2m USER'S HANDBOOK

Section :

Date : 08.11.1970

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PREFACE

2m USER'S HANDBOOK

Section : PREFACE
Date : 10.3.1970

A 001

COVER NOTE

New large chamber windows were installed in the 2m chamber at the beginning of 1970. All fiducial marks were oriented at 45° with respect to the beam direction (x-axis) for the convenience of automatic film measuring machines.

It was then decided to measure fiducial marks on the CERN HPD's as a standard procedure to monitor the quality of photographs throughout the chamber operation.

During the set up of the fiducial measuring system on HPD it was felt that a new presentation of information concerning chamber operation might be appropriate. After some discussion it was decided to create a loose-leaf USER'S HANDBOOK which would supply all information useful and necessary to evaluate photos taken in the 2m chamber.

This folder contains the first set of documents of the handbook. Additional information is still being prepared and will be added later.

The people who contributed to the set up of the fiducial measuring system and the write-up of this handbook are:

W. Blair, R. Messerli, S. Santiago, DD-Division
T. Ball, M. Dykes, G. Kellner, K. Kundson, R. Mac Kenzie,
J. Zoll, TC-Division.

Any suggestions or criticism concerning the handbook are welcome and should be sent to G. Kellner - TC-Division. Requests for additional information (titles, etc.) should be addressed to Miss K. Gieselmann - TC-Division.

2m USER'S HANDBOOK

Section : PREFACE
Date : 20.7.1971

A 002

COVER NOTE

As a by-product of the fiducial measuring system we have obtained precise co-ordinates of the fiducial marks on film for all experiments done on the 2m chamber since the beginning of 1970. These precise measurements can then be used for the calculation of geometry titles. One should be careful, however, when one uses these titles.

Strictly speaking, the precise measurements will be valid for the CERN HPD at the time of measurement only. If there are any film distortions introduced by the measuring machines (either the CERN HPD or the machines used for the measurement of an experiment at the user's laboratory) those precise measurements are not at all useful! It is then strongly recommended to measure the fiducial marks on the measuring machine that is used for the experiment and calculate geometry titles that include enough distortion parameters to compensate for non-linear film distortions, optical and machine- dependent.

It has been discovered that films measured on the CERN HPD2 were systematically distorted in a non-linear way. Since this distortion was extremely reproducible we were able to correct the fiducial measurements.

Measurements of fiducial marks (and PYTHON titles derived from these measurements) distributed after the date of this note are considered to be free from non-linear film distortions introduced by the HPD fiducial measuring system. It should of course still be verified whether the user's measuring machine does distort the films.

2m USER'S HANDBOOK

Section : PREFACE
Date : 10.3.1970

B 001

USE OF THIS MANUAL

The 2m USER'S HANDBOOK contains detailed information on the 2m chamber layout and operation for all experiments performed since March 10, 1970. Information pertaining to experiments run before this date has been published in several separate notes and a list of these documents is included in the last section.

The handbook has been grouped into several sections for easier reference:

Sections CHAMBER and OPERATION deal with technical information on chamber layout and various operation criteria for different liquids to produce good results on bubble density, contrast and stability.

The very extensive section OPTICS gives all the optics information needed for reconstruction of film measurements in space.

Section TELESCOPE describes methods and results of telescope measurements which are used to align camera plate and chamber windows.

Section GEOM-TITLE provides all information relevant for any given experiment in condensed form. This information is contained on DATA SHEETS which specify all experiments run during a period with identical optics set-up and reference all documentation contained in the handbook which is relevant for these experiments. A detailed description of the measuring and analysis system used for fiducial measurements on the CERN HPD's is given.

Section : PREFACE
Date : 10.3.1970

B 002

UPDATING OF MANUAL

Generally one will not throw away any pages contained in this manual, unless it is specifically requested (e.g. because some mistake has to be corrected). Information for chamber or optics set-up will, of course, change from time to time (e.g. new windows installed, new telescope measurements, etc.). This updated information will then be distributed automatically to all owners of the handbook and should be filed in the appropriate sections.

The date marked in the upper left corner of a sheet indicates the first day of validity of the information contained on this sheet. The period of validity will end with the date of the updated information.

The length of a period may vary considerably with the kind of information concerned, it will be typically 1-3 years for information about chamber windows and a few weeks for a given optics set-up.

In order to facilitate the search for information valid for a given experiment, we have indicated (on the DATA SHEET) the references to the corresponding pages in the handbook.

CHAMBER

2m USER'S HANDBOOK

Section : CHAMBER

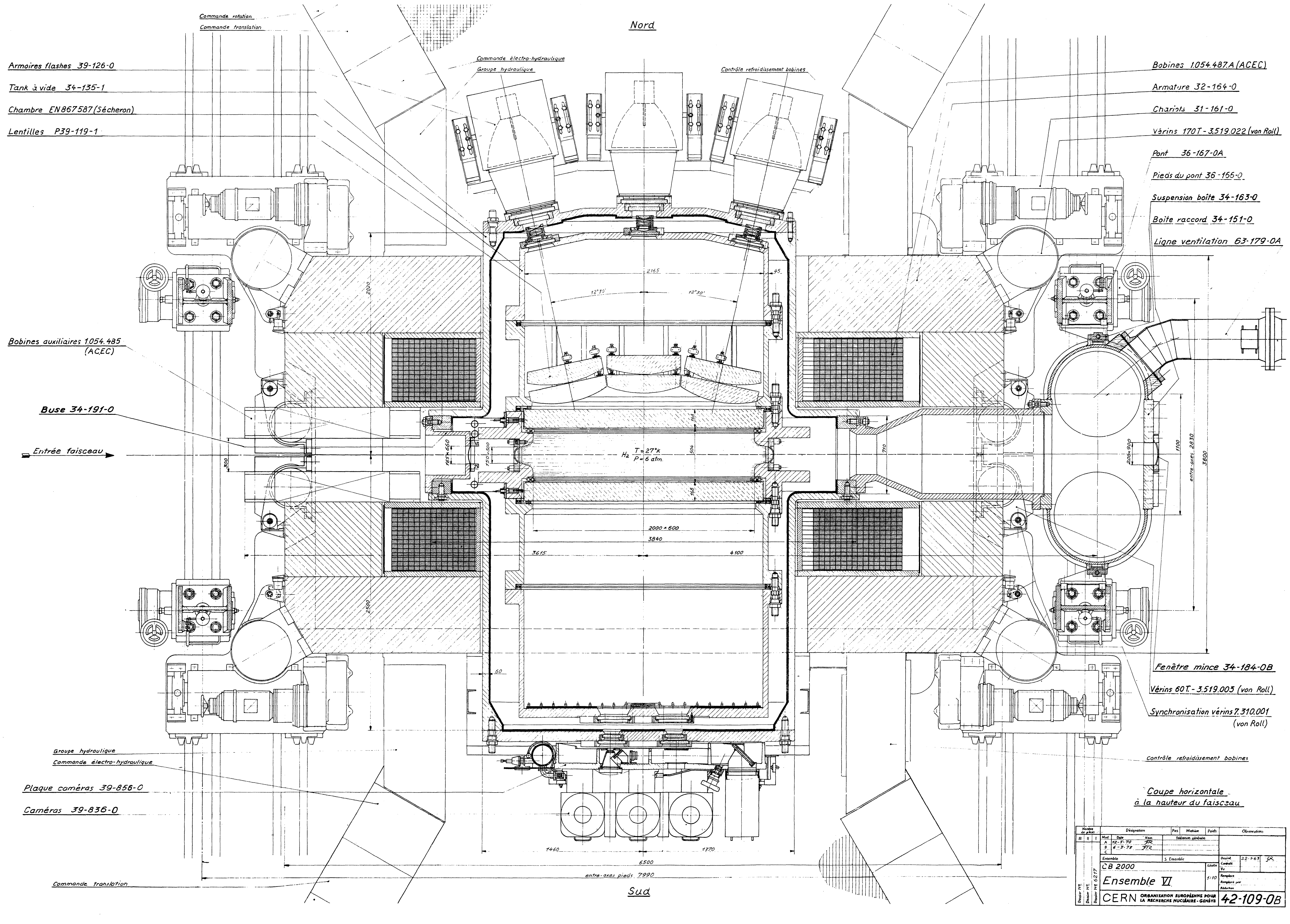
Date : 28.1.1977

A 001

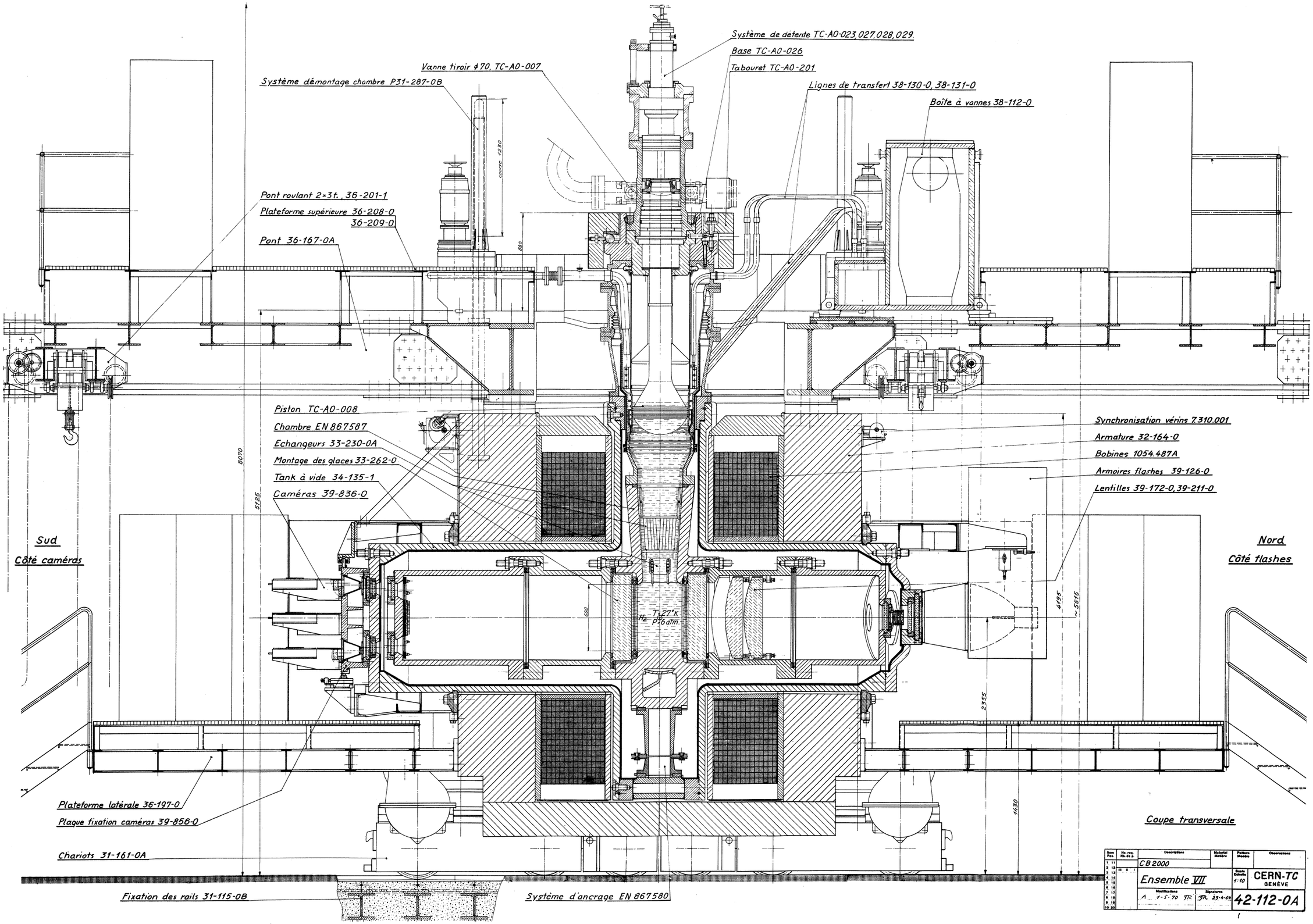
The three accompanying drawings show sections of the 2m chamber. The drawing labelled Ensemble VI shows a view looking down on the chamber with the beam coming in from the left, the three flash boxes at the top of the drawing, and the cameras at the bottom. The four shaded boxes represent the two coils of the magnet which are again shown in a similar way in the drawing called Ensemble VII. Here the cameras are on the left and the flash boxes on the right, as seen in this vertical section looking against the beam.

The drawing Ensemble VIII is a vertical section as seen from the camera side. The magnet coils are shown in outline as two dashed curves. In all the drawings the dimensions are given in millimetres.

OPERATION

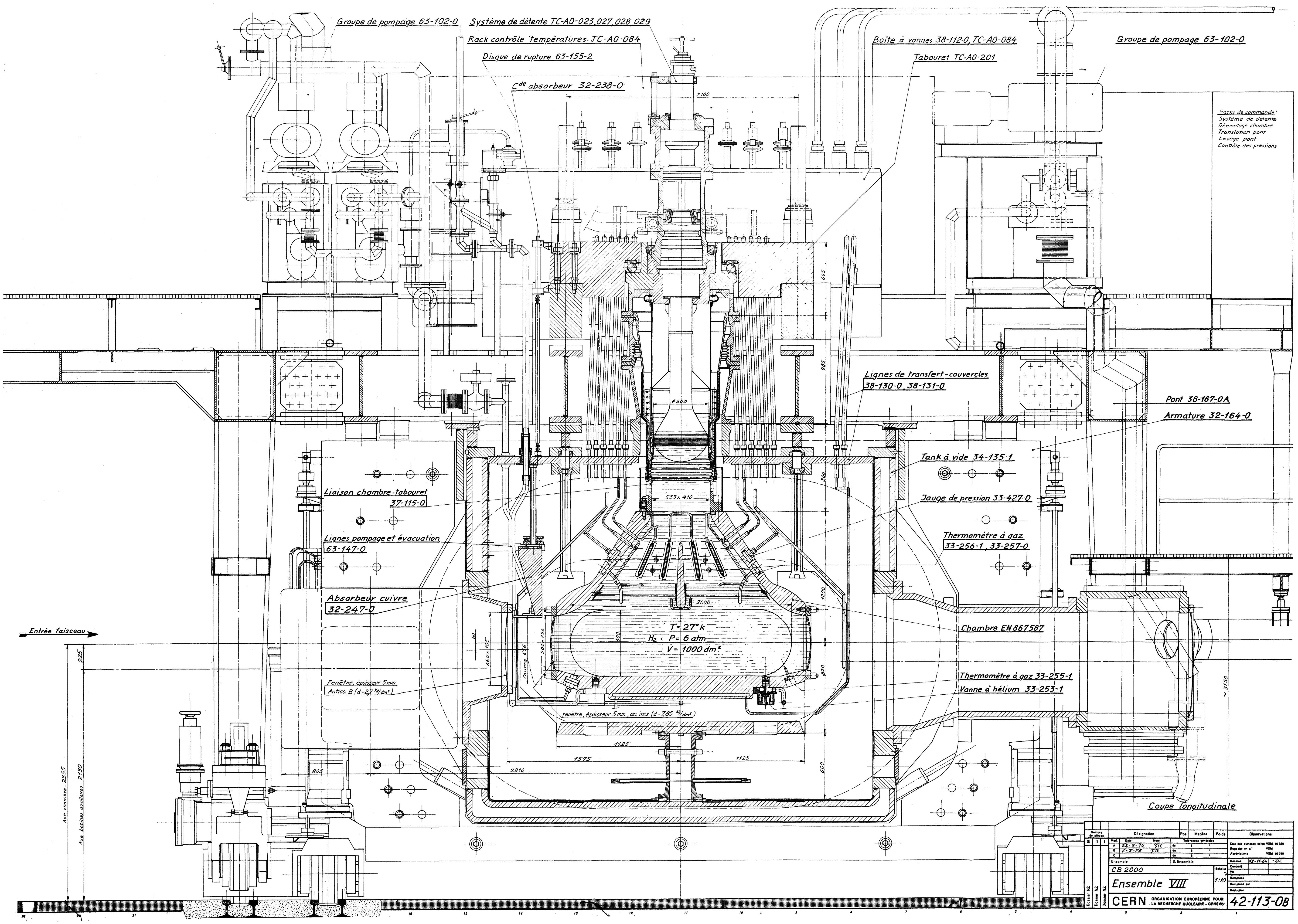


Nord
Commande rotation
Commande translation
Armoires flashes 39-126-0
Tank à vide 34-135-1
Chambre EN867587 (Sécheron)
Lentilles P39-119-1
Commande électro-hydraulique
Groupe hydraulique
Contrôle refroidissement bobines
Bobines 1.054.487.A (ACEC)
Armature 32-164-0
Chariots 31-161-0
Vérins 170T - 3.519.022 (von Roll)
Pont 36-167-0A
Pieds du pont 36-166-0
Suspension boîte 34-163-0
Boîte raccord 34-151-0
Ligne ventilation 63-179-0A
Bobines auxiliaires 1.054.485 (ACEC)
Buse 34-191-0
Entrée faisceau
H_2 T = 27°K P = 6 atm.
Fenêtre mince 34-184-0B
Vérins 60T - 3.519.005 (von Roll)
Synchronisation vérins 7.310.001 (von Roll)
Groupe hydraulique
Commande électro-hydraulique
Plaque caméras 39-856-0
Caméras 39-836-0
Contrôle refroidissement bobines
Coupe horizontale à la hauteur du faisceau
Commande translation
entre-axes pieds 7990
Sud
CB 2000
Ensemble VI
CERN ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE - GENÈVE
42-109-0B



Coupe transversale

Item Pos.	No. req. Nb. de p.	Description	Material Matière	Pattern Modèle	Observations
1 11		CB 2000			
2 12	10 0 1	Ensemble VII		Scale Echelle 1:10	CERN-TC GENÈVE
3 13		Modifications	Signatures		
4 14		A 1-5-70 JTR	JTR 23-4-68		42-112-0A
5 15					
6 16					
7 17					
8 18					
9 19					
10 20					



Groupe de pompage 63-102-0
Système de détente TC-A0-023,027,028,029
Rack contrôle températures: TC-A0-084
Disque de rupture 63-155-2
Cde absorbeur 32-238-0
Boîte à vannes 38-112-0, TC-A0-084
Tabouret TC-A0-201
Groupe de pompage 63-102-0
Racks de commande:
Système de détente
Démontage chambre
Translation pont
Levage pont
Contrôle des pressions
Lignes de transfert-couvercles
38-130-0, 38-131-0
Pont 36-167-0A
Armature 32-164-0
Tank à vide 34-135-1
Jauge de pression 33-427-0
Thermomètre à gaz
33-256-1, 33-257-0
Liaison chambre-tabouret
37-115-0
Lignes pompage et évacuation
63-147-0
Absorbeur cuivre
32-247-0
Entrée faisceau
T = 27°k
H2
P = 6 atm
V = 1000 dm³
Chambre EN 867587
Thermomètre à gaz 33-255-1
Vanne à hélium 33-253-1
Fenêtre, épaisseur 5mm.
Antica B (d = 2.7 kg/dm³)
Fenêtre, épaisseur 5mm, ac. inox (d = 7.85 kg/dm³)
Axe chambre - 2355
Axe bobines auxiliaires 2130
Coupe longitudinale
Nombre de pièces
Désignation
Pos.
Matière
Poids
Observations
Mod.
Date
Nom
Tolérances générales
A 22-9-70
B 6-3-73
Etat des surfaces selon VSM 10 320
Rugosité en µ'' VSM
Abréviations VSM 10 319
Ensemble
S. Ensemble
Dessiné 12-11-64
Contrôlé
Vu
CB 2000
Echelle
1:10
Ensemble VIII
Remplace
Remplacé par
Réduction
Dossier No
CERN
ORGANISATION EUROPÉENNE POUR LA RECHERCHE NUCLÉAIRE - GENÈVE
42-113-0B

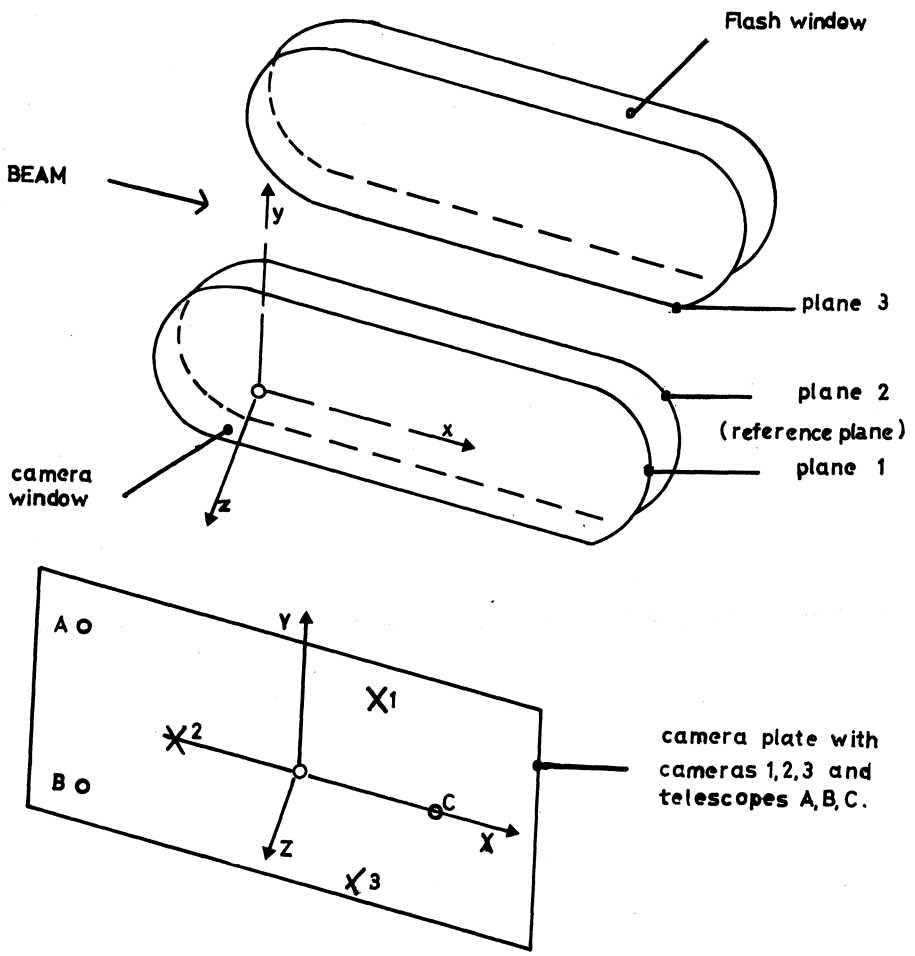
OPTICS

2m USER'S HANDBOOK

Section : OPTICS
Date : 10.3 .1970

A 001

REFERENCE SYSTEM



(x, y, z) - is a right-handed system arbitrarily attached to plane 2

x-axis points along beam direction
z-axis is perpendicular to plane 2, points towards cameras

(X, Y, Z) - is a right-handed system attached to the camera plate with origin at the circumcentre of the camera triangle

X-axis defined through circumcentre and camera 2
Z-axis is parallel to z-axis

Section : OPTICS

Date : 10.3.1970

B 002

LAYOUT OF FILM

The film used at the chamber is 50 mm wide and the length of one photograph (camera advance) is 170 to 174 mm. Each photograph has a chamber image and a databox image as shown life size in fig. 1. The nominal dimensions of the data box image are shown in fig. 2.

Each roll of film taken at the chamber is identified by a serial letter and a three digit roll number. Each photograph of a roll is given a 4 digit photo number. The roll number and photo number appear in arabic and binary on the film. Each decimal digit is encoded as eight bits as shown in table 1. A lamp lit corresponds to a 1 and a lamp unlit corresponds to a 0.

The four decimal digits of the photo number are encoded as in table 1 and occupy the 32 right hand bits of row 1. For example,

00110011	11100001	01100110	10110100
3	1	6	4

Similarly the three decimal digits of the roll number are encoded as the 24 right hand bits of row 2.

The thirty-eighth bit from the right of row 1 is lit to indicate a phototgraph taken on a second expansion. The remaining 29 bits are not used.

After exposure at the chamber, the three views of a roll are developed and then cut into four parts, labelled A, B, C, and D. Thus one roll ends up as 12 length of film. These are despatched in 4 boxes, each containing three views of one part, see fig. 3.

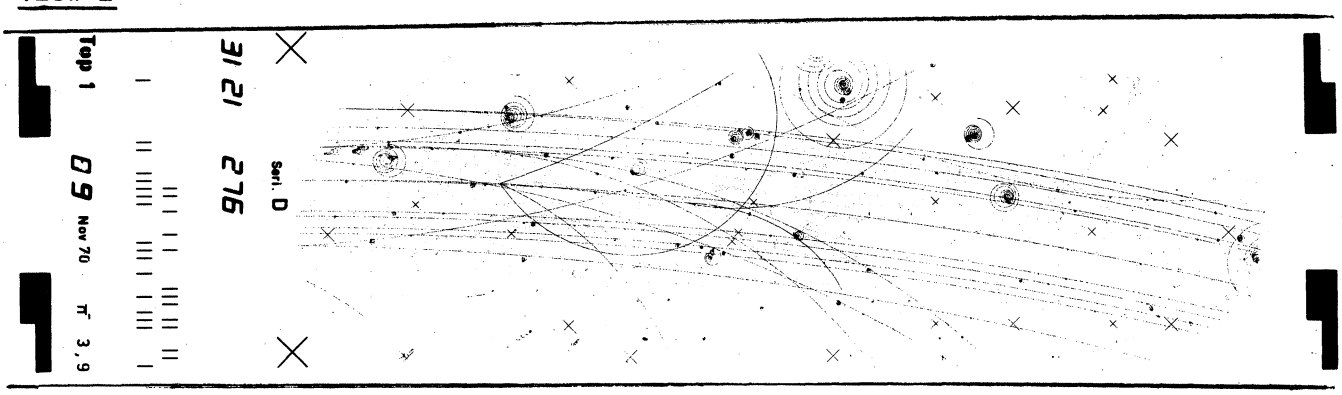
T A B L E 1

DECIMAL	BINARY
1	1 1 1 0 0 0 0 1
2	1 1 0 1 0 0 1 0
3	0 0 1 1 0 0 1 1
4	1 0 1 1 0 1 0 0
5	0 1 0 1 0 1 0 1
6	0 1 1 0 0 1 1 0
7	1 0 0 0 0 1 1 1
8	0 1 1 1 1 0 0 0
9	1 0 0 1 1 0 0 1
0	1 0 1 0 1 0 1 0

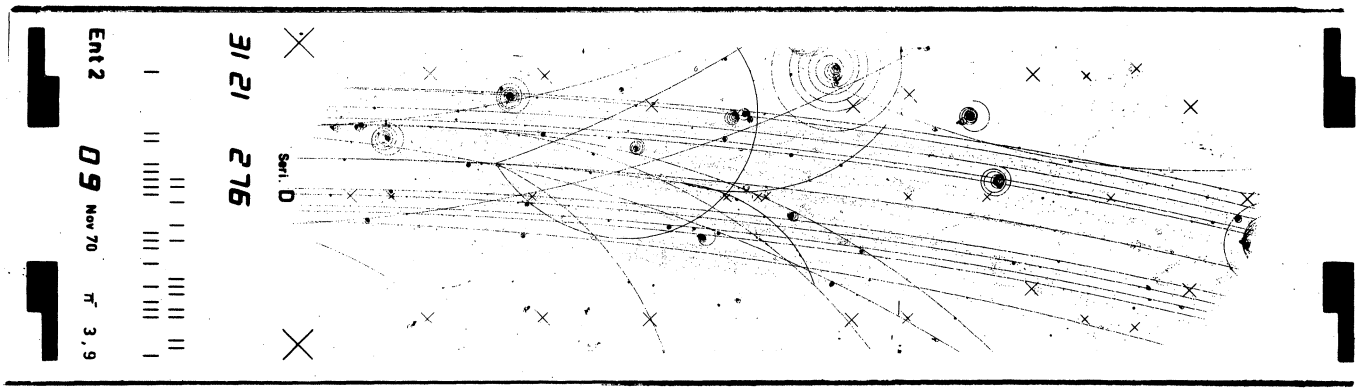
The parity code is chosen so that there are four bits illuminated in the representation of each decimal digit. Thus a quick check of the data box is possible : there should be 16 of the 32 photo number bits and 12 of the 24 roll number bits illuminated on each photograph.

Fig. 1 Data box image on film

View 1



View 2



View 3

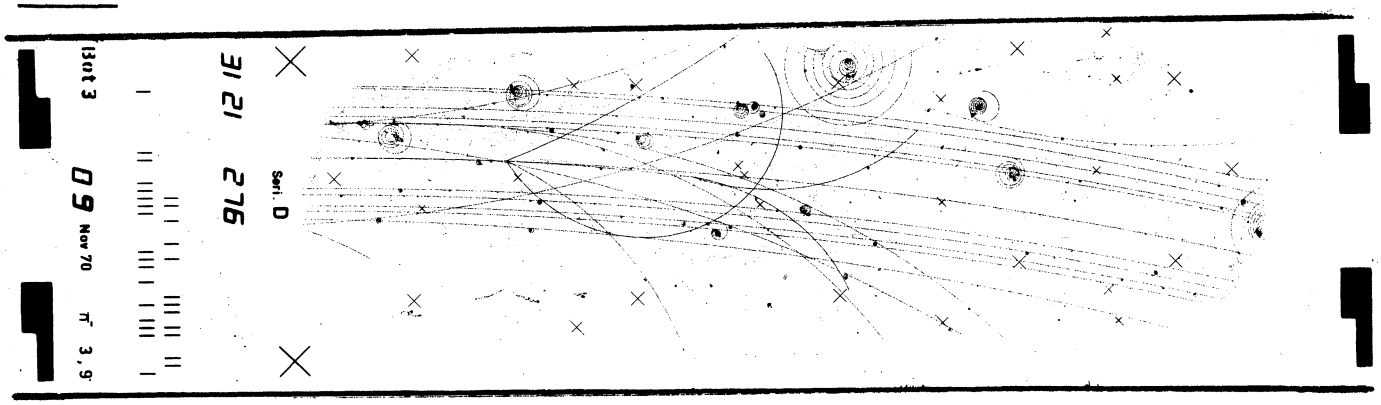


Fig.2 : Nominal dimensions of data box image (all dimensions in mm)

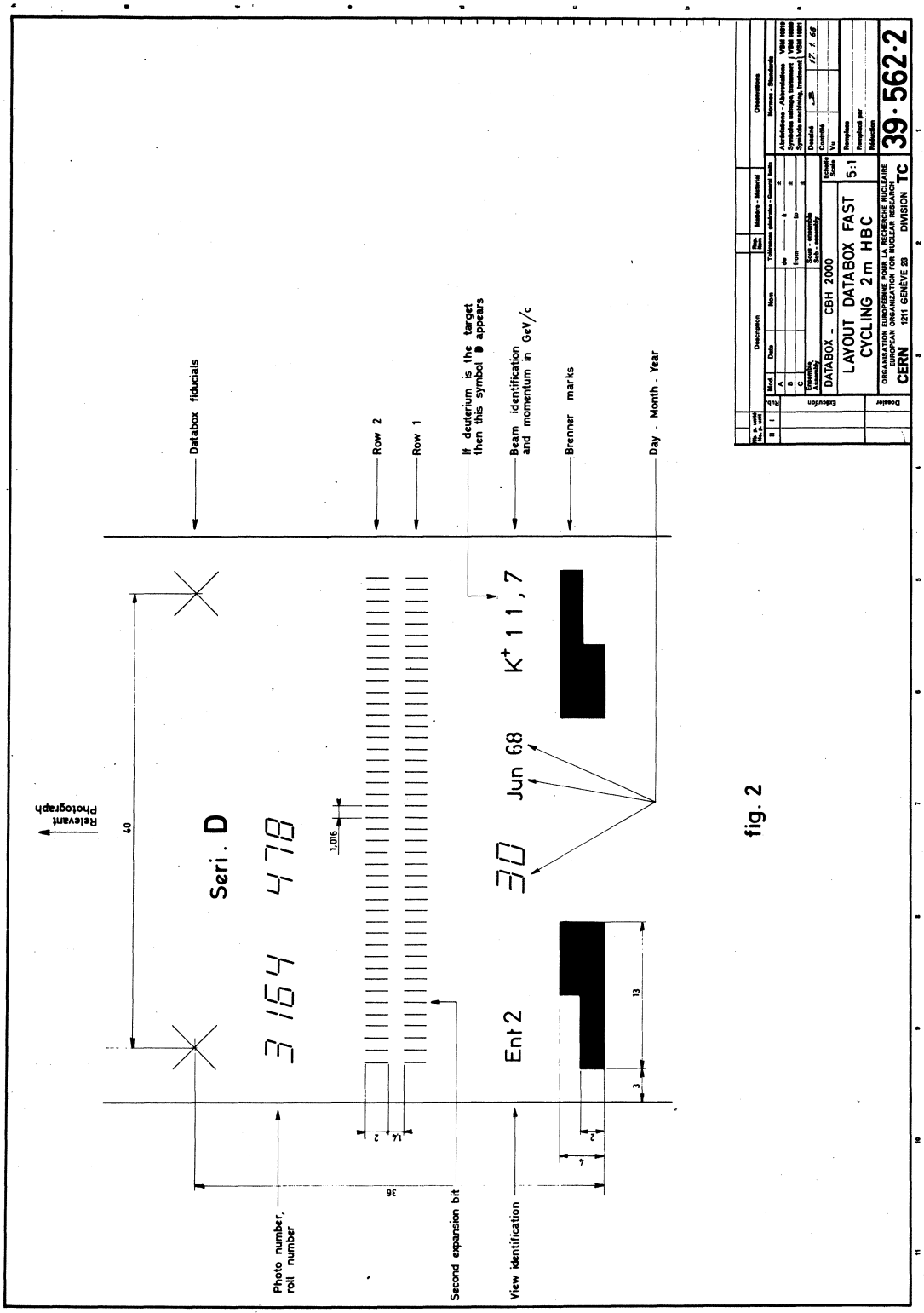


Fig.3 : Distribution of film

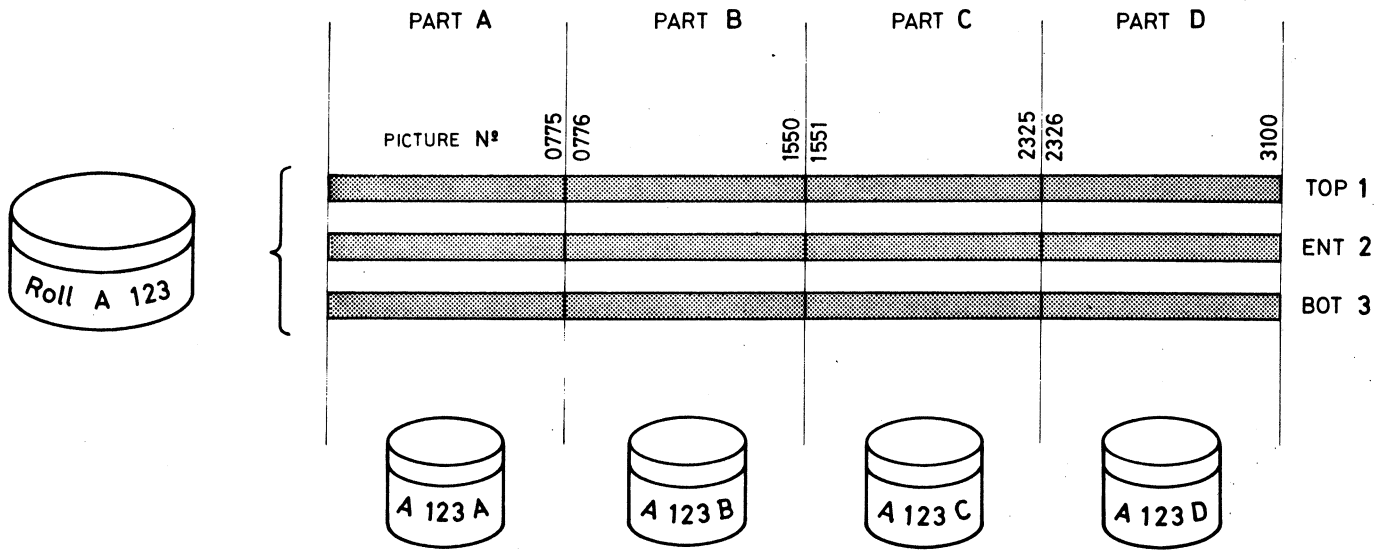


Fig. 3

B002 A

Section: OPTICS

Date: 10.8.1976

Valid from
27.2.1976 onward
(period 1048)

LAYOUT OF FILM

A new data box will be used for all experiments performed during and after 1976. The film used at the chamber is 50mm wide and the length of one photo (camera advance) is 170 to 174 mm. Each photo has a chamber image and a data box image as shown life-size in fig.1. The nominal dimensions of the data box image are shown in fig 2.

On each photo the photo number and roll number are identified by four-digit decimal numbers which appear in arabic and binary on the film. The view number appears as a single-digit decimal number also shown in arabic and binary on the film whereas the expansion number appears in binary only. Each of the ten decimal digits is encoded as 8 bits as shown in Table 1, a lit lamp corresponding to a 1 and an unlit lamp to a 0.

The four decimal digits of the photo number occupy the 32 right-hand bits of row 1. For Example

Photo 0164 is encoded as 10101010111000010110011010110100

0 1 6 4

Similary the four decimal digits of the roll number are encoded as the 32 right-hand bits of row 2. The 8 left-hand bits of row 2 encode the view or camera number so that this is now available for measuring machines. The 8 left-hand bits of 1 encode the expansion number.

With the new system the numbering of photos and rolls can be carried out exactly as in the past, exept that the serial letter is replaced by the fourth decimal digit of the roll number. In this case after development a roll will be cut into four parts of nominally 800 photos each, called parts A,B,C an D. Section OPTICS B002 fig. 3 refers, but with no serial letter and a four-decimal-digit roll number.

However it is now possible, if desired, to increment the roll number at any desired photo number. For example the roll number might be incremented at photo 0800, so that a 550 metre roll would after development be cut into four parts with different roll numbers, thus doing away with the need to mark parts A,B,C and D. In this case, the first three rolls cut from a 550 metre roll would have 800 photos and the last apprximately 800, as at present. Alternatively the roll number might be incremented at photo 1600 where the film is to be analysed on machines using 300 metre (nominal)roll lengths.

Valid from
27.2.1976 onward
(period 1048)

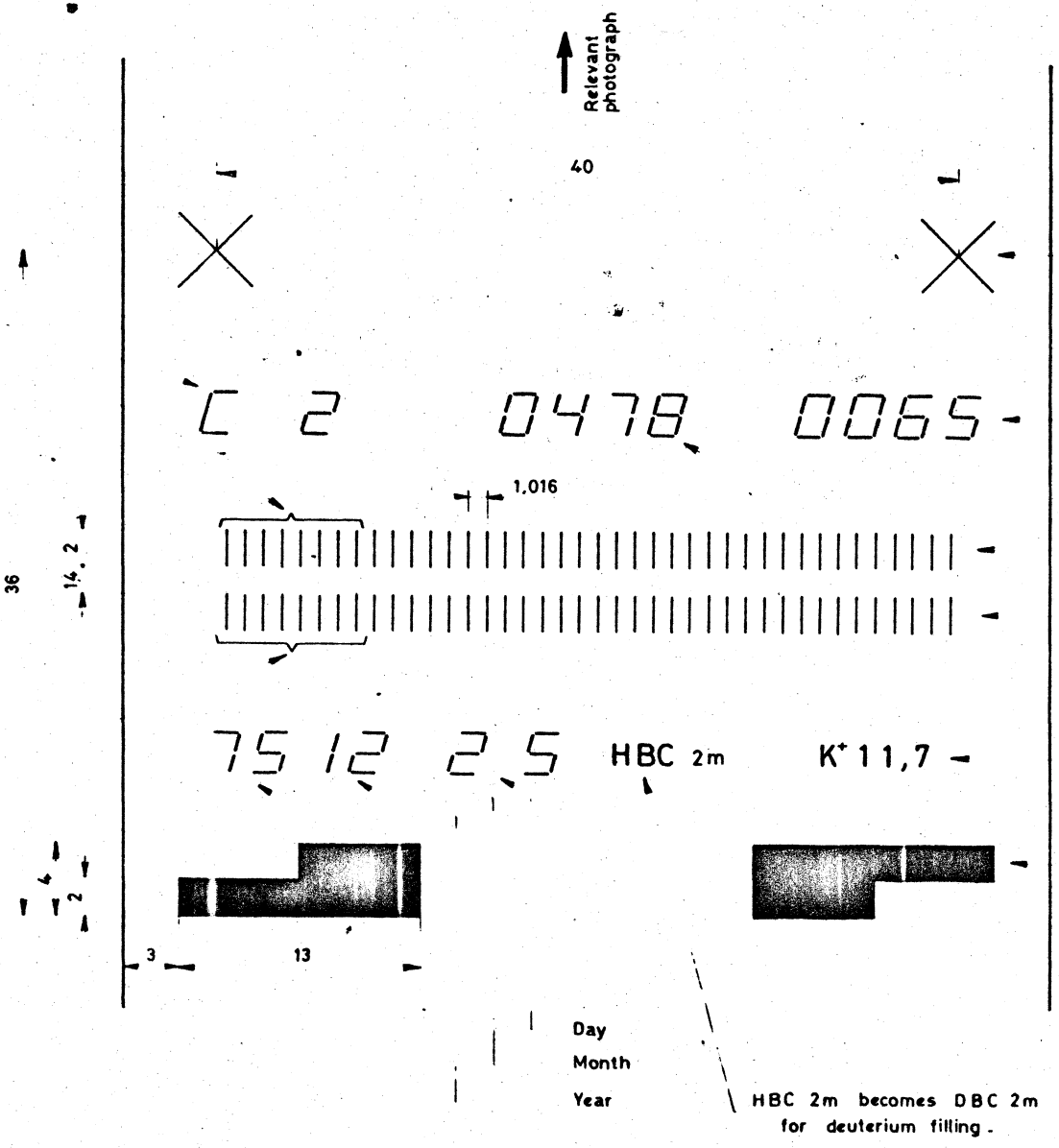
TABLE 1

DECIMAL	BINARY
1	1 1 1 0 0 0 0 1
2	1 1 0 1 0 0 1 0
3	0 0 1 1 0 0 1 1
4	1 0 1 1 0 1 0 0
5	0 1 0 1 0 1 0 1
6	0 1 1 0 0 1 1 0
7	1 0 0 0 0 1 1 1
8	0 1 1 1 1 0 0 0
9	1 0 0 1 1 0 0 1
0	1 0 1 0 1 0 1 0

The parity code is " single error correcting and double error detecting" and there are four bits illuminated in the representation of each decimal digit. Thus a quick check of the data box is possible : there should be 16 of the 32 photo number bits and 16 of the 32 roll number bits illuminated on each photograph.

Similary four bits in both the view number and the expansion number should be illuminated.

