.80000	.11400
.064	4.10000	.12300
.075	3.40000	.10200
.089	2.85000	.08550
.096	3.25000	.09750
.109	2.40000	.07200
.140	1.81000	.05430
.160	1.80000	.05400
.161	1.57000	.04710
.180	1.81000	.05430
.181	1.17000	.03510
.220	. 90000	.02700
.240	.94000	.02820
.270	.6ŬÛOO	.01600

мон	TRANSE	SIGMA +-	DSIGMA			
		(MILLIBAR	RNS/ I GEV	/()++	2)	
	.700	.07600	.00	800		
	.800	.04300	.00	600		
	.990	.02400	.00	300		
	1.460	.01200	.00	300		
	1.720	.00500	.00	100		
	1.910	.00900	.00	100		
	2.670	.00350	.00	050		
	3.080	.00200	•00	100		
	Q SQUARE	= 3.911				
PLUS	POSSIBLE	SYSTEMATIC	ERROR C)F +-	12PER	CENT
A NK E	NBRAND	PR	170	12230	1968)	CNTR

8EAM NOMENTUM∞	6.060 GE	v/c			
MOM TRANSF	SIGMA +-	DSIGMA			
	(MILLIBA	RNS/(GEV/	(C)**2	21	
.056	1.74000	.052	20		
.070	1.94000	.058	120		
.107	1.06000	.031	80		
.128	.67000	.020	010		
.154	.59000	.017	70		
.260	.27000	.008	310		
ZO SOUARE=	4.873				
PLUS POSSIBLE ST	STEMATIC	ERROR OF	: +- 3	OPER	CENT
BLAIR	NC	63A	529()	9691	CNTR

SIGMA ← DSIGMA (MILLIBARNS/(GEV/C)+*2) -41000 .04000 -22000 .02000 -18000 .02000 .04400 .00900 .02400 .00300 .02100 .00200 .02100 .00200

170 1223(1968)

CNTR

29 SQUARE≕ 2.975 Plus possible systematic error of →- 12PER CENT

PR

20 SQUARE= 3-479

PLUS POSSIBLE SYSTEMATIC ERROR OF + 10PER CENT 63A 529(1969) CNTR BLAIR NC

BEAN NUMENTUN= 6.070 GEV/C BEAM MOMENTUM= 7.120 GEV/C SIGMA ← DSIGMA SIGMA ← DSIGMA (MILLIBARNS/(GEV/C)**2) .01100 .00300 .00900 .00300 .00900 .00300 .00300 .0090 .00300 .00060 .00210 .00060 .00090 .00010 .00000 .00010 .00000 .00010 SIGMA +- DSIGMA (MILLIBARNS/(GEV/C)++2) .00800 .00300 .00500 .00100 .00420 .00080 .00260 .00090 .00110 .00050 .00100 .00060 .00005 .00009 MOM TRANSF MON TRANSF 1.330 1.500 1.720 2.270 7.600 3.050 4.220 1.030 1.030 1.160 1.440 1.750 2.080 2.400 2.730 3.180 3.750 4.250 20 SQUARE= 5.058 PLUS POSSIBLE SYSTEMATIC ERROR OF + 129ER CENT 20 SQUARE= 4.883 PLUS POSSIBLE SYSTEMATIC ERROR DF +- 12PER CENT ANKENBRAND PR 170 1223(1968) 170 1223(1968) CNTR ANKENBRAND PR

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BEAM MOMENTUM= 7.880 GEV/C

CNTR

BLAIR

MON TRANSF	SIGMA ↔-	DSIGMA			
	INILLIBA	RNS/(GE	V/C)*4	2)	
.046	1.75000	.0	5250		
.089	.72000	.0	2160		
.093	1.00000	.0	3000		
.114	.58000	.0	1740		
.117	.63000	.0	1890		
+140	.41000	۰.	1230		
.181	.35000	•0	1050		
.217	.17000	•0	0510		
.250	.17000	-0	0510		
.260	+19000	• 0	0570		
.295	.16000	•0	0480		
.340	.06000	.0	0180		
.390	.12000	.0	0360		
.440	.04600	-0	0138		
.500	+07400	-0	0222		
.526	.02900	-0	0087		
20 SQUARE=	6.565				
PLUS POSSIBLE	SYSTEMATIC	ERROR I	0F +-	LOPER	CENT

NC

63A 529(1969)

CNTR

BEAN MOMENTUM= 4.000 GEV/C

MON TRANSE

ANKENBRAND

.450 .510 .640 1.120 1.520 2.120 2.650



Fig. 18 (continued)

Fit to $d\sigma/dt$ for pp \rightarrow N $\Delta(1236)$



Fig. 18 (continued)

P _{beam} (GeV/c)	dø/dt [mb/(Ge	$\frac{t=0}{2V/c}^{2}$	SLOPE (GeV/c) ⁻²	χ ² /Ν	
2.800 6.600 8.100 10.016	101.44 ± 18.52 5.86 3.34	15.67 1.46 1.45 1.36	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	1. 70 1. 95 37 48	n∆ ++
2.850 4.550 6.060 7.880	12.65 ± 7.12 4.06 2.46	1.29 .72 .44 .26	$\begin{array}{rrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrrr$	28. 45 19. 32 25. 90 27. 02	¢∆+



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P _{beam}			^σ pN*(1470)	+ (mb)			Referen	ces
(GeV/c)	$N^* \rightarrow n\pi$	I	N* -	→ pπ ⁰	$N^* \rightarrow all modes$		
4.550 5.520 6.060 6.070 7.880 8.100 10.000 10.010 15.000 20.000 28.500 30.000		.800 ± .1 -270 .1 .500 .1 .200 .1	60 30 50 30	.360 .110 .250	t -060 .090 .150	$ \begin{bmatrix} 640 & \pm & ,080 \\ 14 & 900 & 40 \\ 650 & 180 \\ 620 & 270 \\ 142 & 300 \\ 620 & 270 \\ 142 & 300 \\ 1544 & 090 \\ 1544 & 090 \\ 620 & 106 \\ 660 & 150 \\ 150 & +200 \\ 660 & 150 \\ 500 & +200 \\ 744 & 350 \\ \end{bmatrix} $	BLAIR ALEXANDER BLAIR TAN GINESTET ANDERSON ALMEIDA ANDERSON CONNOLLY ANDERSON	69 67 69 68 69 66 68 66 68 66 66 65
1 2 3 4 5 6 7	REFERENC ANDERSON ALEXANDER CONNOLLY ALMEIDA TAN BLAIR GINESTET	ES 66PR 67BNL 68PR 68PL 68NC 69NC	16 154 1 11980 174 1 288 634 813	855 284 638 195 529 283		SPRK HBC HBC HBC MBC CNTR HBC	•	

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Pbeam	、 ^σ pΝ*(1	(520)+ (mb)		References	
(GeV/c)	$N^* \rightarrow n\pi^+$	$N^* \rightarrow p\pi^o$	N [*] → all modes		
4.000 4.550 5.520 6.060 6.070 7.880 10.000 15.000 20.000 30.000	.388 † .291 .440 .200 .150 .090	.130 ± .015 0040 .080 .050	[1980 ± .550] - 680 .000 - 830 .390] - 450 .090 - 430 .190] - 430 .190] - 430 .050 - 140 .035 - 140 .032 - 170 .030 - 166 .042	COLETTI 67 BLAIR 67 BLAIR 67 BLAIR 67 BLAIR 68 BLAIR 69 ANDERSON 66 ANDERSON 66 ANDERSON 66 ANDERSON 66	
REFERE 1 ANDERSON 2 ALEXANDE 3 COLETTI 4 TAN 5 BLAIK	NCES 66PRL R 67PR 67NC 68PL 69NL	16 855 154 1284 49A 479 288 195 654 569	SPRK HBC HBC HBC GNTR		
P _{beam} (GeV/c)	$\begin{array}{cc} E_{c.m.} & & {}^{\sigma}pN^{*}(219)\\ (GeV) & & N^{*} \rightarrow all \end{array}$	0)+ (mb) modes		References	
20.000 30.000 Refere 1 Anderson	6.272 .128 ± 7.621 .108 ENCES 66PRL	024 036 16 855	SPAK	ANDERSON 66 ANDERSON 66	
P _{beam} (GeV/c)	E _{c.m.} ^o pN*(14) (GeV) N [*] →	70)+ (mb) µn+n		References	
6.000 ± .020 10.010 .010 19.000 21.800	3.627 .680 ± . 4.542 .180 . 6.120 .080 . 6.535 .155 .	090 040 020 030	•	KINSEY 68 Almeida 68 Buggild 68 Jespersen 68	
REFER 1 ALMEIDA 2 BOGGILD 3 JESPERS 4 KINSEY	ENCES 68PR 68SUB VNA EN 68UCRL 68UCRL L	174 1638 21 1368 7707	Н8С НВС , НВС НВС НВС	· ·	not plotted
P _{beam} (GeV/c)	$e_{c.m.}$ $f_{c.m.}$ (GeV) $N^* \rightarrow p$	20) ⁺ (mb) π ⁺ π ⁻		References	
5.520 ± .010 10.010 .010 REFERI	3.503 .570 ± . 4.542 .150 . ENCES	050 040 154 1284	нас	ALEXANDER 67 Almeida 68	
2 ALMEIDA	68PR	174 1638	HBC		

DATA IN SQUARE BRACKETS HAVE BEEN CALCULATED BY US



In (a) and (b) we show those experiments that re-Fig. 19. Cross sections for "elastic-like" pp interactions ($pp \rightarrow pN_{1/2}^+$). (a) $N^*(1470)$ -"Roper", data above 10 GeV/c have been fitted to the formula $\sigma = Kp_{beam}^{2n}$. The dashed lines are our best ported only one or two $N\pi$ decay modes, as well as those which have reported all decay modes. of $\Gamma(N^* \rightarrow N\pi)/\Gamma(N^* \rightarrow all)$ of 0.61±0.09 for $N^*(1470)$ and 0.53±0.04 for $N^*(1520)$. These ratios only $N^*
ightarrow p \pi^+ \pi^-$ are not plotted, but are tabulated on the facing page. In (c) only those experiments reporting all decay modes (i.e., mainly counter experiments) have been included. The The former have been converted by us to the total rates by using isospin and taking the ratios fits. $n_{N(1470)} = -0.09\pm0.27$, and $n_{N(1520)} = 0.10\pm0.33$. See discussion in text concerning were taken from the most recent "Review of Particle Properties." Experiments reporting background subtractions and differences in data from various detectors. (c) the first two plus N^* (2190). (b) N^{*}(1520),

$d\sigma/dt$ for $pp \rightarrow pN(1470)^+$

MOMENTUM TRANSFER BETWEEN BEAM AND PROTON (GEV/C)**2

.

BEAM MOMENTUM=	4.550 GEV	/c	96AM MOHENTUN≈	6.000 BE	V/C	
MOM TRANSF	SIGMA +	DSIGMA	MOM TRANSF	SIGMA +-	DSIGMA	
	(MILLIBAR	NS/(GEV/C)**2)		(MILLIBA	RNS/(GEV/C)**2)	
.044	2.72000	.08160	.061	2.50000	.07500	
.045	3.05000	.09150	.074	2.50000	.07500	
.052	3.02000	.09060	•110	.70000	.02100	
.053	2.61000	.07830	.130	.38000	.01140	
.062	2.20000	.06600	+154	.45000	.01350	
.063	2.30000	.06900	.260	.13000	.00390	
.073	2.13000	.06390				
.084	1.53000	.04590	20 SQUARE=	4.873		
.098	1.31000	.03930	PLUS POSSIBLE S	YSTEMATIC	ERROR OF +- 10PER	CENT
.117	1.08000	.03240			· · · · · · · · · · · · · · · · · · ·	
11+0	.67000	. UZUIU	BLAIR	NC	63A 529(1969)	CNTR
166	. 55000	.01650				
.220	.26000	.00780			_	
20 SOUMPE-	3 470					

PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

BLAIR	NC	63A	529(1969)	CNTR

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MOM TRANSE	SIGMA +-	DSIGNA	
	(MILLIBA	RNS/(GEV/C)**	2)
.048	2.20000	.06600	
.090	.69000	.02070	
.094	.79000	.02370	
.115	.35000	•01058	
.117	.54000	.01620	
.145	+25000	.00780	
. 180	.25000	.00750	
.214	.15000	.00450	
250	.16000	.00480	
.290	.07000	.00210	
20 SQUARE=	= 6.565		
PLUS POSSIBLE	SYSTEMATIC	ERROR UF +- 1	OPER CENT
BLAIR	NC	63A 529()	1969) C

CNTR

(

BEAM MOMENTUM= 7.880 GEV/C

 $d\sigma/dt$ for $pp \rightarrow pN(1470)^+$



$d\sigma/dt$ for pp→pN(1520)⁺

. MOMENTUM TRANSFER BETWEEN BEAM AND PROTUN (GEV/C)**2

		16				
DEAM MUMENTUM	4.000 GEV		DEAR MUMENIUS	- 4.330 GEV		
MOM TRANSF	SIGMA +- 1	DSIGMA NS/(GEV/C)##2)	MOM TRANSF	SIGMA +- (MILLIBAR	DS1GMA NS/(GEV/C)**2)	
.440	.25000	.04000	.057	1.30000	.03900	
.500	.20000	.02000	.058	1.27000	.03810	
.620	.15000	.02000	- 065	2.05000	+06150	
1.430	.12000	.00900	.074	1.28000	.03840	
1.990	.09200	.00600	.075	1.35000	.04050	
2.050	.12200	.00900	-085	1.28000	.03840	
29 SQUARE=	= 2.975		.107	1,29000	.03870	
PLUS POSSIBLE	SYSTEMATIC	ERRUK OF +- 12PER CENT	.126	1.43000	.04290	
ANKENBRAND	68	 170 1223(1968) CNTR	.157	- 99000	.02970	
			.175	.67000	.02010	
			• 191	.64000	.01920	
			-191	. 49000	.01470	
			.250	.64000	.01920	
			-270	.62000	.01860	
			20 SQUARE	3.479	50000 05 to 10059	CENT
				3131044110	(34 E20(10/B)	CHIT
	·		DLAIR	NC	63A 927(1707)	CNIX
BEAN MOMENTUR	4= 5.020 GEV	/c	BEAM MOMENTU	1= 6.060 GE\	//c	
MOM TRANSF	SIGMA +-	DSIGMA	NOM TRANSF	SIGMA +-	DSIGMA	
	(MILLIBAR	NS/(GEV/C)**2)	a	(MILLIBAR	RNS/IGEV/CI*+21	
.670	.10000	- 10000	.065	.99000	-03450	
.940	.08800	.00600	.114	.95000	.02850	
1.380	-07000	.01000	-134	.79000	.02370	
1,610	.05200	.00500	.260	.32000	.00960	
2.490	.03700	.00300				
2.830	.03000	.01000		4.873	68808 OF +- 100F0	CONT
3.140	.02500	.00500		STSTEMATIC	CRACK OF V- IVPER	LENI
			BLAIR	NC	634 529(1969)	CNTR
PLUS POSSIBLE	SYSTEMATIC	ERROR DF +- 12PER CENT				
		170 1000/10/01 6970				
BEAM MOMENTUR	M= 6.070 GEV	/c	BEAM MOMENTUR	1= 7.120 GEV	//C	
MOM TRANSF	ŚIGNA +-	USIGMA	HOH TOANSE	SIGMA +-	DSIGNA	
	(MILLIBAR	NS/(GEV/C)*#2)		IMILLIBAR	NS/(GEV/C]**2)	
1.100	.06300	.00800	1.370	.03500	.00500	
1.360	.05900	• UU8ŮŮ	1.490	.02000	.00300	
1.650	.03200	.00300	2.160	.00700	.00100	
2.270	.02800	.00200	2.470	.00700	.00100	
2.580	.01400	.00100	4.010	-00320	-00080	
3.000	.01070	.00070	5.010	.00130	.00030	
3.890	.00700	.00100	20 500085	5 959		
4.070	.00640	.00080	PLUS POSSIBLE	SYSTEMATIC	ERROR OF +- 12PER	CENT
20 SUUARE PLUS POSSIBLE	4.683 Systematic	ERROR OF +- 12PER CENT	A MR E NUB AND	PR	170 1223(1968)	CNTR
ANKENBRAND	PR	170 1223(1968) CNTR				
BEAN MOMENTU	M= 7.880 GEV	/C	BEAM MUMENTUN	1=19.200 GEV	//C	
MOM TRANSF	SIGMA +- (M[1]]TRA9	D310HA NS/(GEV/C1##2)	MOM TRANSF	SIGMA +-	DSIGMA NS/(CFV/C)##71	
.051	1.12000	.03360	.560	57,00000	11.40000	
.092	.57000	.01710	.870	21.00000	4.20000	
+096	.48000	-01320	1.230	3.60000	. 72000	
.119	45000	.01350	2.140	.16000	.03200	
-146	.40000	.01200	2.660	.32000	.06400	
.180 .214	- 32000	.00780	3.230	.02000	.00400	
.2 50	.24000	.00720	5.810	.00057	.00028	
.255	.27000	.00810				
.288	.19000	-00690	ZO SQUARE:	1/.156		
.380	.12000	.00360	ALLABY	PL	288 229(1968)	CNTR
.414	.08200	-00246				
.460 .484	.05000	-00204				
.509	.10000	.00300				
.626	.02800	.00084				
- 6 / 0	.02100	*00133				
.750	.06500	.00195				•

2Q SQUARE= 6.565 PLUS POSSIBLE SYSTEMATIC ERROR OF +- LOPER CENT

63A 529(1969) UNTR

NC

BLAIR

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pp → p "N^{*}(1688)⁺" Bump

P _{beam}	Ecm	^o pN*(168	38)+ (m	b)			
(GeV/c) (GeV	$\dot{N} \rightarrow a$	ll modes		Reference	es	
4.550 6.060 7.880 10.000 15.000 20.000 28.500	3.237 3.642 4.081 4.540 5.474 6.272 7.434	- 700 - 500 - 460 - 562 - 638 - 562 - 560 - 320	± .100 .100 .090 .058 .068 .070 .130 070		BLAIR BLAIR BLAIR ANDERSON ANDERSON CONNOLLY	69 69 66 66 66 66 67	
30.000	7.621 REFERENCES	•576	•084		ANDERSON	66	
1	ANDERSON 66	PRL	16	855			SPRK
2	CONNOLLY 67	7BNL	11980				HBC
3	BLAIR 69	9.,,,,NC	63A	529			CNTR



.



Fig. 22. Cross sections for $pp \rightarrow p "N^*(1688)^+$ ". We have included only those experiments (mostly counters) that reported all decay modes. Experiments reporting only $p\pi^+\pi^-$ are tabulated on the facing page. Due to the existence of resonances in this region with both I = 1/2 and I = 3/2, we are unable to compute total cross sections from experiments reporting only one mode of decay. See discussion in text concerning background subtractions and differences in data from various detectors.

$pp \rightarrow p "N^*(1688)^+"$ Bump

MOMENTUM TRANSFER BETWEEN BEAM AND PROTON (GEV/C)**2

BEAM MOMENTUM	= 4.000 GE	//C		BEAM	MOMENTUM=	4.550 GEV/	c
MOM TRANSF	SIGMA +-	DSIGMA		MOM T	RANSF	SIGMA +- D	SIGMA
	(MILLIBA	RNS/(GEV/C)**2)				(MILLIBARN	S/{GEV/C}**2)
.470	.66000	.09000			.091	1.45000	.04350
.520	.34000	.03000			.098	1.85000	.05550
.640	.45000	.04000			.116	.72000	.02160
1.050	.23000	.03000			.139	.75000	.02250
1.400	.16000	.01000			.157	1.60000	.04800
1.930	.12900	.00900			.171	1.80000	.05400
					.186	1.05000	.03150
2Q SQUARE≠	2.975				.198	.80000	.02400
LUS POSSIBLE	SYSTEMATIC	ERROR DF +- 12PER	CENT		-204	.62000	.01860
					.216	.46000	.01380
ANKENBRAND	PR	170 1223(1968)	CNTR		.250	.66000	.01980
					.270	.77000	.02310

2Q SOUARF= 3.479 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT NC 634 529(1969) CNTR BLAIR

.

170 1222(1968) CNIK

BEAN MOMENTUM=	5.020 GE	v/c	BEAM MOMENTUM	• 6.060 GE	v/c
MON TRANSF	SIGMA +-	DSIGMA	MOM TRANSF	SIGMA +-	DSIGMA
	(MILLIBA	<ns (gév="" c)*#2)<="" td=""><td></td><td>(MILLIBA</td><td>RNS/(GEV/C)**21</td></ns>		(MILLIBA	RNS/(GEV/C)**21
.670	.23000	.02000	.081	1.45000	.04350
.750	.18000	.02000	.093	.96000	.02880
.920	.12000	.01000	.12/	• 5 8 0 0 0	.01740
1.330	.09000	01000	.146	.88000	.02640
1.550	.07800	-00800	.168	.74000	.02220
1.730	.07400	.00700	.260	. 52000	.01560
2.390	.05100	.00400			
2.740	.04300	.00800	20 SQUARE=	4.873	
			PLUS POSSIBLE S	SYSTEMATIC	ERROR OF +- 10PER CENT
20 SOUARE=	3.911				
PLUS POSSIBLE S	STEMATIC	ERROR OF +- 12PER CENT	BLATR	NĊ	63A 529(1969) CNTR

ANKENBRAND	PR	170 1223(1968)	CNTR

← DSIGMA BARNS/(GEV/C)*+2) D 00900	MOM TRANSF	SIGMA +- (MILLIDA .05000	DSIGMA RN3/(029/01##2)	
BARNS/{GEV/C}**2} 0 00900 0 00900	1.230	(MILLIDA .05000	QN3/(329/01##2)	
0 •00400 U UČAČG	1.230	.05000		
.00900			.00700	
	1.380	.04500	.00600	
00800	1.590	.02800	.00400	
.00400	2.080	.01000	+00200	
0 .00400	2.380	.00700	.00100	
.00200	2.790	00400	.00100	
.00100	3.860	.00740	.00040	
0 00080				
0,00080	20 SOUARE=	5.858		
.00100	PLUS POSSIBLE	SYSTEMATIC	ERROR OF +- 12PF	CENT
	ANKENBRAND	PR	170 1222(1968)	i Či
IC ERROR OF +- 12PER CENT				
170 1223(1968) UNTR				
	0 .00400 0 .00400 0 .00200 0 .00100 0 .00080 0 .00100 IC ERROR DF +- 12PFR (FNT 170 1223(1968) UNTR	0 .00400 2.080 0 .00400 2.380 0 .00200 2.790 0 .00100 3.860 0 .00080 20 SQUARES 0 .00100 PLUS POSSIBLE IC ERROR DF +- 12PFR (FRNT 170 1223(1968) UNTR	0 -00400 2.080 .01000 0 00400 2.380 .00700 0 .00200 2.790 .00400 0 .00100 3.860 .00240 0 .00080 20 SQUARE= 5.858 0 .00100 PLUS PDS1BLE SYSTEMATIC IC ERROR NF +- 12PFR (FNT 170 1223(1968) UNTR	0 -00400 2.080 .00700 .00200 0 -00400 2.380 .00700 .00100 0 -00200 2.790 .00400 .00100 0 .00100 3.860 .00240 .00040 0 .00080 20 SQUARE= 5.858 0 .00100 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12PFR 170 1223(1968) CNTR

BEAN NOMENTUM= 7.880 GEV/C

мом

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TRANSF	SIGMA +-	DSIGMA
	(MILLIBAF	N\$/(GEV/C)**2)
.059	1.02000	.03060
.098	.90000	.02700
,102	.78000	02340
.121	.78000	.02340
.124	.74000	.02220
.150	-62000	.01860
.183	.53000	.01590
.215	.42000	.01260
.250	.43000	.01290
.255	.36000	.01080
.287	.39000	.01170
.330	.32000	.00960
.370	.19000	.00570
.397	.17000	.00510
.454	.17000	.00510
.476	.09600	.00288
.500	.16700	.00501
.613	.08200	.00246
.640	.07200	.00216
.735	.10000	.00300

2Q SQUARE= 6.565 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10PER CENT

63A 529(1969) BLAIR NC CNTR

SEAM MOMENTUM=19.200 GEV/C

мом	TRANSF	SIGNA +-	DSIGMA		
		INICROBAR	NS/{GEV	/6]##2]	
	.550	100.00000	20.00	000	
	.860	26.00000	5.20	000	
	1.220	4.20000	-84	000	
	1.640	.64000	.12	800	•
	2.100	. 31000	.06	200	
	2.620	.33000	.06	600	
	3.180	.03500	.00	700	
	3.770	.01800	.00	360	
	5.720	.00071	.00	035	
;	2Q SQUARE	= 17.156 .			
ALL	ABY	PL	288	229(1968)	CNTR




Table III. Fits to $d\sigma/dt$ for various pp quasi-two-body final states. These are the values the authors report when fitting their own data. Thus there may be some inconsistencies from experiment to experiment.

P _{beam}		t	FORMULA		PARAM	METER	s					Reference	S
(GeV/c)	min	max											
2.85	.03	.160	•	Α	15.000	1.600	B	6.900 1	1.200	٦		BLAIR	69
4.55	•03	.270		A	6.900	.700	8	8.900	.900			BLAIR	69
6.00	.01	.110		A	2.960	•560	в	15.800	2.900			ANDERSON	66
6.06	• 05	.260	X=A*EXP[B*T]	A	2.800	.500	8	10.000	1.000	}	p∆+	BLAIR	69
7.88	• 04	• 340		A	2.100	.300	в	9.900	.600			BLAIR	69
10.00	.01	.130		A	1.600	.500	B	17.300	2.000			ANDERSON	66
15.00	•02	.130)	۵	1.500	1.000	в	21.100	4.400	J		ANDERSON	66
4.55	•04	.220)	A	5.500	.800	8	14.000	1.300	ר		BLAIR	69
6.06	• 06	.160		A	8.800	2.900	8	20.700	2.700			BLAIR	69
6.070				BL	10.400	1.000						TAN	68
1.88	• 04	.145		A	5.900	2.500	8	22.100	4.100			BLAIR	69
10.00	•01	.110	x=A*EXPLB*f}	۸	6.060	1.000	8	22.300	3.400	}	pN*(1470)	ANDERSON	66
15.00	• 02	.140		Δ	4.800	.900	8	15.900	2.300			ANDER SON	66
20.00	• 02	.140		A	4.750	1.200	8	14.400	2.500			ANDERSON	66
21.800		.250		в	18.000	2.300						JESPERSEN	68
30.00	.07	.130 🖵)	A	8.820	4.200	B ·	23.500	5.100	J		ANDERSON	66
4.99	÷05	۲ 278 ،	١	A	2.200	.200	Ū	5.400	.800]		BLAIR	69
6.06	• 06	.290		A	1.800	.400	в	7.100	1.100			81 A TR	69
7.88	.09	,484		A	.900	.100	в	5.200	.500			BLAIR	69
10.00	.30	*800 °	X=4+FXP[B+T]	۵	- 390	.120	₿	3.950	.510	_ }	pN*(1520)	ANDERSON	66
15.00	•20	.900	1	A	.310	.070	8	3.880	.450			ANDERSON	6 6
20.00	•20	.900		A	.330	.070	в	3.830	.370			ANDERSON	66
30.00	•20	•900	J	A	.360	.100	в	4.300	.500	J		ANDERSON	66
4.55	- 09	. 270	`	A	2.100	.500	в	4.600	1.300	٦		BLAIR	69
6.06	.08	.300		4	1.800	±500	Ű	5.600	1.300			BLAIR	69
7.88	.05	.500		A	1.300	.200	в	4.800	.400			BLAIR	69
10.00	.01	.800	X=A*EXP(B*T]	A	1.280	.100	в	4.500	.500	ļ	pN [*] (1688)	ANDERSON	66
15.00	. 02	.600	Į.	A	1.610	.170	в	5.050	.380	(- (/	ANDERSON	66
20.00	• 04	.800		4	1.470	-200	8	5.250	- 480			ANDERSON	66
30.00	-07	•900	J	A	1.790	.290	в	6.190	.500	J		ANDER SUN	66
										-			

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Fits to various pp $d\sigma/dt's$.



Fig. 24. Results of our least-squares fits to various pp quasi-two-body differential cross sections of the form $d\sigma/dt = Ae^{-v/v_0}$, where v is as defined in the text. The points at 19 GeV/c have been fitted over a somewhat different v region than were the lower-energy points.

P _{beam} (GeV/c)	SLOPE (1/v.) (GeV/c) ⁻²	χ ² /Ν	
5.02 6.07 7.1 7.12 8.1 9.2 10.1 11.1 12.1 19.2	$\begin{array}{cccccccccccccccccccccccccccccccccccc$	11, 31 1, 53 1, 67 1, 31 4, 84 6, 78 9, 35 12, 38 11, 76 1, 72	elastic
2. 98	3,03 .18	3, 13	p∆+
4. 0	2.80 .09	8, 83	
5. 02	2.59 .13	4, 48	
6. 07	2.44 .15	2, 28	
7. 12	2.12 .26	, 34	
4. 00	.73 .10	2. 62	pN*(1520)
5. 02	1.04 .09	. 45	
6. 07	1.60 .06	69	
7. 12	1.91 .11	1. 66	
19. 2	2.22 .18	2. 29	
4.00	1.55 .11	5. 28	pN*(1688)
5.02	1.31 .09	2. 07	
6.07	1.87 .06	1. 33	
7.12	2.22 .12	1. 66	
19.2	2.95 .27	3. 43	

$$pp \rightarrow \begin{cases} p\pi^{+}\Delta(1236)^{0} \\ p\pi^{-}\Delta(1236)^{++} \end{cases}$$

P _{beam} ((GeV/c)	E _{c.m.} (GeV)	^σ pπ ⁻ Δ	++ (mb)	Reference	es	
5.520 5.970 6.900 10.010 19.000 28.500	± .010 .050 .010	3.503 3.620 3.851 4.542 6.120 7.434	•280 1•180 2•300 1•250 •830 •600	± .040 .200 .300 .140 .150 .100	ALEXANDER CASO YEKUTIELI ALMEIDA BOGGILD CGNNGLLY	67 68 69 68 68 68	
1 2 3 4 5 6	REFER ALEXAND CONNOLL ALMEIDA BOGGILD CASO YEKUTIE	ENCES ER 67 Y 67 68 68 68 LI 69	PR BNL PR SUB NC REHC	VNA	154 1284 11980 174 1630 554 66		НВС НВС НВС НВС НВС НВС

P_{bcam} (GeV/c)

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.

 $\sigma_{p\pi}^{+}\Delta^{o}$ (mb)

References

	Δυ	→ pπ	Δ	ALL MODES		
5.52C 5.97C 10.010 19.000 28.500	.120 .050 .290 .180 .080	± .010 .116 .030 .020		•360 2 •030 J •150 J •870 -348 J •540 •090 J •240 •060 J	ALEXANDER CASO ALMEIDA BOGGILD CONNOLLY	68 68 68 68 67
К 1 ALE 2 CON 3 ALM 4 ВСС 5 САS	EPERENCES XANDER 67PR NOLLY 67BNL EIDA 68PR GILD 68SUB	154 11980 174 VNA	1284		HBC HBC HBC	

DATA IN PARENTHESES HAVE BEEN CORRECTED BY US.





pp→

$$\begin{cases} \Delta(1236)^{++}\Delta(1236)^{0} \\ \Delta(1236)^{++}N^{*}(1520)^{0} \end{cases}$$

 P_{beam} (GeV/c) $\sigma_{\Delta}^{++}\Delta o \text{ (mb)}$ References $\Delta^o \rightarrow p\pi^+$ (GEV/C) $\Delta^0 \rightarrow$ all modes ---------- $\begin{bmatrix} .750 \pm .120 \\ [2.160 .450] \\ [1.980 .210] \\ [1.260 .300] \\ [.660 .154] \\ [.060 .030] \\ \end{bmatrix}$.250 ± .C4C .720 .150 .660 .07C .420 .100 ALEXANDER CASO KINSEY 5.520 5.970 6.000 67 68 68 6.900 YEKUTIELI 69 .220 .051 KAYAS 68 BOGGILD 19.000 .010 68 t .060 CONNOLLY 28.500 .020 .010 .0301 67 REFERENCES . 1. ALEXANDER 67....PR CONNOLLY 67....BNL BOGGILD 68....SUB VNA 154 1284 нвс 2 3 11980 HBC HBC 55A 66 85 169 4 CASC 68....NC H8C 5 KAYAS 68....NP HBC KINSEY 68....UCRL YEKUTIELI 69....REHC 17707 6 7 нвс HBC

P_{beam} (GeV/c)

.

^σΔ++N*(1520)σ (mb)

References

(GEV/C)	$N^{*0} \rightarrow$	р <i>π</i> ⁻		$N^{*0} \rightarrow \text{all modes}$		
5.520		.020 ±	•020		•113 ± •113 *	ALEXANDER	67
5.970		• 2 <u>3</u> 0	.120		[1.302 .679]	CASO	68
6.000		-440	.050		[2.490 .283]	KINSEY	68
6.900		.230	.070		[1.302 .396]	YEKUTIELI	69
8.110		.130	.041		[.736 .229]	KAYAS	68
19.000		.020	.010		[.113 .057]	BOGGILD	68
	REFERENC	ES					
1	ALEXANDER	6 7 PK	154	1284	HBC		
2	BOGGILD	68SUD VI	NA		HBC		
3	CASO	68NC	55A	66	нвс		
4	KAYAS	68NP	85	165	HBC		
5.	KINSEY	68UCRL	17707		HDC		
6	YEKUTIELI	69REHO			нвс		•

DATA IN PARENTHESES HAVE BEEN CALCULATED BY US.

* The error (~8%) in X = $\frac{\Gamma(N^* \rightarrow N\pi)}{\Gamma(N^* \rightarrow all modes)}$ has not been folded in the quoted errors.



Fig. 26. Some double-resonance production cross sections in pp collisions. (a) $\Delta(1236)^{++}$ $\Delta(1236)^{0}$ and (b) $\Delta(1236)^{++} N(1520)^{0}$. Both have been corrected for all modes. These data are from bubble chambers.

 P_{beam}^{lab} (GeV/c)



P _{beam} (G	eV/c)	•	σ _{ppω} (mb)		References
		$\omega \rightarrow \pi^+\pi^-\pi^0$		$\omega \rightarrow \text{All modes}$	
4.000 5.520 5.970 6.600 6.900 10.010 28.500	:	$\begin{array}{cccc} .080 \pm .030 \\ .110 & .020 \\ .180 & .050 \\ .180 & .023 \\ .140 & .040 \\ .145 & .030 \\ .050 & .010 \end{array}$		[.092 ± .034]* [.126 .023] [.207 .057] [.207 .026] [.161 .046] [.167 .034] { .057 .011]	BODINI 68 ALEXANDER 67 CASO 68 COLTON 69 YEKUTIELI 69 ALMEIDA 60 CUNNOLLY 67
1 2 3 4 5 6 7	REFERENC ALEXANDER CONNOLLY ALMEIDA BODINI CASO COLTON YEKUTIELI	ES 67PR 67PR 68PR 68NC 68NC 69UCRL 69REHO	154 1284 11980 174 1638 58A 175 55A 66 19330	НВС НВС НВС НВС НВС НВС НВС НВС	

P_{beam} (GeV/c)

 $\sigma_{\mathrm{pp}\eta}$ (mb)

References

		-	$\eta \rightarrow \pi^+\pi^-\pi^0$			η -	→ ALI	L MODES			
4.000			.040 ± .020			£	.140	± .0701*		800191	60
5.520			•020 •010			£	•070	.0351		ALEXANDER	67
5.970			.070 .050			ſ	.245	.1751		CASO	68
6.600			.029 .009			٤.	.101	•0311		COLTON	69
6.900			.040 .010			(.140	•0351		YEKUTIELI	69
10.010	•	•	.036 .015			ſ	•126	+05Z 1		ALMEIDA	68
	REPER	CRCES									
1	ALEXAND	ER 67	PR	154 1284					HBC		
2	ALMEIDA	68	PR	174 `1638	i i				нвс		
3	BODINI	68	• • NĆ	58A 175					нвс		
4	CASO	68	• • NC	55A 66					нвс		
5	COLTON	69	UCRL	19330					HBC		
6	YEKUTIE	LI 69	REHO						HBC		
P _{beam} (GeV/c)	E _{c.m.} (GeV)	$\sigma_{\mathrm{pp}\rho o}(\mathrm{mb})$	Referer	1ces						
5.520	.010	3.503	.0,70 ± .050	ALEXAND	ER 67		2	Not plott	ed.		
0.110	, 010 i	4.100	4 10	KA YAS	68		J				
	REFER	ENCES									
1	ALEXAND	ĒR 67	• • P R	154 1284			•		нвс		
		10			10					•	

*The error in $X = \frac{\Gamma(\omega \to \pi^+ \pi^- \pi^0)}{\Gamma(\omega \to all modes)}$ (~1%) and $X = \frac{\Gamma(\eta \to \pi^+ \pi^- \pi^0)}{\Gamma(\eta \to all modes)}$ (~4%) have not been folded in the quoted errors.

DATA IN PARENTHESES HAVE BEEN CORRECTED BY US.



Fig. 27. Boson resonance production in pp interactions. (a) $pp \rightarrow pp\omega$ and (b) $pp \rightarrow pp\eta$. Albelieve that their numbers are really for the sum of the $\pi^+\pi^-\pi^0$ and $\pi^+\pi^-\gamma$ modes, and we have though the authors state that their cross sections are only for the decay $\eta \rightarrow \pi^{+}\pi^{-}\pi^{0}$, they have these experiments are done) in the bubble chamber the π^0 's and γ 's are readily confused, we Cross sections for p production are apparently not made any cuts to separate π^{0_1} s from γ^1 s. Since at 4 to 10 GeV/c (where all of used this assumption in correcting to the total decays. tabulated only.

 $pp \rightarrow pp \begin{cases} \omega \\ \eta \\ \rho \end{cases}$

$d\sigma/dt$ for $pp \rightarrow d\rho^+$

$P_{beam}^{lab} = 21.100 \text{ GeV/c}$



	(MICROBA	RNS/STER/	DIAN	1)	
. • 716	.078	.012			
1.146	.025	.004			
1.719	.012	.002			
2.292	\004	.001			
2.865	.001	.000			
3.438	.000	.000			
29 SQUAR	E= 18.936				
PLUS POSSIBL	E SYSTEMATIC	ERROR OF	-+ =	LZPER	CENT
ALLABY	PL	29B	198(1969)	CNTR

Fig. 28. Differential cross sections for the $pp \rightarrow d\rho^+$.

Кx

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pp Inelastic Interactions—Strange Particle Production

beam	(GeV/c)	E _{c.m.} (GeV)	$^{\sigma}p\Lambda K^{+}$	(mb)	Reference	S		
2.807	± .005	2.705	.018 ±	.005	FICKINGER	62 68		
3.670	.037	2.978	.051	.012	LOUTTIT	61		
4.950		3.349	.048	.004	BIERMAN	66		
5.520	.010	3.503	.036	.010	ALEXANDER	67		
5.970	.050	3.620	.059	.011	CASO	68		
6.050	.060	3.640	•054 +	.003	CHINOWSKY	68		
		And States	- 11	.005		all the shares		
6.920	.075	3.856	.043	.008	ALEXANDER	68		
7.870		4.078	.054	.007	FIREBAUGH	68		
	REEER	ENCES						
1	LOUTTIT	61	PR		123 1465			HBC
2	FICKING	ER 62.	PR		125 2082		1	HBC
3	BIERMAN	66	PR		147 922		1	HBC
4	ALEXAND	ER 67	PR		154 1284		1	HBC
5	ALEXAND	ER 68	NC		53A. 455		1	HBC
6	CASO	68	NC		55A 66		weeks there and	HBC
7	CHINOWS	KY 68	· · · · PR		165 1466			HBC
8	FIREBAU	GH 68	PR		172 1354		the second s	HBC
9	HOGAN	68	•••PR		166 1472		(INTR



Fig. 29. Cross section for $pp \rightarrow p\Lambda K^{\dagger}$, including any possible resonance contributions.

(a)

P _{beam} (C	GeV/c)	E _{c.m.} (GeV)	$\sigma_{p\Sigma}^{+}K$	o (mb)	Reference	S	
3.670 :	± .037	2.978	•030 ±	.010	LOUTTIT	61	
4.950		3.349	.017	.003	BIERMAN	66	
4.950		3.349	•025	.002	SONDHI	68	
5.520	.010	3.503	.004	•004	ALEXANDER	67	
6.050	•060	3.640	•026	•004	CHINOWSKY	68	
6.920	.075	3.856	.020	.007	ALEXANDER	68	
7.870		4.078	.014	•005	FIREBAUGH	68	
10.000		4.540	.060	•020	HOLMGREN	67	ţ
	REFER	ENCES					
1	LOUTTIT	61	•••PR		123 1465		нвс
2	BIERMAN	66	•••PR		147 922		HBC
3	ALEXAND	ER 67	•••PR		154 1284		HBC
4	HOLMGRE	N 67	NC		51A 305		НВС
5	AL EXAND	ER 68	NC		53A 455		HBC
6	CHINOWS	KY 68	PR		165 1466		HBC
7	ETREBAU	GH 68.	e e PR		172 1354		HBC
8	SONDHI	68	•••PL		26B 645		HBC

(b)

P _{beam} (C	GeV/c)	E _{c.m.} (GeV)	^σ pΣ ⁰ K ⁺	(mb)	Referenc	es	
3.670 -	L .037.	2.978	.013 ±	.007	LOUTTIT	61	
4.950		3.349	.025	.003	BIERMAN	66	
5.520	.010	3.503	.016	.007	ALEXANDER	67	
5.970	•050	3.620	•012	.005	CASO	68	
6.050	.060	3.640	.017 +	.004	CHINOWSKY	68	
			-	.002			
6.920	.075	3.856	•029	.007	ALEXANDER	68	•
7.870		4.078	.025	.005	FIREBAUGH	68	
	REFER	RENCES					
1	LOUTTI	61.	PR		123 1465		HBC
2	BIERMAN	N. 66.	PR		147 922		HBC
3	ALEXAN	DER 67.	••••PR		154 1284		HBC
4	ALEXAN	DÉR 68.	NC		53A 455		HBC
5	CASO	68.	•••NC		55A 66		HBC
6	CHINDWS	SKY 68.	•••PR		165 1466		HBC
7	FIREBAU	JGH 68.	PR		172 1354		HBC





 $pp \rightarrow N\Lambda K\pi$

P _{beam}	(GeV/c)	E _{c.m.} (GeV)	^{<i>о</i>} рЛ К ^о л	.+ (mb)	Reference	S	
4.950 5.520 5.970 6.000 6.920 7.870 10.000) ± .010 .050 .007 .075)	3.349 3.503 3.620 3.627 3.856 4.078 4.540	.042 .078 .071 .064 .090 .072 .106	005 .013 .010 .006 .010 .007 .029	BIERMAN ALEXANDER CASO KLEIN ALEXANDER FIREBAUGH HOLMGREN	66 67 68 68 68 68 68 68 68 67	
1 2 3 4 5 6 7	REFE BIERMA ALEXAN HOLMGR ALEXAN CASO FIREBA KLEIN	RENCES N 66. DER 67. EN 67. DER 68. 68. UGH 68. 68.	PR PR NC NC NC PR UCRL		147 922 154 1284 51A 305 53A 455 55A 66 172 1354 18306		НВС НВС НВС НВС НВС НВС
P _{beam}	(GeV/c)	E _{c.m.}) (GeV)	^o n∧K ⁺	η+ (mb)	Referenc	es	
4.950 5.520 6.000 6.920 7.870	0 0 ± .010 0 .007 0 .075 0	3.349 3.503 3.627 3.856 4.078	.041 .075 .049 .078 .101	± .005 .015 .004 .011 .010	BIERMAN ALEXANDER KLEIN ALEXANDER FIREBAUGH	66 67 68 68	
1 2 3 4 5	REFE BIERMA ALEXAN ALEXAN FIREBA KLEIN	RENCES N 66. DER 67. DER 68. UGH 68. 68.	••••PR ••••PR ••••PR ••••UCRL		147 922 154 1284 53A 455 172 1354 18306		НВС НВС НВС НВС НВС
·							

P _{beam}	(GeV/c)	E _{c.m.} (GeV)	^σ pΛ K ⁺ τ	r ^o (mb)	Reference	es	
4.950		3.349	.028 ±	.003	BIERMAN	66	
5.520	±.010	3.503	.062	.012	ALEXANDER	67	
6.000	.007	3.627	.039	.006	KLEIN	68	
6.920	.075	3.856	.074	.010	ALEXANDER	68	
7.870		4.078	.077	.009	FIREBAUGH	68	
	REFER	ENCES					
1	BIERMAN	66.	••••PR		147 922		HBC
2	ALEXAND	ER 67.	PR		154 1284		HBC
3	ALEXAND	ER 68.	NC		53A 455		HBC
4	FIREBAU	GH 68.	•••PR		172 1354		HBC
5	KLEIN	68.	UCRL		18306		HBC

•

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Fig. 31. The $pp \rightarrow N\Lambda K\pi$ reaction cross sections.

 $pp \rightarrow N\Sigma K^0 \pi$

		-						
Pharm (GeV/c)	E _{c.m.}		- (mb) Reference	25		
- beam <			p2°K°#	` 				
4.950	+ 010	3.349	•020 ±	.003	BIERMAN	66 67		
5.970	-010 -050	3.620	•029	-005	CASO	68		
6.000	•007	3.627	.011	.002	KLEIN	68		
6.920	.075	3.856	.054	.012	ALEXANDER	68		
7.870		4.078	•029	•007	FIREBAUGH	68		
-	REFER	ENCES			1/7 000			100
1	ALEXAND	ER 67	PR		147 922			HBC
3	ALEXAND	ER 68	•••NC		53A 455			HBC
4	CASO	68	NC		55A 66			HBC
5	FIREBAU	IGH 68	•••PR		172 1354			НВС
0	KLEIN	00	• • • UUNL		10500			100
	5	Ecm						
Pharm ((GeV/c)	(GeV)	Onstro	-+ (n	b) Reference	es		
- beam x	,	· /	112 K°	71 \				
4.950		3.349	.007 ±	•002	BIERMAN	66		
5.520 :	± •010	3.503	•004	•004	ALEXANDER	67	•	
6.920	•075	3.856	•005	• 004	ALEXANDER	68		
10.000		4.078	.021	•005 •016	FIREBAUGH HOLMOREN	68 67		
10.000			••••		neenouell	0.		
•	REFER	ENCES			147 022			upr
2		ER 67	•••PR		154 1284			HBC
3	HOLMGRE	N 67	•••NC		51A 305			HBC
4	ALEXAND	ER 68	NC		53A 455			HBC
5	FIREBAU	GH 68	•••PR		172 1354			HBC
		Ecm						
P. (C	eV/c	(GeV)		o (mh) Reference	25		
beam ((00)	°ρΣ'Κ ^ο π) () itererene			
					01 CD MAN			
4.90	± .010	3.503	.007 2	.002	ALEXANDER	60 67		
6.920	.075	3.856	.011	.005	ALEXANDER	68		
7.870		4.078	.018	•006	FIREBAUGH	68		
10.000		4.540	•031	•013	HULMGREN	67		
	REFER	ENCES	00		1/7 000			
1	BIERMAN	66	•••PR		147 922			НВС
3	HOLMGRE	N 67	•••NC		51A 305			HBC
4	ALEXAND	ER 68	NC	•	53A 455			HBC
5	FIREBAL	IGH 68	•••PR		172 1354			HBC

· · ·

Deam	Ň	,	P= 11 /	·			
4.950	3	.349	•020 ±	.003	BIERMAN	66	 **
5.520	±.010 3	.503	.029	.012	ALEXANDER	67	
5.970	.050 3	.620	.016	.005	CASO	68	
6.000	.007 3	.627	.011	.002	KLEIN	68	
6.920	.075 3	. 856	.054	.012	ALEXANDER	68	
7.870	4	•078	.029	.007	FIREBAUGH	68	
	REFEREN	ICES					
1	BIERMAN	66	PR		147 922		HBC
2	ALEXANDER	67.	•••PR		154 1284		HBC
3	ALEXANDER	68.	NC		53A 455		HBC
4	CASO	68.	NC		55A 66		HBC
5	FIREBAUGH	1 68.	• • PR		172 1354	•	HBC
					the second s		

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Fig. 32. The pp $\rightarrow N\Sigma K^0 \pi$ cross sections.

 $pp \rightarrow \begin{cases} pp K^{\circ} \overline{K}^{\circ} \\ pn K^{+} \overline{K}^{\circ} \end{cases}$

P _{beam} (GeV/c)	E _{c.m.} (GeV)	^σ ppK⁰	\overline{K}^{o} (mb)	Reference	es		
4.950		3.349	.003	±.001	BIERMAN	66		• <i>•</i> *****
5.520	±.010	3.503	•006	•004	AL EX ANDER	67		
5.970	.050	3.620	.005	.003	CASO	68		
6.920	.075	3.856	.008	.004	ALEXANDER	68		
7.870		4.078	.010	.003	FIREBAUGH	68		
10.000		4.540	.033	.016	HOLMGREN	67		
	REFER	ENCES			•		•	
1	BIERMAN	66	PR		147 922			нвс
2	ALEXAND	ER 67.	PR		154 1284			нвс
3	HOLMGRE	N 67.	NC		51A 305			нвс
4	ALEXAND	ER 68.	NC		53A 455			HBC
5	CASO	68	NC		55A 66			HBC
6	FIREBAU	GH 68.	•••PR		172 1354			HBC

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P _{beam}	(GeV/c)	E _{c.m.} (GeV)	^σ pnK ⁻	+ K o (mb)	Reference	es		
4.950		3.349	.012	1.003	BIËRMAN	66	·	
5,520	± .010	3.503	.019	.010	ALEXANDER	67		
5.970	•050	3.620	.013	.007	CASO	68		
6.920	.075	3.856	.028	.008	ALEXANDER	68		
7.870		4.078	.025	.0.07	FIREBAUGH	68		
	REFER	ENCES	• .	•		•		
1	BIERMAN	66	PR		147 922			HBC
2	ALEXAND	ER 67	•••PR		154 1284			HBC
3	ALEXAND	ER 68	NC		53A 455			HBC
4	CASO	68	•••NC		55A 66			HBC
5	FIREBAU	IGH 68.	•••PR		172 1354			HBC



$$pp \rightarrow \begin{cases} ppK^{\circ}K^{\circ} \\ pnK^{+}\bar{K}^{\circ} \end{cases}$$

Fig. 33. $pp \rightarrow pp K^0 \overline{K}^0$ and $pp \rightarrow pnK^+ \overline{K}^0$ cross sections.

Table IV.	Various	$\mathbf{p}\mathbf{p}$	strange-particle	cross	sections	(not	plotted).
-----------	---------	------------------------	------------------	-------	----------	------	-----------

Pbe (Ge ^v	am V/c)	E _{c.m.} (GeV)	σ _P	pK ⁺ K ⁻ mb)	Re	ferenc	ės										
6.600	± .010	3.778	.034	± .012	CÓL	TON	68										
1	REFE	RENCES	UCL	A	1025						нвс						
P _b . (Ge	eam :V/c)	E _{c.m.} (GeV)	⁰ рпК (п	⁰ π ⁺ nb)	Re	ference	es			_				•			
6.920 7.870 10.000	± .075	3.856 4.078 4.540	.016 .025 .053	± .011 .012 .020	ALE Fir Kul	XANDER Eðaugh Muken	68 68 67		·								
1 2 3	REFE HOLMGR ALEXAN FIRESA	RENCES EN 67 DER 68 UGH 68	NC NC PR		51A 53A 172	305 455 1354					нвс нвс нвс						
۲ _{bcann} (GeV/c	;)		^v րրК (mb)		⁰ p <u>n</u> K ⁴ (n	·Κ^π+π nb)		٥ppl	(mb)	n+π ⁰		՞րո	K ⁻ K ⁰ π ⁺ π (mo)	r ⁺	Referenc	es
6.920 7.870 10.000			.006 .000	± .003		.005 : .008	1.004 .004		.00	13 ± 16	.002 .003		.0	04 ± -00	3	ALEXANDER FIREBAUGH HOLMGREN	68 68 67
1 2 3	REFE HOLMGRI ALEXAN FIREBA	RENCES EN 67 DER 68 UGH 68	NC PR		51A 53A 172	305 455 1354			_		HBC HBC HBC						
P _{beam} (GeV/c)	. ^σ pΣ	⁺ K ⁰ π+π- (mb)	^υ pΣ ⁻ К (π	ο _π + _π + ab)	٥p	5°K ^μ π+ (mb)	+ _π . α	′p∧ K⁰ (n	π+"¢ nb)		⁰ n∧ K ((o _π + _π + mb)	٥p٨	(mb)	Referen	nces
4.950 5.520 6.920 7.870 10.000		.004 .010 .015 .035	± .004 .005 .007 .013	.008 ± .025 .018	.005 .006 .007	.00; .01; .02;	2 ± .00; 4 .00; 1 .00;	2	.01/ 1 .040 .067 .058	.012 .013 .015 .014		.030 .020 .042	± .011 .008 .014	- 007 - 021 - 028 - 049	±.002 .008 .006 .007	BIERMAN ALE⊼ANDÊŘ ALEXANDER ⊢IREBAUGH HOLMGREN	66 67 68 68 67
1 2 3 4 5	REFE BIEPMA ALEXAN HOI MGRI ALEXAN FIREBA	RENCES N 66 DER 67 FN 67 DER 68 UGH 68	PR PR NC PR		147 154 51A 53A 172	922 1284 305 455 1354	-				H8C HBC HBC HBC HBC						
P _{beam} (GeV/c	n ;)		°p∧ K° (m	π ⁺ π ⁺ π ⁻	σp∧l	K ⁺ π ⁺ π. (mb)	-π0	σ _{n∧ K}	(+π+π+ mb)	-π-	ø _n	£ ⁺ K⁰ո (mե	^π + _π + _π .	σ _{pΣ} ο	K ⁰ π ⁺ π ⁺ π (mb)	Refere	nces
5.520 6.920 7.870 10.000			.006 .023 .023	+ .001 .003 .004 .012	.01	4 t.00 9 .00	ii. 16	,001 .010 .020	±.002 .003 .005		10 10	• ± دن 105 -	668 004	003	+ NA3	ALEXANDI AI FXANDI FIPERAIII HOLMGREI	R 67
1 2 3 4	REFEI ALEXANI HOLMGRI ALEXANI FIREBAI	RENCES DER 67 EN 67 DER 68 JGH 68	PR NL PR		194 51A 53A 172	1284 305 455 1354					HBC HBC HBC HBC						
P _{beam} (GeV/c)	•	^ø ppK ^ø	^{wnb})	, o	ppK ⁰ I	χο _π ο)	°p∃-	<u>к</u> +к+ nb)	-	°pn]	K ⁰ K ⁰ π (mb)	+ _π + _π -			Referer	nces
10.000	KFFF KOLAGRI	KENLES FN 67	. 005	+ .005	.02	1 ± .01 нвс	1	.007	±.005		-0	936 ± .	.018			HOLMGREP	67
P _{hear} (GeV/c	n c)		^σ pΣ-K ^o (m	π+π+πο ib)	σ _{nΣ}	-K ⁰ π ⁺	π+π+	σn∧l	— Κ ⁰ π ⁺ π (mb)	+ _π + _π	r [,] 0	ρΛΚ ⁰ (r	π+π+π- nb)	π ⁰		Referen	ces
10.000			.013	±.006	.00	7 * .00	•	.013	t.00	8	.03	4 ± .0				HOLMGREN	N 67
ı	REFE HOLMGR	RENCES En 67	NC			нвс	. •	NC				нвс					

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P_{beam} (GeV/c) 2p 4p 6p 8p 10p 12p Author Number

(001)01	••		٩Þ	• F				
4.	34. 1±1. 1						Coletti	55
4.		7. 5±. 20	. 09±. 02				Bodini	42
6.6		10, 5±, 46					Colton	141
6.92	28.4±.3						Alexander	41
8.1	26. 1±1. 4						Ginestet	131
28.5			~5.5	~2.4	~. 45	~. 05	Connolly	97

Table V. Cross sections for various reactions of the type $pp \rightarrow n$ -prongs (not plotted).

nn Interactions

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nn total cross section



Fig. 34. nn total cross section. The smooth curve is the pp total cross section from Fig. 1.

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nn elastic $d\sigma/d\omega$

 $P_{beam}^{lab} = 1.207 \text{ GeV/c}$



DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAM MOMENTUM=	1.207 GEV/	C	
COS(THETA)	SIGMA +- D	SIGMA	
	(MILLIBARN	S/STERADIAN)	
.017	2.500	.250	
.200	2+300	.300	
.391	2.900	.350	
.574	3.800	.400	
.656	4.700	.500	
.866	5.800	.800	
29 SQUARE=	.554		
07451 6001	CERN CONE	2 115710561	CNTÓ

Fig. 35. nn elastic differential cross section. Because of the indistinguishability of the neutrons, this distribution is symmetric about $\cos \theta_{c.m.} = 0$.

np and pn Interactions



P _{beam} (GeV/	c) σ_{np}^{T} (mb)	^o pn	(mb)	References
	504 00 ± 10 00			BARASHENKO 61 X
.19	223.00 7.60			BARASHENKO 61 X
.35	126.00 3.00			BARASHENKO 61 X BARASHENKO 61 X
.42	80.00 7.00			BARASHENKO 61 X
.56	46.40 1.20			BARASHENKO 61 X
.57	51.20 2.60 42.70 .90	42.70	± .90	KAZARINOV 63
.68	41.00 4.00			BARASHENKO 61 X
.88	35.60 .70	33.00	2.00	DZHELEPOV 56
.97	33.70 1.30			BARASHENKO 61 X
1.09	35.00 2.00	36 72	24	DZHELEPOV 56
1.11	36.00 2.00	33.12	•20	DZHELEPOV 56
1.26	37.00 4.00			DZHELEPOV 56
1.29	35.80 1.60	38.04	.20	PALEVSKY 64
1.41		39.44	.14	BUGG 66 \$
1.61		39.77	-13	BUGG 66 \$
1.66		38.20	3.70	BAISUN 59 6
1.78		40.56	.10	8UGG 66 \$ 8UGG 88 \$
1.94		41.53	.09	BUGG 66 \$
1.95		41.48	.09	BUGG 66 S
2.08		42.17	.09	BUGG 66 \$
2.28		42.50	.08	BUGG 66 \$
2.30	38.30 2.10	42.68	.08	BUGG 66 \$
2.59		42.89	.08	BUGG 66 \$
2.68		42.96	-07	8066 66 \$
2.82		43.02	.08	BUGG 66 \$
2.86		43.04	.08	BUGG 66 \$
2.90		43.11	.08	BUGG 66 \$
3.00	40.30 1.40			PALEVSKY 64
3.00		41.67	.09	BUGG 66 \$
3.11		43.23	.07	BUGG 66 \$
3.14		43.12	.07	BUGG 66 \$
3.28		42.81	.07	BUGG 66 \$
3.30	20.10.2.40	42.99	.07	BUGG 66 \$
3.41	38.10 2.60	42.58	.07	BUGG 66 \$
3.55		42.52	.07	BUGG 66 \$
3.62	39.40 3.30	42.52	-06	BUGG 66 \$
4.00	43.10 .60			PARKER 70
4.04		42.49	.07	BUGG 66 \$
4.30	40.40 1.90	42.20		ENGLER 68
4.51		(36.80	-90)	DIDDENS 62
4.55	43.40 1.60	42.23	.07	PANTUEV 65
4.97		42.07	.07	BUGG 66 \$
5.22		42.02 42.03	.05	BUGG 66 \$
5.70	42.50 .60			PARKER 70
5.82		41.82	.07	BUGG 66 S DIDDENS 62
5.86	33.60 1.60	131100		ATKINSON 61
6.00	61 20 1 70	42,60	1.70	GALBRAITH 65 \$
6.37	41.20 1.70			PANTUEV 65
6.50	38.70 1.50	177.40		ENGLER 68
7.78	39.30 1.70	(37.60	1.00 /	PANTUEV 65
7.83		41.33	.08	BUGG 66 \$
8.00	40.80 1.90	41.80	1.70	GALBRAITH 65 S PANTUEV 65
9.19	41.20 2.60			OZHDYANI 62
9.90	70 50 50	(36.00	2.50 1	ASHMORE 60
10.00	34.50 .50	41.50	1.70	GALBRAITH 65 \$
12.00		40.40	1.70	GALBRAITH 65 \$
14.00	37,10 1 20	40.20	1.70	GALBRAITH 65 \$ KREISLER 68
15.80	51.10 1.20	(36.20	2.00)	ASHMORE 60
16.00	22.50 1.00	40.20	1.70	GALBRAITH 65 \$
18,00	37.50 1.20	39.20	1.70	GALBRAITH 65 \$
19.30		38.90	.70	BELLETTINI 65 \$
20.00	37.70 .80	38.70	1.70	KREISLER 68
22.00	51110 100	38.20	1.70	GALBRAITH 65 \$
24.20	20.00.10	(35-51)	2.00 1	ASHMORE 60
27.00	38.90 .60			BAELSEGN 00
S GLAUBE	KEN FROM & REVUE ARTICLE			
A DATA TO	ACTIVITY A REFUE ANTICLE			
	REFERENCES	2 116	CALTO	
2	SATSON 59P.RDY-SOC.	251 233	CC	
3	SHMORE 60 PRL	5 576	CNTR	
4 5	ATKINSON 61PR	123 1850 9 549	CNTR	
6	DIDDENS 62PRL	9 32	CNTR	
7	DZHDYANI 62JETP	15 272	CNTR	
9	CHACHATURY 63PL	7 80	CNTR	
10	PALEVSKY 64 PARIS CUNF	1964 162	CNTR	
11	SELLETTINI 65PL	19 341 138 8913	SPRK+CNTR CNTR	
13	ANTUEV 65SJNP	1 93	CNTR	
14	3UGG 66PR	146 980	CNTR	
15	REISIER 68PL	278 599 20 468	CNTR	
17	ABRAMS 59BNL	14125	CNTR	
18	PARKER 70 PL	318 246	CNTR	

DATA IN PARENTHESES HAVE NOT BEEN INCLUDED IN THE FIGURE



Fig. 36. np and pn total cross sections. (a) On log-log plot and (b) on a linear scale. We have plotted only those pn data that have had Glauber-type corrections applied. The accompanying table contains the non-Glauber corrected points as well. The solid curve in (a) is the pp total cross section from Fig. 1. In (b) we have not included symbols on the points in order not to mask the actual values.



Fig. 36 (continued)



Fig. 37. Elastic cross sections for (a) all np and pn, and (b) np in the backward direction only (i.e., charge exchange). The pn data have had Glauber-type corrections applied. The solid curve in (a) represents the pp elastic data (Fig. 1). The dashed line in (b) represents our best fit to the data of $\sigma = Kp_{beam}^{-n}$ (n = 3.0±0.6). Note the surprisingly few experiments that have been reported on these reactions.

* FOR DISPLAY OF THESE DATA SEE FIG. 42

20 SOUARE= 2.113 PLUS POSSIBLE SYSTEMATIL ERROR OF +- 5PER CENT PERL SLAC PUB-622 (1969) SPRK

MINIMUM	HAX LAUM	SIGMA +	DSIGNA	
		INILLIB.	ARNS/(GEV/C	1**21
.100	.200	44.437	4.030	
.200	.300	18.111	1.553	
.300	.400	8.262	1.003	
.400	.500	6.267	. 782	
.500	.000	2.663	. 391	
.600	.700	1.927	. 268	
.700	.800	1.535	.259	
. 800	. 900	1.223	.171	
.900	1.000	- 666	.103	
1,000	1.200	.714	.083	
1.200	1.400	.597	.075	
1.400	1.600	. 337	.040	
1.600	1.800	.217	.035	
1.800	2.200	.171	. 020	
2.200	2.600	. 115	.015	
2.600	3.000	.140	- 025	
3.000	3.430	. 122	031	
3.000				

BEAM HOMENTUM RANGES FROM 2.790 TO 3.310 GEV/C

HEAR MURENTUNIOENTIAL VALUETE 3.050 GEV/C*

NOM TR

* 7 7 7	17.007	1.003					
1.075	27.637	2.126			-		
1.127	37.204	3.189		20 SQUAR	LE= 1.171		
1.147	42.518	3.189		PLUS POSSIBL	E SYSTEMATIC	ERROR OF +-	5PER CENT
1.162	49,959	4.252					
1.173	63.778	4.252		PERL	SLAC	PU8-622 [1]	969) SPRK
1 180	70.155	4.252					
1 1 87	85 237	5.315					
20 SOVARE=	.591 Systematic	. LRÁÚŇ 86 - 10069 (CENT				
ANAGLOBELI	JETP	37 1125(1960)	CNTR	BEAN MONEN	UMICENTRAL VA	IVE1= 2.520 G	FV /C
				DCVN HOMENI	THE TANGES FRU	M 2,250 TO 2	.790 GEV/C
				MOM	4 TR		
BEAN MUMENIUM	CENTRAL N	ALUCI- 2 741 GPV/C		MINIMUM	HAXLAUR	SIGNA +	- DSIGMA
						(#11719	ARN\$/(GEV/C1**2)
BEAN MOMENTUM	RANGES F	UM 1.69/ 10 2.785	GEV/C	.100	.200	49.933	5.245
				.200	.300	19.447	2.073
****THIS DAFA	WAS READ	FROM A GRAPH***		.300	.400	13.582	1.681
				.400	.500	7.128	. 761
MON TRANSF	SIGMA ↔	DSIGMA		. 500	.600	3.745	.468
	(MILLIB/	RNS/(GEV/C)++21		.600	.700	2.397	.382
.250	21.000	2.000		.700	.800	1.706	.223
.350	8.000	1.000		.800	.900	1.090	.154
.500	7.000	1.000		.900	1.000	1.051	.153
.600	2.550	5.000		1.000	1.200	.636	.084
.100	7.500	- 450		1.200	1.400	. DÚO	+064
-800	1.500	- 400		1.400	1.600	.353	.049
.850	1.650	.450		1.600	1.800	.270	.041
1.000	.800	.300		1,800	2.000	. 299	.049
1.200	.700	-100		2.000	2.490	.391	.000
1.450	- 500	.100					
				20 501148	E= 1.642		
20 SQUARE=	1.398			PLUS POSS IBL	E SYSTEMATIC	ERRUK UF +-	SPER CENT
	PRI	16 1217(1966)	SPRK	PERI	SLAC	PU8-622 []	9691 5028

****THIS DATA	WAS READ	ROM A GRAPH****
MOM TRANSF	SIGMA +-	DSIGMA
	(MILLIBAI	RN\$/(GEV/C1*+2)
.009	88.226	11.693
.047	53.148	8.504
-113	39.330	2.126
.166	27.637	3.189
.235	23.385	2.126
296	18.070	1.063
.389	15.944	1.063
488	12.756	1.063
.60)	11.693	1.063
. 714	10-630	1.063
803	10.630	1.063
.013	14.881	1.063
006	17.007	1.063
1 075	27 637	2.126
1 1 1 7 7	37 204	3,189
1.147	47 518	3,189
1 1 4 7	40.050	6 252
1.102	49.779	4 252
1.1.73	70 165	4 252
1-180	10.155	5 316
1 1 167	87 8 8 ? Y	
	603	
A SUNARE	. 291	
PLUS PUSSIAIR	STSIEMATIC	furnin OL , furnes

.

.

381.710 385.058 20 SQUARE= .188

BEAN MOMENTURe 1.257 GEV/C

HEAM MOMENTUM= .645 GEV/C

MON TRANSF

.001 .003 .011 .0256 .1000 .114 .1145 .211 .211 .2466 .303 .331 .3460 .364 .367 .371 .375

KAZARINOV

****THIS DATA WAS READ FROM A GRAPH****

MA	
GEV/C1*+21	
93	
04	
26	
89	
26	

		•		
BEAM MOMEN	FUNICENTRAL VAL	UEI= 1.975	GEV/C	
BEAM NOMEN	TUM RANGES FROM	1.700 10	2.250 GEV/C	
10K	1 TR			
MININUM	MAX [MUM	S I GMA	+- DSIGMA	
		(MILL)	BARNS/ (GEV/C	1++21
.100	-200	46.008	5.237	
.200	.300	23.956	3.038	
.300	.400	15.324	1.744	
.100	.500	8.090	1.037	
.500	.600	7.501	. 910	
+ 600	.700	3.336	. 442	
.700	.800	2.722	.457	
. 800	. 900	1.957	.297	
.900	1.000	1.536	.260	
1.000	1.250	1.034	.176	
1 360				

A WAS REAL	D FROM A GR	APH####		мам
SIGMA	+- DSIGMA			
(MILLI	BARNS/(GEV/	C)++2)		
318.091	83.708			
277.911	23.438			
157.372	23.438			
140.630	16.742			
100.450	13.393			
83.708	10.045			
73.663	3.348			
A6.967	3.348			
66.957	3.348			
73.663	3.348			
93.753	3.348			
110.495	6.697			
127.237	6.697			
157.372	6.697			
184.158	3.348			
234.383	3.348			PLUS
271.215	3.348			
308.046	6.697			DZH
348.226	6.697			
381.710	6.697			
385.058	10.045			
188				
JETP	16	24(1963)	CNTR	
			•	

BEAM NUMENTUM	1.194	GEV/C
MOM TRANSF	SIGMA	+- DSIGMA
	CALLE	BARNS/IGEV/CI++21
.098	42.720	2.309
.159	34.638	3.464
.224	26.556	1.963
.297	24.247	2.309
.385	18.474	1.501
.478	12.701	.924
.573	10.507	.693
.667	9.006	.577
.766	9.006	. 577
.848	11.546	.808
.929	19.628	1.501
1.001	24.247	2.309
1.045	39.256	3.464
1.078	41 104	5.773

BEAM MOMENTUM= 1.194 GEV/C

1.078 61.194 5.773 29 SQUARE# .544 5 POSSIBLE SYSTEMATIC ERKOR OF +- 13PER CENT

ELEPOV CERN CONF 2 115(1956) CNTR

np Forward elastic do/d

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2



have been transformed to $d\sigma/dt$ vs. t. One experiment (Besliu, Rei. 145) which reported numbers of events rather than $d\sigma/dt$ (and did not give a factor that would en-Some distributions given originally as $d\sigma/d\omega$ vs. possible structures, systematic errors have not been in-(t is the momentum transfer between the incoming and outgoing neutrons.) So as not to mask able us to convert to $d\sigma/dt$) has not beer included. The cluded, even though they may have beer given by the Fig. 38. np elastic differential cross section for $|t| \le 2 (GeV/c)^2$. authors. θ c. m.

The lack of points in the forward direction in most experi-(t) interval than we used in fitting the pp data. For a dis-The solid lines are the results of our least-squares fit to $d\sigma/dt = \frac{d\sigma}{dt} \begin{vmatrix} \sigma & bt \\ \pm & t \end{vmatrix}$, using data in the interval $|t| \le 0.7 (GeV/c)^2$. The lack of small momentum-transfer data forced us to use a larger = 90 deg. cussion of the limitations of these fits see the caption of ments is due to the difficulty in detecting neutrons scatvertical arrows indicate the positions of $heta_{
m c.\,m.}$ tered through very small angles. the following figure (and the text).

Forward elastic $d\sigma/dt$

np Forward elastic do/dt

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM

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BEAN MOMENTUMICENTRAL VALUE) = 3.306 GEV/C BEAM NOMENTUMICENTRAL VALUELE 3.570 GEV/C BEAM MOMENTUM RANGES FROM 2.785 TO 3.826 GEV/C SEAM MOMENTUM RANGES FROM 3.310 TO 3.830 GEV/C ****THIS DATA WAS READ FROM A GRAPH**** MOM TR SIGHA +- DSIGHA (MILLIBARNS/IGEV/C)++2) 43.885 3.679 15.932 1.214 4.703 .860 5.564 .729 3.327 .356 1.432 .188 809 .143 MON TRANSF SIGMA ← DSIGMA {MILLIBARNS/(GEV/C)**2) MINIMUM MAXINUM (MILL) 24.000 15.000 5.400 5.600 2.650 1.100 1.150 1.050 .250 2.000 .100 . 200 3.679 1.214 *860 .729 .356 .188 .143 .142 .096 .050 .035 .033 .022 .019 .250 .350 .450 .550 .650 .750 .900 .100 .200 .300 .400 .500 .600 .700 .200 .300 .400 .500 .600 .700 .800 .700 .600 .450 .300 .300 .808 1.000 1.200 1.400 1.800 2.500 3.200 .250 .150 .100 .050 .030 .040 .808 .687 .654 .442 .232 .218 .164 .130 .800 .900 .900 1.000 1.200 1.400 1.600 1.800 2.000 2.500 3.000 .800 .400 .400 .160 .150 .900 1.000 1.200 1.400 1.600 1.800 .019 .012 .007 .007 .012 20 SOUARE= 2.343 2.000 2.500 3.000 3.500 .084 .081 .045 .059 3.500 KREISLER PRL 16 1217(1966) SPRK

20 SOUARE= 2.582 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5PER CENT

BEAM MOMENTUM(CENTRAL VALUE)= 4.338 GEV/C

****THIS DATA WAS READ FROM A GRAPH****

2.700 1.400 .900 .350 .340 .310 .080 .034 .037 .034

3.283

PRI

MOM TRANSF

.200 .300 .400 .550 .700

.700 .800 .900 .950 1.100 1.400 1.750 2.500 3.500 4.600

20 SQUARE=

KREISLER

BEAM MOMENTUM RANGES FROM 3.826 TO 4.849 GEV/C

SIGMA ← DSIGMA (MILLIBARNS/IGEV/CI*+2) 18.000 2.000 9.000 1.000 4.300 7700 2.700 400

.700 .400 .300 .200 .130 .130 .060 .070 .020 .020 .608 .010 .006

16 1217(1966)

SPRK

SLAC PUB-622 (1969) SPRK PERI

DEAM MOMENTUM(CENTRAL VALUE) = 4.085 GEV/C

MON TR

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BEAM MOMENTUM RANGES FROM 3.830 TO 4.340 GEV/C

.

M IŅ IMUM H	MUM] XAP	SIGMA +	- OSIGMA
		IMILLIB	ARNS/(GEV/C)##2)
.100	.200	36.458	2.676
. 200	.300	18.225	1-196
.300	.400	8.090	.708
.400	.500	4.257	.559
.500	.600	2.473	.337
.600	.700	1.559	.192
.700	.800	1.007	.141
.800	.900	.413	.090
.900	1.000	.612	.119
1.000	1.200	.256	.034
1.200	11400	. 227	.030
1.400	1.600	.171	.028
1.600	1.800	.109	.018
1.800	2.000	.072	.013
2.000	2.500	.050	.007
2.500	3.000	.037	.007
3.000	3.500	.026	.004
3,600	4.000	.023	. 004
4.000	4.500	.019	.007
4.500	5.300	.055	.013
ZQ SQUARC-	3.051		
PLUS POSSIBLE SY	STEMATIC	ERRUR OF +-	SPER CENT
PERL	SLAC	PUB-622 (1	969) SPRK

BEAM MOMENTUM(CENTRAL VALUE) = 4.595 GEV/C

BEAM HOMENTUM RANGES FROM 4.340 TO 4.850 GEV/C

MOM	۲R·
-----	-----

PERL

MINIMUM	HAXIMUM	SIGMA	+- DSIGMA
	•	CALLE	BARNS/(GEV/C)++2)
.100	-200	34.847	2.177
• 2 UÚ	•300	11.930	.770
.300	.400	6.294	.490
.400	.500	3.037	+354
• 500	.600	1.484	+217
.600	.700	.973	.121
./00	· • 000	. 573	.080
.800	. 900	.414	.068
.900	1.000	.248	.055
1.000	1.200	.210	.031
1.200	1.400	.117	.016
1.400	1.600	.078	.013
1.600	1.800	.055	.012
1.800	2.000	.025	.006
2.000	2.500	.021	•003
2.500	3.000	014	.003
3.000	3.500	.011	.003
3.500	4.000	.009	.002
4.000	4.500	.012	.002
4.500	5.000	.012	.002
5.000	5.500	.005	.002
5.500	6.250	.020	.006
20 50	UARF= 3.519		
PLUS POSS	IBLE SYSTEMATIC	ERROR OF +-	SPER CENT

PUB-622 (1969)

SPRK

SLAC

BEAM	MOMENTUM	CENTRA	VAL	16)= 5	.105	GEV/C	
BEAM	MOMENTUM	RANGES	FROM	4.850	о то	5.360	GEV/C

	MOM TR		
MINIMUM	MAXIMUM	SIGMA	+- DSIGMA
		(MILL)	BARNS/(GEV/C)++2
-110	• 200	33.477	2.080
- 200	.300	16.948	1.000
. 300	.+00	7,206	• 523
.400	.500	3.464	.369
.500	.600	1.903	.264
.600	.700	1.036	.134
.700	.800	.545	.075
.800	.900	.568	-079
• 900	1.000	.281	.055
1.000	1.200	.197	.035
1.200	1.400	+090	.014
1.400	1.600	.060	.011
1.600	1.800	.044	.010
1.800	2.000	•028	.009
2.000	2.500	.014	.002
2.500	3.000	.016	.003
3.000	3.500	.010	.002
3.500	4.180	.004	.001
4.330	5.000	.006	.002
5.000	5.500	.006	.002
5.500	6.000	.010	.003
6.000	6.500	.012	.003
6.500	7.180	.017	.005
2Q SQ	QUARE= 3.989		
PLUS POSS	SIBLE SYSTEMATIC	ERROR OF +-	SPER CENT
PERL	SLAC	PUB-622 (1969) SPRK





np Forward elastic $d\sigma/dt$

HOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUM	(CENTRAL	. VALUE)= 5.357 GEV/C		BEAM MONEN	UNICENTRAL VAL	UE)= 5.615 G	EV/C
BEAM MOMENTUN	RANGES	FROM 4.849 TO 5.865	GEV/C	BEAM MOMENT	UM RANGES FROM	5.360 TO 5	.970 GEV/C
****THIS DATA	WAS REA	AD FRUM A GRAPH****		MOM	1 TR		
MOM TRANSF	SIGMA	+- DSIGMA		MINIMUM	MAXEMUM	SIGMA +	- DSIGMA
	(MILL)	BARNS/(GEV/C)**2)				(MILLIB	ARNS/{GEV/C}**2
.200	14.000	1.000		.110	.200	39.129	2.611
.350	6.500	.500		.200	.300	17.365	1.161
,450	4,000	.300		.300	.400	8.532	- 583
• 5 5 0	.850	.140		.400	.500	4.792	.413
.650	1.100	.100		.500	.600	2, 231	. 302
.750	.440	.070		.600	.700	1.480	150
.850	.610	.100		.700	.800	.791	.091
1.000	.320	.080		.800	. 900	. 455	.066
1.150	.110	.020		. 900	1.000	- 305	- 056
1.350	.090	.020		1.000	1.200	.167	. 030
1.750	.050	.010		1.200	1.400	.158	. 024
2,500	.016	.004		1.400	1.600	.055	.010
3.600	.005	.002		1-600	1.800	. 030	007
4.700	.005	.002		1.800	2.000	. 027	008
5.500	.306	.003		2 - 000	2.500	022	006
6.500	.008	.003		2.500	3,000	.022	.004
		• • • •		3 000	3 500	000	.002
20 SQUARE=	4.221			3 500	4 4 9 0	.004	.002
				2.700	4.400	.004	.001
KREISLER	PRI	16 1217(1966)	SPPR	4.990	4 500	.004	.001
			5. KN	B.000	2,000	.005	.002
				5.500	7.000	• 006	+002
				7.000	7.500	.013	.004
				7.500	1.910	-012	-005

.110	.200	39.129	2.611
.200	.300	17.365	1.161
.300	.400	8.532	- 583
.400	.500	4.792	.413
.500	.600	2,231	. 302
.600	.700	1.480	.150
.700	.800	.791	.091
.800	.900	. 455	.066
.900	1.000	.305	.056
1.000	1.200	.167	.030
1.200	1.400	.158	.024
1.400	1.600	.055	.010
1.600	1.800	.030	.007
1.800	2.000	.027	.008
2.000	2.500	.022	.004
2.500	3.000	.013	.002
3.000	3.500	.004	•00Z
3.500	4.480	.004	.001
4.990	6.000	.004	.001
6.000	6.500	.005	.002
6.500	7.000	• 006	.002
7.000	7.500	.013	.004
7.500	7.970	.012	.005
20 SOLARE	* 4.460		
	CVCTENATIC	58000 OF +-	EDED CENT
LUNA LASSIOCE	ararematic	ERROR OF #-	SPER LENI

PUB-622 (1969) SPRK

.

BEAM	MOMENTUMICENTRAL	VALUET	6.120	GEV/C

BEAN MOMENTUN RANGES FROM 5.870 TO 6.370 GEV/C

MOM TR MINIMUM

.

MINIMUM	MAXIMUM	SIGMA +-	- DSIGMA
		(MILLIG	ARNS/(GEV/C)**2)
.130	.200	30.350	2.318
.200	.300	15.191	.970
.300	.400	6.116	.421
.400	.500	3.240	.283
.500	.600	2.269	.267
.600	.700	1.196	.118
.700	.800	.631	.078
.800	.900	.361	.050
.900	1.000	:100	.014
1,000	1.200	.111	.022
1.200	1.400	• ÚU 5	.916
1.400	1.600	.030	.007
1.600	1.800	.022	.005
1.800	2.000	-021	.006
2.000	2.500	.012	.003
2.500	3.000	+006	.001
3.000	3.500	.005	.001
3.500	4.000	.006	.002
4.000	4.790	.001	.001
5.650	7.000	+002	.001
7.000	8.000	.0054	.001
8.000	8.750	+012	-003
20 50048	E= 4.928		
PLUS POSSIBL	E SYSTEMATIC	ERROR OF +- 5	PER CENT
PERL	SL AC	PUB-622 (19	69) SPRK

BEAM MUMENTUMICENTRAL VALUEI= 6.775 GEV/C BEAM MOMENTUM RANGES FROM 6.370 TO 7.180 GEV/C

NUM TR

MINIMUM	MAXIMUM	SIGMA	+- DSIGMA
		(MILL T	HARNS/ (GEV/C1++2)
.170	.200	32.876	3,598
. 200	.300	15.414	1.000
.300	. 400	8.736	.578
.400	.500	3.901	. 327
.500	. 600	2.050	. 252
.600	.700	1.177	- 149
.700	.800	. 709	.089
.800	.900	. 382	.057
.900	1.000	. 282	.049
1.000	1.200	.145	. 026
1.200	1.400	.059	.017
1.400	1.500	1077	.011
1.600	1.800	.041	.009
1.800	2.000	-018	- 005
2.000	2.500	.018	.004
2.500	3.000	.006	.002
3.000	3.500	-004	-001
3.500	4.000	.005	.002
4.000	5.090	- 001	001
6.360	7.250	.003	-001
7.350	8.500	-001	.001
8.500	9.630	-006	-002
20 SQUARE= 5.536			
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +-	5PER CENT
PERL	SLAC	PUB-622 (1969) SPRK

BEAM MOMENTUM RANGES FROM 5.865 TO 7.178 GEV/C ****THIS DATA WAS READ FROM A GRAPHITTE MON TRANSF STOMA + BSTONA

BEAM MOMENTUM(CENTRAL VALUE) = 6.522 GEV/C

SLAC

PERL

nun.	1.0.404.01	21004	. 031944		
		(MILLIE	BARNS/IGE	//()++2)	
	.250	14.000	1.000		
	.250	6.700	.500		
	.400	3.100	.200		
	-500	1,300	.200		
	.600	.930	+150		
	.700	.800	.130		
	.800	.400	•090		
	.900	.250	060		
	1.100	.100	.030		
	1.350	.040	-012		
	1.700	.027	•008		
	2.500	.013	•003		
	3.500	.004	-001		
	4.400	•004	• 002		
	6.300	.002	.001		
	7.500	.034	• 002		
	8.000	• 008	.003		
20	SUUARE=	5.301			
KRET	SILER	PRI.	16	1217(1966)	SPRK

BEAM NOMENTUM= 7.400 GEV/C SIGMA +- DSIGMA (MILLBARNS/IGEV/C)**2) 22.000 L.300 15.400 1.000 10.300 .860 8.200 .750 5.700 .660 2.570 .560 2.570 .560 2.600 .460 1.150 .340 .764 .270 .423 .210 .208 .070 MON TRANSF .174 .223 .274 .323 .423 .423 .473 .538 .649 .743 .851 .934 20 SQUARE= 6.117

GIBBARD

.

PRL 24 22(1970) SPRK+CNTR


Fig. 38 (continued)

np Forward elastic $d\sigma/dt$

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2

BEAM MOMENTUM	CENTRAL V	/ALUE)= 9	.895 GEV/C		BEAM MOMENTUM	=11.400	GEV/C		
BEAM MOMENTUM	RANGES FF	ROM 8.890	TD10.899	GEV/C	NOM TRANSF	S I GMA	+- DSIGMA IBARNS/(GEV.	([]**2]	
****THIS DATA WAS READ FROM A GRAPH****			.175	21.000	.930				
					•224	15.500	.880		
MOM TRANSF	SIGMA +-	- DSIGMA			.274	10.600	.700		
	(MILLIBA	ARNS/(GEV	/C)**2)		.323	7.180	.570		
.350	6.600	.400		• •	.374	5.340	.510		
.450	3.100	.200			.422	3.500	.430		
.550	1.700	-200			.474	2.590	.390		
.650	.710	•090			.545	1.830	.260		
.750	.350	.080			.651	.799	.170		
.850	.190	•050			.744	.426	.130		
.950	.Ó90	.040	· .		.846	.306	.110		
1.050	.062	.030			.974	.173	.096		
1.150	.026	.026			1.170	.069	.021		
1.250	.018	.018			1.476	.034	.012		
2Q SQUARE=	8.444				20 SQUARE=	9.851	·		
ENGLER	PL	29B	321(1969)	SPRK	GIBBARD	PRL	24	22(1970)	SPKK+CNTR

BEAM MOMENTU	M MOMENTUM=15.400 GEV/C				BEAM MOMENTUM=19.400 GEV/C			,	
MOM TRANSF	SIGMA +-	DSIGMA			MOM TRANSF	SIGMA	+- DSIGMA		
	(MILLIBA	RNS/(GEV	/C)**2)			(MILL.	IBARNS/(GEV	/C)**2)	
.175	20.700	.870			.223	14.800	.790		
•223	14.100	.770			.274	9.940	.630		
.273	10.000	.630			.323	6.620	.510		
.323	7.460	.540			.374	4.880	.440		
.373	5.130	.450			.423	3.580	.390		
.423	3.200	.370			.473	2.380	.320		
.474	2.180	.320			.550	1.140	.220		
.549	1.540	.230			.638	.633	.140		
. 649	• 555	.140			.743	.328	.100		
.745	.294	.100			.851	.147	.069		
.846	.128	.007			985	•062	020		
.969	.056	.022			1.201	.036	.013		
1.197	.010	.006			1.638	•002	.003		
1.515	.019	.008						•	
					20 SQUARE	= 17.342			
ZQ SQUARE	- 13.574								
					GIBBARD	PRI.	24	22(1970)	SPRK+UNIR
GIBBARD	PRL	24	22(1970)	SPRK+CNTR					
				•					

BEAM MOMENTU	EAM MOMENTUM=23.400 GEV/C				BEAN MOMENTUM=27.400 GEV/C				
MOM TRANSF	SIGMA +-	DSIGMA			MUM TRANSP	SIGMA +	DSIGNA		
•	(MILLIBA	RNS/(GEV)	/C)**2)			(MILLIB/	ARNS/(GEV	/C)**2)	
.227	11.700	.820			.325	4.840	.680		
.273	6.560	.470			.373	3.080	.490		
.324	4.610	.380			.422	2.190	.430		
.373	3.030	.310			.472	1.370	.250		
.422	2.160	.270			.553	.951	.260		
.474	1.370	.220			.651	.391	.160		
.550	.721	.150			.738	•065	.026		
.650	.421	.110			+881	-012	.009		
.743	.072	.039							
.848	.110	.051			2Q SQUARE	= 24.842			
.982	.016	.009							
1.185	.012	.006			GIRBARD	PRL	24	22(1970)	SPRK+CNTR
20 SQUARE	= 21.091								
GIBBARD	PRL	24	22(1970)	SPRK+CNTR					

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Fig. 39. The slope (b) coefficient from our least squares fit to the forward np elastic differential cross section to the formula $d\sigma/dt = \frac{d\sigma}{dt}\Big|_{t=0}$. e^{bt} over the range $|t| \leq 0.7 (GeV/c)^2$. In the table χ^2/N is the chi-square of the fit divided by the number of degrees of freedom. We have tabulated and plotted values from only those distributions having $\chi^2/N \leq 6$. All experiments in this figure, except Dzhelepov (Ref.137), have normalized their data by using the optical theorem, laking various amounts of real parts. Thus a plot of the intercept, $d\sigma/dt|_{t=0}$ is meaningless in the present case, and we have not given it. A more serious consideration (since it can affect not only the intercept but also the slope) is the fact that $d\sigma/dt$ has not been measured at small angles (i.e., small |t| values). Thus there could be considerable structure that has not yet been uncovered. [See for example Fig. 43, which shows that the structure in the backward direction is very narrow indeed, starting at $|u| \leq 0.01 (\text{GeV/c})^2$. Therefore one must be very cautious about using the values from our fits above. For comparison we have also plotted our fits to the slopes of the pp elastic scattering (from Fig. 3b). For a discussion of the apparent difference between the np and pp data see the text. Fitted values of the slope, whenever given by the authors, are presented in Table VI.

P_{beam} t FORMULA PARAMETERS References (GeV/c) min max 1.697 .400 X=A *EXP[-B*T] KREISLER .10 в -6.321 ± .647 66 1.70 .10 .500 Y=A*EXP[-8*T] в -5.500 PERL 69 .800 1.70 .10 .400 Y=A*EXP[-B*T] PERL 69 в -5.660 .540 2.30 .10 .500 Y=A*EXP[-B*T] -6.670 PERL 69 8 .810 2.30 Y=A*EXP[-B*T] в -6.220 .480 PERL 69 2.785 X=A*EXP(-B*T) .10 .500 в -5.527 KREISLER 66 .463 2.80 Y=A*EXP[-8*T] PERL .10 .400 в -6.860 .480 69 2.80 Y=4*EXP(-8*T) 8 PERL .10 .500 -8.480 .740 69 3.30 Y=A*EXP[-B*T] 8 -7.140 PERI .10 .400 .460 69 3.30 Y=A*EXP[-B*T] PERL ß 69 .10 .500 -8.230 .640 3.80 Y=A*EXP[-8*T] PERL 69 .10 .400 в -7.330 .430 3.80 Y=A*EXP[-B*T] -7.480 PERL 69 в .570 3.826 X=A*EXP[-B*T] KREISLER .10 .400 в -6.655 66 .432 4.30 Y=A*EXP[-8*T] .10 .500 в PERL 69 -8.730 .490 4.30 .10 .400 Y=A*EXP[-8*T] 8 -8.250 PERL 69 - 380 4.80 Y=A*EXP[-B*T] -7.630 PERL 69 .10 .500 8 .480 4.80 Y=A*EXP(-B*T) -7.650 PERL 69 я .360 4.849 X=EXP[A+BT] 8 6.220 .310 ENGLER 69 4.849 X=A*EXP[-8*T] .10 .500 B -7.720 KREISLER 66 .411 Y=A*EXP(-B*T) 5.40 8 -7.110 .330 PERL 69 5.865 X=A+EXP[-B*T] -7.562 KREISLER .10 .500 8 .391 66 5.90 Y=A*EXP(-B*T) .500 -7.940 PERI .10 А .370 69 6.40 Y=A*EXP[-B*T] PERI в -7.310 .440 69 6.876 X-EXP[A+BT] B ENGLER 69 6.430 .480 7.400 Y=EXP[+A*ARS(T)] GIBBARD 70 A 7.010 .290 8.890 X=EXP[A+BT] в 7.140 ENGLER 69 .380 10.899 X=EXP(A+BT) в 7.040 ENGLER 69 .460 11.400 Y=EXP[-A*ABS(T)] GIBBARD 70 Α 7.120 .220 12.905 X=EXP[A+BT] ENGLER 69 в 7.640 .610 14.910 X=EXP[A+BT] ENGLER 8 8.060 .880 69 15.400 Y=EXP[-A*ABS(T)] A 7.290 GIBBARD 70 .230 19.400 Y=EXP[-A*ABS(T)] A 7.310 GIBBARD 70 .230 23.400 Y=EXP[-A*A8S(T)] A 8.570 GIBBARD 7 C .330 27.400 Y=EXP[-A*ABS(T)] ۵ 8.580 .380 GIBBARD 70

Table VI. Fits reported by authors to their own np forward elastic scattering data. For our fits to these data see Fig. 39.

pn elastic $d\sigma/dt$



Fig. 40. pn elastic differential cross section. t is the momentum transfer between the outgoing and incoming protons.

MOMENTUM TRANSFER BETWEEN BEAM AND SCATT BEAM (GEV/C)**2 BEAM MOMENTUM= 1.690 GEV/C ****THIS DATA WAS READ FROM A GRAPH**** MOM TRANSF SIGMA +- DSIGMA (MILLIBARN&/(CEV/C)##2) 10+)EXTRAPOLATED POINT (106.894+-8.067) 5.378 .032 84.708 .056 70.590 2.689 .088 51.766 1.345 .125 37.648 1.345 .219 16.135 1.345 10.757 .334 1.345 8.740 461 672 4.034 .615 .672 772 3.361 .672 935 2.017 .672 .097 1.345 .672 1.254 1.345 .672 1.402 1.345 .672 2.017 1.535 .672 1,651 2.689 1-345 1.744 6.723 1.345 1.869 24.875 6.723 2Q SQUARE= .935 MURRAY NC 49A 261(1967) CNTR





Fig. 41. Ratio of the real to the imaginary parts of the forward np elastic scattering amplitudes.

P _{beam} (GeV/	F c) (^E c.m. GeV)	.a. 1	: ለሚ	Referen	CC3	
. 85		2.03	.05	.20	DUTTON	69	
1.29		2.18	68	:25	DUTTON	68	
1.39		2.22	48	.13	DUTTON	68	
1.54		2.27	36	• 18	DUTTON	68	
	REFERE	NCES					
1 0	UTTON	68	PRL		21 1416		SPRK
2 0	UTTON	69.	NP		89 594		SPHR



Fig. 42. np elastic differential cross sections for $d\sigma/dt$ beyond $|t| = 2 (GeV/c)^2$. (t is the momentum transfer be-tween the incoming and outgoing neurrons.) Those experi-

ments reporting data at_less than $|t| = 2 (GeV/c)^2$ only, are presented in Fig. 38. See the caption to Fig. 38 for additional information on these data.





np backward $d\sigma/du$.

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U BETWEEN BEAM AND SCATT TARG {GEV/C]**2

BEAM MOMENTU	JMICENTRAL	VALUE)=	.613 GEV/C		BEAM MOMENTU	MICENTRAL	VALUE}=	.637 GEV/C	
BEAM MOMENTU	JM RANGES	FRDM .600	TO .625	GEV/C	BEAM MOMENTU	M RANGES F	ROM .625	TO .650	GEV/C
U	SIGMA (MILLI	+- DSIGMA BARNS/(GEV	/C)**2)		U	SIGMA + (MILLIB	- DSIGMA ARNS/IGEV.	/()**2)	
047	87.820	2.280			117	71.200	2.800		
086	95.170 104.580	2.400			105	85.000	2.310		
066	116.530	4.200			082	95.210	2.400		
056	126.440	4.400			071	108.550	4.100		
009	235.100	7.600			051	130.280	4.500		
006	244.000	7.300			043	133.890	4.600		
002	317.300	11.400	٠.		006	231.400	7.200		
001	331.400	10.300			004	271.700	10.800		
000	358.700	13.300			002	317.000	10.200		
000	333.800	14.000			001	346.200	10.000		
20 SQUARE	= .171		C 4- 00C0	CENT	000	396.700	22.600		
	STOTEMAT	IC ERROR DI	r V- OFEK	CENT	20 SQUARE	= .184			
SHEPARD	PPAR	10	(1969)	SPRK	PLUS POSSIBLE	SYSTEMATIC	C ERROR OF	*+- 5PER	CENT
					SHEPARD	PPAR	10	(1969)	SPRK
							•		
BEAM MOMENTU	JM= .645	GEV/C			BEAM MOMENTU	MICENTRAL V	VALUE)= .	.662 GEV/C	
****THIS DAT	TA WAS REA	D FROM A G	RAPH****		BEAM MOMENIU	M KANGES FI	ROM .650	TO .675	GEV/C
U	SIGMA	+- DSIGMA			U	SIGMA +	- DSIGNA		
374	(MILLI 318.091	83-708	/()**2)		124	(MILLIB) 62,800	ARNS/(GEV/ 2.500	(C)**2)	
372	277.911	23.438			113	76.190	2.110		
364	157.372	23.438			100	79.150	2.160		
329	100.450	13.393			077	102.840	3.900		
276	83.708 73.663	10.045			066	114.650 123.860	4.200		
230	66.967	3.348			046	132.570	4.500		
197	66.967 73.663	3.348			011	213.900	7.100		
130	93.753	3.348			- 100 -	260.700	10.500		
=.100	110.495	6.697			- 003	294.800	11.000		
072	127.237	6.677			002	312.300	10:000		
072 044	127.237	6.697			002	312.300 337.800	10.000		
072 044 029 015	127.237 157.372 184.158 234.383	6.697 6.697 3.348 3.348			002 001 000 000	312.300 337.800 337.300 303.100	10:000 9.800 11.900 22.800		
072 044 029 015 011	127.237 157.372 184.158 234.383 271.215	6.697 6.697 3.348 3.348 3.348 3.348			002 001 000 000	312.300 337.800 337.300 303.100	10:000 9.800 11.900 22.800		
072 044 029 015 011 008 004	127.237 157.372 184.158 234.383 271.215 308.046 348.226	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697			002 001 000 000 20 30UARC PLUS PUSSIBLE	312.300 337.800 337.300 303.100 197 SYSTEMATIC	10:000 9.800 11.900 22.800	• • • • • • • • • • • • • • • • • • •	CENT
072 044 029 015 011 000 004 002	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710	6.697 6.697 3.348 3.348 3.348 6.497 6.697 6.697			002 001 000 000 20 300ARC PLUS PDSSIBLE	312.500 337.800 337.300 303.100 * 197 SYSTEMATIC	10:000 9.800 11.900 22.800	• •• • • • • • • • • • • • • • • • • •	CENT
072 044 029 015 011 001 004 002 .000	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058	6.697 6.697 3.348 3.348 6.697 6.697 6.697 10.045			002 001 000 000 20 JQUARC PLUS PUSSIBLE SHEPARD	312.300 337.800 337.300 303.100 	10:000 9.800 11:900 22.800 C ERROR OF	ې مې و ۹۶۴ (۱۹6۹)	CENT SPRK
072 044 029 015 011 008 004 002 .000 20 SQUARE	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058	6.697 6.697 3.348 3.348 3.348 4.697 6.697 10.045		÷	002 001 000 000 20 300AAC PLUS PUSS IBLE SHEPARD	312.300 337.300 337.300 303.100 • 177 SYSTEMATIC PPAR	10:000 9.800 11.900 22.800 C ERROR OF 10	4PER (1969)	CENT SPRK
072 044 029 015 011 000 004 002 .000 2Q SQUARE KAZARINOV	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP	6.697 6.697 3.348 3.348 3.348 6.697 6.697 6.697 10.045	24(1963)	: CNTR	002 001 000 000 20 300ARC PLUS PUSSIBLE SHEPARD	312.300 337.800 337.300 303.100 • 127 SYSTEMATIC PPAR	10:000 9.800 11.900 22.800 2.800 2.800	' ≠∽ 4PER (1969)	CENT SPRK
072 044 029 015 011 000 004 002 .000 ZQ SQUARE KAZARINOV	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP	6.697 3.348 3.348 3.348 4.697 6.697 6.697 10.045	24(1963)	: CNTR	002 001 000 -:000 20 3QUARC PLUS PUSSIBLE SHEPARD	312.300 337.300 303.100 • 107 Systematic PPAR	10:000 9:800 11:900 22:800 22:800 10	' ⊷ 4P€R (1969)	CENT SPRK
072 044 029 015 011 000 004 002 .000 2Q SQUARE KAZARINOV	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP	6-697 6-697 3-348 3-348 3-348 3-348 3-348 6-697 6-697 10-045	24(1963)	: CNTR	002 001 000 000 20 30UARC PLUS PUSSIBLE SHEPARD	312, 300 337, 800 337, 300 303, 100 • 127 Systematic PPAR	10:000 9:800 11:900 22:800 22:800 10	' 4P€R (1969)	CENT SPRK
072 044 029 015 011 000 004 002 .000 2Q SQUARE KAZARINOV	127.237 157.372 184.158 234.383 271.215 30A.046 361.710 385.058 = .188 JETP	6-697 6-697 3-348 3-348 3-348 3-348 6-697 6-697 10-045	24(1963)	: CNTR	002 000 000 000 20 30UARC PLUS PUSSIBLE SHEPARD	312.300 337.300 303.100 	10.000 9.800 11.900 22.800 22.800 10	' ≠=	CENT SPRK
072 044 029 015 011 000 004 000 20 SQUARE KAZARINOV	127.237 157.372 184.158 234.383 271.215 30A.046 381.710 385.058 = .188 JETP	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16	24(1963) ≠688 GEV/G	: CNTR	002 000 000 20 300ARC PLUS PUSSIBLE SHEPARD	312.300 337.300 303.100 	10:000 9:800 11:900 22:800 2:800 10 10	• ••• •PER (1969) •712 GEV/C	CENT SPRK
072 044 029 015 011 000 000 20 SOUARE KAZARINOV BEAM MOMENTI BEAN MOMENTI	127.237 157.372 184.158 234.383 271.215 308.046 381.710 385.058 = .188 JETP JM (CENTRAL	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 16 YALUEJ= FROM .675	24(1963) •688 GEV/G TO .700	: CNTR GEV/G	002 000 000 20 300ARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU	312.300 337.300 303.100 • 127 Systematic PPAR M(Central M Ranges F	10.000 9.800 11.900 22.800 10 10 VALUE}= ROM .700	• ••• 4PER (1969) •712 GEV/C TO •725	CENT SPRK GEV/C
072 044 029 015 011 000 000 2Q SQUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU U	127.237 157.372 184.158 234.383 271.215 30A.046 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 16 FROM .675 +- DSIGMA	24(1963) •688 GEV/G TO •700	: CNTR GEV/C	002 000 000 20 30UARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U	312.300 337.300 303.100 	10:000 9:800 11:900 22:800 10 10 VALUE1= ROM .700 - DS1GMA	• ••• •PER (1969) •712 GEV/C TO •725	CENT SPRK GEV/C
072 044 029 015 011 000 004 002 .000 2Q SQUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU U	127.237 157.372 184.158 234.383 271.215 30A.04A 340.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI 54 700	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 16 FRDM .675 +- DSIGMA BARNS/(GEV	24(1963) •688 GEV/G TO .700 /CJ**2)	: CNTR GEV/C	002 000 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144	312.300 337.300 303.100 	10:000 9:800 11:900 22:800 10 10 VALUE1= ROM .700 - DS1GMA ARNS/(GEV) 2:200	• ••• •PER (1969) •712 GEV/C TO •725 /C)**2)	CENT SPRK GEV/C
072 044 029 015 011 000 004 002 .000 20 SQUARE KAZARINOV BEAM MOMENTI BEAN MOMENTI U 135 121	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JM (CENTRAL IM RANGES SIGMA (MILLI 54.700 65.180	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 YALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.990	24(1963) •688 GEV/G TO .700 /C]**2)	: CNTR Gev/C	002 001 000 000 20 3QUARC PLUS PDSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130	312.300 337.300 303.100 • 197 Systematic PPAR M(CENTRAL M RANGES F/ SIGMA + (MILLIB 51.800 58.830	10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.850	• ••• •PER (1969) •712 GEV/C TO •725 /C]++2)	CENT SPRK GEV/C
072 044 029 015 011 000 000 20 SQUARE KAZARINOV BEAM MOMENTI BEAN MOMENTI U 135 121 108	127.237 157.372 184.158 234.383 271.215 308.046 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580	6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 10.045 16 YALUEJ- FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 1.940	24(1963) *688 GEV/G TO -700 /C]**2)	: CNTR Gev/C	002 001 000 000 20 3QUARC PLUS PDSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116	312.300 337.300 303.100 • 137 Systematic PPAR M(CENTRAL M RANGES F/ SIGMA + (MILLIB 51.800 58.830 62.650 69.060	10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.850 1.900	• ••• 4PER (1969) •712 GEV/C TO •725 /C]**2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 20 SOUARE KAZARINDV BEAM MOMENTU BEAM MOMENTU U 135 121 108 092	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JM (CENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580 T3.290 85.480	6.697 6.697 3.348 3.348 3.348 3.348 4.697 6.697 10.045 16 VALUEJ= FRDM .675 +- DSIGMA BARNS/GEV 2.300 1.940 1.970 2.020 3.610	24(1963) *688 GEV/G TO .700 /C]**2)	cntr Gev/C	002 000 000 20 30UAAC PLUS PUSSIBLE SHEPARD BEAM MOMENTU U 144 130 116 102 088	312.300 337.300 303.100 • .107 Systematic PPAR M(CENTRAL N RANGES F/ SIGMA + (MILLIB 51.800 58.830 62.650 69.060 77.390	10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.850 1.900 1.920 3.310	• ••• 4PER (1969) •712 GEV/C TO .725 /C)*+2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 ZQ SOUARE KAZARINOV BEAM MOMENTI BEAM MOMENTI U 135 121 108 082 071 082 071	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580 T3.230 85.480 107.150	6.697 6.697 3.348 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 16 FROM .675 +- DSIGMA BARNS/GEV 2.300 1.940 1.940 1.940 2.600 3.610 4.010	24(1963) •688 GEV/G TO .700 /C]**2)	CNTR GEV/C	002 001 000 000 20 30UARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 076	312.300 337.300 303.100 • .107 SySIEMAIIC PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 69.060 77.390 81.440 98.250	10.000 9.800 11.900 22.800 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.850 1.900 1.920 3.310 3.410 3.410	• ••• 4PER (1969) •712 GEV/C TO •725 /C)++2)	CENT SPRK GEV/C
072 044 029 011 000 014 002 .000 2Q SQUARE KAZARINOV BEAM MOMENTI BEAM MOMENTI BEAM MOMENTI U 135 121 108 082 082 081 060	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JM (CENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 085.5400 107.150 110.890 114.830	- DSI/A BARNS/GEV 2,300 16 •- DSI/A BARNS/GEV 2,300 1.940 0.3610 4.010 4.110	24(1963) •688 GEV/G TO .700 /C]++2]	CNTR Gev/C	002 001 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 076 064 053	312.300 337.300 303.100 • 107 Systematic PPAR M(CENTRAL N RANGES FI SIGMA + (MILLIB, 51.800 58.830 62.650 69.060 77.390 81.440 98.250 96.180	10.000 9.800 11.900 22.800 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.890 1.900 1.920 0.310 3.10 3.720 3.720	• ••• 4PER (1969) •712 GEV/C TO .725 /C)++2)	CENT SPRK GEV/C
072 044 029 015 011 000 20 SQUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU BEAM MOMENTU U 135 121 108 108 071 069 011 069 011	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JM(CENTRAL IM RANGES SIGMA 68.580 T5.290 10.8508 10.800 07.150 110.800 114.830 180.800 218.000	6.697 6.697 3.348 3.348 3.348 3.348 3.348 3.348 4.697 6.697 10.045 16 16 FROM .675 +- DSIGMA BARNS/(GEV 2.300 1.940 0.970 2.020 3.610 4.010 4.110 6.300 6.300	24(1963) •688 GEV/C TO .700 /C]**2]	CNTR Gev/C	002 001 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 068 076 053 043 018	312.300 337.300 303.100 * 137 SYSIEMAI H PPAR PPAR MICCENTRAL N RANGES FI SIGMA + (MILLIB) 51.800 58.830 62.650 69.060 77.390 81.440 98.250 96.180 111.010	10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.900 1.920 1.920 3.310 3.720 3.720 4.020 6.000	• 4PER (1969) •712 GEV/C TO .725 /C)++2)	CENT SPRK GEV/C
072 044 029 011 001 000 20 SQUARE KAZARINOV BEAM MOMENTI BEAM MOMENTI BEAM MOMENTI U 135 121 108 =.099 082 071 069 011 004	127.237 157.372 184.158 234.383 271.215 30A.04A 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGNA (MILLI 54.700 65.180 07.150 10.890 110.890 236.400	6.697 6.697 3.348 3.348 3.348 3.348 3.348 3.348 4.697 6.697 10.045 16 16 VALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 0.970 2.020 3.610 4.010 4.110 6.300 6.800 9.800	24(1963) •688 GEV/C TO .700 /C]**2)	CNTR GEV/C	002 001 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 076 053 043 018 012	312.300 337.300 303.100 • 127 SYSIEMAI IC PPAR M CENTRAL M RANGES FI SIGMA + (MILLIB 51.800 58.830 62.650 69.060 77.390 81.440 98.250 96.180 111.010 154.100	10:000 9:800 11:900 22:800 10 10 10 10 10 10 10 10 10 10 10 10 1	•712 GEV/C TD .725	CENT SPRK GEV/C
072 044 029 015 011 000 000 20 SQUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 049 049 049 049 049 049 041 004 004 004 004 004	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 E= .188 JETP JM (CENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580 07.150 110.890 114.830 180.080 218.080 236.400 276.900	C = 507 6 = 697 3 = 348 3 = 348 3 = 348 3 = 348 3 = 348 6 = 697 6 = 697 10 = 045 16 16 VALUEI= FROM = 675 +- DSIGMA BARNS/(GEV 2,300 1.9400 2.020 3.610 4.110 4.110 4.110 4.110 6 = 300 9.800 10.400 9.800 10.400	24(1963) *688 GEV/G TO .700 /C]**2]	CNTR GEV/C	002 001 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 076 064 053 018 012 008 012 008	312.300 337.300 303.100 * 127 SYSTEMATIC PPAR PPAR M CENTRAL M RANGES FI SIGMA + (MILLIB S1.800 54.830 62.650 69.060 77.390 81.440 96.180 111.010 154.100 164.000 196.600 206.100	I0:000 9.800 11.900 22.800 I0 I0 I0 I0 I0 I0 I0 I0 I0 I0 I0 I0 I	•712 GEV/C TO .725	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 20 SQUARE KAZARINOV BEAM MOMENTI BEAN MOMENTI U 135 121 108 049 071 060 049 011 004 003 002 001	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 SE .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580 10.890 114.830 110.890 144.830 236.400 236.400 275.600 300.900	5.697 6.697 3.348 3.348 3.348 3.348 4.697 6.697 10.045 16 VALUCI- FROM .675 +- DSIGMA BARNS/IGEV BARNS/IGEV 3.610 4.010 4.010 4.010 4.110 6.300 6.800 9.800 10.400 9.500 8.900	24(1963) •688 GEV/G TO .700 /C]**2)	CNTR GEV/C	002 001 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MONENTU U 144 130 116 102 088 076 053 043 018 012 008 005 003	312.300 337.300 337.300 303.100 - 137 SySIEMAIN PPAR PPAR MICENTRAL M RANGES FI SIGMA +- (MILLIB. 51.800 58.330 62.650 69.060 77.390 81.440 96.180 114.010 154.100 154.000 196.600 204.100 242.300	I	• ••• 4PER (1969) •712 GEV/C TO .725 /C]**2)	CENT SPRK Gev/C
072 044 029 015 011 000 000 20 SQUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 071 060 049 011 004 003 004 003 004 003 000	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGNA (NILLI 54.700 65.180 68.580 10.890 114.830 18.400 276.600 275.600 300.900 318.400	5.597 6.697 3.348 3.348 3.348 3.348 3.348 3.348 4.697 10.045 10.045 16 VALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 1.940 3.610 4.110 6.300 6.800 9.800 9.800 10.400 9.500 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 8.900 11.400 9.100 1.900 1.900 1.900 1.900 1.900 1.900 1.910 1.900 1.9100 1.910 1.90	24(1963) *688 GEV/G TO .700 /C]**2)	CNTR GEV/C	002 001 000 000 20 30UAAC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MONENTU U 144 130 144 130 144 102 088 076 064 053 064 012 008 012 008 003 003 003 003 003 003	312.300 337.300 303.100 • 137.300 303.100 • 137.300 303.100 • 137.300 303.100 • 137.300 9PAR PPAR PPAR MICENTRAL N RANGES FI SIGMA +• (MILLIB 51.800 58.830 62.650 69.060 77.390 81.440 96.180 111.010 154.100 154.100 154.000 154.000 154.000 204.000 204.000 204.000 204.000 204.100	I	• ••• 4PER (1969) •712 GEV/C TO •725 /C)**2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 20 SOUARE KAZARINDV BEAM MOMENTU BEAM MOMENTU U 135 121 108 042 071 060 049 011 003 002 001 003 000 000	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI 54.700 65.180 68.580 T3.290 10.7.150 110.890 114.830 218.400 276.900 275.600 30.900 318.400 354.300	<pre>6.697 6.697 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 VALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 1.970 2.020 3.610 4.110 6.300 6.800 9.800 10.400 9.800 10.400 9.800 10.400 21.200</pre>	24(1963) *688 GEV/G TO .700 /C]**2)	CNTR GEV/C	002 000 000 20 30UAAC PLUS PUSSIBLE SHEPARD BEAM MOMENTU U 144 130 116 102 088 064 053 064 012 012 018 012 008 005 003 002 001 001 001	312.300 337.300 303.100 • .137 SySIEMAIIC PPAR PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 62.650 69.060 77.390 81.440 98.250 96.180 111.010 154.100 114.000 1154.100 204.000 242.300 249.700 276.100 310.000	10.000 9.800 11.900 22.800 22.800 10 10 10 VALUE1= ROM .700 - DS1GMA ARNS/(GEV, 2.200 1.900 1.920 3.310 3.720 3.7000 3.7000 3.7000 3.7000 3.7000 3.7000 3.7000 3.70000 3.70000 3.70000 3.70000000000	• ••• 4PER (1969) •712 GEV/C TO .725 /C)*+2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 20 SOUARE KAZARINDV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 071 060 049 011 003 002 001 003 002	127.237 157.372 184.158 234.383 271.215 30A.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI S4.700 65.180 68.580 T3.290 110.890 114.830 10.890 114.830 236.400 308.400 354.300 275.600 275.700 275.700 275.700 275.700 275.700 275.700 275.700 2		24(1963) +688 GEV/G TO .700 /C]**2) F +- 3PED	CNTR GEV/C	002 000 000 20 30UAAC PLUS PUSSIBLE SHEPARD BEAM MOMENTU U 144 130 116 102 088 064 053 043 018 018 018 018 018 005 003 002 000 000	312.300 337.300 303.100 • 197 SySIEMAIIC PPAR PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 69.060 77.390 81.440 98.250 96.180 111.010 154.100 164.000 114.000 164.000 242.300 249.700 249.700 249.700 248.600	I	• ••• 4PER (1969) •712 GEV/C TO •725 /C)*+2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 ZQ SOUARE KAZARINOV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 011 060 049 011 003 002 001 002	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI S4.700 65.180 68.580 T3.230 10.890 114.830 180.800 236.400 0275.600 308.400 354.300 = .211 SYSTEMAT	6.697 6.697 3.348 3.348 3.348 3.348 3.348 6.697 6.697 10.045 16 VALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 1.940 1.940 0.4110 6.800 9.800 0.4110 6.800 9.800 10.400 9.500 8.900 8.900 11.400 21.200 1C ERROR 01	24(1963) •688 GEV/G TO .700 /C]**2) /C]**2)	CNTR GEV/C	002 000 000 20 30UARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 064 053 018 018 018 018 018 018 008 003 001 000 000 000 000 000	312.300 337.300 337.300 303.100 • 197 SYSIEMAIIC PPAR PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 69.060 77.390 81.440 98.250 96.180 111.010 154.100 154.100 154.100 154.200 249.700 226.100 288.600 = .225	<pre>10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .7000 - DSIGMA ARNS/(GEV, 2.200 1.900 1.900 1.900 1.920 3.310 3.720 3.720 3.720 3.720 3.720 3.720 3.720 0.900 1.900 5.900 0.900 1.7.600</pre>	 4PER (1969) 712 GEV/C TO .725 7C)++2) 	CENT SPRK GEV/C
072 044 029 015 011 000 000 ZQ SOUARE KAZARINDV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 011 060 049 011 003 002 001 000 20 SQUARE PLUS POSSIBLE SHEPARD	127.237 157.372 184.158 234.383 271.215 308.046 348.226 381.710 385.058 = .188 JETP JMICENTRAL IM RANGES SIGMA (MILLI S4.700 65.180 68.580 T3.230 10.890 114.830 180.800 275.600 275.600 318.400 354.300 = .211 ESYSTEMAT PPAR		24(1963) •688 GEV/G TO .700 /C]**2) F +- 3PER (1969)	CNTR GEV/C CENT SPRK	002 000 000 000 20 3QUARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 064 053 018 018 018 018 018 018 018 008 003 001 000 000 000 000 000 000 000 000	312.300 337.300 337.300 303.100 • 197 SySIEMAIIC PPAR PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 69.060 77.390 81.440 98.250 96.160 111.010 154.100 154.100 154.100 154.100 154.200 249.700 276.100 300.000 288.600 = .225 SySTEMATIC	<pre>10.000 9.800 11.900 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.850 1.900 1.920 3.310 3.720 3.310 3.720 3.720 3.720 3.720 3.720 3.720 0.900 1.920 0.900 1.7.600</pre>	• •• 4PER (1969) •712 GEV/C TO •725 /C)++2)	CENT SPRK GEV/C
072 044 029 015 011 000 002 .000 ZQ SOUARE KAZARINDV BEAM MOMENTU BEAM MOMENTU U 135 121 108 049 071 060 069 069 011 003 002 001 003 000	127.237 157.372 184.158 234.383 271.215 308.046 348.226 361.710 385.058 348.226 361.710 385.058 348.226 361.710 385.058 348.226 361.710 385.058 361.710 365.058 361.000 365.400 365.300 365.300 365.400 365.300 365	6.697 6.697 3.348 3.348 3.348 3.348 3.348 3.348 4.697 6.697 10.045 16 YALUEJ= FROM .675 +- DSIGMA BARNS/IGEV 2.300 1.940 1.970 2.020 3.610 4.110 6.800 9.800 10.400 9.800 10.400 10.400 11.400 21.200 IC ERROR DI 10	24(1963) .688 GEV/G TO .700 /C]**2) F +- 3PER (1969)	CNTR GEV/C Cent SPRK	002 000 000 20 30UARC PLUS PUSSIBLE SHEPARD BEAM MOMENTU BEAM MOMENTU U 144 130 116 102 088 064 053 018 018 018 018 018 018 018 018 018 003 003 002 000 000 000 000 000 000 000 000 000 000 000 000 000	312.300 337.300 303.100 • .107 SySIEMAIIC PPAR PPAR MICENTRAL N RANGES FI SIGMA + (MILLIB 51.800 58.830 69.060 77.390 81.440 98.250 96.180 111.010 154.100 164.000 114.00 164.000 242.300 249.700 249.700 288.600 = .225 SySTEMATIC PPAR	10.000 9.800 11.900 22.800 22.800 10 10 10 VALUE1= ROM .700 - DSIGMA ARNS/(GEV, 2.200 1.920 3.310 3.720 3.310 3.720 3.310 3.720 3.310 3.720 3.720 3.720 3.720 0.000 1.920 0.400 9.600 8.900 0.8400 10.900 17.600 C ERROR OF 10	 *** 4PER (1969) *712 GEV/C TO .725 *C)**2) *C)**2) *+- 3PER (1969) 	CENT SPRK GEV/C CENT SPRK

np

backward $d\sigma/du$.



incoming neutron and the outgoing prois the momentum matic errors have not been included, even though they may have been transformed to $d\sigma/du$ have been given by the authors. Distributions given origi-(between the incident neutron and the outgoing proton), but So as not to mask possible structures, systevs. u only when they contained data for $\cos \theta_{\rm c.\,m.}$ Fig. 43. np elastic scattering in the backward direction we call it "u" to emphasize the fact that it is backward Most authors have given this data in terms of "t" Þ (i. e. , "charge exchange" scattering). nally as $d\sigma/d\omega vs. \theta_{c.m.}$ transfer between the

scatering.

ton.

near $u = -0.01 (GeV/c)^2$ (independent of beam momentum). $(GeV/c)^2$. The square symbols on the graph represent the rection go very close to the kinematical limit (i. e. , u = 0), A general feasince forward-going protons are easier to detect than forture of all of these data is the very abrupt change of slope Unlike in the forward direction, data in the backward dir-The solid lines are the results of our least-squares fit to $d\sigma/du = \frac{d\sigma}{du}\Big|_{u=0}$. e^{bu} , using data in the interval $|u| \le 0.01$ ralues of $d\sigma/du|_{u=0}$ obtained from our fits. The vertical = 90 deg. ward neutrons when using a neutron beam. arrows represent the u values for $heta_{
m c.\,m.}$

np backward $d\sigma/du$.

U BETWEEN BEAM AND SCATT TARG (GEV/C)**2

B EA M	HOMENTUM	ICENTRAL	VALUE)= .	.742 GEV/	c	BEAM	NOMENTUM	CENTRAL	VALUE)= .	830 GEV/C	
BEA M	MOMENTUM	RANGES	FROM .725	10 .76	O GEV/C	BEAM	NONENTUR	RANGES F	RON .810	TO .850	GEV/C
	υ	SIGNA	+- DSIGMA				υ	SEGMA 4	- DSIGMA		
		ENTLL	BARNS/ (GEV/	(6)**2)				INILLIE	BARNS/(GEV/	C]**21	
	173	39.300	1.600				214	28.500	1.300		
	156	43.300	1.600				194	29.400	1-200		
	141	49.420	1.370				174	33.420	1.100		
	125	54.690	1.510				155	37.340	1.140		
	110	59.830	1.590				137	41.670	1.210		
	096	65.140	2.610				119	46.050	2.080		
	082	66.080	2.620				102	48.440	2.090		
	069	81.730	2.920				086	55.470	2.310		
	057	88.320	3.020				072	58.430	2.320		
	046	96.740	3.220				058	73.890	2.640		
	020	132.000	4.600				025	103.000	3.700		
	013	144.200	4.600				017	118.800	3.900		
	008	158,400	4.800				010	125.000	3.900		
	005	182.100	7.200				006	131.800	5.700		
	003	194.300	7.200				004	149.900	5.900		
	3001-	321 200	7.200				003	195.100	6.200		
	001	257.800	7.000				001 2	218.700	6.100		
	000	271.900	9.200					231.300	7 300		
	000	323.300	14.900				000	238.000	11.800		
20	SQUARE	.242				20	SQUARE=	.295			
PLUS	OSSIBLE	SYSTEMAT	IC ERROR OF	+ 3PEI	R CENT '	PLUS P	OSSIBLE	SYSTEMATI	C ERROR OF	+- 2PER	CENT
SHEP	AKD	PPAR	10	(1969) SPRK	SHEPA	RD	PPAR	10	(1969)	SPRK

BEAN MOMENTUMICENTRAL VALUE)= .875 GEV/C

BEAN MOMENTUM RANGES FROM .850 TO .900 GEV/C

υ	SIGMA +	- DSIGMA	
	(MILLIB	ARNS/(GEV/C)**	2)
259	23.200	1.100	
237	22.600	1.000	
214	23.700	1.000	
193	25.900	1.000	
172	29.000	1.100	
151	36.040	.960	
131	36,940	1.610	
113	10,130	1.730	
095	47.430	1.850	
- 079	54,360	2.090	
064	60,190	2.210	
050	66.030	2.340	
027	82.800	3.000	
019	95.600	3.200	
911	104,200	3.300	
-,007	122.400	4.900	
005	144.600	5.400	
003	180.100	5.600	
002	193.000	5.100	
001	208.800	6.400	
000	227.000	10.600	

29 SQUARE= PLUS POSSIBLE	.323 SYSTEMATIC	ERROR	OF	•	ZPER	CENT
SHEPARD	PPAR	10		0	1969)	SPRK

BEAM	MOMENTUM(CENTRAL	VALUE]=	.975	GEV/C	

BEAM	MONENTUR	RANGES	FROM	.950	TO 1.000	GEV/Ç

	DCAN	HUNCHION	RANGES	rkon	• • • • •			0
		U	31011A	1 . 011	GMA			
			(MELLI	BARNS/	IGEV/	C3+4	iž)	
		+.577	33.660	1.	610			
			29, nun	1.	+10			
		531	28,470	i.	410			
		504	27.370	1.	320			
		479	23.010	۱.	220			
		454	22.320	1.	130			
		428	18,970	1.	030			
		318	15.900		YÚ0			
		291	16.000		900			
		265	15,200		800			
		237	17.000		900			
		211	20.700		900			
		107	22.440		010			
		162	25.530	1.	410			
		140	30.970	1.	550			
		118	33.520	1.	700			
		098	40.570	1.	850			
		079	45.660	1.	880			
		062	56.150	2.	150			
		048	59.880	2.	310			
		023	75.000	2.	900			
		014	91.300	3.	100			
		009	107.300	4.	700			
		006	120.100	4.	800			
		004	143.700	4.	800			
		002	165.600	4.	600			
		001	182.600	6.	000			
		000	195.600	10.	000			
	2	O SOUARE=	.389					
1	ριυς	POSSIBLE	SYSTEMAT	TIC ERR	OR OF	· +-	2 PER	CENT

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DEAN MOMENTUMICENTRAL VALUEI= .925 GEV/C

BEAN MOMENTUM RANGES FROM .900 TO .950 GEV/C

	U	SIGMA +-	- DSIGMA			
		(MILLIB)	ARNS/IGEV/	C)**	21	
	505	31.420	1.510			
	482	30.600	1.410			
	460	29.090	1.320			
	436	26.880	1.320			
	412	24.480	1.230			
	289	20.100	1.000			
	262	19.900	1.000			
	238	21.400	1.000			
	214	21.500	1.000			
	191	29.400	1.000			
	169	29.940	.940			
	.117	77 A7N	1,650			
	125	39,100	1.800			
	107	45.310	1.950			
	088	48.400	1.990			
	012	55.530	7.140			
	056	61.190	2,300			
	-1051	76.000	2.900			
	013	104.500	3.300			
	008	111.000	4.700			
	005	140.600	5.500			
	003	152.200	5.300			
	002	177.700	4.800			
	001	204.000	6,400			
	000	207.700	10.200			
1	O SQUARE	.356				
PLUS	POSSIBLE	SYSTEMATIC	C ERROR OF	+-	2PER	CENT
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BEAN MOMENTUNICENTRAL VALUE)= 1.050 GEV/C

BEAM MOMENTUM RANGES FROM 1.000 TO 1.100 GEV/C

BEAM NOACHTON	AMOLD THE			
U	SIGMA +-	DSIGNA		
•	(MILLIBAN	RNS/(GEV/C	}**2}	
678	32.010	1-210		
655	29.780	1.110		
-,678	25,650	1.010		
604	23.760	• 47.Ú		
574	21.980	.920		
544	20.210	+030		
515	17.500	.730		
485	16.790	.740		
363	12-400	.600		
332	11.300	.500		
302	12.200	.500		
271	12.600	.500		
242	15.900	-600		
-,214	17.240	.500		
185	10+750	- 940		
160	24.420	1.100		
136	26.740	1.130		
112	31.890	1.300		
091	38.980	1.480		
072	44.760	1.510		
055	49.120	1.690		
039	54.800	1.800		
027	64.400	2.000		
016	74.600	2.100		
010	93.600	3.300		
007	100.500	3.400		
004	120.300	3.400		
002	137.900	3.500		
001	154.900	4.200		
000	159.900	6.700		
2Q SQUARE=	. 440			
PLUS POSSIBLE	SYSTEMATIC	ERROR OF	+- 2PER	CENT

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np backward $d\sigma/du$.



Fig. 43 (continued)

np backward do/du.

U BETWEEN BEAM AND SCATT TARG (GEV/C)**2

BEAM MOMENTUM= 1.257 GEV/C

BEAM	NUMENTUM	ICENTRAL	VALUE}=	1.150	GEV/C	
BEAM	MOMENTUM	RANGES	FROM 1.10	00 TO	1.200	GEV/C
		SIGMA	+- DSIGNA	<u>،</u>		
	•	(MILLI)	BARNS/ GE	V/C)+4	21	
	849	31.700	1.810	5		
	823	28.330	1.510)		
	198	25.780	1.210	5		
	766	23.150	1.010)		
	738	19.910	.910)		
	709	17.890	.820)		
	676	15.670	.820)		
	643	13.220	.730)		
	606	12.340	.630)		
	573	10.810	-640)		
	465	7.600	.500)		
	431	7.200	.400)		
	391	7.100	. 400)		
	356	7.700	.400)		
	323	8.400	.400)		
	289	10.130	.420			
	254	11.930	.420)		
	222	12.730	.820)		
	192	13.760	.840			
	101	16.720	-870	<u>.</u>		
	134	10.020	. 890	<u>'</u>		
	109	23.510	1.050	<u> </u>		
	- 065	23.450	1.230	<u>.</u>		
	067	61 200	1 500	<u> </u>		
	- 037	43 500	1 600			
	- 019	55,900	1 800			
	012	66.900	2.800			
	008	80.700	3.000			
	005	95.500	3.000			
	003	110.400	3-600	, ,		
	001	115.100	1.600			
	000	136.700	6.200	,		
20	-	512				
PLUSP	OSSIBLE	SYSTEMAT	IC ERROR	0F +	3PER	CENT

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****THIS DATA	WAS READ	FROM & GRAPH***	
υ	SIGNA +-	DSIGNA	
	CNILLIBA	RNS/(GEV/C)**2)	
-1.173	88.226	11.693	
-1.135	53.148	8.504	
-1.069	39.330	2.126	
-1.016	27.637	3.189	
947	23.385	Z-120	
887	18.070	1-063	
793	15.944	1.063	
694	12.756	1.063	
581	11.693	1.063	
468	10.630	1.063	
379	10.630	1.063	
269	14.881	1-063	
·188	17.007	1.063	
107	27.637	2.126	
055	37.204	3.189	
036	42.518	3.189	
020	49.959	4.252	
009	63.778	4.252	
002	70.155	4-252	
.000	85.037	5.315	
20 SOUARF=	. 591		
PLUS POSSIBLE	SYSTEMATIC	ERROR OF +- 19PE	RCENT
AMAGLOBEL I	JETP	37 1125(1960)) CNTR

8 E A M	MONENTUN	CENTRAL	VALUE *	1.300	GEV/C	
BEAM	HOMENTUM	RANGES	FROM 1.20	00 TO	1.400	GEV/C
	U	SIGMA	+- DSIGN	\ ≣V/C)*4	21	
	997	34-110	2.110	5		
	963	29.550	1.510	5		
	930	24.180	1.110	5		
	895	18.800	.810)		
	861	17.360	.810)		
	824	14.190	. 710	ו		
	774	11.520	.620)		
	735	10.060	.520)		
	696	8.070	.420)		
	656	7.320	. 420)		
	527	4.200	.300)		
	486	4.000	- 200)		
	439	4.900	.300)		
	399	4.900	.300)		
	≁.358	5.250	.250)		
	313	5.610	-730)		
	275	5.910	.370)		
	238	6.140	.380)		
	202	7.390	.380)		
	167	9.180	.520)		
	136	10.750	.520)		
	107	15.540	.660)		
	081	20.720	.570)		
	059	25.740	-650	2		
	040	30.900	1.000	3		
	024	34.900	1.000	2		
	015	42.600	1.600)		
	010	54.100	1.900)		
	006	57.600	1.700	2		
	003	65.300	2.200	2		
	001	81.600	2.400	2		
	000	87.800	3.700	2		

.

BEAM	ROMENTUM	1.356	GEV/C		
	U	SIGNA	+- OSIGNA		
		CALL	IBARNS/IGE	V/C1*+21	
	~.045	24.995	2.169		
	035	25.560	2.264		
	028	31.597	2.641		
	020	29.428	2.358		
	014	36.219	2.924		
	009	37.445	3.584		
	005	41.406	3.678		
	002	47.537	4.810		
	.000	58.006	5.093		
2	SQUARE=	. 666			
LARS	EN	NU	18	1839(1040)	CNTR
				•	

20 SQUARE= PLUS PUSSIBLE	.623 SYSTEMATIC	FRADR	OF	•	4PER	CENT
SHEPARD	PPAR	10		ι	1969)	SPRK

BEAN MOMENTUMICENTRAI VALUEI= 1.500 GEV/C

BEAM MOMENTUM (CENTRAL VALUE)= 1.500 GEV/C BEAM MOMENTUM RANGES FROM 1.400 TO 1.600 GEV/C

BEAM	MOMENTUM	CENTRÁ	L VALUEJ# 1.000 864/6	
BEAM	MOMENTUM	RANGES	5 FRUM 1.600 TO 2.000 GEV/C	
	U	SEGMA	A ← DŠIGHA BARNS/(GEV/C)++2}	
-	1.524	8.450	1.010	
	-1.550	6.560	.810	

BEAN	AUABA1 QAS	8.000	06470				
	U	SIGMA	+- 051	GMA			
		(MILL)	BARNSZ	(CEV/	(C)+4	21	
	475	.030	•	010			
	424	020					
	375	.040					
	329	.040	•	010			
	286	.050	•	010			
	-+240	060					
	-,209	.080					
	174	• I V Ŭ					
	143	.130	- 1	020			
	129	.100	. •!	030			
	117	.170	-	030			
	107	.180					
	097	• 210					
	087	.180					
	078	• 220					
	069	.230					
	-,061	.170					
	054	• 230					
	046	.270	•	040			
	-,040	.340					
	034	. 310					
	-,028	.290					
	023	.390					
	018	.350					
	014	.470					
	~.011	,520					
	008	.480	• •	050			
	~1005	.670					
	003	.710	•	060			
	002	.960	•	060			
	001	. 840	•	000			
	000	.950	••	040			
20	SQUARE =	6.676					
PLUS	OSSIBLE S	STEMAT	IC ERR	DR OF	÷ +	30PER	CENT
MANN	NG	NC		41A	1670	1966)	SPRK

85	AR NUMENIUR	RANGES	FRUM	1,40	30 H		.600	GEVA
	U	SEGMA	+- 05	SIGN/	4			
		(HILL	BARN	5/(G	EV/C)	**2)	
	-1.268	16.170	1		0			
	-1.230	12.780	1	1.010	0			
	1.170	10.400		.710	D			
	-1.147	7.800		:614	U U			
	-i.UV8	01120		41/	n			
	-1.048	4.210		.310	5			
	-1.009	4.760		- 310	0			
	955	3.140		. 310				
	905	2.650		.210				
	856	2.360		- SIC	3			
	799	1.740		.220	2			
	743	2.200		.200	D			
	679	2.200		+ 200				
	636	2.200		.200	כ			
	584	2.500		.200	0			
	522	3.700		+ 200	0			
	470	3.200		• 200				
	420	2.570		370	n			
	373	3.130		.380	0			
	313	3.950		.300)			
	265	3.750		.390	2			
	223	5.770		.390)			
	180	6.900		.530	2			
	-+143	9.390		.540	3			
	109	11.080		.430	5			
	079	14.100		.491	U U			
	054	17.400		.800	0			
	032	21.200		.900	0			
	020	30.100	1		0			
	014	35.200	1		0			
	÷.008	40.200	1		0			
	004	44.700	1	2.000	2			
	002	50.400		2.300	2			
	000	57.000	1	1.300	0			
	2Q SQUARE=	.779						
PLU	S POSSIBLE	SYSTEMA	ric ex	ROR	OF +-		6PER	CENT

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	INTELION		.,	~ *		
-1.524	8.450	1.010				
-1.550	6.560	.810				
-1.517	5.680	.510				
-1,487	3.670	.310				
-1.400	3.000	.210				
1 363	2.590	.310	•			
~1.293	1.570	+210				
-1,254	1.060	.110				
-1.163	1.510	.220				
-1.098	1.100	-110				
-1.047	.890	.110				
892	1.000	.100				
831	1.100	.100				
770	1.400	.100				
694	1.500	.100				
614	1.900	.200				
559	1.410	.260				
483	1.560	.260				
+,437	1,980	.260				
358	2.540	.210				
290	3.110	.270				
246	3.560	.270				
- .192	5.390	.410				
147	6.000	.320				
10/	8.160	.320				
072	10.700	.600				
044	14.200	,700				
028	17.900	1.000				
019	23.900	1.200				
011	25.400	1.100				
006	32.100	1.400				
002	38.100	2.000				
000	36.800	2.500				
20 SQUARE	- 1.024					
PLUS POSSIBLE	SYSTEMATIC	ERROR OF	+	8PER	CENT	

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P _{beam} (GeV/c)	dø/du { mb/(Ge	′u=0] eV/c) ²	(GeV	/c) ⁻²	x ² /N
.613	331.98 2	28.81	51.11	4.08	2.34
.637	350.52	18.59	51.59	3.73	7.02
. 645	395.91	6.61	30.18	3.66	1.17
-662	353.72	15.84	67.47	5.98	. 73
.688	320.25	11.66	58.12	5.68	1.55
. 712	290.46	10.67	56.56	5.45	1.78
.742	276.83	9.82	75.22	4.61	5.53
.830	248.40	7.42	110.0	7.57	1.06
. 875	222.68	6.51	65.92	6.42	.60
- 925	207.22	6.17	80.39	6.00	1.30
.975	189.76	5.76	71.04	5.59	.97
1.050	162.51	4.82	72.00	6.23	.15
1.150	127.40	4.99	57.63	5.80	1.77
1.257	80.30	15.78	28.08	9.86	2.35
1.300	87.53	4.24	70.46	7.08	2.42
1.356	54.83	3.85	47.01	13.67	. 59
1.500	54.70	3.93	38.74	7.36	. 89
1.900	39.23	3.86	32.19	13.43	1.32
8-000	. 98	30	89.55	15.00	2 07

Fig. 44. Coefficients from our least-squares fit of the np differential cross section in the backward direction to the formula $d\sigma/du = \frac{d\sigma}{du}\Big|_{u=0}$. e^{bu} over the range $|u| \le 0.01 (GeV/c)^2$. Systematic scaling errors in the data have been folded into the errors of $\frac{d\sigma}{du}\Big|_{u=0}$. In the table χ^2/N is the chi-square of the fit divided by the number of degrees of freedom. Notice the possible structure in the slope around 0.8 GeV/c. See text for a discussion of this effect. We have fit the intercept to $d\sigma/du\Big|_{u=0} = Kp_{beam}^{-n}$ and find $n = 2.02 \pm 0.02$, with $\chi^2/N = 3.04$. We have not plotted this in (a) because it obscures the data.

Fits to np backward elastic $d\sigma/du$.

Polarization in np elastic scattering

DISTRIBUTION IN COS(THETA) OF THE SCATT TARG WITH RESPECT TO THE BEAM DIRECTION IN THE C.N. SYSTEM

					•		
BEAN MOMENT	'UM= 1.500 GEV/	'C		BEAM MOMENT	TUM= 2.500 GEV/	[′] د	
COSIT	HETA)			cost	THETA)		
MINIMUM	MAXIMUM	POLARIZ+	-090L	MINIMUM	MAXIMUM	POLARIZ+	-DPOL
.615	.743	420	.150	.631	.754	610	- 240
.743	.872	140	.040	.754	.815	360	.110
.872	.923	040	.030	.815	.877	280	.060
.923	.961	060	.040	.877	.938	170	.040
. 961	.987	100	.080	.938	.963	170	.040
				• 963	.982	170	.050
20 SQUAR	RE= .779	۲ <u>۔</u>		982	.994	030	.060
PLUS POSSIBL	E SYSTEMATIC E	ERROR OF +- 96	PER CENT	• 994	1.000	030	.120
ROBRISH	PL	318 617(19	70) CNTR	20 SQUA	RE= 1.624		
				PLUS POSSIB	LE SYSTEMATIC E	RROR OF +- 96	PER CENT
				ROBRISH	PL	318 617(19	70) CNTR

BEAM MOMENT	'UM≃ 3.500 GEV/	°C		BEAM MOMEN	TUM= 4.500 GEV/	'C	
COSIT	HETA)			cost	[HETA]	•	· · ·
MINIMUM	MAXIMUM	PQI, ARTZ+	-DPOL	MENTMUM	HAX THUH	POL AR 1 Z +	-0201
.762 .841 .881 .921 .960 .976 .988 .996	.841 .881 .921 .960 .976 .988 .996 1.000	260 220 310 210 270 150 170 .040	.030 .090 .060 .040 .050 .050 .070 .120	.825 .883 .913 .942 .971 .983 .991 .997	.883 .913 .942 .971 .983 .991 .997 1.000	490 340 220 140 110 090 .040 110	.070 .070 .050 .040 .050 .050 .060 .100
20 SQUAR PLUS POSSIB	RE= 2.519 LE SYSTEMATIC E	ERROR OF +- 5	PER CENT	20 SQUAF PLUS POSSIBI	RE= 3.432 .E Systematic e	RROR OF +- 96	PER CENT .
RÖBRISH	μſ	318 81/114	IUI CHTR	RÖBR 15H	ΡL	318 617(19	70) CNTR

REAM MOMENTUM= 5.250 GEV/L

	COST	(HETA)		
	MINIMUM	MAXIMUM	POLARIZ+	-DPOL
	. 854	.903	420	.090
	.903	.927	170	.090
	.927	.951	370	.070
	- 951	.976	280	.050
	.976	.985	200	.060
	. 985	.993	.260	030.
	. 993	.998	090	.070
·	.998	1.000	200	.120
	20 SQUA	RE= 4.123		
•	PLUS POSSIB	LE SYSTEMATIC	ERROR OF +- 96	PER CENT
	ROBRISH	PL	318 · 617(19	70) CNTR
	· · ·			



Polarization in np elastic scattering

Fig. 45. Polarization in backwards np elastic scattering. θ is the angle between the incident neutron and the outgoing proton. This data is preliminary.

Polarization in pn elastic scattering

DISTRIBUTION IN COS(THETA) OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

BEAM MOMEN	ITUM= .823 GE	V/C		BEAM MOMENT			
COSI	THETA			COSET	HETAI		
MINIMUM	MAXIMUM	POLARIZ+	-DPOL	MINIMUM	MAXIMUM	POLARI	Z+-DPOL
854	698	133	.031	861	757	104	.056
	558	174	.018	731	576	158	.018
561	324	218	.016	546	340	272	.022
302	035	239	.019	284	051	309	.025
021	.255	114	.024	002	.240	152	•026
.262	.521	.093	.020	.279	.509	.083	• 032
.574	.759	.287	.026	• 571	.750	.264	•023
.768	.896	.421	.038	• 766	.897	.411	.087
20 SQUA	RE= .291			20 SQUAR	E= .376		
PLUS POSSIB	LE SYSTEMATIC	ERROR OF +- 3	PER CENT	PLUS POSSIBL	E SYSTEMATIC	ERROR OF +-	3PER CENT
CHENG	PR	163 1470(19	67) CNTR	CHENG	PR	163 1470(1967) CNTR

BEAM MOMENT	fum= 1.090 GEV	//C.		BEAM MOMENTUM≖ 1.219 GEV/C					
COSE	THETA)			COSE	THETA)				
MINIMUM	MAXIMUM	POLARIZ+	-DPOL	MINIMUM	MAXIMUM	POLARIZ	+-0POL		
867	769	111	.017	872	772	090	.023		
727	576	147	.017	721	572	241	.023		
514	327	263	.017	505	327	345	.030		
239	035	264	.018	232	038	315	•031		
.051	• 254	155	.017	.052	.249	155	.028		
.332	.518	.090	.017	.335	.512	.084	.030		
.579	.738	.255	.016	. 584	.735	•251	.041		
.775	.886	.297	.024	.111	•091	• 364	- 040		
20 SQUAR	RE= .470			20 SQUA	RE= .564				
PLUS POSSIBI	F SYSTEMATIC	ERROR OF +- 3	PER CENT	PLUS POSSIB	LE SYSTEMATIC	ERROR OF +-	3PER CENT		
LHENG	PR	163 1470(19	67) CNTR	CHENG	PR	163 1470(1			

BEAM MOMENTUM- 1.343 CEV/C

COSIT	HETA)						
MINIMUM	MAXIMUM	POLARI	Z+-DPOL				
849	747	146	.019				
674	527	247	.019				
443	267	411	.032				
165	.033	352	.026				
.120	.324	068	.030				
. 392	.589	.157	. 035				
.629	.792	.305	.017				
.807	.922	.334	.027				
29 SQUAR	E= .658						
PLUS PUSSIBL	E SYSTEMALIC	ERROR OF +-	3PER CENT				

CHENG	PR	163 1470()	1967)	CNTR



Fig. 46. Polarization in pn elastic scattering. θ is the angle between the incoming and outgoing proton in the grand c.m. The data have been corrected for deuteron effects.

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Polarization in pn elastic scattering

Table VII. Various pn inelastic cross sections (not plotted).