Valid from
27.2.1976 onward
(period 1048)



NOTE: *Dimensions are nominal.*

DATABOX HBC 2000 / DBC 2000
2m HBC. FAST DATABOX IMAGE ON FILM.
51

CERN LAB 1 TC 39-562-2C

Section : OPTICS

Date : 12.9.1975

B 002 A

Fig.3 : Distribution of film

Valid from 16.3.1974 onwards
(period 1035)

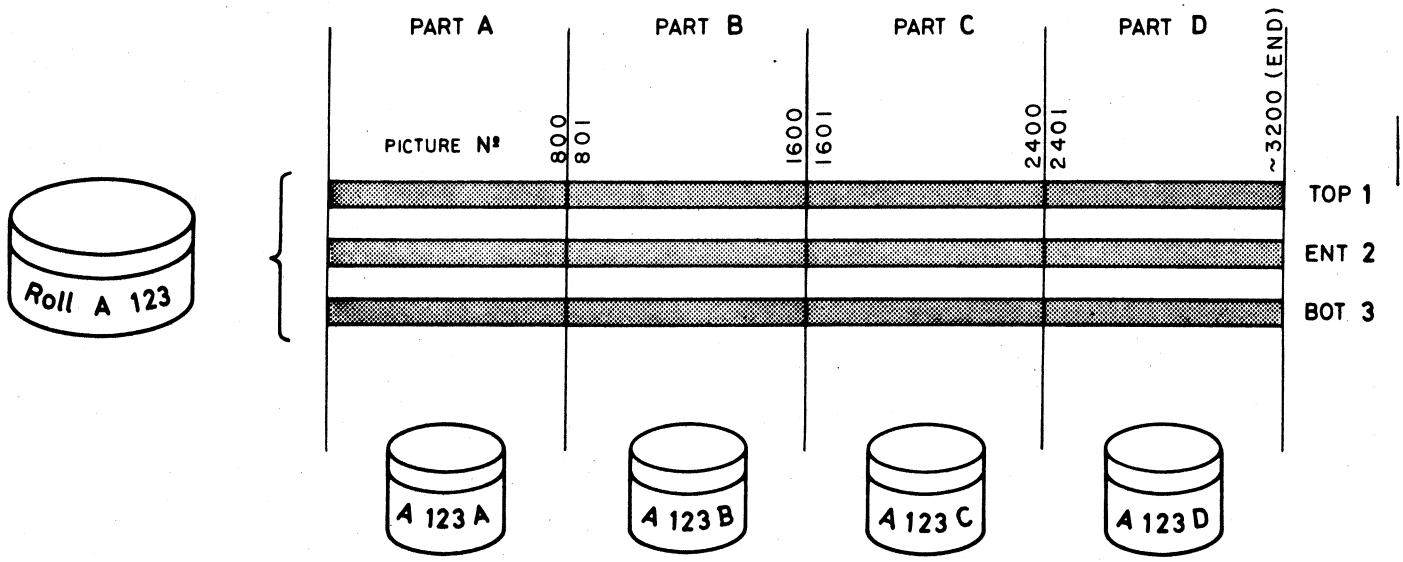


Fig. 3

Section : OPTICS

Date : 10.3.1970

B 003

Camera plate and objectives

1) The camera plate carries 3 objectives and 2 precise locations for the alignment telescope (A and B). A third telescope location (C) is at the place of the former camera "exit",but it is not precisely fixed to the camera plate.

Coordinates of objectives 1,2,3 and telescope locations A,B,C are given in a system with origin at the circumcentre of the camera triangle and x-axis through camera 2.

		x(mm)	y(mm)
Objective	1	+ 131.66	+ 289.98
	2	- 318.40	0.00
	3	+ 131.64	- 289.98
Telescope	A	- 428.35	+ 229.99
	B	- 428.41	- 230.01
	C	≃ + 270	≃ 0

precision $\pm$ 0.10 mm

2) The objectives are of the type Schneider Symmar 5.6/180 working at f/32. Their focal lengths are :

Camera 1 (top) : f = 181.5mm
Camera 2 (entry) : f = 182.5mm
Camera 3 (bottom) : f = 183.0mm

The geometrical distance from the principal planes of the objectives to the reference plane (plane 2) is about 2430 mm.

The optical axes of the objectives are perpendicular to the reference plane within 0.5 mrad.

The film planes are parallel to the reference plane within 0.5 mrad.

Section : OPTICS
Date : 12.9.1975

B 003 A

Valid from 9.6.1975 onwards
(period 1021)

Camera plate and objectives

1) The camera plate carries 3 objectives and 2 precise locations for the alignment telescope (A and B). A third telescope location (C) is at the place of the former camera "exit",but it is not precisely fixed to the camera plate.

Coordinates of objectives 1,2,3 and telescope locations A,B,C are given in a system with origin at the circumcentre of the camera triangle and x-axis through camera 2.

		x(mm)	y(mm)
Objective	1	+ 131.66	+ 289.98
	2	- 318.40	0.00
	3	+ 131.64	- 289.98
Telescope	A	- 428.35	+ 229.99
	B	- 428.41	- 230.01
	C	≃ + 270	≃ 0

precision $\pm$ 0.10 mm

2) The objectives are of the type Schneider Symmar 5.6/180 working at f/22. Their focal lengths are :

Camera 1 (top) : f = 181.5mm
Camera 2 (entry) : f = 182.5mm
Camera 3 (bottom) : f = 183.0mm

The geometrical distance from the principal planes of the objectives to the reference plane (plane 2) is about 2430 mm.

The optical axes of the objectives are perpendicular to the reference plane within 0.5 mrad.

The film planes are parallel to the reference plane within 0.5 mrad.

Section : OPTICS

Date : 10.3.1970

B 004

Lens distortions

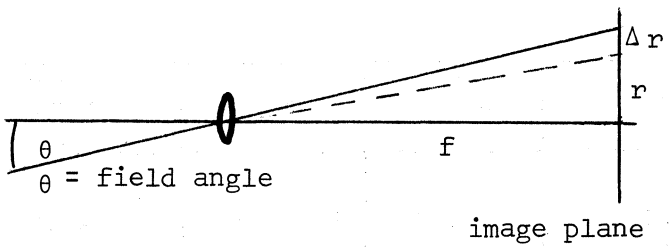
Detailed measurements of lens distortions have been made by the "Physikalisch Technische Bundesanstalt", Braunschweig (Germany) on the objectives used on the 2m chamber. All objectives have been measured for field angles up to 25° and the azimuth angles 0°, 60°, -- up to 300°. The results for different azimuth angles agree within the errors, therefore average values have been used for the following analysis.

a) Measured distortions

field angle (degrees)	Δr/r (o/oo) TOP	Δr/r (o/oo) ENTRY	Δr/r (o/oo) BOTTOM	error (o/oo)
4.88	+ 0.10	+ 0.10	+ 0.04	0.09
9.63	+ 0.27	+ 0.28	+ 0.21	0.04
14.67	+ 0.53	+ 0.61	+ 0.50	0.03
19.60	+ 0.92	+ 1.10	+ 0.85	0.02
25.22	+ 1.59	+ 1.87	+ 1.43	0.01

Positive Δr/r corresponds to displacement of image away from optic axis.

The errors correspond to a measurement precision of 1-2μ on the film and are due to instabilities in the set up, non-flatness of film, angular deviation of optic axis, etc.



The measurements were made at f/32 and with a demagnification m = 13.5

b) Fit to distortions

The lens distortions have been fitted by the following expression :

$$\frac{\Delta r}{r} = \alpha_1 \tan^2\theta + \alpha_2 \tan^4\theta + \alpha_3 \tan^6\theta$$

$$\tan\theta = r/f$$

Camera	fit	α_1	α_2	α_3	$\frac{\Sigma(res)^2}{6 - NPAR}$
TOP	1 par.	+ 0.00720	-	-	228.6
	2 par.	+ 0.00764	- 0.00215	-	162.2
	3 par.	+ 0.00920	- 0.02387	+ 0.06628	49.7
ENTRY	1 par.	+ 0.00848	-	-	200.7
	2 par.	+ 0.00907	- 0.00290	-	27.9
	3 par.	+ 0.00953	- 0.00931	+ 0.01956	22.7
BOTTOM	1 par.	+ 0.00651	-	-	319.8
	2 par.	+ 0.00724	- 0.00361	-	53.1
	3 par.	+ 0.00816	- 0.01630	+ 0.03872	14.0

We have also fitted the 3 lenses simultaneously to the formula :

$$\frac{\Delta r}{r} = \alpha_1 \tan^2\theta \,(1 + \beta_1 \tan^2\theta + \beta_2 \tan^4\theta)$$

with β_1 and β_2 common to all lenses. This fit may be useful if one does not want to introduce too many terms into fiducial reconstruction or geometry programs. The results of this fit were :

Camera	α_1	β_1	β_2	$\frac{\Sigma(res)^2}{13}$
TOP	+0.00867			
ENTRY	+0.01022	- 1.783	+ 4.472	46.8
BOTTOM	+0.00784			

Section : OPTICS

Date : 16.10.1972

C 001

valid from 8.6.1972 onwards
(period 1021)

Small Chamber Windows

Each camera and telescope looks through a set of three small windows (glass Schott BK7). Two windows are mounted on the vacuum tank and are at ambient temperature and the third window is in the cold tank at about liquid temperature (see CHAMBER/A for more details).

The light deflection of any **single window** (due to wedge angle, surface defects, etc.) is below **0.1 mrad.**

1) Small telescope windows :

1.1. Light deflection : angle α in telescope readings

	horizontal	vertical
telescope A	+ 2 seconds	- 1 seconds
telescope B	+ 1 seconds	- 3 seconds

positive angles indicate deflections to the right or upwards.

1.2. Total thickness : not needed, since telescope axes are parallel to optical axis within 0.5 mrad.

2) Small camera windows :

2.1. Light deflection : not needed, since it is taken into account in the reconstruction of camera positions.

2.2. Total thickness : (at 20° C)

Camera 1 (TOP) : 74.63 ± 0.05 mm
Camera 2 (ENTRY) : 75.02 ± 0.05 mm
Camera 3(BOTTOM) : 75.01 ± 0.05 mm

From these values 0.03 mm should be subtracted to account for the contraction of the third window at chamber operating conditions.

Section : OPTICS

Date : 21.1.1971

C 001

valid from 21.1.1971 onwards (period 1008)

Small Chamber Windows

Each camera and telescope looks through a set of three small windows (glass Schott BK7). Two windows are mounted on the vacuum tank and are at ambient temperature and the third window is in the cold tank at about liquid temperature (see **CHAMBER**/A for more details).

The light deflection of any single window (due to wedge angle, surface defects, etc.) is below 0.3 ± 0.1 mrad. In general these windows are mounted in such a way that the systematic deflections partly compensate each other.

1) Small telescope windows :

1.1. Light deflection : angle α in telescope readings

	horizontal	vertical
telescope A	- 10 seconds	- 5 seconds
telescope B	+ 5 seconds	+ 5 seconds

positive angles indicate deflections to the right or upwards.

1.2. Total thickness : not needed, since telescope axes are parallel to optical axis within 0.5 mrad.

2) Small camera windows :

2.1. Light deflection : not needed, since it is taken into account in the reconstruction of camera positions.

2.2. Total thickness : (at 20° C)

Camera 1 (TOP) : 74.99 ± 0.05 mm
Camera 2 (ENTRY) :75.54 ± 0.05 mm
Camera 3(BOTTOM) :75.59 ± 0.05 mm

From these values 0.03 mm should be subtracted to account for the contraction of the third window at chamber operating conditions.

Section : OPTICS

Date : 12.9.1975

C 001 A

valid from 21.1.1971 onwards (period 1008)

Small Chamber Windows

Each camera and telescope looks through a set of three small windows (glass Schott BK7). Two windows are mounted on the vacuum tank and are at ambient temperature and the third window is in the cold tank at about liquid temperature (see **CHAMBER**/A for more details).

The light deflection of any single window (due to wedge angle, surface defects, etc.) is below 0.3 ± 0.1 mrad. In general these windows are mounted in such a way that the systematic deflections partly compensate each other.

1) Small telescope windows :

1.1. Light deflection : angle α in telescope readings

	horizontal	vertical
telescope A	- 10 seconds	- 5 seconds
telescope B	+ 5 seconds	+ 5 seconds

positive angles indicate deflections to the right or upwards.

1.2. Total thickness : not needed, since telescope axes are parallel to optical axis within 0.5 mrad.

2) Small camera windows :

2.1. Light deflection : not needed, since it is taken into account in the reconstruction of camera positions.

2.2. Total thickness : (at 20° C)

Camera 1 (TOP) : 74.99 ± 0.05 mm
Camera 2 (ENTRY) :75.54 ± 0.05 mm
Camera 3(BOTTOM) :75.59 ± 0.05 mm

From these values 0.03 mm should be subtracted to account for the contraction of the third window at chamber operating conditions.

Section : OPTICS

Date : 12.9.1975

C 001 B

valid from 8.6.1972 onwards (period 1021)

Small Chamber Windows

Each camera and telescope looks through a set of three small windows (glass Schott BK7). Two windows are mounted on the vacuum tank and are at ambient temperature and the third window is in the cold tank at about liquid temperature (see **CHAMBER/A** for more details).

The light deflection of any **single window** (due to wedge angle, surface defects, etc.) is below **0.1 mrad.**

1) Small telescope windows :

1.1. Light deflection : angle α in telescope readings

	horizontal	vertical
telescope A	+ 2 seconds	- 1 seconds
telescope B	+ 1 seconds	- 3 seconds

positive angles indicate deflections to the right or upwards.

1.2. Total thickness : not needed, since telescope axes are parallel to optical axis within 0.5 mrad.

2) Small camera windows :

2.1. Light deflection : not needed, since it is taken into account in the reconstruction of camera positions.

2.2. Total thickness : (at 20° C)

Camera 1 (TOP) : 74.63 ± 0.05 mm
Camera 2 (ENTRY) : 75.02 ± 0.05 mm
Camera 3(BOTTOM) : 75.01 ± 0.05 mm

From these values 0.03 mm should be subtracted to account for the contraction of the third window at chamber operating conditions.

Section : OPTICS

C 002 A

Date : 12.9.1975

Valid from 28.6.1975 onwards
(period 1045)

Large Chamber Windows

1) Camera Window (Window No. 2)

This window, unlike its predecessor, is made of borosilicate crown glass Schott BK7. It is the old pre-1970 window ground down and re-etched with fiducials. Due to a chip in camera window No. 4 it was necessary to replace it with this new glass. See CERN report D.PH.II/200 75-1 (July 17, 1975) for further details as to how and why the window was changed.

Dimensions :	length	: 2170.1 mm
	width	: 771.3 mm
	thickness	: 169.5 ± 0.1mm
Density (g/cm^3)		: 2.51
Refractive index (4450 Å)		: 1.5258

all values at 20° C

The window is slightly prestressed in order to increase its mechanical strength. Internal stresses, lack of surface flatness and non-uniform refractive index deflect light rays passing through the window. The integral effect of all these defects is smaller than 0.02± 0.01 mrad for any light ray passing through the free area of the window, the angle of incidence being less than 30° from the normal.

This is the upper limit of random light deflections. The two window surfaces are parallel within errors, therefore no systematic light deflection has to be taken into account.

The fiducial marks etched on this window are described in section OPTICS/D 002A, page 1.

2) Flash Window (Window No. 3)

This window is made of borosilicate crown glass Schott BK7

Dimensions :	length	:	2171.5 mm
	width	:	772.0 mm
	thickness	:	166.60 $\pm$ 0.02 mm
Density (g/cm^3)		:	2.51
Refractive index (4450 Å)		:	1.5258

All values at 20° C

The fiducial marks etched on this window are described in section OPTICS/D 002, page 2.

Section : OPTICS
Date : 10.3.1970

C 002

Large Chamber Windows

1) Camera Window (Window No. 4)

This window is made of borosilicate crown glass Schott K50. It is of slightly different composition and has improved properties compared with Schott BK7.

Dimensions :	length	:	2170.1 mm
	width	:	771.3 mm
	thickness	:	170.50 ± 0.04 mm
Density (g/cm^3)		:	2.62
Refractive index (4450 Å)		:	1.5324

all values at 20° C

The window is slightly prestressed in order to increase its mechanical strength. Internal stresses, lack of surface flatness and non-uniform refractive index deflect light rays passing through the window. The integral effect of all these defects is smaller than 0.02 ± 0.01 mrad for any light ray passing through the free area of the window, the angle of incidence being less than 30° from the normal.

This is the upper limit of random light deflections. The two window surfaces are parallel within errors, therefore no systematic light deflection has to be taken into account.

The fiducial marks etched on this window are described in section OPTICS/D 002, page 1.

2) Flash Window (Window No. 3)

This window is made of borosilicate crown glass Schott BK7.

Dimensions :	length	:	2171.5 mm
	width	:	772.0 mm
	thickness	:	166.60 $\pm$ 0.02 mm
Density (g/cm^3)		:	2.51
Refractive index (4450 Å)		:	1.5258

All values at 20° C

The fiducial marks etched on this window are described in section OPTICS/D 002, page 2.

Section : OPTICS

Date : 12.9.1975

C 003

Chamber Windows

(Miscellaneous Data)

1) Refractive Index of Glass

Precise data at cryogenic temperatures are not available. When glass is cooled the refractive index decreases until a minimum is reached, which is at about 200° K for borosilicate crown glass. The refractive index then rises again and, at 77° K, is almost equal to the value at room temperature. (For further reference see : F.A. Molby, Journal of the Optical Society of America, 39, (1949), 600).

It is therefore suggested that one may use the room temperature values at chamber operating conditions:

$n = 1.5324 \pm 0.0003$ for K 50 (But see paragraph 3)
$n = 1.5258 \pm 0.0003$ for BK 7

2) Thermal Contraction of Glass

The integral thermal contraction of borosilicate crown glass (K50 and BK7) when cooled from room temperature to chamber operating conditions (26° K for H_2, 31° K for D_2) :

$$\frac{L\,(293^\circ\,K) - L\,(\sim 30^\circ\,K)}{L\,(293^\circ\,K)} = (1.28 \pm 0.04) \times 10^{-3}$$

3) Correction to refractive index of K50 glass at low temperatures

When fitting in Python (CERN's geometry title producing program), it was noticed that by using the quoted value of index of refraction for K50 glass the plane 3 fiducials were systematically shifted by nearly a millimeter toward the cameras. By increasing the refractive index value from 1.5324 to 1.5375 it was found that these fiducials were reconstructed in their expected plane. It is therefore possible that the quoted value of refractive index is wrong and that one is better off using the 1.5375 value if one believes in the accuracy of the other chamber parameters - like depth of chamber, etc. No such problem has been observed with the BK7 glass so one may safely continue to use the value quoted in paragraph 1 above.

Section : OPTICS

Date : 10.3.1970

D 001

Fiducial Marks

Fiducial marks are etched on three different window faces : the outer face of the camera window (plane 1), the inner face of the camera window (plane 2, in contact with liquid), and the inner face of the flash window (plane 3, in contact with liquid). See OPTICS /A 001 for reference.

All crosses are etched with hydrofluoric acid which has the advantage of not reducing the mechanical strength of the glass as do scratches and sharp holes in the surface. Each cross is composed of many circular holes, but individual holes are normally not resolved by the camera objectives at f/32, thus giving continuous lines.

Holes etched into glass BK7 are shallow and smooth and have a light scattering characteristic similar to that of bubbles (that means, light is scattered from a small region only). Holes etched into glass K50 look like small craters with many irregularities, therefore light is scattered more uniformly from the whole region.

The arms of all fiducial crosses form angles of about 45° with respect to the reference coordinate system. This should facilitate measurements by automatic measuring devices. Crosses on the 3 planes are different in shape to make their identification on the pictures easier.

Each fiducial mark is labelled with a 2-digit number, which can be used directly for standard labelling conventions of measuring machines and reconstruction programs.

Section : OPTICS

Date : 12.9.1975

D 002 A

Fiducial Marks

(Coordinates and Size)

Valid from 28.6.1975 onwards
(period 1045)

1) Camera Window (Window No. 2)

	Fiducial Mark	x (mm)	y (mm)
Plane 1	11	-360.49	229.97
	12	-361.14	-229.86
	13	-0.37	0.52
	14	334.41	-0.49
	15	559.46	194.43
	16	559.58	-194.64
alignment)	18	-360.85	300.23
crosses)	19	559.09	299.85
Plane 2	21	-650.44	0.35
	22	-525.27	195.30
	23	-524.75	-195.35
	24	-360.02	0.45
	25	-169.65	145.33
	26	-169.68	-195.35
	27	-20.51	0.53
	28	150.32	145.28
	29	150.35	-195.08
	30	434.72	194.83
	31	435.31	-144.86
	32	560.01	0.27
	33	684.71	144.73
	34	685.34	-144.87
	35	774.50	-0.41
alignment)	38	-360.20	300.00
crosses)	39	559.74	299.74

For details on how these coordinates were obtained see CERN report D.PH.II/200 75-1 (July 17,1975). The values quoted here are in the same reference system as the one used on the previous window, thus facilitating comparisons between the two sets.

All values measured at $22^{o} \pm 2^{o}$ C; error ± 0.030mm.

2) Flash Window (window No. 3)

	Fiducial Mark	x (mm)	y (mm)
Plane 3	41	0.000	0.000
	42	290.195	230.056
	43	290.128	- 229.983
	44	639.994	0.002
	45	985.130	195.017
	46	985.095	0.000
	47	985.120	- 229.959
	48	1320.019	229.967
	49	1319.942	- 230.034

All coordinates are given in a system with arbitrary origin at fiducial mark No. 41.

All values measured at $20^{\circ} \pm 3^{\circ}$ C ; error $\pm$ 0.050 mm.

3) Size of Fiducial Marks (nominal value in mm)

	Shape of crosses as seen from cameras	small crosses	large crosses
Plane 1		21.0 x 13.5	--
Plane 2		16.5 x 16.5	--
Plane 3		25.5 x 16.5	42.0 x 27.4

Section : OPTICS
Date : 12.9.1975

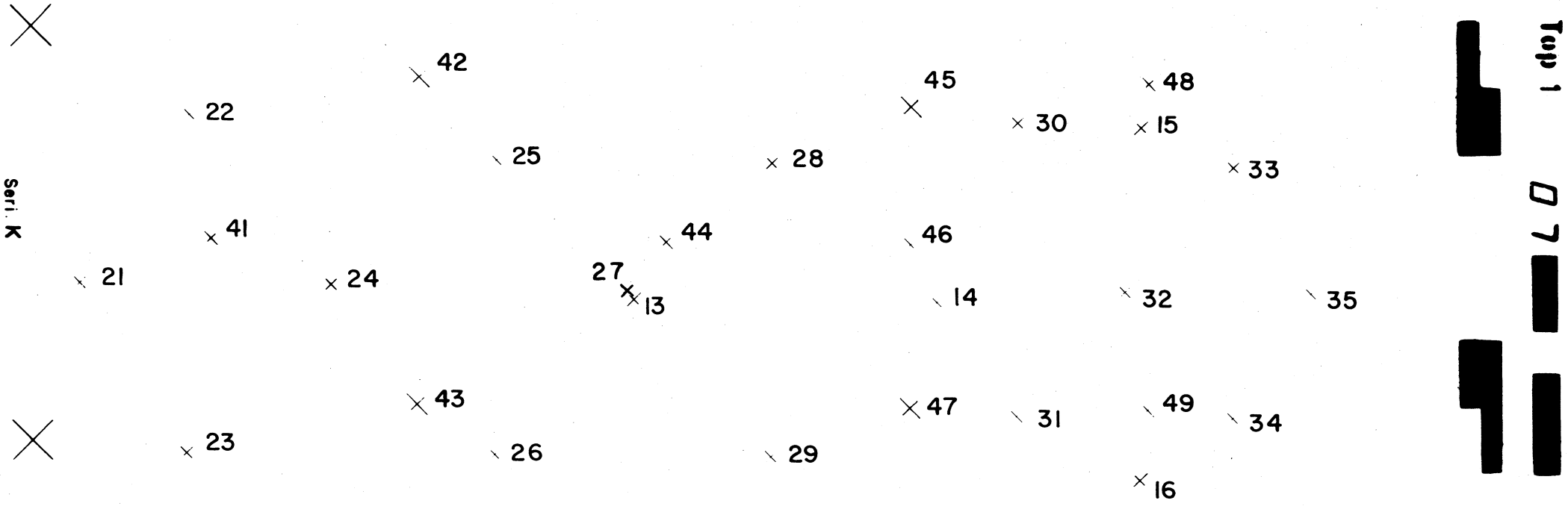
D 002 A

Fiducial marks

(as seen from cameras)

Valid from 28.6.1975 onwards
(period 1045)

Camera 1 : (Top)

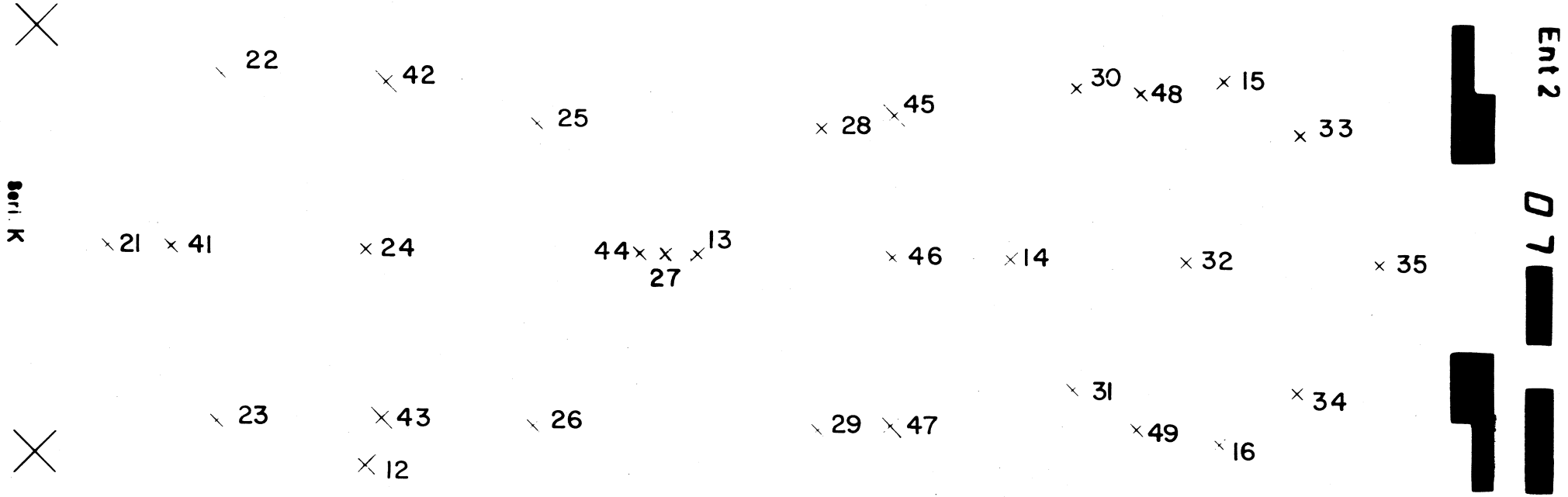


Section : OPTICS
Date : 12.9.1975

D 002 A

Fiducial marks

Camera 2 : (Entry) (as seen from cameras) Valid from 28.6.1975 onwards (period 1045)



Section : OPTICS
Date : 12.9.1975

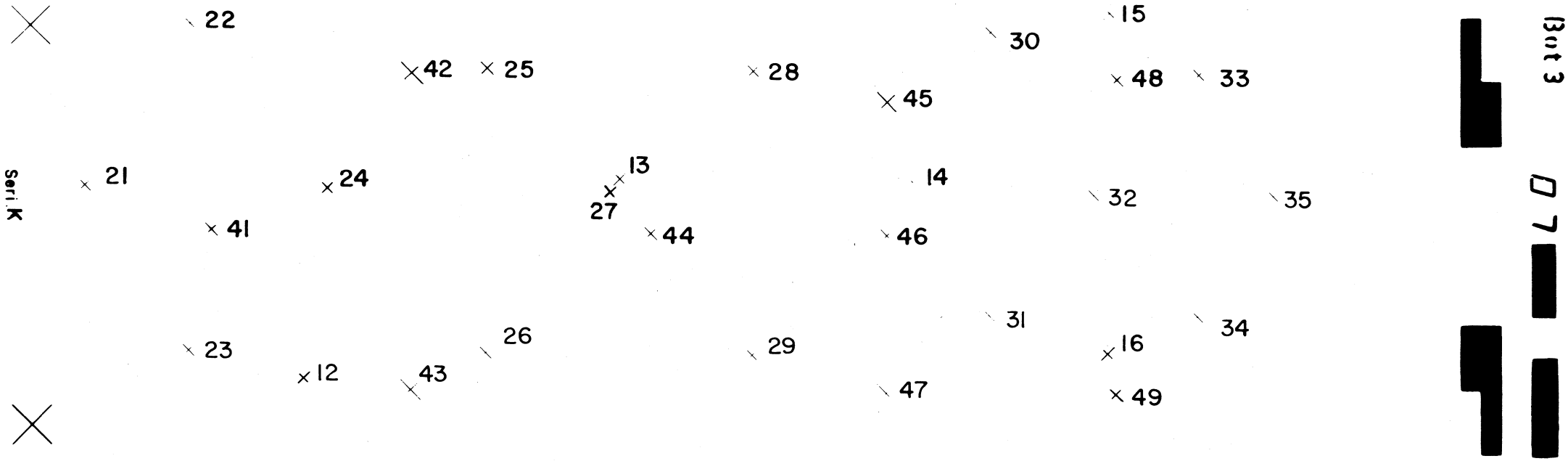
D 002 A

Fiducial marks

Camera 3 : (Bottom)

(as seen from cameras)

Valid from 28.6.1975 onwards
(period 1045)



Section : OPTICS

Date : 10.3.1970

D 002

Fiducial Marks

(Coordinates and Size)

1) Camera Window (Window No. 4)

	Fiducial Mark	x (mm)	y (mm)
Plane 1	11	- 359.776	230.183
	12	- 359.677	- 229.867
	13	0.283	0.297
	14	335.330	0.493
	15	560.240	195.602
	16	560.399	- 194.392
alignment)	18	- 359.853	300.020
crosses)	19	560.077	300.418
Plane 2	21	- 649.960	0.109
	22	- 524.966	195.092
	23	- 525.051	- 194.921
	24	- 359.970	0.063
	25	- 169.985	144.981
	26	- 170.091	- 195.009
	27	0.000	0.000
	28	149.998	145.023
	29	149.976	- 194.974
	30	435.024	194.985
	31	434.972	- 144.985
	32	559.970	0.021
	33	684.968	144.964
	34	684.959	- 144.973
	35	774.963	0.000
alignment)	38	- 359.863	299.996
crosses)	39	560.040	299.968

All coordinates are given in a system with arbitrary origin at fiducial mark No. 27.

All values measured at $22^{\circ} \pm 2^{\circ}$ C; error $\pm$ 0.050 mm

2) Flash Window (window No. 3)

	Fiducial Mark	x (mm)	y (mm)
Plane 3	41	0.000	0.000
	42	290.195	230.056
	43	290.128	- 229.983
	44	639.994	0.002
	45	985.130	195.017
	46	985.095	0.000
	47	985.120	- 229.959
	48	1320.019	229.967
	49	1319.942	- 230.034

All coordinates are given in a system with arbitrary origin at fiducial mark No. 41.

All values measured at $20^{\circ} \pm 3^{\circ}$ C ; error $\pm$ 0.050 mm.

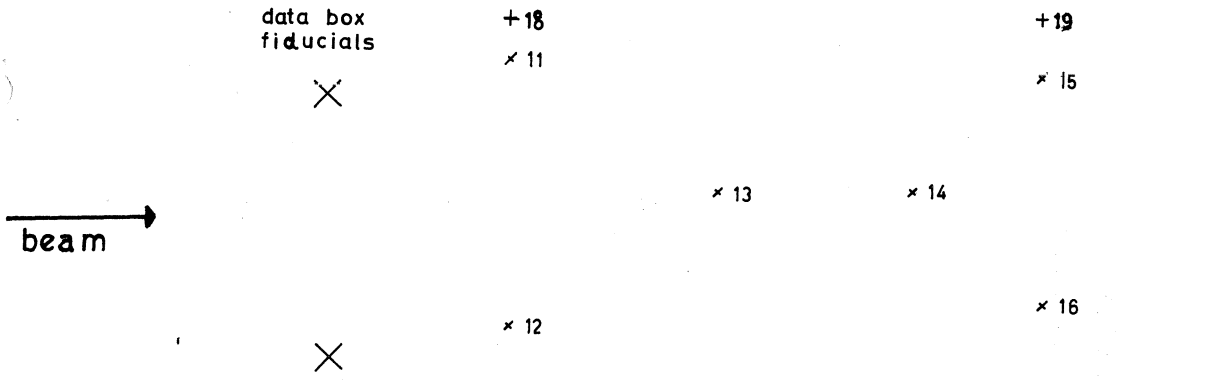
3) Size of Fiducial Marks (nominal value in mm)

	Shape of crosses as seen from cameras	small crosses	large crosses
Plane 1		21.0 x 13.5	--
Plane 2		16.5 x 16.5	28.5 x 28.5
Plane 3		25.5 x 16.5	42.0 x 27.4

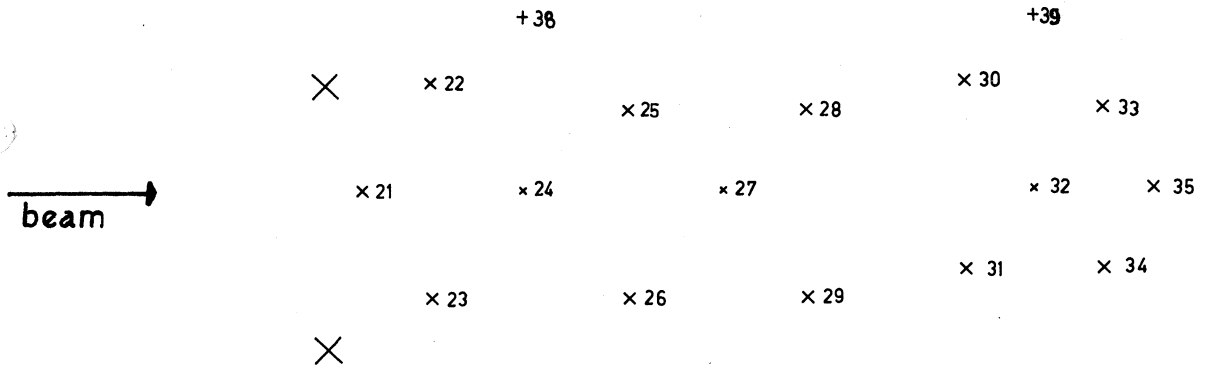
Fiducial marks

(position on fiducial planes)

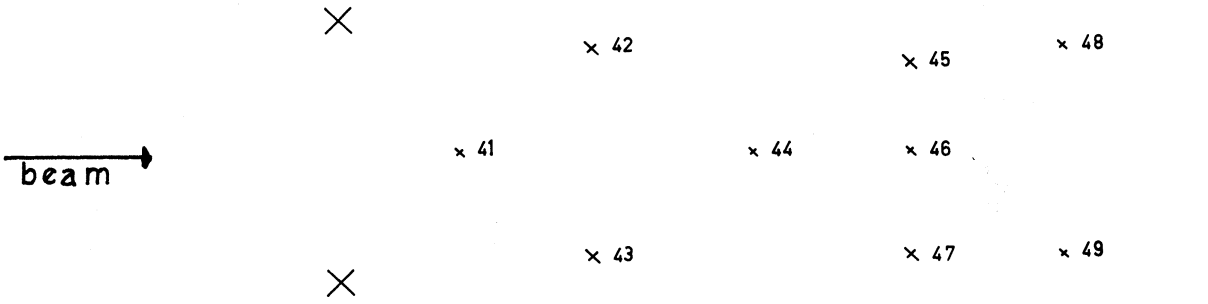
Plane 1 : (front face of camera window (facing cameras)



Plane 2 : (back face of camera window (in contact with liquid)



Plane 3 (front face of flash window (in contact with liquid)

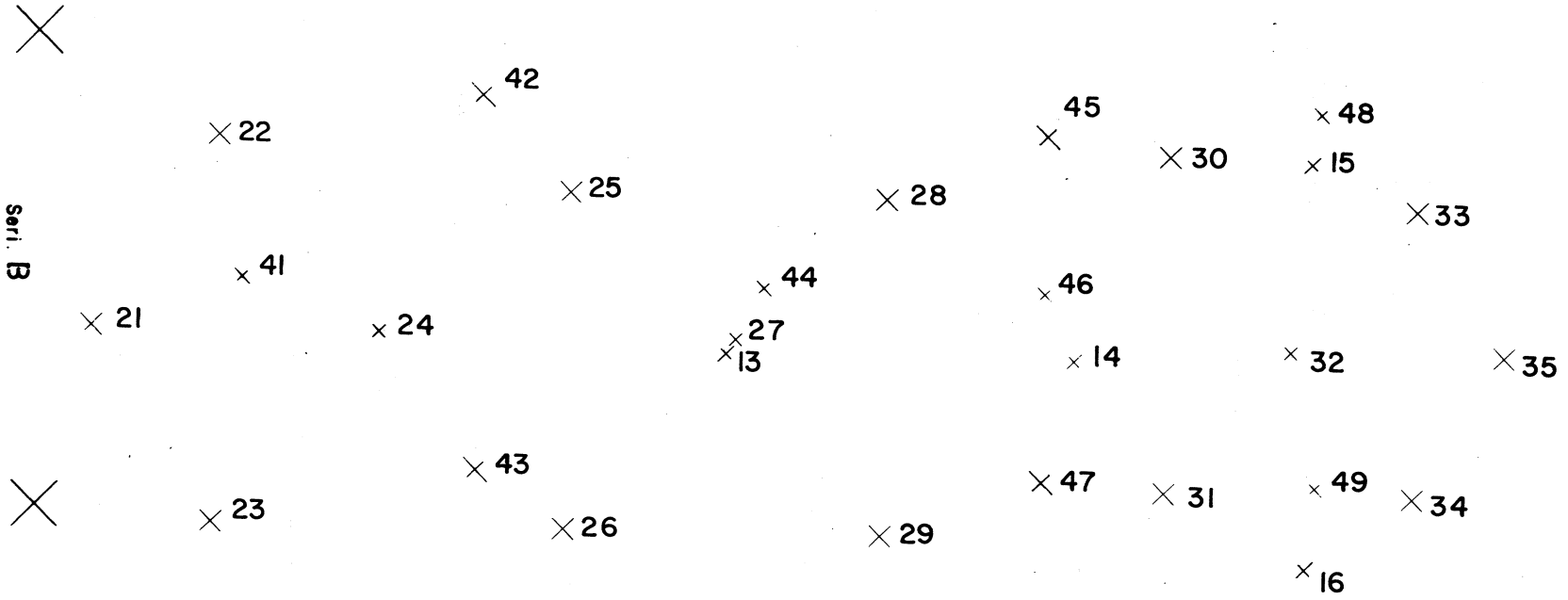


Section : OPTICS
Date : 10.3.1970

Fiducial marks

(as seen from cameras)

Camera 1 : (Top)



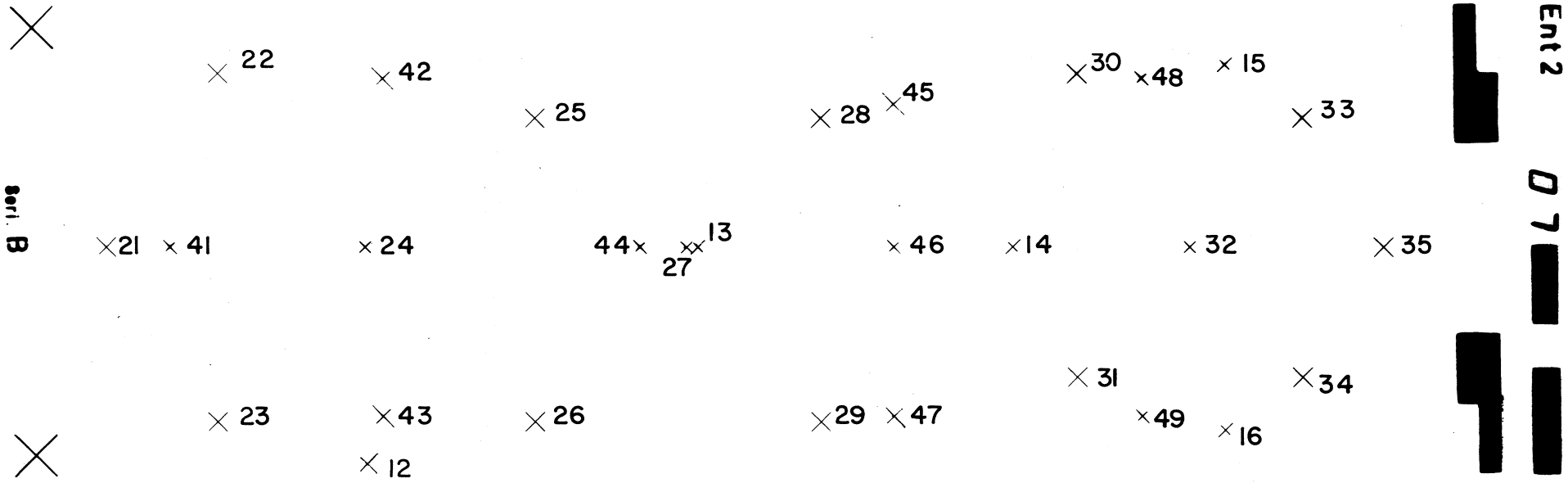
Section : OPTICS
Date : 10.3.1970

D 002

Fiducial marks

(as seen from cameras)

Camera 2 : (Entry)

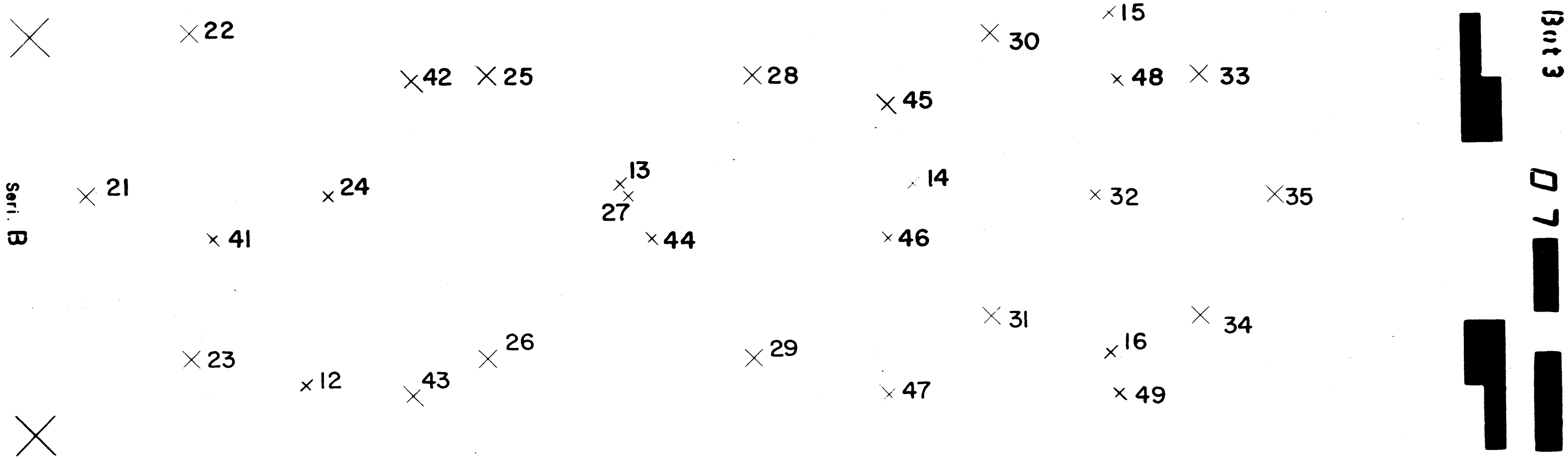


Section : OPTICS
Date : 10.3.1970

D 002
page 6

Fiducial marks
(as seen from cameras)

Camera 3 : (Bottom)



Section : OPTICS
Date : 12.9.1975

E 001 A

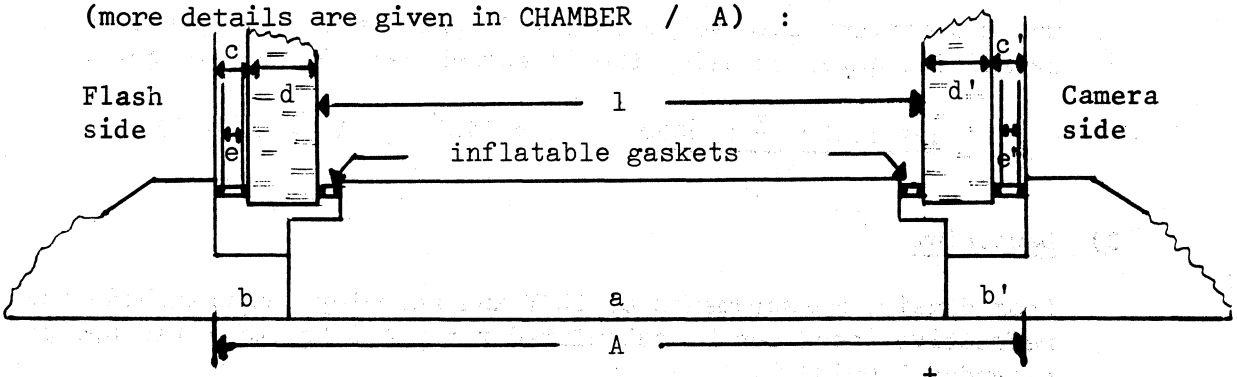
Valid from 28.6.1975 onwards
(period 1045)

Chamber

1) Depth of Chamber

The depth of the cold and filled chamber cannot be measured directly. It has to be calculated from measurements of the chamber body and the glass windows at ambient temperature, taking into account thermal contraction of steel and glass and also the crushing of the indium pads. The latter can only be measured after complete dismantling of the chamber. The best possible estimate at present is 1.6 mm total thickness of indium, but one does not know how the chamber depth varies in time during several months of operation.