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P _{beam} (GeV/c)	^E c.m. (GeV)	σ _{pnπ} o (mb)	σ _{nnπ} + (r	nb)	Referen	ices
1.662	2.313	14.300 ± 3.500	4.300±1.	100	BATSON	59 \$
S GLAUBER CORR	ECTION AP	PLIED				
REFEI 1 BATSON	RENCES 59	P.ROY.SOC.	251 233			cc
P _{beam} (GeV/c)	E _{c.m.} (GeV)	σ _{ppπ} - (mb)	Referen	ces		
1.662 1.825 ± .045 2.110 .045 7.000	2.313 2.370 2.470 3.877	2.700 ± .600 2.570 .140 2.680 .190 1.010 .130	BATSON BRUNT BRUNT SHAPIRA	59 \$ 69 \$ 69 \$ 68		
S GLAUBER CORR	ECTION AF	PPL1E0				
REFE L BATSON 2 SHAPIR 3 BRUNT	RENCES 59 A 68 69	P.ROY.SOC. PRL PR	251 233 21 1835 187 1856			CC DBC HBC
p _{beam} (GcV/c)	E _{c.m.} (GeV)	σ _{p11π} + _π - (mb)	Referen	ces		
1.825 ± .045 2.110 .045	2.370	.770 ± .070 1.750 .200	BRUNT	69 \$ 69 \$		
4 CLANDER CA18	5, 57 5		4-101 LBA			
REFE 1 BRUNT 2 Shapir	RENCES 69 A 70	PR REHO	187 1856			НВС Н8С
P _{beam} (GeV/c)	E _{c.m.} (GeV)	σ _{ppπ-π} ο (mb)	Reference	ces		
1.035 f .nas 2.110 .045	2.370 2.470	.160 ± .030 .350 .040	BRUNI DRUNT	69 \$ 49 \$		
\$ GLAUBER CORR REFE 1 Brunt	EUTION AF RENCES 69	PPLIED PR	187 1856			нвс
P _{beam} (GeV/c)	E _{c.m.} (GeV)	^o pN*(1470) ^o (mb) Referen	ces		
7-000	3.877	N ^{*°} →,pπ ⁻	SHAPIRA	68 -		
REFE 1 SHAFIR	RENCES A 68.	••••PRL	21 1835			DBC
P _{beam} (GeV/c)	E _{c.m.} (GeV)	σ _Δ ++ _Δ - (mb)	Referen	ces		
6.980	3.873	$\Delta^{-} \rightarrow n\pi^{-}$ 1.100 ± .200	SHAPERA	70 s		
S GLAUBER CORR REFE 1 SHAPIR	ECTION AF RENCES A 70	PPL 1 ED				нвс

. .

NN Interactions in the I = 0 State

E_{c.m.}

NN total cross section (I=0)

P _{beam} (GeV/c)	(GeV) σ_{NI}^{1}	N (mb)	Referenc	es	
1.11	± .01	2.12 36.7	5 ± .75	BUGG		
1.29	.01	2.18 34.4	2 .52	BUGG	66	
1.41	.01	2.22 32.9	9.38	BUGG	66	
1.61	.01	2.29 32.2	2 .36	BUGG	66	
1.66	.01	2.31 32.7	6 .35	BUGG	66	
1.78	.01	2.35 33.6	8 .26	BUGG	66	
1.86	.01	2.38 35.0	4 .23	BUGG	66	
1.94	.01	2.41 35.7	6 .24	BUGG	66	
1.95	.01	2.41 35.6	1 .22	BUGG	66	
2.08	.01	2.46 36.6	8 .22	BUGG	66	
2.21	.01	2.50 37.5	4 .26	BUGG	66	
2.20	.01	2.53 38.4	4 .21	BUGG	66	
2.45	.01	2.59 39.5	2 .20	BUGG	66	
2.59	.01	2.63 40.2	.19	BUGG	66	
2.68	.01	2.66 40.6	2 .19	BUGG	66	
2.70	.01	2.67 40.7	2 .19	BUGG	66	
2.82	.01	2.71 41.0	.19	BUGG	66	
2.86	.01	2.72 41.2	1.19	BUGG	66	
2.96	.01	2.75 41.6	6 .19	BUGG	66	
2.99	.01	2.77 41.8	5 .19	BUGG	66	
3.00		2.77 38.5	7 .23	ABRAMS	69	
3.05	.02	2.78 41.6	4 .19	BUGG	66	
3.11	.02	2.80 42.3	3.19	BUGG	66	
3.14	.02	2.81 42.1	9.18	BUGG	66	
3.28	.02	2.86 42.0	3 .18	BUGG	66	
3.30	.02	2.86 42.3	1 .18	BUGG	66	
3.44	.02	2.91 41.9	6 .18	BUGG	66	
3.55	.02	2.94 42.0	5 .16	BUGG	66	
3.91	.02	3.05 42.7	5 .15	BUGG	66	
4.04	.02	3.09 42.8	6 .17	BUGG	66	
4.26	.02	3.16 42.7	6 .17	BUGG	66	
4.55	.02	3.24 43.0	3 .17	BUGG	66	
4.97	.02	3.35 47.9	8 .17	BUGG	66	
5.22	.03	3.42 42.8	7 .13	BUGG	66	
5.53	.03	3.50 43.1	9.17	BUGG	66	
5.82	.03	3.58 42.8	0.17	BUGG	66	
7.83	.04	4.07 42.5	8 .20	BUGG	66	
	REFE	RENCES				
1	BUGG	66 P	R	146 980		
2	ABRAMS	69B	NI	14125		

CNTR CNTR



Fig. 47. NN total cross section in the I = 0 state. The solid line represents the I = 1 total cross section [i.e., the $\sigma^{\text{total}}(\text{pp})$ from Fig. 1].

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ND Interactions

pc nc	l] l] GeV/c)	E _{c.m.} (GeV)	tot	al	Cross	S	sections
1.111	± .006	3.138	67.209	± .090	BUGG	66	
1.408	.008	3.277	80.490	.057	BUGG	66	
1.607	.008	3.373	82.472	.063	BUGG	66	
1.660	.008	3.398	82.889	.063	BUGG	66	
1.780	.009	3.456	83.377	.052	BUGG	66	
1.858	.009	3.493	84.039	.047	BUGG	66	
1.940	.010	3.532	84.260	.046	BUGG	66	
1.952	.010	3.538	84.280	.047	BUGG	66	
2 212	.011	3 662	84.526	.047	BUGG	66	
2.280	-011	3.694	84.624	.047	BUGG	66	
2.450	.012	3.773	84.239	.047	BUGG	66	
2.592	.013	3.839	84.212	.047	BUGG	66	
2.080	*013	3.879	84.085	=Q44	BUGG	66	
2.704	.014	3.890	83.912	.047	BUGG	66	
2.819	.014	3.942	83.840	.047	BUGG	66	
2.958	-015	4-004	83-602	.047	BUGG	66	
2.994	.015	4.020	83.452	.047	BUGG	66	
3.000		4.023	81.780	.658	ABRAMS	69	
3.054	.015	4.047	83.289	.047	BUGG	66	
3.110	.016	4.072	83.328	.047	BUGG	66	
3.142	.016	4-086	83.166	.047	BUGG	66	
3 303	.017	4.156	82.730	.047	BUGG	66	
3.444	.017	4.217	81.960	.047	BUGG	66	
3.546	.018	4.261	81.710	.047	BUGG	66	
3.908	.020	4.412	81.107	.033	BUGG	66	
4.037	.020	4.465	80.930	.047	BUGG	66	
4.265	.021	4.558	80.417	.047	BUGG	66	
4.552	.023	4.672	80.125	.047	BUGG	66	
5.221	-026	4.928	79.578	-037	BUGG	66	
5.526	.028	5.041	79.316	.047	BUGG	66	
5.824	.029	5.150	79.091	.047	BUGG	66	
6.000	.105	5.213	77.400	1.300	GALBRAITH	65	
7.835	.039	5.830	77.858	.052	BUGG	66	
8.000	•140	5-882	75 200	1.300	CALBRAITH	65	
12.000	-210	7.038	74.400	1.300	GALBRAITH	65	
14.000	.245	7.551	74.000	1.300	GALBRAITH	65	
16.000	.280	8.031	73.700	1.300	GALBRAITH	65	
18.000	.315	8.485	72.800	1.300	GALBRAITH	65	
19.300		8.767	74.100	.700	BELLETTINI	65	
20.000	.350	8.915	72.100	1.300	GALBRAITH	65	
22.000	• 385	9.326	11.600	1.300	GALBRAITH	00	
	REFE	RENCES					
1	BELLET	TINI 65.	PL		19 341		SPRK, CNT
2	GALBRA	ITH 65.	••••PR		138 8913		CNTR
3	BUGG	66.	PR		146 980		CNTR
4	ABRAMS	09.	BNL		14125		UNIR

P _{beam} (C	GeV/c)	(GeV)	σ_{nd}^{T}	(mb)	Re	ferenc	es	
2.996		4.022	80.300	± 1.900	PAL	EVSKY	64	
4.000 1	.600	4.451	80.300	1.900	PAR	KER	70	
5.700	.600	5.105	77.800	1.300	PAR	KER	70	
6.371		5.343	76.000	2.400	PAN	TUEV	65	
9.192		6.249	71.600	2.500	PAN	TUEV	65	
10.000		6.486	73.300	1.100	ENG	LER	68	
14.600		7.698	72.200	1.500	KRE	ISLER	68	
27.000		10.282	69.700	.700	KRE	ISLER	68	
	REFER	ENCES						
1	PALEVSK	Y 64.	PARI	S CONF	1964	162		CNTR
2	PANTUEN	65.	SJNP		1	93		CNTR
3	ENGLER	68	PL		27B	599		CNTR
4	KREISLE	R 68.	PRL		20	468		CNTR
F	DADKED	70	DI		210	246		CNTD



Fig. 48. pd and nd total cross sections. According to isospin invariance these should be equal.

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pd elastic $d\sigma/d\Omega$ (very forward angles)

DISTRIBUTION IN THE ANGLE OF THE SCATT BEAM WITH RESPECT TO THE BEAM DIRECTION IN THE LAB SYSTEM

.

BEAM MOMENTUM=	: 1.290 GEV	10		BEAM MOMENTUM= 1.390 GEV/C					
THETA(DE	G)			THET	(DEG)				
MINIMUM	MAXIMUM	SIGMA + (millib	+− DSIGMA MINIMUM MAXIMUM SIGMA +− DSIGMA BARNS/STERADIAN) (MILLIBARNS/STI						
1.117	1.232	1072.000	96.000	1.060	1.175	791.000	63.000		
1.232	1.346	756.000	82.000	1.175	1.289	607.000	43.000		
1.346	1.461	653.000	70.000	1.289	1.404	520.000	34.000		
1.461	1.576	622.000	63.000	1.404	1.518	511.000	32.000		
1.576	1.690	447.000	54.000	1.518	1.633	482.000	29.000		
1.690	1.805	392.000	52.000	1.633	1.748	424.000	27.000		
1.805	1.919	392.000	29.000	1.748	1.862	395.000	25.000		
1.919	2.034	382.000	27.000	1.862	1.977	357.000	24.000		
2.034	2.149	363.000	26.000	1.977	2.091	347.000	22.000		
2.149	2.263	350.000	25.000	2.091	2.206	312.000	21.000		
2.263	2.378	394.000	25.000	2.206	2.320	326.000	21.000		
2.378	2.492	340.000	23.000	2.320	2.435	248*000	20.000		
2.492	2.607	334.000	23.000	2.435	2.550	297.000	19.000		
2.607	2.722	389.000	23.000	2.550	2.664	296:000 *	19.000		
2.722	2.836	364.000	23.000	2.664	2.779	292.000	19.000		
2.836	2,951	348.000	22.000	2.779	2.893	302.000	19.000		
2.951	3.065	311.000	21.000	2.893	3.008	268.000	18.000		
				3.008	3.123	247.000	17.000		
20 SQUARE=	1.128			3.123	3.237	289.000	18.000		
				3.237	3.352	257.000	17.000		
DUTTON	PRI	21 1416(1	968) SPRK	3.352	3.466	250.000	17.000		
	• •			3.466	3.581	252.000	17.000		
				3.581	3.696	228,000	16.000		
				3.696	3.810	274.000	16.000		
				3.810	3.925	249.000	16.000		

BCAN HOMENTUN- 1.549 G)6V/G
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THE TA (DEG)

MINIMUM	MAXIMUM .	SIGMA +-	DSIGMA
		I MILLIBA	RNS/STERADIANI
1.003	1.117	856.000	87,000
1.117	1.232	536.000	64.000
1.232	1.346	458.000	57.000
1.346	1.461	458.000	50.000
1.461	1.576	499.000	47.000
1.576	1.690	440.000	24.000
1.690	1.805	436.000	22.000
1.805	1.919	401.000	21.000
1.919	2.034	413.000	20.000
2.040	2.154	392.000	20.000
2.149	2.263	347.000	18.000
2.263	2.378	346.000	18.000
2.378	2.492	338.000	18.000
2.492	2.607	311.000	17.000
2.607	2.722	336.000	17.000
2.722	2.836	324.000	16.000
2.836	2.951	356.000	16.000
2.951	3.065	361.000	16.000
3.065	3.180	327.000	16.000
3.180	3.295	305.000	16.000
3.295	3.409	314.000	16.000
3.409	3.524	278.000	15.000
3.524	3.638	277.000	15.000
3.638	3.753	307.000	15.000
3.753	3.867	273.000	15.000
3.867	3.982	253.000	14.000
3.982	4.097	254.000	14.000
2Q SQUARE=	1.494		
DUTTON	PRL	21 1416(19	68) SPRK

. . . .

BEAN MOMENTUM- 1.090 BEA/C

2Q SQUARE= 1.271

DUTTON

. . . .

THETA (DEG)

MINIMUM	MAXINUM	SIGMA +- (Mîllîb)	- DSIGMA ARNSZSTERÁDIÁN)
1.117	1.232	598.000	39.000
1.232	1:346	546.000	36.000
1.346	1.461	471.000	33.000
1.461	1.576	494.000	32.000
1.576	1.690	395.000	28.000
1.690	1.805	356.000	27.000
1.805	1.919	332.000	25.000
1.919	2.034	359.000	26.000
2.034	2.149	346.000	25.000
2.149	2.263	317.000	23.000
2.263	2.378	344.000	23.000
2.378	2.492	286.000	22.000
2.492	2.607	304.000	22.000
2.607	2.722	290.000	23.000
2.722	2.836	323.000	23.000
29 SQUARE=	1.725		
DUTTON	PL	258 245(1	967) ŞPRK

PRL 21 1416(1968)

SPRK



Fig. 49. Small-angle pd elastic differential cross sections in the Coulomb-nuclear interference region. θ is the angle between the incoming and outgoing proton. The main purpose of such experiments is to accurately measure parameters related to the forward nuclear elastic amplitudes.

pd elastic $d\sigma/d\omega$

DISTRIBUTION IN COSIFICTAL OF THE SCATT DEAM WITH RESPECT TO THE BEAM DIRECTION IN THE C.M. SYSTEM

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BEAN MOMENTUM=	1.194 GE	V/L			BEAM MOMENTU	N= 1.696 G	FV/C	
COSCINETAL		DSTGMA				51 CHA A	- 0510#4	
00011110147	(MILLIBA	RNS/STERAD	IAN)		COSTINETAT	INICROB	ARNS/STERADIANI	
971	.172	.026			885	12.990	. 420	
947	.168	.007			875	10.930	.360	
911	.172	.008			850	8.800	.290	
899	.121	.009			825	7.990	.260	
862	.117	.018			800	6.820	.220	
- 705	.037	.003			/50	4.520	.150	
588	.020	.003			/00	3.300	-110	
438	.022	.002			600	2.700	.120	
352	023	.003			550	2.150	.130	
257	.028	.002			500	1.990	.070	
156	.039	.005						
047	.045	-002			20 SQUARE	= 1.734		
.066	.055	.003			PLUS POSSIBLE	SYSTEMATI	C ERRUR OF +- LCPER	CENT
+182	.0/1	.003						
.291	.08,5	.005			COLEMAN	PR	164 1655(1967)	CNTR
+423	.091	.005					•	
.472	. 001	.005						
.605	.110	.010						
.648	.150	.010						
.708	.270 .	.020			•			
.711	.380	.020						
.801	.820	.070						
.833	1.240	.100						
.878	3.100	.500					•	
.904	3.700	.600						
*738	5.400	- 600						
.938	11 900	1 000						
• • • • •	11.700	1.400						
20 SQUARE=	. 993							
								• • •
V LINC CIT	PRL	74 7	36(1970)	CNTR				
DEAM MUMENTUMP	2.032 00	W/C			BEAM MUMENTU	M= 2.251 G	EV/C	
COS(THETA)	SIGMA +-	USIGMA			COS(THETA)	STORA 4	- 0516#4	
	[MICROBA	RNS/STEPAD	1 4 N 1			(MICROB.	ARNS/STERADIANI	
895	4.500	.330			900	2.050	.210	
875	4.070	. 350			875	1.730	.170	
850	3.470	•260			850	1.060	.120	
825	3.390	.230			800	.760	.080	
800	2.220	-110			750	.630	.060	
750	1.490	.150			700	.490	.040	
/00	1.080	.110			650	.300	.030	
600	. 800	.080			- 500	. 340	.030	
550	.560	.060			500	.290	.030	
500	.660	.060				• 2 70	1030	
400	.500	.050			20 SQUARE=	2.630		
					PLUS POSSIBLE	SYSTEMATIC	C ERROR OF +- LOPER	CENT
20 SQUARE=	2.270			17	C 01 C 11 A 11	•••		
PLUS PUBBIULE .	11210200110	Sector In-	CA DULLE AR		CULENCN.	РК	164 1655(1967)	CNTR
LULCIAN	po .	166 16	55(1967)	CNTR				
		1	BEAM NOMENTU	M= 2.784	GEV/C			
			OSTHETAN	SIGNA	A- 051CHA			
			COLLINE LAT	INICO	ORARNS/STEPAD	IANI		
			. 565	4.970	-150			
			.600	7.110	.210			
			.650	12.180	:) 10			
			.700	22,790	.680			
			. /50	36.420	1.070			
			.800	51.550	1.550			
			.850	64.650	1.940			
			.875	18.090	2.520			
			20 SQUARE	3.537				
		PI	US POSSIBLE	SYSTEMA	TIC ERROR OF	- 10PER C	ENT	
			10 FMAN		1.1.1.1.0	55110(7)	CNTP.	
				FR	, 101 165	*******		
							,	
		•						
							÷	
·								

Table VIII. pd elastic cross section (not plotted).

		••	,	
P _{beam} (GeV/c)	E _{c.m.} (GeV)	^o elastic (m) References	
19.300	8.767	9.200 .30	0 BELLETTINI 65	•
REI L BELLI	ERENCES	PL	19 341	SPRK+CNTR



Fig. 50. pd elastic differential cross sections. θ is the angle between the incoming and outgoing proton.

pd elastic $d\sigma/d\Omega$

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Section III.

DATA LISTINGS

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In this section we present a listing of all the NN articles on our DATA TAPE. These are the actual data used in forming the graphs and tables in Section II. The information is presented article-by-article, just as we store it.

We debated for some time whether or not we should give these listings because they are rather lengthy. As an experiment, we decided to put them in the first few editions. If you find them useful, let us know.

Actually, these listings do contain a large amount of information not included in the tables and graphs already presented in Section II.

• In particular there are a number of articles giving mass spectra etc., for which we have <u>punched no data</u> but have punched the bibliographic information and keywords. A person interested in nucleon interactions may find many of these papers quite useful. (These papers are not referred to in any way in Section II.)

• In addition we have also punched the <u>title and abstract</u> for every article, to assist you in your selection of articles for further reading.

• Also in this section you will find <u>com-</u> <u>ments</u> on many pieces of data—it is in general not yet practical to present these comments in Section II.

• Many articles give data that we feel we cannot meaninfgully compile at present (only partially corrected, integrated only over a certain interval, etc.). These data have in many cases been punched and will be found in this section.

• You will also find in this section, data reported as upper and lower limits, approximate values, etc.

• We also indicate here how backgroundresonance separations were made and the values of the parameters used (or fitted).

• Occasionally we do not use the data

as originally given in the article. This section tells exactly where our data came from (private communications, unpublished companion report, etc.).

• The size of an experiment is frequently indicated by the total number of pictures taken, or by the number of events in various distributions.

• To give you an idea of the scope of a particular article, KEYWORDS are included for each article. These words can also be used to form classified indices (see Section IV).

• Some papers give fitted values for various parameters in which we are interested. These fits will be found in this section.

To repeat, the above items are some of the things you will find in this section that are not presented in Section II.

We have also found that theses are frequently hard to come by. Thus we feel that our listing of theses may help give their data greater distribution than they might otherwise have. We would like to make the general appeal that a copy of all particle physics theses be sent to us.

Finally this section may serve the useful function of permitting the reader to easily check on the accuracy of our input data. The data is arranged article-by-article, and in most cases we have indicated [in square brackets] the exact location of the data in the article (i. e., the figure, table, or page number). If you find any errors or misinterpretations, <u>please let us know</u> as soon as possible.

As for the organization of the information in this section, we should first mention that the order of the articles is "random," and has no physical meaning. The order is, however, the same as given in the Reference list, and as given in the Indices in Section IV.

<u>Above the double line</u> in each article you will find the title, authors and institutions, abstract (if the article had one), citations, KEY WORDS, comments, beam information, etc.

Below the double line in each article appear the data. We generally enter the data in exactly the same units as given by the authors. (This is done primarily to facilitate the verification of the data.) If we do alter the data in any way, we indicate this fact by an appropriate comment.

Occasionally authors give the same data in two different forms. We punch both, if we feel that both forms are useful, and display them side-by-side in the listings that follow.

We have tried to be particularly careful about including systematic errors, whenever given by the authors. We have also tried to indicate exactly how resonance and background separations have been made. In some cases it is quite unclear from the original article and we have had to contact the authors directly.

Another reason for contacting authors has been to get tables of data that correspond to the published graphs. If we are unable to get tables from an author, or if the article is more than a couple of years old, we read the data off the published graph, and then include the warning that "This data was read from a graph." (In some cases the tables we received have been more up to date than the published graphs.)

Because of the limitations imposed by not having a printer with Greek letters, we have had to spell out many symbols. One exception is, however, the abbreviation for microbarns, μ b: we use "UB." We hope that we will be able, in the near future, to use a more complete set of characters, so that our output will be easier to read.

1 TOTAL CROSS-SECTIONS FOR N	P ANC N D SCATTERING AT 10 GEV/C NEUTRON MOMENTUM. [PHYS. LETTERS 278, 599 (1968)]
J.ENGLER,K.HORN, J.KONIG,F. GERMANY 1	MONNIG,P.SCHLUDECKER,H.SCHOPPER,P.SIEVERS, H.ULLRICH (TECHNISCHE UNIV. KARLSRUHE, KARLSRUHE,
K.RUNGE LEDRUPEAN URG. FOR	NUC. KES., GENEVA, SWIJZERLANDI
ABSTRACT THE TOTAL NEU NEUTRON MOMENTUM OF 1 THESE VALUES ARE IN E CROSS SECTION BETWEEN	TRON CROSS-SECTIONS WERE MEASURED WITH HIGH PRECISION FOR MYDROGEN AND DEUTERIUM. AT AN AVERAGE O GEV/C WE OBTAINED THE TOTAL CPOSS SECTIONS FOR NP = 39.5 +- 0.5 MR AND ND = 73.3 +- 1.1 MB. XCELLENT AGREEMENT WITH PP AND PD TOTAL CROSS SECTIONS. NO ENERGY DEPENDENCE WAS FOUND FOR NP 4 AND 10 GEV/C.
CITATIONS PHYS. REV. 100, 242 (PHYS. REV. LETTERS 19 15 272 (1962), 2URN. PHYSICS,PARIS,FRANCE	1955), PHYS. REV. 135, 8358 (1964), PHYS. REV. LETTERS 20, 468 (1968), PHYS. REV. 138, 8913 (1965 , 857 (1967), CEPN MPS/ALO-7 (1963), CERN TH 851, ZURN. EKSP. TEOD. FIZ. 42, 392 (1962), JETP EKSP. TEOR. FIZ. 45, 1808 (1963), JETP 18 1239 (1964), INT*L. CONGRESS ON NUCLEAR 162 (1964), AND PHYS. REV. 101, 427 (1956).
ARTICLE READ BY ODETTE BEN	ARY IN 1/69, AND VERIFIED BY LERCY PRICE.
BEAM NO. 1 IS NEUTRON ON NO. 2 IS NEUTRON ON	PROTCN FROM 4.3 TO 10.0 GEV/C. Deuteron At 10 gev/C.
THIS EXPERIMENT USES COUNT	ERS.
KEY WORDS - CROSS SECTION	
NEUTRON PROTON TOTAL CROSS	SECTION. [TABLE IB]
BEAM MOMENTUM	
GEV/C [1] 4.3	MILLI-BARNS 40.4 +- 1.9
6.5 10.0	38.7 1.5 39.5 .5
[1] MEAN VALUES.	
NEUTRON DEUTERON TOTAL CRO	SS SECTION. (PAGE 601)
LABGRATORY	
GEV/C (1)	MILLI-BARNS
10.	73+3 +- 1+1
LIJ HEAN VALUE.	
TOTAL NEUTRON-PROTON INTER	ACTION CROSS SECTION AT 5.5 GEV. [PHYS. LETTERS 7, 80 (1963)]
M.N.KHACHATURYAN.V.S.PANTU	YEV (JOINT INST. FOR NUCL. RESEARCH, DUBNA, USSR)
CITATIONS JETP 42 392 (1963), J 8559 (1958), Phys. Re	ETP 42 909 (1962), JETP 44 1411 (1963), REVIEW OF SCIENTIFIC INSTRUMENTS 32, 949 (1961), UCRL V. 123, 1850 (1961), AND PHYS. REV. 98, 1369 (1955).
ARTICLE READ BY OGETTE BEN	ARY IN 1/69, AND VERIFIED BY LERGY PRICE.
BEAM IS NEUTRON ON HYDRUG	EN LUMPUUNU FHUM 5.053 IU 1.380 GÉV/C. (BEAM KINETIC ENERGY = 4.2 TO 6.5 GEV)
THIS EXPERIMENT USES COUNT	ERS.
KEY WORDS + CROSS SECTION	
NEUTRON PROTON TOTAL CROSS	SECTION. (PAGE B11
LABORATORY	
BEAM ENERGY GEV [1]	MILL I-BARNS
5.5	41.2 +- 1.7
[1] MEAN VALUE.	•

NEUTRON-PROTON SCATTERING AND THE DETERMINATION OF THE PION-NUCLEON COUPLING CONSTANT. (NUOVO CIMENTO 18, 1039 (1960)) 3 R.R.LARSEN [U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA] CITATIONS

TIONS Phys. Rev. 112, 1380 (1958), UCRL 8148 (1958), Review of Scientific Instruments 26, 229 (1955), Zurn. Eksp. Tfor. Fiz. 21, 1113 (1951), UCRL 8523 (1958), And Phys. Rev. 116, 226 (1959). ARTICLE READ BY ODETTE BENARY IN 1/69, AND VERIFIED BY LERCY PRICE.

```
BEAM NO. 1 IS NEUTRON CN PROTON AT 1.356 GEV/C. (REAM KINETIC ENERGY = .71 GEV)
NO. 2 IS NEUTRON ON DEUTERON AT 1.356 GEV/C. (BEAM KINETIC ENERGY = .71 GEV)
```

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 THE DIFFERENTIAL CROSS SECTION WAS MEASURED IN THE CHARGE EXCHANGE REGION ICENTER OF MASS SCATTERING ANGLE BETWEEN 100 AND 180 DEGREES).

[TABLE 1]

KEY WORDS + DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

LABORATORY BEAN ENERGY . .71 GEV (MEAN VALUE).

THETA	D-SIGMA/D-OMEGA		
DEGREES	ME/SR		
180.00	6.15 +54		
175.89	5.04 .51		
172.94	4.39 .39		
1/0.80	3.47 .38		
168.25	3.84 .31		
165.90	3+12 +25		
163.25	3.35 .28		
161.37	2.71 .24		
158.90	2.65 .23		

THETA IS THE ANGLE THAT THE NEUTRON MAKES WITH THE BEAM IN THE GRAND C.M.

THE REAL PART OF THE PROTON-NEUTRON SCATTERING AMPLITUDE AT 19.3 GEV/C. [PHYS. LETTERS 19, 341 (1965)] 4

G.BELLETTINI,G.COCCONI,A.N.DIODENS,E.LILLETHUN,G.MATTHIAE,J.P.SCANLON, A.M.WETHERELL [EUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLAND]

CITATIONS PHYS. LETTERS 14, 164 (1965), CERN 64-30 (1964), PHYS. REV. 138, B913 (1965), INT.CON. ON NUC.FORCES...UNIV. COLLECE, LONDON 1 233 (1959), PHYS. REV. 135, 8358 (1964), PHYS. REV. 112, 618 (1958), NUOVO CIMENTU 11, 67U (1959), AND UUUNA E-1820 (1964).

ARTICLE READ BY ODETTE BENARY IN 1/69, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON DEUTERON AT 19.3 GEV/C.

THIS EXPERIMENT USES SPARK CHAMBERS AND COUNTERS.

KEY WORDS + CROSS SECTION CIFFERENTIAL CROSS SECTION

PROTON DEUTERON TOTAL CROSS SECTION. [PAGE 342]

LABORATORY BEAM FOMENTUM GEV/C 19.3 MILLI-BARNS 74.1 +- .7

PROTON NEUTRON TOTAL CROSS SECTION. CLAUBER CORRECTION APPLIED 1 PAGE 3431 LABORATORY BEAM MOMENTUM GEV/C 19+3 MILLI-BARNS 38.9 +- .7

.

PROTON DEUTERON ELASTIC CROSS SECTION. [PAGE 344] (THE QUASI ELASTIC C.S.HAS BEEN REMOVED)

LABCRATCRY BEAN MOMENTUM GEV/C 19.3

MILLI-BARNS 9.2 +- .3

5 NEUTRON-NUCLEON INTERACTIONS IN THE GEV ENERGY REGION. IINT'L. CONGRESS ON NUCLEAR PHYSICS, PARIS, FRANCE IN 6 H. PALEVSKY, J.L. FRIEDES, R. J. SUTTER, R. E. CHRIEN, H. R. MUETHER I BROOKHAVEN NAT. LAR., UPTON, L.I., N. Y., USA) CITATIONS PHYS. REV. LETTERS 9, 509 (1962), PHYS. LETTERS 4, 19 (1963), PHYS. REV. LETTERS 11, 88 (1963), PHYS. REV. 444 (1963), DUBNA 01329 (1963), PHYS. REV. 103, 211 (1956), AND PHYS. REV. LETTERS 9, 32 (1962). ARTICLE REAC BY OCETTE BENARY IN 1/65, AND VERIFIED BY LEROY PRICE. BEAM. NO. 1 IS NEUTRON CN PROTON FROM 1.380 TO 3.620 GEV/C. (BEAM KINETIC ENERGY = .73 TO 2.80 GEV) NO. 2 IS NEUTRON CN DEUTERON AT 2.996 GEV/C. (BEAM KINETIC ENERGY = 2.2 GEV)	964 162 (1964)] . LETTERS 11 ,
CITATIONS PHYS. REV. LETTERS 9, 509 (1962), PHYS. LETTERS 4, 19 (1963), PHYS. REV. LETTERS 11, 88 (1963), PHYS. REV 444 (1563), DUBNA DI329 (1563), PHYS. REV. 103, 211 (1956), AND PHYS. REV. LETTERS 9, 32 (1962). ARTICLE REAC BY OCETTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE. BEAM NO. 1 IS NEUTRON CM PROTON FROM 1.380 TO 3.620 GEV/C. (BEAM KINETIC ENERGY = .73 TO 2.80 GEV) NO. 2 IS NEUTRON ON DEUTEPON AT 2.996 GEV/C. (BEAM KINETIC ENERGY = 2.2 GEV)	. LETTERS 11 ,
ARTICLE REAC BY OUETTE BENARY IN 1765, AND VERIFIED BY LERUT PALES. BEAM NO. 1 IS NEUTRON ON PROTON FROM 1.380 TO 3.620 GEV/C. (BEAM KINETIC ENERGY = .73 TO 2.80 GEV) NO. 2 IS NEUTRON ON DEUTERON AT 2.996 GEV/C. (BEAM KINETIC ENERGY = 2.2 GEV)	
NO. 2 IS NEUTRON ON DEUTERON AT 2.996 GEV/C. (BEAN KINETIC ENERGY = 2.2 GEV)	
THIS EXPERIMENT USES COUNTERS. Key words + cross section	
NEUTRON PROTON TOTAL CRCSS SECTION. (PAGE 163)	
BEAM ENERGY GEV MILLI-BARNS	
.73 $35.8 + 1.61.60 38.3 2.12.20 40.3 1.4$	
2.80 39.4 3.3	
NEUTRON DEUTERON TOTAL CROSS SECTION. (PAGE 163)	
LABORATORY BEAM ENERGY GEV MILLI-BARNS	
2.2 80.3 +- 1.9	
AN INVESTIGATION OF THE REACTION PPOD PI+ AT AN INCIDENT PROTON ENERGY OF 990 MEV. [PHYS. LETTERS 11, 253	(1964))
K.R.CHAPMAN,T.W.JONES, C.H.KHAN, J.S.C.MCKEE, H.B.VAN DER RAAY, Y.TANIMURA (BIRMINGHAM UNIV., BIRMINGHAM, ENGLAND)	
CITATIONS ZURN. EKSP. TEOR. FIZ. 34, 767 (1958), UNIV. OF MICH. TECH. REPORT 16, AND COKL. AKAD. NAUK. SSSR 100 673	(1955).
APTICLE READ BY ODETTE BENARY IN 4/67, AND VERIFIED BY LERGY PRICE.	
BEAM IS PROTON ON PROTON AT 1.68 GEV/C.	
THIS EXPERIMENT USES COUNTERS.	
CRCSS SECTION FOR PROTON PROTON • DEUTERON PI+. (PAGE 253)	
LABURATURY BEAM ENERGY GRU MICRC-HARNS	
.99 560. +- 30.	
7 NEUTRAL-PION PRODUCTION FROM PROTON-PROTON COLLISIONS AT 735 MEV. (PHYS. REV. 131, 2713 (1963))	
R.J.CENCE,D.L.LIND,G.D.MEAD,B.J.MOYER (U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA)	
ABSTANTEL AN INVESTIGATION THE STATEMANDE UNITE CEARCING DEFACTOR DEFACTOR OF A LIQUID-HYDEREFY TAKEN ENERGY KERE MEASURED AT LABORATORY ANGLES OF & 23, AND 60 DEG MITH RESPECT TO THE PRODUMANT. THO HIGH-RESPECT SPECTROMETERS MERE USED TO HAKE THESE NO 60 DEG MITH RESPECT TO THE PRODUMANT. THO HIGH-RESOLVED SPECTROMETERS MERE USED TO HAKE THESE NO 60 DEG MITH RESPECT TO THE PRODUMANT. THO HIGH-RESOLVED SPECTROMETERS MERE USED TO HAKE THESE NO 60 DEG MITH RESPECT TO THE PRODUMANT AND THE MEASURED TO HAKE ALL NEEDS TO HAKE THESE NO 60 DEG MITH RESPECT TO THE PRODUMANT AND THE MEASURED FOR THE PINAL SECTION. THE SPECTROMETICAL SECTION OF MIS MEASURED FOR DEG SAGA AND DEST MEASURED FOR THE PINAL SECTION. THE SPECTROMETICAL SECTION OF MIS MEASURED FOR DE 3.46A FORDUADS AND MEASURED FOR THE PINAL SECTION. THE PINAL SECTION OF THE MEASURED FOR DE 3.46A FORDUADS AND MEASURED FOR THE PHOTON SPECTRAL. THE PION ANDULAR OISTRIBUTION SCIEVEN BY D-SIGNA //D-OMEGA SIS B34 OLOGGING SOUREES, NOULRE AND THE PION ANDULAR OISTRIBUTION SCIEVEN BY D-SIGNA //D-OMEGA SIS B34 OLOGGING SOUREES THE FOR THE AND THE TION ANDULAR OISTRIBUTION SCIEVEN BY D-SIGNA //D-OMEGA SIS B34 OLOGGING SOUREES THE FOR THE AND OF THE RESOLUTION AND SIGNA TO SIGNA FOR THE TO MEASURED HED FOR THE PHOTON SOUTO TO THE AND THE TION AND THE TION THE TION AND TH	SPECTRA ION PAIR TIONS TO THE DURCE OTHER OF THE ITRIC SYSTEM GMA-T/4 PIJIO. SION. PION IN THE ISOBAR
TUDEL. CITATIONS Phys. Rev. 92, 780 (1953), Phys. Rev. 92, 749 (1953), UCRL 1637 (1952), Annual Rev. Of Nuclear Science 4, Phys. Rev. 96, 139 (1954), Jetp 9 1179 (1959), Phys. Rev. 109, 1716 (1958), Carnegie Inst. Of Tech. Repor	219 (1954), T NYO-7108
(1956), PHYS, REV. 88, 632 (1952), PHILOSOPHICAL MAGAZINE 2 215 (1957), PROC. OF THE ROYAL SOCIETY OF LON 218 (1959), PHYS. REV. 107, 283 (1957), JETP 5 618 (1957), PHYS. REV. 113, 1339 (1959), JETP 5 779 (1957) (1962), UCCH 2922 (1960), UCCH 10781 (1963), UCCH 8000 (1957), PROC. OF THE ROYAL SOCIETY OF LONDON A146, PHYS. REV. 93, 788 (1954), PHYS. REV., AND 105, 1874 (1957),.	DON A251, , UCRL 10187 83 (1934),
ARTICLE READ BY ODETTE BENARY IN 5/67, AND VERIFIED BY LERGY PRICE.	
BRAM IS PRUTUN ON PRUTUN AT 1.39 GEV/C.	
THIS EXPERIMENT USES COUNTERS.	
THIS EXPERIMENT USES COUNTERS. KEY HORDS • CROSS SECTION ANGULAR DISTRIBUTION	
THIS EXPERIMENT USES COUNTERS. KEY MCROS • CROSS SECTION ANGULAR OISTRIBUTION	
THIS EXPERIMENT USES COUNTERS. KEY WORDS - CROSS SECTION ANGULAR DISTRIBUTION CROSS SECTION FOR PROTON PROTON + PROTON PIO. (PAGE 2717) LABORATORY	

8 SEARCH FOR DIBARYON RESONANT STATES (PHYS. REV. 147, 522 (1966))

E.BIERMAN,A.P.COLLERAINE,U.NAUENBERG (PRINCETON UNIV., PRINCETON, N. J., USA, AND PRINCETON-PENN. PPOTON ACCEL., PRINCETON, N.J.,USA)

ABSTRACT A SEARCH FOR DIBARYON RESONANT STATES WAS CARRIED OUT IN PP COLLISIONS AT 5.0 BEV/C IN THE 80-IN BROOKHAVEN BUBBLE CHAMBER. A TOTAL OF ABOUT 1400 EVENTS WAS MEASURED AND ANALYZED. WE WERE NOT ABLE TO DETECT ANY EFFECT WHICH COULD BE CONSTRUED AS BEING OUE TO A DIBARYON RESONANCE. WE OBSERVED THE Y*(1) AND THE N*** RESONANCE. WE ALSO OBSERVE THE EFFECT OF THE 1688*** RESONANCE IN ITS (LAMBDA-0,K*) DECAY MODE. OUR DATA ARE CONSISTENT WITH THE ONE-PIGN-EXCHANGE MODEL.

CITATIONS

FIONS PHYS. REV. 131, 2239 (1963), PHYS. LETTERS 11, 164 (1964), BULL. AP. PHYS. SGC. 10, 517 (1965), PHYS. REV. LETTERS 14, 604 (1965), PHYS. REV. LETTERS 13, 355 (1964), PHYS. REV. 123, 1465 (1961), BNL DC-H-10, CERN 60-33, CERN 61-29, PHYS. REV. 128, 1836 (1962), BNL BC-04-3-B, PHYS. REV. 120, 988 (1960), PHYS. PEV. 125, 1048 (1962), PHYS. REV. 8458 (1964), PHYS. REV. LETTERS 15, 468 (1965), NUOVO CIMENTO 34, 735 (1964), NUOVO CIMENTO 34, 1644 (1964), ANC PHYS. REV. LETTERS 8, 14C (1962).

ARTICLE READ BY OCETTE BENARY IN 4/67, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON PROTON AT 4.95 GEV/C.

THIS EXPERIMENT USES THE 8.N.L. BO IN. (H) BUBBLE CHAMBER.

KEY WORDS + CRDSS SECTION DALITZ PLOT MASS SPECTRUM MODELS 'N*(1688)' Y*(1385) ANGULAR DISTRIBUTION STRANGE PARTICLES

(TABLE 1)

LABORATORY BEAM MOMENTUM = 4.95 GEV/C.

REACTION	NICRO-BARNS	NO. EVENTS
PROTON PROTON .		
PROTON LAMBDA K+	48. +- 4.	173
PROTON SIGMAD K+	25. 3.	91
PROTON LAMBDA K+ PIO	28. 3.	112
NEUTRON LAMBDA K+ PI+	41. 5.	163
PROTON LAMBOA PI+ KO	42. 5.	198
PROTON PI+ KO SIGMAD	20. 3.	36
PROTON SIGMA+ KO	17. 3.	31
PROTEN PIO SIGMA+ KO	7. 2.	13
NEUTRON PI+ SIGMA+ KO	7. 2.	14
PROTON PI+ K+ PI- LAM8DA	7. 2.	24
PROTON K+ NEUTRON KOBAR	12. 3.	21
PROTON PROTON KO KOBAR	3. 1.	10

ELASTIC SCATTERING OF PROTONS, ANTIPROTONS, NEGATIVE PIONS, AND NEGATIVE KAONS AT HIGH ENERGIES. (PHYS. REV. LETTERS 15, 45 (1965)] 9

-K.J.FOLEY,E.S.GILMORE,S.J.LINDENBAUM,W.A.LOVE,S.OZAKI,E.H.WILLEN,R.YAMADA, L.C.L.YUAN (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

CLOSELY RELATEC REFERENCES. CONTINUATION OF PREVIOUS EXPERIMENT IN PHYS. REV. LETTERS 11, 425 (1963).

ADDITIGNAL CITATIONS PHYS. REV. LETTERS 10, 376 (1963), NUCLEAR INSTRUMENTS AND METHODS 30, 45 (1964), PHYS. REV. LETTERS 11, 503 (1963), PHYS. REV. LETTERS 8, 173 (1962), PHYS. REV. LETTERS 7, 184 (1961), PHYS. REV. LEITERS 7, 352 (1961), PHYS. REV. 2285 (1963), PHYS. REV. LETTERS 12, 206 (1964), AND PHYS. REV. 138, B1167 (1964).

ARTICLE READ BY ODETTE BENARY IN 6/67, AND VERIFIED BY LERGY PRICE.

BEAM NO. 1 IS PROTON ON PROTON FRCM 10.94 TC 24.63 GEV/C.
 ND. 2 IS PI- ON PROTON FRCM 14.84 TO 25.34 GEV/C.
 NO. 3 IS ANTI-PROTON ON PROTON FROM 11.80 TO 15.91 GEV/C.
 NO. 4 IS K- ON PROTON FROM 11.88 TO 15.91 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.

[TABLE 1]

LABORATORY BEAM MOMENTUM = 10.94 GEV/C.

- T	D-SICMA/D-T
(GEV/C)*+2	MB/(GEV/C)**2
•200 ·	13.190 +320
.263	8.100 .230
.333	4.660 .160
-411	2.570 .110
.493	1.411 .076
.582	.641 .048
+ 67 9	.393 .639
.782	.178 .026
.891 .	.094 .018

T IS THE NOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LOUTGOING PROTONI.

(TABLE 1)

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.

LABORATORY BEAM MOMENTUM = 14.93 GEV/C.

-T	D-SIGMA/D-T
(GEV/C)**2	M8/(GEV/C)++2
.216	11.480 +230
.284	6.670 .160
.360	3.480 .100
.444	1.752 .064
. 534	.886 .039
.631	.402 .024
.736	.189 .016

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUP = 19.84 GEV/C. D-SIGHA/D D-SIGMA/D-T MB/(GEV/C)**2 9.290 +- .280 5.140 .190 2.640 .120 1.269 .C70 .552 .042 (GEV/C)**2 .230 .302 .383 .474 . 569 .674 . 291 .018 .100 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LOUTGOING PROTONI. - - - - - - - - -ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON. ITABLE 11 LABORATORY BEAM NOMENTUM = 21.88 GEV/C. D-SIGMA/D-T MB/(GEV/C)**2 8.980 +- .280 4.820 .180 2.250 .100 1.100 .C63 .494 .C38 .209 .024 .096 .C16 -T (GEV/C)**2 .235 .309 .392 .485 .583 .691 .807 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOHING PROTONI AND THE LOUTCOINC PROTONI. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 24.63 GEV/C. D-SIGNA/D-T MB/(GEV/C)++2 7.560 +- .340 3.740 .210 1.712 .122 .824 .074 .203 .C36 .110 .028 (GEV/C)++2 EV/C) • 254 • 334 • 424 • 525 • 632 • 748 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 10.94 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = EXP(A + B[T] + C(T**2}) WHERE D-SIGMA/O-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [Incoming proton] and the [dutgding proton]. FITTED VALUE A = 4.25 +- .09 B = 8.56 +- .47 C = 1.20 +- .54 . FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 14.93 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = EXP(A + B[T] + C[T*+2]) WHERE D-SIGMA/D-T IS IN M8/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (DUTGDING PROTON). FITTED VALUES A = 4.32 +- .10 B = 8.89 +- .52 C = .98 +- .62 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 1] ABORATORY BEAN NOMENTUM = 19.84 GEV/C. Fitted formula is d-sigma/d-t = exp(a + b[t] + c[t**2]) WHERE O-SIGMA/D-T IS IN MB/IGEV/CI++2 AND T IS IN (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGDING PROTON). FITTED VALUES A = 4.19 +- .15 B = B.68 +- .79 C = .70 ← .92 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 21.88 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = EXP(A + B[T] + C(T**2]) WHERE O-SIGMA/D-T IS IN MB/IGEV/CI++2 AND T IS IN (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [Incoming proton] and the idutgoing proton]. FITTED VALUES A = 4.38 +- .16 B = 9.63 +- .78 C = 1.56 +- .89

FIT TO ELASTIC DIFFER	ENTIAL CROSS SECTION FOR PROTON	PRCTON. [TABLE 1]		
LABORATORY BEAM / Fitted formula 1	MOMENTUM = 24.63 GEV/C. S D-SIGMA/D-T = EXP(A 4	• B[T] + C(T++2])		
WHERE D-	SIGMA/D-T IS IN MB/(GEV/C)**2 AM Coming Proton) and the loutgoing	ND T IS IN (GEV/C)**2. T IS G proton].	THE MOMENTUM TRANSFER B	ETWEEN THE
FITTED VALUES				
A ∞ 4.(B ∞ 7.) C = .8:	29 +30 97 +- 1.56 2 +- 1.83			
			•	
10 PROTON-PROTON INTERAC	TIONS AT 2.75 BEV. [PHYS.]	REV. 103, 1484 (1956)]		
N.M.BLGCK, E.M.HARTH (V.T.CDCCONI, E.HART (C W.B.FOWLER, R.P.SHUTT,	DUKE UNIVERSITY, DURHAM, N.C., U GRNELL UNIV., ITHACA, N. Y., US A.M. THORNCIKE,K.L.WHITTEMORE (JSA) A] Brookhaven Nat. Lab., Upton,	L.I., N. Y., USA]	
ABSTRACT 212 INTE DATA INDICATE AN PRODUCTION, 13 M OFFINITE EXAMPLE ELASTIC SCATTERI CONSISTENT WITH	RACTIONS OF 2.75-BEV PROTONS HA ELASTIC CROSS SECTION OF 15 MII ILLIBARNS FOR DOUBLE, AND 4 FOR OF THE PRCDUCTION OF HEAVY UNS ING ANGLE WAS 19 DEC. IN THE C.M. THOSE OBSERVED AT LOWER ENERGIE	VE BEEN OBSERVED IN A HYDROGE LIIBARNS, WITH ABOUT 9 MILLIE TRIPLE. THERE IS ONE EXAMPLE FABLE PARTICLES WAS OBSERVED, System. Angle and Homentum S.	N-FILLED DIFFUSION CLOU MARNS CROSS SECTION FOR E OF QUADRUPLE PION PROD , AND THO DOUBTFUL CASES DISTRIBUTIONS FOR INELA	D CHAMBER. THE SINGLE PION UCTION. ONE . THE MEDIAN STIC EVENTS ARE
CITATIONS Phys. Rev. 103, Instruments 25, Phys. Rev. 99, 2	1472 (1956), PHYS. REV. 103, 14 996 (1955), PHYS. REV. 103, 212 61 (1955).	79 (1956), PHYS. REV. 103, 14 (1956), REV. MOD. PHYS. 27,	489 (1956), REVIEW OF SC 1 (1955), PHYS. REV. 98	IENTIFIC , 121 (1955), AN ¹
ARTICLE READ BY OCETT	E BENARY IN 3/67, AND VERIFIED I	BY LERDY PRICE.		
BEAM IS PROTON ON PR	DTON AT 3.57 GEV/C.			
THIS EXPERIMENT USES	A CLOUD CHAMBER.			
KEY WORDS + CROSS SEC	TICN DIFFERENTIAL CROSS SECT			
	[PAGE 1485}		
LABORATORY BEAM ENERG	¥ ≈ 2.75 +10 GEV.			
REACTION PRUIUN PRUTUN +		MILL I-BARNS	NO. EVENTS	
ELASTIC		35. + 8. - 5. 15. (1)	61	
TOTAL INELASTIC		26. [1]	150	
[1] VALUE IS AP	PROXIMATE CNLY.			
THE REAL PART OF THE I J.D.DOWELL, R.J.HOMER, CLOSELY RELATED REFER SEE ALSO SIENNA	FCRHARD AMPLITUCE IN PROTON-PROT Q.F.KHAN,W.K.MCFARLANE,J.S.C.HCH ENCES CONFERENCE 683 (1963).	ION SCATTERING AT 1.7 GEV/G. Kee,a.w.o'dell (birmingham un	(PHYS. LETTERS 12, IIV., BIRMINGHAM, ENGLANI	252 {1964}1 D]
AUUITIUNAL CITATIONS				
PHYS. REV. LETTE (1961), Phys. Re Instruments and 285 (1964), Phys. 3, 190 (1958), Ni	XS 9, 108 (1962), PHYS. LETTERS V. 118, 575 (1960), PHYS. REV. L METHODS 171 (1962), NUOVO CINK REV. 111, 1178 (1958), SIENNA UC. PHYS. 9, 60C (1959), JETP 14	1, 41 (1962), NUOVO CIMENIO LETTERS 9, 425 (1963), NUOVO NITO 18, 818 (1960), KYGTO UN CONFERENCE 593 (1963), PHYS. 3 412 (1964), AND SIENNA CONF	28, 943 (1963), NUCYO C CIMENTO 23, 690 (1962), NUVERSITY RFIP-31 (1963), Letters 3, 184 (1963), Ference 598 (1963).	IMENTO 20, 1049 NUCLEAR , PHYS. LETTERS ANNALS OF PHYSI
ARTICLE READ BY ODETT	E BENARY IN 10/69, AND VERIFIED	BY LEROY PRICE.		
BEAM IS PROTON ON PRI	OTON AT 1.7 GEV/C.			
THIS EXPERIMENT USES	COUNTERS.	DIECEDENTIAL CODIC CECTION		
		• • • • • • • • • • • • • • • • •	· 	
* THE REVIN RATIO FOR T	HE FORWARD ELASTIC AMFLITUDE FOR	R PROTON PROTON. [PAGE	254)	
LÁBORATORY BEAN MONENTUN	ALPHA			
GEV/C 1.7	007 +070			
12 PROTON-PROTON SCATTER E.LOHRMANN, H.MEYER LOS H.WINZELER (EUROPEAN C	ING AT VERY SMALL ANGLES AT 24 C Eutsches Elektronen-Synch., Hame DRG. For Nug. Res., Geneva, Smit	EV/C. (PHYS. LETTERS 13 BURG, GERMANY) ZERLAND)	., 78 (1964)}	
CITATIONS ANNALS OF PHYSICS	5 3. 190 (1958). DHVS. DEV 4571	FRS 11. 425 (10431. AND DUVE	. I FTTERS 7. 73 (10/3)	
ARTICLE READ BY OCETT	E BENARY IN 10/69, AND VERIFIED	BY LERDY PRICE.		
BEAM IS PROTON ON PRO	DTCN AT 24 GEV/C.			
THIS EXPERIMENT USES E	EMULSIONS.			
KEY WORDS - REAL (AMP	_ITUDE)/INAGINARY (AMPLITUCE)	DIFFERENTIAL CROSS SECTION		

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THE RE/IM RATIO FOR THE FORWARD ELASTIC AMPLITUDE FOR PROTON PROTON. (PAGE 79)

LABORATORY	ALPHA
BEAM MCMENTUM	
GEV/C	
24	19 +09

NUCLEON-NUCLEON TOTAL CROSS SECTIONS FROM 1.1 TO 8 GEV/C. (PHYS. REV. 146, 980 (1966)) 13

D.V.BUGG,D.C.SALTER,G.H.STAFFORC (RUTHERFCRD HIGH EN. LAB., CHILTON,DID.BERK.ENGLAND) R.F.GEORGE,K.F.RILEY,R.J.TAPPER (CAVENDISH LAB., CAMB. UNIV., CAMBRIDGE, ENGLAND)

NACI MEASUREMENTS HAVE EVEN RADE OF THE TOTAL CROSS SECTIONS SIGNA(P-P) AND SIGMA(P-D) OVER THE LABORATORY NOMENTUM RANGE 1.1 TO 8 GEV/C, WITH RELATIVE ERRORS OF 0.1 PER CENT. THE ABSOLUTE ACCURACIES OF THESE CROSS SECTIONS ARE LIMITED TC 0.3 PER CENT BY LACK OF INFORMATION WHICH WILL ALLOW THE COULOMB-NUCLEAR INTERFERENCE TO BE CALCULATED ACCURATELY, VALUES OF THE TOTAL CROSS SECTIONS SIGMATP-N) AND SIGMATO ARE DECUCED BY ASSUMING THE GLAUMER CORRECTION. STRUCTURE IS CBSERVED IN SIGMATP-P) NEAR A MASS VALUE OF 2.75 GEV/C-SQUARED; ITS INTERPRETATION IS OISCUSSED. SIGMATON REPORTS REPORT OF STRONG INELASTIC SCATTERING. ABSTRACT

CLOSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES PHYS. REV. LETTERS 15, 214 (1965).

ADDITIONAL CITATIONS ADDITIONAL CITATIONS PHYS. REV. 103, 211 (1956), PHYS. REV. 125, 701 (1962), DOKL. AKAD. NAUK. SSSR 104 380 (1955), PHYS. REV. LETTERS 9, 32 (1962), PHYS. REV. 138, B913 (1965), PHYS. REV. LETTERS 7, 185 (1961), DOKL. AKAD. NAUK. SSSR 104 717 (1957), SOVIET JNP 1 93 (1965), INT'L. CONCRESS ON NUCLEAP PHYSICS, PARIS, FRANCE 2 162 (1964), NUUNO CIMENTO 34, 825 (1964), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 9, 108 (1962), PHYS. LETTERS 14, 54 (1965), RUTHEREDOD HIGH ENERGY LAB. NIRL/AF93, REV.LETTERS 14, 74 (1965), PHYS. LETTERS 13, 93 (1964), PHYS. LETTERS 13, 78 (1964), PHYS. LETTERS 14, 74 (1965), PHYS. LETTERS 13, 93 (1964), PHYS. (1964), PHYS. REV. LETTERS 12, 252 (1964), PHYS. LETTERS 14, 164 (1965), PHYS. LETTERS 13, 93 (1964), PHYS. REV. LETTERS 14, 604 (1963), PHYS. REV. LETTERS 5, 263 (1964), PHYS. REV. 12, 2077 (1958), SOVIET JNP 1 379 (1965), PHYS. REV. LOJ. 242 (1955), SIENNA CONFERENCE 1 634 (1963), PHYS. REV. 12, 1066), PHYS. REV. 123, 216C (1965), PHYS. REV. 125, 2082 (1962), PHYS. REV. LETTERS 5, 2091 (1962), PHYS. REV. 124, 1159 (1964), PHYS. REV. 139, 1607 (1965), PHYS. REV. 125, 2082 (1962), OF LONDON A244, 491 (1958), NUOVO CIMENTO 27, 1450 (1964), PHYS. REV. 130, 816C (1965), PHYS. REV. 125, 2082 (1962), PHYS. REV. LETTERS 13, 668 (1964), PHYS. LETTERS 11, 164 (1964), AND PHYS. REV. LETTERS 14, 604 (1965).

ARTICLE READ BY OCETTE BENARY IN 4/67, AND VERIFIEC BY LERCY PRICE.

BEAM NG. 1 IS PRGTON ON PROTON FRGM 1.111 TO 7.835 GEV/C. NO. 2 IS PROTON ON CEUTERON FRGM 1.111 TO 7.835 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . CROSS SECTION REAL (AMPLITUDE)/IMAGINARY (AMPLITUDE)

PROTON PROTON TOTAL CRGSS SECTION. COULONB CORRECTIONS APPLIED [TABLE 2]

•

LABO	DRATORY		
BEAM P	KOMENTUM		
GE	EV/C	MILLI-B	ARNS
	PER CENT		
1.111	+5	34.029 +-	.170
1.289	.5	43.234	-113
1.408	.5	46.487	.052
1.607	.5	47.476	.058
1.660	- 5	47.553	.058
1.780	.5	47.490	.046
1.858	.5	47.455	.041
1.940	.5	47.357	.046
1.952	.5	47.409	.041
2.019	.5	47.224	.041
2.212	.5	46.985	.046
2.280	.5	46.669	.041
2.419	.5	46.130	.041
2.450	.5	45.827	.041
2.592	.5	45.533	.041
2.680	.5	45.331	.C41
2.704	.5	45.174	.041
2.819	.5	45.008	.041
2.857	.5	44.928	.041
2.958	.5	44.651	.041
2.994	.5	44.466	.041
3.054	.5	44.401	.041
3.110	.5	44.188	.041
3.131	.5	44.156	.041
3.142	.5	44.114	.041
3.277	.5	43.610	.C41
3.303	.5	43.669	.041
3.444	.5	43.138	.041
3.546	.5	42.978	.037
3.731	.5	42.680	.041
3.908	.5	42.316	. C41
4.037	.5	42.136	.041
4.265	.5	41.765	.C41
4.552	.5 .	41.457	.041
4.783	.5	41.377	.037
4.966	.5	41.165	. C41
5.221	.5	41-171	.032
5.526	.5	40.878	.041
5.824	.5	40.848	.041
7.835	• 5	40.075	-05z

PROTON	NEUTRON	TOTAL	CROSS	SECTION.		(TABLE	5)			
	* THIS	ΠΑΤΑ SH	กมากส		FC * * 1	VALUES	ARE	APPROXIMATE	ONLY	,
G		FERMI	HOTTOM	CORRNS.						
LAB	ORATORY									
BEAM	NOMENTUM									
6	FV/C			MILL T-BA	885 [1]					
	PER C	ENT								
1.111	+5			35.22						
1.289	. 5			36.76						
1.408	- 5			35.61						
1.607	.5			39.61						
1.660	.5			39.97						
1.780	.5			40.51						
1.858	• 5			41.20						
1.94)	- 5			41.54						
1.952	.5			41.49						
2.079	.5			41.95						
2.212	.5			42.27						
2.280	.5			42.57						
2.450	.5			42.65						
2.592	.5			42.91						
2.680	• 5			43.00						
2.704	.5			42.97						
2.819	• 5			43.06						
2.857	.5			43.05						
2.958	- 5			43.17						
2.994	• 5			43.17						
3.054	•5			43.04						
3.110	• 5			43-27						
·3.142	• 5			42.17						
3.277	•5			42.84						
3.303	• 2			43.00						
3.994	• 2	•		42.50						
3. 240	•?			42.52						
3.908	•2			42.50	•					
4.037	• ?			42+51						
4.200	• ?			42.21						
9.332	•2			42.24						
6 331	• 2			42.08						
5 534	• • •			42.03						
5 924	• 2			41.03						
7 024	- 7			41-03						
1.033	• 2			41+33						

[1] VALUES ARE APPROXIMATE ONLY.

PROTON NEUTRON TOTAL CRCSS SECTION. Glauber correction applied [TABLE 5]

LABCPATCPY BEAN MCMENTUM GEVYC PER CENT 1.111 → -5 1.4008 -5 1.4008 -5 1.4008 -5 1.4008 -5 1.4008 -5 1.4008 -5 1.952 -5 2.212 -5 2.280 -5 2.212 -5 2.280 -5 2.212 -5 2.280 -5 2.212 -5 2.280 -5 2.212 -5 2.280 -5 2.212 -5 2.280 -5 2.2450 -5 2.2450 -5 2.450 -5 2.450 -5 2.450 -5 2.450 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.104 -5 3.144 -5 3.140 -5 3.145 -5 3.140 -5 3.145 -5 3.145 -5 3.054 -5 3.054 -5 5.526 -5 5.526 -5 5.526 -5 5.526 -5 5.526 -5 5.526 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.526 -5 5.7.835 -5 5.7 MILLI-BARNS .

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(TABLE 4)

PROTON CEUTERON TOTAL CROSS SECTION. Coulomb corrections applied

LACORATORY			
BEAM M	OMENTUM		
GE	V/C	MILLI-84	RNS
	PER CENT		
1.111	+5	67.209 +-	.090
1.289	.5	76.905	.110
1.408	.5	80.490	.057
1.607	.5	82.472	.063
1.660	.5	62.889	.063
1.780	.5	83.377	-052
1.858	.5	84.039	• 647
1.940	.5	84.280	.046
1.952	.5	£4.28C	·C47
2.079	.5	84.526	.047
2.212	.5	84.524	.C47
2.280	•5	84.624	.047
2.450	.5	84.239	.047
2.592	.5	84.212	.047
2.680	.5	84.085	.044
2.704	.5	83.912	.047
2.819	.5	83.846	. 647
2.857	.5	83.790	.047
2.958	.5	83.602	. 647
2.994	.5	83.452	.047
3.054	.5	83.289	.047
3.110	.5	83.328	. C47
3.142	.5	83.166	.047
3.277	.5	82.489	.047
3.303	.5	82.730	.047
3.444	.5	81.960	.047
3.546	.5	81.710	. C47
3.908	.5	81.107	.033
4.037	•5	80.930	.047
4.265	.5	80.417	.047
4.552	.5	80.125	.047
4.966	• 5	79.632	.C47
5.221	.5	79.578	.037
5.526	.5	79.316	.047
5.824	.5	79.091	.047
7.835	•5	77.858	•052

I = O NUCLECN NUCLEON TOTAL CRESS SECTION. CGULOMB CORRECTIONS APPLIED

[TABLE 5]

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.

LABORATORY BEAM MOMENTUM CVVC MILLI-BARNS PER CENT 1.111 + - 5 36.75 + - .75 1.209 .5 32.99 .38 1.607 .5 32.99 .38 1.607 .5 32.92 .36 1.600 .5 32.76 .35 1.780 .5 33.68 .26 1.858 .5 35.76 .24 1.952 .5 35.76 .24 1.952 .5 37.54 .26 2.200 .5 37.54 .26 2.200 .5 38.44 .21 2.279 .5 36.68 .22 2.212 .5 37.54 .26 2.280 .5 38.44 .21 2.280 .5 39.52 .20 2.592 .5 40.24 19 2.600 .5 40.62 .19 2.600 .5 40.62 .19 2.704 .5 40.72 19 2.704 .5 41.01 19 2.994 .5 41.01 19 2.994 .5 41.66 .19 3.110 .5 42.33 19 3.127 .5 42.63 18 3.454 .5 42.33 19 3.145 .5 42.61 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.03 18 3.454 .5 42.05 .6 3.908 .5 42.75 .15 4.037 .5 42.66 .17 4.255 .5 42.66 .17 4.552 .5 42.67 .13 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17 5.221 .5 42.60 .17

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P.BRE ITENLOHNER, P. EGLI, H. MOFER, H. K. UNIV. BERN, BERN, SWITZERLAND G. CZAPEK, G. KELLINER IUNIV. WIEN, W	24.5 GEV/C PROTONS ON HYDROGEN NUCLEI. IPHYS. LETTERS 7, 73 (1963)] GCH,M.NIKOLIC,J.PAHL,A.PALLINGER, E.PALLINGER,M.SCHNEEBERGEP,R.SCHNEERERGEP,H.WINZELER (] IEN, AUSTRIA]
CITATIONS Nuovo cimento lo, 525 (1958), Phys. Rev. Letters 9, 108 (19 Letters 9, 183 (1962).	PFYS. REV. LETTERS 7, 185 (1961), PHYS. REV. LETTERS 10, 413 (1963), JETP 37 651 (1959) 62), PHYS. REV. LETTERS 10, 376 (1963), PHYS. LETTERS 1, 29 (1962), AND PHYS. REV.
ARTICLE READ BY ODETTE BENARY IN 4	/67, AND VERIFIED BY LERDY PRICE.
BEAM IS PROTON ON PROTON AT 24.5	GEV/C.
KEY WORDS + CROSS SECTION DIFF	ERENTIAL CROSS SECTION
	[P4GE 75]
LABORATORY BEAM MOMENTUM = 24.5	GEV/C.
REACTION	MILL I-BARNS
TOTAL ELASTIC	39.3 +8 8.8 .3
FIT TO ELASTIC CIFFERENTIAL CROSS	SECTION FOR PROTON PROTON. (PAGE 75)
LABORATORY BEAM MOMENTUM	24.5 GEV/C.
WHERE D-SIGMA/D-T IS	IN MB/IGEV/CI**2 AND T IS IN IGEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE
LINCOMING PROTON	.) ANC THE [OUTGOING PROTON].
B - 9.0 +3	
15 HIGH-ENERGY, SMALL-ANGLE, PP AND P K.J.FOLEY, R.S.JONES, S.J.LINDE ABAUM	-BAR P SCATTERING, AND PP TOTAL CROSS SECTIONS. [PHYS. REV. LETTERS 19, 857 (1967)]
L.I., N. Y., USAJ	
PHYS. REV. LETTERS 19, 193 (1 705 (1966), PHYS. REV. 146, 9 13, 78 (1964), NUOVO CIMENTO LETTERS 14, 74 (1965), PHYS.	967), PHYS. REV. LETTERS 19, 330 (1967), PHYS. LETTERS 14, 164 (1965), PHYS. LETTERS 19, 180 (1966), PHYS. REV. LETTERS 7, 185 (1961), PHYS. REV. 138, 8913 (1965), PHYS. LETTERS 38, 95 (1965), PHYS. LETTERS 14, 54 (1965), PHYS. LETTERS 13, 93 (1964), PHYS. REV. LETTERS 13, 185 (1964), AND PHYS. LETTERS 8, 285 (1964).
ARTICLE READ BY ODETTE BENARY IN 1	1/67, AND VERIFIEC BY LERDY PRICE.
BEAM NO. 1 IS PROTON ON PROTON FR NO. 2 IS ANTI-PROTON ON PROT	OM 7.82 TO 26.00 GEV/C. On At 12 GEV/C.
THIS EXPERIMENT USES COUNTERS.	
KEY WORDS + CROSS SECTION REAL	(APPLITUDE)/IMAGINARY (AMPLITUDE)
PROTON PROTON TOTAL CROSS SECTION.	(TABLE 1)
BEAR MEMENTUM GEV/C MILLI-B	AKAS
PER CENT 7.82 +2 40.34 +-	•12
11.90 ·2 39.62 14.01 ·2 39.42	.12
16.03 .2 39.23 17.91 .2 39.18	.12
20.22 .2 39.05 20.46 .2 39.09 22.00 1.0 38.88	•12 •12
24.00 1.0 38.89 26.00 1.0 38.90	.12 .12
ANALYSIS OF PP • PP PI+ PI- AT 16 J.G.RUSHBROOKE,J.R.WILLIAMS (CAVEN	GEV/C BY THE NULTI-REGGE-PCLE EXCHANGE MODE. (PHYS. REV. LETTERS 22, 248 (1969)] DISH LAD., CAMB. UNIV., CAMBRIDGE, ENGLAND]
ÁÚJTÁÁCT LÁPCAIMENYAL DISIRIBU REGGE-POLE MODEL INCORPORATIN DISTINCTIVE TEST IN FAVOR CF	ΊΙΩRS PUR THE REACTION PP÷PP PI+ PI- AT 16 GEV/C ΔŘE ČÓŇŠÍŠŤĚŇŤ WÍŤH PREDICTIONS OF A G EXCHANGE OF A REGGEIZED PION. THE TREIMAN-YANG ANGLE DISTRIBUTION AFFORDS A PION REGGEIZATION FOR THIS REACTION.
CITATIONS Phys. Rev. Letters 19, 614 (1 701 (1968), Phys. Rev. Letter:	967), PHYS. REV. 163, 1572 (1967), NUOVO CIMENTO 27, 1450 (1963), PHYS. REV. LETTERS 21, 20, 964 (1968), AND PHYS. REV. LETTERS 20, 1078 (1968).
ARTICLE READ BY ODETTE BENARY IN 2. BEAM IS PROTON ON PROTON AT 14 45	765, AND VERIFIED BY LERGY PRICE.
THIS EXPERIMENT USES THE CERN 24 (1	H) BUBBLE CHAMBER.
KEY WORDS + CROSS SECTION MEDE	LS MASS SPECTRUM ANGULAR DISTRIBUTION

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CROSS SECTION FOR PROTON • PROTON PROTON PI+ PI-. (PAGE 2511 LABORATCRY BEAM MCMENTUM GEV/C HILLI-BARNS 1.66 + .13 - .C6 16. SCATTERING OF PROTONS BY GEUTERIUM FRCM 1.C TO 2.0 BEV. [PHYS. REV. 164, 1655 (1967)] 17 E.COLEMAN, R.N. HEINZ, D.E. OVERSETH, D.E. PELLETT (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) ARCT THE DIFFERENTIAL CROSS SECTIONS FOR PROTON-DEUTERON ELASTIC SCATTERING AT HIGH MOMENTUM TRANSFERS HAVE BEEN MEASURED AT INCIDENT PROTON KINETIC ENERGIES FROM 1 TO 2 BEV IN A COUNTER EXPERIMENT.THE DIFFERENTIAL CROSS SECTIONS FOR BACKMAD ELASTIC SCATTERING AT INCIDENT KINETIC EMERGIES OF 1.0, 1.3, AND 1.5 BEV HAVE BEEN MEASURED FOP VALUES OF THE COSINE OF THE CENTER-OF-PASS PROTOM SCATTERING ANGLE (COS THETA*) FROM -0.5 TO -0.9, WHICH CORRESPONDS TO VALUES OF THE FORM-MONENTUM TRANSFER SUARED (-1) FROM 2.6 TO 5.0 (BEV/C)-SQUARED. A BACKMARD PEAK IS OBSEPVERO. AND THE CROSS SECTION DECREASES RAPIOLY WITH INCREASING EMERGY. AT 2.0 BEV, THE FORMARD ELASTIC DIFFERENTIAL CROSS SECTION HAS BEEN MEASURED FOR -F FROM 0.45 TO 1.55 (BEV/C)-SQUARED, OR COS THETA* FROM 0.875 TO 0.565. A SHOULDERLIKE DEPARTURE FROM THE FORMARD DIFFRACTION PEAK IS OBSERVED. ABSTRACT CLOSELY RELATED REFERENCES CONTINUATION OF PREVICUS EXPERIMENT IN PHYS. REV. LETTERS 16, 761 (1966). ACDITIGNAL CITATIONS PHYS. REV. LETTERS 17, 827 (1966), PHYS. REV. 142, 1195 (1966), PHYS. REV. 138, 8619 (1965), PHYS. REV. 140, 81291 (1965), PHYS. REV. 130, 276 (1963), PHYS. REV. 126, 831 (1962), PHYS. LETTERS 248, 598 (1967), JETP 5 371 (1957), PHYS. REV. LETTERS 13, 59 (1964), BULL. AM. PHYS. SOC. 10, 19 (1965), PHYS. REV. 143, 1340 (1966), PHYS. REV. 133, 81507 (1964), PHYS. REV. 111, 1386 (1558), PHYS. REV. 103, 211 (1956), NUC. PHYS. 12, 629 (1959), NUC. PHYS. 1. 379 (1965), AND JETP 3 8 (1966). ARTICLE READ BY ODETTE BENARY IN 1/69, AND VERIFIED BY LERDY PRICE. SEAM IS PROTON ON DEUTERCH FROM 1.696 TO 2.784 GEV/C. (BEAM KINETIC EMERGY = 1 TO 2 GEV) THIS EXPERIMENT USES COUNTERS. KEY WORDS + DIFFERENTIAL CROSS SECTION FITS MODELS COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON DEUTERON. [TABLE 2] LABORATORY BEAM ENERGY # 1. GEV. C-SIGMA/D-OMEGA UE/SR [1] 12.99 *- .42 10.93 .36 8.80 .29 7.99 .26 6.82 .22 4.52 .15 3.30 .11 2.84 .09 2.70 .12 2.15 .13 1.59 .05 COS(THETA) -.885 -.875 -.850 -.825 -.800 -.750 -.700 -.650 -.600 -.550 -.500 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON DEUTERON. (TABLE 2) LABORATORY BEAM ENERGY = 1.3 GEV. D-SIGMA/D-DMEGA UB/SR (11 4.5C ← .33 3.407 .24 3.39 .23 2.22 .11 1.49 .15 1.08 .11 1.00 .10 .80 .08 .56 .06 .50 .05 COSITHETAL -.895 -.875 -.950 -.825 -.800 -.750 -.750 -.650 -.650 -.550 -.500 -.460 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.H. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON DEUTERON. (TABLE 2) LABORATORY BEAM ENERGY = 1.5 GEV. D-SIGMA/D-OMEGA UP/SR (1) 2.05 ← .21 1.73 .17 1.C6 .12 .76 .08 .63 .C6 .49 .C6 .49 .C3 .34 .03 .29 .03 COS(THETA) -.900 -.875 -.850 -.750 -.700 -.600 -.550 -.500

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT.

[TABLE 3]

FLASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON DEUTERON.

LABORATORY	BEAM	ENERGY	3	2.	GEV.
COS(THETA)		C-S	I GM/	1/0	-OMEGA
			0	3/5	R (1)
.875		78	.09	+-	2.52
.850		64	. 65		1.94
.800		51	. 55		1.55
.750		36	. 42		1.09
.700		22	. 79		.68
.650		12	.18		.37
.600		7	. 11		.21
.565		4	.97		.15

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR CF +- 10 PER CENT.

18 STRUCTURE IN THE ANGULAR DISTRIBUTION OF HIGH ENERGY PROTON-PROTON SCATTERING. (PHYS. LETTERS 288, 67 (1968)) J.V.ALLABY, F.BINON, A.N.DIDDENS, P.DUTEIL, A.KLOVNING, R. MEUNIER, J.P.PEIGNEUX, E.J.SACHARIDIS, K.SCHLUPMANN, M.SPIGMEL, J.P.STRO A.M.THORNOI KE, A.M.METHERELL (EURCPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLAND)

ABSTRACT

RACT RESULTS ARE PRESENTED ON MEASUREMENTS OF ELASTIC PROTON-PROTON SCATTERING AT 19.2 AND 21.1 GEV/C IN THE ANGULAR REGION WHERE PREVIOUSLY STRUCTURE HAD BEEN UBSEAVED AI LOWER ENERGIES.

CLOSELY RELATED REFERENCES Continuation of previcus experiment in Phys. Letters 258, 156 (1967).

ACDITIONAL CITATIONS UCRL 16275 (1966), PHYS. REV. 170, 1223 (1968), PHYS. LETTERS 278, 49 (1968), CERN MPS/H/68-1 (1968), NUCLEAR INSTRUMENTS AND METHCOS 22, 165 (1963), BNL 11360 (1967), NUOVO CIMENTO 38, 60 (1965), PHYS. REV. 152, 1162 (1966), PHYS. REV. LETTERS 17, 1105 (1966), PHYS. REV. 154, 1138 (1467), INT. CONF. ON M.E. PHYS.NUC.STRUCTURE.RCHOVOTH 340 (1967), PHYS. REV. 170, 1591 (1966), PHYS. REV. LETTERS 20, 637 (1968), PHYS. REV. LETTERS 20, 1213 (1968), CERN TH-892, CERN TH-914, AND CERN TH-909.

.

ARTICLE READ BY OCETTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON PROTON FROM 19.20 TO 21.12 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . DIFFERENTIAL CROSS SECTION

......

[TABLE 1]

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAF MOMENTUM . 19.2 GEV/C.

S SECTION INTUM ■ 19.2 GEV/C D-SIGMA/O-T U8/IGEV/CI*2 [1] 968500. → 6 11000. 6 41701. 6 1000. 6 41701. 6 1000. 6 566. 6 566. 6 566. 6 169. 6 16 (GEV/C) **2 4.3020 4.636C 4.9760 5.3230 5.6760

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 8 PER CENT.

ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON.

[TABLE 1]

	LABURATORY BEAM M	DKENTUK -	21.12 GEV/C.				
	T (GEV/CI++2	D-SIGMA UB/(GEV/	/C-T 'C}**2 [1] PER CENT				
	. C 6 9 6	3930C. +-	4				
	.1776	14400.	4				
	.2769	2150	4				
	.5391	690.	4				
	.7012	212.	4				
	.7898	89.	4				
	-8834	40.	4				
	1.0850	10.	4				
	1.1930	.5.	4				
	1.3050	4.	4				
	1.4230	3.	4				
	1.5440		4				
	1.8000	2.	4				
	1.9340	2.	4				
	T IS THE MOMENTUM	TRANSFER BE	TWEEN THE LINCO	MING PROTONJ AND	THE COUTGOING PROTON	1.	
	[1] PLUS POSSIBL	E SYSTEPATIC	ERRCR OF +- 8	PER CENT.			· ·
19	SIGMA PRODUCTION IN I	PP COLLISION	S AT 5 GEV/C.	LPHYS. LETTER	S 268, 645 (1968)]		·
			OD THE DEACTION				
	K SIGHA MASS SPI THE ONE-PION EXC FOUND TO BE 24.4	CTRUM SHOWS HANGE MODEL +- 2.3 MIC	AN ENHANCEMENT FOR THE REACTION ROBARNS.	AT 1.86 GEV, WHI DN IS DISCUSSED.	CH MAY BE DUE TO THE THE CROSS SECTION FOR	DELTA(1920) RESONANCE R THE REACTION PP + S	E. ADEQUACY OF
,	CITATIONS ATHENS CONFERENC	E 72 (1965)	, CERN DD 63/12	, CERN DD 62/10,	AND PHYS. REV. 147,	922 (1966).	
	ARTICLE READ BY ODET	E BENARY IN	1/69, ANC VERI	FIED BY LERGY PRI	CE.		
	BEAM IS PROTON ON PI	ROTON AT 4.9	5 GEV/C.				
	THIS EXPERIMENT USES	THE B.N.L.	80 [K. (H) BUBBI	LE CHAMBER. A	TOTAL OF 120000 PICT	URES ARE REPORTED ON.	
	GENERAL COMMENTS ON 1 1 THE K SIGMA IN	HIS ARTICLE	S SPECT. SHOWS	AN ENHANCEMENT WH	ICH MAY BE DUE TO TH	E N*(1920) RESONANCE.	
	KEY WORDS + CROSS SEC BARYON RESO	TICN DA	LITZ PLOT MA Y#1 AT 1860 MEV	ASS SPECTRUM	ANGULAR DISTRIBUTION	MODELS	
				[PAGE 645]			•
	LABGRATORY BEAM MOMEN	ITUM = 4.5	5 GEV/C.				
PROTO	REACTION			H	CRC-BARNS		
	SIGMA+ K+ NEUTRON SIGMA+ KO PROTON			48 24	.1 *- 3.5 .9 2.3		
20	POLARIZATION IN PROTO	IN-PROTON SC	ATTERINGS AT 735	5 MEV. [PHYS	. REV. 148, 1280 (19	661]	
L	P.G.MCMANIGAL, R.D.EAN	IDI,S.N.KAPL	AN, B.J.MOYER [U.	C. LAWRENCE RAD.	LAB., BERKELEY, CAL	IF., USA]	
	ABSTRACT NEW MEAS REDUCE UNCERTAIN IT IS CONCLUDED	UREMENTS BY TY IN OUR PA THAT THE PP	CHENG OF P-C PC Reviously Report Polapization at	DLARIZATION AS A Teo measurement o 735 mev reaches	FUNCTION OF ANGLE AND PP POLARIZATION. ON A MAXIMUM OF (60 +-	D INCIDENT PROTON ENER N THE BASIS OF THIS NU 2) PER CENT.	RGY ALLOW US TO EW INFORMAT ION,
	CLOSELY RELATED REFER THIS ARTICLE SUP	ENCES ERSEDES PART	T OF PHYS. REV.	137, 8620 (1965)			
	ADDITIONAL CITATIONS PHYS. REV. 137,	B620 (1965),	, UCRL 11926 (19	865), BULL. AM. PI	HYS. SOC. 10, 717 (19	965), AND PHYS. REV. ?	148, 1289 (1966).
	ARTICLE READ BY OCETT	E BENARY IN	4/67, AND VERIF	IED BY LERCY PRI			
	BEAM IS PROTON ON PR	OTON AT 1.38	85 GEV/C.				
	THIS EXPERIMENT USES	CCUNTERS.					
	GENERAL COMMENTS ON T 1 FIRST SCATTERI	HIS ARTICLE NG ON HYDRGO	GEN: SECOND SCAT	TERING ON CARBON	,		
	KEY WORDS . POLARIZAT	ION					

ELASTIC POLARIZATION FOR PROTON PROTON.

LABGRATORY BEAM ENERGY = .735 GEV (APPROXIMATELY).

(THIS DATA REPLACES VALUES GIVEN EARLIER IN MCMANIGAL, ET AL., PHYS. REV. 137, B620 (1965))

THETA	PELAFIZATION
CEGREES	
4.5	.248 +013
6-C	.352 .014
7.3	.387 .C11
8.6	.421 .015
10.0	.468 .C13
11.5	.530 .017
13.0	.543 .015
15.3	.574 .018
16.4	.602 .023
18.0	.599 .023
20.5	.591 .027

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB. The polarization is of the proton along the normal to the production plane in the grand C.M.

21 PRODUCTION OF THE N+(1470) IN PO +F(SPECTATOR) PP PI- AT 7.0 GEV/C. [PHYS. REV. LETTERS 21, 1835 (1968)] A.SHAPIRA.O.BENARY,Y.EISENBERG,E.E.RONAT,C.YAFFE.G.YEKUTIELI (WEIZMANN INST. OF SCI., REHOVOTH, ISRAEL)

ABSTRACT WE SEE A SIGNIFICANT PEAK (M = 1.446 +- 0.011 GEV, GAMMA = 198 +- 40 MEV), CONSISTENT WITH A I = 1/2, J * 1/2 STATE, IN THE P PI- MASS DISTRIBUTION OF THE REACTION PO + PISPECTATOR! PP PI- AT 7.0 GEV/C. WE INTERPRET IT AS THE N=(1470) PRODUCED IN THE REACTION PN - PN=0(1470) (N=0(1470) + P PI-) IN DEUTERIUM. THE PRODUCTION OF THE N=(1470) IS STRONGLY PERIPMERAL AND FAVORS I = 0 EXCHANGE. A DISCUSSION OF THIS PEAK IN TERMS OF DDUBLE-REGGE-POLE EXCHANGE MECHANISM IS PRESENTED.

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ARTICLE REAC BY OCETTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON DEUTERON AT 7 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 48000 PICTURES ARE REPORTED ON.

GENERAL COMMENTS ON THIS ARTICLE 1 NORMALIZED TO COUNTER EXPERIMENTS

KEY WORDS . CROSS SECTION MASS SPECTRUM ANGULAR DISTRIBUTION FITS MODELS

COMPOUND KEY WORDS - FITS ANGULAR DISTRIBUTION

CROSS SECTION FOR PROTON NEUTRON - PROTON PROTON PI-. [PAGE 1835]

LABGRATORY BEAM MUMENIUM GEV/C MILLI-BARNS 7. 1.01 -- .12

1.01 +- .13

CROSS SECTION FOR PROTON NEUTRON • PROTON N+(1470)0. (PAGE 1838) N+(1470)0 • PROTON P1- (1) (NOT CORRECTED FOR DEUTERCN EFFECTS.) LABORATORY

(1) FITTED FOR MASS AND/OR WIDTH (MASS = 1.446 GEV; WIDTH = .198 GEV), AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND. (2) VALUE IS APPROXIMATE (NLY.

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23 DIFFERENTIAL COST SECTION FOR THE RECEIPTS P* 0 FILM OF P* 0 MOD AT 21 GAVC. (PMS. LETTER 24.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1.1			
-1.4. Lattria BURGLA, A. CLEDER, J. CUTLING, J. CURINE, J. MUNICES, J. F. ELENSIN, T. J. CALCASTON, AND C. SANCE OF LASK CALL AND AND CALL	2 DIFFERENTIAL CROSS	SECTIONS FOR THE REACTIONS PP + D	PI+ AND PP + D RHO+ AT 21 GEV/C. (PHYS. LETTERS 298, 198 (196
A STATU A SUBJECT AND	J.V.ALLABY, F.BINON, A.M.THORNDI K	,A.N.CIODENS,P.DUTEIL,A.KLCVNING,R E, A.M.WETHERELL LEUROPEAN ORG. FO	.MEUNIER,J.P.PEIGNEUX, E.J.SACHARIDIS,K.SCHLUPMANN,M.SPIGHEL,J.P.ST R NUC. RES., GENEVA. SWITZERLAND}
Meteocontom is in the design meteodor is a subsection where is a subsection is	ABSTRACT RESULT	TS ARE PRESENTED FROM AN EXPERIMEN	T IN WHICH HIGH-ENERGY DENTERCOS, DODCHCED BY DODTON-DODTON
LABORATORY CEAN ANGLES DISTRIBUTION FOR THESE RECTIONS AND FAST PRESENTED AND CORPANES VITTO PARAMETERS. CONTACT THE ANGLES OF PARTICLE FOR THE VIEWS CONTACT STATE PARTS AND CORPORED VIEWS AND THE AND CORPORED VIEWS AND AND AND CORPORED VIEWS AND AND CORPORED VIEWS AND AND CORPORED VIEWS AND AND CORPORED VIEWS AND AND AND AND AND CORPORED VIEWS AND AND AND CORPORED VIEWS AND	INTERACTIONS A	AT 21.1 GEV/C INCIDENT MEMENTUM, W	ERE OFFECTED OVER A RANGE OF ANGLES FROM 12.5 MRAD TO 60 MRAD IN TH
Descript: Construction Antipercess Contrame.true Antipercess Contrue Antipercess Contrue Antipercess Contrue Antipe	IDENTIFIED. TH	HE ANGULAR DISTRIBUTION FOR THESE I	REACTIONS ARE PRESENTED AND COMPARED WITH PREVIOUS DATA AT LOWER
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ADDITIONAL (117100) PMORE REV. 95, 548 (1654), DOLL, AKAD, MUK. SDIS 100 673 (1955), PMC, RT, L3D, BURG (1964), PMS, LETTER L1, PMORE REV. (1677), PMC, RUY, BUT, ST, 100, 100, PMS, REV. L17, 81 (1677), REV. LITTER L1, PMC, LETTER L1, PMC, RUY, RUY, RUY, RUY, RUY, LATTER JAD, ST, 100, PMC, PMC, REV. CETTER L1, REV. LETTER L1, REV. RUY, PMC, REV. CETTER JAD, PMS, REV. LITTER JAD, ST, 100, PMC, PMC, REV. REV. REV. REV. REV. REV. REV. REV.	CLOSELY RELATED REP CONTINUATION C	FERENCES DF PREVIGUS EXPERIMENT IN VIENNA CO	CNFERENCE 353 (1968), AND CERN NP-66-2 (1966).
Model EVEN 05, 2001 (1991), 2001, 2002, 2002 (1991), 2003, 200	ADDITIONAL CITATION	NS	
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MUDIO CIMENTO 35, 66 (1988), PMS. LETTERS 22, 226 (1986), PMY. REV. 136, 956 (1986), PMS. 87, 137 (1986). MATICLE REG D Y GOTTE BEMAY IN 0364, AND VERTER D Y LEROY PHICE. BEAM 15 SPECIFIC BEMAY IN 0364, AND VERTER D Y LEROY PHICE. BEAM 15 SPECIFIC BEMAY IN 0364, AND VERTER D Y LEROY PHICE. BEAM 15 SPECIFIC BEMAY IN 0364, AND VERTER D Y LEROY PHICE. THIS EXPERIPENT USES CONTENS. KEY WORDS - CADOS SECTION DIFFERENTIAL CADSS SECTION (PAGE 200] LABORATORY BEAM MORENTUM - 21.1 GEV/C - 21PER CEMT. BEACTION REACTION REACTION REACTION ATO MECHANIS (1) TO	261 (1963), NU Rev. Letters J	JCLEAR INSTRUMENTS AND METHODS 22, LB, 89 (1967), PHYS. REV. LETTERS (165 (1963), REVIEW OF SCIENTIFIC INSTRUMENTS 35, 1523 (1964), PHYS 9, 133 (1962), PHYS, REV. 154, 1284 (1967), PHYS, REV. 161, 1387 (19
ATTICLE READ BY DOTTE BERNAT IN A JAN, AND VERIFIED BY LEBOY PAICE. BEAM IS PADION OF PADION AT 21.1 GEV/C. THIS EXPERIENT USSS COUNTERS. KEY WORDS - CROSS SECTION DIFFERENTIAL CROSS SECTION FITS COMPUND KEY WORDS - FITS DIFFERENTIAL CROSS SECTION LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21PER CENT. MELACIION MODIFYEIN FECTION MODIFYEIN LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21PER CENT. MICRO-ARMS (1) TOTON FACTOR - 11 EEVIERON HANGINSS 111 PLUS POSSIBLE SYSTEMATIC BRAUN UP + 12 PER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON P1+. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON P1+. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON P1+. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON P1+. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON P1+. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON AND/ASSI. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) DIFFERENTIAL CROSS SECTION FOR PADION PADION - DEUTERON AND/ASSI. (TABLE 1) LABORATORY BEAM ROMENTUM - 21.1 GEV/C 21FER CENT. MICRO-ARMS (1) MICRO-ARMS (1) MICRO	NUOVO CIMENTO Phys. Rev. Let	55, 66 (1968), PHYS. LETTERS 22, TERS 21, 389 (1968), PHYS. REV. 1	528 (1966), PHYS. REV. 134, 8454 (1964), NUC. PHYS. 87, 37 (1968), FITERS 22, 102 (1969), AND VIENNA CONFERENCE 376 (1968).
ELAN IS PADTON ON PADTON AT 21.1 GEV.C. THIS BAPATON WORDS - FITS DIFFERENTIAL CADISS SECTION FITS COMPOUND WORDS - FITS DIFFERENTIAL CADISS SECTION FITS COMPOUND WORDS - FITS DIFFERENTIAL CADIS SECTION FITS GIFFERENTIAL CADES SECTION FOR OIFFERENTIAL CADSS SECTION FOR PADTON + OLUTERON PI+. THETA COMPOUND WORDS - 21.1 GEV/C - 21000 CMTI. THETA COMPOUND WORDS - 2000 FORM PADTON - DEUTERON PROTONSI. <t< td=""><td>ARTICLE READ BY 005</td><td>TTE RENARY IN 4/40 AND VEDICIED</td><td></td></t<>	ARTICLE READ BY 005	TTE RENARY IN 4/40 AND VEDICIED	
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THIS EXPERIMENT USES COUNTESS. KEY WORDS - FOIDS SECTION DIFFERENTIAL CROSS SECTION FITS COMPOUND KEY WORDS - FITS DIFFERENTIAL CROSS SECTION LABORATORY EEAN KOMENTUM - 21.1 GEV/C 21/PER CENT. RECOTION FLAT RECOTION TOTON FLAT RECOTION TOTON TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON FLAT RECOTION TOTON	BEAM 15 PROTON UN	PROTON AT 21.1 GEV/C.	
KEY WORDS - COOSS SECTION OFFERENTIAL COOSS SECTION FITS COMPUTER VERSES - FITS DIFFERENTIAL COOSS SECTION (FITS) (CAMPUTER VERSES - FITS DIFFERENTIAL COOSS SECTION (FITCH FITS) COMPUTER VERSES ACCTION FITCH FITS CONTON FROM FITCH FITS CONTON FROM FITCH FITS CONTON FROM FITS CONTON FROM FITS CONTON FITS CONTON FROM FITS CONTON FROM FITS CONTON FROM FITS CONTON F	THIS EXPERIMENT USE	ES COUNTERS.	
COMPOUND KEY MORDS - FITS DIFFERENTIAL CROSS SECTION ILABORATORY PEAN MOMENTUM - 21.1 GEV/C 2(PER CENT). RECTION NICRO-BARNS [1] CEVTEDW PHT. CEUTEDW PHT.	KEY WORDS - CROSS S	SECTION DIFFERENTIAL CROSS SEC	TION FITS
[PAGE 200] LABODATORY FEAN MOMENTUM + 21.1 GEV/C 2/PER CENT. REACTION	COMPOUND KEY WORDS	 FITS DIFFERENTIAL CROSS SECTION 	N
LABORATORY PEAM HOMENTUM + 21.1 GEV/C +- 21PER CENT). REACTION NICRO-BARNS [1] OTIN PERTON .0151 +0015 EUTERON MAIT .0151 +0015 III PLUS POSSIBLE SYSTEMATIC EMMON UP +- 12 PER CENT. .0017 LABORATORY BEAM MORENTUM - 21.1 GEV/C +- 2/PER CENT. .0165 .0100 .0131 15 .0000			
LABORATORY DEEM MOMENTUM + 21.1 GEV/C +- 2/PER CENTJ. REACTION TOTON PECON- TOTON P			
(PAGE 200) LABORATORY TEAM ROMENTUM + 21.1 GEV/C +- 21PER CENT. REACTION R			
LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT., REACTION REACTION REACTION TOTON PACTON. EEUTERON RHOTOSIN EEUTERON RHOTOSIN CEUTERON RHOTOSIN EEUTERON RHOTOSIN CEUTERON RHOTOSIN CIII PLUS POSSIBLE SYSTEMATIC EMMUK UM + 12 PEK CENT. OTFFERENTIAL CAOSS SECTION FOR PAOTON PAOTON - OEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT. CIEFERENTIAL CAOSS SECTION FOR PAOTON PAOTON - OEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT. CIEFERENTIAL CAOSS SECTION FOR PAOTON PACTON - OEUTERON RHOTOSI+. (TABLE 1) LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT. CIEFERENTIAL CAOSS SECTION FOR PAOTON PACTON - OEUTERON RHOTOSI+. (TABLE 1) LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT. CIEFERENTIAL CAOSS SECTION FOR PAOTON PACTON - OEUTERON RHOTOSI+. (TABLE 1) LABORATORY BEAM MOMENTUM + 21.1 GEV/C +- 21PER CENT.		C 1	PAGE 2001
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111 PLUS POSSIBLE SYSTEMATIC EMMUM UM + 12 PEK CENT. 111 PLUS POSSIBLE SYSTEMATIC EMMUM UM + 12 PEK CENT. 111 LABORATORY BEAK MOMENTUM + 21.1 GEVTC - 2(PER CENT). THTA C-SIGNYJD-DEEGA NGSS 111 ANDIANS UFSS 111 ANDIANS 0005 20 THETA IS THE ANGLE THAT THE DEUTEMON PAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC EMRON OF + 12 PER CENT. 111 LABORATORY BEAM MOVENTUM + 21.1 GEVTC -> 2(PER CENT). THETA IS THE ANGLE THAT THE DEUTEMON PAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC EMRON OF +- 12 PER CENT. 112 LABORATORY BEAM MOVENTUM + 21.1 GEVTC +> 2(PER CENT). THETA D-SIGNAD-DEEGA NATIANS UV/SF 11 COLOR - 2023 13 0000 - 0005 20 THETA IS THE ANGLE THAT THE DEUTEMON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC EMRON OF +- 12 PER CENT). THETA D-SIGNAD-DEEGA NATIANS UV/SF 11 COLOR - 0005 20 THETA IS THE ANGLE THAT THE DEUTEMON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC EMRON CF +- 12 PER CENT). THETA D-SIGNAD-DEEGA NATIANS UV/SF 11 COLOR - 0005 20 THETA IS THE ANGLE THAT THE DEUTEMON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC EMPOTOR PROTON PROTON PROTON PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTON PROTON PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTOR PROTON PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTOR PROTON PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTOR PROTOR PROTOR PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTOR PROTOR PI. (TABLE 1) LABORATORY BEAM MOVENTUM - 19.2 GEV/C +- 21PER CENT). THETA D-SIGNAD-DEEGA NOTIFIERENTIAL CROSS SECTION FOR PROTOR PROTOR PRO	CEUTERON PI+ CEUTERON RHO(765	i)+	-0151 +0015 -0159 -0024
<pre>111 PLUS POSSIBLE SYSTEMATIC EMMUN UP ++ 12 PEK CENT. DIFFERENTIAL CROSS SECTION FCR PAGTON PAGTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAM ROMENTUM + 21.1. GEV/C +- 21PER CENT. THETA C-SIGM/D-DEGA ADDIANS UP/SE CENT .0125 .0773 +- 15 .0200 .0000 20 .0000 .0000 20 .0000 .0000 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEMATIC EMRON DF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PAGTON PARCON - DEUTERON RHO(765)+. (TABLE 1] LABORATORY BEAM ROMENTUM = 21.1 GEV/C +- 2(PER CENT). THETA D-SIGM/D-OMEGA RODIANS UP/SF 15 .0200 .0125 15 .0200 .0125 15 .0200 .0125 15 .0200 .0125 15 .0200 .0128 15 .0200 .0128 15 .0200 .0128 15 .0200 .0006 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEMATIC EMROR OF +- 12 PER CENT. THETA D-SIGM/D-OMEGA RODIANS UP/SF 15 .0200 .0006 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEMATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1] LABORATORY BEAM ROMENTUM = 19.2 GEV/C ++ 21PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1] LABORATORY BEAM ROMENTUM = 19.2 GEV/C ++ 21PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1] LABORATORY BEAM ROMENTUM = 19.2 GEV/C ++ 21PER CENT. THETA D-SIGMA/D-OMEGA RODIANS UP/SF 11 PER CENT .04 .0046 ++ 13 </pre>			
LABORATORY BEAM MOMENTUM + 21.1.GEV/C +- 2(PER CENT). THETA C-SIGMA/D-OPECA RADIANS UPSR [1] PEC CENT .0125			
THETA C-SIGMA/D-OPECA WESK 11 PER CENT 02200 PER CENT 02200 .0200 .02122 + 13 0300 .0133 15 0.0200 .0300 .0013 15 0.0200 .0013 15 0.0200 .0400 .0013 15 0.0200 .0014 .0500 .0000 20 0.0000 20 .0017 THETA IS THE ANGLE THAT THE DEUTERON PAKES WITH THE BEAM IN THE LAB. .011 DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON RHO(765)+. (TABLE 1) LABORATORY BEAM MOVENTUP. = 21.1 GEV/C +- 2(PER CENT). THETA D-SIGMA/D-OMEGA RADIANS .0175K 11 PER CENT .0125 .0718 +- 15 .0200 .0013 15 0.0718 +- 15 .0200 .0013 15 0.0718 +- 15 .0200 .0013 15 0.0014 +- 15 .0135 .0718 +- 15 .0200 .0013 15 0.0014 +- 12 .0130 .0014 +- 12 .01400 .0014 +- 12 .0151 .0014 +- 12 .01600 .0014 +- 13 .017 .004 +- 13	DIFFERENTIAL CROSS	SECTION FOR PROTON PROTON + (DEUTERON PI+. (TABLE 1)
AADIAMS UBJSR [1] PEP CENT PEP CENT P	DIFFERENTIAL CROSS Laboratory beam	SECTION FOR PROTON PROTON + ((MOMENTUM = 21.1 GEV/C +- 2(PER	DEUTERON PI+. (TABLE 1) CENT).
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	DIFFERENTIAL CROSS LABORATORY BEAM THETA	SECTION FOR PROTON PROTON + (Romentum = 21.1 Gev/C +- 2(Per C-Sigma/D-Opega	DEUTERON PI+. (TABLE 1) CENT).
-0300 -0103 15 -0500 -0009 20 -0600 -0006 20 THETA IS THE ANGLE THAT THE DEUTERON PAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEPATIC ERROP OF ← 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON → DEUTERON RHO(765)+. (TABLE 1) LABORATORY BEAM MOMENTUM = 21.1 GEV/C ← 2(PER CENT). THETA D-SIGMA/D-ONEGA RADIANS UF/SR [1] -0125 -0770 ← 15 -0200 -0255 15 -0300 -0118 15 -0400 -0043 15 -0500 -00C4 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEPATIC ERROR CF ← 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON → DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C ← 21PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON → DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C ← 21PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON → DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C ← 21PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON → DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C ← 21PER CENT. THETA STATE D-SIGMA/D-ONEGA RADIANS UF/SR [1] PER CENT -04 .0048 ← 15	DIFFERENTIAL CROSS Laboratory beam Theta Radians	SECTION FCR PROTON PROTON + ((Romentum = 21.1 Gev/C +- 2(Per C-Sigma/D-Opega U8/SR (1) Per Cent	DEUTERON PI+. (TABLE 1) Centj.
$\begin{array}{cccccccccccccccccccccccccccccccccccc$	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200	SECTION FCR PROTON PROTON + (KOMENTUM = 21+1 GEV/C +- 2(PER C-SIGMA/D-OMEGA UB/SR (1) PER CENT .0773 +- 15 .0282 15	DEUTERON PI+. (TABLE 1) Centj.
.0000 1000 20 THETA IS THE ANGLE THAT THE DEUTERON PAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF + 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON RHO(765)+. (TABLE 1) LABORATORY BEAM HOPENTUM = 21.1 GEV/C +- 2/PER CENT). THETA D-SIGMA/D-OMEGA VU/SB 111 PER CENT .0125 .0178 +- 15 .0200 .018 .0200 .018 .0300 .018 .0300 .00643 .0500 .00643 .0500 .00643 .0500 .00643 .00600 .0064 .00600 .0064 .019FFERENTIAL CROSS SECTION FOR PROTON MAKES WITH THE BEAM IN THE LAB. (11 PLUS POSSIBLE SYSTEPATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAN HOPENTUM = 19.2 GEV/C +- 2IPER CENT. THETA D-SIGMA/D-OMEGA RADIANS UPSR (11 .04 .0048 +- 13	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS -0125 -0200 -0300 -0400	SECTION FCR PROTON PROTON + ((MOMENTUM + 21+1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR (1) PER CENT .0773 +- 15 .0282 15 .0033 15 .0033 15	DEUTERON PI+. (TABLE 1) Cent).
THETA IS THE ANGLE THAT THE DEUTERON PAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEPATIC ERROP OF + 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON • DEUTERON RHO(165)•. (TABLE 1) LABORATORY BEAM MOMENTUM = 21.1 GEV/C += 2(PER CENT). THETA D-SIGMA/D-ONEGA W078 [1] 0125 .0778 += 15 0300 .0125 04 .0048 += 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0300 .0300 .0300	SECTION FCR PROTON PROTON • (MOMENTUM • 21.1 GEV/C •- 2(PER C-SIGMA/D-DPEGA U0/SR (1) PER CENT .0773 •- 15 .023 15 .003 15 .003 20 .009 20	DEUTERON PI+. (TABLE 1) CENT).
<pre>(1) PLUS POSSIBLE SYSTEPATIC ERROR OF + 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON - DEUTERON RHO(765)+. (TABLE 1) LABORATORY BEAM MOPENTUM = 21.1 GEV/C += 2IPER CENT). THETA D-SIGMA/D-ONEGA RADIANS UF/SR [1] PER CENT .0125 .0770 += 15 .0200 .0215 15 .0200 .0215 15 .0300 .0118 15 .0300 .0014 12 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEMATIC ERROR CF += 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON - DEUTERON PI+. (TABLE 1) LABORATORY BEAM HOPENTUM = 19.2 GEV/C += 2IPER CENT. THETA D-SIGMA/D-ONEGA UF/SR [1] PER CENT .04 .0048 += 15</pre>	DIFFERENTIAL CROSS LABORATORY BEAN THETA RADIANS .0125 .0200 .0300 .0400 .0500 .0500	SECTION FCR PROTON PROTON • (KOMENTUM = 21.1 GEV/C •- 2(PER C-SIGHA/O-OPEGA UGSR (1) PEP CON .0773 •- 15 .0282 15 .0103 15 .0003 15 .0006 20	DEUTERON PI+. (TABLE 1) Cent).
DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON RHO(765)+. (TABLE 1) LABORATORY BEAM MOMENTUM = 21.1 GEV/C += 2(PER CENT). THETA D=SIGMA/D=OMEGA RADIANS UF/SR [1] PER CENT .0125 .0178 += 15 .0200 .0013 15 .0300 .0013 15 .0300 .0016 20 .0600 .0016 20 .0000 .0016 .0	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 .0500 .0600 THETA IS THE AN	SECTION FCR PROTON PROTON • (K MOMENTUM • 21-1 GEV/C •- 2(PER C-SIGWA/D-DVEGA UG/SR (1) PEP CENT .0773 •- 15 .0282 15 .0103 15 .0003 15 .0006 20 GLE THAT THE DEUTERON PAKES WITH 1	DEUTERON PI+. (TABLE 1) CENT). Ime Beam in The Lab.
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DIFFERENTIAL CROSS SECTION FOR PROTON PROTON - DEUTERON RHO(765)+. [TABLE 1] LABORATORY BEAM MOVENTUM = 21.1 GEV/C +- 2(PER CENT). THETA D-SIGMA/D-OMEGA WE/SR [1] 0125 .0778 +- 15 0200 .0215 15 0300 .0118 15 .0300 .0018 15 .0300 .0008 20 .0600 .0004 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. [1] PLUS POSSIBLE SYSTEMATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON + DEUTERON PI+. [TABLE 1] LABORATORY BEAM MOMENTUM = 19.2 GEV/C +- 21PER CENT]. THETA D-SIGMA/D-OMEGA WE/SR [1] PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 .0500 .0600 THETA IS THE AN [1] PLUS POSSI	SECTION FCR PROTON PROTON → (1 MOMENTUM = 21.1 GEV/C → 21PER C-SIGHA/O-OPEGA UG/SR (1) PEP CENT .0173 → 15 .0103 15 .0006 20 	DEUTERON PI+. (TABLE 1) CENT). The beam in The Lab. Cent.
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.0000 .0004 20 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAN MOMENTUM = 19.2 GEV/C +- 2IPER CENT). THETA RADIANS UB/SR (1) PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300	SECTION FOR PROTON PROTON → ((MOMENTUM → 21.1 GEV/C → 2(PER UB/SR (1) PER CENT .0773 → 15 .0282 15 .003 15 .0033 15 .0009 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0007 20 .0008 20 .0009 20 .0000 20 .0009 20	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RHO(7651+. (TABLE 1) CENT).
THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C +- 21PER CENT). THETA D-SIGMA/D-OMEGA RADIANS UB/SR [1] PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500	SECTION FCR PROTON PROTON → ((MOMENTUM → 21.1 GEV/C → 2(PER	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT).
INEIA IS THE ANGLE THAT THE DEGLEMENT MARES WITH THE GRAP IN THE LAB. (1) PLUS POSSIBLE SYSTEMATIC ERROR CF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C +- 21PER CENT). THETA D-SIGMA/D-OMEGA RADIANS UB/SR (1) PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500	SECTION FCR PROTON PROTON → ((MOMENTUM → 21-1 GEV/C → 2(PER UB/SR (1) PER CENT .0773 → 15 .0282 15 .0033 15 .0033 15 .0039 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0007 20 .0008 20 .0008 20 .0255 15 .018 15 .0275 15 .018 15 .0268 15 .0018 20 .0004 20	DEUTERON PI+. (TABLE 1) CENT). IHE BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT).
(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C +- 2IPER CENT). THETA D-SIGMA/D-OMEGA RADIANS UB/SR (1) PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500	SECTION FCR PROTON PROTON → ((MOMENTUM → 21-1 GEV/C → 2(PER UB/SR (1) PER CENT .0773 → 15 .0282 15 .0033 15 .0033 15 .0039 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0007 20 .0008 20 .0008 20 .0255 15 .0118 15 .0255 15 .0128 15 .0018 20 .0004 20	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT).
DIFFERENTIAL CROSS SECTION FOR PROTON PROTON POEUTERON PI+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C +- 2IPER CENT). THETA D-SIGMA/D-OMEGA RADIANS UB/SR [1] PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0500 THETA IS THE AN [1] PLUS POSSI LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 THETA IS THE AN	SECTION FCR PROTON PROTON + ((MOMENTUM + 21.1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR (1) PER CENT .0773 +- 15 .0282 15 .0033 15 .0033 15 .0039 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0007 20 .0008 20 .0078 +- 15 .0255 15 .0118 15 .0028 20 .0006 20 .0006 21 .0078 +- 15 .0255 15 .0118 15 .0008 20 .0006 20 .0006 20 .0006 21 .0078 +- 15 .0255 15 .0118 15 .0008 20 .0006 20 .0006 20 .0006 21 .0008 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0000 20	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT).
DIFFERENTIAL CROSS SECTION FOR PROTON PROTON POLUTERON PI+. (TABLE 1) LABORATORY BEAN MOMENTUM = 19.2 GEV/C +- 2IPER CENT). THETA D-SIGMA/D-DHEGA RADIANS UB/SR (1) PER CENT +04 +0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 THETA IS THE AN [1] PLUS POSSI	SECTION FCR PROTON PROTON + () I MOMENTUM + 21.1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR (1) PEP CENT .0773 +- 15 .022 15 .003 15 .0009 20 .0006 20 .0006 20 .0006 20 .0007 20 .0008 20 .0009 20 .0009 20 .0006 20 .0006 20 .0007 21 SECTION FOR PROTON PAKES WITH 1 BLE SYSTEMATIC ERROR OF - 12 PER D-SIGMA/D-OMEGA UE/SR (1) PER CENT .00708 +- 15 .0073 15 .0073 15 .0073 5- 15 .0116 15 .0073 15 .0064 20 .00064 2C IGLE THAT THE DEUTERON MAKES WITH 1 BLE SYSTEMATIC ERROR CF +- 12 PER	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT.
DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 1) LABORATORY BEAN MOMENTUM = 19.2 GEV/C +- 2IPER CENT). THETA D-SIGMA/D-DMEGA RADIANS UB/SR [1] PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 THETA IS THE AN [1] PLUS POSSI	SECTION FCR PROTON PROTON → (MOMENTUM = 21.1 GEV/C → 21PER C-SIGMA/D-OPEGA UB/SR (1) PEP CENT .0773 → 15 .0222 15 .0033 15 .0039 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0006 20 .0007 PROTON PROTON - 12 PER 	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT.
LABORATORY BEAN MOMENTUM = 19.2 GEV/C +- 2IPER CENT). Theta D-Sigma/D-Onega Radians UB/SR [1] PER CENT .04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0500 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0400 .0500 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI	SECTION FCR PROTON PROTON → C (NOMENTUM → 21.1 GEV/C → 2(PER UB/SR (1) PEP CENT .0773 → 15 .0262 15 .003 15 .0006 20 .0006 20	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT.
THETA D-SIGMA/D-DHEGA RADIANS UU/SR [1] PER CENT +04 -0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0200 .0300 .0500 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS .0200 .0300 .0400 .0500 .0400 .0500 .0400 .0500 .0400 .0500 .0400 .0500 .0400 .0500 .0500 .0400 .0500 .0500 .0500 .0400 .05000 .05000 .05000 .05000 .05000 .05000 .05000 .05000 .05000 .050000 .05000 .050000 .050000 .050000 .050000000 .0500000000	SECTION FCR PROTON PROTON + C I NOMENTUM 21.1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR [1] PEP CENT .073 +- 15 .003 15 .003 15 .0006 20 IGLE THAT THE DEUTERON PAKES WITH T BLE SYSTEMATIC ERROR OF ← 12 PER	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON PI+. (TABLE 1)
NPUIANS UUSN LLI PER CENT +04 -0048 ↔ 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM [1] PLUS POSSI .0200 .0300 .0400 .0500 .0500 .0500 .0500 .0500 .0600	SECTION FCR PROTON PROTON + 0 INDMENTUM + 21.1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR [1] PEP CENT .0773 +- 15 .0033 15 .0033 15 .0006 20 IGLE THAT THE DEUTERON PAKES WITH T BLE SYSTEMATIC ERROP OF ← 12 PER D-SIGMA/D-OMEGA UE/SR 11 PER CENT .0006 20 GUE THAT THE DEUTERON PROTON PROTON + 0 D-SIGMA/D-OMEGA UE/SR 11 PER CENT .018 15 .0025 15 .018 15 .0026 20 .0024 20 .0025 15 .018 15 .0026 20 .0024 20 .0024 20 .0025 15 .0024 20 .0025 20 .0024 20 .0025 15 .0026 20 .0026 20 .0026 20 .0026 20 .0026 20 .0026 20 .0026 20 .0026 20 .00270 PROTON PROTON PROTON + 0 <td>DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON PI+. (TABLE 1) CENT).</td>	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RMO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON PI+. (TABLE 1) CENT).
.04 .0048 +- 15	DIFFERENTIAL CROSS LABORATORY BEAM THETA RADIANS .0125 .0300 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAM THETA IS THE AN [1] PLUS POSSI .0200 .0300 .0400 .0500 .0500 .0500 .0600	SECTION FCR PROTON PROTON → C I NOMENTUM → 21.1 GEV/C → 2(PER C-SIGMA/D-OPEGA UB/SR (1) PEP CENT .0773 → 15 .0282 15 .033 15 .0033 15 .0006 20 NGLE THAT THE DEUTERON PAKES WITH T BLE SYSTEMATIC ERROR OF → 12 PER D-SIGMA/D-ONEGA UE/SR (1) PER CENT .0778 → 15 .016 15 .0025 15 .016 15 .0064 20 .0006 20 .016 15 .0043 15 .0063 20 .0006 20 .00	DEUTERON PI+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT). IME BEAM IN THE LAB. CENT. DEUTERON PI+. (TABLE 1) CENT).
	DIFFERENTIAL CROSS LABORATORY BEAN THETA RADIANS .0125 .0300 .0400 .0500 .0600 THETA IS THE AN [1] PLUS POSSI DIFFERENTIAL CROSS LABORATORY BEAN THETA IS THE AN [1] PLUS POSSI .0200 .0300 .0400 .0500 .0500 THETA IS THE AN [1] PLUS POSSI .0500 .0500 .0500 .0500 .0600	SECTION FCR PROTON PROTON + C I NOMENTUM + 21.1 GEV/C +- 2(PER C-SIGMA/D-OPEGA UB/SR (1) PEP CENT .0773 +- 15 .0282 15 .0033 15 .0039 20 .0006 20 NGLE THAT THE DEUTERON PAKES WITH T BLE SYSTEMATIC ERROR OF +- 12 PER D-SIGMA/D-ONEGA UB/SR (1) PER CENT .0778 +- 15 .016 15 .0062 20 .0006 20 .016 15 .0043 15 .0062 20 .0006 20	DEUTERON PI+. (TABLE 1) CENT). THE BEAM IN THE LAB. CENT. DEUTERON RHO(765)+. (TABLE 1) CENT). THE BEAM IN THE LAB. CENT. DEUTERON PI+. (TABLE 1) CENT).

LABORATORY BEAP	MOMENTUM = 19.2 GEV/C +- 2(PER CEN	71.
RADIANS.	C-SIGMA/D-OMEGA UB/SR (1)	
-04	PER CENT .0049 +- 15	
THETA IS THE AN	CLE THAT THE DENTEDON MAKES WITH THE	
	BLE SYSTEMATIC ERROR OF 4- 12 OFD CEN	T.
· · · · · · · · · · · · · ·		
DIFFERENTIAL CROSS	SECTION FCR PROTON PROTON + DEUT	ERON P(+. (TABLE 1)
LABORATORY BEAM	MOMENTUM = 19.4 GEV/C +- 2(PER CEN	TI
THETA RACIANS	D-SIGMA/C-OMEGA UB/SR (1)	
• C2 5	PER CENT -02 +- 30	
THETA IS THE AN	SLE THAT THE DEUTERON MAKES WITH THE	CEAM IN THE LAB.
III PLUS POSSI	BLE SYSTEMATIC ERROR OF +- 12 PER CEN	τ.
SCATTERING DE 200 ME	V NEUTRONS BY PRCTONS. [JETP 16.	24 (1963)]
Y.M.KAZARINOV, YU.N.S	IMONOV (JOINT INST. FOR NUCL. RESEARC	H, DUBNA, USSR)
ABSTRACT THE TOT	AL AND THE DIFFERENTIAL CROSS SECTION	S FOR THE SCATTERING OF 200 MEV (EFFECTIVE ENERGY) NEUTRONS BY
PROTONS WERE ME Appreciably Asy. From the Angula	ASURED. THE TOTAL CROSS SECTION IS (4 WHETRIC WITH RESPECT TO THE ANGLE THE R DISTRIBUTIONS OF THE SCATTERED PART	2.7 +- 0.9) X 10**-27 CM-SQUARED. THE FUNCTION SIGMA(THETA) IS TA = 90 DEG. THE PION-NUCLEON INTERACTION CONSTANT, DETERMINED ICLES, IS F-SQUARED = 0.08 +- 0.02.
CITATIONS JETP 37 1587 (1 949 (1960), JET 360 (1950), JET	959], JETP 10 1125 (1959], PHYS. REV. P 12 657 (1961), JETP 41 197 (1961), P 34 53 (1958), JETP 7 37 (1958), PHY	116, 226 (1959), JETP 38 660 (1960), JETP 11 474 (1960), JETP 3 JETP 14 143 (1962), PHYS. REV. 72, 1008 (1948), REV. MOD. PHYS. S. REV. 88, 15 (1952), AND JINR D-573 (1960).
ARTICLE READ BY ODET	TE BENARY IN 1/65, AND VERIFIED BY LE	ROY PRICE.
BEAM IS NEUTRON ON	HYCROGEN COMPOUND AT .654 GEV/C. (B	EAN KINETIC ENERGY = .205 GEV)
THIS EXPERIMENT USES	COUNTERS.	
KEY WORDS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	
KEY WGRDS + CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	
KEY WORDS • CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	
KEY WORDS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	241
KEY HORDS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	241
KEY HORDS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION CTICN CIFERENTIAL CROSS SECTION CFAGE GY = .2 GEV (MEAN VALUE).	241 MILLI-BARNS
KEY HGROS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION	24] MILLI-BARNS 42.7 45
KEY HGROS - CROSS SE LABORATORY BEAM ENER REACTION 101 PAOTON TOTAL ELASTIC	CTICN DIFFERENTIAL CROSS SECTION	24] MILLI-BARNS 42.7 45 42.7 .9 (1)
KEY HORDS - CROSS SE LABORATORY BEAM ENER REACTION NON PROTON TOTAL ELASTIC (1) AT THIS EN	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). ERGY, THIS IS THE ONLY CHANNEL OPEN	24) MILLI-BARNS 42.7 +5 42.7 -9 [1]
KEY WORDS - CROSS SE LABORATORY BEAM ENER Reaction Yotal Elastic (1) at this EN	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). ERGY, THIS IS THE ONLY CHANNEL OPEN	24] MILLI-BARNS 42.7 45 42.7 -9 (1)
KEY WORDS - CROSS SE LABORATORY BEAM ENER Reaction TOTAL ELASTIC [1] AT THIS EN	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). ERGY, THIS IS THE ONLY CHANNEL OPEN	24] MILLI-BARNS 42.7 49 42.79 [1]
KEY WORDS - CROSS SE LABORATORY BEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN ELASTIC DIFFERENTIAL	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). ERGY, THIS IS THE ONLY CHANNEL OPEN CRCSS SECTION FOR NEUTRON PROTON.	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 (1) (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY BEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN ELASTIC DIFFERENTIAL LABORATORY BEAM	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE).	24] MILLI-BARNS 42.7 45 42.79 (1) (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN ELASTIC DIFFERENTIAL LABORATORY BEAM	CTICN DIFFERENTIAL CROSS SECTION (PAGE) GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE).	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 (1) (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN ELASTIC DIFFERENTIAL LABORATORY BEAM . THIS DATA MAS	CTICN DIFFERENTIAL CROSS SECTION (PAGE) GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). READ FROM A GRAPH .	24] MILLI-BARNS 42.7 45 42.79 (1) (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN LABORATORY BEAM LABORATORY BEAM . THIS DATA MAS . THETA	CTICN DIFFERENTIAL CROSS SECTION (PAGE) CY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CSIGMA/C-OMEGA	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 (1) (FIGURE 2)
KEY WGRDS - CROSS SE LABORATORY DEAM ENER REACTION ON PROTON - TOTAL ELASTIC [1] AT THIS EN LABORATORY BEAM 	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CONTINUES (MARCHINE). CONTINUES (MARCHIN	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 (1) (FIGURE 2)
KEY WGROS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC LI} AT THIS EN LABORATORY BEAM ELASTIC DIFFERENTIAL LABORATORY BEAM . THIS DATA MAS . THIS DATA MAS . THETA DEGREES 7. 10- 20-	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C-OMECA MB/SP 9.5 4-2.5 8-3 -7 4.7 7	24] MILLI-BARNS 42.7 49 42.79 [1] (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY BEAM ENER REACTION ON PROTON (1) AT THIS EN LABORATORY BEAM LABORATORY BEAM . THIS DATA MAS . THETA DECREES 7. 10. 20. 30.	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CCSIGMA/C-OMEGA MB/SP 9.5 +- 2.5 8.3 .7 4.7 .7 4.2 .5	24] MILLI-BARNS 42.7 45 42.7 .9 (1) (FIGURE 2)
KEY WGROS - CROSS SE LABORATORY BEAM ENER REACTION ON PROTON (I) AT THIS EN LABORATORY BEAM (I) AT THIS EN LABORATORY BEAM LABORATORY BEAM THIS DATA WAS THETA DEGREES 7. 10. 20. 30. 41. 62.	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CROSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CCSIGMA/D-OMEGA MB/SB 9.5 4- 2.5 8.7 4.7 .7 4.2 .5 3.0 .4 2.5 .1	24] HILLI-BARNS 42.7 +5 42.7 -9 [1] (FIGURE 2)
KEY WORDS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC ELASTIC LABORATORY BEAM CONTRACTORY ELASTIC LABORATORY BEAM THIS DATA WAS THETA DECREES T. 10. 20. 30. 41. 62. 9.1	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C=OMEGA ME/SP 5.5 + - 2.5 6.37 4.25 3.0 - 4 2.53 4.25 3.0 - 4 2.53 4.25	24] MILLI-BARNS 42.7 ← .5 42.79 [1]
KEY WGRDS - CROSS SE LABORATORY DEAM ENER REACTION ON PROTON - TOTAL ELASTIC [1] AT THIS EN LABORATORY BEAM CLASTIC DIFFERENTIAL LABORATORY BEAM THETA DEGREES 7. 10- 20- 30. 41. 62. 61. 77. 87.	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE) (PAGE) GY = .2 GEV (MEAN VALUE). CY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CSIGMA/C=OMECA MB/SP S.5 +- 2.5 8.3 .7 4.7 .7 4.2 .5 3.0 .4 2.5 .3 2.4 .1 2.0 .1 2.0 .1	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 [1] [FIGURE 2]
KEY HORDS - CROSS SE LABORATORY BEAM ENER REACTION TOTAL ELASTIC LABORATORY BEAM III AT THIS EN LABORATORY BEAM . THIS DATA MAS THETA DECREES 7. 10. 20. 30. 41. 62. 01. 77. 87.	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CCSIGMA/C-OMEGA MB/SP 9.5 +- 2.5 8.3 .7 4.7 .7 4.2 .5 3.0 .4 2.5 .3 2.2 .1 2.0 .1 2.0 .1 2.2 .1	24] MILLI-BARNS 42.7 45 42.7 -9 (1) (FIGURE 2)
KEY HGROS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CROSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CROSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C-OMEGA MB/SB 9.5 $+-$ 2.5 8.3 C-SIGMA/C-OMEGA MB/SB 9.5 $+-$ 2.5 8.3 C-SIGMA/C-OMEGA MB/SB 9.5 $+-$ 2.5 8.3 C-SIGMA/C-OMEGA 2.5 C-SIGMA/C-OMEGA 2.5 C-SIGMA/C-OMEGA C-SIGMA/C-C-C-SIGMA/C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-C-	24] MILLI-BARNS 42.76 42.79 [1]
KEY HORDS - CROSS SE LABORATORY DEAM ENER REACTION TOTAL ELASTIC LIJ AT THIS EN LABORATORY DEAM ELASTIC DIFFERENTIAL LABORATORY DEAM THETA DECREES T. 10. 20. 30. 41. 62. 01. 77. 87. 97. 108. 118. 128.	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CSIGMA/C=OMEGA MEVSR 9.5 $+-$ 2.5 8.3 -7 4.7 -7 4.2 -5 3.0 -4 2.5 -3 2.0 -1 2.0 -1 2.2 -1 2.0 -1 2.2 -1 2.3 -1 3.3 -2 3.8 -2	24) MILLI-BARNS 42.7 49 42.79 (1) (FIGURE 2)
KEY HGROS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CCCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CSIGMA/C-OMEGA MB/SR 9.5 +- 2.5 8.3 .7 4.7 .7 4.2 .5 3.0 .4 2.5 .3 2.6 .1 2.0 .1 2.2 .1 2.3 .2 3.4 .2 3.3 .2 3.4 .2 3.4 .2 3.4 .2 3.4 .2 3.4 .2 3.5 .2 5.5 .2 5.	24] MILLI-BARNS 42.7 45 42.7 -9 [1] (FIGURE 2]
KEY HORDS - CROSS SE LABORATORY BEAM ENER REACTION TOTAL ELASTIC LI} AT THIS EN LABORATORY BEAM CONTREMENTIAL LABORATORY BEAM THIS DATA WAS THIS DATA WAS THETA DEGREES 7. 10. 20. 30. 41. 62. 61. 77. 87. 97. 108. 118. 128. 140. 148. 157.	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CRGY, THIS IS THE ONLY CHANNEL OPEN ERGY, THIS IS THE ONLY CHANNEL OPEN CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C-OMECA MB/SB 9.5 +- 2.5 8.3 -7 4.7 2.5 3.0 .4 2.5 3.0 .4 2.5 3.0 .4 2.5 3.0 .4 2.5 3.0 .4 2.5 3.0 .4 2.5 3.0 .4 2.5 .5 .1 2.0 .1 2.2 .1 2.2 .1 2.5 .1 .2 .1 .2 .1 .2 .1 .2 .2 .1 .2 .1 .2 .1 .2 .1 .2 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .1 .2 .5 .2 .1 .2 .1 .2 .1 .2 .1 .2 .5 .1 .2 .5 .5 .1 .1 .2 .5 .5 .1 .1 .2 .5 .5 .1 .1 .2 .5 .5 .1 .7 .5 .5 .5 .1 .5 .5 .1 .7 .5 .5 .5 .1 .7 .5 .5 .1 .7 .5 .5 .1 .5 .5 .5 .1 .7 .5 .5 .5 .1 .5 .5 .1 .1 .5 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .1 .1 .5 .5 .5 .1 .5 .5 .1 .5 .5 .1 .5 .5 .1 .5 .5 .1 .5 .5 .1 .5 .5 .5 .5 .5 .5 .5 .5 .5 .5	241 NILLI-BARNS 42.7 45 42.79 (1) (FIGURE 2)
KEY HORDS - CROSS SE	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). CROSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). CROSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C=OMEGA ME/SP 9.5 +- 2.5 8.3 -7 4.2 -5 3.0 -4 2.5 -1 2.0 -1 2.0 -1 2.2 -1 2.3 -2 3.3 -2 3.4 -2 5.5 -1 7.0 -1 8.1 -1	24) MILLI-BARNS 42.7 45 42.79 (1) (FIGURE 2)
KEY HORDS - CROSS SE I ABDRATORY DEAM ENER REACTION TOTAL ELASTIC [1] AT THIS EN II] AT THIS EN ELASTIC DIFFERENTIAL LABORATORY BEAM CONTRACTORY BEAM THETA DEGREES 7. 10. 20. 30. 41. 62. 01. 77. 108. 128. 140. 163. 163.	CTICN DIFFERENTIAL CROSS SECTION (PAGE) (PAGE) CTICN CONFERENTIAL CROSS SECTION (PAGE) (PAGE) CPAGE)	24] MILLI-BARNS 42.7 4- 5 42.7 - 9 [1] [FIGURE 2]
KEY HGROS - CROSS SE LABORATORY BEAM ENER REACTION ON PROTON III AT THIS EN LABORATORY BEAM III AT THIS EN LABORATORY BEAM . THIS DATA MAS . THIS DATA	CTICN DIFFERENTIAL CROSS SECTION (PAGE GY = .2 GEV (MEAN VALUE). ERGY, THIS IS THE ONLY CHANNEL OPEN ERGY, THIS IS THE ONLY CHANNEL OPEN CRCSS SECTION FOR NEUTRON PROTON. ENERGY = .2 GEV (MEAN VALUE). C-SIGMA/C-OMECA MB/SP 9.5 +- 2.5 8.3 .7 4.7 .7 4.2 .5 3.0 .4 2.5 .3 2.2 .1 2.0 .1 2.2 .1 2.0 .1 2.2 .1 2.3 .8 .2 3.8 .2 3.7 4.7 .2 5.5 .1 7.0 .1 8.1 .1 9.2 .2 10.4 .2 11.4 .2 11.4 .2	24] MILLI-BARNS 42.75 42.79 [1] (FIGURE 2)

POLARIZATION PARAMETER IN P-P SCATTERING FROM 328 TO 736 NEV. (PHYS. REV. 148, 1285 (1966)) 24 F.BETZ,J.ARENS,O.CHANBERLAIN,H.ECST,P.GRANNIS,F.HANSROUL,L.HOLLOWAY, C.SCFULTZ,G.SHAPIRO (U.C. LAWRENCE RAD. LAB., BERKELEY, RACT THE POLARIZATION PARAMETER IN ELASTIC PROTON-PROTON SCATTERING HAS BEEN MEASURED USING AN UNPOLARIZED PROTON BEAM AND A POLARIZED PROTON TARGET. MEASUREMENTS WERE TAKEN AT LABORATORY KIMETIC ENERGIES OF 328, 614, 679, AND 736 MEV IN THE ANGULAR REGIGINS FROM 33 TO IOI CEGREES CENTER-OF-MASS. THE RESULTS INDICATE THAT THE MAXIMUM POLARIZATION AT A GIVEN ENERGY INCREASES IN THE REGIGN FROM 328 TO 679 MEV. AT 328 MEV THE RESULTS AND CAD AGREEMENT WITH THOSE OF A PREVICUS EXPERIMENT AT 315 MEV PERFORMED BY THE GUBLE-SCATTERING TECHNIQUE. A BS TRAC T CITATIONS IUNS ANKUAL REV. OF NUCLEAR SCIENCE 10, 291 (1960), PHYS. LETTERS 3, 265 (1963), PHYS. REV. 138, 8291 (1965), BULL. AM. PHYS. SOC. 9, 724 (1964), ANNUAL REV. OF MUCLEAR SCIENCE 6, 443 (1956), PHYS. REV. 148, 1297 (1966), PHYS. LETTERS 2, 310 (1962), PHYS. LETTERS 7, 293 (1963), UCRL 11149, PRCG. NUCL. TECH. INSTR. 1 173 (1964), KYOTO UNIVERSITY RIFP-30 (1963), UCRL 11565, AND PHYS. REV. 105, 200 (1957). ARTICLE READ BY ODETTE BENARY IN 4/67, AND VERIFIED BY LERGY PRICE. BEAM IS PROTON ON HYDROGEN COMPOUND FRCF .850 TO 1.386 GEV/C. TARGET IS POLARIZED 40 PER CENT (NORMAL TO THE BEAM Direction). THIS EXPERIMENT USES COUNTERS. KEY WORDS . POLARIZATION FLASTIC POLARIZATION FOR PROTON PROTON-(TABLE 2) LABORATORY BEAM ENERGY = .614 +- .005 GEV. THETA POLARIZATION [1] DEGREES DEGREE 58.0 +-62.8 66.2 67.5 71.9 72.3 77.6 83.5 2.0 .505 +- .C19 +- 2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0 .505 .492 .413 .463 .325 .357 .238 .091 .019 .019 .C20 .C19 .018 .C19 .016 .015 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 19 PER CENT. ELASTIC POLARIZATION FOR PROTON PROTON. (TABLE 3) LABORATORY BEAM ENERGY = .679 +- .007 GEV. THETA DEGREES 38.8 + 1.0 45.0 1.0 45.0 1.0 45.1 1.0 51.2 1.0 57.4 1.0 66.5 1.0 66.7 1.0 66.7 1.0 70.8 1.0 70.6 1.0 70.6 1.0 70.6 1.0 THETA POLARIZATION (1) .578 +- .028 .578 -019 .583 .019 .586 .017 .570 .013 .529 .013 .484 .018 .363 .019 .293 .018 .293 .019 .274 .027 .247 .031 .151 .036 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 02.4 .073 .044 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grang c.m. [1] PLUS POSSIBLE SYSTEMATIC EPROR OF + 6.5 - 5.8 PER CENT. ELASTIC POLARIZATION FOR PROTON PROTON. TABLE 41 LABORATORY BEAM ENERGY = .736 +- .CC5 GEV. THETA DEGREES POLARIZATION [1] 579 +- .049 .579 -- .049 .553 .017 .550 .014 .559 .015 .528 .011 .520 .011 .497 .013 .473 .014 .419 .018 .305 .017 .4419 .018 .305 .017 .4419 .018 .305 .017 .4419 .018 .305 .017 .4419 .018 .304 .018 .231 .018 .144 .023 DEGREES 32.5 +- 1.0 35.6 1.0 42.0 1.0 45.1 1.0 48.3 1.0 51.4 1.0 54.6 1.0 57.7 1.0 57.7 60.9 65.5 68.4 71.4 74.3 77.2 8C.2 83.2 1.0 1.0 1.0 1.0 1.0 1.0 1.0 .144 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. THE POLARIZATION IS GF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M. (1) PLUS POSSIBLE SYSTEMATIC ERPOR OF + 6.5 - 5.8 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 1]

	٤,	BORATORY	BEAM	ENERGY		.328	•-	.006	GEV.
	T	ETA			GLA	FIZAT	ION	(11	
	DEC	REES							
	44.1	+- 1.0			.389	+1	045		
	52.2	1.0			. 349		031		
	55.3	1.0			. 324	•	025		
	58.4	1.0			.317		220		
	61.6	1.0			. 255		20		
	64.8	1.0			256		327		
	68.1	1.0			. 191		24		
	71.4	1.0			. 165		023		
	74.7	1.0			. 187		223		
	85.3	1.0			. 163		035		
•	88.9	1.0			.016		027		•
	92.6	1.0		.	.006		225		
	96.5	1.0		-	.054		C 2 4		
	100.6	1.0		-	.094		027		

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF + 6.5 - 5.8 PER CENT.

25 TOTAL CROSS SECTIONS OF PROTONS WITH POMENTUM BETWEEN 10 AND 28 GEV/C. (PHYS. REV. LETTERS 5, 576 (1960)) A.ASHMORE,G.COCCONI,A.N.DIDDEKS,A.M.WETHERELL [EUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLAND]

CITATIONS HELVETICA PHYSICA ACTA 33 544 (1960), REVIEW OF SCIENTIFIC INSTRUMENTS 25, 1C7C (1954), PHYS. REV. LETTERS 5, 333 (1960), AND PHYS. REV. LETTERS 3, 568 (1959). ARTICLE READ BY ODETTE BENARY IN 4/67, AND VERIFIED BY LERDY PRICE.

BEAM NO. 1 IS PROTON ON FYOROGEN COMPOUND FROM 9.9 TO 28.4 GEV/C. NO. 2 IS PROTON ON CEUTERIUM COMPOUND FROM 9.9 TO 24.2 GEV/C.

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 FOR THE P-N MEASUREMENTS H2O AND D2C TARGETS WERE USED.

KEY WORDS + CROSS SECTION

LEIGURE 21 PROTON PROTON TOTAL CROSS SECTION.

LABORATORY BEAM MOMENTUR

.

BEAM MO	INENTUM		
GEV/C		MILL[-B4	RNS
	PER CENT		
9.9 +	- 2.5	39.4 +-	1.5
12.4	2.5	39.0	1.5
15.8	2.5	38.7	1.5
11.1	2.3	39.1	1.5
19.4	2.5	39.7	1.5
21.4	2.9	59.4	1.7
24.2	2.5	38.7	1.5
28.4	2.5	39.9	1.5

PROTON NEUTRON TOTAL CROSS SECTION. (FIGURE 2)

(P-N CROSS SECTION WAS MEASURED USING D2D AND H20 TARGETS. GLAUBER CORRECTION NOT APPLIED.)

LABOR	ATORY		
BEAM PC	MENTUM		
GEV	70	MILLI-	BARNS
	PER CENT		
7: 7 *	- Lij	30.0 **	2.9
15.8	2.5	36.2	2.0
24.2	2.5	35.5	5-0

26 PRODUCTION OF K MES	DNS IN THREE-BODY STATES IN PROTON-	PROTEN INTERACTIONS AT 6 BEV/C. (PHYS. REV. 165, 1466 (1968))
H.CHINONSKY,R.R.KIN	SEY,S.L.KLEIN,P.MANCELKERN,J.SCHULT T.H.TAN (STANFCRD LINEAR ACCEL. CNT	Z (U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA) R., STANFORD.CALIF., USA)
ABSTRACT ANALYS PROTONS IN THE +HYPERON K-HES 54(-5+3) MICR MICROBARNS, ST MSS NEAR 1700 INTO SIGMAF K+ SINGLE-PION-EX SIGMA-NUCLEON	IS OF 9700 EVENTS, CONTAINING AT LE LRL 72-IN. LIQUID-HYDROGEN BUBBLE DN NUCLEON. PRODUCTION CROSS SECTIO DBARNS: SIGMA-0 K+ $P = 171-2 + 41$ MI RONG N* PRODUCTIGN IS OBSERVED IN A NEV/C-SOUARED, EECAVING INTO LANBD , ARE PRODUCED. IN ALL CASES THE DA CHANGE MECHANISH. NO EVIDENCE IS FO SYSTEM.	AST ONE OBSERVED NEUTRAL DR CHARGED DECAY, PRODUCED BY 6-REV/C CAMBER HAS YIELDED 1746 EXAMPLES OF THE REACTION PROTON-PROTON NS FOR THESE THREE-BODY REACTIONS ARE AS FOLLOWS LANGLA K+ P = CROBARNS: SIGMA+ KO P = 26 +- 4 MICROBARNS: SIGMA+ K N = 57 +- 7 LL CHANNELS. IN PARTICULAR, ONE OF MORE T = 1/2 RESONANT STATES WITH A K+, AND A T = 3/2 RESONANCE WITH MASS DOWN MATED BY TA ARE CONSISTENT WITH A PRODUCTION PROCESS DOWINATED BY UND FOR A DIBARYCN STATE IN EITHEP THE LAMBDA-PROTON OF
CITATIONS PHYS. REV. 131 10, 529 (1965) LETTERS 14, 60 (1965), UCRL 8 PHYS. REV. 139 PHYS. REV. 113 NUOVO CIMENTO 135 (1962), PH CIMENTO 43A, 1 LETTERS 8, 332 (1967).	, 2239 (1363), PMYS. PEV. LETTEPS 1 , PMYS. LETTERS 21, 587 (1966), PMY 4 (1565), PMYS. LETTERS 11, 164 (19 360, LR. INTERDEPARTHENTAL REPOPT E 8, 1348 (1565), PMYS. REV. LETTERS 1640 (1595), PMYS. REV. 120, 988 33, 506 (1564), PMYS. REV. 139, 884 33, 506 (1564), PMYS. REV. 139, 885 (25, REV. LETTERS 7, 188 (1961), PMY 42 (1966), NUOVO CIMENTC 454, 885 ((1962), PMYS. REV. 133, 8457 (1964	3, 282 (1964), PHYS. REV. LETTERS 12, 625 (1964), BULL. ÁM. PHYS. SGC. S. LETTERS 21, 236 (1966), UNIV. DF MARYLAND 469 (1965), PHYS. REV. 64), BULL. AM. PHYS. SOC. 12, 517 (1965), PHYS. REV. LETTERS 15, 207 ET-1071, PHYS. REV. 147, 922 (1966), REV. MDD. PHYS. 39, 1 (1967), 10, 192 (1963), PHYS. REV. 148, 1444 (1966), NUC. PHYS. B3, 10 (1967), (1960), PHYS. REV. 211, 1541 (1961), PHYS. REV. 125, 1048 (1962), 8 (1965), PHYS. REV. 211, 1541 (1961), PHYS. REV. 25, 1048 (1962), 8 (1965), PHYS. REV. LETTERS 19, 1079 (1967), PHYS. REV. LETTERS 9, S. LETTERS 16, 83 (1965), PHYS. REV. 1398, 1411 (1965), NDUVO 1966), PHYS. REV. 139, 81097 (1965), CERN TCL/66-20, PHYS. REV. 1, UCRL 10838, PHYS. REV. 108, 1353 (1957), AND PHYS. REV. 163, 1430
ARTICLE READ BY OCE	TTE BENARY IN 1/69, AND VERIFIED BY	LERDY PRICE.
BEAM IS PROTON ON	PROTON AT 6 GEV/C.	
THIS EXPERIMENT USE General comments on	S THE L.R.L. 72 IN. (H) BUBBLE CHAM This Article	BER. A TOTAL OF SOOCCO PICTURES ARE REPORTED ON.
1 CONSIDERABLE MASS DISTRI	NUCLEON ISOBAR PRODUCTION (N+11920 Butions.) AND N*(1688)) OBSERVED IN THE K+ SIGMA+ , AND K+ LAMEDA EFFECTIVE
KEY WORDS + CROSS S	ECTION ANGULAR DISTRIBUTION	DALITZ PLOT MASS SPECTRUM MODELS
	{ TA	BLE 1)
LABORATORY BEAM MOM	ENTUP = 6.C5 +06 GEV/C.	
REACTION		MICRO-BARNS
PROTON PROTON + LAMBDA PROTON K+		54. + 3.
SIGMAD PROTON K+		- 5. 17. + 4.
SIGMA+ PROTON KO SIGMA+ K+ NEUTRO	N	26. 4. (1) 57. 7.
[1] BASEC ON	EVENTS WHERE THE KO DECAY IS SEEN	
NP ELASTIC CHARGE E H.PALEVSKY, J.A. MOCR Y., USA	XCHANGE IN THE BEV ENERGY REGION. E.R.L.STEARNS,H.R.PEUTHER,R.J.SUTTE	(PHYS. REV. LETTERS 9, 509 (1962)] R,R.E.CHRIEN,A.P.JAIN K.OTNES IBROOKMAVEN NAT. LAB., UPTON, L.I., N.
CLOSELY RELATED REF PART OF THIS A	ERENCES RTICLE SUPERSEDED BY PHYS. REV. LET	TERS 15, 30 (1965).
ACCITIGNAL CITATIGN Nuũvũ cimento Phys. Rev. 127 Physik 9, 549	S 18, 1039 (1960), PHYS. REV. 95, 102 , 1836 (1962), REV. MOD. PHYS. 33, 4 (1961).	6 (1954), PHYS. REV. 111, 138 (1958), PHYS. REV. LETTERS 6, 484 (1961), 458 (1961), REV. MOD. PHYS. 28, 214 (1956), AND FORTSCHRITIE DEK
ARTICLE READ BY ODE	TTE BENARY IN 1/69, AND VERIFIED BY	LEROY PRICE.
BEAM IS NEUTRON ON	PROTON FROM 2.828 TO 3.672 GEV/C.	(BEAM KINETIC ENERGY = 2.04 TO 2.85 GEV)
THIS EXPERIMENT USE	S COUNTERS.	
KEY WORDS + CROSS S	ECTION DIFFERENTIAL CPOSS SECTION	אס
NEUTOCN PROTON FLAS	TIC CROSS SECTION (PAGE 51)	1
DATA IS INTEGR	ATED OVER COS(THETA) FROM -1. TO 0.	. THETA IS THE ANGLE THAT THE NEUTRON MAKES WITH THE BEAM IN THE
GRAND C.M	•	
LANDRATORY	D NOT BE USED - RUKE RECENT VALUES I	MAY BE FOUND IN FRIEDES, ET AL., PHYS. REV. LEFTERS 15, 38 (1965)]
BEAM ENERGY GEV 2.04	MILLI-BARNS .65 +15	
		· · · · · · · · · · · · · · · · · · ·
NEUTRON PROTON ELAS	TIC CROSS SECTION. (PAGE 511	1
DATA IS INTEGRA GRAND C.M	ATED OVER COS(THETA) FROM -1. TO O.	. THETA IS THE ANGLE THAT THE NEUTRON MAKES WITH THE BEAM IN THE
LABORATORY		
BEAM ENERGY GEV	MILL I-BARNS	
2.85	.43 +16	
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PROTON-PROTON INTERACTIONS AT 810 MEV. [PHYS. REV. 103, 1472 (1956)] 28 T.W.MORRIS, E.C.FOWLER, J.D.GARRISON (YALE UNIV., NEW HAVEN, CONN., USA) RACT 244 EXAMPLES OF PRETON-PROTON SCATTERING HAVEN, CENN., USA1 CHAMBER OF THE REOKHAVEN (LOUD CHAMBER GROUP. THE MEAN EMBORY OF THE INCIDENT PROTONS WAS MEASURED DIFFUSION CLOUD CHAMBER OF THE REOKHAVEN (LOUD CHAMBER GROUP. THE MEAN EMBORY OF THE INCIDENT PROTONS WAS MEASURED TO RE 810 +- 100 MEV. THE REACTIONS OBSERVEC WERE [1] PP - PP. 126 EXAMPLES, (2) PP - P N P1+, 84 EXAMPLES, (3) PP - D P1+, 1 EXAMPLE AND (4) PP - PP P10, 5 EXAMPLES, WITH CALES WHICH CAN BE EITHER PREACTION (2) OR (4). THE TOTAL PROTON POTON CROSS SECTION WAS DETERMINED TO BE 45 +- 6 MB. THE RAITIC R OF THE REACTION TOR P1+ PRODUCTION TO THAT FOR P10 PRODUCTION 1S 17 +- 8. AN ELASTIC DIFFERENTIAL DISTRIBUTION STRONGLY PEAKED IN THE FCRWARD DIFFCION MAS OBTINED. ANGLE AND MOMENTUM DISTRIBUTIONS OF PARTICLES AND AND ULAR CORRELATIONS BETWEEN PAIRS OF PARTICLES FROM REACTION (2) ARE PRESENTED. NO INTERACTIONS LEADING TO THE PRODUCTION OF MORE THAN ONE MESON OR OF HEAVY UNSTABLE PARTICLES WERE IDENTIFIED. ABSTRACT CITATIONS REV. MOD. PHYS. 22, 77 (1950), PRCC. PHYS. MATH. SDC. JAPAN 17 48 (1935), PHYS. REV. 98, 1513 (1955), PHYS. PEV. 98, 840 (1955), PHYS. REV. 97, 583 (1955), PHYS. REV. 95, 1694 (1954), PHYS. REV. 93, 1430 (1954), NATURE 173 946 (1954), PHYS. REV. 93, 927 (1953), PHYS. REV. 83, 929 (1951), PHYS. REV. 163, 212 (1956), PHYS. REV. 90, 980 (1953), PHYS. REV. 95, 1026 (1954), PHYS. REV. 95, 663 (1954), PHYS. REV. 103, 212 (1956), PHYS. REV. 97, 797 (1955), PHYS. REV. 91 1287 (1953), PHYS. REV. 93, 804 (1954), PHYS. REV. 81, 121 (1955), PHYS. REV. 97, 1186 (1955), PHYS. REV. 91 SOCIETY OF LONDON A230, 215 (1955), PROC. DF THE RNYAL SOCIETY OF LONDON A230, 222 (1955), PHILOSOPHICAL MAGAZINE 46 877 (1955), PHYS. REV. 100, 962 (1955), AND ROCHESTER CCMFERENCE 43 (1955). ARTICLE READ BY OCEITE GENARY IN 3/67, AND VERIFIED BY LEROY PRICE. BEAM IS PROTON ON PROTON AT 1.48 GEV/C. THIS EXPERIMENT USES A CLOUD CHAMBER. A TOTAL OF 17500 PICTURES ARE REPORTED ON. KEY WORDS . CROSS SECTION DIFFERENTIAL CROSS SECTION _____ • PROTON PROTON TOTAL CROSS SECTION. [PAGE 1475] LABORATORY BEAM ENERGY GEV .81 +- .10 MILLI-BARNS 45. +- 6. NO. EVENTS 29 NUCLEON AND NUCLEAR CROSS SECTIONS FCR POSITIVE PIONS AND PROTONS ABOVE 1.4 BEV/C. (PHYS. REV. 125, 701 (1962)) .J.LONGO.8.J.MCYER (U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA) ABSTRACT

RACT TOTAL (PI+ P) AND (PP) CROSS SECTIONS IN THE MEDENIUM MANGE 1.4 TO 4.0 GEV/C ARE PRESENTED. THESE MEASUPEMENTS, MITH AN ACCURACY OF APPROXIMATELY 2 PER CENT, WERE MADE AT THE BERKELEY BEVATRON BY USING COUNTER TECHNIQUES. PIDNS WERE DISTURGUISHED FROM PROTONS BY PEANS OF A GAS-FILLED CENERNROY COUNTER. THE (PI+ P) TOTAL CROSS SECTION WAS FOUND TO BE ALMOST CONSTANT ABOVE 2.0 BEV/C AT A VALUE NEAR 29 MB. THE (PP) CROSS SECTION CECREASES GRADUALLY FROM 47.5 MB TO 41.7 MB OVER THE MOMENTUM RANGE COVERED. THANSINISION MEASUREMENTS OF PI+ NUCLEUS CROSS SECTIONS IN BOTH GOOD AND POOR GEDMETRY WERE MADE AT 3.0 BEV/C. THE RESULTS ARE COMPAPED WITH THE PREDICTIONS OF THE DITICAL MODEL. IN CONTRAST TO MOST PREVIOUS WORK AT HIGH ENERGIES, AN ESSENTIALLY EXACT SOLUTION OF THE WAVE EQUATION FOR A POTENTIAL WELL WITH A DIFFUSE EDGE MAS USED. THE VALUES OF THE IMAGINARY PART UF INE OPTICAL POTENTIAL THAT BEST FIT THE EXPERIMENTAL DATA ARE IN GOOD AGREEMENT WITH THE PREDICTIONS FOR METHER FAIL PART OF THE POTENTIAL WAS POSSIBLE. ABSORPTICM AND TOTAL ELASTIC SCATTERING CROSS SECTIONS FOR BE, C, AL, AND CU APE PRESENTED. THE TOTAL ELASTIC SCATTERING CROSS SECTIONS FOR THIS EXPERIMENT DISAGREE WITH WIKNER'S FOR PI- NUCLEUS SCATTERING.

CLOSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES PHYS. REV. LETTERS 3, 568 (1959).

ADDITIONAL CITATIONS PHYS. REV. 125, 690 (1962), REVIEW OF SCIENTIFIC INSTRUMENTS 30, 865 (1959), UCRL 8000 (1957), UCRL 3307, UCRL 845/ (1959), J. RES. NATIONAL BUREAU OF STANDAROS A1 379 (1948), REVIEW OF SCIENTIFIC INSTRUMENTS 25, 1070 (1954), UCRL 8030 (1961), ATOMIC ENERGY RES. ESTAB., HARWELL, REPORT M521 (1959), PHYS. REV. 2, 117 (1959), PHYS. REV. 99, 857 (1955), PHYS. REV. LETTERS 5, 333 (1960), NUUVO CIMENTO 19, 210 (1961), PHYS. REV. 116, 824 (1960), NUDVO CIMENTO 120, 1458 (1960), PHYS. REV. 101, 891 (1956), PHYS. REV. 118, 579 (1960), UCRL 9366 (1999), ANNUAL REV. FOR INITIAN SCIENCF 8, 49 (1958), REV. HOL. 891 (1955), PHYS. REV. 118, 579 (1960), UCRL 9366 (1991), ANNUAL REV. FOR INITIAN SCIENCF 8, 49 (1953), REV. HOD. PHYS. 20, 214 (1956), ANNUAL HEV. OF NUCLEAR SCIENCF 7, 231 (1957), PHYS. REV. 108, 795 (1951), PHYS. REV. 60, 1035 (1952), PHYS. REV. 107, 1121 (1957), JETP 34 499 (1958), DWYC REW LGTTERG 6, 892 (1960), AND UBAL AGGY (1957);

ARTICLE REAU BY UDEITE BENARY IN 6/67, AND VERIFIED BY LERGY PRICE.

BEAM NO. 1 IS PRGTON GN PROTCN FROM 1.42 TO 4.00 GEV/C. NO. 2 IS PI+ ON PROTON FRCM 1.42 TO 4.00 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORDS + CROSS SECTION FITS

COMPOUND KEY WORDS + FITS MODELS

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PROTON PROTON TOTAL CROSS SECTION.

MILLI-BARNS 14.20 . .30 4/.50 + 1.02

- .61

- ,46 46.80 + 1.51

43.20 + .43

41.60 + .62

MODEL S

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1.60 2.5

1.73 2.5

2.5

2.5

2.5

2.5

2.5

1.89

2.05

2.47 2.97 2.5

3.58

4.00

[TABLE 1]

LABORATURT
REAM MCMENTUM
GEV/C
PER CENT
1.47 4= 7 5

	K+ MESON PRODUCTION IN PP	COLLISIONS AT 2.5-3.0 GEV.	(PHYS. REV. 166, 1472 (1968))
	W.J.HOGAN, P.A. PIRCUE, A.J.	S.SMITH [PRINCETCN UNIV., PRIN	(CETON, N. J., USA)
	ABSTRACT DIFFERENTIAL COLLISIONS AT INCIDE AND 40 DEG. RELATIVE GEV. THE RESULTS FOL LAMBDA P IN THE FINA DATA ARE COMPARED TO PP • K* X+, WHERE X+ THE DHE-PION-EXCHANG SUCCESSFUL IN PREDIC	CROSS SECTIONS AS A FUNCTION NT PRCION CHERCIES OF 2.54, 2. "TO THE DIRECTION OF THE INTER LOW CLOSELY THE PREDICTIONS YR L STATE.1 AT 2.88 AND 3.03 GEV 1 THE PREDICTIONS OF THREE MODE .15 A B=2, S = -1 RESONANCE W .16 A GDEL, MCDEL (11 IS FOUND TO TING TOTAL CROSS SECTIONS, BUT	OF MOMENTUM ARE PRESENTED FCR THE PRODUCTION OF K+ PESONS IN i 88, AND 3.03 GeV. THE PRESUBERENTS WERE MADE AT 20 DEC., 30 OD INAL PROTON BEAM-OF THE PRINCETOM-PENNSYLVANIA ACCELERATOR. AT 10M PHASE SPACE (iTH 60 PER CENT K+ SIGMA NAMO 60 PER CENT K+, HOWEVER, THERE IS A DEFINITE DISAGREEMENT WITH PHASE SPACE. ILS (I) A MODEL BASED ON THE ASSUMPTION THAT K'S ARE PRODUCE IGHT EN SIGNA AND ADDEL THE SPACE. ILC HOCATS INTO A NUCLEON-HYPERON; (2) THE ISDBAR MODEL; AND (1) HE INCONCLUSIVE, MODEL (2) IS INADEQUATE, AND MODEL (3) IS PI NOT IN INTERPRETING THE OTHER INTERNATIONS.
	CITATIONS PHYS. REV. 148, 1315 PHYS. REV. 112, 614 (1962), IEEE TRANS. (1966), PHYS. REV. L 1107 (1957), PHYS. REV. L 107 (1957), PHYS. REV. 125, NUDVO CIMENTO 21, 10 AND PHYS. REV. 125,	(1966), PMYS. LETTERS 11, 164 (1958), PMYS. REV. 123, 1665 (NUCL. SCI. 12 249 (1965), REVI ETTERS 13, 668 (1964), PMYS. FTTERS 13, 668 (1964), PMYS. NUDVC CIMENTO 35, 735 (1965), N. NUDVO CIMENTO 24, 453 (1962) 228 (1961), CEAN COMFERENCE 271 1048.(1962).) (1964), PHYS. REV. 108, 1048 (1957), PHYS. PEV. 108, 1322 (10 1961), IEEE TRANS. NUCL. SCI. 12 251 (1965), PHYS. REV. 128, 2 IEW OF SCIENTIFIC INSTRUMENTS 25, 1070 (1954), PHYS. REV. 128, 2 IEW. 167, 822 (1966), PHYS. REV. 105, 1474 (1957), PHYS. REV. I. REV. 109, 1723 (1958), PHYS. REV. 23, 333 (1961), BULL AP. PHYS. REV. 154, 1284 (1967), NUGVO CIMENTO 47A, 322 (1967), P 21, PHYS. REV. 154, 1284 (1967), NUGVO CIMENTO 47A, 322 (1967), 21, PHYS. REV. LETTERS 7, 387 (1961), NUGVO CIMENTO 27, 1450 (1 1962), PHYS. REV. 133, 8458 (1964), PHYS. REV. 120, 988 (19
	ARTICLE READ BY QUETTE BE	NARY IN 1/69. AND VERIFIED BY	LERGY PRICE.
	BEAM IS PROTON ON PROTON	FROM 3.308 TO 3.825 GEV/C.	(BEAM KINETIC ENERGY = 2.5 TO 3.0 GEV)
	THÍS EXPERIMENT USES COUN	ITERS	
	KEY WORDS + CROSS SECTION	CIEFERENTIAL CROSS SECTIO	IN MODELS MASS SPECTRUM
	CROSS SECTION FOR PRO	ITON PROTON - K+ LAMBDA PROTO	JN + K+ SIGMA NUCLEON. 【TABLE 2】
	LABORATORY BEAM ENERGY		· · · · ·
	GEV 2.54 +02	MICRC-BARNS 61. +- 10.	
	CROSS SECTION FOR PRO NUCLEON PION.	TCN PRCTON + K+ LAMBDA PROTO (TABLE 2)	IN + K+ SIGMA NUCLEON + K+ SIGMA NUCLEON PIGN + K+ LAMBDA
	LABORATORY		
	GEV	MICRC-BARNS	
	2.88 +02	123. +- 21.	
·			
	NUCLEON PION.	ITABLE 2]	N + K+ SIGMA NUCLEUN + K+ SIGMA NUCLEUN PIUN + K+ LAMEUA
	BEAM ENERGY	HT606 BARNS	
	3.03 +02	160. +- 29.	
	LABORATORY BEAM ENERG	[PAG GY = 2.54 ↔ .02 GEV.	E 1477]
	LABORATORY BEAM ENERG	[PAG GY = 2.54 ↔ .02 GEV.	E 1477] FRACTION OFD CENT (1)
PROTO	LABORATORY BEAM ENERG REACTION N PROTON -	[PAG GY = 2.54 ↔ .02 GEV.	E 1477] FRACTION DEP (ENT 11)

(1) THESE FRACTIONS SHOULD BE FULTIPLIED BY 61. +- 10. TO GET CROSS SECTIONS IN MICROBARNS.

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CITATIONS PHYS. REV. 123, 1465 (1961), PHYS. REV. 147, 922 (1966), PHYS. REV. LETTERS 13, 355A (1964), PHYS. REV. 165, 1466 (1968), BULL. AM. PHYS. SOC. 12, 505 (1967), BULL. AM. PHYS. SOC. 12, 505 (1967), NUQVO CIMENTO 51, 305 (1967), NUQVO CIMENTO 29, 8 (1963), PHYS. CO, 20 (1964), PHYS. REV. LETTERS 14, 604 (1965), PHYS. REV. LETTERS 15, 668 (1964), BULL. AM. PHYS. SOC. 11, 342 (1566), PHYS. LETTERS 20, 318 (1966), PHYS. LETTERS 11, 164 (1964), BNL HIO (1962), PHYS. REV. 138, B913 (1965), PHYS. CO F THE ROYAL SOCIETY OF LONGON 378A, 401 (1964), PHYS. LETTERS 13, 190 (1964), PHYS. REV. 137, BJOB (1965), PHYS. REV. 156, 1555 (1967), PHYS. REV. LETTERS 18, 1218 (1967), PHYS. REV. LETTERS 19, 198 (1967), BULL. AM. PHYS. SOC. 11, 360 (1966), BULL. AM. PHYS. SOC. 22, 45 (1967), PHYS. REV. LETTERS 19, 108 (1967), BULL. AM. PHYS. SOC. 11, 360 (1966), BULL. AM. PHYS. SOC. 22, 45 (1967), PHYS. REV. LETTERS 19, 108 (1967), BULL. AM. PHYS. SOC. 11, 360 (1966), BULL. AM. PHYS. SOC. 21, 45 (1967), PHYS. REV. LETTERS 8, 332 (1962), NUOVO CIMENTC 43, A1010 (1966), PHYS. REV. 127, 607 (1965), PHYS. REV. 138, B433 (1965), PHYS. REV. 134, B383 (1964), PHYS. REV. 127, 636 (1962), PHYS. REV. 137, B1232 (1963), NUOVO CIMENTO 43, 14961), PHYS. REV. 137, 1479 (1967), PHYS. REV. LETTERS 9, 135 (1962), PHYS. REV. 137, B1232 (1963), PHYS. REV. LETTERS 18, 266 (1967), PHYS. LETTERS 248, 489 (1967), AND BULL. AM. PHYS. SOC. 12, 916 (1967).

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ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PRETEN AT 7.87 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 37000 PICTURES APE REPORTED ON.

KEY HORDS + CROSS SECTION ANGULAR DISTRIBUTION DALITZ PLOT MASS SPECTRUM MODELS DELTA(1238) DELTA(1920) K+(85C) Y+(1385) STRANGE PARTICLES

(TABLE 1)

LABCRATORY BEAR MORENIUM = 7.87 GEV/C.		
REACTION	MICRO-BARNS	
ROTON PROTON +		
K+ PROTON LAMBDA	54.4 +- 7.3	
K+ PROTON SIGMAO	25.2 5.0	
KO PROTON SIGMA+	14.3 5.1	
PROTON PROTON KO KOBAR	10.4 3.3	
K+ PROTON KOBAR NEUTRON	25.0 6.7	-
PI+ K+ LAHBOA NEUTRON	101.0 10.3	
K+ PROTON LAMBCA PIO	77.5 8.7	
PI+ PROTON KO LAMBDA	72.4 7.4	
PI+ PROTON KO SIGMAO	29.5 7.0	
P1+ SIGMA+ KO NEUTRON	21.4 6.2	
PROTON SIGMA+ KO PIO	17.9 5.7	
K+ PROTON SIGMA+ PI-	37.4 7.8	
PI+ K+ PROTON SIGNA-	31.// 49	
PI+ PROTON KO KOBAR NEUTRON	24.8 12.4	
K+ PROTON PROTON PI- KOBAR	9.8 4 4	
PI+ PRUTUN PRUTUN K- KA	13.0 5.2	
PI+ K+ PROTON PI- LAMBDA	49.0 7.2	
PI+ PROTON KC LAMBDA PIO	67.4 15.0	
PI+ PI+ KO LAMBOA NEUTRON	20.2 0.5	
PI+ K+ PROTON PI- SIGMAO	21.4 4.8	
K+ PRUTUN SIGMA+ PI- PIC	17.3 7.1	
PI+ PROTON SIGMA+ PI- KO	14.7 7.4	
PI+ K+ SIGMA+ PI- NEUTRON	28-8 9-1	
PII RI PROTON SIGHA- PIU	22.2 4.6	
PI+ PI+ PROTON SIGPA- KO	24.7 5.6	
PI+ PI+ K+ SIGNA- NEUTRON	6.8 2.6	
PI+ PROTON PROTON PI- KO KOBAR	6-3 2.0	
PI+ K+ PROTON PI- KOBAR NEUTRON	7.8 3.9	
PI+ PROTON PROTON K- KC PIC	5.9 3.4	
FI+ FI+ PROTON K- KO NEUTRON	3.9 2.8	
PI+ PI+ PROTON PI- KO LAMBCA	23.1 4.2	
PI+ K+ PROTON PI- LAMBCA PIO	39.5 6.3	
PI+ PI+ K+ PI- LAMBDA NEUTRON	20.3 4.7	

[PAGE 1356]

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LABORATORY REAM MOMENTUM = 7.87 GEV/C.

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REALITON	MILLI-BARNS
TUTAL	39.6 +- 1.3
STRANGE PARTICLES	1.8 .2

32 S-BEV NEUTRON CROSS	SECTIONS IN HYCREGEN AND OTHER ELEMENTS (PHYS. REV. 123, 1850 (1961))
J.H.ATKINSON,W.N.HE	SS,V.PEREZ-MENDEZ,R.WALLACE [U.C. LAWRENCE RAD. LAC., BERKELEY, CALIF., USA]
ABSTRACT THIS E WERE MADE IN G BEAM STRUCK A WERE THEN DETE COUNTER DEFINE ENERGY DISTRIB	XPERIMENT PEASURED THE NEUTRON TOTAL AND REACTION CROSS SECTIONS AT 5-0 BEV. TRANSMISSION REASUREMENTS DDD AND POOR GECMETRY. THE HIGH ENERGY NEUTRON BEAM WAS PRODUCED WHEN THE BEVATRON CIRCULATING PROTON COPPER TARGET. NEUTRONS WERE IDENTIFIED BY THEIR PRODUCTION OF PIONS IN A BERVILIUM HIGCK. THE PIONS CTED BY A COLNTER TELESCOPE INCLUDING A GAS CERENKOV COUNTER. THE THRESHOLD OF THIS GAS CERENKOV C THE MEAN EFFECTIVE NEUTRON ENERGY AT 5.0 +- 0.4 BEV, WITH THE MALF-INTENSITY POINTS OF THE NEUTRON UTION AT 5.9 AND 4.2 BEV. THE CROSS SECTIONS MEASURED FOR THE VARIOUS ELEMENTS AFFLIN MILLIBANNS)
PB SIGMA(T) 234 SIGMA(R) 1670 THE S-BEV TOTA WHEREAS THE RE OF THE CROSS S	→ 105 1966 ↔ 88 1158 ↔ 34 614 ↔ 33 319 ↔ 20 33.6 ↔ 1.6 ↔ 79 586 ↔ 25 381 ↔ 27 235 ↔ 16 L CRCSS SECTIONS ARE 20 PER CENT BÈLOW THE TOTAL CROSS-SECTIONS MEASURED AT 1.4 BEV BY CODR ET AL., ACTION CROSS SECTICNS REMAIN ESSENTIALLY CONSTANT AS A FUNCTION OF ENERGY ABOVE 300 MEV. THIS BEHAVIOR ECTICNS CAN EE INTERPRETEC BY A GENERALIZED DIFFRACTION THEGRY DEVELOPED BY GLASSGOLD AND GRIEDEP.
CITATIONS PHYS. REV. 98, REVIEW DF SCIE NUOVO CIMENTO (1957), AM. PH AND REV. MCD.	1365 (1955), PHYS. REV. 58, 1393 (1955), PHYS. REV. 107, 859 (1957), PHYS. REV. LETTERS 2, 169 (1959), NTIFIC INSTRUMENTS 30, 1004 (1959), UCRL 8559 (1958), PHYS. REV. 114, 1374 (1959), UCRL 3289 (1956), 4, 359 (1956), PHYS. REV. 107, 1121 (1957), J. MASH. ACAD. SCI. 29 416 (1939), PHYS. REV. 105, 1587 YS. 10 100, (1960), PHYS. REV. 75, 1352 (1949), PHYS. REV. 98, 1387 (1955), REV. MOD. PHYS. 28, 214 (1956), PHYS. 30, 430 (1950).
ARTICLE READ BY OCE	TTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE.
BEAM IS NEUTRON CN	PROTON AT 5.865 GEV/C. (BEAM KINETIC ENERGY = 5 GEV)
THIS EXPERIMENT USE	S COUNTERS.
KEY WORDS + CROSS S	ECTION WODELS
	•
NEUTRCN PROTON TOTA	L CROSS SECTION. (PAGE 1850)
LABORATORY	
BEAM ENERGY GEV [1]	MILLI-BARNS
5.	33.6 +- 1.6
(1) MEAN VALU	Ε.
ABSTRACT WE HAV ABSTRACT WE HAV 08TAINEC THE F E(N) TOT. C.S. (NP) TOT. C.S. (NN)	HATURYAN,I.V.CHUVILO [JOINT INST. FOR NUCL. RESEARCH, DUBRA, USSR] E MEASURED THE TOTAL CRCSS SECTIONS FOR INTERACTION OF NEUTRONS HAVING MEAN EFFECTIVE ENERGIES OF 2.6, AND 8.3 BEV WITH PROTONS AND NEUTRONS UNDER COMDITIONS OF GOOD GEOMETRY (THETA = 0.228 DEG.). WF MAVE CLCWING VALUES 2.6 BEV 3.9 BEV 5.5 BEV 6.9 BEV 3.3 BEV MB 38.1 +- 2.6 43.4 +- 11.6 41.2 +- 1.7 39.3 +- 1.7 40.8 +- 1.9 MB 31.5 +- 1.7
CITATIONS Phys. Rev. 98, Experimental T Techniques 6 1 Sci. 29 416 (1 Jetp 44 2184 (348 (1558), Ani	1369 (1955), PFYS. REV. 123, 1850 (1961), BULL. AM. PHYS. 50C. 9, 94 (1964), INSTRUMENTS AND COMMIQUES 2 382 (1961), JETP 42 392 (1962), JETP 15 272 (1962), UCRL 8559, INSTRUMENTS AND EXPEPIMENTAL 025 (1964), PHYS. PEV. 55, 1026 (1954), REVIEW OF SCIENTIFIC INSTRUMENTS 32, 949 (1961), J. WASH. ACAD. 939), BULL AM. PHYS. 5CC. 1, 385 (1956), NUOVO CIMENTO 4, 359 (1956), PHYS. REV. LETTERS 8, 142 (1962), 1963), JETP 17 1466 (1963), PHYS. REV. LETTERS, 7, 185 (1961), PHYS. REV. 100, 242 (1955), NUC. PHYS. 6, D PHYS. REV. 103, 211 (1956).
ARTICLE READ BY OCE	ITE BENARY IN 1/65, AND VERIFIED BY LEROY PRICE.
BEAM NG. 1 IS NEUTR ND. 2 IS NEUTR	NON ON HYDROGEN CCMPQUND FROM 3.413 TO 9.192 GEV/C. (BEAN KINETIC ENERGY = 2.6 TO 8.3 GEV) Non on ceuterium compound from 6.371 to 9.192 Gev/C. (BEAN KINETIC ENERGY = 5.5 to 8.3 GeV)
THIS EXPERIMENT USE:	S COUNTERS.
KET WCROS + CROSS SI	ECTION
	· · ·
NEUTRON PROTON TOTAL	L CRCSS SECTION. [TABLE 2]
LABORATORY	· ·
HEAM ENERGY Gev [1]	MILLI-BARNS
2.6	38.1 +- 2.6 43.4 1.6
5.5	41.2 1.7
8.3	40.8 1.9
•	
111 MEAN VALUE	·s.
	•••••••••••••••••••••••••••••••••••••••
NEUTRON NEUTRON TOTA	IL CROSS SECTION. ITABLE 3)
. NOT CORRECTE	. FCR DEUTERIUM EFFECTS. I
LABORATORY	
BEAM ENERGY GEV (1)	MILLI-BARNS
5.5	34.8 +- 1.6 31.5 1.7
(11 ME24	
LII PEAN VALUE	

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[PAGE 99] NEUTRON DEUTERON TOTAL CROSS SECTION. LABORATORY BEAM ENERGY GEV [1] 5.5 8.3 MILLI-BARNS 76.0 +- 2.4 71.6 2.5 [1] MEAN VALUES. . POLARIZATION IN PP ELASTIC SCATTERING AT LARGE MEMENTUM TRANSFERS. (PHYS. REV. LETTERS 21, 651 (1968)) 34 N.E.BOOTH,G.CONFORTO.R.J.ESTERLING,J.PARRY,J.SCHEIO,D.SHERDEN LENRICO FERMI INST. FOR NUC. STU., CHICAGO,ILL.,USA) A.YOKOSAWA LARGONNE NAT. LAB., ARGONNE, ILL., USA) ABSTRACT MEASUREMENTS OF THE POLARIZATION IN PP ELASTIC SCATTERING HAVE BEEN MADE AT 5.15 GEV/C OVER THE RANGE -T = 0.2 TO 1.8 (GEV/C)-SQUARED. THE DATA APE COMPARED WITH A REGGE-POLE MODEL, AND WITH THE DIFFRACTION MODEL OF DURAND AND LIPES IN WHICH THIC ABSCRIPTIVE PART OF THE PP INTERACTION IS DERIVED FROM THE ELECTPOMAGNETIC FORM FACTOR OF THE PROTON. THE LATTER MODEL REPRODUCES THE T DEPENDENCE OF THE EXPERIMENTAL DATA IN A QUALITATIVE WAY. CITATIONS PHYS. LETTERS 248, 77 (1967), PHYS. REV. 148, 1297 (1966), PHYS. REV. 161, 1374 (1967), PHYS. REV. 164, 1672 (1967), REV. MCD. PHYS. 39, 531 (1567), UCRL 16275 (1966), PHYS. REV. 165, 1615 (1968), AND PHYS. REV. LETTERS 20, 637 (1968) . ARTICLE READ BY OCETTE BENARY IN 1/65, AND VERIFIED BY LEROY PRICE. BEAM IS PROTON ON HYDROGEN COMPOUND AT 5.15 GEV/C. TARGET IS POLARIZED 55 PER CENT (NORMAL TO THE BEAM DIRECTION). THIS EXPERIMENT USES COUNTERS. KEY WORDS . POLARIZATION POCELS ELASTIC POLARIZATION FOR PROTON PROTON-LEIGURE 11 LABORATORY BEAM MCMENTUM . 5.15 GEV/C. THIS DATA WAS READ FROM A GRAPH _? PGLARIZATION [1] .22 +- .Cl .21 .Ol .19 .Cl .18 .Cl .17 .Ol .12 .O2 .12 .O2 .12 .O2 .13 .C3 .13 .C3 .14 .C5 .24 .C7 .26 .OB .15 .13 .14 .C1 .24 .C1 .25 .C1 .25 .C2 .24 .C1 .25 .C2 .24 .C1 .25 .C2 .24 .C1 .25 .C2 .25 (GEV/C) ++2 .22 .28 .34 .40 .48 .56 .67 .92 1.02 1.12 1.23 1.36 1.47 1.57 1.75 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGCING PROTON). The polarization is of the proton along the normal to the production plane in the grand C.M. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT. 35 SEARCH FOR FLUCTUATIONS IN THE ANGULAR DISTRIBUTION OF PROTON-PROTON SCATTERING AT 16.9 GEV/C. (1966)] LPHYS. LETTERS 23, 389 J.V.ALLABY,G.BELLETTINI.G.COCCONI,A.N.DIDDENS,N.L.GOOD,G.MATTHIAE, E.J.SACHARIDIS,A.SILVERMAN,A.M.WETHERELL [EUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLAND] ABSTRACT MEASUREMENTS OF THE ANGULAR DISTRIBUTION OF PROTON-PROTON ELASTIC SCATTERING AT 16.9 GEV/C FROM 67 DEG. TO 90 DEG. IN THE C.M.S. ARE PRESENTED. THE DATA ARE FITTED BY AN EXPONENTIAL IN THE TRANSVERSE NOMENTUM. EXP -(P SIN THETA/B) WITH B = (225 +- 4) MEV/C AND DO NOT DISPLAY THE CHARACTERISTIC FLUCTUATION PREDICTED BY ERICSON'S ETATLETICAL MODEL. CLOSCLY RELATED REFERENCES DATA SUPERSEDED BY PHYS. LETTERS 258, 156 (1967). ADDITIONAL CITATIONS CERN DL 65-10, CERN NP/66-2, PHYS. REV. 128, 2392 (1962), ANNUAL REV. OF NUCLEAR SCIENCE 13, 261 (1963), PHYS. LETTERS 13, 190 (1964), PHYS. REV. 138, B165 (1965), UCRL 11441, UCRL 16275, NUOVO CIMENTO 27, 856 (1963), NUOVO CIMENTO 27, 208 (1963), NUOVO CIMENTO 33, 643 (1964), PHYS. LETTERS 8, 287 (1964), NUOVO CIMENTO 35, 216 (1965), NUOVO CIMENTO 35, 1211 (1965), NUOVO CIMENTO 35, 1050 (1965), CERN 1H 406 (1964), CERN 66/TH/686, ANNALS 0F PHYSICS 23, 390 (1563), PHYS. REV. 85, 947 (1952), PHYS. REV. 105, 302 (1957), CERN 65-22, AND REV. HOD. PHYS. 36, 655 (1964). ARTICLE READ BY OCETTE BENARY IN 5/67, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON PROTON AT 16,9 GEV/C-

THIS EXPERIMENT USES COUNTERS.

KEY WORUS - DIFFERENTIAL CRUSS SECTION FITS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL	CROSS SECTION FOR PPOTON PROT	ION. [TABLE 1]
LABORATORY BEAP	MOMENTUM = 16.9 GEV/C.	

[THIS DATA SHOULD NOT BE USED - MCRE RECENT VALUES MAY BE FOUND IN ALLABY, ET AL., PHYS. LETTERS 258, 156 (1967))

THETA	D-SIGMA/C-CMEGA	•	
DEGREES	NANCEARNS/SR [1]		
67.	1.85 +04		
70.	1.45 .05		
72.	1.31 .05		
75.	1.11 .04		-
17.	.95 .03		
80.	.85 .04		
62.	.79 .03		
es.	.74 .04		
90.	.69 .04		

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M.

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT.

36 NEUTRAL STRANGE-PARTICLE PRODUCTION IN VV COLLISIONS AT 6.92 GEV/C. [NUQVO CIMENTO 53A, 455 (1968)] G.ALEXANDER, A.SHAPIRA, E.SIMOPOULOU, G.YEKUTIELI (MEIZMANN INST. OF SCI., REMOVOTH, ISRAEL)

ABSTRACT NEUTRAL STRANGE PARTICLE PRODUCTION IN PP COLLISIONS AT 6.92 GEV/C HAS BEEN STUDIED IN THE BO IN. HBC AT BNL. PARTIAL CROSS-SECTIONS FOR THE DIFFERENT CHANNELS ARE GIVEN. NO EVIDENCE FOR HYPERON-NUCLEON RESONANCES HAS BEEN OBSERVED. STRONG PRODUCTION OF N+11236) AND Y+11385) HAS BEEN SEEN IN THE FOUR- AND FIVE-BODY FINAL STATES, WHICH HAS BEEN ANALYICO IN TERMS OF & (NE-FION-EXCHANGE MECHANISM.

CITATIONS PHYS. REV. LETTERS 13, 355A (1964), PHYS. REV. 154, 1284 (1967), PHYS. REV. 147, 922 (1966), AND NUOVO CIMENTO 24, 453 (1962).

ARTICLE READ BY OCETTE BENARY IN 1/65, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 6.92 GEV/C.

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THIS EXPERIMENT USES THE B.N.L. BO IN. (H) BUBBLE CHAMBER. A TOTAL OF 64000 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION DELTA(1238) Y+(1385) MASS SPECTRUM HODELS ANGULAR DISTRIBUTION STRANGE PARTICLES

ITABLE 11

REALTIÙN	MICRO-BARNS	NO. EVENTS
ROTON PRCTON +		
LAMBOA PROTON K+	43.3 +- 8.0	29.6
SIGMAD PROTON K+	28.9 6.6	19.1
SIGMA+ PROTON KO	20.2 7.4	7.4
PRUTÚN PROTON KOBAR KO	8.2 3.6	5.2
NEUTRON PROTON KOBAR K+	28.3 8.5	11.0
SIGMAD PROTON KO PI+	54.3 12.1	20.2
SIGMA+ NEUTRON KO PI+	5.3 3.6	2.1
SIGMA+ PROTON KO PIO	10.6 5.3	4.2
LAMBDA NEUTRON K+ PI+	78.2 10.6	54.2
LAMBOA PROTON KO PI+	89.8 10.1	78.3
LAMBDA PROTON K+ PIO	74.1 10.4	50.7
NEUTRON PROTON KOBAR KO PI+	15.7 10.8	2.1
PROTEN PROTON KOBAR K+ PI-	16.0 6.4	6.3
SIGMA+ PROTON KO PI+ PI-	10.5 5.1	4.2
SIGMA- PROTON KO PI+ PI+	8.3 4.7	3.1
SIGMAD PROTON K+ PI+ PI-	13.7 4.3	10.2
LAMBDA PROTON KO PI+ PIO	39.6 12.8	9.5
LAMBDA NEUTRON KO PI+ PI+	29.6 10.9	7.4
LAFBOA PROTON K+ PI+ PI-	28.1 6.4	19.2
NEUTRON PROTON KOBAR K+ PI+ PI-	5.4 3.8	2.1
PROTON PROTON KO K- PI+ PIO	2.6 2.5	1.1
LANGDA PROTON KO PI+ PI+ PI-	6.2 2.6	5.6
LAMBDA PROTON K+ PI+ PI- PIO	14.2 4,3	10.9
LAMBCA NEUTRON K+ PI+ PI+ PI-	10.1 3.5	8.4
SIGMA+ NEUTRON KO PI+ PI+ PI-	2.6 2.5	1.1
SIGMAD PROTON KO PI+ PI+ PI-	1.3 1.8	.5

37 PROTON-PROTON DIFFERENTIAL CRCSS SECTION FROM 600 TO 1800 MEV/C. (PRINCETON-PENN ACCELERATOR PPAR-11 (1969))	
B.A.RYAN, A.KANOFSKY (LEFIGH UNIVERSITY, BETHLEMEN, PA., USA) T.J.DEVLIN, R.E.MISCHKE, P.F.SHEPARO (PRINCETON UNIV., PRINCETGN, N. J., USA)	
ABSTRACT PROION-PROION ELASTIC DIFFERENTIAL CROSS SECTIONS HAVE BEEN MEASURED IN THE 34 DEG. BEAM LINE DF THE 3-GEV PRINCETON-PRONSVLVANIA ACCELEPATOP FOR INCIDENT LAB MOMENTA OF 600 TO 1800 MEV/C AND CENTER-OF-MASS ANGLES OF 5 DE TO 90 DEG. THE MOMENTA ET THE PROIOS INCIDENT ON A LIQUID-MYDROGEN TARGET WERE MEASURED BY INK-OF-FLIGHT TECHNIQUES. THE MOMENTA AND SCATTERING ANGLES OF THE RECOIL PRCTONS WERE MEASURED BY A SPECTROMETER CONSISTING OF SETS OF MAONETOSTRICTIVE WIRE SPARK CHAMBERS PLACED AT THE ENTRANCE AND EXIT OF AN ANALYING MACHTE. A KINEMATICAL RECONSTRUCTION WAS PERFORMED FOR EACH EVENT BY AN ON-LINE POP-T COMPUTER WHICH ALSO RECORDED THE RAW DATA AND NONITORED VARIOUS ASPECTS OF THE EXPREMIENTIAL EQUIPMENT. A NORE DETAILED CFF-LIME ANALYIS MACHTED IN NORMALIZED DIFFERENTIAL CROSS SECTIONS. THE DIFFERENTIAL CROSS SECTIONS WERE COMPARED WITH SIMPLE MODELS FOR PP SCATTERING MH PROVED TO BE INADEQUATE C EXPLAIN MANY OF THE EXPRINENTAL DETAILS.	G. TWC
CITATIONS REV. MOD. PHYS. 30, 364 (1958), ATOMIC ENERGY RES. ESTAB., MARWELL, REPORT 135 (1961), ATOMIC ENERGY RES. ESTAB., MARWELL, REPORT 149 (1966), PHYS. REV. 169, 1149 (1968), NUOVO CIMENTO 494, 261 (1967), PROGR. THEORET. PHYS. (KVO 31 615 (1964), DUBNA CONFERENCE 24 (1964), ANNALS OF PHYSICS 10, 100 (1960), PHYS. REV. 72, 1009 (1947), SLAC 66 (PHYS. REV. 130, 1571 (1963), NUOVO CIMENTO 174, 190 (1968), PHYS. REV. LETTERS 7, 394 (1561), PHYS. REV. FITTERS 8 41 (1962), NUOVO CIMENTO 14, 951 (1959), NUOVO CIMENTO 16, 947 (1960), CERN 67-16 (1967), PHYS. REV. 163, 1603 (19 NUCLEAR INSTRUMENTS AND PETHODS 4-, 197 (1967), PHYS. REV. 146, 1315 (1966), PRINCETON-PENN ACCELERATOR PPAR-3 (15 PRINCETUN-PENN ACCELERATOR PPA0279-0 (1966), PRINCETON-PENN ACCELERATOR PPAR-10 (1969). PHYS. REV. 120, 2230 (1960) JETP 23 52 (1966), PHYS. LETTERS 12, 275 (1964), DUBNA CONFERENCE 61 (1964), PHYS. LETTERS 8, 285 (1964), PHYS. REV LETTCRS 15, 45 (1965), ADD PHYS. REV. 132, 1252 (1963).	TO) 1966) 67) 68) 1.
ARTICLE READ BY DDETTE BENARY IN 12/69, AND VERIFIED BY LEROY PRICE.	
BEAM IS PRCTON ON PROTON FROM .6 TO 1.8 GEV/C.	
THIS EXPERIMENT USES SPARK CHAMBERS.	
KEY MORDS + CIFFERENTIAL CROSS SECTION FITS MODELS	
COMPUUNU KEY WORDS - ' FITS DIFFERENTIAL CROSS SECTION	
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ELASIIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE 111]	
CATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .600 TO .699 GEV/C.	
(GEV/C)++2 KD/(GEV/C)++2 (1)	
.050 .099 122.5 ↔ 7.5	
.100 .149 95.4 8.3 .150 .199 128.3 6.7	
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T IS THE NOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (DUTGDING PRUTON).	
111 PLUS POSSIBLE SYSTEMATIC ERROR OF +4 PER CENT.	

ELASTIC DIFFERENTIAL CRCSS SECTICN FCR PROTON PRGTON. (TABLE 1V) DATA IS AVERAGED OVER LABORATORY BEAM NOMENTUM FROM .800 TO .899 GEV/C. D-SIGMA/D-T #B/(GEV/C)++2 [1] -T (GEV/C)**2 MIN M .C5C .0 100 .1 .150 .1 .20C .2 .250 .2 *2 .099 .149 .199 .249 .299 89.5 +- 4.0 8C.7 4.5 76.6 3.2 84.3 3.7 81.8 4.9 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). LET PLUS POSSIBLE SYSTEPATIC COROP OF +- .6 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. [TABLE V] DATA IS AVERAGED OVER LARCHATORY BEAM MOMENTUM FROM .900 TO .999 GEV/C. -T (GEV/C)**2 MIN MAX (C5C .099 .100 .149 .150 .199 .200 .249 .250 .299 .300 .349 D-SIGMA/C-T #B/(GEV/C1++2 [1] PIN .C5C .100 76.1 +- 3.8 67.8 5.3 71.2 4.2 63.9 3.5 66.6 2.8 66.3 3.2 .150 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 1.2 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE VI] DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.000 TO 1.099 GEV/C. D-SIGMA/D-T MB/(GEV/C)**2 [1] -T (GEV/C)**2 MIN # .050 .0 .100 .1 .150 .1 .200 .2 .250 .2 .300 .3 .350 .3 .400 .4 MAX .099 .149 .199 .249 .299 .349 .399 .449 58.1 +- 2.9 63.6 3.3 56.5 3.5 58.6 3.7 54.4 2.4 46.5 2.3 49.5 2.6 50.9 3.0 T IS THE MOMENTUM TRANSFER BETWEEN THE [INCCMING PROTON] AND THE [OUTGOING PROTON]. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2.1 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE VII] DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.100 TO 1.199 GEV/C. -T IGEV/C)**2 PIN MAX .050 .099 .100 .149 .150 .199 .250 .249 .250 .249 .300 .349 .400 .449 .500 .499 .500 .349 D-SIGNA/D-T MD/(GEV/C)++2 (1) 53.3 +- 2.8 52.7 2.0 43.7 2.8 45.1 3.6 46.1 2.5 41.4 2.1 36.3 2.0 33.6 2.0 40.4 2.4 50.9 2.9 T IS THE FOMENTUM TRANSFER BETWEEN THE LINCCMING PROTONI AND THE (OUTGOING PROTON). (1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2.3 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. (TABLE VIII) DATA IS AVERAGED OVER LABORATORY BEAN NOMENTUM FROM 1.200 TO 1.299 GEV/C. D-SIGMA/D-T MB/(CEV/C)**2 [1] -T KIN HAX -C50 .099 -100 .149 -150 .199 -200 .249 -250 .299 -350 .399 -400 .449 -550 .549 -550 .549 -550 .549 . T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE COUTGOING PROTONI. (1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2.4 PER CENT.

ELASTIC CIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1X)

DATA IS AVERAGED OVER LARGRATORY BEAM MCMENTUM FROM 1.300 TO 1.399 GEV/C.

-1		D-SIGMA/D-T	
(GEV/C	1++2	MB/(GEV/C)++2 [1]	
PIN	MAX		
.C5C	.099	80.6 +- 3.9	
• 100	.149	63.8 3.7	
.150	.199	46.6 3.2	
.200	.249	38.6 3.2	
.250	.299	40.8 3.7	
.300	.349	28.0 4.1	
.350	.399	23.0 1.7	
.400	.449	18.8 1.5	
.45C	.499	15.3 1.4	
.500	.549	15.1 1.4	
.550	.599	13.5 1.4	
.600	.649	14.0 1.5	
.650	.699	11.8 1.4 .	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE INITADING PROTON).

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11] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 2.8 PER CENT.

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE X]

DATA IS AVERAGED OVER LABCRATORY BEAP MCMENTUM FROM 1.400 TO 1.499 GEV/C.

-1	ſ	0-516#A/C-T
(GEV/O	:1**2	MB/(GEV/C)++2 (1)
MIN	MAX	
. C5C	.099	89.1 +- 5.0
.100	.149	68.5 4.3
.150	.199	54.6 4.0
.200	.249	42.7 3.6
.250	.299	32.1 3.6
.300	.349	22.6 3.3
.350	.399	19.8 4.5
.400	.449	19.3 1.7
.450	.499	16.4 1.5
.500	.549	12.7 1.4
.550	.599	10.5 1.3
.600	.649	8.5 1.2
.650	.699	10.4 1.4
.700	.749	5.5 1-1

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

(1) PLUS POSSIBLE SYSTEMATIC EFROR OF +- 2.5 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE XI]

CATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.500 TO 1.599 GEV/C.

-1		D- \$1 GM#	10-T	
(GEV/C]**2	MB/IGEV/	() **2 []	1
1111	州 山 A			
.050	.099	93.5 +-	5.5	
.100	.133	ف ذر	4.9	
.200	. 299	31.6	3.1	
.300	.399	19.3	2.9	
- 400	.499	14.0	1.3	
. 500	.599	8.8	1.1	
.600	.699	7.0	1.1	
.700	.799	ů.8	1.1	
.000	. 899	1.1	.9	
. 900	4 3 5 1	Ú.U	1.1	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE COUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 1.4 PER CENT.

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ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE XII)

DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.600 TO 1.609 GEV/C.

D-SIGMA/D-T
MB/(GEV/C)**2 [1]
93.8 +- 6.2
58.5 6.1
28.8 4.7
13.7 3.5
8.3 1.2
5.6 1.3
4.0 i.Ú
4.6 .9
5.6 1.1

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LUUIGDING PROTONI.

[1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 1.1 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE XIII] DATA IS AVERAGED EVER LAEGRATORY BEAM MOMENTUM FROM 1.700 TO 1.799 GEV/C. D-SIGMA/D-T MB/(GEV/C)++2 [1] (GEV/C) **2 (GEV MIN .C50 .100 .200 .300 .500 MAX .099 .199 .299 .399 .599 98.5 +- 9.1 46.C 8.5 27.2 8.7 16.9 7.7 6.8 1.3 6.2 1.2 6.5 1.3 4.8 1.5 5.0 1.6 .699 .799 .899 .999 .600 .800 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LOUTGOING PROTONI. [11] PLUS POSSIBLE SYSTEMATIC ERROR OF += 1.1 PER CENT. FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE 14] DATA IS FIT OVER LABCRATCRY BEAP MOMENTUM FROM .800 TO .899 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-8T+CT++2] WHERE D-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. I IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (CUTGOING PROTON). FITTED VALUE A = 87.1 +- 5.1 B = -.96 +- .55 C = 2.91 +- 1.81 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 14] DATA IS FIT GVER LABCRATCRY BEAM MOMENTUM FROM .900 TO .999 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-BT+CT**2] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTON). FITTED VALUES ∆ = 78.8 +- 4.7 B = -1.17 +- .57 C = 1.85 +- 1.69 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 14] DATA IS FIT CVER LABORATORY BEAF NGMENTUM FROM 1.000 TO 1.099 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-BT+CT**2] WHERE N-SIGMA/D-T 15 IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE Lincoming Proton) and the Loutgoing Prulum). FITTED VALUES FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 14] DATA IS FIT OVER LABGRATORY BEAP MOMENTUM FROM 1.100 TO 1.199 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-BT+CT**2] WHERE O-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCUMING PRUTUNI AND THE (OUTDOIND PROTONI. FITTED VALUES A = 60.4 + 3.4 B = -2.01 + .47 C = 2.10 + .95FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. **ITABLE 141** DATA IS FIT OVER LABORATORY BEAP PCMENTUM FROM 1.200 TO 1.299 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-BT+CT**2] WHERE D-SIGMA/D-T IS IN M8/IGEV/C)**2 AND -T IS IN IGEV/CJ**2. T IS THE MOMENTUM TRANSFER BETWEEN INE [Incoming proton] and the Ioutgoing Proton]. FITTED VALUES A = 79.6 +- 4.7 B = -4.38 +- .44 C = 3.96 +- .72

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FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                                                           [TABLE 14]
                DATA IS FIT EVER LABERATORY BEAP NOMENTUM FROM 1.300 TO 1.399 GEV/C.
FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-BT+CT**2]
                            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE
(INCOMING PROTON) AND THE (OUTGOING PROTON).
                FITTED VALUES
                            A = 107.4 +- 5.8
B = -5.76 +- .41
C = 3.68 +- .69
              FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                                                            [TABLE 14]
                DATA 15 FIT OVER LABCRATCRY BEAP MOMENTUM FROM 1.400 TO 1.499 GEV/C.
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-BT+CT**2]
                            WHERE D-SIGNA/D-T IS IN MB/IGEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE NOMENTUM TRANSFER BETWEEN THE
LINCOMING PROTON) AND THE LOUTGOING PROTON1.
                FITTED VALUES
                            _____
        FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                                                                           [TABLE 14]
                DATA 13 111 UVER LABURAIURY BEAP HUMENTUM FROM L.500 TO 1.599 GEV/C.
Fitted Formula 15 D-Sigma/D-T = A+Exp[-BT+CT++2]
                           WHERE D-SIGMA/D-T IS IN MB/IGEV/CI++2 AND -T IS IN (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE LOUTGOING PROTON].
                FITTED VALUES
                            A = 120.2 *= 5.6
B = -6.51 +- .34
C = 3.56 *- .39
                                                                                                       .
              FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                                                          [TABLE 14]
                DATA IS FIT DVER LABORATGRY BEAM MOMENTUM FRCM 1.600 TO 1.699 GEV/C.
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-BT+CT**2]
                            WHERE D-SIGMA/D-T IS IN HO/(GEV/C)++2 ANU -1 IS IN (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LOUTGOING PROTONI.
                FITTED VALUES
                           ∆ = 137.0 +- 11.7
B = -7.20 +- .49
C = 3.80 +- .57
                   FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PODTON.
                                                                                                            (TAĐLÊ 14)
                DATA IS PIT ÜVER LABURATORY BEAM MOMENTUM FROM 1.700 TO 1.700 GEV/C.
FITTED FORMULA 15 U-SIGKA/D-T = A*EXP[-87+CT**2]
                           INICAC O SIGNA/D-T IS IN MB/LUEV/C)++2 AND -T IS IN (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONJ.
                FITTED VALUES
                           A = 140.9 + -15.7

B = -7.66 + -.59

C = 4.39 + -.72
        EVIDENCE FOR A N+(1450) IN PP COLLESIONS AT 10 GEV/G+
                                                                                            ENUOVO CIMENTU 504. 1000 (1967))
38
        S.P.ALMEIDA,J.G.RUSHBROOKE,J.F.SCHARENGUIVEL ICAVENDISH LAB., CAMB. UNIV., CAMBRIDGE, ENGLAND)
M.BEHRENS,V.BLOBEL, H.C.DEHNE,J.DIA1,R.SCHAFER,W.P.SWANSON (UNIV. HAMBURG, HAMBURG, GERMANY)
I.BORECKA,G.KNIES [DEUTSCHES ELEKTRONFN=SYNFW , WAMOURC, GERMANY]
        CLOSELY RELATED REFERENCES
DATA SUPERSEDED BY PHYS. REV. 174, 1638 (1968).
        CERN TH 705 (1966), UCRL 8030 JAN. (1967), PHYS. LETTERS 8, 134 (1964), PHYS. LETTERS 8, 137 (1964), PHYS. REV.

LETTERS 13, 555 (1964), PHYS. REV. LETTERS 14, 1043 (1965), PHYS. LETTERS 18, 167 (1965), NUOVO CIMENTO 35, 1057 (1965),

PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 17, 709 (1960), PHYS. LETTERS 23, 386 (1966), NUOVO CIMENTO 24,

435 (1962), NUOVO CIMENTO 39, 169 (1965), NUOVO CIMENTO 27, 1450 (1963), NUOVO CIMENTO 30, 240 (1963), PHYS.

COMFERENCE 1 148 (1964), DESY 67/4 (1967), PHYS. REV. 150, 1292 (1966), PHYS. REV. LETTERS 7, 199 (1961), PHYS.

COMFERENCE 1 148 (1964), DESY 67/4 (1967), PHYS. REV. 150, 1292 (1966), PHYS. REV. LETTERS 7, 199 (1961), PHYS.

REV. 154, 1284 (1967), NUOVO CIMENTO 47A, 232 (1967), PHYS. LETTERS 7, 584 (1966), NUOVO CIMENTO 40, 839 (1965),

PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 47A, 232 (1967), PHYS. LETTERS 12, 76 (1964), AND PHYS. REV. LETTERS 16, 863

(1966), NUOVO CIMENTO 34, 1644 (1564), PHYS. LETTERS 16, 342 (1965), PHYS. LETTERS 12, 76 (1964), AND PHYS. REV. 139,

B1566 (1965).
        ARTICLE READ BY ODETTE BENAKY IN 9/67, AND VERIFIED BY LERGY PRICE.
        BEAM IS PROTON GN PROTON AT' 10.01 GEV/C.
        THIS EXPERIMENT USES THE SACLAY BI CM (H) BUBBLE CHAMBER. A TOTAL OF 80000 PICTURES ARE REPORTED ON.
        KEY WORDS - CROSS SECTION MASS SPECTRUM N+(1470)P11 HODELS
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(FROM PAGE 1001 AND PAGE 1005)

LABORATORY BEAM MOMENTUM = 10.01 +- .01 GEV/C.

(THIS DATA SHOULD NDT BE USED - MORE RECENT VALUES MAY BE FOUND IN ALMEIDA ET AL., PHYS. REV. 174, 1638 (1968)]

REACTION	MILL I-BARNS	NO. EVENTS
PROTON PRCTÓN +		
PROTON PROTON PI+ PI-	2.40 +20	1133
PROTON NEUTRON PI+	3.70 .40	657
PRCTON N+ (1470)+	.18 .04	
N+(1470)+ + PROTON PI+ PI- [1]		
PROTON N*(1470)+	.18 .12	
N#(1470)+ . NEUTRON PI+ [2]		

(1) FITTED FOR MASS AND/CR WIDTH - I MASS = 1.450 GEV; WIDTH = -220 GEV), AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGRCUND. 121 FITED DISTRIBUTION WITH FIXED MASS AND WIDTH [MASS = 1.450 GEV; WIDTH = .220 GEV] AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGRCUND.

39 PRODUCTION OF THE NUCLEON ISOBARS 1236, 1410, 1518, AND 1688 MEY IN PROTON-PROTON COLLISIONS AT 2.85, 4.55, 6.06, AND 7.88 GEV/C. IPHYS. REV. LETTERS 17, 789 (1966)1

I.M.BLAIR,A.E.TAYLOR LATOMIC EN. RES. ESTAB., HARMELL, BERKS., ENCLANDI M.S.CHAPMAN,P.I.F.KALMUS,J.LITT,P.C.MILLER,D.B.SCOTT,H.J.SHERMAN IOUEEN MARY COLLEGE, LONDON, ENGLANDI A.SSTBURY,T.G.WALKER (AUTHERFORE MIGH EN. LAB., C.HILTCN,OID.BERK.ENGLANDI

RACT MOMENTUM SPECTRA OF PROTONS SCATTERED INELASTICALLY IN PROTON-PROTON CCLLISIONS WERE OBTAINED IN AN EXTEPNAL BEAM AT NINROD USING INCIDENT PROTON MOMENTA OF 2.85, 4.95, 6.06, AND 7.88 GEV/C AND VARIOUS SCATTERING ANGLES IN THE RANGE 22 TO 144 NRAD. THERE IS EVIDENCE FOR THE PRODUCTION OF THE 1410 PEV ISOBAR AT SHALL ANGLES. THE NELL-KNOWN ISOBARS OF MASS VALUES 1236, 1518, ANC 1688 MEV ARE ALSO SEEN. THE DIFFERENTIAL CROSS SECTIONS ARE PRESENTED FOR THE PRODUCTION OF THESE ISOBAPS. THEY ARE ANALYZED IN TERMS OF THE USUAL VARIABLES S AND T. FITS TO THE ORSERVED MOMENTUM SPECTRA INDICATE FOR THE N+(1410) A MASS OF 1410 +- 15 MEV AND A WIDTH OF 125 +- 20 MEV. ABSTRACT

CLOSELY RELATED REFERENCES DATA SUPERSEDED BY NUDVO CIMENTO 63A, 529 (1969).

ADDITIONAL CITATIONS PHYS. REV. LETTERS 4, 611 (1960), PHYS. REV. 128, 1823 (1962), PHYS. REV. LETTERS 7, 450 (1961), PHYS. LETTERS 8, 134 (1964), PHYS. LETTERS 18, 167 (1965), NUDVO CIMENTO 35, 1052 (1965), PHYS. REV. LETTERS 16, 855 (1966), REV. MDD. PHYS. 37, 633 (1965), PHYS. LETTERS 8, 137 (1964), PHYS. REV. LETTERS 13, 555 (1964), PHYS. REV. LETTERS 14, 1043 (1965), PHYS. REV. LETTERS 12, 340 (1964), PHYS. REV. 138, B190 (1965), PHYS. LETTERS 12, 76 (1964), PHYS. LETTERS 11, 339 (1964), AND PHYS. REV. LETTERS 14, 881 (1965).

APTICLE PEAC BY ONFITE BENARY IN 5/67, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON PROTON FROM 2.85 TO 7.88 GEV/C.

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 NO DATA PUNCHED FOR THIS ARTICLE BECAUSE SAME DATA ARE MORE RECENTLY REPORTED IN NC 63A, 529(1969)

KEY WORDS . CROSS SECTION

DISCONTINUOUS BEHAVIOUR IN LARGE ANGLE PROTON-PROTON ELASTIC SCATTERING AT HIGH ENERGIES. (1667)] 40 [PHYS. LETTERS 258, 156

J.V.ALLABY,G.COCCONI,A.N.CIDDENS,A.KLOVNING,G.MATTHIAE,E.J.SACHARIDIS, A.M.WETHERELL LEUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLANDJ

ABSTRACT MEASUREMENTS OF ELASTIC PROTON-PROTON DIFFERENTIAL CROSS SECTIONS FOR ANGLES BETWEEN 65 DEG. AND 90 DEG. C.W.S. Have been made at 8, 9, 10, 11, 14, 15 and 21 GeV/C. The Shape of the angular distribution is found to change Suddenly between 8 and 11 GeV/C. An interpretation of this discontinuous behaviour in terms of the reactive effects of baryon-antibaryon pair production is proposed.

CLOSELY RELATED REFERENCES This Article Supersedes phys. Letters 23, 389 (1966). Part of This Article Superseded by CERN 68-7 580, and Cern Hadron Conference 1 580 (1968).

ACCITIONAL CIIAIIUNS CERN TH 406 (1964), ANNUAL REV. OF NUCLEAR SCIENCE 11, 183 (1966), UCRL 16275, UCRL 11441, PHYS. ŘĚV. 128, 2392 (1962), ANNUAL REV. OF NUCLEAR SCIENCE 13, 261 (1963), PHYS. LETTERS 13, 190 (1964), PHYS. REV. 138, B165 (1963), UCRL 17257, PHYS. REV. LETTERS 17, 1105 (1966), PHYS. LETTERS 8, 80 (1964), AND PHYS. REV. LETTERS 12, 257 (1964).

ARTICLE READ BY ODETTE BENARY IN 10/67, AND VERIFIED BY LERCY PRICE.

BEAM IS PROTON ON PROTON FROM 8.1 TC 21.3 GEV/C.

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 AT 8, 9, AND 10 GEV/C, CH2 TARGETS WERE USED.

KEY WORDS + DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORCS . FITS DIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. TABLE 11

LABORATORY BEAM MOMENTUM = 8.1 GEV/C.

[THIS DATA SHOULD NOT RE USED - MORE RECENT VALUES MAY BE FOUND IN ALLABY, ET AL., CERN 68-7 580 (1968)]

THETA	D-SIGMA/D-ONEGA
DEGREES	U8/SR [1]
68.8	.543 +016
72.2	.455 .020
76.2	.323 .010
02.2	.714 .007

THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 7.14 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUN - 9.1 GEV/C. (THIS DATA SHOULD NOT BE USED - MCRE RECENT VALUES MAY BE FOUND IN ALLABY, ET AL., CERN 68-7 580 (1968)] THETA DEGREES 68.1 74.2 82.2 C-SIGYA/C-GYEGA UB/SR I11 .188 +- .005 .118 .C03 .094 .C03 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. (1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7.14 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 10. GEV/C. (THIS DATA SHOULD NOT BE USEC - MORE RECENT VALUES MAY BE FOUND IN ALLABY, ET AL., CERN 68-7 580 (1968)] C-SIGMA/C-OMEGA UB/SR [1] .1062 +- .0017 .0791 .0017 .0589 .0015 .0494 .0011 THETA DEGREES 67. 70. 75. 83. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. - [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7.14 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM + 11. GEV/C. [THIS DATA SHOULD NOT BE USEC - MORE RECENT VALUES MAY BE FOUND IN ALLABY, ET AL., CERN 68-7 580 (1968)} THETA Degreșeș 73. 78. 86. D-SIGNA/C-OMEGA UE/SR [1] .0360 +- .0C09 .0296 .0C07 .0265 .CC09 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. (1) PLUS POSSIBLE SYSTEPATIC ERROR OF +- 7.14 PER GENT. ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE 1] CHOOPPTORY DEAR HENCHTUN - 14429 DEVIC. (THESE VALUES MANE DES!) CORRECTED ADDONOTHO TO LEAN DOT! VUL. 1, PAGE 580. 3 C-SIGMA/D-DMEGA NANGBARNS/SR [1] THETA DEGREES 67. 71. 77. 8.11 ****** .25 6.27 .20 4.47 .15 3.54 .10 4.47 .15 90, THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 7.14 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON ITABLE 11 LABORATORY BEAF HOMENIUF = 16.9 GEV/C. [THIS DATA REPLACES VALUES GIVEN EARLIER IN ALLABY ET AL., PHYS. LETTERS 23, 389 (1966)] (THESE VALUES HAVE BEEN CORRECTED ACCORDING TO CERN 68-7 VOL.1, PAGE 580.) D-SIGHA/D-CPEGA NAKCBARNS/SR [1] 2.15 +- .04 1.65 .C6 1.53 .C5 1.29 .C6 1.10 .03 .98 .04 THETA DEGREES 67. 70. 72. 75. 77. 80. 82. 85. .05 .04 .03 .04 .03 .04 .05 .92 . 80 50. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7.14 PER CENT.

	ELASTIC CIFFERENTIAL	CRGSS SECTION FOR PROTON	PROTON. [TABLE	11				
	LABORATORY BEAP	MOMENTUM = 19.3 GEV/C.						
	(THESE VALUES	HAVE BEEN CORRECTED ACCORD	ING TO CERN 68-7 VOL.	1, PAGE 58	BC. /			
	THETA DEGREES	D-SIGMA/C-OMEGA NANCBARNS/SR [1]						
	64 . 69 .	.723 +C3C .419 .028						
	75. 90.	.25C .C21						
	THETA IS THE AN	IGLE THAT THE PROTON MAKES	WITH THE BEAM IN THE G	RAND C.M.				
	[1] PLUS POSSI	BLE SYSTEPATIC ERROR OF +-	7.14 PER CENT.					
						-		
	ELASTIC DIFFERENTIAL	CRESS SECTION FOR PROTON	PROTON. [TABLE	11				
	LABORATORY BEAM	MOMENTUM = 21.3 GEV/C.						
	(THESE VALUES HAVE BEEN CORRECTED ACCORDING TO CEPN 68-7 VOL. 1, PAGE 580.)							
	THETA	C-SIGMA/D-OMEGA						
	DEGREES 66.	NANCEARNS/SR [1] .231 +C19			,			
	70. 75.	.142 .012						
	87.	.064 .009						
	THETA IS THE AN	GLE THAT THE PROTON MAKES	WITH THE BEAM IN THE G	PANC C.M.				
	[1] PLUS POSSI	BLE SYSTEPATIC ERROR OF +-	7.14 PER CENT.					
41	ELASTIC SCATTERING A	NC SINGLE-PION PRODUCTION	IN PROTON-PROTON INTER	ACTIONS AT	6.92 BEV/C. [PHYS. REV. 173, 1322	(1968)]		
	G.ALEXANDER,Z.CARMEL A.FRIDMAN,G.MAURER,J	.Y.EISENBERG, E.E.RONAT, A.S. .OUGET, C.ZECH, P.CUER [CENT	HAPIRA,G.YEKUTIELI [WE Re des res. Nucleaires	IZMANN INS , STRASBGU	ST. GF SCI., REHOVDTH, ISRAEL) JRG, FRANCE]			
	ABSTRACT ELASTIC HYDROGEN BUBBLE N#(123B)++ WITH SINGLE-PION PRO	SCATTERING AND SINGLE-PIC CHAMBER. PARTIAL CROSS SE SIGMA = 1.9 +- 0.3 MB IS DUCTION CAN BE EXPLAINED A	N PRODUCTION IN PP COLL Ctions for the differed Analyzeu and is in Agri S due mainly to tho chi	LISIONS AT NT FINAL S EEMENT WIT ANNELS	I 6.92 BEV/C WERE STUDIED IN THE ANL 80-I STATES ARE GIVEN. THE REACTION PP NEUTRO IN THE MODIFIED CNE-PION EXCHANGE MODEL. (a) PP-New(1233)+> NEUTRON AND (8) PP-PIN	N . N		
	PI+) OR PP+P(P	PIO), WHERE THE (N PI+) AND	D (P PIO) PAIRS ARE IN	AN I = 1/	2 STATE.			
	CLOSELY RELATED REFE SEE ALSO NUDVO	RENCES CIMENTO 53, 455 (1968).						
	ADDITIONAL CITATIONS PHYS. REV. 154, NUOVO CIMENTO 3 125, 2082 (1962	1284 (1967), PHYS. REV. 1 3, 305 (1964), PHYS. REV.), PHYS. REV. 162, 1320 (1)	46, 980 (1966), PHYS. 4 151, 1306 (1966), UCRL 967), NUQVO CIMENTG 49/	REV. 144, 18010 (19 A, 475 (19	1122 (1966), PHYS. REV. 160, 1410 (1967) 367), PHYS. REV. 168, 1773 (1968), PHYS. 367), NUOVO CIMENTO 534, 232 (1968), PHYS	REV. . REV.		
		TE SENARY IN 1770 AND VED	5150 HX 1500X 00165					
		POTON AT 4 C2 C54/C	IFIED OF CERDI PRICE.					
	BEAR 13 FROTUN UN F	THE R H I DO IN ANY RUD		05 (1000				
	THIS EXPERIMENT USES	THE E.N.L. 80 IN. (H) 608	SEE CHAMBER. A TOTAL	L UF 64000	DICTORES ARE REPORTED UN.			
	MODELS	DENSITY MATRIX CALITZ	PLOT REAL (AMPLITE	JDE 1/ IMAGI	NARY (AMPLITUDE) DELTA(1238)			
	COMPOUND KEY WORDS +	FITS CIFFERENTIAL CROSS	SECTION					
						-		
		(FR)	DM PAGE 1322, TABLE 1,	AND PAGE	13261			
1	LABORATORY BEAF HOME	NTUM = 6.920 +075 GEV	/c.					
	REACTION		MILLI-A	BARNS	NO. EVENTS			
PROTON	PROTON - TOTAL		42.6 *-	- 1.3	20000			
	ELASTIC PROTON NEUTRON PI	•	11.4	.5 .4				
	PROTEN PROTON PIC	8)++	2.0	•2 •3				
	DELTA(1238)+	+ • PROTOK PI+ [1]	28-4	. 3	· ·			

(1) FITTED DISTRIBUTION WITH FIXED PASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

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 (GEV/C)+	*2 MAX	MB/(GEV/C)++2 (1 NO. EVENTS
.01	-02	14.0 +- 2.6	28.0
.02	.03	40.0 4.5	80.0
04	.05	68.0 5.8	136.0
.05	.06	50.0 5.0	100.0
.07	-07	5.2 48.0 4.9	96.0
08	.09	43.0 4.6	86.0
09	.10	50.0 5.0	100.0
11	•11	31.0 3.9	80.0 62.0
12	.13	24.0 3.5	48.0
13 .	.14	29.0 3.8	58.0
15	.16	18.0 3.0	36.0
16	-17	28.C 3.7	56.0
17	-18	20.0 3.7	54.U 40.0
19	.20	12.0 2.4	24.C
20	.21	15.0 2.7	30.0 26.0
22	.23	14.0 2.6	28.0
23	- 24	13.0 2.5	26.0
24	.25	6.0 1.7	12.0
26	. 27	11.0 2.1	22.0
27	.28	12.0 2.4	24.0
28	- 29	17.0 2.9	21.0 34_0
30	.31	13.5 2.6	27.0
31	- 32	14.0 2.6	28.0
33	. 3 3	8.0 2.0	20-0
34	.35	5.0 1.0	10.0
35	•36 37	4.0 1.4	R.Q
37	.38	5.0 1.6	10.0
38	.39	2.7 1.7	5.4
יג 40	-40 -41	2.0 1.0	₩.0 Ú.0
41	.42	6.0 1.7	12.0
42	-43	2.0 1.0	4.0
43 66	-44	4.5 L.5 5.0 L.6	9.0
45	.46	4.5 1.5	9.0
46	-47	4.5 1.5	9.0
41 69	.48	1.0 .7	2.0
50	.51	1.0 .7	2.0
51	- 52	.5 .5	1.0
53	.54	.5 .5	1.0
54	.55	1.0 .7	2.0
55 94	.56	1.5 .9	3.0 7_ñ
57	.58	.5 .5	1.0
50	• ? ?	و. ز.۱	3.0
.60	.6U .61	.5 .5	· 3.0
61	. 62	1.5 .9	3.0
•			
1 33 1	HE HOMENTUR	IRANSFER BETWEEN T	E LINCUMING PROIDNI AND THE LOUTGOING PROTON).
[1] C	OUNTS WERE M	ULTIPLIED BY .5 TO	GET THESE. ERRORS ARE TAKEN AS PROPORTIONAL TO THE SQUARE-ROOT OF THE COUN
TC ELAS	TIC DIFFEREN	TIAL CRESS SECTION	FOR PROTON PROTON. (PAGE 1324)
LABORA	TORY BEAP MO	MENTUM = 6.920 +	.075 GEV/C.
DATA 1	S PIT OVER -	T FRUM .04 IU .12 Ton).	GEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND TH
PLITED	FORRULA 15	C-SIG#4/0-1	⇒ A*EXP(8[T])
	WHERE D-SI	GMA/D-T IS IN MB/(EV/C)**2 AND -T IS IN IGEV/C)**2.
FITTED	VALVES		
	A = 89.3	+- 6.7	
	0 - 1.1	,	
			•••••
TO	TIC 01000000		
IU ELAS	TIC UIFFEREN	ITAL LKUSS SECTION	FUR PRUIUN PRUIUN. [PAGE 1323]
LABORA	TORY BEAM MO	MENTUM = 6.920 +	.075 GEV/C.
DATA I	S FIT OVER -	T FROM .04 TO .50	GEV/C)*+2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND TH
FITTEO	FORMULA IS	D-SICHA/D-T	- A+EXP(B[T]+C[T++2])
	WHERE D-SI	GMA/D-T IS IN MB/(EV/C)**2 AND -T IS IN (GEV/C)**2.
	VALUC3		
FITTED			
F 1 T T E D	A a 04 A	+- 2.5	
F 1 T T E D	A = 94.C B = 9.03	+- 2.5 +15	
F1TTE0	A = 94.0 B = 9.03 C = 3.68	+- 2.5 +15 +60	
FITTEO	A = 94.C B = 9.03 C = 3.68	+- 2.5 +15 +6C	
F1TTED	A = 94.0 B = 9.03 C = 3.68	+- 2.5 +15 +6C	
F1TTEO	A = 94.0 B = 9.03 C = 3.68	+- 2.5 +15 +6C	

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ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON. LABORATORY BEAM MOMENTUM = 6.920 +- +C75 GEV/C.

• THIS DATA WAS READ FROM A GRAPH .

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[FIGURE 2]

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DIFFERENTIAL	CROSS	SECTION	FOR	PROTON	FROTON	•	DELT	Α (1238)++	NEU	TRON.	
					DELTA(12)	3814			PROTON	+19	[1]	

LABORATORY BEAM MOMENTUM = 6.520 +- .075 GEV/C. (BACKGROUND ESTIMATED TO BE <15 PER CENT.)

٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠	٠
•		t	н	I	s		0	A	τ	A		H	A	s		R	E	A	D		FI	R	0	۲		۵		G	R	4	ρ	н		•
•	•			•							•			•	•	•											•			٠				

•		
-1		D-SIGMA/D-T
(GEV/C	1**2	MB/(GEV/C)++2
MIN	MAX	
,000	.025	11.0
.025	.050	13.0
.050	.075	13.5
.075	.100	7.0
.100	.125	3.7
. 125	.150	4.7
.150	.175	. 1.7
175	200	4-0
200	-225	3-0
. 225	.250	1.4
250	.275	2.0
. 275	- 300	1.6
300	325	1 4
325	.350	
350	175	
375		1.0
	.400	•7
.400	• 425	
	.450	1.0
. 450	.475	• 2
. 415	.500	·
.500	.525	• 6
- 525	. 550	-4
.550	.575	•6
.575	.600	- 4

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (DELTA(1238)++1.

[1] COUNTED ALL EVENTS IN MASS BAND.

A BUBBLE-CHAMBER STUDY OF PROTON-PROTON COLLISIONS AT 4 GEV/C. 11. - MULTIPLE PION PRODUCTION. 175 (1968)] INUDVO CIMENTO 584.

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AGENT ABOUT 50,000 PICTURES WERE TAKEN IN THE 81 CM SACLAY MYDROGEN BUBBLE CHAMBER EXPOSED AT THE CERN PROTON-SYNCHROTRON TC A SEPARATED REAM DF 4 GEV/C INCIDENT MOMENTUM PROTONS. CROSS-SECTIONS FOR THE VARIOUS CHANNELS FOR MULTIPLE PION PRODUCTICN ARE REPORTED, AS WELL AS PRODUCTION CROSS-SECTIONS FOR BARYON AND BOSON RESONANCES, TAKING INTO ACCOUNT THE PERIPHERAL BEHAVIOUR OF THE INTERACTION IN THE EVALUATION OF THE BACKGOUND. ALL THE CHANNELS APPEAR TO BE DONINATED BY THE MAIL236 JISOBAR PRODUCTION, WHILE THE PRESENCE OF HIGHER ISDARS DOES NOT SEEN TO AFFECT APPRECIABLY THE GENERAL FEATURES OF THE DIFFERENT REACTIONS. THE CALL EVIDENCE AMONG THE BOSON RESONANCE SIS FOR ETA (SIGPARTET) = (0.04 +- 0.02) MBI AND DNEGA (SIGMAIGNEGA) = (0.08 +- 0.03) MBI. THERE IS NO STRONG EVIDENCE FOR THE I = 5/2 ISOBAR AROUND 1.58 GEV/C-SQUARED. FINALLY AN AMALYSIS OF REACTIONS PRODUCING MORE THAN ONE NEUTRAL PARTICLE HAS BEEN TRIED, ALLOWING AN ESTIMATE OF THE MEAN MULTIPLICITIES FOR BOTH CHARGEC AND UNCHARGED PIONS. ABSTRACT

CLGSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES SIENNA CONFERENCE 1 348 (1963). THIS ARTICLE SUPERSEDES PART OF PHYS. LETTERS 16, 75 (1965). CONTINUATION OF PREVICUS EXPERIMENT IN NUIVO CIMENTO 49A, 479 (1967).

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ADDITIONAL CITATIONS NUCVO CIMENTO 434, 1210 (1966), UCRL 8030 JAN. (1968), CERN 65-7 (1965), CERN 66-18 (1966), CERN TH 837 (1967), PHYS. REV. LETTERS 17, 884 (1966), PHYS. REV. 1388, 190 (1965), PHYS. REV. LETTERS 15, 468 (1965), NUDVO CIMENTO 554, 66 (1968), NUDVO CIMENTO 504, 1000 (1967), NUDVO CIMENTO 24, 453 (1962), CORAL GABLES COMFERENCE 89 (1965), PHYS. REV. LETTERS 15, 207 (1965), PHYS. LETTERS 21, 582 (1966), AND PHYS. REV. 154, 1254 (1967)

ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERUY PRICE.

BEAM IS PROTON ON PROTON AT 4 GEV/C.

THIS EXPERIMENT USES THE SACLAY BI CP (H) BUBBLE CHAMBER. A TOTAL OF 50000 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION DELTA(1238) ETA(548) OMEGA(783) FITS MASS SPECTRUM DALITZ PLOT MODELS 'N+(1688)' N+(1520)D13

COMPOUND KEY WORDS . FITS ANGULAR DISTRIBUTION

[TABLE 1]

LABCRATORY REAM MOMENTUM = 4. GEV/C.

REACTION	MILLI-BARNS	NO. EVENTS
PROTON PROTON +		
PROTON PROTON PI+ PI-	2.95 +15	1206
PROTON PROTON PI+ PI- PIO	1.10 .10	448
PROTON NEUTRON PI+ PI+ PI-	1.60 .10	636
PROTON NEUTRON PI+ HM≥1PIO	5.8Û .6Ŭ	905
PROTON PROTON FM22PIO	1.20 .30	203
NEUTRON NEUTRON PI+ PI+ MF20PI0	1.50 .30	254
4 PRONGS	7.50 .20	3066
6 PRONGS	.09 .02	46

-----CROSS SECTION FOR PROTON PROTON . PROTON NUCLEON RH0(765) PION. [PAGE 489] LABORATORY BEAM POMENTUM GEV/C .

v/c	MICRC-BARNS
4.	< 150.

(FIGURE 8)

[PAGE 490] LABORATORY BEAM MOMENTUM = 4. GEV/C. REACTION PROTON PROTON + PROTON PROTON ETA(548) ETA(548) + PI+PI-PIO [1] PROTON PROTON CMEGA(783) OUEFCATA31 + DI+PIO [2] MILLI-BARNS .04 +- .02 .08 .03 PI+ PI- PIO [2] OMEGA(783) (1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTEC) BACKGROUND.
(2) FITTED FOR MASS AND/OR WIDTH [MASS = .784 GEV; WIDTH = .014 GEV], AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGRCUNC. [PAGE 491] LABORATURY BEAM NUMENIUM = 4. GEV/C. REACTION PROTON PROTON + MILLI-BARNS NOTON +
DELTA(1238)++ N*(1520)C
DELTA(1238)++ PROTON PI+ [1]
N*(1520)0 + PRCTON PI- PI0 [1]
DELTA(1238)++ 'N*(1688)0'
DELTA(1238)++ PRCTON PI+ [1]
'N*(1688)0' + PRCTON FI- PI0 [1] .04 +- .04 .12 .07 (1) FITTED DISTRIBUTION WITH FIXED MASS AND WIOTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND. [PAGE 4931 LABORATORY BEAM MOMENTUM = 4. GEV/C. REACTION PROTON PROTON + MICRG-BARNS RCTON • DELTA(1238)++ DELTA(1238)- PI+ DELTA(1238)++ • PROTON PI+ [1] DFITA(1238)++ NEUTPON PI- [1] DELTA(1238)+0 NEUTRON PI+ PI-DELTA(1238)- PROTON PI+ PI+ DELTA(1238)- • NEUTRON PI- [1] DELTA(1238)- • NEUTRON PI- [1] 640. +- 160. < 30. < 100. (1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND. (TABLE 31 LABORATORY BEAM MOMENTUM . 4. GEV/C. REACTION MILLI-BARNS PROTON PI+ NEUTRON PIO PROTON PI+ NEUTRON PIO PIO 3.8 +- .3 43 ELASTIC PROTON-PROTON SCATTERING AT 5C DEG. AND STRUCTURE WITHIN THE PROTON (PHYS. REV. 159, 1138 (1967)) C.W.AKERLOF,R.H.HIEBER,A.D.KIRSCH (UNIV. OF PICHIGAN, ANN ARBOR, MICH., USA) K.W.EUNAPDS IUNIV. OF IONA. IOWA (ITY, IOMA, USA) L.G.RATNER (ARGONNE NAT. LAB., ARGONNE, ILL., USA) K.RUDDICK (UNIV. OF MINNESOTA, PINNEAPOLIS, FINN., USA) RACT THE CIFFERENTIAL CRCSS SECTION OF PROTON-PROTON ELASTIC SCATTERING AT 90 DEG. IN THE CENTER-OF-MASS SYSTEM MAS MEASURED AT LABORATORY MOMENTA RANGING FROM 5.0 TO 13.4 GEV/C. FIFTY-ONE MEASUREMENTS WERE MADE AT MOMENTUM INTERVALS OF 100 OR 200 MEV/C. THE EXTRACTED PROTON BEAM OF THE ZGS IMPINGED UPON A CH2 TARGET. THE TWO SCATTERED PROTONS WERE DETECTED BY THO SPECTROMETERS CONSISTING OF MAGNETS AND SCINTILATION COUNTER TELESCOPES IN COINCIDENCE. THE INCIDENT BEAM FLUX WAS MEASURED BY HAULUCHENICAL ANALYSIS OF THE CH2 TARGETS. THE EXPERIMENT SHOWED NO EVIDENCE FOR ANY SO, T=1 DIBARYON RESONANCES IN THE 3300 - 3200 MEY MASS RANGE. IT ALS NOT THE SCATTERING AGUIT TWE VALIDIT UF THE STATISLICAL MUDEL AND THE AND THE AND THE SCATTERING AMPLITUDE. THE MOST INTERESTING RESULT OF THE EXPERIMENT WAS AS PREASURED TO THE AND THE AND THE AND THE SCATTERING AMPLITUDE. THE MOST INTERESTING RESULT OF THE REPERIMENT WAS AS ARAP BREAK IN THE FILED-ANGLE CROSS SECTION. THIS MAY REFUTIORCE FOR THE EXISTENCE OF TWO INNER REGIONS OF THE PROTON WITH RADIT 0.51 +- .02 AND 0.34 +- .02 F. ABSTRACT TIONS
PMYS. REV. LETTERS 10, 376 (1963), PMYS. REV. LETTERS 10, 543 (1963), PMYS. REV. LETTERS 11, 425 (1963), PMYS. REV. LETTERS 11, 503 (1963), PMYS. REV. LETTERS 15, 309 (1965), PMYS. REV. LETTERS 11, 503 (1963), PMYS. REV. LETTERS 15, 313 (1965), PMYS. REV. LETTERS 11, 201 (1965), PMYS. REV. LETTERS 15, 313 (1965), PMYS. REV. LETTERS 12, 2125 (1963), PMYS. REV. LETTERS 15, 309 (1965), PMYS. REV. LETTERS 11, 201 (1965), PMYS. REV. LETTERS 15, 313 (1965), PMYS. REV. LETTERS 11, 201 (1965), PMYS. REV. LETTERS 15, 368 (1965), PMYS. REV. LETTERS 11, 201 (1965), PMYS. REV. LETTERS 15, 468 (1965), PMYS. REV. LETTERS 16, 1217 (1966), PMYS. REV. LETTERS 16, 1666), PMYS. REV. LETTERS 16, 1217 (1966), PMYS. REV. LETTERS 16, 363 (1966), PMYS. REV. LETTERS 16, 365 (1966), PMYS. REV. LETTERS 16, 1217 (1966), PMYS. REV. LETTERS 16, 365 (1966), PMYS. REV. LETTERS 16, 1217 (1966), PMYS. REV. LETTERS 16, 365 (1966), PMYS. REV. LETTERS 16, 325 (1965), PMYS. REV. LETTERS 16, 325 (1966), PMYS. REV. LETTERS 16, 325 (1966), PMYS. REV. LETTERS 16, 365 (1962), UCAR 16275 (1966), PMYS. REV. LETTERS 12, 1212 (1963), PMYS. REV. LETTERS 16, 1217 (1966), PMYS. REV. LETTERS 16, 1217 (1963), PMYS. REV. LETTERS 16, 1217 (1963), PMYS. REV. LETTERS 12, 200 (1964), PMYS. REV. 126, 2392 (1962), ANL LCA-7, ANL RU-3, ANL RU-5, AND RU-5, REV. LETTERS 17, 196 (1964), PMYS. REV. 135, B1263 (1964), PMYS. REV. 135, B1263 (1964), PMYS. REV. 137, B100 (1964), PMYS. REV. 136, D1364), PMYS REV. 137, B136 (1965), PMYS. REV. 146, D135 (1966), PMYS. REV. RU-15, RU-16, R CITATIONS ARTICLE READ BY LERDY PRICE IN 10/67, AND VERIFIED BY ODETTE BENARY. BEAM IS PROTON ON HYDROGEN COMPOUND FROM 5.0 TO 13.4 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WORDS + PROTON CROSS SECTION DIFFERENTIAL CROSS SECTION MODELS FORM FACTORS

THET	A =	90.	DEGREES.	THETA	15 THE	ANGLE	THAT	THE	PROTON	MAKES	WITH	THE	8EA#	. 1N	THE	GRAND	с.н.
LABORA	TORY		0-	SIGMAZO	D-C≠EGA												
PEAM MON	ENTUN	L															
GEV	C (1)			U2/5	58 [2]												
					PER CE	T											
5.000 +-	.005	i	8.	5100 +-	2.9												
5.100	.005		7.	9000	3.3												
5.200	.005		7.	0900	3.1												
5.300	.005		6.	4900	3.6												
5.400	.005		5.	53CC	3.1												
5.500	.005		4.	9000	3.4												
5.600	.005		4.	4760	3.1												
5.700	.005	i i	3.	7200	3.3												
5.800	.005		3.	3700	3.3												
5.900	.005		2.	7400	3.5												
6.000	.005		2.	4400	3.1												
6.100	.005		Ζ.	1900	3.7												
6.200	.005		1.	8300	3.7												
6.400	+005	i i	1.	5000	3.7												
6.600	+005		1.	0700	4.7												
6.800	.005		•	7960	4.7												
7.000	.005		•	6450	4.1												
7.200	-005	i i		5150	4.0												
7.400	.005		•	3860	4.8												
7.600	• CO 5		•	3050	5.4												
7.800	.005		•	2530	4.5												
8.00C	.005		•	2170	4.5												
8.100	-005		•	1650	3.9												
8.200	.005		•	1720	4.4												
8.300	.005		•	1540	3.8												
8.400	.005		•	1530	4.6												
8.600	.005			1270	4.6												
8.800	• 005		•	1030	4.8												
9.000	.005		•	0809	4.6												
9.200	.005		•	0780	4.3												
9.400	.005		•	0676	5.3												
9.600	.005		•	0589	4.9												
9.800	.005	i i	•	0536	4.7												
10.000	.005		•	0468	4.9												
10.200	-005		•	0440	4.8												
10.400	.005		•	0386	4.1												
10.600	.005		•	0320	4.8												
11.800	.005		•	0303	4.9												
11.000	.005		•	0264	3.5												
11.200	-005		•	0235	5.4												
11.400	005		•	0100	5.2												
11.000	.005		•	0190	5.4												
12 600	.005		•	0143	5.4												
12.000	- 005		•	0110	5 3												
12.400	- 005			0116	5.4												
12.600	.005			0095	6.3												
12.800	.005			0087	5.7												
13.000	- 005			0074	5.5												
13.200	.005			0072	7.1												
13.400	.005			0053	5.7												

ELASTIC DIFFERENTIAL CRESS SECTION (AT FIXED ANGLE OR T) FOR PROTON PROTON.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- .5 PER CENT. [2] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2 PER CENT.

NUCLEON-NUCLEON POLARIZATION BETWEEN 300 AND 700 MEV. [PHYS. REV. 163, 1470 (1967)]

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ABSTRACT THE PRINTE FRAINCE COLLEGE SERTICES MEANING MEAN MASS BEEN MEASURED AT BEAM ENERGIES OF 310, 400, 500, 600, AND 700 MEV OVER THE RANCE IN THE C.M. SCATTERING ANCLES 30 DEG 4 THETA * ISJU DEG TO AM ACCURACY OF TWPICALLY ** 0.03 FOR PN SCATTERING, AND ** 0.02 FOR PP SCATTERING. A POLARIZED PROTON SEAM WAS SCATTERED FROM NUMPOLARIZED TARGET--DEUTERION FOR QUASIFREE PN AND PP MEASUREMENTS, HYDROGEN FOR FREE PP MEASUREMENTS.--AND BOTH OF THE OUTGOING NUCLEONS FROM THE (QUASI-) ELASTIC SCATTER WERE DETECTED BY AM ARRAY OF 27 SCITILLATION COUNTERS IN MULTICHANKEL CCINCIDENCES. IT WAS FOUND THAT P(THETA *) FOR PP SCATTERING CAN BE APPROXIMATED BY A SIN THETA * 0S THETA *, WHERE A VARIES FROM -0.25 AT 310 MEY TO -0.4 AT 700 MEV IN THIS RANGE. A COMPARISON OF PITHETA *) FOR FREE AND QUASIFREE PP SCATTERING REVEALS GOOD AGREEMENT BETWEEN THE TWO.

CITATIONS PHYS. REV. 85, 947 (1952), UCRL 11339 (1964), UCRL 121 (1949), PHYS. REV. 117, 485 (1959), PHYS. REV. 137, 862C (1965), AND UCRL 1122C (1965).

ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERDY PRICE.

BEAM NO. 1 IS PROTON ON PROTON FROM .823 TO 1.343 GEV/C. (BEAM KINETIC ENERGY = .31 TO .70 GEV) (POLARIZED BEAM) No. 2 is proton on ceuteron from .823 to 1.343 Gev/C. (Beam Kinetic Energy = .31 to .70 Gev) (Polarized Ream)

THIS EXPERIMENT USES COUNTERS.

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GENERAL COMMENTS ON THIS ARTICLE 1 BEAM IS POLARIZED BY SCATTERING ON CARBON.

KEY WORDS . POLARIZATION FITS

COMPOUND KEY WORDS . FITS POLARIZATION

f

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ELASTIC POLARIZATION FOR PROTON PROTON. (TABLE 4)

LABORATORY BEAM ENERGY = .7 GEV.

(USING HYDROGEN TARGET)

 THETA
 POLAPIZATION (1)

 DEGREES
 30.8 ++ 1.7
 .555 +- .019

 35.7 1.7
 .577 .012

 43.2 3.5
 .556 .016

 52.4 3.1
 .529 .022

 60.1 3.6
 .474 .011

 68.7 3.3
 .354 .031

 77.0 3.6
 .255 .015

 86.1 3.5
 .109 .038

THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE GRAND C.M. The polarization is CF the proton along the normal to the production plane in the grane c.m.

(TABLE 1)

(1) PLUS POSSIBLE EVETEMATIC EMPIRE OF +- 3 PER GENT.

FLASTIC POLARIZATION FOR PROTON PROTON. TABLE 41 LABORATORY BEAM ENERGY = .6 GEV. C USING HYDROGEN TARGET F THETA DEGREES 3.6 +- 2 POLARIZATION (1) .513 +- .C10 .595 .C35 .516 .010 .484 .C10 .369 .C19 .361 .C38 .168 .010 .114 .C25 DEC 33.6 34.5 46.1 49.5 63.1 65.6 80.2 82.9 2.5 1.5 3.6 3.2 3.6 3.4 3.4 3.5 THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE GPAND C.M. The polarization is up the proton along the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF ++ 3 PER CENT. ELASTIC POLARIZATION FOR PROTON PROTON. TABLE 41 LABORATORY BEAM ENERGY = .5 GEV. (USING HYCROGEN TARGET) THETA POLARIZATION [1] THETA DEGREES 33.7 + 2.3 36.8 1.0 46.9 3.6 48.7 3.1 64.1 3.6 64.6 3.3 81.3 3.6 81.8 3.5 . 490 +- -011 .490 .510 .461 .452 .270 .313 .107 .113 .011 .059 .018 .014 .010 .025 .015 .016 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. THE POLARIZATION IS OF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 3 PER CENT. ·_____ ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 4] LABORATORY BEAM ENERGY = .4 GEV. I USING HYDROGEN TARGET 1 THETA POLARIZATION [1] THETA DEGREES 33.8 +- 2.3 47.8 3.1 48.0 3.6 63.5 3.3 05:2 3.7 80.6 3.5 02:5 3:7 .442 +- .014 .419 .018 .419 .011 .275 .008 .272 .010 .105 .008 .084 .075 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE BRAND C.M. The polarization is get the proton along the normal to the production plane in the grand c.m. (1) PLUS POSSIBLE SYSTEPATIC ERROR OF +- 3 PER CENT. CLASTIC POLARIZATION FOR PROTON PROTON. [TABLE 4] LABORATORY BEAM ENERGY . .31 GEV. (USING HYDROGEN TARGET) THETA PULARIZATION 111
 THETA

 DEGREES

 53.6 6 = 2.4

 47.3 2.8

 50.1 2.7

 62.4 3.2

 66.3 3.7

 79.4 3.5

 83.7 3.6 .402 +- .025 .374 .C07 .362 .011 .276 .CC7 .217 .C08 .117 .007 .035 .CC8 THETA IS INL ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand r.w. (11 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 3 PER CENT. ELASTIC POLARIZATION FOR PROTON NEUTRON. TABLE 31 LABORATORY BEAM ENERGY = .7 GEV. I USING DEUTERIUM TARGET. BLAUBER CORRELIIUN APPLIED THETA PELAFIZATION [1] DEGREE 29.5 --44.3 60.4 77.1 93.8 110.9 127.1 143.2 DECREES .334 -- .027 .305 .017 .157 .033 -.068 .030 -.352 .C26 -.411 .C32 -.247 .019 -.146 .C19 6.7 6.7 6.5 5.7 5.4 5.3 4.9 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the neutron along the normal to the production plane in the grand c.m. (1) PLUS POSSIBLE SYSTEPATIC ERROR OF ← 3 PER CENT.

ELASTIC POLARIZATION FOR PROTON NEUTRON. (TABLE 3) LABORATORY BEAP ENERGY = .6 GEV. (USING DEUTERIUM TARGET) GLAUBER CORRECTION APPLIED THETA DEGREES 33.0 +- 6.0 48.5 5.6 81.3 5.7 57.8 5.6 114.5 5.6 120.5 5.6 PGLARIZATION [1] .364 +- .040 .364 .251 .084 -.155 -.315 -.345 -.741 -.090 .C40 .C41 .C30 .O28 .C31 .C30 .O23 .C23 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M. The polarization is of the neutron along the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 3 PER CENT. - - - - - -ELASTIC POLARIZATION FOR PROTON NEUTRON. (TABLE 3) LABORATORY BEAM ENERGY = .5 GEV. ۰. (USING DEUTERIUM TARGET) GLAUBER CORRECTION APPLIED THETA DEGREES PCLAFIZATION [1]
 DEGREES

 33.4

 48.5

 64.7

 5.9

 81.2

 5.9

 97.9

 5.9

 115.0

 5.7

 145.2

 4.9
 .297 +- .024 .297 .255 .090 -.155 -.264 -.263 -.147 -.111 .C16 .C17 .O17 .C18 .C17 .C17 .C17 115.0 13C.9 145.2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAN IN THE GRANG C.M. The polarization is of the neutron along the normal to the production plane in the grang c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 3 PER CENT. ELASTIC POLARIZATION FOR PROTON NEUTRON. (TABLE 3) LABORATORY BEAM ENERGY - .4 GEV. (USING DEUTERIUM TAPGET) GLAUBER CORRECTION APPLIED THETA POLAFIZATION (1) DEGREES $\begin{array}{c} 0168125\\ 33.1 \ end{pmatrix} 6.9\\ 48.3 \ end{pmatrix} 6.9\\ 66.6 \ 7.2\\ 83.1 \ 7.0\\ 99.7 \ 6.8\\ 116.5 \ 6.6\\ 131.1 \ 5.9\\ 144.3 \ 5.1 \end{array}$.411 +- .087 .264 .089 -.152 -.309 -.272 -.158 -.104 .023 .032 .026 .025 .025 .025 .025 .025 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN IHE GRAND C.M. The polarization is of the neutron along the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +-'3 PER CENT. ELASTIC POLARIZATION FOR PROTON NEUTRON. (TABLE 3) LABORATORY BEAN ENERGY . .31 GEV. (USING DEUTERIUM TARGET) GLAUBER CORRECTION APPIIED THETA POLAPIZATION [1] DEGREES .421 +- .C38 .287 .026 .093 .022 -.114 .024 -.239 .C19 -.218 .C16 -.174 .018 -.133 .C31
 OEGREES

 33.1
 +-6.7

 47.8
 7.2

 66.7
 8.1

 83.2
 8.0

 99.8
 7.8

 116.5
 7.6

 13C.7
 6.8

 141.5
 7.2
 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M. THE POLARIZATION IS OF THE NEUTRON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRANC C.M. LEE PLUS POSSIBLE EVETERATIC ERBOR OF +- 3 PER CENT.

45	ISOBAR PRODUCTION MECHANISMS IN PROTON-PROTON COLL	ISICNS AT 5 GEV/C. (PEY)	S. REV. 161. 1387 (196	711
ŦŪ	A.P.COLLERAINE.U. NAVENBERG (PRINCETCN UNIV., PRINC	FTON. No. Jos USA. AND PRINCE	TON-PENN, PROTON ACCEL	. PRINCETON.
	N.J.,USA]			
	ABSTRACT APPROXIMATELY 7500 FOUM-PROMC PROTON- HYOROGEN BUBBLE CHAMBER. TWE THREE PRINCIPAL +-0.12 MB, IBJ PP+PP PI+ PI- PI0 1.76 +-0.0 SINGLE AND DCUBLE N° PROCUCIION GCCURS AND TH CALCULATED WHENEVER POSSIBLE. THESE PARAMETER LOW VALUES OF MOMENTUM TRANSFER AND THAT AT HEVIDENCE FOR MOMENTUM TRANSFER AND THAT AT EVIDENCE FOR MOMENTUM TRANSFER AND THAT AT EVIDENCE FOR MOMENTUM TRANSFER AND THAT AT UBSERVED IN REACTION (B), BUT IN NOME OF THE OCCUR. IN REACTION (B), BUT IN NOME OF THE (I=5/2) SYSTEM WHICH MAS OBSERVED BY ALEXANDE AS BEING PRINCIPALLY DUE TO N°++ AND N°- FORM	PROTON COLLISIONS AT 5 GEV/C REACTIONS STUDIED WITH THEIR 7 MG, (CI PP-P N PI+ PI+ PI- E DECAY ANGULAR DISTRIBUTION: 5 INDICATE THAT PSEUDOSCALAR IGHER MOMENTUM TRANSFER ABSO NO++ N+0. THE FORMATION OF T REACTIONS STUDIED IS ANY SIG OM PHASE SPACE IN THE REGION R ET AL., BUT WE ASCRIBE THI ATION IN THIS CHANNEL.	HAVE BEEN STUDIED US! CROSS SECTIONS ARE (A 2.19 +- 0.09 MB. IN E 5 AND DENSITY MATRIX E (PION) EXCHANCE APPEA RATIVE EFFECTS BECOME E TA AND OMEGA MESON VIFICANT RHO-MESON PROJ OF THE IS80-MEV MASS I 5 DEPARTURE FROM PHASE	VC THE BNL 80-IN.) PD-PD PI+ PI- 2.96 ACH REACTION BOTH LEMENTS HAVE BEEN ST TO BE DONINANT AT IMPORTANT. WE FIND NO RESONANCES IS DUCTION FOUND TO SUMP IN THE P PI+ PI+ SPACE AT OUR ENERGY
	CLOSELY RELATED REFERENCES See Also Princeton-Penn Accelerator PPAD-600F	(1966).		
	ACDITIONAL CITATIONS BNL BC-H-10, CERN CD/63/12 (1963), CERN DD/62 REV. 129, 2035 (1963), NUGVO CIPENTO 34, 1644 PHTS. REV. 144, 1122 (1966), PHYS. REV. 101, (1966), PHYS. REV. LETTERS 11, 90 (1963), PHY	/10 (1962), BNL BC-04-3-8 (1 (1965), PHYS. REV. 101, 157(1149 (1956), PHYS. REV. 134, S. REV. 134, B1095 (1964), AP	965), PHYS. REV. 128, D (1956), NUOVO CIMENTI B1062 (1964), PHYS. RI ND PHYS. REV. LETTERS	1836 (1962), PHYS. J 30, 240 (1963), EV. LETTERS 17, 884 15, 207 (1965).
•	ARTICLE READ BY ODETTE BENARY IN 11/67, AND VERIFI	ED BY LERCY PRICE.		
	BEAM IS PRCTON ON PROTON AT 4.95 GEV/C.			
	THIS EXPERIMENT USES THE 8-N-L. 80 IN. (H) BUBBLE	CHAMBER.		
	KEY WORDS - CROSS SECTION MASS SPECTRUM AN Deuteron eta(54b) omega(783)	GULAR DISTRIBUTION MODELS RHO(765)	S DENSITY MATRIX	DELTA(1238)
		(TABLE 1)		
	LABCRATORY BEAM MEMENTUM = 4.95 +03 GEV/C.			
PROTO	REACTION N PROTON +	MILLI-BARNS	NO. EVENTS	
	PROTON PROTON PI+ PI- Proton Pruton PI+ PI- P10	2.96 +12 1.76 .07	2680 1592	•
	PROTON NEUTRON PI+ PI+ PI-	2.19 .09	1985	
	DEUTERON PI+ PI+ PI- PIO	.08 + .01	73	
		[PAGE 1401]		
	LABORATORY BEAM MEMENTUM = 4.95 +03 GEV/C.			
	REACTION	WILLE-BARNS		
64040	PROTON PROTON OMEGA(783)	•17 t- •02		
	NPOTCH PROTON 2TA(346)	.12 .04		
46	PROTON-PROTON SCATTERING AT 970 MEV. (PHYS. RI	EV. 133. B1017 (1964))		
TV	D.V.BUGG+A.J.OXLEY,J.A.ZOLL,J.G.RUSHBROOKE,V.E.BAR	NES [CAVENDISH LAB., CAMB. UN	IV., CAMBRIDGE, ENGLAN	iD 1
	J.B.KINSON, W.P.DODD, G.A.DORIAN, L.RIODIFORC [BIRMI	NGHAM UNIV., BIRMINGHAM, ENGL	AND I	
	ABSTRACT PROTON-PROTON SCATTERING MAS BEEN SU 9-INDIAN LIQUID-MYDROGEN BUBBLE CHAMBER: 39- VARIOUS REACTIONS. IHE LLASTIC SCATTERING CRO DOWELL ET AL. USING COUNTERS. THE THO EXPERIM NORMALIZATION: POSSIBLE REASONS FOR THIS ARE ISTRONGLY FORMARO. BUT DOES NOT AREE GUANTITI SCATTERING AGREE WITH PREVIOUS AND MORE ACCUR. THE 13/2,3/2) PI+ PREVIOUS AND HORE ACCUR. MODEL ANG COMFANEU IN DETAIL WITH THE EXPERIM MOMENTUM TRANSFESS, PARTICULARINY FRA THE BEAF INGLMAN-YANG TEET AND DEPARTURE FROM THE EXPERIM INGLMAN-YANG TEET AND DEPARTURE FROM THE EXPERIM	SIED AI '970 MEY USING INE BI SEVENTS HAVE REFN DNALYLED SS SECTION OF 24-8 +- 0.9 ME ENTS AGREE ON THE SHAPP OF TH DISCUSSED. THE ELASTIC SCATTE VELY MITH PURE DIFFRACTION. F THE COUNTER EXPERIMENTS. INEL AL MECHANIBS. THE THE TO ENTAL RESULTS AND COLD QUANT THOM PART PILS FYCH POA SMA TED (1 + 3 (COS)-SQUARED THE YOSS SECTION FOR DOUBLEFFICM.	(RINGMAR UNIVERSITY 1- IS SIGNIFICANTLY HIGH (E ANGULAR DISTRIBUTIO (CLARIZATION EFFECTS OF ASSILC SCATTERING IS SI EDICTIONS BASED ON THE TATIVE AGREEMENT IS (LI = "UMENTUM THATSFERS) TAI PI+ P ANGULAR OTS TAI PI+ P ANGULAR OTS	THE START RULINUM AND A TEANING PAGE THE RE THAN THE RESULT OF 10N IS PEAKED SERVED IN THE ELASTIC RONGLY INFLUENCED BY SIMGLE-PIGE ALL. SIMGLE-PIGE ALL. SIMGLE-PIGE ALL. RESULTION EACHANCE RESULTION INDICATE RESULTION INDICATE SLESS THAN 0.2 PB.
	CITATIONS PHYS. REV. 125, 2082 (1962), PHYS. REV. LETTEF PHYS. REV. 107, 859 (1957), PROC. DF THE ROYAI LONDOM A251, 233 (1959), PHYS. REV. LETTERS 7. INSTRUMENTS AND METHOES 13, 118 (1961), NUCLE: INSTRUMENTS 32, 538 (1961), PRCC. OF THE ROYAI CIMENTO 18, 818 (1960), UNIV. OF BIRMINGHAM 12 OF NUCLEAR SCIENCE 6, 43 (1956), PRCC. OF THE PHYSICS 5, 570 (1950), PHYS. REV. 103, 406 (1 CIMENTO 22, 125 (1961), NUCUU LIMENTO 27, 1450 PHYS. REV. LETTERS 7, 387 (1961), PHYS. REV.	RS 7, 196 (1961), PHYS. REV. L SOCIETY GF LONDON A251, 218 , 288 (1961), NUCLEAR INSTRUM AR INSTRUMENTS AND METHODS 9, L SOCIETY OF LONDON A70, 165 3 (1962), JETP 12 802 (1961), ROYAL SOCIETY OF LONDON A244 5601, PHYS, REV, L131, 1640 11 0 (1963), PHYS. REV. LETTERS (23, 2160 (1961), NUDVO CIMEG, 140 (1962), AND PHYS. LETTE	105, 1874 (1957), PHYS 1 (1959), PRDC. OF THE TENTS AND METHODS 4, 22 92 (1960), REVIEW OF (1957), NUGVO CIMENTO NUGVO CIMENTO 16, 113 , 491 (1958), PROGRESS 950), NUTVO CIMENTO 22 6, 64 (1961), NUBVO CI 170 21, 1028 (1962).	. REV. 118, 579 (1960), ROYAL SOCIETY OF 5 (1959), NUCLEAR SCIENTIFIC 23, 690 (1962), NUDVO 2 (1960), ANNUAL REV. 5 OF THEORETICAL . 533 (1962), NUOYÙ MENTO 15, 465 (1960), NOGRESS OF THEORETICAL
	ARTICLE READ BY ODETTE BENARY IN 5/67, AND VERIFIE	C BY LERGY PRICE.		
	BEAM IS PROTON CN PRCTCN AT 1.661 GEV/C.			
	THIS EXPERIMENT USES A HYCROGEN BUBBLE CHAMBER.			
	GENERAL COMMENTS ON THIS ARTICLE			
	1 NORMALIZED TO A TOTAL CRCSS SECTION OF 47.3	+-1.0 MB.		1 0.07
	KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SI DELTA(1238) MODELS DEUTERON	ECTION POLARIZATION P ANGULAR DISTRIBUTION	ASS SPECTRUM DALII	2 PLOT

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LETCURE 11

LABCRATORY BEAM ENERGY = .970 +C15 GEV.		
REACTION	MILL I-BARNS	NO. EVENTS
PROTON PROTON -		
ELASTIC	24.80 +90	2160
DEUTERON PI+	.48 .08	42
PROTON NEUTRON PI+	18.30 .70	1414
PROTEN PROTON PIO	3.70 .30	285

47 NUCLECN ISCEAR PRODUCTION IN PRCTON-PROTON COLLISIONS BETWEEN 3 AND 7 GEV/C. [PHYS. REV. 170, 1223 (1968)1 C.M.ANKENBRANCT,A.R.CLARK,B.CORK,T.ELIOFF,L.T.KERTH,W.A.WENZEL [U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA]

ACT A SYSTEMATIC STUDY HAS BEEN MADE OF THE REACTIONS PP-PP AND PP-PN+ IN THE ANGULAR RANGE FROM THETALLAB) = 10 DEG. TO THETAIC.M.J = 90 DEG. AT 3, 4, 5, 6, AND 7 GEV/C. AN ORTHOGONAL DISPERSION MAGNETIC SPECTROMETER DETECTED PROTONS FROM INTERACTIONS IN HYDROGEN WITH NOMENTUM TRANSFER (-T) IN EXCESS OF 0.5 (GEVISOUARED. WELL-DEFINED PEAKS IN THE MISSING MASS SPECTRA OCCURRED AT AVERAGE N= MASSES OF 1240+- 6, 1508+- 2, AND 1683-- 3 MEV WITH AVERAGE FULL WIDTHS OF 102 \leftrightarrow 4, 92 \leftrightarrow - 3, AND 110 \leftrightarrow 4 MEV, RESPECTIVELV. BELOW 2400 MEV NO OTHER SIGNIFICANT ENHANCEMENTS WERE FOUND. THE NPRODUCTION CROSS SECTIONS D-SIGNATOT NEAR THETAIC.M.J = 90 DEG. ARE IN QUALITATIVE AGREEMENT WITH THE PREDICTIONS OF THE STATISTICAL MODEL. FOR EACH ISOBAR THE DIFFERENTIAL CROSS SECTION AT FIXED ENERGY VARIES AS EXP(-V/O), WHERE VIS DEFINED AS I-TU/(T + U)]: VO VARIES SYSTEMATICALLY WITH ENERGY AND THES AS THE VALUE (APPROXIMATELY EQUAL TO 0.4(GEV - SQUARED) FOR EACH ISOBAR AT THE UPPER LINIT OF OUR ENERGY RANGE. ABSTRACT

CITATIONS PHYS. REV. LETTERS 7, 450 (1961), PHYS. REV. 128, 1823 (1962), PHYS. LETTERS 8, 134 (1964), PHYS. LETTERS 18, 167 (1965), NUDVO CIMENTO 35, 1052 (1965), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 12, 340 (1964), UCRL 17257 (1967), NUOVO CIMENTO 27, 208 (1963), NUOVO CIMENTO 27, 856 (1963), NUOVO CIMENTO 35, 216 (1965), PHYS. REV. LETTERS 12, 112 (1964), PHYS. LETTERS 13, 190 (1964), UCRL 16275 (1966), PHYS. LETTERS 23, 389 (1966), PHYS. LETTERS 258, 156 (1967), PHYS. REV. LETTERS 17, 1105 (1966), PHYS. LETTERS 23, 16228 (1965), UCRL 9727 (1961), NUOVO CIMENTO 34, 1644 (1964), PHYS. LETTERS 8, 80 (1964), AND PHYS. REV. LETTERS 12, 257 (1964).

ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERCY PRICE.

BEAM IS PROTON ON PROTON FROM 2.0 TC 7.1 GEV/C.

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 USES A MISSING MASS TECHNIQUE

KEY WORDS + DIFFERENTIAL CROSS SECTION FITS NODELS 'N+(1608)' MASS SPECTRUM DELTA(1238) N+(1520)D13

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

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ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE 1]

LABORATORY REAM MOMENTUM = 2.58 GEV/C.

-1 (GEV/C#**2 .27 .39 .58 .68 .79 .94 1.34 1.75 1.98

I IS THE HOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE COUTGOING PROTONI.

[1] PLUS POSSIBLE SYSTEPATIC EPRCR CF +- 7 PER CENT.

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ELASTIC DIFFERENTIAL CROSS SECTION FOR FROTON FROTON. (TABLE 1)

LABORATORY BEAM MEMENTUR = 4.00 +- .02 GEV/C.

-T	0-SIGMA/0	- T
(GEV/C)**2	MB/(GEV/C)	••2 (1)
-48	4.900 +	200
.49	4.500 .	300
.54	3.200	200
.69	1.600 .	100
1.18	.320 .	LCO
1.61	.188 .0	07
2.23	.087 .0	204
2.85	. 059 .4	:02

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T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE LOUTGOING PROTONI.

.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT.

..

[TABLE 1]

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAM MEMENTUM = 5.02 +- .02 GEV/C.

-T	D-SIGMA/D-T	
(GEV/C)**2	MB/(GEV/C)++2 [1]	
.73	.9500 +C600	
.75	1.0500 .0800	
.75	1.0700 .0800	
.83	.6300 .0400	
.84	.7100 .0500	
1.03	.3200 .0300	
1.04	.3300 .0200	
1.52	.1000 .C100	
1.76	.0640 .0050	
1.80	.0600 .0030	
2.80	.0210 .0010	
3.08	.0198 .CC07	
3.23	.0168 .0004	
3.59	.0150 .CC10	
3.64	-0164 .CC04	
3.64	.0147 .0007	
3.80	.0190 .0020	
	-	

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON].

[1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 7 PER CENT.

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. LABORATORY BEAM MOMENTUM = 6.07 +- .01 GEV/C.

TTABLE 11

Ŧ	D SICHA/O-T
(GEV/C1**2	MB/(GEV/C)++2 [1]
1.09	.20006200
1.23	.1230 .0090
1.51	.0570 .0030
1.83	.0290 .CC20
2.18	.0170 .0010
2.18	.0170 .0020
2.18	.0170 .0020
2.51	.0121 .0006
2.85	.0093 .0006
3.32	.0062 .0003
3.90	.0015 .0002
4.44	.0031 .0002
4.66	.0031 .0001
4.66	.003C .CC02
4.67	.0032 .0001

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE (OUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEMATIC FROM OF +- 7 PER CENT.

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.

TABLE 11

LABURATURY BEAR RUMENTUM = 7.12 +- .05 GEV/C.

U-3100707-1 H8/(GEV/C1++2(1) -0530 +- 0060 -0340 - 0060 -0210 - C020 -0075 - 0010 -0039 - 0005 -0015 - 0002 -0011 - C003 -0011 - C003 -0011 - C003 -0010 - 0001 (GEV/C)**2 1.42 1.58 1.81 2.37 £.71 3.16 4.36 4.46 4.43 5.67

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON].

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT.

DIFFERENTIAL CROSS SECTION FOR PROTON PROTON • PROTON DELTA(1238)+. (TABLE 3)

LACORATORY BEAM MOMENTUM = 2.98 GEV/C.

-T	D-SIGNA/O-T
{GEV/C}**2	MB/(GEV/C]**2 [1]
.26	1.50 +20
.29	.90 .10
. 17	.90 .10
.64	.39 .04
.74	.19 .04
.88	.31 .03
1.26	.10 .02
1.63	.15 .02

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON].

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT.

DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON DELTA(1238)+. TABLE 31

LABORATORY BEAM NOMENTUM = 4.00 +- .02 GEV/C.

-T	D-SIGMA/D-T
(GEV/C)**2	MB/(GEV/C)++2 [1]
.45	.410 +040
.51	.250 .020
.64	.180 .020
1.12	.044 .CO9
1.52	.024 .003
2.12	.021 .0C2
2.65	.021 .002

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE (OUTGOING PROTON].

113 PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT.

DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. (TABLE 3) \TUM ■ 5... D-SIGMA/D-T #8/(GEV/C)*22 [1] .0760 ← .0680 .0240 .0030 .0240 .0030 .0050 .0010 .0050 .0010 .0035 .0005 .0035 .0005 LABORATORY EEAN NOMENTUM = 5.02 +- .04 GEV/C. -T (GEV/C)**2 .7G .80 .99 1.46 1.72 1.91 2.67 3.08 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT. CIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. (TABLE 3) LABORATORY BEAM MOMENTUM = 6.07 +- .01 GEV/C. D-S1GMA/D-T MB/(GEV/C)++2(11) 0110 +- CC30 0010 -- CC30 0006 -CC09 00050 -CC09 00050 -CC09 0021 -CC06 0021 -CC06 00021 -CC06 00004 -C002 -T (GEV/C)**2 1.03 1.16 1.44 1.75 2.08 2.40 2.73 3.18 3.75 4.25 T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON]. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT. CIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON DELTA(1238)+. [TABLE 3] LABORATORY BEAN MOMENTUM = 7.12 +- .05 GEV/C. D-SICHA/D-T HB/(GEV/C)+*2 [1] -0080 +- .0030 .0050 .0010 .0042 .0008 .0026 .0009 .0011 .CC05 .0010 .C006 .0003 .C001 -T (GEV/C)**2 1.33 1.50 1.72 2.27 2.60 3.05 4.22 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON N#(1520)+. [TABLE 4] LABORATORY BEAM MOMENTUM = 4.00 +- .02 GEV/C. D-SIGHA/D-T HB/(GEV/C)+*2 [1] -250 +- .040 .220 .020 .150 .020 .150 .020 .120 .020 .120 .020 .122 .006 -1 {GEV/CJ**2 .44 .50 .62 1.06 1.43 1.99 2.05 T IS THE MOMENTUM TRANSPER BETWEEN THE (INCOMING PROTON) AND THE (OUTCOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+(1520)+. (TABLE 4) LABORATORY BEAM MOMENTUM = 5.02 +- .04 GEV/C. D-SICHA/D-T #b/(dev/c)++2 (1) .100 +- .100 .105 - .009 .088 .006 .070 .010 .052 .UUb .057 .C05 .037 .003 .030 .010 .031 .005 .025 .005 -T 16EV/L1**2 .67 .76 .94 1.38 1.61 1.79 2.49 2.83 2.83 2.86 3.14 T IS THE MOMENTUP TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON]. (1) PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT.

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DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+11520)+. **ITABLE 41** LABORATORY BEAM MEMENTUM = 6.07 +- .01 GEV/C. D-SIGMA/C-T MB/(GEV/C)**2 (1) .0660 +- .0060 .0630 .CC60 .0590 .CC80 .0320 .CC30 (GEV/C)++2 .98 1.10 1.36 1.65 1.97 .0040 .0020 .0010 .0007 .0006 .0006 .0280 .0190 .0140 .0167 .0082 .0070 2.27 3.00 3.52 3.89 4.02 .0064 .0008 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON N*(1520)+. TABLE 41 LABORATORY BEAN MOMENTUP = 7.12 +- .05 GEV/C. D-SIGNA/C-T HB/(GEV/C)+2[1] .0350 +- .0050 .0290 .C040 .0200 .0030 .0010 .0010 .0012 .0018 .0032 .0008 . (GEV/C)++2 1.27 1.43 1.64 7.16 2.47 2.89 . 6003 5.01 .0013 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT. _____ DIFFERENTIAL CROSS SECTION FOR PROTON - PROTON 'N+(1688)+*-TABLE 51 LABORATORY BEAM MOMENTUM = 4.00 +- .02 GEV/C. D-SIGMA/D-T PB/(GEV/C)++2 [1] (GEV/C)*#2 .47 .52 .64 1.05 .660 +- .C90 .340 .030 .450 .C40 .230 .C30 1.40 .160 .010 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). THE PHUS DESSIBLE SYSTEMATIC EDGED OF -- 12 DED CENT. • DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON *N*(1688)+*. TABLE 51 LABORATORY BEAM MEMENTUM . 5.02 1- 404 GEV/C. D-SIGNA/D-T - T MB/(GEV/C)++2 [1] .230 -- .C20 .180 .C20 .120 .010 (GEV/C)++2 V/C1* .67 .75 .92 1.33 1.55 1.73 2.74 .010 .090 .078 .074 .008 .007 .043 .008 T IS THE MOMENTUP TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTON). [1] PLUS POSSIBLE SYSTEFATIC ERROR OF +- 12 PER CENT. DIFFERENTIAL CROSS SECTION FCR PROTON PROTON . PROTON 'N*(1688)+'. [TABLE 51 - T (GEV/C)*+2 .95 1.07 1.32 1.59 1.90 2.18 2.47 2.88 3.38 3.85 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). [1] PLUS POSSIBLE SYSTEPATIC ERROR GF +- 12 PER CENT.

DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON *N*(1688)+*. TTABLE 51 LABORATORY BEAM MOMENTUM = 7.12 +- .05 GEV/C. -T (GEV/r D-SIGHA/D-T

V/C1++2	MB/(GEV/CJ++2 [1]	
1.23	.0500 +007C	
1.38	.0450 .0060	
1.59	.0280 .0040	
2.08	.0100 .0020	
2.38	.0070 .0010	
2.79	.0040 .0010	
3.86	.0024 .0004	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTUN) AND THE (OUTGOING PROTON).

111 PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 12 PER CENT.

THE POLARIZATION PARAMETER IN PI+- P AND PP ELASTIC SCATTERING FROM 6 TO 12 GEV/C. (PHYS. LETTEPS 248, 77 (1967)] 48 M.BORGHINI,G.COIGNET,L.DICK,K.KURODA,L.DILELLA,P.C.MACQ,A.MICHALOWICZ, J.C.DLIVIER IEURCPEAN OPG. FOR NUC. RES., GENEVA, SWITZERLAND)

ABSTRACT EXPERIMENTAL RESULTS ARE GIVEN FOR THE POLARIZATION PARAMETER P(G) IN PI- P SCATTERING AT 6.0, B.O. 10.0 AND 12.0 GEV/C, AND IN PI+ P AND PP SCATTERING AT 6.0, 10.0 AND 12.0 GEV/C. THE INVARIANT FOUR-MOMENTUM TRANSFER SOUARED -T VARIES FRCM 0.1 TO 0.75 (GEV/C)-SQUARED.

CLOSELY RELATED REFERENCES CONTINUATION OF PREVIOUS EXPERIMENT IN PHYS. LETTERS 21, 114 (1966).

ACDITIONAL CITATIONS UCRL 16940 (1960), Phys. Rev. 139, B1336 (1965), Phys. Rev. 148, 1297 (1966), POSCEW INST. FOR THEOR. AND EXPTL. Physics N-238 (1964), AND JETP 18 874 (1964).

ARTICLE REAC BY DEETTE BENARY IN 4/67, AND VERIFIED BY LERCY PRICE.

BEAM NO. 1 IS PROTON ON HYDROGEN COMPOUND FROM 6 TO 12 GEV/C. TARGET IS POLARIZEC 70 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 2 IS PI- ON HYDROGEN COMPOUND FROM 6 TO 12 GEV/C. TARGET IS POLARIZED 70 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 3 IS PI+ ON HYDROGEN COMPOUND FROM 6 TO 12 GEV/C. TARGET IS POLARIZED 70 PER CENT (NORMAL TO THE BEAM DIRECTION). THIS EXPERIMENT USES COUNTERS.

GENERAL CEMMENTS ON THIS ARTICLE 1 THIS ARTICLE ALSO CONTAINS DATA ON POLARIZATION IN PI+P AND PI- P. THIS EXPERIMENT USES UNPOLARIZED BEAPS AND POLARIZED TARGET.

KEY WORDS . POLARIZATICN PRCION PI+ PI-

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY BEAM MOMENTUM = 6. GEV/C.

-1	PELAFIZATION [1]
(GEV/C1++2	
.109	·124 +- ·C69
.136	.041 .034
. 166	.122 .025
.198	.138 .016
.233	.101 .014
.271	.117 .014
.312	.095 .015
.355	.141 .017
-400	.117 .018
. 448	-083 -019
.499	.108 .023
.551	.063 .029
.00.	.125 .041
.665	.062 .080
. 723	.052 .164

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCCMING PROTONI AND THE LOUTGOING PROTONI. The polarization is of the proton along the normal to the production plane in the grand C.M.

113 PLUS POGGIBLE SYSTEMATIC EPENDE OF +- 5 PER GENT.

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY	BEAM	ROMENTUM	10. GEV/	·c.
-1		POLA	IZATION LI	1
(GEV/C)**2				
.102		.074	+072	
.129		.059	.030	
.159		.058	.023	
. 192		.097	.015	
. 339		.093	.C13	
.267		.071	.013	
.309		.082	.014	
.354		.053	.017	
.401		.081	.018	
.452		.047	. 019	
.505		.024	.023	
.561		.067	.028	
.620		.077	.037	
+681		.117	+046	
.745		.080	.045	

T IS THE NOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGGING PROTON]. THE POLARIZATION IS OF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY	BEAM	HOMENTUM	a 1	Ζ.	GEV/C
- T		POLA	8 I Z A	T I C	N [1]
(GEV/C)**2					
.103		.034	+-	. 05	5
.131		.032		• C 2	3
+163		.036		•ŮI	8
.199		.042		• C 1	3
.237		.066		.¢1	2
.279		.064		• C 1	3
.324		.081		. Cl	4
.373		.055		.01	1
.424		.031		. (1	9
.479		.046		. 0 2	0
.537		.073		. C 2	3
.629		.066		.¢2	6
. 76.2		.002		- 05	6

T IS THE MOMENTUM TRANSFER OCTWCCN THE FINCOMING PROTONI AND THE LUDICUNG PROTONI. The polarization is of the proton along the normal to the production plane in the grand c.m.

[1] PLUS POSSIBLE SYSTEPATIC EPROR OF +- 5 PER CENT.

49 PROTON-PROTON SCATTERING AT 1.48 BEV. [PHYS. REV. 138, 8670 (1965)]

A.M.EISNER, G.L.HART, R.I.LOUTTIT, T.W.HORRIS (BROOKHAVEN NAT. LAB., UPION, L.I., N. Y., USA)

ACT A SAPPLE OF 2657 PROTON-PROTON SCATTERING EVENTS AT 1.48 BEV HAS BEEN ANALYZED. THE ELASTIC CROSS SECTION IS 19.86 MB, AND THE ELASTIC, SCATTERING IS CONSISTENT WITH A SIMPLE GORAUG-DIGHI OFTIGAL HOUGE, WITH $\pi = u_s y_1 + and (1 - a) = 0.864$. The dominant feature of the inelastic scattering is the production of the (372,372) isobar. The reaction PP + P N P1+ IS interpreted Satisfactorily in terms of the ONE-PION-Exchange Model. ABSTRACT

CITATIONS PMYS. REV. 125, 701 (1962), PMYS. REV. 128, 1836 (1962), PMYS. REV. 128, 1832 (1962), PMYS. REV. 103, 211 (1956), PMYS. REV. 107, 859 (1957), PMYS. REV. LETTERS 3, 568 (1959), UCRL 9497 (1961), PMYS. REV. LETTERS 5, 333 (1960), PMYS. REV. 123, 2160 (1961), PMYS. REV. LETTERS 5, 571 (1960), PMYS. REV. LETTERS 7, 196 (1961), PMYS. REV. 125, 2082 (1962), PMYS. REV. 125, 2091 (1962), PMYS. REV. 126, 747 (1962), PMYS. NEV. LI37, BIO17 (1964), PMYS. REV. 125, 2082 (1964), PMYS. REV. 105, 1874 (1957), PMYS. REV. 123, 333 (1961), PMYS. REV. LETTERS 6, 64 (1961), CERN 8956/TM428, PMYS. REV. LETTERS 8, 140 (1962), AND PMYS. LETTERS 2, 66 (1962).

ARTICLE READ BY ODETTE BENARY IN 5/67, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 2.23 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 4000 PICTURES ARE REPORTED CN.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION DIFFERENTIAL CROSS SECTION FITS MASS SPECTRUM MODELS CELTA(1238)

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

TABLE 11

LABERATORY BEAM MOMENTUR - 2.23 +- .06 GEV/C.

PROTON

REACTION	FILLI-BARNS	NO. EVENTS
RCTON +		
ELASTIC	19.86 + .73	1072
	64	
PROTON NEUTRON PI+	17.22 + .66	1048
	57	
PROTON PROTON PLO	3.98 + .27	242
	26	
CEUTERON PI+	.13 .05	8
CEUTERON PI+ PIO	.43 .00	26
PI+ PI+ NEUTRON NEUTRON	.25 .06	15
PROTEN PROTON PIG PIG	.41 .08	25
PROTON PI+ NEUTRON PIO	2.37 .20	144
PROTON PROTON PI+ PI-	1.22 .14	58
PROTON PROTON PI+ PI- PIO	.02 .02	1
PROTON PI+ PI+ PI- NEUTRGN	.02 .02	ĩ

(FIGURE 2)

ELASTIC DIFFERENTIAL	CRESS SECTI	JN FCR	PROTON	PROTON.
LABORATORY BEAM	MOMENTUM	2.23	+06	GEV/C.

THIS DATA WAS	READ FROM A	GRAPH .
-T	C-SIGMA/	C-C⊬EGA
(GEV/C)**2	MB/:	SR
.0100	1.8 **	9
.0196	10.5	2.2
.0324	17.0	2.0
.0484	20.5	3.0
.0676	19.0	3.0
-0900	16.0	2.0
.1156	11.0	1.0
1444	8.5	1.0
1764	8.0	1.0
.2116	6.5	1.0
3500		
2500	4.7	
.2100	3 •4	1.0
.3400	3.1	• •
. 3900	3.5	• ?
.4400	Z • 7	• •
-4900	1.7	• 3
.5500	1.0	.3
.6400	1.3	• 2
.7100	.9	+2

T IS THE NOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (DUTGOING PROTON).

221

R.ERLICH,R.NIEPORENT,R.J.PLANO,J.B.WHITTAKER (RUTGERS UNIV., NEW BRUNSWICK, N. J., USA) C.Baltay,J.FEINMAN, P.FRANZINI,R.NEWPAN,N.YEH (COLUMBIA UNIV., NEW YORK, N. Y., USA)

XACT → A STUDY OF THE REACTION PP + PP PI+ PI- AT 24.8 GEV/C, BASED ON 3250 EVENTS, GIVES STRONG SUPPORT FOP THE PRODUCTION OF RESONANT P PI+ PI- STATES AT 1.423 +- 0.027 AND 1.688 +- 0.023 GEV. ABSTRACT

TIONS BULL. AM. PHYS. SOC. 13, 7C4 (1968), PHYS. REV. LETTERS 21, 1368 (1968), BULL. AM. PHYS. SCC. 13, 682 (1968), NUCVO CIMENTO 50A, 1000 (1968), PHYS. REV. LETTERS 17, 884 (1966), UNIV. OF ILLINOIS CODI195-78, PHYS. LETTERS 18, 67 (1965), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 19, 397 (1967), BULL. AM. PHYS. SOC. 13, 682 (1968), PHYS. REV. LETTERS 18, 973 (1967), AND PHYS. REV. LETTERS 13, 169 (1964).

ARTICLE REAC BY OCETTE BENARY IN 1/65. AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 24-8 GEV/C.

CITATIONS

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER.

GENERAL CCMMENTS ON THIS ARTICLE L THE P PI+ PI- INVARIANT MASS SHOWS ENHANCEMENTS AT 1.42 AND 1.688 GEV. HOWEVER THE RESONANCE PRODUCTION CROSS SECTIONS DEPEND CRITICALLY UPON THE ASSURED SHAPE OF THE BACKGROUND.

KEY WORDS + CROSS SECTION N+(147C)P11 *N+(1688)* MASS SPECTRUM DELTA(1238)

CROSS SECTION FOR	PROTON PROTON	PRCTCN PROTON PI+ PI	[PAGE 1839]
LABORATORY BEAN MOMENTUM			
GEV/C	MILL1-RARNS	NO. EVENTS	
24.8	1.5 +2	15500	

51

THE REAL PART OF THE SPIN-INDEPENDENT FORWARD SCATTERING AMPLITUDE IN ELASTIC NUCLEON-NUCLEON COLLISIONS. [PHYS. LETTERS 258, 245 (1967)]

L.N.C.DUTTON, R.J.W. HOWELLS, J.D. JAFAR, H. 8. VAN DER RAAY IBIRMINGHAM UNIV., BIRMINGHAM, ENGLANDI

ABSTRACT ELASTIC PP ANC PC SCATTERING IN THE COULOMB INTERFERENCE REGION HAVE BEEN STUDIED USING A SONIC SPARK CHAMBÉP TECHNIQUE. ANALYSES OF THESE DATA YIELD ALPHA(P) = 0.10 ↔ 0.16 AND ALPHA(N) = -0.50 ↔ 0.15 AT 1.69 GEV/C IN GOOD AGREEMENT WITH DISPERSION RELATION CALCULATIONS, THE VALUE OF ALPHA(P) = -0.30 ↔ 0.09 OBTAINED AT 1.54 GEV/C IS HOMEVER NOT CONSISTENT WITH. THESE CALCULATIONS.

CLOSELY RELATED REFERENCES SEE ALSO PHYS. LETTERS 268, 679 (1968), AND PHYS. REV. LETTERS 19, 1416 (1968).

ADDITIONAL CITATIONS AUGULEAR INSTRUMENTS AND METHODS 55, 80 (1967), PROC. OF THE PHYSICAL SOCIETY OF LONDON 63A 599 (1950), PROGRESS OF THEORETICAL PHYSICS 31, 162 (1964), PHYS. LETTERS 12, 252 (1964), PHYS. REV. 135, B35B (1964), PHYS. LETTERS 19, 341 (1965), PHYS. LETTERS 8, 285 (1566), RUTHERFORD HIGH ENERGY LAG, PPP/H/14 (1966), PHYS. REV. 139, B362 (1965), PHYS. REV. 139, B386 (1965), SOVIET JNP 1620 (1965), EETP 8 810 (1964), KYOTO UMIVERSTTY RIFP 46 (1965), PRCC. OF THE PHYSICAL SOCIETY OF LONDOW 71 781 (1957), PHYS, REV. 119, 381 (1960), JETP 6 28 (1958), SOVIET PHYSICS DOKLADY 1, 361 (1956), PHYS. REV. 1181 579 (1960), JETP 18 412 (1964), SOVIET JNP 1 379 (1965), PHYS. REV. LETTERS 14, 74 (1965), PHYS. LETTERS 15, 38 (1965), PHYS. LETTERS 20, 203 (1966), JETP 19 542 (1964), SOVIET PHYSICS, JETP LETTERS 6, 8 (1966), PHYS. REV. LETTERS 15, 38 (1965), AND NUGVO CIMENTO 40, 167 (1966).

ARTICLE READ BY DEETTE BENARY IN 4/69, AND VERIFIED BY LEROY PRICE.

NO. 1 IS PROTON ON PROTON FROM 1.54 TO 1.69 GEV/C. ND. 2 IS PROTON ON CEUTERCN FROM 1.54 TO 1.69 GEV/C.

THIS EXPERIMENT USES SPARK CHAMBERS.

KEY WORDS + DIFFERENTIAL CROSS SECTION REAL (AMPLITUDE)/INAGINARY (AMPLITUDE)

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON DEUTERON.

LABORATORY BEAM MOMENTUM = 1.69 GEV/C +- .6(PER CENT).

(CORRECTED FOR BEAN DISTRIBUTION AND PLURAL SCATTERING, PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969)

THE	TA	Ċ−ŠÍĠŇ∆/I	-OMEGA
RACI	ANS	M873	R
0205 +	0010	598. +-	- 35.
0225	.0010	546.	36.
0245	.0010	471.	33.
0265	.0010	494.	32.
0285	.010	395.	28.
0305	.0010	356.	27.
0325	.0010	332.	25.
0345	.0010	359.	26.
0365	.0010	346.	25.
0385	.0010	317.	23.
0405	.0010	344.	23.
0425	.0010	286.	22.
0445	.0010	304.	22.
0465	.0010	290.	23.
0485	.0010	323.	23.

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAM MOMENTUM = 1.69 GEV/C +- .6(PER CENT).

(CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING, PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969 |

Thi	ETA	C-SIGMA/D	-OMEGA
RAC	IANS	MB/SR	
.0195	+0010	372. +-	50.
.0235	.0010	253.	39.
.02/5	.0010	194.	32.
.0315	+0010	142.	26.
.0355	.010	137.	23.
•0395	.001Ó	121.	20.
.0435	.0010	142.	19.
.0475	.0010	154.	19.
.0515	.0010	133.	17.

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

LABORATORY BEAM MOMENTUM = 1.54 GEV/C +- .6(PER CENT).

(CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING, PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969)

THE	TA	D-SIGMA/D	-OFEGA
RADI	ANS	re/s	R
.0185 +	0010	533. +-	53.
.0205	. CO10	472.	47.
.0225	.0010	431.	41.
.0245	.0010	321.	34.
.0265	. CO10	259.	30.
.0285	.0010	215.	27.
.0305	.0010	176.	25.
.0325	.0010	144.	22.
.0345	.0010	176.	22.
.0365	.0010	100.	20.
.0385	- CO10	122.	15.
.0405	.0010	114.	15.
.0425	.0010	127.	15.
.0445	.0010	114.	16.
.0465	.0010	129.	17.
.0485	.0010	111.	17.

THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE LAB.

1

THE REVIN RATIO FOR THE FORWARD ELASTIC AMFLITUDE FOR PROTON PROTON. (PAGE 245)

t	THESE	VALUES	ASSUME	THAT	THE	SPIN-DEPENDANT	AMPL I TUDE	MAY	ßE	NON-ZERG

LABORATORY	ALPH	A .
BEAM MOMENTUM		
GEV/C		
1.69	· 10 +-	.16
1.54	30	.09

THE REVIN RATIO FOR THE FORWARD ELASTIC AMPLITUDE FOR PROTON PROTON. [PAGE 245]

(THESE VALUES	ASSUME THAT THE	SPIN-DEPENDANT	AMPL ITUDE	ΗΛY	BE NON-	ZERO. J
LABCPATORY BEAM MOMENTUM	ALPHA					
GEV/C 1.69	50 +-	• 15				

52 SPALL ANGLE PP SCATTERING IN THE MOMENTUM RANGE 1.3 TO 1.5 GEV/C. [PHYS. LETTERS 26B, 679 (1968)] L.H.C.DUTTON,H.B.VAN DER RAAY (BIRMINGHAM UNIV., BIRMINGHAM, ENGLAND]

ABSTRACT ELASTIC PP SCATTERING IN THE COULOMB INTERFERENCE REGION HAS BEEN STUDIED HISING SONIC SPARK CHAMBERS WITH A MAGNETIC SPECTROMETER. MEASUREMENTS WERE HADE AT 1.29, 1.39, AND 1.54 GEV/C AND THE DATA WERE ANALYZED TO DETERMINE THE REAL PART OF THE SPIN INDEPENDENT FORWARD SCATTERING AMPLITUDE. DISAGREEMENT WITH THE PREOICTIONS OF DISPERSION BELATION CALLY ATTORS WIT FORWARD SCATTERING AMPLITUDE. DISAGREEMENT WITH THE PREOICTIONS OF DISPERSION

CLGSELY RELATED REFERENCES SEE ALSO PHYS. REV. LETTERS 19, 1416 (1968). CONTINUATION OF PREVIOUS EXPERIMENT IN PHYS. LETTERS 258, 245 (1967). ANDITIONAL CITATIONS PHYS. LETTERS 8, 265 (1964), NUCLEAR INSTRUMENTS AND METHODS 55, 80 (1967), PHYS. REV. 146, 980 (1966), JETP 18 412 (1964), PHYS. REV. 119, 381 (1960), AND PHYS. REV. 95, 1350 (1934).

ARTICLE READ BY ODETTE BENARY IN 4765, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON FROM 1.29 TO 1.54 GEV/C.

THIS EXPERIMENT USES SPARK CHAMBERS.

KEY WORDS + DIFFERENTIAL CRDSS SECTION REAL (AMPLITUDE)/IMAGINARY (AMPLITUDE)

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAM MOMENTUM = 1.54 GEV/C.

{ CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER PAAY APRIL 1969 }

THETA	D-SIGMA/C	-OPEGA
RACIANS	MB/S	. P
.0165	1014. +	213.
.0185	590.	76.
.0205	532.	58.
.0225	337.	36.
.0245	326.	31.
.0265	278.	27.
.0285	228.	24.
.0305	220.	22.
.0325	147.	19.
.0345	183.	22.
.0365	146.	21.
.0385	192.	20.
.0405	136.	18.
.0425	135.	18.
.0445	116.	17.
.0465	135.	16.
.0485	144.	16.
.0505	144.	15.
.0525	101.	14.
.0545	128.	15.
.0565	91.	14.
.0585	126.	14.
.0605	95.	13.
.0625	123.	13.
.0645	106.	13.
.0665	162.	12.
.0685	105.	12.
.0705	96.	11.
.0725	86.	10.

LABURATORY BEAM MUMENTUM = 1.39 GEV/C.	LABORATORY	BEAM	MOMENTUM	•	1.39	GEV/C.
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(CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER RAAV APRIL 1969)

THETA	D-SIGMA/C-GMEGA	
RACIANS	ME/SF	
.0175	1039. +- 135.	
.0195	535. 72.	
.0215	524. 40.	
.0235	430. 31.	
.0255	384. 28.	
.0275	324. 24.	
.0295	267. 22.	
.0315	212. 20.	
.0335	175. 19.	
.0355	130. 17.	
.0375	146. 16.	
.0395	129. 14.	
.0415	75. 13.	
.0435	106. 13.	
.0455	99. 13.	
.0475	121. 13.	
.0495	94. 12.	
.0515	95. 12.	
.0535	55. 12.	
.0555	94. 11.	
.0575	97. 11.	
.0595	71. 11.	
.0615	81. 11.	
.0635	\$6. 11.	
.0655	80. 10.	
.0675	73. 9.	
.0695	62. 9.	
.0715	56. 7.	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAM MOMENTUM = 1.29 GEV/C.

CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969 J

THETA	D-SICMA/C	-OMECA
RADIANS	₩8/5	R
+0205	892. +-	166.
.0225	657.	85.
.0245	608.	73.
.0265	306.	60.
.0285	292.	33.
.0305	263.	30.
.0325	244.	27.
.0345	214.	24.
.0365 .	162.	22.
.0385	164.	20.
.0405	167.	19.
.0425	154.	18.
.0445	142.	17.
.0465	163.	17.
.0485	136.	16.
.0505	132.	16.
.0525	137.	15.
.0565	132.	26.
.0585	97.	20.
.0605	101.	20.
.0625	94.	20.
.0645	81.	19.
.0665	65.	18.
.0685	78.	16.
.0705	71.	16.
.0725	55.	14.

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

THE RE/IM RATIC FOR THE FORWARD ELASTIC APPLITUDE FOR PROTON PROTON. [TABLE 1]

I THESE VALUES ASSUME THAT THE SPIN-DEPENDANT PART OF THE AMPLITUDE MAY BE NON-ZERO.)

LABORATORY	ALPHA
BEAM MOMENTUM	
GEV/C	
1.54	32 +07
1.39	58 .06
1.29	76 .13

53 HIGH-FNFRGY PROTON-PROTON SCATTERING. (PHYS. REV. LETTERS 9, 111 (1962))

A.N.DIDDENS,E.LILLETHUN,G.MANNING,A.E.TAYLOR,T.G.WALKER,A.M.WETHERELL [EUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLANC] CLOSELY RELATED REFERENCES THIS APTICLE SUPERSTOLS PHYS. NEV. LETTERS 7, 450 (1961).

ADDITIONAL CITATIONS PHYS. REV. 127, 950 (1962), PHYS. REV. LETTERS 9, 108 (1962), PHYS. REV. 107, 859 (1957), INT*L. CONF. ON ELEM. PARTICLES, AIX-EN-PROVENCE 2 128 (1961), PHYS. REV. LETTERS 7, 394 (1961), ZURN. EKSP. TEOR. FIZ. 41, 667 (1961), Jeif 14 478 (1862), AND PHYS. REV. LETTERS 1, 29 (1962).

ARTICLE REAC BY ODETTE BENARY IN 4/67, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON HYDROGEN COMPOUND FROM 12.99 TO 22.92 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORCS . DIFFERENTIAL CROSS SECTION

FLASTIC DIFFERENTIAL CROSS SECTION (AT FIXED ANGLE OR T) FOR PROTON PROTON. THETA = .0565 RADIANS. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB. [THIS DATA REPLACES VALUES GIVEN EARLIER IN COCCONI ET AL., PHYS. REV. LETTERS 7, 450 (1961)] LABORATORY BEAM MCMENTUM GEV/C C-SIGMA/C-CMEGA PER CENT 45.00 +- 5C 10.00 50 4.50 50 1.50 50 1.50 50 .53 50 .54 50 .24 50 .24 50 .10 50 12.99 15.89 17.30 17.75 18.69 19.56 19.75 19.91 21.88 22.74 26.02 FLASTIC DIFFERENTIAL CRESS SECTION (AT FIXEC ANGLE OR T) FOR PROTON PROTON. THETA = .0605 RADIANS. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB. [THIS DATA REPLACES VALUES GIVEN EARLIER IN COCCONI ET AL., PHYS. REV. LETTERS 7. 450 (1961)] LABORATORY REAM MOMENTUM C-SIGMA/D-DNEGA ME/SR PER CENT ĢEV/Ç 18.29 .560 +- 50 .026 50 ELASTIC DIFFERENTIAL CRCSS SECTION (AT FIXED ANGLE OR T) FOR PROTON PROTON. THETA = .11 RADIANS. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB." LABORATURY Am Momentum Gev/C D-SIGMA/D-DMEGA REA MB/58 PER 2.7500 +- 50 .3100 50 .1200 50 .0400 50 .0055 50 .0011 50 PER CENT 8.94 11.28 13.98 15.96 18.97 21.46 54 SKALL-ANGLE PD SCATTERING IN THE MOMENTUM RANGE 1.3 TO 1.5 GEV/C. (PHYS. REV. LETTERS 21, 1416 (1968)) L.M.C.DUTTON, H.B.VAN DER RAAY [BIRNINGHAM UNIV., BIRMINGHAM, ENGLAND] TACT THE ELASTIC AND GUASIELASTIC SCATTERING OF INCIUENI PHUIUNS BY A DEUTERIUM TARGEY, OVER THE ANGULAR PANGE 20-70 MRAD IN THE LABORATORY SYSTEM, HAS BEEN DETERMINED USING A SONIC SPARK-CHAMBER SYSTEM. DATA MERE OBTAINED AT INCIOENT MOMENTA OF 1.29, 1.39, AND 1.54 GEV/C AND ANALYZED TO DETERMINE THE RATIO OF THE REAL TO INAGINARY PARTS OF THE TM FORMAND GGATTERING AMPLITUDE. SATISPACTORY AGREETENT WITH THE PREDICTIONS OF UISPERSION-RELATION CALCULATIONS MAS ARTAINED. ABSTRACT CLOSELY RELATED REFERENCES CONTINUATION OF PREVICUS EXPERIMENT IN PHYS. LETTERS 258, 245 (1967). ADDITIONAL CITATIONS PHYS. LETTERS 20, 203 (1964), PHYS. REV. 135, 8358 (1964), PHYS. LETTERS 268, 679 (1968), PHYS. REV. 146, 980 (1966), PHYS. LETTERS 19, 341 (1965), PHYS. LETTERS 6, 38 (1965), NUOVO CIMENTO 41A, 167 (1966), PHYS. REV. 139, 8362 (1965), PHYS. REV. 139, 8360 (1965), AND JETP 19 542 (1964). ARTICLE READ BY ODETTE BENARY IN 4/69, AND VERIFIED BY LEROY PRICE. BEAM IS PROTON ON DEUTERON FROM 1.25 TO 1.54 GEV/C. THIS EXPERIMENT USES SPARK CHAPEERS. KEY WORDS . DIFFERENTIAL CROSS SECTION REAL (AMPLITUDE)/IMAGINARY (AMPLITUDE) FLASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON GENTERON. LABORATORY REAP MCMENTUM . 1.54 +- .60 GEV/C. CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969 J
 MAX
 DISTRIBUTION AN

 C-SIGMA/D-CPEGA

 MBJSP

 856. +

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 458. 50.