The chamber depth can be calculated from the following values (more details are given in CHAMBER / A) :



dimensions : $A = a + b + b'$ $= 880.0 \pm 0.21$ mm (steel)
$D = d + d'$ (169.5, 166.6) $= 336.1 \pm 0.14$ mm (glass)
$E = e + e'$ (15.5, 18.3) $= 33.8 \pm 0.15$ mm (steel)
$F = c + c' - e - e'$ $= 1.6$ mm (crushed indium)

All values at 20° C

contraction: glass : 1.28×10^{-3}
steel : 2.96×10^{-3}
} total contraction from 20° C to about 30° K

The best values for the chamber depth are at present :

$l = 508.5 \pm 0.3$ mm (at 20° C)
$l = 506.4 \pm 0.3$ mm (at ~ 30° K)

The inner faces of the two large windows are parallel to each other within 0.2 ± 0.1 mrad. The deformation of the window by the chamber pressure is negligibly small. In the most unfavourable case the sagitta is 25 μ at 6 kg/cm^2 pressure difference across the window.

Chamber

2) Hydrogen

Data on the absolute refractive index of liquid hydrogen as a function of temperature are given by A.V. Belonogov and V.M. Gorbunkov, Pribory i teknika eksperimenta, 3, (1965), 188 and Cryogenics, Dec. 1965, 315. Unfortunately the pressures are not given explicitely. The measurements were probably made at the vapour pressure corresponding to the given temperatures.

For parahydrogen at $T = 26^{\circ}$ K ($p = 4$ kg/cm^3) and $\lambda = 4450$ Å they give $n = 1.1010 \pm 0.0003$.

One can convert this value to $p = 2$ kg/cm^3 absolute (pressure of expanded liquid) by using the Lorentz-Lorenz formula to get :

$$n = 1.1005 \pm 0.0003 \quad (T = 26^{\circ} \text{ K}, \ \lambda = 4450 \text{ Å})$$

3) Deuterium

From density measurements at DESY and Berkeley (unpublished) the refractive index can be calculated for $p = 3$ kg/cm^3 (pressure of expanded liquid) :

$$n = 1.1110 \pm \_\_\_\_\_ \quad (T = 31^{\circ} \text{ K}, \ \lambda = 4450 \text{ Å})$$

Section : OPTICS

Date : 10.3.1970

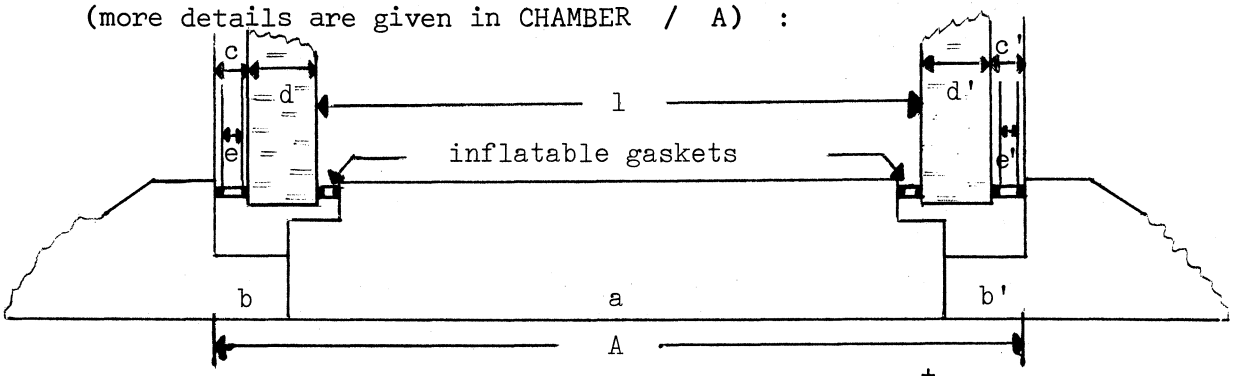
E 001

Chamber

1) Depth of Chamber

The depth of the cold and filled chamber cannot be measured directly. It has to be calculated from measurements of the chamber body and the glass windows at ambient temperature, taking into account thermal contraction of steel and glass and also the crushing of the indium pads. The latter can only be measured after complete dismantling of the chamber. The best possible estimate at present is 1.6 mm total thickness of indium, but one does not know how the chamber depth varies in time during several months of operation.

The chamber depth can be calculated from the following values (more details are given in CHAMBER / A) :



dimensions : $A = a + b + b'$ $= 880.0 \pm 0.21$ mm (steel)
$D = d + d'$ (170.5, 166.6) $= 337.1 \pm 0.07$ mm (glass)
$E = e + e'$ (15.5, 18.3) $= 33.8 \pm 0.15$ mm (steel)
$F = c + c' - e - e'$ $= 1.6$ mm (crushed indium)

All values at 20° C

contraction: glass : 1.28×10^{-3}
steel : 2.96×10^{-3}
} total contraction from 20° C to about 30° K

The best values for the chamber depth are at present :

$l = 507.5 \pm 0.3$ mm (at 20° C)
$l = 505.4 \pm 0.3$ mm (at ~ 30° K)

The inner faces of the two large windows are parallel to each other within 0.2 ± 0.1 mrad. The deformation of the window by the chamber pressure is negligibly small. In the most unfavourable case the sagitta is 25 μ at 6 kg/cm^2 pressure difference across the window.

Chamber

2) Hydrogen

Data on the absolute refractive index of liquid hydrogen as a function of temperature are given by A.V. Belonogov and V.M. Gorbunkov, Pribory i teknika eksperimenta, 3, (1965), 188 and Cryogenics, Dec. 1965, 315. Unfortunately the pressures are not given explicitely. The measurements were probably made at the vapour pressure corresponding to the given temperatures.

For parahydrogen at $T = 26^{\circ}$ K ($p = 4$ kg/cm^3) and $\lambda = 4450$ Å they give $n = 1.1010 \pm 0.0003$.

One can convert this value to $p = 2$ kg/cm^3 absolute (pressure of expanded liquid) by using the Lorentz-Lorenz formula to get :

$$n = 1.1005 \pm 0.0003 \quad (T = 26^{\circ}\text{ K}, \ \lambda = 4450\text{ Å})$$

3) Deuterium

From density measurements at DESY and Berkeley (unpublished) the refractive index can be calculated for $p = 3$ kg/cm^3 (pressure of expanded liquid) :

$$n = 1.1110 \pm \_\_\_\_\_ \quad (T = 31^{\circ}\text{ K}, \ \lambda = 4450\text{ Å})$$

TELESCOPE

2m USER'S HANDBOOK

Section :

Date : 16.10.1972

Please replace the following pages in your copy of the "2m USER'S HANDBOOK" :

a) section TELESCOPE, A001

b) section TELESCOPE, B001 - B019

Various tests were made with the telescope that is used for alignment of chamber windows. It was realized that the scale of the device was calibrated to indicate the tilt angle β of the normal of the reflecting surface if measured with autocollimation (telescope focussed at infinity). The method of autoreflection is used, however, to determine the alignment of the telescope axis (see section TELESCOPE). In this case the telescope reading just indicates $\beta/2$. Consequently, the angles β quoted on the sheets for telescope readings were just half the true values and the corrections for the coordinates of the telescope fiducial marks were too small.

We have studied the implications on track reconstruction by comparing individual tracks. A sample of 1000 events (all multiplicities) has been passed through THRESH with two geometry titles obtained with wrong and correct telescope values. The differences of $1/\varrho, \lambda, \varphi$ for individual tracks were plotted for different intervals of momentum.

NO difference could be seen. The mean values and RMS deviations for 4650 tracks are :

$$\Delta\, 1/\varrho \;:\; -0.000000 \pm 0.000004$$

$$\Delta\, \lambda \;:\; -0.000001 \pm 0.000019$$

$$\Delta\, \varphi \;:\; 0.000002 \pm 0.000048$$

This is not surprising because the small translation of the windows, introduced by the wrong telescope readings, is compensated in PYTHON in the reconstruction of camera positions.

Section : TELESCOPE

Date : 16.10.1972

A 001

Telescope measurements

The position of the flash window and the camera plate relative to the reference system based on the camera window (z = 0 for the plane in contact with liquid) must be determined for the filled and cold chamber. This is done with an alignment telescope looking at the pairs of fiducial marks 11/42 and 12/43 (plane 1/plane 3).

The telescope can be mounted on the camera plate on two precision V-bearings. The optical axes are then perpendicular to the film planes and parallel to the optical axes of the cameras within 0.5 mrad. A precise measurement of the angle that the optical axis of the telescope makes with the normal to either plane 1 or plane 2 (reference plane) can then be done in the following way: a cross hair in front of the first telescope lens is illuminated and the telescope focussed to twice the distance from the plane (4700 mm and 4900 mm, respectively). The reflected image of the cross hair is seen and its displacement from the telescope axis can be measured, yielding an angular precision of 0.1 mrad. The angle β quoted in the telescope readings (section TELESCOPE/B...) is the true angle as quoted in the formulae and drawings.

The same procedure can also be used to check the parallelism of the flash window with respect to the reference plane by focussing at twice the distance to the flash window, but it is rather difficult to see the reflected image of the cross hair.

The x- and y- positions of the fiducial marks relative to the telescope axis can be measured by means of glass blocks with parallel surfaces in front of the alignment telescope. An inclination of the glass block relative to the telescope axis displaces the line of sight parallel to the optical axis. This displacement can be measured to $\pm$ 0.05mm in a coordinate system with axes parallel to the reference coordinate system within 0.5 mrad. The methods are illustrated in fig. 1.

These telescope readings have to be corrected for the effects of non-parallel planes for the various windows, as shown in Fig. 2. The integral deviation α is taken for the combined deflection of the light ray through the set of small telescope windows. Wedge angles ε_x (horizontal) and ε_y (vertical) are taken into account for the large camera window.

The formulae used for the calculation of these corrections are listed below.

Corrections for plane 1 : (fiducial marks 11 and 12)

$$\bar{x}\,(11) = \frac{x\,(11)}{\cos\,(\alpha + \beta - \varepsilon_x)} - a.\,\tan\,(\alpha + \beta - \varepsilon_x) - b.\,\tan\,(\beta - \varepsilon_x) \simeq$$

$$\simeq x\,(11) - a.\alpha - (a + b).\beta + (a + b).\,\varepsilon_x = x\,(11) + \Delta x\,(11)$$

$$\underline{\Delta x\,(11) = -\,a.\alpha - (a + b).\beta + (a + b).\,\varepsilon_x}$$

$$\bar{y}\,(11) \simeq y\,(11) - a.\alpha' - (a + b).\beta' + (a + b).\,\varepsilon_y = y(11) + \Delta y(11)$$

$$\underline{\Delta y\,(11) = -\,a.\alpha' - (a + b).\beta' + (a + b).\,\varepsilon_y}$$

Corrections for plane 3 : (fiducial marks 42 and 43)

$$\bar{x}\,(42) = \frac{x\,(42)}{\cos\,(\alpha + \beta - \varepsilon_x)} - a.\,\tan\,(\alpha + \beta - \varepsilon_x) - b.\,\tan\,(\beta - \varepsilon_x) -$$

$$- c.\,\tan\,\gamma \qquad - d.\,\tan\,\delta$$

$$\simeq x\,(42) - a.\alpha - \left(a + b + \frac{c}{n_G} + \frac{d}{n_H}\right).\beta + \left(a + b + \frac{c}{n_G} + \frac{d}{n_H}\right).\varepsilon_x$$

$$= x\,(42) + \Delta x\,(42)$$

$$\underline{\Delta x\,(42) = \Delta x\,(11) - \left(\frac{c}{n_G} + \frac{d}{n_H}\right).\,\beta + \left(\frac{c}{n_G} + \frac{d}{n_H}\right).\varepsilon_x}$$

$$\bar{y}\,(42) \simeq y\,(42) - a.\alpha' - \left(a + b + \frac{c}{n_G} + \frac{d}{n_H}\right).\beta' + \left(a + b + \frac{c}{n_G} + \frac{d}{n_H}\right).\varepsilon_y$$

$$= y\,(42) + \Delta y\,(42)$$

$$\underline{\Delta y\,(42) = \Delta y\,(11) - \left(\frac{c}{n_G} + \frac{d}{n_H}\right).\beta' + \left(\frac{c}{n_G} + \frac{d}{n_H}\right).\,\varepsilon_y}$$

n_G : refractive index of glass

n_H : refractive index of liquid

$\Delta x > 0$: correction consists of a shift towards the right
$\Delta y > 0$: correction consists of a shift upwards

Angles α and β are given as seen from telescope positions A or B (opposite to sign of telescope reading). They can directly be inserted into the formulae without change of sign.

From measurements of the angles β at planes 1 and 2 one can determine the wedge angles ε. Since these angles are very small they have been averaged over many independent readings to compensate for random measurement errors.

The following values are used for calculations :

a	=	200 mm	
b	=	2050 mm	
c	=	169.3 mm	(OPTICS/ C 002A)
d	=	506.4 mm	(OPTICS/ E 001A)
n_G	=	1.53 mm	(OPTICS/ C 003)
n_H	=	1.10 or 1.11	(OPTICS/ E 001)
α, α'	=		(TELESCOPE /B)
β, β'	=		
$\varepsilon_x, \varepsilon_y$	=		

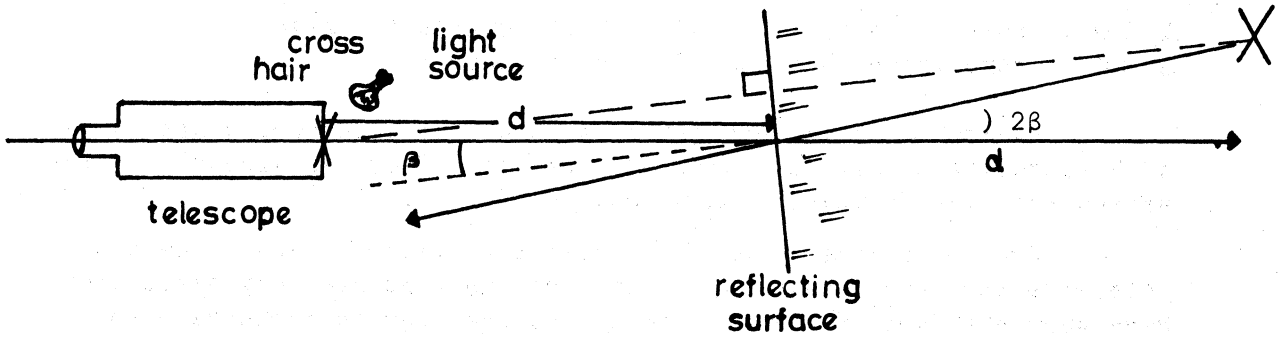
Section : TELESCOPE

Date : 16.10.1972

A 001

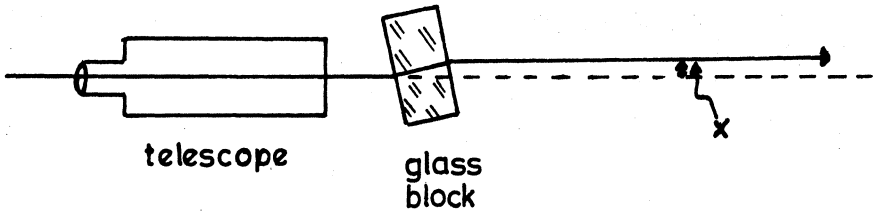
Fig. 1 : TELESCOPE MEASUREMENTS

a) measurement of angles :

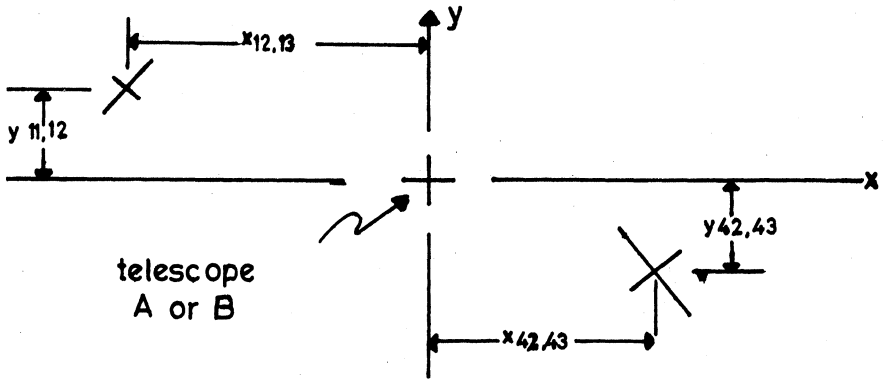


Telescope is focussed at 2d, distance of reflection from telescope axis gives 2β

b) measurement of displacements :



c) fiducial marks as seen by telescope



$\Delta x > 0$: correction consists of a shift towards the right
$\Delta y > 0$: correction consists of a shift upwards

Angles α and β are given as seen from telescope positions A or B (opposite to sign of telescope reading). They can directly be inserted into the formulae without change of sign.

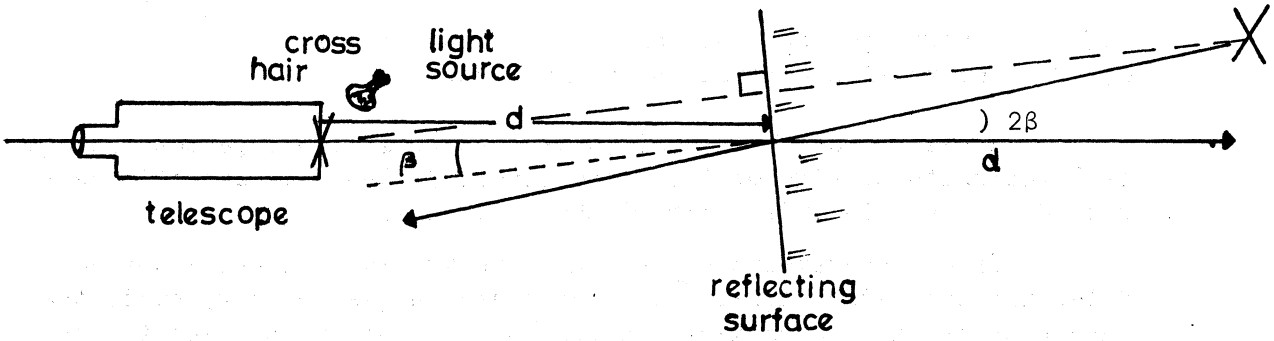
From measurements of the angles β at planes 1 and 2 one can determine the wedge angles ε. Since these angles are very small they have been averaged over many independent readings to compensate for random measurement errors.

The following values are used for calculations :

a	= 200	mm	
b	= 2050	mm	
c	= 170.3	mm	(OPTICS/ C 002)
d	= 505.4	mm	(OPTICS/ E 001)
n_G	= 1.53	mm	(OPTICS/ C 003)
n_H	= 1.10 or 1.11		(OPTICS/ E 001)
α, α'	=		(TELESCOPE /B)
β, β'	=		
$\varepsilon_x, \varepsilon_y$	=		

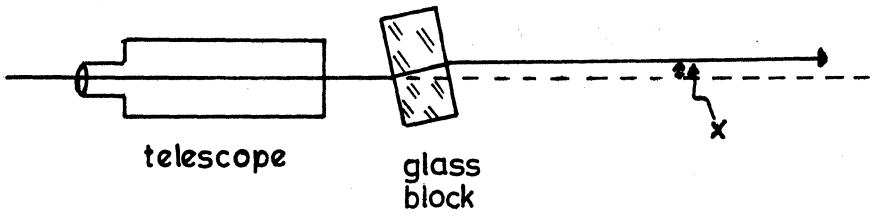
Fig. 1 : TELESCOPE MEASUREMENTS

a) measurement of angles :



Telescope is focussed at 2d, distance of reflection from telescope axis gives 2β

b) measurement of displacements :



c) fiducial marks as seen by telescope

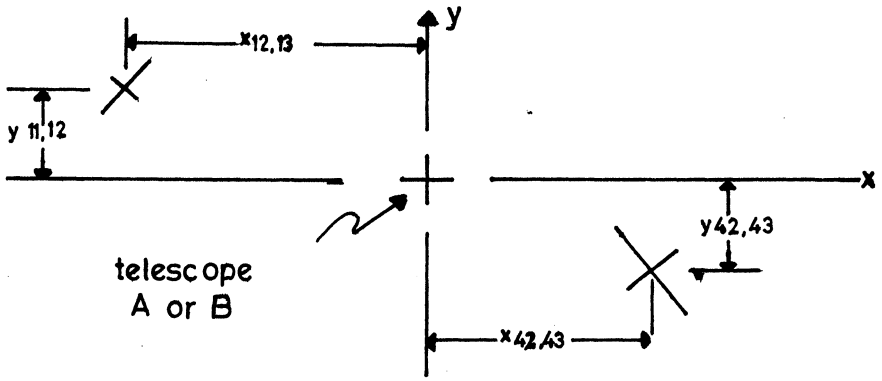
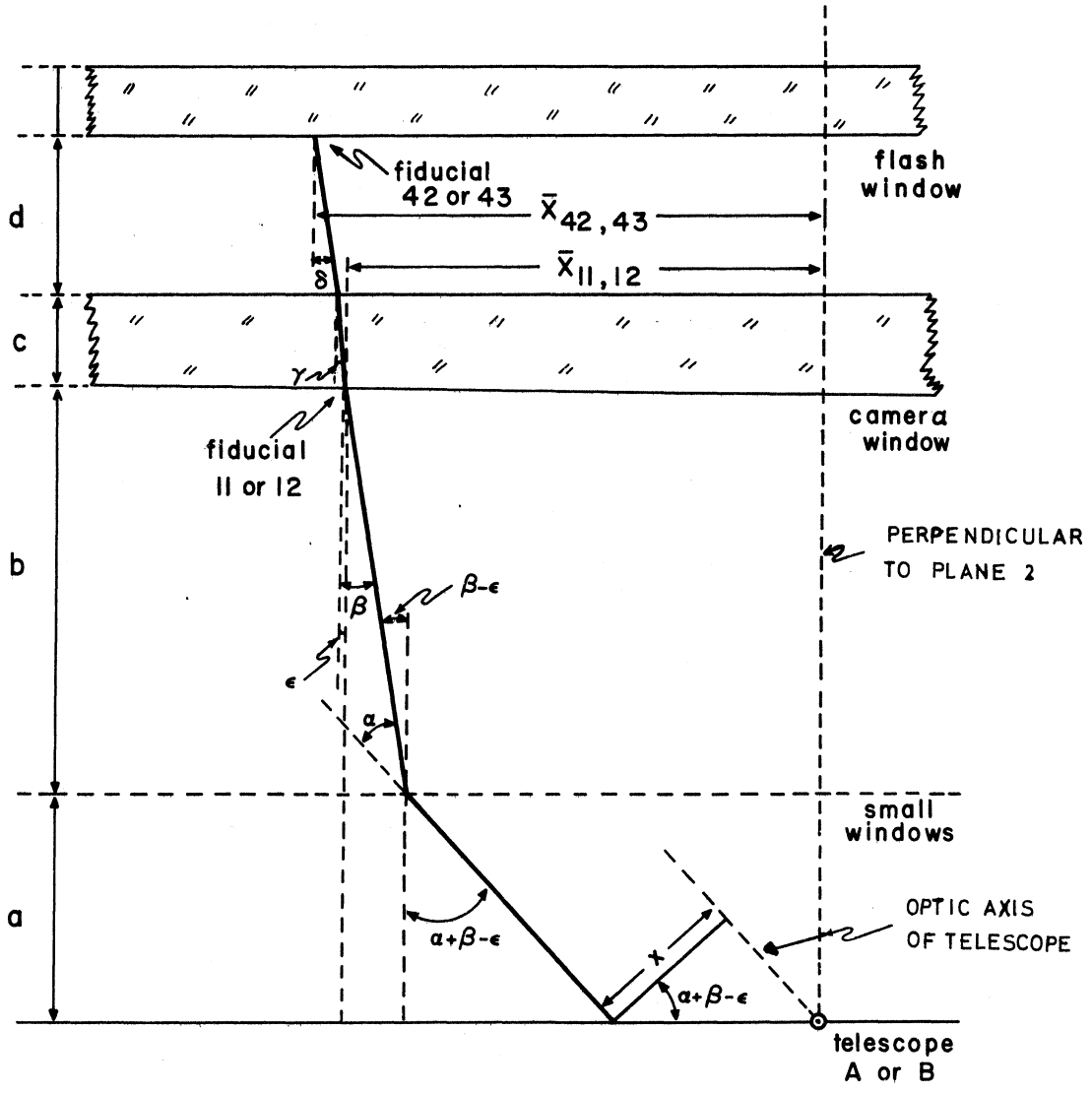


Fig. 2 : CORRECTION OF TELESCOPE MEASUREMENTS



Section : TELESCOPE

B 001

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1001

Validity : 13.3.1970 - 25.3.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.50	+0.29	-0.21
y (11)	+2.90	+0.58	+3.48
x (42)	-0.50	+0.37	-0.13
y (42)	+2.60	+0.73	+3.33
x (12)	-1.24	-0.09	-1.33
y (12)	+2.90	+0.65	+3.55
x (43)	-1.27	-0.11	-1.38
y (43)	+2.52	+0.80	+3.32

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.19	-0.07
	vertical	-0.02	-0.29	-0.03
Bottom	horizontal	0.00	-0.05	-0.09
	vertical	-0.32	-0.19	+0.07

Section : TELESCOPE

B 002

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1002

Validity : 11.4.1970 - 21.5.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.93	-0.09	+1.84
y (11)	+0.11	-0.07	+0.04
x (42)	+1.79	-0.11	+1.68
y (42)	+0.01	-0.09	-0.08
x (12)	+2.08	-0.94	+1.14
y (12)	-0.11	+0.02	-0.09
x (43)	+2.19	-1.17	+1.02
y (43)	-0.26	+0.02	-0.24

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.02	-0.07
	vertical	-0.02	0.00	-0.03
Bottom	horizontal	0.00	+0.33	-0.09
	vertical	-0.32	+0.08	+0.07

Section : TELESCOPE

B 003

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1003

Validity : 5.6.1970 - 21.7.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.01	-0.25	-0.26
y (11)	+0.65	-0.07	+0.58
x (42)	-0.23	-0.32	-0.55
y (42)	+0.49	-0.09	+0.40
x (12)	+0.65	-0.96	-0.31
y (12)	+0.69	-0.17	+0.52
x (43)	+0.76	-1.20	-0.44
y (43)	+0.48	-0.22	+0.26

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.05	-0.07
	vertical	-0.02	0.00	-0.03
Bottom	horizontal	0.00	+0.34	-0.09
	vertical	-0.32	+0.17	+0.07

Section : TELESCOPE

B 004

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1004

Validity : 7.8.1970 - 7.9.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.57	+0.48	+1.05
y (11)	+0.76	-0.07	+0.69
x (42)	+0.11	+0.60	+0.71
y (42)	+0.48	-0.09	+0.39
x (12)	-0.41	+0.45	+0.04
y (12)	+1.55	-0.72	+0.83
x (43)	-0.71	+0.57	-0.14
y (43)	+1.46	-0.91	+0.55

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.28	-0.07
	vertical	-0.02	0.00	-0.03
Bottom	horizontal	0.00	-0.29	-0.09
	vertical	-0.32	+0.42	+0.07

Section : TELESCOPE

B 005

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1005

Validity : 20.9.1970 - 17.10.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.19	+0.42	+0.61
y (11)	+0.78	-0.04	+0.74
x (42)	-0.34	+0.53	+0.19
y (42)	+0.48	-0.05	+0.43
x (12)	-0.90	+0.36	-0.54
y (12)	+1.52	-0.77	+0.75
x (43)	-1.26	+0.46	-0.80
y (43)	+1.42	-0.98	+0.44

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.25	-0.07
	vertical	-0.02	-0.02	-0.03
Bottom	horizontal	0.00	-0.25	-0.09
	vertical	-0.32	+0.44	+0.07

Section : TELESCOPE

B 006

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1006

Validity : 17.10.1970 - 6.11.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.51	+0.35	+0.86
y (11)	+0.70	+0.10	+0.80
x (42)	-0.08	+0.44	+0.36
y (42)	+0.36	+0.12	+0.48
x (12)	-0.64	+0.34	-0.30
y (12)	+1.59	-0.54	+1.05
x (43)	-1.10	+0.44	-0.66
y (43)	+1.36	-0.70	+0.66

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.22	-0.07
	vertical	-0.02	-0.07	-0.03
Bottom	horizontal	0.00	-0.24	-0.09
	vertical	-0.32	+0.34	+0.07

Section : TELESCOPE

B 007

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1007

Validity : 6.11.1970 - 13.11.1970

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.38	+0.35	+0.73
y (11)	+0.82	+0.04	+0.86
x (42)	-0.10	+0.44	+0.34
y (42)	+0.38	+0.05	+0.43
x (12)	-0.69	+0.34	-0.35
y (12)	+1.53	-0.54	+0.99
x (43)	-1.17	+0.43	-0.74
y (43)	+1.38	-0.70	+0.68

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	-0.22	-0.07
	vertical	-0.02	-0.05	-0.03
Bottom	horizontal	0.00	-0.24	-0.09
	vertical	-0.32	+0.34	+0.07

Section : TELESCOPE

B 008

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1008

Validity : 21.1.1971 - 10.2.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.62	-0.48	-1.10
y (11)	+0.86	-0.73	+0.13
x (42)	-1.17	-0.59	-1.76
y (42)	+0.75	-0.91	-0.16
x (12)	-2.01	-0.41	-2.42
y (12)	+0.95	-0.72	+0.23
x (43)	-2.19	-0.52	-2.71
y (43)	+0.81	-0.91	-0.10

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.15	-0.07
	vertical	-0.02	+0.29	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.39	+0.07

Section : TELESCOPE

B 009

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1009

Validity : 11.2.1971 - 3.3.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.78	-0.52	-1.30
y (11)	+0.78	-0.70	+0.08
x (42)	-1.14	-0.67	-1.81
y (42)	+0.59	-0.87	-0.28
x (12)	-2.10	-0.47	-2.57
y (12)	+0.90	-0.95	-0.05
x (43)	-2.36	-0.59	-2.95
y (43)	+0.73	-1.18	-0.45

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.17	-0.07
	vertical	-0.02	+0.28	-0.03
Bottom	horizontal	0.00	+0.12	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 010

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1010

Validity : 4.3.1971 - 24.3.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.97	-0.58	-1.55
y (11)	+0.95	-0.94	+0.01
x (42)	-1.35	-0.73	-2.08
y (42)	+0.88	-1.18	-0.30
x (12)	-2.21	-0.37	-2.58
y (12)	+1.00	-0.95	+0.05
x (43)	-2.52	-0.47	-2.99
y (43)	+0.86	-1.18	-0.32

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.19	-0.07
	vertical	-0.02	+0.39	-0.03
Bottom	horizontal	0.00	+0.08	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 011

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1011

Validity : 25.3.1971 - 14.4.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-1.00	-0.50	-1.50
y (11)	+0.92	-0.94	-0.02
x (42)	-1.35	-0.63	-1.98
y (42)	+0.81	-1.19	-0.38
x (12)	-2.32	-0.47	-2.79
y (12)	+0.94	-0.99	-0.05
x (43)	-2.58	-0.59	-3.17
y (43)	+0.84	-1.25	-0.41

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.16	-0.07
	vertical	-0.02	+0.39	-0.03
Bottom	horizontal	0.00	+0.12	-0.09
	vertical	+0.02	+0.51	+0.07

Section : TELESCOPE

B 012

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1012

Validity : 15.4.1971 - 11.5.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-1.04	-0.58	-1.62
y (11)	+0.93	-1.05	-0.12
x (42)	-1.39	-0.73	-2.12
y (42)	+0.86	-1.32	-0.46
x (12)	-2.32	-0.41	-2.73
y (12)	+0.96	-0.94	+0.02
x (43)	-2.58	-0.52	-3.10
y (43)	+0.77	-1.18	-0.41

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.19	-0.07
	vertical	-0.02	+0.44	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 013

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1013

Validity : 12.5.1971 - 1.6.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.81	-0.47	-1.28
y (11)	+0.95	-0.94	+0.01
x (42)	-1.13	-0.59	-1.72
y (42)	+0.87	-1.18	-0.31
x (12)	-2.03	-0.41	-2.44
y (12)	+0.96	-0.94	+0.02
x (43)	-2.27	-0.52	-2.79
y (43)	+0.84	-1.18	-0.34

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.15	-0.07
	vertical	-0.02	+0.39	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 014

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1014

Validity : 2.6.1971 - 23.6.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.72	-0.50	-1.22
y (11)	+0.94	-0.90	+0.04
x (42)	-1.06	-0.64	-1.70
y (42)	+0.83	-1.14	-0.31
x (12)	-2.03	-0.41	-2.44
y (12)	+1.00	-0.87	+0.13
x (43)	-2.25	-0.52	-2.77
y (43)	+0.94	-1.09	-0.15

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.16	-0.07
	vertical	-0.02	+0.37	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.45	+0.07

Section : TELESCOPE

B 015

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1015

Validity : 24.6.1971 - 19.7.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.90	-0.58	-1.48
y (11)	+0.95	-0.95	0.00
x (42)	-1.22	-0.73	-1.95
y (42)	+0.85	-1.18	-0.33
x (12)	-2.22	-0.48	-2.70
y (12)	+1.02	-0.95	+0.07
x (43)	-2.43	-0.61	-3.04
y (43)	+0.87	-1.18	-0.31

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.19	-0.07
	vertical	-0.02	+0.39	-0.03
Bottom	horizontal	0.00	+0.13	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 016

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1016

Validity : 20.7.1971 - 27.8.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.90	-0.40	-1.30
y (11)	+0.86	-0.84	+0.02
x (42)	-1.24	-0.50	-1.74
y (42)	+0.70	-1.05	-0.35
x (12)	-2.12	-0.42	-2.54
y (12)	+0.89	-0.95	-0.06
x (43)	-2.36	-0.52	-2.88
y (43)	+0.76	-1.18	-0.42

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.11	-0.07
	vertical	-0.02	+0.34	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 017

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1017

Validity : 28.8.1971 - 14.9.197

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.69	-0.58	-1.27
y (11)	+1.01	-1.02	-0.01
x (42)	-1.02	-0.73	-1.75
y (42)	+0.98	-1.27	-0.29
x (12)	-2.06	-0.41	-2.47
y (12)	+1.00	-0.94	+0.06
x (43)	-2.33	-0.52	-2.85
y (43)	+0.93	-1.18	-0.25

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.19	-0.07
	vertical	-0.02	+0.42	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	+0.02	+0.48	+0.07

Section : TELESCOPE

B 018

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1018

Validity : 15.9.1971 - 27.10.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.93	-0.49	-1.42
y (11)	+0.93	-0.99	-0.06
x (42)	-1.25	-0.62	-1.87
y (42)	+0.89	-1.24	-0.35
x (12)	-2.23	-0.46	-2.69
y (12)	+0.98	-0.98	0.00
x (43)	-2.50	-0.58	-3.08
y (43)	+0.89	-1.24	-0.35

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.16	-0.07
	vertical	-0.02	+0.41	-0.03
Bottom	horizontal	0.00	+0.12	-0.09
	vertical	+0.02	+0.50	+0.07

Section : TELESCOPE

B 019

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1019

Validity : 28.10.1971 - 25.11.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.93	-0.29	-1.22
y (11)	+0.96	-0.87	+0.09
x (42)	-1.28	-0.37	-1.65
y (42)	+0.95	-1.10	-0.15
x (12)	-2.23	-0.35	-2.58
y (12)	+1.01	-1.09	-0.08
x (43)	-2.45	-0.43	-2.88
y (43)	+0.91	-1.37	-0.46

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.06	-0.07
	vertical	-0.02	+0.36	-0.03
Bottom	horizontal	0.00	+0.06	-0.09
	vertical	+0.02	+0.55	+0.07

Section : TELESCOPE

B 020

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1020

Validity : 26.11.1971 - 15.12.1971

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.99	-0.55	-1.54
y (11)	+0.78	-0.87	-0.09
x (42)	-1.32	-0.68	-2.00
y (42)	+0.71	-1.10	-0.39
x (12)	-2.47	-0.48	-2.95
y (12)	+0.82	-1.02	-0.20
x (43)	-2.69	-0.61	-3.30
y (43)	+0.69	-1.27	-0.58

b) Angles (mrad) :

		α	β	ε
Top	horizontal	-0.05	+0.18	-0.07
	vertical	-0.02	+0.36	-0.03
Bottom	horizontal	0.00	+0.13	-0.09
	vertical	+0.02	+0.52	+0.07

Section : TELESCOPE

B 021

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1021

Validity : 9.6.1972 - 9.7.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.17	-0.92	-1.09
y (11)	+0.17	-2.58	-2.41
x (42)	-1.78	-1.15	-2.93
y (42)	+0.91	-3.23	-2.32
x (12)	-1.16	-1.29	-2.45
y (12)	+0.43	-2.54	-2.11
x (43)	-2.62	-1.61	-4.23
y (43)	+1.23	-3.19	-1.96

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.34	-0.07
	vertical	-0.01	+1.12	-0.03
Bottom	horizontal	0.00	+0.48	-0.09
	vertical	-0.01	+1.20	+0.07

2m USER'S HANDBOOK

Section : TELESCOPE

B 022

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1022

Validity : 10.7.1972 - 10.8.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	-0.14	-0.92	-1.06
y (11)	+0.33	-2.37	-2.04
x (42)	-1.71	-1.15	-2.86
y (42)	+1.02	-2.97	-1.95
x (12)	-1.03	-1.23	-2.26
y (12)	+0.56	-2.41	-1.85
x (43)	-2.53	-1.55	-4.08
y (43)	+1.37	-3.02	-1.65

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.34	-0.07
	vertical	-0.01	+1.02	-0.03
Bottom	horizontal	0.00	+0.46	-0.09
	vertical	-0.01	+1.14	+0.07

Section : TELESCOPE

B 023

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1023

Validity : 11.8.1972 - 9.9.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.21	-0.09	+1.12
y (11)	-1.61	+0.47	-1.14
x (42)	-0.92	-0.10	-1.02
y (42)	-1.64	+0.59	-1.05
x (12)	-0.42	-0.27	-0.69
y (12)	-1.30	+0.30	-1.00
x (43)	-2.14	-0.34	-2.48
y (43)	-1.29	+0.38	-0.91

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	-0.03	-0.07
	vertical	-0.01	-0.24	-0.03
Bottom	horizontal	0.00	+0.03	-0.09
	vertical	-0.01	-0.06	+0.07

Section : TELESCOPE

B 024

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1024

Validity : 10.9.1972 - 8.10.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.88	-0.56	+1.32
y (11)	-0.77	+2.44	+1.67
x (42)	+0.25	-0.71	-0.46
y (42)	-1.28	+3.05	+1.77
x (12)	-0.29	-0.80	-1.09
y (12)	-0.53	+1.73	+1.20
x (43)	-1.84	-1.00	-2.84
y (43)	-0.98	+2.18	+1.20

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.18	-0.07
	vertical	-0.01	-1.12	-0.03
Bottom	horizontal	0.00	+0.27	-0.09
	vertical	-0.01	-0.70	+0.07

2m USER'S HANDBOOK

Section : TELESCOPE

B 025

Date : 23.10.72

TELESCOPE READINGS

for chamber operation during period

Reference : 1025

Validity : 9.10.1972 - 4.11.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.77	-0.46	+1.31
y (11)	-0.86	+2.06	+1.20
x (42)	+0.14	-0.57	-0.43
y (42)	-1.38	+2.57	+1.19
x (12)	-0.25	-0.67	-0.92
y (12)	-0.57	+1.79	+1.22
x (43)	-1.89	-0.83	-2.72
y (43)	-1.05	+2.24	+1.19

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.13	-0.07
	vertical	-0.01	-0.95	-0.03
Bottom	horizontal	0.00	+0.21	-0.09
	vertical	-0.01	-0.73	+0.07

Section : TELESCOPE

B 026

Date : 13.11.1972

TELESCOPE READINGS

for chamber operation during period

Reference : 1026

Validity : 13.11.1972 - 1.12.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.97	-0.66	+1.31
y (11)	-0.62	+1.96	+1.34
x (42)	+0.37	-0.83	-0.46
y (42)	-1.14	+2.45	+1.31
x (12)	-0.20	-0.92	-1.12
y (12)	-0.41	+1.32	+0.91
x (43)	-1.57	-1.16	-2.73
y (43)	-0.86	+1.65	+0.79

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.23	-0.07
	vertical	-0.01	-0.90	-0.03
Bottom	horizontal	0.00	+0.32	-0.09
	vertical	-0.01	-0.52	+0.07

Section : TELESCOPE

B 027

Date : 8.12.1972

TELESCOPE READINGS

for chamber operation during period

Reference : 1027

Validity : 8.12.1972 - 18.12.1972

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.77	-0.59	+1.18
y (11)	-0.43	+1.81	+1.38
x (42)	+0.12	-0.74	-0.62
y (42)	-0.93	+2.28	+1.35
x (12)	-0.31	-0.82	-1.13
y (12)	-0.27	+1.25	+0.98
x (43)	-1.87	-1.02	-2.89
y (43)	-0.66	+1.56	+0.90

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.19	-0.07
	vertical	-0.01	-0.84	-0.03
Bottom	horizontal	0.00	+0.27	-0.09
	vertical	-0.01	-0.48	+0.07

Section : TELESCOPE

B 028

Date : 25.2.1973

TELESCOPE READINGS

for chamber operation during period

Reference : 1028

Validity : 25.2.1973 - 15.3.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.88	-0.66	+1.22
y (11)	-0.53	+1.49	+0.96
x (42)	+0.22	-0.83	-0.61
y (42)	-1.04	+1.87	+0.83
x (12)	-0.30	-0.85	-1.15
y (12)	-0.26	+1.32	+1.06
x (43)	-1.86	-1.07	-2.93
y (43)	-0.71	+1.65	+0.94

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.23	-0.07
	vertical	-0.01	-0.69	-0.03
Bottom	horizontal	0.00	+0.29	-0.09
	vertical	-0.01	-0.52	+0.07

Section : TELESCOPE

B 029

Date : 27.4.1973

TELESCOPE READINGS

for chamber operation during period

Reference : 1029

Validity : 27.4.1973 - 25.5.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.34	-0.18	+1.16
y (11)	+0.66	+0.14	+0.80
x (42)	-0.56	-0.22	-0.78
y (42)	+0.76	+0.18	+0.94
x (12)	-0.80	-0.50	-1.30
y (12)	+0.93	-0.26	+0.67
x (43)	-2.59	-0.63	-3.22
y (43)	+1.03	-0.33	+0.70

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.01	-0.07
	vertical	-0.01	-0.10	-0.03
Bottom	horizontal	0.00	+0.14	-0.09
	vertical	-0.01	+0.18	+0.07

Section : TELESCOPE

B 030

Date : 7.6.1973

TELESCOPE READINGS

for chamber operation during period

Reference : 1030

Validity : 7.6.1973 - 12.6.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+2.04	-0.15	+1.89
y (11)	-0.64	+1.56	+0.92
x (42)	+0.15	-0.19	-0.04
y (42)	-1.04	+1.96	+0.92
x (12)	-0.05	-0.42	-0.47
y (12)	-0.30	+1.25	+0.95
x (43)	-1.80	-0.52	-2.32
y (43)	-0.66	+1.56	+0.90

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	-0.73	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	-0.01	-0.48	+0.07

Section : TELESCOPE B 031

Date : 26.6.1973

TELESCOPE READINGS
for chamber operation during period

Reference : 1031 **Validity** : 26.6.1973 - 13.8.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+2.29	-0.26	+2.03
y (11)	-0.29	+1.32	+1.03
x (42)	+0.41	-0.33	+0.08
y (42)	-0.67	+1.65	+0.98
x (12)	+0.16	-0.50	-0.34
y (12)	-0.06	+1.30	+1.24
x (43)	-1.56	-0.63	-2.19
y (43)	-0.38	+1.63	+1.25

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.05	-0.07
	vertical	-0.01	-0.62	-0.03
Bottom	horizontal	0.00	+0.13	-0.09
	vertical	-0.01	-0.51	+0.07