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 495. 47.

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 401. 21.

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 347. 18.

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 27. 15.

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 254. 14.
 (CORRECTED THETA RACIANS 0185 ← .0010 0225 .0010 0225 .0010 0225 .0010 0225 .0010 0225 .0010 0326 .0010 0336 .0010 0336 .0010 0336 .0010 0445 .0010 0445 .0010 0445 .0010 0445 .0010 0445 .0010 0455 .0010 0555 .0010 0555 .0010 0555 .0010 0625 .0010 0625 .0010

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

.0625 .0645 .0665 .0685 .0705

.0010 .0010 .0010 .0010 ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON DEUTERON.

LABORATORY BEAM MOMENTUM = 1.39 +- .6C GEV/C.

(CORRECTED FOR BEAM DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969)

THE	TA	D-\$16#4/0	-OFEGA
RACI	ANS	MB/:	5 P
.0195 +	0010	791. +-	- 63.
.0215	.010	607.	43.
.0235	.0010	520.	34.
.0255	.010	511.	32.
.0275	.0010	482.	29.
.0295	.0010	424.	27.
.0315	.0010	395.	25.
.0995	.0010	357.	24.
.0355	.0010	347.	22.
.0375	.0010	312.	21.
.0395	.0010	326.	21.
.0415	.0010	298.	20.
.0435	.0010	297.	19.
.0455	.0010	296.	19.
.0475	.0010	292.	19.
.0495	.0010	302.	19.
.0515	.0010	268.	18.
.0535	.0010	247.	17.
.0555	.0010	289.	18.
.0575	.0010	257.	17.
.0595	.0010	250.	17.
.0615	.0010	252.	17.
.0635	.0010	228.	16.
.0655	.0010	274.	16.
-0675	. 010	249.	16.

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON CEUTERON.

LABORATORY BEAM NOMENTUM = 1.29 +- .6C GEV/C.

I CORRECTED FOR BEAN DISTRIBUTION AND PLURAL SCATTERING. PRIVATE COMMUNICATION FROM VAN DER RAAY APRIL 1969)

т	4FTA	D-SIGMA/	D-C⊭EGA
8 4	DIANS	MB/	SR
.0205	+0010	1072. +-	- 96.
.0225	.0010	756.	82.
.0245	.0010	653.	70.
.0265	.0010	622.	63.
.0285	.0010	447.	54.
.0305	.0010	392.	52.
.0325	.0010	392.	25.
.0345	.0010	382.	27.
.0365	.0010	363.	26.
.0385	.0010	350.	25.
.0405	.0010	394.	25.
.0425	.0010	340.	23.
.0445	.010	334.	23.
.0465	.0010	385.	23.
.0485	.0010	364.	23.
.0505	.0010	348.	22.
.0525	.0010	311.	21.

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

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THE REVIN NATIO FOR THE FORWARD BLASTIC AMPLITUDE FOR PROTON NEUTRON. (TABLE 1)

(THESE VALUES ASSUME THAT THE SPIN-DEPENDANT PART OF THE AMPLITUDE MAY BE UNEQUAL TO ZERD.)

Δίρηδ
68 +25
48 .13
36 .18

55

A BUBBLE CHAMBER STUDY CF PROTON-PROTON INTERACTIONS AT 4 GEV/C. PART I - ELASTIC SCATTERING, SINGLE-PION AND CEUTERON PRODUCTION. INUCVC CIMENTO 494, 475 (1967)1

S.CCLETTI,J.KIDD,L.MANCELLI,V.PELOSI,S.RATTI,V.RUSSO,L.TALLONE,E ZAMPIERI (UNIV. DI MILANG, MILANG, ITALY) C.CASO,F.CONTE,N.DAMERI,C.GROSSC,G.TCMASINI IUNIV. DI GENOVA, GENOVA, ITALY)

RACT ELASTIC SCATTERING, SINGLE-PION AND DEUTERCN PRODUCTION HAVE BEEN INVESTIGATEC. THE CROSS-SECTION FOR ELASTIC SCATTERING, SINGLE-PION AND DEUTERCN PRODUCTION HAVE BEEN INVESTIGATEC. THE CROSS-SECTION FOR ELASTIC SCATTERING IS (13.5 \leftarrow 0.3) NB. THE ARGULAR DISTRIBUTION HAS BEEN FITTED TO D-SIGMA/DT = [D-SIGMA/DT (AT T = 0) EXP(-B*T) IN THE REGION CF LOW VALUES OF T. THE BEST FIT GIVES B = (6.7 \leftarrow 0.5) (GEV/CI*+2 AND (D-SIGMA/DT (AT T = C)] (9.7 \leftarrow 0.4) MB. THE SECTIONS FOR ELASTIC SECTIONS FOR POLO. AND DEVICEON-DION SADE RESPECTIVELY (2.6 \leftarrow 0.3) MB AND (9.7 \leftarrow 0.4) MB. THESE REACTIONS ARE COMINATED BY THE (3/2,3/2) NUCLEON-DION SADE RESPECTIVELY (2.6 \leftarrow 0.3) MB AND BACKWARD COLLIMATION OF THE NUCLEONS. THE PRODUCTION RATES FOR THE ISOBAS N*+(1238), N*+(1238), N*+(1250), HAVE BEEN ESTIMATEO, TAKING INTC ACCCUNT THE EXPERIMENTAL PERIPHERAL BEHAVIOUR OF THE INTERACTION. IN THE PN PI* REACTION THEY ARE (50 \leftarrow 2) PER CENT. (10 \leftarrow 3) PER CENT. (4 \leftarrow 3) PER CENT. IN THE PP DID REACTION THE PRODUCTION OF N*+(1238) IS ESTIMATED TO BE (55 \leftarrow 0.01) MB. AND (0.04 \leftarrow 0.01) MB. ABSTRACT

CLOSELY RELATED REFERENCES SEE ALSO SIENNA CONFERENCE 1 591 (1963), PHYS. LETTERS 16, 75 (1965), PHYS. LETTERS 16, 196 (1965), AND NUCIVO CIMENTO 43, 1710 (1964).

43, 1710 (1964).
ADDITIONAL CITATIENS
PHYS. REV. 105, 1874 (1557), PHYS. KEV. LETIEKS 5, 24 (1960), PHYS. REV. 123, 333 (1961), PROGRESS OF THEORETICAL PHYSICS 5, 57C (1950), CERN 59-08 (1959), NUDVO CIMENTO 27, 208 (1963), NUDVO CIMENTO 27, 856 (1963), PHYS. REV. 131, 164(11957), REV. 131, 164(11957), REV. ADD CIMENTO 27, 1650), NUDVO CIMENTO 27, 856 (1964), PHYS. REV. 131, 164(11957), REV. 131, 1355A (1964), NUDVO CIMENTO 40, 839 (1965), PHYS. REV. 127, 136, 1961), PHYS. REV. 125, 201 (1962), PHYS. REV. 121, 126, 201, 1965), RHYS. REV. 127, 126, 201, 1965), RHYS. REV. 127, 213, 1465 (1961), PHYS. REV. 127, 213, 1455 (1961), PHYS. REV. 127, 213, 1455 (1961), PHYS. REV. 127, 213, 1455 (1961), PHYS. REV. LETTERS 15, 201 (1965), PHYS. REV. LETTERS 15, 184 (1966), PHYS. REV. LETTERS 15, 201 (1965), PHYS. REV. 127, 223, 2136, 2136, 213, 2137,

ARTICLE READ BY OCETTE BENARY IN 1/65. AND VERIFIED BY LERGY PRICE.

REAM IS PROTON ON PROTON AT 4 GEV/C.

THES	5 87	PEF	RIME	ENT	US	ES	T۲	E	SAC	LA	Y i	81	ÇM	C	н)	BU	EBL	E	сн/	A MB	ER.	•	٨	10		LO	F 5	000	00 F	10.	IURI	E S	ARE	R	EPO	RT	ED	ON	•					
KEY	WGF	RDS	• (DE/	CRO NS 1	5 S T Y	SEC Mat	CT 1 FR 1	CN X		D	6 L (FFE	R E 1 2	NT 38	1 A ()	LC	ROS N#	is • ()	S E (CT 1 D) D	0N 13		F O	119 101	S reri	ON	MAS	s :	SPEC	TRI	IM		A N	GUI	AR	D	15	TP I	80	TIC	אנ			
COMP	200	ND P	(EY	WDI	RDS	•		FI	τs	01	FFI	ERE	INT	IA	L	CRC	ss	SE	CT	10N																								
					-			-	-	-				-	-	-			-	-		• •	•			-		-					-			-	-	-	-			-	-	

TABLE 11

LABORATORY BEAM MOMENTUM = 4.00 +- .04 GEV/C. REACTION PROTON PROTON -MILLI-84RNS NO. EVENTS ROTON + TCTAL ELASTIC PROTON PROTON PIO PROTON NEUTRON PI+ CEUTERON PI+ DEUTEPON PI+ RI+ RI-43.000 +- 1.500 .300 .300 .400 .010 13.500 2205 2.600 .027 - 010 2 PRONGS 34.100 1.100

FRACTION

[PAGE 492]

LABORATORY PEAN NUMENTUM = 4.00 +- .04 GEV/C.

REACTION	PER CENT (1
PROTON PROTON +	
DELTA(1238)++ NEUTRON	50. +- 2.
DELTA(1238) PROTON PI+ (2)	
DELTA(1238)+ PROTON	10. 3.
DELTA(1339): * NEUTIUN 11) [2]	
N*(1520)+ PROTCN	4. 3.
N+(1520)+ + NEUTRON P1+ 121	

[1] THESE FRACTIONS SHOULD BE MULTIPLIED BY 9.7 +- .4 TO GET CROSS SECTIONS IN MILLIBARNS. [2] USED SIMPLE MASS CUT.

[PAGE 492]

LABORATORY REAM MOMENTUP = 4.00 +- .04 GEV/C.

REACTION	FRACTION PER CENT [1]
PROTON PROTON +	
DELTA(1238)+ PROTON	45. +- 10.
DELTA(1238)+ + PROTON PIO (2)	
N#(1520)+ PROTUN	< 5.
N#(1520)+ • PROTON PIC (2)	

[1] THESE FRACTIONS SHOULD BE PULTIPLIED BY 2.6 +- .3 TO GET CROSS SECTIONS IN MILLIBARNS. [2] USED SIMPLE MASS CUT.

LABORATORY BE		
	AM MEMENTUM = 4.00 +-	-04 GEV/C-
. THIS DATA W	AS READ FROM & GRAPH .	
-1	D-\$16#4/F-T	
(GEV/C)++2	#B/(GEV/C)++2	
.025	80.000 +- 8.000	
.050	67.000 8.000	
.075	50.000 7.000 40.000 8.000	
.130	32.000 6.000	
.150	28.000 5.000 25.000 5.000	
.230	20.000 3.000	
.380	8.000 1.000	
.65C	1.300 .400	
1.300	.020 .050	
1.60C 2.400	.080 .003 .011 .002	
T IS THE MOMEN	ITUM TRANSFER BETWEEN TH	E (INCOMING PROTON) AND THE LGUTGGING PROTON].
•		
FIT TO ELASTIC DIFF	ERENTIAL URUSS SECTION (FOR PROTON PROTON. [PACE 488]
LABORATORY BEA	M MOMENTUM = 4.00 +-	.04 GEV/C.
DATA IS FIT OV IQUTGOING FITTED FORMULA	/ER -T FROM .02 TO .40 () ; PRGTON]. A IS D-SIGMA/D-T	GEV/C)++2. T. IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONJ AND THE = A+EXP(8[T])
WHERE	D-SIGMA/D-T IS IN ME/IG	EV/CI**2 AND -T IS IN (GEV/C)**2.
FITTED VALUES		
A =	91. +- 5.	
0 -		
1		
CROSS SECTIONS FUR	ELEMENTARY PARTICLE INT	ERACTIONS (FORTSCHRITTE DER PMYSIK 9, 549 (1961))
V.S.BARASHENKOV,V.M	I-MALTSEV (JOINT INST. F	GR NUCL. RESEARCH, DUBNA, USSRI
* * THIS IS A C	COMPILATION * *	
ARTICLE READ BY ODE	TTE BENARY IN 10/69, ANI	D VERIFIED BY LERCY PRICE.
GENERAL COMPENTS ON	THIS ARTICLE	
1 WE HAVE NOT	ENCODED ALL OF THE DATA	GIVEN BY BARASHENKOV IN HIS TABLES , BUT RATHER HAVE ARBITRARILY SELECTED OUT
SUME REPRES	ENTATIVE PLINIS.	
KEY WORDS . CROSS S	ECTION	
PROTON PROTON TOTAL	CRGSS SECTION. [1]	[TABLE 1]
PROTON PROTON TOTAL	CROSS SECTION. (1)	(TABLE 1)
PROTON PROTON TOTAL Laboratory BEAM ENERGY	CROSS SECTION. (1)	(TABLE 1)
PROTON PROTON TOTAL Laboratory Beam Energy Gev .0100	CROSS SECTION. (1) Mill1-BARNS 314.0 +- 13.0	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV .0100 .0198 .0312	NILLI-BARNS 314.0 +- 13.0 155.0 2.0	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396	CRGSS SECTICN. (1) NILLI-BARNS 314.0 ↔ 13.0 155.0 2.0 92.0 1.0 70.0 1.0	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY CEV .0100 .0198 .0312 .0396 .0502 .040	. CRGSS SECTION. (1) NILLI-BARNS 314.0 ← 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 ←	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV -0100 -0112 -0312 -0396 -0502 -0619 -0695	NILLI-BARNS 314.0 → 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV -0100 -0312 -0396 -0592 -0619 -0695 +0705 +0705	NILLI-BARNS 314.0 ← 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 32.0 2.0 32.0 2.0	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERCY C CV 0100 0198 0312 0396 0502 0619 0695 0705 0705 0990	MILLI-BARNS 314.0 +- 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 32.0 2.0 28.5 1.3 27.7 1.3	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0502 0502 0502 0505 0505 0505 0505 05	MILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .6 42.5 .6 37.4 2.0 37.4 2.0 28.5 1.0 28.5 1.0 29.5 1.0 2	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV .0100 .0198 .0312 .0396 .0302 .0619 .0645 .0705 .0950 .1180 .1420 .1600	NILLI-BARNS 314.0 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 32.0 2.0 28.5 1.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY CEV 0100 0312 0396 0502 0615 0705 0750 0950 1180 1420 1600 1700 2750	$\begin{array}{c} \text{CRGSS SECTION. (1)}\\ \text{MILLI-BARNS}\\ 314.0 \leftarrow 13.0\\ 155.0 & 2.0\\ 92.0 & 1.0\\ 70.0 & 1.0\\ 52.8 & .6\\ 42.5 & .4\\ 37.4 & 2.3\\ 32.0 & 2.0\\ 28.5 & 1.3\\ 27.7 & 1.3\\ 24.8 & .8\\ 25.2 & 1.7\\ 26.1 & 1.0\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.2 & 1.9\\ 23.4 & 1$	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERCY CCV 0100 0198 0312 0396 0502 0619 0695 0705 0705 0990 1180 1420 1100 1700 2250 2470	$\begin{array}{c} \text{CROSS SECTION. (1)} \\ \text{MILLI-BARNS} \\ 314.0 \leftarrow 13.0 \\ 155.0 & 2.0 \\ 92.0 & 1.0 \\ 70.0 & 1.0 \\ 52.8 & .6 \\ 42.5 & .4 \\ 37.4 & 2.3 \\ 22.9 & 2.0 \\ 28.5 & 1.3 \\ 27.7 & 1.3 \\ 24.8 & .8 \\ 25.2 & 1.7 \\ 26.1 & 1.0 \\ 23.2 & 1.9 \\ 22.4 & .8 \end{array}$	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERCY CEV 0100 0198 0312 0396 0502 0619 0695 0795 0795 0795 0795 0795 0795 0795 07	MILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .6 42.5 .6 37.4 2.3 37.0 2.0 28.5 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.2 1.9 25.2 1.9 25.2 1.9 25.4 1.6 27.4 1.6 2	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0312 0396 0502 0619 0605 0750 0750 0750 1180 1420 1600 1180 12250 2470 2406 3300	NILLI-BARNS 314.0 ↔ 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 32.0 2.0 26.5 1.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 1.8 22.4 1.9 22.4 1.0 23.4 .9	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GCV -0100 -0198 -0396 -0396 -0396 -0396 -0502 -0619 -0645 -0705 -0950 -1180 -1420 -1600 -1180 -1250 -2470 -2406 -3150 -3300 -3450 -3450	NILLI-BARNS 314.0 → 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 32.0 2.0 28.5 1.3 27.7 1.3 24.8 .8 25.2 1.9 23.2 1.9 22.4 .9 22.4 .9 23.2 .3 24.3 .0 23.2 .3 24.4 .4	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV -0100 -0198 -0312 -0396 -0619 -0605 -0619 -0605 -0705 -0705 -0705 -0705 -0705 -0705 -1180 -1420 -1420 -1420 -1420 -2250 -2470 -2470 -3300 -3350 -3350 -3800 -4100	MILLI-BARNS 314.0 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 37.0 2.0 28.5 1.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 .9 23.2 .3 24.3 .0 23.2 .3 24.4 .4 24.0 1.0 26.9 .7	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0312 0396 0502 0619 0605 0705 0705 1180 1420 1100 2250 2470 2470 3150 3300 3450 3800 4100	$\begin{array}{c} \text{CRGSS SECTION. (1)}\\ \text{MILLI-BARNS}\\ \text{314.0} \leftarrow 13.0\\ 155.0 & 2.0\\ 92.0 & 1.0\\ 70.0 & 1.0\\ 52.8 & .6\\ 42.5 & .4\\ 37.4 & 2.3\\ 32.0 & 2.0\\ 28.5 & 1.3\\ 27.7 & 1.3\\ 24.8 & .8\\ 25.2 & 1.7\\ 26.1 & 1.0\\ 23.2 & 1.9\\ 22.4 & .9\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 22.4 & 1.6\\ 23.2 & 1.3\\ 24.4 & 1.6\\ 24.0 & 1.0\\ 26.9 & .7\\ \end{array}$	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY CEV -0100 -0198 -0312 -0396 -0502 -0695 -0505 -0505 -0505 -0500 -1800 -1800 -1000 -1000 -2250 -2470 -2470 -2470 -2470 -3300 -3300 -4080 -4100	$\begin{array}{c} \text{CRGSS SECTION. (1)} \\ \text{MILLI-BARNS} \\ \text{314.0} \leftarrow 13.0 \\ 155.0 & 2.0 \\ 92.0 & 1.0 \\ 70.0 & 1.0 \\ 52.8 & .6 \\ 42.5 & .4 \\ 37.4 & 2.3 \\ 37.4 & 2.3 \\ 37.4 & 2.3 \\ 26.5 & 1.3 \\ 27.7 & 1.3 \\ 24.8 & .8 \\ 25.2 & 1.7 \\ 26.8 & .8 \\ 25.2 & 1.7 \\ 26.1 & 1.0 \\ 23.2 & 1.9 \\ 22.4 & 1.6 \\ 22.4 & 1.6 \\ 22.4 & 1.6 \\ 22.4 & 1.6 \\ 22.4 & 1.6 \\ 23.2 & .3 \\ 24.3 & 1.0 \\ 23.2 & .3 \\ 24.4 & .4 \\ 24.0 & 1.0 \\ 26.9 & .7 \\ \end{array}$	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396 0502 0619 0695 0705 0705 0705 0705 1180 1420 1100 1700 2250 2470 3150 3300 3450 3450 3450 3450 4100	MILLI-BARNS 314.0 13.0 155.0 13.0 92.0 1.0 70.0 1.0 52.8 .4 42.5 .4 37.4 2.3 28.7 1.3 27.7	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396 0502 0619 0619 0695 0705 0705 0705 1800 1420 1000 1700 2250 24100 3150 3300 3450 3400 3450 3400 34	 CRGSS SECTION. (1) MILLI-BARNS 314.0 + 13.0 15.0 2.0 92.0 1.0 70.0 1.0 52.8 4 42.5 4 37.0 2.0 20.7 1.3 20.7 1.3 20.7 1.3 20.7 1.3 20.7 1.3 21.9 22.4 16 22.4 16 23.2 3 24.3 1.0 23.4 3 24.3 1.0 23.4 4 24.0 1.0 26.9 7 M A REVIEW ARTICLE. L CRGSS SECTION. (11) 	(TABLE 1) [TABLE 4]
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396 0502 0619 0695 070	 CRGSS SECTION. (1) NILLI-BARNS 314.0 ↔ 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 37.4 2.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 .9 22.4 .9 23.2 .3 24.4 .4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. [1] 	(TABLE 1)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0502 0695 0785 0785 0785 1180 1120 1200 12250 2250 2250 3350 3450 4100 (1] TAKEN FRO LABORATORY BEAM ENERGY GEAM E	■ CRGSS SECTION. (1) NILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 37.7 2.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 1.8 24.3 1.0 23.4 .9 23.2 .3 24.4 .4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. [1] MILLI-BARNS	(TABLE 1) (TABLE 4)
PROTON PROTON TOTAL LABORATORY BEAM ENERCY GEV 0100 0198 0312 0396 0502 0619 0619 0619 0619 0705 070	A REVIEW ARTICLE. NILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 6 42.5 4 37.4 2.3 32.0 2.0 28.5 1.3 27.7 1.3 24.8 8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 9 22.4 9 22.4 1.0 23.2 1.9 22.4 1.0 23.2 1.9 22.4 1.0 23.2 1.9 22.4 1.0 23.2 1.9 22.4 1.0 23.2 1.9 24.3 1.0 23.2 3 24.3 1.0 23.4 9 23.2 3 24.4 4 24.0 1.0 26.9 7 M A REVIEW ARTICLE.	(TABLE 1) (TABLE 4)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0366 0502 0619 0655 078	 CRGSS SECTION. (1) MILLI-BARNS 314.0 + 13.0 195.0 2.0 92.0 1.0 92.0 1.0 92.0 1.0 92.5 4.4 22.5 4.4 22.5 2.7 2.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.4 8.8 27.7 1.3 27.4 1.6 22.4 1.6 22.4 1.6 22.4 1.6 22.4 1.6 22.4 1.6 23.4 .9 23.2 3 24.4 4.4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. (1) MILLI-BARNS 504.C + 10.0 273.0 7.6 126.0 3.0 	(TABLE 1) (TABLE 4)
PROTON PROTON TOTAL LABORATORY BEAM ENECY GEV 0100 0198 0312 0396 0502 0619 0619 0619 0619 0619 0705	CRGSS SECTION. (1) MILLI-BARNS 314.0 ← 13.0 195.0 ← 13.0 195.0 ← 10.0 92.0 1.0 70.0 1.0 92.0 1.0 70.0 1.0 92.7 1.3 20.7 1.3 21.7 1.3 22.8 1.0 23.2 1.9 22.4 1.6 22.4 1.6 23.2 3 24.4 1.0 23.4 0 1.0 23.4 1.0 23.4 3 1.0 23.4 3 1.0 23.4 3 1.0 24.4 1.6 25.7 1.3 24.4 1.6 25.7 1.3 24.4 1.6 25.2 1.9 23.4 0 1.0 25.4 1.0 25.7 1.3 24.4 1.6 25.9 .7 X4.4 1.0 26.9 .7 X X4.6 1.0 26.9 .7 X X4.6 0 1.0 25.9 .7 X504.0 .7 .0 X4.6 0 3.0 76.0 1.7 80.0 7.0	(TABLE 1) [TABLE 4]
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396 0502 0619 0695 070	CRGSS SECTION. (1) NILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 37.5 2.0 26.5 1.3 27.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 .9 23.2 1.9 23.2 1.9 23.2 1.9 23.4 .9 23.4 .9 23.4 .9 23.4 .9 23.4 .9 24.4 .4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. (11) MILLI-BARKS 504.C + 10.0 27.0 7.6 126.0 3.0 76.0 1.7 80.0 7.0 40.9 1.2	(TABLE 1) (TABLE 4)
PROTON PROTON TOTAL LABORATORY BEAM ENERCY 0100 0198 0312 0396 0502 0619 0695 0705 0705 0705 1180 1420 1600 1700 2470 2470 2470 3150 3150 3450 4100 (11) TAKEN FRO 0400 0000 04000 0400 0400 0400 0400 040	ARCSS SECTION. (1) NILLI-BARNS 314.0 + 13.0 155.0 2.0 92.0 1.0 70.0 1.0 52.8 .6 42.5 .4 37.4 2.3 37.7 1.3 24.8 .8 25.2 1.7 26.1 1.0 23.2 1.9 22.4 .9 22.4 1.8 24.3 1.0 23.4 .9 23.2 .3 24.4 .4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. [1] MILLI-BARNS 504.0 + 10.0 27.0 7.6 126.0 3.0 7.60 1.7 80.0 7.0 46.4 1.2 51.2 2.6 41.0	(TABLE 1) (TABLE 4)
PROTON PROTON TOTAL LABORATORY BEAM ENERGY GEV 0100 0198 0312 0396 0502 0619 0695 0705 0705 0705 0705 1180 1420 1000 2470 2470 2470 3150 3300 4100 (1] TAKEN FRO 0400 4100 (1] TAKEN FRO NEUTRCN PROTON TOTA LABORATORY BEAP ENERGY GEV 0199 0300 1011 1530 1600 2200	 CRGSS SECTION. (1) MILLI-BARNS 314.0 +- 13.0 195.0 2.0 92.0 1.0 92.0 1.0 92.0 1.0 92.8 -5 22.5 4.4 22.5 4.4 22.5 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.7 1.3 27.8 -8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.8 22.4 1.0 23.2 3 24.4 4.4 24.3 1.0 23.4 -9 23.2 3 24.4 4.4 24.0 1.0 26.9 .7 M A REVIEW ARTICLE. L CRGSS SECTION. (1) MILLI-BARAS 504.C +- 10.0 273.0 7.6 126.0 3.0 76.0 1.7 80.0 7.0 46.4 1.2 51.2 2.6 41.0 4.0 	(TABLE 1) (TABLE 4)

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(1) TAKEN FROM A REVIEW ARTICLE.

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PROTEN-PROTEN INTERACTIONS AT 5.5 GEV/C. [PHYS. REV. 154, 1284 (1567)]

G.ALEXANDER.O.BENARY.G.CZAPEK.B.MABER.N.KIORON.B.REUTER.A.SHAPIRA, E.SIMOPOULQU.G.YEKUTIELI [WEIZMANN INST. OF SCI., REMOVOTH, ISRAEL]

RACT THIS REPORT IS BASED ON ABOUT 10,500 PP COLLISION EVENTS PRODUCED IN THE BI-CH SACLAY HYDROGEN BUBBLE CHAMBER AT CERN. CROSS-SECTION VALUES FOR THE DIFFERENT IDENTIFIED FINAL STATES AND RESUMANCES ARE GIVEN. THE ISOBARS N*(1238), N*(1420), N*(1518), N*(1688), N*(1920), AND N*(2360) WERE IDENTIFIED AND THEIR PROPUCTION CROSS-SECTION VALUES WERE FOUND VIA A BEST-FIT ANALYSIS OF DIFFERENT INVARIANT-MASS HISTOGRAMS. ABOUT 70 PER CENT OF THE ISOBARS ARE GOVENCTED WITH THE QUASI-TWO-BOCY REACTIONS PP-NEN AND PP-NEWE. THE REACTION PP-NEUTRON N*(1238)++ WITH A CROSS SECTION DF 3.25 + O.16 NB WAS ANALYZED IN TERNS OF A PERIPHERAL ABSORPTION MODEL, WHICH WAS FOUND TO BE IN GOOD AGREEHENT NITH THE DATA. VARIOUS CECAY MODES OF THE N*(1518) AND N*(1688) ISOBARS WERE CBSERVED AND THEIR BRANCHING RATIOS DETERMINED. THE BRANCHING RATIO OF N PI+ TC P PI+ PI- MAS FOUND TO BE O.77 +- 0.45 FOR *(1518) AND 0.57 +- 0.45 FOR N*(1518) THE BRANCHING RATIO OF N PI+ 10 PI+ PI- OF N*(1688) WAS STIMATED TO BE 0.74 +- 0.14. PION PRODUCTION TURNED OUT TO BE MAINLY DUE TO DECAY OF ISOBARS. PRODUCTION OF MESON RESONANCES TURED OUT TO BE LESS IMPORTANT: THE REACTION PP-PP DMEGA -PP PI+ PI- PIO WAS IDENTIFIED WITH A CROSS-SECTION VALUE OF 0.11 +- 0.02 MB. FINALLY. THE PRODUCTION OF NEUTAL STRANGE PARTICLES WITH A CROSS SECTION OF 0.45 +- 0.04 MB IS DISCUSSEC. STRONG FORMATION OF Y*(1385) IS COSERVED. ABSTRACT

CLOSELY RELATED REFERENCES CONTINUATION OF PREVICUS EXPERIMENT IN PHYS. REV. LETTERS 13, 355A (1964), PHYS. REV. LETTERS 15, 207 (1965), NUEVO CIMENTO 39, 384 (1965), NUEVO CIMENTO 40A, 839 (1965), AND PHYS. REV. 144, 1122 (1966).

ADDITIONAL CITATIONS PHYS. REV. 123, 2160 (1961), PHYS. REV. 125, 2082 (1962), PHYS. REV. 133, BI017 (1964), PHYS. REV. 138, 9670 (1965), PHYS. LETTERS 16, 75 (1965), PHYS. LETTERS 7, 222 (1963), REV. MOD. PHYS. 37, 633 (1965), NUOVO CIMENTO 38, 60 (1965), PHYS. LETTERS 8, 285 (1964), PHYS. LETTERS 13, 185 (1964), OXFORD CONFERENCE 93 (1965), NUOVO CIMENTO 24, 719 (1962), NUOVO CIMENTO 34, 1644 (1564), NUOVO CIMENTO 33, 309 (1564), PHYS. LETTERS 8, 134 (1964), NUOVO CIMENTO 24, 719 (1962), PHYS. REV. LETTERS 14, 855 (1966), OUENA CONFERENCE 480 (1964), PHYS. LETTERS 5, 279 (1963), OXFORD CONFERENCE 131 (1965), PHYS. REV. LETTERS 14, 604 (1965), AND PHYS. LETTERS 11, 164 (1964). 119651.

ARTICLE READ BY DEETTE BENARY IN 1/65, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON PROTON AT 5.52 GEV/C.

THIS EXPERIMENT USES THE SACLAY BI CF (H) BUBBLE CHAMBER. A TOTAL OF 30000 PICTURES ARE REPORTED ON.

KEY WORGS + CROSS SECTION ANGULAR DISTRIBUTION NASS SPECTRUM DALITZ PLCT CIFFERENTIAL CROSS SECTION FITS DENSITY MATRIX DELTA(1238) N*(1520)DI3 'N*(1608)' N*(1470)PI1 DELTA(1920) DELTA(2420) RHN(765) ETA(548) OMEGA(783) BRANGHING RATIO STRANGE PARTICLES

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION *N*(1688)* BRANCHING RATIO

FROM PAGE 1204 AND TABLE 11

LABORATORY BEAM MOMENTUM = 5.52 +- .01 GEV/C.

REACTION	MILLI-BAR	NS	NO. EVENTS
PROTON PROTON .			
TOTAL	41.600 +- 1	400	
ELASTIC	11.990	.250	2512
PRETON NEUTRON PI+	8.030	.190	1682
PROTON PROTON PIC	2.770	.110	581
PROTON PROTON PI+ PI-	2.840	.080	1120
PROTON NEUTRON PI+ PI+ PI-	2.850	.080	1127
PROTON PROTON PI+ PI- PIO	1.840	.070	729
PROTON PROTON FI+ PI+ PI- PI-	-227	.023	91
NEUTRON PROTON PI+ PI+ PI+ PI- PI-	.098	.015	39
PROTON PROTON PI+ PI+ PI- FI- PIO	.088	.014	36

[TABLE 3]

LABCRATORY EEAM MOMENTUM = 5.52 +- .01 GEV/C.

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	REACTION	HILLI-BAN	RNS
TON P	ROTON •		
	DELTA(1230) + NEUTRON	3.25 +-	• 16
	DELTA(1238)++ + PROTON PI+ [1] DELTA(1238)+ PROTON	.75	.08
	DELTA(1238)+ • NEUTRON PI+ [1]		
	DELTA(1238)+ PROTON	.72	.05
	DELTA(1238)+ • PROTEN PIO (1)		
	NELTA(1020)++ NEWTREN	192	.10
	OELTA(1920)++ + PROTON PI+ ₹1]		
	DELTÁ(2420)++ NEUIRÚN	-20	.08
	DELTA(2420)++ + PROTON PI+ [1]		
	N#(1470)+ PROTON	.80	.16
	N*(1470)+ • NEUTRON PI+ [1]		
	N*(1470)+ PROTON		. 06
	N#(1470)+ + PROTON PIC [1]		
	N#(1520)+ PROTON	.44	. 20
	N#(1520)+ + NEUTRON P1+ [[]		
	N+(1520)+ PROTUN	.00	.04
	N+(1520)+ + PRUTUN PIU [1]		
	N(1688)+* PRUTUN	- 32	-10
	INTERESTIC		
	*N*116001/* PROTCH	•22	.06
	•N=(1688)+• • PRUIUN PIU []]		

111 FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

ſ	TABL	6 4 1

LABORATORY BEAM MOMENTUM = 5.52 +01 GEV/C.		
REACTION	MILLI-	BARNS
PROTON PRETEN .		
N#(1520)+ PROTCN	.57 4	05
N+(1520)+ + PROTGN PI+ PI- (1)		
"N*(1688)+" PRCTCN	•48	•04
N(1688)+* - PROTON FI+ P1- [1]		
DELTA(1920)+ PROTUN	. 42	.06
DELTA(1920)+ + PROTCN PI+ PI- [1]		
CELTA(1238)++ PROTON PI-	.28	.04
DELTA(1238)++ • PRCTON PI+ (1)		
DELTA(1238)++ DELTA(1238)C	-25	-04
DELTA(1238)++ + PROTON PI+ [1]		
DELTA(1238)0 + FROT(N PI- 1))		
DELTA(1238)++ N+(147C)C	.13	- 04
DELTA(1238)++ + PROTON PI+ [1]		
N+(1470)0 + PROTUN PL- [1]		
CELTA(1230)++ N#(1520)C	102	.02
DELTA(1238)++ + PRCTEN' PI+ [1]		
N#(1520)0 + PROTEN P1- [1]		
DELTA(1238)++ *N#(1688)0*	. 21	.04
	- 12	. 01
	•••	
	04	. 01
	•••	•••
	A 8	02
	0.2	02
	•••	.02
	07	05
	+07	• • • •
KHULIOJU • PI+ PI- [1]		

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

TABLE 51

LABORATORY BEAM MOMENTUM = 5.52 +01 GEV/C.		
REACTION	MILLI-8	BARNS
PROTON PRETON +		
DELTA(1238)++ NEUTRON PI+ PI-	1.02 +-	15
DELTA(1238)++ - PROTON PI+ [1]		
DELTA(1238)++ N*(1520)C	• 15	.02
DELTA(1238)++ + PROTON PI+ [1]		
N+(1520)0 - NEUTRUN PI+ PI- (1)		
DELTA(1238)++ 'N*(1688)0'	.06	•02
DELTA(1238)++ • PROTON PI+ [1]		
N(1688)0* - NEUTREN PI+ PI- [1]		
DELTA(1238)++ DELTA(1238)- PI+	.59	.16
DELTA(1238)++ • PROTON P1+ (1)		
DELTA(1238)- + NEUTRON P1- [1]		
CELTA(1238)+ PROTON PI+ PI-	- 17	- 06
DELTA(12381+ + AEUTRON P1+ [1]		
Natiszchi PROTON RI+	.26	- 03
	.04	. 02
	•••	
	42	10
	• • • •	
N(1688)+* NEUIKUN PI+	.07	.02
*N#(1688)** * PRCION PI+ PI- [1]	•	
NEUTRON PROTON PI+ PI+ PI- [2]	•24	.03

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TODK EVENTS ONLY ABOVE (FITTED) BACKGROUND. 121 CROSS SECTION IS FOR THE NON-RESONANT PRODUCTION OF THESE PARTICLES ONLY.

[TABLE 6]

REACTION PROTON

LABERATERY EEAM MOMENTUN = 5.52 +- .01 GEV/C.

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REACTION	FILLI-BARNS	
PREIUN +	20 1 02	
UELIA(1238)++ PRUTUN PI- PIU	.20 +02	
	24 05	
DELIPTI238/** DELIATI238/* PI-	•28 •03	
DELIA(1238)++ • PROTON PI+ (1)		
DELIATI2381+ + PRUTUN PIU LLI	24 04	
DELIATIZSBI++ DELIATIZSBIC PIC	•28 •08	
DELIA(1238)++ • PRUIUN PI+ [1]		
UELIA(1238)0 • PRUIEN PI- [1]		
DELTA(1238)+ PROION PI+ PI-	.30 .03	
DELTA(1238)+ + PRUTUN PTO LTJ		
DELTA(1238)O PROTON PI+ PIC	.01 .01	
DELTA(1238)0 • PROTON PI- 111		
N*(1520)C PROTON PI+	•11 •04	
Nº[152010 + PROTON PI- PI0, [1]		
'N#(1688)0' PROTEN P1+	.02 .02	
N(1688)0* • PROTON PI- PIC [1]		
NA(1520)4 PROTON PTO	.11 .09	
N*(1520)+ + PRUTON F1+ P1- [1]		
"N*(1688)+" PROTON PIO	•17 •13	
'N*(1688)+' + PROTON PI+ PI- [1]		
PROTON PROTON PI+ RHC(765)-	.07 .07	
KHU(765)- • PI- PIO (1)		
PRETEN PROTON PI- RHE(765)+	.05 .05	
RHO(765)+ + PI+ PIO [1]		
PROTON PROTON ETA(548)	.02 .01	
ETA(548) • PI+ PI- PIO [1]		
PROTON PROTON DMEGA(783)	.11 .02	
OMEGA(783) • PI+ PI- PIO (1)		
PROTON PROTON PI+ PI- PIO [2]	.16 .02	

(1) PITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.
(2) CROSS SECTION IS FOR THE NON-RESONANT PRODUCTION OF THESE PARTICLES ONLY.

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LABGRATCRY EEAM MGMENTUM = 5.52 +- .01 GEV/C.

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REACTION	MICRO-BARNS	NO. EVENTS
PROTEN PROTON +		
LAMBDA PROTON K+	35.8 +- 9.9	13.0
SIGHAO PROTON K+	16.0 7.5	4.5
SIGMA+ PROTON KO	4.5 4.5	1.0
LAMBCA NEUTRON K+ PI+	75.4 15.7	23.0
LAMBDA PROTON KO PI+	78.4 12.6	38.5
LAMBDA PROTON K+ PIO	62.3 12.3	25.5
SIGMAD PROTON KO PI+	28.8 11.8	6.5
SIGMA+ NEUTRON KO PI+	4.1 4.1	1.0
SIGNA+ PROTON KG PIO	9.4 6.6	2.0
NEUTRON PROTON KOBAS K+	19.4 10.4	3.5
PROTEN PROTON KOBAR KO	6-4 4-0	2.5
LAMBGA PROTON K+ PI+ PI-	21.3 8.1	7.0
LAMBEA PROTON KO PI+ PIO	17.4 12.3	2.0
SIGMAD PROTON K+ PI+ PI-	2.0 2.0	1.0
SIGPA+ PROTON KO PI+ PI-	4-1 4-1	1.0
LANBDA PROTON KO PI+ PI+ PI-	.9 1.3	.5
LAMBCA NEUTRON K+ PI+ PI+ PI-	1.1 1.6	.5

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY REAM MOMENTUM = 5.52 ++ .01 GEV/C.

[FIGURE 3]

- THIS DATA WAS READ FROM A GRAPH . -T D-SIGMA/O-T

(GEV/C)**	•2	MB/(G	EV/C]##2 [1]	NQ.	EVENTS
MIN	MAX				
-01	·02	25.9	+- 3.5		54.0
.02	.03	57.8	5.3		120.5
.03	.04	61.9	5.5		129.0
•04	.05	54.0	5.1		112.5
.05	.06	62.9			131.0
•06	.07	60.0	5.4		125.0
.07	.08	43.9	4.6		91.5
.08	•09	44.9	4.6		93.5
•09	.10	38.7	4.3		01.0
.10	• 11	36.0	4.2		75.0
.11	.12	29.0	3.7		60.5
-12	• 13	32.9	4.0		68.5
.13	.14	26.9	3.6		56.0
-14	•15	27.8	3.7		58.0
-15	.16	25.0	3.5		52.0
•16	•17	14.9	2.1		31.0
-17	.18	19.0	3.0		39.5
-18	.19	18.0	7.9		17.5
.19	.20	19.0	3.0		34-5
.20	•21	10.2	3.0		38.5
•21	• 22	18.1	3.0		34.0
.22	• 23	10.0	2.3		22.0
-23	• 24	11.0	23		23.0
.24	• 25	14.9	2.1		31.0
•25	• 20	10.0	23		22.0
•20	•21	10.1	2.2		21.0
•21	.28	14.9	2.1		31.0
• • • •	• • • •	4 5	1 0		17.2
	- 10	12.0	2.4		25.5
- 50	• 31	12.0	2.4		25.0
• • • •	• 32		1.4		10.2
.32	• • • •	4.1	2.1		19.0
	• 34	9.0	2.1		20.0
• 3 1	• • • •				10.5
	+ 30	2.2	1.0		11.2
		3 3 0			14.5
	.30		1.7		10.5
- 10		6 2	1.4		11.0
	.40	2.5	1.0		
40			1 4		0.5
	. 42	5 0	1.4		10.5
.43	- 44	6.0	1.7		12.5
.44	. 45	1.9	1.0		4.0
45	46	4 1	1.4		
		1.4	**		1.11
.47	. 48	2.9	1.2		6.0
.48	. 44	1.4	1.0		4.0
.49	-50	1.9	1.0		4.0
.50	-51	2.9	1.2		6.0
.51	- 52	2.9	1.2		6.0
-52	. 53	2.9	1.2		6.0
.53	. 54	1.4	.8		3.0
.54	. 55	2.9	1.2		6.0
.55	.56	1.0			2.0
.56	.57	.0	.5		-0
.57	.58	1.9	1.0		4.0
.58	. 59	2.4	1.1		5.0
.59	.60	2.4	1.1		5.0
.00	401	1.0	.1		2.0
.61	-62	1.4	.8		3.0
.62	.63	1.0	.7		2.0
.63	. 64	1.0	.7		2.0
.64	.65	1.0	.7		2.0
.65	. 66	.0	.5		.0
.66	.67	•0	.5		.0
-67	.68	.0	.5		.0
.68	.69	• 0	.5		.0
.69	.70	1.9	1.0		4.0
.70	.71	1.0	.7		2.0
:71	.Tź	•U	. 5		.U
.72	.73	.0	.5		.0
.73	.74	1.0	•1		2.0
.74	.75	1.9	1.0		4.0

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON].

(1) COUNTS WERE NULTIPLIED BY .48 TO GET THESE. ERRORS ARE TAKEN AS PROPERTIONAL TO THE SQUARE-ROOT OF THE COUNTS.

⁽TABLE 7)

```
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PRCTON.
                                                                                                                                                                                                [TABLE 2]
                              LABORATORY BEAM MCMENTUM = 5.52 +- .01 GEV/C.
                              DATA IS FIT OVER -T FROM -03 TO -75 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
[CUTCOING PROTON].
FITTEC FORMULA IS C-SIGMA/D-T = EXP(A+BLT]]
                                                  WHERE D-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
                              FITTED VALUES
                                                   A = 4.39 +- .C4
B = 7.17 +- .18
                  FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                                                                                                                                                [TABLE 2]
                              LABORATORY BEAM MOMENTUM = 5.52 +- .01 GEV/C.
                             DATA IS FIT OVER -T FROM .03 TO .75 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
(OUTGOING PROTON).
FITTED FORMULA IS U-SIG#A/D-T = EXP(A+BLT)+C(T+*2))
                                                  WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
                             FITTED VALUES
                                                  DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DELTA(1238)++ NEUTRON-
DELTA(1238)++ + PROTON PI+ [1]
                                                                                                                                                                                                                                       LFIGURE 91
                              LABORATORY BEAM MOMENTUM = 5.52 +- .01 GEV/C.
                              . THIS DATA WAS READ FROM A GRAPH .
                                                                                 D-SIGMA/D-OMEGA
ME/SP
                        COSITHETAL
                       MAX

1.099

.998

.975

.955

.954

.955

.925

.921

.900

.887

.885

.865
                                                                                                  7.0
4.4
2.8
1.9
1.0
.8
1.0
.7
1.0
.5
.5
4.3
.3
.3
                                                   THETA IS THE ANGLE THAT THE DELTA(1238)++ MAKES WITH THE BEAN IN THE GRANC C.M.
                             [1] COUNTED ALL EVENTS IN MASS BANG.
58 A STUDY OF NUCLEON ISOBAR PRODUCTION IN PROTON-PROTON COLLISIONS.
                                                                                                                                                                                                    [NUDVO CIMENTO 63A, 529 (1969)]
                I.M.BLAIR,A.E.TAYLGR (ATOMIC EN. RES. ESTAP., HARWELL, BERKS., ENGLAND)
M.S.CHAPMAN,P.I.P.KALMUS.J.LITT,F.C.FILLER,H.J.SHERMAN IQUEEN MARY COLLEGE, LONDON. ENGLAND]
A.ASTBORY, D.B.S.COTI,T.G.WALKER (RVIHEPORD NIGH EN. LAB.- CHITON,DID.HERK.ENGLAND]
               ABSTRACT THE MOMENTUM SPECTRA OF PROTONS SCATTERED INELASTICALLY IN PROTON-PPOTON COLLISIONS WERE OBTAINED IN AN
EXTERNAL BEAM AT NIKAGO, USING INCIDENT PROTON MOMENTA OF 2.85, 4.55, 6.06 AND 7.88 GEV/C, AND VARIOUS SCATTERING
ANGLES IN THE RANCE 22 TO 144 MRAD. THE ISOBARS OF MASS 1236, 1518, AND 1688 MEV ARE CLEARLY SEEN. THERE IS EVICENCE
ALSO IN THE SPECTRA AT SHALL ANGLES FGR THE PRODUCTION OF THE 1410 MEV ISOBAR TA MASS OF (1410 + 15) MEV AND NIDTH
(125 +- 20) MEV. IT IS SHOWN THAT THE OBSERVED PEAK CANNOT BE EXPLAINED BY THE DECK EFFECT. THE DIFFERENTIAL
CROSS-SECTIONS FOR THE PROLUCTION OF THES ISOBARS ARE MELSENIEU IN IEMS OF THE USUAL VARIABLES AND ARE
COMPARED WITH ABSORPTION AND REGGE-POLE NODEL PREDICTIONS. FITS TO THE DATA WITH VAPIOUS EMPIRICAL FUNCTIONS OF THESE
VARIABLES ARE ALSO INVESTIGATED. THE BEHAVIOUR OF THE TOTAL CROSS-SECTION FOR THE ISOBAR TOTAL CROSS-SECTIONS FOR TIS FOUND TO EXHIBIT
ENERGY DEPENDENCE CONSISTENT WITH ONE-PION EXCHANGE, WHEREAS THE 1410 MEV AND 1688 MEV ISOBAR IS FOUND TO EXHIBIT
ENERGY-DEPENDENCE IN THIS ENERGY RANGE.
               CLOSELY RELATED REFERENCES
THIS ARTICLE SUPERSEDES PHYS. REV. LETTERS 17, 789 (1966).
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LETTERS 19, 925 (1967), PHYS. REV. LETTERS 13, 555 (1964), PHYS. REV. LETTERS 14, 1063 (1965), PHYS. REV.

LETTERS 19, 925 (1967), PHYS. REV. LETTERS 13, 555 (1964), PHYS. REV. LETTERS 14, 1063 (1965), PHYS. REV.

LETTERS 19, 925 (1967), PHYS. REV. LETTERS 18, 355 (1964), PHYS. REV. LETTERS 14, 1063 (1965), PHYS. REV.

LETTERS 19, 925 (1967), PHYS. REV. LETTERS 18, 355 (1964), PHYS. REV. LETTERS 14, 1063 (1965), PHYS. REV.

LETTERS 19, 925 (1967), PHYS. REV. LETTERS 18, 355 (1964), PHYS. REV. LETTERS 14, 1063 (1965), PHYS. REV.

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CIMENTO 38, 1433 (1965), PHYS. LETTERS 13, 190 (1964), AND PHYS. LETTERS 258, 156 (1967).
                ARTICLE READ BY ODETTE BENARY IN 10/69. AND VERIFIED BY LERDY PRICE.
                BEAM IS PROTON ON PROTON FROM 2.85 TO 7.88 GEV/C.
                THIS EXPERIMENT USES COUNTERS.
                                                                                                                                                                   INALIGUES CROSS SECTION
                KEY WORDS + DELTA(1238) N*(1470)P11 N*(1520)D13
UIPPERENTIAL CR033 SECTION F173
                CCMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION
```

CROSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. (TABLE 2) LABORATORY BEAM MOMENTUM GEV/C MILLI-BARNS 3.80 +- .60 1.50 .20 .60 .10 .41 .06 2.85 6.06 - - - - - - -CROSS SECTION FOR PROTON PROTON . PROTON N#(1470)+. (TABLE 2) LABURATURY EEAM MOMENTUM CEV/C 4.55 MILLI-BARNS .64 +- .C8 .65 .18 .45 .09 6.06 PROTEN PRETON . PROTON N#(1520)+. CROSS SECTION FOR [TABLE 2] LABORATORY BEAM POMENTUM GEV/C MILLI-BAPNS 6.06 .45 .09 - - - - - - - - -PROTEN PRETON + PROTEN 'N+(1688)+'. [TABLE 2] CROSS SECTION FOR LABORATORY BEAM MOMENTUM MILLI-BARNS .70 +- .10 .50 .10 .46 .C9 GEV/C 4.55 6.06 7.88 FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. [TABLE 3] LABORATORY BEAM MOMENTUM . 2.85 GEV/C. DATA IS FIT OVER -T FROM .C31 TO .160 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE [CUTGOING PROTON]. FITTED FORPULA 15 C-SIGHA/0-T = A+ExP(8+T) WHERE C-SIGNA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2. FITTED VALUES A = 15.0 + - 1.6B = 6.9 + - 1.2 FIT TO CIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON DELTA(1238) . [TABLE 3] LABORATORY BEAK HOMENTUR . 4.55 GEV/C. DATA IS FIT OVER -T FROM -034 TO -270 (GEV/C)**2, T IS THE MOMENTUM TRANSFER BETHEEN THE LINGOMING PROTONI AND THE LUDICUING PROTONI. FITTED FORMULA IS O-SIGNATO-T = AMEYPERATI WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2. FITTED VALUES A = 6.9 + .7 B = 8.9 + .9ÉTT TO DIFFÉRÊNTÍAL CRCSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. TABLE 31 LABORATORY BEAK MOMENTUM . 6.C6 GEV/C. DATA IS FIT OVER -T FROM .056 TO .260 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE LUDIGUING PRUIUNI. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[8+T] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUES A = 2.8 +- .5 B = 10. +- 1. FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. (TABLE 3) LABORATORY BEAM MOMENTUM . 7.88 GEV/C. DATA IS FIT OVER -T FROM .046 TO .340 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON]. FITTED FORMULA IS D-SIGMA/D-T = A*EXP[B*T] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2. FITTED VALUES A = 2.1 += .3 B = 9.9 += .6

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÷
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N*(1470)+.
                                                                          ITABLE 31
    LABORATORY BEAM MOMENTUM = 4.55 GEV/C.
    DATA IS FIT OVER -T FROM .044 TC .220 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
(CUIGGING PROTON).
FITTED FORMULA IS D-SIGMA/D-T = A*EXP[8*T]
           WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
            A = 5.5 +- .8
B = 14.C +- 1.3
. . . . . . . . . . . . .
FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON N#(1470)+.
                                                                            [TABLE 3]
    LABORATORY BEAM MOMENTUM + 6.66 GEV/C.
    DATA IS FIT OVER -T FROM .061 TC .160 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETMEEN THE [INCOMING PROTON] AND THE
[CUTGOING PROTON].
FITTED FORMULA IS D-SIGMA/D-T = A*EXPIB*T].
            WHERE D-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
           A = 8.8 + 2.9
B = 20.7 + 2.7
FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON N#(1470)+.
                                                                            TTABLE 31
    LABORATORY BEAM MOMENTUM = 7.88 GEV/C.
    DATA IS FIT OVER -T FROM .048 TC .145 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE
LOUTGOING PROTONI.
FITTED FORMULA IS D-SIGMA/C-T = A*EXP(B*T]
           WHERE D-SIGMA/D-T IS IN HB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUES
           A = 5.9 + 2.5

B = 22.1 + 4.1
_____
FIT TO DIFFERENTIAL CRESS SECTION FOR PROTON PROTON . PROTON N+(1520)+.
                                                                            [TABLE 3]
    LABORATORY REAM MCMENTUM = 4.55 GEV/C.
    DATA IS FIT OVER -T FROM .057 TO .270 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE 
{OUTGOING PROTON].
FITTED FORMULA IS O-SIGMA/D-T = A*EXP(B*T)
           WHERE D-SIGMA/D-T IS IN M8/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
            A = 2.2 + - .2

B = 5.4 + - .8
ELT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+(1520)+-
                                                                            ITABLE 31
    LABORATORY BEAM MOMENTUM = 6.06 GEV/C.
    DATA IS FIT OVER -T FROM .065 TO .290 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
IOUTGOING PROTON].
FITTED FORMULA IS D-SIGMA/D-T = A*EXP(B*T]
           WHERE D-SICHA/D-T IS IN HB/(CEV/C)++2 AND -T IS IN (CEV/C)++2.
    FITTED VALUES
           A = 1.8 + .4

B = 7.1 + 1.1
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON N#(1520)+.
                                                                            (TABLE 3)
    LABORATORY BEAM MOMENTUM . 7.88 GEV/C.
    DATA IS FIT OVER -T FROM .C92 TO .484 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE {INCOMING PROTON} AND THE 
[CUTCOINC PROTON].
FITTED FORMULA IS D-SIGMA/D-T = A*EXP[8+T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUES
           A = .9 + - .1

B = 5.2 + - .5
[TABLE 3]
    LABORATORY BEAM MOMENTUM = 4.55 GEV/C.
    DATA IS FIT OVER -T FROM .C91 TC .270 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
    LICUTGOING PROTONI.
FITTED FORMULA IS D-SIGMA/O-T = Å+ĒXP[B+T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
           A = 2.1 + .5

B = 4.6 + 1.3
```

```
FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON .N#(1688)...
                                                                                                [TABLE 3]
     LABORATORY BEAM MOMENTUR = 6.06 GEV/C.
     DATA IS FIT OVER -T FROM .CBI TO .300 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [CUTCOING PROTON].

FITTED FORMULA IS D-SIGMA/D-T = A*EXP(B*T)
              WHERE D-SIGMA/D-T IS IN ME/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
              A = 1.8 + .5

B = 5.6 + 1.3
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PPOTON 'N+(1688)+'.
                                                                                                [TABLE 3]
     LABORATORY BEAM MOMENTUM = 7.88 GEV/C.
     DATA IS FIT OVER -T. FROP .058 TO .500 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEK THE [INCOMING PROTON] AND THE
[OUTGOING PROTON].
FITTED FORMULA IS D-SIGMA/D-T = A*EXP[8*T]
              WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
              A = 1.3 + .2
B = 4.8 + .4
DIFFERENTIAL CROSS SECTION FOR PROTON + DELTA(1236)+ PROTON.
                                                                                        [FIGURE 8A]
     LABORATORY BEAM MOMENTUM = 2.85 GEV/C.
     ( PRIVATE COMMUNICATION FREM A.ASTBURY (DECEMBER 1969) )
                             D-SIGMA/C-T

MB/(GEV/C)+*2 [1]

PER CENT

13.10 +- 3

12.80 3

16.70 3

9.65 3

9.60 3

7.40 3

8.30 3

11.30 3

7.50 3

10.90 3
   -T
(GEV/C}++2
      .031
.034
.039
.048
.049
.052
.058
                             13.10 +-

12.80

16.70

9.65

9.65

9.66

7.40

8.30

11.30

7.50

10.90

10.90

10.90

10.90

7.60

6.60

5.60

5.60

5.45

5.48
       .065
       .078
       .085
       .092
       .102
       . 110
       .119
       .128
       .138
       .148
     T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE LOUTGOING PROTON).
     (1) PLUS POSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT.
DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DELTAL 12381+ PROTON-
                                                                                          (FIGURE AB)
     LABORATORY BEAM MOMENTUP = 4.55 GEV/C.
     ( PRIVATE COMPUNICATION FROM A.ASTBURY (DECEMBER 1969) THERE ARE TWO VALUES BELOW AT -T=.053 .ALSO THE VALUE AT
-T=.140 IS GIVEN IN THE ORIGINAL TABLE AS -T=.040 )
                             D-SIGMA/D-T
   -T
($$v/$)##3
                                      PER CENT
      .034
.035
.042
                              4103 1-
                              5.30
5.60
4.70
5.05
3.80
4.10
3.40
2.85
3.25
2.40
       .043
                                       ******
       .053
       .064
       . 689
       .096
      .109
.140
.160
.161
.180
.181
.220
.240
.270
                              . 81
1.57
                                       1.81
1.17
.90
.94
.60
     T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE COUTGOING PROTON).
```

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT.

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DIFFERENTIAL CROSS SECTICN FOR PRCTCN FRCTON . DELTA(1238)+ PROTON. LETURE BUILT LABORATORY REAF MCMENTUM = 6.06 GEV/C. (PRIVATE COMMUNICATION FROM A.ASTBURY (DECEMBER 1969)) D-SIGMA/D-T MB/(GEV/C)++2 [1] PER CENT 1.74 +- 3 1.94 3 06 3 1.74 1.94 1.06 .67 .59 .27 1 10 10 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTON). [1] PINS POSSIBLE SYSTEMATIC FRADE OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR _____PROTON_ PROTON - _____PROTON. [FIGURE 8D] TUK = ... ICN FRCM A.ASTBUM D-SIGMA/C-T MB/IGEV/CI*2 [1] PER CENT 1.750 +- 3 1.060 3 .500 3 .100 3 .100 3 .100 3 .100 3 .100 3 .100 3 .100 3 .040 3 .046 3 .074 3 .029 3 LABORATORY BEAM MOMENTUM = 7.88 GEV/C. (PRIVATE COMMUNICATION FROM A.ASTBURY (DECEMBER 1969)) T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . N*(1470)+ PROTON. LEIGURE 941 LABORATORY BEAM MOMENTUM = 4.55 GEV/C. (PRIVATE COMMUNICATION FROM A.ASTBURY (DECEMBER 1969))
 IGN FREM A.ASTBURY

 D-SIGMA/U-1

 PB/GEV/CI+2

 PER CENT

 2.72 +-3

 3.05 - 3

 3.02

 2.61 - 3

 2.30 - 3

 2.30 - 3

 1.33 - 3

 1.33 - 1.33

 1.43 - 3

 1.60 - 3

 .67 - 3

 .55 - 3

 .26 - 3

T IS THE NOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE COUTODING OPOTONI.

[1] PLUS POSSIBLE SYSTEPATIC ERRCR GF +- 10 PER CENT.

DIFFERENTIAL CROSS SECTION FCR PROTON PROTON . N+(1470)+ PROTON. LEIGURE 981

LABORATORY BEAM MOMENTUM = 6.06 GEV/C.

(PRIVATE COMMUNICATION FROM A.ASTBURY (DECEMBER 1969))

-T	D- 51 GPA / D- T
(GEV/C)++2	MB/(GEV/C)++2 [1]
	PEP CENT
.061	2.50 +- 3
.074	2.50 3
.110	.7C 3
.130	.38 3
.134	145 B
.260	.13 3

-T (GEV/C)**2

.056 .07C .107 .128 .154 .260

(GEV/C)++2

.046 .089 .093 .114 .117 .146 .181 .217 .250

.25C .260 .295 .340 .390 .44C .500 .526

(GEV/C) ++2

.044 .052 .053 .063 .063 .063 .003 .003 .0098 .117 .148 .166 .220

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (CUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT.

DIFFEPENTIAL CRC	SS SECTION FOR PROTON	PROTON + N+(147C)+ PROTON. [FIGURE SC.
LABORATORY 8	EAM MOMENTUM = 7.88 GEV	
I PRIVATE CO	MUNICATION FROM A.ASTRUB	Y (DECEMBER 1969))
-		
(GEV/C)**2	PB/(GEV/C)**2 [1	.1
.048	PER CENT 2.20 +- 3	
.090	-69 3	
.115	.35 3	
-117	-54 3 -26 3	
. 180	-25 3	
.250	•15 3 •16, 3	·
. 290	.07 3	
T 15 THE NOW	ENTIN TRANCEED BETLEEN TH	E TINCONING BRATCHI AND THE CONTENTS PROTENT
1 13 182 804	ENION INANGPER DEINEEN (H	
(1) PLUS PO	SSIBLE SYSTEPATIC ERROR O	F +- 10 PER CENT.
OIFFERENTIAL CRO	SS SECTION FOR PROTON	PRCTON + N+(1520)+ PROTON. [FIGURE 10A]
LABORATORY P	FAM MOMENTUM = 4.55 GEV	//C.
4 0014175 00		
I PRIVATE CO	ROWICATION FROM ALASIBOR	T LUCCENDER 1989) INCRE ARE THU VALUES AT -15.191 IN THE OCLUM TABLE J
-T (689/63442	D-SIGMA/D-T MB/(GEV/LJ##2 11	
057	PER CENT	
.058	1.30 +- 3	
.064	2.05 3	
.074	1.28 3	
.075 .U89	1.35 3	
.095	1.28 3	
. 126	1.43 3	
.157	1.20 3	
.175	. (7 3	
.191	.67 3	
.230	.49 3 .64 3	
.270	.62 3	
T IS THE MOM	ENTUM TRANSFER BETWEEN TH	E LINCEMING PROTONI AND THE LOUTGOING PROTONI.
111 PLUS PO	SSIBLE SYSTEPATIC EPROP O	F +- 10 PER CENT.
DIFFERENTIAL CRU	SS SECTION FOR PROTON	PROTOR • N•(1)2C/+ PROTOR. (PIGORE TOB)
LASORATORY D	EAM MOMENTUM = 6.C6 GEV	/c.
(PRIVATE CO	PMUNICATION FROM A.ASTBUR	Y (DECEMBER 1969))
-1	U=5168A7U-1	
(GEV/C)++2	PB/(Gév/C/P=2 L1 PER CENT	.
.065	1.15 +- 3	
.114	.99 3	
-134	.75 3	
.260	.32 3	,
T IS THE MOM	ENTUM TRANSFER BETWEEN TH	E [INCOMING PROTON] AND THE (OUTGOING PROTON).
(1) PLUS PO	SSIBLE SYSTEMATIC EPROR O	IF +- 10 PER CENT.
DIFFERENTIAL CRO	SS SECTION FOR PROTON	PROTON + N+(1520)+ PROTON. [FIGURE LOC]
ENCORPTORY C	EAR MUNCKIUF - 1.88 GEV	
(PRIVATE CO	MPUNICATION FROM A.ASTBUR	Y (DECEMBER 1969))
-T (GEV/C)*#2	D-SIGMA/D-T MB//GEV/C1##2 [1	1
	PER CENI	
.051	1.120 +- 3	
-096	.480 3	
.119	.440 3	
-146	.400 3	
. 21 4	.260 3	
.25C .255	.240 3 .276 3	
- 288	•190 3 -230 3	
.380	.120 3	
.414 .460	.082 3 .06C 3	
.484	.068 3	•
. 509	.028 3	
.670	.051 3 .065 3	
T IS THE MON	ENTUM TRANSFER BETWEEN TH	E LINCOMING PROTON) AND THE COUTGOING PROTON).
(1) PLUS PO	SSIBLE SYSTÉMATIC ERROR O	IF +- 10 PER CENT.
		••••••••••••••

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	DICECTENTIAL C				[EICIRE 114]
	DIFFERENTIAL C	RUSS SECTION PUR	PROTON PROTON	· ·Netteaster Protok.	CFIGURE ITAT
	LABORATORY	BEAN NOMENTUM =	4.55 GEV/C.		
	(PRIVATE)	COMMUNICATION FROM	A.ASTBURY (DECEN	(BER 1969))	
	-T (GEV/C)++2	D-SIGM MB/(GEV.	∆/0-1 /C)++2 {11		
			PER CENT		
	.091	1.45 +-	- 3		
	.116	.72	3		
	.135	. 75	3		
	.171	1.80	3		
	.186	1.05	3		•
	.204	. 62	3		
	.216	- 46	3		
	- 250	. 66	3		
	T IS THE M	DMENTUM TRANSFER B	ETWEEN THE LINCOM	AING PROTON) AND THE COUTGO	ING PROTON L.
	1 10 112 1				
	[1] PLUS I	POSSIBLE SYSTEPATIO	C ERROR OF +- 10	PER CENT.	
	DIFFERENTIAL C	RCSS SECTION FOR	PRCTON PRCTON	 'N*(1688)+' PROTON. 	(FIGURE 118)
	LABORATORY	BEAN MOMENTUM .	6.C6 GEV/C.		
	(PRIVATE (COMMUNICATION FROM	A.ASIBURY IDECEP	185K 1969) J	
	-T	0-SIGM/	A/D-T		
	(GEV/C)**2	MB/(GEV/	/C)**2 [1] PFR (FNT		
	.081	1.45 +-	- 3		
	.093	.96	3		
	.127	. 58	3		
	.168	.74	3		
	.260	• 52	3		
	T IS THE MO	DMENTUM TRANSFER BI	ETWEEN THE LINCEM	VING PROTONI AND THE LOUIGO	ING PROTONJ.
	(1) PLUS I	POSSIBLE SYSTEMATIC	CERROR OF +- 10	PER CENT.	
					• • • • • • • • • • • • • • • • • • • •
	DIFFERENTIAL CO	RCSS SECTION FOR	PROTON PROTON	 'N*(1688)** PROTON. 	(FIGURE 11C)
		REAN NOMENTUM #	7. FR GEV/C.		
	200000000				
	(PRIVATE (COMMUNICATION FROM	A.ASTBURY (DECEM	BER 1969) 1	
	- T	0-SIGM	10-T		
	(GEV/C]++2	MB/(GEV/	(C)**2 [1]		
	.059	1.020 +-	• 3		
	-098	-900	3		
•	.102	.780	3		
	.124	.740	3		
	.150	- 520	3		
	.215	.420	3		
	• 250	- 430 - 360	3		
	. 287	.390	3		
	.330	.320	3		
	.397	.170	3		
	.454	.170	3		
	.500	.167	3		
	.613	.082	3		
	.735	.100	3		
	T IS THE MO	MENTUR TRANSFER BE	TWEEN THE LINCOM	ING PROTON) AND THE COUTGO	ING PROTON].
	[1] PLUS P	POSSIBLE SYSTEMATIC	ERROR OF +- 10	PER CENT.	
	1				
59	NEUTRON-PROTON	ELASTIC SCATTERING	FROM 8 TC 30 GEV	//C. [PHYS. REV. LETTE	RS 24, 22 (1970)]
	B.G.GIBBARO.L.W.	IONES MULLIONGO	R. C' FALLON LUNIN	. OF MICHIGAN, ANN ARBOR, I	N1CH USA1
	J.COX, M.L.PERL,	.T.TONER [STANFOR	LINEAR ACCEL. C	NTR., STANFORD, CALIF., USA	1
	M.N.KREISLER [P	ALMER PHYS. LAB., A	PRINCETON UNIV.,	PRINCETON, N.J]	
	ABSTRACT TH	E DIFFERENTIAL CRO	SS SECTION FOR NE	UTRON-PROTON ELASTIC SCATT	ERING WAS HEASURED IN THE DIFFRACTION REGION
	WITH INCIDE CONDUCTED A ENERGY PP (ENT NEUTRON MOMENTA AT THE A.G.S. RESUL DATA.	A BETWEEN 8 AND 3 .TS ARE PRESENTED	O GEV/C. THE EXPERIMENT WA D AND COMPARED TO CURRENTLY	S A SPARK CHAMBER-COUNTER EXPERIMENT, AVAILABLE LOWER ENERGY NP DATA AND COMPARABLE
	CIASELY RELATED CONTINUATIO	RFFERENCES ON OF PREVIOUS EXPE	RIMENT IN PHYS.	REV. LETTERS 16, 1217 (196	6).
	ACDITIONAL CITA UCRL 16275 Letters 15	TICNS (1966), PHYS. REV. , 45 (1965), PHYS.	LETTERS 20, 468	(1968), NUCLEAR INSTRUMEN (1969), AND NUOVO CIMENTO	TS AND METHODS 39, 335 (1966), PHYS. REV. 38, 60 (1965).
	ADTICLE DC40 C		7/69. AND VEDICE	ED BY LEDOY DOTCE	
	ADDITUTE READ BY	OULTIE BENART IN I	LIGIT MAD VERIFI	LU DI LLIUI FRICE.	
	BEAM IS NEUTRON	N ON PROTON FROM 5	4 TO 29.4 GEV/C.		
	THIS EXPERIMENT	USES SPARK CHAMBER	S AND COUNTERS.		
	GENERAL COMMENTS 1 THE DATA THE PORM AND 20 0	S UN THIS ARTICLE PRESENTED ARE NGRE WARC SCATTERING AME GEV/C.	ALIZED TO THE OP PLITUDE, AND TAKI	TICAL THEOREM POINT, NEGLE NG A CONSTANT VALUE OF 98	CTING THE CONTRIBUTION FROM THE REAL PART OF ND FOR THE NP TOTAL CROSS SECTION DETWEEN 5
	MINU 20 (
	KEY WORDS . DIF	FERENTIAL CROSS SEC	TIGN FITS	NODELS	
	COMPOUND KEY WO	ROS + FITS DIFFER	RENTIAL CROSS SEC	TION	
	 -				`

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[TABLE 1]

3,4

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

LABORATORY BEAM MOMENTUM = 7.4 +- 2.0 GEV/C.

- 1	0-SIG#4/	C-T
(GEV/C)++2	PB/(GEV/C	**2
.174	22.000 +-	1.300
.223	15.400	1.000
.274	10.300	.860
.323	8.200	.750
.372	5.700	.660
.423	3.690	.540
.473	2.570	.560
.538	2.600	. 460
.649	1.160	.340
.743	.764	.270
.851	.423	.210
.934	.208	.070

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCCHING NEUTRON) AND THE (OUTGOI & NEUTRON).

TABLE 11

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

LABORATORY BEAM MOMENTUM = 11.4 +- 2.0 GEV/C.

-T	D-SIGMA/D-T
(GEV/C)**2	#B/(GEV/C)**2
.175	21.000 +930
.224	15.50C .880
.274	10.600 .700
.323	7.180 .570
.3/4	5.340 .510
.422	3.5CC .430
.474	2.590 .390
.545	1.830 .260
.651	.799 .170
.744	.426 .130
. 646	.3C6 .110
.974	.173 .096
1.170	.069 .021
1.476	.034 .012

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTCOING NEUTRON).

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 1)

LABORATORY BEAM MOMENTUM = 15.4 +- 2.0 GEV/C.

-1	D-SIGMA/D-T
(GEV/C)++2	MB/(GEV/C)++2
.175	20.700 +870
.223	14.100 .770
.273	10.000 .630
.323	7.460 .540
.373	5.130
.423	3.200 .3/0
.474	2.180 .320
.549	1.540 .230
.649	.555 .140
.745	.294 .100
.846	.128 .067
.969	.056 .022
1.197	.010 .006
1.515	-014 -008

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE COUTGOING NEUTRON).

ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (TABLE 1)

LABORATORY BEAM NOMENTUM = 19.4 +- 2.0 GEV/C.

-T	0-SIGMA/C-T
(GEV/C)++2	M8/(GEV/C)**2
. ?? 3	14.800 +790
.274	9.940 .630
.323	6.620 .510
.374	4.880 .440
.423	3.580 .390
.473	2.380 .320
.550	1.140 .220
.638	.633 .14C
.743	.328 .100
. 851	.147 .069
.985	.062 .020
1.201	.036 .013
1.638	.002 .003

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON).

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

OTON. [TABLE 1]

LABORATORY BEAM MCMENTUM = 23.4 +- 2.0 GEV/C.

-T	D-SIGMA/D-T
{GEV/C}**2	MB/(GEV/C)**2
.227	11.700 +820
.273	6.560 .470
.324	4.610 .380
.373	3.030 .310
.422	2.160 .270
.474	1.376 .220
.550	.721 .150
.650	.421 .110
.743	.072 .C39
. 84 8	.110 .051
.982	.016 .009
1.185	.012 .006

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE (OUTGOING NEUTRON).

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TA8LE 1] LABORATORY BEAM MOMENTUP = 27.4 +- 2.0 GEV/C. D-SICMA/D-T HB/ICEV/C)**2 4.8400 +- 6800 3.08C0 -4900 2.1900 -4300 1.37CC -2500 .9510 .2600 .9910 .1600 .0649 .C264 .0124 .CC94 (GEV/C)#+2 .325 .373 .422 .472 .553 .6800 .6800 .4900 .4300 .2500 .2600 .1600 .C260 .CC90 .651 .881 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE LOUTGOING NEUTRON). _____ EIT TO FLASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (FIGURE 2) LABORATORY REAF MOMENTUM = 7.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .C TE .5 (GEV/CI=02. T IS THE MOMENTUM TRANSFER BETMEEN THE (INCOMING NEUTRON) AND THE (CUTGGING NEUTRON). FITTED FORMULA IS C-SIGMA/C-T = EXP[-A+ABS(T]] WHERE D-SIGNA/D-T IS IN MR/(GEV/C)++2 AND -T IS IN (GEV/C)++2. ETTER VALUES A = 7.01 +- .29 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON-[FIGURE 2] LABORATORY BEAM MOMENTUP = 11.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .0 TC .5 (GEV/C)**2. T IS THE NOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE ICUTGOING NEUTRONI. FITTED FORMULA IS C-SIGMA/C-T = EXP(-A*ABS(T)] WHERE D-SIGNA/D-T IS IN M8/(GEV/C)++2 AND -T IS IN (GEV/C)++2. FITTED VALUE A = 7.12 + -.22FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [FIGURE 2] LABORATORY BEAN MOMENTUM = 15.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .0 TO .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON] AND THE Loutgoing Neutronj. Fitted Formula IS D-Sigma/D-T = Exp[-A*ABS(T]] WHERE C-SIGMA/D-1 IS IN MB/(GEV/C)##2 AND -T IS IN (GEV/C)##2. ETTTED VALUE A = 7.29 +- .23 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [FIGURE 2] LABORATORY BEAM MOMENTUM = 19.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .0 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [CUTGOING NEUTRON]. FITTED FORMULA IS C-SIGMA/O-T = EXP[-A*ABS(T)] WHERE D-SIGNATO T IS IN HOTIGEV/GITTE AND IT IS IN (GEV/GITTE. FITTED VALUE A = 7.31 +- .23 . FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [FIGURE 2] LABORATORY BEAM MOMENTUM = 23.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .0 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE {CUTGGING NEUTRON}. FITTED FORMULA IS C-SIGMA/O-T = GXP(-A*A\$S(T)} WHERE D-SIGMA/D-T IS IN MB/(GEV/CI**2 AND -T IS IN (GEV/CI**2. FITTED VALUE A = 8.57 +- .33 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. FEIGURE 21 LABORATORY BEAN MOMENTUM = 27.4 +- 2.0 GEV/C. DATA IS FIT OVER -T FROM .0 TE .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE IQUIGOING NEUTRON]. FITTED FORMULA IS C-SIGMA/D-T = EXP(-A*ABS(T)) WHERE D-SIGMA/D-T IS IN MB/(GEV/CI**2 AND -T IS IN (GEV/C)**2. FITTED VALUE A = 8.58 +- .38

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60
        NEASUREMENT OF PP AND PC TOTAL CROSS SECTIONS AT 3.00 GEV/C.
                                                                                               [BNL 14125 (1969)]
         R.J.ABRAMS,R.L.CODL,G.GIACOMELLI,T.F.KYCIA,B.A.LEONTIC,K.K.LI,D.N.MICMAEL (BRECKMAVEN NAT. LAB., UPTON, L.I., N. Y., USAI
               LACT IN A NEW MEASUPEMENT OF PROTON TOTAL CROSS SECTIONS AT 3.00 GEV/C, THE PD TOTAL CROSS SECTION IS FOUND TO BE
LOWER THAN A PREVIOUS MEASUREMENT BY 1.17 +- .09 MB. THIS IMPLIES A CORRESPONDING NEW VALUE FOR THE TOTAL CROSS
SECTION FOR I=0 WHICH IS 2.18 +- 0.27 MB LOWEP THAN THE PREVIOUS VALUE. POSSIBLE SOURCES OF SYSTEMATIC ERROR ARE
DISCUSSED.
        CITATIONS

PHYS. REV. 146, 980 (1966), PHYS. REV. 138, 8913 (1965), PHYS. REV. LETTERS 16, 1228 (1966), PHYS. REV. LETTERS 17,

102 (1966), BKL 14047, PHYS. REV. LETTERS 18, 1209 (1967), PHYS. REV. LETTERS 19, 259 (1967), PHYS. REV. LETTERS 19,

678 (1967), BKL 14046, PHYS. REV. 144, 1101 (1966), PHYS. REV. LETTERS 15, 330 (1967), PHYS. REV. LETTERS 19, 857

(1967), NUC. PHYS. 75, 609 (1966), PHYS. REV. 168, 1466 (1968), CENR 66-18 (1966), PHYS. REV. LETTERS 19, 853 (1967),

PHYS. REV. 112, 2077 (1958), CROYGENICS 3 16 (1963), INT'L. CONGRESS ON NUCLEAR PHYSICS, PARIS, FRANCE 162 (1964), AND

PHYS. REV. LETTERS 20, 468 (1966).
         ARTICLE READ BY DEETTE BENARY IN 12/69, AND VERIFIED BY LERDY PRICE.
        BEAF NO. 1 IS PROTON ON PROTON AT 3 GEV/C.
ND. 2 IS PROTON CN CEUTERCN AT 3 GEV/C.
        THIS EXPERIMENT USES COUNTERS.
        KEY WORDS + CROSS SECTION
         PROTON PROTON TOTAL CROSS SECTION.
                                                               (PAGE 2)
          LABORATORY
BEAM MCMENTUM
GEV/C
3.
                                            MILLI-BARNS (1,2)
44.23 +- .06
               [1] ERRORS ARE STASTICAL CNLY.
[2] PLUS POSSIBLE SYSTEMATIC ERROR OF +- .7 PER CENT.
        _____
         PROTON DEUTERON TOTAL CRCSS SECTION.
                                                                  (PAGE 2)
          LABCRATORY
BEAM MCMENTUM
GEV/C
3.
                                            MILLI-BARNS (1,2)
81.78 +- .07
               [1] ERRORS ARE STASTICAL CNLY.
[2] PLUS POSSIBLE SYSTEMATIC EPROR OF +- .8 PER CENT.
         I = O NUCLEON NUCLEON TOTAL CROSS SECTION.
                                                                             [PAGE 7]
               ( ÎĤIŜ VĂLUË HĂŜ BEEN CALCULATED BY RESCALING THE P-P AND P-DEUTERUN IUTAL LRUSS SELTIONS TRUA BUGG ET ALTUMITS.MEV.140,
980(1966)) AND TAKING A VALUE OF .0311 MB++(-1) FOR THE INVERSE SQUARE SEPARATION OF THE NUCLEON IN THE DEUTERON.J
          LABORATORY
BEAM MOMENTUM
GEV/C
3.
                                            MILL1-BARNS [1]
38.57 +- .23
               [1] ERRORS ARE STASTICAL CNLY.
         PROTON NEUTRON TOTAL CROSS SECTION.
GLAUBER CORRECTION APPLIED
                                                                   (PAGE 7)
          LABERATERY
BEAN NOMENTUH
GEV/C
3.
                                            MILLI-BARNS [1]
41.67 +- .09
               [1] ERRORS ARE STASTICAL CNLY.
```

61 THE REACTION PP . PP PI+ PI- AT 7.9 BEV/C. (UNIV. OF ILLINCIS COOL195125 (1968)) D.F.GRETHER (UNIV. OF ILLINDIS, URBANA, ILL., USA) ARCT THE REACTION OF P + PP PI+ PI- IAS BEEN STUDIED AT AN INCIDENT MOMENTUM OF 7.9 BEV/C USING THE BROOKHAVEN BO INCH HYDROGES BUBBLE CHAPBER. APPRCXIPATELY 3600 EVENTS OF THE REACTION WERE IDENTIFIED: THE CPOSS SECTION WAS DETERNING TO BE 2.54 \leftarrow .13 HB. THE REACTION IS FOUND TO BE DOWINATED BY PREDUCTION OF THE QUASI-THREE ROOY FINAL STATE N++ P PI-. A SIMPLE ONE PICH EXCHANCE MODEL IS COMPARED TO THE DATA AND IS SHOWN TO GIVE GENERALLY OCCCO RESULTS FOR INVARIANT MASS DISTRIBUTIONS FOR THE ENTIRE FINAL STATE, AND FOR MASS AND ANGLARD DISTRIBUTIONS FOR THE QUASI-THREE BODY STATE. DISCREPANCIES BETWEEN THE DATA AND THE MODEL ARE FOUND TO BE PRIMARILY ASSOCIATED WITH ENHANCEMENTS IN THE N+++ PI-I MASS DISTRIBUTIONS AT ABOUT 1425 MEV AND 100 MEV. EXAMINATION OF THE 1425 BENNANCEMENTS IN THE N+++ PI-I MASS DISTRIBUTIONS AT ABOUT 1425 MEV AND 100 MEV. EXAMINATION OF THE 1425 MEV ENHANCEMENTS IN THE N+++ PI-I MASS DISTRIBUTIONS AT ABOUT 1425 MEV AND 100 MEV. EXAMINATION OF THE 1425 MEV ENHANCEMENTS IN THE N+++ PI-I E ENHANCEMENT COULD NOT BE IDENTIFIED AS THE ++(1470). THE PILIP WAVE RESONANCE OF PI-P PHASE SHIFT ANALYSIS. EXAMINATION OF THE PI+ PI- MASS DISTRIBUTIONS GIVES SOME INDICATION FOR PRODUCTION OF THE RHOM MESON, BUT NO INDICATION OF THE PI PI RESONANCES. NO EVIDENCE IS FOUND FOR PRODUCTION FOR PRODUCTION OF THE RHOM MESON, BUT NO INDICATION OF THE PI PI RESONANCES. NO EVIDENCE IS FOUND FOR PRODUCTION FOR PRODUCTION OF THE RHOM MESON, BUT NO INDICATION OF THE PI PI RESONANCES. NO EVIDENCE IS FOUND FOR PRODUCTION FOR PICK BARYON NUMBER * 2. BARIUM HUNGER - 2.
 CITATIONS
 PHYS. LETTERS 16, 75 (1965), PHYS. REV. 154, 1284 (1967), PHYS. REV. LETTERS 17, 884 (1966), NUOVO CIMENTO 50, 1000 (18671, PHYS. REV. 1450 (1963), NUOVO CIMENTO 30, 240 (1963), NUOVO CIMENTO 34, 1644 (1964), REV. MOD. PHYS. 39, 1 (1968), PHYS. LETTERS 164 (1964), PHYS. REV. 126 (1963), PHYS. REV. 110480, PHYS. REV. LETTERS 17, 1804 (1966), REV. MOD. PHYS. 39, 1 (1968), PHYS. LETTERS 164 (1967), PHYS. REV. 126 (1963), PHYS. REV. 11968), PHYS. REV. LETTERS 17, 1960 (1968), PHYS. REV. LETTERS 19, 1965, PHYS. 164 (1963), PHYS. REV. LETTERS 13, 109 (1964), PHYS. REV. 120, 107 (1965), PHYS. REV. LETTERS 19, 1965, REV. 126, 1975, REV. 126, 1975, REV. 126, 1975, REV. 126, 1975, REV. 127, 1975, RE ARTICLE READ BY OCETTE BENARY IN 10/69, AND VERIFIED BY LERCY PRICE. BEAM IS PROTON ON PROTON AT 7.9 GEV/C. THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. KEY WORCS . CROSS SECTION MASS SPECTRUM MODELS ANGULAR DISTRIBUTION CROSS SECTION FOR PROTON PRCTON . PROTON PROTON PI+ PI-. [PAGE 29] LABORATOPY BEAM MOMENTUM GEV/C • 7.875 +- .044 MILLI-BARNS 2.54 +- .13 ND. EVENTS 3600 62 EVICENCE FOR DEMINANCE OF POMERON LIKE EXCHANGE IN PP - NN PI AT 19 GEV/C. [PHYS. LETTERS 308, 369 (1969)] M-BOGGILO,K.HANSEN,H.JOHNSTAC,P.#CLLERUD,M.SLK,L.VEJE (NIELS BOHR INSTITUTE, COPENHAGEN, CENMARK] M.KORKEA-AHO, K.V.LAURIKAINEN,P.K.LAURIKAINEN (HELSINGIN YLIOPISTO, HELSINKI, FINLAND] V.BAKKEN,S.BJASTAD,FO.JBREIVIN,I. JACOBEN,S.G.SORENSEN (OSLO UNIV., OSLO, NORMAY) D.JOHNIELSSON,G.EKSPONG,L.GRANSTROM,B.RONNE (STOCKHOLMS UNIV., STOCKHOLM, SWEDEN) ABSTRACT THE REACTIONS PP + NN PI ARE STUDIED AT 19 GEV/C AND ANALYSEC IN TERMS OF THE AMPLITUDES WITH THE LCN MASS NPI SYSTEM IN ISOSPIN STATES 1/2 AND 3/2 RESPECTIVELY. THE I=1/2 CROSS SECTION IS COMPARED WITH THE CORRESPONDING ONE IN PI P + PI PI N AT 8 GEV/C. CITATIONS PHYS. REV. LETTERS 15, 49 (1965), CERN TH 1001 (1969), PHYS. REV. 88, 1211 (1952), NUC. PHYS. RB, 45 (1968), CERN TH 1022 (1969), PHYS. REV. LETTERS 19, 330 (1967), PHYS. REV. LETTERS 19, 857 (1967), PHYS. LETTERS 14, 164 (1965), PHYS. REV. 125, 2C82 (1962), PHYS. REV. 123, 2160 (1961), PHYS. REV. 162, 1320 (1967), NUOVO CIMENTO 47A, 470 (1967), PHYS. REV. 154, 1284 (1967), PHYS. REV. 173, 1322 (1968), AND NUOVO CIMENTO 53A, 232 (1968). ARTICLE REAC BY OCETTE BENARY IN 10/69, AND VERIFIED BY LERGY PRICE. BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2K (H) BUBBLE CHAMBER. KEY WORDS + CROSS SECTION MASS SPECTRUM MODELS LABORATORY CEAM MOMENTUM = 19. GEV/C. REAL.. PROTON PRCTON + ELASTIC PROTON PROTON PIO PROTON NEUTRON PI+ OELTA(1238)++ NEUTRON DELTA(1238)++ • PROTON PI+ [1] FILL I-BARNS 8.70 +- .50 . 10 .20 1.90 .20

63 PRCTGN-CEUTERON INTERACTIONS AT 970 MEV. (PROC. OF THE ROYAL SOCIETY OF LONDON 251, 233 (1959)) A.P.BATSGN, B.B.CULWICK, F.B.KLEPP, L.RIDDIFORD [81PMINGHAM UNIV., BIRMINGHAP, ENGLAND] ALCE A HIGH-PRESSURE DIFFUSION COTFFINUMAR UNIV., BIRMINGHAP, ENGLANDI RACT A HIGH-PRESSURE DIFFUSION CLOUD CHAMBER HAS BEEN USED TO STUDY THE INTERACTIONS OF 970 MEV PROTONS FROM THE BIRMINGHAM SYNCHROTRON WITH DEUTERIUM. ANALYSIS OF THE 569 COLLISIONS GESERVED INCIGATES THAT AT THIS ENERGY THE DEUTERON BEHAVES AS IF IT WERE COMPOSED OF TWO FREE NUCLEONS. THE PROPERTIES OF PROTON-PROTON AND PROTON-RUTRON SCATTERING HAVE BEEN DETERFUNDED ON THIS ASSUMPTION, AN ESTIMATE IS MADE CF THE EXTRA OF THE "SHADDNING" OF EACH NUCLEON IN THE DEUTEROM BY THE GTHER. THE PARTIAL CROSS-SECTIONS FOR PP AND PN ELASTIC SCATIFFING HAVE BEEN DLIEVMINEU, AS HAVE ALSO THE VALUES FOR THE FIVE POSSIBLE SINGLE MESON PROCUCTION PROCESSES. THEY HAVE THE FOLLOWING "BEST" VALUES (1) (PP - PP) = 25.5 + 7.4 M AS HAVE ALSO THE VALUES FOR THE FIVE POSSIBLE SINGLE MESON PROCUTION PROCESSES. THEY HAVE THE FOLLOWING "BEST" VALUES
(1) (PP · PP) = 25.5 +- 1.7 MB
(2) (PN · PN) = 16.2 +- 3.5 MB
(3) (PP · PP PIO) = 5.4 +- 1.6 MB
(4) (PP · PP PIO) = 15.4 +- 1.7 MB
(5) (PN · PN PIC) = 15.4 +- 1.7 MB
(5) (PN · PN PIC) = 14.3 +- 3.5 MB
(6) (PN · PN PIC) = 14.3 +- 3.5 MB
(7) (PN · NN PIC) = 14.3 +- 3.5 MB
(7) (PN · NN PIC) = 2.7 +- C.6 MB
(7) (PN · NN PIC) = 4.3 +- 1.4 MB
DOUBLE MESON PRODUCTION ANC REACTIONS INVOLVING SECONDARY DEUTERONS ARE NOT IMPORTANT. THE CROSS-SECTIONS (1), (2),
(3), (4), AND (5) ARE CONSISTENT MITH VALUES EXTRAPOLATED FRGM DATA AT ENERGIES BELOW 660 NEV BY RUSSIAN MOPKERS.
KNOWLEDGE OF THE OTHER CROSS-SECTIONS (6) AND (7) MAKES POSSIBLE A TEST CF THE VALIDITY OF THE CHARGE INDEPENDENCE OF
INDICATE THAT, ASSUMING CHARGE INDEPENDENCE, THE FORMATION OF EXCITED NUCLEONS OF ISOTOPIC SPIN 3/2 DDES NOT DOMINATE
OBSERVED. THE ANGULAR DISTRIBUTION OF PROTON-NEUTRON ELASTIC SCATTERING HAS THE FORM EXPECTED FREW LOWER ENERGY DATA. TIONS NUDVO CIMENTO 9, 547 (1958), PRGC. OF THE ROYAL SOCIETY OF LONDON A237, 175 (1956), J. SCI. INSTRUM. 33 302 (1956), J. SCI. INSTRUM. 34 17 (1957), PROC. CF THE ROYAL SOCIETY OF LONDON A251, 218 (1959), PROC. OF THE ROYAL SOCIETY OF LONDON A71, 293 (1958), PHYS. REV. 103, 211 (1956), PHYS. REV. 74, 803 (1948), PHYS. REV. 65, 568 (1952), PHYS. REV. 98. 1369 (1955), PROCES IN THEORETICAL PHYSICS, JAPAN 5, 570 (1950), PHYS. REV. 66, 368 (1954), CEN COMFRENCE 2 115 (1956), PROGRESS IN THEORETICAL PHYSICS, JAPAN 5, 570 (1950), PHYS. REV. 92, 452 (1953), PHYS. REV. 93, 1434 (1954), PHYS. REV. 75, 1352 (1949), PHYS. REV. 95, 1026 (1954), PHYS. REV. 104, 1479 (1956), PHYS. REV. 024, (1955), PHYS. REV. 89, 109C (1953), JINR P-157 (1952), PHYS. REV. 104, 784 (1956), PHYS. REV. 101, 397 (1956), PHYS. REV. 94, 1795 (1974), PHYS. REV. 101, 107 (1956), PHYS. REV. 94, 1085 (1954), PHYS. REV. 94, 11950, ONK. AKAN. NAUK. SSR 99 955 (1954), PHYS. REV. 103, 1472 (1556), PHYS. REV. 94, 1085 (1954), PHYS. REV. 95, 1580 (1954), JETP 32 750 (1957), PHYS. REV. 96, 139 (1974), PHYS. REV. 40, 77 (1954), PHYS. REV. 97, 1186 (1955), PHYS. REV. 97, 1033 (1955), PHYS. 105, 1058 (1957), UCRL 2540 (1954), PRUGRESS OF THEORETICAL PHYSICS 19, 622 (1958), AND PHYS. REV. 103, 1330 (1955). CITATIONS ARTICLE READ BY OCETTE BENARY IN 10/69. AND VERIFIED BY LERCY PRICE. BEAM IS PROTON ON DEUTERCN AT 1.662 GEV/C. (BEAM KINETIC ENERGY = .57 GEV) THIS EXPERIMENT USES A CLOUD CHAMBER. GENERAL COMMENTS ON THIS ARTICLE 1 THE QUDTED CROSS SECTIONS WERE NORMALIZED TO A TOTAL PD CROSS SECTION OF 77+-2.5 MB. KEY WORDS - CROSS SECTION DIFFERENTIAL GROSS SECTION ANGULAR DISTRIBUTION [TABLE 2] LABCRATORY BEAM ENERGY = .97 GEV. REACTION MILLI-BARNS REACTION PROTON NEUTRON + ELASTIC PROTON NEUTRON PIO KEUIRUN NEVIRUR PIT PROTON PROTON PIT TOTAL (1) THE WAY THE SCREENING CORRECTION HAS BEEN CALCULATED IS SHOWN IN PAGE 242 GF THE ARTICLE. 64 OMEGA PRODUCTION IN PP - PP PI+ PI- PIO AT 6.6 GEV/C. [UCRL 19330 (1969)] E.COLTON.E.GELLERT [U.C. LAWRENCE RAC. LAP., BERKELEY, CALIF., USA, AND UNIV. OF CALIFOPNIA, BERKELEY, CALIF., USA] RACT WE PRESENT A STUDY OF THE 3 PI SYSTEM IN PP • PP PI+ PI- PIO AT 6.6 GEV/C. BOTH ETAI549) AND OMEGA[783] PRODUCTION ARE OBSERVED. THE DALITZ PLOT IS DISPLAYED FOR THE PP OMEGA EVENTS, IN ADDITION TO SEVERAL GTHER EXPERIMENTAL DISTRIBUTIONS. THERE IS NO EVIDENCE FOR P OMEGA RESONANCES. THE PP OMEGA EVENTS HAVE BEEN ASSIGNED SEPARATELY TO THE SIX POSSIBLE MULTIPERIPHERAL DIAGRAMS ON THE BASIS OF CRITERIA IN THE FOUR-MOMENTUM TRANSFERS AND C.M. LONGITUDINAL MOMENTA, RESPECTIVELY. IN ADDITION WE DISCUSS THE MEANS OF ACHIEVING AN EFFECTIVE DIAGRAM SEPARATION. ABSTRACT CLOSELY RELATED REFERENCES SEE ALSU UCLA 1025 (1968), ANU ULLA 1036 (1969). ADDITIONAL CITATIONS PHYS. REV. LETTERS 21, 1548 (1968), NUOVO CIMENTO 58, 475 (1968), PHYS. REV. 161, 1387 (1967), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 554, 66 (1968), UCRL 17707 (1968), PHYS. REV. 174, 1638 (1968), PHYS. REV. LETTERS 23, 42 (1969), PHYS. REV. 177, 2092 (1969), AND NUOVO CIMENTO 514, 696 (1967). ARTICLE READ BY ODETTE BENARY IN 12/69. AND VERIFIED BY LERCY PRICE. BEAM IS PROTON ON PROTON AT 6.6 GEV/C. THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CHAMBER. KEY WORDS + CROSS SECTION OMEGA(783) ETA(548)

(TABLE 1)

LABORATORY BEAM MCMENTUM = 6.6 GEV/C.		
REACTION	MICRO-BARNS	NO. EVENTS
PROTON PROTON PROTON GMEGA(783)	180. +- 23.	671
OMEGA(783) - PI+ PI- PIO (1) PROTON PROTON ETA(548) FTA(548) - PI+ PI- PIO (1)	29. 9.	

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

65 POLE EXTRAPELATION RESULTS FREM PP + DELTA ++ N AT 6.6 GEV/C. [PHYS. REV. LETTERS 23, 342 (1969)] Z.M.MA,G.A.SMITH,R.J.SPRAFKA (MICHIGAN STATE UNIV., EAST LANSING, MICH., USA) E.COLTON,P.E.SCHLEIN IUNIV. OF CALIF., LCS ANGELES, CALIF., USA) RACT WE PRESENT AN EXPERIMENTAL STUDY OF THE LOW-MOMENTUM-TRANSFER DELTA++ N COMPONENT OF 6424 PP • P PI+ N EVENTS AT 6.6 GEV/C. THE PI+ P ELASTIC CROSS SECTIONS IN THE DELTA++ REGION ARE MEASURED BY MEANS OF SEVERAL DIFFERENT POLE-EXTRAPOLATION PROCEDURES. WE FIND THAT THE CONVENTIONAL CHEM-LOW EXTRAPOLATION PROCEDURE YIELDS RESULTS NOT IN SATISFACTORY AGREEMENT WITH THE KNOWN ON-SHELL CAOSS SECTIONS. WE SUGGEST A MODIFIED EXTRAPOLATION PROCEDURE WHICH IN OUR CASE YIELDS RESULTS IN GOOD AGREEMENT WITH THE UN-SHELL VALUES. CITATIONS INGAS Pays. Rev. Letters 5, 571 (1960), Phys. Rev. 113, 1640 (1959), NUC. Phys. 83, 349 (1967), Phys. Rev. Letters 21, 1613 (1968), Phys. Rev. Letters 19, 925 (1967), UCLA UCLA-1023 (1968), NUGVO CIMENTC 404, 899 (1965), Cern TH 838 (1967), AND Phys. Letters 62 (1963). ARTICLE REAG BY OCETTE BENARY IN 9765, AND VERIFIED BY LERGY PRICE. BEAM IS PROTON ON PROTON AT 6.6 GEV/C. THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CHAMBER. KEY WORDS . CROSS SECTION MASS SPECTRUM CIFFERENTIAL CRCSS SECTION MODELS DELTA(1238)++ CRCSS SECTION FOR PROTON FRCTON PRCTCN PI+ NEUTRON. [PAGE 343] LARCPATCRY BEAM MOMENTUM GEV/C 6.6 MILLI-BARNS 5.73 +- .35 DIFFERENTIAL CROSS SECTION FOP PPGTCN FRGTON + NEUTRON DELTA(1238)+++ DELTA(1238)+++ + PROTON PI+ [1] [FIGURE 18] LABORATORY REAN MOMENTUM = 6.6 GEV/C. (PRIVATE COMMUNICATION FROM E.COLTON SEPT.1969) D-SIGMA/D-T M8/(GEV/C)**2 (GEV/C)**2 *2 •010 •020 •030 •040 •060 •080
 11.80
 + 1.12

 11.80
 + 1.12

 12.40
 1.03
 12.25

 12.11
 1.02
 1.02

 11.12
 4.03
 1.02

 11.14
 57
 6.60
 54

 3.64
 4.03
 54
 4.43

 3.64
 4.03
 3.64
 4.03

 2.27
 .31
 2.27
 .31

 1.67
 .27
 .31
 1.67

 1.67
 .27
 .31
 1.27
 MIN .CO2 .010 .020 .C3C .C3C .C40 .C60 .C80 .100 .100 .120 .140 .160 .200 .220 .240 .240 .260 .280 .120 -120 -140 -160 -200 -220 -220 -240 -260 .41 .31 .31 .27 .28 .25 .24 1.41 -280 . 300 T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE INEUTRONI. [1] COUNTED ALL EVENTS IN MASS BANC. PROTON PROTON • NEUTRON DELTA(1238)++. DELTA(1238)++ • PROTON PI+ (1) FIT TO DIFFERENTIAL CRCSS SECTION FOR [PAGE 3431 LABORATORY BEAM MEMENTUM = 6.6 GEV/C. DATA IS FIT OVER T FRCM .03 TG .30 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE LNEUIRUNJ. FITTED FORMULA IS D-SIGMA/D-T = A*ExP[8x+Cx**2] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND X=T-TMIN. FITTED VALUE $\begin{array}{rcl} A &=& 21.3 + - 2.3 \\ B &=& -16.1 + - 1.9 \\ C &=& 23.0 + - 6.2 \end{array}$ (1) COUNTED ALL EVENTS IN MASS BAND.

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POLARIZATION PARAMETER IN ELASTIC PROTON-PROTON SCATTERING FROM 0.75 TO 2.84 GEV. [PHYS. PEV. 161, 1374 (1967)]

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H.A.NEAL,M.J.LONGC (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA)

NEAL, M.J.LONGE (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) RACT THE POLARIZATION PARAMETER IN ELASTIC PROTON-PROTON SCATTERING HAS BEEN MEASURED AT 0.75, 1.03, 1.32, 1.63, 2.24, AND 2.86 GEV RW EMPLCING A DOUBLE-SCATTERING TECHNIQUE. AN EXTERNAL PROTON BEAM FROM THE BROMKHAVEN COSMOTRON MAS FOCUSEO ON A 3 IN.-LONG LIQUID HYCROGEN TARGET AND THE ELASTIC RECOIL BEAM WAS DETERMINED FROM THE BROMKHAVEN COSMOTRON MAS FOCUSEO ON A 3 IN.-LONG LIQUID HYCROGEN TARGET AND THE ELASTIC RECOIL BEAM WAS DETERMINED FROM THE BROMKHAVEN COSMOTRON MAS FOCUSEO ON A 3 IN.-LONG LIQUID HYCROGEN TARGET AND THE ELASTIC RECOIL BEAM WAS DETERMINED FROM THE AZIMUTHAL SYMMETRY EXHIBITED IN ITS SCATTERING FROM A LARGEN TARGET. THIS ASYMMETRY WAS MESURED BY A PAIR OF SCINTILLATION COUNTER TELESCOPES WHICH SYMMETRICALLY VIEWED THE CARBON TARGET. THE ANALYZING POWER OF THIS SYSTEM WAS PREVIOUSLY DETERMINED IN AN INDEPENDENT CALIBRATION EXPERIMENT EMPLOYING A 40 PER CANECLLED TO A HIGH ORDER BY PERIODICALLY ROTATING INSTITUTE OF TECHNOLGGY SYNCHROCYCLOTRON. FALSE ASYMMETRIES WERE CANECLLED TO A HIGH ORDER BY PERIODICALLY ROTATING THE BAALYZER 180 DEG. ABGUT THE RECOIL BEAM LINE. SPARK CHAMBERS WERE UTILIZED TO DOBTAIN THE SAFITAL DISTRIBUTION OF THE BEAM AS IT ENTERED THE ANALYZER: THIS INFORMATION ALLOWED AN ACCURATE DETERMINATION OF THE CORRECTIONS NECESSARY POLARIZATION PARAMETER IS A FUNCTION OF THE CENTER-OF-MASS SCATTERING ANGLE ARE GIVEN FOR EACH INCIDENT BEAM EMPERS. THE PROLARIZATION PARAMETER IS A FUNCTION OF THE CENTER-OF-MASS SCATTERING ANGLE ARE GIVEN FOR EACH INCIDENT BEAM EMPERS. THE PROLARIZATION DARAMETER THE DAY OF DOLARIZATION IN ALLOWED AN ANGLE ARE GIVEN FOR EACH INCIDENT BEAM EMPERS. PHEASE-SHIFT SOLUTIONS ARE COMPARED WITH THE EXPERIMENTAL RESULTS. SURPRISINGLY GOOD AGREEMENT WITH THE REGGE PREDICTIONS IS FOUND DESPITE THE LOW EMERGIES INVOLVED. ABSTRACT

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CLOSELY RELATED REFERENCES CONTINUATION OF PREVIOUS EXPERIMENT IN PHYS. REV. LETTEPS 16, 536 (1966).

ADCITIONAL CITATIONS PHYS. REV. 148, 1257 (1966), NUOVO CIMENTO 20, 1C49 (1961), PROGR. THEORET. PHYS. (KVOTO) 35 261 (1966), PHYS. REV. 85 947 (1952), PHYS. REV. 99, 996 (1955), PROGR. THEORET. PHYS. (KVOTO) 28 1048 (1962), PHYS. REV. LETTERS 9, 475 (1962), ANNALS OF PHYSICS 7, 404 (1959), PHYS. REV. 120, 2250 (1960), UNIV. OF MICH. TECH. REPORT 03106-23-T (1966), PHYS. REV. 148, 1289 (1966), UCRL 11926 (1965), AND NUOVO CIMENTO 23, 650 (1962).

ARTICLE READ BY OCETTE BENARY IN 10/67, AND VERIFIED BY LERCY PRICE.

BEAM IS PROTON ON PROTEN FROM 1.403 TC 3.659 GEV/C.

THIS EXPERIMENT USES COUNTERS AND SPARK CHAMBERS.

GENERAL CONMENTS ON THIS ARTICLE 1 FIRST SCATTERING ON HYCROGEN, SECOND SCATTERING ON CARBON.

KEY WORDS . POLARIZATION POCELS

ELASTIC POLARIZATION FOR PROTON PROTON. TABLE 11

LABORATORY	BEAM	ENERGY		.75	6E V	+-	2{PER	CENT).
THETA			POLA	PIZA	TIGN	a	1	
DEGREES								
43.85			. 541	+-	.075			
47.19			.513		. 644			
53.25			. 5 3 0		. 629			
63.98			. 470		.067			
86.29			.057		.078			

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAN IN THE GRANC C.M. The polarization is of the proton along the normal to the production plane in the granc c.m.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

CTABLE 11 ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY	BEAM	ENERGY	=	1.0	3	GE V	+-	2 (P ER	CENT).
THETA			PCLA	FIZ	١T		(1)		
DEGREES									
39.89			. 419	+-	- 1	131			
42.47			. 464			640			
53.60			- 4 B L			Č 2 3			
57.01			. 417			238			
61.62			.325			133			
65.32			.258			073			
68.52			.245			633			
71.37			.265			037			
77.25			.095			129			
88.25		· -	-021		1	461			

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polanization is of the proton along the mormal to the opposition plane in the grand c.m.

(1) PLUS POSSIBLE SYSTEPATIC EPROR OF +- 5 PER GENT.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 1]

LABORATORY BEAM ENERGY = 1.32 GEV +- 2(PER CENT). THFTA CEGREES POLAPIZATION [1]

LOWCED	
32.30	.361 +C36
34.77	•4C3 •C3C
39.06	.343 .045
46.63	.407 .025
49.77	.339 .022
53.13	.266 .020
61.21	.190 .025
68.26	.034 .030
74.76	+C62 +C32
81.81	.059 .034
88.23	.034 .029

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE REAM IN THE GRAND C.M. THE POLARIZATION IS OF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEMATIC EFROR OF +- 5 PER CENT.
LABORATO	RY BEAM ENERGY =	1.63 GEV +	- 2(PER CENT).
THETA	POLAR	IZATION [1	1
28.87	.228	+029	
32.80	.352	.032	
44.07	.365	. C20	
49.67	.177	.040	
61.91	- 141	.035	
67.04 73.93	.025	.028	
80.57	.000	.031	
THETA IS	THE ANGLE THAT THE	PROTON MA	KES WITH THE BEAM IN THE GRAND C.M.
(1) PLU	S POSSIBLE SYSTEMAT	IC EPROP O	F +- 5 PER CENT.
		•	
ELASTIC POLAR	IZATION FOR PROTON	PROTEN.	TABLE 1)
LABORATO	RY BEAM ENERGY =	2.24 GEV +	- 2(PER CENT).
THETA	POLAR	ZATICN (1)
DEGREES	. 227	031	
27.09	.315	. C26	
30.42	.252	.026	
38.74	- 229	.052	
43.45	.178	. 627	
47.14	-182	.033	
52.25	.134	.036	
54.01 57.04	-147	.032	
62.22	.020	.041	
69.30 85.24	.093	.050	
THETA IS The Pola	THE ANGLE THAT THE RIZATION IS OF THE	PROTON MA	KES WITH THE BEAM IN THE GRAND C.M. Ng the Normal to the production plane in the grand c.m.
	C DOSSIBLE SASTENAT		E 5 DEQ CENT
(1) (0	3 70331022 31312741		
THETA . 0EGREES 22.18 23.78	RY BEAM ENERGY = PGLAR .193 .188	2.84 GEV + IZATICN [] C26 .C54	- 2(PER CENT).]
THETA DEGREES 22.18 23.78 31.65 35.91 41.37 47.15	RY BEAM ENERGY = : PGLAP .193 .193 .237 .195 .175 .142	2.84 GEV + ZATICN [] 626 .654 .039 .657 .637 .071	- 2(PER CENT).]
LABURATO THETA OEGREES 22.18 23.78 31.65 35.91 41.37 47.15 60.04 72.72	RY BEAM ENERGY = . PGLAR .193 .237 .193 .175 .175 .142 .115 .043	2.84 GEV + (ZATICN [1 626 .039 .057 .037 .071 .055 .059	- Z(PER CENT). 1
LABORATO THETA . DEGREES 22.18 31.65 35.91 41.37 47.15 60.04 72.72 THETA 1S	RY BEAM ENERGY = . PGLAP. .193 .237 .199 .175 .142 .115 .043 The Angle That The	2.84 GEV + 12ATICN [1 626 .C54 .039 .C37 .C37 .C37 .C57 .C59 PROTCN MA	- 2(PER CENT).] KES WITH THE BEAM IN THE GRAND C.M.
LABORATO THETA . OCGREES 22.18 31.05 35.91 41.37 47.15 60.04 72.72 THETA IS THE POLA	RY BEAM ENERGY = PGLAR 193 193 237 195 175 142 115 043 The angle that the Rization is of the 1	2.84 GEV + 12ATICN [1 C26 .C54 .C39 .C57 .C37 .C37 .C55 .C59 PROTCN MA PROTCN ALO	- 2(PER CENT).] KES WITH THE BEAM IN THE GRAND C.N. NO THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.N.
LABURATO THETA . OFGREES 22.18 31.05 35.91 41.37 47.15 60.04 72.72 THETA 1S THE POLA [1] PLU	RY BEAM ENERGY = PGLAP -193 -193 -193 -193 -193 -193 -193 -193 -175	2.84 GEV + 12ATICN [1 626 .C54 .C57 .C37 .C37 .C55 .C59 PROTCN MA PROTCN MA PROTCN ALO	- 2(PER CENT).] KES WITH THE BEAM IN THE GRAND C.N. NG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M. F +- 5 PER CENT.
LABURATO THETA DEGREES 22.18 31.05 35.01 41.37 47.15 60.04 72.72 THETA 1S THE POLA [1] PLU	RY BEAM ENERGY = PGLAP .193 .184 .237 .197 .175 .142 .115 .043 THE ANGLE THAT THE RIZATION IS OF THE A S POSSIBLE SYSTEMAT	2.84 GEV + 12ATICN [1] 626 .039 .037 .037 .037 .037 .037 .055 .059 PROTCN MA PROTCN MA PROTCN ALO	- 2(PER CENT).] KES WITH THE BEAM IN THE GRAND C.N. RG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M. F +- 5 PER CENT.
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THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

PROTON PROTON ELASTIC CROSS SECTION. [PAGE 950]

LABORATORY BEAM ENERGY	
GEV	MILL I-BARNS
	20.0 ** 2.5

FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [PAGE 943]

LABORATORY BEAM ENERGY = .97 GEV. FITTED FORMULA IS D-SIGMA/D-OMEGA = A+(B+PO(COS(THETA))+C+P2(COS(THETA))+D+P4(COS(THETA))+E+P6(COS(THETA))) WHERE C-SIGHA/D-CMEGA IS IN MB/SR. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.F.

FITTED VALUES

68 ELASTIC SCATTERING AND SINGLE MESON PRODUCTION IN PROTON-PROTON COLLISIONS AT 2.85 BEV. [PHYS. REV. 123, 2160 (1961)] G.A.SMITH,H.COURANT,E.C.FCWLER,H.KRAYBILL,J.SANDHEISS,H.TAFT [YALE UNIV., NEW HAVEN, CONN., USA, AND BROOKHAVEN NAT. LAB., Upton, L.I., N. Y., USA }

ARCT THE BRUCKHAVEN NATIONAL LABGRATGRY TWENTY-INCH LIQUID HYDROGEN BUBBLE CHAMBER WAS EXPOSED TO A MONOENEPGETIC BEAN OF 2.85-BEV PROTONS, ELASTICALLY SCATTERED FROM A CARBON TARGET IN THE INTERNAL BEAN OF THE COSMOTRON. ALL TWO-PRONG EVENTS, EXCLUDING STRANGE PARTICLE EVENTS, HAVE BEEN STUDIED BY THE VALE HIGH-ENERGY GROUP. THE REPAINING INTERACTIONS SCATTERING AT CENTER-OF-MASS ANGLES UP TO ABOUT THETY-IVE DEGREES. SOME PHASE SHIFT AND/OP TAPERING OF THE PROTON BODE WAS REQUIRED TO FIT THE DATA AT LARGER MALES. NU POLARIZATION EFFECTS IN THE PROTON-CARBON SCATTERING WERE GESERVED USING HYDROGEN AS AN ANALYZER OF POLARIZED PROTONS. NULLEONIC ISOBAR FORMATION IN THE T = 3/2, J = 3/2 STATE WAS FOUND TO ACCOUNT FOR A LARGE PART OF SINGLE PION PRODUCTION. HIGH-MERGINA MAGULAR EVENTURE WERE FOUND TO RE GREATLY FAVOREC IN SINGLE PION PRODUCTION. THE ISOBAR MODEL OF LINDENBAUM AND STERNHEINER GAVE GOOD ARGEFEMENT WITH THE OBSERVED NUCLEON AND PION ENERGY SPECTRA. NO POLARIZATION OR ALIGNMENT EFFECTS WERE OBSERVED FOR THE ISOBAR ASSUMED IN THIS MODEL. ABSTRACT

CITATIONS

TIONS PMYS. REV. 103, 1448 (1956), PHYS. REV. 107, 859 (1957), PMYS. REV. 103, 211 (1956), PMYS. REV. LETTERS 3, 568 (1959) , PMYS. REV. 118, 575 (1960), CERA CONFERENCE 440 (1959), BULL AM. PMYS. SCC. 2, 11 (1957), BULL AM. PMYS. SGC. 5, 282 (1960), RULHESIEK CONFERENCE 203 (1960), PMYS. REV. 72, 1114 (1947), PMYS. REV. 75, 1525 (1949), PMGCRESS IN THEORETICAL PMYSICS, JAPAN 5, 570 (1554), PMYS. REV. 74, 1085 (1954), PMYS. REV. 75, 1526 (1954), CEPN 59-3 (1959), PMYS. REV. 101, 730 (1990), PMYS. REV. LETTERS 4, 242 (1520), PMYS. REV. 105, 1847 (1957), PMYS. REV. 106, 572 (1957) , PMYS. REV. 75, 1664 (1949), AND PMYS. REV. LETTERS 5, 571 (1960).

ARTICLE READ BY OCETTE BENARY IN 3/67, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 3.67 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 9000 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM

LERUM PAGE 2163 AND TABLE 11

LABCRATORY REAM MOMENTUM = 3.67 GEV/C +- 3(PER CENT).

REACTION ARCTEN +	#1111-84X43
ELASTIC РКИТИМ № ЙИТАЙМ #1+ РАПТИМ РАПТИМ РІО ПОЛИТИЛИ ВІА	15.32 +/6 [1] 11.44 .45 2.90 .31

(1) CORRECTED FOR SMALL ANGLE SCANNING LOSSES USING AN OPTICAL MODEL CURVE..

ISGEAR PRODUCTION IN PP + PP FI+ PI- AT 6.6 GEV/C. (PHYS. REV. LETTERS 17, 884 (1966))

E.GELLERT,G.A.SMITH,S.WOJCICKI [U.C. LAMPENCE RAD. LAB., BERKELEY, CALIF., USA] E.COLTON,P.E.SCHLEIN,F.K.TICHC (UNIV. OF CALIF., LOS ANGELES, CALIF., USA)

ABSTRACT AT 6.6 GEV/C, THE REACTION PP • P PI+ P PI- PROCEEDS DOMINANTLY THROUGH THE N*** P PI- CHANNEL, WHEN PERIPHERAL N***S ARE SELECTED, THE P PI- ANGULAR DISTRIBUTION REPRODUCES THE ANGULAR DISTRIBUTIONS OF FREE PI- P SCATTERING IN THE C.P. ENERGY RANGE FROM THRESHOLD TO 2.0 GEV. THE DIFFRACTION SCATTERING AT THE UPPER END OF THIS ENERGY BAND CAN ACCOUNT FOR THE 1.4-CEV N* DEDUCED IN RECOIL-PROION SPECTRUM STUDIES.

CLOSELY RELATED REFERENCES PART OF THIS ARTICLE SUPERSEDED BY UCLA 1025 (1968).

69

ADDĪTĪĠNAL CITATICKS PHYS. REV. 128. 1833 (1962), NUGVO CIMENTO 35, 1052 (1965), PHYS. LETTERS 18, 167 (1965), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 12, 340 (1964), PHYS. LETTERS 18, 342 (1965), PHYS. LETTERS 14, 159 (1965), PHYS. REV. 8190 (1965), PHYS. REV. LETTERS 15, 468 (1965), PHYS. REV. LETTERS 13, 169 (1964), PHYS. LETTERS 15, 281 (1965), PHYS. REV. LETTERS 15, 731 (1965), PHYS. REV. LETTERS 16, 481 (1966), AND NUGVO CIMENTO 10, 839 (1965).

ARTICLE READ BY ODETTE BENARY IN 4/67, AND VERIFIEC BY LERCY PRICE.

BEAM IS PROTON ON PROTON AT 6.6 GEV/C.

THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CHAMBER.

KEY WORDS + CROSS SECTION N*(1470)P11 DALITZ PLCT MASS SPECTRUM DELTA(1238)++ ANGULAR DISTRIBUTION

CRESS SECTION FOR PROTEN PRCTON + PRCTON PROTON PI+ PI-. (PAGE 887) THIS DATA SHOULD NOT BE USED - MORE RECENT VALUES MAY BE FOUND IN COLTON. LOLA 1025 (1968)1 LABORATCRY BEAM MCMENTUM GEV/C 6.6 MILLI-BARNS 2.6 +- .3 NO. EVENTS 70 DIFFERENTIAL CROSS SECTIONS FCR PP + D PI+ FRCM 1 TO 3 BEV. (PHYS. REV. 167, 1222 (1968)) R.M.HEINZ,O.E.OVERSETH,C.E.PELLETT (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) M.L.PERL (STANFORD UNIV., STANFERD, CALIF., USA) PERC ISTANDAD UNITY, STANLED, CHLIFT, CSAT RACT THE DIFFERENTIAL ANC IDTAL CROSS SECTIONS FOR THE REACTION PP - D PI+ HAVE BEEN MEASURED IN A COUNTEP EXPERIMENT FOR INCIDENT PRCTON KINETIC ENERGIES OF 1.0, 1.3, 1.5, 1.7, 2.0, 2.5, AND 2.8 NEV. VALUES OF THE DIFFERENTIAL CROSS SECTION ARE GIVEN FOR BAR VEBHIC DEUTERON ANGLES THETA FOR 0.2 COS THETA -0.97 TH SYALL SIFFERENTIAL CROSS SECTION ARE GIVEN FOR BAR VEBHIC DEUTERON ANGLES THETA FOR 0.2 COS THETA -0.97 TH SYALL ALSSES TAROUNDED ASTRUMED MAXIMUM, AND THEN DECREASES RAPIDLY. THIS MAXIMUM PROPAGATES FROM COS THETA -0. RISES, PASSES TAROUNDED MAXIMUM, AND THEN DECREASES RAPIDLY. THIS MAXIMUM PROPAGATES FROM COS THETA -0. BEV. THE TOTAL CROSS SECTION CECREASES RAPIDLY AND MONOTONICALLY WITH ENERGY FROM 450 MICROBARNS AT 1.0 REV TO 30 MICROBARNS AT 2.8 BEV. ABSTRACT -0.8 CLOSELY RELATED REFERENCES CONTINUATION OF PREVICUS EXPERIMENT IN PHYS. REV. LETTERS 13, 59 (1964). ACCITIONAL CITATIONS PHYS. REV. 132, 1273 (1963), PHYS. REV. 134, B454 (1964), PHYS. REV. LETTERS 11, 506 (1963), NUDVO CIMENTO 35, 216 (1965), PHYS. REV. LETTERS 11, 474 (1963), PHYS. LETTERS 7, 222 (1963), PHYS. LETTERS 11, 253 (1964), PHYS. REV. LETTERS 11, 161 (1964), BULL. AM. PHYS. SOC. 7, 349 (1962), PHYS. REV. 123, 2160 (1961), PHYS. REV. 136, B775 (1963), PHYS. REV. 142, 918 (1966), PHYS. REV. LETTERS 17, 100 (1966), PHYS. REV. 123, 1462 (1961), PHYS. REV. 136, B1577 (1964), PHYS. REV. 111, 1380 (1958), PHYS. REV. LETTERS 6, 464 (1961), PHYS. REV. 124, 2392 (1962), PHYS. REV. 103, 211 (1956), JETP-7 528 (1958), OBL. AKAD. NAK. SSSR 100 673 (1955), DCKL. AKAD. NAUK. SSSR 100 677 (1955), BULL. AM. PHYS. SOC. 10, 19 (1965), PHYS. REV. 143, 1340 (1966), AND PHYS. REV. LETTERS 18, 1218 (1967). ARTICLE REAC BY DEETTE BENARY IN 1/69, AND VERIFIED BY LERGY PRICE. BEAM IS PROTON ON PROTON FROM 1.696 TO 3.618 GEV/C. (BEAM KINETIC ENERGY = 1.0 TO 2.8 GEV) THIS EXPERIMENT USES COUNTERS. KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION MODELS CROSS SECTION FOR PROTON PROTUN + DEUTERON PI++ 1 1401 (2) I ABORATORY BFAM ENERG M ENE GEV 1.0 1.3 1.5 1.7 2.0 2.5 2.8 MICRE-BARNS [1] MICRL-BARNS 452. +- 21. 217. 11. 123. 7. 84. 5. 53. 3. 84. 53. 33. 30. 3. [1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERCN PI+. TABLE 21 LABORATORY BEAM ENERGY = 1. GEV. COS(THETA) C-SIGMA/D-OPEGA U-SIGMA/D-DPEG U2/SR [1] 50.1 +- 2.5 49.9 2.7 52.1 2.C 51.2 2.4 -.96 -.93 -.90 -.80 -.1L -.60 -.50 -.4C -.30 -.20 -.10 51.2 45.9 42.1 33.4 31.9 24.4 23.5 21.0 20.3 2.4 £+£ 1.5 1.7 1.6 1.1 .00 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M. (11 PUIS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. [TABLE 2] LABORATORY BEAM ENERGY = 1.3 GEV. COS(THETA) C-SIGMA/O-GPEGA UE/SR [1] 17.5 +- 1.3 22.7 1.6 -.950 -.925 -.900 -.850 -.800 -.700 -.600 -.500 -.400 -.300 -.200 +.100 22.7 21.0 24.2 25.0 23.8 20.1 17.8 14.5 13.6 12.4 .8 1.1 .87.977.676 13.0 .000 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT.

DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON + DEUTERON PI+. (TABLE 2) LABCRATORY BEAM ENERGY = 1.5 GEV. C-SIGMA/C-OMEGA UE/SR [1] 9.5 *- .8 12.1 .7 14.6 11.0 15.9 .6 13.3 .6 13.1 .7 10.2 .5 9.7 .5 7.6 .3 8.6 .5 6.2 .4 6.3 .4 COSTTHETAL --965 -.950 -.925 -.900 -.850 -.800 -.700 -.600 -.600 -.400 -.300 -.300 -.100 .000 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTERATIC ERRCR OF +- 10 PER CENT. DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . DEUTERON PI+. (TABLE 2) LABORATORY BEAM ENERGY = 1.7 GEV. C-SIGMA/D-OMEGA UP/SK L11 10.6 ↔ - .5 12.5 .5 12.5 .5 12.9 .5 11.9 .8 9.4 .5 6.0 .4 5.0 .3 4.4 .2 3.8 .2 3.1 .2 3.0 .2 2.9 .2 COS(THETA) -.965 -.950 -.925 -.900 -.850 -.800 -.700 -.600 -.500 -.400 -.300 -.200 -.100 .000 THEFA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAF IN THE GRAND C.M. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . DEUTERON PI+. (TABLE 2) LABORATORY BEAM ENERGY = 2. GEV. COSITHETA) -.987 -.940 -.920 -.900 -.650 -.800 -.700 -.600 -.500 -.400 -.200 -.100 .000 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M. (1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT. DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . DEUTERON PI+. TABLE 2] LABORATORY BEAM ENERGY = 2.5 GEV.
 L-SIGMA/D-OPEGA

 UB/SR [1]

 12.3 +- 1.2

 10.6

 6.4

 1.6

 3.5

 2.7

 1.9

 2

 1.4

 .7

 .8

 .1
 COS(THETA) . . . -.970 -.970 -.925 -.925 -.900 -.800 -.700 -.600 -.500 -.300 -.100 THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAF IN THE GRANC C.M. ILI PLUS PUSSIBLE SYSTEPATIC ERROR OF +- 10 PER CENT. DIFFERENTIAL CRESS SECTION FOR PROTEN PRETEN . DEUTERON PI+. (TABLE 2)

LABORATORY BEAM EN	NERGY =	2.8	GEV.
--------------------	---------	-----	------

J3(1KE14)	UE/	SR [1]	
97	12.8 +-	- 2.3	
95	8.3	.5	
90	5.1	.4	•
85	3.7	.3	
80	3.3	.3	
70	2.2	.2	
60	1.7	• 2	
50	1.2	+1	
40	1.0	• 1	

THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 10 PER CENT.

71 PRODUCTION OF STRANGE PARTICLES IN PP COLLISIONS AT 2.85 BEV. (PHYS. REV. 123, 1465 (1961))

R.J.LCUTTIT.T.W.MORRIS,D.C.RAHM,R.R.RAU,A.M.THORNDIKE,W.J.WILLIS (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA) R.M.LEA (CITY COLLEGE OF NEW YORK. NEW YORK, N. Y., USA)

FROM A SAMPLE OF 98 HYPERON PRODUCTION EVENTS OBSERVED IN A LIQUID HYDROGEN BUBBLE CHAMBER THE PARTIAL CROSS SECTIONS FOR VARIOUS FINAL STATES ARE FCUND TO BE -- SIGMA+ K+ N - 0.047, SIGMA+ K0 P - 0.030, SIGMA-C K+ P - 0.031, LAMBDA-0.515(M+ P - 0.051, SIGMA- K+ P PI+ - 0.003, SIGMA-10 H - 0.004, (LAMBDA-0.515(M-0) K+ P PI0 - 0.011, (LAMBDA-0.515(M-0) K0 P FI+ - 0.014, (LAMBDA-0.515(M-0) K+ N PI+ - 0.002, ALL IN MILLIBARS, FOR THE FIRST FOUR PROCESSES THE VALUES ARE IN GENEPAL AGREEMENT WITH THOSE CALCULATED BY FERRARI USING A ONE-PION-EXCHANGE MODEL. ONLY ONE EXAMPLE OF K PAIR PRODUCTION WAS CBSERVED, INDICATING A CROSS SECTION LESS THAN 0.01 HB. ABSTRACT

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CITATIONS PHYS. REV. 108, 1048 (1957), PHYS. PEV. 108, 1322 (1957), PHYS. REV. 112, 614 (1958), PHYS. PEV. 112, 614 (1558), PHYS. REV. 109, 546 (1958), NUGUC CIMENTO 15, 652 (1960), PHYS. REV. 120, 988 (1960), BULL. AM. PHYS. SOC. 5, 508 (1960), PHYS. REV. 108, 1046 (1957), JETP 4 661 (1957), PHYS. REV. 119, 432 (1960), UCRL 9098, PHYS. REV. LETTERS 5, 520 (1960), UCRL 9097, AAC ROCHESTER CONFERENCE V-6 (1957).

ARTICLE READ BY DEETTE BENARY IN 3/67. AND VERIFIED BY LERCY PRICE.

REAM IS PROTON ON PROTON AT 3.67 GEV/C.

THIS EXPERIMENT USES THE BANAL 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 900CO PICTURES ARE REPORTED CN.

KEY WORDS . CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM LAMBDA SIGMA

[TABLE 2]

LABCRATORY BEAM MOMENTUM = 3.67 GEV/C +- 1(PER CENT).

REACTION	MILLI-BARNS	NG. EVENTS
PROTON PRCTON +		
SIGMA+ K+ NEUTRON	.047 +013	74.3
SIGMA+ KO PROTON	.030 .010	46.7
SIGMAO K+ PROTEN	.013 .007	20,3
LAMBDA K+ PROTGN	.051 .012	80.2
SIGMA- K+ PROTON PI+	.003 .002	5.0
SIGMA+ KAON NUCLEON PION	.004 .003	2.0

72 SMALL-ANGLE ELASTIC SCATTERING OF PROTONS AND PIONS, 7-20 BEV/C. [PHYS. REV. LETTERS 11, 425 (1963)]

K.J.FOLEY,S.J.LINDENBAUM,W.A.LOVE,S.CZAKI,J.J.RUSSELL,L.C.L.YUAN (BROCKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

CLOSELY RELATED REFERENCES SEE ALSO PHYS. REV. LETTERS 10, 376 (1963).

ADDITIONAL CITATIONS PHYS. REV. LETTERS 10, 543 (1963), PHYS. REV. LETTERS 7, 185 (1961), PHYS. REV. LETTERS 7, 362 (1961), PHYS. REV. LETTERS 8, 173 (1962), PHYS. REV. LETTERS 10, 413 (1963), PHYS. REV. LETTERS 9, 108 (1962), ZURN. EKSP. TEOR. FIZ. 41, 1748 (1961), JETP 14 1243 (1962), PHYS. REV. 107, 859 (1957), PHYS. LETTERS 1, 226 (1962), ZURN. EKSP. TEOR. FIZ. 38, 426 (1960), JETP 11 313 (1960), PHYS. REV. 130, 1182 (1963), AND PHYS. REV. 118, 579 (1960).

ARTICLE READ BY ODETTE BENARY IN 5/63, AND VERIFIEC BY LEROY PRICE.

BEAM IS PROTON ON PROTON FROM 6.8 TO 19.6 GEV/C.

THIS EXPERIMENT USES COUNTERS.

GENERAL COMMENTS ON THIS ARTICLE 1 SAME EXPERIMENT GIVES TOTAL AND DIFFERENTIAL CROSS SECTIONS FOR PI-P AND PI+P ELASTIC SCATTERING.

KEY WORDS . CROSS SECTION CIFFERENTIAL CROSS SECTION

PROTON PROTON CLASTIC GROSS SECTION. TTABLE 11

LABORATORY BEAM MOMENTUM GEV/C

GE V/C	HILLI-	BARNS [1]	
6.8	11.79 +	22	
8.8	11.71	-22	
10.8	11.04	.22	
12.8	10.89	+ 30	
14.8	10.48	.32	
16.7	9.74	.37	
19.6	9.64	.44	

(1) PLUS POSSIBLE STATEPATIC EAROR OF ++ & PER CENT.

ELASTIC CIFFERENTIAL CRESS SECTION FOR PROTON PROTON. TABLE 1

LA	BORATORY	8EAP	MOMENTUM	•	6.8 GEV/C.	•
	-T		D- 5 I	GMA	10-T	
(GEV	/()++2		MB/(G	EV/	(C)**2 [1]	
	PER CE	¥T				
.0000	2]		105.50	+-	- 2.40	
.C23	8		86.80		3.40	
+034	8		76.70		3.00	
.046	8		69.30		2.50	
·C63	8		57.10		2.10	
.082	8		46.80		1.80	
.101	8		41.60		1.80	
.248	8		10.88		.44	
.317	8		6.65		.31	
.395	8		3.83		•21	
.476	8		2.23		.14	
.564	8		1.22		.09	
.658	8		. 12		.07	
.758	8		. 42		.05	
. 863	8		.23		.03	

T IS THE MEMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 6 PER CENT.
(2) EXTRAPOLATED POINT.

ELASTIC DIFFERENTIAL CRESS SECTION FOR PAGTON PARTON.

[TABLE 1]

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LABUR		AP PUPERIUP	= 8.8 GEV/L.
- T		D-SI	GMA/D-T
(GEV/C)	**2	MB/(G	EV/C)**2 [1]
F	PER CENT		
.000(2)		106.40	+- 2.70
.039	8	74.70	2.50
.057	8	60.30	2.10
.018	8	49.90	1.10
.105	8	38.90	1.20
.137	8	32.20	1.20
.168	8	22.51	. 92
.263	8	9.50	. 38
.337	8	5.32	.25
.415	8	2.64	.16
. 504	8	1.55	.10
.597	8	.03.	.06
.697	6	.40	.C4
+803	8	.19	.03
. 516	8	•11	•02

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (DUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 6 PER CENT.
[2] EXTRAPOLATED POINT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. (TABLE 1)

LABORATORY	BEAM	FORENTUP	10.8	GEV/C.	

-T		0-SIGM/	1/D-T
(GEV/C	;)**2	MB/(GEV	()**2 [1]
	PER LENI		
.00012)	102.80 +-	. 3.10
.050	٥	59+48	1.70
.084	6	44.8C	1.40
.116	0	32.70	1.10
.157	8	23.73	.76
- 204	8	16.56	.61
.25C	8	10.26	.45
. 268	8	8.10	. 32
.343	8	4.53	•21
.427	8	2.38	.13
.515	8	1.15	.08
.612	8	. 35	.04
.713	A	.79	.03
. 824	8	.14	.02

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTON).

(1) PLUS POSSIBLE SYSTEPATIC EPROR OF +- 6 PER CENT.
(2) EXTRAPOLATED POINT.

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ELASTIC DIFFERENTIAL CRCSS SECTION FCP PRUTON PROTON. (TABLE 1)

	LABUR	AIURT	CEAM	AUPENIUM		12.0	62 V/C .
	-T			D- 51	GMA.	/0-T	
- (1	GEV/C)	**2		MB/(G	EV/	C)*+2	[1]
	P	ER CE	νT I				
. 04	1 5 300			104.00	+-	4.30	
. C	49	8		66.20		4.60	
.0	73	8		46.70		1.70	
• 13	20	8		33.90		1.40	
.1	66	8		22.50		1.10	1
. 2	24	8		13.93		78	
. Z	78	e		6.88		.28	
. 2	83	6		7.64		.54	
.3	56	8		3.64		+17	
. 4	43	8		1.52		- 11	
.5	34	8		. 90		.06	
. 6	34	8		. 42		.04	
. 7	41	8		. 23		. C3	
. 6	56	8		.09		.02	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCCMING PROTON) AND THE (CUTGOING PROTON).

[11] PLUS POSSIBLE SYSTEPATIC EARGE OF +- & PEP CENT.
[2] EXTRAPGLATEC PGINT.

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ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. (TABLE 1)

LAPORATORY REAM NOMENTUM . 14.8 GEV/C.

-T		0-SIGN/	4/0-1
(GEV/C)**2		MB/(GEV/	([]++2 []]
	PER CENT		
.00012	1	103.20 +-	- 4.60
. 666	8	49.40	1.90
.120	8	34.20	1.30
.160	8	20.82	.96
.221	8	10.98	.68
.294	8	5.78	.25
.298	8	5.63	.47
.376	8	2.53	.15
.386	8	2.40	.28
.468	8	1.49	.09
.564	8	. 66	.05
. 66 8	6	. 32	.C3
.781	6	.13	. C2

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

(11 PLUS POSSIBLE SYSTEMATIC ERROP OF +- 6 PER CENT.
(2) EXTRAPOLATED POINT.

ELASTIC DIFFERENTIAL CRCSS SECTION FCR PRCTCN PROTON. [TABLE 1]

LARORATORY REAF POMENTUM # 16.7 GEV/C.

	т	D-SIGMA/D-T
(GEV/C)++2 PER CENT		MB/(GEV/C)++2 [1]
.000(z	1	92.200 +- 5.500
.042	8	56.CCO 4.300
.C84	8	42.400 2.900
.141	8	24.420 .580
. 204	8	13.240 .680
. 281	8	7.030 .430
.308	8	5.040 .220
.380	8	2.810 .260
. 393	8	2.430 .130
.488	8	1.114 .072
.491	8	1.090 .170
.589	8	.471 .038
.698	8	.214 .C23

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 6 PER CENT.
[2] EXTRAPOLATED POINT.

ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.

[TABLE 1]

··· ···
0-T
)**2 [1]
7.000
1.200
.410
.260
.240
.130
+130
.C76
.073
.043
.023
.018

T IS THE MOMENTUM TRANSFER RETWEEN THE LINCOMING PROTONI AND THE LOUIGUING PROTONI.

(11 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 6 PER CENT.
(21 EXTRAPOLATED PGINT.



STRANGE-PAPTICLE PRODUCTION IN 10 GEV/C PROTON-PROTON COLLISIONS HAS BEEN STUDIED. THE FOLLOWING CROSS SECTIONS WERE OBTAINED -- (SIGMA+ KO) = (239 +- 40) MICROBARNS: (SIGMA- KO) = (44 +- 12) MICROBARNS: (LAMBDA O/SIGMA-O KOJ = (334 +- 44) MICROBARNS AND (KO KO) = (204 +- 42) MICROBARNS. IN THE FINAL STATES Y N K PI ANN Y N K PI PI THRE IS EVIDENCE FOR PROCUCTION OF THE FOLLOWING RESONANCES -- DELTA(1236), (37 +- 9) PER CENT, N*(APPROXIMATELY 16501, (18 +- 5) PER CENT, SIGMA(1383), (28 +- 7) PER CENT AND SIGMA(1650), (16 +- 6) PER CENT (PERCENTAGES OF (339 +- 42) MICROBANSI. NO EVIDENCE KAS FOUND FOR THE PRODUCTION OF TWO-BODY INTERHECIATE STATES CORRESPONDING TO PARTICLES WITH DEFINED MASS AND QUANTUM NUMBERS. ABSTRACT

CITATIONS IUNS NUC. PHYS. 60, 209 (1964), CERN CONFERENCE 247 (1962), CERN D502, NUOVO CIMENTC 40, A844 (1865), CERN TC 66.12, BULL. Am. PHYS. SOC. 11, 360 (1966), BULL. Am. PHYS. SOC. 11, 360 (1966), AND NUOVO CIMENTO 29, 8 (1963).

ARTICLE READ BY DEETTE BENARY IN 11/67, AND VERIFIED BY LERDY PRICE.

BEAF IS PRETON ON PROTON AT 10 GEV/C.

THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE CHAMBER. A TOTAL OF 83000 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM DELTA(1238) 'N+(1688)' Y+(1385) Y+(1660) STRANGE FARTICLES

FROM TABLE 1 AND PAGE 3091

LABERATORY BEAM MOMENTUM - 10. GEV/C.

REACTION	MICRO-BARNS	NO. EVENTS
PROTON PRETEN +		
SIGMA+ PROTON KC	60. +- 20.	9.0
SIGMA+ PROTON KO PIO	31. 13.	5.5
SIGMA+ NEUTRON KO PI+	49. 16.	9.5
SIGMA+ PROTON KO PI+ PI-	35. 13.	7.0
SIGMA+ NEUTRON KO PI+ PI+ PI-	5. 4.	2.0
SIGMA- PROTON KO PI+ PI+	18. 7.	6.0
SIGNA- DOOTON NO DIA DIA DIO	13. 6.	5.0
SIGPA- NEUTRON KO PI+ FI+ PI+	7. 4.	3.0
LANBDA PROTON KO PI+	106. 29.	13.3
LAMBCA PROTON KO PI+ PIO	58. 14.	16.2
LANGCA NEUTRON KO PI+ PI+	42. 14.	8.7
LAMBDA PROTON KO PI+ PI+ PI-	23. 12.	5.0
LANBDA PROTUN KO PI+ PI+ PI- PIO	34. 11.	9.0
LAMBCA NEUTRON KO PI+ PI+ PI+ PI-	13. 8.	2.5
PROTON PROTON KOBAR KO	33. 16.	4.0
PROTON PROTON KO KOBAR PIC	21. 11.	3.5
PROTON PI+ KOBAR KO NEUTRON	53. 20.	7.3
PROTON PROTON KOBAR KO PI+ PI-	9. 9.	1.0
PROTON PROTON KOBAR KO PI+ PI- PIG	5. 5.	.5
PROTON NEUTRON KOBAR KO PI+ FI+ PI-	36. 18.	4.0
SIGMA+ PROTON KO PI+ PI- PIC	0.	
PROTEN K+ K+ XI-	7. 5.	2.0

A DESCRIPTION OF FINAL STATES WITH THREE, FOUR, AND FIVE PARTICLES IN PP INTERACTIONS AT 28.5 GEV/C. [BNL 13671 (1969)] W.E.ELLIS,T.W.MORPIS,R.S.PANVINI,A.M.THORNCIKE (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

CLOSELY RELATED REFERENCES See Also BML 12673 (1968), AND PHYS. Rev. Letters 21, 697 (1968). This Article Supersedes Part of BNL 11980 (1967).

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ADDITIONAL CITATIONS PHYS. REV. LETTERS 16, 855 (1966), PHYS. LETTERS 18, 167 (1965), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. 120, 1857 (1960), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 554, 66 (1965), PHYS. REV. 173, 173 (1968), NUC. PHYS. B5, 164 (1968), CESY DESY 68/17 (1968), AND PHYS. REV. LETTERS 15, 45 (1965).

ARTICLE REAC BY ODETTE BENARY IN \$765, AND VERIFIED BY LEROY PRICE.

BEAP IS PROTON ON PROTON AT 28.5 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 83000 PICTURES ARE REPORTED ON.

GENERAL CEMMENTS ON THIS ARTICLE 1 EXCEPT FOR THE ONE REACTION GIVEN BELOW THE 20.5 GEV/C RESULTS GIVEN IN FIGURE L ARE JUST REPEATS OF DATA GIVEN IN BRU 11908 II10701.

KEY WORES + CROSS SECTION MASS SPECINUN ANGULAR DISTRIBUTION DIFFERENTIAL CRUSS SECTION .

PROTEN PRETON - CELTA(1238)++ NEUTRON. (PAGE 5) DELTA(1238)++ - PROTON PI+ (1) CRCSS SECTION FOR

(THIS DATA REPLACES VALUES GIVEN EARLIER IN CONNOLLY ET AL., BNL 11980 (1967))

LABORATORY BEAM MOMENTUM GEV/C 28.5

MICRC-BARNS 115. +- 15.

[1] USED SIMPLE MASS CUT.

75 PP INTERACTIONS AT 2 BEV. 1. SINGLE-PICN PRODUCTION. [PHYS. REV. 125, 2082 (1962)] W.J.FICKINGER [YALE UNIV., NEW FAVEN, CCNN., USA, ANC BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA] E.P.ICKUP.D.K.ROBINSON.E.O.SALANT (BREOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA] RACT 3600 TWO-PRONGED EVENTS, OBTAINED IN PP INTERACTIONS AT 2 BEV IN THE BAL 20-IN. HYDROGEN BUBBLE CHAMBER, HAVE BEEN ANALYZED. CROSS SECTICNS HAVE BEEN MEASURED FOR ELASTIC SCATTERING, FOR THE TWO MODES OF SINGLE-PION PRODUCTION, PP + P N PI+, PP + P P PIO, AND FOR STRANGE-PARTICLE PRODUCTION. THE BRANCHING RATIO FOR THE TWO MODES OF SINGLE-PION PRODUCTION, REACTIONS IS SIGMAIP N PI+) / SIGMAIP P PIO] = 4.17 + 0.25, MOMENTUM DISTRIBUTIONS AND O VALUES INDICATE THAT SINGLE-PION PRODUCTION PRODUEDS ALNOST ENTIRELY THPOUGH THE 3/2,3/2) RESONANT STATE. THE DATA HAVE BEEN CONSIDERED IN TERMS OF THE EXTENSED SIGMAR MODEL AND ALSO A ONE-PION EXCHANGE MODEL FOR PRODUCTION, THE BRANCHING RATIO AND MOMENTUM DISTRIBUTIONS CAN BE EXPLAINED BY INCLUDING A SMALL EFFECT FROM THE I = 1/2 RESONANT STATE IN ADDITION TO THE DOMINANT I = 3/2 RESONANCE. THE C.H. ANGULAR DISTRIBUTION OF THE NUCLEONS IN SINGLE-PION PRODUCTION SHOS VERY MARKED BACKWARD-FORMARD PEARING INDICATING A ONE-PION EXCHANGE MECHANISM. ABSOLUTE DIFFERENTIAL CROSS SECTIONS AS A FUNCTION OF LABORATORY KINETIC EMERGY HAVE BEEN CALCULATED FREM SELLERI'S EQUATION FOR THE P N PI+ REACTION. THEFE IS ROOM AGREEMENT WITH THE CATA FOR LOW FOUR-MOVENTUM TRANSFERS (Q-SOUARED < 0.1518UFC)-SOUARED, AUFC)-SOUARED, HEFE HEGRETICAL CRCSS SECTIONS ARE LARGER THAN THE EXPERIMENTAL CROSS SECTIONS. ABSTRACT

CITATICKS

FICAS Phys. Rev. 97, 1186 (1955), Phys. Rev. 100, 1802 (1955), Phys. Rev. 103, 211 (1956), Phys. Rev. 107, 859 (1957), Phys. Rev. Letters 3, 568 (1959), Phys. Rev. 103, 1484 (1956), PRCC. OF THE Royal Scciety OF London A251, 218 (1959), Phys. Rev. 123, 1465 (1961), Phys. Rev. 123, 2160 (1961), Phys. Rev. 123, 2091 (1962), Phys. Rev. 123, 333 (1961), Phys. Rev. Letters 6, 64 (1960), UCPL 9097 (1960), PRCC. OF THE Royal Scciety OF London A251, 218 (1959), Phys. Rev. 75, 1352 (1949), Phys. Rev. 94, 1085 (1964), CRN Conference 195 (1956), AND Phys. Rev. Letters 7, 196 (1961).