Section : TELESCOPE B 032

Date : 23.8.1973

TELESCOPE READINGS

for chamber operation during period

Reference : 1032 **Validity** : 23.8.1973 - 9.10.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+2.20	-0.26	+1.94
y (11)	-0.74	+1.98	+1.24
x (42)	+0.35	-0.33	+0.02
y (42)	-1.25	+2.47	+1.22
x (12)	+0.01	-0.55	-0.54
y (12)	-0.44	+1.38	+0.94
x (43)	-1.72	-0.68	-2.40
y (43)	-0.88	+1.73	+0.85

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.05	-0.07
	vertical	-0.01	-0.91	-0.03
Bottom	horizontal	0.00	+0.16	-0.09
	vertical	-0.01	-0.54	+0.07

Section : TELESCOPE B 033

Date : 12.10.1973

TELESCOPE READINGS
for chamber operation during period

Reference : 1033 **Validity** : 12.10.1973 - 6.11.1973

a) **Coordinates** (mm) :

	readings	corrections	true values
x (11)	+1.43	-0.29	+1.14
y (11)	-0.45	+1.64	+1.19
x (42)	-0.44	-0.37	-0.81
y (42)	-0.88	+2.06	+1.18
x (12)	-0.78	-0.61	-1.39
y (12)	-0.14	+1.08	+0.94
x (43)	-2.53	-0.76	-3.29
y (43)	-0.63	+1.36	+0.73

b) **Angles** (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.06	-0.07
	vertical	-0.01	-0.76	-0.03
Bottom	horizontal	0.00	+0.18	-0.09
	vertical	-0.01	-0.41	+0.07

Section : TELESCOPE

B 034

Date : 27.11.1973

TELESCOPE READINGS

for chamber operation during period

Reference : 1034 **Validity** : 27.11.1973 - 13.12.1973

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.80	-0.15	+1.65
y (11)	-0.48	+1.81	+1.33
x (42)	-0.17	-0.20	-0.37
y (42)	-0.97	+2.27	+1.30
x (12)	-0.47	-0.45	-0.92
y (12)	-0.06	+0.96	+0.90
x (43)	-2.20	-0.56	-2.76
y (43)	-0.46	+1.20	+0.74

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	-0.84	-0.03
Bottom	horizontal	0.00	+0.11	-0.09
	vertical	-0.01	-0.36	+0.07

Section : TELESCOPE

B 035

Date : 17.2.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1035

Validity : 17.2.1974 - 8.4.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.40	-0.26	+1.14
y (11)	+2.01	-1.13	+0.88
x (42)	-0.47	-0.33	-0.80
y (42)	+2.23	-1.41	+0.82
x (12)	-0.49	-0.38	-0.87
y (12)	+2.35	-1.21	+1.14
x (43)	-2.21	-0.48	-2.69
y (43)	+2.58	-1.51	+1.07

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.05	-0.07
	vertical	-0.01	+0.47	-0.03
Bottom	horizontal	0.00	+0.08	-0.09
	vertical	-0.01	+0.61	+0.07

Section : TELESCOPE

B 036

Date : 24.4.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1036

Validity : 24.4.1974 - 22.5.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.07	-0.16	+0.91
y (11)	+2.10	-1.27	+0.83
x (42)	-0.89	-0.19	-1.08
y (42)	+2.28	-1.60	+0.68
x (12)	-0.81	-0.31	-1.12
y (12)	+2.40	-1.39	+1.01
x (43)	-2.57	-0.39	-2.96
y (43)	+2.63	-1.75	+0.88

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.53	-0.03
Bottom	horizontal	0.00	+0.05	-0.09
	vertical	-0.01	+0.69	+0.07

Section : TELESCOPE

B 037

Date : 1.6.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1037

Validity : 1.6.1974 - 20.6.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	÷1.60	-0.23	+1.37
y (11)	+2.06	-1.31	+0.75
x (42)	-0.30	-0.29	-0.59
y (42)	+2.34	-1.65	+0.69
x (12)	-0.25	-0.42	-0.67
y (12)	+2.41	-1.39	+1.02
x (43)	-2.06	-0.53	-2.59
y (43)	+2.58	-1.74	+0.84

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.03	-0.07
	vertical	-0.01	+0.55	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	-0.01	+0.69	+0.07

Section : TELESCOPE

B 038

Date : 3.7.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1038

Validity : 3.7.1974 - 25.7.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.28	-0.15	+1.13
y (11)	+2.13	-1.39	+0.74
x (42)	-0.38	-0.20	-0.58
y (42)	+2.25	-1.73	+0.52
x (12)	-0.45	-0.42	-0.87
y (12)	+2.47	-1.37	+1.10
x (43)	-2.24	-0.53	-2.77
y (43)	+2.64	-1.72	+0.92

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.58	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	-0.01	+0.68	+0.07

Section : TELESCOPE

B 039

Date : 11.8.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1039

Validity : 11.8.1974 - 24.8.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.11	-0.20	+0.91
y (11)	+2.13	-1.33	+0.80
x (42)	-0.74	-0.26	-1.00
y (42)	+2.37	-1.67	+0.70
x (12)	-0.62	-0.39	-1.01
y (12)	+2.36	-1.37	+0.99
x (43)	-2.33	-0.49	-2.82
y (43)	+2.62	-1.72	+0.90

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.02	-0.07
	vertical	-0.01	+0.56	-0.03
Bottom	horizontal	0.00	+0.09	-0.09
	vertical	-0.01	+0.68	+0.07

Section : TELESCOPE

B 040

Date : 10.9.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1040

Validity : 10.9.1974 - 26.9.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.14	-0.15	+0.98
y (11)	+1.91	-1.39	+0.52
x (42)	-0.98	-0.19	-1.17
y (42)	+2.08	-1.74	+0.34
x (12)	-0.69	-0.33	-1.02
y (12)	+2.16	-1.30	+0.86
x (43)	-2.61	-0.41	-3.02
y (43)	+2.39	-1.63	+0.76

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.58	-0.03
Bottom	horizontal	0.00	+0.06	-0.09
	vertical	-0.01	+0.65	+0.07

Section : TELESCOPE

B 041

Date : 4.10.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1041

Validity : 4.10.1974 - 21.10.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.78	-0.15	+0.62
y (11)	+2.04	-1.49	+0.54
x (42)	-1.31	-0.19	-1.50
y (42)	+2.25	-1.87	+0.38
x (12)	-0.97	-0.31	-1.27
y (12)	+2.27	-1.35	+0.92
x (43)	-2.82	-0.38	-3.20
y (43)	+2.45	-1.69	+0.76

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.63	-0.03
Bottom	horizontal	0.00	+0.05	-0.09
	vertical	-0.01	+0.67	+0.07

Section : TELESCOPE

B 042

Date : 31.10.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1042

Validity : 31.10.1974 - 20.11.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.86	-0.15	+0.70
y (11)	+2.12	-1.49	+0.63
x (42)	-1.28	-0.20	-1.47
y (42)	+2.34	-1.87	+0.47
x (12)	-0.91	-0.33	-1.24
y (12)	+2.31	-1.26	+1.05
x (43)	-2.78	-0.41	-3.19
y (43)	+2.49	-1.58	+0.91

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.63	-0.03
Bottom	horizontal	0.00	+0.06	-0.09
	vertical	-0.01	+0.63	+0.07

Section : TELESCOPE

B 043

Date : 28.11.1975

TELESCOPE READINGS

for chamber operation during period

Reference : 1043

Validity : 28.11.1974 - 03.12.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.93	-0.15	+1.78
y (11)	+1.23	-1.09	+0.14
x (42)	-0.16	-0.20	-0.36
y (42)	+1.56	-1.37	+0.19
x (12)	+0.42	-0.41	+0.01
y (12)	+1.50	-1.26	+0.23
x (43)	-1.57	-0.52	-2.09
y (43)	+1.69	-1.58	+0.10

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	0.00	-0.07
	vertical	-0.01	+0.45	-0.03
Bottom	horizontal	0.00	+0.10	-0.09
	vertical	-0.01	+0.63	+0.07

Section : TELESCOPE

B 044

Date : 12.12.1974

TELESCOPE READINGS

for chamber operation during period

Reference : 1044

Validity : 12.12.1974 - 19.12.1974

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+2.30	-0.23	+2.07
y (11)	+1.29	-1.17	+0.12
x (42)	+0.17	-0.29	-0.12
y (42)	+1.47	-1.46	+0.01
x (12)	+0.81	-0.54	+0.27
y (12)	+1.52	-1.23	+0.29
x (43)	-1.14	-0.68	-1.82
y (43)	+1.70	-1.54	+0.16

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.04	-0.07
	vertical	-0.01	+0.48	-0.03
Bottom	horizontal	0.00	+0.15	-0.09
	vertical	-0.01	+0.61	+0.07

Section : TELESCOPE

B 045

Date : 12.9.1975

TELESCOPE READINGS

for chamber operation during period

Reference : 1045

Validity : 28.6.1975 - 3.7.1975

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+ 2.26	- 0.70	+ 1.56
y (11)	+ 0.50	- 0.08	+ 0.42
x (42)	+ 2.17	- 0.88	+ 1.29
y (42)	+ 0.97	- 0.09	+ 0.88
x (12)	+ 0.02	- 0.85	- 0.83
y (12)	+ 0.92	- 0.39	+ 0.53
x (43)	+ 0.53	- 1.07	- 0.54
y (43)	+ 1.28	- 0.49	+ 0.79

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+ 0.01	+ 0.24	- 0.07
	vertical	- 0.01	0.00	- 0.03
Bottom	horizontal	0.00	+ 0.29	- 0.09
	vertical	- 0.01	+ 0.24	+ 0.07

Section : TELESCOPE

B 046

Date : 12.9.1975

TELESCOPE READINGS

for chamber operation during period

Reference : 1046

Validity : 25.7.1975 - 29.8.1975

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+ 1.22	- 0.56	+ 0.66
y (11)	+ 0.70	- 0.11	+ 0.59
x (42)	+ 0.97	- 0.69	+ 0.28
y (42)	+ 1.30	- 0.14	+ 1.16
x (12)	- 0.97	- 0.85	- 1.82
y (12)	+ 1.17	- 0.35	+ 0.82
x (43)	- 0.56	- 1.07	- 1.63
y (43)	+ 1.60	- 0.44	+ 1.16

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+ 0.01	+ 0.18	- 0.07
	vertical	- 0.01	+ 0.02	- 0.03
Bottom	horizontal	0.00	+ 0.29	- 0.09
	vertical	- 0.01	+ 0.23	+ 0.07

Section : TELESCOPE

B 047

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1047

Validity : 30.10.1975 - 18.12.1975

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.74	-0.37	+0.37
y (11)	+0.50	-0.01	+0.49
x (42)	+0.36	-0.46	-0.10
y (42)	+1.10	0.00	+1.10
x (12)	-1.41	-0.61	-2.02
y (12)	+1.04	-0.14	+0.90
x (43)	-1.11	-0.77	-1.88
y (43)	+1.45	-0.17	+1.28

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.10	-0.07
	vertical	-0.01	-0.03	-0.03
Bottom	horizontal	0.00	+0.18	-0.09
	vertical	-0.01	+0.13	+0.07

Section : TELESCOPE

B 048

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1048

Validity : 27.2.1976 - 2.4.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.01	-0.20	+0.81
y (11)	+0.79	-0.36	+0.43
x (42)	+0.48	-0.25	+0.23
y (42)	+1.53	-0.45	+1.08
x (12)	-1.05	-0.29	-1.34
y (12)	+1.25	-0.07	+1.17
x (43)	-0.94	-0.37	-1.31
y (43)	+1.73	-0.10	+1.63

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.02	-0.07
	vertical	-0.01	+0.13	-0.03
Bottom	horizontal	0.00	+0.04	-0.09
	vertical	-0.01	+0.10	+0.07

Section : TELESCOPE

B 049

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1049

Validity : 27.4.1976 - 13.5.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.72	+0.15	+0.87
y (11)	+0.59	-0.33	+0.26
x (42)	+0.06	+0.18	+0.24
y (42)	+1.25	-0.42	+0.83
x (12)	-1.25	-0.21	-1.46
y (12)	+1.07	-0.33	+0.74
x (43)	-1.18	-0.27	-1.45
y (43)	+1.55	-0.41	+1.14

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	-0.13	-0.07
	vertical	-0.01	+0.11	-0.03
Bottom	horizontal	0.00	+0.01	-0.09
	vertical	-0.01	+0.21	+0.07

Section : TELESCOPE

B 050

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1050

Validity : 20.5.1976 - 17.6.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.48	-0.07	+0.41
y (11)	-0.04	-0.58	-0.62
x (42)	-0.09	-0.08	-0.17
y (42)	+0.70	-0.73	-0.04
x (12)	-1.49	-0.45	-1.94
y (12)	+0.40	-0.72	-0.32
x (43)	-1.38	-0.57	-1.94
y (43)	+0.98	-0.90	+0.08

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	-0.04	-0.07
	vertical	-0.01	+0.23	-0.03
Bottom	horizontal	0.00	+0.11	-0.09
	vertical	-0.01	+0.39	+0.07

Section : TELESCOPE

B 051

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1051

Validity : 25.6.1976 - 15.7.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.83	-0.21	+0.62
y (11)	+0.02	-0.62	-0.60
x (42)	+0.24	-0.27	-0.03
y (42)	+0.76	-0.78	-0.02
x (12)	-1.18	-0.47	-1.65
y (12)	+0.49	-0.46	+0.03
x (43)	-1.00	-0.59	-1.59
y (43)	+1.03	-0.58	+0.45

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.02	-0.07
	vertical	-0.01	+0.24	-0.03
Bottom	horizontal	0.00	+0.12	-0.09
	vertical	-0.01	+0.27	+0.07

Section : TELESCOPE

B 052

Date : 10.8.1976

TELESCOPE READINGS

for chamber operation during period

Reference : 1052

Validity : 29.7.1976 - 3.8.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.70	-0.81	+0.89
y (11)	+0.11	-0.73	-0.62
x (42)	+1.34	-1.01	+0.33
y (42)	+0.94	-0.92	+0.02
x (12)	-0.35	-1.07	-1.42
y (12)	+0.55	-0.72	-0.17
x (43)	-0.12	-1.34	-1.46
y (43)	+1.12	-0.90	+0.22

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.29	-0.07
	vertical	-0.01	+0.29	-0.03
Bottom	horizontal	0.00	+0.39	-0.09
	vertical	-0.01	+0.39	+0.07

Section : TELESCOPE

B 053

Date : 13.1.1977

TELESCOPE READINGS

for chamber operation during period

Reference : 1053

Validity : 12.8.1976 - 20.8.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+1.09	-0.26	+0.82
y (11)	+0.18	-0.73	-0.55
x (42)	+0.46	-0.33	+0.12
y (42)	+0.94	-0.92	+0.02
x (12)	-0.97	-0.58	-1.55
y (12)	+0.54	-0.67	-0.13
x (43)	-0.81	-0.73	-1.53
y (43)	+1.05	-0.83	+0.21

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.05	-0.07
	vertical	-0.01	+0.29	-0.03
Bottom	horizontal	0.00	+0.17	-0.09
	vertical	-0.01	+0.36	+0.07

Section : TELESCOPE

B 054

Date : 13.1.1977

TELESCOPE READINGS

for chamber operation during period

Reference : 1054

Validity : 26.8.1976 - 24.9.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.30	-0.26	+0.03
y (11)	+0.08	-0.73	-0.65
x (42)	-0.28	-0.33	-0.61
y (42)	+0.83	-0.91	-0.09
x (12)	-1.81	-0.47	-2.27
y (12)	+0.50	-0.71	-0.22
x (43)	-1.62	-0.59	-2.20
y (43)	+1.07	-0.90	+0.17

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.05	-0.07
	vertical	-0.01	+0.29	-0.03
Bottom	horizontal	0.00	+0.12	-0.09
	vertical	-0.01	+0.39	+0.07

Section : TELESCOPE

B 055

Date : 13.1.1977

TELESCOPE READINGS

for chamber operation during period

Reference : 1055

Validity : 15.10.1976 - 20.12.1976

a) Coordinates (mm) :

	readings	corrections	true values
x (11)	+0.60	-0.39	+0.21
y (11)	0.00	-0.53	-0.53
x (42)	+0.03	-0.50	-0.47
y (42)	+0.77	-0.67	+0.10
x (12)	-1.56	-0.63	-2.19
y (12)	+0.46	-0.63	-0.17
x (43)	-1.47	-0.79	-2.26
y (43)	+1.02	-0.79	+0.23

b) Angles (mrad) :

		α	β	ε
Top	horizontal	+0.01	+0.11	-0.07
	vertical	-0.01	+0.20	-0.03
Bottom	horizontal	0.00	+0.19	-0.09
	vertical	-0.01	+0.35	+0.07

A-TITLE

Section : GEOM-TITLE
Date : 10.3.1970

C 001

INFORMATION PROVIDED BY CERN

Survey measurements on the chamber and on films taken during chamber runs are performed systematically to provide the user with information necessary for geometry reconstruction programs.

The results of these measurements, for a given period, are presented in concentrated form on DATA SHEETS (see GEOM-TITLE/D...) which contain references to all relevant documents in this handbook. They contain furthermore a list of all experiments done during this period, together with information on chamber operation and magnetic field.

The information provided by CERN for a given period consists of:

1. Telescope measurements: These measurements of the relative orientation of chamber windows and camera plate are done in the way described in section TELESCOPE/A 001. Detailed information about angles and displacement of fiducial marks is given on a separate sheet for users who like to do their own reconstruction.

2. Field origin: The relative orientation of the centre of the chamber (origin of field map) is measured with respect to the camera plate as described in section FIELD/A 001. The results (x_o, y_o, z_o) are indicated on the DATA SHEETS.

3. Fiducial marks: The results of the fiducial measurements on the CERN-HPD (see section GEOM-TITLE/B) are presented in different ways:

   a) Co-ordinates of all fiducial marks measured on individual frames. This very detailed information is kept on tapes for library purposes.

It may be useful for people who intend to study longterm operation of the chamber.

b) "Average" photo for individual rolls: This is the basic output from the data checking and averaging procedure mentioned in the previous chapter (GEOM-TITLE/B). It is used to check variations of parameters during a period (or experiment). These checks are done at CERN as a routine procedure.

c) "Average" photo for experiment (or period): This information is obtained from averaging all rolls measured for a given experiment (or period). It may be used as input to fiducial reconstruction programs other than PYTHON, or for any special calculations by the user.

d) PYTHON title for experiment (or period): THRESH title blocks CAMERA, MEDIA, MEDIA2, REFER and CORREC are calculated from the "average" photo of the experiment (or period).

DATA SHEETS (section GEOM-TITLE/D) and telescope measurements (section TELESCOPE/B) will automatically be circulated to all owners of the "2m USER'S HANDBOOK". Any information concerning fiducial measurements and titles should be requested explicitly from CERN. Every period is identified by a reference number and every experiment by a code number quoted on the DATA SHEET. It will help greatly to avoid misunderstandings if period reference and experiment code are stated for any request.

2m USER'S HANDBOOK

Section : GEOM-TITLE
Date : 10.3.1970

C 002

REQUEST FOR CHAMBER DATA

Name : .....

Address : .....

.....

Experiment : .....

Code : T ..... Period : .....

Code number and period can be found from the DATA SHEETS, see section GEOM-TITLE/D.

Please indicate with a cross which information you would like to obtain :

☐ PYTHON title for experiment, small box
☐ PYTHON title for experiment, big box

☐ "Average photo" for period
☐ "Average photo" for experiment
☐ "Average photo" for individual rolls

☐ FIELD map M1OC1 ☐
☐ FIELD polynomial M1OCO ☐
M8C1 ☐
M6C1 ☐

☐ Other information:

Please send this form to : Miss Karin Gieselmann
CERN, TC-Division
1211 GENEVE 23 (Suisse)

Section : GEOM-TITLE

Date : 13.1.1977

D 054

DATA SHEET

for chamber operation during period

Reference : 1054 Validity : 26.8.1976 - 24.9.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	0653 - 1040	H_2, dp	-M10C1

Origin of FIELD map : (x_o = -0.9 ,y_o = -0.8 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 054
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 13.1.1977

D 055

DATA SHEET

for chamber operation during period

Reference : 1055 Validity : 15.10.1976 - 20.12.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	1041 - 1668	H_2, dp	-M10C1

Origin of FIELD map : (x_o =-0.9 ,y_o= -0.8 ,z_o=-24.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 055
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 13.3.1970

D 001

DATA SHEET

for chamber operation during period

Reference : 1001 Validity : 13.3.1970 - 25.3.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T130	K^-, 1.45 - 1.82 GeV/c	C001 - C012	H_2, dp	- M8C1
		C013 - C050	H_2, dp	- M10C1
T155	K^+, 1.32 GeV/c	C051 - C135	H_2, dp	+ M8C1

Origin of FIELD map : (x_o = -1.7, y_o = -0.3, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 , C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 001
- Field map : -"- , FIELD / B 001, B 003

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 11.4.1970

D 002

DATA SHEET

for chamber operation during period

Reference : 1002 **Validity** : 11.4.1970 - 21.5.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T155	K^+, 1.25 GeV/c	C136 - C194	H_2, dp	+ M8C1
T178	K^-, 1.00 - 1.40 GeV/c	C195 - C337	H_2, dp	- M6C1
T173	$\bar{p}$, 1.50 - 2.04 GeV/c	C338 - C364	H_2, dp	- M8C1
		C365 - C481	H_2, dp	- M10C1
T130	K^-, 1.45 - 1.82 GeV/c	C482 - C493	H_2, dp	- M10C1
		C494 - C499	H_2, dp	- M8C1

Origin of FIELD map : (x_o = -1.5, y_o = -0.6, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 002
- Field map : -"- , FIELD / B 001, B 003, B 004

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 5.6.1970

D 003

DATA SHEET

for chamber operation during period

Reference : 1003 Validity : 5.6.1970 - 21.7.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T174	K^-, 1.18 - 1.78 GeV/c	C500 - C546	D_2, dp	- M1OC1
		C547 - C648	D_2, dp	- M8C1
T152	π^-, 9.0 GeV/c	C649 - C753	D_2, dp	- M1OC1
T188	K^+, 8.25 GeV/c	C754 - C786	D_2, dp	+ M1OC1

Origin of FIELD map : (x_o = -1.7, y_o=-0.5 , z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 003
- Field map : -"- , FIELD / B 001, B 003

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 7.8.1970

D 004

DATA SHEET

for chamber operation during period

Reference : 1004 Validity : 7.8.1970 - 7.9.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T179	π^+, 4.0 GeV/c	C791 - C925	D_2, dp	+ M1OC1
-	π^-, 16.0 GeV/c, tests	KOO1 - KO14	D_2, dp	O
T162	p, 19.2 GeV/c	C926 - C952	D_2, sp	+ M1OC1
T169	$\bar{p}$, 9.2 GeV/c	C953 - C990	D_2, sp	- M1OC1
T188	K^+, 8.25 GeV/c	DOO1 - DO10	D_2, dp	+ M1OC1

Origin of FIELD map : (x_o = -1.7 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 004
- Field map : -"- , FIELD / B C01

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 20.9.1970

D 005

DATA SHEET

for chamber operation during period

Reference : 1005 Validity : 20.9.1970 - 17.10.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T188	K^+, 8.25 GeV/c	D013 - D065	D_2, dp	+ M1OC1
T182	K^+, 5.46 GeV/c	D066 - D148	D_2, dp	+ M1OC1
T169	$\bar{p}$, 9.2 GeV/c	D149 - D164	D_2, sp	- M1OC1
T194	p, 19.2 GeV/c	D165 - D183	D_2, sp	+ M1OC1
T179	π^+, 4.0 GeV/c	D184 - D195	D_2, dp	+ M1OC1

Origin of FIELD map : (x_o = -1.7 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 005
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 31.10.1970

D 006

DATA SHEET

for chamber operation during period

Reference : 1006 Validity : 31.10.1970 - 5.11.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T148	K^+, 16.0 GeV/c	D196 - D246	H_2, dp	+ M1OC1

Origin of FIELD map : (x_o = -1.7 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 , C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 006
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 6.11.1970

D 007

DATA SHEET

for chamber operation during period

Reference : 1007 Validity : 6.11.1970 - 13.11.1970

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T187	π^-, 3.9 GeV/c	D247 - D333	H_2, dp	- M1OC1

Origin of FIELD map : (x_o = -1.7, y_o=-0.5 , z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 007
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 21.1.1971

D 008

DATA SHEET

for chamber operation during period

Reference : 1008 Validity : 21.1.1971 - 5.2.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T148	K^+, 16.0 GeV/c	D400 - D460	H_2, dp	+ M1OC1
T186	K^-, 14.3 GeV/c	D461 - D546	H_2, dp	- M1OC1

Origin of FIELD map : (x_o = -1.8 ,y_o = -0.5 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 008
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 11.2.1971

D 009

DATA SHEET

for chamber operation during period

Reference : 1009 Validity : 11.2.1971 - 26.2.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T158	p, 24.0 GeV/c	D547 - D597	H_2, sp	+ M1OC1
T159	p, 12.0 GeV/c	D598 - D629	H_2, dp	+ M1OC1
T195	$\bar{p}$, 7.3 GeV/c	D630 - D654	H_2, dp	- M1OC1

Origin of FIELD map : (x_o =-1.8 ,y_o=-0.5 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 009
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 4.3.1971

D 010

DATA SHEET

for chamber operation during period

Reference : 1010 Validity : 4.3.1971 -19.3.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T201	π^+, 16.0 GeV/c	D655 - D730	H_2, dp	+ M10C1
T184	$\bar{p}$, 9.2 GeV/c	D731 - D764	H_2, dp	- M10C1
T195	$\bar{p}$, 7.3 GeV/c	D765 - D808	H_2, dp	- M10C1

Origin of FIELD map : (x_o = -1.8, y_o = -0.5, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 010
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 25.3.1971

D 011

DATA SHEET

for chamber operation during period

Reference : 1011 Validity : 25.3.1971 - 8.4.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T180	π^-, 11.2 GeV/c	D809 - D 976	H_2, dp	- M1OC1

Origin of FIELD map : (x_o = -1.8 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 , C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 011
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 15.4.1971

D 012

DATA SHEET

for chamber operation during period

Reference : 1012 Validity : 15.4.1971 - 26.4.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T177	K^-, 16.0 GeV/c	D977 - D999 E001 - E033	H_2, sp	-M1OC1

Origin of FIELD map : (x_o = -1.8, y_o = -0.5, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001, C 002
- Fiducial marks : -"- , OPTICS / D002
- Chamber : -"- , OPTICS / E001
- Telescope readings : -"- , TELESCOPE / B012
- Field map : -"- , FIELD / B001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 12.5.1971

D 013

DATA SHEET

for chamber operation during period

Reference : 1013 Validity : 12.5.1971 - 17.5.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T201	π^+, 16.0 GeV/c	E034 - E053	H_2, dp	+ M1OC1

Origin of FIELD map : (x_o = - 1.8, y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 013
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 2.6.1971

D 014

DATA SHEET

for chamber operation during period

Reference : 1014 Validity : 2.6.1971 - 17.6.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T177	K^-, 16.0 GeV/c	E054 - E139	H_2, sp	- M1OC1

Origin of FIELD map : (x_o = -1.8 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 014
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 24.6.1971

D 015

DATA SHEET

for chamber operation during period

Reference : 1015 Validity : 24.6.1971 - 19.7.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 168	K^-, 14.3 GeV/c	E250 - E319	H_2, dp	-M1OC1
T 148	K^+, 16.0 GeV/c	E320 - E379	H_2, dp	+M1OC1

Origin of FIELD map : (x_o = -1.8, y_o = -0.5, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 015
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 28.10.1971

D 019

DATA SHEET

for chamber operation during period

Reference : 1019 Validity : 28.10.1971 - 25.11.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 197	π^-, 1.03 GeV/c	F327 - F344	H_2, dp	-4500A + 520A
	π^-, 1.01 GeV/c	F345 - F362	H_2, dp	-5000A + 500A
	π^-, 0.98 GeV/c	F363 - F372	H_2, dp	-5000A + 500A
	π^-, 0.98 GeV/c	F373 - F382	H_2, dp	-4000A + 500A
	π^-, 1.05 GeV/c	F383 - F401	H_2, dp	-4500A + 500A
	π^-, 1.07 GeV/c	F402 - F419	H_2, dp	-4500A + 520A
T 198	π^+, 1.12 GeV/c	F420 - F443	H_2, dp	+5000A - 520A
	π^+, 1.24 GeV/c	F444 - F467	H_2, dp	+5000A - 580A
T 197	π^-, 1.12 GeV/c	F468 - F482	H_2, dp	-5000A + 600A
	- camera plate removed to clean small windows.			

Origin of FIELD map : (x_o = -1.8 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001, C002
- Fiducial marks : -"- , OPTICS / D002
- Chamber : -"- , OPTICS / E001
- Telescope readings : -"- , TELESCOPE / B019
- Field map : -"- , FIELD / B ....

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 26.11.1971

D 020

DATA SHEET

for chamber operation during period

Reference : 1020 Validity : 26.11.1971 - 15.12.1971

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 202	$\bar{p}$, 3.0 GeV/c	E765 - E907	D_2, dp	-M10C1
	- chamber emptied and warmed up			
	- small telescope and camera windows replaced			
	- standard maintenance and cleaning			

Origin of FIELD map : (x_o = -1.8 , y_o = -0.5 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 020
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 9.6.1972

D 021

DATA SHEET

for chamber operation during period

Reference : 1021 Validity : 9.6.1972 - 1.7.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 181	π^-, 11.2 GeV/c	E908 - E999 F001 - F031	H_2, dp	-M10C1
T 215	K^-, 8.25 GeV/c	F032 - F102	H_2, dp	-M10C1
	- camera plate removed			

Origin of FIELD map : (x_o =-1.8 ,y_o=-0.7 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001, C002
- Fiducial marks : -"- , OPTICS / D002
- Chamber : -"- , OPTICS / E001
- Telescope readings : -"- , TELESCOPE / B021
- Field map : -"- , FIELD / B001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 10.7.1972

D 022

DATA SHEET

for chamber operation during period

Reference : 1022 Validity : 10.7.1972 - 3.8.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 203	d , 11.0 GeV/c	F103 - F125	H_2, dp	+M10C1
T 214	K^-, 14.3 GeV/c	F550 - F672	H_2, dp	-M10C1
—	p , 24.0 GeV/c, tests	K041 - K054	H_2, sp	0
T 158	p , 24.0 GeV/c	G631 - G670	H_2, sp	+M10C1
	- camera plate removed			

Origin of FIELD map : (x_o =-1.8 ,y_o=-0.7 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001, C002
- Fiducial marks : -"- , OPTICS / D002
- Chamber : -"- , OPTICS / E001
- Telescope readings : -"- , TELESCOPE / B022
- Field map : -"- , FIELD / B001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 10.8.1972

D 023

DATA SHEET

for chamber operation during period

Reference : 1023 Validity : 10.8.1972 - 31.8.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 158	p , 24.0 GeV/c	G671 - G675	H_2, sp	+M10C1
T 220	K^-, 16.0 GeV/c	F673 - F753	H_2, sp	-M10C1
T 201	π^+, 16.0 GeV/c	F754 - F836	H_2, dp	+M10C1
	- chamber warmed up, blockage of refrigerator			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.6 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001, C002
- Fiducial marks : -"- , OPTICS / D002
- Chamber : -"- , OPTICS / E001
- Telescope readings : -"- , TELESCOPE / B023
- Field map : -"- , FIELD / B001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 12.9.1972

D 024

DATA SHEET

for chamber operation during period

Reference : 1024 Validity : 12.9.1972 - 28.9.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 221	K^-, 1.04 GeV/c	F837 - F844	H_2, dp	-M8C0
	0.96 GeV/c	F845 - F854	H_2, dp	-M8C0
	0.92 GeV/c	F855 - F867	H_2, dp	-M8C0
	1.00 GeV/c	F868 - F949	H_2, dp	-M8C0
	- Camera plate removed			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 024
- Field map : -"- , FIELD / B 002 , **but take value of B_o from FIELD/B003**

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 9.10.72

D 025

DATA SHEET

for chamber operation during period

Reference : 1025 Validity : 9.10.1972 - 3.11.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 208	K^0_L, 1.04 GeV/c	F953	H_2, sp + dp	-M10C1
	K^0_L, 1.09 GeV/c	F954 - F983		
	K^0_L, 1.14 GeV/c	F984 - G010		
	K^0_L, 1.18 GeV/c	G011 - G039		
	K^0_L, 1.04 GeV/c	G040 - G066		
	K^0_L, 1.00 GeV/c	G067 - G092		
	K^0_L, 1.11 GeV/c	G093 - G119		
	K^0_L, 1.04 GeV/c	G120 - G126		

Origin of FIELD map : (x_o = -1.6 , y_o = -0.3 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 025
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 13.11.1972

D 026

DATA SHEET

for chamber operation during period

Reference : 1026 Validity : 13.11.1972 - 1.12.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 182	K^+, 5.46 GeV/c	G150 - G222	D_2, dp	+M10C1
T 194	p^+, 19.0 GeV/c	G223 - G264	D_2, sp	+M10C1
	- Camera plate removed to change f-stop.			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 (8.6.72), C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 026
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 8.12.1972

D 027

DATA SHEET

for chamber operation during period

Reference : 1027 Validity : 8.12.1972 - 18.12.1972

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 179	π^+, 4.0 GeV/c	G265 - G367	D_2, dp	+M10C1
	- chamber emptied and warmed up.			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 (8.6.72), C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 027
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 25.2.1973

D 028

DATA SHEET

for chamber operation during period

Reference : 1028 Validity : 25.2.1973 - 15.3.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 218	K^-, 2.45 GeV/c	G370 - G386	H_2, dp	-M10C1
	K^-, 2.55 GeV/c	G387 - G402	H_2, dp	-M10C1
T 197	π^-, 1.26 GeV/c	G403 - G420	H_2, dp	-5000A + 460A
	π^-, 1.32 GeV/c	G421 - G440	H_2, dp	-5000A + 460A
	π^-, 1.38 GeV/c	G441 - G447	H_2, dp	-5500A + 480A
	π^-, 1.38 GeV/c	G448 - G465	H_2, dp	-5500A + 500A
	π^-, 1.44 GeV/c	G466 - G489	H_2, dp	-5500A + 530A
	π^-, 0.94 GeV/c	G490 - G513	H_2, dp	-4000A + 350A
T 198	π^+, 1.32 GeV/c	G514 - G528	H_2, dp	+5000A - 440A

- Remove windows and fix gasket leak

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C 001(8.6.72), C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 028
- Field map : -"- , FIELD / B 001,....

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 27.4.1973

D 029

DATA SHEET
for chamber operation during period

Reference : 1029 Validity : 27.4.1973 - 25.5.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 198	π^+, 1.32 GeV/c	G529 - G534	H_2, dp	+5000A - 440A
	1.38 GeV/c	G535 - G550	H_2, dp	+5200A - 440A
	1.44 GeV/c	G551 - G564	H_2, dp	+5500A - 440A
	1.50 GeV/c	G565 - G578	H_2, dp	+5700A - 580A
	1.56 GeV/c	G579 - G593	H_2, dp	+5900A - 560A
	d^+, 1.32 GeV/c	G594 - G596	H_2, dp	+5000Avariable
	1.03 GeV/c	G596 - G597	H_2, dp	+4500A - 390A
	π^+, 1.62 GeV/c	G598 - G611	H_2, dp	+6100A - 560A
	1.69 GeV/c	G612 - G623	H_2, dp	+6400A - 620A
T 112	K^-, 4.2 GeV/c	G765 - G829	H_2, dp	-M10C1
	- chamber warmed up to fix expansion system			

Origin of FIELD map : (x_o = -1.6 , y_o = -0.2 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001(8.6.72), C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B029
- Field map : -"- , FIELD / B 001,...

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 7.6.1973

D 030

DATA SHEET
for chamber operation during period

Reference : 1030 Validity : 7.6.1973 - 12.6.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 112	K^-, 4.2 GeV/c	H500 - H533	H_2, sp+dp	-M10C1
	- camera plate removed because of condensation on outer windows.			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.2 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001(8.6.72), C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 030
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 26.6.1973

D 031

DATA SHEET
for chamber operation during period

Reference : 1031 **Validity** : 26.6.1973 - 13.8.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 112	K^-, 4.2 GeV/c	G830 - G943	H_2, dp	-M10C1
		H001 - H071	H_2, dp	-M10C1
		H550 - H580	H_2, dp	-M10C1
T 227	π^-, 3.95 GeV/c	H581 - H626	H_2, dp	-M10C1
	- empty chamber for	deuterium runs		

Origin of FIELD map : (x_o =-1.5 ,y_o=-0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001(8.6.72), C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 031
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 23.8.1973

D 032

DATA SHEET

for chamber operation during period

Reference : 1032 Validity : 23.8.1973 - 9.10.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 211	K^-, 1.95 GeV/c	H701 - H798	D_2, dp	-M10C1
T 210	$\bar{p}$, 4.0 GeV/c	H072 - H149	D_2, dp	-M10C1
	4.5 GeV/c	H150 - H228	D_2, dp	-M10C1
	5.0 GeV/c	H229 - H312	D_2, dp	-M10C1
	3.5 GeV/c	H313 - H324	D_2, dp	-M10C1
	- camera plate removed	to clean inner	windows	

Origin of FIELD map : (x_o = -1.5 , y_o = -0.3 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001(8.6.72), C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 032
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 12.10.1973

D 033

DATA SHEET

for chamber operation during period

Reference : 1033 Validity : 12.10.1973 - 6.11.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 182	p, 5.46 GeV/c	G944 - G948	D_2, dp	+M10C1
	π^+, 5.46 GeV/c	G949 - G952	D_2, dp	+M10C1
	K^+, 5.46 GeV/c	G953 - G998	D_2, dp	+M10C1
T 217	K^-, 8.2 GeV/c	H800 - H913	D_2, dp	-M10C1
	- camera plate removed for tests on new filters			

Origin of FIELD map : (x_o = -1.6 , y_o = -0.3 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001(8.6.72), C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 033
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 12.9.1975

D 034

DATA SHEET
for chamber operation during period

Reference : 1034 Validity : 27.11.1973 - 13.12.1973

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 229	π^-, 21 GeV/c	H325 - H390	D_2, sp	-M10C1
		H391 - H467	D_2, dp	-M10C1
	- Long PS shutdown			

Origin of FIELD map : (x_o =-1.6 ,y_o = -0.3 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001 (8.6.72), C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 034
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 17.2.1974

D 035

DATA SHEET

for chamber operation during period

Reference : 1035 Validity : 17.2.1974 - 8.4.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 216	K^0_L, 14 GeV/c	J001 - J126	H_2, sp	+M10C0
T 220	K^-, 16 GeV/c	J127 - J263	H_2, sp	-M10C1
	- Chamber warmed up, blockage of refrigerator - Cold-Tank camera windows cleaned			

Origin of FIELD map : (x_o = -1.6, y_o = -0.3, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 035
- Field map : -"- , FIELD / B 001, B 002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 24.4.1974

D 036

DATA SHEET

for chamber operation during period

Reference : 1036 Validity : 24.4.1974 - 22.5.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 227	π^-, 4 GeV/c	J340 - J394	H_2, sp	-M10C1
T 201	π^+, 16 GeV/c	J395 - J461	H_2, dp	+M10C1
T 158	p , 24 GeV/c	G676 - G750	H_2, sp	+M10C1
	- Chamber warmed up, blockage of refrigerator			
	- All small windows cleaned			

Origin of FIELD map : (x_o = -1.6 ,y_o = -0.3 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001,C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 036
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 1.6.1974

D 037

DATA SHEET

for chamber operation during period

Reference : 1037 Validity : 1.6.1974 - 20.6.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 226	$\bar{p}$, 12 GeV/c	J462 - J542	H_2, sp	-M10C1
T 220	K^-, 16 GeV/c	J264 - J306	H_2, sp	-M10C1
	- Camera plate removed			
	- Vacuum tank windows cleaned			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.3 ,z_o= -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 037
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 3.7.1974

D 038

DATA SHEET

for chamber operation during period

Reference : 1038 Validity : 3.7.1974 - 25.7.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 201	π^-, 16 GeV/c	J543 - J594	H_2, sp	-M10C1
T 226	$\bar{p}$, 12 GeV/c	F150 - F166 G127 - G149	H_2, sp	-M10C1
T 209	K^-, 8.25 GeV/c	K000 - K061	H_2, dp	-M10C1
	- Chamber emptied for blockage of refrigerator			

Origin of FIELD map : (x_o = -1.6 , y_o = -0.3 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / P 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 038
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 11.8.1974

D 039

DATA SHEET

for chamber operation during period

Reference : 1039 Validity : 11.8.1974 - 24.8.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T 232	K^0_L 1.13 GeV/c	J596 - J622	H_2, dp	-M10C1
	K^0_L 0.97 GeV/c	J623 - J669	H_2, dp	
	K^0_L 1.00 GeV/c	J670 - J701	H_2, dp	
	K^0_L 1.02 GeV/c	J702 - J717	H_2, dp	
	K^0_L 1.17 GeV/c	J718 - J729	H_2, dp	
	K^0_L 1.17 GeV/c	J730 - J733	H_2, sp	
	- Dirty big windows due to power failure - Chamber emptied			

Origin of FIELD map : (x_o = -1.6, y_o = -0.3, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 039
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 10.9.1974

D 040

DATA SHEET

for chamber operation during period

Reference : 1040 Validity : 10.9.1974 - 26.9.1974

Experiments run during this period :

code	experiment		roll numbers	chamber operation	chamber magnets
T232	K^o_L	1.075 GeV/c	J749 - J765	H_2, dp	-M10C1
		1.10 GeV/c	J766 - J779	H_2, dp	
		1.17 GeV/c	J780	H_2, dp	
T233	K^o_L	1.51 GeV/c	J801 - J817	H_2 dp	-M10C0
		1.46 GeV/c	J818 - J834		
		1.41 GeV/c	J835 - J851		
		1.36 GeV/c	J852 - J868		
		1.30 GeV/c	J869 - J885		
		1.25 GeV/c	J886 - J902		
		1.19 GeV/c	J903 - J923		
		1.25 GeV/c	J924 - J927		
		1.30 GeV/c	J928 - J931		
		1.36 GeV/c	J932 - J935		
		1.41 GeV/c	J936 - J939	- Camera plate removed to clean windows	
		1.47 GeV/c	J940 - J943		
		1.51 GeV/c	J944 - J947		

Origin of FIELD map: (x_o = -1.6, y_o = -0.4, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 040
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 4.10.1974

D 041

DATA SHEET

for chamber operation during period

Reference : 1041 Validity : 4.10.1974 - 21.10.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
NONE	p, 2.1 GeV/c	L097 - L100	H_2, dp	+M10C1
T112	K^-, 4.2 GeV/c	L101 - L248	H_2, dp	-M10C1
	- Chamber warmed up, blockage of refrigerator - Cold tank camera windows cleaned			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.4 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 041
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 31.10.1974

D 042

DATA SHEET

for chamber operation during period

Reference : 1042 Validity : 31.10.1974 - 20.11.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T112	K^-, 4.2 GeV/c	L250 - L381	H_2, dp	-M10C1
T197	π^- 1.55 GeV/c	L383 - L409	H_2, dp	-5700A+580A
	π^- 1.61 "	L410 - L438	H_2, dp	-5900A+640A
	π^- 1.05 "	L439	H_2, dp	-4100A+460A
	π^- 1.63 "	L440 - L468	H_2, dp	-6100A+640A
	π^- 1.67 "	L469 - L495	H_2, dp	-6400A+780A
	- Blockage of refrigerator			

Origin of FIELD map : (x_o =-1.6 ,y_o=-0.4 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 042
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 28.11.1974

D 043

DATA SHEET

for chamber operation during period

Reference : 1043 Validity : 28.11.1974 - 03.12.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T227	π^-, 4 GeV/c	L496 - L559	H_2, dp	-M10C1
	- Blockage of refrigerator			

Origin of FIELD map : (x_o = -1.5 ,y_o = -0.4 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 043
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 12.12.1974

D 044

DATA SHEET

for chamber operation during period

Reference : 1044 Validity : 12.12.1974 - 19.12.1974

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T239	$\bar{p}$, 0.60 GeV/c	L560 - L615	H_2, sp	-2600A
	- Long PS shutdown			

Origin of FIELD map : (x_o =-1.5 ,y_o=-0.4 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001, C 002
- Fiducial marks : -"- , OPTICS / D 002
- Chamber : -"- , OPTICS / E 001
- Telescope readings : -"- , TELESCOPE / B 044
- Field map : -"- , FIELD / B 001

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 12.9.1975

D 045

DATA SHEET

for chamber operation during period

Reference : 1045 Validity : 28.6.1975 - 3.7.1975

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T227	π^-, 4 GeV/c	L616 - L623	H_2, sp	-M10C1
- Stop to fix H_2 leak due to cracked welding				

Origin of FIELD map : (x_o = -0.9 ,y_o = -0.7 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 045
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 12.9.1975

D 046

DATA SHEET

for chamber operation during period

Reference : 1046 Validity : 25.7.1975 - 29.8.1975

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T227	π^-, 4 GeV/c	L624 - L739	H_2, dp	-M10C1
T209	K^-, 8.25 GeV/c	K062 - K117	H_2, dp	-M10C1

- Power failure due to PS fire
- Chamber warmed up and leak repaired

Origin of FIELD map : (x_o = -0.9, y_o = -0.7, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001B, C002A
- Fiducial marks : -"- , OPTICS / D002A
- Chamber : -"- , OPTICS / E001A
- Telescope readings : -"- , TELESCOPE / B046
- Field map : -"- , FIELD / B001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 10.8.1976

D 047

DATA SHEET

for chamber operation during period

Reference : 1047 Validity : 30.10.1975 - 18.12.1975

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T237	$\bar{p}$, 7.3 GeV/c	L810 - L933	H_2, dp	-M10C1
T209	K^-, 8.25GeV/c	K119 - K350	H_2, dp	-M10C1
	- Long PS Shutdown			

Origin of FIELD map : (x_o =-0.9 ,y_o=-0.7 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B003
- Windows : -"- , OPTICS / C001B, C002A
- Fiducial marks : -"- , OPTICS / D002A
- Chamber : -"- , OPTICS / E001A
- Telescope readings : -"- , TELESCOPE / B047
- Field map : -"- , FIELD / B001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE
Date : 10.8.1976

D 048

DATA SHEET
for chamber operation during period

Reference : 1048 Validity : 27.2.1976 - 2.4.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T236	K^-, 0.4 - 0.8 GeV/c	0001 - 0008	H_2, sp	3000A-3600A
T239	$\bar{p}$, 0.68 GeV/c	0009 - 0031	H_2, sp	3300A
	- Chamber emptied & camera plate removed to clean ports.			

Origin of FIELD map : (x_o =-0.9 ,y_o=-0.7 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 048
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE
Date : 10.8.1976

D 049

DATA SHEET
for chamber operation during period

Reference : 1049 Validity : 27.4.1976 - 13.5.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	0351-0455	H_2, dp	-M10C1
	- Camera plate removed to change F-Stop to f/32 for next experiment - double glazing also cleaned.			

Origin of FIELD map : (x_o = -0.9 , y_o = -0.7 , z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 049
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 10.8.1976

D 050

DATA SHEET

for chamber operation during period

Reference : 1050 Validity : 20.5.1976 - 17.6.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T237	$\bar{p}$, 7.3 GeV/c	0100-0342	H_2, dp	-M10C1
	- Camera plate removed to change F-Stop back to f/22.			
	- Ports cleaned again.			

Origin of FIELD map : (x_o =-0.9 ,y_o=-0.8 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 050
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE
Date : 10.8.1976

D 051

DATA SHEET
for chamber operation during period

Reference : 1051 Validity : 25.6.1976 - 15.7.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	0456 - 0652	H_2, dp	-M10C1
	- Camera Plate removed to clean ports			

Origin of FIELD map : (x_o =-0.9 ,y_o=-0.8 ,z_o=-25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 051
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 10.8.1976

D 052

DATA SHEET

for chamber operation during period

Reference : 1052 Validity : 29.7.1976 - 3.8.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T227	π^-, 4GeV/c	2740 - 2768	H_2, dp	-M10C1
	- Blockage of refrigerator causing partial warm-up. - Camera plate removed and ports cleaned.			

Origin of FIELD map : (x_o = -0.9 ,y_o = -0.8 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 052
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE

Date : 13.1.1977

D 053

DATA SHEET

for chamber operation during period

Reference : 1053 Validity : 12.8.1976 - 20.8.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T227	π^-, 4 GeV/c	2769 - 2860	H_2, dp	-M10C1

Origin of FIELD map : (x_o = -0.9, y_o = -0.8, z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B053
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

2m USER'S HANDBOOK

Section : GEOM-TITLE

Date : 13.1.1977

D 054

DATA SHEET

for chamber operation during period

Reference : 1054 Validity : 26.8.1976 - 24.9.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	0653 - 1040	H_2, dp	-M10C1

Origin of FIELD map : (x_o = -0.9 ,y_o = -0.8 ,z_o = -25.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 054
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

Section : GEOM-TITLE
Date : 13.1.1977

D 055

DATA SHEET
for chamber operation during period

Reference : 1055 Validity : 15.10.1976 - 20.12.1976

Experiments run during this period :

code	experiment	roll numbers	chamber operation	chamber magnets
T209	K^-, 8.25 GeV/c	1041 - 1668	H_2, dp	-M10C1

Origin of FIELD map : (x_o =-0.9 ,y_o = -0.8 ,z_o = -24.2) cm

Documents valid for this period :

- Cameras : 2m USER'S HANDBOOK, OPTICS / B 003
- Windows : -"- , OPTICS / C 001B, C002A
- Fiducial marks : -"- , OPTICS / D 002A
- Chamber : -"- , OPTICS / E 001A
- Telescope readings : -"- , TELESCOPE / B 055
- Field map : -"- , FIELD / B 001, B002

Additional information available :

- Magnetic field map
- PYTHON title for period
- PYTHON title for experiment
- 'Average'photo for period
- 'Average'photo for experiment
- 'Average'photo for individual rolls
- Individual measurements of fiducial marks

FIELD

Section : FIELD

Date : 10.3.1970

A 001

Relation of coordinate systems of field measurements and optics parameters

New measurements of the magnetic field of the 2m chamber were made in Dec. 1969. A detailed report on the results of these measurements is filed in FIELD / A002.

The system of coordinates used for the field measurements has its origin in the geometric centre of the bubble chamber at ambient temperature. The x-axis is along the beam direction, the y-axis is pointing upwards and is perpendicular to the bottom of the chamber, the z-axis is perpendicular to the chambers windows with the positive direction towards the cameras.

The relation of this coordinate system (x,y) to the coordinate system used for the optics parameters (X,Y) is found in the following way :

Fig. 2 shows a view from the camera side towards the camera plate and the magnet yoke. The camera plate contains two marks on the vertical sides and one mark on top of the plate which are defined by a coordinate system attached to the camera plate. The origin is given by the circumcentre of the camera triangle, the X-axis leads through camera 2 (-318.4,0.0) and is positive along the beam direction, the Y-axis points upwards.

The y-axis of the field measurements is indicated by a mark on top of the magnet yoke. This line is continued downwards near to the camera plate. Since this region is not easily accessible another mark is indicated, displaced by 200 mm to the left. Similarly one has a mark displaced by 200 mm to the left of the Y-axis on top of the camera plate.

The measurements of the marks on the vertical sides of the camera plate with respect to the top of the magnet (against the Al-beams as indicated in Fig. 1) and the mark on the top horizontal side of the plate with respect to the y-axis define the coordinates x_o, y_o of the origin of the field measurements with respect to the (X,Y)-system. The coordinate z_o is given by the difference of the centres of the cold chamber and the warm chamber with respect to the reference plane (inside of camera window). It can be calculated from the values given in OPTICS / E001.

If origin and orientation of the coordinate system in which cameras and fiducial marks are calculated are chosen to coincide with the (X,Y)-system indicated above, then one can use the values of x_o, y_o, z_o quoted on the DATA SHEET (see GEOM-TITLE / D...) directly in the title block FIELD. Otherwise one has to find the coordinate transformation between the (X,Y)-system and the system used for optics parameters.

PYTHON titles calculated from fiducial measurements on the CERN-HPD will be given in the (X,Y)-system.

The error on the values of x_o, y_o is in the order of 1 - 2 mm (due to uncertainties of camera coordinates, levelling of the top of the magnet and the AL-beams, measurement errors of the horizontal displacement, etc.). The error on z_o is in the order of 0.5 mm.

- - - - - - - - - - - -

Fig. 1 : Camera plate and magnet yoke seen from beam entry side

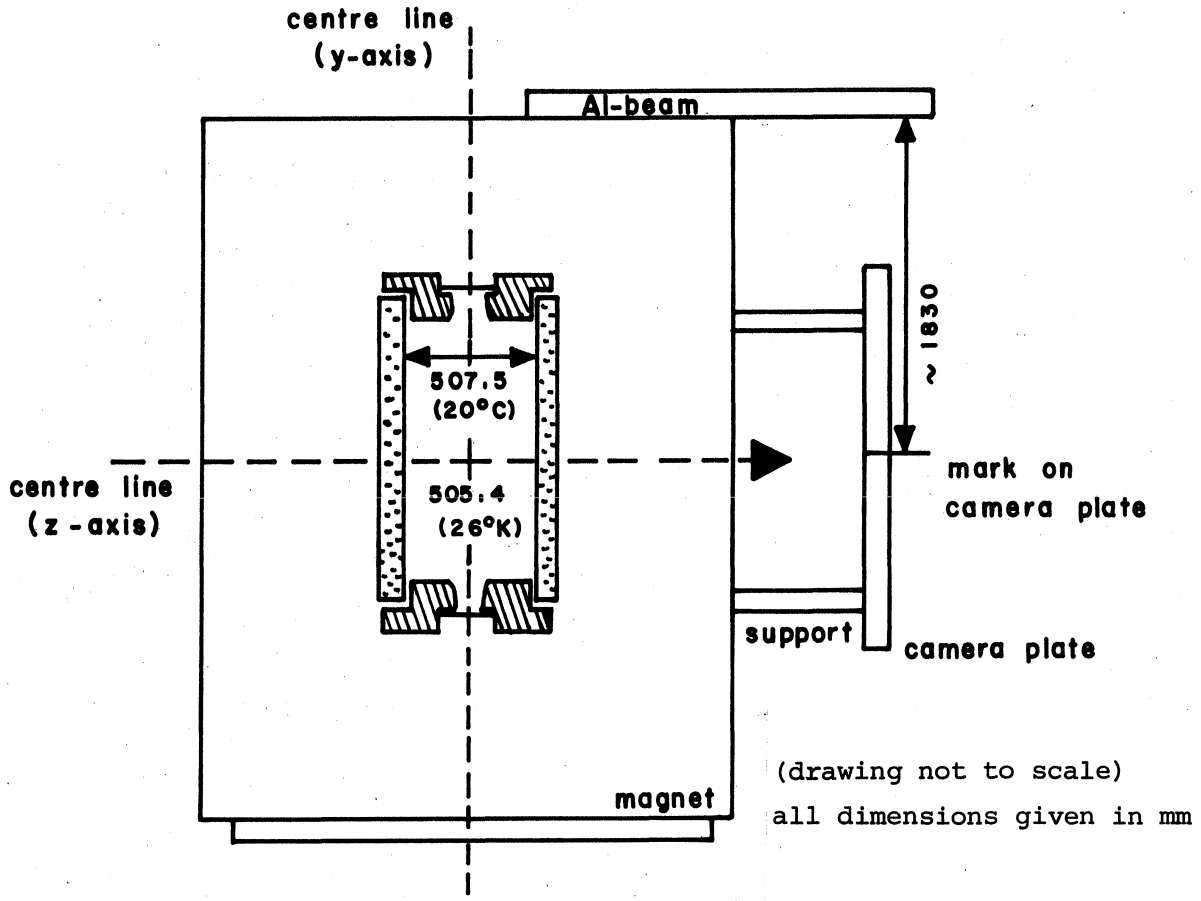
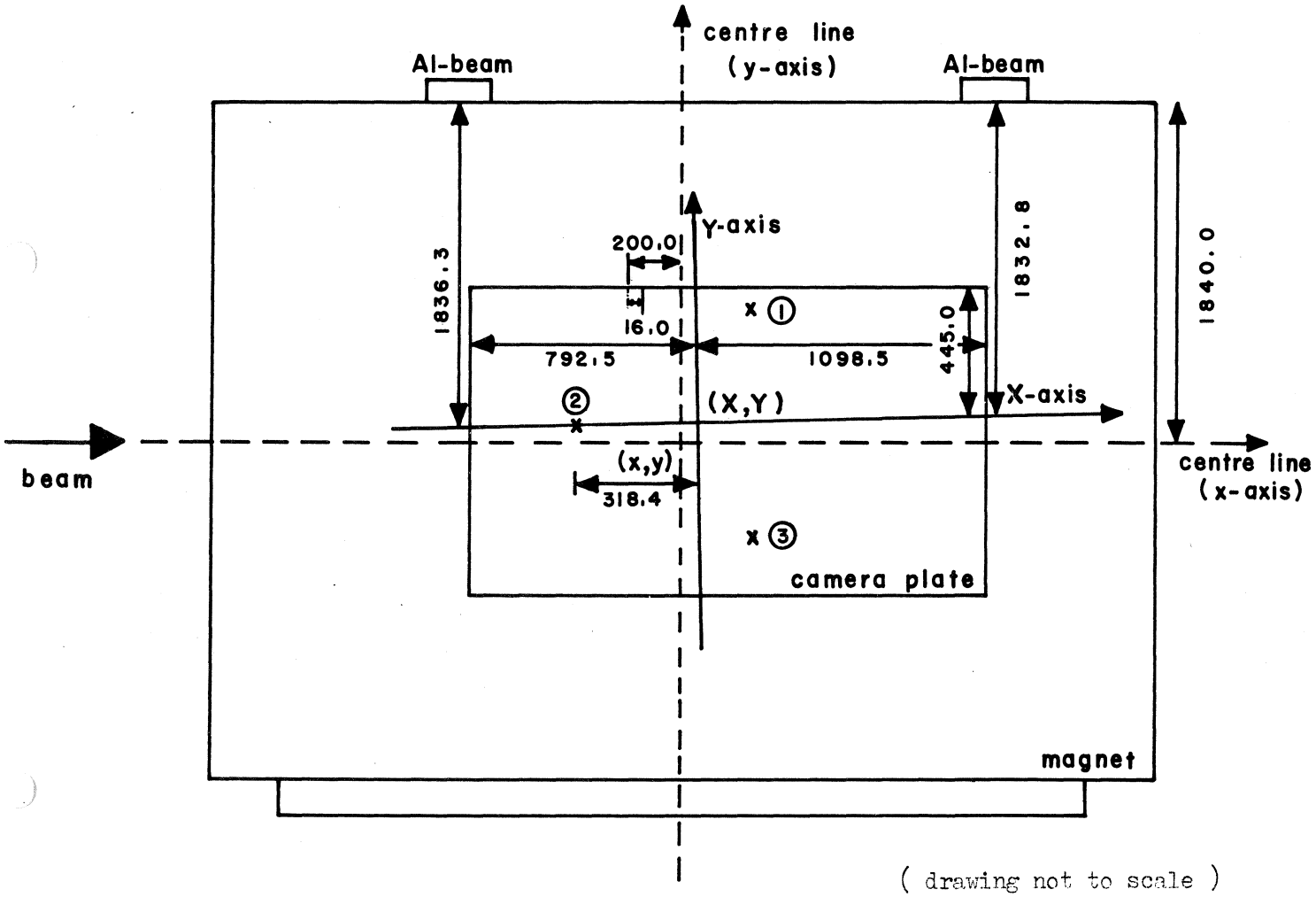


Fig. 2 : Camera plate and magnet yoke seen from camera side



(drawing not to scale)

all dimensions given in mm

The figures in this drawing correspond to an actual measurement and are quoted as an example. The field origin with respect to the origin of the optics parameters (circumcentre of cameras) would be given by :

x_o = -16.8 mm

y_o = -5.2 mm

Section : FIELD
Date : 10.3.1970

A 002

FIELD MEASUREMENTS

The detailed report (2) on the new measurements of the 2m chamber field is filed in this section and should be consulted for reference. We would like to update and correct a few statements in this report:

The "geometric centre" of the chamber (warm), the centre of the "visible region" (warm) and the centre of the magnetic field coincide. They are given by the intersection of the 3 symmetry planes of the chamber at room temperature (≡warm). The various systems used for field measurements, tables and polynomial fits are illustrated in Fig. 1.

The field measurements have been normalized to the measurement at the centre of the chamber (point 3F14) and then fitted to extract the field tables. The value at the centre of the chamber may therefore be slightly different from 1.0.

A small mistake had been introduced when the original measurements were transferred from labels to co-ordinates, namely, the first 4 x-values were displaced 5cm to more negative values (they should have been -95., -90., -85., -80., respectively). These wrong co-ordinates were then used to derive the field tables quoted in (2). The polynomials and tables quoted in FIELD/B have been recalculated with corrected co-ordinates. It has been verified that within the visible region of the chamber old and new table values differ by less than 5×10^{-4}.

Another polynomial fit to the field tables has been performed by A. Brandstetter. This fit uses fewer coefficients and gives polynomial expressions also for the small field components Bx and By. The results are available in report (3).

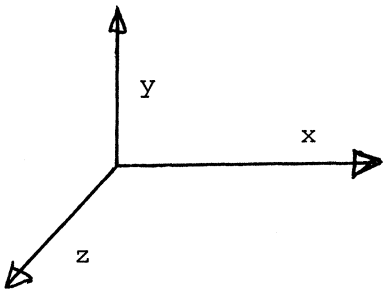
(1) CERN, 3.1.1963 : 2m Hydrogen Bubble Chamber Magnet Field Measurements, G. Petrucci.

(2) CERN/D.Ph.II/200 70-2 : New measurements of the 2m HBC magnetic field, R. Armenteros and P. Baillon.

(3) RHEL/M/H/3 : Polynomial evaluation of the 2m HBC field measurements, for use in the Rutherford Laboratory Geometry program, A. Brandstetter.

Fig. 1 : Co-ordinate systems used for field measurements, field tables and polynomials.

a)



origin: at geometric centre of chamber (warm)

x-axis: positive along beam direction

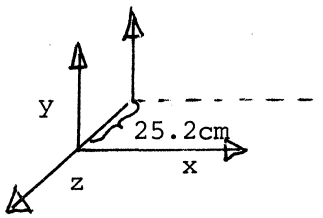
y-axis: positive upwards, perpendicular to bottom of chamber

z-axis: positive towards cameras, perpendicular to chamber windows.

This system has been used for :

- field measurements quoted in (2)
- tables and polynomials quoted in section FIELD/B
- polynomial fit to Petrucci's measurements (1).

b)



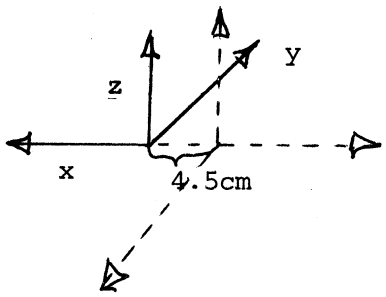
origin: shifted 25.2 cm towards cameras to coincide with reference plane (inside of camera window)

x-, y-, z- axes: parallel to a)

This system has been used for:

- tables given on pages 41-56 of report (2)

c)



origin: shifted 4.5cm along X-axis towards beam entry (symmetry plane of internal aperture of coil cases).

x-axis: positive against beam direction.

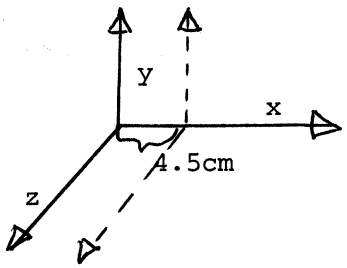
y-axis: positive away from cameras, perpendicular to chamber windows

z-axis: positive upwards, perpendicular to bottom of chamber.

This system has been used for:

- original measurements by Petrucci (1).

d)



origin: shifted 4.5cm along x-axis towards beam entry

x-, y-, z- axes: parallel to a)

This system has been used for:

- field table derived from Petrucci's measurements.

Section : FIELD

Date : 10.3.1970

A 003

Polynomial evaluation of new magnetic field measurements

The new magnetic field measurements have been fitted with a polynomial of seventh order which satisfies Maxwell's equations.

$$B_z = c_{ijk}\, x^i\, y^j\, z^k \qquad (i, j, k = 0,1,\ldots,7)$$

In the entry and exit regions of the chamber we have taken only those points which were actually measured, in the centre region we have included all points given in the tables.

Some terms of the polynomial were eliminated because their contribution was insignificant in all four measurements. The actual form of the fitted polynomial is given below :

$$\begin{aligned}
B_z = {} & c_1 + c_2(z^2-x^2) + c_3(y^2-x^2) + c_4(z^4-6x^2z^2+x^4) + \\
& + c_5(3y^2z^2-3x^2z^2-3x^2y^2+x^4) + c_6(y^4-6x^2y^2+x^4) + \\
& + c_7(z^6-15x^2z^4+15x^4z^2-x^6) + c_8(5y^2z^4-5x^2z^4-30x^2y^2z^2+10x^4z^2+ \\
& \quad 5x^4y^2-x^6) + c_9x + c_{10}(3xz^2-x^3) + c_{11}(3xy^2-x^3) + \\
& + c_{12}(5xz^4-10x^3z^2+x^5) + c_{13}(15xy^2z^2-5x^3z^2-5x^3y^2+x^5) + \\
& + c_{14}(5xy^4-10x^3y^2+x^5) + c_{15}(105xy^2z^4-49x^3z^4-210x^3y^2z^2 + \\
& \quad 42x^5z^2+21x^5y^2-3x^7) + c_{16}y + c_{17}(yz^2-x^2y) + c_{18}(y^3-3x^2y) + \\
& + c_{19}(yz^4-6x^2yz^2+x^4y) + c_{20}(y^3z^2-3x^2yz^2-x^2y^3+x^4y) + \\
& + c_{21}(y^5-10x^2y^3+5x^4y) + c_{22}(5xyz^4-10x^3yz^2+x^5y) + \\
& + c_{23}(15xy^3z^2-15x^3yz^2-5x^3y^3+3x^5y) + c_{24}(3xy^5-10x^3y^3+3x^5y)
\end{aligned}$$

The coding of this expression is optimized in order to save computing time. As a matter of fact, the polynomial evaluation of the field at any random point inside the chamber is about 2.5 times faster than the table interpolation (with routine POWEZE written in assembler code). See listing of routines on page 3.

The values obtained for the coefficients of the fits to the four measurements are listed in FIELD / B001...B004, respectively.

The quality of the polynomial fit can be judged from the standard deviation of the residuals after the fit to the four measurements :

σ	= $\pm$ 2.6	Gauss for magnet	=	10000 A,	correction =	1000 A
	= $\pm$ 2.4	Gauss - " -		10000 A,	- " -	0 A
	= $\pm$ 2.1	Gauss - " -		8000 A,	- " -	1000 A
	= $\pm$ 1.5	Gauss - " -		6000 A	- " -	1000 A

These values agree well with the precision of measurements quoted in FIELD / A002, page 7.

Routines for polynomial evaluation of magnetic field :

```
      FUNCTION ZFIELD (XX,YY,ZZ)

C--       POLYNOMIAL FIT TO NEW MEASUREMENTS OF 2M CHAMBER FIELD
C--       ORIGIN IS AT GEOMETRIC CENTRE OF WARM CHAMBER

      COMMON /PHYS/ C( 49)
      DIMENSION X( 8),Y( 8),Z( 8)
      DATA FIELD/5HFIELD/

      ZFIELD=0.
      L=ITIT (FIELD)
      IF       (C(L+1).NE.-3.)      GO TO      100
      CALL POWEZE ((XX-C(L+8))*C(L+5),X, 7)
      CALL POWEZE ((YY-C(L+9))*C(L+6),Y, 7)
      CALL POWEZE ((ZZ-C(L+10))*C(L+7),Z, 7)


      ZFIELD=C(L+11)+C(L+12)*Z(3)+C(L+13)*Z(5)+C(L+14)*Z(7)+Y(2)*(C(L+15
     1)+C(L+16)*Z(3)+C(L+17)*Z(5))+Y(3)*(C(L+18)+C(L+19)*Z(3)+C(L+20)*Z(
     25))+Y(4)*(C(L+21)+C(L+22)*Z(3))+C(L+23)*Y(5)+C(L+24)*Y(6)+X(2)*(C(
     3L+25)+C(L+26)*Z(3)+Z(5)*(C(L+27)+C(L+28)*Y(2))+Y(3)*(C(L+29)+C(L+3
     40)*Z(3)+C(L+31)*Z(5))+C(L+32)*Y(4)*Z(3)+C(L+33)*Y(5)+C(L+34)*Y(6))
     5+X(3)*(C(L+35)+C(L+36)*Z(3)+C(L+37)*Z(5)+Y(2)*(C(L+38)+C(L+39)*Z(3
     6))+Y(3)*(C(L+40)+C(L+41)*Z(3))+C(L+42)*Y(4))+X(4)*(C(L+43)+C(L+44)
     7*Z(3)+C(L+45)*Z(5)+C(L+46)*Y(2)*Z(3)+Y(3)*(C(L+47)+C(L+48)*Z(3))+C
     8(L+49)*Y(4))+X(5)*(C(L+50)+C(L+51)*Z(3)+C(L+52)*Y(2)+C(L+53)*Y(3))
     9+X(6)*(C(L+54)+C(L+55)*Z(3)+C(L+56)*Y(2)+C(L+57)*Y(3))+C(L+58)*X(7
     1)+C(L+59)*X(8)


      ZFIELD=C(L+2)*ZFIELD+C(L+3)
  100 RETURN
      END



      SUBROUTINE POWEZE (XX,X,N)

C--       STORES SUCCESSIVE POWERS OF XX INTO ARRAY X,.DECLARE DIMENSION X(N+1)
C--       IN CALLING ROUTINE. SUGGESTED TO REWRITE IN ASSEMBLER CODE.

      DIMENSION X(N)
      Y = XX
      X(1) = 1.
      DO  2  I = 1, N
      X(I+1) = X(I)*Y
    2 CONTINUE
      RETURN
      END
```

Section : FIELD

Date : 10.3.1970

B 001

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : -1000 A

The sign of word 2 of the title block FIELD is positive (negative) for a positive (negative) beam particle bent clockwise in the chamber (e.g. to bottom of chamber).

The values of x_o, y_o, z_o given on the DATA SHEET (see GEOM-TITLE / D..) should be used for words 8-10 in title block FIELD, respectively. Please consult FIELD / A001 if you are not using geometry titles produced by CERN.

This title block can only be used with routine ZFIELD described in FIELD / A003. Words 5-7 give the orientation of the field axis system with respect to the geometry axis system (+1 for same direction, -1 for opposite direction).

a) FIELD Polynomial :

```
*     FIELD        59  10F7.0/(5E14.7)                                    M10C1-01
   -3.0    1.0    0.0  .0005    1.0    1.0    1.0    0.0    0.0  -25.2  M10C1-02
 1.7395979E+01 1.2566094E-04-6.0510881E-08 3.9107120E-13-3.1970422E-04  M10C1-03
-2.0764962E-07 1.6984916E-10-1.6828528E-04 3.3609175E-07-9.4518989E-13  M10C1-04
 6.9160138E-08-3.3711820E-10-5.4126152E-08 3.3514912E-11 2.0223675E-04  M10C1-05
-4.6439119E-08 7.8493450E-12-1.4411355E-12-2.6852464E-08-4.1208433E-11  M10C1-06
-3.1718178E-15 2.7512830E-12 4.4859069E-12-2.6821674E-13 4.2624337E-05  M10C1-07
 2.6973538E-08-4.9208781E-12 1.6920283E-10-7.7403607E-12-1.1334838E-08  M10C1-08
 5.6711393E-12 1.9690776E-12 2.4430528E-08-1.9625457E-12 1.0572726E-15  M10C1-09
 1.3098809E-13 4.7643306E-12 6.3436356E-15-2.3038508E-14-2.6064500E-09  M10C1-10
 3.9756882E-12 3.0552133E-13-9.4518989E-13-2.8017848E-13-1.2687271E-15  M10C1-11
-6.1872565E-15-6.3436356E-16-2.0203322E-13 9.0623366E-17                M10C1-12
```

b) FIELD Tables :

This title block should be used with the standard routine ZFIELD provided in TC Program Library / GENERAL.

Section : FIELD

Date : 10.3.1970

B 001

MAGNETIC FIELD

Main magnet : 10000 A

Compensating magnet : -1000 A

```
*     FIELD     2290 4F10.5,3I5,3F5.0,3(/14F5.0)/5F5.0/( 9F8.5)
C-- FIELD TITLE FOR 2 M CHAMBER, MEAS. DEC 69, MAIN MAGNET=10000 A, CORR=-1000 A
C-- MEASURED AT GEOMETRIC CENTRE OF CHAMBER (WARM) - X=0, Y=0, Z=-25.2
C-- FOR TRANSFORMATION TO CAMERA SYSTEM SEE '2 M USERS HANDBOOK' SECTIONS
C-- GEOM-TITLE/D... AND FIELD/A...
0.        17.395117 0.        .0005        29   11    70.   0.   -25.2  M10C1 -4
-95. -90. -85. -80. -75. -70. -65. -60. -55. -50. -40. -30. -20. -10.   M10C1 -3
0.   10.  20.  30.  40.  50.  55.  60.  65.  70.  75.  80.  85.  90.     M10C1 -2
95.  -25. -20. -15.  -10. -5. 0.   5.   10.  15.  20.  25.  -25.2-18.9  M10C1 -1
-12.6  0.0 12.6 18.9 25.2                                              M10C1  0
 1.02157 1.02078 1.01983 1.01876 1.01759 1.01636 1.01510 1.01382 1.01256M10C1  1
 1.01134 1.00907 1.00717 1.00575 1.00488 1.00462 1.00499 1.00598 1.00755M10C1  2
 1.00963 1.01213 1.01350 1.01492 1.01638 1.01785 1.01931 1.02072 1.02207M10C1  3
 1.02333 1.02445 1.02172 1.02106 1.02020 1.01917 1.01801 1.01676 1.01544M10C1  4
 1.01411 1.01277 1.01146 1.00902 1.00696 1.00541 1.00447 1.00420 1.00462M10C1  5
 1.00573 1.00747 1.00977 1.01250 1.01397 1.01550 1.01705 1.01859 1.02010M10C1  6
 1.02154 1.02288 1.02408 1.02511 1.02231 1.02159 1.02079 1.01980 1.01860M10C1  7
 1.01723 1.01573 1.01418 1.01265 1.01117 1.00855 1.00650 1.00506 1.00421M10C1  8
 1.00397 1.00435 1.00541 1.00715 1.00952 1.01239 1.01395 1.01557 1.01722M10C1  9
 1.01886 1.02049 1.02206 1.02353 1.02484 1.02586 1.02259 1.02208 1.02119M10C1 10
 1.02002 1.01866 1.01717 1.01563 1.01407 1.01255 1.01108 1.00845 1.00632M10C1 11
 1.00478 1.00388 1.00364 1.00407 1.00516 1.00691 1.00928 1.01219 1.01381M10C1 12
 1.01552 1.01728 1.01906 1.02081 1.02248 1.02401 1.02531 1.02629 1.02296M10C1 13
 1.02215 1.02110 1.01987 1.01850 1.01703 1.01551 1.01398 1.01246 1.01098M10C1 14
 1.00828 1.00605 1.00442 1.00347 1.00325 1.00376 1.00498 1.00685 1.00929M10C1 15
 1.01219 1.01378 1.01543 1.01713 1.01886 1.02061 1.02234 1.02404 1.02570M10C1 16
 1.02728 1.02287 1.02225 1.02126 1.02000 1.01856 1.01701 1.01541 1.01380M10C1 17
 1.01223 1.01073 1.00804 1.00587 1.00429 1.00336 1.00310 1.00352 1.00463M10C1 18
 1.00641 1.00884 1.01185 1.01354 1.01531 1.01715 1.01900 1.02082 1.02256M10C1 19
 1.02414 1.02547 1.02646 1.02279 1.02197 1.02092 1.01969 1.01831 1.01685M10C1 20
 1.01533 1.01379 1.01227 1.01080 1.00810 1.00586 1.00422 1.00326 1.00303M10C1 21
 1.00353 1.00474 1.00661 1.00905 1.01196 1.01355 1.01521 1.01691 1.01864M10C1 22
 1.02038 1.02211 1.02381 1.02544 1.02700 1.02268 1.02173 1.02061 1.01934M10C1 23
 1.01798 1.01654 1.01507 1.01359 1.01213 1.01071 1.00810 1.00592 1.00430M10C1 24
 1.00332 1.00304 1.00350 1.00467 1.00652 1.00896 1.01189 1.01349 1.01515M10C1 25
 1.01685 1.01857 1.02027 1.02193 1.02351 1.02498 1.02630 1.02171 1.02088M10C1 26
 1.01986 1.01871 1.01744 1.01610 1.01472 1.01332 1.01193 1.01058 1.00809M10C1 27
 1.00599 1.00442 1.00347 1.00320 1.00363 1.00475 1.00653 1.00889 1.01172M10C1 28
 1.01327 1.01488 1.01653 1.01820 1.01985 1.02146 1.02300 1.02444 1.02573M10C1 29
 1.02115 1.02033 1.01934 1.01821 1.01698 1.01568 1.01433 1.01298 1.01164M10C1 30
 1.01034 1.00794 1.00593 1.00443 1.00352 1.00326 1.00368 1.00477 1.00649M10C1 31
 1.00876 1.01149 1.01299 1.01454 1.01613 1.01774 1.01934 1.02090 1.02239M10C1 32
 1.02378 1.02504 1.02036 1.01949 1.01846 1.01733 1.01612 1.01486 1.01356M10C1 33
 1.01227 1.01100 1.00977 1.00752 1.00565 1.00426 1.00344 1.00321 1.00362M10C1 34
 1.00464 1.00624 1.00835 1.01088 1.01226 1.01370 1.01517 1.01666 1.01814M10C1 35
 1.01958 1.02096 1.02225 1.02341 1.00404 1.00605 1.00728 1.00790 1.00804M10C1 36
 1.00782 1.00732 1.00664 1.00584 1.00498 1.00326 1.00174 1.00059  .99991M10C1 37
  .99974 1.00008 1.00093 1.00224 1.00394 1.00591 1.00694 1.00795 1.00891M10C1 38
 1.00976 1.01044 1.01088 1.01098 1.01066 1.00978 1.00673 1.00869 1.00983M10C1 39
 1.01033 1.01034 1.00997 1.00935 1.00855 1.00764 1.00668 1.00480 1.00317M10C1 40
 1.00195 1.00123 1.00104 1.00141 1.00232 1.00377 1.00566 1.00788 1.00904M10C1 41
 1.01019 1.01127 1.01221 1.01293 1.01334 1.01333 1.01275 1.01144 1.01035M10C1 42
 1.01149 1.01214 1.01232 1.01206 1.01147 1.01064 1.00965 1.00859 1.00751M10C1 43
 1.00550 1.00384 1.00263 1.00190 1.00169 1.00205 1.00301 1.00454 1.00657M10C1 44
 1.00891 1.01012 1.01131 1.01244 1.01347 1.01433 1.01497 1.01529 1.01518M10C1 45
 1.01444 1.01178 1.01292 1.01339 1.01335 1.01293 1.01222 1.01132 1.01030M10C1 46
 1.00922 1.00812 1.00605 1.00431 1.00302 1.00227 1.00209 1.00249 1.00347M10C1 47
 1.00500 1.00703 1.00942 1.01070 1.01199 1.01324 1.01440 1.01540 1.01616M10C1 48
 1.01658 1.01654 1.01592 1.01246 1.01349 1.01389 1.01379 1.01332 1.01257M10C1 49
 1.01163 1.01058 1.00947 1.00835 1.00623 1.00444 1.00313 1.00235 1.00216M10C1 50
 1.00256 1.00355 1.00510 1.00716 1.00960 1.01091 1.01223 1.01353 1.01475M10C1 51
 1.01583 1.01669 1.01724 1.01736 1.01694 1.01267 1.01370 1.01407 1.01394M10C1 52
 1.01343 1.01264 1.01167 1.01059 1.00945 1.00832 1.00618 1.00440 1.00308M10C1 53
 1.00231 1.00211 1.00250 1.00347 1.00502 1.00709 1.00958 1.01092 1.01229M10C1 54
 1.01363 1.01489 1.01599 1.01685 1.01737 1.01742 1.01685 1.01227 1.01333M10C1 55
 1.01374 1.01364 1.01316 1.01240 1.01145 1.01038 1.00926 1.00814 1.00601M10C1 56
```

Section : FIELD

Date : 10.3.1970

B 001

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : -1000 A

1.00422	1.00290	1.00213	1.00193	1.00232	1.00330	1.00484	1.00688	1.00932M10C1 57
1.01063	1.01196	1.01327	1.01450	1.01558	1.01644	1.01699	1.01710	1.01664M10C1 58
1.01143	1.01246	1.01287	1.01281	1.01239	1.01170	1.01082	1.00982	1.00876M10C1 59
1.00768	1.00563	1.00387	1.00257	1.00179	1.00159	1.00199	1.00298	1.00454M10C1 60
1.00659	1.00900	1.01028	1.01157	1.01282	1.01398	1.01497	1.01573	1.01615M10C1 61
1.01613	1.01554	1.00970	1.01088	1.01145	1.01153	1.01123	1.01066	1.00987M10C1 62
1.00896	1.00797	1.00695	1.00497	1.00327	1.00199	1.00122	1.00103	1.00142M10C1 63
1.00239	1.00390	1.00588	1.00820	1.00942	1.01063	1.01180	1.01287	1.01377M10C1 64
1.01443	1.01476	1.01466	1.01400	1.00882	1.00947	1.00975	1.00972	1.00943M10C1 65
1.00894	1.00828	1.00750	1.00664	1.00573	1.00391	1.00228	1.00100	1.00022M10C1 66
1.00001	1.00041	1.00141	1.00293	1.00486	1.00704	1.00816	1.00926	1.01031M10C1 67
1.01126	1.01208	1.01272	1.01314	1.01329	1.01311	1.00634	1.00698	1.00728M10C1 68
1.00729	1.00705	1.00662	1.00604	1.00534	1.00456	1.00374	1.00209	1.00059M10C1 69
.99943	.99871	.99852	.99889	.99980	1.00120	1.00297	1.00497	1.00600M10C1 70
1.00700	1.00795	1.00882	1.00956	1.01014	1.01051	1.01062	1.01043	.99670M10C1 71
.99855	.99991	1.00082	1.00136	1.00159	1.00156	1.00132	1.00092	1.00042M10C1 72
.99922	.99801	.99701	.99637	.99620	.99653	.99735	.99857	1.00005M10C1 73
1.00159	1.00230	1.00292	1.00341	1.00372	1.00381	1.00362	1.00309	1.00216M10C1 74
1.00076	.99799	1.00082	1.00273	1.00390	1.00450	1.00466	1.00449	1.00408M10C1 75
1.00352	1.00285	1.00144	1.00013	.99912	.99851	.99836	.99869	.99951M10C1 76
1.00077	1.00240	1.00421	1.00510	1.00592	1.00660	1.00707	1.00723	1.00697M10C1 77
1.00615	1.00462	1.00218	1.00124	1.00386	1.00553	1.00648	1.00686	1.00683M10C1 78
1.00648	1.00593	1.00524	1.00448	1.00292	1.00152	1.00046	.99983	.99969M10C1 79
1.00007	1.00095	1.00231	1.00403	1.00595	1.00690	1.00779	1.00855	1.00913M10C1 80
1.00946	1.00943	1.00896	1.00793	1.00623	1.00359	1.00583	1.00726	1.00803M10C1 81
1.00830	1.00817	1.00776	1.00715	1.00641	1.00560	1.00396	1.00250	1.00140M10C1 82
1.00075	1.00060	1.00098	1.00188	1.00325	1.00501	1.00701	1.00802	1.00899M10C1 83
1.00986	1.01056	1.01102	1.01113	1.01079	1.00985	1.00816	1.00469	1.00682M10C1 84
1.00815	1.00884	1.00904	1.00885	1.00838	1.00773	1.00695	1.00611	1.00441M10C1 85
1.00292	1.00180	1.00114	1.00100	1.00139	1.00230	1.00369	1.00548	1.00751M10C1 86
1.00855	1.00956	1.01047	1.01123	1.01176	1.01197	1.01175	1.01097	1.00949M10C1 87
1.00504	1.00712	1.00840	1.00906	1.00922	1.00901	1.00853	1.00786	1.00707M10C1 88
1.00622	1.00452	1.00301	1.00187	1.00120	1.00104	1.00141	1.00232	1.00371M10C1 89
1.00552	1.00760	1.00867	1.00971	1.01065	1.01144	1.01199	1.01222	1.01200M10C1 90
1.01120	1.00967	1.00454	1.00666	1.00799	1.00867	1.00886	1.00867	1.00820M10C1 91
1.00755	1.00677	1.00594	1.00425	1.00276	1.00164	1.00097	1.00080	1.00116M10C1 92
1.00204	1.00340	1.00517	1.00721	1.00826	1.00927	1.01020	1.01097	1.01152M10C1 93
1.01175	1.01154	1.01076	1.00927	1.00332	1.00546	1.00683	1.00758	1.00784M10C1 94
1.00772	1.00732	1.00673	1.00601	1.00521	1.00358	1.00211	1.00100	1.00034M10C1 95
1.00019	1.00058	1.00149	1.00288	1.00465	1.00664	1.00765	1.00861	1.00946M10C1 96
1.01015	1.01059	1.01070	1.01037	1.00948	1.00787	1.00114	1.00339	1.00489M10C1 97
1.00577	1.00616	1.00616	1.00587	1.00537	1.00473	1.00399	1.00245	1.00103M10C1 98
.99992	.99925	.99909	.99946	1.00035	1.00171	1.00344	1.00536	1.00631M10C1 99
1.00720	1.00797	1.00857	1.00891	1.00891	1.00847	1.00747	1.00576	.99960M10C1100
1.00130	1.00251	1.00328	1.00368	1.00377	1.00361	1.00325	1.00274	1.00213M10C1101
1.00075	.99940	.99830	.99761	.99744	.99783	.99874	1.00011	1.00178M10C1102
1.00354	1.00438	1.00514	1.00578	1.00624	1.00648	1.00645	1.00609	1.00532M10C1103
1.00410	.99652	.99817	.99935	1.00013	1.00057	1.00071	1.00061	1.00033M10C1104
.99990	.99938	.99817	.99697	.99599	.99538	.99524	.99559	.99641M10C1105
.99765	.99914	1.00072	1.00146	1.00212	1.00266	1.00305	1.00322	1.00314M10C1106
1.00274	1.00197	1.00077	.98894	.99143	.99335	.99477	.99576	.99638M10C1107
.99670	.99678	.99665	.99638	.99557	.99464	.99383	.99331	.99320M10C1108
.99352	.99427	.99534	.99659	.99779	.99829	.99866	.99886	.99885M10C1109
.99856	.99794	.99692	.99545	.99345	.99252	.99507	.99702	.99844M10C1110
.99940	.99997	1.00022	1.00021	1.00000	.99963	.99863	.99753	.99659M10C1111
.99600	.99586	.99624	.99709	.99832	.99977	1.00120	1.00181	1.00229M10C1112
1.00259	1.00266	1.00244	1.00187	1.00088	.99940	.99734	.99513	.99806M10C1113
1.00015	1.00156	1.00241	1.00281	1.00287	1.00267	1.00229	1.00178	1.00059M10C1114
.99943	.99852	.99798	.99790	.99829	.99913	1.00036	1.00184	1.00339M10C1115
1.00410	1.00471	1.00516	1.00540	1.00533	1.00488	1.00395	1.00241	1.00013M10C1116
.99748	1.00028	1.00226	1.00355	1.00430	1.00461	1.00459	1.00433	1.00389M10C1117
1.00333	1.00206	1.00084	.99988	.99931	.99920	.99957	1.00042	1.00168M10C1118
1.00323	1.00489	1.00568	1.00637	1.00692	1.00725	1.00729	1.00694	1.00609M10C1119
1.00463	1.00240	.99887	1.00152	1.00338	1.00459	1.00527	1.00554	1.00548M10C1120
1.00518	1.00471	1.00413	1.00281	1.00155	1.00055	.99995	.99984	1.00023M10C1121
1.00111	1.00241	1.00400	1.00570	1.00650	1.00722	1.00779	1.00816	1.00825M10C1122
1.00797	1.00724	1.00593	1.00391	.99929	1.00190	1.00372	1.00490	1.00555M10C1123