ARTICLE READ BY ODETTE BENARY IN 6/67. AND VERIFLED BY LERGY PRICE.

BEAK IS PROTON ON PROTON AT 2.807 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 45000 PICTURES ARE REPORTED ON. CIFFERENTIAL CROSS SECTION MASS SPECTRUM ANGULAR DISTRIBUTION KEY WORDS + CROSS SECTION DELTA(1238)

(TABLE 1)

LABORATORY PEAP MOMENTUM = 2,807 +- .005 GEV/C.

REACTION	FILL I-BARNS	NO. EVENTS
DN PRETEN +		
ELASTIC	19.210 +480	[1] 1493
PROTON PROTON PIO	3.850 .220	318
PRCTON NEUTRON PI+	16.060 .440	1326
LAMBDA K+ PROTON	.018 .005	11
CEUTERON PI+ + DEUTERON PI+ PIO	.170 .045	14

(1) CORRECTED FOR SPALL ANGLE SCANNING LOSSES.

MULTIPLE MESON PRODUCTION IN FRCTON-PROTON COLLISIONS AT 2.85 BEV. (PHYS. REV. 126, 747 (1962))

E-L.HART,R.I.LOUTTIT,D.LUERS,T.W.PGRRIS,W.J.WILLIS,S.S.YAMAMOTO [BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA]

RACT NEASUREMENTS HAVE GEEN FACE GA TOS FOUR-PROMO EVENTS BEING TO CONSUME THE DELT OF THE BROWNAVEN NATIONAL LABGRATGRY 20-IN. LIQUID WYDROGEN BUBBLE CHAMBER TO 2.85-BEV PROTONS. THE PARTIAL CRCSS SECTIONS OBSERVED FOR MULTIPLE MESON PRODUCTION REACTIONS ARE -- PP--(PP - PP PI+ PI-1, 2.67+-0.13; PM++-, 1.15+-0.03; PP+--0.07; P+--0.07; D++-, 0.07; -- 0.02; FOUR OR NORE MESON PRODUCTION, 0.04 -- 0.02; ALLI M MB. PRODUCTION OF MESONS APPEARS TO CECOR MAINLY IN PERIPHERAL COLLISIONS WITH RELATIVELY LITTLE MOMENTUM TRANSFER. IN CASES OF THREE-MESON PRODUCTION, HOMEVEN, THE PROTONS ARE TYPICALLY DEFLECTED AT LARGE ANGLES AND ARE MORE STRONGLY DEGRADED IN NERREY. THE J22, 32 PION-MULLEON RESONANCE DOMINATES THE INTERACTION: THERE IS SOME INDICATION THAT ONE OR BOTH OF THE T = 1/2, PION-MULLEON RESONANCES ALSO PLAY A PART. THE RECENTLY DISCOVERED RESONANCE IN A T NO. THE EPPEND STATE APPEARS TO BE PRESENT IN THE PP+-O REACTION. RESULTS ARE CCMPARED WITH THE PRECICTIONS OF THE ISOBARIC NUCLEON RODEL OF STERNMEIMER AND LINDENBAUM, AND WITH THE STATISTICAL MODEL OF CENTLUS AND MAGEDORN. THE CROSS SECTION FOR THE REACTION PIOP - PI+ PI- P IS DERIVED USING AN EXPRESSION FROM THE ONE-PION EXCHANGE HODEL OF ORCLL. ABSTRACT

CLOSELY RELATED REFERENCES SEE ALSO PHYS. REV. 123, 1465 (1961), AND PHYS. REV. 123, 2160 (1961).

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ACCITIONAL CITATIONS PHYS. REV. 103, 211 (1956), PHYS. REV. 107, 859 (1957), PHYS. REV. LETTERS 3, 568 (1959), UCRL 9497, PHYS. REV. LETTERS 5, 333 (1960), PHYS. REV. 103, 1479 (1956), PHYS. REV. 103, 1484 (1956), PHYS. REV. 103, 1443 (1999), PHYS. REV. 118, 579 (1960), BULL. AN. PHYS. SOC. 6, 302 (1961), PHYS. REV. 125, 2091 (1962), PHYS. REV. 125, 2082 (1962), PHYS. REV. 123, 333 (1961), PHYS. REV. LETTERS 5, 24 (1960), ROLHSER CONFERENCE 205 (1960), PHYS. REV. 4, 1085 (1954), PHYS. REV. 95, 158C (1954), PHYS. REV. 105, 1874 (1957), CERN 5008/TN.13 (1959), PROGRESS IN THEORETICAL PHYSICS, JAPAN 5, 570 (1950), PHYS. REV. 2452 (1953), PHYS. REV. 31, 1644 (1954), PHYS. REV. LETTERS 5, 342 (1960), PHYS. REV. 113, 1640 (1959), REVIEW OF SCIENTIFIC INSTRUMENTS 32, 1116 (1961), UCRL 9097, BERKELEY CONFERENCE 117 (1960), PHYS. REV. 117, 96 (1956), PHYS. REV. LETTERS 5, 6, 628 (1961), PHYS. REV. LETTERS 7, 127 (1961), LETTERS 6, 624 (1961), PHYS. REV. LETTERS 7, 178 (1961), AND PHYS. REV. LETTERS 7, 327 (1961).

ARTICLE READ BY OCETTE BENARY IN 6/67, AND VERIFIED BY LERDY PRICE.

BEAM IS PROTON ON PROTON AT 3.67 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 8669 PICTURES ARE REPORTED CN.

KEY WORDS + CROSS SECTION ' MASS SPECTRUM ANGULAR DISTRIBUTION CELTA(1238) HODEL S

(FROM PAGE 750 AND TABLE 1)

LABCRATORY EEAN MOMENTUM = 3.67 GEV/C +- 1.6(PER CENT).

REACTION	MILL I-BARNS	NG. EVENTS	
PROTON PROTON .			
TOTAL	42.100 +- 1.200		
PROTEN PROTON PI+ PI-	2.670 .130 [1]	414	
PROTON NEUTRON PI+ PI+ PI-	1.150 .090 (1)	176	
PROTON PRUTON PI+ PI- PIO	.740 .070 [1]	115	
DEUTERON PI+ PI+ PI-	.064 .020 [1]	10	

[1] ERRORS ARE STASTICAL CALY.

PROTON-PROTON INTERACTIONS AT 1.5 BEV. (PHYS. REV. 103, 1479 (1956))

W.B.FOWLER,R.P.SHUTT,A.M.THORNCIKE,W.L.WHITTEMORE (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

RACT 152 INTERACTIONS OF 1.5-BEV PROTONS HAVE BEEN OBSERVEO IN A HYDROGEN-FILLED DIFFUSION CLOUD CHAMBER. THE DATA INDICATE AN ELASTIC CROSS SECTION OF 20 HILLIBARNS, WITH ABOUT 22 HILLIBARNS CROSS SECTION FOR SINGLE PION PRODUCTION AND 5 HILLIBARNS FOR DOUBLE PION PRODUCTION. HOST SINGLE PION PRODUCTION CASES ARE PP + P NI+. NO DEFINITE CASES OF - D PI+ OR - P PIO WERE CBSERVED. THE MEDIAN ELASTIC SCATTERING ANGLE IS 24 CEG. IN THE C.M. SYSTEM. INELASTIC EVENTS HAVE PIONS ENTITED ISOTROPICALLY WITH LOW MOMENTA, MUCLEONS EMITTED NERR O DEG. AND 180 DEG. WITH HIGH MUMENTA. THE AVERAGE RELATIVE ENERGY (O VALUE) FOR THE P, PI+ PAIR IS 154 MEV. ABSTRACT

CITATIONS

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нска рит3. Rev. 1C3, 1472 (1956), рит3. Rev. 103, 1484 (1956), рит3. Rev. 103, 1489 (1956), Review of Scientific Instrument3 25, 996 (1955), рит3. Rev. 97, 797 (1955), рит3. Rev. 95, 663 (1954), рит3. Rev. 103, 212 (1956), рит3. Rev. 92, 652 (1953), рит3. Rev. 93, 1434 (1954), рит3. Rev. 94, 1083 (1954), AND PHT3. Rev. 93, 1580 (1954).

ARTICLE READ BY OCETTE BENARY IN 3/67, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 2.25 GEV/C.

THIS EXPERIMENT USES & CLOUD CHAMBER. A TOTAL OF 15600 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION CIFFERENTIAL CROSS SECTION ANGULAR CISTRIBUTION

[FROM PAGE 1480 AND PAGE 1481]

LABCRATORY EEAM NEMENTUM = 2.25 +- .30 GEV/C.

REACTION	MILLI-BARNS	NC. EVENTS
TOTAL	35. + 8.	152
ELASTIC Total inelastic	20. (1) 27. (1)	55 91
		•

[1] VALUE IS APPRCXIMATE CNLY.

78 EXPERIMENTAL INVESTIGATIONS OF THE NUCLEON-NUCLEON INTERACTION AT 6CC-650 MEV. (REV. MOD. PHYS. 39, 509 (1967)] Y.M.KAZARINDV [JGINT INST. FCR NUCL. RESEARCH, DUBNA, USSR]

ACT THE UPPER BOUNDARY OF THE UNAPBIGUOUS PHASE-SHIFT ANALYSIS AS IS KNOWN, IS AT 310 NEV. ABOVE THE MESON PRODUCTION THRESHOLD THIS UNAMBIGUITY IS ABSENT. IN THE RANGE FROM 600-650 MEV WHERE THE PHYSICISTS OF OUR LABORATORY HAVE WORKED OURING RECENT YEARS THE SCATTERING AMPLITUDE HAS BEEN DETERMINED AMBIGUOUSLY AND NOT VERY RELIABLY. IN THIS CONNECTION ALL THE EXPERIMENTS FOR STUDYING NUCLEON-NUCLEON SCATTERING BEING CARRIED OUT AT OUR LABORATORY HAVE TWO PURPOSES -- FIRST, THE MORE ACCURATE DETERMINATION AND IMPROVMENT OF THE PHASE-SHIFT ANALYSIS AND SECOND, THE DISCRIMINATION OF THE OBTAINED PHASE SHIFT SETS FOR THE DETERMINATION OF THE MOST PROBABLE SET OF THEM. MY PEPORT IS A SHORT SURVEY OF SOME OF EXPERIMENTS PERFORMED WITH THE ABOVE PURPOSE AT CUBNA IN RECENT YEARS. ABSTRACT

CITATIONS

TUNS -PHYS. REV. 105, 280 (1957), NUOVO CIMENTO 43A, 709 (1966), SOVIET JNP 2 636 (1966), UCRL 11440 (1964), ANNALS OF PHYSICS 7, 65 (1959), NUOVO CIMENTO 8, 265 (1958), AND JETP 19 542 (1964).

ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERCY PRICE.

BEAM NO. 1 IS PRCTON ON HYDROGEN COPPCUND AT 1.263 GEV/C. (BEAM KINETIC ENERGY = .635 GEV) (BEAM IS POLAPIZED 42 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 2 IS PRGTON ON DEUTERIUM COMPOUND AT 1.225 GEV/C. (BEAM KINETIC ENERGY = .605 GEV) (BEAM IS POLARIZED 34 PER CENT (NORMAL TO THE BEAM DIRECTICN).

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . POLARIZATION

ELASTIC POLARIZATION FOR PROTON PROTON.

[TABLE 1]

	LABOR	ATORY	BEAM	ENERGY	2	.635	GEV.
ſ	THETA	s		P	NI. 46	T & S T F	FUN
27.0	50 +-	1.25			475	·	024
32.2	20	1.25			499		021
34.4	0	1.25			496	•	024
36.7	10	1.25			522	•	C19
38.9	0	1.25			522	•	019
41.2	20	1.25		•	518	•	014
43.4	0	1.25			511	•	014
44.5	i0	1.25			513	•	C16
45.6	SC .	1.25			508	•	614
46.7	0	1.25		•	501	•	014
47.8	30	1.25			485	•	09
49.0	00	1.25			482	•	C16
50.1	0	1+25			492		014
51.2	2C	1.25		•	452	•	014
52.3	30	1.25			482		014
54.5	50	1.25			445	•	014
56.6	0	1.25			419	•	C14
58.8	30	1.25		•	455	•	016
60.8	30	1.25			395	•	C14
63.1	0	1.25		•	405	•	021
71.8	sc	1.25			296		014
79.9	0	1.25			161	•	016
89.7	0	1.25		•	012	•	009

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. THE POLARIZATION IS OF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M.

ELASTIC POLARIZATION FOR FROTON NEUTPON. ITABLE 21

LABORATORY	8 E A M.	ENERGY	Ŧ	.605	GEV.
THETA		P	CLAR	IZAT	ICN
DEGREES					
70.		-	+ C 5	+	18
90.		-	.07	•	C 6
125.		-	.44	•	16

THETA IS THE ANGLE THAT THE TARGET WAKES WITH THE BEAM IN THE GRAND C.M. The polaritation is of the neutron along the normal to the production plane in the grand c.m.

79 EXPERIMENTAL RESULTS ON PROTON-PROTON INTERACTIONS AT 10 GEV/C WITH SIX CHARGEC PARTICLES IN THE FINAL STATE. (NUDVO CIMENTO 57A, 20 (1968))

S.C.HOLMGREN, S.NILSSON, T.CLHECE, N.YAPCAGNI [STOCKHOLMS UNIV., STOCKHOLM, SHEDEN]

HIGH-MULTIPLICITY PROTCA-PPOTON REACTIONS AT 10 GEV/C HAVE BEEN STUDIED. IN THE ANALYSIS OF 1937 EVENTS THE FOLLOWING RESULTS WERF RATAINER. -- REACTION (1) PP + PP PI+ PI+ PI- PI-, SIGMA = (0.46 +- 0.64) MB, (2) PP + PP PI+ PI+ PI- PI- PIO, SIGMA = (0.69 +- 0.05) MB, (3) PP+ PN PI+ PI+ PI+ PI+ PI- PI-, SIGMA = (0.54 +- 0.64) MB, (4) PP +> 1 MUTRAL PARTICLE, SIGMA = (0.76 +- 0.05) MB. THE FRACTION OF DELTA++ -P PI+ IS 0.64 +- 0.16 IN CHANNEL (1), 0.60 +- 0.12 IN (2) AND 0.48 +- 0.09 IN (3). THERE IS EVICENCE FOR PRODUCTION OF DELTA++(1920) + P PI+ IN REACTION (3) AND DELTA++(1920) + P PIO IN REACTION (2). NO SIGNIFICANT EVIDENCE FOR OTHER BARYON RESONANCES, MESONANCES OF DOUBLE ISOBAR PRODUCTION WAS FOUNC. ABSTRACT

CITATIONS

IIONS PMYS. REV. 125, 2091 (1962), PHYS. PEV. 126, 747 (1962), PHYS. LETTERS 21, 351 (1966), PHYS. REV. 138, 8913 (1965), PMYS. LETTERS 19, 311 (1965), PHYS. LETTERS 14, 164 (1965), CENN THA.TOB, REV. HOD. PHYS. 39, 1 (1967), PHYS. REV. Letters 18, 84 (1941), CEPA TC 67-1, AND PHYS. REV. 120, 300 (1960).

ARTICLE READ BY ODETTE BENARY IN 1/69. AND VERIFIED BY LERCY PRICE.

BEAM IS PROTON ON PROTON AT 10 GEV/C.

THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE CHAMBER. A TOTAL OF 82000 PICTURES ARE PEPORTED ON.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM DELTA(1238) DELTA(1920) STRANGE PARTICLES

[TABLE 2]

LABCRATORY BEAN HOMENTUM = 10. GEV/C.

REACTION PROTON PRGTON PI+ PI- PI+ PI-Proton Proton PI+ PI- PIO PI+ PI-Proton Proton PI+ PI- PIO PI+ PI-Proton Neutron PI+ PI- PI- PI+ PI-MILLI-BARNS NC. EVENTS .457 +- .037 251 382 295 .049 .695



80 PP INTERACTIONS AT 2 BEV. 11. MULTIPLE-PION PRODUCTION. (PHYS. REV. 125, 2091 (1962))

E.PICKUP, D.K. ROBINSON, E.O. SALANT (BROOKHAVEN NAT. LAR., UPTON, L.I., N. Y., USA)

ARACT ANALYSES HAVE BEEN HADE FOR BJI FOUM-PRONG EVENTS AND 463 TWO-PRONG EVENTS CORRESPONDING TO PULTIPLE PION PRODUCTION, RESULTING FRCM PP INTERACTIONS AT 2 BEV IN THE BNL 20-IN. HYGROGEN BUBBLE CHAMBER. CROSS SECTIONS HAVE BEEN OBTAINED FOR ALL THE GESERVABLE COUBLE AND TRIPLE PION PRODUCTION PROCESSES; THE BRAACHING RATIOS PREDICTEG BY THE EXTENDED ISOBAR MODEL ARE SHCHN TO BE IN FAIR AGREEMENT WITH THE DATA, BUT THERE ARE SIGNIFICANT OIFFERENCES. THE C.M. MOMENTUM DISTRIBUTIONS ARE ALSC IN FAIR AGREEMENT WITH THE PREDICTICNS OF THE MODEL, ALTHOUGH THERE ARE AMBIGUITIES IN THE INTERPRETATION. THE PION-NUCLEON Q VALUES GIVE CLEAR EVIDENCE FOR THE IMPORTANCE OF THE (3/2,3/2) THE FEATURES OF DOUBLE PION PRODUCTION, BUT CONSIDERATION OF THIS STATE ALONE DOES NOT PROVIDE AN EXPLANTION OF THE FEATURES OF DOUBLE PION PRODUCTION, SOME CONTRIBUTION FOR MARCHER STATE, ADOS SOM BACKMAD-FORMARD FEAKING SUGGESSTIVE OF A ONE-PION EXCHANCE PROCESS. THE ANGULAR DISTRIBUTIONS OF THE NUCLEONS FROM TRIPLE PRODUCTION ARE ALMOST ISTREFIN. ABSTRACT ALFOST ISOTROPIC

CLOSELY RELATED REFERENCES Cumtinuation of parvidus expertment in phys. RCV. 123, 2002 (1962).

ADCITIONAL CITATIONS PHYS. REV. 103, 1484 (1956), UCRL 9097, PHYS. REV. 123, 333 (1961), PHYS. REV. LETTERS 5, 342 (1960), PHYS. PEV. LETTERS 5, 377 (1960), PHYS. REV. LETTERS 7, 192 (1961), PHYS. REV. LETTERS 7, 178 (1961), NUDVO CIMENTO 16, 388 (1960 ANC PHYS. REV. LETTERS 7, 421 (1961).

ARTICLE READ BY OCETTE BENARY IN 6/67, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 2.807 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER.

ANGULAR DISTRIBUTION MASS SPECTRUM KEY WORDS . CROSS SECTION DEL TA(1238)

(148LE 1)

LABORATORY BEAM MCMENTUM = 2.807 +005 GEV/C.			
REACTION	MILLI-	BARNS	NO. EVENTS
PROTON PRETON +			
PRCTCN PROTON PI+ PI-	2.5100 +	1400	681
PROTON PROTON PIC PIC + PROTON PROTON PIC			
P10 P10	.9200	.1000	76
PROTON NEUTRON PI+ PIO + PROTON NEUTRON PI+			
PIC PIC	4.0700	.2100	336
NEUTRON NEUTRON PI+ PI+ + NEUTRON NEUTRON			
PI+ PI+ PIO	.6200	·C830	51
PROTON PROTON PI+ PI- PIQ	.2170	.0290	59
PROTON NEUTRON PI+ PI+ PI-	. 4050	.0400	110
PROTON NEUTRON PI+ PI+ PI- PIO	< .0007		
PROTON PROTON P1+ P1- P10 P10	< .0050		2
DEUTERON PI+ PI+ PI- + DEUTERON PI+ PI+ PI-			-
PIO	.0550	-0140	15
PIO	.0550	.0140	15

	348 (1963)]					
	J.K1DD, S.RATTI, A.S1CHIRCLLC, G.VEGNI [UNIV	. DI MILANO, MIN	ANC, ITALY)			
	CLOSELY RELATED REFERENCES SEE ALSO PHYS. LETTERS 16, 75 (1965) Data superseded by Nucvc Cimente 584	, 175 (1968).				
	ACCITIONAL CITATIONS	EV. LETTERS 9. 1	133 (1962). A	NO PHYS. RE	-V. 126. 747 (19	521.
	ARTICLE REAG BY OCETTE BENARY IN 4/67. AN	O VERIFIED BY L	EROY PRICE.			
	BEAM IS PROTON ON PROTON AT 4 GEV/C.					
	THIS EXPERIMENT USES THE SACLAY 81 CM (#)	BURBLE CHAMBER.				
	KEY WORCS + CROSS SECTION MASS SPECTA	UM DELTA(12	BB) OMEGA	(-783)		
		[TABL	.E 1)			
	LABCRATCRY FEAM MOMENTUM = 4. GEV/C.					
	THIS DATA SHUULD NOT BE USEC - MORE	RECENT VALUES MA	Y BE FOUND IM	N BCDINI ET	AL., NUOVO CIM	NTO 58A, 175 (1968)]
•	REACTION		MILLI-8	BARNS (1)	NC. EVENTS	
PRO	PROTON PRUTON PI+ PI-		2.89 +-	15	259	
•	PROTON NEUTRON PI+ PI- PI+ Proton proton pi+ pi- pio		.83	.05	74	
•	[1] ERRORS ARE STASTICAL GALY.					
						• • • • • • • • • • • • •
	CROSS SECTION FOR PROTON PRCTCN -	PROTON PROTON OF	4EGA(783).	(PAGE	3401	
	(AUTHORS QUOTE AN ERROR OF +06 C	N LOWER LIMIT)				
	I, ABORATORY					
	GEAM MORENTUM	ND. EVEN	rs			
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83 TWO AND THREE PION PRODUCTION IN PP COLLISIONS AT 6.92 GEV/C. [WEIZMANN INST REPORT (1969)]

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STRACT CROSS SECTIONS ARE GIVEN FOR THE MAIN PROCESSES CONTRIBUTING TO THE FINAL STATES PP PI+ PI-, PP PI+ PI- PIO AND PN PI+ PI+ PI- T. IN ALL REACTIONS N*12381 IS DBSERVED TO BE STRUNGLY PRODUCED. FOR THESE THREE REACTIONS THE BARYONS ARE STRONGLY FORWARD/BACKWARD PEAKED IN THE CENTER OF MASS. THE REACTION PP • N*1238)** P PI- MAS BEEN EXAMINED IN SOME DETAIL, AND COMPARED WITH THE PREDICTIONS OF VARIOUS PERIPEREAL MIDELS. AS IS ALREACT WELL KNOWN, THE FERRARI-SELLERI MODEL IS INADEQUATE, BUT WHEN SOME OF THE EFFECTS OF ABSORPTION ARE INCLUDED, THE AGREEVENT WITH THE DATA IS CONSIDERABLY INFROVED, THE ALTERNATIVE OF REPLACING THE PROPAGIDE CORRESPONDING TO ELEMENTARY PION EXCHANGE BY THAT FOR A REGGE EXCHANCE ALSO GIVES GOOD AGREEMENT WITH EXPERIMENT. FINALLY WE HAVE TESTEC A DOULLE REGGE EXCHANGE MODEL, AND FOUND THAT ITS PREDICTION FOR OME OF THE TREIMAN-YANG ANGLES IS UNSATISFACTORY. A OISCUSSION IS ALSO GIVEN OF A CLASSIFICITION IN WHICH EVENTS ARE DIVIDED INTO CATEGORIES DEPENDING ON WHICH PARTICLES ARE ENTITED IN THE SAFE HEINSPHERE. THE THAL STATES PP ONEGA, PP ETA AND POSSIBLY PP RHOD ARE OBSERVED, AND CROSS SECTIONS ARE COMPARED WITH VALUES OBTAINED AT CHTHE MORENTA. ABSTRACT

CLOSELY RELATED REFERENCES SEE ALSO NUOVO CIMENTO 53, 455 (1968), AND PHYS. REV. 173, 1322 (1968).

ADDITIONAL CITATIONS PHYS. REV. 161, 1387 (1967), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 55, 66 (1968), PHYS. REV. LETTERS 20, 964 (1968), PHYS. REV. 174, 1638 (1968), NUC. PHYS. 810, 221 (1969), PHYS. LETTERS 278, 376 (1968), NUOVO CIMENTO 24, 453 (1962), ANNALS OF PHYSICS 41, 456 (1967), NUC. PHYS. 88, 686 (1968), PHYS. REV. 168, 1773 (1968), PHYS. REV. LETTERS 21, 701 (1968), CERN TH-850 (1967), AND NUOVO CIMENTO 518, 404 (1967).

ARTICLE READ BY OCETTE BENARY IN 10/69, AND VERIFIEC BY LERCY PRICE.

BEAM IS PROTON ON PROTON AT 6.9 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM 'N+(1688)' RHO(765) DMEGA(783) ETA(548) DEL TA (1238) HODELS N+(1520)013

(TABLE 2)

LABORATORY BEAN MOMENTUH = 6.5 GEV/C.

REA	ACTION	MILLI	-BARNS
OTON PROTON +			
PROTON P	ROTON PI+ PI-	3.00	+30
PROTON N	EUTRON PI+ PI+ PI-	2.60	.30
PROTON P	POTON PI+ PI- PIO	2.60	.30
DELTA(12	238)++ PROTON PI-	2.30	. 30
DEL	TA(1238)++ • PROTON PI+ [1]		
DELTA(12	38)++ DELTA(1238)0	.42	.10
DEL	TA(1238)++ + PROTON PI+ [1]		
DEL	TA(1238)0 + PROTEN PI- (1)		
DELTA(12	38)++ N+(1520)C	.23	.07
DEL	.TA(1238)++ • PROTON P[+ [1]		
N+ (152010 + PROTEN PI- [1]		
DELTA(12	38)++ *N+(1688)0*	.23	.07
DEL	TA(1238)++ + PROTON PI+ [1]		
N	(1688)0" - PROTON FI- [1]		
DELTA(12	38)++ NEUTRON PI+ PI-	1.56	.15
DEL	TA(1238)++ + PROTON PI+ [1]		
DELTA(12	38}- PROTON PI+ PI+	.84	.10
DEL	TA(1238)- • NEUTRON PJ- [1]		
DELTA(12	38)++ PROTON PI- PIO	1.56	.16
DEL	TA(1238)++ • PROTON PI+ [1]		
PROTCN P	ROTON ETA(548)	.04	. 01
ETA	(548) • PI+ PI- PIO [1]		
PROTON P	ROTON DAEGA(783)	-14	- 04
OME	GA(783) + PI+ PI- PIO [1]		

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

ELASTIC SCATTERING OF LAMEDA HYPERONS WITH AVERAGE MOMENTUM 2.7 BEV/C BY PROTONS. [SOVIET JNP 3 511 (1966)]

V.F.VISHNEVSKII,T.YUAN-CHAI,V.I.HOROZ,A.V.NIKITIN,YU.A.TROYAN,C.SHAO-CHUN, C.WEN-YU,B.A.SHAKHBAZYAN,Y.WU-KUANG (JOINT INNI. FUR NULL RESEARCH, DURMA, USSRI

ABSTRACT

CITATIONS PHYS. REV. LETTERS 2, 174 (1559), PHYS. REV. LETTERS 7, 348 (1961), JETP 42 979 (1962), JETP 15 676 (1962), PHYS. REV. 129, 1372 (1963), PHYS. REV. LETTERS 12, 625 (1964), PHYS. REV. LETTERS 13, 262 (1964), PHYS. REV. LETTERS 1 484 (1964), PHYS. LETTERS 12, 350 (1964), PRIBORI I TECH TECH. EXP. 1 41 (1959), JINR R-1959 (1965), JINR R-2215 (1965), JINR R-1352 (1963), JINR R-1468 (1963), AND NUOVO CIMENTO 36, 189 (1965).

ARTICLE READ BY OCETTE BENARY IN 1/69. AND VERIFIED BY LEROY PRICE.

BEAM IS NEUTRON ON HEAVY LIQUID FROM 2.786 TO 10.900 GEV/C. (BEAM KINETIC ENERGY = 2 TO 10 GEV)

INIS CAPERINENS USES A NEAVY LIQUÍD BUBBLE CHAMBER. - À TÔTAL OF LIQUÓD FICTURES ARE REPORTED ON.

KEY WORCS + LAMEDA CROSS SECTION ANGULAR DISTRIBUTION

COMPOUND KEY WORDS . LAMBDA CRCSS SECTION

LAPBDA PROTON ELASTIC CROSS SECTION. [PAGE 514]

LABORATORY BEAF PCKENTUM GEV/C 2.7 +- 1.2 MILLI-BARNS NO. EVENTS

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	DATA WAS RE	AD FROM A GRAPH .	
	· ^)		
PIN	MAX		
-1.0	5	3.5	
.0	•5 1•0	3.5	
THETA			VEC VITH THE BEAM IN THE COAND C M
FORWARD TO	BACKWARD RAT	IG FOR LAMECA PROTO	N ELASTIC SCATTERING. [1]
LABCRATO BEAM MOMEN	IRY	(F-8)/(F+8)	······································
GEV/C 2.7 +- 1	.2	.30'+22	· · · · ·
(1) (ALCULATED BY	Y US FRCM DATA IN TH	IS ARTICLE.
			•••••••
POLAR TO CO	WATORIAL RAT	TIG FOR LAMODA PROTO	N CLASTIC SCATTERING. [1]
BEAM MONEN GEV/C	IRY ITUM	(P-E)/(P+E)	
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ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. IFIGURE 21

LABORATORY BEAM MOMENTUM = 3. GEV/C.

(QUDTED VALUES ARE NEW DATA PLUS DATA FREM PRL 9,509(1962))

. THIS DATA WAS	READ FROM A GRAPH .
THETA	C-SIGMA/D-DMEGA
DEGREES	ME/SR
.00	31.6 + 5.0
	- 5.0
1.25	27.8 + 2.9
	- 2.9
2.50	15.8 + 2.5
• • •	2.5
3.00	16.4 *9
	9
3.75	10.9 + 1.3
	- 1.3
5.00	11.2 + 1.0
	- 1.0
5.00	10.3 + .7
	7
5.00	8.2 + 1.6
	- 1.6
7.00	6.7 * .3
	- ,.7
7.00	5.7 + .3
	7
7.50	6.2 + .5
	9
9.00	4.6 + .5
	5
11.00	4.0 + .3
	3
15.00	1.0 + .2
	2

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE LAB.

86 SINGLE-ISOBAR PRODUCTION IN PRCTON-PRCTON INTERACTIONS AT 28.5 GEV/C. (PHYS. REV. LETTERS 21, 697 (1968)) W.E.ELLIS, D.J.MILLER, T. W. MORRIS, R.S. PANVINI, A.M. THORNCIKE [BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA] RACT TWO AND FCUR PRONG FINAL STATES IN A 28.5-GEV/C PP BUBBLE-CHAMBER EXPERIMENT WERE EXAMINED FOR SINGLE-ISOBAR PRODUCTION IN VARIOUS DECAY CHANNELS. RESULTS ARE COMPAREO WITH HISSING-MASS-SPECTROMETER DATA. THE 1400 EMHANCEMENT WAS FOUND TO BE AN N PI SYSTEM WITH THE RATIO N PI+/P PIO ABOUT 2, WHICH ESTABLISHES THE ISOSPIN ASSIGNMENT I = 1/2. THE FINAL STATE DELTA++(123B) N WAS REASURED AND COMPARED WITH LOW-ENERGY DATA TO SHOW THAT THE CROSS SECTION DECREASES ACCORDING TO P(LAB)**-(1.91 +- 0.08), CONSISTENT WITH SINGLE-PION EXCHANGE. ABSTRACT CLOSELY RELATED REFERENCES DATA SUPERSEDED BY BAL 13671 (1969). ACCITIONAL CITATIONS PHYS. REV. LETTERS 16, 855 (1966), PHYS. LETTERS 18, 167 (1965), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 19, 397 (1567), PHYS. REV. LETTERS 20, 964 (1968), PHYS. REV. LETTERS 20, 1078 (1968), PHYS. REV. 165, 1659 (1968), AND REV. MOD. PHYS. 38, 476 (1966). ARTICLE READ BY DDETTE BENARY IN 1/65. AND VERIFIED BY LERDY PRICE. BEAM IS PROTON ON PROTON AT 28.5 GEV/C. THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 8300C PICTURES ARE REPORTED ON. GENERAL COMMENTS ON THIS ARTICLE I NO DATA PUNCHED FOR THIS ARTICLE. SAME CATA REPORTED AT LUND CONFERENCE -- BNL 13671 (1969). KEY WORDS + CROSS SECTION MASS SPECTRUM MODELS N+(1470)P11 NEUTRON-PROTON AND NEUTRON-DEUTEREN TOTAL CRESS SECTIONS AT 4.0 AND 5.7 GEV/C. 87 [PHYS, LETTERS 318, 246 (1970)] E.F.PARKER, L.W. JONES (MICHIGAN STATE UNIV., EAST LANSING, MICH., USA) ABSTRACT THE NP AND NO TGTAL CRCSS SECTIONS HAVE BEEN MEASURED DIRECTLY WITH A NEUTPGN BEAM WITH MOMENTA OF 4.0 +- 0.6 AND 5.7 +- 0.6 GEV/C. THE DATA ARE CCMPARED WITH THE PREVIDUS NUCLEON-NUCLEON AND NUCLECN-DEUTERON RESULTS, AND THE DEUTERON SCREENING TERM WAS ALSO EVALUATED. THE MEASURED TOTAL CROSS SECTIONS ARE 43.1 +- 0.6 AND 80.3 +- 1.9 MB AT 4.0 GEV/C AND 42.5 +- 1.3 MB AT 5.7 GEV/C. CITATIONS PHYS. REV. LETTERS 20, 468 (1968), SLAC 66 (1966), J. AM. CHEM. SOC. 74 824 (1952), JETP 2 349 (1956), PPOC. GF THE PHYSICAL SOCIETY OF LONOCN 71 293 (1958), INT'L. CCMCRESS ON NUCLEAR PHYSICS.PARIS.FRANCE 2 162 (1964), PHYS. REV. 94, 174 (1954), PROC. OF THE PHYSICAL SOCIETY OF LONDON A70 745 (1957), PHYS. LETTERS 7, 80 (1963), PHYS. LETTERS 278, 599 (1568), PHYS. REV. 138, 913 (1965), PHYS. REV. LETTERS 19, 857 (1967), PHYS. REV. 146, 980 (1966), AND PHYS. REV. 100, 242 (1955). ARTICLE READ BY OCETTE BENARY IN 1/70, AND VERIFIED BY LEROY PRICE. . BEAM NO. 1 IS NEUTRON CN PROTCN FRCM 4.0 TO 5.7 GEV/G. NO. 2 IS NEUTRON GN CEUTERGN FRCM 4.0 TG 5.7 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WERDS + CROSS SECTION MODELS

NEUTRON PROTON TOTAL CROSS SECTION. [TABLE .1]

LABORATORY BEAM FOMENTUM GEVC MILLI-BARNS -4.0 +-.6 43.1 +-.6 5.7 -6 42.5 -6

NEUTRON GEUTERON TOTAL CROSS SECTION. [TABLE 1] LABCRATORY BEAM MCMENTUM GEV/C 4.0 +- .6 5.7 .6 MILLI-BARNS 80.3 +- 1.9 77.8 1.3 . NEUTRON NEUTRON TOTAL CROSS SECTION. (EVALUATED USING THE GALLERAITH ET.AL.(PHYS.REV.138,912(1965)) EXPERIMENTAL VALUE FOR THE GLAUBER SCREENING TERM (1.E.. 042+-.003 MB++-1) THESE VALUES ARE TAKEN FROM PARKER ET AL. MICHIGAN 03028-3-T(1969)) GLAUBER CORRECTION APPLIED LABORATORY BEAP MOMENTUM GEV/C MILLI-BARNS 43.5 +- 2.4 41.2 1.7 4. 6. 88 NEUTRON-PROTON ELASTIC SCATTERING IN THE FCRWARD DIRECTION BETWEEN 4 AND 16 GEV. (PHYS. LETTERS 298, 321 (1969)] J.ENGLER,K.HORN,J.KONIG,F.MONNIG,P.SCHLUDECKER,H.SCHOPPER,P.SIEVERS, H.ULLRICH (TECHNISCHE UNIV. KARLSRUHE, KARLSRUHE, COMMANY) K.RUNGE [EUROPEAN ORG. FOR NUC. RES., GENEVA, SHITZERLAND] ABSTRACT NACT THE CIFFERENTIAL CRCSS-SECTION FOR THE ELASTIC NEUTRON-PROTON-SCATTERING HAS BEEN MEASURED FOR NEUTRON INCRGICS DCTHICN 4 AND 16 GEV AND ADSIT] FROM 0.3 TO 1.3 IOEV/C)-SQUAREC. THE RESULTS CAN BE FITTED BY EXPLA + BT], WHERE B INCREASES SLIGHTLY NITH ENERGY INDICATING SHRINKAGE. THE VALUES OF B FOP N-P SCATTERING ARE IN GOOD AGREEMENT WITH THE CORRESPENDING DATA FOR P-P SCATTERING CITATIONS PHYS. REV. LETTERS 16, 1217 (1966). SLAC SLAC-66 (1966), PHYS. REV. LETTERS 21, 645 (1966), PHYS. LETTERS 278, 599 (1968), PHYS. LETTERS 288, 64 (1968), CCMPTES RENDUS. ACAD. SCI. 265, 1350 (1967), UCRL 17275 (1966), NUDVO CIMENTO 38, 60 (1965), AND PHYS. REV. LETTERS 15, 45 (1965). ARTICLE READ BY ODETTE BENARY IN 9/65, AND VERIFIED BY LERCY PRICE. BEAM IS NEUTRON ON PROTON FROM 4.850 TO 16.914 GEV/C. (PEAM KINETIC ENERGY = 4 TO 16 GEV) THIS EXPERIMENT USES SPARK CHAMPERS. KEY WORDS - DIFFERENTIAL CROSS SECTION EITS CCMPOUND KEY WORCS . FITS DIFFERENTIAL CROSS SECTION ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [FIGURE 2] DATA IS AVERAGED OVER LANGRATORY BEAM ENERGY FROM B. TO 10. GEV. (THE CROSS SECTION AT T+O IS NORMALIZED TO THE OPTICAL THEOREM POINT) . THIS DATA WAS READ FROM A GRAPH C-SIGMA/C-T #8/(GEV/C)**2 6-600 *- .400 3.1C0 .200 1.700 .200 .71U .590 .250 .C8C .190 .050 .090 .C40 .062 .030 -T (GEV/C)**2 .35 .55 .65 .75 .85 .95 1.05 1.15 .200 .090 .080 .050 .040 .030 .030 .026 .026 i :01 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (DUTGOING NEUTRON). . ' FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1] DATA IS FIT OVER LABCRATCRY BEAN ENERGY FROM 4. TO 6. GEV. FITTED FORMULA IS D-SIGMA/D-T = EXP[A+BT] WHERE USSIGNATUST IS IN NETIGEVICITY AND I IS IN IGEVICITY. I IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON). FITTED VALUES . 8 = 6.22 (= .31 FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON. (TABLE 1) DATA IS FIT OVER LABCRATCRY BEAP ENERGY FROM 6. TO 8. GEV. FITTED FORMULA IS C-SIGMA/D-T = EXP(A+BT) WHERE O-SIGMA/D-T IS IN MB/IGEV/C)**2 AND T IS IN IGEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCCMING NEUTRON) AND THE (CUTGOING NEUTRON). FITTED VALUE B = 6.43 +- .48

	Y FIT TC ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1] Data is fit over laboratory beam energy from 8. To 10. Gev. Fitted formula is D-Sigma/D-T = Expla=bt]
	WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETHEEN THE (Incoming Neutron) and the Coutgoing Neutron).
	FITTED VALUE
	8 = 7.14 +38
	FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1]
	DATA IS FIT OVER LABEPATCRY 8£AM ENERGY FROM 10. TO 12. GEV. Fitted formula 1s C-Sigma/D-T = EXP(A+8T)
	WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER RETWEEN THE
	FITTED VALUE
	B = 7.04 +46
	·
	FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 1) Data is fit over laboratory beam energy from 12, to 14, gev- Elited forwards - energy charact
	WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE
	[INCOPING NEUTRON] AND THE [CUTGCING NEUTRON].
	File Value $B = 7.44 +61$
	· · · · · · · · · · · · · · · · · · ·
	FIT TO ELASTIC DIFFERENTIAL CRCSS SECTICN FOF NEUTRON PPOTON. (TABLE 1)
	DATA IS FIT OVER LABCRATCRY EEAM ENERGY FROM 14. TO 16. GEV. Fitted formula is d-sigma/d-t = exp[a+bt]
	WHERE D-SIGMA/D-T IS IN NB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE Lincoming Neutron) and the [Cutgoing Neutron].
	FITTED VALUE
	B = 8.06 +88
89	NEUTRON-PROTON ELASTIC SCATTERING FROM 2 TO 7 GEV/C. [SLAC PUB-622 (1969)]
89	NEUTRON-PROTON ELASTIC SCATTERING FROM 2 TO 7 GEV/C. [SLAC PUB-622 (1969)] H.L.PERL,J.COX [STANFORD LINEAR ACCEL. CNTR., STANFORD,CALIF., USA, AND STANFORD UNIV., STANFORD, CALIF., USA] H.J.LONDO (UNIV. OF MICHIGAN, ANN AREOR, MICH., USA]
89	NEUTRON-PROTON ELASTIC SCATTEPING FROM 2 TO 7 GEV/C. [SLAC PUB-622 (1969)] M.L.PERL,J.COX [STANFORD LINEAR ACCEL. CNTR., STANFORD,CALIF., USA, AND STANFORD UNIV., STANFORD, CALIF., USA] M.J.LONGD (UMIV. OF MICHIGAM, ANN AREOR, MICH., USA) M.N.KREISLER (PPINCETON UNIV., FRINCETON, N. J., USA) ABSTRACT DIRECT MEASUREMENTS WERE MAGE OF NEUTRON-PROTON ELASTIC SCATTERING DIFFERENTIAL CROSS SECTIONS AT HIGH
89	NEUTRON-PROTON ELASTIC SCATTEPING FRGM 2 TO 7 GEV/C. ISLAC PUB-622 (1969)] N.L.PERL, J.COX (STANFORD LINEAR ACCEL. CNTR., STANFORD, CALIF., USA, AND STANFCRD UNIV., STANFORD, CALIF., USA] N.J.LONGO (UNIV. OF MICHIGAN, ANN AREOR, RICH., USA] M.N.KREISLER (PPINCETON UNIV., FRIKCETON, N. J., USA] ABSTRACT DIRECT MEASURENENTS WERE MACE OF NEUTRON-PROTON ELASTIC SCATTERING DIFFEPENTIAL CROSS SECTIONS AT HIGH ENERGIES. A NEUTRON BEAM WITH A CONTINUOUS MONENTUM SPECTRUM BETWEEN 1.2 AND 6.7 GEV/C WAS SCATTERED OFF A LIQUID MYDROGEN TARGET, AND SPARK CHAMEERS WERE USED TO DETERMINE THE NEUTRON SCATTERING ANGLE AND, IN A PROTON SPECTROMETER, TO MEASURE THE MOVENTUM AND SCATTEPING ANGLE OF THE RECUL PROTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED OVER THE INCIDENT NUITAGEN MOMENTUM RANGE IN INTERVALS OF THE ORDER OF 1/2 GEV/C WIDS. THE CPOIDS SCATIONS MAVE AN EXPONENTIAL PEAK IN THE FORMADO DIRECTION AND INTERVALS OF THE ORDER OF 1/2 GEV/C WIDE. THE CODES SCATIONS ARE PRESENTED OVER THE SLOPE OF THE DIFFRACTION AND AND HEN FLATTEN AND BECOME IN THUC AND LET FLEWENT IN THE ON DEG. C.M. CROSS SECTIONS, FOR THE SLOPE OF THE DIFFRACTION PARK. AND COMPARISONS ARE MADE BETWEEN THESE SLOPES. AND THE 90 DEG. C.M. CROSS SECTIONS, FOR THE SLOPE OF THE DIFFRACTION PARK. HE RESULTS PRESENTED HERE OFTARE OFTARE PREVIDINGLY REPORTED DUE TO AN ERROR IN A MCNTE CARLO CALCULATION AND IN THE AVAILABILITY OF IMPROVED DATA AN THE RANG PERVIDINGLY REPORTED DUE TO AN ERROR IN A MCNTE CARLO CALCULATION AND IN THE AVAILABILITY OF IMPROVED DATA AND THE REAL PAPT OF THE MP ELASTIC CAATTERING AMGLE. AT THE PART AND CAMPARISONS ARE MADE BETWEEN THESE SLOPES. AND THE APAT OF THE ME ELASTIC CAATTERING APAGE.
89	NEUTRON-PROION ELASTIC SCATTEPING FRGM 2 TO 7 GEV/C. [SLAC PUB-622 (1969)] N.L.PERL, J.COX (STANFGRO LIMEAR ACCEL: CNTR., STANFORD, CALIF., USA, AND STANFGRD UNIV., STANFORD, CALIF., USA] M.J.CONGO (UNIV. OF MICHIGAN, ANN AREOR, MICH., USA] ANN-KREISLER (PPINCETON UNIV., FRINCETON, N. J., USA] ABSTRACT DIRECT MEASUREMENTS WERE MACE OF NEUTRON-PROION ELASTIC SCATTERING DIFFEPENTIAL CROSS SECTIONS AT HIGH ENERGIES. A NEUTRON BEAM WITH A CONTINUOUS MOMENTUM SPECTRUM BETMEEN 1.2 AND 6.7 GEV/C WAS SCATTERED OFF A LIQUID MYDROGEN TARGET, AND SPARK CHAMBERS WERE USED TO DETERMINE THE NEUTRON SCATTERING ANGLE AND, IN A PROTON SPECTROWETER, TO MEASURE THE MOVENTUM AND SCATTERING ANGLE OF THE RECOLL PROTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED OVER THE INCIDENT NUITANON MOMENTUM RANGE IN INTERVALS CF THE OPDER OF 1/2 CEV/C WIDS. THE CPOSS SCCTIONS SCATTERING ANGLE. AT LARGER ANGLES THE KORSNIM RANGE IN INTERVALS CF THE OPDER OF 1/2 CEV/C WIDE. THE CODES SCCTIONS ARE PRESENTED OVER THE SICHEMAND DIRECTION AND INTERVALS CF THE OPDER OF ANY OTHER STRUCTURE IN THE CODES SCCTIONS AND WITHIN THE RANGE OF THE SUPERIMENT. THERE IS LITTLE EVIDENCE OF ANY OTHER STRUCTURE IN THE CROSS SECTIONS ARE PRESENTED FOR THE SICPE OF THE DIFFRACTION PERKS AND COMPARISONS ARE MADE BETWEEN THESE SLOPES, AND THE 90 DEG. C.M. CROSS SECTIONS, FOR PLANSING PLANSING ANTE CARTER AND COMPARISONS ARE MADE BETWEEN THESE SLOPES, AND THE 90 DEG. C.M. CROSS SECTIONS FOR PLANSING AND CLASSITERING. THE RESULTS PRESENTED HARE OFFEN IN THE CROSS SECTIONS VALUES ARE PRESENTED FOR THE SLOPE OF THE DIFFRACTION PLANSING THE AVAILABILITY OF IMPROVED DATA ON THE REAL PAPT OF THE MP ELASTIC SCATTERING ANCLES. THE OFFEN A DATE CARDE COMPARISON OF PA AND NO TATA ALLOWS THE I = O DIFFRENTIAL CROSS SECTIONS TO BE EXTRACTED. THE NP DATA HAVE BEEN FITTED IN POWERS OF COSINE THETA (C.M.) FOR /COSINE THETA(C.M.)/ CONTINUATION OF PREVICUS EXPERIPENT IN PHYS. REV. LETTERS 16, 1217 (1966), AND PHYS. REV. LETTERS 21, 641 (1968].
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89	NEUTRON-PROTON ELASTIC SCATTEPING FROM 2 TO 7 GEV/C. (SLAC PUB-622 (1969)1 M.L.PERLJ.COK (STANFORD LINEAR ACCEL. CNTR., STANFORD.CALIF., USA, AND STANFORD UNIV., STANFORD, CALIF., USA) M.A.KREISLER (PPINCETON UNIV., FRINCEION, N. J., USA) ANSTRACT DIRECT MEASUREMENTS WERE MACE OF NEUTRON-PROTON ELASTIC SCATTERING DIFFERENTIAL CROSS SECTIONS AT HIGH BNERGIES. A NEUTRON BEAM WITH A CONTINUOUS MOMENTUM SPECTRUM BETWEEN 1.2 AND 6.7 GEV/C WAS SCATTERED OFF A LIQUID HYDROGON TARGET, NAD SPARK CHAMERS WERE USED TO DETERNIME THE NEUTRON SCATTERING ANCE NO., IN A PROTON SPECTROMETER, TO MEASURE THE MOFENTUM AND SCATTEPING ANGLE OF THE RECOIL PROTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED OVER THE INCIDENT WHITRIN MOMENTUM SPECTRUM BETWEEN 1.2 AND 6.7 GEV/C WAS SCATTERED OFF A LIQUID HYDROGON TARGET, NO SPARK CHAMERS WERE USED TO DETERNING THE NEUTRON SCATTERING ANGLE OF THE RECOIL PROTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED OVER THE INCIDENT WHITRIN MOMENTUM SPECTRUM BETWEEN 1.2 AND 6.1 /2 GEV/C WIDE. THE CROSS SECTIONS HAVE AN EXPONENTIAL PEAK IN THE FEGNATED DIRECTION AND THEN FLATTEN AND BECDME ISOTOPIC ABOUT THE NO DEG.C" NOT NITHIN THE REALED TO THE INCIDENT THERE OF IN INTERVALS OF THE ORDER OF ANY OTHER STRUCTURE IN THE CROSS SECTIONS ARE PRESENTED FOR THE SLOPE OF THE DIFFRACTION PEAK, AND COMPARISONS BETWEEN THESE SLOPES, AND THE 90 DEG. C.M. CROSS SECTIONS, FOR PP AND NP ELASTIC SCATTERING. THE EXUSTS PRESENTED MERE DIFFRE FROM THOSE THEY OUTLY REPORTED DUE TO AN ERROR IN A MENTE CARLO CALCULATION AND IN THE AVAILABILITY OF IMPROVED DATA ON THE REAL PAPT OF THE NP ELASTIC SCATTERING ARGULTUDE. AT S GEV A DIFFERENTIAL CROSS SECTION TO BE EXTRACIED. THE NP DATA HAVE BEEN FIITED IN POWERS OF COSINE THETA (C.M.) FOR /COSINE THETA(C.M.)/ NOUVO CIMENTO 31, 105 (1900), UCK 372 (1902), PMYS, REV. LETTERS 9, 500 (1902), PMYS, REV. LETTERS 15, 38 (1904), NOUVO CIMENTO 41A, 127 (1566), CENN HADDON COMPERENCE 523 (1368), PMYS, LEV. LETTERS 15, 38 (1965)), NUOVO CIMENTO 41A, 127 (1566), CENN
89	NEUTRON-PROTON ELASTIC SCATTEPING FROM 2 TO 7 GEV/C. (SLAC PUB-622 (1969)1 NLI-PERLIJ-COX ISTANFORD LINEAR ACCEL. CNTR., STANFORD,CALIF., USA, AND STANFERD UNIV., STANFORD, CALIF., USA) M.J.,TONNO LUMIV. OF MICHIGAN, ANN ARGOR, MICH., USA) ABSTRACT DIRECT MEASUREMENTS WERE AACCE OF MEUTRON-PROTON ELASTIC SCATTER ING DIFFEPENTIAL CROSS SECTIONS AT HIGH ENERGIES. A MEUTRON BEAM WITH A CONTINUOUS MOMENTUM SPECTRUM BETHEEN LIZ AND G.T. CEV/C MAS SCATTERED OFF A LIQUID MARKETSLEED (PPINCETON UNIV., FRINCEION., R. J., USA) ABSTRACT DIRECT MEASUREMENTS WERE AACCE OF MEUTRON-PROTON ELASTIC SCATTER ING DIFFEPENTIAL CROSS SECTIONS AT HIGH ENERGIES. A MEUTRON BEAM WITH A CONTINUOUS MOMENTUM SPECTRUM BETHEEN LIZ AND G.T. CEV/C MAS SCATTERED OFF A LIQUID MENTON THE AND MEASURE THE MEDDENTIM MOMENTUM SPECTRUM BETHEEN LIZ AND G.T. CEV/C MAS SCATTERED OFF A LIQUID MENTON THE INFINITIM THE RADDE OF THE OPENTUM AND SCATTEPING ANGLE OF THE RECOIL PROTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED OVER THE INCIDENT MENTRUM MOMENTUM RANGE IN INTERVALS OF THE ROBOR OF J2 CEV/C MIDE. THE CROSS SECTIONS ARE NAVE ANE EXPONENTIAL PEAK IN THE FORMADO DIRECTION AGAIN RISE TOMANDS THE EXPECTED CHARGE SECHANCE PEAK WHICH WAS ACT PRESENTED OVER THE INCIDENT THERE SEPERIMENT THERE IS LITTLE EVIDENCE OF ANY CITHER STUCLORE PEAK WHICH WAS ACT PRESENTED OVER THE MELTER ANDLEPE OF THE DIFFACTION YEAK, AND COMPARISONS MER MADE BETHEEN THESE SUPERS, AND DEC. THE NP ELASTIC SCATTERING AMOLITUPE. AT 5 GEV A DIRECT COMPARISONS ME MADE BETHEEN THESE SUCHANCE PEAK WHICH WAS SALE AND REARD IN A MONTE CARACE CAL CALUATION AND IN THE AVAILABILITY OF IMPROVED DATA ON THE REAL CAPAT OF THE NP ELASTIC SCATTERING AMOLITUPE. AT 5 GEV A DIRECT COMPARISON OF PP ANC NP DATA ALLOWS THE I - O DIFFERENTIAL COOSTINUATION OF DEFENSION CONTINUATION OF DEFENSION CONTINUATION OF DEFENSION CONTINUATION OF MERCICS EXPERIMENT IN PHYS. REV. LETTERS 16, 1217 (1966), AND PHYS. REV. LETTERS 17, 36 (1967), PHYS. REV. LETTERS 18, 36 (1966), PHYS. REV. LETTERS 19
89	 NEUTRON-PROTON ELASTIC SCATTERING FROM 2 TO T GEV/C. ISLAC PUB-622 (1969)1 NLLPERLIJ.COX ISTANEGRO LINEAR ACCEL. CNTR., STANFORD,CALIF., USA, AND STANFCRD UNIV., STANFORD, CALIF., USA) M.J.LONGO (UNIV. OF MICHIGAN, ANN ARGOR, AICH., USA) NL.PERLIJ.COX ISTANEGRO LINEAR ACCEL. CNTR., STANFORD,CALIF., USA, AND STANFCRD UNIV., STANFORD, CALIF., USA) M.KAREISER IPPINCETON UNIV., FRIENCEION, N.J., USA) ABSTRACT DIRECT MEASUREMENTS WERE MACE OF NEUTRON-PROTON ELASTIC SCATTERING ON FREENTIAL CROSS SECTIONS AT HIGH ENERGIES. A NUTRON BEAM WITH A CONTINUOUS MONETIUM SPECTRUM BETWEEN L.2 AND 6.7 GEV/C MAS SCATTERED OF A LIGUID SPECIFICADE MEAN WITH A CONTINUOUS MONETIUM SPECTRUM BETWEEN L.2 AND 6.7 GEV/C MAS SCATTERED OF A LIGUID SPECIFICAD WEAT THE INCIDENT MENTER WERE USED TO DETERMINE THE NEUTRON SCATTERING ANCLE AND, IN A PROTON SPECIFICAD WEAT THE INCIDENT MENTERMENT OF MER CATER NUTRON SCATTERING ANCLE AND, IN A PROTON SPECIFICAD WEAT THE INCIDENT MENTER WERE USED TO DETERMINE THE RECOIL POTON. DIFFERENTIAL CROSS SECTIONS ARE PRESENTED ONE TO AN THE SCAPED FOR THE OIFFRANCE IN MER CATER NUTRON SCATTERING AND ECODE SOTOPIC ABOUT THE 500 DEC. C.J.CH MAS AND WITHIN THE RANGE OF THIS EXPERIMENT. THERE IS LITTLE EVIDENCE OF ANY OTHER STRUCTURE IN THE CROSS SECTION. VALUES ARE PRESENTED DUE TO AN THE SLOPE OF THE DIFFRANCIAL CALUES AND THE SOTO. C.J.CH MAS ARE PRESENTED DUE TO AN THE SLOPE OF THE DIFFRANCIAL CALUES AND THE REAL PART OF THE AF ESCHTORY FANGE OF THE DIFFRANCIAL CALUELAND ON THE AVAILABILITY OF IMPOVED DATA DA THE SLOPE OF THE DIFFRANCIAL CAUSE THE STOTON. VALUES ARE PRESENTED DUE TO AN CHERCH THE OISTAND ON THE AVAILABILITY OF IMPOVED ONTO AND THE REAL PART OF THE AF CONTINUATION OF PREVIOUS EXPERIMENT. THERE SI IS AND THE AVAILABILITY OF IMPOVED ONTO AN THE REAL PART OF THE AF ESCHTED FOR THOSE SECTION PAN. AND COMPARISON OF PD AND LISS (1000), NUOVO CIMENTO 21, SAI (11961). ANDY CONTENT ON THE AND THE AND AP ELASTIC SCATTERING.

CCMPOUND KEY WORDS' . FITS DIFFERENTIAL CROSS SECTION

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ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (TABLE 1)

DATA IS AVERAGED OVER LARCRATCRY BEAM MCMENTUM FROM 1.70 TO 2.25 GEV/C.

-T (GEV/C)**2		D-SIGMA/D-T		
		#B/(GEV/C)**2 [1]		NC. EVENTS
MIN	NAX			
.10	.20	46.008 +	- 5.237	153
.20	.30	23.956	3.038	89
.30	.40	15.326	1.744	149
.40	• 5 C	8.090	1.037	100
.50	.60	7.501	. 518	127
.60	.70	3.336	.442	85
.70	.80	2.722	.457	56
.80	.90	1.957	.297	64
.90	1.00	1.536	.260	59
1.00	1.25	1.034	.176	106
.25	1.55	1.077	.224	144

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRUNI AND THE LUUTUUING NEUTRONI.

ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (TABLE 1)

DATA IS AVERAGED OVER LABORATORY BEAF MOMENTUM FROM 2.25 TO 2.79 GEV/C.

-	7	D-SIGM	A/C-T	
(GEV/C)**2		MB/(GEV/C)**2 [1]		NO. EVENTS
MIN	MAX			
.10	.20	49.533 +	- 5.295	189
.20	.30	19.447	2.073	137
.30	.40	13-582	1.681	104
.40	.50	1.128	.761	132
.50	.60	3.745	-468	81
.6C	.70	2.397	.382	44
.70	.80	1,706	. 223	77
.80	.90	1.090	.154	59
.90	1.00	1.051	+153	54
1.00	1.20	636	.084	79
1.20	1.40	.506	.064	100
1.40	. 1.60	.353	.049	74
1.60	1.80	.270	.041	67
1.80	2.00	.299	.049	71
2.00	2.49	. 391	.080	157

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE (DUTGOING NEUTRON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 1)

DATA IS AVERAGED OVER LARCRATORY BEAM MOMENTUM FROM 2.79 TO 3.31 GEV/C.

-	uî	0-316MA/0-T		
(GEV/C)**2		M8/(GEV/C)**2 [1]		NO. EVENTS
ini n	РÍÅ X			
.10	.20	44.427 +-	- 4.C30	202
.20	.30	18.111	1.553	195
.30	.40	8.262	1.003	79
.40	.50	6.267	.782	91
.50	.60	3.663	.391	102
100	.70	1.927	• 5 • 0	
. / U	. 5Ú	1.939	.239	50
100	. 10	1.005	•171	69
.90	1.00	.666	.103	. 47
1.00	1.20	.714	.083	104
1.20	1.40	.597	.075	86
1.40	1.60	.997	.C40	. 90
1.60	1.80	.217	.035	77
1.80	2.20	.171	.020	109
2.20	2.60	.115	.015	94
2.60	3.00	.140	.025	80
3.00	3.43	.122	.031	44

T IS THE HUMENTUP TRANSFER BEIMEEN THE LINCUMING NEUTRUNT AND THE LUUTGUING NEUTRUNT.

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

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ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (TABLE 1)

DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 3.31 TO 3.83 GEV/C.

-1		D-310K4/D-T M8/(GEV/C)**2 [1]		ND. EVENTS
IGEV/C	1**2			
EIN	MAX			
.10	.20	43.885 +-	- 3.679	226
.20	.30	15.932	1.214	220
.30	.10	8.703	.860	117
.40	.50	5.564	.729	73
.50	.60	3.327	•356	79
.60	.70	1.432	.188	63
.70	.80	.808	.143	34
.80	.90	.687	+142	25
.90	1.00	.654	.096	. 52
1.00	1.20	.442	.050	96
1.20	1.40	. 232	-C35	49
1.40	1.60	.218	.033	50
1.60	1.60	.164	.022	61
1.80	2.00	.130	.019	53
2.00	2.50	.084	+012	65
2.50	3.00	.081	.009	113
3.00	3.50	.045	.007	56
3.50	4.37	.059	.012	62

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE [OUTGOING NEUTRON].

111 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC DIFFERENTIAL	CRCSS SECTION FOR NEUTRON PROTON.	TABLE 1
DATA IS AVERAGED	OVER LABORATORY BEAP MCMENTUP FRCM 3.83	TO 4.34 GEV/C.
-7 (GEV/C)*+2	D-SIGMA/D-T MB/(GEV/C)**2 [1] NG. EVENTS	

000707772		F0/ (UEV/6/**2 (1)		NUL EVENI.	
4IN	MAX				
•1	• 2	36.458 +	- 2.676	251	
.2	.3	18.225	1.196	295	
.3	.4	8.050	.708	150	
•4	۰5	4.257	.559	63	
• 5	.6	2.473	.337	73	
.6	.7	1.559	.192	75	
.7	.8	1.007	.141	57	
.8	• 9	.413	.040	22	
.9	1.0	.612	.119	28	
1.0	1.2	.256	.034	61	
1.2	1.4	.227	.030	. 62	
.4	1.6	.171	•028	41	
1.6	1.8	.109	.018	40	
1.8	2.0	.072	.013	35	
2.0	2.5	.05C	.007	62	
2.5	3.0	.037	.007	33	
3.0	3.5	.026	.004	39	
3.5	4.0	.023	.004	35	
	4.5	.019	.004	33	
1.5	5.3	.055	.013	37	

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE COUTGOING NEUTRON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1]

DATA IS AVERAGED EVER LARGRATORY BEAM MEMENTUM FROM 4.34 TO 4.85 GEV/C.

- T		D-SIGMA/D-T			
(GEV/C)*+2		MB/(GEV/C1++2 [1]		NO. EVENTS	
MIN	MAX				
.10	+20	34.847 +	- 2.177	357	
-20	.30	11.930	.770	319	
.30	.40	6.294	.490	205	
.40	.50	3.037	.354	84	
.50	.60	1.484	.217	62	
.60	.70 ·	.973	.121	73	
.70	.80	.573	.080	56	
.80	.90	. 414	.068	39	
.90	1.00	.248	+055	21	
1.00	1.20	. 210	.031	60	
1.20	1.40	.117	.016	57	
1.40	1.60	.078	.013	37	
1.60	1.80	.055	.012	22	
1.80	2.00	•025	.006	21	
2.00	2.50	.021	.003	47	
2.50	3.00	.014	.003	23	
3.00	3.50	.011	.003	17	
3.50	4.00	.009	.002	15	
4.00	4.50	.012	.002	31	
4.50	5.00	.012	.002	35	
5.00	5.50	.005	.002	6	
5.50	6.25	.020	.006	21	

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [OUTGOING NEUTRON].

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

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ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1]

DATA IS AVERAGED OVER LABORATORY BEAM MCHENTUM FROM 4.85 TO 5.36 GEV/C.

-1		D-SIGMA/	D-SIGMA/D-T		
(GEV/C)**2		MB/(GEV/C	3**2 [1]	NO. EVENTS	
MIN	MAX				
.11	.20	33.477 +-	2.080	346	
.20	.30	16.948	1.000	- 420	
.30	.40	7.206	.523	254	
.40	.50	3.464	.369	106	
.50	.60	1.903	.264	66	
.60	.70	1.036	.134	69	
.70	.80	.545	.075	56	
.80	.90	.568	.079	55	
-90	1.00	.281	.055	27	
1.00	1.20	.197	.035	34	
1.20	1.40	.090	.014	43	
1.40	1.60	.060	.011	32	
1.60	·1.80	.044	.010	21	
1.80	2.00	.028	.009	11	
2.00	2.50	.014	.002	33	
2.50	3.00	.016	.003	32	
3.00	3.50	.010	.002	16	
3.50	4.18	.004	.001	10	
4.33	5.00	.006	.002	16	
5.00	5.50	.006	·C02	19	
5.50	6.00	+010	.003	15	
6.00	6.50	.012	.003	13	
4.50	7 <u>i</u> A	.017	.005	14	

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE (OUTGOING NEUTRON).

(1) PLUS POSSIBLE SYSTEPATIC ERROR OF +- 5 PER CENT.

[TABLE 1] ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. DATA IS AVERAGED OVER LARGRATCRY BEAM MCHENTUM FROM 5.36 TO 5.87 GEV/C.

-T (GEV/C}++2		D-SIGMA/C-T			
		MB/(GEV	/C)**2 [1]	NO. EVENTS	
PIN	MAX				
-11	.20	39.129 +	- 2.611	386	
.20	.30	17.365	1.161	420	
•3C	.40	8.532	.583	332	
.4C	.50	4.792	.413	170	
.50	.60	2.231	.302	59	
-9C	.70	1.480	.150	110	
.7C	.80	.791	.091	81	
.80	.90	.455	.066	51	
.90	1.00	.305	.056	31	
1.00	1.20	.167	.030	32	
1.20	1.40	.158	.024	56	
1.40	1.60	.055	.C10	35	
1.60	1.80	•030	. 607	18	
1.80	2.00	.027	.008	12	
2.00	2.50	.022	.004	36	
2.50	3.00	.013	.002	33	
3.00	3.50	.004	- CO2	7	
3.50	4.48	.0C4	-C01	13	
4.99	6.00	.0C4	.001	21	
6.00	6.50	.005	.C02	9	
6.50	7.00	.0C6	+002	9	
7.00	7.50	.013	.004	15	
7.50	7.97	. C 1 Z	.0C5 ·	7	

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T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON).

11] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRCK PRGTCN. (TABLE 1)

DATA IS AVERAGED OVER LAECRATORY BEAM MOMENTUM FRCH 5.87 TO 6.37 GEV/C.

-	r	D-SIGM	4/0-T	
(GEV/	C)++2	₩B/IGEV	/C)**2 [1]	NC. EVENTS
MIN	MAX			
.13	.20	30.350 +	- 2.318	278
20	.30	15.191	.970	471
• 20	.40	6.116	.421	316
.40	.50	3.240	.283	158
.50	.60	2.269	.267	79
.60	.70	1.196	.118	114
.70	.80	.631	.078	72
.80	+ 90	.361	.050	55
.90	1.00	.168	.034	25
1.00	1.20	.111	.022	27
1.20	1.40	.063	.016	17
1.40	1.60	.030	.007	22
1.60	1.60	.022	.005	18
1.80	2.00	•021	.006	13
2.00	2.50	.012	.003	18
2.50	3.00	.006	.001	22
3.00	3.50	.005	-001	14
3.50	4.00	.006	.002	12
4.00	4.79	.001	-001	5
5.85	1.00	.002	.001	14
7.00	8.00	.005	-001	19
8.00	8.73	.012	.003	18

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [TABLE 1]

CATA IS AVERAGED OVER LABORATORY BEAM MCMENTUM FROM 6.37 TO 7.18 GEV/C.

-1	r	D-SIGN	A/D-7	
1529/6	.1**2	887 (GEV.	NU. EVENIS	
MIN	MAX			
. 17	.20	32.876 +	- 3.598	108
.26	- 30	15,413	1.066	371
.30	.40	8.736	.578	348
.40	.50	3.901	.327	172
.50	.60	2.050	+252	75
.60	.70	1.177	.149	82
.70	.80	.709	.089	69
.80	.90	.362	.057	49
.90	1.00	.282	.C49	35
1.00	1.20	.146	.026	34
1.20	1.40	.057	.017	13
1.40	1.60	.027	.011	7
1.60	1.80	.041	.009	23
1.80	2.00	.018	-005	12
2.00	2.50	.018	.004	23
2.50	3.00	.006	.002	10
3.00	3.50	+004	.001	ç
3.50	4.00	.005	+C02	10
4.00	5.09	-001	.001	5
6.36	7.25	.003	.001	8
7.35	8.50	.001	.001	5
8.50	9.63	+006	+002	14

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE LOUTGOING NEUTRON).

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

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FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.
                                                            (TABLE 2)
    DATA IS FIT OVER LABORATORY BEAP MCMENTUM FROM 1.7 TO 2.3 GEV/C.
    DATA IS FIT OVER -T FROM .1 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
ICUTGOING NEUTRON).
FITEO FORMULA IS C-SIGMA/D-T = A*EXP(-8*T)
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    EITTED VALUE
           B = -5.66 +- .54
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.
                                                            1 TABLE 21
    DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 2.3 TO 2.8 GEV/C.
    DATA IS FIT OVER -T FROM -1 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
ICUTGOING NEUTRON).
FITTED FORMULA IS C-SIGMA/D-T - A*EXP[-B+T]
           WHERE D-SIGMA/D-T IS IN MO/(GEV/CI++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUE
      8 = -6.22 +- .48
  .
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOP NEUTRON PROTON.
                                                            [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 2.8 TO 3.3 GEV/C.
    DATA IS FIT OVER -T FROP .1 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETMEEN THE LINCOMING NEUTRON) AND THE
(CUTGDING NEUTRON).
FITTED FORMULA IS C-SIGMA/O-T = A*EXP[-8+T]
           WHERE D-SIGNA/D-T IS IN M8/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
           8 = -6.86 +- .48
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                            [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAN NOMENTUM FROM 3.3 TO 3.8 GEV/C.
    DATA IS FIT OVER -T FROM .1 TO .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE
[CUTGOING NEUTRON].
[TITED FORMULA IS C-SIGMA/D-T = A*EXP[-B*T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUE
         8 = -7.14 +- .46
FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON.
                                                            [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 3.8 TO 4.3 GEV/C.
    DATA IS FIT OVER -T FROP .1 TC .5 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE
[CUIGDIAG NEUTRON].
FITTED FORMULA IS 0-SIGMA/D-T = A+EXP[-8+T]
           WHERE C-SIGNA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUE
           B = -7.33 +- .43
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                            [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 4.3 TO 4.8 GEV/C.
    DATA IS FIT OVER -T FROM .1 TO .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE
(CUIGGIAG NEUTRON).
FITED FORMULA IS O-SIGMA/D-T = A*EXP[-B*T]
           WHERE D-SIGMA/D-T IS IN ME/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTEC VALUE
           B = -8.25 +- .38
____
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.
                                                            [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 4.8 TO 5.4 GEV/C.
    DATA IS FIT DVER -T FROM -1 TO .5 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE
(CUTGDIAG NEUTRON).
FITTED FORMULA IS O-SICMA/D-T + A+EXP[-8+T]
           WHERE D-SIGMA/D-T IS IN M8/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTER VALUE
           B = -7.65 +- .26
```

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FIT TO ELASTIC DIFFERENTIAL CRCSS SECTICN FOR NEUTRON PROTON.
                                                         [TABLE 2]
    DATA IS FIT OVER LABORATORY REAM MOMENTUM FROM 5.4 TO 5.9 GEV/C.
    DATA IS FIT OVER -1 FROM -1 TG -5 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
ICUTGDING NEUTRON).
FITTED FORMULA IS C-SIGMA/D-T = A+EXP[-B+T]
          WHERE D-SIGMA/D-T IS IN #B/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUE
          8 - -7.11 +- .33
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                         [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAP MEMENTUM FROM 5.9 TO 6.4 GEV/C.
    DATA IS FIT OVER -T FROM .1 TC .5 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETMEEN THE LINCOMING NEUTRON) AND THE
[CUTGOING NEUTRON].
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-B+T]
          WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUE
          8 = -7.94 +- .37
------
FIT TO FLASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON-
                                                         TABLE 23
    DATA IS FIT OVER LABORATORY BEAP MOMENTUM FROM 6.4 TO 7.2 GEV/C.
    DATA IS PIT OVER -T FROF -1 TC -S IGEV/CI++2. I IS HIL HUMENIUM HAMSFER BETMEEN THE (INCOMING NEUTPON) AND THE
LCUTGOING NEUTRONI-
FITTED FORMULA IS C-SIGMA/D-T = A+EXPL-B+1J
          WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          H = -7.31 +- .44
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRCH PROTON. [TABLE 2]
    DATA IS FIT OVER LABORATORY BEAP MCMENTUM FROM 1.7 TO 2.3 GEV/C.
    DATA IS FIT DVER -T FROM .1 TG .4 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
[GUIGGING NEUTRON].
FITTED FORMULA IS D-SIGMA/D-T = A*EXP[-8+T]
          WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    B = -5.5 t- .8
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                          [TABLE 2]
    DATA IS FIT OVER LARGRATORY EEAF HOMENTUM FROM 2.3 TO 2.8 GEV/C.
    DATA IS FIT OVER -T FROM .1 TC .4 (GEV/C)**2. T IS THE HOMENTUM TRANSFFR AFTWEEN THE [INCOMING NEUTRON] AND THE
LOUTGOING NEUTRON].
FITTED FORMULA IS O-SIGMA/D-T = A*EXP[-B+T]
         WHERE D-SIGHA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          B = -6.67 +- .81
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                         TABLE 21
    DATA IS FIT OVER LABORATORY BEAF MOMENTUM FROM 2.8 TO 3.3 GEV/C.
    DATA IS FIT OVER -T FROM .1 TC .4 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE
COUTODING NEUTRON:
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-B+T]
          WHERE D-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          8 = -8.48 +- .74
{TABLE 2}
FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PRCTON.
    DATA IS FIT OVER LABORATORY BEAF MCMENTUM FROM 3.3 TO 3.8 GEV/C.
    DATA IS FIT OVER -T FROM -1 TC .4 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
ICUICOING NEUTRON).
FITED FORMULA IS 0-SIGMA/D-T = A+EXP(-8+T)
         WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          B = -8.23 +- .64
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FIT TO ELASTIC DIFFERENTIAL CPCSS SECTION FOR NEUTRON PROTON. . (TABLE 2)
     DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 3.8 TO 4.3 GEV/C.
     DATA IS FIT OVER -T FROM .1 TC .4 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE
[CUTCOING NEUTRON].
FITTED FORMULA IS C-SIGMA/C-T = A*EXP[-B+T]
            WHERE D-SIGNA/D-T IS IN NB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUE
            8 = -7.48 +- .57
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                              [TABLE 2]
     DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 4.3 TO 4.8 GEV/C.
     DATA IS FIT OVER -T FROP .1 TC .4 (GEV/C)**2. T IS THE HOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE
LOUTGOING NEUTRONI.
FITTED FORVULA IS C-SIGNA/C-T = A*EXP[-8+T]
            WHERE D-SIGMA/D-T IS IN ME/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUE
           8 = -8.73 +- .49
 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                              [TABLE 2]
     DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 4.8 TO 5.4 GEV/C.
     DATA IS FIT OVER -T FROM .1 TO .4 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
[CUTCOING NEUTRON].
FITTED FORMULA IS C-SIGMA/O-T = A+EXP[-B+T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUE
            8 = -7.63 +- .48
 FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.
                                                              (TABLE 2)
     DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 5.4 TO 5.9 GEV/C.
     DATA IS FIT OVER -T FROM .1 TG .4 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE

[CUTGOING NEUTRON].

FITTED FORMULA IS C-SIGMA/D-T - A*EXP[-B+T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUE
          8 = -7.62 +- .48
 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                             TABLE 21
     DATA IS FIT OVER LABORATORY BEAM NOMENTUM FROM 5.9 TO 6.4 GEV/C.
     DATA IS FIT OVER -T FROM .1 TC .4 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE
LOUTGOING NEUTRON).
FITTED FORMULA IS D-SIGMA/O-T = A*EXP[-B+T]
                                                                                                        .
            WHERE D-SIGMA/D-T IS IN M8/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUE
            8 = -8.47 +- .54
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                              (TABLE 2)
     DATA IS FIT OVER LABORATORY BEAM MOMENTUM FROM 6.4 TO 7.2 GEV/C.
     DATA IS FIT OVER -T FROM +1 TO +4 (GEV/C)*+2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE
(CUTGOING NEUTRON).
FITTED FORMULA IS D-SIGMA/D-T = A+EXP[-8+T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
     FITTED VALUE
            8 = -7.12 +- .68
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90 DESERVATION OF THE P PI PI DECAY MODE OF THE N+1/2114001 RESONANCE IN PP INTERACTIONS AT 22 GEV/C. [PPYS. REV. LETTERS 21, 1368 (1968)] R.A.JESPERSEN,Y.W.KANG,W.K.KERNAN,R.A.LEACOCK,J.I.RHODE,T.L.SCHALK, L.S.SCHRCEDER [IOWA STATE UNIV., AMES, ICWA, USA] RACT APPROXIMATELY 12,CCO FOUR-PRONGED INTERACTIONS CF 22-GEV/C PROTONS IN A HYDRCGEN BUBBLE CHAMBER FAVE BEEN MEASURED. IN A SAMPLE OF 1234 PP PI+ PI- EVENTS THE FINAL STATE IS DOMINATED BY DELTA++11236J PRODUCTION. APPROXIMATELY 120 OF THESE EVENTS ARE ATTRIBUTEC TO THE P PI+ PI- DECAY OF A RESONANT STATE WITH MASS 1443 +- 15 MEV AND HIDTH 100 +- 25 MEV IOBENTIFIED WITH THE M+1/2(1400] RESONANCE. THERE IS ALSO STRONG EVIDENCE FOP P PI PI ENHANCEMENT WITH & CENTRAL MASS VALUE OF 1693 MEV. ABSTRACT CITATIONS PMYS. REV. LETTERS 12, 340 (1964), PMYS. LETTERS 18, 342 (1965), PMYS. REV. 165, 173C (1968), PMYS. LETTERS 18, 167 (1965), NUDVO CIMENTO 35, 1052 (1965), PMYS. REV. LETTERS 16, 855 (1966), PMYS. REV. LETTERS 17, 789 (1966), PMYS. REV. LETTERS 19, 397 (1967), PMYS. REV. LETTERS 13, 555 (1964), PMYS. REV. LETTERS 14, 1043 (1965), PMYS. LETTERS (1966), PMYS. REV. LETTERS 20, 164 (1968), BULL. AM. PMYS. SUC. 13, 662 (1968), PMYS. REV. LETTERS 17, 884 (1566), UCLA UCLA-1023, PMYS. REV. LETTERS 20, 964 (1968), NUDVO CIMENTO 50A, 1000 (1967), UNIV. DP ILLINDIS CODI195-78 (1967), PMYS. REV. LETTERS 13, 159 (1964), PMYS. REV. LETTERS 19, 564 (1567), NUDVO CIMENTO 24, 453 (1962), NUDVC CIMENTO 40A, 899 (1965), PMYS. REV. LETTERS 19, 925 (1967), SLAC 43 (1965), AND PMYS. REV. 139, B1023 (1965). ARTICLE READ BY OCETTE BENARY IN 1/69, AND VERIFIED BY LERDY PRICE. BEAM IS PRCTON ON PRCTCN AT 21.8 GEV/C. THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 70000 PICTURES ARE REPORTED ON. KEY WGRDS + CROSS SECTION MASS SPECTRUM DIFFERENTIAL CROSS SECTION FITS N+(1470)P11 DELTA(1238) Baryon Resonance with y = 1 at 1700 MeV COMFOUND KEY WORDS . FITS CIFFERENTIAL CROSS SECTION CRESS SECTION FOR PROTEN PROTEN + PRETEN PROTON PI+ PI-. [PAGE 1368] LABORATORY BEAM MOMENTUM GEV/C 21.8 MILLI-BARNS 1.36 +- .16 NO. EVENTS CRISS SECTION FOR PROTON PROTON + PROTON N+(1470)+. [PAGE 1369] N+(1470)+ + PROTON PI+ PI- [1] LABORATORY BEAN MOMENTUN Gev/C 21+8 MICRC-BARNS 155. +- 30. [1] FITTED FOR MASS AND/OR WICTH { MASS = 1.443 GEV; WIDTH = .100 GEV], AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND. FIT TO DIFFERENTIAL CONTE SECTION END - ADDITON & NATIATOLA PROTON. [PAGE 13701 LABORATORY BEAM POPENTUP . 21.8 GEV/C. T (DEV/C)++2 < 1250. T 13 THE HOHENTUM TRANSFER DETWEEN THE LINCOMING PROTON) AND THE LINA(14701+). Fitted formula is d-sigma/d=t = a+exp(8[1]) WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. FITTED VALUE B = 18.0 +- 2.3 91 NEUTRON-PROTON AND NEUTRON-DEUTERON TOTAL CROSS SECTIONS FROM 14 TG 27 GEV/C. [PFYS. REV. LETTERS 20, 468 (1968)] M.N.KREISLER (PRINCETON UNIV., PRINCETCN, N. J., USA) L.W.JONES,M.J.LONGO,J.R.O'FALLON (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) ADSTRACT THE FIRST DIACCT MEASUREMENTS OF NEUTRON-PROTON AND NEUTRON-DEUTERON TOTAL CROSS EECTIONS IN THE MOMENTUM Range 14 TO 27 GEV/C ARE PRESENTED. THE NP TOTAL CROSS SECTION APPARENTLY BECOMES LESS THAN THE PP TOTAL CROSS Section in This Momentum Redick. Cur results show no evidence for a mapio vanishing of the glauder generation Correction as predicted by Abers et al. On the basis of Regge Theory. CITATICAS PHYS. REV. 138, B913 (1965), PHYS. LETTERS 19, 341 (1965), PHYS. LETTERS 14, 164 (1965), PHYS. REV. LCO, 242 (1955), PHYS. REV. LETTERS 19, 857 (1967), BERKELEY CONFERENCE 253 (1967), PHYS. LETTERS 21, 339 (1966), NUOVO CIMENTO 424, 365 (1966), PHYS. REV. 146, 980 (1966), INT'L. CONGRESS ON NUCLEAR PHYSICS,PARIS,FRANCE 162 (1964), AND JETP 18 1239 (1963). ARTICLE READ BY ODETTE OCNARY IN 1/65, AND VERIFIED BY LERGY PRICE. BEAM NO. 1 IS NEUTRON CN PROTON FROM 14.6 TO 27.0 GEV/C. NO. 2 IS NEUTRON ON DEUTERON FROM 14.6 TO 27.0 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WORDS . CROSS SECTION NEUTRON PROTON TOTAL CROSS SECTION. [TABLE 1] LABORATORY BEAM MCMENTUM GEV/C [1] MILLI-BARNS 37.1 +- 1.2 37.5 1.2 37.7 .8 14.6 17.8 21.6 [1] MEAN VALUES.

NEUTRON DEUTERON TOTAL CROSS SECTION. [TABLE 1] LABCRATCRY BEAM MOMENTUN GEV/C [1] MILLI-BARNS 72.2 +- 1.5 65.7 .7 14.6 27.0 (1) PEAN VALUES. 92 TOTAL CRUSS SECTION FOR INTERACTICN BETWEEN PROTONS AND B.3 BEV NEUTRONS. IJETP 15 272 (1962)1 L.OZHDYANI, V.S. PANTUYEV, M.N. KHACHATURYAN, I.V. CHUVILC (JOINT INST. FOR NUCL. RESEARCH, DUBNA, USSR) ABSTRACT THE TOTAL NEUTRON-PROTON INTERACTION CROSS SECTION WAS MEASURED FOR A MEAN EFFECTIVE NEUTRON ENERGY 8.2 -1.3 +1.2 BEV (IN THE L.S.) UNDER GOOD GEOMETRY (THETA/2 = 0.228 DEG.). THE TOTAL CROSS SECTION WAS FOUND TO EQUAL 41.2 +-2.6 MB. CITATIONS Phys. Rev. 98, 1365 (1955), Phys. Rev. 103, 212 (1956), Nuc. Phys. 9, 600 (1959), PRCC. OF THE ROYAL SOCIETY OF LONDON A251, 233 (1959), BULL. AM. Phys. Soc. 4, 253 (1959), AND Phys. Rev. Letters 5, 576 (1960). ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERCY PRICE. BEAM IS NEUTRON ON HYDROGEN COPPOUND AT 9-192 GEV/C. (BEAM KINETIC ENERGY = 8-3 GEV) THIS EXPERIMENT USES COUNTERS. KEY WORDS + CROSS SECTION NEWTRON PROTON TOTAL CRESS SECTION. [PAGE 2721 LABORATORY BEAM ENERGY BEAM ENERGY GEV 8.3 + 1.2 - 1.3 MILLI-BARNS 41.2 +- 2.6 93 STUDY OF PP INTERACTIONS AT 28.5 BEV/C IN TWO- AND FOUR-PRONG FINAL STATES. (BNL 11980 (1967)) P.L.CCNNCLLY,W.E.ELLIS,P.V.C.HOUGH,O.J.MILLER,T.W.MORRIS,C.OUANNES, R.S.PARVINI,A.M.THORNCIKE (BROCKHAVEN NAT. LAB., " UPTON. L.I.. N. Y., USA] CITATIONS .1003 BNL 11681, PHYS. REV. 120, 1857 (1960), PHYS. REV. LETTERS 19, 546 (1967), USAEC REPORT UC-34 (1967), PHYS. PEV. Letters 16, 855 (1966), Phys. Letters 18, 167 (1965), Phys. REV. Letters 17, 789 (1966), Phys. REV. 154, 1284 (1967), Princeton-Penn Accelerator Ppub 600F (1966), AND Phys. REV. 137, 1566 (1964). ARTICLE READ BY ODETTE BENARY IN 9/65, AND VERIFIED BY LERCY PRICE. BEAM IS PROTON ON PROTON AT 28.5 GEV/C. THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 83000 PICTURES ARE REPORTED ON. KEY WORDS + CROSS SECTION CIFFERENTIAL CROSS SECTION FITS MASS SPECTRUM ANGULAR DISTRIBUTION COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION . LERUM TABLE IN AND TABLE 181 LABCRATORY BEAM MCMENTUM = 28.5 GEV/C. REACTION PROTON PROTON + MILLI-BARNS PRCTCN N+(1470)+ .50 + .20 .10 .20 .10 .40 + PROTON N+(1470)+ N*(147C)+ • NUCLEON PION [1] PROTON NEUTRON PI+ DELTA(1238)++ DELTA(1238)++ • PROTON PI+ [1] DELTA(1238)++ • PROTON PI+ [1] DELTA(1238)+ • PROTON PI+ [1] DELTA(1238)0 • NEUTRON PIO [1] DELTA(1238)0 PROTON PI+ 1.50 .10 .02 .03 .16 + .10 1.10 .20 .08 . 02 .03 .01 .02 .01 .01 .30 .03 .05 1.60 .45

11) USED SIMPLE MASS CUT. 121 THIS DATA SHOULD NGT RE USED - MORE RECENT VALUES MAY BE FOUND IN ELLIS ET AL., BNL 13671 (1969).

.05

> .ca .32 + .13

.01

FLASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. LETGURE 11 LABORATORY REAM NOMENTUM = 28.5 GEV/C. (NORMALIZED TO COUNTER EXPERIMENTS) . THIS DATA WAS READ FREM A GRAPH . NC. EVENTS (GEV/C)*+2 MINO2468C2468C2468C2468C24684444 37 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (CUTGOING PROTON). _ _ _ _ _ _ _ _ _ FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. FEIGURE 11 LABORATORY BEAM MOMENTUM = 28.5 GEV/C. Fitted Formula IS C-Sigma/D-T = Exp[a-B+T+C+T++2] WHERE D-SIGMA/D-T IS IN MB/IGEV/CI++2 ANC T IS IN (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCCMING PROTON) AND THE (OUTGOING PROTON). FITTED VALUE $\begin{array}{rcl} A &=& 7.34 \ +- & .11 \\ B &=& -10.91 \ +- & 1.05 \\ C &=& 4.18 \ +- & 2.11 \end{array}$ 94 NEUTRON-PROTON CHARGE-EXCHANGE SCATTERING BETWEEN 600 MEV/C AND 2000 MEV/C. [PPAR 10 (1969)] P.F.SHEPARD,T.J.DEVLIN,R.C.NISCINC,J.SOLOMON (PALNER PHYS. LAB., PRINCETON UNIV., PRINCETON, N.J] RACT N-P ELASTIC DIFFERENTIAL CRGSS SECTIONS IN THE CHARGE-EXCHANGE REGION HAVE BEEN MEASURED FOR INCIDENT NEUTRON MCMENTA BETWEEN 600 MEV/C AND 2000 MEV/C. A SECONDARY NEUTRON BEAM FROM THE BOPBARDMENT OF A 1 1/2 IN. PLATINUM TARGET BY THE 3 GEV INTERNAL PROTON BEAM AT THE PRINCETON- PENNSULVANIA ACCELERATOR WAS SCATTERED FROM A LIQUID-HYDROGEN TARGET. THE INCIDENT NEUTRON INERGY WAS DETERNINED BY A MEASUREMENT OF FLIGHT TIME OVER A 108 FT. FLIGHT TATH. THE MCHENTUM AND SCATTERING ANGLE OF THE RECOLL PROTON WERE MEASURED BY A WIRE-SPARK-CHAMBER MAGNETIC SPECTROMETER NITH MAGNETOSTRICITIVE READOUT. APPROXIMATI ASC, AUGU ELASILE EVENTS WERE UFICEUD FUR PRUINU ALABKATORY ANALGS AFT-CCHI FFAG AFGA. AND ME AND THE ALABATIC CHUSS SCATTERED BY A MERE-SPARK-CHAMBER MAGNETIC ANALGS AFT-CCHI FFAG AFGA. AND ME AND THE ALABATIC CHUSS SCATTERED AND THE PROTONEL AND AND AND AND ALABATIC NORMALIZATION OF THE CROSS SECTIONS AS ACHIEVED BY MEASURED THE UNERD NELLED UND FUNIUM LABULUIE NORMALIZATION OF THE CROSS SECTIONS AS ACHIEVED BY MEASURED THE UNDERD NELLED HUR PROTON ADDULUS EFFICIENCY WAS DETERMINED EXPERIMENTALLY. ABSTRACT

CITATIONS
MIDNEST CONF. THEORET. PHYS., PURDUE UNIV. 50 (1960), PHYS. REV. 169, 1128 (1968), PHYS. REV. 169, 1149 (1968), PHYS. REV. 173, 1272 (1968), PHYS. REV. 1579 (1968), REV. MOD. PHYS. 39, 56C (1967), PHYS. REV. LETTERS 15, 38 (1965), NUOVO CIMENTO 141, 167 (1966), PHYS. REV. 103, 1529 (1965), PHYS. REV. 169, 1579 (1968), REV. MOD. PHYS. 30, 56C (1967), PHYS. REV. LETTERS 15, 38 (1965), PHYS. REV. 173, 1272 (1968), PHYS. REV. 165, 1579 (1968), REV. MOD. PHYS. 30, 56C (1967), PHYS. REV. LETTERS 15, 38 (1965), JETP 16 24 (1963), PHYS. REV. 79, 96 (1950), PHYSICS 32, 193 (1965), PHYS. REV. 50, 250 (1962), PHYS. REV. 45, 564 (1966), JETP 16 24 (1963), PHYS. REV. 79, 96 (1950), PHYSICS 32, 10900), PHORCE. THEORET. PHYS. (RV010) 504, 32 (1956), PHYS. REV. 171, 10900), PHYS. REV. 1960), PHORCE. THEORET. PHYS. (RV010) 504, 32 (1956), PHYS. REV. 1971 10 1125 (1960), PHYS. REV. 113, 1360 (1958), REV. MOD. PHYS. 864, 127, 1380 (1958), REV. MOD. PHYS. 8145 (1963), PHYS. REV. 1000 (1966), PHYS. REV. 175, 1357 (1969), PHYS. LETTERS 4, 19 (1963), PHYS. REV. LETTERS 11, 444 (1963), PHYS. REV. 130, B033 (1964), PHYS. REV. 137, B01500 (1963), PHYS. REV. 134, B033 (1964), PHYS. REV. 136, B071, PHYS. REV. 142, 576 (1964), PHYS. REV. 155, 1773 (1967), PHYSICS 7, 404 (1967), PHYS. REV. 163, 1163 (1964), PHYS. REV. 156, 1703 (1967), PRINCETON-PENN ACCELERATOR A-101 (1964), PHYS. REV. 164, 106, 1999), JETP 17 720 (1963), PHYS. REV. 164, 166, 1599 (1966), PHYS. REV. 142, 576 (1966), PHYS. REV. 140, DECELERATOR PARA-215 (1966), PHYS.

ARTICLE REAC BY ODETTE BENARY IN 10/69, AND VERIFIED BY LEROY PRICE.

BEAM IS NEUTRON ON PROTON FROM 6 TO 2 GEV/C.

THIS EXPERIMENT USES SPARK CHAPBERS.

GENERAL COMMENTS ON THIS ARTICLE 1 THIS IS SHEPARD'S THESIS. IT CONTAINS A NICE DISCUSSION OF THE HISTORY AND THEORY OF NP CHARGE EXCHANGE SCATTERING. KEY WORDS . DIFFERENTIAL CROSS SECTION CHARGE EXCHANGE FITS

COMPOUND KEY WORDS . FITS CHARGE EXCHANGE DIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. ITABLE 51 DATA IS AVERAGED OVER LABGRATCRY BEAF NOMENTUP FROF .600 TO .625 GEV/C. $\begin{array}{c} \textbf{C} \quad \textbf{C} = \textbf{C} = \textbf{C} = \textbf{C} + \textbf{C} + \textbf{C} + \textbf{C} + \textbf{C} + \textbf{C} \\ \textbf{D} = \textbf{C} = \textbf{C} + \textbf{C} + \textbf{C} = \textbf{C} \\ \textbf{M} = \textbf{C} \in \textbf{C} + \textbf{C} + \textbf{C} \\ \textbf{3} = \textbf{3} \\ \textbf{C} = \textbf{3} \\ \textbf{C} = \textbf{C} + \textbf{C} \\ \textbf{3} \\ \textbf{3} \\ \textbf{3} \\ \textbf{4} \\ \textbf{C} \\ \textbf{5} \\ \textbf{5} \\ \textbf{6} \\ \textbf{7} \\ \textbf{5} \\ \textbf{5} \\ \textbf{6} \\ \textbf{7} \\ \textbf{5} \\ \textbf{5} \\ \textbf{6} \\ \textbf{7} \\ \textbf{5} \\ \textbf{6} \\ \textbf{5} \\ \textbf{6} \\ \textbf{5} \\ \textbf{6} \\ \textbf{5} \\ \textbf{5} \\ \textbf{6} \\ \textbf{6} \\ \textbf{6} \\ \textbf{5} \\ \textbf{6} \\ \textbf{$ (GEV/C 1++2 .0000 .0003 .0007 .0014 .0023 .0034 .0055 .0091 .0475 .0563 .0657 .0563 .0657 .0563 .0657 .0563 U IS THE MCMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE (PROTON). (11 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 8 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 6] DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .625 TO .650 GEV/C. ER LABORATORY BEAK M D-SIGPA/R-U MB/(GEV/C)+22(1) 396,70 +- 22.60 374.2C 13.00 346.20 1C.00 346.20 1C.00 317.c0 1C.20 278.40 10.70 271.70 10.80 231.70 7.40 133.89 4.60 130.28 4.50 120.36 4.30 108.55 4.10 95.21 2.40 85.02 2.31 71.20 2.80 U IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [PROTON]. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5.5 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 7] DATA-IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .650 TO .675 GEV/C. $\begin{array}{c} \mbox{Fr} & LABCRATGRY BEAM H\\ \mbox{C-SIGPA/C-U} & \mbox{II} \\ \mbox{H}/(5EVC) + 2 (11) \\ \mbox{337, eC} & \mbox{Sec} \\ \mbox{340, ro} & \mbox{11, eC} \\ \mbox{340, ro} & \mbox{7, ro} \\ \mbox{340, ro} & \mbox{340, ro} \\ \mbox{340,$ Gev.C ***2 -0001 -0001 -0003 -0009 -0016 -0027 -0040 -0065 -0167 -0455 -0655 -0655 -0657 -0769 -0682 -1002 -1128 -1257 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE [PROTON]. (1) PLUS PUSSIBLE SYSTEPATIC ERROR OF +- 3.6 PER CENT. ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 8] DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .675 TO .700 GEV/C. -U (GEV/C)**2 *0001 .0004 .0029 .0018 .0029 .0070 .0115 .0494 .0395 .0708 .0395 .0708 .0395 .0708 .0395 .1077 .1211 .1350 U IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [PROTON]. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 3.2 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 9) OATA IS AVERAGED OVER LABORATORY BEAP MOMENTUM FROM .700 TO .725 GEV/C.

-U	0- 5 I GMA	/D-U
(GEV/C]**2	MB/(GEV/	C1++2 [1]
.0001	288.60 +-	17.60
.0004	300.00	16.90
.0010	276.10	8.40
.0019	249.70	8.90
.0031	242.30	5.60
.0047	204.10	9.00
.0076	196.60	6.40
.0124	164.00	5.90
.0182	154.10	6.00
.0429	111.81	4.02
.0532	96.18	3.72
.0640	58.25	3.72
.0759	81.44	3.41
.0684	77.39	3.31
.1016	69.06	1.92
.1155	62.65	1.90
.1299	58.83	1.65
.1445	51.8C	2.20

U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). (1) Plus possible systematic error of +- 3.1 per cent.

FLASTIC DIFFEBENTIAL CRUSS SECTION FOR NEUTRON PROTON. (TABLE 10) Data is averaged over laeopatory beam momentum from .725 to .760 gev/c.

-u		0-SIGM4	1/C-U				
(GEV/C)*	*2	M8/(GEV/	(1) \$**(1)				
.0001		323.30 +-	- 14.90				
.0004		271.90	9.20				
.0011		257.80	7.00				
.0021		221.20	7.20				
.0034		194.30	7.20				
.0051		182.10	7.20				
-0081		158.40	4.80				
.0135		144.20	4.60				
•0200		132.00	4.60				
.0464		56.74	3.22				
.0574		88.32	3.02				
.0693		81.73	2.92				
.0823		66.08	2.62				
.0957		65.14	2.61				
-1100		59.83	1.59				
.1248		54.69	1.51				
.1407		49.42	1.37				
.1564		43.30	1.60				
.1732		39.50	1.60				
UIST	HE MOMENTUM	TRANSFER BE	TWEEN THE	LINCOMING	NEUTRONI	AND THE	[PROTON].
£13 0	Chè aùssioil	SYSTEMATIC	ERROR OF	+- 3 PER 4	CENT		

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NATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .81 TO .85 GEV/C.

	0.51644	10-11
-0	U- 31 64 A	/0-0
(GEV/C)**2	MB/(GEV/	C)##2 [1]
.0001	238.00 +-	11.80
.0005	234.30	7.30
.0013	214.70	6.10
.0026	195.10	6.20
.0043	149.90	5.90
.0063	131.00	5.70
.0102	125.00	3.90
.0168	118.80	3.90
. 0350	103.00	3.70
.0582	73.89	2.64
.0717	50.47	2.37
.0860	55.47	2.31
.1018	48.44	2.09
.1189	46.05	2.08
.1367	41.67	1.21
.1555	37.34	1.14
.1743	33.42	1.10
.1937	29.40	1.20
.2137	28.50	1.30

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U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON).

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 2.4 PER CENT.

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[TABLE 12]

ER LABOFATORY BEAP M D-SIGMA/D-U MB/(GEVC)+2 (1) 227.00 \leftarrow 10.60 153.00 5.10 180.1C 5.60 180.1C 5.60 124.6C 5.40 124.6C 5.40 124.6C 5.40 124.6C 3.20 82.8C 3.20 66.3 2.31 60.35 2.21 54.36 2.09 47.43 1.85 40.13 1.73 36.74 1.61 36.64 .96 25.9C 1.00 25.9C 1.00 23.20 1.10 -U (GEV/C)4*22 .0001 .0005 .0015 .0029 .0047 .0113 .0187 .0274 .0365 .0793 .1134 .1314 .1314 .1314 .1314 .2136 .2366 .2293

U IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [PROTON].

[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 2.1 PER CENT.

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FROM .85 TO .90 GEV/C.

ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [TABLE 13] DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FREM .90 TO .95 GEV/C.

-0	D-SIGMA/D-U
(GEV/C)++2	MB/(GEV/C)**2 [1]
.0001	207.70 +- 10.20
.0007	2C4.CO 6.40
.0017	177.70 4.80
.0032	152.20 5.30
.0053	140.60 5.50
.0078	111.00 4.70
.0127	104.50 3.30
.0208	76.00 2.90
.0562	. 61.19 2.30
.0718	53.53 2.14
.0883	48.4C 1.99
.1669	45.31 1.95
.1262	39.18 1.60
+1469	33.42 1.65
.1687	29.94 .94
.1912	24.40 1.00
-2144	21.50 1.00
.2385	21.40 1.00
.2624	19.90 1.00
.2887	20.10 1.00
.4125	24.48 1.23
.4365	26.88 1.32
.4597	29.09 1.32
.4824	30.60 1.41
.5048	31.42 1.51

U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON).

(1) PLUS POSSIBLE SYSTEMATIC ERROR OF - 2 PER CENT.

[TABLE 14]

ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.

DATA IS AVERAGED OVER LABORATORY BEAM MOMENTUM FRCM .95 TO 1.00 GEV/C.

-U	D-SIGPA/D-U	
(GEV/C)++2	R87(GEV/1.1##7 111	
.0001	195.60 +- 10.00	
.0007	182.60 6.00	
.0016	165.60 4.60	
.0036	143.70 4.80	
.0058	120.10 4.80	
.0087	107.30 4.70	
-0140	\$1.30 3.10	
.0228	75.00 2.90	
.0476	59.86 2.31	
+0625	56.15 2.15	
.0794	45.66 1.88	
.0984	40.57 1.85	
.1185	33.52 1.70	
.1400	30.97 1.55	
.1625	25.53 1.41	
.1868	22.43 .8Ì	
.2115	20.70 .90	
.2372	17.00 .90	
.2646	15.20 .80	
.2909	16-00 .90	
.3179	15.90 .90	
.4282	18.97 1.03	
.4539	22.32 1.13	
.4787	23.01 1.22	
.5044	27.37 1.32	
.5310	28.47 1.41	
.5533	28.09 1.41	
. 5773	33.66 1.61	

U IS THE MOMENIUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE (PROTONI.

[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 2 PER CENT.

FLASTIC DIFFERENTIA	AL CRESS SECTION I	FCR NEUTREN PROT	IN. (TABLE 15)		
DATA IS AVERAG	SEG LVEK LAULKAID	RY BEAR HUMENIUM	PRUM 1.0 10 1.1 GEV/C.	•	
-u	. D-SIGMA/	0-U			
(GEV/C]++2	P8/(GEV/C)**2 [1]			
.0002	159.90 +- 0	6.70			
-0008	154.90	4.20			
.0021	137.50	3.50			
.0041	120.30	3.40			
.0068	100.50	3.40			
.0100	\$3.EC 3	3.30			
-0161	74.60	2.10			
-0267	64.40	2.00			
.0393	54.EC	1.80			
.0549	49.12	1.69			
.0721	44.76	1.51			
.0912	38.96	1.48			
-1122	31.89	1.30			
.1357	26.74	1.13			
.1603	24.42	1.10			
.1862	18.95	.94			
.2135	17.24	.50			
-2422	15.50	.60			
.2707	12.60	.50			
.3023	12.20	.50		•	
.3316	11.30	.50			
.3634	12.40	.60			
.4850	16.79	.74			
.5153	17.50	•73			
.5443	20 - 21	.83			
.5744	21.58	•72			
.6036	23.76	.92			
+6285	25.65	1.01			
6553	29.78	1.11			
#Ú Ť ŮĴ	52+01	1.31			
ELASTIC DIFFERENTIA	AL CROSS SECTION (FCR NEUTRCN PROTI	DN. (TABLE 16)		
ELASTIC DIFFERENTIA	AL CROSS SECTION F	FCR NEUTRCN PROTI	DN. (TABLE 16)		
ELASTIC DIFFERENTIA DATA IS AVERAG	AL CROSS SECTION I	FCR NEUTRCN PROTO	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U	AL CROSS SECTION I SED OVER LARCRATCI D-SIGMA/I	FCR NEUTRCN PROTI Ry beam womentum C-U	JN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC	L CROSS SECTION I SED OVER LARGRATGI D-SICMA/I PB/IGEV/C	FCR NEUTRCN PROTO Ry beam Mgmentum C-U 1**2 (1)	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)*+2 -0002	L CROSS SECTION I SED OVER LABORATO D-SIGWA/I PB/IGEV/C 136-70 +- 1	FCR NEUTRCN PROTI Ry beam mgmentum C-U 1++2 (1) 6-20	JN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)++2 -0002 -0010	AL CROSS SECTION (SED OVER LABERAATG) D-SIGMA/(MB/(GEV/C 136-70 +- 115-10	FCR NEUTRCN PROTO RY BEAM MCHENTUM C-U 1**2 (1) 6-20 3-60	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -0002 *0010 *0225	AL CROSS SECTION I SED OVER LAPCRATGI D-SIGMA/I MB/GEV/C 136.70 +- 115.10 110.40	FCR NEUTRCN PROT RY BEAM MGMENTUM C-U 10+22 (1) 6-20 3-60 3-60	JN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)++2 -0010 -0010 -0025 -0049	AL CROSS SECTION / SED OVER LABERATGI D-SIGWA/I MB/IGEV/C 136.70 +- 115.10 110.40 95.50	FCR NEUTRCN PROTO RY BEAM MGMENTUP C-U 1+2 (1) 6.20 3.60 3.60 3.00 3.00	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (EEV/C)++2 -0002 -0010 -0025 -0049 -0061	AL CROSS SECTION I SED OVER LAPERATGI D-SIGMA/I MB/GEV/C 136.70 +- (115.10 110.40 95.50 80.70	FCR NEUTRCN PROT RY BEAM MGMENTUM C-U 10+2 (1) 6.20 3.60 3.60 3.60 3.60 3.60 3.60 3.60	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0049 -0049 -0041 -0121	AL CROSS SECTION / SED OVER LAPORATO D-SIGWA/ 18/164/C 136.70 +- 115.10 10.40 95.50 90.71 64.50 64.50	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1**2 (1) 6-20 3.60 3.60 3.00 3.00 3.00 3.00 3.00 3.0	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (CEV/C)++2 .0010 .0010 .0025 .0049 .0049 .0049 .0049 .0049 .0049 .0049 .0011 .0121 .0192	AL CROSS SECTION I SED OVER LARGRATGI MB/GEV/C 136.70 +- (115.10 110.40 95.50 80.70 64.50 55.50 54.50	FCR NEUTRCN PROTU RY BEAM MCMENTUM C-U 10-2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0049 -0141 -0121 -0192 -0319	AL CROSS SECTION SED OVER LAPERATO D-SIGPA/I 18/168//C 15.10 10.40 10.40 95.50 90.70 64.50 55.90 43.50 43.50	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1**2 (1) 6-20 3.60 3.60 3.00 3.00 2.80 1.80 1.80 1.80 1.90	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	• • • • • • • • • • • • • • • • • • •	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0121 -0121 -0192 -0319 -0472 -0472	AL CROSS SECTION I SED OVER LABERATGI MB/GEV/C 136.70 +- (115.10 110.40 95.50 00.7(64.50 55.5(41.2) 41.2(3.2)	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 10*2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.60 1.50 56	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.	• • • • • • • • • • • • • • • • • • •	
ELASTIC DIFFERENTIA DATA IS AVERAC -U (CEV/C)**2 -0002 -0010 -0025 -0049 -0049 -0121 -0121 -012 -0192 -0319 -0319 -0513	AL CROSS SECTION / SED OVER LABORATO D-SIGPA/I NB/(GEV/C 136.70 +- 115.10 10.40 95.50 90.70 90.70 90.70 90.70 91.50 91.50 92.50 93.50 94.50 94.50 95.50	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1**2 (1) 6-20 3.60 3.60 3.00 3.00 3.00 1.60 1.80 1.80 1.60 1.50 1.55 1.51	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	• • • •	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (GEV/C)++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0121 -0192 -051 -0651 -0651 -0651	AL CROSS SECTION / SED OVER LABERATO D-SIGPA/I PB/GEV/C 136.70 +- (115.10 95.50 90.70 64.50 55.90 41.20 33.28 28.45 23.51	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1+*2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.60 1.50 •\$9 1.23 1.05	DN. (TABLE 16) FRCV 1.1 TO 1.2 GEV/C.	• • • • • • • • • • • • • • • • • • •	
ELASTIC DIFFERENTIA DATA IS AVERAC -U (CEV/C)++2 -0002 -0010 -0025 -0049 -0049 -0121 -0121 -0121 -0121 -012 -0513 -0651 -0653 -1065 -1362	AL CROSS SECTION / SED OVER LABORATO D-SIGPA/J B/(GEV/C 136.70 +- 115.10 +0 10.40 95.50 90.70 60.70 64.50 55.90 43.50 43.50 43.50 43.50 43.50 43.20 28.45 28.45 23.51 16.22	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1002 (1) 6.20 3.60 3.60 3.60 3.60 3.60 3.60 1.60 1.60 1.50 1.50 1.50 1.51 2.23 1.05 2.89	. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	• •	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (GEV/C)++2 -0002 -0010 -0025 -0049 -0040	AL CROSS SECTION / SED OVER LABERATO/ PB/IGEV/C 136-70 +- (115.10 110.40 95.50 00.7C 64.50 55.5C 41.2C 33.22 28.45 23.51 16.22 16.72	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1+2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.50 .59 1.23 1.95 .97 .97	DN. (TABLE 16) FRCV 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (CEV/C)++2 -0002 -0010 -0025 -0049 -0049 -0041 -0121 -0192 -0319 -0472 -0651 -0653 -1095 -1342 -1413 -1413 -1413	AL CROSS SECTION SED OVER LABORATO D-SIGPATO 10, 10 + 10 + 10 + 10 + 10 + 10 + 10 + 1	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1002 (1) 6.20 3.60 3.60 3.60 3.60 3.60 1.60 1.50 1.50 1.50 1.53 1.55 1.53 1.55 1.55 1.23 1.05 1.05 1.	. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (GEV/C)++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0121 -0121 -051 -0651 -0651 -0651 -1342 -1613 -1342 -1613 -1342	AL CROSS SECTION / SED OVER LABERATCI PB/IGEV/C 136.70 +- (115.10 110.40 95.50 00.7C 64.50 55.9C 41.2C 33.22 28.45 23.51 16.22 16.72 15.70 12.73	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1+*2 (1) 6.20 3.60 3.60 3.60 3.60 3.60 1.60 1.80 1.80 1.80 1.60 1.50 .59 1.23 1.05 89 82 89 .87 .89	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (EEV/C)++2 -0002 -0010 -0025 -0049 -0041 -0121 -0192 -0319 -0472 -0651 -0853 -1095 -1342 -1613 -1542 -2562	AL CROSS SECTION SED OVER LABORATO D-SIGPAJ B/(GEV/C 136.70 115.10 10.40 95.50 90.70 64.50 55.90 43.50 43.50 43.50 43.50 43.50 43.50 16.22 16.72 13.72 12.73 11.53	FCR NEUTRCN PROTU RY BEAP MGMENTUP C-U 1+2 (1) 6-20 3.60 3.60 3.00 3.00 3.00 1.60 1.50 .59 1.23 1.05 .59 .23 .05 .59 .23 .05 .60 .42 .60 .42 .60 .42 .60 .50 .59 .23 .60 .42 .60 .50 .59 .59 .42 .42 .42 .44 .45 .45 .45 .45 .45 .45 .45	. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0061 -0121 -0192 -0319 -0472 -0651 -0853 -1095 -1342 -1613 -1950 -2222 -2886	AL CROSS SECTION / EED OVER LABEGRATCI PB / (GEV/C 136.70 +- (115.10 - 110.40 95.50 00.7C 64.50 55.9C 41.2C 33.22 28.45 16.62 16.62 16.72 15.73 11.93 10.13	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1++2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA OATA (S AVERAC -U (CEV/C)**2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0121 -0192 -0319 -0472 -0651 -0853 -1095 -1342 -1613 -1542 -2252 -2562 -2866 -3728	AL CROSS SECTION SED OVER LABORATO D-SICPAN B/(GEV/C 136.70 115.10 10.40 95.50 90.70 64.50 55.90 43.50 43.50 43.50 43.50 43.50 43.50 16.72 18.45 16.72 15.10 11.43 10.13 8.40	FCR NEUTRCN PROTU RY BEAP MGMENTUP C-U 1+2 (1) 6-20 3.60 3.60 3.00 3.60 3.00 1.60 1.60 1.50 .59 1.23 1.05 .89 .27 .28 .42 .42 .42 .42 .42 .42 .42	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0061 -0121 -0122 -0319 -0472 -0651 -0653 -1095 -1342 -1613 -1905 -2222 -2886 -2256	AL CROSS SECTION 1 D-SICPA/I PB/IGEV/C 136.70 +- 0 115.10 110.40 95.50 00.7C 64.50 55.9C 41.2C 33.22 28.45 16.22 16.72 11.93 10.13 8.40 7.70	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1+*2 (1) 6-20 3.60 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCV 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (EEV/C)+*2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0121 -0192 -0319 -0472 -0651 -0853 -1095 -1342 -1613 -1942 -2222 -25542 -2886 -3228 -3556 -3910	AL CROSS SECTION SED OVER LABORATO D-SICFA/ BJ(GEV/C 136.70 +- 115.10 +0 10.40 95.50 90.7C 64.50 43.5C 43.5C 43.5C 43.5C 43.5C 43.5C 16.72 28.45 16.72 15.7C 11.53 11.53 11.53 8.40 7.70 7.10	FCR NEUTRCN PROTI RY BEAP MGMENTUP C-U 1002 (1) 6.20 3.60 3.60 3.60 3.60 3.60 3.60 1.60 1.50 1.50 1.50 1.53 1.65 89 87 89 87 42 42 42 42 40 40 40 40 40 40 40 40 40 40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)++2 -0002 -0010 -0029 -0049 -0049 -0049 -0121 -0121 -0121 -0121 -0121 -0121 -0122 -0319 -0472 -0651 -1095 -1342 -1613 -1905 -2222 -2886 -3228 -3256 -3910 -4300	AL CROSS SECTION SED OVER LABERATO D-SIGMA/ MB/(GEV/C 136.70 +- 0 115.10 110.40 95.50 00.7C 64.50 41.2C 33.22 28.45 16.22 16.72 13.73 11.93 10.13 8.40 7.10 7.10 7.20	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1*22 (1) 6.20 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (EEV/C)+*2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0121 -0192 -0319 -0472 -0051 -0053 -1342 -1613 -1955 -1342 -1613 -1955 -1342 -2866 -3228 -3556 -3910 -4300 -1011	AL CROSS SECTION SED OVER LABORATO D-SIGPA/I BJ(GEV/C 136.70 +- 115.10 10.40 95.50 90.7C 64.50 43.5C 43.5C 43.5C 43.5C 43.5C 43.5C 16.72 28.455 16.72 15.7C 11.53 11.53 11.53 11.53 8.40 7.70 7.10 7.20 -20	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1002 (1) 6.20 3.60 3.60 3.60 3.60 3.00 1.60 1.50 1.50 1.50 1.53 1.05 .59 1.23 1.05 .89 .87 .42 .42 .42 .42 .42 .40 .40 .40 .40 .40 .40 .40 .40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -002 -0049 -0049 -0049 -0049 -0141 -0121 -0121 -0122 -0319 -0472 -0651 -1095 -1342 -1613 -1905 -1342 -2562 -2866 -3228 -3556 -3010 -4300 -4300	AL CROSS SECTION SED OVER LABERATGI D-SIGMA/I MB/IGEV/C 136.70 +- 1 110.40 95.50 00.7C 64.50 41.2C 33.22 28.45 16.22 16.72 13.73 11.93 10.13 8.40 7.10 7.10 7.10 7.10 7.10 7.20 1.2	FCR NEUTRCN PROTO RY BEAP MGMENTUP C-U 1+2 (1) 6.20 3.60 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCM 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA OATA IS AVERAC -U (EEV/C1++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0122 -0319 -0472 -0651 -0853 -1342 -1413 -1150 -2222 -2866 -3226 -3256 -3310 -4300 -111 -5732 -6065	AL CROSS SECTION / ED OVER LABORATGI D-SIGPA/I BJ/(GEV/C 136.70 +- 115.10 110.40 95.50 43.50 43.50 43.50 43.50 43.50 43.50 43.50 11.22 28.45 16.72 15.10 11.93 10.13 8.40 7.70 7.10 7.20 1.20 1.20 1.20 1.20 1.23 4.20 1.27 1.2	FCR NEUTRCN PROTI RY BEAP MCMENTUP C-U 1002 (1) 6-20 3.60 3.60 3.00 3.00 2.80 1.60 1.60 1.50 .59 1.23 1.05 .59 4.23 4.2 .42 .42 .42 .42 .40 .40 .40 .40 .40 .40 .40 .40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 0002 0010 0025 0049 00141 0121 0121 0122 0122 0319 0472 0472 0472 0451 1095 1342 1413 1160 2222 2866 3228 3556 3010 4301 4301 4311 5732 6431	AL CROSS SECTION SED OVER LABERATGI D-SIGWA/I MB/IGEV/C 136.70 +- 1 115.10 95.50 00.7C 64.90 55.9C 41.2C 33.22 28.45 16.22 16.72 13.73 11.93 10.13 8.40 7.10 7.10 7.20 1.20 12.34 13.22	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1+2 (1) 6.20 3.60 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA OATA IS AVERAC -U (EEV/C1++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0192 -0319 -0472 -0651 -0853 -1342 -1413 -1150 -2222 -2562 -2866 -3226 -3516 -3557	AL CROSS SECTION / ED OVER LABORATO D-SIGPA/I BJ/(GEV/C 136.70 +- 115.10 10.40 95.50 90.7C 64.50 43.5C 43.5C 43.5C 43.5C 43.5C 16.72 28.455 16.72 15.70 11.93 10.13 8.40 7.70 7.10 7.20 1.234 13.22 15.47	FCR NEUTRCN PROTU RY BEAP MGMENTUP C-U 1002 (1) 6.20 3.60 3.00 3.00 3.00 2.80 1.60 1.60 1.50 .59 1.23 1.05 .59 4.2 89 .87 .89 .87 .42 .42 .42 .42 .40 .40 .40 .40 .40 .40 .40 .40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/C)**2 -0002 -0010 -0025 -0049 -0011 -0121 -0122 -0149 -0172 -0472 -0472 -0472 -0472 -1613 -1945 -194	AL CROSS SECTION 1 SED OVER LABERATO D-SIGPA/ PB/IGEV/C 136.70 + 115.10 95.50 00.7C 64.90 55.9C 43.9C 41.2C 33.22 28.45 16.22 16.72 15.10 7.70 7.10 7.20 1.00 1.00	FCR NEUTRCN PROTO RY BEAM MGMENTUM C-U 1**2 (1) 6.20 3.60 3.60 1.80 1.80 1.80 1.80 1.80 1.80 1.80 1.8	DN. (TABLE 16) FRCV 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA OATA IS AVERAC -U (EEV/C1++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0122 -0319 -0472 -0651 -0853 -1342 -1413 -1413 -1426 -3228 -3256 -3210 -4300 -4300 -4301 -6757 -7087 -7381	AL CROSS SECTION / ED OVER LABORATO D-SIGPA/I BJ/(GEV/C 136.70 +- 115.10 110.40 95.50 95.50 43.50 43.50 43.50 43.50 43.50 43.50 16.72 28.455 16.72 15.10 11.93 10.13 8.40 7.70 7.10 7.20 10.81 12.34 13.22 15.47 17.69 19.91	FCR NEUTRCN PROTU RY BEAP MCMENTUP C-U 1002 (1) 6.20 3.60 3.00 3.00 3.00 1.60 1.60 1.50 .59 1.23 1.05 .59 1.23 1.05 .59 4.2 .42 .42 .42 .42 .42 .40 .40 .40 .40 .40 .40 .40 .40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (GEV/CI**2 -0002 -0010 -0025 -0049 -0061 -0121 -0122 -0319 -0472 -0651 -1095 -1342 -1613 -1095 -1342 -2866 -3228 -3256 -3256 -3010 -4306 -431 -6757 -7087 -7381 -7556	AL CROSS SECTION 1 SED OVER LABERATO D-SIGPATO 105.10 + 115.10 + 115.10 + 115.10 + 115.10 + 115.10 + 115.10 + 115.10 + 115.10 + 115.10 + 43.70 + 43.90 +- 43.90 +- 43.90 +- 43.90 +- 43.90 +- 43.90 +- 43.90 +- 12.73 +- 16.82 +- 16.82 +- 12.73 +- 11.93 +- 8.40 +- 7.10 +- 7.10 +- 12.31 +- 12.31 +- 12.31 +- 12.31 +- 12.31 + 12.31 +	FCR NEUTRCN PROTU RY BEAM MGMENTUM C-U 1**2 (1) 6-20 3.60 3.60 3.60 1.80 1.80 1.80 1.80 1.50 .50 .52 .89 .89 .89 .87 .89 .89 .89 .89 .89 .89 .89 .89	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	
ELASTIC DIFFERENTIA OATA IS AVERAC -U (EEV/CI++2 -0002 -0010 -0025 -0049 -0049 -0049 -0049 -0049 -0049 -0121 -0121 -0121 -0319 -0472 -0651 -0853 -1342 -1413 -1566 -3228 -2566 -3210 -4308 -4308 -4311 -6757 -7381 -7565 -7985	AL CROSS SECTION / ED OVER LABORATO D-SIGPA/I BJ/(GEV/C 136.70 +- 110.40 95.50 43.22 55.50 43.50	FCR NEUTRCN PROTU RY BEAP MCMENTUP C-U 1+*2 (1) 6-20 3.60 3.00 3.00 3.00 1.60 1.60 1.50 .59 1.23 1.05 .59 1.23 4.0 .64 .62 .42 .42 .42 .42 .42 .40 .40 .40 .40 .40 .40 .40 .40	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.		
ELASTIC DIFFERENTIA DATA IS AVERAC -U (CEV/CI**2 -0002 -0010 -0025 -0049 -0111 -0121 -0192 -0511 -0553 -1095 -1392 -1613 -1110 -2222 -2366 -3228 -3556 -3556 -3512 -6431 -6757 -7087	AL CROSS SECTION 1 SED OVER LABERATO D-SIGWA/ 105.10 +- 0 115.10 +- 0 115.10 +- 0 10.40 95.50 80.70 64.40 95.50 43.50 41.20 33.22 28.45 28.45 28.45 28.45 28.45 16.72 13.70 11.43 8.40 7.70 7.10 7.20 1.	FCR NEUTRCN PROTU RY BEAP MGMENTUP C-U 1**2 (1) 6-20 3.60 3.00 3.00 2.80 1.80 1.80 1.80 1.80 1.95 .50 .51 .89 .89 .89 .82 .82 .82 .82 .82 .82 .42 .40 .40 .40 .40 .51 .51 .52 .89 .89 .89 .89 .89 .80 .80 .23 .80 .80 .80 .80 .23 .80 .23 .80 .80 .80 .23 .80 .80 .80 .23 .80 .80 .80 .80 .80 .80 .80 .80	DN. (TABLE 16) FRCP 1.1 TO 1.2 GEV/C.	•	

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U IS THE MOMENTUM TRANSFER RETWEEN THE CINCOMING NEUTRONI AND THE (PROTCH).

[1] PLUS POSSIBLE SYSTEMATIC EPROR OF +- 3.1 PER CENT.

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-11	C-SICHA	(0-1)					
	0-31 (HA)						
(GEV/C)**2	MB/(GEV/C	.1442 [11]					
.0003	87.80 +-	3.70					
-0012	81.60	2.40					
0033	46 30	3 30					
.0032	03.30	4.20					
.0063	57.60	1.70					
.0102	54.10	1.90					
0152	42 60	1 60					
.0152	42.00	1.00					
.0244	34.80	1.00					
.0397	30.50	1.00					
0591	25.74	. 65					
.0391	23.14			•			
.0815	20.12	+71					
.1074	15.54	.66					
1362	10.75	. 52					
	10115						
.1904	9.18	• 32					
.2023	7.39	.38					
2378	6-14	. 38					
.2370							
•2751	5.51	. 37					
.3134	5.61	.23					
3585	5.25	. 25					
. 3480	4.90	• 30					
.4390	4.50	.30					
- 4863	4.00	. 20					
6240	6 30	10					
• 5268 ·	4.20	+30					
.6558	7.32	.42					
. 6961	8-07	- 42					
3344	10.04	6.7					
./340	10.00	. 22					
.7737	11.52	.62					
8736	14.19	. 71					
	17 74						
	17.30	.01					
.8949	18.80	•81					
. 9301	24.18	1.11					
0433	20 55	1 51					
		1					
.9971	34+11	2.11					
(1) PLUS POSSI	IBLE SYSTEMATIC	ERROR OF +-	4.3 PER CENT	t.			
(1) PLUS POSSI	IBLE SYSTEMATIC	ERROR OF +-	4.3 PER CENT	t. 		 	
(1) PLUS POSSI	IBLE SYSTEMATIC	ERROR OF +-	4.3 PER CENT PROTON.	(TABLE 1		 	
(I) PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE	IBLE SYSTEMATIC	ERROR OF +- For Neutrgn	4.3 PER CENT PROTON.	(TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI 	IBLE SYSTEMATIC L CROSS SECTION ED GVER LABORAT(U-SIGRA)	ERROR OF +	4.3 PER CENT PROTON. ENTUM FROM 1.	(TABLE 1 .4 TO 1.6 GE		 	
(L) PLUS POSSI 	IBLE SYSTEMATIC	ERROR OF +-	4.3 PER CENT PROTON.	(TABLE 1 .4 TO 1.6 GE		 	
<pre>[1] PLUS POSSI =</pre>	IBLE SYSTEMAIIC L CROSS SECTION ED OVER LAPORATO U-SIGMA, MB/(GEV/C	ERROR OF +-	4.3 PER CENT PROTON. ENTUM FROM 1.	(TABLE 1 .4 TO 1.6 GE		 	
(I) PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 -0003	IBLE SYSTEMATIC 	ERROR OF +- FOR NEUTRGN)RY BEAF MCMI 'U-U :) ++2 [1] 3.30	4.3 PER CENT	(TABLE 1 .4 TO 1.6 GE		 	
<pre>[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA 15 AVERAGE -U (GEV/CI+*2 .0003 .0016</pre>	IBLE SYSTEMAIIC 	EPROR OF +- FOR NEUTRGN JRY BEAF MCMI 'U-U)++2 [1] 3.30 2.30	4.3 PER CENT PROTON.	(UN) AND THE T. (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)++2 -0016 -0043	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABORAT(U-SICFA) MB/(GEV/ 57.00 +- 50.40 44.70	ERROR OF +- FOR NEUTRGN)RY BEAF MCMI /U-U 11+42 [1] 3-20 2-30 2-60	4.3 PER CENT PROTON.	T. (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (EEV/C)++2 .0003 .0016 .0043	IBLE SYSTEMAIIC 	EPROP OF +-	4.3 PER CENT	T. (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA 15 AVERAGE (GEV/C)+2 .0003 .0016 .0016 .0043 .008	IBLE SYSTEMAIIC 	ERROR OF +-	4.3 PER CENT	T. (TABLE 1 .4 TO 1.6 GE		 	-
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI++2 .0003 .0016 .0013 .0084 .0137	IBLE SYSTEMATIC 	ERROR OF +-	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 .0003 .0016 .0043 .0084 .0137 .023	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON JRY BEAF MCMI (U-U 1)*22 [1] 3.30 2.60 1.60 1.60	4.3 PER CENT	τ. (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON IRY BEAF MCMI U-U 1)++2 [1] 3-30 2-30 2-30 1-60 1-60 1-50 -90	4.3 PER CENT PROTON.	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA 15 AVERAGE -U (EEV/C)**2 .0003 .0016 .0043 .0064 .0137 .0237 .0235 .0326	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON JRY BEAF MCMI 'U-U 1.402 [1] 3.30 2.60 1.60 1.60 1.50 .90	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON IRY BEAF MCHI /U-U 1.4-2 [1] 3.30 2.30 1.60 1.60 1.50 1.50 .80 .80	4.3 PER CENT	(TABLE 1 (TABLE 1		 	-
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (EEV/C)+*2 .0003 .0016 .0043 .003 .003 .003 .003 .003 .003 .00	IBLE SYSTEMATIC L CRCSS SECTICN ED GVER LAPCRATC WB/GEV/C 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 14.10	ERROR OF +-	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 -0003 -0016 -0043 -0084 -0137 -0203 -0325 -0536 -0788 -1688	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCHI //	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE	 181 :v/C.	 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABERAT(U-SICFA) MB/(GEV/C 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39	ERROR OF +- FOR NEUTRON INY BEAF MCMI /U-U IN+02 [1] 3-30 2-30 2-30 1-60 1-60 1-50 -90 -89 -49 -43 -54	4.3 PER CENT	(TABLE 1 (TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA 1S AVERAGE -U (GEV/CI++2 .0003 .0016 .0043 .0064 .0037 .0203 .0325 .0536 .0788 .1688 .1688 .1688 .1695	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON WY BEAF MCMI (U-U (1)+02 [1] 3.30 2.60 1.60 1.60 1.60 1.60 1.60 1.60 1.50 .60 .43 .54 .53	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0016 .0016 .0043 .0044	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCHI /U-U 11+2 [1] 3-30 2-30 2-30 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-60 1-51 	4.3 PER CENT	(TABLE 1 (TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAI DATA IS AVERAGE -U (GEV/C)**2 .0003 .0016 .0064 .0137 .0203 .0034 .0137 .0225 .0536 .0788 .1688 .1433 .1805 .2232	IBLE SYSTEMAIIC L CROSS SECTION ED GVER LARCRAIG WB/(GEV/C) 57.00 +- 50.40 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77	ERROR OF +- FOR NEUTRON (V-U 1)*02 [1] 3.30 2.30 2.30 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.50 .60 .49 .43 .54 .33	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 .0003 .0016 .0043 .0064 .0037 .0203 .0137 .0203 .0376 .0336 .1433 .1805 .2232 .2648	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCHI (1-4) (1-4	4.3 PER CENT	KUNJ AND TRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAILC L CRCSS SECTICN ED CVER LABORAT(U-SICFA) MB/(GEV/C 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.95	ERROR OF +- FOR NEUTRON IV-U IV-U IV-2 [1] 3.30 2.30 2.30 2.30 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.50 .59 .59 .59 .59 .59 .53 .39 .39 .39 .39 .39 .39 .39 .3	4.3 PER CENT	(TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 .0003 .0016 .0043 .0064 .0037 .0203 .0036 .0034 .0036 .0036 .0325 .0536 .0536 .1433 .1688 .1433 .1605 .2322 .2448 .3131 .3131	IBLE SYSTEMATIC 	ERROR OF +- FOR NEUTRON JRY BEAF MCMI (U-U 1)*22 [1] 3.30 2.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.50 .90 .43 .53 .33 .33 .33 .33 .33 .33 .3	4.3 PER CENT	KUN] AND THE (TABLE 1 .4 TO 1.6 GE		 	
II) PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCMI (U-U)1+2 [1] 3-30 2-30 2-30 1-60 1-60 1-60 1-60 1-60 1-60 1-60 3-30 -39 -39 -39 -39 -39 -39 -39	4.3 PER CENT	KUN] AND ITE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0003 .0016 .0064 .0137 .0203 .0034 .0137 .0225 .0536 .0788 .1688 .1433 .1805 .2232 .2648 .1433 .1805 .2248 .1311 .3726 .4196	IBLE SYSTEMAILC L CROSS SECTION ED GVER LARCRAIG WB/(GEV/C) 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59	ERROR OF +- FOR NEUTRON (V-U 1)*02 [1] 3.30 2.30 2.30 2.30 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.50 .60 .80 .49 .43 .54 .53 .39 .38 .38 .38 .37	4.3 PER CENT 4.3 PER CENT PROTON. ENTUM FROM 1.	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAT(WB/(GEV/C 57.00 + 50.40 + 50.	ERROR OF +- FOR NEUTRON IRY BEAF MCHI /U-U 1.0-2 [1] 3.30 2.20 2.20 2.20 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 3.30 .20 .31 .33 .33 .33 .33 .33 .33 .33	4.3 PER CENT	ΚΟΝ] ΑΝΟ ΙΤΕ (TABLE 1 .4 ΤΟ 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAIC U-SICFAJ MB/(GEV/C 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.25 3.13 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.13 3.20	ERROR OF +- FOR NEUTRON INY BEAF MCMI /U-U 1)++2 [1] 3.30 2.30 2.30 1.60 1.50 .54 .54 .54 .58 .39 .38 .38 .38 .38 .38 .38 .39 .38 .38 .38 .38 .38 .39 .38 .38 .38 .38 .39 .38 .38 .38 .39 .38 .38 .39 .38 .38 .39 .38 .38 .38 .39 .38 .38 .38 .39 .38 .38 .38 .38 .38 .38 .38 .38	4.3 PER CENT	(TABLE 1 (TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/CI**2 .0003 .0016 .0043 .0064 .0064 .0084 .0137 .0203 .0325 .0536 .0788 .1688 .1688 .1688 .1688 .1688 .1688 .1688 .1433 .1805 .2232 .2648 .3131 .3726 .4196 .4196 .4195 .5814	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON IRY BEAF MCMI (U-U) (U-V) (U-	4.3 PER CENT	ΚΟΝ] ΑΝΟ ΙΤΕ (TABLE 1 .4 ΤΟ 1.6 GE		 	
II) PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCMI (U-U))+*2 [1] 3-30 2-30 2-30 1-60 1-60 1-60 1-60 1-60 3-30 -39 -39 -39 -39 -39 -39 -39 -39	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0003 .0016 .0043 .0084 .0137 .0203 .0025 .0536 .0788 .1688 .1433 .1805 .2232 .2648 .1433 .1805 .2232 .2648 .3131 .3726 .4196 .4196 .4196 .5519 .5536	IBLE SYSTEMAILC L CROSS SECTION ED GVER LARCRAIG WB/(GEV/C) 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.20 3.20 3.20 3.20 3.13 2.59 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.13 2.59 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.13 2.59 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.13 3.25 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.20 3.13 3.25 3.20 3.20 3.20 3.20 3.25 3.22 3.20 3.25 3.22 3.20 3.25 3.22 3.20 3.25 3.22 3.20 3.2	ERROR OF +- FOR NEUTRON IV-U	4.3 PER CENT PROTON. ENTUM FROM 1.	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE	.81 XV/C.	 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAT(D-S16FA) MB/(GEV/(57.00 44.70 40.20 35.20 30.10 21.20 17.40 14.10 14.10 14.10 14.10 14.10 14.10 5.77 3.95 3.13 2.59 3.20 2.20	ERROR OF +- FOR NEUTRON IRY BEAF MCHI /U-U 11+2 [1] 3.30 2.00 2.00 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 3.30 2.00 .43 .53 .39 .38 .37 .20 .20 .20 .20 .20 .20 .20 .20	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAIC U-SICFAJ MB/(GEV/C 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 2.20 2.20	ERROR OF +- FOR NEUTRON INY BEAF MCMI /U-U 1)++2 [1] 3.30 2.30 2.30 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 1.60 2.30 .54 .54 .53 .38 .38 .38 .38 .38 .38 .38 .3	4.3 PER CENT	(TABLE 1 (TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE U (GEV/CI**2 -0003 -004 -0043 -0043 -0043 -0044 -0137 -0203 -0235 -0536 -0788 -1688 -1688 -1433 -1688 -1433 -1685 -2322 -2648 -3131 -3726 -4196 -4195 -5194	IBLE SYSTEMATIC L CRCSS SECTICN ED CVER LAPCRATC WB/GEV/C 57.00 +- 50.4C 40.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.13 3.25 3.13 3.25 3.25 2.50 2.20 2.20 2.20 1.46	ERROP OF +- FOR NEUTRON (U-U 1)**2 [1] 3.30 2.30 2.50 1.60 1.50 .90 .20 .49 .33 .39 .39 .39 .39 .39 .39 .3	4.3 PER CENT	ΚΟΝ] ΑΝΟ ΙΤΕ (TABLE 1 .4 ΤΟ 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCM (U-U)1+2 [1] 3-30 2-30 2-30 1-60 1-60 1-60 1-60 1-60 3-30 -20 -20 -33 -35 -35 -35 -35 -35 -35 -35	4.3 PER CENT	KUN] ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAI DATA IS AVERAGE -U (GEV/C)**2 .0003 .0016 .0043 .0084 .0137 .0203 .0025 .0536 .0748 .1688 .1433 .1805 .2232 .2648 .1433 .1805 .2232 .2648 .3131 .3726 .4196 .4196 .4196 .4196 .4336 .3728 .4196 .4196 .435 .7988 .6362 	IBLE SYSTEMAIIC L CROSS SECTION ED GVER LARCRAIG WB/(GEV/C) 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.13 2.59 3.20 3.20 1.74 2.50 2.20 2.20 1.74 2.36	ERROR OF +- FOR NEUTRON ('U-U 1)*2[11] 3.30 2.30 2.30 1.60	4.3 PER CENT PROTON. ENTUM FROM 1.	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAT(U-S16FA) HB/(GEV/ 57.00 +- 50.40 40.20 35.20 30.10 21.20 17.40 14.10 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 2.20 2.20 2.20 2.20 2.20 2.20 2.20 2.36 2.20	ERROR OF +- FOR NEUTRON RY BEAF MCM. /U-U 1.4*2 [1] 3.30 2.30 2.30 2.30 1.60 1.50 1.60 1.50 .80 .43 .54 .53 .59 .39 .38 .39 .39 .38 .37 .20 .20 .20 .20 .20 .20 .20 .20	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0016 .0014 .0014 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0034 .0036 .0738 .1688 .1688 .1633 .1688 .1688 .1688 .1688 .1688 .1688 .1688 .1688 .1633 .1688 .1688 .1633 .1688 .1688 .1688 .1632 .2322 .2648 .3131 .3726 .3131 .3726 .4795 .5219 .5219 .5219 .5219 .5219 .7986 .6362 .6362 .6362 .6362 .9551	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABECRAIC U-SICFAJ MB/(GEV/C 57.00 +- 50.4C 40.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.10 2.20 1.74 2.50 2.20 1.74 2.36 2.20 1.74 2.36 2.65 3.14	ERROR OF +- FOR NEUTRON DRY BEAF MCM /U-U 1) + 2 [1] 3.30 2.30 2.30 1.60 2.30 .20 .20 .20 .20 .20 .20 .20 .2	4.3 PER CENT	(TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAI DATA IS AVERAGE 	IBLE SYSTEMATIC L CRCSS SECTICN ED GVER LAPECRATC WB/GEV/C 57.00 +- 50.4C 40.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.15 3.13 2.59 3.25 3.25 2.20 2.20 2.20 1.16 4.25 3.44 4.26 2.36 2.46 2.36 2.46 3.44 4.26 3.44 4.26 3.44 4.26 3.44 4.26 3.44 3.45	ERROR OF +- FOR NEUTRON DRY BEAF MCM ('L-U 1)**2 [1] 3.30 2.30 2.30 1.60 1.50 .90 .80 .43 .54 .53 .37 .38 .38 .38 .38 .38 .38 .38 .20 .20 .20 .20 .20 .20 .20 .20	4.3 PER CENT	ΚΟΝΊ ΑΝΟ ΤΤΕ (TABLE 1 .4 ΤΟ 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0016 .0043 .0043 .003 .0137 .0203 .0137 .0203 .0137 .0203 .0137 .025 .0536 .1683 .1683 .1683 .1683 .1683 .1683 .2322 .2648 .3131 .3726 .4196 .4196 .4196 .4196 .4196 .4195 .2171 .5836 .6362 .7781 .7786 .8560 .5051 .7081 .5051	IBLE SYSTEMAIIC 	ERROR OF +- FOR NEUTRON RY BEAF MCM /U-U 1)+*2 [1] 3.30 2.30 2.30 1.60 1.50 .90 .20 .43 .54 .53 .39 .38 .39 .38 .39 .38 .39 .38 .39 .20 .20 .20 .20 .20 .20 .20 .20	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (CEV/C)+*2 .0016 .0043 .0014 .0137 .0203 .0253 .0364 .0148 .1433 .1805 .2232 .2648 .1433 .1805 .2232 .2648 .1433 .1805 .2232 .2648 .1433 .1805 .2232 .2648 .1433 .1805 .2536 .3131 .3126 .4196 .4196 .4791 .5836 .6362 .0791 .7435 .7986 .8660 .5650 .5651 .0090 .0480	IBLE SYSTEMAIIC L CROSS SECTION ED GVER LARCRAIG WB/(GEV/C) 57.00 +- 50.40 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.20 1.74 2.50 2.20 1.74 2.50 2.20 1.74 2.36 2.65 3.14 4.76 4.76 4.76 4.76 4.76 4.76 4.76 4.76 4.76 4.76 4.77 3.75 3.13 4.76 4.77 3.75 3.13 4.76 4.776 4.777 4.7777 4.77777 4.777777777777	ERROR OF +- FOR NEUTRON DRY BEAF MCM /U-U 1)*2 [1] 3.30 2.30 2.30 1.60 2.30 .20 .20 .20 .20 .20 .20 .20 .2	4.3 PER CENT	(TABLE 1 (TABLE 1		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0013 .0043 .0043 .0043 .0037 .0025 .0036 .0788 .1688 .1688 .1688 .1433 .1688 .1695 .2242 .2448 .3131 .3726 .4196 .4196 .4196 .4195 .5219 .7986 .8560 .5051 .0090 1.0480 .10000	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABCRAT(U-S16FA) MB/(GEV/ 57.00 +- 50.40 40.20 35.20 35.20 35.20 17.40 14.10 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.75 3.13 2.59 3.20 2.55 3.14 4.71 4.71 4.21 4.55 5.55	ERROR OF +- FOR NEUTRON RY BEAF MCM /U-U 1.4-2 [1] 3.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.30 2.31 3.31	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE		 	
II) PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAIIC L CRCSS SECTICN ED CVER LABORAT(U-SICHA) MB/(GEV/C) 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.10 2.20 1.74 1.08 9.39 5.375 3.13 2.59 3.22 3.20 2.20 3.13 2.20 3.13 2.20 3.16 2.20 3.16 3.25 3.13 3.26 3.16 4.20 2.46 3.14 4.76 4.77 4.76 4.776 4.76 4.76 4.776 4.776 4.776 4.776 4.777777777	ERROR OF +- FOR NEUTRON DRY BEAF MCM /U-U))+e2 [1] 3.30 2.30 2.30 2.30 1.60 1.50 .50 .50 .50 .50 .59 .39 .39 .38 .38 .38 .38 .38 .38 .38 .38	4.3 PER CENT	(TABLE 1 (TABLE 1 4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAI DATA IS AVERAGE -U (GEV/C)**2 .0003 .0016 .0064 .0137 .0203 .0034 .0137 .0203 .0253 .0378 .1085 .2322 .2448 .3131 .3726 .4196 .41	IBLE SYSTEMATIC L CRCSS SECTICN ED GVER LAECRATC WB/(GEV/) 57.00 +- 50.4C 40.20 35.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.13 2.59 3.22 3.76 2.20 1.74 4.76	ERROR OF +- FOR NEUTRON DRY BEAF MCM //L-U 1)**2 [1] 3.30 2.30 2.30 2.30 2.30 1.60 1.50 .50 .50 .50 .50 .53 .39 .39 .39 .39 .39 .39 .39 .3	4.3 PER CENT PROTON. ENTUM FROM 1.	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE	.81 XV/C.	 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)**2 .0013 .0043 .01433 .1683 .1683 .1683 .2248 .3131 .3726 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4195 .2731 .7356 .5810 .5814 .5814 .5814 .5951 .1090 .10780 .10700 .11700	IBLE SYSTEMAILC 	ERROP OF +- FOR NEUTRON RY BEAF MCM /U-U 1)+2 [1] 3.30 2.30 2.30 1.60 1.50 .20 .20 .43 .54 .53 .53 .39 .38 .37 .38 .39 .38 .37 .20 .20 .20 .20 .20 .20 .20 .20	4.3 PER CENT	(UN) ANU IRE (TABLE 1 -4 TO 1.6 GE		 	
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE -U (GEV/C)+*2 .0016 .0064 .0137 .0203 .0125 .0236 .0748 .1688 .1433 .1805 .2232 .2248 .3131 .3126 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .5217 .5219 .5219 .5219 .5232 .2448 .3131 .3126 .4196 .4196 .4196 .4196 .4196 .4196 .4196 .5217 .5232 .2498 .3131 .3126 .5219 .5219 .5236 .5251 .5236 .5219 .5236 .53566 .53566	IBLE SYSTEMAILC L CROSS SECTION ED CVER LARCRAIC U-SIGFA/ MB/(GEV/C) 57.00 +- 50.40 40.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.75 3.13 2.59 3.20 3.20 3.10 2.20 1.74 2.50 2.20 2.20 1.74 4.76 4.76 4.76 4.70 5.70	ERROP OF +- FOR NEUTRON DRY BEAF MCM (U-U 1) + 2 [1] 3.30 2.30 2.30 2.30 1.60 1.60 1.60 1.60 1.60 1.60 1.60 3.37 .39 .37 .38 .38 .38 .38 .38 .38 .38 .38	4.3 PER CENT	(TABLE 1 (TABLE 1 4 TO 1.6 GE			
[1] PLUS POSSI ELASTIC DIFFERENTIAL DATA IS AVERAGE 	IBLE SYSTEMAILC L CRCSS SECTICN ED CVER LABCRAIG WB/GEV/C 57.00 +- 50.4C 40.20 30.10 21.20 17.40 11.08 9.39 6.90 5.77 3.15 3.15 3.25 2.20 2.78	ERROP OF +- FOR NEUTRON JRY BEAF MCM /U-U 1.942 [11] 3.30 2.30 2.50 1.60 1.50 .90 .20 .49 .33 .39 .39 .39 .39 .39 .39 .3	4.3 PER CENT	KUNJ ANU IRE (TABLE 1 .4 TO 1.6 GE	18) :v/C.		

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON.

DATA IS AVERAGED OVER LARCEATORY BEAM MOMENTUM FROM 1.2 TO 1.4 GEV/C.

U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON).

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[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5.8 PER CENT.

[TABLE 17]

ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 19) DATA 15 AVERAGED OVER LABORATORY BEAM MOMENTUM FROM 1.6 TO 2.C GEV/C. $\begin{array}{c} D=51\,(5\,AA\,/D=U\\ MB/\,(5\,EV/C)++2\ (1)\\ 36\,,100\ (-2,50\\ 32\,,10\ (-2,50\\ 32\,,10\ (-1,00\\ 23\,,90\ (-1,00\\ 23\,,90\ (-1,00\\ 14\,,20\ (-70\\ 14\,,20\ (-70\\ 14\,,20\ (-70\\ 16\,,10\\ 16\,,12\\ 5\,,39\ (-1,0)\\ 5\,,19\ (-2,1)\ (-2,1)\ (-2,1)\\ 5\,,19\ (-2,1)\$ D-SIGMA/D-L (GEV/C)**2 +0004 +0023 +0059 .0114 .0278 0441 0722 1070 1922 .21 .27 .27 5:90 3:11 7:54 1:98 2985 4318 4826 1.56 1.41 1.90 1.50 1.40 1.10 1.00 1.00 1.51 1.06 1.57 2.59 .26 5587 26 6143 .10 7698 .10 8308 .8916 . 10 . 1 1 0980 •11 •22 1630 2540 .11 .11 .21 .31 .31 .71 .51 .81 1.01 2930 3630 3.60 3.61 5.68 6.50 8.45 1.48/0 1.5170 1.5500 1.6240 U IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE (PROTON). (1) PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7.7 PER CENT. FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [TABLE 201 LABORATORY BEAM ENERGY . .182 GEV (MEAN VALUE). (THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY) FITTED FORMULA IS D-SIGMA/D-U = ALPHA+[EXP(BETA+U]]+GAMMA+[EXP(DELTA+U]] WHERE D-SIGMA/D-U IS IN MD/(GEV/C)++2 AND U IS IN (GEV/C)++2. U IS THE MOMENTUM TRANSPER BETWEEN THE (Incoming Neutron) and the (proton). FITTED VALUES ALPHA = .4C +- .C3 BETA = 208. +- 44. Gamma = .60 +- .C3 DELTA = 9.7 +- .7 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PRCTON. [TABLE 20] LABORATORY BEAM ENERGY = .195 GEV (MEAN VALUE). T INE +11 IS PERFURMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY) Fitted formula IS D-Sigma/D-U = Alpha+(Exp(Beta+u))+Gamma+(Exp(Delta+u)) WHERE C-SIGMA/D-U IS IN MB/IGEV/CI**2 AND U IS IN IGEV/CI**2. U IS THE MOMENTUM TRANSFER BETWEEN THE [INCCMING NEUTRON] AND THE (PROTON). FILLED VALUES ALPHA = .44 +- .C2 BETA = 238. +- 52. GAMMA = .56 +- .C2 DELTA = 9.2 +- .5 FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 20] LABORATORY BEAM ENERGY = .21 GEV (MEAN VALUE). (THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY) FITTED FORMULA IS O-SIGNA/D-U = ALPMA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U)) WHERE D-SIGNA/D-U IS IN MB/(GEV/CI**2 AND U IS IN (GEV/CI**2. U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOVINC NEUTRON) AND THE (INCOTON). FITTED VALUES ALPHA = .42 +- .C2 BETA = 203. +- 34. GAMMA = .5E +- .C2 DELTA = 9.4 +- .5 . FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [TABLE 20] LABORATORY BEAM ENERGY = .224 GEV (MEAN VALUE). (THE FIT IS PERFORMED EEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY) FITTED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U)) WHERE D-SIGMA/D-U IS IN ME/IGEV/CI**2 AND U IS IN IGEV/CI**2. U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). FITTED VALUES ALPHA = .44 +- .C2 BETA = 177. +- 21. GAMMA = .56 +- .C2 DELTA = 8.9 +- .4

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FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                        TABLE 201
       LABORATOPY BEAM ENERGY = .239 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMEC CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U))
                 WHERE D-SIGMA/D-U IS IN MR/(GEV/CI++2 AND U IS IN (GEV/CI++2. U IS THE MOMENTUM TRANSFER BETWEEN THE
(INCOMING NEUTRON) AND THE (PROTON).
      FITTED VALUES
                 ALPHA = .48 +- .C2
BETA = 135. +- 2C.
GAMMA = .52 +- .C2
DELTA = 7.5 +- .4
    FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                        TABLE 201
      LABORATORY BEAM ENERGY = .257 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMEC CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+[EXP(BETA+U])+GAMMA+[EXP(DELTA+U]]
                 WHERE D-SIGMA/D-U IS IN MB/(GEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
Lincoming Neutron) and the (Proton).
      FITTED VALUES
                 ALPHA = .510 +- .015
BETA = 222. +- 25.
GAMMA = .45C +- .015
DELTA = 7.6 +- .3
             FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                       [TABLE 20]
      LABORATORY BEAM ENERGY = .313 GEV (MEAN VALUE).
      ( THE FIT IS PERFCRMED CEMANCING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U))
                WHERE D-SIGHA/O-U IS IN M8/IGEV/CI++2 AND U IS IN (GEV/C)++2. U IS THE MOMENTUM TRANSFER BETWEEN THE
(INCOMING NEUTRON) AND THE (PROTON).
      FITTED VALUES
                 ALPHA = .540 +- .015
BETA = 204. +- 25.
GAMMA = .46C +- .015
DELTA = 7.2 +- .2
        FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                        [TABLE 20]
      LABORATORY BEAN ENERGY . . . 343 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U))
                WHERE D-SIGMA/D-U IS IN MB/IGEV/CI**2 AND U IS IN (GEV/CI**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
LINCOMING NEUTRONJ AND THE (PROTON).
      FITTED VALUES
                 ALPHA = .580 +- .013
BETA = 175. +- 15.
GAMMA = .42C +- .013
DELTA = 6.8 +- .2
     FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                        [TABLE 20]
      LABORATORY BEAM ENERGY = .378 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS O-SIGMA/D-U = ALPHA+[EXP(BETA+U]]+GAMMA+[EXP(DELTA+U]]
                WHERE C-SIGMA/D-U IS IN NB/(GEV/CI++2 AND U IS IN (GEV/CI++2. U IS THE MOMENTUM TRANSFER BETWEEN THE
[INCOMING NEUTRON] AND THE (PROTON).
      FITTED VALUES
                ALPHA = .500 +- .015
BETA = 160. +- 15.
GAMMA = .420 +- .015
DELTA = 6.4 +- .3
   FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                        [TABLE 20]
      LABORATORY BEAN ENERGY = .414 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+[EXP(BETA+U)]+GAMMA+[EXP(DELTA+U]]
                WHERE D-SIGMA/D-U IS IN MB/IGEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
[Incoming Neutron] and the (proton).
      FITTED VALUES
                ALPHA = .570 +- .016
BETA = 157. +- 16.
GAMMA = .430 +- .016
DELTA = 7.2 +- .3
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FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                  (TABLE 20)
      LABORATORY BEAP ENERGY = .466 GEV (PEAN VALUE).
      ( THE FIT IS PERFORMED CEPANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(CELTA+U))
               WHERE O-SIGMA/D-U IS IN ME/(GEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
(INCOMING NEUTRON) AND THE (PROTON).
      FITTED VALUES
               ALPHA = .540 +- .014
BETA = 146. +- 14.
GAMMA = .46C +- .014
DELTA = 7.3 +- .3
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                   [TABLE 20]
      LABORATORY BEAM ENERGY = .542 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED-TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+[EXP{BETA+U}]+GAMMA+[EXP{DELTA+U}]
             WHERE D-SIGMA/D-U-IS IN ME/(GEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
LINCOMING NEUTRON, AND THE (PRUIDN).
      FITTER VALUES
               ALPHA = .570 +- .016
BETA = 122. +- 11.
GAMMA = .430 +- .C16
DELTA = 7.8 +- .4
  . . . . . . . . . . . . . . . . . .
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON.
                                                                                  TABLE 201
      LABORATORY BEAM ENERGY . .649 GEV (MEAN VALUE).
     ( THE FIT IS PERFORMED DEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS O-$16MA/D=U = ALPMA+CEXPIBETA+UI)+GAMMA+(EXPIDE,IA+U))
               WHERE U-SIGMA/U-U IS IN H8/(GEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE
[INCOMING NEUTRON] AND THE (PROTON).
      FITTED VALUES
               ALPHA = .49 +- .02
BETA = 162. +- 18.
GANMA - .51 +- .C2
DELTA = 9.9 +- .3
  ELT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON AROTON
                                                                                   (TARLE DO)
      LABORATORY BEAM ENERGY = .817 GEV (MEAN VALUE).
      ( THE FIT IS PERFORMED CEMANCING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGNA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U))
               WHERE D-SIGMA/D-U IS IN MB/IGEV/C)**2 AND U IS IN (GEV/C)**2. U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE LPROTONI.
      FITTED VALUES
               ALPHA = .58 +- .03
BETA = 65. +- 7.
Gamma = .42 +- .03
DELTA = 6.5 +- .7
  FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON.
                                                                                   [TABLE 20]
      LABORATORY BEAM ENERGY = 1.028 GEV (MEAN VALUE).
     ( THE FIT IS PERFORMED CEMANDING (ALPHA+GAMMA) NORMALIZED TO UNITY )
FITTED FORMULA IS D-SIGMA/D-U = ALPHA+(EXP(BETA+U))+GAMMA+(EXP(DELTA+U))
      WHERE G-SIGMA/D-U IS IN MB/(GEV/CI*+2 AND U IS IN (GEV/CI++2. U IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON).
      FITTED VALUES
               ALPHA = .60 +- .05
BETA = 56, +- 11,
GAMMA = .4C +- .C5
DELTA = 6.2 +- 1.2
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<pre>classical_classical_prove</pre>		CHARGE SCATTERING AT 8 GEV/C.		MENIO 414, 187 (19	0071	
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<pre>Unit dow</pre>	ABSTRACT THE DI MEASURED AT 8 O.5(GEV/CI-SQU ANALYZED. A VAI CBTAINED FOR T EXCHANGE CROSS COMPARED NITH D-S1GMA/D-T PR NITH ENERGY. F: SPIN-DEFEMDENT COMPARISONS NI REGGE PDLE APP UTA OND DESIN	FFERENTIAL CRCSS SECTICN FOR EL GEV/C OVER FORWARC LABORATORY S AREOJ. THE METHOD UTILIZEC ACOU UUE OF ID-SIGMA/D-OMEGALLABJ] HE FORWARD DIFFERENTIAL (ROSS-S SECTION. BOTH CRCSS SECTIONS SECULTS AT LCWER ENERGIES. FURT EVIOUSLY OBSERVED FOR -T < 0.05 MOT -T >0.1 HOWEVER, ENERGY DEP ANC/OR THAT THE REAL PARTS OF ANC/OR THAT THE REAL PREDICTIONS ROACH OF ANMADIADEN. THE MODEL	ASTIC CHARGE-E CATTERING ANGL STIC SPARK CHA (22 + - 6)PB/S ECTION AND AN HER CCMPARISON (), IS STILL PRE ENDENCE IS APP THE SCATTERING SHOW GOOL AGRE OF RINGLAND AN	XCHANGE SCATTERING ES (0-901MRAD (SOU MBERS AND ABOUT 19 RIC-SIGMA/C-T = (0 ESTIMATED (0.06 +- SEC VALUES EXPECTE (SNOHS THAT THE NA SENT AT B GEV/C, V ARENT, THE RESULTS AMPLITUDES IN THE EMENT HITH THE VAL D PHILLIPS FOR SIN WA AT -T ADDON'LM	DF NEUTRGNS ON F ARE DF FGUR-POME 00 ELASTIC-SCATTE -93 ← 0.281MB/(0.03) MB FOR THI D FRGM POMERANCH PRGM FORWARD PEA APVING IN SHAPE (4LSO SUGGEST THI ISOSPIN STATES (UE OF FORWARD (GLE-PION EXCHANG)	PPOTONS HAS BEEN VTUM TRANSFER O < -T < RING EVENTS WERE SEV/C-SQUARED) WAS E LASTIC CHARGE JK'S SECCNO THEOREM WHEN (IN THE DISTRIBUTION OF DNLY SLOWLY, IF AT ALL, THE INTERACTION IS D AND I ARE CIFFERENT. DS SECTION GIVEN BY THE E WITH ABSORPTION AGREES OBSERVED
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ATTICLE READ BY DOETTE EDNARY IN 1/45, AND VERIFIED BY LERCY PRICE. B&/ IS ADUITADA GA PROTON AT B GOVCE. THIS EXCREMENTIVUSES STATEME CARPAGES. MEUTRON PROTON ELASTIC CAGOS SECTION. (PAGE 1A7) DATA IS INTEGRATED OVER COSTINETAL FROM FACTON. (PAGE 1A7) DATA IS INTEGRATED OVER COSTINETAL FROM FACTON. (PAGE 1A7) LABORATORY BEF FORTON BEF FORTON	CITATIONS JETP 7 499 (19 CONFERENCE 574 PHYS. REV. LET B1783 (1964), I EANDC CONF. ON PHYS. REV. L27 PHYS. REV. L27 JETP 16 24 (15)	58), ANNALS CF PHYSICS 32, 193 (1962), PHYS. REV. LETIERS 9, FERS 11. 442 (1963), PHYS. REV. PHYS. REV. 137, 1530 (1965), PU NUC. DATA REOUCTIONKARLSRU NUC. DATA REOUCTIONKARLSRU 950 (1962), PHYS. REV. 128, 2 TERS 11, 425 (1963), PHYS. REV. 3), PHYS. REV. 100, 242 (1955)	(1965), PHYS. 509 (1962), PH LEITERS 11, 4 IC. PHYS. 30, 4 HE 426 (1964), 392 (1962), CA LETTERS 15, 3 , AND PHYS. RE	REV. 134, 8633 (15 (YS. LETTERS 4, 19)44 (1563), PHYS. L 175 (1962), NUCLEAR USAEC REPOPT IDO- N. J. PHYS. 40 926 18 (1965), JETP 10 (V. 134, 8630 (1964)	64), PHYS. LETTEF (1963), PHYS. REV ETTERS 7, 365 (1) INSTRUMENTS AND 16880, CERN 62-22 (1962), CAN. J. 1.55 (1960), NUON).	IS 12, 62 (1964), CEPN - LETTERS 11, 88 (1963) 531, PHYS. REV. 136, METHODS 29, 115 (1964), 2 (1962), UCRL 2426 (195 PHYS. 40 926 (1962), MC CIMENTO 18, 1039 (196
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NEUTRON PROTON ELASTIC CROSS SECTION [PAGE 14] Laboratory Ref Cent State 1 State Cross Section Ref Cent State 1 State Cross Section (Page 11) Control Ref Cent State 1 State Cross Section FG Cent State 1 State Cross Section FG Cent State 1 State Cross Section FG Cent Control O State Cent Control Cross Section Control Cross Sectin Control<						
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LABORATORY DEFX (CARTON DEFY	DATA IS INTEGRA Grand C.M	NTED OVER COS(THETA) FRCM -1. T	O O THETA IS	THE ANGLE THAT TH	E NEUTRON MAKES N	WITH THE BEAM IN THE
θ. +5 .06 + .03 ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM * 0. GEV/C +5IPER CENT. (LAST 9 POINTS HAVE AN ADDITIONAL SYSTEMATIC ERROR OF 15 PERCENT 1 ••••••••••••••••••••••••••••••••••••	LABORATORY BEAM MOMENTUM GEV/C	MILL I-BARNS				
ELASTIC DIFFERENTIAL CROSS SECTION FCR NEUTRON PROTON. TABLE 13 LASTIC DIFFERENTIAL CROSS SECTION FCR NEUTRON PROTON. TABLE 13 LASTIC OFFERENTIAL CROSS SECTION FCR ACTIONAL SYSTEMATIC ERROR OF 15 PERCENT. U D-160M/D-U THETA D-510M/D-0WEGA U D-160M/D-U THETA D-510M/D-0WEGA 0001 O-510M/D-0WEGA 00010 11.2 00010 1.2 0016 O-510M/D-0WEGA 0016 O-610M/D-0WEGA 0016 O-610M/D-0WEGA 0016 O-610M/D-0WEGA 0016 O-610M/D-0WEGA 0	PER CENT 8. +5	.06 +03				
-U D-SIGMA/D-U STREAMINE ENDER DE LA PERCENTA (GEV/C)**2 MB/(GEV/C)**2 (11 · PADEIANS PERCENTA 0000 · 64 · C6 · 0010 20.4 +- 1.9 0000 · 64 · C6 · 0030 18.1 - 1.2 0001 · 71 · C6 · 0050 20.8 1.3 0003 · 71 · C6 · 0000 14.4 · C1 00070 · 64 · C6 · 0010 10.4 · C1 00170 · 64 · C6 · 0010 10.4 · C1 00171 · 64 · C6 · 0010 10.4 · C1 00171 · 64 · C6 · 0010 10.0 · C1 00153 · 73 · C0 · 0010 8.4 · C1 0016 · 74 · C0 · 0010 8.4 · C1 00170 · 64 · C6 · 0010 8.4 · C1 00180 · 75 · C1 00180 · 75 · C1 00190 8.4 · C1 00290 · C1 · C1 00190 8.4 · C1 00190 8.4 · C1 00190 8.4 · C1 00290 · C1 · C1 00190 8.4 · C1 00290 · C1 · C1 00190 8.4 · C1 00290 · C1 · C1 00190 8.4 · C1	ELASTIC DIFFERENTIA LABORATORY BEA	L CROSS SECTION FOR NEUTRON PRO Momentum = 8. Gev/C +5(P	TON. (T ER CENT).	ABLE 1]		
TO Description Image of the second seco	(LAST 9 PUINT:	DESIGNATIONAL SYSTEMATIC	- ERROR UF 15 P	THET A	D-510H4/D-	ONECA
-0001 -03 + -03 . 0010 20 + + -19 -0016 -44 -06 . 0030 18.1 1.2 -0016 -90 -000 14.4 1.3 -0017 -46 -00 -0000 14.4 1.3 -0018 -52 -00 -0110 10.4 1.1 -0118 -13 -0010 10.4 1.1 -0 -0144 -47 -00 -0110 10.4 1.1 -0145 -35 .00 -0110 10.4 1.1 -0144 -47 -00 -0130 11.1 -0 -0145 -35 .00 -0140 8.4 -0 -0231 -39 .00 -0210 6.4 -0 -0338 -31 .00 -0230 5.9 -9 -0465 -27 .04 -0230 5.9 -0 -0413 -77 .00 -0330 4.4 -0 -0410 -22 .00 -0330 4.4 -0 -00	(GEV/C)**2	MB/(GEV/C)++2 (1)	:	RADIANS	MB/SF	
.0016 .66 .0050 20.8 1.3 .0052 .67 .00 .0070 15.3 1.2 .0052 .67 .00 .0070 14.4 .0 .0018 .52 .00 .010 10.4 1.1 .0185 .52 .00 .0130 11.1 .0 .0185 .57 .00 .0130 11.1 .0 .0185 .57 .00 .0130 11.1 .0 .0185 .57 .00 .0170 7.5 .0 .0231 .39 .00 .0190 8.4 .0 .0238 .11 .00 .0210 6.4 .0 .0338 .31 .00 .0230 6.6 .0 .0340 .27 .60 .0350 4.6 .0 .0350 .44 .00 .0310 4.7 .0 .0466 .27 .60 .0330 4.7 .0 .0570 .21 .60 .0330 4.4 .0	.0001	.55 +09 .84 .C6	:	.0010	20.4 +-	1.2
0052	.0016	.96 .06 .71 .06	:	.0050 .0070	20.8	1.3
1000 100 100 100 100 100 1014 100 100 100 100 100 100 1014 100 100 100 100 100 100 100 1014 100 100 100 100 100 100 100 100 100 1014 100	.0052	.67 .00	•	.0090	14.4	.0
.0144 .47 .000150 10.0 .0 .0185 .25 .000170 7.5 .0 .0231 .39 .C00190 8.4 .0 .0282 .29 .000230 6.6 .0 .0338 .31 .000250 7.3 .0 .0465 .27 .C40270 5.9 .9 .0465 .27 .C40270 5.0 .0 .0613 .17 .000330 4.9 .0 .0613 .17 .000330 4.9 .0 .0614 .22 .000350 4.6 .0 .0780 .22 .000370 3.7 .0 .0760 .22 .000370 3.7 .0 .0760 .000075 1.0 .22 .0 .1300 .000555 2.2 .0 .2300 .00 .000575 1.0 .2 .2460 .00 .000575 1.0 .2 .3750 .00 .000575 1.0 .2 .3750 .00 .000575 1.0 .2 .3750 .00 .00 .00 .00 .00 .00 .00 .4750 .00 .00 .00 .00 .00 .00 .0625 .12 .0 .4750 .00 .00 .00 .00 .00 .00 .0625 .12 .0 .4750 .00 .00 .00 .00 .00 .00 .00 .00 .0625 .12 .0 .0625 .22 .0 .0476 .00 .00 .00 .00 .00 .00 .00 .0625 .12 .0 .000 .00 .00 .00 .00 .00 .00 .00 .00 .0	.0108	.52 .00	:	.0130	11-1	.0
0231 03 0.0 0	.0144	•47 •00 •35 •00	•	.0150	10.0	.0
10282 .27 .00 .0210 0.4 .0 .0338 .31 .00 .0230 6.6 .0 .0338 .21 .00 .0250 7.3 .0 .0465 .27 .04 .0270 5.0 .0 .0513 .17 .00 .0270 5.0 .0 .0613 .17 .00 .0330 4.9 .0 .0694 .23 .00 .0330 4.9 .0 .0780 .22 .00 .0330 4.9 .0 .0781 .10 .00 .0330 4.4 .0 .0781 .10 .00 .0330 4.6 .0 .0867 .21 .00 .0330 3.7 .0 .0867 .21 .00 .0430 3.7 .0 .1070 .18 .00 .0430 3.5 .7 .1430 .13 .02 .0630 2.2 .6 .1430 .13 .02 .00 .0555 1.0	-0231	.39 .00		-0190	8.4	.0
. C399 . 14 .000250 7.3 .0 .0645 .27 .C40270 5.9 .9 .0516 .23 .000290 5.0 .0 .0613 .17 .000310 3.7 .0 .0694 .23 .000350 4.9 .0 .0780 .22 .000350 4.6 .0 .0781 .18 .000370 3.7 .0 .0967 .21 .C00390 4.4 .0 .1070 .18 .000610 3.7 .0 .1070 .18 .000610 3.7 .0 .1170 .10 .0306450 2.2 .6 .1390 .10 .0306450 2.2 .6 .1430 .10 .000555 2.2 .0 .2090 .C8 .000555 1.6 .0 .2090 .C8 .000555 1.6 .0 .2090 .C8 .000555 1.2 .0 .2090 .C8 .000555 1.2 .0 .2090 .C8 .000555 1.2 .0 .2090 .C8 .000555 1.2 .0 .2090 .C8 .000575 1.0 .2 .2090 .C8 .000225 .0 .2090 .C8 .000075 .0 .2090 .C8 .000075 .0 .2090 .C8 .000075 .0 .2090 .C8 .000075 .0 .2090 .04 .010075 .0 .2090 .04 .010075 .0 .2090 .04 .000075 .0 .0025 .4 .0 .4760 .02 .000075 .5 .2 .0025 .4 .0 .4760 .03 .C100825 .4 .0 .4760 .03 .C100875 .5 .2 .0025 .4 .0 .4760 .03 .C1	.0282	.29 .00	•	.0230	6.6	.0
0536 23 CO 5.0 CO 0613 17 CO 5310 3.7 CO 0694 22 CO 0330 4.9 CO 0780 22 CO 0330 4.9 CO 0780 22 CO 0330 4.4 CO 0780 22 CO 0330 4.4 CO 07970 21 CO 0370 3.7 CO 07970 21 CO 0370 4.4 CO 1070 18 CO 0370 4.4 CO 1170 17 C3 0430 3.7 CO 1290 10 C2 0430 3.7 CO 1270 13 C2 0430 3.7 CO 1280 13 C2 0430 3.7 CO 1290 10 C2 0475 2.7 3 1280 13 C2 0475 1.2 CO 2000 C6 C0 <t< td=""><td>.0399</td><td>.34 .00</td><td>•</td><td>.0250</td><td>7.3</td><td>.0</td></t<>	.0399	.34 .00	•	.0250	7.3	.0
10613 11 100 10310 3.7 10 00694 23 00 0330 4.9 0 00700 22 00 0350 4.6 0 00711 18 00 0370 3.7 0 10700 18 00 0370 3.7 0 10700 18 00 0410 3.7 0 1170 17 C3 0430 3.5 7 1290 10 03 0450 2.2 5 1430 13 C2 0430 3.5 7 1430 13 C2 0450 2.2 0 2090 C8 00 0375 1.6 0 22660 05 01 0775 1.0 2 3230 04 02 00 0775 1.0 2 23200 04 01 0775 1.0 2 2 3730 04 02 00 0775 1.0 2	.0536	.23 .00		.0290	5.0	.0
.0780 .22 .00 .0350 4.6 .0 .0071 .18 .00 .0370 3.7 .0 .00967 .21 .CC .0390 4.4 .0 .1070 .18 .00 .0390 4.4 .0 .1170 .17 .C3 .0410 3.7 .0 .1170 .17 .C3 .0430 3.5 .7 .1200 .10 .03 .0450 2.2 .6 .1430 .13 .C2 .0450 2.2 .6 .1400 .10 .06 .0525 2.7 .3 .1740 .10 .06 .0525 2.2 .0 .2090 .C6 .00 .0525 1.2 .0 .2860 .05 .01 .0675 1.0 .2 .3750 .04 .00 .0725 .8 .2 .3750 .04 .00 .0825 .4 .0 .47461 .02 .00 .0875 .5 .2 <	.0694	.23 .00	:	.0330	4.9	.0
.0967 .21 .00 .0000	.0780	.22 .00	:	.0350	4.6	.0 .0
1170 117 C3	.0967	-21 -60	:	.0390	4.4	•0 • 0
.1290 .10 .03 .0450 2.2 .6 .1330 .13 .62 .0675 2.7 .3 .1740 .10 .00 .0575 2.2 .0 .2090 .68 .00 .0575 1.6 .0 .2090 .68 .00 .0575 1.6 .0 .2460 .66 .00 .0675 1.2 .0 .2460 .05 .01 .0675 1.0 .2 .3290 .04 .00 .0725 .8 .2 .3750 .04 .00 .0725 .8 .2 .4740 .02 .00 .0825 .4 .0 .4750 .03 .01 .0825 .4 .0 .4750 .03 .01 .0825 .5 .2 U 15 THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE [PROTONI. .0875 .5 .2 U 15 THE MOMENTUM TRANSFER BETWEEN THE INCOMING NEUTRONI AND THE [PROTONI. .0875 .5 .2	.1170	.17 .03	•	.0430	3.5	.7
.1740 .10 .00 .0525 2.2 .0 .2090 .08 .00 .0575 1.6 .0 .2460 .00 .0625 1.2 .0 .2860 .05 .01 .0625 1.0 .2 .3290 .04 .01 .0725 .8 .2 .3750 .04 .00 .0775 .8 .2 .3750 .04 .00 .0725 .8 .2 .3750 .04 .00 .0075 .8 .2 .4760 .02 .00 .0825 .4 .0 .4750 .03 .01 .0825 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE IPROTONI. .0875 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE IPROTONI. .0 .0 .0 .15 THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. .0 .0 .0 .11 PLUS POSSIBLE SYSTEMATIC ERRER OF +- 30 PER CENT. .30 .30 .30 .0	.1290 .1430	.10 .03 .13 .C2	•	.0450 .0475	2.2	.o .3
12660 126 <td< td=""><td>.1740</td><td>• 10 • 00 • 08 • 00</td><td>•</td><td>-0525</td><td>2.2</td><td>.0 .0</td></td<>	.1740	• 10 • 00 • 08 • 00	•	-0525	2.2	.0 .0
.2000 .01 .0075 1.0 .2 .3290 .04 .01 .0725 .8 .2 .3750 .04 .00 .0775 .8 .0 .4740 .02 .00 .0825 .4 .0 .4750 .03 .01 .0875 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE (PROTONI. .0875 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE (PROTONI. .0875 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE (PROTONI. .00875 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONI AND THE GRAND C.M. .11 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 30 PER CENT.	-2460	.64 .60	:	.0625	1.2	•0
.3750 .04 .00 .0775 .8 .0 .4740 .02 .00 .0825 .4 .0 .4750 .03 .C1 .0825 .5 .2 U IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON] AND THE [PROTON]. THETA IS THE ANGIF THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND G.M. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 30 PER CENT.	.2860	.05 .01	:	.0725	1.0	•2
.4750 .03 .CI0875 .5 .2 U LS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRGN] AND THE [PROTON]. THETA IS THE ANGIT THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. (1] PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 30 PER CENT.	.3750	.04 .C0 .02 .00	:	-0775 -0825	• 8 • 4	•0 •0
U IS THE MUNENTUM TRANSFER BETWEEN THE LINUMING NEUTRON AND THE LYRUTONI. THETA IS THE ANGI'T THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. (1] PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 30 PER CENT.	.4750	.03 .01	-	.0875	.5	.2
(11 PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 30 PER CENT.	U IS THE MOMEN' Theta is the a	IGH TRANSPER BEINEEN THE LINCOM IGIT THAT THE PROTON MAKES WITH	THE BEAM IN T	HE GRAND C.M.		
	(1) PLUS POSS	BLE SYSTEMATIC ERRCR OF +- 30	PER CENT.			

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96 PROTUN-PROTON REACTIONS AT 15 GEV/C WITH PRODUCTION OF TWO AND THREE PIONS (SUBMITTED TO THE VIENNA CONF., 1968 (1968)] H.BOGGILD,J.EADES,K.HANSEN,H.JCFNSTAG.R.PCLLERUG,L.VEJE (NIELS BCHR INSTITUTE, COPENHAGEN, DENMARK) P.LAURIKAINEN, P.LINOBLOH,J.TUCMINIEMI (HELSINGIN YLIOPISTO, HELSINKI, FINLANC) T.JACOBSEN,S.O.SCRENSENO.J.HINGVOLO (CSLO UNIV., OSLO, NORMAY) G.EKSPONGJL.GRANSTROM,S.O.HOLMGREN,S.NILSSEN,T.OLMEDE,U.SVEDIN,N.YAMDAGNI (STGCKHOLMS UNIV., STOCKHOLM, SWEDEN)

ARTICLE READ BY OCETTE BENARY IN 10/69, AND VERIFIED BY LERGY PRICE.

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BEAM IS PROTON ON PROTON AT 19 GEV/C.

THIS EXPERIMENT USES THE CERN 2P (H) BUBBLE CHANBER.

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GENERAL COMMENTS ON THIS ARTICLE 1 THE RESULTS ARE PRELIMINARY

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KEY WORDS + CROSS SECTION	MASS SPECTRUM	MODELS C	DALITZ PLOT	ANGULAR DISTRIBUTION	

[TABLE 1]

LABORATORY SEAP POMENTUP = 19. GEV/C.		
REACTION	MILLI-BARNS	NO. EVENTS
PROTON PROTON .		
PROTON PROTON PI+ PI-	1.50 +20	2107
DELTA(1238)++ PROTON PI-	.63 .15	
DELTA(1238)++ + PROTON PI+ [1]		
OELTA(1238)++ CELTA(1238)0	.02 .01	
DELTA(1238)++ • PROTON PI+ [1]		
DELIALIZZAJU + PROTUN PI- [1]		
UELIN(1230)++ N=(1320)V	.02 .01	
PROTON PROTON F(1260)	.02 .01	
F(1260) + PI + PI - [1]		
DELTA(1238)O PRCTON PI+	.18 .03	
DELTA(1238)0 . PROTCN P1- [1]		
N#(14/01+ PROIDN	.08 .02	
N#(1470)+ + PROTON FI+ PI- [1]	•	
N#(1688)+ PROTON	.11 .03	
"N#(1688)+" • PRCTON FI+ PI- [1]		
N#(1520)0 PROTON P1+	.14 .03	
N+(1520)0 + PROTON PI- (1)		
NEUTRON PROTON PI+ PI+ PI-	1.70 .30	1977
DELTALIZZBI++ NEUTRON PI+ PI-	.45 .15	. 21
DELTA(1238)++ + PRCIUN PI+ [1]		
UELIALI2387++ UELIALI2387- PI+	.08 .02	
DELTA(12381- • NEUTOCN DI+ [1]		
DELTHILESUP RECTREM FI (1)	.07 .01	
DELTA(1238)++ + CROTON PIL [1]	102 101	•
N#(147C)0 + NEUTRON PI+ PI- (1)		
DELTA(1238)++ 'N+(168810'	.03 .01	
DELTA(1238)++ + PRCTCN PI+ [1]		
'N#(1688)0' + NEUTRON PI+ PI- (1)		
DELTA(1238)++ DELTA(1920)0	.02 .01	
DELTA(1238)++ • PROTON PI+ [1]		
DELTA(192010 + NEUTRON PI+ PI- (1)		
DELTA(1238)++ RHG(765)0 NEUTRON	.19 .03	[2]
DELTA(1238)++ • PRGTON PI+ (1)		
KHU176510 + PI+ PI- []]		
DELTA(1238)++ NEUIRUN F(1260)	•03 •01	
$\frac{1}{2}$		
DELTA(1238)+ PROTON PI+ PI-	.03 .01 /	21
DELTA(1238)+ + NEUTRON PI+ [1]	105 101	
UELTALIZABI- PRUTUN PI+ PI+	.30 .10	
DELTA(1238)- • NEUTRON PI- (1)		
*N#(1688)O' PROTON PI+	.08 .02	
"N*(1688)Q" . NEUTRCN PI+ PI- [1]		
DELTA(1238)+ RH0(765)0 PROTON	.02 .01 1	[2]
DELTA(1238)+ • NEUTRON PI+ [1]		
RH0(765)0 • PI+ PI- [1]		
PRUTUN PRUTUN PI+ PIO	1.70 .30	2049
	.44 .13	2)
DELTA(1238) + DELTA(1238) + DI-	.05 .03	
DELTA(1238)++ + PROTON PI+ [1]	105 105	
UELIALIZSBI · PRUTUN PIU III		
OFLTA(1238)0 RHC(765)+ PROTON	-07 -03	21
DELTA(1238)0 • PRDŤCN PI- (1)		
RH01765)+ + PI+ PIO (1)		
DELTA(1238)+ PROTON PI+ PI-	.17 .10	[2]
DELTA(1238)+ + PROTON PIO [1]		
DELTA(123B)O PROTON PIC PI+	.00 .05	[2]
DELTA(1238)0 + PROTCN PI- (1)	** ***	
PROTEN PROTON EMEGA(783)	.08 .02	. 3 1
UMEGA(783) • PI+ PI- PIO [1]	12 62 6	
DELTALIZEDITT RAULIODIT PRUTUN DELTALIZEDITT RAULIODIT PRUTUN	-12 -03	
RH0(765)- + PI- PIO (1)		
CELTA(1238)+ RH0(765)0 PROTON	.03 .01 0	21
DELIALIZ381+ + PRUIUN PIO [11		·
RH0(765)0 . P1+ P1- [1]		

(1) USCD SIMPLE MASS CUT.
(2) .45 .15 PRIVATE COMMUNICATION FROM G. EKSPONG, OCTOBER, 1969.
(3) THIS DATA IS NOT TO BE USEG. SAME DATA REPORTED AT LUND CUMFERENCE..
97 THE ANALYSIS OF 28.5 GEV/C PP INTERACTIONS PRODUCING 6 CR MORE CHARGEC PARTICLES. (ANL 13694 (1969)) P.L.CCNNOLLY, I.R.KENYON, R.R.KINSEY, A.M. THORNEIKE [PROGKFAVEN NAT. LAR., UPTON. L.I., N. Y., USA]

CLGSELY RELATEC REFERENCES SEE ALSO BNL 13671 (1969), AND BNL 11580 (1967).

ADDITICNAL CITATIONS NUGVO CIMENTO 57A, 93 (1568), VIENNA CCNFERENCE 367 (1968), PHYS. REV. 120, 1857 (1960), PHYS. REV. LETTERS 7, 199 (1961), PHYS. REV. 165, 1655 (1968), CERN HADRUN CONFERENCE 2 208 (1968), PHYS. REV. LETTERS 19, 201 (1967), PHYS. LETTERS 268, 515 (1968), PHYS. LETTERS 258, 519 (1568), BNL 13189 (1968), PHYS. REV. LETTERS 16, 855 (1966), CERN TH 919 (1968), PHYS. REV. LETTERS 22, 674 (1969), PHYS. REV. LETTERS 19, 198 (1967), PHYS. REV. LETTERS 12, 112 (1964), PHYS. REV. LETTERS 20, 964 (1568), PHYS. REV. LETTERS 21, 701 (1968), AND PHYS. REV. LETTERS 21, 1009 (1968).

ARTICLE READ BY ODETTE BENARY IN 7/65, AND VERIFIED BY LERCY PRICE.

BEAM IS PROTON ON PROTON AT 28.5 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER. A TOTAL OF 150000 PICTURES ARE REPORTED ON. KEY WORDS - CROSS SECTION MODELS 'N*(1688)' N*(1520)D13 MASS SPECTRUM ANGULAR DISTRIBUTION CELTA(1238) RHD(765)

TABLE 11

LABCRATCRY EEAM MCMENTUM = 28.5 GEV/C.

REACTION	MILLI-BARNS (1)
RATON PRGTON -	
PROTON PROTON PI+ PI+ PI- PI-	.380
6 PPCNGS	5.500
8 PRCNGS	2.400
10 PRONGS	.450
PROTON PROTON FI+ FI+ FI+ FI- FI- FI-	.115
PROTON PROTON PI+ PI+ PI+ PI+ FI- PI- PI- PI-	.020
12 PRONGS	.050
PROTEN PROTON PI+ PI+ PI+ PI+ PI+ PI- PI- PI-	
P1- P1-	.002

[1] VALUES ARE APPRCAIMATE ONLY.

(PAGE 7)

LABORATORY BEAM MOMENTUM = 28.5 GEV/C.

REACTION PROTON PRCTCN + N*(152C)D13 N*(152C)D13 'N*(1688)' 'N*(1688)' FICRC-BARNS < 40. < 110.

98



PI+- P AND PP ELASTIC SCATTERING AT 8.5. 12.4 AND 18.4 GEV/C. [NUDVD CIMENTO 38. 60 (1965)]

D.HARTING,P.BLACKALL,B.EISNER,A.C.HELMHOLZ,W.C.HIDDLECOCP,B.POWELL, B.ZACHARGV,P.ZANELLA (EUROPEAN ORG. FOR NUC. RES., GENEVA, SHITZERLAND) P.DALPIAZ,M.N.FUGACCI,S.FOCARCI,G.GIACCMELLI, L.MONARI (UNIV. DI BOLOGNA, BOLOGNA, ITALY) J.AZEANEY,R.A.ZONALG,P.MASCN (LIVERPOOL UNIV., LIVERPOOL, ENGLAND) J.AZEANEY,R.A.ZONALG,P.MASCN, ILIVERPOOL UNIV., LIVERPOOL, ENGLAND) J.AZEANEY,R.A.ZONALG,P.MASCN, AN ARER, MICH., USA) D.G.CALEWELL (UNIV. OF CALIFCRNIA, BERKELEY, CALIF., USA)

RACT APPROXIMATELY 60,000 EVENTS FAVE BEEN COLLECTED IN A SPARK CHAMBER EXPERIMENT AT THE CERN PROTON SYNCHROTROM WHICH STUDIED ELASTIC DIFFRACTION SCATTERING OF PI-P AND P-P AT INCIDENT MOMENTA OF 8.5 AND 12.4 GEV/C.MAGNETIC ANALYSIS OF THE INCOVING AND DIFFRACTION SCATTERING OF PI-P AND P-P AT INCIDENT MOMENTA OF 8.5 AND 12.4 GEV/C.MAGNETIC ANALYSIS OF THE INCOVING AND DIFFRACTION SCATTERING OF PI-P AND P-P AT INCIDENT MOMENTA OF 8.5 AND 12.4 GEV/C.MAGNETIC ANALYSIS OF THE INCOVING AND DIFFRACTION SCATTERING OF PI-P AND P-P AT INCIDENT MOMENTA OF 8.5 AND 12.4 GEV/C.MAGNETIC HIGH EFFICIENCY, EVEN AT THE LARGER MOMENTUM TRANSFERS. MUCH OF THE CATA HAVE BEEN PROCESSED BY THE CERN AUTOMATIC FLVING SPOT DIGITIZER IFPDI.A CETAILED DESCRIPTION OF THE EXPERIMENTAL TECHNIQUE AND OF THE METHODS OF ANALYSIS IS GIVEN. THE RESULTS, TOGETHER WITH DATA FROM LOWER ENERGIES, CONFIRM THE REMARKABLE ENERGY-INDEPENDENCE OF THE SHAPE OF THE PION-PROTON DIFFRACTION SCATTERING PEAK UNTO YIL 1.5 (GEV/CL-SQUARED, MIERET I ST HE SOUANE OF THE FOUR-MOMENTUM TRANSFER, QVER A RANGE CF PION ENERGIES FROM 2 TO 18 GEV. PROTON-PROTON SCATTERING DOES HOWEVER APPEAR FOUR-MOMENTUM TRANSFER, QVER A RANGE CF PION ENERGIES FROM 2 TO 18 GEV. PROTON-PROTON SCATTERING DOES HOWEVER APPEAR FOUR-MOMENTUM TRANSFER, QVER A RANGE CF PION ENERGIES FROM 2 TO 18 GEV. PROTON-PROTON SCATTERING DOES HOWEVER APPEAR FOUR-MOMENTUM TRANSFER, QVER A RANGE CF PION ENERGIES FROM 2 TO 18 GEV. PROTON-PROTON SCATTERING DOES HOWEVER APPEAR FOUR-MOMENTUM TRANSFER, OVER A RANGE OF APPEAR. DURING THE EXPERIMENT, DATA KERE TAKEN WHICH SET AN UPPEP LIMIT OS SHOL AS HAIRNING DIFFRACTION PEAK. IN GENERAL, THE OFTA A GREE WITH OTAE EXPERIMENTS USING BOTH COUNTER AND BUBBLE CHAMBER TECHNIQUES. BUT SCHE CIFFERENCES OD APPEAR. DURING THE EXPERIMENT, DATA KERE TAKEN WHICH SET AN UPPEP LIMIT 20.9 TO 23.4 (GEV/CI-SQUARED AT 13.4 GEV/CI INCIDENT PION MOMENTUM ABSTRACT

CITATIONS PHYS. LETTERS 8, 288 (1964), CERN CONFERENCE 897 (1962), SIENNA CONFERENCE 2 L22 (1963), PHYS. LETTERS 5, 252 (1963), PHYS. LETTERS 7, 76 (1963), REV. MOD. PHYS. 26, 655 (1964), JETP 3 813 (1556), PHYS. REV. LETTERS 10, 357 (1963), REV. MOD. PHYS. 36, 669 (1564), PHYS. REV. LETTERS 10, 357 (1964), PHYS. REV. LETTERS 10, 357 (1963), REV. MOD. PHYS. 36, 669 (1564), PHYS. REV. LETTERS 10, 357 (1964), PHYS. REV. LETTERS 10, 357 (1963), REV. MOD. PHYS. 36, 669 (1564), PHYS. REV. LETTERS 10, 357 (1964), PHYS. REV. LETTERS 10, 357 (1964), PHYS. REV. LETTERS 10, 257 (1963), REV. MOD. PHYS. 36, 669 (1564), PHYS. REV. LETTERS 10, 357 (1963), PHYS. REV. LETTERS 10, 376 (1963), PHYS. REV. LETTERS 10, 503 (1963), PHYS. REV. LETTERS 10, 376 (1963), PHYS. REV. LETTERS 10, 503 (1963), PHYS. REV. LETTERS 10, 376 (1963), PHYS. REV. LETTERS 10, 503 (1963), PHYS. REV. LETTERS 9, 468 (1962), PHYS. REV. LETTERS 10, 413 (1963), PHYS. REV. LETTERS 7, 352 (1963), PHYS. REV. LETTERS 10, 413 (1963), PHYS. REV. LETTERS 7, 357 (1964), PHYS. REV. LETTERS 7, 127 (1964), REV. LETTERS CONFERENCE 443 (1960), PHYS. REV. LETTERS 7, 352 (1961), PHYS. REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), PHYS. REV. LETTERS 7, 352 (1961), PHYS. REV. LETTERS 7, 357 (1961), REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), CERN 63-34, LRL INTERDEPARTMENTAL REPORT UCID-1809, CERN 00/63-15, PHYS. REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), PHYS. REV. LETTERS 7, 352 (1961), PHYS. REV. LETTERS 7, 357 (1961), PHYS. REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), CERN 63-34, LRL INTERDEPARTMENTAL REPORT UCID-1809, CERN 00/63-15, PHYS. REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), PHYS. REV. LETTERS 7, 359 (1961), PHYS. REV. LETTERS 7, 127 (1961), ROCHESTER CONFERENCE 443 (1960), PHYS. REV. LETTERS 7, 359 (1957), NUOVO CIPENTO 18, 818 (1962), RUVOV CIMENTO 24, 515 (1963), PHYS. REV. LETTERS 13, 391 (1964), PHYS. REV. LOTTERS 13, 729 (1964). CIPENTO 18, 818 (1960), RUVOV C

ARTICLE READ BY OCETTE RENARY IN 3765, AND VERIFIED BY LERGY PRICE.

REAM NO. 1 IS PI- ON PPOTON FROM 8.5 TO 18.4 GEV/C. NO. 2 IS PROTON ON PROTON FROM 8.5 TO 18.4 GEV NO. 3 IS PI+ ON FROTON FROM 8.5 TO 12.4 GEV/C. GEV/C.

THIS EXPERIMENT USES SPARK CHAPBERS.

KEY WORDS + DIFFERENTIAL CROSS SECTION FITS CROSS SECTION MODELS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

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ELASTIC DIFFERENTIAL CRCSS SECTION FCP PROTON PROTON. [TABLE 4] LABGRATORY BEAM MOMENTUM = 8.5 GEV/C +- 2.5(PER CENT).
 ENIUM
 B
 8.5 GEV/C

 D-SIGMA/0-T
 B8/(6EV/C)+*2 [2]
 24.500

 787/(6EV/C)+*2 [2]
 24.500
 570

 14.950
 520
 11.400
 330

 8.740
 280
 7.210
 250

 4.770
 200
 3.350
 177

 2.450
 150
 1.760
 120

 1.760
 120
 1.370
 110

 1.370
 110
 1.370
 1.130

 .4605
 .641
 .623
 .478

 .278
 .632
 .616
 .059

 .058
 .016
 .058
 .616
 (GEV/C)++2 (1) .13 .15 .17 .19 .22 .26 .30 .34 .38 .42 .46 .50 .54 .58 .65 .75 .85 .95 1.05 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE COUTGOING PROTON). [1] PLUS POSSIBLE SYSTEMATIC CARGE OF -- 1 PER CENT.
[2] PLUS POSSIBLE SYSTEMATIC ERECE OF -- 7 PEP CENT. ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. (TABLE 4) LABORATORY BEAM MOMENTUM = 12.4 GEV/C +- 2.5(PER CENT). ExtUP = 12.4 GEV/GD-SICMA/O-TMB/(GEV/GI+22 I2)123.430 +- .77018.400 .65016.220 .61C12.440 .450IC.430 .320/.15U .260S.36C .220IC.430 .320/.15U .260S.36C .220IC.430 .1001.430 .1101.280 .1101.280 .1101.280 .110.506 .C69.370 .C38.176 .C28.067 .C20.034 .C11.020 .C65.012 .C05.012 .C05.012 .C05.012 .C05.012 .C05.012 .C05.012 .C05014015016016016017-T (GEV/C)**2 [1] .13 .15 .17 .19 .22 .26 .34 .38 .42 .46 .50 .54 .58 .45 .75 .85 .95 1.10 1.30 1.50 2.00 T IS THE MIMENIUM INANSHER BEINEEN THE (INCOMING PROTON) AND THE [CUTGOING PROTON]. (1) PLUS POSSIBLE SYSTEMATIC ERROP OF +- 1 PER CENT. [2] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT. ELASTIC DIFFERENTIAL CROSS SECTION FCP PROTON PROTON. [TABLE 4] LABORATORY BEAM MOMENTUM = 18.4 GEV/C +- 2.5(PER CENT). ENIOR = 18.4 GEVC D-SIGMA/C-T MB/GEV/CI++2 121 12.510 +- .860 12.350 -410 4.200 -280 2.360 -170 1.70 -120 1.200 -100 1.200 -100 1.200 -100 1.203 -015 .602 -018 .603 -055 .603 -005 .003 -005 .003 -002 -T (GEV/C)++2 {1} .19 .22 .26 .30 . .31 .38 .42 .46 .5C .94 .58 .100 .C95 .U/1 .C57 .C30 .018 .G11 .C14 .C05 .CC3 .UU2 .000 .C00 .65 .75 .85 .95 1.10 1.30 1.50 2.00 .002 3.60 .000 T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTOK] AND THE [OUTGOING PROTON]. 111 PLUS PUSSIBLE SYSTEPATIC ERRCP CF +- 1 PER CENT.
21 PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 7 PER CENT. _______ PROTON PROTON ELASTIC CROSS SECTION. (TABLE 9) (THE TOTAL ELASTIC CROSS SECTION IS OBTAINED BY EXTRAPOLATING THE MEASURED CROSS SECTION TO A POINT & PERCENT ABOVE THE OPTICAL POINT AT THE 3 LABORATORY BEAM MOMENTUM GEV/C PER CENT 8.5 +- 2.5 12.4 2.5 18.4 2.5 MILLI-BARNS [1] 9.68 +- .62 8.90 .61 8.8C .72 [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 7 PER CENT.

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FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                  (TABLE 6)
     LABORATORY BEAM MOMENTUM . 8.5 GEV/C +- 2.5(PER CENT).
     DATA IS FIT OVER -T FROM .13 TO .50 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
(QUIGDING PROTON).
FITTED FORMULA IS C-SIGMA/C-T = EXP(A+BT)
             WHERE D-SIGMA/D-T IS IN HB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
             A = 4.198 ↔ .C28
B = 7.75 ↔ .11
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON.
                                                                  [TABLE 6]
     LABORATORY BEAM MOMENTUM = 12.4 GEV/C +- 2.5(PER CENT).
     CATA IS FIT OVER -T FROM -13 TO .50 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE

[GUTGOING PROTON].

FITED FORMULA IS O-SIGMA/D-1 = EXP(A+BT)
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTEC VALUES
             A = 4.150 + -.033
B = 8.19 + -.13
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PPOTON PROTON.
                                                                  [TABLE 6]
     LABORATORY BEAM MOMENTUM = 18.4 GEV/C +- 2.5(PER CENT).
     DATA IS FIT OVER -T FROM .19 TO .50 (GEV/CI*+2. T IS THE MOMENTUM TRANSFER BETWEEN THE {INCOMING PROTON] AND THE
ICUTGOING PROTON].
FITTED FORMULA IS C-SIGMA/D-T = EXP[A+RT]
             WHERE D-SIGMA/D-T IS IN M8/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
             A = 4.178 +- .080
B = 8.58 +- .24
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                                  (TABLE 7)
     LABORATORY BEAM MCMENTUM = 8.5 GEV/C +- 2.5(PER CENT).
     DATA IS FIT OVER -T FROM -13 TO .95 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
[GUIGDING PROTON].
FITED FORMULA IS D-SIGMA/D-T = EXP[a+BT+CT**2]
            WHERE D-SIGMA/D-T IS IN ME/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTEC VALUES
           A = 4.241 +- .(44
B = 8.16 +- .28
C = .84 +- .36
                                                                                                 .
(TABLE 71
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOP PROTON PROTON.
     LABORATORY BEAM MOMENTUM = 12.4 GEV/C +- 2.5(PER CENT).
     DATA IS FIT OVER -T FRDM .13 TO .95 (GEV/C)**2. T IS THE HOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
[CUTGOING PROTON].
FITTED FORMULA IS D-SIGMA/D-T = CHP(A:BT+GT+*2)
           WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
            A = 4.255 +- .C53
B = 9.05 +- .34
C = 1.41 +- .44
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                 TABLE 71
    LABORATORY BEAM MOMENTUM - 18.4 GEV/C +- 2.5(PER CENT).
     DATA IS FIT OVER -T FROM .19 TO .95 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
    ECUTGOING PROTON).
FITTED FORMULA IS C-SIGMA/C-T = EXP[A+BT+CT++2]
            WHERE D-SIGHA/D-T IS IN MB/IGEV/CI**2 AND -T IS IN (GEV/C)**2.
     FITTED VALUES
            A = 4.391 +- .131
B = 9.79 +- .63
C = 1.53 +- .69
. . . . . . . . . . . . . . . . . . .
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FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                                                                                 (TABLE 8)
                LABORATORY BEAM NOMENTUM = 8.5 GEV/C +- 2.5(PER CENT).
                DATA IS FIT OVER -T FROM .13 TO 1.05 (GEV/C)**2. T IS THE NOMENTUM TRANSFER RETWEEN THE (INCOMING PROTON) AND THE
Igutgoing proton).
Fitted formula IS C-Sigma/C-T = EXP(A+BT+CT**2) '
                             WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
                FITTED VALUES
                             A = 4.266 +- .C42
B = 8.35 +- .25
C = 1.14 +- .31
         FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PRCTON.
                                                                                                                (TABLE 8)
                LABORATORY BEAM MOMENTUM = 12.4 GEV/C +- 2.5(PER CENT).
                DATA IS FIT OVER -T FROM -13 TO 2.00 (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
(CUTGQING PROTON).
FITTED FORMULA IS C-SIGMA/D-T = EXP[A+8T+CT++2]
                             WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
                 FITTED VALUES
                             A = 4.352 +- .C34
B = 9.71 +- .16
C = 2.33 +- .14
         FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                                                                                 [TABLE 8]
                LABORATORY BEAN NOMENTUM = 18.4 GEV/C +- 2.5(PER CENT).
                DATA IS FIT OVER -T FROM .19 TO 3.60 (GEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
Icutgoing Proton].
Fitted Formula IS C-Sigma/D-T = Exp[a+bt+ct**2]
                             WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
                 FITTED VALUES
                             A = 4.418 +- .066
B = 9.96 +- .21
C = 1.76 +- .1C
99
         PION EXCHANGE DOMINANCE IN THE REACTION PP . N DELTA++ (1236) AT HIGH ENERGIES.
                                                                                                                                      (PHYS. REV. LETTERS 24, 1031 (1970)]
         Z.M.MA,G.A.SMITH,R.J.SPRAFKA,G.T.WILLIAMSCN [MICHIGAN STATE UNIV., EAST LANSING, MICH., USA]
         ABSTRAGT THE CHANGE FYGHANGE BEACTION DD & N DELTA&& 137341 WAS 855M AMALYIER UP TO 34.2 COV/C TO TEST THE CONCEPT OF
Dominance in the T-Channel by High-Lying regge trajectories at very migh energies. The results provide clear evidence
for no more than pion exchange up to the highest momentum studied.
         CITATIONS
                 TIONS
PHYS. LETTERS 18, 176 (1565), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV.
LETTERS 10, 037 (1967), PHYS. REV. 113, 1440 (1967), HUDVO CIMENTO 34, 735 (1964), HUDVO OJMENTO 644 039 (1303), PHYS.
REV. LETTERS 19, 025 (1967), PHYS. REV. LETTERS 23, 342 (1969), MUDVO CHENTO 564, 269 (1566), PHYS. REV. 182, 1538
(1969), PHYS. REV. 182, 1579 (1960), PHYS. REV. LETTERS 23, 342 (1967), MUDVO CHENTO 564, 269 (1566), PHYS. REV. 182, 1538
(1969), PHYS. REV. 182, 1579 (1960), PHYS. REV. 154, 1284 (1967), PHYS. REV. 138, B670 (1965), PHYS. REV. 127, 2082
(1962), PHYS. REV. 182, 1260 (1961), MUDVO CIMENTO 494, 479 (1967), PHYS. REV. 173, 1322 (1969), NUOVO CIMENTO 534,
232 (1568), PHYS. REV. 174, 163E (1966), AMD PHYS. REV. LETTERS 21, 697 (1968).
          ARTICLE READ BY OCETTE BENARY IN 12/69, AND VERIFIED BY LERDY PRICE.
          BEAF IS PRCTON ON PROTON FROM 13.0 TO 24.2 GEV/C.
          THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER.
          KEY WORDS + CROSS SECTION DELTA(1238)++ MODELS
             PROTON PRCTON + NEUTPON DELTA(1238)++. (PAGE 4)
UEL)A(1238)++ + PROTUN PI+ 11)
           CROSS SECTION FOR
                 ( THE QUOTED ERRORS INCLUDE POSSIBLE SYSTEMATIC UNCERTAINTIES )
           LABORATORY
BEAM MOMENTUM
GEV/C
                                                   MILLI-BARNS
                                                    .550 +- .099
.301 .052
.217 .053
                   13.0
                   21.1
24.2
                                                    205
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[1] COUNTED ONLY EVENTS ABOVE BACKGROUND.

100	RECENT EXPERIMENTAL RESULTS ON NP SCATTERING FROM 6 TO 30 GEV/C. (CERN HADRON CONFERENCE 2 523 (1968))
	M.J.LONGO [UNIV. OF MICHIGAN, #NN ARECR, MICH., USA]
	PART OF THIS ARTICLE SUPERSEDED BY PHYS. REV. LETTERS 20, 468 (1968).
	ACDITIONAL CITATIONS Phys. Rev. 138, 8913 (1965), Phys. Letters 19, 341 (1965), Phys. Letters 14, 164 (1965), Phys. Rev. Letters 19, 857 (1967), Phys. Letters 21, 339 (1966), NUDVD CIMENTO 424, 365 (1966), Phys. Rev. 100, 242 (1955), Phys. Rev. 146, 980 (1966), INT'L. CONGRESS CN NUCLEAR PHYSICS,PARIS,FRANCE 162 (1964), JETP 18 1239 (1963), NUC. Phys. 75, 699 (1966), Phys. Rev. Letters 16, 1217 (1966), SLAC 66 (1966), AND NOVO CIMENTO 38, 60 (1965).
	ARTICLE READ BY LERGY PRICE IN 4/7C, AND VERIFIED BY ODETTE BENARY.
	BEAM IS NEUTRON ON PROTON FRCM 14 TE 30 GEV/C.
	THIS EXPERIMENT USES COUNTERS AND SPARK CHAMBERS.
	KEY WORDS + CROSS SECTION
	* * * * * * * * * * * * * * * * * * *
101	STUDY OF INELASTIC PROTON-PROTON SCATTERING AT 12.5 GEV/C. [PHYS. REV. LETTERS 21, 1097 (1968)]
	J.G.ASBURY, L.G.RATNER (ARGONNE NAT. LAG., ARGONNE, ILL, USA)
	A.L.KEAD (NATIUNAL ACCELERATUR LOBA, BATAVIA, ILLINDIS) D.G.CRABB,J.L.DAY,A.D.KRISCH,M.T. LIN,M.L.MARSHAK (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA)
	ABSTRACT WE HAVE TESTED EXPERIMENTALLY THE MODEL THAT THE THREE REGIONS SEEN IN PP ELASTIC SCATTERING ARE THE DIFFRACTION SCATTERING DUE TO PI, K, AND PBAR PRODUCTION. THE INELASTIC PP CROSS SECTION HAS MEASURED ON CIRCLES OF CONSTANT PIC.M.J. ONE CONTAINED A PURE SAMPLE OF INELASTIC PI EVENTS; THE OTHER, BOTH PI AND K EVENTS. THE CROSS SECTION HAS A BREAK CN BOTH CIRCLES SHOWING THAT THE BREAK IS NOT DUE TO K MESONS AND THAT THE MODEL IS WRONG.
	CITATIONS PHYS. REV. LETTERS 10, 376 (1963), PHYS. REV. LETTERS 10, 563 (1963), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 11, 503 (1963), PHYS. REV. LETTERS 14, 862 (1965), PHYS. REV. LETTERS 15, 45 (1966), UCRL 16275 (1966), PHYS. REV. LETTERS 11, 499 (1963), PHYS. REV. 188, 8165 (1965), PHYS. REV. LETTERS 17, 1105 (1966), PHYS. REV. 159, 1138 (1967), PHYS. LETTERS 23, 389 (1566), PHYS. LETTERS 250, 156 (1967), PHYS. LETTERS 278, 49 (1966), PHYS. REV. LETTERS 19, 1149 (1967), PHYS. REV. LETTERS 18, 1147 (1967), PHYS. REV. LETTERS 216, 49 (1966), PHYS. REV. LETTERS REV. 166, 1339 (1960), PHYS. REV. LETTERS 19, 198 (1961), AND PHYS. REV. LETTERS 21, 830 (1966), REV. 166, 1339 (1960), PHYS. REV. LETTERS 19, 198 (1961), AND PHYS. REV. LETTERS 21, 830 (1966).
	ARTICLE REAC BY LERGY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.
	BEAM IS PROTON ON PROTON AT 12.5 GEV/C.
	THIS EXPERIMENT USES COUNTERS.
	KEY WERDS + CROSS SECTION
	* * * * * * * * * * * * * * * * * * *
102	PION, KAON, AND ANTIPROTON PRODUCTICN IN THE CENTER OF MASS IN HIGH ENERGY PROTON PROTON COLLISIONS. (CERN HADRON CONFERENCE 2 262 (1968)]
	C.M.AXERLOF,D.G.CRABB,J.L.DAY,A.D.KRISCH,M.T.LIN (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) L.G.RATNER (ARGONNE NAT. LABA, ARGONNE, ILL., USA) K.M.EDWARDS (UNIV. OF IOMA, IGWA CITY, IGWA, USA)
	CLOSELY RELATED REFERENCES Data Superseded by Phys. Rev. 166, 1353 (1968). Continuation of Previous Experiment in Phys. Rev. Letters 18, 1218 (1967).
	ADDITIONAL CITATICNS PHYS. REV. LETTERS 7, ICI (1961), NUOVO CIMENTO 31, 961 (1964), PHYS. REV. 137, B962 (1965), PHYS. REV. LETTERS 14, 504 (1965), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 19, 196 (1967), UCRL 10022 (1961), PHYS. REV. LETTERS 17, LIOS (1966), PHYS. REV. LETTERS 159, 1138 (1967), PHYS. REV. 135, B1456 (1964), PHYS. LETTERS 258, 156 (1967), NUOVO CIMENTO 27, 203 (1963), AND NUOVO CIMENTO 27, 856 (1963).
	ARTICLE REAC BY LERCY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.
	BEAM IS PROTON ON PROTON AT 12.5 GEV/C.
	THIS EXPERIMENT USES CUCHTERS.
	GENERAL CCHMENTS ON THIS ARTICLE 1 THIS ARTICLE IS ESSENTIALLY IDENTICAL TO RATNER, ET AL., PHYS. REV. 166, 1353(1968)
	KEY WORDS . ANGULAR DISTRIBUTION FITS
	COMPOUND KEY WORDS + FITS ANGULAR DISTRIBUTION
	, * * * * * * * * * * * * * * * * * * *

103	PION, KAON, AND ANTIPROTON PREDUCTION IN THE CENTER-OF-MASS IN HIGH-ENERGY PROTEN-PRETCN COLLISIONS. (PMys. Rev. 166,
	L.G.RATNER (ARGONNE NAT. LAB., ARGGNNE, ILL., USA) K.M.EDWARDS (UNIV. OF IOWA, IGWA CITY, IOWA, USA) C.W.AKERLOF,O.G.CRABB,J.L.DAY,A.D.KRISCH, M.T.LIN (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA)
	ABSTRACT THE DIFFERENTIAL PRODUCTION CROSS SECTION (D**2-SIGMA/D-DNEGA DP) HAS BEEN MEASURED FOP PIDNS, KACNS, AND ANTIPROTONS PRODUCED IN 12.5-GEV/C PROTOM-PROTON COLLISIONS. IN THIS EXPERIMENT WE STUDIED THE DEPENDENCE OF LO*-2-SIGMA/D-COMEGA DP) CN THE LONGITUDINAL AND TRANSVERSE COMPONENTS OF THE C.M. PCHENTA CF THE PRODUCED PARTICLES, P-LONGITUDINAL AND P-PERPENDICULAR, WHILE HCLDING ALL OTHER VARIABLES FIXED IN THE CENTER-OF-, MASS SYSTEM, THE RANGES OF THE COMPONENTS MASURED WERE P-LONGITUDINAL = 0.0 - 1.0 GEV/C AND P-PERPENDICULAR*2 = 0.1 = 1.5 (GEV/C)**2. THE 12.5-GEV/C EXTRACTEC PROTON BEAM OF THE ARGONNE ZOS IMPINGED UPOM A LIQUID-HYDROGEN TARGET. THE PRODUCED PARTICLES WERE DETECTED BY A SPECTROMETER CONTAINING TWO BENING MAGNETS AND CERMENTS CONTERNANCE SCINTILLATION COUNTERS IN COINCIDENCE. THE INCIDENT PROTON FLUX WAS DETERNINED BY MONITOR SCINTILLATORS CALIBRATEC DURING GOLD-FOIL IRRADIATIONS. THE CRCSS SECTIONS FOR THE PRODUCTION OF PI+- AND K+-, WERE ALL FOUND TO HAVE AN UNAMBIGUOUS GAUSSIAN DEPENDENCE ON P-PEPPENDICULAR OVER THE BRIDING MAGNETS AND CERMENT CONTERS CALIBRATEC DURING GOLD-FOIL IRRADIATIONS. THE CRCSS SECTIONS FOR THE PRODUCTION OF PI+- AND K+-, WERE ALL FOUND TO HAVE AN UNAMBIGUOUS GAUSSIAN DEPENDENCE ON P-PEPPENDICULAR OVER THE BRITIRE RANGE. IN THE FORMULA (D**2-SIGMA/D-OMEGA DP) = 8 EXP (-AP-PERPENDICULAR*2), WE FOUND A APPROXIMATELY = 3.5 (GEV/C)**2 FOR PI+ AND K+-, MERE ALL FOUND TO HAVE AN APPROXIMATELY = 2.7 (GEV/C)**2. IN STUDYING THE DEPENDENCE OF (0**2-SIGMA/D-OMEGA DP) ON P-LONGITUDINAL, WE FOUND THAT THE CROSS SECTION HAS VERY STRONGLY PERKED ABOUT P-LONGITUDINAL APPROXIMATELY ECUAL TO 0.5 GEV/C, WITH VERY FEW PARTICLES PRODUCED HEAR P-LONGITUDINAL = 0. THIS SHOWS THAT THRE IS NO TENDENCY FOR PARTILLES. TO BE PROLOCED AT REST IN THE CENTER-OF-MASS SYSTEM, (SUCH PRODUCTION IS PREDICED BY THES STATISTICAL MODEL.) IN STEAD, PARTICLES COME OUT IN TWO CLOUDS OR 'FIREBALLS' FOLLOWING THE TWO DEPARTING BARYONS. THESE FIREBALLS MAVE A MASS OF ABOUT 2100 MEV.
	CLOSELY RELATED REFERENCES SEE ALSO PHYS. REV. LETTERS 21, 830 (1968). This Article Supersedes CERN Hadron Conference 2 262 (1968). Continuation of Previous Experiment in Phys. Rev. Letters 18, 1210 (1967).
	ADDITIONAL CITATIONS NUGYO CIMENTO 31, 961 (1964), PHYS. REV. 137, 8962 (1965), PHYS. REV. LETTERS 14, 504 (1965), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. LETTERS 19, 198 (1967), UCRL 10022 (1961), CERN MPS/EP66-4 (1967), DHYS. REV. 185, 81456 LETTERS 17, 1105 (1966), PHYS. REV. 159, 1138 (1967), PHYS. LETTERS 258, 156 (1967), SEV. 155, 81456 (1964), PHYS. LETTERS 258, 222 (1667), PHYS. REV. 128, 2392 (1962), ANNUAL REV. OF NUCLERS SCIENCE 13, 261 (1963), ANL PAD RUL-2, ANL PAD RJL-3, ANL PAD RJL-5, ANL PAD RJL-6, CERN MP/INT66-2 (1964), CERN MP/613. NUCYO CIMENTO 27, 703 (1964), CERN MP 02-17 (1963), AND PHYS. REV. 7) 101 (1964).
	ARTICLE REAC BY LERCY PRICE IN 4/70, AND VERIFIEC BY OCETTE BENARY.
	BEAM IS PROTON ON PROTON AT 12.5 GEV/C.
	THIS EXPERIMENT USES COUNTERS.
	KEY NORDS + ANGULAR DISTRIBUTION FITS
	COMPOUND KEY WORDS - FITS ANGULAR DISTRIBUTION
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104	PARTICLE PRODUCTION AT HIGH TRANSVERSE MOMENTUM. [PHYS. REV. LETTERS 21, 836 (1968)]
	D.G.CRABB.J.L.DAYIA.O.KRISCH.F.T.LIN.F.L.KARSHAK [UNIV. DF MICHIGAN, ANN ARBOR, MICH., USA] J.G.ASBURY.L.G.RAINER [ARGONNE NAT. LAB., ARGONNE, ILL., USA] A.L.READ [NATIONAL ACCELERATOR LAB., BATAVIA, ILLINOIS]
	ABSTRACT WE HAVE MEASURED 10**2-SIGMA/D-CMEGA DP), THE DIFFERENTIAL CROSS SECTION FOR THE PRODUCTION OF PI+- MESONS, AT HIGH P-PERPENDICULAR, IN 12.5-GEV/C PROTON-PROTON COLLISIONS. WE COVERED THE RANGE P-PERPENDICULAR-SCUARED = 1.0 - A.D. (CH/(14*) AND THE COOL SECTION APPEARD TO BRCAH AT ADOUT 1.5 (GLV/(1**2. IMUS, (U**2=SIGMA/D-UMEGA DF) APPEARS TO BE THE SUM OF THO GAUSSIANS IN P-PERPENCICULAR.
	CLOSELY RELATED REFERENCES Continuation of previous experiment in phys. Rev. 166, 1353 (1968).
	ADDITIONAL CITATIONS Phys. Rev. Letters 17, 1105 (1966), Phys. Rev. 159, 1138 (1967), Phys. Letters 258, 156 (1967), Phys. Letters 278, 49 (1968), AND Phys. Rev. Letters 10, 1140 (1947).
	ARTICLE READ BY LERCY PRICE IN 4/7C, AND VERIFIED BY CDETTE BENARY.
	BEAM IS PROTON ON PROTON AT 12.5 GEV/C.
	THIS EXPERIMENT USES COUNTERS.
	KEY WORDS + ANGULAR DISTRIBUTION FITS
	CC#FOUND KEY WORDS • FITS ANGULAR DISTRIBUTION

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105	PROCUCTION OF K+ #ESONS IN 2.85-ANC 2.40-BEV PP CCLLISIONS. [PHYS. REV. 168, 1495 (1968)]
	J.T.REED,A.C.MELISSINGS,N.W.REAY,T.YAMANQUCHI (UNIV. OF ROCHESTER, ROCHESTER, N. Y., USA) E.J.SACHARIDIS, S.J.LINDENBAUM,S.OZAKI,L.C.L.YUAN (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)
·	ABSTRACT WE REPORT AN EXPERIMENTAL MEASUREMENT OF K* MESON PRODUCTION IN PP COLLISIONS AT 2.85 AND 2.40 PEV. THE MOVENTUM SPECTRA OF THE K* MESONS ARE GIVEN AT THE THREE LABORATORY ANDLES OF LEAD DEG. IT DEG. AND 32 DEG. THE K* MESONS WERE IDENTIFIEC BY MOMENTUM AND VELOCITY USING DIFFERENTIAL CERENKCY COUNTEPS WITH A COMBINED REJECTION OF THE ORDER OF LOW-A. IT IS SHOWN THAT THE PRODUCTION SPECTRA CAN BE ACCOUNTED FOR BY A ONE-MESON-EXCHANGE WECHANISM WITH THE INTRODUCTION OF APPROPRIATE CUTOFFS. AT THE THRENERGY LIMIT OF THE JEND DEG. SPECTRUM, A CLEAR PEAK IS DESENVED, WHICH IS ATTRIBUTED TO THE LOW-ENERGY LIMIT OF THE JEND DEG. SPECTRUM, A CLEAR PEAK IS ENHANCEMENTS ON PRONDUNCE FFFECTS DUE TO RESONANCES EITHER IN THE YF OR KY SYSTEM ARE DOSERVED.
	CLOSELY RELATED REFERENCES SEE ALSO PHYS. REV. 142, 918 (1966). Imis Akiille Supersedes Phys. Rev. Letters 14, 604 (1965). Continuation of Previous Experiment in Phys. Rev. 93, 1431 (1954), Phys. Rev. 103, 404 (1956), Phys. Rev. 105, 1931 (1957), AND Phys. Rev. 128, 2373 (1962).
	ACCITIONAL CITATICNS PMYS. REV. 123, 1665 119611, PMYS. REV. 147, 922 (1966), PMYS. REV. 154, 1284 (1967), NUQUO CIMENTO SUPPLEMENT 24 453 (1962), NUCLEAR INSTRUMENTS AND METHODS 35, 301 (1965), BML 711(1748), FORTSCHRITTE DER PMYSIK 9, 549 (1961), REVIEM OF SCIENTIFIC INSTRUMENTS 25, 1C70 (1954), PMYS. REV. 107, 859 (1957), PMYS. REV. 128, 2392 (1962), PMYS. REV. 137, B962 (1965), PMYS. REV. 148, 1315 (1966), PMYS. REV. 107, 859 (1957), PMYS. LETTERS 21, 229 (1966), BERKELEY CONFERENCE ABS.9.4.6 (1967), BULL. AM. PMYS. SOC. 10, 717 (1965), UNIV. CF MARYLANO 469 (1965), PMYS. REV. 82, 738 (1951), ANNALS OF PMYSICS 19, 458 (1962), PMYS. REV. 131, 229 (1963), PMYS. REV. 11965), PMYS. REV. 1164 (1967), AND PMYS. REV. 24 LETTERS 13, 484 (1564), PMYS. REV. LETTERS 13, 668 (1964), BULL. AM. PMYS. SOC. 12, 104 (1967), AND PMYS. REV. LETTERS 13, 242 (1964).
	ARTICLE REAC BY LERDY PRICE IN 4/7C, AND VERIFIED BY ODETTE BENARY.
	BEAM IS PROTON ON PROTON FROM 3.203 TO 3.67C GEV/C. (BEAM KINETIC ENERGY = 2.40 TO 2.85 GEV)
	THIS EXPERIMENT USES COUNTERS.
	KEY WORDS + ANGULAR DISTRIBUTION CPOSS SECTION STRANGE PARTICLES
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106	PROTON-NEUTRON TRIPLE SCATTERING AT 425 MEV. [PHYS. REV. 175, 1704 (1968)]
	S.C.WRIGHT,D.SHAWHAN (UNIV. OF CHICAGG, CHICAGG, ILL., USA] L.PCNDROM,S.OLSEN,R.HANDLER (UNIV. OF WISCONSIN, MADISON, WISC., USA]
	ABSTRACT THE PROTON-NEUTRON TRIPLE SCATTERING PARAMETERS P. O. R. AND A MAYE BEEN MEASURED AT LAB ANGLES OF 20 DEG, 30 DEG, AND 42 DEG, AT 425 MEV INCIDENT PROTON EMERGY. POLARIZED PROTONS WERE SCATTERED FROM MEUTRONS IN DEUTERIUM, AND THE FINAL PROTON PCLARIZATION WAS MEASURED WITH A CARBON PLATE WIRE-SPARK-CHAPEER SYSTEP. THE PECOIL NEUTRONS WERE DETECTED. PP QUASIELASTIC SCATTERING FREM DEUTERIUM WAS ALSO STUDIED AT 30 DEG. AND 42 DEG. AS A.CHECK ON THE IMPULSE APPROXIMATION.
	CLOSELY RELATED REFERENCES See ALSO Phys. Rev. 169, 1026 (1968), AND [®] Phys. Rev. 140, 1533 (1965).
	ACDITIONAL CITATIONS
	URL 20420, PHTS. REV. 173, 1272 (INAR), ANI REV. HIN. PHTM. 34, 513 (1497).
	ARTILLE KEAU BY LEKUY PHILE IN 47/0, ARU VERTIEU BY QUETTE BERARY - ARE CENT ARTAN IS ROLADITED EA DER CENT ANDREAL TO
	THE REAM DIRECTION.
	THIS EXPERIMENT USES SPARK CHAMPERS.
	KEY WORDS - POLARIZATION
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107	NP INELASTIC INTERACTIONS AT ENERGIES FROM 2 TO 10 GEV. 111. STUDY OF N PI PI-COMBINATIONS IN THE REACTION NP+NP PI+ PI+ PI- PI- (M PIO) [JINR EI-3940 (1968)]
	V.I.MGROZ,A.V.NIKITIN,YU.A.TROYAN [JCINT INST. FOR NUCL. RESEARCH, DUBNA, UŠŠŘ]
	ABSTRACT 730 EVENTS OF THE 1YPE NP+NP PI+ PI- PI- (M PIO) ORIGINATING IN A PROPANE BUBBLE CHAMBER IN AN EXPOSURE To neutrons with energies from 2 to 10 GeV have been selected. It is seen that the effective mass distributions of p pi+ pi+,p pi+ pi- and p pi- pi- combinations are satisfactorily explained by N+++(1236) and N+-+(1236) productions.
	CITATICNS JINR PL-3145 (1967), NUC. FHYS. 47, 33 (1963), NUOVO CIMENTO 34, 1644 (1964), NUOVO CIMENTO 55, A66 (1968), PHYS. Rev. 154, 287 (1967), AND PHYS. REv. 161, 1387 (1967).
	ARTICLE REAC BY LERCY PRICE IN 4/70, ANC VERIFIED BY ODETTE BENARY.
	BEAM IS NEUTRON ON HYEROGEN CEMPOUNC FROM 2.786 TO 10.900 GEV/C. (BEAM KINETIC ENERGY = 2 TO 10 GEV)
	THIS EXPERIMENT USES THE DUBNA 24 LITER (HLBC) BUBBLE CHAMBER. A TOTAL OF 22000 PICTURES ARE REPORTED ON.
	KEY WEPDS + MASS SPEČTŘUN FITS
	COPPOUND KEY WORDS + FITS MASS SPECTRUM
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POLARIZATION AND CIFFERENTIAL CROSS SECTIONS IN PROTON-PROTON AND PROTON-NUCLEUS SCATTERINGS AT 725 MEV. 137, B62C (1965)] 108 (PHYS. REV.

P.G.MC MANIGAL,R.D.EANCI,S.N.KAFLAN,B.J.MDYER [U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA, AND UNIV. OF CALIFORNIA, BERKELEY, CALIF., USA]

ACT THE PULARIZATION AND ANGULAR DISTRIBUTION OF PROTONS SCATTERED FROM PRCTONS, HELIUM, REPYLLIUM, CARRON, ALUMINUM, CALCIUM, IPON, AND TANTALUM WERE MEASUREE AS FUNCTIONS OF ANGLE AT 723 MEV. A VARIATION OF THE USUAL DOUBLE-ELASTIC SCATTERING FITHOD WAS USED, IN THAT THE SENSE OF THE FIRST SCATTERING ANGLE WAS REVERSED IN FINDING ASYMMETRIES, RATHER THAN THE SECONC ANGLE. ENERGY ANALYSIS OF THE SCATTERED BEAM WAS ACCOMPLISHED BY MEANS OF A 102-DEGREE MAGNETIC SFECTRCHETER ALLOWING A TOTAL RESOLUTION OF 4-10 MEV. THE DATA NERE FITTED NITH AN OPTICAL MODEL. IN THE PROTON-NUCLEUS SCATTERING THE POLAPIZATION REACHES A MAXIMUM VALUE OF ABOUT 40 PER CENT AT ANGLES LESS THAN THE DIFFRACTICK MINIMUM, RESULTS IN PROTON-PROTON SCATTERINGS ARE MACE INTERSTING: MGEVER, BECAUSE OF AN UNCERTAINTY IN THE ANALYZING FORER CF CARBCM, A CEFINITE STATEMENT CANNOT BE MADE. OME CAN SAY, HOMEVER, THAT ETHMER THE POLARIZATION IN PROTON-PORTON SCATTERINGS OF RE CENT AT THIS ENERGY CH THE ANALYZING POMEWE OF CARBON GUERTAINTY IN THE ANALYZING FORER CF CARBCM, A CEFINITE STATEMENT CANNOT BE MADE. OME CAN SAY, HOMEVER, THAT ETHMER 6 DEG AND 600 MEV IS MORE THAN 40 PER CENT, WHICH IS CONSIDERABLY GREATER THAN THE 30 PER CENT MEASURED AT 725 MEV. ABSTRACT

CLOSELY RELATED REFERENCES DATA SUPERSEDED BY PHYS. REV. 148, 128((1966).

ACDITIONAL CITATIONS PHYS. REV. 75, 1352 (1949), NUOVO CIMENTO 11, 407 (1954), PROGR. NUCL. PHYS. 8 47 (1960), PHYS. REV. 102, 1659 (1956), NUC. PHYS. 23, 562 (1961), UCRL 10637 (1963), JETP 4 337 (1957), NUC. PHYS. 3, 185 (1957), PHYS. REV. 104, 445 (1956), PHYS. REV. 106, 1271 (1957), JETP 35 64 (1959), NUC. PHYS. 43, 213 (1963), NUC. PHYS. 25, 642 (1961), PHYS. REV. 890 (1961), PHYS. REV. 105, 288 (1957), PHYS. REV. 95, 1694 (1954), NUOVO CIMENTO 23, 690 (1962), PHYS. REV. 102, 1157 (1956), ANNUAL REV. 0F NUCLEAR SCIENCE 7, 231 (1957), ANNUA REV. 10 PUCLEAR SCIENCE 8, 49 (1958), SOVIET PHYSICS DCKLACY 1, 607 (1956), JETP 2 349 (1956), AND NUOVO CIMENTO 6, 235 (1957).

ARTICLE READ BY LERGY PRICE IN 4/7C, AND VERIFIED BY ODETTE BENARY.

BEAM IS PROTON UN PROTON AT 7.25 GEV/C.

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . POLARIZATION

• NO DATA PUNCHEC FOR THIS ARTICLE

109 EXCHANGE MECHANISM FOR THE REACTION PN+DELTA++ CELTA-. (PHYS. LETTERS 268, 598 (1968))

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NACT IN THE REACTION PN • PN PI+ PI- WE HAVE OBSERVED COPIOUS DELTA++ AND DELTA- PRODUCTION AT FOUR-HOMENTUM TRANSFERS GREATER THAN 100 PION MASS-SQUARED EVEN WHEN RESTRICTION WAS MADE TO THE ODUBLE ISOBAR OVERLAP REGION. SUCH BEHAVIOR IS NOT OBSERVED IN THE ANALOGUE PP AND PBAR P REACTIONS AND STRONGLY SUGGESTS THE IMPORTANCE OF A MECHANISM IN ADDITION TO ONE PION EXCHANGE. ABSTRACT

CITATIONS PHYS. REV. 136, 8843 (1964), PHYS. REV. 138, 81528 (1965), PHYS. REV. 154, 1264 (1867), PHYS. REV. LETTERS 19, 397 (1967), PHYS. REV. 17, 884 (1966), PHYS. REV. 161, 1387 (1967), UCRL 1617C, AND BULL. AM. PHYS. SOC. 11, 841 (1966).

ARTICLE READ BY LEROY PRICE IN 4/70, AND VERIFIED BY COETTE BENAPY.

BEAM IS PROTON ON PROTON AT 2.7 GEV/C.

THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. A TOTAL OF 30000 PICTURES ARE REPORTED ON.

KEY WURUS + LRUSS SELIIUN UELI4(1238) MASS SPELTRUP PUMENTUP TRANSFER

110 DOUBLE-REGGE-POLE MEDEL ANALYSIS OF PP + DELTA++ P PI- AT 6.6 GEV/C. (PHYS. REV. LETTERS 20, 964 (1968)] E-L.BERGER [U.C. LAWRENCE RAC. LAB., BERKELEY, CALIF., USA, AND UNIV. OF CALIFCRNIA, BERKELEY, CALIF., USA, AND DARTMOUTH COLLEGE, MANGVER, NEW MAPPSHIRE] E-GELLET.G.G.ASHITH (U.C. LAMRENCE RAD. LAB., BERKELEY, CALIF., USA, AND UNIV. OF CALIFORNIA, BERKELEY, CALIF., USA] E-GELLET.S.SCHLEIN (UNIV. OF CALIF., LOS ANGELES, CALIF., USA)

ABSTRACT REASONABLE FITS TO INVARIANT-MASS, MOMENTUM-TRANSFER, AND TREIMAN-YANG ANGLE DISTRIBUTIONS FOR THE REACTION PP - QELTA++ P PI- AT 6.6 GEV/G ARE OBTAINED FROM A QUUBLE-REGGE POLE MODEL WITH PION FXCHANGF.

CLOSELY RELATED REFERENCES See Also UCLA 1025 (1960). This Article Supersedes PHYS. Rev. Letters 17, 804 (1966).

ADDITIONAL CITATIONS Phys. Rev. Letters 19, 614 (1967), Phys. Rev. 163, 1572 (1967), NUOVO CIMENTO 49A, 157 (1967), NUOVO CIMENTO 51A, 696 (1967), Phys. Rev. 160, 1322 (1567), Phys. Rev. 160, 1326 (1967), Phys. Rev. 166, 1525 (1968), Phys. Rev. 138, B190 (1965), Phys. Rev. Letters 15, 468 (1965), Phys. Rev. 163, 1603 (1967), Phys. Rev. 166, 1768 (1968), AND Phys. Rev. Letters 20, 628 (1968).

ARTICLE READ BY LEROY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.

REAM IS PROTON ON PROTON AT 6.4 GEV/C.

THIS EXPERIMENT USES THE L.R.L. 72, IN. (H) BUBBLE CHAMBER.

KEY WORDS . ANGULAR DISTRIBUTION FITS MASS SPECTRUM DELTAI12381 MUCELS

COMPOUND REY MURCS . FITS ANGULAR CISTRIBUTION

111	FORWARD CIFFERENTIAL CR 853 (1968)]	OSS SECTIONS FOR TH	E REACTION PP + D PI+	IN THE RANGE 3.4 TO 12.3 GEV/C.	(PHYS. REV. LETTERS 21,
	H.L.ANDEPSON, M.OIXIT, H. R.L.MARTIN (ARGONNE NAT K.M.ECWARDS, D.KESSLER (D.E.NAGLE, H.A.THIESSEN C.K.MARGROVE, E.P.HINCKS S.FUKUI (NAGOYA UNIVERS	J.EVANS,K.A.KLARE,D. LAB., ARGONNE, ILI CARLTON UNIVERSITY, {U.C. LOS ALAMOS SC: [NATIONAL RESEARCH ITY, NAGCYA, JAPAN}	.A.LARSON,M.V.SHERBAG L., USA} GTTAWA, CANACA} IENTIFIC LAB., LGS AL COUNCIL, OTTAWA, CAN	OK LUNIV. OF CHICAGO, CHICAGO, ; Anos, n.f.] Ada]	ILL., USA)
	ABSTRACT A SPARK-CH PP + D PI+ AT CLOS DATA CONFIRM THE E SHOW A HITHERTC UN UNE-PIUN-EXCHANGE	AMBER MISSING-MASS ELY SPACED INTERVAL XISTENCE OF A PROMI REPORTED SHOULDER A ANU UNE-NUCLECN-EAC	SPECTROMETER WAS USED 5 DF INCIDENT MOMENTU VENT PEAK IN THE FORW 5 E(C.M.) = 3.6 GEV. 14NGE MODELS.	TO MEASURE THE DIFFERENTIAL CRO M BETWEEN 3.4 AND 12.3 GEV/C ANG ARD CROSS SECTION AT E(C.M.) API THE RESULTS MAKE EVIDENT THE IN/	DSS SECTION FOR THE REACTION) AT SMALL C.M. ANGLE. THE PROXIMATELY = 2.9 GEV AND DEGUACIES OF PRESENT
	CITATIONS COKL. AKAD. NAUK. PHYS. REV. LETTERS 1232 (1968), PHYS. REV. 142, 918 (196 63 (1966), PHYS. 491 (1958), PHYS. LETTERS 16, 709 (1	SSSR 1CO 673 (1955) 11, 474 (1963), PH LETTERS 11, 161 (14 6), REVIEW OF SCIEN EV. LETTERS 18, 89 REV. 13C, 2407 (196 966), AND NUOVD CIM	, DOKL. AKAD. NAUK. S YS. LETTERS 7, 222 (1 364), PHYS. LETTERS 2 (1967), NUC. PHYS. 76 3), PHYS. REV. 134, B NTO 55A, 346 (1968).	SSR 100 677 (1955), ZURN. EKSP. 963), PHYS. REV. LETTERS 13, 59 2, 708 (1966), PY'S. PEV. LETTER 492 (1966), INT.CONF. ON NUCLE/ , 123 (1966), PROC. OF THE ROYAL 454 (1964), PHYS. REV. LETTERS 2	TEOR. FIZ. 34, 767 (1558), (1964), PHYS. REV. 167, (5 17, 100 (1966), PHYS. R STRUCTURE, STANFORD UNIV. SOCIETY OF LONDON &244, 20, 607 (1968), PHYS. REV.
	ARTICLE READ BY LERCY P	RICE IN 4/7G, AND VI	ERIFIED BY ODETTE BEN	ARY.	
	BEAM IS PROTON CN PROT	CN FROM 3.4 TC 12.3	GEV/C.	•	
	THIS EXPERIMENT USES SP	ARK CHAMBERS.			
	KEY WORCS . DIFFERENTIA	L CROSS SECTION			
					·
	0155505N7141 50055 555	110N /AT EIVER ANCI			1610005 31
	DATA IS AVERAGED O GRANC C.M.	VER COS(THETA) FROM	.99 TO 1.00. THEYA I	S THE ANGLE THAT THE DEUTERCN MA	KES WITH THE REAM IN THE
	. THIS DATA WAS RE	AD FROM A GRAPH .	•		
	LABORATORY	C-SIGMA/C-OPEGA			
	GEV/C 3.2	UE/SR [1] 11.0 +1			
	3.3	15.0 .1 14.6 .1			
	3.8 4.0	11.0 .1 10.5 .1			
	4.3 4.6	7.0 .1 4.8 .1			
	4.8 5.0	4.0 .1 3.5 .1			
	5.1 5.3	3.0 .1 2.8 .1			
	5.5 5.8	2.6 .1 2.5 .1			
	6.C 6.1	2.6 .1 2.5 .1			
	6.2	2.6 .1 2.3 .1			
	6.8 7.1	2.0 .1 1.7 .1			
	7.3 7.6	1.8 .1 1.6 .1			
	1.4 8.4	1.4 .1 1.1 .1			
	9.0 9.5	.9 .1 .8 .1			
	10.5	.6 .1 .5 .1			
	11.5 12.3	.5 .1 .4 .1			
	{1] PLUS PUSSIBLE	STSIEPALLC ERROR OF	+- o peñ cent.		
112	MEASUREPENT OF PP . PI+	D AT 90 DEG. AND 5	GEV/C. (PHYS. F	EV. 165, 1442 (1968)]	
	K.RUDDICK EUNIV. OF MIN	NESOTA, MINNEAPOLIS	. MINN., USA1		
	L.G.RATNER [ARGONNE NAT K.W.EDWARDS [UNIV. OF]	. LAB., ARGENNE, IL IGWA, IOWA CITY, IGW	L., USA] A, USA]		
	C.W.AKERLOF,R.H.HIEBER,	A.C.KRISCH LUNIV.	OF MICHIGAN, ANN ARBO	R, MICH., USAI	
	ABSTRACT THE DIFFER ANGLE OF 90 DEG. T PROTUN-PROTON ELAS TARGET. THE PION A TELESCOPE, IN COIN 90 DEG. CROSS SECT	THE EXPERIMENT WAS O THE EXPERIMENT WAS O TIC SCATTERING EXPE ND CEUTERON WERE DE NCIDENCE. THE INCIDE TION AT 5.0 GEV/C WA	N FOR THE PROCESS PP ONE ON THE ARGONNE ZO RIMENT. THE EXTRACTED TECTED BY TWO SPECTRO NT BEAM FLUX WAS MEAS S FOUND TO BE 35 +- 9	• PIND WAS REASURED AT 5.0 GEV S WITH THE SAME APPAPATUS AS WAN I PROTON BEAM OF THE ZGS KAS MADI IMETERS, EACH CONTAINING MAGNETS UNEO BY A RADIOCHEMICAL ANALYSI I NB/SR.	S USED IN A RECENT 90 DEG. E TO IMPINGE UPON A CH(2) AND A SCINTILLATION-COUNTER S OF THE CH(2) TARGET. THE
	CITATIONS PHYS. REV. 159, 11 100 673 (1955), PH Phys. REV. 128, 23 REV. 135, B1456 (1	138 (1967), PHYS. LE 195. REV. LETTERS 13 192 (1962), Annual R 1964), ANC PHYS. REV	TTERS 7, 222 (1963), , 59 (1964), Phys. Re EV. Of Nuclear Scienc . Letters 17, 1105 (1	PHYS. REV. LETTERS 11, 474 (196 V. 136, B779 (1964), PHYS. REV. E 13, 261 (1963), PHYS. REV. LE 966).	3], OOKL. AKAD. NAUK. SSSR LETTERS 18, 1218 (1967), TTERS 11, 217 (1963), PHYS.
	ARTICLE REAC BY LERCY P	RICE IN 4/70, AND V	ERIFIED BY ODETTE REA	IARY.	
	BEAM IS PROTON ON PROT	IGN AT 5 GEV/C.			
	THIS EXPERIMENT USES CO	DUNTERS.			•
	KEY WORCS . DIFFERENTIA	L CROSS SECTION			
	DIFFERENTIAL CROSS SEC	TICN FCR PROTON	PRCTON + CEUTERON F	1+. [PAGE 1444]	
	LABORATORY BEAM MO	MENTUM # 5.000 +-	.005 GEV/C.		
	THETA DEGREES 90.	C-SIGMA/D-OMEGA NANCEARNS/SR 35. +- 9.			

THETA IS THE ANGLE THAT THE DEUTERUN MAKES WITH THE BEAM IN THE GRANG C.M.

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SMALL-ANGLE DP ELASTIC SCATTERING AT 1.69 GEV/C. [NUC. PHYS. 89, 594 (1969)]

L.M.C.DUTTON,R.J.W.HOWELLS, J.C. JAFAR, F.B.VAN DER RAAY (BIRMINGHAM UNIV., BIRMINGHAM, ENGLAND)

ACT THE DIFFERENTIAL CROSS SECTION FOR ELASTIC OP SCATTERING NAS MEASURED CVER THE ANGULAR RANGE 18-70 MPAO. THESE DATA WHEN ANALYSED GAVE A VALUE OF 0.05 +- 0.20 FOR THE RATID OF THE REAL TO IMAGINARY PARTS OF THE SPIN INDEPENDENT NP SCATTERING AMPLITUDE AT 0.845 GEV/C, IN GOOD AGREEMENT WITH THE PRECITIONS OF FORMARD NN DISPERSION RELATIONS. ABSTRACT

CLOSELY RELATED REFERENCES See ALSO NUCLEAR INSTRUMENTS 55, 80 (1967), PHYS. REV. LETTERS 21, 1416 (1968), AND PHYS. LETTERS 258, 245 (1967).

ACCITIONAL CITATIONS PHYS. REV. 135, 8358 (1964), NUC. PHYS. 7, 113 (1958), REV. MOD. PHYS. 30, 368 (1958), PHYS. REV. 95, 1350 (1954), PHYS. REV. 139, 8362 (1965), PHYS. LETTERS 8, 285 (1964), PROC. OF THE ROYAL SOCIETY OF LONDON 63A, 595 (1950), PHYS. LETTERS 20, 203 (1566), JETP 19 542 (1964), NUOVO CIMENTO 40, 167 (1966), PHYS. LETTERS 19, 341 (1965), AND PHYS. REV. 102, 473 (1956).

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ARTICLE READ BY LERGY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.

BEAM IS DEUTERON ON PROTON AT 1.69 GEV/C.

THIS EXPERIMENT USES SPARK CHAMBERS.

KEY WORDS + REAL (AMPLITUDE)/IMAGINARY (AMPLITUDE) ANGULAR DISTRIBUTION

ELASTIC CIFFERENTIAL CRCSS SECTION FOR DEUTERON PROTON. [TABLE 1]

LABORATORY	BEAM MOMENTUM	= 1.65 +05 GEV/C.	
THETA	D-516	MA/D-OMEGA	

HETA	C-SIGMA/D-CMEGA	
MR	M8/SR	
18.5	349. +- 68.	
20.5	431. 58.	
22.5	444. 56.	
24.5	275. 44.	
26.5	207. 37.	
28.5	197. 34.	
30.5	104. 23.	
32.5	163. 28.	
34.5	164. 26.	
36.5	177. 24.	
38.5	139. 23.	
40.5	106. 24.	
42.5	150- 22-	
44.5	142. 21.	
46.5	142. 20.	
48.5	160. 20.	
50.5	140. 19.	
52.5	140. 19.	
54.5	141. 18.	
56.5	131. 16.	
58.5	146. 19.	
60.5	125. 17.	
62.5	111. 17.	
64.5	121. 16.	
66.5	85. 15.	
68.5	107. 15.	
76.5	127. 15.	

THETA IS THE ANGLE THAT THE DEUTERON MAKES WITH THE BEAM IN THE GRAND C.M.

THE RE/IM RATIG FOR THE FORWARD ELASTIC AMPLITUDE FOR NEUTRON PROTON. [PAGE 600]

I THIS IS THE VALUE OBTAINED FOR THE BEAT FIT WITH ARTA LARIN ARTRADAUT PARTH NOT LOCATICALL, COURT TO ILAUT F

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LABURATURY BEAM MCMENTUM GEV/C .85

AL PHA .05 +- .20

114 ISOTOPIC SPIN DEPENDENCE OF NUCLEON-AUCLECA CROSS-SECTIONS BETWEEN 600 AND 1000 MEV. (NUDVO CIMENTO 21, 581 (1961)) G.MARTELLI,H.B.VAN DER RAAY,R.RUEINSTEIN,K.R.CHAPMAN,J.D.DOWELL,W.R.FRISKEN, B.MUSGRAVE,D.H.READING IBIRMINGHAM UNIV., BIRMINGHAM, ENGLANCI

ABSTRACT THE RATIC CF THE DIFFERENTIAL CROSS-SECTION FOR PP AND PN SCATTERING AT 90 DEG. IN THE C.M.S MAS BEEN MEASURED AT THREE DIFFERENT ENERGIES, BETKEEN 600 MEV AND 1000 MEV, USING FAST SCINTILLATICN COUNTERS IN CONJUNCTION WITH MAGNETIC MOMENTUM ANALYSIS. THE VALUE OF THIS RATID DECREASES MARKEDLY WITH INCREASING ENERGY, FROM 3.06 +- 0.56 AT 595 MEV, TO 1.00 +- 0.18 AT 775 MEV AND TO 0.683 +- 0.097 AT 1010 MEV, SHOWING AN ENHANCEMENT OF THE SCATTERING AMPLITUDE IN THE T=0 STATE ABOVE 600 MEV. IT IS SHOWN HOW THIS BEHAVIOUR MAY BE RELATED TO THE SECOND RESONANCE IN PI P SCATTERING.

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CITATIONS REV. HOD. PHYG. 30, 360 (1930), CURH. CH3F. TCOR. FIL. 371 [307 (1939), HUCLEPR (ASIAURENIS HRU REIRUUS /, 227 (1960), PHYS. REV. 97, 1186 (1955), RUDVO CIMENTO 18, 818 (1960), ZURN. EKSP. TEOR. FIL. 31, 169 (1956), ZURN. EKSP. TEOR. FIL. 32, 440 (1957), CERN COMFERENCE 2 115 (1956), PROC. OF THE ROVAL SOCIETY OF LONDON A251, 233 (1959), PHYS. REV. 118, 325 (1560), AND CERN COMFERENCE 2 195 (1956).

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ARTICLE REAG BY LERGY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.

BEAM IS PROTON ON HYDROGEN COMPOUND FROM 1.219 TO 1.696 CEV/C. (CEAH KINETIC ENERGY - .6 TO 1.0 GEV)

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . ANGULAR DISTRIBUTION

	J.V.ALLABY,A.N.DIDDENS,A.KLOVNING,E.LILLETHUN,E.J.SACHARIDIS,K.SCHLUPMANN, A.M.WETHERELL LEUROPEAN ORG. FOR NUC. RES.,
	GENEVA, SWITZERLAND)
	ABSIKALI MEASUREMENTS OF WILE ANELE ELASTIC PP SCATTERING BEIWEEN 7 AND 12 GEVIC ARE REPURIED. STRULTURE FOUND IN THE Angular distributions is suggestive of diffraction.
	CLOSELY RELATEC REFERENCES See also cern Hadron Confedence 1 580 (1968). Continuation of Previous Experiment in Phys. Letters 258, 156 (1967).
	ACCITIONAL CITATIONS PMYS. REV. LETTERS 17, 1105 (1966), PMYS. REV. 159, 113E (1967), ANNLAL REV. OF NUCLEAR SCIENCE 13, 261 (1963), BNL 11360 (1967), UCRL 16275 (1966), UCRL 17257 (1966), PMYS. REV. LETTERS 11, 425 (1963), PMYS. REV. LETTERS 15, 45 (19 NUDVO CIMENTO 38, 60 (1965), PMYS. REV. LETTERS 9, 111 (1962), PMYS. REV. 136, B165 (1965), PMYS. REV. 152, 1162 (1966), PMYS. LETTERS 13, 190 (1964), PMYS. REV. LETTERS 19, 1149 (1967), PMYS. REV. ETTERS 0, 357 (1503), REV. MOD. PMYS. 36, 645 (1964), PMYS. REV. LETTERS 20, 637 (1968), PMYS. REV. 137, BT08 (1965), AND PMYS. LETTERS 256, 22 (1967).
	ARTICLE READ BY LERGY PRICE IN 4/7C, AND VERIFIED BY OCETTE BENARY.
	BEAM IS PROTON ON FROTON FROM 8.1 TO 12.1 GEV/C.
	THIS EXPERIMENT USES COUNTERS.
	GENERAL CCMMENTS ON THIS ARTICLE I DATA IN THIS ARTICLE IS IN GRAPHICAL FORM ONLY. FOR TABULAR DATA SEE ALLABY ET AL., CERN HADRON CONFEPENCE, VOL 1, P 580 (1960).
	KEY WORDS + DIFFERENTIAL CROSS SECTION
	* * * * * * * * * * * * * * * * * * *
. 6	SEARCH FOR THE RESONANCE "SMALL DELTA"", OF MASS 960 MEV IN THE REACTION PP - D DELTA". (PHYS. LETTERS 258, 565"(196 M.BANNER,J.CHEZE,J.L.HAMEL,G.MAREL,J.TEIGER,J.ZSEMBERY (CNTP. D'ETUCÉS NUC. SACLAY, GIF-SUR-YVETTE, FRANCE)
	P.CHAVANON, M.CROZON,L.K.PANGAN (COLLEGE DE FRANCE, PARIS, FRANCE) ABSTRACT A HISSING MASS EXPERIMENT OF THE PEACTION PP • C DELTA• SHOWS NO EVICENCE FOR THE EXISTENCE OF A BOSON ARCUN 9 And Mev.
	CITATIONS PHYS. REV. LETTERS 17, 890 (1966), PHYS. LETTERS 22, 708 (1566), PHYS. LETTERS 258, 300 (1967), AND PHYS. LETTERS 11 141 (1564).
	ARTICLE READ BY LERGY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.
	BEAM IS PROTON ON PROTON AT 3.6 GEV/C.
	THIS EXPERIMENT USES COUNTERS.
	KEY WORCS + MASS SPECTRUM
	* * * * * * * * * * * * * * * * * * *
7	THE STUDY OF 28.6 GEV/C PP INTERACTIONS WITH 6 CHARGED PARTICLES IN THE FINAL STATES. ICERN HADRON CONFERENCE 2 208
	ABSTRACT RESULTS FROM A STULY OF FIGH-HULTIPLICITY HIGH-ENERGY PP INTERACTICRS AT 28-6 GEV/C IN A HYDROGEN BUBBLE CHAMBER ARE DESCRIBED. THE MEASUREMENTS OF 29500 PICTURES YIELDED 5230 WELL-RECONSTRUCTED EVENTS, MASS DISTRIBUTIONS ARE SHOWN FROM WHICH THE DOMINANCE OF DELTAI(1230) IS NOTED. ALSO CONSIDERABLE ENHANCEMENT APPERAS FROM 1440 TO 170- GEV WHICH IS NOT INCONSISTENT WITH THE KNOWN LARGE DECAY PATES OF THE NI1525) AND NI1670J. THE 1-CONSTRAINT FITS SHO THE PRESENCE OF CHECA PRODUCTION IN THE REACTION PP - 2P 2P1-2P1-PIO. IT IS OBSERVED THAT THE REACTION PP - 2P 2P1 2P1- SHOWS SEVERAL SIMPLE FEATURES WHICH ARE CONSISTENT WITH OMINANCE CF THE REACTION BY DIFFRACTION DISSOCIATION OF THE PROTONS. BUT THIS DEVILANCE IN NOT ESTABLISHED BY THESS FEATURES.
	CLUSELY NELAIEU REFERENLES SEE ALSO BNL 11993 (1967).
	ADDITIONAL CITATIONS Phys. Rev. Letters 16, 855 (1966), Phys. Letters 12, 57 (1964), USAEC REPORT UC341D4500 (1967), Phys. Rev. 120, 1857 (1960), and Phys. Rev. Letters 7, 199 (1961).
	ARTICLE REAC BY LERGY PRICE IN 4/7C, AND VERIFIED BY ODETTE BENARY.
	BEAM IS PROTON ON PROTON AT 28.6 GEV/C.
	THIS EXPERIMENT USES THE B.N.L. 80 IN. (H) BUBBLE CHAMBER.
	GENERAL COMMENTS ON THIS ARTICLE
	1 THIS IS THE SAME AS BNL-11993.
	I THIS IS THE SAME AS BNL-11993. Ret wurus + Lhuss Seliiun Mass Sfelihum N+(1230)
	I THIS IS THE SAME AS BNL-11993. Ret wuxus + lkuss seliiun mass sfelikum n+(1230)

118 ELASTIC PP SCATTERING AT 1.45 BEV. (SOVIET JNP 1 225 (1965)) S.P.KRUCHININ,K.N.MUKHIN,A.S.ROPANISEVA,I.A.SVEILOLOBOV,M.M.SULKOVSKAYA, S.A.CHUEVA,R.S.SHLYAPNIKGV [JOINT INST. FOR NUCL. RESEARCH, DUENA, USSR} RACT ELASTIC OP SCATTERING AT 1.45 BEV HAS BEEN INVESTIGATED WITH THE HELP OF A PROPANE BUBBLE CHAMBER WITH A PULSED MACMETIC FIELC. THE DIFFERENTIAL CROSS SECTION MAS BEEN OBTAINED EVER THE ENTIPE ANGULAR REGION ZERO DEG. TO 90 DEG. (C.M.SJ. THE RESULTS ARE COMPARED WITH OPTICAL-MODEL PREDICTIONS AND OPTIMAL VALUES OF THE PARAPETERS ARE DBTAINED. IT IS SNOWN THAT THE EXPERIMENTAL DEPENDENCE OF D-SIGMA7D-CHEGA CN P-PERPENDICULAR DETAINED OFR LARGE P-PERPENDICULAR IS WELL APPROXIPATED BY THE EXPONENTIAL DEPENDENCE SUGGESTED BY OREAR D-SIGMA7D-OHEGA APPROXIPATELY EXP (--PERPENDICULAR/PO). IT IS NOTED THAT THE BEST AGREEMENT WITH THE EXPONENTIAL APPROXIMATION IS OSTAINED FOR C.M.S SCATTERING ANGLES CF CHI = 90 DEG. WHEN P-PERPENDICULAR = P C.M.S. IN THIS CASE (CHI = 90 DEG.) WE HAVE D-SIGMA7D-OHEGA = A EXPI-P C.M.SYPDI. A = 115 MB/SR. PO = 143 MEV/C, AND THE EXTRAPOLATION IS CORRECT FGR ALL KNEWN DATA GN ELASTIC PP SCATTERING IN THE ENERGY REGION 0.38 - 30.9 BEV. ABSTRACT CITATIONS PHYS. REV. 103, 1484 (1556), PHYS. REV. 128, 1836 (1962), CERN CCNFEPENCE 514 (1959), PRIBORI I TECH TECH. EXP. 6 48 (1963), PHYS. REV. 87, 425 (1952), PHYS. REV. 130, 762 (1963), PHYS. REV. 104, 221 (1956), PHYS. REV. 125, 701 (1962) JINR E-1802 (1964), PHYS. REV. 75, 1352 (1949), PHYS. REV. 107, 859 (1957), PHYS. REV. 125, 2082 (1962), PHYS. REV. 123, 2160 (1961), PHYS. REV. LETTERS 12, 112 (1964), REV. MOD. PHYS. 30, 368 (1958), AND PHYS. REV. LETTERS 11, 499 (1963). ARTICLE READ BY LERGY PRICE IN 4/70, AND VERIFIED BY CDETTE BENARY. BEAM NO. 1 IS PI+ ON HYDROGEN COMPOUND AT 2.2 GEV/C. NO. 2 IS PROTON ON HYDROGEN COMPOUND AT 2.2 GEV/C. THIS EXPERIMENT USES THE CUBNA 1/2 METER BUBBLE CHAMBER. A TOTAL OF 17000 PICTURES ARE REPORTED ON. KEY WORDS . ANGULAR DISTRIBUTION FITS COPPOUND KEY WORDS - FITS ANGULAR DISTRIBUTION NO DATA PUNCHEC FOR THIS ARTICLE 119 THE FINAL STATE P D PI+ PI- IN PD INTERACTIONS AT ABOUT 2 GEV/C. (PHYS. LETTERS 268, 317 (1968)) D.C.BRUNT,M.J.CLAYTCN,8.A.WESTWCCC [CAVENDISH LAB., CAME. UNIV., CAMBRIDGE, ENGLAND] NACT RESULTS ARE PRESENTED ON 265 EXAMPLES OF THE FINAL STATE P D PI+ PI-. IT IS SHOWN THAT A LARGE NUMBER OF THE Events involve baryon exchange. Evidence is also presented for a d pi resgnance of mass 2130 mev and width 50 mev. ABSTRACT CLOSELY RELATED REFERENCES Data superseded by PHYS. Rev. 187, 1856 (1969). ADDITIONAL CITATIONS JETP 7 528 (1958), PHYS. REV. LETTERS 11, 474 (1963), PHYS. REV. LETTERS 15, 125 (1965), PHYS. LETTERS 19, 68 (1965), AND PHYS. LETTERS 19, 526 (1965). ARTICLE READ BY LERCY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY. BEAM IS PROTON ON DEUTERON FROM 1.825 TG 2.110 GEV/C. THIS EXPERIMENT USES THE SACLAY 180 LITER BUBBLE CHAMBER. A TOTAL OF 65000 PICTURES ARE REPORTED ON. KEY WORDS + CROSS SECTION NON-STRANGE CIBARYON AT 2130 MEV. MASS SPECTRUM CROSS SECTION FOR PROTON CEUTERON . PROTON DEUTERON PI+ PI-(TABLE 1) [THIS DATA SHOULD NOT BE USEC - A MORE RECENT VALUE MAY BE FOUND IN BRUNT ET AL., PHYS. REV. 187, 1856 (1969)] LABORATORY BEAM MOMENTUM GEV/C 1.825 +- .045 2.110 .045 MICRC-BARNS 125. +- 30. 170. 3C. NO. EVENTS 75 100 CROSS SECTION FOR PROTON DEUTERON + PROTON DEUTERON PI+ PI- PIO + NEUTRON DEUTERON PI+ PI-(TABLE 11 LABORATORY BEAM MGMENTUM GEV/C 1-825 +- -045 2.110 -045 MICRC-BARNS 3. +- 2. 25. 5. NG. EVENTS 2 14

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PROTON-PROTON INTERACTIONS AT 6 GEV/C. [NUOVO CIMENTO 55A, 66 (1968)]

C.CASO,F.CONTE,G.TOMASINI (UNIV. DI GENGVA, GENGVA, ITALY) L.CASE,L.MOSCA,S.RATTI,L.TALLONE-LCHBARDI (UNIV. DI MILANO, MILANO, ITALY) I.BLODDWORTH,L.LYCKS,A.NORTON (CXFCRC UNIV., DXFORC, ENGLAND)

ABSTRACT

CLOSELY RELATED REFERENCES ANALYSIS OF THIS DATA IN NUC. PHYS. 88, 686 (1968).

ANALTSIS UF INIS UFI INIS UFIA IN AUCT THE DEC. THE ANALYSIS OF THE ANALTSIS UF INIS UFIA IN AUCT THE DEC. THE ANALTSIS UF INIS UFIA IN AUCT THE DEC. THE ANALTSIS UFIATIONS AUGUNC CHEMICD 27, 1450 (1963), FHYS. REV. 127, 1703 (1965), NUGVO CIMENIO 33, 906 (1964), PHYS. REV. 123, 333 (1961) . NUGVO CIMENIO 27, 1450 (1963), PHYS. REV. 125, 1703 (1962), PHYS. REV. 139, 8646 (1965), PHYS. REV. 125, 1048 (1962), PHYS. REV. 146, 1031 (1964), PHYS. REV. 131, 2235 (1963), NUGVO CIMENIO 34, 1167 (1964), PHYS. REV. 125, 1048 (1962), PHYS. REV. 146, 1031 (1966), PHYS. REV. 131, 2235 (1963), NUGVO CIMENIO 34, 1167 (1964), PHYS. REV. 125, 1048 (1962), PHYS. REV. 146, 1031 (1966), PHYS. REV. 131, 2235 (1963), NUGVO CIMENIO 34, 1167 (1964), PHYS. REV. 125, 1048 (1962), PHYS. REV. 146, 1031 (1966), PHYS. REV. 131, 2235 (1963), PHYS. REV. 142, 918 (1966), PHYS. REV. LETTERS 15, 207 (1965), PHYS. REV. 125, 2051 (1962), PHYS. REV. 126, 747 (1962), PHYS. REV. 142, 918 (1966), PHYS. REV. 125, 1054, 1967), BULL. AM. PHYS. SOC. 12, 10 (1967), BULL. AM. PHYS. SOC. 11, 300 (1966), BULL. AM. PHYS. REV. 154, 1284 (1967), NUOVO CIMENIO SOA, 1000 (1967), PHYS. REV. LETTERS 16, 855 (1966), PHYS. LETTERS 22, 226 (1966), PHYS. REV. 154, 1284 (1966), MUOVO CIMENIO SOA, 1000 (1967), PHYS. REV. LETTERS 16, 855 (1966), PHYS. REV. 127, 202 (1966), PHYS. REV. 25, 228 (1966), MUOVO CIMENIO 47A, 222 (1967), PHYS. REV. LETTERS 17, 304 (1966), NUOVO CIMENIC 43A, 1210 (1966), CERN 66-18, CERN 1320/5-TH (1965), NUOVO CIMENIO 488, 438 (1966), REV. MODO PHYS. 39, 1 (1967), PHYS. LETTERS 21, 581 (1966), NUOVO CIMENIO 47A, 222 (1967), PHYS. REV. 1444 (1966), NUOVO CIMENIO 34, 1644 (1964), AND UCRL 17619. THEND 42A, 606 (1960), PHYS. HYS. 444 (1966), NUOVO CIMENIO 34, 1644 (1964), AND UCRL 17619.

ARTICLE READ BY OCETTE BENARY IN 1/65, AND VERIFIED BY LEROY PRICE.

BEAF IS PROTON ON PRCTON AT 5.57 GEV/C.

T	HIS	E)	PER	R I N	ENT	US	ES .	THE	BR	111	SH	NAT	ICN	AL	150	CM	• 1	BUB	BLE	Сн	AMB	ER.		۸	101	AL	C۶	750	000	P1C	TUR	ES	ARE	RE	PO	PTEC	CI	۰.			
ĸ	EΥ	WOI	RDS	•	CRO	ss	SEC	1 10	N		ANG	ULA	R D	IST	R I 8	110	ON		м	ASS	SP	ECT	RUN		C	AL I	12	PLO	пτ		FGDI	ELS		\$	STR.	ANGE	P	ART	ICL	E \$	
				Y*	(13)	35)		N	•(1	520	101	3		• **	(16	88)	•		OM	EGA	(78	31		ET	A(5	48)	f	RHOO	765	1										
-	-			-		-				-		-		-		-			-		-		-				• •						-				-	-		-	

(TABLE 2)

LABORATORY BEAN MOMENTUM = 5.57 +- .05 GEV/C.

REACTION	MILL I-BARNS	ND. EVENTS
ROTEN PROTON +		
PROTON PROTON PI+ PI-	2.800 +100	1111
PROTON PROTON PI+ PI- PIO	2.200 .200	850
PROTON NEUTRON PI+ PI+ PI-	2.300 .200	1038
PROTON K+ LAMBDA	.059 .011	74
PROTON K+ SIGMAD	.012 .005	16
PROTON K+ LAMBOA PIO + PROTON K+ 5	IGMAD PIO .036 .009	48
PROTON KO LAMBDA PI+	.071 .010	106
NEUTRON K+ LAMBCA PI+ + NEUTRON K+	SIGMAD	
P1+	.052 .009	71
PROTON KO SIGMAO PI+	.016 .005	8
PROTON PROTON KO KOBAR	.005 .003	6
PROTON NEUTRON K+ KOBAR	.013 .007	4

[TABLE 3]

LABCRATORY EEAM MOMENTUM = 5.97 +05 GEV/C.		
REACTION	MILLI-	BARNS
DELTA(1238)++ PROTON PI-	1.18 +	20
DELTA(1230)++ + PROTON PI+ [1] DELTA(1230)++ DELTA(1230)0	.72	.15
DELTA(1238)++ + PROTON PI+ [1] DELTA(1238)+ + N#(1520)0 DELTA(1238)++ N#(1520)0	-23	.12
- DELTA(1238)++ + PROTON PI+ (1) N+(1520)C + PROTGN FI- (1)		
OELTA(1238)++ 'N+(1688)C' DELTA(1238)++ • PROTON PI+ (1)	.18	• 10
CELTA(1238)0 PROTON PI+	.05	[2]
DELTA(1238)0 + PROTON P1- (1) N*(1520)C PROTON P1+	.13	{21
N#(152C)O + PROTON PI- (1) 'N#(168810' PROTON PI+	.05	[2]
N(1688)0* + PROTON PI- [1] Proton Proton PI+ PI- [3]	.00	[2]

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGPOUND. (2) VALUE IS APPROXIMATE CALV. (3) CROSS SECTICH US FOR THE NCK-RESCNANT PRODUCTION OF THESE PARTICLES ONLY.

TABLE 4A1

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LABCRATCRY REAM MCMENTUM = 5.57 +- .05 GEV/C.

REACTION PROTON PRETON + MILLI-BARNS RCION + DELTAIL238)++ OELTAIL238)- PI+ DELTAIL238)++ PPGTEN PI+ (1) DELTAIL238)++ PPGTEN PI+ (1) DELTAIL238)++ PFGTEN PI+ PI+ DELTAIL238)- PROTON PI+ PI+ DELTAIL238)- PROTON PI+ PI+ DELTAIL238)- NEUTRON PI- (1) PROTON NEUTRON PI+ PI- (2) .00 +- .30 . 1.10 .30 .85 .20 .35 .10 (1) FITTED DISTRIBUTION WITH FIXED PASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.
(2) CROSS SECTION IS FOR THE NON-RESONANT PRODUCTION OF THESE PARTICLES ONLY. [TABLE 48] LABORATORY PEAM MOMENTUM = 5.57 +- .05 GEV/C. LABGRATORY PEAM MOMENTUM = 5.57 +- .05 REACTION PROTOR PROTOR PLAIL2381++ PROTOR PI- PIO DELTA(1238)+ PROTOR PI- PIO DELTA(1238)+ PROTOR PI- (1) DELTA(1238)+ PI- PIO (2) PROTOR PROTOR PI+ PI- PIO (3) PROTOR PROTOR ETA(548) ETA(548) + PI+ PI- PIC (1) MILLI-BARNS 1.20 +- .30 .60 . 20 .25 .10 .00 .10 . 10 .00 .00 .10 .07 .05 E11 FITTED DISTRIBUTION WITH FIXED WASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.
 CROSS SECTION IS FOR THE NCN-RESCNANT PRODUCTION OF THESE PARTICLES ONLY.
 FITTED FOR MASS AND/OR WIDTH (MASS = .786 GEV; WIDTH = .025 GEV), AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND. 121 TOTAL CROSS SECTIONS FOR P, P-BAR, CHARGEC K, AND CHARGED PI ON HYDROGEN BETWEEN 3 AND 10 GEV/C. (PHYS. REV. LETTERS 5, 333 (1960)] .G. VONDARDEL, D. H. FRISCH, R.MERMOG, R.H. MILBURK, P.A. PIROUE, M. VIVARGENT, G. WEBER, K. KINTER LEURCPEAN ORG. FOR NUC. RES., GENEVA, Switzerlandi CITATIONS JETE 34 475 (1938), FHY3. REV. LETTERS 4, 63 (1968), REVIEW OF SCIENTIFIE INSTRUMENTS 25; 1010 (1994); FM13. REV. LETTERS 3, 568 (1959), JETP 37 872 (1960), PHYS. REV. 119, 2668 (1960), PHYS. REV. LETTERS 2, 117 (1959), PHYS. REV. 118, EFT (1960), UCAL 3437 (1967), UND UCAL 006F. ARTICLE READ BY NAOMI BARASH-SCHMIDT IN 6/68, AND VERIFIED BY LEROY PRICE. BEAM NO. 1 IS K+ ON PROTON FRO∦ 3 TC 10 GEV/C. NG. 2 IS PROTON GN PROTCN FRO∦ 3 TO 10 GEV/C. NG. 3 IS ANTI-PROTON ON PROTON FRO∦ 3 TO 10 GEV/C. NG. 4 IS K- ON PROTON FRO∦ 3 TO 10 GEV/C. NG. 5 IS PI• ON PROTON FRC∦ 3 TC 10 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WORDS . CROSS SECTION K+ PROTON TOTAL CRCSS SECTION. . THIS DATA WAS READ FROM A GRAPH . LABORATORY BEAM MOMENTUM GEV/C 3.0 3.5 5.0 8.0 MILLI-BARNS 24.5 +- 2.5 23.5 2.5 26.C 1.5 19.5 1.C PROTON PROTON TOTAL CROSS SECTION. [FIGURE 3] . THIS DATA WAS READ FROM A GRAPH . LABORATORY LABURATERY BEAM MOMENTUM GEV/C 5.C 6.0 7.0 MILLI-BARNS 44.0 +- 1.0 44.0 1.0 43.C 1.0 42.0 .5 41.0 .5 10.0

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K- PROTON TOTAL CRESS SECTION. (- NO DATA PUNCHED FOR THIS PARAMETER.) PI+ PROTON TOTAL CROSS SECTION. (- NO GATA PUNCHED FOR THIS PARAMETER.) - PROTON TOTAL CROSS SECTION. (- NO DATA PUNCHED FOR THIS FARAMETER.) PRAP PPCTON TOTAL CROSS SECTION. (- NO DATA PUNCHED FOR THIS PARAMETER.) 122 FOUR-BOCY STRANGE-PARTICLE PRODUCTION IN PP COLLISIONS AT 6 BEV/C. (UCRL 18306 (1968)) S.L.KLEIN (U.C. LAWRENCE RAD. LAE., BERKELEY, CALIF., USA) ABSTRACT AN EXPOSURE CF THE LRL 72-IN. LIQUID-HYDROGEN BUBBLE CHAMBER TO 6 BEV/C PROTONS HAS YIELDED SCME 3000 EXAMPLES OF PRODUCTION OF STRANGE PARTICLES IN FOUR-BODY FINAL STATES. CROSS SECTIONS FOR THE REACTIONS PP + LAMBOA KO P PI+, PP + LAMEDA K+ P PIO, AND PP + LAMBOA K+ N PI+ ARE 64 +- 6 MICROBARNS, 39 +- 6 MICROBARNS, AND 43 +- 4 MICROBARNS, RESPECTIVELY. THE RESONANCES K+(890), N+1236), AND Y+(1385) ARE PRODUCEO WITH CROSS SECTIONS SIGMALP LAMBOA K++) = 9 +- 3 MICROBARNS SIGMALPK to N++) = 23 +- 3 MICROBARNS SIGMALPK to N++) = 23 +- 3 MICROBARNS SIGMALPK to N++) = 14 +- 2 MICROBARNS SIGMALPK 0 Y++) = 11 +- 2 MICROBARNS SIGMALPK V+0) = 17 +- 1 MICROBARNS SIGMALPK Y+0) = 15 +- 2 MICROBARNS. MADDITION, THE QUASI-THO-BODY REACTION PP - N N+1950, N* Y* K IS OBSERVED. EXCEPT FOR THE LOW K PI EFFECTIVE MASS REGION, THE DATA ARE FOUND TO BE IN GOOD AGREEMENT WITH A PION EXCHANGE MODEL. CLOSELY RELATEC REFERENCES THIS ARTICLE SUPERSEDES PART CF PHYS. REV. 171, 1421 (1968). ADDITICAAL CITATIONS PHYS. REV. LETTERS 19, 357 (1967), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 16, 855 (1966), NUOVO CIMENTO 35, LOSZ (1965), PHYS. LETTERS 4, 134 (1964), PHYS. REV. 133, 81017 (1564), PHYS. REV. 128, 1823 (1962), PHYS. REV. LETTERS 7, 450 (1961), PHYS. REV. LETTERS 4, 611 (1960), PHYS. REV. 161, 1387 (1987), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 49A, 475 (1967), PHYS. REV. 138, 8570 (1965), NUOYO CIMENTO 40A, 839 (1965), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTO 49A, 475 (1967), PHYS. REV. 138, 8570 (1965), PHYS. REV. 155, 160 (1961), UCRL 17707, PHYS. REV. LETTERS 1, 452, 2082 (1967), NUCVO CIPENTO 53A, 455 (1968), PHYS. REV. 165, 1466 (1968), PHYS. REV. 147, 922 (1966), UCLA UCLA-1031, PHYS. REV. 125, 1048 (1962), UCRL 16275, PHYS. REV. LETTERS 15, 214 (1963), PHYS. REV. 1696), UCLA UCLA-1031, PHYS. REV. 121, 1048 (1962), UCRL 16275, PHYS. REV. LETTERS 15, 214 (1963), PHYS. REV. 169, 814 (1965), PHYS. REV. LETTERS 10, 192 (1963), PHYS. LETTERS 268, 161 (1968), PHYS. REV. 165, 1730 (1968), REV. MOD. PHYS. 41, 109 (1969), PHYS. REV. 121, 1541 (1961), PHYS. REV. LETTERS 8, 32 (1962), PHYS. REV. 133, 857 (1964), UCRL 10838, PHYS. REV. 161, 1384 (1967), PHYS. REV. 12464, 430 (1967), PHYS. REV. 163, 1377 (1967), NUOVO CIMENTO 43, ALOIO (1966), PHYS. REV. 161, 1384 (1967), PHYS. REV. 1348, 1964), AND PHYS. REV. 1398, 1097 (1965). ARTICLE READ BY OCETTE BENARY IN 1/65, AND VERIFIED BY LERCY PRICE. BEAM IS PROTON ON PROTON AT & GEV/C. THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CHAMBER. A TOTAL OF SSOOCO PICTURES ARE REPORTED ON. KEY WCRDS + CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM MODELS K+(890) Y+(1385) CELTA(1920) STRANGE PARTICLES DELTA(1238) [TABLE 1] LABORATORY PEAK MOMENTUM = 6. GEV/C +- .12(PER CENT). MICRO-BARNS NO. EVENTS REACTION PROTON PROTON RGTON + LAMBDA PROTON KO PI+ Sigmad proton ko pi+ Lambda proton k+ pio Lambda neutron k+ pi+ 64. +- 6. [1] 11. 2. 39. 6. [1] 43. 4. [1] 959 160 492 554 (1) THIS DATA REPLACES VALUES GIVEN EARLIER IN CHINDWSKY ET AL., PHYS. REV. 171, 1421 (1968). (TAOLC 21 LABORATORY BEAF MOMENTUP = 6. GEV/C +- .12(PER CENT). MEACIIUN REACIIUN Y*(1365)+ PRCTCN KC Y*(1365)+ CAMBDA PI+ [1] CELTA(1238)++ LAMBDA KC DELTA(1238)++ CAMBDA KC DELTA(1238)++ KO PI+ (1] LAMBDA PROTON KO PI+ (2] Y*(1365)C K+ PROTON W*(1365)C K+ PROTON PIO [1] DELTA(1238)+ LAMBDA K+ DELTA(1238)+ CAMBDA PI+ (1] LAMBDA PROTON K+ PIO [2] Y*(1385)+ NEUTRON K+ Y*(1385)+ CAMBDA PI+ (1] DELTA(1238)+ CAMBDA PI+ (1] LAMBDA NEUTRON K+ PI+ (2) REACTION HICRO-BARNS PROTON PROTON 11. +- 2. 23. з. 6. Ζ. ·23. 7. 3. 1. 4. 2. 2. 1.

26. 15. 4. 2. 1. ' ٥. 29. з.

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND. (2) CROSS SECTION IS FOR THE NON-RESONANT PRODUCTION OF THESE PARTICLES ONLY.

LARGE-ANGLE ELASTIC PROTON-PROTON SCATTERING FKOM 1.5 TO 3.5 GEV/C. (PHYS. REV. LETTERS 23, 1306 (1969)]

B.B.BRABSGN,R.R.CRITTENCEN,R.M.FEINZ,R.C.KAMMERUD,H.A.NEAL,H.W.PAIK, R.A.SICHELL,K.F.SUEN (UNIV. DF INDIANA, BLOOMINGTON, IND., USA)

RACT WE PRESENT PP ELASTIC DIFFERENTIAL CROSS SECTION RESULTS AT NINE MOMENTA IN THE RANGE 1.5 TO 3.5 GEV/C FOR 40 Deg. & Thetaic(M.) < 90 deg. No strong evidence of secondary diffraction-like behavior in this momentum pecion is DBSERVED. Rapid Changes in the slippe CF the 90 ceg. ABSTRACT

CITATIONS PHYS. REV. 161, L374 (1967), PHYS. REV. LETTERS 21, 651 (1968), PHYS. REV. 174, 915 (1968), PHYS. REV. 159, 1L38 (1967), PHYS. LETTEPS 278, 45 (1968), PHYS. LETTERS 288, 67 (1968), UCRL 16275 (1966), PHYS. REV. 170, 1223 (1968), NUCLEAR INSTRUMENTS AND METHODS 54, 1 (1967), NUOVO CIMENTO SUPPLEMENT 3 147 (1565), PHYS. REV. 146, 1075 (1966), NUOVO CIMENTO 62A, 275 (1909), ANNALS OF PHYSICS 54, 62 (1969), PHYS. LETTERS 258, 228 (1967), CERN TH-801 (1567), PHYS. LETTERS 298, 348 (1999), AND PHYS. LETTERS 13, 190 (1964).

ARTICLE READ BY ODETTE BENARY IN 12/69, AND VERIFIED BY LEPGY PRICE.

BEAM IS PROTON ON PROTON FROM 1.5 TO 3.5 GEV/C.

THIS EXPERIMENT USES SPARK CHAMPERS.

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GENERAL COMMENTS ON THIS ARTICLE 1 TABLE OF VALUES FOR FIGURE 3 REQUESTED FROM AUTHORS 29 JANUARY 1970. CROSS SECTIONS ARE REPORTED NEAR -T = 0.7 AND 3 IGEV/CISOUAREC.

KEY WORDS . DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

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124 MEASUREMENTS OF THE POLARIZATION PARAMETERS P AND C(N,N) IN PP ELASTIC SCATTERING BETWEEN 500 AND 1200 MEV. (PHYS. REV.

GCC0221KA,Y.DUCROS,A.DE LESQUEN,J.MOVCHET,J.C.RADUL,L.VAN ROSSUM [CNTR. D'ETUCES NUC. SACLAY, GIF-SUR-YVETTE, FRANCE] J.DEREGEL,J.M.FONTAINE [LAB. CE PHYS. COPPUSCULAIRE, CAEN, FRANCE]

ABSTRACT THE POLARIZATION PARAMETER P AND THE SPIN CORRELATION PARAMETER C(N,N) IN PROTON-PROTON ELASTIC SCATTERING HAVE BEEN MESURED IN AN EXFERIENT WITH A POLARIZED-PROTON TARGET IN THE BEAM EXTRACTED FROM THE SYNCHROTRON SATURNE. THE ANGULAR DISTRIBUTION OF P WAS MEASURED AT 7 EMERGIES BETWEEN 0.5 AND 1.2 GEV. THE VALUE OF P SHONS A MAXINUM OF +0.6 AT ABOUT 700 MEV FOR A SCATTERING ANGLE OF 45 DEG. IN THE CENTER-OF-MASS SYSTEM. AT 1.2 GEV THE VALUE OF P IS CONSISTENT WITH A POLARIZED TARGET AT THE ASSATURATION CORFLICIENT OF THE VALUE OF A STATERING AND DEG. (MOMENIUM TRANSFERS -TRO.8 (GEV/C)-SOUARED). THE SPIN CORRELATION COEFFICIENT CIN.NI WAS MEASURED AT THREE ENERGIES, 0.735, 0.778, AND 1.15 GEV, BY SCATTERING A PDLARIZED-PROTON BEAM ON THE POLARIZED TARGET. THE VALUE OF C(N,N) AT 90 DEG. C.M. DECREASES FROM 0.7 TO 0.4 AS THE ENERGY INCREASES FROM 0.735 TO 1.19 GEV.

CLOSELY RELATED REFERENCES This article superseces rev. Moc. Phys. 39, 531 (1967).

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ARTICLE READ BY ODETTE BENARY IN 1/68. AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON HYDRCGEN CCMFOUNC FROM 1.09 TO 1.91 GEV/C. TARGET IS POLARIZED 65 PER CENT (NORMAL TO THE BEAM DIRECTION).

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . POLARIZATION

ELASTIC POLARIZATION FCR PROTON .

ITABLE 11

LABORATORY REAM ENERGY = .5 GEV.

THETA	POLARIZATION	
DECUEEC		
34.6	.490 +C35	
39.0	.440 .054	
43.2	.430 .622	
43.8	.490 .034	
47.0	.420 .032	
48.2	.454 .030	
51.7	.375 .022	
52.4	.435 .040	
56.0	-345 .022	
57.2	.340 .032	
60.0	.330 .020	
61-0	.360 .620	
63.8	.295 .020	
64.8	.240 .020	
68.6	.230 .020	
72.4	.190 .020	
73.4	.141 .C17	
76.0	.125 .013	
77.0	.C87 .C19	
79.8	.095 .005	
80.6	.094 .005	
83.7	.066 .018	
87.Z	.015 .016	
90.4	031 .013	
93.6	070 .005	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 1]

LABORATORY	8 E A M	ENERGY	=	.609	GEV.
THETA		F	GLAP	1241	10N
DEGREES					
30.3		•	44C	** •	C80
30.8		-	360	• •	691
35.2			415		C43
37.8			440	•	C26
39.8			415		C29
42.6			480	•	C 2 7
44.1			45C	•	026
47.0			476	•	C29
48.7			45C		C19
50.0			500		023
51.1			410		045
51.1			455		C24
54-2			500		C24
57.3			410		C25
58.4			465		025
62.2			400		636
66.6			380		C18
67 6			345		20
70.3			320		010
71 4			246		020
74 0			200		70
75 1		•	210	•	20
70 0			140	•	115
10.7		•	122	•	
02+0		•	122	•	
80.1		•	029	•	.12
94+0			006	•	020

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M. The polarization is CF the proton along the normal to the production plane in the granc C.M.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 1]

LABORATORY BEAM ENERGY = .735 GEV.

(FIRST TWO VALUES (SMALL ANGLES) GETAINED USING UNPOLARIZED TARGET (DOUBLE SCATTERING TECHNIQUE).)

1

THET	A	POLARIZ	AT ION	
DEGRE	ES			
6.7 +-	2.0	.118 +-	.160	
18.3	2.0	.367	.032	
25.4	.0	- 490	.030	
29.8	.0	.520	.040	
34.2	- ċ	.530	. Ó4D	
39.0	.0	.570	.030	
43.6	.0	. 550	.030	
48.0	.0	.500	. C 30	
54.2	.0	- 486	.030	
58.2	. 0	- 460	.020	
62.4	.0	- 404	. 0 10	
66.2		. 364	. 630	
70.4	-0	.296	.050	
74 4		268	. (15	
/	••			
THET THE	A IS 1 POLARI	HE ANGLE THAT THE P ZATION IS OF THE PR	ROTON M Oton Al	AKES WITH THE BEAM IN THE GRAND C.M. ONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M.
ELASTIC P	CLARIA	ATION FOR PROTON PR	GT GN.	[TABLE 1]

L)

LABORATORY	BEAM	ENERGY		•82	GEV.
THETA		F	CLA	IZAI	TION
DEGREES					
23.2			435	*	035
28.0			465	•	035
30.0			.443		.C29
32.6			.470		. C 2 5
34.6			. 6 6 7		.016
37.2			484		. C 25
39.4			455		. C 1 2
42.0			476		.030
43.8			. 475		.C16
44.8			450		.017
46.3			.410		.C40
48.2			435		.022
49.3			. 455		. C15
52.8			.465		. C16
53.6			.445		.016
58.4			.410		.017
62.4			392		.012
63.6			.330		. 617
66.4			355		. C17
67.4			.335		•C25
76.4			315		635
71.2			.300		. C 1 1
75.4			.225		.017
75.2			155		C16
82.9			100		036
80.0			056		. 085

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

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ELASTIC POLARIZATION FOR PROTON PROTON. (TABLE 1)

LABORATORY	8 E A M	ENERGY =	.924	GEV.
THETA		POLA	RIZATI	ON
DEGREES				
23.4		.340	+0	18
28.0		.400	••	17
32.8		.435	• •	21
37.4		•445		24
42.4		.385		24
47.0		.385		24
51.4		. 370		118

THETA IS THE ANGLE TFAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY	BEAM	ENERGY =	1.0	29	GEV.
THETA		POLA	R 1 2 4	TIC	3N
DEGREES					
25.9		.345	+-	• 04	10
36.9		.355		.c.	20
35.6		.370		. C 3	30
40.0		+305		+ C :	30
42.0		.405		.07	27
45.4		.370		. 03	20
46.6		- 360		• C Z	25
50.0		.345		.c.	21
51.2		.330		.01	20
55.4		.330		. C :	20
60.0		.285		.02	20
64.6		. 265		. C 3	30
67.2		.287		- 0 !	50
68.7		.210		• 06	50
71.6		.210		.03	20
75.6		.080		.03	35
79.4		.092		+ G I	13
83.2		.090		.02	20
97 0		017		- 04	6

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY BEAM ENERGY = 1.194 GEV.

[TABLE 1]

(FIRST TWO VALUES (SPALL ANGLES) UBIAINED USING UNPOLAPIZED TARGET (DOUBLE SCATTERING TECHNIQUE).

18	ETA	PGLAPIZATION
13.8	+- 2.0	-124 +033
21.7	2.0	.224 .030
23.9	.0	.350 .090
28.8	-0	.355 .034
29.0	.0	.390 .025
34.C	.0	.370 .044
34.2	.0	.405 .016
39.0	-0	.392 .060
441.9		.375 .615
41.9	.0	. 385 . 037
44.2	- 0	.385 .017
45 7		310 . 636
		337 640
		110 (16
49.0	• •	*330 *017
50.0	••	.305 .024
33.6	.0	.320 .023
54.0	•0	.245 .020
55.2	•0	.275 .024
59.8	•0	.19C .C20
64.4	.0	.105 .C19
65.3	•0	.085 .024
68.5	•0	.085 .030
65.6	•0	.080 .028
72.7	.0	.020 .035
77.8	-0	.035 .017
81.6	.0	083 .025
85.4	.0	016 .070

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarijation is of the proton along the normal to the production plane in the grand C.M.

INELASTIC REACTIONS IN PROTON-CEUTERON SCATTERING AT 1.825 AND 2.11 GEV/C. [PHYS. REV. 187. 1856 (1969)]

D.C.BRUNT, N.J.CLAYTON, B.A.WESTWOOD [CAVENDISH LAB., CAMB. UNIV., CAMBRIDGE, ENGLANC]

ACT THE FINAL STATES P(SPECTATCR) P P PI-, P(SPECTATOR) P P PI- PIO, P(SPECTATOR) P N PI+ PI-, AND N(SPECTATOR) P P PI+ PI- HAVE BEEN CBSERVED IN PD COLLISIONS AT 1.825 AND 2.11 GEV/C. THE SPECTATOR-NUCLEON HOMENTUM AND ANGULAR DISTRIBUTIONS ARE SHCHN TO RECUIRE THE ADDITION OF ODUBLE-SCATTERING EVENTS TO THE USUAL IMPULSE-MODEL PREDICTIONS, IN PROPORTIONS VARING DETHER IS AND COLE OF COMENT. RESULTS FOR THE REACTION P NP P PI - ARE IN GUD AGKEFENN WITH THE ONE-PION-EXCHANGE MODEL, THE CROSS SECTION FOR THE T = O PART OF THE REACTION P NP N PI+ PI- RISES BY 0.97 +-U.22 HB BETNEEN 1.25 AND 2.11 GEV/C. CHAPARED WITH A AISS OF 3 HB IN THE TOTAL T = O NOCLON-NUCLEON CROSS SECTION IN THE SAME ENFRGY REGION; BUT NO FVIDENCE HAS BEEN FOUND FOR THE PEACTION P N=N N#1470). ABSTRACT

CLOSELY RELATED REFERENCES CONTINUATION OF PREVIOUS EXPERIMENT IN PHYS. LETTERS 268, 317 (1968).

ADDITIONAL CITATICAS NUDVO CIMENTO 33, 15C5 (1964), PHYS. REV. 146, 980 (1966), BULL. AM. PHYS. SOC. 12, 470 (1967), PHYS. LETTEPS 268, 598 (1968), PHYS. REV. LETTERS 21, 1835 (1968), PHYS. REV. 157, 2C91 (1962), PHYS. REV. 126, 747 (1962), PHYS. REV. 133, BIO17 (1964), PHYS. REV. 188, BO70 (1965), PHYS. REV. 80, 196 (1950), PHYS. REV. 126, 747 (1962), PHYS. REV. 636 (1952), PHYS. REV. 142, 1195 (1966), PHYS. REV. 100. 242 (1955), PHYS. REV. 135, BASR (1964), PHYS. REV. 137, AB3E (1965), HANDBUCH DER PHYSIK 89 (1957), PHYS. REV. 123, 1393 (1961), CEN TH 66-15 (1968), NUC. PHYS. 53, 650 (1964), NUC. PHYS. 36, 281 (1962), PHYS. REV. 139, B362 (1965), PHYS. REV. 139, B380 (1965), NUDVO CIMENTO 30, 240 (1963), NUDVO CIMENTO 34, 1644 (1964), FORTSCHRITTE DER PHYSIK 9, 549 (1961), NUDVO CIMENTO 50, PHY 453 (1967). AND NUOVO CIMENTO SUPPLEMENT 27 1450 (1963).

ARTICLE READ BY OCETTE BENARY IN 3/7C, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON DEUTERON FROM 1.825 TO 2.110 GEV/C.

THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE CHAMBER. A TOTAL OF 56000 PICTURES ARE REPORTED ON.

GENERAL COMMENTS ON THIS ARTICLE I IN THE ABSENCE OF ANY INFORMATION ON THE DISTRIBUTION OF THE TOTAL SHADOWING EFFECT CONTRIBUTION BETWEEN THE VARIOUS REACTIGN CHANNILS, THE AUTHORS HAVE ASSUMED THAT THE N AND P SHADOWING ARE FOMAL. AND THAT THE SHADW EFFECT FOR EACH ABSORPTIVE REACTION IS PROPORTIONAL TO ITS SHARE OF THE TOTAL-ABSORPTION CROSS SECTION. SHADOWING

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KEY WORDS . CROSS SECTION ANGULAR DISTRIBUTION MASS SPECTRUM MODELS DALITZ PLOT

¹²⁵

CROSS SECTION FOR PROTON NEUTRON - PROTON PROTON PI-. GLAUBER CORRECTION APPLIED (TABLE 5) LABCFATCRY BEAM MOMENTUM GEV/C 1.825 +- .045 2.110 .045 MILLI-8ARNS 2.57 +- .14 2.68 .19 ND. EVENTS 1379 1362 . CRCSS SECTION FOR PROTON NEUTRON + PROTON PROTON PI- PIO. GLAUBER CORRECTION APPLIED [TABLE 5] LABORATORY BEAP MCMENTUM GEV/C 1.825 +- .C45 2.110 .045 MILL1-BARNS .16 +- .03 .35 .04 NO. EVENTS 48 97 CROSS SECTION FOR PROTON NEUTRON + PROTON NEUTRON PI+ PI-. GLAUBER CORRECTION APPLIED [TABLE 5] LABORATCRY BEAM MCMENTUM GEV/C 1.825 +- .045 2.110 .045 MILL 1-BARNS .77 +- .C7 1.75 .2G NO. EVENTS 300 564 CRCSS SECTION FOR NEUTRON PROTON . CEUTERON PI+ PI-. (TABLE 5) LAUCRATCRY BEAM MOMENTUM GEV/C 1.825 +- .045 2.110 .045 MILLI-BARNS .13 +- .03 .17 .03 CRCSS SECTION FOR PROTON CEUTERON - PROTON CEUTERON PI+ PI+. [TABLE 51 (THIS DATA REPLACES VALUES GIVEN EARLIER IN BRUNT ET AL., PHYS. LETTERS 268, 317 (1968)] (ONLY EVENTS IN WHICH THE D DOES NOT BREAK) LABORATORY BEAM MOMENTUM GEV/C 1.025 2.110 MILLI-BARNS .18 +- .02 .17 .02 NO. EVENTS 136 129 126 ZERO STRANGENESS RESONANCE PRODUCTION IN 6 GEV/C PROTON-PROTON COLLISIONS. IUCRL 17707 (1968)] R.R.KINSEY [UNIV. OF CALIFORNIA, BERKELEY, CALIF., USA, AND U.C. LAWRENCE RAD. LAP., BERKELEY, CALIF., USA] R.R.KINSEY [UNIV. OF CALIFORNIA, BERKELEY, CALIF., USA, AND U.C. LAMPENCE RAD. LAE., BERKELEY, CALIF., USA] ABSTRACT APPROXINATELY 33,0C0 FOUR-PROADED PROTON-PROTON INTERACTIONS AT 6 GEV/C HAVE BEEN EXAMINED FOR THE PRODUCTION CF NONSTRANGE MESON AND EARYON RESONANCES. THESE EVENTS WERE FOUND BY SCANNING APPROXIMATELY 112,000 PICTURES TAKEN IN THE LRL 72-IN. HYDROGEN BUBBLE CHAMBER. THE REACTIONS STUDIED IN DETAIL AND THEIR CROSS SECTIONS ARE (1) PP • PP PI + PI - 2.2 + - 0.3 MB (2) PP • PN PI + PI - 11 - 71.2 + - 0.3 MB (3) PP • PP PI + 11 - 11 - 2.4 + - 0.4 MB PROTON-PROTON INTERACTIONS HAVE BEEN STUDIED BY OTHERS IN THIS EMERGY REGION AND THIS EXPERIMENT AGREES WITH THESE STUDIES IN THE GENERAL FEATURES OF REACTION (1). REACTION (1) IS DOMINATED BY THE PSEUDO-TWO-BODY FINAL STATES NNM AND N=N* PRODUCED IN A PERIPHERAL MANNER. FITS TC THE VARIOUS POSSIBLE FINAL STATES HAVE BEEN MADE AND ARE REPORTED. DATA FROM THIS REACTION VALUE USEN CUMPARED TO THE PERIPHERAL ONE-FION EXCHANGE (OFC) MODEL AND THE RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE FING FEATURE IS THE PRODUCTION OF AN I = 3/2 RARYON RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE PIONS AND WHICH PRODUCTION OF AN I = 3/2 RARYON RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE PIONS AND WHICH PRODUCTION OF AN I = 3/2 RARYON RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE PIONS AND WHICH PRODUCTION OF AN I = 3/2 RARYON RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE PIONS AND WHICH PRODUCTION OF AN I = 3/2 RARYON RESONANCE WHICH IS OBSERVED TO DECAY INTO A NUCLEON AND THREE PIONS AND WHICH PRODUCTION OF AN I = 3/2 RARYON RESONANCE HOLE IS NEXT.YC-SQUAREC. IN ADDITION, THE HOW RESON MAS BEEN OFTECTED FOR THE FIRST TIME IN A BUBBLE CHAMBER PROTON PRODUCTION EXPERIMENT IN ADDITION TO THE ETA AND OMEGA PESONS ALREADY REPORTED. DUE TO THE COMPLICATED NATURE OF THE FINAL STATES ARE NOT A THE PROPORE IN A THE PRODUCTION CROSS SECTIONS FOR VARIOUS NEW OR INTERESTING RES CLESELY RELATEC REFERENCES PART OF THIS ARTICLE SUPERSEDED BY PHYS. REV. 171, 1421 (1968). ACDITIONAL CITATIONS CERN TC 66-20, PHYS. LETTERS 19, 925 (1967), PHYS. LETTERS 12, 356 (1964), UCRL 17003 (1966), PHYS. REV. 154, 1284 (1967), NUCLEAR INSTRUMENTS AND METHODS 20, 393 (1963), UCRL 16508 (1965), REVIEW OF SCIENTIFIC INSTRUMENTS 34, 484 (1963), LRL INTERCEPARTVENTAL REPORT UCID 1930 (1963), UCRL 16508 (1965), REVIEW OF SCIENTIFIC INSTRUMENTS 34, 484 (1963), LRL INTERCEPARTVENTAL REPORT UCID 1930 (1963), LRL INTERCEPARTMENTAL REPORT UCID 1931 (1963), PHYS. REV. LETTERS 15, 214 (1965), PHYS. REV. 138, B670 (1965) PHYS. REV. 125, 2091 (1962), PHYS. REV. 126, 747 (1962), PHYS. LETTERS 15, 75 (1963), PHYS. REV. 138, B670 (1965) PHYS. REV. 125, 2091 (1962), PHYS. REV. 126, 747 (1962), PHYS. LETTERS 15, 75 (1963), RINCFTON-PENN ACCELERATOR PPAD 600F (1966), NUOVO CIMENTO 33, 309 (1964), LRL INTEROPERATIENTAL REPORT P-156 (1966), PHYS. REV. 113, 1660 (1955), NUOVO CIMENTO 33, 309 (1964), LRL (1963), NUOVO CIMENTO 33, 906 (1964), NUOVO CIMENTO 34, 1841 (1964), UCRL 17651 (1968), NUOVO CIMENTO 35, 1644 (1964), AND PHYS. REV. LETTERS 10, 192 (1963). ARTICLE READ BY ODETTE BENARY IN 1/65, AND VERIFIED BY LERGY PRICE. BEAF IS PPOTON ON PROTON AT 6 GEV/C. THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CMAMBER. A TOTAL OF 112000 PICTURES ARE REPORTED ON. KEY WORDS + CRUSS SECTION MASS SPECTRUP H RHO(765) DMEGA(783) DELTA(1920) MODELS ANGULAR DISTRIBUTION DELTA(1238) ETA(548) ------

LABORATORY BEAM MOMENTUM = 6.00 +- .02 GEV/C.

REACTION	MILLI-BARNS	NO. EVENTS
PROTON PROTON .		
PROTON PROTON PI+ PI-	3.20 +30 [1]	3445
NEUTRON PROTON PI+ PI+ PI-	2.90 .40 [1]	3182
PROTON PROTON PI+ PI- PIO	2.40 .20 [1]	2634
CEUTERON PI+ PI+ PI-	.04 .01	50
DEUTERON PI+ PI+ PI- PIC	.16 .03	178

(1) THIS DATA SHOULD NOT BE USED - HORE RECENT VALUES MAY BE FOUND IN CHINOWSKY ET AL., PHYS. REV. 171, 1421 (1968).

(TABLE 3)

	LABORATORY BEAM MOMENTUM = 6.CC +02 GEV/C.	
	REACTION	MILL I-BARNS
RUTCI	N PROTON +	
	DELTA(1238)++ CELTA(1238)0	.66 +07
	DELTA(1238)++ + PROTON PI+ [1]	
	OELTA(1238)0 + PROTON PI- (1)	
	DELTA(1238)++ N#(152C)C	.44 .05
	DELTA(1238)++ + PROTON PI+ [1]	
	N#1152010 + PROTON P1- [1]	
	DELTA(1238)++ 'N+(1688)0'	.25 .04
	DELTA(1238)++ + PROTON P1+ [1]	
	N(1688)0* + PRETON FI- [1]	
	PROTON N+(1470) +	.68 .09
	N#(1470)+ + PROTON PI+ P1- (1)	
	PROTON DELTA(1920)+	-19 -04
	DELTA(1920)+ + PROTON PI+ PI- [1]	
	PROTON PROTON PI+ PI- [2]	.07 .12

(1) FITTED DISTRIBUTION WITH FIXED HASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGRÜUND.
(2) CROSS SECTION IS FOR THE NON-RESONANT PRODUCTION OF THESE PARTICLES ONLY.

{TABLE 4]

LABORATORY EEAM MOMENTUM = 6.00 +02 GEV/C.	
REACTION PIC	RC-BARNS
PROTON PROTON +	
PROTON DELTA(1230)++ RHO(765)- 153	· +- 31.
DELTA(1238)++ • PROTON PI+ [1]	
RHO(765)- • PI- PIO [1]	
PROTON DELTA(1238)+ RHG(765)C 45	. 12.
DELTA(1238)+ + PRGTCN PIO [1]	
RH0(765)0 • PI+ PI- [1]	
PROTON DELTA(1238)0 RHC(765)+ 65	. 18.
AELTA(1230)G - PROTCH PI- (1)	
RH0(765)+ • PI+ PIO (1)	
NEUTONN GELTA(133914+ BUG(765)0 200	. 40.
DELTA(1238)++ + PROTON PI+ [1]	
RH0(765)0 + PI+ PI- [1]	

(1) FITTED DISTRIBUTION WITH FIXEC MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FI11EU) BACKGRUUND.

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P

PERIPHERAL PROCESSES IN PRCTCN-FPCTON INTERACTIONS AT 29 GEV/C. (BNL 13918 (1965))

W.E.ELLIS, T.W.MORRIS, R.S. PANVINI, F.TURKOT (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA)

ABSTRACT BUBBLE CHAMBER AND MISSING-MASS-SPECTROMETER DATA ARE COMBINED TO STUDY DETAILS OF PRIPHERAL, QUASI-TWO-RODY PP INTERACTIONS PAP-P+M. DISTRIBUTIONS AS A FUNCTION OF MCMENTUM TRANSFER T TO THE RECOIL PROTOM AND OF THE MASS M ARE MEASURED FOR THE TOTAL INTERACTION AND FOR SPECIFIC PARTICLE COMPOSITIONS OF M. T-DISTRIBUTIONS ARE FOUND TO BE EXPUNENTIAL, WITH A CHANGE IN SLEPE AT APPROXIMATELY T = 0.2 GEV*-2. AT LOW T, THE SLOPE IS A STRONG FUNCTION OF MASS M, BUT IS NEARLY CONSTANT WITH MASS AT LARGE T. ENHANCEMENTS IN THE MASS DISTRIBUTIONS AT 1.4 AND 1.7 GEV ARE ANALYZED.

CLOSELY RELATED REFERENCES ANALYSIS OF DATA FROM PHYS. REV. LETTERS 16, 855 (1966), AND PHYS. REV. LETTERS 21, 697 (1968).

AGGITIONAL CITATIONS PHYS. LETTERS 18, 167 (1965), PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. 179, 1567 (1969), AND PHYS. REV. LETTERS 15, 45 (1965).

ARTICLE READ BY LERDY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY.

KEY WORCS . MASS SPECTRUM ANGULAR DISTRIBUTION

128 THE REACTION PP+N+P PI- AT 6 GEV/C. [NUC. PHYS. 88. 686 (1968)] L.LYONS (OXFORD UNIV., CXFORD, ENGLAND) NACT SCME ASPECTS OF THE REACTICN PP•N+(1238)P PI- AT 6 GEV/C ARE COMPARED WITH THE PREDICTIONS OF A ONE-PION-EXCHANGE PROCESS IN WHICH SCME OF THE EFFECTS OF ABSORPTICN HAVE BEEN TAKEN INTO ACCOUNT. THE AGREEMENT BETWEEN THEORY ANC EXFERIMENT IS ENCOUNCEINGE ABSTRACT CLOSELY RELATED REFERENCES ANALYSIS OF CATA FROM NUCVC CIMENTO 55, 66 (1968). ADDITIONAL CITATIONS NUOVO CIMENTO SUPPLEMENT 24 453 (1962), NUOVO CIMENTO 31, 360 (1966), ANNALS OF PHYSICS 41, 456 (1967), REV. MOD. PHYS. 37, 484 (1965), AND LCLA IC23 (1968). ARTICLE REAC BY LERCY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY. KEY WORDS . FITS ANGULAR DISTRIBUTION DELTA(1238) RODELS CEMPOUND KEY WORDS . FITS ANGULAR DISTRIBUTION 129 PROTON-NEUTRON QUASI-ELASTIC SCATTERING AT 991 MEV. [NUOVO CIMENTO 494, 261 (1967)] T.A.MURRAY, L.RIDDIFGRD.G.H.GRAYER.T.W.JONES, Y.TANIMURA [BIRMINGHAM UNIV., BIRMINGHAM, ENGLAND] RACT THE PROTON-PPOTCN AND PROTON-NEUTRON ELASTIC-SCATTERING ANGULAR DISTRIBUTIONS MAVE BEEN MEASUREC AT 1.69 GEV/C (= 991 PEV) FROM 14.5 DEG. TO 150 DEG. C.M.S USING FAST SCINITULATION COUNTERS IN CONJUNCTION WITH MAGNETIC MOMENTUM MANLYSIS. IN BOTH CASES. THE FORMARD ELASTIC CROSS-SECTIONS ARE CONSIDERABLY IN EXCESS OF THEIR RESPECTIVE OPTICAL-THEDREM MINIMA, THE RESULTS BEING CONSISTENT WITH THE EXISTENCE OF A REAL PAPT IN THE T = 0 SCATTERING AMPLITUME TOGETHER WITH SPIN DEFENDENCE IN BOTH INTERACTIONS. THE PROTON-NEUTRON ANGULAR DISTRIBUTION IS MOPE STRONGLY ASYMMETRIC ABOUT 90 DEG. C.M.S THAN IT IS AT LOWER EMERGIES, INCICATING THE OMSET OF DIFFRACTION SCATTERING AND INCREASED INTERFERENCE BETWEEN THE SCATTERING AMPLITUDES IN THE T = 0 AND T = 11-SPIN STATES. AT THE LARGEM CENTER OF MASS ANGLES, THE DATA SUGGESTED THAT SUBSTANTIAL CORRECTIONS WERE MECESSARY BECAUSE OF THE INAPPLICABILITY OF THE IMPUSE APPROXIMATICA SA ARESULT OF MULTIPLE NUCLEAR SCATTERING IN THE DEFERDING. AS A MELASURE OF A MEASUREMENT OF THE RATIO OF QUASI-ELASTIC TC ELASTIC PROTON-PROTON SCATTERING FROM 100 DEG. TO 150 DEG. C.M.S. ABSTRACT CITATIONS PROGRESS OF THEORETICAL PHYSICS 31, 615 (1964), PROGRESS OF THEORETICAL PHYSICS 31, 1162 (1964), JETP 19 542 (1964), PHYS. REV. 139, B362 (1965), PHYS. REV. 139, B38C (1965), NUOVO CIMENTO 28, 943 (1963), NUCLEAR INSTRUMENTS AND METHODS 36, 277 (1965), PHYS. REV. 80, 136 (1950), PHYS. REV. 85, 636 (1552), PHYS. REV. 85, 636 (1952), PHYS. REV. 10661, PHYS. REV. 126, B31 (1962), NUC. PHYS. 66, 673 (1965), JETP 5 371 (1967), SOVIET PHYSICS, JETP LETTERS 3, 8 (19661, PHYS. REV. 126, B31 (1962), PHYS. REV. LETTERS 17, B27 (1966), PHYS. RETTERS 72 (1966), PHYS. REV. 100, 242 (1955), NUOVO CIMENTO 42, 365 (1966), PHYS. LETTERS 21, 339 (1966), PHYS. REV. 146, 980 (1966), PHYS. LETTERS 12, 252 (1364), NUCVO CIMENTO 42, 365 (1966), PHYS. LETTERS 20, 203 (1966), CHM COMFERENCE 2 115 (1956), JETP 36 516 (1959), NUCVO CIMENTO 23, 600 (1962), PHYS. LETTERS 20, 203 (1966), CHM COMFERENCE 2 151 (1953), MUOVO CIMENTO 18, 1035 (1560), PHYS. REV. LETTERS 9, 505 (1962), PHYS. REV. 157, 1666 (1945), JETP 16 42 (1963), MUOVO CIMENTO 18, 1035 (1560), PHYS. REV. 134, 8633 (1964), PHYS. LETTERS 22, 90 (1966), AND PHYS. REV. LETTERS 16, 1217 (1966). ARTICLE READ BY ODETTE BENARY IN 1/69, AND VERIFIED BY LERDY PRICE. BEAM NO. 1 IS PROTON ON HYDROGEN COMPOUND AT 1.69 GEV/C. NO. 2 IS PROTON ON CEUTERIUM COMPOUND AT 1.69 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION FITS COMPOUND KEY WORCS . FITS DIFFERENTIAL CROSS SECTION PROTON PROTON ELASTIC CROSS SECTION. [PAGE 267] LABORAŤĊŔY BEAM MOMENTUM GEV/C 1.65 MILLI-BARNS 28.2 +- 2.1 PROTON NEUTRON ELASTIC CROSS SECTION. Glauber correction applied [PAGE 267] . LABCRATORY CEAN MOMENTUM MILL1-BARNS 19.5 +- 2.5 1.69

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON NEUTRON. (FIGURE 4) LABORATORY BEAM MOMENTUM = 1.69 GEV/C.

THIS DATA WAS I	READ FROM A	GRAPH .
. INTS DATA #45 /	ALAU PAGE P	GRAPH +
	• • • • • • • • • • • • •	•••••
T	Destend	
0500555	L-310H#/	C-01-C04
DEGREES	PC/	37
0.[1]	15.5 +	- 1.2
15.	12.6	•8
20.	10.5	•4
25.	7.7	• 2
30.	5.6	.2
40.	2.4	.2
50.	1.6	
60.	1.3	
20.		•;
10.	• •	• •
80.	• 5	•1
90.	.3	-1
100.	-2	•1
110.	•2	.1
120.	.2	•1
130.		
140		
140.		• 4
120.	1.0	
180+[1]	3.7	1.0

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] EXTRAPOLATED POINT.

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BACKWARD NP SCATTERING WITH A PCLARIZED TARGET. [PHYS. LETTERS 318, 617 (1970)]

P.R.ROBRISH.O.CHAMBERLAIN.R.D.FIELD JR.,R.Z.FUZESY,N.GORN,C.C.MOREPOUSE, T.POWELL,S.ROCK,S.SHANNON,G.SHAPIRO,H.WEISBERG (U.C. LAWRENGE RAD. LAB., BERKELEY, CALIF., USA) M.J.LONGO (UNIV. CF MICHIGAN, ANN ARBOR, MICH., USA)

NACT — WE MEASURED THE POLARIZATION PARAMETER P IN NEUTRON-PROTON ELASTIC SCATTERING NEAR THE BACKNARD DIRECTION, USING A POLARIZED PROTON TARCET, MEASUREMENTS COVERED THE RANCE OF INCIDENT NEUTRON MOMENTA FROM 1.0 TO 5.5 GEV/L OF FOUR-MOMENTUM TRANSFER SOURDED OF MOM -0.005 TO -0.5 (GEV/LSOURRED. ABSTRACT

CITATICNS PHYS. REV. LETTERS 23, 542 (1965), NUOVO CIMENTO 41A, 167 (1966), PHYS. REV. LETTERS 15, 38 (1965), PHYS. REV. 164, 1726 (1967), PHYS. REV. 163, 1603 (1967), PHYS. REV. 182, 1579 (1969), PHYS. LETTERS 298, 372 (1969), PHYS. REV. 156, 1703 (1967), PHYS. LETTERS 4, 15 (1963), PHYS. REV. 130, 1571 (1963), AND PHYS. REV. 177, 2318 (1969).

ARTICLE REAC BY OCETTE BENARY IN 6/7C, AND VERIFIED BY LEROY PRICE.

BEAM IS NEUTRON ON HYDROGEN COMPOUND FROM 1.0 TO 5.5 GEV/C. TARGET IS POLARIZED 50 PER CENT (NORMAL TO THE BEAM DIRECTION). THIS EXPERIMENT USES COUNTERS.

KEY WORDS + POLARIZATION

ELASTIC POLARIZATION FOR NEUTRON PROTON. [FIGURE 2]

DATA IS AVERAGED OVER LARCRATORY BEAF MCMENTUM FROM 1. TO 2. GEV/C.

[PRIVATE COMMUNICATION FRCM P.R.ROBRISH, JUNE, 1976]

(THESE ARE PRELIPINARY RESULTS)

- T		POLARIZ	ATION	(1)
GEV/C)**2			
IN	MAX			
01	.03	10 +-	.08	
03	.06	06	. 64	
06	.10	04	.03	
10	.20	14	. 64	
20	30	- 47	. 15	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). The polarization is CF the proton along the normal to the production plane in the granc c.m.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC POLARIZATION FOR NEUTRON PROTON. [FIGURE 2]

NATA IS AVERAGED OVER LABORATORY BEAM HOMENTUM FROM 2. TO 3. OCV/C.

[PRIVATE COMMUNICATION FROM P.R.RCERISH, JUNE, 1970]

(THESE ARE PRELIMINARY RESULTS)

-T		POLARIZATION [1]
IGEV/C	\$ * * 7	
PIN	MAX	
.00	.01	03 +12
• 01	.03	03 .06
.03	.04	17 .05
-06	.10	17 .04
-10	-20	17 .04
-20	.30	28 .06
-30	.40	36 .11
-4C	.60	61 .24

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). The polarization is of the proton along the normal to the production plane in the grand C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC	POLARIZATION	FCR	NEUTRON	PRCTCN.

DATA IS AVERAGED OVER LARCRATORY BEAF MOMENTUM FROM 3. TO 4. GEV/C.

I PRIVATE COMMUNICATION FROM P.R. PORRISH, JUNE, 1970)

	THESE	ARE	DREI INTNARY	RESAULTS
•		ANG	FREE FREIMANT	ne cuti.

-1		POLARIZATION (1)
IGEV/C	**2	
PIN	MAX	
.oc	.01	.04 +12
.01	.03	17 .07
.03	. 66	15 .05
•06	.10	27 .05
.10	.20	21 .04
. 20	.30	31 -06
.30	-40	22 .05
.40	.60	26 .09

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). The polarization is of the proton along the normal to the production plane in the grand C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

ELASTIC POLARIZATION FOR NEUTRON PROTON. [FIGUPE 2]

DATA IS AVERAGED OVER LARCRATORY BEAM MOMENTUM FROM 4. TO 5. GEV/C.

[PRIVATE COMMUNICATION FROM P.R.ROBPISH, JUNE, 1970]

(THESE ARE PRELIMINARY RESULTS)

- 7		051 407 747 108 1	,
GEVIC	1**2	PEEANIZATION (1
16	MAX		
00	.01	11 +10	
01	.03	.04 .06	
03	.06	09 .05	
06	.10	11 .05	
10	.20	14 .C4	
20	.30	22 .05	
30	.40	34 .67	
40	.60	49 .07	

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRONJ AND THE (PROTON). The polarization is of the proton along the normal to the production plane in the grand c.m.