Section : FIELD

Date : 10.3.1970

B 001

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : -1000 A

1.00578	1.00570	1.00539	1.00490	1.00431	1.00299	1.00172	1.00072	1.00012M10C1124
.99998	1.00035	1.00120	1.00249	1.00410	1.00584	1.00667	1.00742	1.00804M10C1125
1.00845	1.00857	1.00831	1.00757	1.00622	1.00412	.99872	1.00138	1.00324M10C1126
1.00443	1.00510	1.00536	1.00529	1.00499	1.00453	1.00395	1.00267	1.00143M10C1127
1.00045	.99984	.99969	1.00001	1.00081	1.00203	1.00358	1.00527	1.00609M10C1128
1.00684	1.00745	1.00786	1.00800	1.00776	1.00703	1.00570	1.00360	.99719M10C1129
.99992	1.00186	1.00314	1.00389	1.00423	1.00423	1.00398	1.00355	1.00300M10C1130
1.00174	1.00051	.99953	.99895	.99883	.99921	1.00007	1.00134	1.00290M10C1131
1.00456	1.00533	1.00601	1.00654	1.00685	1.00688	1.00653	1.00570	1.00428M10C1132
1.00214	.99530	.99773	.99955	1.00085	1.00170	1.00217	1.00232	1.00222M10C1133
1.00192	1.00147	1.00033	.99912	.99809	.99744	.99728	.99766	.99855M10C1134
.99985	1.00140	1.00295	1.00364	1.00421	1.00461	1.00479	1.00468	1.00423M10C1135
1.00337	1.00202	1.00011	.99234	.99478	.99664	.99798	.99889	.99942M10C1136
.99963	.99960	.99937	.99900	.99799	.99689	.99596	.99538	.99525M10C1137
.99561	.99645	.99767	.99910	1.00051	1.00112	1.00161	1.00192	1.00201M10C1138
1.00182	1.00129	1.00035	.99894	.99697	.98834	.99080	.99269	.99409M10C1139
.99506	.99567	.99598	.99604	.99590	.99562	.99480	.99386	.99305M10C1140
.99253	.99241	.99274	.99349	.99457	.99582	.99703	.99753	.99791M10C1141
.99813	.99812	.99785	.99724	.99624	.99479	.99280	.99188	.99555M10C1142
.99811	.99978	1.00076	1.00121	1.00126	1.00103	1.00061	1.00007	.99884M10C1143
.99769	.99680	.99627	.99616	.99648	.99723	.99839	.99987	1.00151M10C1144
1.00229	1.00297	1.00349	1.00375	1.00364	1.00302	1.00174	.99959	.99635M10C1145
.99773	1.00049	1.00237	1.00354	1.00415	1.00433	1.00418	1.00381	1.00328M10C1146
1.00265	1.00129	1.00003	.99905	.99845	.99830	.99864	.99946	1.00072M10C1147
1.00235	1.00417	1.00507	1.00590	1.00659	1.00706	1.00723	1.00697	1.00615M10C1148
1.00461	1.00217	1.00105	1.00356	1.00521	1.00617	1.00659	1.00659	1.00629M10C1149
1.00576	1.00510	1.00435	1.00281	1.00142	1.00039	.99979	.99970	1.00011M10C1150
1.00102	1.00238	1.00410	1.00600	1.00694	1.00783	1.00859	1.00918	1.00949M10C1151
1.00945	1.00892	1.00779	1.00588	1.00332	1.00557	1.00701	1.00780	1.00809M10C1152
1.00799	1.00760	1.00702	1.00630	1.00551	1.00389	1.00246	1.00137	1.00074M10C1153
1.00062	1.00102	1.00193	1.00332	1.00510	1.00710	1.00812	1.00908	1.00994M10C1154
1.01064	1.01108	1.01118	1.01082	1.00988	1.00819	1.00441	1.00658	1.00793M10C1155
1.00865	1.00887	1.00871	1.00826	1.00763	1.00687	1.00604	1.00437	1.00290M10C1156
1.00180	1.00116	1.00104	1.00145	1.00238	1.00379	1.00559	1.00763	1.00866M10C1157
1.00966	1.01057	1.01131	1.01183	1.01202	1.01178	1.01098	1.00947	1.00478M10C1158
1.00691	1.00823	1.00890	1.00908	1.00889	1.00842	1.00776	1.00699	1.00615M10C1159
1.00448	1.00302	1.00191	1.00126	1.00112	1.00149	1.00239	1.00378	1.00559M10C1160
1.00767	1.00875	1.00979	1.01074	1.01153	1.01209	1.01231	1.01207	1.01124M10C1161
1.00964	1.00413	1.00639	1.00779	1.00851	1.00871	1.00853	1.00806	1.00741M10C1162
1.00665	1.00583	1.00419	1.00277	1.00170	1.00106	1.00089	1.00121	1.00204M10C1163
1.00334	1.00507	1.00711	1.00817	1.00922	1.01018	1.01099	1.01157	1.01180M10C1164
1.01156	1.01069	1.00901	1.00303	1.00519	1.00659	1.00737	1.00766	1.00757M10C1165
1.00721	1.00664	1.00594	1.00516	1.00355	1.00210	1.00100	1.00035	1.00021M10C1166
1.00061	1.00154	1.00295	1.00473	1.00673	1.00773	1.00868	1.00953	1.01020M10C1167
1.01063	1.01072	1.01038	1.00948	1.00787	1.00076	1.00307	1.00462	1.00554M10C1168
1.00596	1.00599	1.00573	1.00525	1.00462	1.00390	1.00238	1.00098	.99990M10C1169
.99924	.99910	.99948	1.00039	1.00176	1.00349	1.00540	1.00635	1.00722M10C1170
1.00798	1.00855	1.00885	1.00880	1.00830	1.00721	1.00539	.99913	1.00088M10C1171
1.00212	1.00293	1.00336	1.00349	1.00336	1.00303	1.00255	1.00197	1.00063M10C1172
.99932	.99825	.99759	.99743	.99783	.99874	1.00010	1.00176	1.00351M10C1173
1.00434	1.00508	1.00570	1.00615	1.00638	1.00633	1.00594	1.00516	1.00391M10C1174
.99585	.99759	.99885	.99970	1.00019	1.00038	1.00033	1.00008	.99969M10C1175
.99919	.99802	.99685	.99589	.99529	.99515	.99550	.99633	.99755M10C1176
.99903	1.00058	1.00130	1.00194	1.00246	1.00281	1.00294	1.00281	1.00236M10C1177
1.00153	1.00026	.99900	1.00326	1.00573	1.00697	1.00738	1.00726	1.00681M10C1178
1.00615	1.00538	1.00457	1.00294	1.00149	1.00038	.99971	.99956	.99995M10C1179
1.00085	1.00219	1.00390	1.00589	1.00695	1.00801	1.00899	1.00979	1.01025M10C1180
1.01010	1.00897	1.00633	1.00145	1.00739	1.00886	1.00967	1.00998	1.00988M10C1181
1.00949	1.00887	1.00811	1.00726	1.00636	1.00460	1.00305	1.00187	1.00115M10C1182
1.00095	1.00131	1.00223	1.00369	1.00560	1.00785	1.00902	1.01017	1.01124M10C1183
1.01219	1.01291	1.01333	1.01334	1.01280	1.01156	1.00943	1.01091	1.01167M10C1184
1.01186	1.01163	1.01107	1.01030	1.00938	1.00838	1.00735	1.00539	1.00372M10C1185
1.00251	1.00181	1.00168	1.00212	1.00311	1.00464	1.00662	1.00894	1.01016M10C1186
1.01137	1.01253	1.01358	1.01444	1.01503	1.01525	1.01497	1.01406	1.01120M10C1187
1.01239	1.01292	1.01294	1.01257	1.01192	1.01106	1.01009	1.00904	1.00799M10C1188
1.00598	1.00428	1.00303	1.00230	1.00213	1.00255	1.00354	1.00508	1.00712M10C1189
1.00953	1.01082	1.01211	1.01336	1.01452	1.01551	1.01624	1.01662	1.01653M10C1190

Section : FIELD

Date : 10.3.1970

B 001

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : -1000 A

1.01582 1.01195 1.01305 1.01351 1.01346 1.01303 1.01233 1.01143 1.01041M10C1191
1.00932 1.00823 1.00615 1.00441 1.00313 1.00239 1.00223 1.00267 1.00369M10C1192
1.00528 1.00735 1.00980 1.01111 1.01242 1.01371 1.01490 1.01594 1.01675M10C1193
1.01723 1.01727 1.01674 1.01221 1.01335 1.01380 1.01371 1.01323 1.01246M10C1194
1.01151 1.01044 1.00932 1.00820 1.00611 1.00437 1.00310 1.00238 1.00221M10C1195
1.00261 1.00360 1.00514 1.00721 1.00969 1.01103 1.01240 1.01374 1.01500M10C1196
1.01610 1.01696 1.01746 1.01748 1.01686 1.01181 1.01294 1.01339 1.01332M10C1197
1.01286 1.01212 1.01119 1.01016 1.00908 1.00799 1.00596 1.00427 1.00302M10C1198
1.00228 1.00206 1.00240 1.00330 1.00477 1.00677 1.00922 1.01056 1.01193M10C1199
1.01328 1.01455 1.01566 1.01652 1.01701 1.01699 1.01630 1.01086 1.01197M10C1200
1.01246 1.01247 1.01211 1.01147 1.01064 1.00968 1.00865 1.00761 1.00559M10C1201
1.00387 1.00259 1.00184 1.00167 1.00210 1.00311 1.00469 1.00675 1.00916M10C1202
1.01044 1.01172 1.01295 1.01408 1.01504 1.01576 1.01614 1.01607 1.01543M10C1203
1.00910 1.01035 1.01098 1.01112 1.01088 1.01035 1.00961 1.00873 1.00777M10C1204
1.00678 1.00486 1.00319 1.00194 1.00121 1.00103 1.00144 1.00243 1.00396M10C1205
1.00595 1.00826 1.00947 1.01067 1.01181 1.01285 1.01371 1.01431 1.01458M10C1206
1.01439 1.01364 1.00800 1.00875 1.00913 1.00919 1.00898 1.00854 1.00794M10C1207
1.00721 1.00639 1.00552 1.00376 1.00217 1.00092 1.00017 .99998 1.00040M10C1208
1.00141 1.00293 1.00486 1.00702 1.00812 1.00920 1.01021 1.01113 1.01190M10C1209
1.01248 1.01283 1.01289 1.01261 1.00535 1.00612 1.00654 1.00665 1.00651M10C1210
1.00616 1.00564 1.00500 1.00428 1.00350 1.00191 1.00046 .99931 .99861M10C1211
.99843 .99879 .99970 1.00109 1.00284 1.00482 1.00583 1.00682 1.00775M10C1212
1.00859 1.00930 1.00985 1.01017 1.01024 1.01000 1.01993 1.01938 1.01865M10C1213
1.01775 1.01673 1.01562 1.01446 1.01326 1.01207 1.01089 1.00870 1.00685M10C1214
1.00547 1.00464 1.00442 1.00484 1.00589 1.00752 1.00966 1.01219 1.01357M10C1215
1.01498 1.01642 1.01785 1.01925 1.02058 1.02183 1.02294 1.02389 1.02793M10C1216
1.02355 1.02076 1.01889 1.01746 1.01621 1.01499 1.01374 1.01246 1.01117M10C1217
1.00873 1.00673 1.00532 1.00454 1.00435 1.00473 1.00569 1.00730 1.00958M10C1218
1.01246 1.01406 1.01569 1.01731 1.01887 1.02034 1.02172 1.02309 1.02463M10C1219
1.02665 1.02129 1.02100 1.02031 1.01932 1.01811 1.01675 1.01532 1.01387M10C1220
1.01243 1.01104 1.00853 1.00649 1.00503 1.00420 1.00401 1.00448 1.00560M10C1221
1.00736 1.00971 1.01256 1.01414 1.01579 1.01748 1.01917 1.02081 1.02236M10C1222
1.02374 1.02487 1.02566 1.02197 1.02156 1.02074 1.01963 1.01832 1.01688M10C1223
1.01537 1.01385 1.01237 1.01094 1.00838 1.00632 1.00483 1.00397 1.00376M10C1224
1.00420 1.00531 1.00708 1.00948 1.01245 1.01411 1.01585 1.01764 1.01943M10C1225
1.02119 1.02284 1.02430 1.02549 1.02630 1.02239 1.02180 1.02086 1.01967M10C1226
1.01830 1.01682 1.01528 1.01374 1.01223 1.01079 1.00819 1.00609 1.00457M10C1227
1.00370 1.00349 1.00396 1.00511 1.00692 1.00935 1.01233 1.01399 1.01573M10C1228
1.01753 1.01934 1.02112 1.02283 1.02440 1.02574 1.02679 1.02239 1.02184M10C1229
1.02069 1.01967 1.01825 1.01673 1.01516 1.01360 1.01207 1.01062 1.00803M10C1230
1.00595 1.00445 1.00357 1.00332 1.00372 1.00479 1.00654 1.00895 1.01198M10C1231
1.01370 1.01551 1.01738 1.01928 1.02114 1.02290 1.02448 1.02576 1.02664M10C1232
1.02204 1.02165 1.02069 1.01943 1.01803 1.01656 1.01507 1.01356 1.01208M10C1233
1.01063 1.00797 1.00580 1.00429 1.00349 1.00335 1.00378 1.00472 1.00624M10C1234
1.00847 1.01148 1.01326 1.01517 1.01715 1.01910 1.02094 1.02261 1.02410M10C1235
1.02552 1.02719 1.02211 1.02123 1.02018 1.01898 1.01767 1.01628 1.01485M10C1236
1.01342 1.01199 1.01061 1.00807 1.00594 1.00437 1.00343 1.00320 1.00369M10C1237
1.00490 1.00678 1.00924 1.01219 1.01379 1.01545 1.01715 1.01886 1.02056M10C1238
1.02220 1.02376 1.02521 1.02650 1.02127 1.02051 1.01955 1.01844 1.01722M10C1239
1.01591 1.01456 1.01318 1.01182 1.01049 1.00802 1.00595 1.00441 1.00349M10C1240
1.00325 1.00371 1.00487 1.00668 1.00906 1.01191 1.01346 1.01507 1.01671M10C1241
1.01836 1.01999 1.02156 1.02306 1.02443 1.02565 1.02023 1.01953 1.01864M10C1242
1.01760 1.01646 1.01523 1.01395 1.01265 1.01136 1.01011 1.00777 1.00581M10C1243
1.00435 1.00348 1.00325 1.00370 1.00481 1.00655 1.00884 1.01157 1.01307M10C1244
1.01462 1.01620 1.01779 1.01936 1.02089 1.02234 1.02369 1.02488 1.01901M10C1245
1.01832 1.01747 1.01648 1.01540 1.01425 1.01305 1.01184 1.01064 1.00947M10C1246
1.00730 1.00549 1.00413 1.00331 1.00309 1.00350 1.00452 1.00612 1.00823M10C1247
1.01077 1.01216 1.01361 1.01510 1.01660 1.01809 1.01955 1.02095 1.02226M10C1248
1.02344 M10C1249

Section : FIELD
Date : 10.3.1970

B 002

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : 0 A

The sign of word 2 of the title block FIELD is positive (negative) for a positive (negative) beam particle bent clockwise in the chamber (e.g. to bottom of chamber).

The values of x_o, y_o, z_o given on the DATA SHEET (see GEOM-TITLE / D..) should be used for words 8-10 in title block FIELD, respectively. Please consult FIELD / A001 if you are not using geometry titles produced by CERN.

This title block can only be used with routine ZFIELD described in FIELD / A003. Words 5-7 give the orientation of the field axis system with respect to the geometry axis system (+1 for same direction, -1 for opposite direction).

a) FIELD Polynomial :

```
*     FIELD        59  10F7.0/(5E14.7)                                          M10C0-01
   -3.0    1.0    0.0  .0005    1.0    1.0    1.0    0.0    0.0  -25.2        M10C0-02
 1.7416518E+01 1.2898470E-04-5.9251910E-08 4.1459310E-13-3.2138320E-04         M10C0-03
-2.4503318E-07 2.0393672E-10-1.7139757E-04 3.2926875E-07-1.1027361E-12         M10C0-04
 8.0934147E-08-4.0897966E-10-5.3222764E-08 4.1006289E-11 2.5642193E-04         M10C0-05
-3.2119815E-08-2.3094769E-13 8.2920110E-13-6.4869722E-08 6.4752595E-12         M10C0-06
-2.4396633E-15-1.6858562E-12-4.3525650E-12 1.5644969E-13 4.2412873E-05         M10C0-07
 2.6242706E-08-5.1161604E-12 2.2307423E-09 3.3187016E-12-9.9321698E-09         M10C0-08
 6.6164166E-12-1.0832307E-12 3.2329846E-08-1.6965245E-12 8.1322111E-16         M10C0-09
 2.7453987E-14 6.5467101E-12 4.8793267E-15 4.0453111E-14-2.7184227E-09         M10C0-10
 4.0134243E-12-1.1501578E-14-1.1027361E-12-4.8501856E-13-9.7586533E-16         M10C0-11
-1.4881332E-14-4.8793267E-16-1.9404588E-13 6.9704667E-17                       M10C0-12
```

b) FIELD Tables :

This title block should be used with the standard routine ZFIELD provided in TC Program Library / GENERAL.

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : 0 A

```
*     FIELD     2290 4F10.5,3I5,3F5.0,3(/14F5.0)/5F5.0/( 9F8.5)
C-- FIELD TITLE FOR 2 M CHAMBER, MEAS. DEC 69, MAIN MAGNET=10000 A, CORR=0 A
C-- MEASURED AT GEOMETRIC CENTRE OF CHAMBER (WARM) - X=0, Y=0, Z=-25.2
C-- FOR TRANSFORMATION TO CAMERA SYSTEM SEE '2 M USERS HANDBOOK' SECTIONS
C-- GEOM-TITLE/D... AND FIELD/A...
0.        17.395117 0.        .0005        29   11    70.   0.   -25.2  M10C0 -4
-95. -90. -85. -80. -75. -70. -65. -60. -55. -50. -40. -30. -20. -10.   M10C0 -3
0.   10.  20.  30.  40.  50.  55.  60.  65.  70.  75.  80.  85.  90.     M10C0 -2
95.  -25. -20. -15. -10. -5. 0.   5.   10.  15.  20.  25.  -25.2-18.9  M10C0 -1
-12.6  0.0 12.6 18.9 25.2                                              M10C0  0
 1.02038 1.01997 1.01935 1.01855 1.01761 1.01656 1.01545 1.01430 1.01313M10C0  1
 1.01199 1.00983 1.00799 1.00662 1.00580 1.00559 1.00604 1.00711 1.00879M10C0  2
 1.01099 1.01359 1.01499 1.01645 1.01792 1.01938 1.02081 1.02218 1.02344M10C0  3
 1.02458 1.02554 1.02201 1.02131 1.02044 1.01942 1.01830 1.01710 1.01585M10C0  4
 1.01458 1.01333 1.01210 1.00983 1.00792 1.00650 1.00565 1.00543 1.00588M10C0  5
 1.00698 1.00870 1.01098 1.01371 1.01521 1.01678 1.01839 1.02001 1.02164M10C0  6
 1.02323 1.02476 1.02620 1.02752 1.02225 1.02156 1.02068 1.01965 1.01851M10C0  7
 1.01727 1.01599 1.01468 1.01338 1.01210 1.00973 1.00773 1.00623 1.00533M10C0  8
 1.00508 1.00552 1.00666 1.00845 1.01083 1.01371 1.01530 1.01695 1.01866M10C0  9
 1.02039 1.02213 1.02384 1.02549 1.02706 1.02850 1.02322 1.02238 1.02135M10C0 10
 1.02018 1.01891 1.01757 1.01618 1.01479 1.01341 1.01207 1.00960 1.00753M10C0 11
 1.00600 1.00510 1.00488 1.00537 1.00657 1.00843 1.01089 1.01384 1.01546M10C0 12
 1.01715 1.01888 1.02064 1.02238 1.02410 1.02576 1.02731 1.02874 1.02295M10C0 13
 1.02218 1.02122 1.02010 1.01886 1.01754 1.01616 1.01477 1.01339 1.01204M10C0 14
 1.00953 1.00743 1.00585 1.00491 1.00467 1.00515 1.00635 1.00824 1.01074M10C0 15
 1.01375 1.01540 1.01713 1.01890 1.02070 1.02249 1.02425 1.02595 1.02755M10C0 16
 1.02902 1.02291 1.02249 1.02164 1.02049 1.01914 1.01766 1.01612 1.01458M10C0 17
 1.01308 1.01166 1.00911 1.00708 1.00563 1.00478 1.00455 1.00497 1.00606M10C0 18
 1.00782 1.01027 1.01334 1.01507 1.01690 1.01878 1.02068 1.02254 1.02426M10C0 19
 1.02577 1.02695 1.02765 1.02280 1.02201 1.02102 1.01989 1.01864 1.01731M10C0 20
 1.01592 1.01453 1.01314 1.01178 1.00928 1.00718 1.00561 1.00468 1.00444M10C0 21
 1.00492 1.00613 1.00802 1.01052 1.01353 1.01518 1.01690 1.01867 1.02046M10C0 22
 1.02225 1.02400 1.02569 1.02728 1.02873 1.02256 1.02185 1.02092 1.01981M10C0 23
 1.01855 1.01721 1.01580 1.01438 1.01296 1.01159 1.00906 1.00697 1.00545M10C0 24
 1.00457 1.00439 1.00493 1.00616 1.00803 1.01047 1.01337 1.01496 1.01662M10C0 25
 1.01833 1.02008 1.02184 1.02359 1.02531 1.02698 1.02857 1.02168 1.02098M10C0 26
 1.02008 1.01903 1.01786 1.01661 1.01530 1.01397 1.01265 1.01136 1.00896M10C0 27
 1.00695 1.00545 1.00456 1.00434 1.00482 1.00599 1.00781 1.01021 1.01308M10C0 28
 1.01465 1.01628 1.01795 1.01963 1.02129 1.02291 1.02446 1.02589 1.02718M10C0 29
 1.02133 1.02053 1.01958 1.01850 1.01733 1.01609 1.01482 1.01354 1.01228M10C0 30
 1.01105 1.00880 1.00692 1.00553 1.00471 1.00452 1.00498 1.00608 1.00780M10C0 31
 1.01006 1.01278 1.01427 1.01582 1.01742 1.01904 1.02066 1.02226 1.02380M10C0 32
 1.02525 1.02659 1.02244 1.02124 1.01996 1.01861 1.01723 1.01584 1.01446M10C0 33
 1.01311 1.01180 1.01056 1.00832 1.00651 1.00520 1.00446 1.00431 1.00478M10C0 34
 1.00584 1.00747 1.00962 1.01218 1.01360 1.01508 1.01661 1.01817 1.01974M10C0 35
 1.02130 1.02283 1.02430 1.02569 1.00584 1.00710 1.00792 1.00835 1.00845M10C0 36
 1.00829 1.00790 1.00735 1.00667 1.00592 1.00432 1.00282 1.00163 1.00091M10C0 37
 1.00073 1.00116 1.00217 1.00368 1.00556 1.00763 1.00866 1.00964 1.01053M10C0 38
 1.01129 1.01187 1.01221 1.01228 1.01200 1.01132 1.00962 1.01037 1.01076M10C0 39
 1.01083 1.01065 1.01025 1.00968 1.00899 1.00822 1.00739 1.00571 1.00419M10C0 40
 1.00300 1.00228 1.00211 1.00253 1.00353 1.00504 1.00696 1.00914 1.01026M10C0 41
 1.01137 1.01242 1.01339 1.01424 1.01492 1.01539 1.01560 1.01551 1.01058M10C0 42
 1.01145 1.01191 1.01203 1.01187 1.01147 1.01088 1.01016 1.00934 1.00846M10C0 43
 1.00667 1.00504 1.00376 1.00299 1.00281 1.00326 1.00433 1.00595 1.00800M10C0 44
 1.01031 1.01150 1.01266 1.01377 1.01478 1.01564 1.01632 1.01676 1.01691M10C0 45
 1.01672 1.01174 1.01301 1.01360 1.01367 1.01334 1.01271 1.01189 1.01094M10C0 46
 1.00993 1.00890 1.00694 1.00530 1.00411 1.00343 1.00331 1.00375 1.00476M10C0 47
 1.00631 1.00834 1.01076 1.01205 1.01336 1.01463 1.01581 1.01684 1.01762M10C0 48
 1.01807 1.01805 1.01743 1.01243 1.01366 1.01421 1.01423 1.01386 1.01319M10C0 49
 1.01233 1.01134 1.01029 1.00923 1.00722 1.00553 1.00430 1.00360 1.00346M10C0 50
 1.00390 1.00491 1.00648 1.00856 1.01103 1.01236 1.01371 1.01503 1.01627M10C0 51
 1.01736 1.01821 1.01873 1.01879 1.01826 1.01273 1.01389 1.01438 1.01436M10C0 52
 1.01395 1.01325 1.01237 1.01137 1.01031 1.00924 1.00723 1.00555 1.00431M10C0 53
 1.00360 1.00344 1.00385 1.00485 1.00641 1.00850 1.01100 1.01236 1.01373M10C0 54
 1.01508 1.01635 1.01745 1.01831 1.01882 1.01884 1.01823 1.01220 1.01345M10C0 55
 1.01402 1.01405 1.01367 1.01300 1.01213 1.01114 1.01008 1.00902 1.00700M10C0 56
```

Section : FIELD

Date : 10.3.1970

B 002

MAGNETIC FIELD

Main magnet : 10000 A

Compensating magnet : 0 A

1.00531	1.00408	1.00338	1.00324	1.00368	1.00469	1.00626	1.00834	1.01081M10C0 57
1.01215	1.01349	1.01481	1.01605	1.01713	1.01797	1.01847	1.01850	1.01792M10C0 58
1.01122	1.01257	1.01321	1.01330	1.01297	1.01235	1.01151	1.01054	1.00951M10C0 59
1.00847	1.00650	1.00486	1.00367	1.00301	1.00289	1.00334	1.00434	1.00588M10C0 60
1.00791	1.01031	1.01160	1.01291	1.01418	1.01536	1.01638	1.01716	1.01759M10C0 61
1.01754	1.01688	1.00925	1.01078	1.01159	1.01183	1.01163	1.01112	1.01040M10C0 62
1.00953	1.00858	1.00761	1.00575	1.00418	1.00304	1.00239	1.00227	1.00269M10C0 63
1.00366	1.00514	1.00710	1.00941	1.01064	1.01188	1.01308	1.01418	1.01510M10C0 64
1.01575	1.01604	1.01583	1.01497	1.00898	1.00967	1.01001	1.01004	1.00982M10C0 65
1.00939	1.00880	1.00809	1.00729	1.00645	1.00475	1.00322	1.00204	1.00132M10C0 66
1.00116	1.00158	1.00258	1.00410	1.00601	1.00818	1.00930	1.01039	1.01144M10C0 67
1.01240	1.01323	1.01390	1.01435	1.01454	1.01442	.99717	1.00205	1.00513M10C0 68
1.00685	1.00757	1.00759	1.00712	1.00636	1.00545	1.00449	1.00268	1.00126M10C0 69
1.00032	.99983	.99977	1.00010	1.00086	1.00210	1.00386	1.00606	1.00723M10C0 70
1.00836	1.00936	1.01007	1.01032	1.00988	1.00845	1.00566	1.00109	.98316M10C0 71
.99057	.99568	.99901	1.00100	1.00201	1.00231	1.00215	1.00170	1.00108M10C0 72
.99973	.99858	.99778	.99738	.99733	.99763	.99831	.99940	1.00092M10C0 73
1.00276	1.00369	1.00452	1.00515	1.00540	1.00508	1.00393	1.00161	.99772M10C0 74
.99179	1.00051	1.00226	1.00352	1.00436	1.00483	1.00499	1.00491	1.00462M10C0 75
1.00419	1.00365	1.00240	1.00117	1.00016	.99954	.99941	.99981	1.00073M10C0 76
1.00208	1.00373	1.00549	1.00633	1.00709	1.00775	1.00824	1.00852	1.00855M10C0 77
1.00825	1.00759	1.00648	1.00222	1.00409	1.00543	1.00631	1.00680	1.00696M10C0 78
1.00686	1.00654	1.00606	1.00546	1.00409	1.00274	1.00164	1.00096	1.00081M10C0 79
1.00123	1.00222	1.00368	1.00546	1.00737	1.00828	1.00911	1.00983	1.01037M10C0 80
1.01069	1.01072	1.01042	1.00972	1.00854	1.00391	1.00618	1.00764	1.00846M10C0 81
1.00879	1.00872	1.00838	1.00783	1.00716	1.00641	1.00488	1.00351	1.00249M10C0 82
1.00190	1.00180	1.00222	1.00314	1.00454	1.00632	1.00834	1.00936	1.01034M10C0 83
1.01122	1.01193	1.01239	1.01251	1.01217	1.01124	1.00956	1.00480	1.00709M10C0 84
1.00855	1.00936	1.00965	1.00955	1.00916	1.00857	1.00785	1.00706	1.00545M10C0 85
1.00403	1.00297	1.00236	1.00226	1.00268	1.00362	1.00503	1.00684	1.00889M10C0 86
1.00995	1.01096	1.01189	1.01267	1.01322	1.01346	1.01327	1.01252	1.01107M10C0 87
1.00524	1.00746	1.00886	1.00961	1.00985	1.00972	1.00930	1.00869	1.00796M10C0 88
1.00716	1.00555	1.00414	1.00307	1.00245	1.00233	1.00273	1.00365	1.00505M10C0 89
1.00687	1.00896	1.01004	1.01108	1.01204	1.01284	1.01340	1.01363	1.01340M10C0 90
1.01258	1.01101	1.00467	1.00696	1.00841	1.00921	1.00948	1.00937	1.00897M10C0 91
1.00837	1.00764	1.00685	1.00523	1.00381	1.00275	1.00214	1.00203	1.00244M10C0 92
1.00337	1.00478	1.00659	1.00866	1.00973	1.01075	1.01169	1.01247	1.01302M10C0 93
1.01324	1.01300	1.01219	1.01063	1.00335	1.00573	1.00727	1.00813	1.00847M10C0 94
1.00841	1.00805	1.00749	1.00680	1.00604	1.00449	1.00312	1.00208	1.00149M10C0 95
1.00139	1.00179	1.00270	1.00408	1.00585	1.00787	1.00890	1.00989	1.01078M10C0 96
1.01151	1.01200	1.01214	1.01181	1.01088	1.00918	1.00151	1.00351	1.00492M10C0 97
1.00584	1.00635	1.00650	1.00637	1.00602	1.00551	1.00488	1.00345	1.00206M10C0 98
1.00095	1.00028	1.00015	1.00061	1.00162	1.00309	1.00487	1.00675	1.00765M10C0 99
1.00847	1.00918	1.00972	1.01005	1.01012	1.00988	1.00927	1.00822	.99988M10C0100
1.00163	1.00288	1.00371	1.00416	1.00431	1.00421	1.00391	1.00346	1.00290M10C0101
1.00163	1.00036	.99933	.99870	.99856	.99897	.99989	1.00125	1.00291M10C0102
1.00468	1.00552	1.00629	1.00694	1.00743	1.00771	1.00772	1.00741	1.00672M10C0103
1.00558	.99883	.99998	1.00081	1.00133	1.00160	1.00164	1.00150	1.00120M10C0104
1.00078	1.00028	.99913	.99799	.99704	.99644	.99630	.99666	.99753M10C0105
.99883	1.00042	1.00206	1.00281	1.00345	1.00392	1.00417	1.00413	1.00372M10C0106
1.00287	1.00149	.99948	.98088	.98710	.99148	.99443	.99628	.99732M10C0107
.99777	.99781	.99759	.99720	.99627	.99540	.99478	.99445	.99442M10C0108
.99469	.99530	.99626	.99755	.99901	.99970	1.00026	1.00059	1.00053M10C0109
.99992	.99852	.99605	.99216	.98644	.99366	.99606	.99790	.99924M10C0110
1.00016	1.00072	1.00097	1.00098	1.00080	1.00048	.99957	.99858	.99773M10C0111
.99720	.99711	.99749	.99832	.99953	1.00094	1.00236	1.00298	1.00348M10C0112
1.00383	1.00397	1.00385	1.00341	1.00258	1.00131	.99952	.99594	.99846M10C0113
1.00037	1.00175	1.00268	1.00323	1.00345	1.00342	1.00318	1.00280	1.00176M10C0114
1.00063	.99968	.99908	.99896	.99936	1.00026	1.00157	1.00313	1.00470M10C0115
1.00540	1.00598	1.00640	1.00660	1.00652	1.00611	1.00530	1.00401	1.00217M10C0116
.99860	1.00096	1.00271	1.00396	1.00476	1.00518	1.00530	1.00517	1.00485M10C0117
1.00438	1.00321	1.00199	1.00097	1.00033	1.00020	1.00062	1.00156	1.00293M10C0118
1.00457	1.00626	1.00702	1.00767	1.00817	1.00845	1.00847	1.00815	1.00744M10C0119
1.00627	1.00455	.99935	1.00186	1.00371	1.00499	1.00580	1.00621	1.00630M10C0120
1.00612	1.00575	1.00523	1.00398	1.00271	1.00167	1.00105	1.00095	1.00141M10C0121
1.00239	1.00378	1.00543	1.00711	1.00788	1.00855	1.00907	1.00941	1.00950M10C0122
1.00931	1.00877	1.00783	1.00642	.99970	1.00240	1.00430	1.00554	1.00626M10C0123

Section : FIELD

Date : 10.3.1970

B 002

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : 0 A

1.00656 1.00654 1.00628 1.00584 1.00529 1.00404 1.00284 1.00188 1.00131M10C0124
1.00120 1.00159 1.00246 1.00377 1.00538 1.00713 1.00797 1.00872 1.00934M10C0125
1.00975 1.00987 1.00963 1.00890 1.00756 1.00549 .99921 1.00173 1.00358M10C0126
1.00487 1.00568 1.00608 1.00616 1.00597 1.00559 1.00506 1.00380 1.00251M10C0127
1.00147 1.00085 1.00076 1.00122 1.00221 1.00361 1.00526 1.00693 1.00770M10C0128
1.00836 1.00887 1.00920 1.00928 1.00908 1.00853 1.00759 1.00618 .99789M10C0129
1.00046 1.00236 1.00368 1.00452 1.00495 1.00505 1.00489 1.00453 1.00403M10C0130
1.00280 1.00156 1.00056 .99998 .99991 1.00039 1.00137 1.00274 1.00434M10C0131
1.00594 1.00666 1.00727 1.00773 1.00800 1.00803 1.00777 1.00717 1.00617M10C0132
1.00472 .99549 .99802 .99994 1.00132 1.00225 1.00280 1.00302 1.00298M10C0133
1.00274 1.00234 1.00129 1.00014 .99917 .99856 .99843 .99882 .99972M10C0134
1.00104 1.00260 1.00417 1.00487 1.00545 1.00587 1.00606 1.00599 1.00557M10C0135
1.00474 1.00344 1.00159 .99285 .99535 .99726 .99866 .99961 1.00018M10C0136
1.00044 1.00045 1.00026 .99992 .99897 .99792 .99703 .99647 .99635M10C0137
.99673 .99758 .99881 1.00026 1.00170 1.00232 1.00283 1.00317 1.00329M10C0138
1.00314 1.00266 1.00177 1.00042 .99852 .98876 .99134 .99335 .99484M10C0139
.99590 .99658 .99695 .99707 .99698 .99674 .99596 .99505 .99424M10C0140
.99372 .99360 .99392 .99467 .99577 .99707 .99835 .99890 .99935M10C0141
.99963 .99971 .99953 .99903 .99816 .99684 .99502 .98390 .99100M10C0142
.99591 .99912 1.00104 1.00201 1.00231 1.00214 1.00170 1.00109 .99975M10C0143
.99859 .99779 .99737 .99732 .99763 .99832 .99942 1.00094 1.00276M10C0144
1.00367 1.00449 1.00511 1.00537 1.00508 1.00399 1.00180 .99812 .99250M10C0145
1.00053 1.00227 1.00353 1.00436 1.00483 1.00499 1.00491 1.00462 1.00419M10C0146
1.00365 1.00240 1.00117 1.00016 .99954 .99941 .99981 1.00072 1.00207M10C0147
1.00372 1.00547 1.00631 1.00708 1.00773 1.00822 1.00851 1.00854 1.00825M10C0148
1.00759 1.00649 1.00210 1.00408 1.00549 1.00640 1.00690 1.00706 1.00693M10C0149
1.00659 1.00608 1.00546 1.00405 1.00268 1.00158 1.00092 1.00080 1.00126M10C0150
1.00227 1.00374 1.00551 1.00738 1.00828 1.00909 1.00979 1.01032 1.01065M10C0151
1.01071 1.01046 1.00983 1.00878 1.00391 1.00618 1.00764 1.00846 1.00879M10C0152
1.00872 1.00838 1.00783 1.00716 1.00641 1.00488 1.00351 1.00249 1.00190M10C0153
1.00180 1.00222 1.00314 1.00454 1.00632 1.00834 1.00936 1.01034 1.01122M10C0154
1.01193 1.01239 1.01251 1.01217 1.01124 1.00956 1.00482 1.00706 1.00849M10C0155
1.00929 1.00958 1.00949 1.00911 1.00853 1.00783 1.00705 1.00546 1.00405M10C0156
1.00298 1.00237 1.00226 1.00268 1.00361 1.00503 1.00684 1.00890 1.00995M10C0157
1.01097 1.01189 1.01267 1.01322 1.01345 1.01327 1.01253 1.01111 1.00524M10C0158
1.00746 1.00886 1.00961 1.00985 1.00972 1.00930 1.00869 1.00796 1.00716M10C0159
1.00555 1.00414 1.00307 1.00246 1.00233 1.00273 1.00364 1.00505 1.00687M10C0160
1.00896 1.01004 1.01109 1.01204 1.01285 1.01341 1.01363 1.01339 1.01255M10C0161
1.01094 1.00467 1.00694 1.00838 1.00917 1.00945 1.00934 1.00895 1.00835M10C0162
1.00763 1.00684 1.00524 1.00382 1.00275 1.00214 1.00203 1.00244 1.00337M10C0163
1.00478 1.00659 1.00867 1.00973 1.01076 1.01170 1.01248 1.01302 1.01323M10C0164
1.01300 1.01219 1.01064 1.00335 1.00573 1.00727 1.00813 1.00847 1.00841M10C0165
1.00805 1.00749 1.00680 1.00604 1.00449 1.00312 1.00208 1.00149 1.00139M10C0166
1.00179 1.00270 1.00408 1.00585 1.00787 1.00890 1.00989 1.01078 1.01151M10C0167
1.01200 1.01214 1.01181 1.01088 1.00918 1.00077 1.00347 1.00524 1.00628M10C0168
1.00675 1.00680 1.00653 1.00604 1.00540 1.00469 1.00322 1.00192 1.00094M10C0169
1.00039 1.00030 1.00070 1.00157 1.00289 1.00458 1.00650 1.00748 1.00840M10C0170
1.00923 1.00987 1.01025 1.01026 1.00978 1.00864 1.00668 .99988 1.00163M10C0171
1.00288 1.00371 1.00416 1.00431 1.00421 1.00391 1.00346 1.00290 1.00163M10C0172
1.00036 .99933 .99870 .99856 .99897 .99989 1.00125 1.00291 1.00468M10C0173
1.00552 1.00629 1.00694 1.00743 1.00771 1.00772 1.00741 1.00672 1.00558M10C0174
.98504 .99140 .99580 .99868 1.00039 1.00124 1.00148 1.00130 1.00085M10C0175
1.00025 .99892 .99775 .99693 .99650 .99645 .99678 .99748 .99859M10C0176
1.00008 1.00182 1.00268 1.00345 1.00403 1.00427 1.00402 1.00306 1.00110M10C0177
.99783 .99286 1.00584 1.00710 1.00792 1.00835 1.00845 1.00829 1.00790M10C0178
1.00735 1.00667 1.00592 1.00432 1.00282 1.00163 1.00091 1.00073 1.00116M10C0179
1.00217 1.00368 1.00556 1.00763 1.00866 1.00964 1.01053 1.01129 1.01187M10C0180
1.01221 1.01228 1.01200 1.01132 1.00964 1.01039 1.01077 1.01084 1.01065M10C0181
1.01025 1.00968 1.00899 1.00821 1.00738 1.00571 1.00419 1.00301 1.00229M10C0182
1.00213 1.00255 1.00355 1.00506 1.00698 1.00915 1.01027 1.01137 1.01243M10C0183
1.01339 1.01423 1.01491 1.01537 1.01558 1.01547 1.00988 1.01140 1.01221M10C0184
1.01245 1.01227 1.01177 1.01105 1.01018 1.00925 1.00828 1.00644 1.00487M10C0185
1.00373 1.00307 1.00295 1.00337 1.00433 1.00583 1.00779 1.01012 1.01136M10C0186
1.01260 1.01379 1.01488 1.01579 1.01643 1.01669 1.01643 1.01551 1.01174M10C0187
1.01301 1.01360 1.01367 1.01334 1.01271 1.01189 1.01094 1.00993 1.00890M10C0188
1.00694 1.00530 1.00411 1.00343 1.00331 1.00375 1.00476 1.00631 1.00834M10C0189
1.01076 1.01205 1.01336 1.01463 1.01581 1.01684 1.01762 1.01807 1.01805M10C0190

Section : FIELD

Date : 10.3.1970

B 002

MAGNETIC FIELD

Main magnet : 10000 A Compensating magnet : 0 A

1.01743 1.01244 1.01363 1.01417 1.01418 1.01381 1.01315 1.01230 1.01132M10C0191
1.01028 1.00922 1.00722 1.00554 1.00431 1.00360 1.00346 1.00389 1.00491M10C0192
1.00648 1.00856 1.01104 1.01237 1.01371 1.01503 1.01627 1.01735 1.01821M10C0193
1.01873 1.01880 1.01829 1.01273 1.01390 1.01439 1.01436 1.01395 1.01325M10C0194
1.01237 1.01136 1.01030 1.00924 1.00723 1.00555 1.00432 1.00361 1.00344M10C0195
1.00385 1.00484 1.00640 1.00849 1.01100 1.01236 1.01374 1.01509 1.01636M10C0196
1.01746 1.01831 1.01879 1.01877 1.01809 1.01221 1.01344 1.01399 1.01401M10C0197
1.01364 1.01297 1.01211 1.01112 1.01008 1.00901 1.00701 1.00532 1.00409M10C0198
1.00338 1.00324 1.00367 1.00468 1.00626 1.00834 1.01081 1.01215 1.01349M10C0199
1.01481 1.01605 1.01713 1.01797 1.01847 1.01850 1.01792 1.01122 1.01257M10C0200
1.01321 1.01330 1.01297 1.01235 1.01151 1.01054 1.00951 1.00847 1.00650M10C0201
1.00486 1.00367 1.00301 1.00289 1.00334 1.00434 1.00588 1.00791 1.01031M10C0202
1.01160 1.01291 1.01418 1.01536 1.01638 1.01716 1.01759 1.01754 1.01688M10C0203
1.00915 1.01079 1.01165 1.01191 1.01172 1.01120 1.01045 1.00956 1.00859M10C0204
1.00760 1.00573 1.00416 1.00302 1.00239 1.00228 1.00271 1.00366 1.00514M10C0205
1.00708 1.00940 1.01063 1.01188 1.01308 1.01418 1.01511 1.01576 1.01604M10C0206
1.01579 1.01487 1.00898 1.00967 1.01001 1.01004 1.00982 1.00939 1.00880M10C0207
1.00809 1.00729 1.00645 1.00475 1.00322 1.00204 1.00132 1.00116 1.00158M10C0208
1.00258 1.00410 1.00601 1.00818 1.00930 1.01039 1.01144 1.01240 1.01323M10C0209
1.01390 1.01435 1.01454 1.01442 .99008 .99726 1.00203 1.00494 1.00648M10C0210
1.00702 1.00689 1.00631 1.00548 1.00454 1.00270 1.00124 1.00029 .99982M10C0211
.99978 1.00012 1.00087 1.00208 1.00382 1.00602 1.00720 1.00836 1.00937M10C0212
1.01009 1.01031 1.00977 1.00814 1.00500 .99987 1.02026 1.01989 1.01929M10C0213
1.01851 1.01759 1.01656 1.01545 1.01430 1.01314 1.01199 1.00983 1.00799M10C0214
1.00661 1.00579 1.00559 1.00603 1.00712 1.00881 1.01102 1.01363 1.01504M10C0215
1.01649 1.01796 1.01942 1.02084 1.02219 1.02344 1.02455 1.02548 1.02205M10C0216
1.02134 1.02045 1.01943 1.01830 1.01709 1.01584 1.01457 1.01332 1.01209M10C0217
1.00982 1.00793 1.00652 1.00568 1.00549 1.00595 1.00706 1.00879 1.01107M10C0218
1.01380 1.01529 1.01684 1.01843 1.02004 1.02163 1.02319 1.02468 1.02607M10C0219
1.02733 1.02228 1.02158 1.02070 1.01966 1.01851 1.01728 1.01599 1.01469M10C0220
1.01338 1.01211 1.00975 1.00776 1.00627 1.00537 1.00514 1.00559 1.00673M10C0221
1.00853 1.01091 1.01378 1.01536 1.01701 1.01870 1.02042 1.02214 1.02383M10C0222
1.02546 1.02701 1.02843 1.02322 1.02238 1.02135 1.02018 1.01891 1.01757M10C0223
1.01618 1.01479 1.01341 1.01207 1.00960 1.00753 1.00600 1.00510 1.00488M10C0224
1.00537 1.00657 1.00843 1.01089 1.01384 1.01546 1.01715 1.01888 1.02064M10C0225
1.02238 1.02410 1.02576 1.02731 1.02874 1.02295 1.02219 1.02124 1.02013M10C0226
1.01889 1.01757 1.01620 1.01480 1.01342 1.01206 1.00954 1.00743 1.00584M10C0227
1.00489 1.00464 1.00512 1.00632 1.00821 1.01072 1.01374 1.01540 1.01713M10C0228
1.01890 1.02070 1.02250 1.02426 1.02595 1.02755 1.02900 1.02291 1.02248M10C0229
1.02163 1.02048 1.01913 1.01766 1.01613 1.01459 1.01309 1.01167 1.00912M10C0230
1.00707 1.00561 1.00476 1.00455 1.00498 1.00607 1.00785 1.01029 1.01334M10C0231
1.01506 1.01688 1.01876 1.02066 1.02252 1.02427 1.02583 1.02709 1.02792M10C0232
1.02279 1.02201 1.02103 1.01990 1.01865 1.01732 1.01594 1.01454 1.01315M10C0233
1.01179 1.00928 1.00717 1.00559 1.00465 1.00440 1.00489 1.00609 1.00798M10C0234
1.01049 1.01350 1.01515 1.01688 1.01865 1.02045 1.02224 1.02400 1.02570M10C0235
1.02729 1.02876 1.02256 1.02185 1.02092 1.01981 1.01855 1.01721 1.01580M10C0236
1.01438 1.01296 1.01159 1.00906 1.00697 1.00545 1.00457 1.00439 1.00493M10C0237
1.00616 1.00803 1.01047 1.01337 1.01496 1.01662 1.01833 1.02008 1.02184M10C0238
1.02359 1.02531 1.02698 1.02857 1.02169 1.02096 1.02005 1.01898 1.01781M10C0239
1.01655 1.01524 1.01392 1.01260 1.01132 1.00894 1.00695 1.00547 1.00460M10C0240
1.00439 1.00487 1.00604 1.00786 1.01025 1.01310 1.01466 1.01629 1.01795M10C0241
1.01962 1.02128 1.02291 1.02445 1.02590 1.02720 1.02133 1.02053 1.01958M10C0242
1.01850 1.01733 1.01609 1.01482 1.01354 1.01228 1.01105 1.00880 1.00692M10C0243
1.00553 1.00471 1.00452 1.00498 1.00608 1.00780 1.01006 1.01278 1.01427M10C0244
1.01582 1.01742 1.01904 1.02066 1.02226 1.02380 1.02525 1.02659 1.01978M10C0245
1.01917 1.01839 1.01746 1.01642 1.01530 1.01414 1.01295 1.01176 1.01060M10C0246
1.00845 1.00664 1.00529 1.00448 1.00429 1.00472 1.00578 1.00743 1.00961M10C0247
1.01222 1.01364 1.01512 1.01664 1.01818 1.01970 1.02119 1.02261 1.02393M10C0248
1.02513 M10C0249

Section : FIELD
Date : 10.3.1970

B 003

MAGNETIC FIELD

Main magnet : 8000 A Compensating magnet : -1000 A

The sign of word 2 of the title block FIELD is positive (negative) for a positive (negative) beam particle bent clockwise in the chamber (e.g. to bottom of chamber).