```
[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 5 PER CENT.
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ELASTIC POLARIZATION FOR NEUTRON PROTON. (FIGURE 2)

DATA IS AVERAGED OVER LABORATORY BEAM NOMENTUM FROM 5.0 TO 5.5 GEV/C.

' PRIVATE COMMUNICATION FROM P.R.POBRISH, JUNE, 19701

I THESE ARE PRELIMINARY RESULTS)

-1		POLADIZATION I	
GEV/C	}**2		• •
PIN	MAX		
.00	.01	20 +12	
.01	.03	09 .07	
.03	.06	26 .06	
.06	.10	20 .06	
.10	- 20	28 .05	
.20	.30	37 .07	
.30	.40	17 .09	
.40	-60	42 .09	

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (PROTON). The polarization is of the proton along the normal to the production plane in the grand c.m.

111 PLUS POSSIBLE SYSTEMATIC ERROR OF +- 5 PER CENT.

131

THO-PRONG EVENTS IN PPOTON-PPOTON INTERACTIONS AT A-1 GEV/C. [NUC. PHYS. 013, 203 (1969)]

J.GINESTET, D.NANESSE, TRAN HA ANF, D. VIGNALD ICNTR. D'ETUCES NUC. SACLAY, GIF-SUR-YVETTE, FRANCE]

AGCT ABOUT 10000 TWO-PRCNG EVENTS OF 8.1 GEV/C PROTON-PROTON INTERACTIONS IN THE CERN 2 M. BUBBLE CHAMBER HAVE BEEN ANALYZED. WE STUDY ELASTIC SCATTERING AND SINGLE-PION PRODUCTION REACTIONS. WE GIVE CROSS SECTIONS FOR ISOBAR PRODUCTION. WE ATTEMPT TO INTERPRET THE GENERAL FEATURES OF THE PP-P N PI& REACTION BY THE DECK MECHANISM. WE COMPARE THE PRODUCTION AND THE CECAY OF DELTA++11236) WITH ABSORPTION OR PI REGGE TRAJECTORY EXCHANGE MODELS. ABSTRACT

CLCSELY PELATED REFERENCES CONTINUATION OF PREVIOUS EXPERIMENT IN NUC. PHYS. 85, 169 (1968).

ADDITICNAL (ITATIONS PHYS. REV. LETTERS 17, 789 (1966), RUTHERFORC HIGH ENERGY LAB. RPP/H/53, PFYS. REV. LETTERS 19, 397 (1967), PHYS. REV. 170, 1223 (1968), PHYS. REV. 173, 1322 (1968), NUOVO CHANTO 494, 479 (1967), PHYS. REV. 154, 1284 (1967), NUOVO CIMENTC 38, 60 (1965), NUOVO CIMENTO 534, 232 (1568), PHYS. REV. 174, 1538 (1968), NUOVO CIMENTO 534, 1000 (1967), PHYS. LETTERS 288, 195 (1968), PHYS. REV. LETTERS 13, 169 (1964), NUOVO CIMENTO 48, 676 (1967), NUOVO CIMENTO 45, 1010 (19664), PHYS. REV. 168, 1773 (1968), PHYS. REV. 144, 1122 (1966), PHYS. REV. 160, 141C (1967), AND NUOVO CIMENTO 55, 667 (1968).

ARTICLE READ BY OCETTE BENARY IN 3/7C, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON PROTON AT 8.1 GEV/C.

THIS EXPERIMENT USES THE CERN 2F (H) BUBBLE CHAMBER. A TOTAL OF 60000 PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION ANGULAR DISTRIBUTION CIFFERENTIAL CROSS SECTION FITS DENSITY MATRIX #ASS SPECTRUM DELTA(1238) N+(1470)P11 'N+(1688)' MODELS DELTA(1920) CEMPOUND KEY WORDS . FITS CIFFERENTIAL CROSS SECTION

(FIGURE 2)

[TABLE 1]

LABCRATORY REAM MOMENTUM = 8.1 +- .1 GEV/C. REACTION MILLI-BARNS NU. EVENTS ROTON + ELASIIC PROTCN PROTON PIO PROTCN NEUTRON PI+ PROTON PROTON MH22PIO PROTON NEUTRON PI+ MH21PIC PI+ PI+ NEUTRON NEUTRCN MH20FIO Z PRCNGS TCTAL 10.80 +- .40 1.75 .20 4.50 .4C 1.60 .40 6.50 .50 >.60 26.10 1.40 40.1C .20 3360 TABLE 31 LABORATORY BEAM MOMENTUM = 8.1 +- .1 GEV/C. REACTION PROTOK PROTON -NEUTRON DELTA(1238)++ DELTA(1238)++ PROTON DELTA(1238)+ DELTA(1238)+ DELTA(1238)+ DELTA(1238)+ PROTON N=(147C)+ N=(147C)+ N=(147C)+ N=(147C)+ N=(147C)+ N=(1488)++ N=(1688)++ DELTA(1920)++ DELTA(1920)++ PROTON PI+ [1] REACTION MILLI-BARNS 1.35 +- .30 .40 .10 .07 .15 .50 .15 - 25 - 15 .10 .05 .10 .05 .45 -20 (1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK FYENTS ONLY ADOVE (FITTED) BACKGROUND.
(2) FITTED FOR MASS AND/OR WIDTH [MASS = 1.435 GEV; WIDTH 4 -200 GEV], AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (FIGURE 2) LABORATORY BEAM NOMENTUM = 8.1 +- .1 GEV/C. NUMBER OF EVENTS = 3220. [PRIVATE COMMUNICATION FROM GINESTET, MAY, 1970] (THE CONVERSION FACTOR FROM NUMBER OF EVENTS TO MILLIBARNS WAS CALCULATED BY US) (GEV/C)+*2 WIN HAM .00(2) .06 .08 .08 .10 .12 .12 .12 .14 .14 .16 .14 .16 .10 .20 .20 .22 .22 .24 .24 .26 .26 .30 .30 .32 .32 .34 .34 .36 .36 .38 .98 .40 .40 .42 .44 .44 U-310##/U-1 MB/(GEV/C)++2 [1] NO. EVENTS

 MB/(GEV/C)*2

 (Y4.6 +- 3.3

 45.0

 27.7

 37.3

 2.2

 34.6

 2.7.7

 17.5

 18.5

 16.9

 1.5

 13.5

 13.5

 14.3

 12.1

 13.5

 1.6

 7.6

 1.0

 6.1

 .9

 5.4

 .9

 3.6

 .7

 .8

 T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [OUTGOING PROTON]. [1] COUNTS WERE MULTIPLIED BY .135 TO GET THESE. ERRORS ARE TAKEN AS PROPORTIONAL TO THE SQUARE-ROOT OF THE COUNTS. (2) EXTRAPOLATED POINT. . FIT TO GEAGTIG DIFFERENTIAL CROSS SECTION FOR PRUIUS PRUIUS. LIABLE 21 LABURATORY BEAF MOMENTUR = 0.1 +- .1 GEV/C. WHERE D-SIGMA/D-T IS IN ME/IGEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUES A = 80. +- 3. Lambca = 7.5 +- .2 .

	DIFFERENTIAL CROSS S	ECTICN FCR PROTON PRG DELT	TON + NEUTRON DE A(1238)++ + PROT	LTA(1238)+++ ON PI+ [1]	[FIGURE 5]	-
	LABORATORY BEAM NUMBER OF EVENTS	MOMENTUM = 8.1 +1 G = 225.	EV/C.			
	[PRIVATE COMMUNIC	ATIGN FRCM GINESTET, MAY	, 1970]			
	(THE CONVERSION	FACTOR FREM NUMBER OF E	VENTS TO MILLIBARN	S WAS CALCULATED BY	US)	
	-T	D-SIGMA/D-T				
	(GEV/C)**2	MB/(GEV/C)++2 [2]	NO. EVENTS			
•	.00 .02	6.5 +9	48			
	.02 .04	3.6.7	27			
	.06 .08	2.6 .6	19			
	.10 .12	2.2 .5	15			
	.12 .14	1.6 .5	12			
	.16 .18	1.2 .4	9			
	-18 -20 -20 -22	.7 .3	5			
	-22 -24	1.2 .4	9			
	.26 .28	.3 .2	2			
	.28 .30	.3.2	2			
	.32 .34	-1 -1	1			
	.34 .30	.0 .1	0			
	.38 .40	.3 .2	2			
	.40 .42		•			
	T IS THE MOMENTU	M TRANSFER BETWEEN THE (INCOMING PROTONI A	NO THE (DELTA(1238)-	++1.	
	<pre>(1) USED SIMPLE (2) COUNTS WERE</pre>	MASS CUT. Multipliec by .135 to g	ET THESE. ERRORS A	RE TAKEN AS PROPORT	IONAL TO THE SQUARE-RO	GT OF THE COUNTS.
132	DELTA(1236)++ DELTA(1	2361- PRODUCTION IN P N	COLLISIONS AT 6.98	GEV/C. [WEIZM	ANN INST REPORT (1970)	1
	A.SHARTRA.C.YEKUTTELT	.C. YAFEE.S. TOAFE.E.F. RON	AT.I.I.YPNS.U.KAPSH	ON. 8. HARER. V. FISEN	RERG (NEIZMANN INST. D	E SCL. REFONDTH.
	I SRAEL)					
	ABSTRACT THE REAC WITH THE REACTIO CROSS-SECTION BE DELTA++ DELIA- COMPARED WITH SO	TION PN • DELTA++ DELTA- NS PBAR P • GELTA-BAR DE HAVES LIKE P(LAB) EXP(-2 GREES WITH THE G.P.C.HOD ME QUARK MGCEL PREDICTIC	WITH A CROSS SECT LTA AND PP + DELTA .5+-0.3), CONSISTE EL WITH SHAPP CUT- NS.	ION OF 1.1 +- 0.2 M DELTA AT DIFFERENT NT WITH ONE-PION-EX OFF AT R=1.3 FERMI,	B IS STUCIED AT 6.98 G INCIDENT MOMENTA SHOW CHANGE. THE PRODUCTION THE DECAY CCRRELATION	EV/C. COMPARISON S THAT THEIP AND DECAY OF S ARE ALSO
	CITATICNS PHYS. REV. 154, CIMENTO 484, 360 REV. 160, 1410 (1284 (1967), NUQVO CIMEN (1967), PHYS. REV. 123, 19681, PHYS. REV. 173, 1	TO 55, 66 (1968), 1307 (1968), PHYS 322 (1968), NHC, P	NUC. PHYS. 318, 30 . Letters 268, 598 Hys. 817, 289 (1965	(1970), NUC. PHYS. 85, (1968), NUC. PHYS. 86, 1. AND NUCYO (1968), 3	169 (1968), NUOVO 465 (1968), PHYS. 4.518 (1965).
	ARTICLE READ BY OCETT	E BENARY IN 6/7C, AND VE	RIFIEC BY LERGY PR	ICE.		.,
	BEAM IS PROTON ON DE	UTERCN AT 6.98 GEV/C.				
	THIS EVOLPTNENT HEES			TOTAL DE 94000 810		
	This Exectinent Oses			10142 2. 94000 112		
	KEY WORDS • CROSS SEC DIFFERENTIA	L CROSS SECTION FITS	DENSITY MATRI	ANGULAR DISTRIBUTIO X	JN MODELS	
	COMPOUND KEY WORCS .	FITS DIFFERENTIAL CROS	S SECTION			
	CROSS SECTION FOR GLAUBER CORRECTI	PROTON NEUTRON + PROTO ON APPLIED	ON NEUTRON PI+ PI-	. (PAGE 4)		
	LABCRATORY BEAM MCMENTUM GEV/C 6.78	MILLI-BARNS 3.72 += .22				
	CROSS SECTION FOR GLAUBER CORRECTI LABORATORY BEAM MCMENTUM GEV/C L+78	PROTON NEUTRON + DELT DELT ON APPLIED MILLI-BARAS 1-1 +2	A(1238)++ DELTA(12 A(1238)++ PROT A(1238)- + NEUTR A(1238)- + NEUTR	38) [PAGE { ON P1+ [1.2] ON P1- [1.2] 	51	
	[1] NGN-INTERFE [2] FITTLU UIŠI	RING AMPLITUDES ASSUMED. Higution with fiven bass	AND WINTH AND TOO	K EVENTS ONLY ABOVE	(FITTED) BACKGROUND.	

•

133	LARGE-ANGLE PD SCATTER IN	G AT 580 M	EV. (PHYS	. REV. LETTERS 24, 236 (1970)]
	J.S.VINCENT, W.K.ROBERTS,	E.T. BCSCHI	TZ [LEWIS RES.	CNTR., NASA, CLEVELAND, CHIC)
	L.S.KISSLINGER (CARNEGIE	-MELLON UN	IV., PETTSBURG	in, PA., USA) VA., USA)
	P.C.GUGELOT LUNIV. OF VI	RGINIA, CH	ARLOTTESVILLE,	VA., USA)
	J.R.PRIEST [MIAM! UNIVER	SITY, OXFO	RO, CHIC, USA)	MARY, WILLIAMSBURG, VA., USA)
	ABSTRACT THE ELASTIC SCATTERING ARE PRES BARYON-EXCHANGE MEC	SCATTERIN ENTED AND HANISF INC	G CF PROTONS FI Discussed Here. Lucing the trai	RCM DEUTERONS FAS BEEN MEASURED AT 560 MEV. THE RESULTS FOR LARGF-ANGLE THE BACKNARD PEAK OBSERVED IN THE EXPERIMENT IS CONSISTENT WITH A INSFER OF BARVON RESCHANCES.
	CLOSELY RELATED REFERENC This Article Supers	ES EDES BULL.	AP. PHYS. SOC	. 13, 872 (1968).
	ACCITIONAL CITATIONS PHYS. REV. LETTERS 030 (1960), PhyS. R (1963), PhyS. LETTE 21, 1496 (1900), AN	16, 761 (1 EV. 180, 1 RS 288, 29 D PHTS. RE	966), PHYS. RE 483 (1965), PH 9 (1968), PHYS. 9. Letters 22,	XV. LETTERS 19, ⁶ 387 (1967), NUGVO CIPENTC 514, 369 (1967), NUGVO CIMENTO 56 NYS. REV. LETTERS 20, 1116 (1968), ANNUAL REV. OF NUCLEAR SCIENCE 13, 261 . LETTERS 298, 211 (1969), PMYS. PEV. 177, 2075 (1969), PMYS. REV. LETTERS . 370 (1969).
	ARTICLE READ BY DEETTE B	ENAPY IN 6	7C. AND VERIE	TED BY LERDY PRICE.
			UND AT 1 166 C	
				Easter (DEA) which to Entral - 190 deal
	THIS EXPERIMENT USES COU	N1273.		
	KEY WORCS . DIFFERENTIAL	CROSS SEC	TICN	
	•			
	ELASTIC DIFFERENTIAL CRC	SS SECTION	FCR PROTON DE	UTERON. [FIGURE 1]
	LABORATORY BEAM ENE	RGY = .5	E GEV.	
	[PRIVATE COMMUNICATI	ON FRCK J.	S.VINCENT. JUN	ie. 1970)
	(THESE DATA ARE CO	RRECTED ED	R CEUTERON BRE	AKUP. THE TWO POINTS AT THETA#20.3 DEGREES ARE OBTAINED BY DIFFERENT
	TECHNIQUES.)		BEOTEKEN BAC	
	THETA	C-SIGMA/D	-CFEGA	
	DEGREES	M8/S	R	
	20.3	7-700	.600	
	25-3	3.700	.600	
	28.6 33.6	3.100	.500	
	36.8	- 820	.070	
	44.5	.270	.020	
	45.6	-150 -110	.010	
	57.4	•091	.005	
	65.0	-091	.005	
	72.7 79.5	.083	.005	
	86.2	-055	.003	
	99.0	-039	.005	
	104.5	-028	.002	
	116.0	-022	.002	
	154.0	+027	1000	
	149.5	.117	.019	
	154.0	•121 •172	.009	
	161.2	. 168	.007	
	THETA IS THE ANGLE	THAT THE P	ROTON MAKES WIT	TH THE BEAM IN THE GRAND C.M.
134				
104	SPALE ANGLE PROTON-PROTO	N SCATTERI	NG AT 7.85 GEV/	/C. (PHYS. LETTERS 14, 54 (1965))
	A.E.TAYLOR LATGMIC EN. R A.ASHMURE,W.S.CHAPHAN,D.	ES. ESTAR. F.FALLA.W.	HARWFILL RERN H.RANGE.D.B.SCC	KS ENGLAND) OTT FOUEEN MARY COLLECE, LONDON, ENGLAND)
	A.ASTBURY . F.CAPRODIT	G.WALKER (BULMED BODD HICH	H EH. LAU., GHILTON, DID. DEAK, ENGLANDI
	CITATIONS			
	LETTERS 13, 93 (196	41, PHYS. 1	LETTERS 8, 285	UOVO CIMENTO 27, 427 (1963), PHYS. REV. LETTERS 11, 427 (1963), PHYS. (1964), AND PHYS. LETTERS 13, 78 (1964).
	ARTICLE READ BY DEETTE B	ENARY IN 1	0/69. AND VERIE	FIFO AV LEDAY ODICE
	BEAM IS OPDION ON PROTO			
	SCAR 15 FROTOR UN FROTO	N AT 7.05 1	6EV/C.	
	THIS EXPERIMENT USES SPA	RK CHAFEER	s.	
	KEY WORDS + CROSS SCCT10	N QIFFI	ERPNTIAL CROSS	SECTION PEAL (AMPLITUDE)/IMAGINARY (AMPLITUDE)
	PROTON PROTON TUTAL CROSS	SECTION.	EPAGE 5	551
	LABORATORY			
	GEV/C	MILL1-84	RNS	
	7.85C + .018	40.0 +-	••	
	THE RE/IM RATIO FOR THE F	ORWARD EL4	STIC AMPLITUDE	E FOR PROTON PROTON. (PAGE 56)
	LABORATORY	ALPHA	м Г 11	
	GEV/C			
	(*d)U ** *018	25 +-	3	
	•			
	[1] ERRORS INCLUCE	SYSTEMATIC	:s.	

135	HIGH ENERGY NUCLECN-NUCLECN TCTAL CRCSS SECTIONS. (PHYS. PEV. LETTERS 9, 32 (1962))
	A.N.DIDDENS,E.LILLETHUN,G.MANNING,A.E.TAYLOR,T.G.WALKER,A.H.WETHERELL (EUROPEAN ORG. FOR NUC. RES., GENEVA, SWITZERLAND)
	CITATIONS Phys. Rev. Letters 5, 576 (1960), Review OF Scientific instruments 25, 1070 (1954), Phys. Rev. 125, 7C1 (1962), Phys. Rev. Letters 5, 333 (196C), Phys. Rev. Letters 7, 185 (1961), Phys. Rev. 103, 211 (1955), Phys. Rev. 100, 242 (1955), Phys. Rev. 98, 1393 (1955), Phys. Rev. 131, 1850 (1961), AND Phys. Rev. 8, 124 (1962)
	ARTICLE REAC BY OCETTE BENARY IN 4/67. AND VERIFIED BY LERGY PRICE.
	BEAM NO. 1 IS PROTON ON HYDROGEN CCMPOUND FROM 3.27 TO 7.75 GEV/C. No. 2 IS PROTON ON CHEFTLUK COMPOUND FROM 3.27 TO 7.75 GEV/C.
	NET NUMUS - CRUSS SECTION
	PROTON PROTON IDIAL GROSS SECTION. TRABLE IJ
	LABORATCRY BEAM MOMENTUM
	GEV/C MILLI-BARNS 3.27 47.1 +5
	4.51 42.1 .7 5.83 41.6 .6
	7.75 41.6 1.1
	PROTCH NEUTRON TOTAL CROSS SECTION. (TABLE 1)
	(NP CROSS SECTION OBTAINED BY LSING DZO AND HZO.GLAUBEP CORRECTION NOT APPLIED.)
	LABORATORY
	EEAM MCMENTUM Gevvc Milli-Barns
	3.27 37.1 +- 1.3 . 4.51 36.8 .5
	5 63 37 C 8
126	
130	A PUSSIBLE T = $2, 5 = 0$ PP FIX HEALMARKE AL 2520 MEV. (PHTS. LETTERS 16, 75 (1905))
	J.KIDGLJMANDELLIV.FELDSIJS.KAIIIJAASILMIADELLIJALUDE LUNIV. UI MILANU, MILANU, MIALTI F.CONTE, G.TOMASINI (UNIV. BI GENOVA, ITALY]
	CLOSELY RELATED REFERENCES
	PART OF THIS ARTICLE SUPERSEDED BY NUDVO CIMENTO 384, 175 (1968). Continuation of previces experipent in Sienna Conference 1 591 (1963), and Sienna Conference 1 348 (1963).
	ADDITIONAL CITATIONS
	CERN 1370/P, PHYS. REV. 110, 765 (1956), PHYS. REV. 105, 1874 (1957), NUCYG CIMENTO 30, 240 (1963), NUOYO CIMENTO 27, 1450 (1962), PHYS. REV. 112, 1640 (1959), REV. HCD, PHYS. 33, 458 (1951), PHYS. REV. 126, 599 (1960), NUOYO CIMENTO 15, 465 (1960), PHYS. REV. 125, 2091 (1963), PHYS. REV. LETTERS 8, 329 (1962), PHYS. REV. 126, 747 (1962), PHYS. PEV. 9, 133 (1962), PHYS. REV. LETTERS 10, 142 (1963), PHYS. REV. LETTERS 12, 674 (1964), PHYS. REV. LETTERS 6, 641 (1961), PHYS. REV. LETTERS 8, 82 (1962), NUOYO CIMENTO 32, 227 (1964), PHYS. REV. LETTERS 12, 134 (1964), PHYS. REV. LETTERS 5, 641 (1961), PHYS. REV. LETTERS 8, 82 (1962), NUOYO CIMENTO 32, 227 (1964), PHYS. REV. LETTERS 12, 134 (1964), PHYS. REV. LETTERS
•	13, 030 113041, PFTS. KEV. LETTENS 13, ETS (13041, AND PHTS. KEV. LETTENS 14, 334 (1405).
	ARTICLE READ BY DEETTE BENARY IN 5/67, AND VERIFIEC BY LERGY PPICE.
	BEAM IS PROTON ON PROTON AT 4 GEV/C.
	THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE CHAMBER.
	KEY WORDS – GROSS SECTION MASS SPECTRUM MODELS DELTA(1238) NON-STRANGE DIBARVON STATE AT 2520 HEV
	CRUSS SECTION FUR PROTON PROTON PROTON PROTON PIF PIF.
	• • THIS DATA SHOULD NOT BE USEC • • (MORE RECENT VALUE PUBLISHED (N NC 584,175(1968))
	LABORATORY -
	GEVC MILLI-BARNS NO. EVENTS
	4. 2.52 4.12 424
1277	
134	ELASTIC SCATTERING UF 580 MEV NEUTRONS BY PROTONS AND NEUTRONS. [CERN CONFERENCE 2 115 (1956)]
•	V.P.DZHELEPOV,B.M.GOLOVIN, Y.P.KAZARINCV,N.N.SEMENOV [JOINT INST. FOR NUCL. RESEARCH, DUBNA, USSR]
	CITATIONS IZV. AKAD. NAUK. SSSR 19 573 (1955), DOKL. AKAD. NAUK. SSSR 104 717 (1955), ZUPN. EKSP. TEOR. FIZ. 28, 727 (1953), PHYS. REV. 97, 1186 (1955), IZV. AKAD. NAUK. SSSR 19 548 (1955), THE PROBLEMS OF WODERN PHYSICS 7 7 (1954), NUOVO CIMENTO 12, 499 (1954), ZUPN. EKSP. TEOR. FIZ. 30, 424 (1956), DOKL. AKAD. NAUK. SSSR 104 380 (1955), PHYS. REV. 96, 398 (1954), PHYS. REV. 96, 1310 (1954), PHYS. REV. 77, 441 (1950), PHYS. REV. 75, 1664 (1949), DOKL. AKAD. NAUK. SSSP 99 943 (1954), AND PHYS. REV. 95, 591 (1954).
	ARTICLE REAC BY ODETTE BENARY IN 10/69, ANC VERIFIED BY LERCY PRICE.
	BEAM NO. 1 IS NEUTRON ON PROTON FROM .927 TO 1.257 GEV/C. (BEAM KINETIC ENERGY = .38 TO .63 GEV)
•	no, « is neutron un deutenon frum szer ið 1.237 gevil Ideam Kinetil Energy = .38 to .63 gev) This fædfrihent USFS Counters.
	THE CREATERT OF SUUTERS.
	VET MENNEN AND SECTION DIFFERENTIAL CRUSS SECTION FILS
	CUMPUUNU NET WURUS + IIIS UIPPERENTIAL CRUSS SECTION
	•••••••••••••••••••••••••••••••••••••••

LABORATORY BEAM ENERGY					
BEAM ENERGY				•	
667 [1]	MILL I-BARNS				
.38 .50	34. +- 2. 35. 2.				
.59	36. 2.				
•••	5				
[1] MEAN VAL	UES.				
			• • • • • • • • • • • • • • •		
ELASTIC DIFFERENTI	AL CRESS SECTION FOR N	UTRCN PRGTON.	[TABLE 1]		
LABURATURY BE	AR ENERGY58 LEV	HEAN VALUET.			
DEGREES	ME/SP [1,2	· ·			
180.	8.40 +7C 5.30 .5C				
157. 147.	3.40 .30				
135. 124.	1.70 .13 1.00 .07				
114. 103.	.78 .05				
93. 83.	.91 .06 1.10 .08				
73. 63-	1.60 .13 2.10 .20				
54. 45.	2.30 .17 3.60 .30	-			
35.	3.70 .20				
THETA IS THE	ANGLE THAT THE NEUTRON	MAKES WITH THE BEAM	IN THE GRAND C.F.		
(2) PLUS POS	SIBLE SYSTEMATIC ERROR	OF +- 13 PER CENT.			
NEUTRON PROTON ELA	STIC CRCSS SECTION.	[TABLE 2]			
LABORATORY					
GEV [1]	HILL I-BARNS				
. 58	26. 3.				
{1] MEAN VAL	UES.			·	
BEAM ENERGY GEV [1] .38 .58	MILLI-BARNS 42. +- 3. 27. 4.				
· (1) NEAN VAL					
(1) HEAN VAL	UES.				
(1) MEAN VAL	UES.		(TADIE))	•••••	• -
(1) MEAN VAL	UES. 	UTREN NEUTRON.	(TABLE 3)		
(1) MEAN VAL	UES. AL CRCSS SECTION FOR NE AM ENERGY = .59 GEV (UTRCN NEUTRON. MFAN VALUE).	ITABLE 3]		
(1) MEAN VAL ELASTIC OIFFERENTI LABORATORY RF THETA DEGREES	UES. AL CRCSS SECTION FOR NE AM ENERGY = .59 GEVA C SIGNA/D GUOA B SOCRE TO	UTREN NEUTRON. Rfan Valuf].	(TABLE 3)		
(1) MEAN VAL ELASTIC OIFFERENTI LARDRATORY RF THETA DEGREES 30. 49. 49.	UES. AL CRCSS SECTION FOR NO AM ENERGY ■ .59 GEV 1 C 3101A/0 0100A ¥8/SP 5.8020 5.7020 5.7020	UTRCN NEUTRON. KFan Valuf].	(TABLE 3)		
(1) MEAN VAL ELASTIC OIFFERENTI LABORATORY RF THETA DEOREES 30. 49. 55. 67.	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 1 0 3101A/0 0100A HB/SP 5.80 -0.20 4.70 3.80 .40 3.90 .30	UTRCN NEUTRON. KFan Väluf].	(TABLE 3)		
(1) MEAN VAL ELASTIC DIFFERENTI LABORATORY RF THETA DEGREES 30. 49. 55. 67. 78. 89.	UES. AL CRCSS SECTION FOR NE AM ENERGY = .59 GEV (C 3101A/0 01C0A Hg/SP 5.6020 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25	UTREN NEUTRON. MFAN VALUFI.	(TABLE 3)		
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(1) MEAN VAL ELASTIC DIFFERENTI LABORATORY RF THETA DEOREES 30. 49. 55. 67. 78. 89. THETA IS THE	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 1 C 3101470 01004 HG/SP 5.6060 4.7050 3.80 -40 2.9035 2.3030 2.5025 ANGLE THAT THE NEUTRON	UTRCN NEUTRON. KFan Vällif]. Pakes with the Beam	ITABLE 31	·····	· · · ·
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(1) HEAN VAL ELASTIC OIFFERENTI LABORATORY RE THETA 06GREES 30. 49. 55. 67. 78. 89. THETA IS THE	UES. AL CRCSS SECTION FOR NO AM ENERGY ■ .59 GEV 0 C 3101A/D 0100A MB/SR 5.80 *20 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F	UTREN NEUTRON. MFØN VØLUFJ. Vakes with the beam Rgton-Proton collisj	ITABLE 3] IN THE GRAND C.M.	RGE MOMENTUM TRANSFERS.	
(1) HEAN VAL ELASTIC OIFFERENTI LABORATORY RE THETA OEGREES 30. 49. 45. 55. 67. 78. 89. THETA IS THE THE PRODUCTION OF LETTERS 288, 22	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 0 0 31011A/D 0100A MB/SR 5.80 *20 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F 9 (1968)]	UTREN NEUTRON. MFØN VØLUFJ. Vakes with the beam Rgton-proton collisi	ITABLE 3] IN THE GRAND C.M. IONS AT HIGH ENERGY AND LA	RGE MDMENTUM TRANSFERS.	
(1) HEAN VAL ELASTIC OIFFERENTI LABORATORY RE THETA DEGRES 30. 49. 49. 55. 67. 67. 67. 70. 89. THETA IS THE THE PRODUCTION OF LETTERS 288, 22 J.V.ALLABY, FB.INON A.M.THORNDI K	UES. AL CRCSS SECTICN FOR NO AM ENERGY ■ .59 GEV 1 0 31011A/D 010E0A MB/SR 5.80 *20 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F 9 (19€0)] .A.N.DIDDENS,P.DUTEIL,A e, A.M.WETHERELL (EUROF	UTREN NEUTRON. MF&N V&LUEJ. MAKES WITH THE BEAM RGTON-PROTON COLLISJ .KLEVNING,R.MEUNIER. EAN ORG. FOR NUE. RE	ITABLE 3] IN THE GRAND C.M. IONS AT HIGH ENERGY AND LA J.P.PEIGNEUX, E.J.SACHAR] S., GENEVA, SWITZERLAND]	RGE MDMENTUM TRANSFERS. DIS,K.SCHLUPMANN,M.SPIGMEL	
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 (1) HEAN VAL ELASTIC DIFFERENTI LARGRATORY RF THETA DEGREES 30- 49- 55- 67- 78- 89- THETA IS THE THETA IS THE J.V.ALLABY, F.BINON A.M.THORNOI K ABSTRACT EXPER PHYS. REV. LE (1953), PHYS. PHYS. REV. LE (1958), PHYS. ARTICLE READ BY OC BEAM IS PROTON ON 	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 1 C 3101A/0 01C0A HG/SP 5.6060 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F 9 (1960)] ,A.N.DIDDENS,P.DUTEIL,A E, A.M.WETHERELL (EUROF IMENTAL RESULTS ARE PRE COLLISIONS AT AN INCL TTERS 7, 450 (1961), PF REV. LETTERS 16, 855 0, 1223 (1568), PHYS. L REV. 1370, 708 (1965), ETTE BENARY IN 1/65, AN PROTICN AT 19.2 GEV/C.	UTREN NEUTRON. MFAN VALUEJ. PAKES WITH THE BEAM RGTON-PROTON COLLISJ .KLCVNING,R.MEUNIER, EAN ORG. FOR NUC. RE SENTED ON THE EXCITA ENT MOMENTUM OF 19.2 YS. REV. 128, 1823 (1966), PHYS. REV. LE ETTERS 288, 67 (1966) CERN NP/68-17, CERN D VERIFIED BY LERGY	ITABLE 3] IN THE GRAND C.M. IONS AT HIGH ENERGY AND LA J.P.PEIGNEUX, E.J.SACHAR] S., GENEVA, SWITZERLAND] ISI, GENEVA, SWITZERLAND] ISION OF THE NUCLEON ISOBA 2 GEV/C AND IN THE RANGE (11562], PHYS. LETTERS 8, 1 ITTERS L7, 789 (1966), PH ITTSERS L7, 789 (1966), PH ITT914, AND CERN TH/516. PRICE.	RGE MOMENTUM TRANSFERS. DIS,K.SCHLUPMANN,M.SPIGHEL INS N*(1518) AND N*(1688) I IF FOUR-MOMENTUM SQUARED O. 134 (1964), PMYS. LETTERS 1 15. REV. LETTERS 19, 397 (1 1968), VIENNA CONFERENCE	[PHYS ,J.P.STR N 6 5/T/55 8, 167 967), PAPER 5
 (1) HEAN VAL ELASTIC OIFFERENTI LARGRATORY RF THETA DEGREES 30. 49. 55. 67. 78. 89. THETA IS THE THETA IS THE THETA IS THE THETA SEARCT EXPER PROTON-PROTON IGEVISQUAREO. CITATIONS PHYS. REV. LE (1965). PHYS. ARTICLE READ EV OC BEAM IS PROTON ON THIS EXPERIMENT US	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 0 C 3101A/0 00000 5.6020 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F 9 (1960)) A.N.DIDOENS.P.DUTEIL/2 6, A.M.WETHEREL (EUROF IMENTAL RESULTS ARE PRE COLLISIONS AT AN INCIO TTERS 7, 450 (1961), PH REV. LETTERS 16, 855 (0, 1223 (1568), PHYS. 1 REV. 1378, 708 (1965), ETTE BENARY IN 1/45, AA PROTON AT 19.2 GEV/C. ES COUNTERS.	UTREN NEUTRON. MFAN VALUE). VAKES WITH THE BEAM RGTON-PROTON COLLISI .KLCVNING, R, MEUNIER, EAN ORG. FOR NUC. RE SENTED ON THE EXCIT. ENT MOMENTUM OF 19-2 YS. REV. 128, 1823 (1 19-61, PHZ). REV. 128 ETTERS 288, 67 (1966 CERN NP/68-17, CERN D VERIFIED BY LERCY	ITABLE 3] IN THE GRAND C.M. IONS AT HIGH ENERGY AND LA J.J.P.PEIGNEUX, E.J.SACHAR] S.J. GENEVA, SWITZERLAND] XTION OF THE NUCLEON ISOBA 2 GEV/C AND IN THE RANGE (11662], PHYS. LETTERS B, TTERS 17, 789 (1966), PH 11/914, AND CERN TH/516. PRICE.	RGE MOMENTUM TRANSFERS. DIS,K.SCHLUPMANN,M.SPIGHEL IRS N*(1518) AND N*(1688) 1 F FOUR-MOMENTUM SQUARED 0. 134 (1964). PHYS. LETTERS 1 S. REV. LETTERS 10, 397 (1 11968). VIENNA CONFERENCE	[PHYS +J.P.STR N 6 s/T/55 8, 167 967), PAPER 5
 (1) HEAN VAL ELASTIC OIFFERENTI LARDRATORY RETTIETA DEGREES 30. 49. 55. 67. 78. 89. THETA IS THE THETA IS THE THETA S 288, 22 J.V.ALLABY, F. BINON A.M.THORNOI K ABSTRACT EXPER PADTON-PROTON IGEVISQUAREO. CITATIONS PHYS. REV. LE SPHS. REV. LE PHYS. REV. REV. REV. REV. REV. REV. REV. REV	UES. AL CRCSS SECTION FOR NO AM ENERGY = .59 GEV 1 C 3101A/D ONCOA ME/SR 5.60 -7.20 4.70 .50 3.80 .40 2.90 .35 2.30 .30 2.50 .25 ANGLE THAT THE NEUTRON NUCLEON RESONANCES IN F 9 (1960)] A.N.DIDDENS,P.DUTEIL/2 E, A.M.WETHERELL (EUROF COLLISIONS AT AN INCIO TTERS 7, 450 (1961), PP AEV. LETTERS 16, 855 (0, 1223 (1568), PM/S. L REV. 1376, 708 (1965), PROTON AT 19.2 GEV/C. ES COUNTERS. ENTIAL CROSS SECTION	UTREN NEUTRON. MFAN VALUF). WAKES WITH THE BEAM RGTON-PROTON COLLISI .KLCVNING,R,MEUNIER, EAN ORG. FOR NUC. RE SENTED ON THE EXCITA: EAT MOMENTUM OF 19-2 YS. REV. 128, 1823 (1 1966), PHYS. REV. LE ETTERS 288, 67 (1966) CERN NP/68-17, CERN D VERIFIED BY LERCY N+(1520)D13 **	ITABLE 3] IN THE GRAND C.M. IONS AT HIGH ENERGY AND LA J.P.PEIGNEUX, E.J.SACHAR] S.F. GENEVA, SWITZERLANDI XTION OF THE NUCLEON ISOBA 2: GEV/C AND IN THE RANGE (ILS62], PMYS. LETTERS 8, IA TTERS 17, 789 (1366), PM I), PMYS. LETTERS 88, IA TH/914, AND CERN TH/516. PRICE.	IRGE MOMENTUM TRANSFERS. DIS,K.SCHLUPMANN,M.SPIGHEL IRS N*(1518) AND N*(1688) I IF FOUR-MOMENTUM SQUARED O. 134 (1964), PHYS. LETTERS 0, 397 (1 1968), VIENNA CONFERENCE	[PHYS +J.P.SIR N 5/7/55 8. 167 967], PAPER 5

DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON + PROTON N+(1520)+. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C. D-SIGNA/D-T (GEV/C)++2 UB/ (GEV/C) ++2 PER CENT
 S7.000
 20

 21.000
 20
 2

 3.600
 20

 .160
 20

 .160
 20

 .020
 20

 .013
 20

 .001
 50
 .56 .87 1.23 1.66 2.14 2.66 3.23 3.83 5.81 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (CUTGGING PROTON). CIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON 'N+(1688)+*. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.2 GEV/C. D-SIGMA/C-T UB/(GEV/C)**2 PER CENT (GEV/C)++2 .55 .86 1.22 1.64 2.10 2.62 3.18 3.77 5.72 100.00 +- 20 26.C0 26.C0 4.20 .64 .31 .33 .03 .02 .C0 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE ICUTGOING PROTON). 139 PROTON-PROTON INTERACTION AT 56C MEV. [NUOVO CIMENTO 26, 1376 (1962)] 8.8ALDONI,S.FOCAROI,H.HROMADNIK,L.MONARI,F.SAPORETTI (UNIV. DI BOLOGNA, BOLOGNA, ITALY) S.FEMINO, F.MEZZANARES (INS. CI FISICA DELL UNIV., MESSINA, ITALY) F.ARERTOI,INI TINIV. NG PADOVA, PADOVA, ITALY) G.GIALAMELLA (UNIV. GEGLI STUGI DI ROMA, RGME, ITALY) RACT IN THIS PAPER RESULTS ARE GIVEN ON THE PROTON-PROTON INTERACTION AT 560 MEV. THE EXPERIMENT WAS PERFORMED AT CERN USING A HYDROGEN BUBBLE CHAMBER. THE EXPERIMENTAL RESULTS SHOW EVIDENCE FOR THE PION-NUCLEON AND PROTON-NEUTRON FINAL STATE INTERACTIONS. ABSTRACT CITATIONS NUOVO CIMENTO 16, 184 (1960), PHYS. REV. 119, 1716 (1960), NUOVO CIMENTO 10, 525 (1958), CERN CONFERENCE 125 (1956), DOKL. AKAD. MAUK. SSSR 100 677 (1955), JETP 5 1033 (1957), PROC. OF THE ROYAL SOCIETY OF LONDON 244, 491 (1958), NUOVO CIMENTO 2, 1269 (1955), CERN CONFERENCE 53 (1958), NUOVO CIMENTO 16, 1073 (1960), PHYS. PEV. 105, 1874 (1957), AND ZURN. EKSP. TEOR. FIZ. 32, 750 (1957). ARTICLE READ BY ODETTE BENARY IN 5767, AND VERIFIED BY LEROY PRICE. BEAM IS PRCTON ON PROTON AT 1.168 GEV/C. (BEAM KINETIC ENERGY = .56 GEV) THIS EXPERIMENT USES & HYCROGEN BUBBLE CHAMBER. A TOTAL OF 16000 PICTURES ARE REPORTED ON. GENERAL COMMENTS ON THIS ARTICLE 1 CROSS SECTIONS HAVE BEEN NORMALIZED TO AN ELASTIC CROSS SECTION OF 25.2 ↔-.8 MB. KEY WORDS - CROSS SECTION DIFFERENTIAL CROSS SECTION ANGULAR DISTRIBUTION (TABLE 1) LABCRATORY BEAM ENERGY = .560 +- .005 GEV. REACTION PROTON PRCTON + DEUTERON PI+ PROTON PROTON PIO PROTON NEUTRON PI+ MILLI-BARNS NO. EVENTS 2.75 +- .29 .91 .15 5.21 .44 8.87 .66 109 40 233 397 TOTAL INELASTIC ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON. LETCHBE 11 LABORATORY BEAM ENERGY = .560 +- .005 GEV. NUMBER OF EVENTS = 1224. . THIS DATA WAS READ FROM A GRAPH . C-SIG#4/D-OFEGA HE/SR 4.50 +- .30 4.00 -.35 4.20 .40 3.90 .40 3.50 .35 3.50 .35 3.10 .20 COS(THETA) .76 .66 .56 .46 .36 .26 .16

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M.

DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + DEUTERON PI+. (FIGURE 2) LABORATORY REAM ENERGY = .560 +- .005 GEV. . THIS DATA WAS READ FROM A GPAPH . ND. EVENTS 8 5 4 12

THETA IS THE ANGLE THAT THE DEUTERON PAKES WITH THE BEAM IN THE GRANC C.M.

MEASUREMENT OF THE POLARIZATION PARAMETER IN PI+-P, K+-P, PP, AND PBAR P ELASTIC SCATTERING AT 6 GEV/C. LCTTERS 310, 405 (1970)] IPHYS.

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ABSTRACT EXPERIMENTAL RESULTS ARE PRESENTED FOR THE POLARIZATION PARAMETEP FIO) IN PI+-P, K+-P, PP, AND PBAR P ELASTIC SCATTERING AT 6 GEV/C, AND IN THE RANGE OF THE INVARIANT FOUR-MOMENTUM TRANSFER SQUARED -T FROM 0.05 TO APPROXIMATELY 2.0 (GEV/CISQUARED.

CLOSELY RELATED REFERENCES CONTINUATION OF PREVICUS EXPERIMENT IN PHYS. LETTERS 248, 77 (1967).

ADDITIONAL CITATICNS NUCLEAR INSTRUMENTS AND METHODS 72, 45 (1969), PHYS. REV. 148, 1297 (1966), PHYS. REV. LETTERS 71, 1410 (1968), PHYS. LETTERS 298, 1924 (1969), PHYS. PEV. 179, 1480 (1969), NUC. PHYS. B9, 549 (1969), PHYS. REV. 177, 2318 (1969), NUOVO CIMENTO 634, 141 (1965), AND CERN TH-1109 (1969).

ARTICLE READ BY OCETTE BENARY IN 3/7C, AND VERIFIED BY LERCY PRICE.

BEAM NO. 1 IS PI+ ON HYDROGEN COMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 2 IS PI- ON HYDROGEN COMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 3 IS K+ ON HYDROGEN CCMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 4 IS K- ON HYDROGEN CCMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 5 IS POTON ON HYDROGEN CCMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 6 IS ANTI-PROTON ON HYDROGEN COMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). NO. 6 IS ANTI-PROTON ON HYDROGEN COMPOUND AT 6 GEV/C. TARGET IS POLARIZED 35 PER CENT (NORMAL TO THE BEAM DIRECTION). THIS EXPERIMENT USES COUNTERS.

KEY WORDS . POLARIZATION

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ELASTIC POLARIZATION FOR PROTON PROTON. (TABLE 51 LABORATORY BEAF MOMENTUM = 6. GEV/C.

. POLARIZATION (1) (GEV/C1++2 .108 +- .032 .108 .129 .137 .131 .142 .112 .124 .007 .007 .009 .009

(GEV/	/C]++Z		
.075	.025	.108 +032	
.125	-025	.129 .008	
.175	.025	.137 .007	
.225	.025	.131 .007	
.275	.025	.142 .009	
.325	. C 2 5	.112 .009	
.375	.025	.124 .011	
675	.025	.113 .013	
.475	.025	.015	
+525	.025	.040 .01/	
.575	.C25	.052 .019	
. 625	.025	.112 .029	
.675	• 025	.107 .029	
.725	.025	.097 .030	
.775	.025	.107 .037	
.825	.025	.064 .C42	
.875	.025	.039 .045	
. 52 5	.025	.034 .056	
. 775	•025	.100 .060	
1.050	.050	.131 .062	
1.150	.050	.217 .C73	
1.250	.050	,344 .093	
1.400	.100	.154 .069	
1.600	-100	.074 .086	
1.800	+100	.120 .127	
2.000	-100	.026 .102	
2.300	÷200	.040 .092	

T IS THE MOMENTUM TRANSFER BETWEEN THE [INCCMING PROTON] AND THE [OUTGOING PROTON]. THE POLARIZATION IS OF THE PROTON ALONG THE NORMAL TO THE PRODUCTION PLANE IN THE GRAND C.M.

(1) PLUS POSSIBLE SYSTEMATIC EPROP OF +- 5 PER CENT.

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PION PRODUCTION IN PROTON-PROTON INTERACTIONS AT 6.6 GEV/C.

E. COLTON (UNIV. OF CALIF., LCS ANGELES, CALIF., USA)

RACT THIS DISSERTATION IS A STUDY OF PROTON-PROTON COLLISIONS RESULTING IN PEACTIONS OF THE TYPE PROTON + PRCTON + NUCLEON + NUCLEON + M PI WHERE M IS AN INTEGER INDICATING THE NUMBER OF PIONS PRODUCED. IN THIS KORK JUST THE CASES FOR M = 0, 1, 2, AND 3 WILL BE DEALT WITH. THE INTERACTIONS KERE PHOTOGRAPPED IN THE LAWRENCE RADIATION LABORATORY'S 72-INCH LIQUID HYDROGEM BUBBLE CHANGED KHICH WAS EXPOSED TO A 6.6 GEV/C SEPARATED EXTERNAL PROTON BEAY. TWO PRODUCTION TOPOLOGIES WERE ANALYZED. THE TWO- PROMO EVENTS WITH NO KINKING SECONDARIES YIELDED THE REACTIONS (1) D = 5 FO DIC (1) ABSTRACT

(UCLA 1025 (1968))

To A W G G, 1, 2, AND 3 WILL BE CLEIT WITH. THE INTERACIONS WERE PONDURAPIDE IN THE LAMENCE AND LATION GENAMICAT'S 72-INCL LIQUID ATMOGGEN BUELE CHANGE WHICH WAS EXPOSED TO A 6.6 GEV/C SEPARATED EXTERNAL PROTON BEAP. TWO PRODUCTION TOPOLOGIES WERE ANALYZED. THE TWO PRONG EVENTS WITH NO KINKING SECONDARIES VIELDED THE REACTIONS PP + PP PI P + PP II PI AND THE FQUR-PRONG EVENTS YILL BEACTIONS PP + PP II PI P + PI P +

CLOSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES PART OF PHYS. REV. LETTERS 17, 884 (1966).

ADDITIONAL CITATIONS UCRL 10868, UCRL 176190, PHYS. REV. 165, 1466 (1968), UCRL 11154, UCRL 16555, UCBL 9099, REV. MOD. PHYS. 39, 1 (1967), PHYS. REV. LETTERS 5, 333 (1960), PHYS. REV. LETTERS 7, 185 (1961), NUOVO CIMENTO 49, 3559 (1967), PHYS. REV. 154, 1284 (1967), CERN 65-24 65 (1965), PHYS. REV. LETTERS 19, 857 (1967), PHYS. REV. 75, 1459 (1949), NUOVO CIMENTO 38, 60 (1965), PHYS. REV. 113, 1640 (1955), NUOVO CIMENTO 24, 453 (1962), NUOVO CIMENTO 27, 1456 (1963), NUOVO CIMENTO 22, 123 (1961), PHYS. REV. 138, 8190 (1965), PHYS. REV. 165, 1730 (1968), PHYS. REV. LETTERS 19, 925 (1967), NUOVO CIMENTO 40, 899 (1965), CERN 66-18, PHYS. REV. 161, 1387 (1967), PHYS. REV. LETTERS 15, 468 (1965), UCRL 8417 (1958), PHYS. REV. LETTERS 20, 964 (1964), PHYS. REV. LETTERS 17, 884 (1966), PHYS. REV. 145, 1305 (1966), CERN TH-850 (1957), NUOVO CIMENTC 33, 906 (1564), AND PHYS. REV. LETTERS 8, 140 (1962).

ARTICLE REAC BY OCETTE BENARY IN 9769, AND VERIFIED BY LEROY PRICE.

BEAF IS PROTON ON PROTON AT 6.6 GEV/C.

THIS EXPERIMENT USES THE L.R.L. 72 IN. (H) BUBBLE CHAMBER.

IBUTION DIFFERENTIAL CPOSS SECTION OMEGA(783) KEY WORDS ← CROSS SECTION MASS SPECTRUM ANGULAR DISTRIBUTION MODELS DALITZ PLOT DELTA(1238) KAON OMEGA(FITS

CEMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

[TABLE 5]

LABERATORY BEAF HEHENTUR - 6.6 GEV/C +- .15(PER CENT).

REACTION	MILLI-BARNS	ND. EVENTS
ROTON PROTON +		
ELASTIC	10.20 +50	2400
PROTON PROTON PIO	2.06 .19	486
PROTON NEUTRON PI+	4.89 .28	1155
DEUTERON PI+	< .01	2

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LABORATORY BEAM MOMENTUM = 6.6 GEV/C +- .15(PER CENT).

KILLI-BARNS	NO. EVENTS
2.700 +160	627
2.150 .130	500
2.470 .150	573
.034 .012	8
10.500 .460	2440
	<pre>KILLI-BARNS 2.700 ← .160 2.150 .130 2.470 .130 2.470 .012 .034 .012 10.500 .460</pre>

ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. [F1GURE 18] LABORATORY BEAM MOMENTUM = 6.6 GEV/C +- .15(PER CENT). . THIS DATA WAS READ FROF A GPAPH -T (GEV/CI**2 MIN MAX .CC .02 .02 .04 .04 .06 0-SIGMA/C-T MB/(GEV/C)++2 [1] NO. EVENTS 66 248 242 212 160 152 152 152 .06 .06 .10 • 1 22 • 1 46 • 1 46 • 2 22 • 4 68 • 2 22 • 2 28 • 3 34 • 4 48 • 5 5 • 5 .14 .16 964 668 566 566 436 222 18 12 154 8 11 11 .20 .24 ·26 ·28 ·30 ·32 ·36 ·38 ·40 ·42 ·44 ·46 ·52 ·54 ·55 T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (OUTGOING PROTON). [1] COUNTS WERE MULTIPLIED BY .25 TO GET THESE. ERRORS ARE TAKEN AS PROPORTIONAL TO THE SQUARE-RODT OF THE COUNTS. FIT TO ELASTIC DIFFERENTIAL CRGSS SECTION FOR PROTON PROTON. [PAGE 63] LABORATORY BEAM MOMENTUM = 6.6 GEV/C +- .15(PER CENT). DATA IS FIT GVER T FRCM .06 TC .60 (GEV/C)**2. T IS THE MONENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE LOUTGOING PROTONI. FITED FONTULA IS D-SIGHA/D+T = CXP(A+D+T) WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. FITTED VALUES A = 4.49 + -.09 B = -7.71 + -.24FIT TO FLASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [PAGE 63] LABORATORY REAM MOMENTUM = 6.6 GEV/C +- .15(PER CENT). DATA IS FIT OVER T FROM .06 TO .60 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETHEEN THE [INCOMING PROTON] AND THE LUIGUING PRUTUNI. FITED FORMULA IS D-SIGPA/N-T = EXP[A+RT+CT**2] WHERE C-SIGMA/D-T IS IN M8/(GEV/C)**2 AND T IS IN (GEV/C)**2. FITTED VALUES A = 4.54 + -.11B = -8.25 + -.92C = 1.05 + -1.72142 EXPERIMENTAL STUDY OF PP+PN* AT INCIDENT ENERGIES OF 6-30 REV. [PHYS. REV. LETTERS 16, 855 (1966)] E.W.ANDERSON,E.J.BLESER,G.B.CCLLINS,T.FUJII,J.MENES,F.TURKCT (BROOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA) R.A.CARRIGAN JR.,R.M.EDELSTEIN,N.C.HIEN,T.J.MCMAHON,I.NADELMAFT (CARNEGIE-MELLON UNIV., PITTSBURGH. PA.. USA) CITATIONS 976 (1966), PHYS. LETT LETTERS 14, 74 (1965). ARTICLE READ BY ODETTE BENARY IN 4/67, AND VERIFIED BY LERGY PRICE. BEAM IS PROTON ON PROTON FROM 6 TO 30 GEV/C. THIS EXPERIMENT USES SPARK CHAMPERS.

GENERAL COMMENTS ON THIS ARTICLE 1 THE CROSS SECTIONS FOR PP+PN® WERE OBTAINED BY MEASURING THE RESONANCES PRODUCTION AT SMALL MOMENTUM TRANSFERS AND INTEGRATING OVER THE WHOLE T PHYSICAL REGION BY ASSUMING AN EXPONENTIAL DEPENDENCE OF THE DIFFERENTIAL CROSS SECTION ON T

KEY WORDS • CROSS SECTION DIFFERENTIAL CROSS SECTION FITS DELTA(1238) N*(1470)Pl1 N*(1520)Dl3 'N*(1688)' N*(219C)G17

CCMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

CROSS SECTION FOR PROTON PROTON + PROTON CELTA(1238)+. (TABLE 1] LABORATORY REAM MOMENTUM GEV/C 6. 10. 15. MILLI-BARKS .376 +- .C76 .184 .C50 .142 .100 CROSS SECTION FOR PROTON PROTON + PROTON N+(1470)+. [TABLE 1] LABORATORY REAN HOMENTUN GEV/C 10. 15. MILLI-BARNS .544 +- .090 .602 .106 .660 .150 .744 .350 20. 30. CRCSS SECTION FOR PROTEN PROTEN . PROTEN N*(1520)+. TTABLE 11 LABCRATCRY BEAM #CMENTUM GEV/C 10. 15. 20. 30. MILLI-BARNS .196 +- .056 .160 .032 .170 .030 .166 .042 CROSS SECTION FOR PROTON PROTON - PROTON 'N+(1668)+'. TABLE 11 LABORATORY PEAR FORENTUR MILLI-84RNS .562 +- .058 .638 .068 .560 .070 .576 .084 GEV/C 10. 15. 20. 30. CROSS SECTION FOR PROTON FROTON + PROTON N+(2190)+. (TABLE 1) LABORATORY MOMENTUM BEAM GEV/C 20. 30. MILLI-BARNS •128 +- •024 •108 •C36 FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON DELTA(1238)+. TABLE 11 LABORATORY BEAM MOMENTUM '= 6. GEV/C. DATA IS FIT OVER -T FROM .CI TO .11 (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETHEEN THE (INCOMING PROTON) AND THE (DELTA(1238)+1. FITTED FORMULA IS D-SIGMA/D-T = A+EXP(8+T) WHERE C-SIGNA/0-T IS IN ME/(GEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUES A = 2.96 +- .56 B = 15.8 +- 2.9 FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON + PROTON OELTA(1238)+. [TABLE 1] LABORATORY BEAF MOMENTUM = 10. GEV/C. DATA IS FIT OVER -T FROM .01 TO .13 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE IDELTAI12381+1. FITTCD FORMULA IS D SICHA/O T - A+EMP(B+T) WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUES A = 1.6 +- .5 B = 17.3 +- 2.C FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON DELTA(1238)+. [TABLE 1] LABORATORY EEAN MOMENTUM = 15. GEV/C. DATA IS FIT OVER -T FROM .02 TO .13 (GEV/C)*+2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE (Delta(1238)+). FITTED FORMULA IS C-SIGMA/D-T = A*EXP[B*T] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUES A = 1.5 + -1.0B = 21.1 + -4.4

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FIT TO CIFFERENTIAL CROSS SECTION FOR PROTON PROTON . PROTON N+(1470)+.
                                                                            [TABLE 1]
    LABORATORY BEAM MOMENTUM = 10. GEV/C.
    DATA IS FIT OVER -T FROM .01 TG .11 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
          N#114701
    [N*(1470)+1.
FITTED FORMULA IS
                         C-SIGMA/D-T = A*EXP[8+T]
            WHERE D-SIGMA/D-T IS IN M8/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    ETTTED VALUES
            A = 6.06 + 1.00
B = 22.3 + 3.4
  FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON N+(1470)+.
                                                                            ITABLE 11
    LABORATORY REAM FOMENTUM = 15. GEV/C.
    DATA IS FIT OVER -T FROM .02 TO .14 (GEV/CJ**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTONI AND THE
(N*(1470)+1.
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[8+T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
            A = 4.8 + .9

B = 15.5 + .2.3
 _____
FIT TO DIFFERENTIAL CROSS SECTION FOR _ PROTON PROTON - PROTON N#(1470)+.
                                                                            (TABLE 1)
    LABORATORY BEAM MOMENTUM = 20. GEV/C.
    DATA 15 FIT OVER -T FROM -02 TO .14 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
[N*[1470]*].
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[8*T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2-
    FITTEC VALUES
            A = 4.75 + 1.20

B = 14.4 + 2.5
  FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON N+(1470)+.
                                                                            (TABLE 1)
    LABORATORY BEAM MOMENTUM . 30. GEV/C.
    DATA IS FIT OVER -T FROM .07 TO .13 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
    [N#(1470)+).
E(TTED BOBWULA [[
                     0+11CHA/0=7 - A+CXP10+T1
           WHERE PASIGNATONT IS IN MRITICHTCIDDO AND AT IS IN (CENTCIDD).
    FITTED VALUES
           A - 0.02 + 4.20
B = 23.5 +- 5.1
  FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+(1520)+.
                                                                            (TABLE 1)
    LABORATORY BEAM MOMENTUM - 10. GEV/C.
    DATA IS FIT DVER -T FROM .3 TC .8 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [N+(1520)+].
    [N*(1520)+].
FITTED FORMULA IS
                         C-SIGMA/D-T = A*EXP[B*T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUES
            A = .39 + .12

B = 3.95 + .51
FIT TO DIFFERENTIAL CRGSS SECTION FOR PROTON PROTON . PROTON N*(1520)+.
                                                                            (TABLE.1)
    LABORATORY BEAN NOVENTUR = 15. CEV/C.
    DATA IS PIT OVER +T PROF -2 TO -9 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BEIMEEN THE LINCUMING PRUTUNI AND THE

[N*(1520)+].

FITED FORMULA IS C-SIGMA/D-T = A+EXP[B+T]
           WHERE D-SIGHA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUES
            A = .31 +- .07
H = 2.99 += .45
   FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+(1520)+.
                                                                            TABLE 11
    LABORATORY BEAM MOMENTUM = 20. GEV/C.
    DATA IS FIT OVER -T FROM .2 TC .9 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [N+(1520)+].
    FITTED FORMULA IS
                          C-SIGMA/D-T = A*EXP[8*T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUES
           A = .33 +- .07
B = 3.83 +- .37
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FIT TO DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON . PROTON N#(1520)+.
                                                                         (TABLE 1)
    LABORATORY BEAM MOMENTUM = 30. GEV/C.
    DATA IS FIT OVER -T FROM .2 TC .9 (GEV/C)+2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
    [N*(152C)+].
FITTED FORMULA IS
                         C-SIGMA/D-T = A+EXP[8+T]
            WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    EITTED VALUES
            A = .36 + .10
B = 4.3 + .5
. . . . . . . . . . . . . . . .
FIT TO DIFFERENTIAL CRGSS SECTION FOR PROTON + PROTON *N*(1688)+*-
                                                                             (TABLE 1)
    LABORATORY BEAF MOMENTUP = 10. GEV/C.
    DATA IS FIT OVER -T FROM .01 TO .80 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE

LINT(L688)**7.

FITED FORMULA IS C-SIGMA/D-T = A*EXPL8*T]
                        C-SIGMA/D-T = A*ExPIB*T1
           WHERE D-SIGHA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUES
            A = 1.28 +- .10
8 = 4.5 +- .5
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON 'N+(1688)+*.
                                                                             (TABLE 1)
    LABORATORY BEAM NOMENTUP . 15. GEV/C.
    DATA IS FIT OVER -T FROM .02 TC .60 (GEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
['M*(1688)+').
FITTED FORMULA IS C-SIGMA/D-T = A*EXP[8+T]
           WHERE D-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
           A = 1.61 +- .17
B = 5.05 +- .38
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON *N*(1688)+*.
                                                                             TABLE 11
    LABORATORY BEAF MOMENTUP = 20. GEV/C.
    DATA IS FIT OVER -T FROM .04 TO .80 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE [INF(1688)+*].
    FITTED FORMULA IS
                        D-SIGMA/D-T = A*EXP(8*T)
           WHERE D-SIGHA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    ETTTED VALUES
           A = 1.47 +- .20
B = 5.25 +- .48
(TABLE 11
FIT TO DIFFERENTIAL CROSS SECTION FOR
                                   PROTON PROTON . PROTON 'N*(1688)+'.
    LABORATORY BEAM MOMENTUP = 30. GEV/C.
    DATA IS FIT OVER -T FROM .07 TO .90 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE [IN*(1688)+*1].
    FITTED FORMULA IS
                        C-SIGMA/D-T = A*EXP[8*T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
           A = 1.79 +- .29
B = 6.15 +- .50
_ _ _ _ . . . . . . . . . . . . .
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N+(2190)+.
                                                                           TABLE 11
   - LABORATORY BEAM MOMENTUM = 20. GEV/C.
    DATA IS FIT OVER -T FROM .07 TO .80 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] ANC THE
IN+(2190)+1.
FITED FORMULA IS C-SIGMA/D-T = A+EXP[8+T]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUES
           A = .328 +- .072
8 - 5.14 +- .56
. . . . . . . . . . . . .
FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON + PROTON N#121901+.
                                                                          (148LE 1)
    LACORATORY REAP MOMENTUM = 30. GEV/C.
  DATA IS FIT OVER -1 FROM +88 TO +68 IGEV/6)++2+ T IS THE HOMENTUM TRAMSFER DETWEEN THE (INGONING PROTON) AND THE .

[Na(2190)+].

*Fitte formula IS E-Sigpa/D-T = A+EXP[8+1]
           WHERE D-SIGMA/D-T IS IN M8/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUES
           A = .274 +- .100
B = 5.07 +- .90
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STRUCTURE IN THE ANGULAR DISTRIBUTION OF PROTON-PROTON ELASTIC SCATTERING AT LARGE MOMENTUM TRANSFERS. (CERN 68-7 580
[1968]]

J.V.ALLABY,A.N.DIDDENS,A.KLOVNING,E.LILLETHUN.E.J.SACHARIDIS,K.SCHLUPMANN, A.M.WETHERELL (EUROPEAN ORG. FCP NUC. PES., Geneva, Skitzerlanc)

CLOSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES PART OF PHYS. LETTERS 23, 389 (1966), AND PHYS. LETTERS 258, 156 (1967).

ACCITIONAL CITATIONS PMYS. REV. 138, B165 (1965), PMYS. LETTERS 13, 190 (1964), PMYS. REV. 159, 1738 (1967), PMYS. REV. LETTERS 19, 1149 (1967), BNL 11360 (1967), UCRL 16275 (1966), UCRL 17257 (1966), PMYS. REV. LETTERS 11, 425 (1963), PMYS. REV. LETTERS 15, 45 (1965), NUQVO CIMENTO 38, 60 (1965), PMYS. REV. 152, 1162 (1966), PMYS. REV. LETTERS 9, 111 (1962), PMYS. REV. LETTERS 16, 1217 (1966), AND NUGVO CIMENTO 41, 167 (1966).

ARTICLE REAC BY OCETTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON HYDRCGEN CCMPCUND FROM 7.1 TO 12.1 GEV/C.

THIS EXPERIMENT USES COUNTERS.

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KEY WORCS . DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORDS . FITS CIFFERENTIAL CROSS SECTION

ELASTIC DIFFERENTIAL CRGSS SECTION FOR PROTON PROTON.

(TABLE 1)

.

LABORATORY BEAM MOMENTUM = 7.1 +- .1 GEV/C.

THE	TA	C-SIGM	¢/€-O⊬EGA
DEGREES		U	8/SR [1]
			PER CENT
c.c +	2	4.090	+- 4
2.0	•2	3.500	4
5.0	• 2	2.540	4
8.0	• 2	2.000	4
1.0	•2	1.548	4
5.C	• 2	. 1.174	4
0.0	•2	.831	4
C+ C	• 2	.625	4

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT.

114816 11

ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.

LABORATORY BEAM NOMENTUM # 8.1 +- .1 GEV/C.

[THIS DATA REPLACES VALUES GIVEN EARLIER IN ALLARY, ET AL., PHYS. LETTERS 258, 156 (1967)]

THETA		C-SIGMA/C-GMEGA	
DEGREES		U8/SR [1]	
		FER CENT	
40.0 +	2	18.020 +- 4	
13.0	• 0	18.119 5	
46.0	• 2	9.050 4	
49.0	• Z	6.370 4	
52.0	. 2	4.610 4	
55.0	• 2	3.320 4	
58.0	.2	2.370 4	
69.9	.2	1.976 4	
62+0	2 ،	1.504 4	
65.0		1.991 4	
68.C	• 2	.777 4	
/1.0	.2	.566 4	
75.0	.2	.376 4	
80.0	. 2	.257 4	
90.0	.2	.158 4	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

111 PLUS POSSIBLE SYSTEMATIC ERROR OF - 7 PER CENT.

ELASTIC DIFFERENTIAL CRGSS SECTION FCR PROTON PRCTON.

[TABLE 1]

LABORATORY BEAM MOMENTUM = 9.2 +- .1 GEV/C.

[THIS DATA REPLACES VALUES GIVEN EARLIER IN ALLABY, ET AL., PHYS. LETTERS 258, 156 (1967)]

THET	A	C-SIGMA/C-OMEGA	
DEGRE	ES	UB/SR [1]	
		PCD CCNT	
40.0 +-	• 2	8.7900 +- 4	
43.0	.2	6.6900 4	
46.0	• Ż	5.1400 4	
49.0	.2	3.8900 4	
52.0	. 2	2-4200 4	
55.0	. 2	1.6940 4	
58.0	. 2	1.1450 4	
60.0	. 2	.8450 4	
62.0	.2	.6160 4	
65.0	.2	.3910 4	
68.0	. 2	.2640 4	
71.0	- 2	.1999 4	
75.C	.2	.1457 4	
80.0	ž	+1112 4	
90.0	• Z	.1051 4	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 7 PER CENT.

	ELASTIC DIFFERENT	IAL CRESS SECTION FOR PRO	TON PROTON. [TABLE 1]
	LABORATORY B	EAM MOMENTUM = 10.1 +-	AL GEV/C.
		ACES VALUES CIVEN EARLIE	D IN ALLARY ET AL . DHYS LETTEDS 250 164 (104711
	THIS DATA REP	LACES VALUES GIVEN EPRLIE	x IN ACCHET, 21 AC., POIS. LEITERS 238, 130 (1401))
	DEGREES	C-SIGMA/C-GPEGA UB/SR [1] PER CENT	
	42.0 .2	5.5800 4	
	44.0 .2	4.4900 4	
	48-0 .2	2.5100 4	
	52.0 .2	1.8650 4	
	54.C .2	.9880 4	
	58.0 .2	.4810 4	
	60.0 .2 62.0 .Z	.3450 4 .2550 4	
	65.0 .2	+1686 4	
	71.0 .2	.0534 4	
	80.0 .2	.0600 4	
	90.0 .2	.0516 4	
	THETA IS THE	ANGLE THAT THE PROTON MAN	KES WITH THE BEAM IN THE GRAND C.M.
	(1) PLUS PO	SSIBLE SYSTEMATIC ERROR OF	F ← 7 PER CENT.
	ELASTIC DIFFERENT	AL CROSS SECTION FUR PRU	IUN PROTON. [TABLE 1]
	LABORATORY BI	AP MOMENTUP = 11.1 +-	.1 GEV/C.
	FTHIS DATA REPI	ACES VALUES GIVEN FARITE	R IN ALLARY. ET AL., PHYS. FTTERS 258, 156 (19671)
	CINIS DATA REPL	ACES VALUES GIVEN CARLIER	N IN ALLAST, ET AL., POTS. LETTERS 238, 130 (1907)]
	THETA	D-SIGMA/C-DMEGA UE/SR [1]	
	45 5 4- 3	PER CENT	
	43.0 .2	3.3200 4	
	46.0 .2 49.0 .2	2.0100 4 1.1930 4	
	52.0 .2	.6660 4	
	58.0 .2	.2230 4	
	60-0 -2 62-C -2	.1569 4	
	65.0 .2	.0771 4	
	71.0 .2	.0465 4	
	80.0 .2	.0384 4	
	THETA IS THE	ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC EPRCR OF	KES WITH THE BEAM IN THE GRAND C.M. F +- 7 PER CENT.
	ELASTIC DIFFERENT	AL CRESS SECTION FOR PROT	TON PRGTON. (TABLE 1)
	LABORATORY DE	AM HOMENTUM = 12.1 +	.1 GEV/C.
	THETA	C-SIGNA/G-OMEGA	
	DEGREES	UE/SR (1)	
	40.0 +2	3.5200 +- 4	
	43.0 .2	1.9500 4	
	49.0 .2	.5540 4	
	55.0 .2	.1610 4	
	58.0 .2	.0914 4	
	DU.U .C	.0714 4	
	62.0 .2	.0714 4 .0565 4	
	62.0 .2 65.0 .2 68.0 .2	.0714 4 .0565 4 .0357 6 .0298 6	
	62.0 .2 65.0 .2 68.0 .2 71.C .2 75.0 .2	.0714 4 .0565 4 .0357 6 .0298 6 .0252 6	<u>.</u> .
	62.0 .2 65.0 .2 68.0 .2 71.C .2 75.0 .2 80.0 .2 90.0 .2	.0714 4 .0565 4 .0357 6 .0298 6 .0252 6 .0192 6 .0192 6 .0173 6	
	62.0 .2 65.0 .2 68.0 .2 71.0 .2 75.0 .2 80.0 .2 90.0 .2	.0714 4 .0565 4 .0357 6 .0258 6 .0252 6 .0192 6 .0173 6 .0166 6	. ·
	62:0 .2 65:0 .2 68:0 .2 71:C .2 75:0 .2 80:0 .2 90:0 .2 90:0 .2 THETA 1S THE	.0714 4 .0565 4 .0357 6 .0258 6 .0252 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAR	(ES WITH THE BEAM IN THE GRAND C.M.
	62.0 .2 65.0 .2 65.0 .2 71.0 .2 71.0 .2 80.0 .2 90.0 .2 THETA 1S THE [1] PLUS POS	.0714 4 .0565 4 .0357 6 .0258 6 .0252 6 .0152 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF	(ES WITH THE BEAN IN THE GRAND C.M. ← 7 PER CENT.
	62.0 .2 62.0 .2 65.0 .2 71.0 .2 71.0 .2 80.0 .2 90.0 .2 THETA 1S THE (1) PLUS POS	.0714 4 .0565 4 .0357 6 .0258 6 .0252 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF	<pre><es beam="" c.m.<br="" grand="" in="" the="" with="">→ 7 per cent.</es></pre>
	62.0 62.0 63.0 64.0 71.0 71.0 73.0 2 80.0 2 90.0 7 THETA IS THE (1) PLUS POS	.0714 4 .0565 4 .0357 6 .0258 6 .0252 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC EPROR OF	KES WITH THE BEAM IN THE GRAND C.M. - ← 7 PER CENT.
144	01.0 .2 62.0 .2 65.0 .2 71.C .2 71.C .2 80.0 .2 90.0 .2 TMETA IS THE (1) PLUS POS POLARIZATION AND S TARGFT. (N	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEPATIC EPROR OF	KES WITH THE BEAN IN THE GRAND C.M. = ← 7 PER CENT. IS MEASUREMENTS IN 600 NEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 366)1
144	01-0 -2 62-0 -2 63-0 -2 71-C -2 71-C -2 80-0 -2 96-0 -2 THETA IS THE (1) PLUS POS POLARIJATION AND S TARGET OL-CROME H.BORGHINI,C.RYTER	.0714 4 .0565 4 .0357 6 .0278 6 .0278 6 .0172 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF PIN CORRELATION PARAMETER UNIVO GIPERTIC 49A1 700 (19 BERGER, KINDROA, AMICHALC (CNTR. D'ETUCES NUC. SAC	KES WITH THE BEAN IN THE GRAND C.M. F ← 7 PER CENT. IS MEASUREMENTS IN 600 HEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON i66)1 WICZJJ.C.OLIVIER.M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, (RSAY, FRANCE) LAY, GIF-SUR-YVETTE, FRANCE)
144	01.0 .2 62.0 .2 65.0 .2 66.0 .2 71.C .2 80.0 .2 96.0 .2 96.0 .2 96.0 .2 96.0 .2 96.0 .2 96.0 .2 96.0 .2 96.0 .2 90.0 .	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC EPROR OF UNVO GIMENTE 43A1 7C0 (15 BERGER, K.KURDCA, A.MICHALC (CNTR. D'ETUCES NUC. SAC A PGLADIZEC CR UNPOLAPIJ ME PARAMETERS PITHETA) AM S SYSTEM AT ABOUT 600 ME SULTS ARE PRESENTED AND C	KES WITH THE BEAN IN THE GRAND C.M. ► → 7 PER CENT. YS MEASUREMENTS IN 600 MEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 566)] WICZIJICIOLIVIER, M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, (RSAY, FRANCE)) LAY, GIF-SUR-YVETTE, FRANCE) IEC PROTON BEAM PREVINISIY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) ID (CIN, MI)ITHETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 DEG. IN THE . THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE . THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE
144	0.0 0.0 0.0 0.2 0.2 0.2 0.2 0.2	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF PIN CORRELATION PARAMETER UNVO GIMENTG 43A, 7C0 (19 BERGER, K.NURDCA, J. HICHALD (CNTR. D'ETUCES NUC. SAG A PCLARIZEC CR UNPOLAPIZ HE PARAMETERS PITHETA) AN S SYSTEM A TABOUT 000 MEW SULTS ARE PRESENTED AND C 501, JETP 17 98 (1963), UCRL 11149	KES WITH THE BEAM IN THE GRAND C.M. F → 7 PER CENT. XS MEASUREMENTS IN 600 NEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 566)1 WICZJJ-C.OLIVIER,M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, CRSAY, FRANCE) IEC PROTON BEAM PREVINISIY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) IO (CIN,NI)(THETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 OPEG. IN THE I, THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE IONPARED TG THOSE ALREADY OBTAINED IN THE SAME ENERGY REGION. ICRL 11440 (1964), UCRL 11877 (1565), NUOVO CIMENTO 43A, 701 (1966), HELVETICA
144	0.0 0.0 0.0 0.2 0.2 0.2 0.2 0.2	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF PIN CORRELATION PARAMETER UNVO GIMENTE 43A1 700 (19 BERGER, K.NURDCA, JMICHALD (CNTR. D'ETUCES NUC. SAG A PCLARIZEC CR UNPOLAPIZ HE PARAMETERS PITHETA) AN S SYSTEM A ABOUT 000 MEW SULTS ARE PRESENTED AND C 501, JETP 17 98 (1963), UCRL 11149 ETTE BENARY IN 5/67, AND	KES WITH THE BEAM IN THE GRAND C.M. F → 7 PER CENT. XS MEASUREMENTS IN 600 NEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 566)1 WICZJJ.C.OLIVIER,M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, CRSAY, FRANCE) IEC PROTON BEAM PREVINISIY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) NO (CIN,NI)(THETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 OPEG. IN THE V. THE EXPERIMENTAL SET-UP AND THE WAY WHICH THE DATA WERE CARRIED OUT ARE IONPARED TG THOSE ALREADY OBTAINED IN THE SAME ENERGY REGION. ICRL 11440 (1964), UCRL 11877 (1565), NUOVO CIMENTO 43A, 701 (1966), HELVETICA VERIFIED BY LERCY PRICE.
144	COLOREROPSION OF A COLOREROPSION	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEPATIC EPROR OF PIN CORRELATION PARAMETER UNVO GIPENTG 43A, 7C0 (15 BERGER, K. MURDCA, A. HICHALD (CNTR. D'ETUCES NUC. SAC A PGLADIEC GR UNPOLAPIJ ME PARAMETERS PITHETAJ AN S SYSTEW AT ADOUT 000 MEW SULTS ARE PRESENTED AND C S01, JETP 17 98 (1963), UCRL 11149 ETTE BENARY IN S/67, ANO PROTON AT 1.212 GEV/C.	KES WITH THE BEAN IN THE GRAND C.M. ► → 7 PER CENT. YS MEASUREMENTS IN 600 MEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 566)] WICZ.J.C.OLIVIER.M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, (RSAY, FRANCE)) LAY, GIF-SUR-YVETTE, FRANCE) TEC PROTON BEAM PREVINISIY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) 10 (CIN.N) I(THETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 OEG. IN THE . THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE COMPARED TG THOSE ALREADY OBTAINED IN THE SAME ENERGY REGION. (CRL 11440 (1964), UCRL 11877 (1565), NUDVO CIMENTO 43A, 701 (1966), HELVETICA VERIFIED BY LERCY PRICE. TARGET IS POLARIZED 70 PER CENT (NORMAL TO THE BEAM DIRECTION).
144	CILO 2 G2.0 2 G2.0 2 G5.0 2 G40.0 2 TI.C 2 G40.0 2 TI.C 2 G2.0	.0714 4 .0565 4 .0357 6 .0278 6 .0252 6 .0192 6 .0192 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF UNYO GIMENTIC 43A, TC0 (15 BERGER, K.KUROCA, J.MICHALC ICMTR. D'ETULES NUC. SAC A PCLABIZEC CR UNPOLAPIZ HE PARAMETERS PITHETA) AA S SYSTEM AT ABOUT 600 MEY SULTS ARE PRESENTED AND C S81, JETP 17 98 (1963), U S8 66C (1965), UCRL 11149 ETTE BENARY IN S/67, AND PROTON AT 1.212 GEV/C.	KES WITH THE BEAN IN THE GRAND C.M. → 7 PER CENT. NEASUREMENTS IN 600 NEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 566)1 NIC2,J.C.OLIVIER, M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, CRSAY, FRANCE) LAY, GIF-SUR-YVETTE, FRANCE1 THE PROTON BEAM PREVINIESLY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) NO (CIN.M)ITHETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 DEG. IN THE J. THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE OMPARED TO THOSE ALREADY OBTAINED IN THE SAME ENERGY A GOION. ICRL 11440 (1964), UCRL 11877 (1965), NUOVO CIMENTO 43A, 701 (1966), HELVETICA J (1964), NUCLEAR INSTRUMENTS AND METHODS 15, 323 (1962), AND UCRL 11565 (1964). VERIFIED BY LERCY PRICE. TARGET IS POLARIZED 70 PER CENT (NORMAL TO THE BEAM DIRECTION).
144	01-0 -2 62-0 -2 63-0 -2 64-0 -2 64-0 -2 71-C -2 71-C -2 80-0 -2 70-0 -4 70-0 -4 70-	.0714 4 .0565 4 .0357 6 .0278 6 .0278 6 .0173 6 .0173 6 .0166 6 ANGLE THAT THE PROTON MAN SIBLE SYSTEMATIC ERROR OF UNION GIMENTIC 43A1 700 (15 BERGER, K.KURDCA, J.MICHALC (CATR. D'ETUCES NUC. SAC A PCLABIZEC CR UNPOLAPIZ HE PARAMETERS PITHETAJ AM S SYSTEM AT ABOUT 600 MEY SULTS ARE PRESENTED AND C 58), JETP 17 98 (1963), U 38 660 (1965), UCE 11149 ETTE BENARY IN 5/67, AND PROTON AT 1.212 GEV/C. ES COUNTERS. ZATICN	KES WITH THE BEAN IN THE GRAND C.M. F ← 7 PER CENT. 25 MEASUREMENTS IN 600 KEV PROTON-PROTON SCATTERING USING A POLAPIZED PROTON 55611 WIC2,J.C.OLIVIER,M.POULET J.TEILLAC (INST. DE PHYS. NUCLEAIRE, (RSAY, FRANCE) LAY, GIF-SUR-YVETTE, FRANCE1 TEC PROTON BEAM PREVINISIY DESCRIBED AND A POLARIZED PROTON TARGET (70 PER CENT) 10 (CIN,M)ITHETA) IN THE ANGULAR INTERVAL FROM 23 DEG. TO 104 DEG. IN THE J. THE EXPERIMENTAL SET-UP AND THE WAY IN WHICH THE DATA WERE CARRIED OUT ARE COMPARED TG THOSE ALREADY OBTAINED IN THE SAME ENERGY REGION. ICAL 11440 (1964), UCRL 11877 (1565), NUOVO CIMENTO 43A, 701 (1966), MELVETICA J (1964), NUCLEAR INSTRUMENTS AND METHODS 15, 323 (1962), AND UCRL 11565 (1964). VERIFIED BY LERCY PRICE. TARGET IS POLARIZED 70 PER CENT (NORMAL TO THE BEAM DIRECTION).

ELASTIC POLARIZATION FCR PROTON PROTON.

LABORATURY BEAM ENERGY = .595 +- .006 GEV.

THETA	PCLAR	IZAT I CN
DEGREES		
23.0	.4446	6740
32.0	.4735	.1170
36.5	.5260	. C 2 7 0
41.0	.4878	.0265
45.4	.4875	. C 2 5 0
49.8	.4585	.0205
54.2	.4255	.0220
62.9	.3805	. C 2 C O
67.C	.2970	.0145
75.6	.2305	.0130
79.7	,1605	.0130
83.9	.1055	. 0110
87.9	.0405	. C110
21.2	0183	.6095
96.0	084C	.0105
103.9	2350	.C140

THETA IS THE ANGLE THAT THE PROTON NAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

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NEUTRON-PROTON ELASTIC SCATTERING FROM 3 TO 10 GEV. [NUOVO CIMENTO 594, 1 (1969)]

C.BESLIU,T.BESLIU,A.CONSTANTINESCU,M.GAVRILAS,A.MIHUL,N.GHEORDANESCU, N.HANGEA,P.TELEMAN,I.TFONORESCU,I.TIPA [BUGHAREST State univ.,Buchanest,Ripala] V.Rahraumuv,VI.TANROL, I.Kefedeva, (Joint Inst. For Nucl. Research. Dubna, USSR]

NACT NEW CATA ON THE NEUTRON-PROTUN DIFFERENTIAL CROSS-SECTION IN THE MOMENTUP-TRANSFER RANGE FROM 0.06 TO 0.30 (Gev/Cisquared, for two energy regimes (from 3 to 6 gev and from 6 to 10 gev), are reported. ABSTRACT

CITATIENS PHYS. REV. LETTERS 16, 1217 (1966), NUOVO CIMENTO 414, 167 (1966), PHYS. REV. LETTEPS 9, 509 (1962), PRIBORI I TECH TECH. EXP. 1 41 (1939), CUENA P-2916 (1566), DUBNA P-1468 (1963), ZURN. EKSP. TEOR. FIZ. 44, 1481 (1963), DUBNA P-1136 (1963), DUBNA D-215 (1965), PHYS. REV. 96, 448 (1954), ZURN. EKSP. TEOR. FIZ. 42, 392 (1962), PHYS. LETTEPS 7, 80 (1963), DUBNA D-280, DUENA D-700, ZURN. EKSP. TEOR. FIZ. 44, 1411 (1563), JACERN. FIZ. 1, 134 (1963), PHYS. LETTEPS 7, CIMENTO 49A, 479 (1967), ZURN. EKSP. TEOR. FIZ. 44, 1487 (1963), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 11, 503 (1963), PHYS. REV. LETTERS 15, 45 (1963), PHYS. LETTERS 10, 376 (1963), PHYS. LETTERS 10, 543 (1963), ANC CUBNA P-2424 (1965).

ARTICLE READ BY ODETTE BENARY IN 2/69. AND VERIFIED BY LERGY PRICE.

BEAM IS NEUTRON ON HEAVY LIQUIC FROM 3.826 TO 10.900 GEV/C. (REAN KINETIC ENERGY = 3 TO 10 GEV)

THIS EXPERIMENT USES THE DUBNA 24 LITER (HLBC) BUBBLE CHAMBER. A TOTAL OF 40000 PICTURES ARE REPORTED ON-

KEY WCRCS . CROSS SECTION DIFFERENTIAL CROSS SECTION FITS

COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION

STASTIC CREEGENTIAL CASES SECTION FOR NEUTRON PAULUM.

NATA IS ANERACED DUED LAREPATERY BEAK NENCHTOP END- J. H. S. LEVIL. NUMBER OF EVENTS = 80.

(PRIVATE COMMUNICATION FROM C.BESLIU APRIL 1969)

_T			
LOEA1C	1##7	AP917BABY	UNITS
MIN	MAX		
.02	.04	83. +-	25.
.04	.06	105.	36.
.06	.05	90.	30.
.08	.10	115.	35.
-10	.12	85.	30.
•12	.14	50.	20.
.14	.20	56.	20.
.20	.40	21.	6.

T IS THE MOMENTUM TRANSFED ACTOCCU THE LINGONING ACUTAGE AND THE LUCIDUMS NEURUNI.

ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON.

CATA IS AVERAGED OVER LAEDRATORY BEAM MOMENTUM FROM 6. TO 10. GEV/C. NUMBER OF EVENTS = 100.

PAIVALE	CUMMUNICALLU	PRUP	L.853LIU	APRIL	1,40,2 1	

-T 11.6970 1##2 APOITORNY WHITS

	-		
PIN	MAX		
+02	.04	76. +-	25.
.04	.06	105.	36.
.06	.08	115.	35.
.08	•10	76.	24.
.1¢	.12	41.	15.
.12	-14	75.	25.
.14	+20	45.	25.
.20	.40	12.	4.

T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON).

NEUTRON PROTON ELASTIC CROSS SECTION. [PAGE 6]

I ASSUMING OPTICAL THEOREM AND TAKING FOR THE TOTAL NP CROSS SECTION THE VALUE OF 41.2 MILIBARNS.)

JR C ASSUMIA LABCPATORY BEAM POPENTUM GEV/C MIN 3. V/C MAX 10. MILLI-BARNS 12.5 +- .8

	FIT TO ELASTIC DIFFEPEN	IAL CRESS SECTION FOR NE	EUTRON PROTON. {TABLE 1}	
	DATA IS FIT OVER L	BCRATCRY BEAM MOMENTUM	FROM 3. TO 6. GEV/C.	
	DATA IS FIT CVER T I CUTGOING NEU EITTED FORMUNA IS	FRCM .06 TO .30 (GEV/C)4 RON].	**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING N FXDI-R#T1	EUTRENI AND THE
	WHERE T IS	18 / CEN/C14+3		
		18 (867)(10-2.		
	FITTED VALUES			
	8 = 6.9	- 1.C		
	FIT TO ELASTIC DIFFEREN	IAL CROSS SECTION FOR NE	EUTRON PROTON. [TABLE 1]	
	DATA IS FIT OVER L	BORATCRY BEAF MOMENTUM 6	FROM 6. TO 10. GEV/C.	
	DATA IS FIT GVER T Igutgoing neu Fitted Formula is	FRCM .06 TO .30 (GEV/C) RON]. NC. EVENTS - 441	**2. T IS THE MOMENTUM TRANSFER BETWEEN THE IJNCOMING N Exp[-8+T]	EUTRONI AND THE
	WHERE T IS	IN (GEV/C)**2.		
		•		
	8 - 8.6	9		
146	ABSOLUTE MEASUREMENTS C {PHYS. LETTERS 14,	PROTEN-PRGTON SMALL-AN 164 (1965)}	GLE ELASTIC SCATTERING AND TOTAL CROSS SECTIONS AT 10,	19, AND 26 GEV/C.
	G.BELLETTINI,G.COCCONI, RES., GENEVA, SWIT	DICCENS,E.LILLETHUN, ERLANCI	J.PAHL,J.P.SCANLON,J.WALTERS ,A.M.WETHERELL,P.ZANELLA (EURCPEAN ORG. FOR NU
	CITATIONS PHYS. REV. 178, 57 (1963), PHYS. REV. (1964), Annals Of 93 (1964), Dubna E) (1959), PHYS. REV. LET LETTERS 11, 425 (1963), "Hysics 3, 196 (1958), PH '1820 (1964), AND PHYS. 1	TERS 9, 108 (1962), SIENNA CONFERENCE 1 593 (1963), PHY SIENN& CONFERENCE 1 598 (1963), CENN 64-30P.183 (1964) HYS. LETTERS 12, 252 (1964), PHYS. LETTERS 14, 54 (1965 LETTERS:13, 78 (1964).	S. PEV. 130, 1182 , CERN 64-30P.211), PHYS. LETTERS 13,
	ARTICLE READ BY OCETTE	ENARY IN 10/69, AND VER	IFIED BY LERGY PRICE.	
	BEAM IS PROTON ON PROT	N FROM 10.1 TO 26.4 GEV	/¢.	
	THIS EXPERIMENT USES SP	RK CHAPPERS.		
	VEV LODOS & COOSS SECTI			
	KET NORDS - CROSS SECTI	IN DIFFERENTIAL CROS	S SECTION REAL (AMPLITUDE//IMAGINARY (AMPLITUDE/	
	PROTON PROTON TOTAL CRO	S SECTION. (TABL	E 1)	
	LABORATORY REAR PERFOTUN			
	GFV/C	MILLI-BARKS		
	19.33	38.9 .3		
	20.42	38.0 .2		
	THE REVIN RAFIO FOR THE	FORWARD ELASTIC AMPLITU	DE FOR PRUTON PROTUN. LIABLE 11	
	(THESE VALUES ASS	ME THAT THE SPIN-DEPEND	ENT CONTRIBUTION IS ZERO J	
	LABORA TORY	ALPHA		
	BEAM MCMENTUM GEV/C			
	10.11	430 +043		
	26.42	320 .033		
147	AN INVESTIGATION OF THE	1.4 GEV NUCLECA ISCBAR	IN PROTON-PROTON INTERACTIONS. (PHYS. LETTERS 288,	195 (1968))
	T.H.TAN,M.L.PERL,F.MART W.CHINOWSKY,R.R.KINSEY, M.MANDELKERN,J.SCHULTZ	N ISTANFORG LINEAR ACCE .L.KLEIN,P.SCHMIDT IU.C. UNIV. OF CALIFORNIA, IR	L. CNTR., STANFORD,CALIF., USA] . LAWRENCE RAD. LAB., BERKELEY, CALIF., USA] VINE, CALIF., USA]	
	ABSTRACT THE PRODUC INVESTIGATED WITH PRODUCTION PROCESS TO BE 0.66.	TON OF N*(14CC) ISOBAR HE AID GF ONE-PION EXCH THE ISOSPIN OF N*(1400	IN THE REACTION PP + P N++(1400), WHERE N+(1400) + N PI ANGE MODEL. THE ONE-PION EXCHANGE PECHANISM DOES NOT SE I IS FOUND TO BE I = 1/2, AND THE ELASTICITY OF THE RES	+ AND P PIO, IS Em to cominate the Onance IS Estimated
	CITATIONS Phys. Rev. Letters 397 (1967), Phys. Phys. Letters 0, 1	12, 340 (1964), PHYS. LI EV. Letters 17, 789 (194 4 (1964), PHYS. Rev. Le	ETTERS 26B, 161 (1968), PHYS. REV. 165, 1730 (1968), PH 66), PHYS. REV. LETTERS 16, 855 (1966), NUQVO CIMENTO 3 17ERS 17, 789 (1966), AND NUDVO CIMENTA 60A. 899 (1965)	YS. REV. LETTERS 17, 5, 1052 (1965),
	ARTICLE READ BY OFFITE	FNARY IN 1/6G. AND HERT	FIEC BY LERDY PRICE.	-
		N AT 4 67 CEN #		
	CEPH IS PROTUN ON PROT	M HE CILF GEV/L.		
	THES EXPERIMENT USES TH	L.R.L. 72 IN. (#) BUND	LE CHAMBER.	
	KEY WORDS + CROSS SECTI DELTA(1238)	N MASS SPECTRUM N+(1920)013 'N+(1)	MCDELS N#(1470)P11 DIFFERENTIAL CRGSS SECTION 688)'	FITS
	COMPOUND KEY WORDS .	ITS DIFFERENTIAL CROSS	SECTION	

.

(FROM PAGE 195 AND TABLE 1)

REACTION	MILLI-BARNS
ROTON PROTON +	
PROTON NEUTRON PI+	6.70 +50
PROTON PROTON PIO	2.80 .30
PROTON DELTA(1238)+	.28 .08
DELTA(1238)+ • NEUTRON PI+ [1]	
PROTON N#(1470)+	.27 .13
N#(1470)+ • NEUTRON PI+[2]	
PROTON N*(1520)+	.15 .09
N#(1520)+ • NEUTRON P[+ [1]	
PROTON 'N*(1688)+*	.19 .09
"N*(1688)+" • NEUTRON PI+ [1]	
PROTON DELTA(1238)+	.52 .13
DELTA(1238)+ + FROTEN PIO (1)	
PROTEN N#(1470)+	.11 .09
N#(1470)+ + PROTON PIO [2]	
PROTON N#(1520)+	-08 -05
N#(1520)+ • PROTON PIO [1]	
PROTON 'N*(1688)+'	.10 .05
•N*(1688)+• • PROTON PIO [1]	

(1) FITTED DISTRIBUTION WITH FIXED WASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.
(2) FITTED FOR MASS AND/OR WIDTH [MASS = 1.390 GEV; WIDTH = .150 GEV], AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND.

FIT TO DIFFERENTIAL CROSS SECTION FOR PROTON PROTON . N+(1470)+ PROTON. [PAGE 197]

LABORATORY BEAM MOMENTUM = 6.07 GEV/C. FITTED FORMULA IS D-SIGMA/D-T = A+ExP(ALPHA+T)

WHERE D-SIGMA/D-T IS IN NB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (N*(1470)*).

FITTED VALUE

ALPHA = 10.4 +- 1.0

148

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TOTAL CROSS SECTIONS OF PROTONS, ANTIPROTONS, AND PI AND K MESCNS ON HYDROGEN AND DEUTERIUM IN THE MOMENTUM RANGE 6-22 GEV/C. (PHYS. REV. 138, 8913 (1965))

W.GALBRAITH,E.W.JENKINS,T.F.KYCIA,B.A.LEONTIC,R.H.PHILLIPS,A.L.READ [RRGOKHAVEN NAT. LAB., UPTON, L.I., N. Y., USA] R.RUBINSTEIN (CORNELL UNIV., IT⊧ACA, N. Y., USA]

RACT THE TOTAL CROSS SECTIONS SIGNARID OF P. ANTI-P. CHARGED PI AND CHARGED K ON HYDROGEN AND DEUTERIUM HAVE BEEN MEASURED BETWEEN 6 AND 22 GEV/C AT INTERVALS OF 2 GEV/C TO AN ACCURACY GREATER THAN PREVIOUSLY REPORTED. THE METHOD UTILIZED MAS A CONVENTIONAL GOOG-GECHETRY TRANSMISSION EXPERIMENT WITH SCINITILIATION COUNTERS SUBTENDING VARIOUS SOLID ANGLES AT TARGETS OF LIQUID H(2) AND D12. WITH THE INCREASE IN STATISTICAL ACCURACY OF THE DATA, IT MAS FOUND THAT A PREVIOUSLY ADOPTED PROCECURE OF LIMERRY EXTRAPOLATING TO ZERO SOLID ANGLE THE PARTIAL CROSS SECTIONS MEASURED THAT A PREVIOUSLY ADOPTED PROCECURE OF LIMERRY EXTRAPOLATING TO ZERO SOLID ANGLE THE PARTIAL CROSS SECTIONS MEASURED PARTICLE-DEUTERN AND PARTICLE-PROTON CROSS SECTIONS. THE TOTAL CROSS SECTIONS OF PID AND PL-D ARE EQUAL AT ALL MEASINGEN MIMERIA. WHICH INFIRES THE VAIDINITY OF CHABRE SYMETRY UP TO 20 GEV/C. BESINTES GRAFTERS THE ORDER SCHIONS AND PROTOTAL CROSS SECTIONS AND PARTICLE-PROTON CROSS SECTIONS. THE TOTAL CROSS SECTIONS OF PL-D ARE EQUAL AT ALL MEASINGEN MIMERIA. WHICH INFIRES THE VAIDINITY OF CHABRE SYMETRY UP TO 20 GEV/C. BESINTES GRAFTECANT DECREASE IN PP TOTAL CROSS SECTIONS AND PARTOLE-PROTON CHOSS SECTIONS. THE TOTAL CROSS SECTIONS DECIDANT DE TOTAL CROSS DECTIONS THE TOTAL CROSS SECTIONS AND PARTOLE-PROTON CHORES IS PRESENTED FOR A SHALL BUT SIGNIFICANT DECREASE IN PP TOTAL CROSS SECTIONS AND PROTOTAL CROSS SECTIONS INTH MOMENTUM FEDERATIONE OF PRESENTED FOR A SHALL BUT SIGNIFICANT DECREASE IN PP TOTAL CROSS SECTIONS AND PN TOTAL CRCSS SECTIONS IN THE MOMENTUM REGION ABOVE 12 GEV/C. ABSTRACT

CITATIONS

TICMS FORTSCHRITTE DER PHYSIK 9, 545 (1961), PHYS. REV. LETTERS 10, 262 (1963), PHYS. REV. LETTERS 13, 205 (1964), PHYS. REV. LETTERS 7, 185 (1961), PHYS. REV. LETTERS 7, 352 (1961), PHYS. REV. LETTERS 5, 576 (1960), PHYS. REV. LETTERS 7, 127 (1961), PHYS. REV. LETTERS 81, 173 (1962), PHYS. REV. LETTERS 9, 32 (1962), NUGUO CIMENTC 34, 825 (1964), PHYS. PEV. 129, 2285 (1963), PHYS. REV. 123, 1850 (1961), INT'L. CONGRESS ON NUCLEAR PHYSICS, PARIS, FRANCE 162 (1964), JETP 15 272 (1962), JETP 18 1239 (1963), PHYS. REV. LETTERS 3, 285 (1959), PHYS. REV. 1869 (1962), PHYS. PEV. 100, 242 (1555), PHYS. REV. 123, 320 (1561), PHYS. REV. 17TERS 7, 187 (1961), JETP 34 499 (1958), NUNUN CIMENTE 14, 951 (1959), NUUWU LIMENIU 18, Y47 (1560), PHYS. REV. LETTERS 7, 187 (1961), JETP 34 499 (1958), NUNUN CIMENTE 14, 951 (1959), NUUWU LIMENIU 18, Y47 (1560), PHYS. REV. LETTERS 7, 187 (1961), JETP 34 499 (1958), NUNUN CIMENTE 14, 951 (1959), NUUWU LIMENIU 18, Y47 (1560), PHYS. REV. LETTERS 7, 187 (1961), JETP 34 499 (1958), NUNUN CIMENTE 14, 951 (1959), NUUWU LIMENIU 18, Y47 (1560), PHYS. REV. LETTERS 7, 187 (1962), PHYS. REV. LEITERS 10, 316 (1963), UCR 342 (1956), NUUWU LIMENIU 18, Y47 (1560), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 11, 503 (1963), UCR 342 (1956), NUCLEAR ELECTRONICS 1, 63 (1962), REVEN DF SCIENTIFIC INSTRUMENTS 25, 1070 (1934), PHYS. REV. 135, B358 (1964), PHYS. LETTERS 14, 164 (1565), PHYS. REV. 134, B633 (1564), AND PHYS. REV. 134, B630 (1964).

ARTICLE READ BY NAOHI BARASH-SCHPIDT IN 3768, AND VERIFIED BY LEROY PRICE.

- BEAM NO.
 1
 IS
 PI+
 ON
 PROTEN
 FFCM
 6
 TO
 20
 GEV/C.

 NO.
 2
 IS
 PI ON
 PROTEN
 FRCM
 6
 TO
 20
 GEV/C.

 NO.
 3
 IS
 PI+
 ON
 PROTEN
 FRCM
 6
 TO
 20
 GEV/C.

 NO.
 3
 IS
 PI ON
 PROTENCE
 FRCM
 6
 TO
 20
 GEV/C.

 NO.
 3
 IS
 PI ON
 DEUTERCN
 FRCM
 6
 TO
 20
 GEV/C.

 NO.
 5
 IS
 K ON
 DEUTERCN
 FRCM
 6
 TO
 10
 GEV/C.

 NO.
 6
 IS
 K CN
 PROTEN
 FRCM
 6
 TO
 10
 IS
 K CN
 PROTEN
 FRCM
 10
 20
 GEV/C.

 NO.
 9
 IS
 PROTON
 N
 PROTEN
 <t
- THIS EXPERIMENT USES COUNTERS. . KEY WORDS . CROSS SECTION

K+ CEUTERON TOTAL CROSS SECTION. [TABLE 3] LABORATORY BEAM FCMENTUM GRV/C PER CENT 6. →- 1.75 10. 1.75 10. 1.75 14. 1.75 14. 1.75 16. 1.75 16. 1.75 16. 1.75 MILLI-BARNS 33.4 + .3 33.9 .3 33.8 .3 33.9 .3 33.4 .3 33.4 .3 33.7 .3 34.2 .3

K+ PROTON TOTAL CROSS SECTION. (TABLE 3) LABORATORY LABORATORY EAM MOMENTUM GEV/C PER CENT 6. +- 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 20. 1.75 BEAM MILLI-BARNS 17.C +- .1 17.3 .1 17.3 .1 17.3 .1 17.4 .1 17.6 .1 17.1 .1 17.5 .1 1. K+ NEUTRON TOTAL CROSS SECTION. [TABLE 3] (UNFOLDED FROM DEUTERIUM CATA) LABCRAIDRY BEAM #CMENTUM GEV/C PER CENT 6. +- 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 20. 1.75 · . MILLI-BARNS . . K- CEUTERON TOTAL CROSS SECTION. [TABLE 3] LABORATORY BEAM FCMENTUM GEV/C PER CENT 6. ← 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 18. 1.75 18. 1.75 MILLI-BARNS 44.1 +- .3 41.7 .3 41.5 .3 40.3 .3 40.1 .3 40.1 .4 39.9 .7 . . K- PRGTCN TOTAL CROSS SECTION. [TABLE 3] LABORATORY ELAM MOMENTUM GEV/C PER CENT 6. 4- 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 18. 1.75 20. 1.75 MILLI-BARNS

 24.0 + .3

 23.6
 .2

 22.5
 .2

 21.6
 .2

 21.5
 .2

 21.3
 .4

 21.0
 .8

 22.4
 4.6

 - - - - - - -K- NEUTRON TOTAL CROSS SECTION. (UNFOLDED FRCH DEUTERIUM CATA) LABCEAICOY DEAM MOMENTUM GEV/C PER CENT 6. +- L.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 14. 1.75 10. 1.75 MILLI-BARNS 21.9 +- .4 14.7 .4 20.6 .4 20.2 .4 20.1 .4 20.3 .6 30.3 1.1 PI+ PROTON TOTAL CROSS SECTION. [TABLE 2] LABORATORY ECAM #CMENTUM GEV/C PER CENT 6. +- 1.75 10. 1.75 12. 1.75 14. 1.75 14. 1.75 16. 1.75 20. 1.75 MILLI-BARNS

 26.2 +- .2

 25.1 .2

 24.8 .2

 24.2 .2

 23.9 .2

 73.4 .2

 23.5 .2

 23.4 .2

 .

PI- PROTON TOTAL CROSS SECTION. [TABLE 2] LABORATORY BEAM MCMENTUM GEV/C PER CENT 6. +- 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 20. 1.75 MILLI-BARNS 28.5 +- .3 27.5 .3 26.5 .3 25.9 .3 25.4 .3 25.1 .3 25.0 .3 24.8 .3 PI+ DEUTERON TOTAL CROSS SECTION. [TABLE 2] LABORATORY BEAM MOMENTUM GEV/C PER CENT 6. ← 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 20. 1.75 MILL I-BARNS 52.8 +- .5 50.5 .5 49.3 .5 48.2 .5 46.9 .5 46.6 .5 46.3 .5 46.3 .5 ٠ PI- DEUTERON TOTAL CROSS SECTION. [TABLE 2] LABOPATORY BEAM MOMENTUM GEV/C PER CENT 6. +- 1.75 10. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 20. 1.75 MILLI-BARNS . . $52.7 \leftarrow .5$ $51.0 \quad .5$ $49.3 \quad .5$ $47.9 \quad .5$ $47.1 \quad .5$ $46.4 \quad .5$ $46.4 \quad .5$ $45.8 \quad .5$ PROTON DEUTERON TOTAL CROSS SECTION. TARIF 41 LABORATGRY PEIM HENTIN GEV/C PR CENT A. +- 1.75 10. 1.75 12. 1.75 14. 1.75 14. 1.75 16. 1.75 18. 1.75 18. 1.75 20. 1.75 22. 1.75 MILLI-BARNS

 77.4
 + 1.3

 76.2
 1.3

 75.8
 1.3

 74.4
 1.3

 74.0
 1.3

 75.8
 1.3

 74.0
 1.3

 75.8
 1.3

 72.8
 1.3

 72.1
 1.3

 71.6
 1.3

 σεύτύη σευτύη τυτή" ζεύές ΣέζτΙζη". [TABLE A] LABORATORY BEAM MOMENTUM GEV/C PER CENT 6. +- L.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 14. 1.75 10. 1.75 20. L.75 22. 1.75 : MILL I-BARNS 40.6 +- .6 40.0 .6 39.9 .6 39.1 .6 38.7 .6 38.7 .6 38.4 .6 38.4 .6 28.3 .6 - - - - - - - - -PROTON NEUTRON TOTAL CRGSS SECTION. [TABLE 4] , (UNFOLDED FROM CEUTERIUM CATA.) Glauber correction applied LABORATORY BEAM MOMENTUM GEV/C PER CENT 6. +- 1.75 8. 1.75 10. 1.75 12. 1.75 14. 1.75 14. 1.75 18. 1.75 20. 1.75 22. 1.75 MILLI-BARNS 42.6 +- 1.7 41.8 1.7 41.5 1.7 40.4 1.7 40.2 1.7 40.2 1.7 39.2 1.7 38.7 1.7 38.2 1.7

PEAR CEUTERON TOTAL CROSS SECTION. TABLE 41 LABCRATORY BEAM MCMENTUM GEV/C PER CENT 6. +- 1.75 8. 1.75 12. 1.75 14. 1.75 16. 1.75 18. 1.75 MILLI-BARKS 106.9 +- 1.3 102.7 1.3 96.1 1.3 95.0 1.4 93.2 1.6 87.2 6.1 . PBAR PROTON TOTAL CROSS SECTION. [TABLE 4] LABORATORY BEAM HOMENTUM GEV/C PEP CENT 6. +- 1.75 16. 1.75 16. 1.75 18. 1.75 12. 1.75 14. 1.75 MILL 1-BARNS 59.3 +- 1.1 56.4 .8 49.2 .8 50.3 3.6 51.7 .8 50.7 .9 NEUTRON PBAR TOTAL CRESS SECTION. [TABLE 4] (UNFOLDED FROM DEUTERIUM CATA) LABGRATORY BEAM P(MENTUM GEV/C PER CENT 6. +- 1.75 12. 1.75 14. 1.75 14. 1.75 18. 1.75 MILLI-BARNS 59.5 +- 4.0 57.3 3.9 53.8 3.7 53.4 3.7 52.7 3.7 44.4 9.0 149 NEUTRON-PROTON ELASTIC SCATTERING FROM 1 TG 6 GEV. [PHYS. REV. LETTERS 16, 1217 (1966)] N.N.KREISLER,F.MARTIN,M.L.PERL (STANFORD UNIV., STANFORD, CALIF., USA) M.J.LONGO,S.T.POWELL III, (UNIV. OF MICHIGAN, ANN ARBOR, MICH., USA) CITATIGNS Phys. Rev. Letters 15, 30 (1965), NUOVO CIMENTO 41, 167 (1966), Phys. Rev. Letters 11, 287 (1963), Phys. Rev. Letters 15, 838 (1965), Ruthepford High Energy Lab. Rpp/H/13 (1966), Jinr Jinr-E2413 (1965), UCPL 11441 (1964), NUOVO CIMENTO 27, 856 (1963), AND FHYS. REV. 137, 8708 (1965). ARTICLE REAC BY OCETTE BENARY IN 1/69, AND VERIFIED BY LEROY PRICE. DEAM IS NEUTRON ON PROTON FREM 1.697 TO 7.179 GEV/C. (BEAM KINETIC ENERGY - 1.0 TO 6.3 GEV) THIS EXPERIMENT USES SPARK CHAPPERS. KEY WORDS . DIFFERENTIAL CROSS SECTION FITS COMPOUND KEY WORDS . FITS DIFFERENTIAL CROSS SECTION ELASTIC DIFFERENTIAL CRESS SECTION FOR NEUTRON PROTON. [FIGURE 2] DATA IS AVERAGED OVER LABORATORY BEAM ENERGY FROM 1. TO 2. GEV. . THIS DATA WAS READ FROM A GRAPH . D-S16MA/D-T MR/GEV/C1*2 21.00 ← 2.00 6.00 1.00 7.60 1.00 2.55 5.00 2.55 .45 1.50 .40 1.65 .45 .60 .30 .70 .10 .50 .10 -T (GEV/C1**2 .25 .35 .50 .60 .7C .80 .85 1.00 1.20 1.45 T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING NEUTRON] AND THE [OUTGOING NEUTRON].

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ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [FIGURE 2] DATA IS AVERAGED OVER LABORATORY BEAM ENERGY FROM 2. TO 3. GEV.

. THIS DATA WA	S READ FROM A GRAPH .	
-T	D-SIGMA/D-T	
(GEV/C)**2	HB/(GEV/C)++2	·
-25	15.00 2.00	
.45	5.40 .70	
.55	5.60 .60	
•65	2.65 .45	(, , , , , , , , , , , , , , , , , , ,
.90	1.15 .30	
1.00	1.05 .25	
1.20	-80 -15	·
1.40	-40 -10	
2.50	.16 .03	
3.20	.15 .04	· ·
T IS THE MOMEN	TUM TRANSFER BETWEEN THE []	NCOMING NEUTRON) AND THE LOUTGOING NEUTRON).
CLASTIC DISERPENTIA	I CROSS SECTION FOR NEUTRON	
DATA IS AVERAG	ED OVER LABORATORY BEAM ENE	RGY FROM 3. TO 4. GEV.
. THIS DATA WA	S READ FROM A GRAPH .	
-T	D-SIGNA/C-T	
1624/61442	MB/16EV/61992	
.30	9.000 1.000	
.40	4.300 .700	
-55	2.700 .400	
-80	.900 .200	
.90	.600 .130	
.95	.350 .110	
1.40	.310 .070	
1.75	.080 .020	
2.50	-054 -008	
3.50	.037 .010	
T IS THE MOMEN	ITUM TRANSFER BETWEEN THE []	NCCMING NEUTRON) AND THE COUTGOING NEUTRON].
DATA IS AVERAG	ED OVER LABORATORY BEAM ENER	RGY FROM 4. TO 5. GEV.
. THIS DATA HA	E READ FROM A CRAPH .	
•••••		
-T	D-SIGMA/D-T	
(GEV/C)*+2	#8/(GEV/C1==2	
-20	14.000 +- 1.000	
.35	4.000 .300	•
.55	.85C .140	
.65	1.100 .100	
. 85	.610 .100	
1 00	.720 .000	
1.15	.110 .020	
1.39	.050 .020	
2.50	.016 .004	
3.60	-006 -002	
4.70	-005 -002	
6.50	.008 .003	
T IS THE MOMEN	TUM TRANSFER DETWEEN THE []	NCCMING NEUTRON) AND THE LOUTGOING NEUTRON].
		·
ELASTIC DIFFERENTIA	L CROSS SECTION FOR NEUTRON	PROTON. (FIGURE 21
DATA IS AVERAG	ED OVER LABOPATORY BEAM ENER	RGY FRDM 5.0 TO 6.3 GEV.
. IMIS DATA WA	S KEAU FRUF A GRAPH .	

-1	D-516M/	1/D-T
(GEV/C)**2	MB/(GEV/	(C)++2
.25	14.000 +-	1.000
.35	6.700	.500
-40	3.100	.200
.50	1.300	.200
.60	.930	.150
.70	.800	.130
.80	.400	.090
-90	.250	.060
1.10	.100	+C30
1.35	.040	.012
1.70	.027	.008
2.50	.013	.003
3.50	.004	.001
4.40	.004	.002
6.30	.002	.001
7.50	.004	+002
8.50	.008	.003

• •

T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING NEUTRON) AND THE LOUTGDING NEUTRON).

FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. (TABLE 1) CATA IS FIT OVER LABGRATGRY BEAP ENERGY FROM 1. TO 2. GEV. FITTED FORMULA IS D-SIGMA/D-T = A*EXP(-B*T)WHERE D-SIGMA/D-T IS IN MB/IGEV/CJ++2 AND T IS IN IGEV/CJ++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE LOUTGOING NEUTRON]. FITTED VALUE B = -6.321 +- .647 FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR NEUTRON PROTON. [TABLE 1] DATA IS FIT OVER LABORATORY BEAM ENERGY FROM 2. TO 3. GEV. FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-B*T] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND T IS IN (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [Incoming neutron] and the (Gutgoing Neutron]. FITTED VALUE B = -5.527 +- .463 FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1] DATA IS FIT GVER LABCRATCPY BEAM ENERGY FROM 3. TO 4. GEV. FITTED FORMULA IS D-SIGMA/D-T = A*EXP(-8*T) WHERE C-SIGMA/D-T IS IN MB/IGEV/CJ**2 AND T IS IN IGEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (CUTGGING NEUTRON). FITTEC VALUE B = -6.655 +- .432 , FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR NEUTRON PROTON. [TABLE 1] DATA IS FIT OVER LABCRATCRY BEAM ENERGY FROM 4. TO 5. GEV. FITTED FORMULA IS D-SIGNA/D+T - $\Delta + EXP[-D+T]$ WHERE D-SIGMA/D-T IS IN MB/IGEV/C)**2 AND T IS IN IGEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCCMING NEUTRON) AND THE (DUTGOING NEUTRON). FITTED VALUE B = -7.720 +- .411 FIT TO ELASTIC DIFFERENTIAL CRUSS SECTION FOR NEUTRON PROTON. [TABLE 1] DATA IS FIT OVER LABCRATORY BEAM ENERGY FROM 5.0 TO 6.3 GEV. FITTED FORMULA IS C-SIGMA/D-T = A*EXP[-B*T] WHERE D-SIGMA/D-T IS IN MB/(GEV/CI**2 AND T IS IN (GEV/CI**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING NEUTRON) AND THE (OUTGOING NEUTRON). FITTED VALUE 8 = -7.562 +- .351 150 THE REACTION PP + PN PI+ AT 10 GEV/C AND THE OPE MODEL. [NUDVC CIMENTO 53A, 232 (1968)] H.C.NFHNF.J.NIAZ.K.STRCMER,A.SCHWITT.H.P.SWANSON (UNIV. HAMBURG, HAMBURG, GERMANY) 1.BORECKA,G.KNIES, G.WOLF (DEUTSCHES ELEKIHUNEN-SYNLH., MAMBURG) GERMANY) ABSTRACT THE REACTION PP + PN PI+ AND ISOBAR PRODUCTION IN PP + N*++(1236) N HAVE BEEN STUDIED AT 10 GEV/C. CUP DATA ARE COMPARED WITH ONE-PION EXCHANGE MODELS WITH FORM FACTORS AND WITH ABSOPPTION CORRECTIONS. CLOSELY RELATED REFERENCES Data superseded by Phys. Rev. 174, 1638 (1968). ADDITIONAL (ITATIENS UCRL 10335 (1962), NUGVO CIMENTE 484, 676 (1967), NUGVO CIMENTO 424, 323 (1966), NUGVO CIMENTO 414, 635 (1966), NUGVO CIMENTO 444, 777 (1966), PHYS. REV. 144, 1122 (1966), PHYS. REV. 154, 1284 (1967), NUGVO CIMENTO 424, 179 (1966), NUGVO CIMENTO 454, 1010 (1966), NUGVO CIMENTO 33, 309 (1964), PHYS. REV. 125, 2082 (1962), PHYS. REV. 123, 2160 (1961) PHYS. REV. 133, BIO17 (1564), NUGVO CIMENTO 494, 479 (1967), PHYS. REV. 138, BETO (1965), NUGVO CIMENTO 27, 1450 (1963), BOULDER CONFERENCE 183 (1964), NUGVO CIMENTO 404, 236 (1965), DUBNA CONFERENCE 1 148 (1966), NUCVO CIMENTO 26 186 (1962), NUGVO CIMENTO 34, 735 (1964), PHYS. REV. 137, BIS3C (1965), REV. MOD. PHYS. 37, 484 (1965), AND PHYS. REV. 127, B55 (1566). ARTICLE READ BY DEETTE BENARY IN 3/68, AND VERIFIED BY LEROY PRICE. BEAM IS PROTON ON PROTON AT 10.01 GEV/C. THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE LHAMBER. A TOTAL OF BOOSD FIGIUNES ARE REPOPTED ON-GENERAL CCMMENTS ON THIS ARTICLE L ONLY EVENTS HAVING & PI+ IN THE BACKWARD HEMISPHERE OF THE OVER-ALL CMS WERE USED FOR THE ANALYSIS. THE GIVEN CROSS SECTIONS WINE CORRESPONDINGLY CORRECTED. KEY WORDS - CROSS SECTION #ASS SPECTRUM DIFFERENTIAL CROSS SECTION MODELS DENSITY MATRIX MOMENTUM TRANSFER

LIKON FACE 233 AND FACE 233	[FROM	PAGE	233	ANC	PAGE	2351
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LARCHAIGH FRANK REAR THORE THE A 16.01 EVEC. THIS GATS HOULD NOT BE USED - MORE RECENT VALUE AND BE FOUND IN ALMEIDA IT AL., PAYS. PLV. 174, 1538 (1960)] PUTCH RECTOR RECENT I. PUTCH RECTOR WEITHON I. PUTCH RECENT I. PUTCH								-			
1111 SAMA SHOULD NOT BE USEC - MCRE FICENT VALUES MAY BE FORD 10 AMPEIDS IT AL., PAYS. PEV. 17. 15.30 (1960)) PADIDA MOTOR TI. FILL-PAPAS ND. EXAMINATION WITH FILED ALSS MAY DE FORD Y ADDY FILLION 111 ATTED DISTRIBUTION WITH FILED ALSS MAY MOTOR AND TODE COLLTAIL2301-1 ADDY FILLION 11.0 FITTED DISTRIBUTION WITH FILED ALSS MAY MOTOR AND THE TODE CHEMIC ONLY ADDYE FITTED) BACKMODNO. 111 ATTED DISTRIBUTION WITH FILED ALSS MAY MOTOR AND THE TODE CHEMIC ONLY ADDYE FITTED) BACKMODNO. IFTERENTIAL COOSS SECTICA FOR PRETON FOR COLLEGATION AND THE TODE CHEMIC ONLY ADDYE FITTED) BACKMODNO. 111 ATTED DISTRIBUTION WITH FILED ALSS MAY MOTOR AND THE TODE CHEMIC FITTED) BACKMODNO. IFTERENTIAL COOSS SECTICA FOR PRETON FOR COLLEGATION AND THE TODE CHEMIC FITTED) BACKMODNO. 111 ADDIDECTION SECTION FOR FACE OF COLLEGATION FOR TOOL FOR MOTOR AND THE TODE CHEMICAL FITTED) BACKMODNO. IFTERENTIAL COOSS SECTION FOR FACE ALL AND THE TODE CHEMICAL FOR TOOL FOR MOTOR AND THE TODE CHEMICAL FITTED) 111 USED SIPPLE AASS CUT I MASS CUT FROM 1.123 TO 1.225 CEV 1. IIII USED SIPPLE AASS CUT I MASS CUT FROM 1.123 TO 1.225 CEV 1. 111 USED SIPPLE AASS CUT I MASS CUT FROM 1.123 TO 1.225 CEV 1. IIIII USED SIPPLE AASS CUT I MASS CUT FROM 1.123 TO 1.225 CEV 1. 111 USED SIPPLE AASS CUT I MASS CUT FROM 1.123 TO 1.225 CEV 1. IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII		LABCRATORY I	REAM MOMENTUM	= 10.0	I GEV/C.						
REACTION FILL-BANKS NO. EVENTS Reference 1.10 + .40 3.1 (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) BACKGODUND. (1) FITTED DISTRIBUTION WITH FIELD AKSS AND VIOTA INC TOCK EVENTS DALY ADDVE (FITTED) (1) FITTED DISTRIBUTION VIEW FIELD AKSS AND VIOTA MAD THE (DELTAILSS)). (1) FITTED DISTRIBUTION FIELD AKSS AND FITTED AKSS AND FITTED AKSS AND THE FILL AKSS AND AND THE FILL AKSS AND AND THE FILL AKSS AND THE FILL AKSS AND THE FILL AKSS AND AND		ETHIS CAL		RE USED	- MORE RECENT VA	ALUES MAY BE	FOUND IN	ALMEIDA	ET AL., PHYS. REV. 174. 1638 (196	5831	
PARTIGN PRETER PRETER VIEW PRETER PRETER VIEW No. EXAMPS 111 PTTED DISTRIBUTION WITH FIRED PASS NO WIGTH AND TOOK SYMTS ONLY ARRY (FITTED) BACKGROWN. III PTTED DISTRIBUTION WITH FIRED PASS NO WIGTH AND TOOK SYMTS ONLY ARRY (FITTED) BACKGROWN. 111 PTTED DISTRIBUTION WITH FIRED PASS NO WIGTH AND TOOK SYMTS ONLY ARRY (FITTED) BACKGROWN. III CONSTRUCTION WITH FIRED PASS NO WIGTH AND TOOK SYMTS ONLY ARRY (FITTED) BACKGROWN. 111 PTTED DISTRIBUTION WITH FIRED PASS NO WIGTH AND TOOK SYMTS ONLY ARRY (FITTED) BACKGROWN. III CONSTRUENT PARTICLE PAR				51 0510				0.00	NO EVENTE		
PROTON RECENT, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	ROTON	PRCTEN +	LIION				FILLI-04	112	NU. EVENIS		
(1) FITTED DISTRIBUTION WITH FIXED ASSS AND WIDTH AND TOOK EVENTS ONLY ADDVE (FITTED) BACKGROUND. DIFFERENTIAL CAOSS SECTION FOR PRECISE AFG. (), (), (), (), (), (), (), (), (), (),		PROTON NE Neutron (Del1	EUTRON PI+ GELTA(1238)++ TA(1238)++ •	PROTON	PI+ [1]		4.10 +- 1.18	.40 .14	341		
DIFFERENTIAL CROSS SECTION FOR PACTOR F. DELTAI2331*** AGUIDON. (FROME 24) LABORATORY BEAM MORENUM + 1C.OL GEVC.		(1) F1	ITTED DISTRIB	UTION WIT	H FIXED MASS AND	D WIDTH AND	TOOK EVENI	S ONLY 4	ABOVE (FITTED) BACKGROUND.		
Differential cross section for proton is defined by the filling of the filling o											
LABORATORY BEAK MODENTUM + 1C.01 GEV/C. ************************************		DIFFERENTL	AL CROSS SECT	ICN FOR	PRCTON PRCTON DELTA(12	• DELTA(1 2381++ • P	238)++ NEL Roton PI+	TRON.	(FIGURE 2A)		
Initis carra was also frage / carra intervention Initis carra was also f		LABORAT	TORY BEAM MOM	ENTUM =	10.01 GEV/C.						
		. THIS	DATA WAS REA	D FROM A	GRAPH .						
ICCV/CIVE PPJ/ICEV/CIVE2 100		-T		D-516M	A/C-T						
100 1.00 101 1.00		IGEV/CI*	•2	MB/IGEV	/C1**2						
.02 .03 .04 .03 .04 .04 .04 .04 .04 .05 .04 .04 .04 .04 .04 .05 .04 .04 .04 .04 .04 .05 .04 .04 .04 .04 .04 .05 .04 .04 .05 .04 .04 .05 .05 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .05 .04 .04 .06 .04 .04 .06 .04 .04 .06 .04 .04 .06 .04 .04 .07 .04		-00	+02	6.70 +	- 1.70						
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T IS THE MOMENTUP INAMSPER BETWEEN THE LINCOMING PROTON PAND THE LOELTAI12381++1. (1) USED SIPPLE MASS CUT (MASS CUT FROM 1.123 TO 1.325 GEV). 1) IGH-ENERGY PROTON-PROTON CIFFPACTION SCATTERING (PHYS. REV. LETTERS 4, 108 (1942)) A.N.OIDDENS, E.ILLLETHUN, G., AMANING, A.E.ITAVLCR, T.G., WARKER, A.H. WTHERELL (EUROPEAN ORG. FOP MUC. RES., GENEVA, SWITZERLY A.N.OIDDENS, E.ILLLETHUN, G., ALEITAVLCR, T.G., WARKER, A.H. WTHERELL (EUROPEAN ORG. FOP MUC. RES., GENEVA, SWITZERLY 101 (1961), NUT'L COMP (NELEF, PARTICLES, AIX-WETHEREUL) (EUROPEAN ORG. FOP MUC. RES., GENEVA, SWITZERLY 2357VI (1961), NUT'L COMP (NELEF, PARTICLES, AIX-WETHERDEVECK (33), AND INST. FOR NUC. RES., WARSAW, POLAN 2357VI (1961), AND INST. FOR NUCL RES., YARAFEMPARYMENCA 50, SOC. 6, 343 (1961), NUDYO (THENT 1021 (1961), NUT'L COMP (NELEF, PARTICLES, AIX-WETHERDEVECK (33), AND INST. FOR NUCL RES., WARSAW, POLAN 2357VI (1961), AND INST. FOR NUCL RES., YARAFEMPARYMENCA 50, SOC. 6, 343 (1961), NUDYO (THENT 1021 (1961), AND INST. FOR NUCL RES. THE AND AND THE ISONY NAIRS. BEAM IS PROTON ON PROTON FROM 12.1 TO 26.2 GEV/C. THIS EXPERIMENT INKES (NUMTRONE) KEY WORDS - DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOVENTUP + 12.1 GEV/C. THETA C-SIGNA/C OPTEGA MOSTER FORT 2.66 146.0 - 19 5.73 160 7.5 16 THETA IS THE ANGLE THAT THE PROTON MARES WITH THE BEAM IN THE GRAND C.H. ELASTIC DIFFERENTIAL GROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUP - 15.5 GEV/C. THETA C-SIGNA/C OPTEGA CONSTRUCTION FOR MOMENTUP - 15.5 GEV/C. THETA C-SIGNA/C OPTEGA 5.00 165.0 - 15 5.00 165.0 -		+20	• 30	.42	.42						
1012 [1961], INTL. CONT. CH PLEP. PARTICLES, ATX-EM-PROVENCE 433 [1961], AND INST. FOR NUCL PES., WARSAN, POLA ARTICLE READ BY QOETTE BENARY IN 4/67. AND VERIFIED AY LEDAY DOINE. BEAM IS PROTON ON PROTON FREM 12.1 TO 26.2 GEV/C. THIS EXPERIMENT URSES CONJUNCS KEY WORDS - DIFFERENTIAL CROSS SECTION CROSS SECTION CONFERENTIAL CROSS SECTION FCR PROTON PROTON. LABORATORY BEAM MOMENTUM + 12.1 GEV/C. THETA 2.66 YER 2.66 YER 2.66 YER 2.66 YER 2.66 YER 2.66 YER YER 2.66 YER 2.66 YER Y		CITATIONS PHYS. R	EV. LETTERS	7, 450 (1	961), PHYS. REV.	125, 1386	(1962), 80	LL. AM.	PHY5. SDC. 6, 343 (1961), NUOVO C	IMENTO	
ARTICLE READ BY QUETTE BENARY IN 4/67. AND VERIFIED BY IEDRY DBIFE. BEAM IS PROTON ON PROTON FROM 12.1 TO 26.2 GEV/C. THIS EXPERIMENT HISES FOUNDERS KEY MORDS - DIFFERENTIAL CROSS SECTION CROSS SECTION ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON. (TABLE 1) LABORATORY BEAM MOVENTUM + 12.1 GEV/C. THETA C-SIGMA/C-OPEGA WEUKNES HE/S 2.66 146.0 - 19 2.72 20.0 16 11.75 21.3 16 14.70 5.9 10 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL GROSS SECTION FOR PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL GROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOVENTUM + 15.5 GEV/C. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL GROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOVENTUM + 15.5 GEV/C. THETA C-SIGMA/D-UPEGA DECRETES ME/SB 0.00 1650 1.5 10.50 1.5 10.50 1.5 10.50 1.5 10.50 1.5 10.50 1.5 10.50 1.5 10.50 1.5 10.		1012 (1 255/VI	(1961), INT'L. (1961),	CONF, CN	ELEM. PARTICLES	, AIX-EN-PR	OVENCE 433	(1981).	, AND INST. FOR NUC. RES., WARSAW,	, POLAN	
BEAM IS PROTON ON PROTON FROM 12.1 TO 26.2 GEV/C. THIS EXPERIMENT WESS FOUNTEPS KEY WORDS - DIFFERENTIAL CROSS SECTION CROSS SECTION ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUP - 12.1 GEV/C. THETA C-SIGMA/C-OPEGA UEUWEUS ME/SR PFF FENT 2.66 146.0 + 19 3.73 70.0 10 6.73 45.0 16 14.70 3.4 16 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL GROSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUP 15.5 GEV/C. THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL GROSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUP 15.5 GEV/C. THETA C-SIUMA/U-UPEGA DEGREES ME/SR 0EGREES ME/SR 0.22 105.0 + 16 3.22 105.0 + 16 3.25 2.4 16 13.25 2.4 16		ARTICLE READ	BY GOETTE B	ENARY IN	4/67. AND VERIEI						
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THETA UEDREES C-SIGMA/C-OPEGA HE/SR PFP FENT 2.66 146.0 +- 19 5.73 76.0 16 6.72 45.0 16 11.75 21.6 14.70 5.9 16 THETA IS THE ANGLE TFAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM + 15.5 GEV/C. THETA C-SIGMA/C-UPEGA DEGREES 02 165.0 C + 18 6.40 76.0 15 3.02 165.0 + 18 6.40 76.0 15 13.25 6.4 16		LABORAT	IORY BEAM MOM	ENTU# =	12.1 GEV/C.						
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11.75 14.70 14.70 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFFRENTIAL CROSS SECTION FCC PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM \bullet 15.5 GEV/C. THETA C-SIGMA/U-UMEGA DEGREES ME/SR 9.71 C-18 6.40 76.0 15 9.71 27.0 15 13.25 6.4 16 16.50 1.11 21		2.66		146.0 + 76.0	- 19 16						
THETA IS THE ANGLE TFAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFFRENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM • 15.5 GEV/C. THETA C-SLUBAJU-UPEGA DEGREES PER 0.670 165.0 + 2E 0.71 27.0 15 13.25 0.4 16 16.50 1.1 21		2.66 5.73 8.72		146.0 + 96.0 45.0	- 19 16 16						
ELASTIC DIFFERFNTIAL GRGSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM • 15.5 GEV/C. THETA C-SIUMA/U-UMEGA DEGREES ME/SR 3.02 165.C • 12 6.40 76.0 15 6.71 27.0 15 13.25 6.4 16 16.50 1.11 21		2.66 5.73 8.72 11.75 14.70		146.0 + 96.0 45.0 21.3 5.9	- 19 16 16 16 16						
ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAK MOMENTUM = 15.5 GEV/C. THETA C-SIGMA/D-UPEGA DEGREES PER CENT 3.02 165.0 - 18 6.40 76.0 15 9.71 27.0 15 13.25 6.4 16 16.50 1.1 21		2.66 5.73 8.72 11.75 14.70 THETA I	IS THE ANGLE	146.0 + 76.0 45.0 21.3 5.9 TFAT THE 1	- 19 16 16 16 16	TH THE BEAM	IN THE GRA	ND C.M.			
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LABORATORY BEAK MOMENTUM = 15.5 GEV/C. THETA C-SLÜPA/U-UPEGA DEGREES PER CENT 3.02 165.0 +- 18 6.40 76.0 15 9.71 27.0 15 13.25 6.4 16 16.50 1.1 21		2.66 5.73 8.72 11.75 14.70 THETA I	IS THE ANGLE	146.0 + 96.0 45.0 21.3 5.9 TFAT THE	- 19 16 16 16 16 PROTON MAKES WIT	TH THE BEAN	IN THE GRA	ND C.M.		• = = 71	
THETA C-SIGPA/U-UPEGA DEGREES ME/SR PER PER 3.02 165.0 +- 18 6.40 76.0 15 9.71 27.0 15 13.25 6.4 16 16.50 1.1 21		2.66 5.73 8.72 11.75 14.70 THETA I	IS THE ANGLE	146.0 + 96.0 45.0 21.3 5.9 TFAT THE F	- 19 16 16 16 19 PROTON MAKES WIT 	TH THE BEAM	IN THE GRA [TABLE 1]	ND C.M.		. 5 2 1	
DEGREES MR/SR PER CENT 3.02 165.0 + 18 6.40 76.0 15 9.71 27.0 15 13.25 6.4 16 16.50 1.1 21		2.66 5.73 8.72 11.75 14.70 THETA I ELASTIC DIFF	IS THE ANGLE	146.0 + 96.0 45.0 21.3 5.9 TFAT THE F SS SECTION ENTUM •	- 19 16 16 16 16 16 16 16 N FCR PROTON PRO 15.5 GEV/C.	(H THE BEAM	IN THE GRA [TABLE 1]	ND C.M.			
$\begin{array}{cccc} & & & & & \\ 3.02 & & 165.0 & + & 18 \\ 6.40 & & 76.0 & 15 \\ 9.71 & & 27.0 & 15 \\ 13.25 & & 6.4 & 16 \\ 16.50 & & 1.1 & 21 \end{array}$		2.66 5.73 8.72 11.75 14.70 THETA I ELASTIC DIFF LABORAT THETA	IS THE ANGLE	146.0 + 96.0 45.0 21.3 5.9 TFAT THE F SS SECTION ENTUM = D-SIGPA/	- 19 16 16 16 10 PROTON MAKES WIT N FCR PROTON PRO 15-5 GEV/C. U-UPEGA	TH THE BEAM	IN THE GRA (TABLE 1)	ND C.M.		. 5 2 M	
6.40 76.0 9.71 13.25 6.4 16 16.50 1.1 21		2-66 5.73 6.72 1.75 14.70 THETA I ELASTIC DIFFF LABORAJ THETA DEGREES	IS THE ANGLE	146.0 + 26.0 45.0 21.3 5.9 TFAT THE P SS SECTION ENTUM C-SIGPA/ ME/	- 19 16 16 16 10 PROTON MAKES WIT N FCR PROTON PRO 15.5 GEV/C. U-UMEGA SR	TH THE BEAM	IN THE GRA [TABLE 1]	ND C.M.			
9.71 27.0 15 13.25 6.4 16 16.50 1.1 21		2-66 5.73 8-72 11.75 14.70 THETA I ELASTIC DIFF LABORAT THETA OEGREES 3.02	IS THE ANGLE	146.0 + 96.0 21.3 5.9 TFAT THE SS SECTION ENTUM C-SIGPA/ ME/ 165.0 +	- 19 16 16 16 19 PROTON MAKES WIT N FCR [°] PROTON PRC 15-5 GEV/C. U-UPEGA SR PER CENT - 18	TH THE BEAN	IN THE GRA [TABLE 1]	ND C.M.			
16.50 1.1 21		2.66 5.73 8.72 11.75 14.70 THETA I ELASTIC DIFF LABORAT THETA DEGREES 3.02 6.40	IS THE ANGLE	146.0 + 76.0 45.0 21.3 5.9 TFAT THE T SS SECTION ENTUM C-SIGMA/ ME/ 165.0 + 7.0.0	- 19 16 16 16 16 16 16 16 16 15 16 16 16 16 16 16 16 16 16 16	(H THE BEAM	IN THE GRA	ND C.M.			
		2-66 5.73 8.72 1.75 14.70 THETA I ELASTIC DIFF LABORAT THETA DEGREES 3.02 6.40 9.71 3.25	IS THE ANGLE	146.0 + 70.0 45.0 21.3 5.9 TFAT THE 55 SECTIO ENTUM C-SIGMA/ ME/ 165.0 + 76.0 27.0 4.2 165.0 + 76.0 27.0	- 19 16 16 16 10 PROTON MAKES WIT N FCR PROTON PRO 15-5 GEV/C. U-UFEGA SR PEP CENT - 18 15 15 15 16 16 16 15 16 16 15 16 15 16 16 10 10 10 10 10 10 10 10 10 10	TH THE BEAM	IN THE GRA [TABLE 1]	ND C.M.			

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.

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	ELASTIC DIFFERENTIA	AL CRESS SECTION FOR PROTON PR	OTON. [TABLE 1]
	LABORATORY BE	M MOMENTUM = 18.6 GEV/C.	
	THETA	C-SIGNA/D-OFEGA	
	DEGREES	ME/SR PER CENT	
	3.82	2C9.00 +- 22 66.00 20	
	10.70 14.40	12.6C 2C 1.60 24	
	17.80	.25 27	
	THETA IS THE A	NGLE THAT THE PROTON MAKES WI	TH THE BEAM IN THE GRAND C.M.
		•••••	•••••••••••••••
	ELASTIC CIFFERENTIA	AL CRESS SECTION FOR PROTON PR	GTON. [TABLE 1]
		M POPENTIAN # 21-4 GEV/C -	
	THETA		
	DEGREES	M8/SR	
	3.29	182.00 +- 21	
	7.3C 11.18	43.00 18 6.40 15	
	15.30 19.00	.52 2C .C4 34	
			· · · · · · · · · · · · · · · · · · ·
	THETA IS THE A	NGLE THAT THE PROTON MAKES WE	TH THE BEAM IN THE GRAND C.M.
			•••••••••••••••••••••••••••••••••••••••
	ELASTIC DIFFERENTIA	L CROSS SECTION FOR PROTON PR	OTON. (TABLE 1)
	LABORATORY CEA	WOMENTUM = 26.2 GEV/C.	
	THETA	E-SIGMA/D-ONEGA	
	DEGREES	ME/SR	
	4.21	189.00 +- 22	
	12.88	1.24 22	
	17.03	.08 28	
•	THETA IS THE A	NGLE THAT THE PROTON MAKES WI	TH THE BEAM IN THE GRAND C.M.
			• • • • • • • • • • • • • • • • • • • •
	PRETON PROTON ELAST	IC CROSS SECTION. {TAB	LE 21
	LABORATORY		
	REAM MOMENTUM	MILL I-BARNS	
	12.1	10.4 + 1.7	
	18.6	9.0 1.8	
	26.2	9.8 2.2	
152	1 THE BEAL AND OF		
100		C CLHSTIC FFF SCATTERING AMPLI	CTDINGU U CUTOTOOU FIGTUT INCT EAD MUCH DECEMPEN DURNA MCCC.
	Z.KCRBEL,L.ROB (HIG P.MARKOV,KH.TCHERNE	WIT STATES AND	(ECHOSLCVARIA) AN ACAO. OF SCI., SOFIA, BULGARIA]
	CLOSELY RELATED REF	ERENCES T JNP 1 379 (1965).	
	ADDITIONAL CITATION CERN CONFERENCI CONFERENCE 643	S E 582 (1962), ZURN. EKSP. TEDF (1963), AND PHYS. IFTTERS A.	L. FIZ. 45, 1261 (1963), ANNALS OF PHYSICS 3, 190 (1958), SIENNA 286 (1963).
	ARTICLE READ BY OFF	TTE BENARY IN 10/69. AND VERIS	TIED BY LEROY PRICE.
	BEAM IS PROTON ON	PROTCN FROM 2.784 TO 10.898 GE	V/C. (BEAM KINETIC ENERGY = 2 TO 10 GEV)
	THIS EXPERIMENT USE	S COUNTERS.	
	KEY WORDS + REAL (A)	MPLITUDE)/IMAGINARY (AMPLITUDE	3
	THE REVIM RATIC FOR	THE FERWARD ELASTIC AMPLITUDE	FOR PROTON PROTON. [TABLE 1]
	LABORATORY BEAM ENERGY	ALPHA	
	GEV Z-	17 +CP	
	10.	25 .67	
	2. 10.	17 +C8 25 .C7	

ALMEIDA,J.G.RUSHBROOKE,J.F.SCHARENGUIVEL (CAVENDISH LAB., CAMB. UNIV., CAPERICGE, ENGLAND) EHRENS,V.BLOREL, I.BORECKA,H.C.DEFNE,J.DIAZ,G.KNIES,A.SCHMITT,K.STROMER,M.P.SMANSON, IDEUTSCHES ELEKTRONEN-SYNCH., HAMBURG, GERMANY, AND UNIV. HAPBURG, HAMBURG, GERMANY) HAMBURG, GERMANY, AND UNIV. HAMBURG, HARBURG, GERMANY] RACT AROUT 3700 TWO-PROAG AND 5600 FGUR-PRONG EVENTS OF 10 GEV/C PP INTERACTIONS IN THE SACLAY BI-CM HYDROGEN BUBBLE CHAMBER HAVE BEEN MEASURED AND ANALYZED. THE RELIABILITY OF THE IDENTIFICATION OF THE DIFFERENT FINAL STATES HAS BEEN CHECKED USING MONTE CARLD-GENERATED EVENTS. FOR THE CHAMMELS ACCESSIBLE TO ANALYSIS, GROSS SECTIONS AND INVARIANT-HASS DISTRIBUTIONS ARE GIVEN. THE C.H. ANGULAR DISTRIBUTIONS AND THE MEAN VALUES OF THE TRANSVERSE POVENTUM FOR ALL FINAL-STATE PARTICLES ARE SHOWN AND DISCUSSED. PRODUCTION OF DELTA++(1236) ACCOUNTS FOR ABOUT 30 PER CENT OF THE CROSS SECTION SIGMAIPP-PN PI+) = (1 + - 0.4 MB. ABOUT 50 PER CENT OF THE CHOSS SECTIONS ISGMAIPP -PP PI+) = 1. 2.4 $\leftarrow 0.2$ MB CAN BE ACCOUNTED FOR BY DELTA++ PROCUCTION. PRODUCTION OF NUCLEEN ISOBARS AT 1450, 1520, AND 1730 MEV AND THEIR SUBSEQUENT DECAY INTO P PI+ PI - ARE INVESTIGATED. THEIR CROSS SECTIONS, T DEPENDENCES, AND BRANCHING RATIOS ARE DETERMINED, USING A DNE-PION-EXCHANGE MODEL (OPEM) FOR CALCULATING THE BACKGROUND DISTRIBUTIONS. THE PRODUCTION FOR RAUKANGES DECAYING INTO P PI- PI - PI - REACTIONS IS SUDIED USING BACKGROUND CINFES CALCULATEN WITH A MODEL BASED ON SIMPLE PARAPETRIZATIONS OF THE C.H. MOMENTUM DISTRIBUTIONS. THE PRODUCTION OF NUCLEON ISOBARS ACCOUNTS FOR NEARLY 100 PPR CENT OF THESE REACTIONS. FOR INDU BACKGROUND CURVES CALCULATENT WITH A MODEL BASED ON SIMPLE PARAPETRIZATIONS OF THE C.H. MOMENTUM DISTRIBUTIONS. THE PRODUCTION FOR LAGONACE IT IS SHOWN THAT MCSI OF THE C.M. ONO.TO - 0.04 MB, PERCETIVELY, CORRECTED FOR UNDERSEVED DECAY POES IT IS SHOWN THAT MCSI GE THE GRESS FEATURES OF THE PICN-PRODUCTION REACTIONS GAN BE EXPLAINED BY THE DPEM WITH THE FORM FACTORS OF FERRARI ANC SELLERI. EVENT ABSTRACT CLOSELY RELATED REFERENCES See also mudyo cimento 57a, 20 (1968), and nudyo cimento 51a, 305 (1967). This article supersedes nucyo cimento 50a, 1000 (1667), and nudyo cimento 53a, 232 (1968).

[PHYS. REV. 174, 1638 (1968)]

THIS ARTICLE SUPERSEDES NUCVO CIMENTO 50A, 1000 (1967), AND NUOVO CIMENTO 53A, 232 (1968). ACCITIONAL CITATIONS PHS. REV. 154, 1284 (1967), NUOVO CIMENTO 49A, 479 (1967), PHYS. REV. 161, 1387 (1967), PAINCETON-PENN ACCELERATCR PPAD-600P (1966), NUOVO CIMENTO 55A, 66 (1968), PHYS. PEV. 177, 1421 (1968), BULL. AM. PHYS. SOC. 12, 10 (1967). BULL. AM. PHYS. SUC. 12, 10 (1967), BULL. AM. PHYS. SOC. 12, 488 (1967). BULL. AM. PHYS. SOC. 12, 10 (1967). BULL. AM. PHYS. SUC. 12, 10 (1967), BULL. AM. PHYS. SOC. 12, 488 (1967). BULL. AM. PHYS. SOC. 13, 692 (1968), CITEPS 19, 307 (1967). PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 18, 89 (1967), PHYS. REV. LETTERS 19, 307 (1967). PHYS. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 18, 89 (1967), ULSY GU/23 (1)JUG1 FILS 11, 1361 UTS1 (1907), PHILOSOPHICAL MAGAINE 6 657 (1961), NUOYO CIMENTO 414, 417 (1966), PHYS. REV. LETTERS 19, 877 (1967). UCRL 10335 (1562), PHILOSOPHICAL MAGAINE 6 657 (1961), NUOYO CIMENTO 414, 417 (1966), PHYS. REV. LETTERS 19, 877 (1967). UCRL 10335 (1562), PHYS. SEV. LETTERS 19, 420 (1967), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 17, 884 (1966), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 19, 877 (1967). NUOVO CIMENTO 32, 60 (1965), PHYS. REV. LETTERS 11, 425 (1963), PHYS. REV. LETTERS 19, 877 (1967). NUOVO CIMENTO 34, 60 (1966), NUOVO CIMENTO 34, 1644 (1966), PHYS. REV. LETTERS 15, 430 (1965), PHYS. REV. LETTERS 19, 810 (1961), PHYS. REV. LETTERS 19, 430 (1965), PHYS. REV. LETTERS 19, 810 (1961), PHYS. REV. LETTERS 19, 430 (1965), PHYS. REV. 165, 1730 (1568), PHYS. REV. LETTERS 19, 470 (1967), PHYS. REV. LETTERS 16, 603 (1966), NUOVO CIMENTO 47A, 232 (1967), PHYS. REV. 165, 1730 (1568), PHYS. REV. LETTERS 19, 430 (1964), PHYS. REV. LETTERS 16, 603 (1966), PHYS. REV. 165, 1730 (1568), PHYS. REV. LETTERS 19, 430 (1965), PHYS. REV. LETTERS 16, 603 (1966), PHYS. REV. 165 (1967), PHYS. REV. LETTERS 15, 1636), PHYS. REV. LETTERS 16, 603 (1966), PHYS. REV. 165 (1967), PHYS. REV. LETTERS 17, 1644 (1966), 15

MODES.

ARTICLE REAC BY OCETTE BENARY IN 1/65, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 10.01 GEV/C.

153 PP INTERACTIONS AT 10 GEV/C.

THIS EXPERIMENT USES THE SACLAY 81 CM (H) BUBBLE CHAMBER. A TOTAL OF BODOO PICTURES ARE REPORTED ON.

KEY WORDS + CROSS SECTION MASS SPECTRUM DALIT2 PLOT ANGULAR DISTRIBUTION MODELS OMEGA(783) ETA(548) F(1260} N+(1520)D13 N+(1700)S11 'N+(1688)' DELTA(1238) N+(1470)P11

(FROM PAGE 1640 AND TABLE 2)

LABORATORY BEAM MOMENTUM = 10.01 +- .01 GEV/C.

REACTION	MILL I-BARNS
PROTON PROTON -	
TOTAL	41.1 +- 1.7
ELASTIC	10-2 -6
PROTON PROTON PIO	1.4 .3
PROTON NEUTRON PI+	4,1 .4
PROTON PROTON PI+ PI-	2.4 .2
PRUILN PRUIUN PI+ PI- PIU	2.3 .2
PROTON NEUTRON FI+ PI+ PI-	2.4 .2
PROTON PROTON MM≥2PIO	1.5 (1)
PROTON NEUTRON PI+ PF21PIO	5-3 (1)
NEUTRON NEUTRON PI+ PI+ MM≥OPIO	2.2 [1]
PRCTCN PROTON PI+ PI- MM≥2PIO	.7 [1]
PROTON NEUTRON PI+ PI+ PI- PF21PIO	4-1 (1)
NEUTRON NEUTRON PI+ PI+ PI+ PI- MM20PIO	-6 [1]

[1] VALUE IS APPROXIMATE CNLY.

[TABLE 4]

LABORATORY REAM MOMENTUM - # 10.01 +- .01 GEV/C.

REACTION	MILLI-BARNS
ROTCH PRCTCH +	
DELTA(1238)++ + PRDTON PI+ [1]	1.18 +14
DELTA(1920)++' NEUTRON	.38 .11
DELTA(1920)++ + PROTON PI+ [1]	30 13
N+(1470)+ + NEUTRON PI+ [1]	.20 .15

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

	(TABLE 6)	
LABCRATORY BEAM MOMENTUM = 10.01 +01 GEV/	v/c.	
REACTION	MILLI-BARNS	
DELTA(1238)++ PROTCN PI-	1.250 +140	
DELTA(1238)++ + PROTON PI+ [1] N*(147C)+ PROTON	.180 .04C	
N#(1470)+ + PRUTON PI+ PI- [2] N#(1520)+ PROTON N#(1520)A = PROTON DIA DIA [3]	.150 .040	
N{1688}+* PRCTON	.220 .070	
N+(1688)+ + PROTON PI+ PI- (4) PROTON PROTON F(1260) F(1260) + PI+ PI- (5)	-064 -027	
(1) FITTED DISTRIBUTION WITH FIXED MASS	S AND WIDTH AND TODE EVENTS ONLY ABOVE (FITTED) BACKGROUND.	
E21 FITTED FOR MASS AND/OR WIDTH I MAS BACKGROUND.	222 = 1.450 GEA: MIDIH = .210 GEA 1+ BUC THEN IGGN ONLY EASHIS ABOAC (*)	
[3] FITTED FOR MASS ANC/OR WIDTH I MAS	ASS = 1.525 GEV; WIDTH = .105 GEV], AND THEN TOOK ONLY EVENTS ABOVE (FI	TTEDI
BACKGRUND. [4] FITTED FOR MASS AND/OR WIDTH & MAS BACKGRUND.	ASS = 1.734 GEV; WIDTH = .140 GEV], AND THEN TOOK ONLY EVENTS AROVE (FI	TTEDI
(5) FITTED DISTRIBUTION WITH FIXED MASS ABOVE (FITTED) BACKGRCUND.	S AND WIDTH [MASS = 1.254 GEV; WIDTH = .117 GEV] AND TOOK EVENTS CNI	.Y

[TABLE 6]

LABGRATORY BEAM MOMENTUM = 10.01 +- .01 GEV/C.

REACTION	MILLI-BARNS PER CENT		
FROTEN PROTEN +			
DELTA(1238)0 PROTON FI+	.29 +- 40.		
OELTA(1238)0 + PROTON P1- [1]			
N#(1520)0 PROTON PI+	.15 40.		
N*(152010 + PROTON PI- [1]			
"N#1168810" PROTON PI+	.16 40.		
N(168810* + PRCTON FI- [1]			

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

.

[TABLE 7]

LABORATORY BEAM MOMENTUM = 10.01 +- .01 GEV/C.

.

	REACTION	MILLI-BARNS		
PROTON	PROTON +			
	DELTA(1238)++ PROTON PI- PIO	1.020 +130		
	DELTA(1238)++ + PROTON PI+ [1]			
	DELTA(1238)+ PROTUN PI+ PI-	.420 .130		
	DELTA(1238)+ + PROTCN PIO (1)			
	DELTA(1238)0 PROTON PI+ PIO	.580 .130		
	DELTA(1238)0 + PROTON PI- [1]			
	N*(1520)C PROTON PI+ PIC	.140 .120		
	N#(1520)0 • PROTON PI- (1)			
	PROTON PROTON GMEGA(783)	.145 .030		
	GHEGA(783) + PI+ PI- PIO [1]			
	PROTEN PROTON ETA(548)	.036 .015		
	ET4(548) + PI+ FI- FIC (1)			

(1) FITTED DISTRIBUTION WITH FIXED MASS AND WIDTH AND TOCK EVENTS ONLY ABOVE (FITTED) BACKGROUND.

[TABLE 8]

LABORATORY BEAM MOMENTUM + 10.01 +01 GEV/C.	
REACTION	N1LL I-BARNS
PROTEN PROTON .	
DELTA(1238)++ NEUTRON PI+ PI- +	
DELTA(1238)++ DELTA(1238)- PI+	1.11 +14
DELTA(1238)++ + PPOTON PI+ [1]	
DELTA(1238)- • NEUTRON PI- [1]	
DELTA(1238)+ PROTON PI+ PI-	.58 .14
DELTA(1238)+ • NEUTRON P1+ [1]	
DELTA(1238)O NEUTRON PI+ PI+	.12 .07
DELTA(1238)0 · PROTON PI- (1)	
DELTA(1230)~ PROTON PI+ PI+ + GELTA(123A)++	
DELTA(1238)- PI+	.77 .10
DELTA(1238)- + NEUTRON PI- [1]	
DELTA(1238)++ • PROTON PI+ [1]	
DELTA(1238)++ DELTA(1238)- PI+	.57 .15
UCLTA(1238)++ - PRETON PI+ LLJ	
DELTA(1238)- • NEUTRON PI- [1]	
N*(1520)+ PROTON PI+ PI-	.07 .07
N*(1520)+ + NEUTRON PI+ [1]	
"N*(1688)0" PROTON PI+	.16 [2]
'N*(1688)0' - NEUTRON PI+ PI- (1)	

[1] FITTED DISTRIBUTION WITH FIXED PASS AND WIDTH AND TOOK EVENTS ONLY ABOVE (FITTED) BACKGROUND.
(2) VALUE IS APPROXIMATE ONLY.

154	ON THE REACTION PP .	PP OMEGA AT 19 GEV/C INC	1DENT WOMENTUM. [LUND CCNFERENCE (1969)]
L	H.BGGGILD, J.EADES, K.H M.KGRKEA-AHO, K.V.LAU P.GROSSMANN, T.JACCBSE G.EKSPONG, L.GRANSTROM	ANSEN,H.JCHNSTAD,R.MOLLEI RIKAINEN,P.K.LAURIKAINEN N,F.SAETRE, S.O.SORENSEN ,S.O.HOLMGREN,S.NILSSON,	RUC,L.VEJE INIELS BOHR INSTITUTE, COPENPAGEN, DENMARK] (IHELSINGIN YLIOPISTO, HELSINKI, FIALAAD] IOSLO UNIV., OSLO, NORWAY] T.OLHEDE (STOCKHCIMS UNIV., STOCKHOLM, SWEDEN]
	ABSTRACT THE EFFE INCIDENT MOMENTU REACTION PP PP O A COUBLE EXCHANG	CTIVE MASS CISTRIBUTION (M SHOWS PRODUCTION OF THI MEGA ARE CONPARED WITH A E MODEL CAN DESCRIBE THE	OF THE PI+ PI- PIC SYSTEM IN THE CHANNEL PF • PP PI+ PI- PIO AT 19 GEV/C IE CHEGA MESON WITH A CROSS-SECTION OF 0.08 +- 0.02 MB. THE DATA FOR THE DOUBLE REGGE-POLE EXCHANGE MCDEL (CLA-MODEL). THE AGPEEMENT FOUND SHOWS THAT REACTION.
	CITATIONS PHYS. REV. 161, PHYS. REV. 174, 438 (1966), AND	1387 (1967), PHYS. REV. 1 1638 (1968), PHYS. REV. 1 NUCVO CIMENTO 57A, 93 (19	154, 1284 (1967), NUOVO CIMENTO 554, 66 (1968), NUOVO CIMENTO 584, 475 (1968) , LETTERS 18, 89 (1967), PHYS. REV. LETTERS 19, 198 (1967), NUOVO CIMENTO 464, 968).
	ARTICLE READ BY ODETT	E BENARY IN 9/65, AND VER	RIFIED BY LERGY PRICE.
	BEAP IS PROTON ON PR	DTCN AT 19 GEV/C.	
	THIS EXPERIMENT USES	THE CERN 2M (H) BUBBLE CH	HAMBER. A TOTAL OF 120000 PICTURES ARE REPOPTED ON.
	KEY WORDS . CROSS SEC	TICN OFEGA(783)	MCDELS · MASS SPECTRUM ANGULAR DISTRIBUTION DALITZ PLCT
÷	CCMPCUND KEY WORDS .	CMEGA(783) CRCSS SECTIO	ON .
	CROSS SECTION FOR	PROTON PROTON + PROTO OMEGA	N PROTON OMEGA(783). [PAGE 1] A(783) - PI+ PI- PIO [1]
	• • THIS DATA SH	OULD NDT BE USED + + (SA	ANE VALUE AS IN BOGGILO SUBMITTED TO VIENNA,1968.)
	LABORATCRY		
	GEV/C	MILL I-BARNS	
	19.	.08 +02	
	[1] COUNTED ONL	Y EVENTS ABOVE BACKGROUND	D.
155	ELASTIC SCATTERING OF	630 MEV NEUTRENS BY PROT Azarinov (Joint Inst. FC)	TONS. (JETP 37 1125 (1960)] R NUCL. RESEARCH, DUBNA, USSR) R Nucle Research, dubna, USSR)
	ABSTRACT THE DIFF TO 180 DEG, IN T IDENTICAL WITH R SIGMA-NP(THETA) CONSTANT BY CHEW	EXENTIAL CROSS SECTION SI HE C.M.S. FOR A MEAN NEUT ESULTS OF MEASUREMENTS CA DN ANGLE IN THE NEICHEURH S METHCD. A VALUE (FISCI	IGMA-NVIMEIAJ FUR ELASILI N-P SLATIENING MAS MEASURED AL ANGLES INELS AL TRON ENERGY 630 MEV. WITHIN THE LIMITS OF ERROR, THE DATA THUS OBTAINED WAS ARRIED OUT PREVIDUSLY WITH NEUTRONS OF MEAN ENERGY 580 MEV. THE DEPENDENCE OF HOUL UF INELA = 180 DEG. WAS USED TO DETERMINE THE PION-NUCLECN COUPLING UARED = 0.06 +- 0.02 WAS OBTAINEC.
	CITATICNS JETP 4 161 (1957 (1959), DOKL. AK (1959).), JETP 7 37 (1558), JET AD. NAUK. SSSR 104 717 (1	P 9 516 (1959), PHYS. REV. 112, 1380 (1958), JETP 9 302 (1959), JETP 8 564 1959), JETP 5 618 (1957), AND PROC. OF THE ROYAL SOCIETY OF LONDON A251, 233
	ARTICLE REAC BY ODETT	E BENARY IN 1/69, AND VEP	RIFIED BY LEROY PRICE.
	BEAM IS NEUTRON GN P	POTON AT 1.257 GEV/C. ((REAM KINETIC ENERGY = .63 GCV)
	THIS EXPERIMENT USES	COUNTERS.	
	KEY WORDS + DIFFERENT	IAL CROSS SECTION	
	ELASTIC DIFFERENTIAL	CRCSS SECTION FOR NEUTRO	N PRDTON. (FIGURE 2)
	LAECRATORY BEAM	ENERGY = .63 GEV (MEAN	VALUE).
	. THIS DATA WAS	READ FRGM & GRAPH .	
	THETA	C-SIGMA/D-CHEGA	
	10.	8.3 +- 1.1	
	36.	3.7 .2	
	53.	2.2 .2	
	70.	1.7 .1 1.5 .1	
	80. 51.	1.2 .1 1.1 .1	
	102. 111.	1.C .1 1.0 .1	
	123.	1.4 .1 1.6 .1	
	145.	2.6 .2	
	160.	4.0 .3	
	170.	6-C .4	
	180.	A.0 .5	

THETA IS THE ANGLE THAT THE NEUTRON MAKES WITH THE BEAM IN THE GRAND C.M. [1]: Plus possible systematic error of +- 19 per cent.

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156 COMPARISON OF ISOBAR PRODUCTION IN PP AND ANTI-PROTON N INTERACTIONS AT 2.8 GEV/C . [PHYS. RFV. 162, 132C (1967)] T.C.BACON,F.M.BOMSE,T.B.COCHRAN,N.J.FICKINGER,E.R.GOZA,H.W.K.HOPKINS, E.O.SALANT (VANDERBILT UNIV., NASHVILLE, TENN., USA) THE REACTIONS PP+N+++(123B)N ANC ANTI-PROTON N - ANTI-N+(123B)++ P AT 2.8 GEV/C INCIDENT LABORATORY MOMENTUM ARE ANALYZED WITH THE RROWHAVEN NATIONAL LABORATORY 20-IN. BUBBLE CHAMBER. ISOBAR AND ANTI-ISOBAR PRODUCTION DIFFERENTIAL CROSS SECTIONS AND DECAY ANGULAR DISTRIBUTIONS ARE COMPARED WITH THE PREDICTIONS OF AN ABSORPTIVE SINGLE-PION-EXCHANGE MODEL. THE ABSOLUTE VALUES, SHAPES, AND RATIOS OF THE CROSS SECTIONS ARE IN GOOD AGREEMENT WITH THE THEORY HEN THE ABSORPTIVE PARAMETERS GAMMAIL AND GAMMA(2) ARE 0.033 AND 0.016 FOR THE ANTI-PROTON N REACTION, AND 0.057 AND 0.015, RESPECTIVELY, FOR THE PP REACTION. CLOSELY RELATED REFERENCES Continuation of previous experiment in phys. Rev. 125, 2082 (1962). ADDITIONAL CITATIONS REV. MOD. PHYS. 37, 484 (1965), Phys. Rev. 139, 8428 (1965), Phys. Rev. 139, 81420 (1965), Nudvo cimento 34, 1644 (1964), Rev. PCD. Fhys. 39, 1 (1967), AND Phys. Rev. 142, 1195 (1966). ARTICLE REAC BY OCETTE BENARY IN 1/69, AND VERIFIED BY LERDY PRICE. BEAN NO. 1 IS PROTON ON PROTON AT 2.8 GEV/C. NO. 2 IS ANTI-PROTON ON CEUTERON AT 2.8 GEV/C. THIS EXPERIMENT USES THE B.N.L. 20 IN. (H) BUBBLE CHAMBER. KEY WORDS + CROSS SECTION DIFFERENTIAL CROSS SECTION ANTI-PROTON PROTON MODELS MASS SPECTRUM DENSITY MATRIX CROSS SECTION FOR PROTCN PRCTON + DELTA(1238)++ NEUTRON. [PAGE 1322] DELTA(1238)++ - PROTON PI+ [1] LABCRATCRY BEAM MONENTUM GEV/C 2.8 MILLI-BARNS 10.63 +- .29 (1) FITTED FOR MASS AND/OR WIDTH (MASS = 1.200 GEV; WIDTH = .077 GEV), AND THEN TOOK ONLY EVENTS ABOVE (FITTED) BACKGROUND. PROTON PROTON - DELTA(1238)++ NEUTRON. Delta(1238)++ - Proton PI+ [1] DIFFERENTIAL CROSS SECTION FOR (FIGURE 10) LABORATORY BEAM MOMENTUM . 2.8 GEV/C. . THIS DATA WAS READ FROM A GRAPH . D-SIGMA/D-GHEGA MB/SR [2] COS(THETA) ND. EVENTS $\begin{array}{c} 141.0\\ 112.0\\ 74.5\\ 66.0\\ 37.5\\ 33.0\\ 21.0\\ 21.0\\ 13.0\\ 13.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 15.0\\ 10.0\\ 4.0\\ 4.0\\ 4.0\\ 10.0\\$ THETA IS THE ANGLE THAT THE DELTA(1238)++ MAKES WITH THE BEAM IN THE GRAND C.F. [1] COUNTED ALL EVENTS IN MASS BAND [MASS CUT FROM 1.160 TO 1.300 GEV]. [2] COUNTS WERE MULTIPLIED BY .12 TO GET THESE. ERRORS ARE TAKEN AS PROPORTIONAL TO THE SQUARE-ROOT OF THE COUNTS. 157 DOUBLE ELASTIC PROTON SCATTERING ON POLARIZED PROTON TARGET. [PHYS. LETTERS 288, 572 (1969)] J. BYSIRILAT, J. LEUR, L. JAKUUT; '. H. KAZAAINOV (F. LENAR (L. B. FARFENOV (JOINT INST. FOR NUGL. REGEARCH, OVBNA, USER) RACT THE TRIPLE SCATTERING DEPOLARIZATION TRANSFER PARAMETER (DT) IN ELASTIC PP SCATTERING WAS MEASURED AT THE ENERGY OF 660 MEV USING A POLARIZED PROTON TARGET. ALL MEASUREMENTS HAVE BEEN MADE WITH THE HELP OF AN OPTICAL SPARK CHAMBER, THE FOLLOWING RESULTS HAVE BEEN OBTAINED (DT) 90 DEG. = (D) 90 DEG. = 0.54 +- C.10; (DT) 130 DEG. = (D) 50 DEG. = 0.72 +- U.11. ABSTRACT CITATIONS CZECH. J. PHYS. B18 570.(1968), NUCLEAR INSTRUMENTS AND NETHODS 63, 83 (1968), INSTRUMENTS AND EXPERIMENTAL TECHNIQUES 5 1102 (1966), JINR P1-3525 (1967), HELVETICA PHYSICA ACTA 39 579 (1966), ZURN. EKSP. TEOR. FIZ. 35, 1398 (1958), ZURN. EKSP. TEOR. FIZ. 38, 1451 (1960), SQVIET JNP 2 892 (1965), DUBNA CONFERENCE 11 (1964), AND DUBNA P1-3971 (1968). ARTICLE READ BY LERCY PRICE IN 4/70, AND VERIFIED BY ODETTE BENARY. BEAM IS PROTON ON PROTON AT 1.294 GEV/C. (BEAM KINETIC ENERGY = .66 GEV) TARGET IS POLARIZED 60 PER CENT (NORMAL TO THE BEAM DIRECTION). THIS EXPERIMENT USES SPARK CHAMBERS. KEY WORDS . POLARIZATION

 15.60 Subject of the second second	_	
<pre>Contender # Concerning Transformer (Concerning) = Contended and the Concerning Transformer (Concerning) = Contended and the Contended</pre>	158 OBSERVATION OF Y*+(1385) K+ AND N*++(1236)	RHOO DECAYS OF A NUCLEON RESONANCE. (PHYS. REV. 171, 1421 (1968))
<pre>ETHELT</pre>	W.CHINOWSKY,P.CONDON,R.R.KINSEY,S.L.KLEIN,P AND UNIV. OF CALIFCANIA, BERKELEV, CAL F.PARTIN,M.L.PERL,T.H.TAN ISTANFORC LINEAR	.MANCELKERN,P.SCHMIDT,J.SCHULTZ (U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA IF., USA) ACCEL. CNTR., STANFORD,CALIF., USA]
CLEASE F HALF A SUBJECT AND A DECEMPTON DE COMPANY DE CONTRACTOR DE COMPANY DE CONTRACTOR DE CONTRAC	ABSTRACT AN ANALYSIS OF PP INTERACTIONS NEAR 2.0 BEV/C(SQUARED), WITH DECAY MOU PRODUCTION MODEL FOR THE REACTION PP N+++(1950) PRODUCTION AND SUBSEQUENT D	AT 6 BEV/C INDICATES THE PRESENCE CF A T = 3/2 NUCLEON RESONANCE WITH MASS DES Y*+(1385) K+, N*++(1236) RHOD, AND N*++(1236) PI+PI A PEPIPHERAL N N*++(1550) GIVES EXCELLENT AGREEMENT WITH THE DATA, WITH A CROSS SECTION FOR RECAY INTO Y*+ K+ OF 13 +- 3 UB.
ABUT LODAL CITERED AND THE SUPER THE SUPER THE SUPER THE THE LINES. THE ALTERNATION AND THE SUPER THE SUPE	CLOSELY RELATED REFERENCES THIS ARTICLE SUPERSEDES PART OF UCRL 1 Part of this article superseded by UCRI Continuation of previous experiment in	7707 (1968). L 18306 (1968). ; PHYS. REV. 165, 1466 (1968).
ATTICLE REAC BY LERGY PRICE IN W70. MOD VERIFIED BY COUTTE SERVET. ALAY 15 MOTION OF PRICE IN W70. MOD VERIFIED BY COUTTE SERVET. ALAY 15 MOTION OF PRICE IN W70. MOD VERIFIED BY COUTTE SERVET. ATTICLE REAC BY LERGY TEST LERGE LERGE. ATTICLE REAC BY LERGY TEST LERGE. ALAY 100 MODEL OF AT A GEV/CL. ALECATERY GEAR MODELLY = 0.66 + -03 CEV/CL. ALECATERY GEAR MODELY = 0.66 + -03 CEV/CL.	ADDITIONAL CITATIONS PHYS. REV. LETTERS 19, 397 (1967), PHY CIMENTO 35, 1052 (1265), PHYS. LETTERS PHYS. REV. LETTERS 7, 450 (1961), PHYS (1967), NUOYO CIMENTC 494, 475 (1967), 747 (1962), PHYS. REV. 125, 2082 (1962) 9, 133 (1962), PHYS. REV. LETTERS 18, I PHYS. REV. 165, 1730 (1968), REV. MOD. NUUYO CIMENTO 27, 724 (1563), ANC PHYS	S. REV. LETTERS 17, 789 (1966), PHYS. REV. LETTERS 16, 855 (1966), NUOVO 0, 134 (1904), PHYS. REV. 133, 81017 (1964), PHYS. REV. 128, 1823 (1962), . REV. LETTERS 4, 611 (1960), PHYS. REV. 161, 1387 (1967), PHYS. REV. 126, PHYS. REV. 138, 8670 (1965), NUOVC CIMENTC 40A, 839 (1965), PHYS. REV. 126, 'I, PHYS. REV. 135, 2091 (1962), PHYS. REV. 123, 2160 (1961), PHYS. REV. 126, 99 (1967), PHYS. REV. LETTERS 10, 192 (1963), PHYS. LETTERS 268, 161 (1968), PHYS. 40, 77 (1968), PHYS. REV. LETTERS 19, 925 (1967), NUC. PHYS. 83, 10 (196
ALAN IS MUDION OF APOLION AT A GEVAC. THIS EARENAGENT USES THE LIARLY 21 IN. (M) BUBBLE COMMERSE. A TOTAL OF SSOCIE FICTURES ME REFERENTED ON. (PAGE 1422) LARCATERY EGAN ADDRINUM + 6.46 + -03 GEVAC. THIS DATA REPLACES VALUES GIVEN EVALUES IN THIS PARTICLES DELTAILSSOI MODELS METIZON WITHOUT FILE METERS AND ADDRINUM + 6.46 + -03 GEVAC. THIS DATA REPLACES VALUES GIVEN EVALUES IN THIS PARTICLES DELTAILSSOI MODELS METIZON MELL-REARS PROTON METERS FILE FILE METERS AND ADDRINUM + 6.46 + -03 GEVAC. THIS DATA REPLACES VALUES GIVEN EVALUES IN MELL-REARS PROTON METERS FILE METERS AND ADDRINUM + 6.46 + -03 GEVAC. THIS DATA REPLACES VALUES COMMENTION OF A COMMENTION OF THE METERS THE METERS ADDRINUM AND ME USE - ACCE RECENTING THIS DATA REFOUND IN ALCIN, UCL. LEDGO (1568) MELL-REARS PROTON METERS FILE MELL-REARS MELL	ARTICLE REAC BY LERGY PRICE IN 4/70, AND VE	RIFIED BY COETTE BENARY.
THIS EXPERIENT USES THE LALL T2 IA. HIT BUBBLE CAMMER. A TOTAL OF SADDEC PICTURES ARE REPETTED ON. KEY YORGS - CARDS SECTION MASS SPECTRUM STANGE PARTICLES CELTAINSON ROOTS MAT12361 V*113851 IFAGE 14221 LARCHATCHY EAM MOMENTUM - A.06 H- 03 GEV/C. THIS DATA REPLACES VALUES OVEN EARLIES IN KINSET, UCAL 17101 (1860) RECTION RECTION FROM POLICING JE PI- MOTOR MOTOR JE PI- MOTOR JE PI	BEAM IS PROTON ON PROTON AT 6 GEV/C.	
KEY YORGS - CROSS SECTION AVAILS SPECTRUM STRAME PARTICLES DELTAILSSOI KODELS AV11323) IFAGE 14223 IFAGE 14223 LARCHATCHY FEM KODENTUP - 6.06 +-03 GEV/C. ITHIS DATA REPLACES VALUES GIVEN EARLIER IN KINSTY, UCAL 17707 (1940)1 IFAGE 14231	THIS EXPERIMENT USES THE L.R.L. 72 IA. (H)	BUBBLE CHAMBER. A TOTAL OF 5500CC PICTURES ARE REPORTED ON.
<pre>FAGE 1422] LARCHATGY FEAM MOMENTUM: + 0.06 + 0.30 GEV/C. ITHIS DATA REPLACES VALUES GIVEN LARLIES IN KINSKY, UCRL 17707 (1989)] SECTION PERFORMENTUM: + 0.06 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 14231 LARCHATGY FEAM MOMENTUM: + 0.456 + 0.30 GEV/C. IERCE 1431 GEV/C. IERCE 14</pre>	KEY WORCS . CROSS SECTION MASS SPECTRUM	STRANGE PARTICLES DELTA(1950) MODELS N+(1236) Y+(1385)
<pre>FAGE 1421 LAGENATION DEF AL OCCUPATION DE ALCON DE CONTROL DE LA DEL 1422 LAGENATION DE LA DELTA-LA DEL DALLES DIVEN DE LA LA DEL DALLES DE LA DELA DEL DALLES DE LA DEL DALLES DE LA DEL DALLES DE LA DEL DA</pre>		
LABCRATCHY FEAR MOMENTUM + 0.454 + .03 GEV/C. ITHIS DATA REPLACES VALUES GIVEN EARLIER IN KINSEY, UCAL 1707 (19681) REACTION		[PACE 1472]
THIS GATA REPLACES VALUES GIVEN EARLIER IN KINSEY, UCAL 17707 (1968)) REACTION FROM NUTROW FIT PI- PROTON PICTOR PICTOR FIT PI- PROTON NUTROW FIT PI- PROTON NUTROW FIT PI- PROTON PICTOR PICTOR PICTOR FIT PI- PROTON PICTOR PICTOR FIT PI- PROTON PICTOR PICTOR FIT PI- PROTON PICTOR PI	LABERATORY FEAN MOMENTUM - 6.04 +03 GE	v/c.
BUTTON FORTER MULLI-BARNS MODION FORTER VIEWER VIEWER 3.2 + - 3 MODION FUEWER VIEWER 3.2 + - 3 MODION FUEWER VIEWER FORTER VIEWER 4.00 + - 00 GEV/C. Its SATATON FEAR MORENTUM + 4.000 A FE USEC - MORE RECENT VALUES MAY BE FOUND IN KLCIN, UCRL 10300 (1660)) MALE MALE MULLI-BARNS MILLI-BARNS MULLI-BARNS MILLI-B	THIS DATA REPLACES VALUES GIVEN EARLIER	IN KINSEY, UCRL 17707 (1968)]
PAUTON PAUTON PAUTON OF A DELTA1910 22.4 3 22.4 3 22	REACTION	MILLI-BARNS
PAGETER MUTTERN P1: P1: P1: 3.1 -5 PAGETER MUTTERN P1: P1: P1: 2.4 -5 Image: P1: P1: P1: P1: P1: Image: P1: P1: P1: P1: P1: P1: Image: P1: P1: P1: P1: P1: P1: P1: P1: P1: P1	PROTON PROTON PROTON FI+ PI-	3.2 +3
Image 14231 LABORATORY FEAR MORENTUM + 6.164 +03 GEV/C. ITHIS DATA SHILLID NOT DE USEC - MORE RECENT VALUES MAY BE FOUND IN KLEIN, UCRL 10306 (1566) REATTON NIGAD-ARANN PROTON LAMBAS PIE NO 61, +-10, PROTON LAMBAS PIE NO 51, +-10, PROTON LAMBAS PIE NO 51, +-10, MEUTRON LAMBAS PIE NO 50, 7, PROTON LAMBAS PIE NO 50, 7, PROTON LAMBAS PIE NO, 50, 7, 7, PROTON DELIZATE PIE NO, 7, 7	PROTON NEUTRON PI+ PI+ PI- Proton Proton FI+ PI- F10	3.1 .5 2.4 .4
Image 14231 LABORATORY FEAM MOMENTUM * 6.44 +-033 GEV/C. ITHIS DATA SHMUTD NOT OF USEC - HOPE RECENT VALUES MAY BE FOUND IN KLCIN, UCAL 10306 (1568): REALTION MICAD-ABARKY PROTON LANGAP PIC NO 67. +- 16. MULTUM FUTURE I 67. +- 16. MEDITION OF A DELTA-+(1900) RESONANCE CECATING INTO DELTA-+(1236) PI-PI (NUC. PHYS. 816, 503 (1970)) MADDELLO, K.MAASEN.H.JCHWISTACLE MOLLEPUD, LVEJE (INTELS BORE INSTITUTE, CORFMAGEN, DERMART) 50. 7. MADDELLO, K.MAASEN.H.JCHWISTACLE MOLLEPUD, LVEJE (INTELS BORE INSTITUTE, CORFMAGEN, DERMART) ************************************	,	
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LABORATORY TEAM MOMENTUM + 0.44 + 0.3 GEV/C. THIS DATA SHOULD NOT NET NET VIEW AND A CONFINITION OF CARACTERS IN THE FOUND IN KLEIN, UCRL 18306 (1568): REALTION TO A CARACTERN AND A CONFINITION AND A CONFINITION OF CARACTERS (1500) MILLAN-ALARNY MULLIN MULTIN (1000) MEDITAL LAMBER PICK MEDITAL PI		(PAGE 1423)
ITHIS DATA SHOULD NOT BE USEC - MORE RECENT VALUES MAY BE FOUND IN NUCLIN, UCBL 10306 (1608)) RELITION PRUIDL ALARDA PIO CO PROTON LANDA PIO CO PROTON LANDA PIO CO RELITANCE ALARDA PIO CO PROTON LANDA PIO CO NEUTRON LOCATION OF A DELTA-+(1900) PICTA-+(1900) N. THE NEUTRON LOCATION OF LANDA PIO LOCAT. NOT LOCATION LOCATION OF THE STATE NEUTRON LICENCE DECA MODE IS 2000 NOT THE CALCOLOGY NOT HE PICTA-+(1900) N. THE DESERVED DECA MODE IS 2011A+++ 107A01 PIO THO SERVED DECA MODE NEUTRON LICENTED THE VIENNA CONF., 1968 (1968). ADDITIONAL CITATIONS PICTA+++ 107A01 ARELIA++++ 107A0 OFF. 1068 (1968). ADDITIONAL CITATIONS PICTA+++ 107A0 OFF. 107A0 OFF. 107A0 OFF. PICTA++++ 107A0 OFF. 107A0 OFF. PICTA+++++ 107A0 OFF. PICTA++++++++++++++++++++++++++++++++++++	LABORATORY REAM MGMENTUM . 6.04 +03 GEV	٧/٥.
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 AND THE PROTON LANDA PIC KO PROTON LANDA PICKO PROTON P	REACTION	MIGRO-BABNS
 10. 12. 12. 12. 12. 12. 12. 12. 12. 12. 12	PROTON LAMBDA PI+ KO PROTON LAMBDA PIO K+	67. +- 10.
 DBSERVATION OF A DELTA++(1900) RESCHANCE CECAVING INTO DELTA++(1236) PI- PI+. (NUC. PHYS. B16, 503 (1970)) ABGCGILD,X.HANSEN,H.JCHNSTAG.R.HOLLERUD,L.VEJE (NTELS BORR INSTITUTE. COPENNAGEN, DENNARTI *. XORKEA-MO, P.LAWIKANINEN,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.JORKEA-MO, P.LAWIKANINEN,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.KORKEA-MO, P.LAWIKANINEN,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.KORKEA-MO, P.LAWIKANINE,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.KORKEA-MO, P.LAWIKANINE,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.KORKEA-MO, P.LAWIKANINE,R.O.RADITIO IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) T.KORKEA-MO, P.LAWIKANINE,R.O.RADITION IMELSINGIN YLIOPISTO, HELSINKI, FINLAND) GERSTAGT P.PODCOVITICO OF CELTA-HOPPOX, 19001 AND THE THATISTAN PL- PI THE CPOSES SECTION FOR THE MODECS (1) MULTIPLIEND (DISTINGT) GERSTAGT P.PODCOVITICO OF CELTA-HOPPOX, 19001 AND SEEN OBSERVED IN THE REALTON POPTIAL ALA-LOPOX, 19001 N. THE GASTAGE SECTION FOR THE MODECS (1) MULTIPLIEND (DISTINGT) GERSTAGT P.PODCOVITICO OF THE OBSERVED DECX MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECX MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECX MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECX MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECX MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECAY MODE IS 29 +- 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OF THE OBSERVED DECAY MODE IS 198 CITAMINE ON THE THE TO THE VIENNA COMF. 1980 (1964). ADDITIONAL CITATIONS MOVENTIATE OF THE VIENNA COMF. 1980 (1964). ADDITIONAL CITATIONS MOVENTIATE OF THE OBSERVED INTA COMPANY PRICE. BEAM IS ORDIT	NEUTRON LAMBDA PT+ K+	50. 7.
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ABSTRACT PRODUCTION OF CELITA++1APPROX. 19001 HAS BEEN OBSERVED INTE PRACHING AND FOR CELITA++1APPROX. 19001 N. THE OBSERVED DECAY MODE IS DELITA++1APPROX. 19001 - AFITA++137A1 PI- PI+. THE CROSS SECTION FOR THE PROCESS (1) MULTIPLIEL BY THE BRACKING RATIO OF THE OBSERVED DECAY MODE IS 29 +- 7 HICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE OFITA++14PPROY. 19001 *AREITA++(137A1 PMON(745). CLOSELY RELATER REFREENCES SEE ALSO SUBMITTED TO THE VIENNA CONF., 1968 (1968). ADDITIONAL CITATIONS PHYS. FEV. 137, B962 (1965), CEPN NP/INT66-2, PHYS. REV. LETTERS 19, 198 (1961), PHYS. REV. 171, 1421 (1968), AND VIENNA CONFERENCE IS (1566). ARTICLE READ EV OCETTE EENARY IN 9/65, AND VERIFIED RY IFRNY PRICE. BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 29 (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY WORKS - CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PROTON - NEUTRON DELTA(1920)++. [PAGE 2] DELITA(1320)++ · DELITA(1230)++ PI+ PI- [1,2] LABCRATCRY BEAM MICRC-BARKS I9. 25. ++ 7.	T.JACOBSEN, S.O. SORENSEN ICSLO UNIV., OSLC, I	LSINGIN TELUFISIU, HELSINKI, FINLANDJ NORWAY] (S. 11 Svenin, Vancagni (Stockhoi MS 1811) , Stockhoi M, Suedeni
CLOSELY RELATEC REFERENCES SEE ALSO SUBMITTED TO THE VIENNA CONF., 1968 (1968). ADDITIONAL CITATIONS PHYS. REV. 137, 8062 (1965), CEPN NP/INT66-2, PHYS. REV. LETTERS 19, 198 (1961), PHYS. REV. 171, 1421 (1968), AND VIENNA CONFERENCE 139 (1568). ARTICLE READ BY OCETTE BENARY IN 9/69, AND VERIFIED RY IFROY PRICE. BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2P (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY WORCS - CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ DELTA(1238)++ PI+ PI- (1,2) LABCRATCRY BEAM MORENTUM GEV/C MICRC-BARNS 19. 29. ++ 7.	ABSTRACT PRODUCTION OF CELTA++(APPROX. OBSERVED DECAY NODE IS DELTA++(APPROX. BY THE BRANCHING RATIO OF THE OBSERVED DET TA++(APPROX. 1900) = NOT TA++(1374) PR	1900] HAS BEEN OBSERVED IN THE REACTION PP +DELTA++(APPPOX. 1900) N. THE 1900] HAS BEEN OBSERVED IN THE REACTION PP +DELTA++(APPPOX. 1900) N. THE 1900] HAT TA++117AAN PI- PI+. THE CPOSE SECTION FOR THE PROCESS (1) MULTIPLIED DECAY MODE IS 29 ++ 7 MICROBARNS. THERE IS NO INDICATION OF THE DECAY MODE MONTYTES.
SEE ALSO SUBMITTED TO THE VIENNA CONF., 1968 (1968). ADDITIONAL CITATIONS PHYS. REV. 137, 0962 (1965), CEPN NP/INT66-2, PHYS. REV. LETTERS 19, 198 (1961), PHYS. REV. 171, 1421 (1968), AND VIENNA CONFERENCE 139 (1965), AND VERIFIED BY IFRMY PRICE. BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2# (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED DN. KEY MORCS - CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ · · DELTA(1238)++ · PI- (1,2) LABCRATCRY BEAM MOMENTUM GEV/C MICRC-BARKS 19. 25. +- 7.	CLOSELY RELATED REFERENCES	
ADDITIONAL CITATIONS PHYS. REV. 137, 8962 (1965), CEPN NP/INT66-2, PHYS. REV. LETTERS 19, 198 (1961), PHYS. REV. 171, 1421 (1968), AND VIENNA COMFERENCE 139 (1965), AND VERIFIED BY IFROY PRICE. BEAM 15 PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2# (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY WORCS - CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. IPAGE 2) DELTA(1920)++. IPAGE 2) DELTA(1920)++. PROTON P1+ 01- (1,2) LABCRATCRY BEAM MOMENTUM GEV/C MICRC-BARNS 19. 25. +- 7.	SEÉ ALSO SUBMITTED TO THE VIENNA CONF.	, 1968 (1968).
ARTICLE READ BY OCETTE BENARY IN 9/69, AND VERIFIED BY IFRMY PRICE. BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2P (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY WORCS - CROSS SECTION MASS SPECTRUM DELTA(1920) 	ADDITIONAL CITATIONS PHYS. REV. 137, B962 (1965), CERN NP/1) VIENNA CONFERENCE 139 (1568).	NT66-2, PHYS. REV. LETTERS 19, 198 (1961), PHYS. REV. 171, 1421 (1968), AND
BEAM IS PROTON ON PROTON AT 19 GEV/C. THIS EXPERIMENT USES THE CERN 2P (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY WORDS • CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PRCTON • NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ • DELTA(1238)++ PI+ PI- (1,2) LABCRATCRY BEAM MOMENTUM GEV/C HICRC-BARKS 19. 25. +- 7.	ARTICLE READ BY OCETTE BENARY IN 9/69, AND N	VERIFIED BY IFROY PRICE.
THIS EXPERIMENT USES THE CERN 2P (H) BUBBLE CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON. KEY MORCS - CROSS SECTION MASS SPECTRUM DELTA(1920) CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ · DELTA(1238)++ PI+ PI- (1,2) LABCRATCRY BEAM MOMENTUM GEV/C HICRC-BARKS 19. 25. +- 7.	BEAM IS PROTON ON PROTON AT 19 GEV/C.	•
CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ · DELTA(1238)++ PI- [1,2] DELTA(1238)++ · PROTON PI+ [1,2] LABCRATCRY BEAM MOMENTUM GEV/C HICRC-BARNS 19. 29. +- 7.	THIS EXPERIMENT USES THE CERN 2M (H) BUBBLE Key words + cross section — Mass spectrum	CHAMBER. A TOTAL OF 120000 PICTURES ARE REPORTED ON.
CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTAI1920]++. [PAGE 2] DELTAI1920]++ * DELTAI1238]++ PI- [1,2] DELTAI1238]++ * PROTON PI+ [1,2] EBAM MONENTUM GEV/C MICRC-BARNS 19. 25. +- 7.		
CROSS SECTION FOR PROTON PRCTON - NEUTRON DELTA(1920)++. [PAGE 2] DELTA(1920)++ + DELTA(1238)++ PI+ PI- [1,2] DELTA(1238)++ + PROTON PI+ [1,2] BEAM MOMENTUM GEV/C MICRC-BARNS 19. 29. +- 7.		
LABCRATCRY BEAM MORNTUM GEV/C MICRC-BARNS 19. 25. +- 7.	CROSS SECTION FOR PROTON PRCTON - NEU Dei Dei Dei	TRON DELTA(1920)++. [PAGE 2] LTA(1920)++ • DELTA(1238)++ P1+ P1- [1,2] LTA(1238)++ • PROTON P1+ [1,2]
GEV/C MICRC-BARKS 19. 29. +- 7.	LABCRATCRY	
	GEV/C MICRC-BARNS	
	19. 25 7.	
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160 THE SLOPE PARAMETEP OF THE DIFFERENTIAL CROSS-SECTION OF ELASTIC P-P SCATTERING IN ENERGY RANGE 12-70 GEV.
LETTERS 308, 274 (1969)]
                                                                                                                          (PHYS.
         G.G.BEZNOGIKH,A.BUYAK,K.I.IOVCHEV,L. KIRILLOVA,P. MARKOV,B.A.MGROZGV, A.V.NIKITIN,P.V.NCMGKONOV,M. SHAFRANOVA,V.
SVIRIDOV,TRUCNG BIEN, V.I.ZOYACHKI, N.K.ZHICKOV,L.S.ZOLIN (JOINT INST. FOR NUCL. RESEARCH, DUBNA, USSR)
S.B.NURUSHEV,V.L.SOLOVIANOV (INST. OF HIGH EN. PHYS., SERPUKCV, USSR)
              NACT THE NEASUREMENTS OF THE DIFFERENTIAL CROSS SECTION OF ELASTIC P-P SCATTERING IN RELATIVE UNITS WERE PEPFORMED
In The Energy Range of 12-70 GeV. The values of the slope parameter were obtained from this data. It was shown that
The slope parameter of the differential P-P scattering is mcnotondusly increasing when the proton energy rises in the
Range 12-70 GeV. We have obtained the slope premanchuk's pole trajectory from this data.40 - 0 + - 0.09.
         ABS IRAC T
         CITATIONS
              ANNALS INF PHYSIGS 3, 190 (1958), JACERN. FIZ. 1, 533 (1965), PHYS. REV. LETTERS 11, 425 (1963), PHYS. LETTERS 14, 164
(1965), AND NUOVO CIMENTO 45, 574 (1966).
         ARTICLE REAC BY OCETTE BENARY IN 2/7C, AND VERIFIEC BY LERGY PRICE.
         BEAN IS PRCTON ON HYDRCGEN CCMPOUND FROM 12.904 TO 70.932 GEV/C. (BEAN KINETIC ENERGY = 12 TO 70 GEV)
         THIS EXPERIMENT USES COUNTERS.
         KEY WORDS + DIFFERENTIAL CRCSS SECTION FITS MODELS
         COMPOUND KEY WORCS . FITS DIFFERENTIAL CROSS SECTION
         FIT TO FLASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                             (TABLE 1)
              LABORATORY DEAN ENERGY - 12.1 GEV.
              DATA IS FIT OVER -T FROM .CC8 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
Igutgoing Proton].
Fitted Formula is C-Sigma/D-T = EXP[-0*ABS(T]]
                     WHERE C-SIGNA/D-T IS IN MB/IGEV/CJ++2 AND -T IS IN (GEV/C)++2.
              FITTED VALUE
                     8 = 9.81 +- .35
         FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON.
                                                                              (TABLE 1)
              LABORATORY BEAM ENERGY = 14-8 GEV.
              DATA IS FIT OVER -T FROM .008 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (CUTGDING PROTON).

[CUTGDING PROTON].

FITTED FORMULA IS C-SIGMA/D-T = EXP(-8*ABS(T))
                     WHERE D-SIGHA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
              FILLER VALUE
                      B = 9.98 +- .12
         FIT TO FLASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON.
                                                                           · [TARLE 1]
              LABORATORY BEAM ENERGY = 17.9 CEV.
              NATA IS FIT OVER -T FROM .008 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETMEEN THE [INCOMING PROTON] AND THE [GUTGOING PROTON].

[GUTGOING PROTON].

FITTED FORMULA IS C-SIGMA/D-T = EXP[-8*A85(T]]
                     WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
              FITTED VALUE
                     B = 10.46 +- .12
         FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                             [TABLE 1]
              LABORATORY BEAM ENERGY = 20.9 GEV.
              DATA IS FIT OVER -I FROM .008 TG .120 (GEV/C)**2. T IS THE NOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
              (OUTGOING PROTON).
FITTED FORMULA IS C-SIGMA/D-T = EXP[-8+A8S(T)]
                     WHERE C-SIGMA/D-T IS IN MB/(GEV/CI**2 AND -T IS IN (GEV/C)**2.
              FITTEC VALUE
                     8 = 10.58 +- .12
         111 TO ELASTIC DIPREPENTIAL CROSS SECTION FOR PROTON PROTON.
                                                                              (TABLE 1)
              LABORATORY BEAM ENERGY = 23.8 GEV.
              DATA IS FIT OVER -T FROM .COB TG .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
              ICUIGUING PROTONI.
FITTEO FORMULA IS C-SIGMA/C-T = EXP[-8+ABS{T}]
                     WHERE D-SIGMA/D-T IS IN MB/(GEV/C)++2 AND -T IS IN (CEV/C)++2.
              FITTED VALUE
                     8 = 10.59 +- .11
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FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                          [TABLE 1]
    LABORATORY BEAM ENERGY = 26.7 GEV.
    DATA IS FIT OVER -T FROP -008 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE [CUTGDING PROTON].

[CUTGDING PROTON].

FITTED FORMULA IS C-SIGPA/D-T = EXP(-B*ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUE
           8 = 10.77 +- .11
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                          (TABLE ))
    LABORATORY BEAF ENERGY = 29.7 GEV.
    DATA IS FIT DVER -T FROM .008 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE (GUTGOING PROTON).
FITTEC FORMULA IS D-SIGMA/D-T = EXP(-8+ABS(T))
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          8 = 10.68 +- .11
FIT TO ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON.
                                                          TABLE 11
    LABORATORY BEAM ENERGY = 32.6 GEV.
    DATA IS FIT OVER -T FROP .008 TC .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE
LOUTGOING PROTON).
FITTED FORMULA IS C-SIGMA/D-T - EXP(-8+ABS(T))
           WHERE D-SIGMA/D-T IS IN HE/(GEV/C)++2 AND -T IS IN (GEV/C)++2.
    FITTED VALUE
           8 = 10.66 +- .11
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                          [TABLE 1]
    LABURATORY BEAM ENERGY = 35.5 GEV.
    DATA IS FIT EVER -T FROM .GOB TE .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
Icuteging protoni.
Fited formula is C-Sigma/D-T = EXP[-8+ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
           D = 10.77 += .11
_____
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                          (TABLE 1)
    LABORATORY DEAM ENERGY = 38.6 GEV.
    DATA 15 FIT DVER -T FROM .COB 1G .120 (GEV/C)**2. T 15 THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE

[Inter formula 15 C-Sigma/C-T = EXPL-8*ABS(T)]
           WHERE C-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
           8 = 10.89 +- .10
FIF TE ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON.
                                                          [TABLE 1]
    LABORATORY BEAM ENERGY = 40.7 GEV.
    DATA IS FIT OVER -T FROM +COB TO .120 (GEV/C)**2. ) IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
[GUTGOING PROTON].
FITTED FORMULA IS D-SIGMA/D-T = EXP[-8+ABS(T)]
           WHERE C-SIGMA/O-T IS IN HB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
           B = 10.87 +- .14
PIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                          (TABLE 1)
    LABORATORY BEAM ENERGY = 44.2 GEV.
    DATA IS FIT OVER -T FROM .008 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE LINCOMING PROTON) AND THE
LOUTGOING PROTON).
FITTED FORMULA IS C-SIGMA/G-T = EXP[-0*ABS(T)]
           WHERE C-SIGNA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
           B = 10.95 +- .10
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FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                          (TABLE 1)
    LABORATORY REAM ENERGY = 48. GEV.
    DATA IS FIT OVER -T FROM .COB TO .120 (GEV/C)**2. T IS THE MOMENTUK TPANSFER BETWEEN THE [INCOMING PROTON] AND THE
[GUTGCING PROTON].
FITED FORMULA IS D-SIGMA/D-T = EXP[-8*ABS(T]]
           WHERE D-SIGMA/D-T IS IN ME/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUE
          8 = 11.19 = .11
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON.
                                                           (TABLE 1)
    LABORATORY BEAM ENERGY = 51.2 GEV.
    DATA IS FIT OVER -T FROM .008 TC .120 (GEV/C)++2. T IS THE MOMENTUM TRANSFER BETWEEN THE (INCOMING PROTON) AND THE
ICUTODING PROTON).
FITTED FORMULA IS C-SIGNA/D-T = EXP[-B+ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTEC VALUE
        8 = 11.31 +- .11
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                           (TABLE 1)
    LABORATORY BEAM ENERGY = 53.4 GEV.
    DATA IS FIT OVER -T FROP .CO8 TC .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PRCTON] AND THE
ICUTCOING PRCTON].
FITED FCRMULA IS C-SIGMA/D-T = EXP[-8+ABS(T]]
           WHERE D-SIGHA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
        B = 11.24 +- .12
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON
                                                           [TAELE 1]
    LABORATORY BEAM ENERGY . 56.1 GEV.
    DATA IS FIT OVER -T FROM .CO8 TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PRCTON] AND THE
LUNGUING PROTON).
FITTED FORMULA IS E-SIGMA/D-T = EXP[-8+ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    BUTTED VALUE
        8 = 11.16 +- .10
FIT TO ELASTIC CIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                           [TABLE 1]
    LABORATORY BEAM ENERGY # 59.3 GEV.
    DATA IS FIT OVER -T FROM .008 TE .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
[QUIGDING PROTON].
FITTED FORMULA IS E-SIGMA/C-T = EXP[-8+ABS(T]]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          8 = 11.40 +- .09
FIT TO ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON.
                                                            [TABLE 1]
    LABORATORY BEAM ENERGY = 62.6 GEV.
    OATA IS FIT OVER -T FROM .CO8 10 .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
ICUIGGING PROTON].
FITTED FORMULA IS C-SIGMA/D-T = EXP(-0*ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
         B = 11.76 +- .12
FIT TO ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON.
                                                           (TABLE 1)
    LABORATORY BEAM ENERGY = 65.2 GEV.
    DATA IS FIT OVER -T FROM .COB TO .120 (GEV/C)**2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PROTON] AND THE
IOUTGOING PROTON).
FITED FORMULA IS C-SIG#A/O-T = EXP[-0+ABS(T)]
           WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2.
    FITTED VALUE
          8 = 11.52 +- .12
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FIT TO ELASTIC DIFFERENTIAL CRGSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY REAM ENERGY = 69. CEV. DATA IS FIT OVER -T FROM .COB TO .120 (GEV/CI++2. T IS THE MOMENTUM TRANSFER BETWEEN THE [INCOMING PRCTON] AND THE LOUTGOING PROTONI. FITTED FORMULA IS C-SIGMA/D-T = EXP(-8+ABS(T)] WHERE D-SIGMA/D-T IS IN MB/(GEV/C)**2 AND -T IS IN (GEV/C)**2. FITTED VALUE 8 = 11.38 +- .11 161 PROTON-PROTON ELASTIC SCATTERING INVCLVING LARGE MOMENTUM TRANSFERS. (PHYS. REV. 138, B165 (1965)) G.COCCONI,V.T.COCCONI,A.D.KIRSCH,J.CREAR,R.RUBINSTEIN,D.B.SCARL, B.T.ULRICH [CORNELL UNIV., ITHACA, N. Y., USA] W.F.BAKER,E.W.JENKINS,A.L.REAC [EROOKFAVEN NAT. LAB., UPTON, L.I., N. Y., USA] BAREN, E.W. JENKINS, ALL REAL LENGURAVEN NAIL LAST, OF UN, LIT, N.Y. USAT RACT TWENTY-NINE PROTON-PROTON DIFFERENTIAL ELASTIC CROSS SECTIONS FOR LAB MOMENTA P(0) FROM 11 TO 31.8 BEV/C, AT FOUR-MOMENTUM TRANSFERS SQUARED, -T, FROM 2.3 TO 24.4 (BEV/C)-SQUARED, HAVE BEEN MEASURED AT THE BROOMHAVEN ALTERNATING GRADIENT SYNCHPOTRON. THE CIRCULATING PROTON BEAM IMPINGED UPON A THIN CH(2) INTERNAL TARGET. BOTH SCATTERED PROTONS FROM PP ELASTIC EVENTS WERE DETECTED BY SCINTILLATION-COUNTER TELESCOPES WHICH WERE PLACED DOWNSTREAM FROM DEFLECTION MAGNETS SET AT THE APPROPRIATE ANGLES TO THE INCIDENT BEAM. THE ANGLEA DURAL A CORPELATION OF THE PROTONS, THEIR MOMENTA, AND THE COPLANARITY OF THE EVENTS WERE DETERMINED BY THE DETECTION SYSTEM. THE RESULTS SHO THAT AT HIGH MOMENTUM TRANSFERS THE DIFFERENTIAL CROSS SECTION D-SIGMA/CT, DEPENDS STRONGLY UPON THE ENERGY: FOR -T = 10(BEV/C)-SQUARED, THE VALUE CF D-SIGMA/DT AT P(0) = 30 BEV/C ISMALLER BY A FACTOR OF ABUUI 1000 IHAM AT P(0) = 10 BEV/C. AT ALL EMERGES, D-SIGMA/DT FALLS RAPOLY WITH INCREASING /T/ FOR SCATTERING ANDLES UP TO ABOUT 65 DEC. (GAM;), WILLE IN THE RANGE FROM 07 TO 30 DEM. THE GRANKS SPETTION BI'S THE IN Y A FACTOR DE ANDHI 2/ INE SAMELEN SECTION MEASURED WAS 9 X 100*-37 CM-SCUARED SREW-ILC.M.), AT P(0) = 31 SIN P(Y A FACTOR DE ANDHI 2/ INE SAMELEN ADOUT 3 X 10*+-12 OF THE ZERO-DEGREE CROSS SECTION AT THE SAME ENERGY. ABSTRACT LLUSELT RELAIEU REFERENLES This Article Supersedes Phys. Rev. Letters 12, 132 (1964), And Phys. Rev. Letters 11, 499 (1963). ADDITIONAL CITATICNS CERN COMFERENCE 576 (1962), PHYS. REV. LETTERS 9, 221 (1962), PHYS. REV. LETTERS 10, 376 (1963), PHYS. REV. LETTERS 11, 425 (1963), NOUVO CIMENTO 18, 818 (1960), PHYS. REV. 133, 81017 (1964), PHYS. REV. 107, 859 (1957), 8NL GTD-2, CAN. J. PHYS. 40 926 (1962), PHYS. REV. 128, 2392 (1962), PHYS. REV. LETTERS 11, 217 (1963), PHYS. LETTERS 5, 365 (1963), PHYS. 40 926 (1962), PHYS. REV. 128, 2392 (1962), PHYS. REV. LETTERS 11, 217 (1963), PHYS. LETTERS 5, 365 (1963), PHYS. 40 926 (1962), PHYS. REV. 128, 2392 (1962), PHYS. REV. LETTERS 11, 217 (1963), PHYS. LETTERS 5, 365 (1963), PHYS. 820, 132 (1964), PHYS. REV. 128, 8240 (1964), PHYS. REV. LETTERS 5, 6, 694 (1964), PHYS. REV. LETTERS 13, 32 (1964), PHYS. REV. 135, 81456 (1964), PHYS. REV. LETTERS 7, 198 (1963), PHYS. 86, 401964), PHYS. REV. 155, 81263 (1564), NOUVO CIMENTO 33, 1167 (1964), PHYS. REV. 137, 81009 (1965), PHYS. REV. 137, 8147 (1965), NUOVO CIMENTO 27, 203 (1563), NUOVO CIMENTO 27, 856 (1963), NUOVO CIMENTO 33, 643 (1964), PHYS. REV. 137, 8147 (1965), PHYS. LETTERS 12, 190 (1964), ANU PHYS. REV. 137, 8708 (1965). ARTICLE READ BY OCETTE BENARY IN 3/67. AND VERIFIED BY LEROY PRICE. REAM IS PROTON ON HYDROGEN COMPOUND FROM 11.0 TO 31.8 GEV/C. THIS EXPERIMENT USES COUNTERS. KEY WORDS . DIFFERENTIAL CRCSS SECTION ELASTIC DIFFERENTIAL CROSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 18.9 GEV/C +- 1(PER CENT). C-SIGMA/C-DMEGA THETA -SIGMA/L-0. UB/SR PER CENT 1.61 + 25 - 20 29.9 +- .2 THETA IS THE ANOLE THAT THE PROTON MAKES WITH THE DEAH IN THE GRAND C.M. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 13. GEV/C +- 1(PER CENT). D-SIGMA/D-OMEGA UB/SR PER CENT 3-C6 + 25 - 20 THETA DEGREES 37.0 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. [TABLE 1] LABORATORY BEAF MOMENTUP = 11. GEV/C +- 1(PER CENT). C-SIGNA/C-OFEGA THETA DEGREES -SIGN#/U-0.2 UB/SR PER CENT 1.52 + 25 - 20 48-1 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PRCTON PRCTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 16.1 GEV/C +- 1(PER CENT). THETA DEGREES D-SIGNA/C-OKEGA UE/SR PER CENT •512 + 25 - 2C 40.8 +- .2

THETA IS THE ANGLE THAT THE PPGTCN MAKES WITH THE BEAM IN THE GRAND C.M.

ELASTIC DIFFERENTIAL CRCSS SECTION FCR PRGTON PRCTON. [TABLE 1] LABORATORY BEAM MOMENTUM . 24.9 GEV/C +- 1(PER CENT). D-SIGMA/D-OMEGA UE/SR PER CENT +116 + 25 - 20 THÉTA DEGREES 33.8 +- .2 THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 13.1 GEV/C +- 1(PER CENT). D-SIGMA/D-OMEGA UB/SR PEA CENT .13 + 25 - 20 THETA DEGREES 51.5 +- .2 THETA IS THE ANGLE THAT THE PROTON PAKES WITH THE BEAM IN THE GRANC C.M. ------ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. (TABLE 1) LABGRATORY CEAM MOMENTUM = 18.1 GEV/C +- 1(PER CENT). C-SIGMA/C-OMEGA U2/SR PER CENT .0743 + 25 - 20 THETA DEGREES 42.8 +- .2 THETA IS THE ANGLE THAT THE PROTCH MAKES WITH THE BEAM IN THE GRAND C.M. - - - - - - - - - -ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON . (TABLE 1) LABORATORY BEAM MOMENTUM = 11.1 GEV/C +- 1(PER CENT). C-SIGM4/D-OMEGA U2/SR PER CENT .0402 + 25 - 20 THETA DEGREES 68.3 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY CEAM MOMENTUM = 15.7 GEV/C +- 1(PER CENT). D-SIGNA/D-DMEGA U2/SR PER CENT +0129 + 25 - 20 THETA DEGREES 55.4 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. TABLE 11 LABORATORY BEAM MOMENTUM = 21.7 GEV/C +- 1(PER CENT). C-SIGMA/D-OMEGA NANOBARNS/SR PER CENT 5.98 + 25 - 20 THETA DEGREES 46.2 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 31.5 GEV/C +- 1(PER CENT). C-SIGMA/C-CFEGA NANGBARNS/SR PER CENT 3.53 + 25 - 20 THETA DEGREES 37.7 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE CRAND C.M.

ELASTIC DIFFERENTIAL CRCS	S SECTION FCR PROTON PROTON. ITABLE 11
LABORATORY BEAM MOME	NTUM = 12.9 GEV/C +- 1(PER CENT).
THETA	C-SIGMA/C-GFEGA
CEGREES	NANDEARNS/SR · PER CENT
12.1 +2	- 20
THETA IS THE ANGLE T	HAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.
ELASTIC DIFFERENTIAL CRCS	S SECTION FCR PROTON PROTON. (TABLE 1)
LABORATORY BEAM MOME	NTUM = 18.2 GEV/C +- 1(PER CENT).
THETA DEGREES	C-SIGMA/C-GHEGA NANCEARNS/SR
58.8 *2	2.52 + 25 - 20
THETA IS THE ANGLE T	FAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.
ELASTIC DIFFERENTIAL CRCS	S SECTION FOR PROTON PROTON. [TABLE]]
LABORATORY BEAM MOMEN	NTUM = 25. GEV/C +- 1(PER CENT).
THETA	C-SIGKA/C-GHEGA
DEGREES	NANCBARNS/SR PEP CENT
49.1 +2	- 20
THETA IS THE ANGLE T	FAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M.
•••••	
ELASTIC DIFFERENTIAL CRCS	S SECTION FCR PROTON PROTON. [TABLE 1]
LABORATORY BEAM MOME	NTUM = 11.4 GEV/C +- 1(PER CENT).
THETA	D-SIGMA/G-GMEGA
00.0 +2	NANUBARNS/SK PER CENT 22.4 + 25
90 . 0 +2	- 20
THETA IS THE ANGLE T	HAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.
ELASTIC DIFFERENTIAL CROS	S SECTION FOR PROTON PROTON. [TABLE 1]
LABORATORY BEAM MOMEN	NTUM = 14.2 GEV/C +- 1(PER CENT).
THETA I	D S10H4/C-CVC0A NANFRARNY/SR
78.4 +2	PER CENT 5-1 + 25
	- 20
THETA IS THE ANGLE T	HAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.
ELASTIC DIFFERENTIAL CRCS	S SECTION FOR PROTON PROTON. [TABLE 1]
LABORATORY BEAM MOMEN	NTUN = 20.9 GEV/C +- 1(PER CENT).
THETA	
62.1 += .2	PEP CENT
	- 20
THETA IS THE ANGLE TH	HAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M.
••••	
ELASTIC DIFFERENTIAL CROSS	S SECTION FCR PROTON PROTON. [TABLE 1]
I ARORATORY REAM MOMEN	<pre>\$100 = 28.7 GEV/C +- 1(PER CENT).</pre>
THETA I Degrees	U-SIGMA/D-DHEGA NANDBARNS/SR
52.0 +2	PEP CENT -147 + 30 - 25
THETA IS THE ANGLE TH	TAT THE PROTON PAKES WITH THE BEAM IN THE GRAND C.M.

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ELASTIC DIFFERENTIAL CRCSS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 30.7 GEV/C +- 1(PER CENT). C-SIGMA/D-OMEGA NANCEARNS/SR PER CENT .0447 + 30 - 25 THETA DEGREES 53.7 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRESS SECTION FOR PROTON PROTON. (TABLE 1) LABORATORY BEAM MOMENTUM = 19.6 GEV/C +- 1(PER CENT). C-SIEMA/D-OMEGA NANCEARNS/SR PER CENT -282 + 30 - 25 THETA DEGREES 76.2 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRESS SECTION FCR PROTON PROTON. ITABLE 11 LABORATORY BEAM MOMENTUM = 16. GEV/C +- 1(PER CENT). C-SICMA/C-OMEGA NANGBARNS/SR PER CENT 1+54 + 25 - 20 THETA DEGREES 81.4 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRGSS SECTION FOR PROTON PROTON. TABLE 1] LABORATORY BEAM MOMENTUM = 23.8 GEV/C +- 1(PER CENT). C-SIGNA/D-OMEGA NANDBARNS/SR PER CENT .0841 + 30 - 25 THETA DEGREES 65.2 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM = 21.9 GEV/C +- 1(PER CENT). D-SIGMA/D-OMEGA NANCBARNS/SR PER CENT .069 + 30 - 25 THETA DEGREES 73.1 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CROSS SECTION FOR PROTON. [TABLE 1] LABORATORY BEAF MOMENTUM = 18. GEV/C +- 1(PER CENT). C-SIGMA/D-OMÉGA NANGEARNS/SR PER CENT .365 + 25 - 20 THETA DEGREES 86.0 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. ELASTIC DIFFERENTIAL CRCSS SECTION FCR PROTON PROTON. [TABLE 1] LABORATORY BEAM MOMENTUM . 26.6 GEV/C +- 1(PER CENT). D-SIGMA/D-DMEGA NANCBARNS/SR PER CENT .0146 + 30 - 25 THETA DEGREES 68.1 +- .2 THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRANC C.M.

L		iss section for photon photon.	
	ABORATORY BEAP PC	JPENTUP = 26.2 GEV/C +- 1(PER	CENTI.
T 0E	HETA GREES	D-SIGMA/D-DMEGA PICCRARNS/SR	
77.9	+2	5+18 + 35 - 3C	
T	HETA IS THE ANGLE	THAT THE PRGTCN MAKES WITH TH	E BEAM IN THE GRAND C.M.
ELAST I	C DIFFERENTIAL CR	CSS SECTION FOR PROTON PROTON.	[TABLE 1]
L	ABORATORY BEAF MO)#ENTUM = 21+9 GEV/C +- 1(PER	CENT).
, DE	HETA GREES	C-SIGMA/C-OMEGA NANEBARNS/SR PER CENT	
90.0	+2	-0515 + 30 - 25	
т	HETA IS THE ANGLE	: THAT THE PROTON PAKES WITH TP	IE BEAM IN THE GRAND C.M.
ELASTI	C DIFFERENTIAL CF	CSS SECTION FOR PROTON PROTON	(TABLE 1)
L	ABORATORY BEAM MC	DMENTUM = 31.8 GEV/C +- 1(PEF	CENT).
T De	HETA	C-SIGMA/C-DMEGA PICGBARNS/SR	
72.8	+2	PCA CENT •92 + 100 - 30	
т	HETA IS THE ANGLE	E THAT THE PROTON MAKES WITH TI	HE REAM IN THE GRAND C.M.
		· · ·	· · · · · · · · · · · · · · · · · · ·
ELASTI	C DIFFERENTIAL CF	RESS SECTION FCR PROTON PROTON	. (TABLE 1)
ι	ABORATORY BEAM PE	DMENTUM = 30.9 GEV/C +- 1(PE	R CENT).
T	HETA	D-SIGMA/D-OMEGA	·
82.4	+- +2	PER CENT 1.1 + 100	
		- 50	
т	HETA IS THE ANGLE	E THAT THE PRCTON PAKES WITH TH	HE BEAM IN THE GRANE C.M.
2 LARGE-	ANGLE NEUTRON-PRO)TON ELASTIC SCATTERING FROM 3.	0 TO 6.8 GEV/C. [PHYS. REV. LETTERS 21, 641 (1968)]
J.COX, M.N.KR N.1.10	A.L.PERL ISTANFOR EISLER [PRINCETOR NGO, S.T.PONELL II	RO LINEAR ACCEL. CNTR., STANFOR V UNIV., PRINCETON, N. J., USA. Li Cuniv. of Michigan, Ann Arg(RD,CALIF., USA]] 38, Mich.; Ušaj
ABSTRA A T I O	CT WE PRESENT IT THE HIGHER HOME META/ SO.3. THIS SOSPIN-O AND ISOS DISCUSSED.	FYTENSIVE NEW NATA ON CUTY S ENTA THE CROSS SECTIONS ARE FOL STARETRY INPLIES THAT THE COM SFIN-I AMPLITUGES IS SMALL IN 1	NECTIONS FOR NEWTRON PROTON CLASTIC SCHTTERING PRUM S.U IU 6.8 GE IND TO BE NEARLY SYMMETRIC ABOUT 90 DEG. IN THE C.M. SYSTEM FOP / RIBUTION TO THE CROSS SECTION FROM INTERFERENCE TERMS BETWEEN TH INIS ANGULAR REGION. OTHER IMPLICATIONS OF THE DATA ARE ALSO
CLOSEL	Y RELATED REFEREN ATA SUPERSECED BY HIS ARTICLE SUPER	NCES Y SLAC PUB-622. RSEDES PHYS. REV. LETTERS 16, ?	1217 (1966), AND SLAC 66 (1966).
D T			
D T ADDITI P S N V V	ONAL CITATIONS Hys. Rev. 146, 98 Ciênce 8, 43 1199 Udvo cimento 27, Hys. Rev. 159, 11	3C (1966), PHYS. REV. 105, 302 301, PHYS. REV. LEITERS 15, 30 856 (1963), NUGVO CIMENTO 494, 169 (1967), PHYS. REV. LETTERS	(1957), PHYS, REV. LETTERS 21. 645 (1968). ANNHAL DEV OF MUCLES (1965), NUOVO CIMENTO 41A, 167 (1966), PHYS. REV. 137, 8708 (196 273 (1967), NUC. PHYS. RI, 309 (1967), PHYS. REV. 147, 1130 (17 19, 265 (1967), AND UCRL 16275 (1966).
D ANNITI P S S N P ARTICL	CNAL CITATIONS HYS. REV. 146, 98 Cièrce 6, 43 119 NOVO CIMENTO 27, HYS. REV. 159, 11 E REAC BY LERDY F	BC (1966), PHYS. REV. 105, 302 IDI, PHTS. REV. LEITERS 15, 38 856 (1963), NUOVO CIMENTO 494, 169 (1967), PHYS. REV. LETTERS 'RICE IN 4/7C, AND VERIFIFD RY	(1557), PHYS, REV. LETTERS 71. 645 (1968). ANNUAL DEV. DE MUCLEA [1965], NUGVO CIMENTO 41A, 167 (1966), PHYS. REV. 137, 8708 (196 , 273 (1967), NUC. PHYS. RI, 379 (1967), PHYS. REV. 147, 1130 (19 19, 265 (1967), AND UCRL 16275 (1966). COETTE BENAPY.
O T ANDITI P S N P ARTICL BEAM	NAMI CITATIONS HYS. REV. 146, 91 Clence 8, 43 119 UDVO CIMENTO 27, HYS. REV. 159, 11 E REAC BY LERDY F IS NEUTRON ON PRO	SC (1966), PHYS. REV. 105, 302 361, PHYS. REV. LEIIERS 15, 38 856 (1963), NUGVO CIMENTO 494, 169 (1967), PHYS. REV. LETTERS 2RICE IN 4/7C. AND VERIFIFD RY 170K FRCM 3.0 TC 6.8 GEV/C.	(1557), PHYS, REV. LETTERS 71. 645 (1968). ANNUAL DEV. DE MUCLE. [1965], NUGVO CIMENTO 41A, 167 (1966), PHYS. REV. 137, 8708 (196 , 273 (1967). NUC. PHYS. RI, 379 (1977), PHYS. REV. 147, 1130 (19 19, 265 (1967), AND UCRL 16275 (1966). COETTE BENAPY.
O T ANNITI P S S N P ARTICL BEAM THIS E	INNAL CITATIONS HYS. REV. 146, 91 Ciènce 8, 43 1199 NOVO CIMENTO 27, Hys. Rev. 159, 11 E Reac by Lerdy F Is Neutron on Pro Xperiment USES SF	SC (1966), PHYS. REV. 105, 302 361, PHYS. REV. LEIIERS 15, 38 856 (1963), NUGVO CIMENTO 494, 169 (1967), PHYS. REV. LETTERS PRICE IN 4/7C. AND VERIFIED BY 170K FRCM 3-0 TC 6-8 GEV/C. PARK CHAMBERS.	(1557), PHYS. REV. LETTERS 71. 645 (1968). ANNIMAL DOW TE MUCLE. [1965], NUGVO CIMENTO 41A, 167 (1966), PHYS. REV. 137, 8708 (196 273 (1967). NUC. PHYS. RI, 379 (1977), PHYS. REV. 147, 1130 (19 19, 265 (1967), AND UCRL 16275 (1966). CDETTE BENAPY.
D ANNITI S S ARTICL BEAM THIS E KEY WO	INNAL CITATIONS HYS. REV. 146, 91 Liènie 8, 43 119 NOVO CIMENTO 27, Hys. Rev. 159, 11 E Reac by Lerdy F Is Neutron on Pro Xperiment USES SF ROS + ANGULAR DIS	SC (1966), PHYS. REV. 105, 302 301, PHYS. REV. LETIERS 15, 38 856 (1963), NUGYO CIMENTO 494, 169 (1967), PHYS. REV. LETTERS PRICE IN 4/7C. AND VERIFIFD BY JTON FRCM 3.0 TC 6.8 GEV/C. PARK CHAMBERS. STRIEUTION	(1557], PHYS. REV. LETTERS 71. 645 (1968). ANNHAL DEV DE MUCLEA [1965], NUGVO CIMENTO 41A, 167 (1966), PHYS. REV. 137, B708 (196 273 (1967). NUC. PHYS. AI, 309 (1967), PHYS. REV. 147, 1130 (19 19, 265 (1967), AND UCRL 16275 (1966). CDETTE BENAPY.
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MEASUREMENT OF POLARIZATION IN 667-NEV PP SCATTERING. [SOVIET JNP 2 636 (1966)]

L.S.AZHGIREI,YU.P.KUMEKIN, M.G.MESHCHERYAKOV, S.B.NURUSHEV, V.L.SGLQVIANDV, G.C.STCLETOV [JGINT INST. FOR NUCL. RESEARCH, DUBNA, USSRI

RACT POLARIZATION IS MEASURED IN DDUBLE PP SCATTERING AT C.M. ANGLES 4.4 DEG.5 THÉTA 5 48.2 DEG. FOR LARGER ANGLES MEASUREMENTS AT 635 MEY MERE RENORMALIZED. AN ENNANCEMENT OF POLARIZATION IN PP SCATTERING IS CBSERVED WITH INCREASE OF THE ENERGY FROM 602 TO 656 MEV. THE ANGULAR DISTRIBUTION OF THE POLARIZATION AT 667 MEY SHOWS THAT A CONSIDERABLE CONTRIBUTION COMES FROM THE TRIPLET STATES WITH ORBITAL ANGULAR MOMENTUM UP IL = 5. A SET OF PHASE SHIFTS DESCRIBING THE OBSERVE FOLARIZATION AND OTHER ENERTIME DATA IN THE REGION CLOSE TO 660 MEV IS PRESENTED. ABSTRACT

CITATIONS DDKL. AKAD. NAUK. SSSR 145 61 (1962), PHYS. REV. 137, B620 (1965), JETP 6 28 (1958), PHYS. LETTERS 6, 196 (1963), JETP 20 830 (1965), UCRL 11440 (1964), UCRL 11877 (1965), JETP 78 810 (1964), JETP 19 728 (1965), JETP 18 806 (1964), AKD PROGRESS OF THEORETICAL PHYSICS 31, 609 (1964).

ARTICLE READ BY ODETTE BENARY IN 3/67, AND VERIFIED BY LERGY PRICE.

BEAM IS PROTON ON PROTON AT 1.302 GEV/C. (BEAM KINETIC ENERGY = .667 GEV)

THIS EXPERIMENT USES COUNTERS.

KEY WORDS + POLARIZATION PHASE SHIFT

ELASTIC POLARIZATION FOR PROTON PROTON.

LABORATORY BEAM ENERGY = .667 +- .005 GEV.

1'HETA	POLARIZATION
DEGREES	
4.4	.012 +028
4.9	.051 .024
7.2	.140 .029
10.4	.242 .026
12.1	.272 .017
16.3	.357 .019
21.3	.448 .C28
27.9	.506 .016
48.2	.580 .046

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAN IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the gpand c.m.

164 SPIN ANALYSIS OF P PI+ PI- ENHANCEMENTS IN THE PP PI+ PI- FINAL STATE PROCUCED IN PP INTERACTIONS AT 22 GEV/C. REV. 187, 1844 (1969)] (PHYS.

J.1.RHODE,R.A.LEACOCK,W.J.KERNAN,R.A.JESPERSEN,T.L.SCHALK [IGWA STATE UNIV., AMES, IGWA, USA]

RACT WE HAVE INVESTIGATED CECAY ANGULAR DISTRIBUTIONS AND GTHER CHARACTERISTICS ASSOCIATED WITH ENHANCEMENTS NEAR 1450 AND 1700 MEV IN THE P PI+ PI- MASS DISTRIBUTION FOR THE PP PI+ PI- FINAL STATE PRODUCED IN PP INTERACTIONS AT 22 GEV/C. OUR RESULTS ABE CONSISTENT WITH A SPIN ASSIGNMENT OF 1/2 FOR THE 1450-MEV EFFECT IF THE DELTA++ PI- BRANCHING OF THIS EFFECT IS ASSUMED TO BE SMALL. WE ASSOCIATE THIS EFFECT WITH THE PII/1470] STATE INFERRED FROM PHASE-SHIFT ANALYSES. IN THE CASE OF THE ITOO-MEV FEATURE, WE FAVOR STRONG CONTRIBUTIONS FROM A J = 5/2+ STATE WHICH CAN BE REASONABLY ASSOCIATED WITH THE FISIL650 STATE REPORTED IN THE PHASE SHIFT WORK. ABSTRACT 22

CLOSELY RELATED REFERENCES Continuation of previcus experiment in Phys. Rev. Letters 21, 1368 (1968), and atmens conference (1967).

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ARTICLE READ BY ODETTE BENARY IN 5/70, AND VERIFIEC BY LERCY PRICE.

BEAM IS PROTON ON PROTON AT 22 GEV/C.

THIS EXPERIMENT USES THE B.N.L. BO IN. (H) BUBBLE CHAMBER.

ANGULAR DISTRIBUTION

165 POLARIZATION PARAMETER IN PP SCATTERING FROM 1.7 TO 6.1 BEV. [PHYS. REV. 148, 1297 (1966)]

F.GRANNIS, J.ARENS, F.BETZ, O.CHAMBERLAIN, B.DIETERLE, C.SCHULTZ, G.SMAPIRO, H.STEINEP, L.VANROSSUM, D.WELOON [U.C. LAWRENCE RAD. LAB., BERKELEY, CALIF., USA]

ABSTRACT THE POLARIZATION PARAMETER IN PROTON-PROTON SCATTERING HAS BEEN REASURED AT INCLOSENT PROTON KINETIC ENERGIES THE POLARIZATION PARAMETER IN PROTON-PROTON SCATTERING MAS BEEN MEASURED AT INCIDENT PROTON KIMETIC ENERGIES OF 1.7, 2.85, 3.5, 4.0, 5.05, AND 6.15 BEV AND FOR FOUR-MOMENTUM TRANSFER SQUARED BETKEEN 0.1 AND 1.0 (BEV/CI-SQUARED. THE EXPERIMENT WAS DONE MITH AN UMPOLARIZED PROTON BEAM FROM THE BETAERON STRIKING A POLARIZED PROTON TARGET. BOTH FINAL-STATE PROTONS WERE DETECTED IN COINCIDENCE AND THE ASYMMETRY IN COUNTING RATE FOR TARGET PROTON SPOLARIZED PARALLEL AND ANTIPARALLEL TO THE SCATTERING MARAL WAS MEASURED. THE MAXIMUM POLARIZATION WAS DBSERVED TO DECREASE FROM 0.4 AT 1.7 BEV TO 0.2 AT 6.1 BEV. THE MAXIMUM OF THE POLARIZATION AT ALL ENERGIES STUDIED OCCURS AT A FOUR-MOMENTUM TRANSFER SQUARED OF 0.3 TO 0.4 (BEV/CI-SQUARED.

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FIONS ANNALS OF PHYSICS 7, 404 (1959), ANNUAL REV. OF NUCLEAR SCIENCE 6, 43 (1956), PHYS. REV. 148, 1289 (1966), UCRL 16070 UCRL 11149, PROG. NUCL. TECH. INSTR. 1 173 (1964), ANNALS OF PHYSICS 5, 229 (1958), PHYS. REV. 124, 800 (1961), UCRL 11926, PHYS. REV. 105, 288 (1957), PHYS. REV. 95, 1694 (1954), PHYS. REV. 137, B6Z0 (1965), PHYS. REV. LETTERS 16, 536 (1966), NUOVO CIMENTO 23, 690 (1962), NUOVO CIMENTO 20, 1049 (1961), MOSCOM INST. FOR THEOR. AND EXPTL. PHYSICS N-258, JETP 18 874 (1964), PHYS. REV. 121, 1534 (1961), PHYS. REV. 130, 1571 (1963), PHYS. REV. 131, 2226 (1963), NUOVO CIMENTO 28, 250 (1963), PHYS. REV. LETTERS 9, 475 (1962), PROGR. THEORET. PHYS. (KYOTO) 28 1048 (1962), PHYS. REV. LETTERS 14, 502 (1565), AND PHYS. REV. 140, 1491 (1966).

ARTICLE PEAD BY ODETTE PENARY IN 4/67. AND VERIFIED BY LEROY PRICE.

BEAM IS PROTON ON HYDROGEN COMPOUND FROM 2.465 TO 7.026 GEV/C. TARGET IS POLARIZED 45 PER CENT (NORMAL TO THE BEAM DIRECTION).

THIS EXPERIMENT USES COUNTERS.

KEY WORDS . POLARIZATION

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 1]

LABOR	ATORY	BEAM	ENERGY =	- 1.	7 GEV.	
THET	1		PC1	APIZ	ATICN []	3
DEGREE	S					
23.3 +-	1.0		- 43	31 +-	.021	
26.0	1.0		.36	35	.014	
28.7	1.0		-42	23	+C15	
31.4	1.0		.40)4	-C16	
34.1	1.0		.39	16	. (17	
36.7	1.0		.36	Z	.020	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton algng the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 2]

U.	ABORATORY	BEAM	ENERGY	•	2.8	5 GE\	1.
TI	HETA		. Р	GLA	RIZA	TION	(1)
CE	GREES						
16.6	+- 1.0			151	+-	.085	
19.0	1.0			188		.020	
21.5	1.0		-	237		.C15	
23.9	1.0			245		.015	
26.2	1.0			255		.017	
28.4	1.0			260		.020	
31 0	1.0		•	221		. (22	
32 0			-	270		010	
32.0	1.0		•	202			
33.3	1.0		•	203			
34.4	1.0		•	242		.022	
30.5	1.0		•	225		.023	
38.8	1_0			196		. C 2 7	
41.0	1.0			142		.031	
43.2	1.0			218		. 636	
45.4	1.0			156		.040	
47.0	1.0			130		.042	
49.7	1.0			171		.055	
51.8	1.0			104		072	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plake in the granc c.m.

(TABLE 3)

[1] PLUS POSSIBLE SYSTEMATIC ERRCR OF +- 12 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON

LABORATORY BEAM ENERGY = 3.5 GEV.

THETA DEGREE 3	POLARIZATION [1]
20 8 4- 1 0	171 +- 616
20.0 - 1.0	
23.0 1.0	1203 1021
24.8 1.0	.203 .024
26.8 1.0	.218 .028
28.8 1.0	.207 .030
30.7 1.0	.224 .035
32.6 1.0	.131 .046
34.5 1.0	.123 .044
36.4 1.0	.083 .054
38.3 1.0	.127 .063

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m.

[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 4]

LABO	RATORY	BEAM	ENERGY	•	4.	GEV.	
THET	A FS			POLA	RIZA	TION	[1]
15.6 +-	1.0			.144	+-	.016	
19.7	1.0			.211		.015	
23.6	1.0			.217		.020	
27.6	1.0			•174		.(22 ;020	

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the grand c.m. [1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT.

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ELASTIC POLARIZATION FOR PROTON PROTON. (TABLE 5)

L/	BORATORY	BEAM	ENERGY	-	5.05	GEV.
TI	ETA		P	CLAS	7 I Z A T	(ON [1]
DEG	MEE2					
12.5	+- 1.0			683	+	100
14.3	1.0			152	. (24
16.1	1.0			166		219
18.0	1.0			153		[19
19.7	1.0			178		222
21.5	1.0			185		27
23.3	1.0			136		230
23.7	1.0			226		204
25.0	1.0			138		:34
25.4	1.0			201		:59
27.2	1.0			145		:55
28.9	1.0			830		262
30.7	1.0			231		87
32.4	1.0			206		100
34.1	1.0			100	•	121
36.2	1.0		•	041	•	138

THETA IS THE ANGLE THAT THE PROTON MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proton along the normal to the production plane in the granc c.m.

[1] PLUS POSSIBLE SYSTEMATIC ERROR OF +- 12 PER CENT.

ELASTIC POLARIZATION FOR PROTON PROTON. [TABLE 6]

LABORATORY BEAM ENERGY = 6.15 GEV.

TH	ETA REES	POLARIZATION (1)
13.2	+- 1.0	-112 +049
15.0	1.0	.177 .031
16.7	1.0	.196 .028
18.4	1.0	.177 .031
20.1	1.0	.262 .037
21.8	1.0	.16C .C42
23.1	1.0	.169 .027
23.5	1.0	.157 .053
24.7	1.0	.117 .032
25.2	1.0	.077 .064
26.4	1.0	.085 .042
28.1	1.0	.142 .053
29.7	1.0	.002 .074

THETA IS THE ANGLE THAT THE PROTCN MAKES WITH THE BEAM IN THE GRAND C.M. The polarization is of the proten along the normal to the production plane in the grand C.M.

[1] PLUS POSSIBLE SYSTEPATIC ERROR OF +- 12 PER CENT.

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THE MAXIMUM POLARIZATION IN PRCTON PROTON ELASTIC SCATTERING. [1]

LABCRATCRY	MAXIMUM
BEAM ENERGY	PGLAFIZATION
GEV	
.150	.230 +C20
.210	.330 .020
.305	.405 .030
. 307	.37C .C30
.310	.395 .050
.400	.440 .015
.410	.43C .C30
- 500	->1Ú -C50
.510	.400 .060

[1] TAKEN FROM A REVIEW ARTICLE.

THE MAXIMUM PULAKIZATION IN PROTON PROTON ELASTIC SCATTERING. (FIGURE 7)

. THIS DATA WAS READ FRO⊮ A GRAPH .

LABCRATCRY	PAXINUM						
BEAM ENERGY	POLARIZATION						
GEV							
1.70	.400 +020						
2.85	.260 .030						
3.50	.210 .030						
4.00	.205 .030						
5.05	.180 .030						
6.15	.210 .030						

(FIGURE 7)

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Section IV.

INDICES

With all of the information for each article stored in a computer - searchable fashion, one could generate numerous types of indices; two types that we have found most useful are included in this section.

1. MOMENTUM INDICES—Here we list all of our NN articles classified by input channel (pp, pn, or np) and then ordered according to increasing beam momentum. If a particular paper reports results at more than one energy, that paper is listed once for each momentum value reported. The reference number in the last column is the article number in Section III. 2. KEY WORDS CLASSIFICATION-As stated in Section III, each article is assigned certain KEY WORDS. These words (or phrases) are intended to indicate the contents of the article. As our list of KEY WORDS has grown, we generally have not yet gone back to older articles and inserted the appropriate new words. Thus references may be missing from some of the categories. We hope to have this remedied by our next edition of NN.

If you have any suggestions for other useful indices, please let us know. We believe that a good set of indices will make this report much more valuable.

Momentum Index (pp)

BEAM MOMENTUM	1ST AUTHOR	JOURNAL	VOLUME, PAGE	INSTITUTIONS	DETECTOR	YEAR PUBLISHED	REF.NR.
.551	GRANN I S	PR	148 1297	LRL	CNTR	66	165
.649	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
.662	GRANNIS	PR	148 1297	LRL	CNTR	66	165
.816	GRANNIS	PR	148 1297		CNTR	00	165
.819	GRANNIS	PR	148 1297		CNIR	00 66	165
.823	CHENC		140 1297		CNTR	67	44
• 823 949	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
.850	BETZ	PR	148 1289	LRL	CNTR	66	24
.949	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
.954	GRANNIS	PR	148 1297	LRL	CNTR	66	165
.954	CHENG	PR	163 1470	LRL UCLA SPC	CNTR	67	44
.968	GRANNIS	PR	148 1297			60	105
1.049	KYAN COANNIIS	PPPA 00	149 1207		CNTR	66	165
1.090	COZZIKA	PR	164 1672	SACI CAEN	CNTR	67	124
1.090	CHENG	PR	163 1470	LRL UCLA SPC	CNTR	67	44
1.103	GRANN I S	PR	148 1297	LRL	CNTR	66	165
1.111	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
1.149	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
1.168	BALDONI	NC	26 1376	BGNA MSNA PADU RUMA	HBL	62	139
1.213	LUIGNEI	NC	43A 708 21 691	IPN SACC	CNTR	61	114
1.219	CHENG	PR	163 1470	IRE UCLA SPC	CNTR	67	44
1.230	COZZIKA	PR	164 1672	SACL CAEN	CNTR	67	124
1.237	BETZ	PR	148 1289	LRL	CNTR	66	24
1.249	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
1.263	KAZARINOV	RMP	39 509	JINR	CNTR	67	78
1.289	BUGG	PR	146 980	RHEL CAVE		60	52
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1.294	ATHCIDET	SIND	2 6 3 6	JINR	CNTR	66	163
1-317	RFT7	PR	148 1289	LRL	CNTR	66	24
1.343	CHENG	PR	163 1470	LRL UCLA SPC	CNTR	67	44
1.349	RYAN	ррра	PPAR-11	LEHI PRIN	SPRK	69	37
1.385	COZZIKA	PR	164 1672	SACL CAEN	CNTR	67	124
1.385	MCMANIGAL	PR	148 1280	LRL	CNTR	66	20
1.385	CENCE	PK	131 2713			66	24
1.387	BEIZ	PK	268 679	BIBM	SPRK	68	52
1.404	NEAL	PR	161 1374	ANNA	CNTR	67	66
1.408	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
1.420	LONGO	PR	125 701	ŁRL	CNTR	62	29
1.450	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
1.475	MORRIS	PR	103 1472	TALE CAEN		20	124
1.487		PR	23 1306	IND	SPRK	69	123
1.540	DUTTON	PL	268 679	BIRM	SPRK	68	52
1.540	DUTTON	PL	258 245	BIRM	SPRK	67	51
1.549	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
1.600	LONGO	PR	125 701	LRL	CNTR	62	29
1.607	BUGG	PR	146 980	RHEL CAVE		67	13
1.609		PK 000A	104 1072 PPAP-11	I CHI DRIN	SPRK	69	37
1.649	RTAN	PR	146 980	RHEL CAVE	CNTR	66	13
1.662	MCFARLANE	NC	28 943	BIRM	CNTR	63	67
1.662	BUGG	PR	13381017	CAVE BIRM	HBC	64	46
1,685	CHAPMAN	PL	11 253	BIRM	CNTR	64	6
1.690	MURRAY	NC	49A 261	BIRM	CNTR	67	129
1.690	DUTTON	PL	258 245	BIRM	SPKK	61	114
1.696	MARIELLI HEINZ		167 1232	ANNA STAN	CNTR	68	70
1.700	DOWELL	PL	12 252	BIRM	CNTR	64	11
1.729	COZZIKA	PR	164 1672	SACL CAEN	CNTR	67	124
1.730	LONGO	PR	125 701	LRL	CNTR	62	29
1.730	NEAL	PR	161 1374	ANNA	CNTR	67	66
1.749	RYAN	PPPA	PPAR-11	LEHI PRIN	SPRK	69	37
1.780	BUGG	PK 00	146 980	NHEL CAVE	CNTR	66	13
1.858		PR	125 701		CNTR	62	29
1.915	COZZIKA	PR	164 1672	SACL CAEN	CNTR	67	124
1.940	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
1.952	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
2.032	HEINZ	PR	167 1232	ANNA STAN		68	10
2.050	LONGO	PR DD	125 701		CNTR	67	27
2.054	NEAL	PR PR	101 13/4	RHEL CAVE	CNTR	66	13
2.200	KRUCHININ	SJNP	1 225	JINR	HLBC	65	118
2.212	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
2.230	EISNER	PR	138 B670	BNL	HBC	65	49
2.250	FOWLER	PR	103 1479	BNL	CC	56	77
2.251	HEINZ	PR	167 1232	ANNA STAN	CNTR	68	10
2.280	BUGG	PK 00	146 980	ANNA	CNTR	67	66
2.391	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
2.450	8UGG	PR	146 980	RHEL CAVE	CNTR	66	13
2.466	GRANNIS	PR	148 1297	LRL	CNTR	66	165
2.466	HEINZ	PR	167 1232	ANNA STAN	CNTR	68	70
2.470	LONGO	PR	125 701	LRL	CNTR	62	29
2.592	BUGG	PR	146 980	RHEL CAVE		00	13
7.680	BUGG	PR .	146 980	KHEL GAVE	UNITE	00	15

2.704	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
2.784	KIRILLOVA HEIN7	PL PR	13	93 1232		STAN	SOFI		CNTR	64 68	152
2.800	BACON	PR	162	1320	VAND				HBC	67	156
2.807	PICKUP	PR	125	2091	BNL YALF	BNI	8NI		HBC	62 62	80 75
2.819	BUGG	PR	146	980	RHEL	CAVE	0.12		CNTR	66	13
2.850	BLAIR	NC	634	529	AERE	QMCL			CNTR	69	58
2.850	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
2.958	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
2.970		PR PR	125	1223						68	47
2.994	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
3.000	ABRANS	BNL	14125	1 374	BNL				GNTR	69 67	60
3.054	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
3.110	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
3.131	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
3.200	ANDERSON	PRL	21	853	CHIC	ANL	CARL	LASL	SPRK	68	111
3.204	DIDDENS	PRL	168	1495	CERN	BNL			CNTR	68	105
3.277	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
3.300	ANDERSON	PRL	21	853	CHIC		CARL	LASL	SPRK	68 66	111
3•305 . 3•300	1161142	PR .	167	1232	ANNA	STAN			CNTA	,66	70
3.349	HOGAN	PR	166	1472	PRIN	ee			CNTR	68	30
3.444	BRABSON	PRL	23	1306	· IND	CAVE			SPRK	69	123
3.500	ANDERSON	PRL	21	853	CHIC	ANL	CARL	LASL	SPRK	68	111
3.546	8UGG BLOCK	PR	146	980	RHEL	CAVE	DNI		CNTR	66 56	13
3.580	LONGO	PR	125	701	LRL	CUAN	UNL		CNTR	62	29
3.619	HEINZ	PR	167	1232	ANNA	STAN			CNTR	68	70
3.660	NFA1, MART	PR	161	1374	ANNA BNL				HBC	67	76
3.670	LOUTTIT	PR	123	1465	BNL	CCNY			HBC	61	71
3.670	SMITH	PR	123	2160	YALE	BNL			HBC	61 66	68 165
3.670	REED	PR	168	1495	ROCH	BNL			CNTR	68	105
3.700	COHN	PL	268	598	ORNL	UCND	TENN	ORNL	HBC	68	109
3.731	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	. 13
3.800	BANNER	PL	2 5B	569	SACL	CDEF			CNTR	67	116
3.856	ANDERSON HOGAN	PRL	166	853	PRIN	ANL	ÇARL	LASL	CNTR	68 68	30
3.908	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
4.000	KIDD	PL 091	16	75	MILA	GEND	C 4 8 1	1 4 5 1	HBG Sprk	65 68	136
4.000	KIDD	STENA LUNE	21	348	MILA	ANL	CARL	LAJL	HBC	63	81
4.000	COLETTI	NC	49A	479	MILA	GEND			HBC	67	55
4.000	BODINI	NC	584	175	HILA	GĒŅŌ			HBC	68	47
4.000	LONGO	PR	125	701	I.RI				CNTR	67	79
4.037	BUGG BUGG	PR PR	146	980 980	RHEL	CAVE			CNTR	56 56	13
4.300	ANDERSON	PRL	21	853	CHIC	ANL	CARL	LASL	SPRK	68	111
4.338	GRANNIS	PR	148	1297	LRL				CNTR	66	165
4.550	BLAIR	NC	63Å	529	AERE	QMCL			CNTR	69	58
4.552	BUGG	PR	146	980	RHEL	CAVE	C 4 8 1		CNTR	66	13
4.600	BUGG	PR	146	980	RHEL	CAVE	CARL	LASL	CNTR	66	13
4.800	ANDERSON	PRL	21	853	CHIC	ÅNL	ĊARL	LASL	SPRK	68	111
4.048 4.950	GRANNIS	PR	140	1297	PRIN	PPPA			CNTR HBC	88 67	45
4.950	SONDHI	PL	268	645	PPPA	,,,,,			HBC	68	19
4.950	BIERMAN	PR	147	922	PRIN	PPPA			HBC	66	8
5.000	VON DARDEL	PRL	140	333	CERN	CATL			CNTR	60	121
5.000	RUDDICK	PR	165	1442	MINN	ANL	IOWA	ANNA	CNTR	68	112
5.000	ANDERSON	PRL	159	853	ANNA	ANL IOWA	ANL	MINN	CNTR	67	43
5.020	ANKENBRAND	AR	170	1223	1.81				CNTR	68	47
5.100	ANDERSON	PRL	21	053	CHIC				SPRK	68 67	43
5.150	BOOTH	PRL	21	651	EFIN	ANL	405		CNTR	68	34
5.200	AKERLOF	PR	159	1138		TOWA	ANL	MINN	CNTR	67	43
5.300	ANDERSON	PRL	21	853	CHIC	ANL	CARL	LASL	SPRK	68	111
5.300	AKERLOF	PR	159	1138	ANNA	IOWA	ANL	MINN	CNTR	67	43
5.400 5.500	AKERLUF	PR PRL	159	1138	ANNA CHIC	ANL	LARL	LASL	SPRK	67	111
5.500	AKERLOF	PR	159	1138	ANNA	IOWA	ANL	MINN	CNTR	67	43
5.520	ALEXANDER	PR	154	1284	REHO	CAVE			HBC	67	57
5.600	AKERLOF	PR	159	1138	ANNA	IOWA	ANL	MINN	CNTR	67	43
5.700	AKERLOF	PR	159	1138	ANNA	IOWA	ANL	MINN		67	43
5.800	AKERLOF	PR	159	075 1138	ANNA	IOWA	ANL	MINN	CNTR	67	43
5.824	BUGG	PR	146	980	RHEL	CAVE			CNTR	66	13
5.830 5.900	DIDDENS	PRL PR	9 150	32 1138		IUMV	ANI	MINN	CNTR	62 67	135
5.914	GRANNES	PR	148	1297	LRL				CNTR	66	165
5.970		NC OP	554	66 8012	GEND	MILA	OXF		HBC	68 65	120
6.000	ANDERSON	PRL	158	855	BNL	CARN			SPRK	66	142
6.000	BORGHINI	PL	31B	405	CERN	ORSA			CNTR	70	140

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6.000	KINSEY	UCRI	17707	BERK I RI	HBC	68	126
6.000		UCRL	18306		HBC	68 60	122
6.000	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK	68	111
6.000	BORGHINI	PL	248 77	CERN ANNA FOWA ANI MT	CNTR NN CNTR	67 67	48 43
6.040	CHINOWSKY	PR	171 1421	LRL BERK SLAC	нас	68	158
6.050	CHINDWSKY	PR	165 1466	LRL SLAC	HBC	68 69	26
6.070	TAN	PL	28B 195	SLAC LRL IRVN	HBC	68	147
6.070	ANKENBRAND	PR	170 1223		ČNTR SI SPRK	68 68	47
6.100	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
6.200	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK NN CNTR	68 67	43
6.300	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK	68	111
6.400		PR	159 1138	ANNA IOWA ANL MI	NN CNTR HBC	67 68	43
6.600	BERGER	PRL	20 964	LRL BERK DART LR	L HBC	68	110
6.600	GELLERT MA	PRL	17 884		HBC	66 69	69 65
6.600	COLTON	UCRL	19330	LRL BERK	нвс	69	64
6.600	AKERLOF	PR	159 1138	ANNA IOWA ANL MI Chic Ani Cari La	NN CNTR SL SPRK	67	43
6.800	FOLEY	PRL	11 425	BNL	CNTR	63	72
6.800	AKERLOF	PR Remo	159 1138	ANNA IOWA ANL MI REHO STRB TELA	NN CNTR HBC	67 69	43 83
6.920	ALEXANDER	PR	173 1322	REHO STRB	HBC	68	41
6.920	ALEXANDER	NC PRI	53A 455 5 333	REHO Cern	HBC	68 60	36 121
7.000	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
7.026	GRANNIS	PR	148 1297 68-7 580	LRL CERN	CNTR	66 68	165
7.100	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK	68	111
7.120	ANKENBRAND	PR PR	170 1223	LRL ANNA IOWA ANL MI	CNTR NN CNTR	68 67	47
7.250	MC MANIGAL	PR	137 B620	LRL BERK	CNTR	65	108
7.300	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK NN CNTR	68 67	43
7.600	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK	68	111
7.600	AKERLOP	28 281	159 1138	ANNA LOWA ANL MT	NN CNTR CNTR	67 62	43
7.800	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
7.820	FOLEY	PRL	19 857 146 980	BNL Rhel Cave	CNTR	66	13
7.850	TAYLOR	PL	14 54	AERE QMCL	SPRK	65	134
7.870	FIREBAUGH	PR	172 1354		НВС НВС	68 68	31 61
7.880	BLAIR	NC	63A 529	AERE QMCL	CNTR	69	58
7.880	BLAIR	PRL	17 789	AERE QMCL Chic Ani Carl La	CNTR SL SPRK	66 68	39
8.000	GALBRAITH	PR	138 8913	BNL CORN	CNTR	65	148
8.000	AKERLOF	PR CERN	159 1138 68-7 580	ANNA IDWA ANL MI Cern	NN CNTR CNTR	68	43 143
8.100	GINESTET	NP	B13 283	SACL	HBC	69	131
8,100 8,100	ALLABY	PL PR	278 49 159 1138	CERN ANNA IOWA ANL MI	NN CNTR	68 67	43
8.100	ALLABY	PL	258 156	CERN	CNTR	67	40
8.110	KAYAS AKERLOF	NP PR	85 169 159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
8.300	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
8.400 8.400	ANDERSON	PRL PR	21 853	ANNA IOWA ANL MI	NN CNTR	67	43
8.500	HARTING	NC	38 60	CERN	SPRK	65	98 43
8.600 8.800	AKERLOF FOLEY	РА Р81	159 1128	ANNA INWA ANI, AL BNL	NN UNTR CNTR	63	72
8.800	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
8.940	ANDERSON	PRL	21 853	CHIC ANL CARL LA	SL SPRK	68	· 111
9.000	AKERLOF	PR	159 1138	ANNA LOWA ANL MI	NN CNTR	67	43
9.100 9.200	ALLABY ALLABY	CERN	68-7 580	CERN	CNTR	68	143
9.200	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67 67	43
9.400 9.500	AKERLOF	PR	21 853	CHIC ANL CARL LA	SL SPRK	68	111
9.600	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
9.800 9.800	AKERLOF FOLEY	PR PRL	159 1138	BNL	CNTR	6/	45
9.900	ASHMORE	PRL	5 576	CERN	CNTR	60 65	25
10.000	GALBRALTH ANDER SON	PRL	158 6915	BNI CARN	SPRK	66	142
10.000	VON DARDEL	PRL	5 333	CERN	CNTR	60	121
10.000	HOLMGREN		51A 20	STOH	HBC	67	73
10.000	BORGHINI	PL	248 77			67	48
10.000	AKERLUF	PK	250 156	CERN	CNTR	. 67	40
10.010	ALMEIDA	PR	174 1638	CAVE	HBC	68	153
10.010	DEHNE ALNEIDA	NC	53A 232 50A 1000	CAVE HAMB DESY	HBC	67	38
10.100	ALLABY	CERN	68-7 580	CERN	CNTR	68	143
10.110	BELLETTINI Akerlof	₽I PR	14 164	ANNA IOWA ANL HI	NN CNTR	67	43
10.400	AKERLOF	PR	159 1138	ANNA IOWA ANL MI	NN CNTR	67	43
10.500	ANDERSON AKERLOF	PRL	21 853 159 1138	ANNA IDWA ANL MI	NN CNTR	67	43
10.700	VON DARDEL	PRL	5 333	CERN	CNTR	60	121
10.800	FOLEY AKERLOF	PR	11 425 159 1138	ANNA IDWA ANL MI	NN CNTR	67	43

10.898	KIRILLOVA	PL	13 93	JINR PRAG SOFI	CNTR	64	152
10.940	FOLEY	PRL	15 45	BNL	CNTR	65	9
11.000		PR	21 853	CHTC ANE CARL LASE	SPRK	68	101
11.000	AKERLOF	PR	159 1138	ANNA IDWA ANL MINN	CNTR	67	43
11.000	ALLABY	PL	258 156	CERN	CNTR	67	40
11.100	COCCONI	PR	138 B165	CORN BNL	CNTR	65 68	161
11.200	AKERLOF	PR	159 1138	ANNA LOWA ANL MINN	CNTR	67	43
11.280	DIDDENS	PRL	9 111	CERN	CNTR	62	53
11.400	COCCONI	PR	138 8165	CORN BNL	CNTR	65	161
11.400		PRI	21 853	CHIC ANY CARL MINN	SPRK	68	111
11.600	AKERLOF	PR	159 1138	ANNA TOWA ANL MINN	CNTR	67	43
11.800	AKERLOF	PR	159 1138	ANNA IOWA ANL MINN	CNTR	67	43
11.900	FOLEY	PRL	17 857		CNTR	67 65	15
12.000	BORGHINI	PL	24B 77	CERN	CNTR	67	48
12.000	AKERLOF	PR	159 1138	ANNA EDWA ANL MINN	CNTR	67	43
12.100	DIDDENS	PRL	9 108	CERN	CNTR	62	151
12.100		PL	278 49	CERN	CNTR	68	115
12.200	AKERLOF	PR	159 1138	ANNA IOWA ANL MINN	CNTR	67	43
12.300	ANDERSON	PRL	21 853	CHIC ANL CARL LASL	SPRK	68	111
12.400	AKERLOE	NC PR	38 60	ANNA TAWA ANL MINN	CNIR	67 67	43
12.400	ASHMORE	PRL	5 576	CERN	CNTR	60	25
12.500	CRABB	PRL	21 830	ANNA ANL NAL	CNTR	68	104
12.500	RATNER	PR	166 1353	ANL IOWA ANNA		68	103
12-500	ASBURY	PRL	21 1097	ANL NAL ANNA	CNTR	68	101
12.600	AKERLOF	PR	159 1138	ANNA LOWA ANL MINN	CNTR	67	43
12.800	FOLEY	PRL	11 425	BNL	CNTR	63	72
12-800	AKERLOP	PK	159 1138 138 8165	CORN BNI	CNTR	67 65	161
12.990	DIDDENS	PRL ·	9 111	CERN	CNTR	62	53
13.000	COCCONI	PR	138 8165	CORN BNI,	CNTR	65	161
13.000	MA	PRL	24 1031		HBC	70 67	99 43
13.100	COCCONI	PR	138 8165	CORN BNL	CNTR	65	161
13.200	AKERLOF	PR	159 1138	ANNA IOWA ANL MINN	CNTR	67	43
13.400	AKERLOF	PR	159 1138	ANNA IOWA ANL MINN	CNTR	67	43
13.980	GALBRAITH	PRL	9 111 138 8913	BNI CORN	CNTR	62 65	148
14.010	FOLEY	PRL	19 857	BNL	CNTR	67	15
14.200	COCCONI	PR	138 8165	CORN BNL	CNTR	65	161
14.250	ALLABY	PL	258 156	CERN		67	40
14.800	FOLEY	PRL	15 45	BNL	CNTR	65	9
15.000	ANDERSON	PRE	16 055	BNL CARN	SPRK	66	142
15.500	DIDDENS	PRL	9 108	CERN	ÇNTR CNTR	62	151
15.800	ASHMORE	PRI	138 8165	CERN	CNTR	60	25
15.890	DIDDENS	PRL	9 111	CERN	CNTR	62	53
15.960	DIDDENS	PRL	9 111	CERN	CNTR	62	53
16.000		PR	138 8165		GNTR	65	101
16.000	RUSHBROOKE	PRL	22 248	LAVE	HBC	69	16
16.030	FOLEY	PRL	19 857	BNL	CNTR	67	15
16.100	COCCONT	PR	138 8165	CORN BNL	CNTR	65	161
16.700	ALLARY	PKL Pl	258 156	ČERN	CNTR	67	40
16.900	ALLABY	PL	23 389	CERN	CNTR	66	35
17.300	DIDDENS	PRL	9 111	CFRN	CNTR	62	53
17.700	ASHMORE	PRL	5 576	CERN		60 62	25
17.910	LUCENS	FRL	14 857	BNL	CNTR	67	15
18.000	COCCONE	PR	138 8165	CORN BNL	CNTR	65	161
18.000	GALBRAITH	PR	138 8913	BNL CORN	CNTR	65	148
18.100	MA	PRI	24 1031	MICH	HBC	70	99
18.200	COCCONI	PR	138 B165	CORN BNL	CNTR	65	161
18.290	DIDDENS	PRL	9 111	CERN	CNTR	62	53
18.400	HARTING	NC	38 60		SPRK	65 62	98
18.690	DIDDENS	PRL	9 111	CERN	GNTR	62	- 93
18.900	COCCONI	PR	138 8165	CORN BNL	CNTR	65	161
18.970	DIUDENS	PRL	9 111			62	150
19.000		LUND CONF	816 905	BOHR HELS	HBC	69	154
19.000	BOGGILD	SUB VNA		BOHR HELS OSLO	HBC	68	96
19.000	BOGGILD	PL	308 369	BUHR HELS	HBC	69	62
19.200	ALLABY	PL	288 229			68 69	22
19.200	ALLABY	PL	288 67		CNTR	68	18
19.300	ALLABY	PL	258 156	CERN	CNTR	67	40
19.330	BELLETTINI	PL	14 164	CERN	SPRK	65	146
19.400	ASHMUKE Allaby	PKL	298 198	VERN	CNTR	69	22
19,560	DIDDENS	PRL	9 111	CERN	CNTR	62	53
19.600	COCCONI	PR	138 B165	CORN BNL	CNTR	65	161
19.600	FOLEY	PRL	11 425	BNL CERN	CNTR	03 62	53
19.840	FOLEY	PRL	15 45	BNL	CNTR	65	9
19.910	DIDDENS	PRL	9 111	CERN	CNTR	62	53
20.000	GALBRAITH	PR	138 8913	BNL CURN	CNTR	65	148
20.000	ANDERSON	PRI	10 855	ONL LAKN ANI	CNTR	67	142
20.460	FOLEY	PRL	19 857	BNL	CNTR	67	15

20.900	COCCONI	PR		138	B165	COR	N BNL		CNTR	6	5	.161
21,100	MA	PRL		24	1031	MIC	4		нвс	7	0	99
21.100	ALLABY	PL		29B	198				CNTR	6	9	22
21.120	ALLABY	PL		288	67				CNTR	6	8	18
21.300	ALLABY	PL		258	156	CER	N		CNTR	6	7	40
21,400	DIDDENS	PRL		9	108	CER	Ň		CNTR	6	2	151
21.400	ASHMORE	PRL		5	576	CER	N I		CNTR	6	0	25
21.460	DIDDENS	PRL		9	111	CERI	Ň		CNTR	6	2	53
21.700	COCCONI	PR		138	8165	COR	N BNL		CNTR	6	5	161
21,800	JESPERSEN	PRL		21	1368	AME	S		HBC	6	8	90
21.880	DIDDENS	PRL		ÿ	111	CER	Ň		CNTR	6	2	53
21.880	FOLEY	PRI		15	45	BNI	•		CNTR	6	5	. 9
21,900	COCCONT	PR		138	B165	COR	N BNL		CNTR	6	5	161
22 000	RHODE	PR		187	1844	ANE	s		HBC	6	9	164
22.000	GALBRATTH	PR		138	8913	8 NI	័ណនា	N	CNTR	°	Ś	148
22.000	FOLEY	DDI		10	857	BNI	00		CNTR	6	ź	15
22.000	DIDDENS	001		۰. ۵	111	CER	u.		CNTR	×	2	53
22 800	COCCONT	DD.		138	8165	0.08			CNTR	6	5	161
23.000		DDI		10	857	BAIL			CNTR	Å	7	15
24.000	I OHD MANIN	01		11	79	065	CEP	N	ENUL	5	4	12
24.000	MA A	001		24	1031	NIC	4		HAC	7	0	- 00
24.200	ACUMORE			27	574	C 601	-		CNTP		0	25
24.200	ASTRUKE				72	BEOI			HACA	6	2	14
24.500	ENCITEMENT	PL		15	15	DEN	•		CNTP	6	5	17
24.030		001		21	1020	BNL				6	0	50
24.800	COCCONT	PRL		120	1034	COD	3 CULI	U U	CNTD	6	с ·	141
24.400	COCCONT	PR		1 20	0102	COR			CNTR	0	2	101
25.000	COLCONI	PR		1 20	0102	CUR	N ONL		CNTR	0	2	101
26.000	FULEY	PRL		14	857	BNL			CNTR	0	2	12
26.020	DIDUENS	PRL				LERI			CNTR	0	2	
26.200	CUCCUNI	PR		138	8102	CURI	N BNL		CNIR	0	2	101
26.200	DIDDENS	PRL			108	LERI	N.		UNIK	2	2	151
26.420	BELLETTINI	PL		14	164	LERI			SPRK	0	2	140
26.600	COCCONI	PR		138	8165	LUKI	N BNL		CNTR	0	5	101
27.830	DIDDENS	PRL			111	LERI	N.		CNIR	6	2	23
28.400	ASHMORE	PRL			576	CER	N		CNTR	6	0	25
28.500	CONNOLLY	BNL	13	694		BNL			HBC	6	9	
28.500	CONNOLLY	BNL	11	980		BNL			HBC	6	7	93
28.500	ELLIS	PRL		21	697	BNL			HBC	6	8	86
28.500	ELLIS	BNL	13	671		BNL			HBC	6	9	74
28.600	CONNULLY	CERN	68-7	2	208	BNL			нвс	6	8	117
28.700	COCCONI	PR		138	B165	COR	I BNL		CNTR	6	5	161
30.000	ANDERSON	PRL		16	855	BNL	CAR	N	SPRK	6	6	142
30.700	COCCONI	PR		138	B165	CORI	N BNL		CNTR	6	5 .	161
30.900	COCCONI	PR		138	B165	CORI	N BNL		CNTR	6	5	161
31.500	COCCONI	PR		138	B165	CORI	N BNL		CNTR	6	5	161
31.900	COCCONI	PR		138	8165	CORI	N BNL		CNTR	6	5	161

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.823	CHENG	PR	163 1470	LRL UCLA SPC	CNTR	67	44
.954	CHENG	PR	163 1470	LRL UCLA SPC	CNTR	67	44
.989	WRIGHT I	PR	175 1704	CHIC WISC	SPRK	68	106
1.090	CHENG I	PR	163 1470	LRL UCLA SPC	CNTR	67	44
1.111	BUGG F	PR	146 980	RHEL CAVE	CNTR	66	13
1.194	VINCENT	PRL	24 236	NASA CARN VPI UVC	CNTR	70	133
1.219	CHENG 8	PR	163 1470	LRL UCLA SPC	CNTR	67	44
1.263	KAZARINOV F	RMP	39 509	JINR	CNTR	67	78
1.289	BUGG I	PR	146 980	RHEL CAVE	ÇNTR	66	13
1.290	DUTTON F	PRL	21 1416	BIRM	SPRK	68	54
1.343	CHENG I	PR	163 1470	LRL UCLA SPC	CNTR	67	44
1.390	DUTTON F	PRL	21 1416	BIRM	SPRK	68	54
1.408	BUGG	PR	146 980	RHEL CAVE	CNTR	66	13
1.540	DUTTON P	PRL	21 1416	BIRM	SPRK	68	54
1.540	DUTTON P	મ	258 245	8 TRM	SPRK	67	51
1.607	BUGG f	PR	146 980	RHEL CAVE	CNTR	66	13
1.660	BUGG F	PR .	146 980	RHEL CAVE	CNTR	66	13
1.662	BATSON P	P.ROY.SOC.	251 233	BIRM	CC	59	63
1.690	MURRAY N	NC	49A 261	BIRM	CNTR	67	129
1.690	DUTTON P	າເ	258 245	BIRM	SPRK	67	51
1.696	COLEMAN F	PR	164 1655	ANNA	CNTR	67	17
1.780	BUGG f	PR	146 980	RHEL CAVE	CNTR	66	13
1.825	BRUNT F	PR .	187 1856	CAVE	HBC	69	125
1.825	BRUNT F	ะ	26B 317	CAVE	HBC	68	119
1.858	BUGG F	PR .	146 980	RHEL CAVE	CNTR	66	13
1.940	BUGG F	R	146 980	RHEL CAVE	CNTR	66	13
1.952	BUGG F	PR	146 980	RHEL CAVE	CNTR	66	13
2.032	COLEMAN F	R	164 1655	ANNA	CNTR	67	17

2.079	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.110	BRUNT	PR	187	1856	CAVE		HBC	69	125
2.110	BRUNT	PL	26B	317	CAVE		HBC	68	119
2.212	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.251	COLEMAN	PR	164	1655	ANNA		CNTR	67	17
2.280	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.419	BUGG	PR	146	980	 RHEL 	CAVE	CNTR	66	13
2.450	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	1.3
2.592	' BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.680	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.704	8 UGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.784	COLEMAN	PR	164	1655	ANNA		CNTR	67	17
2.819	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.857	8UGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2,958	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
2.994	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.000	ABRAMS	BNL	14125		8 NL		CNTR	69	60
3.054	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.110	8 UGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.131	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.142	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.270	DIDDENS	PRL	9	32	CERN		CNTR	62	139
3.277	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.303	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.444	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.546	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
3.731	BUGG	PR	146	980	8 HEL	CAVE	CNTR	66	15
3.908	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
4.037	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
4.265	8UGG	PR	146	980	RHEL	CAVE	CNTR	66	13
4.510	DIDDENS	PRL	9	32	CERN		CNTR	62	135
4.552	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
4.783	BUGG	PR	146	980	RHEL	CAVE	CNTR	, 66	13
4.966	BUGG	PŘ	146	980	RHEL	CAVE	CNTR	66	13
5.221	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
5.526	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
5.824	មហថថ	PR	146	980	RHEL	CAVE	ĊNTR	66	13
5.830	DIDDENS	PRI,	9	32	CERN		CNTR	62	13
6.000	GALBRAITH	PR	138	8913	BNL	CORN	CNTR	65	148
6.980	SHAPIRA	REHO			REHO		HBC	70	132
7.000	SHAPIRA	PRL	21	1835	REHO		DBC	68	21
7.750	DIDDENS	PRL	9	32	CERN		CNTR	62	135
7.835	BUGG	PR	146	980	RHEL	CAVE	CNTR	66	13
8.000	GALBRAITH	PR	138	8913	BNL	CORN	CNTR	65	148
9,900	ASHMORE	PRL	5	576	CERN		CNTR	60	25
10.000	GALBRAITH	PR	138	B913	BNL	CORN	CNTR	65	148
12.000	GALBRAITH	PR	138	8913	BNL	CORN	CNTR	65	148
12.400	ASHMORE	PRL	5	576	CERN		CNTR	60	25
14.000	GALBRAITH	PR	138	8913	BNI.	GORN	CNTP	66	140
15.800	ASHMORE	PRL	5	576	CERN		CNTR	60	25
16.000	GAI BRAITH	0 B	179	8013	9 NL	GONN	CHTR	ΰÿ	141
17.700	ASHMORE	PRL	5	576	CËRN		CNTR	60	25
18.000	GALBRAITH	PR	138	8913	BNL	CORN	CNTR	65	148
19.300	BELLETTINI	PL	19	341	CERN		SPKR	65	· 4
19.400	ASHMORE	PRL	5	576	CERN		CNTR	60	2 5
20.000	OALBRAITH	PR	138	8913	BNL	CORN	CNTR	65	140
21.400	ASHMORE	PRL	5	576	CERN		CNTR	60	25
22.000	GALBRAITH	P R	138	B913	BNL	CORN	CNTR	65	148
24.200	ASHMORE	PRL	5	576	CERN		CNTR	60	25
28.400	ASHMORE	PRL	5	576	CERN		CNTR	60	25

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.712	SHEPARD	PPAR	10	PPL	SPRK	69	94
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pp →	total	26 -29 (11)	A REAL PROPERTY OF		A CARLEND AND A CARLEND	
	elastic	26 -29 (11)	30 -55 (11)	56 -57 (13)	58 -70 (14)
	ΝΝπ	72 -73 (15)				
	ΝΝππ	80 -81 (15)				Star Barris
	ΝΝπππ	82(15)				
	$d\pi^+$	74 -75 (15)	76 -79 (15)			
	dp ⁺	83(19)	110(19)			
	NΔ	84 -85 (16)	86 -90 (16)			
	NN*	92 -93, 117)	94 -97, (17)			
		98 -99 (11)	100-101(17)			
	$\Delta \Delta$	106-107(18)				
	$N^{*}\Delta$	106-107(18)				
	ΝπΔ	104-105(18)				
	pp(ω, η, ρ)	108-109(19)				
	additional					
	nonstrange					
	reactions	83(15)				
	strange-particle					
	production	112-122(19)				
	n-prongs	122(19)				
nn →	total	125(19)				
	elastic	126(19)				
np, pi	$n \rightarrow total$	128-130(20)				
	elastic (includin	g 131(20)	132-142,(20	143(21)	146-153(21)	154-157(21)
	charge exchan	ge) 101(20)	144-145 (20) 110(21)	110 100(01)	
	inelastic	158(20)				
NN(I:	=0)→total	160-161(22)				
pd, n	d→total	164-165(22)				
	elastic	168(22)	166-169(22)			