The values of x_o, y_o, z_o given on the DATA SHEET (see GEOM TITLE / D..) should be used for words 8-10 in title block FIELD, respectively.
Please consult FIELD / A001 if you are not using geometry titles produced by CERN.

This title block can only be used with routine ZFIELD described in FIELD / A003. Words 5-7 give the orientation of the field axis system with respect to the geometry axis system (+1 for same direction, -1 for opposite direction).

a) FIELD Polynomial :

```
*     FIELD        59  10F7.0/(5E14.7)                                    M 8C1-01
   -3.0    1.0    0.0  .0005    1.0    1.0    1.0    0.0    0.0  -25.2  M 8C1-02
 1.4479174E+01 9.6169752E-05-5.1320571E-08 3.3525770E-13-2.8208507E-04  M 8C1-03
-2.5090405E-07 1.5697882E-10-1.2642339E-04 2.8613786E-07-8.4058550E-13  M 8C1-04
 7.8427437E-08-3.1676078E-10-4.6072968E-08 3.1419699E-11 2.4039304E-04  M 8C1-05
-6.9082060E-08 2.2685716E-13-7.4797912E-13-8.7588918E-09-1.3168707E-11  M 8C1-06
-4.4168837E-15 1.3157892E-12 2.4898644E-12-1.3639728E-13 3.0253640E-05  M 8C1-07
 2.1785560E-08-4.1882800E-12 1.5621737E-08 8.4094482E-12-9.7000563E-09  M 8C1-08
 5.0435130E-12 2.5637946E-12 2.5946984E-08 3.9358546E-12 1.4722946E-15  M 8C1-09
 1.8016900E-13-5.9015980E-13 8.8337674E-15 1.6061173E-14-2.0142505E-09  M 8C1-10
 3.3476945E-12-2.6834720E-12-8.4058550E-13-3.3456948E-13-1.7667535E-15  M 8C1-11
-2.2835252E-14-8.8337674E-16-1.6714060E-13 1.2619668E-16               M 8C1-12
```

b) FIELD Tables :

This title block should be used with the standard routine ZFIELD provided in TC Program Library / GENERAL.

Section : FIELD

Date : 10.3.1970

B 003

MAGNETIC FIELD

Main magnet : 8000 A

Compensating magnet : -1000 A

```
*     FIELD     2290 4F10.5,3I5,3F5.0,3(/14F5.0)/5F5.0/( 9F8.5)
C-- FIELD TITLE FOR 2 M CHAMBER, MEAS. DEC 69, MAIN MAGNET= 8000 A, CORR=-1000 A
C-- MEASURED AT GEOMETRIC CENTRE OF CHAMBER (WARM) - X=0, Y=0, Z=-25.2
C-- FOR TRANSFORMATION TO CAMERA SYSTEM SEE '2 M USERS HANDBOOK' SECTIONS
C-- GEOM-TITLE/D... AND FIELD/A...
0.        14.47857  0.        .0005        29   11    70.   0.   -25.2  M 8C1 -4
-95. -90. -85. -80. -75. -70. -65. -60. -55. -50. -40. -30. -20. -10.    M 8C1 -3
0.   10.  20.  30.  40.  50.  55.  60.  65.  70.  75.  80.  85.  90.     M 8C1 -2
95.  -25. -20. -15.  -10. -5. 0.   5.   10.  15.  20.  25.  -25.2-18.9  M 8C1 -1
-12.6  0.0 12.6 18.9 25.2                                               M 8C1  0
 1.01528 1.01606 1.01622 1.01593 1.01531 1.01446 1.01347 1.01242 1.01135M 8C1  1
 1.01030 1.00841 1.00688 1.00580 1.00519 1.00505 1.00541 1.00627 1.00765M 8C1  2
 1.00953 1.01187 1.01316 1.01450 1.01583 1.01710 1.01824 1.01915 1.01971M 8C1  3
 1.01980 1.01924 1.01845 1.01800 1.01736 1.01656 1.01565 1.01464 1.01358M 8C1  4
 1.01249 1.01139 1.01031 1.00830 1.00659 1.00531 1.00454 1.00435 1.00476M 8C1  5
 1.00576 1.00733 1.00939 1.01185 1.01319 1.01459 1.01601 1.01743 1.01884M 8C1  6
 1.02020 1.02149 1.02267 1.02372 1.01826 1.01823 1.01777 1.01700 1.01600M 8C1  7
 1.01485 1.01363 1.01237 1.01113 1.00994 1.00778 1.00605 1.00482 1.00413M 8C1  8
 1.00398 1.00439 1.00536 1.00689 1.00896 1.01152 1.01295 1.01446 1.01602M 8C1  9
 1.01760 1.01914 1.02059 1.02190 1.02296 1.02369 1.01894 1.01865 1.01800M 8C1 10
 1.01709 1.01599 1.01477 1.01349 1.01218 1.01090 1.00966 1.00743 1.00562M 8C1 11
 1.00431 1.00356 1.00339 1.00381 1.00482 1.00642 1.00859 1.01126 1.01275M 8C1 12
 1.01433 1.01596 1.01761 1.01924 1.02080 1.02224 1.02349 1.02445 1.01917M 8C1 13
 1.01879 1.01807 1.01709 1.01594 1.01466 1.01333 1.01199 1.01067 1.00939M 8C1 14
 1.00710 1.00524 1.00390 1.00313 1.00294 1.00336 1.00439 1.00603 1.00825M 8C1 15
 1.01099 1.01253 1.01415 1.01582 1.01753 1.01922 1.02084 1.02234 1.02365M 8C1 16
 1.02467 1.01914 1.01880 1.01807 1.01708 1.01589 1.01458 1.01321 1.01183M 8C1 17
 1.01048 1.00918 1.00687 1.00501 1.00368 1.00292 1.00275 1.00317 1.00420M 8C1 18
 1.00584 1.00806 1.01082 1.01237 1.01401 1.01571 1.01743 1.01913 1.02076M 8C1 19
 1.02224 1.02350 1.02443 1.01901 1.01854 1.01785 1.01693 1.01580 1.01450M 8C1 20
 1.01311 1.01168 1.01027 1.00893 1.00658 1.00482 1.00366 1.00305 1.00294M 8C1 21
 1.00333 1.00424 1.00575 1.00791 1.01069 1.01227 1.01392 1.01562 1.01731M 8C1 22
 1.01897 1.02056 1.02209 1.02361 1.02523 1.01822 1.01818 1.01763 1.01673M 8C1 23
 1.01559 1.01431 1.01297 1.01162 1.01031 1.00906 1.00686 1.00513 1.00389M 8C1 24
 1.00318 1.00301 1.00339 1.00434 1.00590 1.00805 1.01074 1.01226 1.01386M 8C1 25
 1.01552 1.01719 1.01883 1.02038 1.02177 1.02293 1.02376 1.01780 1.01764M 8C1 26
 1.01709 1.01626 1.01523 1.01407 1.01284 1.01158 1.01034 1.00915 1.00700M 8C1 27
 1.00526 1.00401 1.00330 1.00313 1.00354 1.00452 1.00607 1.00818 1.01080M 8C1 28
 1.01226 1.01379 1.01537 1.01697 1.01852 1.01999 1.02129 1.02235 1.02307M 8C1 29
 1.01778 1.01723 1.01650 1.01564 1.01467 1.01362 1.01253 1.01141 1.01029M 8C1 30
 1.00920 1.00717 1.00546 1.00418 1.00342 1.00324 1.00366 1.00468 1.00626M 8C1 31
 1.00834 1.01084 1.01221 1.01363 1.01509 1.01656 1.01802 1.01945 1.02082M 8C1 32
 1.02209 1.02325 1.01730 1.01668 1.01593 1.01506 1.01411 1.01310 1.01206M 8C1 33
 1.01100 1.00995 1.00893 1.00705 1.00548 1.00432 1.00364 1.00350 1.00390M 8C1 34
 1.00485 1.00633 1.00827 1.01061 1.01189 1.01322 1.01460 1.01599 1.01738M 8C1 35
 1.01876 1.02008 1.02134 1.02250 1.00458 1.00549 1.00606 1.00634 1.00638M 8C1 36
 1.00622 1.00590 1.00545 1.00491 1.00432 1.00307 1.00191 1.00100 1.00046M 8C1 37
 1.00036 1.00073 1.00156 1.00280 1.00435 1.00606 1.00692 1.00776 1.00853M 8C1 38
 1.00922 1.00977 1.01017 1.01035 1.01029 1.00994 1.00467 1.00649 1.00760M 8C1 39
 1.00816 1.00829 1.00810 1.00767 1.00708 1.00640 1.00566 1.00419 1.00291M 8C1 40
 1.00195 1.00140 1.00129 1.00166 1.00249 1.00378 1.00547 1.00743 1.00845M 8C1 41
 1.00946 1.01039 1.01120 1.01181 1.01213 1.01206 1.01147 1.01022 1.00662M 8C1 42
 1.00833 1.00931 1.00971 1.00968 1.00933 1.00876 1.00804 1.00724 1.00641M 8C1 43
 1.00482 1.00347 1.00249 1.00194 1.00185 1.00223 1.00308 1.00440 1.00613M 8C1 44
 1.00820 1.00929 1.01039 1.01145 1.01241 1.01319 1.01370 1.01385 1.01351M 8C1 45
 1.01251 1.00833 1.00965 1.01037 1.01060 1.01045 1.01003 1.00940 1.00863M 8C1 46
 1.00779 1.00691 1.00520 1.00374 1.00266 1.00205 1.00194 1.00236 1.00329M 8C1 47
 1.00469 1.00651 1.00864 1.00977 1.01091 1.01201 1.01305 1.01397 1.01470M 8C1 48
 1.01517 1.01531 1.01500 1.00892 1.01024 1.01092 1.01109 1.01087 1.01037M 8C1 49
 1.00966 1.00883 1.00793 1.00700 1.00523 1.00373 1.00263 1.00201 1.00191M 8C1 50
 1.00233 1.00327 1.00471 1.00659 1.00882 1.01001 1.01121 1.01238 1.01347M 8C1 51
 1.01442 1.01516 1.01560 1.01563 1.01514 1.00917 1.01046 1.01110 1.01123M 8C1 52
 1.01097 1.01043 1.00970 1.00884 1.00792 1.00699 1.00522 1.00373 1.00264M 8C1 53
 1.00203 1.00191 1.00231 1.00323 1.00466 1.00655 1.00882 1.01003 1.01127M 8C1 54
 1.01247 1.01359 1.01455 1.01528 1.01568 1.01561 1.01495 1.00875 1.01009M 8C1 55
 1.01076 1.01091 1.01067 1.01014 1.00942 1.00859 1.00769 1.00678 1.00505M 8C1 56
```

MAGNETIC FIELD

Main magnet : 8000 A

Compensating magnet : -1000 A

1.00361	1.00257	1.00197	1.00186	1.00224	1.00312	1.00450	1.00634	1.00856M	8C1 57
1.00976	1.01097	1.01217	1.01328	1.01423	1.01495	1.01532	1.01522	1.01450M	8C1 58
1.00777	1.00922	1.00998	1.01021	1.01004	1.00957	1.00890	1.00810	1.00724M	8C1 59
1.00635	1.00466	1.00325	1.00222	1.00165	1.00155	1.00195	1.00283	1.00421M	8C1 60
1.00602	1.00819	1.00935	1.01053	1.01167	1.01272	1.01362	1.01427	1.01458M	8C1 61
1.01442	1.01365	1.00610	1.00772	1.00864	1.00902	1.00899	1.00864	1.00808M	8C1 62
1.00737	1.00658	1.00575	1.00413	1.00275	1.00173	1.00114	1.00104	1.00143M	8C1 63
1.00231	1.00366	1.00545	1.00754	1.00865	1.00975	1.01081	1.01176	1.01254M	8C1 64
1.01305	1.01321	1.01290	1.01196	1.00461	1.00593	1.00677	1.00720	1.00730M	8C1 65
1.00712	1.00673	1.00618	1.00552	1.00479	1.00329	1.00192	1.00088	1.00028M	8C1 66
1.00019	1.00063	1.00155	1.00291	1.00459	1.00647	1.00744	1.00841	1.00935M	8C1 67
1.01024	1.01107	1.01181	1.01244	1.01294	1.01329	1.00395	1.00472	1.00518M	8C1 68
1.00536	1.00532	1.00509	1.00471	1.00422	1.00365	1.00302	1.00174	1.00057M	8C1 69
.99966	.99912	.99903	.99941	1.00025	1.00152	1.00310	1.00487	1.00577M	8C1 70
1.00665	1.00748	1.00824	1.00887	1.00936	1.00966	1.00974	1.00954	.99390M	8C1 71
.99597	.99754	.99868	.99946	.99991	1.00011	1.00010	.99992	.99962M	8C1 72
.99881	.99792	.99718	.99672	.99666	.99703	.99780	.99891	1.00022M	8C1 73
1.00154	1.00213	1.00262	1.00298	1.00316	1.00311	1.00279	1.00214	1.00109M	8C1 74
.99960	.99487	.99795	1.00012	1.00156	1.00243	1.00285	1.00293	1.00276M	8C1 75
1.00242	1.00197	1.00093	.99994	.99916	.99871	.99864	.99899	.99974M	8C1 76
1.00086	1.00229	1.00386	1.00462	1.00530	1.00585	1.00620	1.00624	1.00589M	8C1 77
1.00500	1.00344	1.00102	.99812	1.00085	1.00272	1.00392	1.00457	1.00482M	8C1 78
1.00475	1.00446	1.00402	1.00349	1.00232	1.00125	1.00043	.99996	.99991M	8C1 79
1.00028	1.00107	1.00225	1.00375	1.00542	1.00625	1.00702	1.00768	1.00816M	8C1 80
1.00838	1.00825	1.00765	1.00644	1.00446	.99990	1.00267	1.00446	1.00550M	8C1 81
1.00599	1.00608	1.00588	1.00549	1.00498	1.00440	1.00319	1.00208	1.00120M	8C1 82
1.00067	1.00055	1.00091	1.00176	1.00305	1.00469	1.00647	1.00733	1.00812M	8C1 83
1.00879	1.00931	1.00962	1.00971	1.00953	1.00909	1.00837	1.00125	1.00371M	8C1 84
1.00534	1.00629	1.00673	1.00677	1.00653	1.00608	1.00551	1.00486	1.00353M	8C1 85
1.00236	1.00149	1.00101	1.00096	1.00135	1.00218	1.00342	1.00502	1.00684M	8C1 86
1.00777	1.00866	1.00946	1.01010	1.01052	1.01060	1.01023	1.00929	1.00760M	8C1 87
1.00162	1.00401	1.00558	1.00650	1.00693	1.00696	1.00671	1.00626	1.00568M	8C1 88
1.00502	1.00366	1.00244	1.00153	1.00102	1.00096	1.00136	1.00222	1.00350M	8C1 89
1.00514	1.00698	1.00792	1.00882	1.00963	1.01028	1.01070	1.01080	1.01048M	8C1 90
1.00961	1.00803	1.00110	1.00355	1.00516	1.00610	1.00653	1.00657	1.00633M	8C1 91
1.00588	1.00531	1.00466	1.00334	1.00217	1.00129	1.00081	1.00075	1.00114M	8C1 92
1.00197	1.00321	1.00481	1.00663	1.00756	1.00845	1.00925	1.00989	1.01029M	8C1 93
1.01035	1.00997	1.00898	1.00725	.99988	1.00237	1.00404	1.00506	1.00557M	8C1 94
1.00569	1.00551	1.00513	1.00462	1.00402	1.00277	1.00163	1.00078	1.00030M	8C1 95
1.00023	1.00061	1.00142	1.00264	1.00420	1.00596	1.00685	1.00769	1.00844M	8C1 96
1.00902	1.00936	1.00936	1.00891	1.00788	1.00611	.99763	1.00034	1.00221M	8C1 97
1.00339	1.00404	1.00427	1.00419	1.00388	1.00343	1.00288	1.00169	1.00059M	8C1 98
.99976	.99929	.99923	.99961	1.00041	1.00162	1.00314	1.00482	1.00566M	8C1 99
1.00643	1.00709	1.00757	1.00778	1.00763	1.00701	1.00577	1.00376	.99534M	8C1100
.99780	.99961	1.00087	1.00166	1.00207	1.00218	1.00204	1.00172	1.00127M	8C1101
1.00019	.99909	.99822	.99773	.99769	.99812	.99898	1.00019	1.00160M	8C1102
1.00307	1.00375	1.00438	1.00492	1.00534	1.00561	1.00571	1.00561	1.00528M	8C1103
1.00469	.99368	.99562	.99709	.99814	.99884	.99923	.99938	.99932M	8C1104
.99911	.99878	.99793	.99702	.99627	.99582	.99576	.99613	.99692M	8C1105
.99804	.99938	1.00074	1.00136	1.00189	1.00230	1.00253	1.00255	1.00231M	8C1106
1.00175	1.00082	.99945	.98605	.98880	.99098	.99267	.99391	.99479M	8C1107
.99535	.99565	.99575	.99568	.99524	.99462	.99405	.99371	.99369M	8C1108
.99405	.99475	.99572	.99681	.99780	.99817	.99842	.99849	.99833M	8C1109
.99790	.99713	.99597	.99435	.99221	.98966	.99243	.99460	.99625M	8C1110
.99745	.99826	.99874	.99896	.99897	.99881	.99819	.99741	.99671M	8C1111
.99628	.99623	.99660	.99738	.99847	.99972	1.00090	1.00139	1.00174M	8C1112
1.00191	1.00186	1.00153	1.00085	.99977	.99822	.99612	.99186	.99508M	8C1113
.99745	.99913	1.00024	1.00090	1.00121	1.00126	1.00112	1.00084	1.00007M	8C1114
.99926	.99860	.99823	.99821	.99856	.99929	1.00035	1.00163	1.00295M	8C1115
1.00355	1.00406	1.00440	1.00452	1.00434	1.00375	1.00266	1.00093	.99841M	8C1116
.99479	.99731	.99939	1.00095	1.00203	1.00265	1.00291	1.00287	1.00263M	8C1117
1.00225	1.00133	1.00045	.99979	.99942	.99936	.99966	1.00036	1.00148M	8C1118
1.00294	1.00448	1.00517	1.00571	1.00604	1.00612	1.00592	1.00546	1.00484M	8C1119
1.00425	1.00404	.99558	.99851	1.00064	1.00210	1.00303	1.00354	1.00372M	8C1120
1.00365	1.00339	1.00301	1.00207	1.00112	1.00036	.99992	.99988	1.00026M	8C1121
1.00105	1.00221	1.00362	1.00512	1.00581	1.00642	1.00688	1.00713	1.00709M	8C1122
1.00668	1.00579	1.00429	1.00205	.99594	.99886	1.00097	1.00242	1.00333M	8C1123

Section : FIELD

Date : 10.3.1970

B 003

MAGNETIC FIELD

Main magnet : 8000 A

Compensating magnet : -1000 A

1.00382	1.00398	1.00388	1.00361	1.00321	1.00223	1.00125	1.00048	1.00003M	8C1124
.99999	1.00037	1.00118	1.00235	1.00379	1.00530	1.00601	1.00663	1.00710M	8C1125
1.00738	1.00737	1.00700	1.00616	1.00473	1.00259	.99547	.99839	1.00051M	8C1126
1.00197	1.00289	1.00340	1.00357	1.00349	1.00323	1.00285	1.00190	1.00095M	8C1127
1.00018	.99974	.99968	1.00005	1.00084	1.00199	1.00340	1.00490	1.00561M	8C1128
1.00622	1.00668	1.00694	1.00690	1.00649	1.00558	1.00406	1.00179	.99390M	8C1129
.99697	.99921	1.00076	1.00176	1.00232	1.00253	1.00250	1.00227	1.00192M	8C1130
1.00102	1.00011	.99938	.99897	.99893	.99930	1.00007	1.00119	1.00255M	8C1131
1.00397	1.00463	1.00519	1.00561	1.00581	1.00571	1.00523	1.00427	1.00269M	8C1132
1.00035	.99152	.99470	.99705	.99871	.99981	1.00046	1.00077	1.00081M	8C1133
1.00066	1.00037	.99957	.99873	.99804	.99763	.99759	.99795	.99869M	8C1134
.99977	1.00109	1.00245	1.00306	1.00356	1.00390	1.00400	1.00378	1.00315M	8C1135
1.00198	1.00014	.99749	.98908	.99186	.99404	.99569	.99689	.99770M	8C1136
.99818	.99839	.99839	.99823	.99759	.99678	.99606	.99561	.99554M	8C1137
.99590	.99667	.99776	.99901	1.00021	1.00071	1.00107	1.00126	1.00123M	8C1138
1.00091	1.00026	.99921	.99768	.99562	.98574	.98845	.99060	.99224M	8C1139
.99345	.99429	.99482	.99509	.99516	.99507	.99459	.99393	.99334M	8C1140
.99298	.99296	.99332	.99404	.99502	.99612	.99713	.99752	.99777M	8C1141
.99785	.99770	.99727	.99651	.99535	.99373	.99158	.99298	.99520M	8C1142
.99689	.99814	.99899	.99952	.99977	.99980	.99966	.99938	.99859M	8C1143
.99772	.99698	.99653	.99648	.99686	.99766	.99879	1.00013	1.00146M	8C1144
1.00205	1.00253	1.00288	1.00303	1.00295	1.00258	1.00186	1.00074	.99915M	8C1145
.99460	.99764	.99980	1.00125	1.00213	1.00258	1.00268	1.00254	1.00223M	8C1146
1.00180	1.00079	.99981	.99905	.99861	.99857	.99894	.99972	1.00088M	8C1147
1.00232	1.00387	1.00462	1.00528	1.00580	1.00612	1.00614	1.00578	1.00490M	8C1148
1.00337	1.00102	.99789	1.00058	1.00245	1.00366	1.00434	1.00462	1.00458M	8C1149
1.00432	1.00390	1.00338	1.00224	1.00118	1.00036	.99990	.99986	1.00025M	8C1150
1.00107	1.00227	1.00379	1.00546	1.00628	1.00705	1.00770	1.00818	1.00841M	8C1151
1.00830	1.00775	1.00662	1.00478	1.00045	1.00256	1.00414	1.00519	1.00577M	8C1152
1.00596	1.00583	1.00547	1.00496	1.00435	1.00308	1.00197	1.00116	1.00071M	8C1153
1.00064	1.00100	1.00181	1.00307	1.00472	1.00657	1.00746	1.00827	1.00894M	8C1154
1.00941	1.00966	1.00967	1.00948	1.00921	1.00903	1.00105	1.00350	1.00514M	8C1155
1.00611	1.00657	1.00665	1.00643	1.00602	1.00547	1.00485	1.00355	1.00239M	8C1156
1.00153	1.00106	1.00101	1.00141	1.00226	1.00352	1.00514	1.00697	1.00790M	8C1157
1.00879	1.00957	1.01019	1.01057	1.01061	1.01019	1.00917	1.00740	1.00137M	8C1158
1.00378	1.00537	1.00632	1.00677	1.00683	1.00660	1.00618	1.00562	1.00499M	8C1159
1.00367	1.00248	1.00160	1.00110	1.00103	1.00143	1.00228	1.00355	1.00519M	8C1160
1.00704	1.00799	1.00889	1.00970	1.01035	1.01077	1.01085	1.01050	1.00957M	8C1161
1.00791	1.00091	1.00338	1.00500	1.00596	1.00641	1.00646	1.00623	1.00580M	8C1162
1.00523	1.00460	1.00330	1.00215	1.00130	1.00083	1.00078	1.00118	1.00201M	8C1163
1.00327	1.00488	1.00672	1.00766	1.00855	1.00935	1.00998	1.01037	1.01041M	8C1164
1.00997	1.00893	1.00709	.99961	1.00214	1.00385	1.00490	1.00543	1.00557M	8C1165
1.00541	1.00504	1.00454	1.00395	1.00271	1.00158	1.00074	1.00027	1.00022M	8C1166
1.00061	1.00144	1.00268	1.00425	1.00602	1.00691	1.00775	1.00848	1.00904M	8C1167
1.00934	1.00930	1.00880	1.00770	1.00584	.99744	1.00011	1.00196	1.00314M	8C1168
1.00380	1.00405	1.00400	1.00373	1.00330	1.00278	1.00163	1.00056	.99974M	8C1169
.99927	.99921	.99959	1.00040	1.00161	1.00315	1.00485	1.00568	1.00645M	8C1170
1.00710	1.00756	1.00774	1.00755	1.00687	1.00555	1.00344	.99494	.99741M	8C1171
.99924	1.00052	1.00135	1.00180	1.00193	1.00183	1.00154	1.00112	1.00008M	8C1172
.99902	.99817	.99768	.99764	.99807	.99893	1.00013	1.00154	1.00300M	8C1173
1.00368	1.00429	1.00481	1.00520	1.00544	1.00549	1.00532	1.00490	1.00419M	8C1174
.99330	.99524	.99672	.99778	.99849	.99890	.99907	.99903	.99884M	8C1175
.99853	.99772	.99686	.99614	.99571	.99567	.99604	.99682	.99794M	8C1176
.99925	1.00058	1.00118	1.00170	1.00208	1.00230	1.00230	1.00204	1.00146M	8C1177
1.00052	.99914	1.00324	1.00438	1.00514	1.00558	1.00574	1.00568	1.00542M	8C1178
1.00503	1.00453	1.00396	1.00274	1.00159	1.00069	1.00016	1.00009	1.00050M	8C1179
1.00139	1.00269	1.00428	1.00602	1.00687	1.00769	1.00842	1.00904	1.00950M	8C1180
1.00976	1.00979	1.00952	1.00892	1.00375	1.00572	1.00697	1.00764	1.00785M	8C1181
1.00773	1.00736	1.00681	1.00616	1.00545	1.00401	1.00275	1.00181	1.00127M	8C1182
1.00119	1.00159	1.00246	1.00378	1.00549	1.00746	1.00847	1.00946	1.01038M	8C1183
1.01116	1.01174	1.01202	1.01190	1.01126	1.00995	1.00616	1.00784	1.00883M	8C1184
1.00927	1.00929	1.00899	1.00847	1.00781	1.00705	1.00625	1.00470	1.00337M	8C1185
1.00239	1.00185	1.00178	1.00219	1.00309	1.00445	1.00622	1.00829	1.00939M	8C1186
1.01047	1.01151	1.01244	1.01319	1.01368	1.01382	1.01348	1.01252	1.00791M	8C1187
1.00925	1.00999	1.01025	1.01014	1.00975	1.00916	1.00842	1.00761	1.00675M	8C1188
1.00509	1.00365	1.00260	1.00202	1.00195	1.00241	1.00338	1.00482	1.00667M	8C1189
1.00880	1.00993	1.01106	1.01215	1.01317	1.01407	1.01478	1.01523	1.01535M	8C1190

Section : FIELD

Date : 10.3.1970

B 003

MAGNETIC FIELD

Main magnet : 8000 A Compensating magnet : -1000 A

1.01504	1.00851	1.00990	1.01062	1.01082	1.01063	1.01015	1.00948	1.00868M	8C1191
1.00781	1.00691	1.00521	1.00378	1.00274	1.00216	1.00206	1.00247	1.00339M	8C1192
1.00482	1.00670	1.00895	1.01015	1.01136	1.01253	1.01361	1.01453	1.01519M	8C1193
1.01550	1.01533	1.01454	1.00866	1.01004	1.01075	1.01093	1.01072	1.01022M	8C1194
1.00952	1.00870	1.00780	1.00689	1.00515	1.00370	1.00265	1.00206	1.00197M	8C1195
1.00240	1.00334	1.00478	1.00669	1.00895	1.01016	1.01138	1.01258	1.01368M	8C1196
1.01463	1.01535	1.01572	1.01564	1.01495	1.00838	1.00977	1.01048	1.01067M	8C1197
1.01045	1.00995	1.00925	1.00842	1.00754	1.00663	1.00492	1.00350	1.00248M	8C1198
1.00191	1.00183	1.00224	1.00317	1.00459	1.00646	1.00870	1.00991	1.01112M	8C1199
1.01230	1.01339	1.01431	1.01499	1.01530	1.01513	1.01432	1.00738	1.00884M	8C1200
1.00963	1.00990	1.00977	1.00935	1.00873	1.00797	1.00714	1.00628	1.00462M	8C1201
1.00322	1.00220	1.00163	1.00155	1.00198	1.00291	1.00432	1.00616	1.00833M	8C1202
1.00947	1.01062	1.01172	1.01273	1.01357	1.01416	1.01441	1.01419	1.01338M	8C1203
1.00560	1.00727	1.00824	1.00866	1.00866	1.00834	1.00780	1.00712	1.00635M	8C1204
1.00555	1.00398	1.00264	1.00166	1.00111	1.00103	1.00143	1.00232	1.00369M	8C1205
1.00548	1.00758	1.00868	1.00978	1.01082	1.01174	1.01247	1.01292	1.01298M	8C1206
1.01251	1.01138	1.00363	1.00512	1.00609	1.00663	1.00681	1.00670	1.00636M	8C1207
1.00585	1.00522	1.00452	1.00306	1.00172	1.00072	1.00015	1.00010	1.00056M	8C1208
1.00151	1.00287	1.00454	1.00638	1.00733	1.00826	1.00916	1.01001	1.01078M	8C1209
1.01146	1.01204	1.01248	1.01277	1.00283	1.00375	1.00433	1.00462	1.00466M	8C1210
1.00451	1.00419	1.00376	1.00323	1.00265	1.00143	1.00030	.99942	.99891M	8C1211
.99884	.99924	1.00010	1.00136	1.00293	1.00465	1.00552	1.00636	1.00713M	8C1212
1.00782	1.00837	1.00875	1.00893	1.00886	1.00849	1.01653	1.01634	1.01594M	8C1213
1.01537	1.01465	1.01383	1.01293	1.01198	1.01101	1.01005	1.00823	1.00667M	8C1214
1.00551	1.00483	1.00470	1.00513	1.00613	1.00765	1.00962	1.01193	1.01317M	8C1215
1.01445	1.01573	1.01700	1.01823	1.01938	1.02044	1.02135	1.02210	1.01779M	8C1216
1.01742	1.01685	1.01611	1.01524	1.01428	1.01325	1.01219	1.01112	1.01006M	8C1217
1.00807	1.00640	1.00515	1.00442	1.00427	1.00473	1.00579	1.00741	1.00952M	8C1218
1.01201	1.01336	1.01476	1.01617	1.01758	1.01896	1.02029	1.02152	1.02264M	8C1219
1.02360	1.01777	1.01776	1.01735	1.01661	1.01566	1.01456	1.01337	1.01216M	8C1220
1.01095	1.00978	1.00766	1.00596	1.00475	1.00407	1.00394	1.00439	1.00540M	8C1221
1.00699	1.00913	1.01175	1.01321	1.01474	1.01631	1.01788	1.01940	1.02081M	8C1222
1.02205	1.02302	1.02362	1.01854	1.01831	1.01771	1.01684	1.01577	1.01457M	8C1223
1.01331	1.01202	1.01075	1.00953	1.00732	1.00554	1.00427	1.00356	1.00343M	8C1224
1.00390	1.00497	1.00663	1.00884	1.01155	1.01306	1.01464	1.01628	1.01793M	8C1225
1.01956	1.02111	1.02253	1.02375	1.02468	1.01878	1.01850	1.01783	1.01688M	8C1226
1.01574	1.01448	1.01317	1.01184	1.01053	1.00929	1.00706	1.00527	1.00399M	8C1227
1.00325	1.00309	1.00351	1.00454	1.00618	1.00844	1.01124	1.01282	1.01447M	8C1228
1.01618	1.01789	1.01955	1.02110	1.02245	1.02349	1.02412	1.01871	1.01842M	8C1229
1.01775	1.01679	1.01565	1.01437	1.01304	1.01170	1.01038	1.00912	1.00685M	8C1230
1.00505	1.00376	1.00304	1.00289	1.00334	1.00440	1.00606	1.00833	1.01113M	8C1231
1.01270	1.01436	1.01607	1.01780	1.01949	1.02108	1.02251	1.02368	1.02448M	8C1232
1.01861	1.01827	1.01758	1.01663	1.01549	1.01423	1.01291	1.01157	1.01026M	8C1233
1.00900	1.00674	1.00494	1.00369	1.00302	1.00295	1.00348	1.00460	1.00629M	8C1234
1.00852	1.01121	1.01270	1.01427	1.01589	1.01755	1.01919	1.02079	1.02230M	8C1235
1.02366	1.02480	1.01792	1.01778	1.01723	1.01638	1.01532	1.01412	1.01284M	8C1236
1.01154	1.01026	1.00903	1.00682	1.00505	1.00379	1.00309	1.00297	1.00342M	8C1237
1.00447	1.00611	1.00831	1.01102	1.01253	1.01411	1.01575	1.01739	1.01899M	8C1238
1.02049	1.02182	1.02288	1.02359	1.01826	1.01724	1.01654	1.01582	1.01493M	8C1239
1.01385	1.01264	1.01137	1.01011	1.00891	1.00683	1.00524	1.00407	1.00331M	8C1240
1.00300	1.00328	1.00426	1.00596	1.00827	1.01102	1.01249	1.01401	1.01557M	8C1241
1.01714	1.01868	1.02009	1.02115	1.02147	1.02038	1.01687	1.01643	1.01581M	8C1242
1.01504	1.01415	1.01318	1.01215	1.01109	1.01002	1.00897	1.00701	1.00535M	8C1243
1.00412	1.00339	1.00324	1.00367	1.00470	1.00629	1.00837	1.01085	1.01221M	8C1244
1.01362	1.01506	1.01650	1.01794	1.01933	1.02066	1.02189	1.02298	1.01503M	8C1245
1.01491	1.01456	1.01400	1.01329	1.01247	1.01156	1.01060	1.00962	1.00865M	8C1246
1.00683	1.00528	1.00414	1.00348	1.00336	1.00380	1.00478	1.00627	1.00821M	8C1247
1.01050	1.01175	1.01305	1.01439	1.01574	1.01710	1.01843	1.01973	1.02098M	8C1248
1.02215								M	8C1249

Section : FIELD
Date : 10.3.1970

B 004

MAGNETIC FIELD

Main magnet : 6000 A Compensating magnet : -1000 A

The sign of word 2 of the title block FIELD is positive (negative) for a positive (negative) beam particle bent clockwise in the chamber (e.g. to bottom of chamber).

The values of x_o, y_o, z_o given on the DATA SHEET (see GEOM TITLE / D..) should be used for words 8-10 in title block FIELD, respectively.
Please consult FIELD / A001 if you are not using geometry titles produced by CERN.

This title block can only be used with routine ZFIELD described in FIELD / A003. Words 5-7 give the orientation of the field axis system with respect to the geometry axis system (+1 for same direction, -1 for opposite direction).

a) FIELD Polynomial :

```
*     FIELD       59  10F7.0/(5E14.7)                                    M 6C1-01
   -3.0    1.0    0.0  .0005    1.0    1.0    1.0    0.0    0.0 -25.2  M 6C1-02
 1.1234555E+01 6.9320990E-05-4.0701612E-08 2.7362924E-13-1.3927857E-04  M 6C1-03
-2.0376957E-07 1.1999991E-10-8.8551288E-05 2.2857475E-07-6.4036891E-13  M 6C1-04
 6.7774749E-08-2.4064628E-10-3.6830492E-08 2.4283317E-11 2.3978317E-04  M 6C1-05
-9.2602956E-08-1.6871902E-12-2.3629851E-13 7.0426991E-09-2.7030079E-11  M 6C1-06
-4.8234191E-15 3.7934182E-13 4.6296545E-12-3.4028442E-14 1.9230298E-05  M 6C1-07
 1.5634925E-08-3.4640696E-12 4.4532400E-10 1.9393645E-12-7.5917934E-09  M 6C1-08
 3.8422134E-12-2.1868935E-12 2.8520086E-08 1.2384407E-11 1.6078064E-15  M 6C1-09
 9.3255204E-14-2.4928262E-13 9.6468382E-15-1.3019135E-14-1.3405219E-09  M 6C1-10
 2.8237007E-12 7.7021936E-13-6.4036891E-13-1.2135124E-12-1.9293676E-15  M 6C1-11
-5.4197798E-15-9.6468382E-16-1.4555545E-13 1.3781197E-16               M 6C1-12
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b) FIELD Tables :

This title block should be used with the standard routine ZFIELD provided in TC Program Library / GENERAL.

MAGNETIC FIELD

Main magnet : 6000 A Compensating magnet : -1000 A

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*     FIELD     2290 4F10.5,3I5,3F5.0,3(/14F5.0)/5F5.0/( 9F8.5)
C-- FIELD TITLE FOR 2 M CHAMBER, MEAS. DEC 69, MAIN MAGNET= 6000 A, CORR=-1000 A
C-- MEASURED AT GEOMETRIC CENTRE OF CHAMBER (WARM) - X=0, Y=0, Z=-25.2
C-- FOR TRANSFORMATION TO CAMERA SYSTEM SEE '2 M USERS HANDBOOK' SECTIONS
C-- GEOM-TITLE/D... AND FIELD/A...
0.        11.235    0.        .0005        29   11    70.   0.   -25.2  M 6C1 -4
-95. -90. -85. -80. -75. -70. -65. -60. -55. -50. -40. -30. -20. -10.    M 6C1 -3
0.   10.  20.  30.  40.  50.  55.  60.  65.  70.  75.  80.  85.  90.     M 6C1 -2
95.  -25. -20. -15.  -10. -5. 0.   5.   10.  15.  20.  25.  -25.2-18.9  M 6C1 -1
-12.6  0.0 12.6 18.9 25.2                                               M 6C1  0
 1.01488 1.01465 1.01427 1.01374 1.01312 1.01241 1.01165 1.01086 1.01005M 6C1  1
 1.00926 1.00777 1.00651 1.00559 1.00507 1.00501 1.00542 1.00631 1.00765M 6C1  2
 1.00939 1.01143 1.01254 1.01368 1.01485 1.01601 1.01716 1.01826 1.01930M 6C1  3
 1.02025 1.02108 1.01492 1.01474 1.01436 1.01382 1.01316 1.01240 1.01158M 6C1  4
 1.01072 1.00984 1.00897 1.00732 1.00593 1.00489 1.00431 1.00423 1.00469M 6C1  5
 1.00566 1.00713 1.00904 1.01127 1.01248 1.01373 1.01499 1.01625 1.01748M 6C1  6
 1.01866 1.01975 1.02074 1.02158 1.01471 1.01487 1.01464 1.01411 1.01337M 6C1  7
 1.01248 1.01150 1.01049 1.00947 1.00848 1.00667 1.00522 1.00419 1.00363M 6C1  8
 1.00357 1.00401 1.00497 1.00643 1.00839 1.01078 1.01210 1.01349 1.01491M 6C1  9
 1.01634 1.01772 1.01901 1.02014 1.02104 1.02162 1.01511 1.01517 1.01481M 6C1 10
 1.01416 1.01330 1.01230 1.01123 1.01012 1.00904 1.00799 1.00612 1.00464M 6C1 11
 1.00361 1.00306 1.00300 1.00344 1.00440 1.00587 1.00785 1.01031 1.01169M 6C1 12
 1.01314 1.01465 1.01618 1.01768 1.01910 1.02037 1.02141 1.02213 1.01543M 6C1 13
 1.01534 1.01485 1.01409 1.01314 1.01209 1.01098 1.00986 1.00878 1.00775M 6C1 14
 1.00593 1.00449 1.00346 1.00286 1.00270 1.00302 1.00386 1.00526 1.00726M 6C1 15
 1.00984 1.01131 1.01288 1.01451 1.01614 1.01772 1.01917 1.02037 1.02122M 6C1 16
 1.02156 1.01543 1.01523 1.01480 1.01408 1.01312 1.01200 1.01080 1.00961M 6C1 17
 1.00849 1.00748 1.00582 1.00458 1.00363 1.00293 1.00255 1.00266 1.00343M 6C1 18
 1.00493 1.00708 1.00973 1.01117 1.01267 1.01422 1.01581 1.01742 1.01899M 6C1 19
 1.02039 1.02139 1.02154 1.01530 1.01520 1.01471 1.01394 1.01299 1.01192M 6C1 20
 1.01080 1.00968 1.00859 1.00755 1.00573 1.00429 1.00327 1.00268 1.00253M 6C1 21
 1.00285 1.00369 1.00509 1.00709 1.00967 1.01114 1.01271 1.01434 1.01597M 6C1 22
 1.01754 1.01898 1.02017 1.02098 1.02128 1.01484 1.01482 1.01446 1.01382M 6C1 23
 1.01295 1.01194 1.01084 1.00971 1.00861 1.00756 1.00572 1.00431 1.00336M 6C1 24
 1.00284 1.00275 1.00311 1.00397 1.00540 1.00739 1.00992 1.01133 1.01282M 6C1 25
 1.01434 1.01586 1.01734 1.01874 1.02002 1.02117 1.02216 1.01423 1.01444M 6C1 26
 1.01421 1.01364 1.01285 1.01191 1.01088 1.00983 1.00878 1.00778 1.00599M 6C1 27
 1.00458 1.00360 1.00307 1.00301 1.00342 1.00432 1.00573 1.00766 1.01007M 6C1 28
 1.01142 1.01286 1.01433 1.01581 1.01724 1.01855 1.01967 1.02049 1.02089M 6C1 29
 1.01467 1.01431 1.01380 1.01316 1.01242 1.01161 1.01075 1.00986 1.00897M 6C1 30
 1.00810 1.00646 1.00509 1.00407 1.00349 1.00340 1.00383 1.00477 1.00621M 6C1 31
 1.00809 1.01035 1.01159 1.01288 1.01421 1.01557 1.01692 1.01825 1.01954M 6C1 32
 1.02077 1.02190 1.01443 1.01404 1.01352 1.01289 1.01218 1.01141 1.01060M 6C1 33
 1.00978 1.00895 1.00814 1.00665 1.00540 1.00448 1.00396 1.00390 1.00430M 6C1 34
 1.00519 1.00652 1.00828 1.01038 1.01154 1.01276 1.01402 1.01530 1.01659M 6C1 35
 1.01787 1.01913 1.02034 1.02147 1.00100 1.00230 1.00323 1.00385 1.00420M 6C1 36
 1.00432 1.00426 1.00405 1.00373 1.00334 1.00243 1.00155 1.00085 1.00045M 6C1 37
 1.00044 1.00084 1.00164 1.00279 1.00419 1.00570 1.00643 1.00712 1.00774M 6C1 38
 1.00824 1.00860 1.00877 1.00872 1.00840 1.00776 1.00088 1.00310 1.00459M 6C1 39
 1.00548 1.00592 1.00600 1.00584 1.00549 1.00502 1.00449 1.00339 1.00240M 6C1 40
 1.00168 1.00130 1.00131 1.00171 1.00251 1.00369 1.00521 1.00693 1.00782M 6C1 41
 1.00868 1.00945 1.01010 1.01054 1.01069 1.01044 1.00968 1.00825 1.00317M 6C1 42
 1.00506 1.00626 1.00692 1.00716 1.00707 1.00676 1.00630 1.00573 1.00511M 6C1 43
 1.00388 1.00280 1.00202 1.00161 1.00161 1.00202 1.00287 1.00412 1.00573M 6C1 44
 1.00760 1.00858 1.00954 1.01045 1.01124 1.01186 1.01222 1.01222 1.01176M 6C1 45
 1.01069 1.00453 1.00624 1.00727 1.00777 1.00787 1.00767 1.00725 1.00670M 6C1 46
 1.00606 1.00539 1.00408 1.00297 1.00218 1.00177 1.00177 1.00219 1.00304M 6C1 47
 1.00430 1.00595 1.00789 1.00892 1.00995 1.01094 1.01184 1.01259 1.01310M 6C1 48
 1.01329 1.01304 1.01221 1.00520 1.00698 1.00794 1.00830 1.00824 1.00792M 6C1 49
 1.00742 1.00683 1.00620 1.00556 1.00436 1.00334 1.00255 1.00204 1.00187M 6C1 50
 1.00212 1.00267 1.00414 1.00589 1.00800 1.00912 1.01023 1.01129 1.01223M 6C1 51
 1.01301 1.01358 1.01387 1.01383 1.01343 1.00546 1.00703 1.00798 1.00837M 6C1 52
 1.00833 1.00797 1.00742 1.00679 1.00613 1.00551 1.00441 1.00350 1.00275M 6C1 53
 1.00216 1.00183 1.00196 1.00267 1.00399 1.00580 1.00791 1.00900 1.01007M 6C1 54
 1.01112 1.01211 1.01298 1.01364 1.01392 1.01349 1.01181 1.00516 1.00681M 6C1 55
 1.00774 1.00813 1.00812 1.00782 1.00733 1.00672 1.00605 1.00537 1.00408M 6C1 56
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Section : FIELD

Date : 10.3.1970

B 004

MAGNETIC FIELD

Main magnet : 6000 A Compensating magnet : -1000 A

1.00301	1.00224	1.00180	1.00173	1.00204	1.00277	1.00396	1.00562	1.00769M	6C1 57
1.00882	1.00998	1.01111	1.01214	1.01298	1.01351	1.01361	1.01309	1.01177M	6C1 58
1.00420	1.00596	1.00701	1.00750	1.00758	1.00735	1.00692	1.00635	1.00570M	6C1 59
1.00503	1.00374	1.00266	1.00191	1.00151	1.00151	1.00190	1.00271	1.00393M	6C1 60
1.00556	1.00751	1.00856	1.00962	1.01065	1.01158	1.01235	1.01286	1.01301M	6C1 61
1.01267	1.01166	1.00274	1.00466	1.00586	1.00650	1.00671	1.00660	1.00627M	6C1 62
1.00578	1.00520	1.00457	1.00333	1.00227	1.00150	1.00110	1.00109	1.00150M	6C1 63
1.00232	1.00355	1.00515	1.00704	1.00803	1.00902	1.00995	1.01078	1.01142M	6C1 64
1.01180	1.01182	1.01134	1.01022	.99952	1.00209	1.00378	1.00478	1.00526M	6C1 65
1.00535	1.00516	1.00477	1.00427	1.00371	1.00258	1.00161	1.00091	1.00057M	6C1 66
1.00058	1.00097	1.00174	1.00290	1.00440	1.00616	1.00707	1.00797	1.00879M	6C1 67
1.00948	1.00994	1.01008	1.00977	1.00886	1.00717	1.00084	1.00194	1.00272M	6C1 68
1.00320	1.00344	1.00348	1.00336	1.00310	1.00275	1.00234	1.00142	1.00054M	6C1 69
.99985	.99947	.99946	.99987	1.00068	1.00184	1.00326	1.00481	1.00558M	6C1 70
1.00632	1.00700	1.00759	1.00805	1.00835	1.00846	1.00833	1.00791	.99039M	6C1 71
.99280	.99471	.99617	.99724	.99798	.99844	.99867	.99872	.99864M	6C1 72
.99819	.99760	.99708	.99678	.99681	.99719	.99792	.99893	1.00008M	6C1 73
1.00119	1.00166	1.00202	1.00224	1.00226	1.00206	1.00157	1.00075	.99953M	6C1 74
.99786	.99158	.99487	.99728	.99898	1.00011	1.00079	1.00113	1.00121M	6C1 75
1.00110	1.00086	1.00020	.99951	.99897	.99869	.99873	.99912	.99985M	6C1 76
1.00088	1.00213	1.00345	1.00406	1.00457	1.00494	1.00510	1.00496	1.00443M	6C1 77
1.00340	1.00172	.99924	.99464	.99763	.99977	1.00124	1.00217	1.00268M	6C1 78
1.00287	1.00282	1.00261	1.00228	1.00148	1.00069	1.00009	.99977	.99980M	6C1 79
1.00021	1.00097	1.00207	1.00343	1.00489	1.00560	1.00623	1.00675	1.00707M	6C1 80
1.00713	1.00683	1.00607	1.00471	1.00261	.99659	.99941	1.00139	1.00271M	6C1 81
1.00350	1.00388	1.00396	1.00381	1.00351	1.00312	1.00223	1.00139	1.00077M	6C1 82
1.00045	1.00048	1.00089	1.00166	1.00278	1.00418	1.00573	1.00650	1.00721M	6C1 83
1.00782	1.00826	1.00845	1.00831	1.00771	1.00654	1.00464	.99769	1.00042M	6C1 84
1.00231	1.00353	1.00422	1.00453	1.00454	1.00436	1.00404	1.00363	1.00274M	6C1 85
1.00192	1.00131	1.00096	1.00093	1.00125	1.00194	1.00301	1.00442	1.00607M	6C1 86
1.00692	1.00774	1.00845	1.00899	1.00927	1.00917	1.00855	1.00725	1.00506M	6C1 87
.99790	1.00075	1.00261	1.00374	1.00434	1.00457	1.00455	1.00436	1.00406M	6C1 88
1.00371	1.00296	1.00224	1.00163	1.00120	1.00103	1.00120	1.00179	1.00285M	6C1 89
1.00432	1.00607	1.00695	1.00779	1.00850	1.00904	1.00931	1.00923	1.00871M	6C1 90
1.00767	1.00601	.99758	1.00032	1.00220	1.00340	1.00408	1.00437	1.00437M	6C1 91
1.00418	1.00386	1.00347	1.00261	1.00182	1.00123	1.00089	1.00084	1.00113M	6C1 92
1.00178	1.00281	1.00422	1.00589	1.00676	1.00759	1.00834	1.00890	1.00919M	6C1 93
1.00908	1.00842	1.00702	1.00467	.99635	.99921	1.00120	1.00250	1.00326M	6C1 94
1.00361	1.00366	1.00349	1.00319	1.00280	1.00193	1.00113	1.00056	1.00027M	6C1 95
1.00031	1.00068	1.00141	1.00248	1.00384	1.00539	1.00617	1.00690	1.00753M	6C1 96
1.00800	1.00822	1.00809	1.00748	1.00625	1.00423	.99436	.99736	.99949M	6C1 97
1.00094	1.00185	1.00233	1.00249	1.00242	1.00219	1.00185	1.00104	1.00024M	6C1 98
.99965	.99933	.99936	.99975	1.00050	1.00160	1.00296	1.00445	1.00517M	6C1 99
1.00582	1.00635	1.00669	1.00676	1.00646	1.00568	1.00426	1.00205	.99245M	6C1100
.99508	.99710	.99858	.99961	1.00026	1.00061	1.00071	1.00062	1.00039M	6C1101
.99970	.99893	.99830	.99796	.99801	.99845	.99926	1.00036	1.00162M	6C1102
1.00287	1.00344	1.00393	1.00432	1.00457	1.00466	1.00456	1.00423	1.00364M	6C1103
1.00275	.99092	.99310	.99480	.99609	.99703	.99767	.99805	.99823M	6C1104
.99824	.99812	.99765	.99706	.99655	.99626	.99629	.99667	.99739M	6C1105
.99839	.99954	1.00068	1.00118	1.00159	1.00187	1.00199	1.00189	1.00154M	6C1106
1.00089	.99989	.99847	.98270	.98577	.98826	.99023	.99176	.99291M	6C1107
.99373	.99427	.99459	.99474	.99467	.99434	.99401	.99382	.99389M	6C1108
.99426	.99492	.99578	.99670	.99747	.99772	.99783	.99776	.99745M	6C1109
.99687	.99594	.99462	.99285	.99054	.98618	.98927	.99176	.99371M	6C1110
.99519	.99628	.99702	.99749	.99772	.99778	.99753	.99706	.99660M	6C1111
.99634	.99638	.99678	.99752	.99851	.99959	1.00056	1.00091	1.00112M	6C1112
1.00114	1.00093	1.00042	.99956	.99830	.99655	.99425	.98850	.99199M	6C1113
.99463	.99658	.99797	.99889	.99945	.99973	.99981	.99972	.99930M	6C1114
.99876	.99831	.99809	.99816	.99856	.99927	1.00025	1.00139	1.00251M	6C1115
1.00298	1.00333	1.00351	1.00346	1.00310	1.00235	1.00109	.99920	.99656M	6C1116
.99069	.99403	.99655	.99838	.99965	1.00048	1.00095	1.00116	1.00117M	6C1117
1.00103	1.00053	.99993	.99945	.99920	.99926	.99966	1.00038	1.00139M	6C1118
1.00259	1.00390	1.00434	1.00477	1.00505	1.00511	1.00488	1.00426	1.00316M	6C1119
1.00145	.99899	.99208	.99532	.99773	.99946	1.00065	1.00140	1.00183M	6C1120
1.00200	1.00198	1.00184	1.00132	1.00073	1.00023	.99994	.99993	1.00025M	6C1121
1.00091	1.00189	1.00312	1.00444	1.00506	1.00559	1.00597	1.00611	1.00595M	6C1122
1.00535	1.00420	1.00234	.99959	.99249	.99559	.99801	.99975	1.00092M	6C1123

Section : FIELD

Date : 10.3.1970

B 004

MAGNETIC FIELD

Main magnet : 6000 A

Compensating magnet : -1000 A

1.00162	1.00197	1.00209	1.00205	1.00193	1.00156	1.00113	1.00070	1.00033M	6C1124
1.00013	1.00025	1.00083	1.00186	1.00320	1.00459	1.00520	1.00570	1.00603M	6C1125
1.00616	1.00603	1.00553	1.00452	1.00276	.99984	.99201	.99523	.99763M	6C1126
.99935	1.00053	1.00129	1.00171	1.00189	1.00189	1.00175	1.00126	1.00068M	6C1127
1.00018	.99988	.99985	1.00014	1.00076	1.00172	1.00295	1.00430	1.00494M	6C1128
1.00548	1.00587	1.00604	1.00587	1.00526	1.00406	1.00211	.99923	.99045M	6C1129
.99388	.99642	.99825	.99951	1.00031	1.00077	1.00096	1.00096	1.00082M	6C1130
1.00033	.99977	.99932	.99909	.99914	.99950	1.00018	1.00114	1.00230M	6C1131
1.00351	1.00405	1.00451	1.00482	1.00490	1.00469	1.00408	1.00295	1.00117M	6C1132
.99856	.98822	.99174	.99440	.99636	.99773	.99865	.99919	.99946M	6C1133
.99952	.99942	.99898	.99842	.99796	.99772	.99778	.99817	.99888M	6C1134
.99986	1.00102	1.00216	1.00265	1.00302	1.00322	1.00318	1.00282	1.00204M	6C1135
1.00074	.99878	.99601	.98613	.98917	.99160	.99351	.99496	.99601M	6C1136
.99673	.99717	.99738	.99742	.99715	.99665	.99617	.99589	.99592M	6C1137
.99631	.99703	.99802	.99910	1.00008	1.00045	1.00067	1.00072	1.00053M	6C1138
1.00006	.99925	.99803	.99635	.99413	.98277	.98578	.98822	.99014M	6C1139
.99163	.99274	.99352	.99404	.99434	.99446	.99436	.99402	.99367M	6C1140
.99347	.99354	.99391	.99457	.99543	.99635	.99713	.99738	.99749M	6C1141
.99741	.99711	.99652	.99559	.99427	.99250	.99020	.98986	.99233M	6C1142
.99428	.99577	.99687	.99764	.99812	.99837	.99844	.99837	.99794M	6C1143
.99738	.99688	.99661	.99666	.99707	.99783	.99885	1.00001	1.00111M	6C1144
1.00156	1.00190	1.00209	1.00208	1.00183	1.00128	1.00038	.99907	.99730M	6C1145
.99188	.99496	.99725	.99889	.99999	1.00068	1.00103	1.00113	1.00104M	6C1146
1.00083	1.00019	.99949	.99894	.99864	.99867	.99906	.99981	1.00087M	6C1147
1.00215	1.00347	1.00408	1.00459	1.00494	1.00509	1.00494	1.00442	1.00341M	6C1148
1.00179	.99942	.99468	.99763	.99975	1.00120	1.00212	1.00262	1.00281M	6C1149
1.00276	1.00255	1.00223	1.00145	1.00068	1.00009	.99979	.99983	1.00022M	6C1150
1.00098	1.00207	1.00342	1.00489	1.00559	1.00623	1.00675	1.00707	1.00713M	6C1151
1.00684	1.00607	1.00470	1.00257	.99665	.99942	1.00137	1.00266	1.00344M	6C1152
1.00382	1.00390	1.00376	1.00347	1.00308	1.00220	1.00137	1.00075	1.00043M	6C1153
1.00046	1.00087	1.00165	1.00278	1.00418	1.00574	1.00651	1.00722	1.00782M	6C1154
1.00826	1.00845	1.00830	1.00771	1.00654	1.00465	.99768	1.00042	1.00230M	6C1155
1.00350	1.00419	1.00448	1.00448	1.00428	1.00395	1.00353	1.00263	1.00180M	6C1156
1.00119	1.00086	1.00085	1.00120	1.00192	1.00301	1.00444	1.00610	1.00695M	6C1157
1.00776	1.00847	1.00900	1.00928	1.00918	1.00857	1.00728	1.00513	.99779M	6C1158
1.00063	1.00250	1.00365	1.00426	1.00450	1.00448	1.00429	1.00398	1.00362M	6C1159
1.00283	1.00208	1.00146	1.00106	1.00094	1.00117	1.00183	1.00294	1.00445M	6C1160
1.00619	1.00707	1.00789	1.00859	1.00910	1.00934	1.00924	1.00870	1.00761M	6C1161
1.00590	.99744	1.00022	1.00213	1.00335	1.00404	1.00434	1.00434	1.00414M	6C1162
1.00381	1.00341	1.00252	1.00171	1.00111	1.00078	1.00076	1.00109	1.00178M	6C1163
1.00284	1.00425	1.00591	1.00677	1.00759	1.00831	1.00886	1.00915	1.00905M	6C1164
1.00842	1.00709	1.00486	.99645	.99922	1.00115	1.00243	1.00318	1.00354M	6C1165
1.00360	1.00345	1.00316	1.00279	1.00194	1.00115	1.00057	1.00027	1.00030M	6C1166
1.00067	1.00140	1.00248	1.00385	1.00540	1.00618	1.00691	1.00753	1.00800M	6C1167
1.00821	1.00808	1.00747	1.00626	1.00427	.99445	.99737	.99946	1.00089M	6C1168
1.00179	1.00227	1.00245	1.00239	1.00217	1.00184	1.00103	1.00024	.99964M	6C1169
.99932	.99935	.99975	1.00051	1.00161	1.00297	1.00444	1.00515	1.00580M	6C1170
1.00631	1.00664	1.00671	1.00642	1.00565	1.00429	1.00218	.99165	.99472M	6C1171
.99697	.99856	.99961	1.00025	1.00056	1.00062	1.00051	1.00027	.99961M	6C1172
.99892	.99837	.99807	.99809	.99847	.99920	1.00025	1.00155	1.00291M	6C1173
1.00353	1.00406	1.00443	1.00458	1.00440	1.00381	1.00267	1.00085	.99817M	6C1174
.99024	.99250	.99428	.99563	.99663	.99731	.99773	.99794	.99798M	6C1175
.99788	.99745	.99688	.99640	.99613	.99617	.99655	.99727	.99826M	6C1176
.99939	1.00048	1.00094	1.00130	1.00152	1.00157	1.00140	1.00096	1.00020M	6C1177
.99907	.99750	1.00000	1.00141	1.00244	1.00314	1.00356	1.00374	1.00373M	6C1178
1.00357	1.00329	1.00293	1.00208	1.00124	1.00058	1.00022	1.00024	1.00067M	6C1179
1.00150	1.00268	1.00409	1.00560	1.00632	1.00700	1.00758	1.00805	1.00836M	6C1180
1.00847	1.00834	1.00793	1.00718	1.00132	1.00324	1.00454	1.00534	1.00574M	6C1181
1.00583	1.00568	1.00537	1.00494	1.00444	1.00337	1.00239	1.00165	1.00125M	6C1182
1.00124	1.00164	1.00247	1.00369	1.00523	1.00696	1.00784	1.00868	1.00943M	6C1183
1.01006	1.01049	1.01064	1.01044	1.00978	1.00853	1.00329	1.00507	1.00621M	6C1184
1.00683	1.00705	1.00697	1.00667	1.00621	1.00566	1.00506	1.00386	1.00280M	6C1185
1.00203	1.00163	1.00162	1.00203	1.00288	1.00413	1.00574	1.00760	1.00857M	6C1186
1.00952	1.01042	1.01121	1.01183	1.01219	1.01222	1.01178	1.01077	1.00463M	6C1187
1.00625	1.00722	1.00770	1.00779	1.00759	1.00719	1.00665	1.00603	1.00537M	6C1188
1.00407	1.00296	1.00217	1.00174	1.00173	1.00215	1.00301	1.00429	1.00596M	6C1189
1.00791	1.00894	1.00997	1.01096	1.01186	1.01260	1.01311	1.01330	1.01305M	6C1190

Section : FIELD

Date : 10.3.1970

B 004

MAGNETIC FIELD

Main magnet : 6000 A

Compensating magnet : -1000 A

1.01224	1.00530	1.00689	1.00780	1.00820	1.00820	1.00793	1.00746	1.00686M	6C1191
1.00619	1.00550	1.00416	1.00304	1.00223	1.00179	1.00174	1.00212	1.00294M	6C1192
1.00420	1.00591	1.00796	1.00908	1.01020	1.01129	1.01228	1.01310	1.01366M	6C1193
1.01384	1.01351	1.01249	1.00511	1.00673	1.00768	1.00809	1.00811	1.00785M	6C1194
1.00738	1.00678	1.00612	1.00543	1.00410	1.00299	1.00218	1.00175	1.00170M	6C1195
1.00207	1.00288	1.00415	1.00585	1.00792	1.00904	1.01018	1.01127	1.01228M	6C1196
1.01311	1.01367	1.01385	1.01349	1.01244	1.00479	1.00657	1.00759	1.00804M	6C1197
1.00807	1.00778	1.00729	1.00668	1.00599	1.00529	1.00395	1.00286	1.00209M	6C1198
1.00167	1.00163	1.00199	1.00277	1.00400	1.00568	1.00773	1.00885	1.01000M	6C1199
1.01110	1.01212	1.01295	1.01350	1.01363	1.01318	1.01197	1.00423	1.00596M	6C1200
1.00697	1.00743	1.00749	1.00726	1.00682	1.00627	1.00564	1.00499	1.00373M	6C1201
1.00268	1.00192	1.00151	1.00148	1.00186	1.00267	1.00391	1.00557	1.00754M	6C1202
1.00860	1.00965	1.01066	1.01157	1.01232	1.01282	1.01299	1.01270	1.01183M	6C1203
1.00288	1.00467	1.00580	1.00640	1.00659	1.00648	1.00616	1.00569	1.00512M	6C1204
1.00451	1.00330	1.00225	1.00149	1.00109	1.00109	1.00150	1.00233	1.00356M	6C1205
1.00516	1.00703	1.00802	1.00899	1.00991	1.01073	1.01137	1.01176	1.01180M	6C1206
1.01137	1.01033	.99989	1.00219	1.00371	1.00463	1.00507	1.00516	1.00499M	6C1207
1.00465	1.00419	1.00366	1.00258	1.00162	1.00092	1.00055	1.00054	1.00092M	6C1208
1.00171	1.00290	1.00443	1.00620	1.00711	1.00798	1.00875	1.00937	1.00973M	6C1209
1.00975	1.00929	1.00820	1.00631	1.00009	1.00122	1.00202	1.00253	1.00281M	6C1210
1.00289	1.00281	1.00259	1.00229	1.00191	1.00107	1.00026	.99963	.99929M	6C1211
.99930	.99971	1.00049	1.00161	1.00297	1.00446	1.00519	1.00589	1.00653M	6C1212
1.00707	1.00749	1.00775	1.00782	1.00765	1.00720	1.01381	1.01372	1.01345M	6C1213
1.01303	1.01248	1.01185	1.01115	1.01040	1.00964	1.00888	1.00744	1.00623M	6C1214
1.00534	1.00486	1.00484	1.00530	1.00623	1.00761	1.00937	1.01142	1.01252M	6C1215
1.01365	1.01478	1.01591	1.01699	1.01802	1.01897	1.01980	1.02049	1.01432M	6C1216
1.01443	1.01422	1.01376	1.01312	1.01236	1.01151	1.01063	1.00973	1.00885M	6C1217
1.00722	1.00588	1.00491	1.00437	1.00430	1.00471	1.00564	1.00705	1.00894M	6C1218
1.01122	1.01247	1.01377	1.01508	1.01638	1.01762	1.01874	1.01970	1.02040M	6C1219
1.02078	1.01479	1.01488	1.01459	1.01403	1.01327	1.01238	1.01140	1.01039M	6C1220
1.00939	1.00841	1.00665	1.00523	1.00422	1.00367	1.00361	1.00404	1.00498M	6C1221
1.00643	1.00838	1.01078	1.01211	1.01350	1.01493	1.01636	1.01774	1.01903M	6C1222
1.02015	1.02103	1.02157	1.01519	1.01517	1.01477	1.01410	1.01323	1.01224M	6C1223
1.01117	1.01009	1.00901	1.00798	1.00612	1.00464	1.00360	1.00303	1.00296M	6C1224
1.00340	1.00436	1.00585	1.00786	1.01034	1.01173	1.01320	1.01471	1.01624M	6C1225
1.01773	1.01914	1.02040	1.02142	1.02211	1.01542	1.01532	1.01485	1.01409M	6C1226
1.01314	1.01208	1.01096	1.00982	1.00871	1.00766	1.00578	1.00430	1.00325M	6C1227
1.00267	1.00257	1.00296	1.00388	1.00536	1.00739	1.00996	1.01141	1.01295M	6C1228
1.01455	1.01616	1.01772	1.01919	1.02046	1.02143	1.02199	1.01502	1.01500M	6C1229
1.01456	1.01383	1.01290	1.01184	1.01071	1.00957	1.00846	1.00739	1.00550M	6C1230
1.00402	1.00298	1.00242	1.00235	1.00278	1.00374	1.00525	1.00733	1.00993M	6C1231
1.01141	1.01296	1.01457	1.01619	1.01777	1.01922	1.02048	1.02144	1.02196M	6C1232
1.01485	1.01495	1.01459	1.01389	1.01296	1.01189	1.01075	1.00960	1.00847M	6C1233
1.00740	1.00551	1.00404	1.00303	1.00248	1.00240	1.00281	1.00372	1.00518M	6C1234
1.00719	1.00976	1.01122	1.01277	1.01438	1.01600	1.01757	1.01901	1.02024M	6C1235
1.02112	1.02153	1.01492	1.01484	1.01440	1.01371	1.01282	1.01183	1.01076M	6C1236
1.00968	1.00861	1.00759	1.00576	1.00431	1.00330	1.00276	1.00268	1.00308M	6C1237
1.00397	1.00540	1.00739	1.00991	1.01133	1.01284	1.01438	1.01593	1.01743M	6C1238
1.01883	1.02008	1.02114	1.02201	1.01433	1.01445	1.01416	1.01356	1.01274M	6C1239
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1.00303	1.00344	1.00433	1.00573	1.00766	1.01006	1.01142	1.01285	1.01433M	6C1241
1.01581	1.01724	1.01856	1.01967	1.02048	1.02087	1.01578	1.01449	1.01363M	6C1242
1.01293	1.01224	1.01151	1.01070	1.00982	1.00891	1.00800	1.00631	1.00496M	6C1243
1.00404	1.00356	1.00352	1.00391	1.00477	1.00613	1.00802	1.01035	1.01163M	6C1244
1.01293	1.01424	1.01551	1.01676	1.01799	1.01929	1.02082	1.02284	1.01345M	6C1245
1.01314	1.01270	1.01213	1.01149	1.01078	1.01002	1.00925	1.00847	1.00771M	6C1246
1.00629	1.00511	1.00426	1.00380	1.00377	1.00421	1.00511	1.00644	1.00816M	6C1247
1.01020	1.01132	1.01247	1.01366	1.01486	1.01606	1.01723	1.01836	1.01942M	6C1248
1.02039								M	6C1249

CERN/D.Ph.II/200 75-1
17 July, 1975

DETERMINATION OF THE SPACIAL COORDINATES OF FIDUCIAL MARKS ON THE 1975 2 METER HYDROGEN BUBBLE CHAMBER FRONT WINDOW

K. Knudson
CERN, Geneva

During the end-1974 PS shutdown the CERN 2 meter bubble chamber was dismantled for an extensive checkup. During the dismounting the front glass was found to be chipped along its edge, thus endangering the liquid hydrogen seal. It was decided that rather than try to repair the damage, the spare window (No. 2) should be etched with fiducials and used to replace the old window (No. 4) when the chamber was scheduled to come up again in June 1975.

The new fiducials were etched in roughly the same place as the old ones (within about a millimeter) with the exception of number 27 which was shifted by approximately 2 centimeters upstream from the beam. Having only a small template available at the time it was decided to make all the crosses with it rather than wait the extra weeks necessary to construct a larger one. Therefore the seventeen plane 2 fiducials have somewhat shorter arms than their 1970-1974 counterparts. The eight plane 1 fiducials remain roughly the same size and shape however.

The new window is the pre-1970 window ground down and re-etched with fiducials. It was made with Schott BK7 glass. This glass has a slightly different composition from the borosilicate crown glass Schott K50 used in the 1970-1974 window (No. 4). One of the unfortunate properties of BK7 glass is that fiducials etched in it have a remarkable smoothness and therefore don't scatter light in the same manner as the rougher K50 fiducials. In addition the new fiducials seem to have not been etched deeply enough. The net effect is that some fiducials defract too much light into the cameras while others don't defract enough. These effects are being studied and it is hoped that geometry titles won't be too adversely affected. Preliminary results seem encouraging.

After the fiducials were etched into the glass the new window was transported to the central workshop where the relative fiducial coordinates were measured on a high precision Collet jig bore machine. Six sets of measurements were made of all twenty-five crosses, three different people doing a pair each. The window was oriented with respect to the telescope as it would be with respect to the cameras under normal operating conditions, (i.e. plane 1 toward the observer, positive x-axis roughly through fiducials 27 and 35, and positive y-axis roughly through fiducials 23 and 22). The window was then turned around and all fiducials were again measured six times. The orientation this time was as though one were looking at the chamber from the flash side, (i.e. plane 2 toward the telescope, x-axis flipped around, and y-axis unchanged).

The six sets of "normal" measurements were averaged and compared to the average of the six sets of "flipped" measurements. By mapping plane 2 "flipped" onto plane 2 "normal" we define a 3 parameter linear transformation. Under this transformation plane 1 "flipped" fiducials map systematically about 3/4 millimeter higher in y than plane 1 "normal" fiducials. This can be explained by assuming that the telescope was not perpendicular to the window, making rather an angle θ_y of about -3.3 milliradians with respect to the normal to the window in an x=constant plane. The effect of this angle is to shift the y-measurements of the front plane with respect to the through plane by an amount equal to half the average y-residuals seen on plane 1 after transformation. This y-shift is found to be -0.364 millimeters.

The angle of nonorthogonality in the x-direction θ_x is not determinable from the measurements made from the two orientations since they cancel out under the transformation. To find this angle it would have been sufficient to make another set of measurements with the window rotated so as to flip the y-axis. This wasn't done however.

Fortunately, a happy accident occured which allows us to determine θ_x and thus also find the x-shift of front plane to through plane fiducials. After measuring three plane 2 fiducials in the "normal" orientation it was discovered that the plane 1 fiducials were out of

focus. To get them in focus it was necessary to move the telescope back by roughly 45 millimeters. The three fiducials were then re-measured as well as the remaining fiducials as explained above. The difference in the x and y coordinates of these three crosses before and after the telescope shift was noted to be $\Delta x = -0.009$ mm and $\Delta y = 0.149$ mm. Knowing the y-shift from above as well as the thickness of the window and its index of refraction it is a simple matter of optics to determine the x-shift necessary to impose on the through plane measurements in order to fix plane 1 with respect to plane 2. (The x-shift value was found in this way to be 0.021 mm arising from an x-nonorthogonality angle of 0.2 milliradians).

Applying these shifts to the fiducials of plane 2 on the "normal" average and to the fiducials of plane 1 on the "flipped" average we obtain two supposedly good values of the relative coordinates of plane 1 and plane 2. These two averages are at least consistent since mapping one onto the other (with 3 parameters) gives us average residuals on the order of 30 microns and a maximum residual of 50 microns. Seeing no reason to prefer one average over the other we then averaged the two together to obtain a "grand average". This grand average was then transformed (again with 3 parameters) to the old 1970-1974 reference system and cards were punched out, rounding to 10 microns. These values are given in Appendix A and will be the values quoted in the 2 Meter Chamber Users' Handbook. The error on these numbers is on the order of 30 microns.

DESCRIPTION OF THE APPENDICES

APPENDIX A gives the fiducial coordinates for the 1975 front window. The tabular values quoted are in millimeters and are rounded to 10 microns.

APPENDICES B, C and D show comparisons of one set of fiducial measurements with another. A least square fit is made to find the best 3-parameter linear transformation which will map the seventeen plane 2 fiducials of one set onto the corresponding fiducials of the other set. (The three parameters used are simply the two translation parameters along with a rotation parameter).

The tail of each vector (represented by a zero) indicates the relative position in space of a particular fiducial. The head of each vector is represented by a 1 or a 2, depending on which plane the fiducial lies. The direction and length of each vector represents the direction and distance a fiducial is from its image under the mapping. The longest vector is 2.5 cm. This represents a distance in space equal to the maximum value quoted in the legend. (Quoted values are in millimeters). The vectors for the other fiducials are scaled down accordingly.

APPENDIX B shows how the average of the six sets of "flipped" measurements maps onto the average of the six sets of "normal" measurements. Plane 2 maps very well onto plane 2 (to about 30μ on average), while the plane 1 "flipped" fiducials are seen to map (under the transformation defined by plane 2) systematically about 3/4 mm higher than their corresponding "normal" fiducials. (This is due to the effect described in the text).

APPENDIX C again compares "flipped" to "normal" measurements, but this time we doctor them up by applying a shift of (-.021, .364) to plane 2 "normal" and plane 1 "flipped". We see, of course, that plane 2 "flipped" maps onto plane 2 "normal" exactly as it did in APPENDIX B. Plane 1 "flipped", however, now maps very nicely onto plane 1 "normal" - so nicely in fact that it is even marginally better than plane 2, which was the plane used to define the transformation in the first place.

APPENDIX D shows how the 1975 window compares with the 1970-1974 window. We see that the difference is not very big - the average discrepancy being

about 1/2 mm on plane 2 and 1 mm on plane 1. This comparison was made without fiducial 27, since this fiducial was deliberately moved by about 2 cm from its previous position so as not to cause any confusion in determining which window is which.

APPENDIX E shows a schematic drawing of the window before and after moving the telescope while measuring the fiducials on the jig bore. Due to the non-orthogonality of the telescope axis with the window a point B on plane 2 will appear to have the same x and y coordinates as a point A on plane 1 when in fact it is a vector (XSHIFT,YSHIFT) away from point C, the point on plane 2 directly beneath point A. The problem is to find this vector so that we can shift all plane 2 measurements by this amount so as to aline them with the plane 1 measurements.

The YSHIFT value was readily determined by the method described in the text. Knowing the thickness d and index of refraction n of the window, XSHIFT can now be found from the value of YSHIFT simply by observing the changes in the x and y coordinates (Δx and Δy) of a plane 2 fiducial measured before and after displacing the window by an (unknown) amount Δz (or equivalently by moving the telescope back along the z-axis by a distance Δz).

The method used was as follows:

1) From triangle ABC, $\theta'_y = \tan^{-1}\left(\frac{\text{YSHIFT}}{d}\right)$.

2) From Snell's law, $\theta_y = \tan^{-1}\left(n \cdot \sin \theta'_y\right)$.

3) From triangle BDB', $\Delta Z = \frac{\Delta y}{\tan \theta_y}$.

4) From triangle BDB', $\theta_x = \tan^{-1}\left(\frac{\Delta x}{\Delta z}\right)$.

5) From Snell's law, $\theta'_x = \tan^{-1}\left(\frac{\sin \theta_x}{n}\right)$.

6) From triangle ABC, YSHIFT = $d \cdot \tan \theta'_x$.

Following the precedent set forth in CERN paper D.Ph.II/200 71-2, we list the computer cards punched directly from the sheets of measurements,

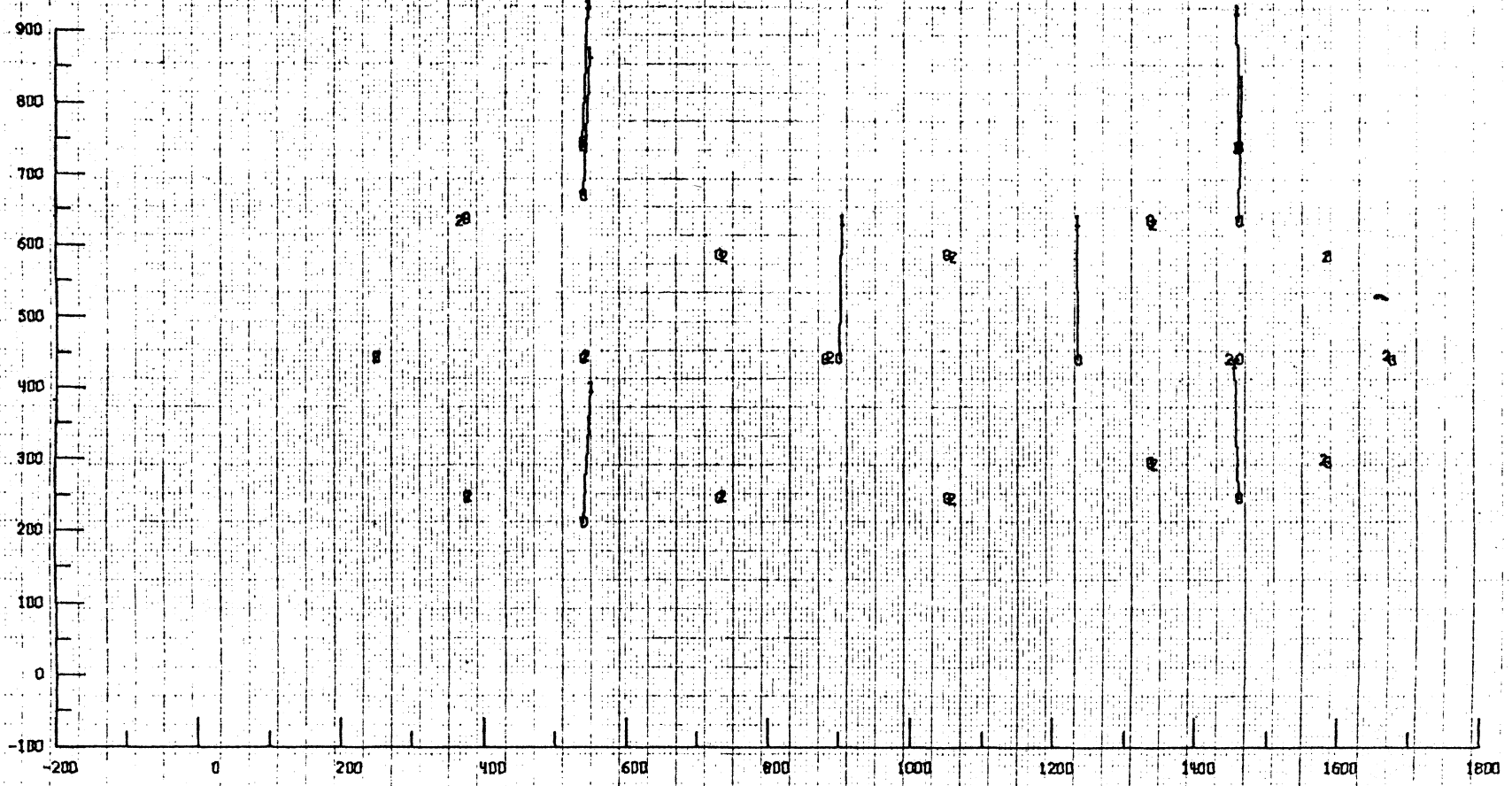
as they were used as input to the processing, doubly cross-checked. People therefore have the possibility of verifying the results published herein. Pages 10 through 12 list the six sets of raw data for what was called the "normal" position. Pages 13 through 15 do the same for the "flipped" position. Page 9 lists the raw data measurements of the three fiducials mistakenly measured before shifting the telescope back so as to bring plane 1 into focus.

Appendix A

FIDUCIAL COORDINATES FOR 1975 FRONT WINDOW

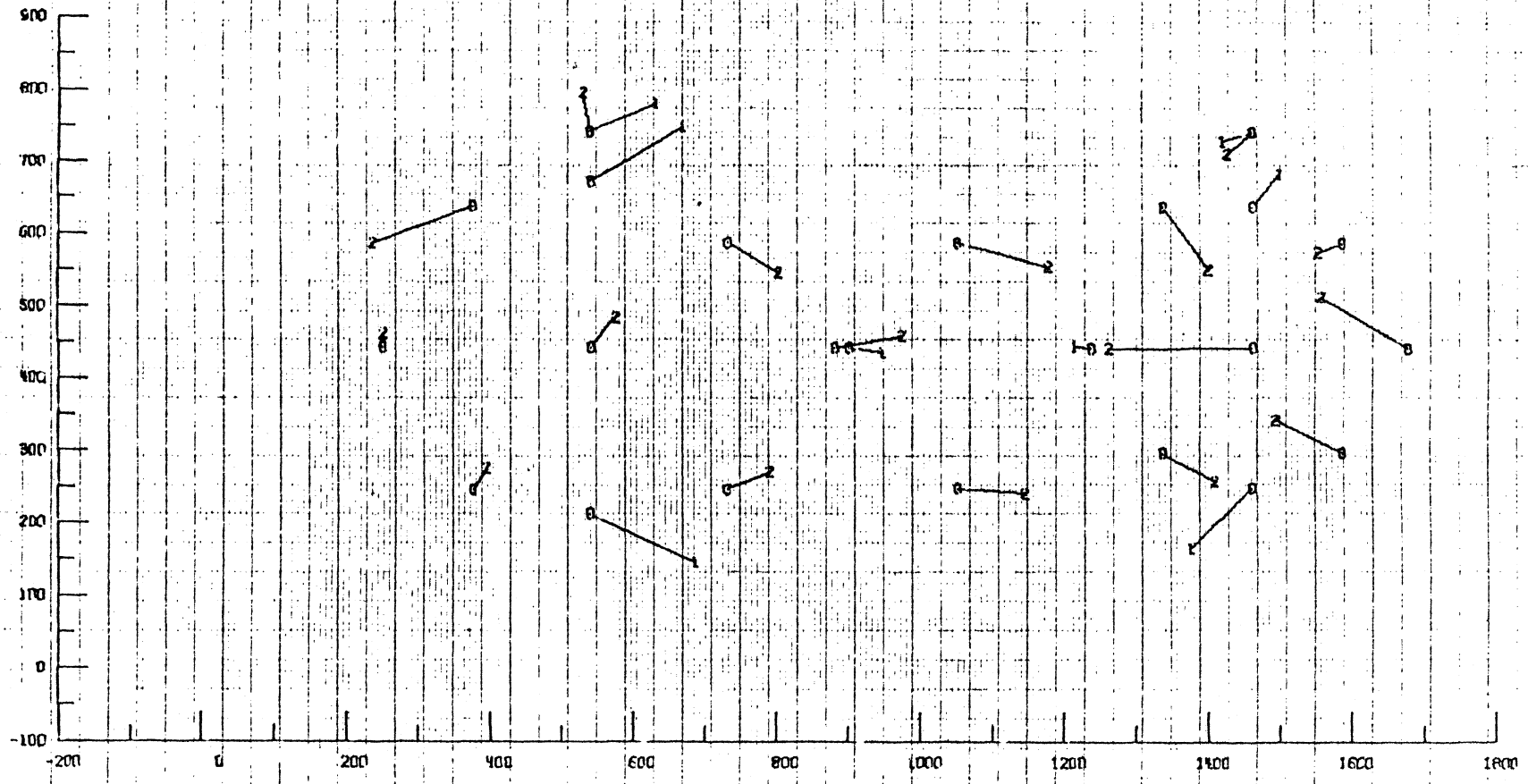
Fiducial Number		x (mm)	y (mm)
Plane 1 :	11	-360.49	229.97
	12	-361.14	-229.86
	13	-0.37	0.52
	14	334.41	-0.49
	15	559.46	194.43
	16	559.58	-194.64
	18	-360.85	300.23
	19	559.09	299.85
Plane 2 :	21	-650.44	0.35
	22	-525.27	195.30
	23	-524.75	-195.35
	24	-360.02	0.45
	25	-169.65	145.33
	26	-169.68	-195.35
	27	-20.51	0.53
	28	150.32	145.28
	29	150.35	-195.08
	30	434.72	194.83
	31	435.31	-144.86
	32	560.01	0.27
	33	684.71	144.73
	34	685.34	-144.87
	35	774.50	-0.41
	38	-360.20	300.00
	39	559.74	299.74

APPENDIX B



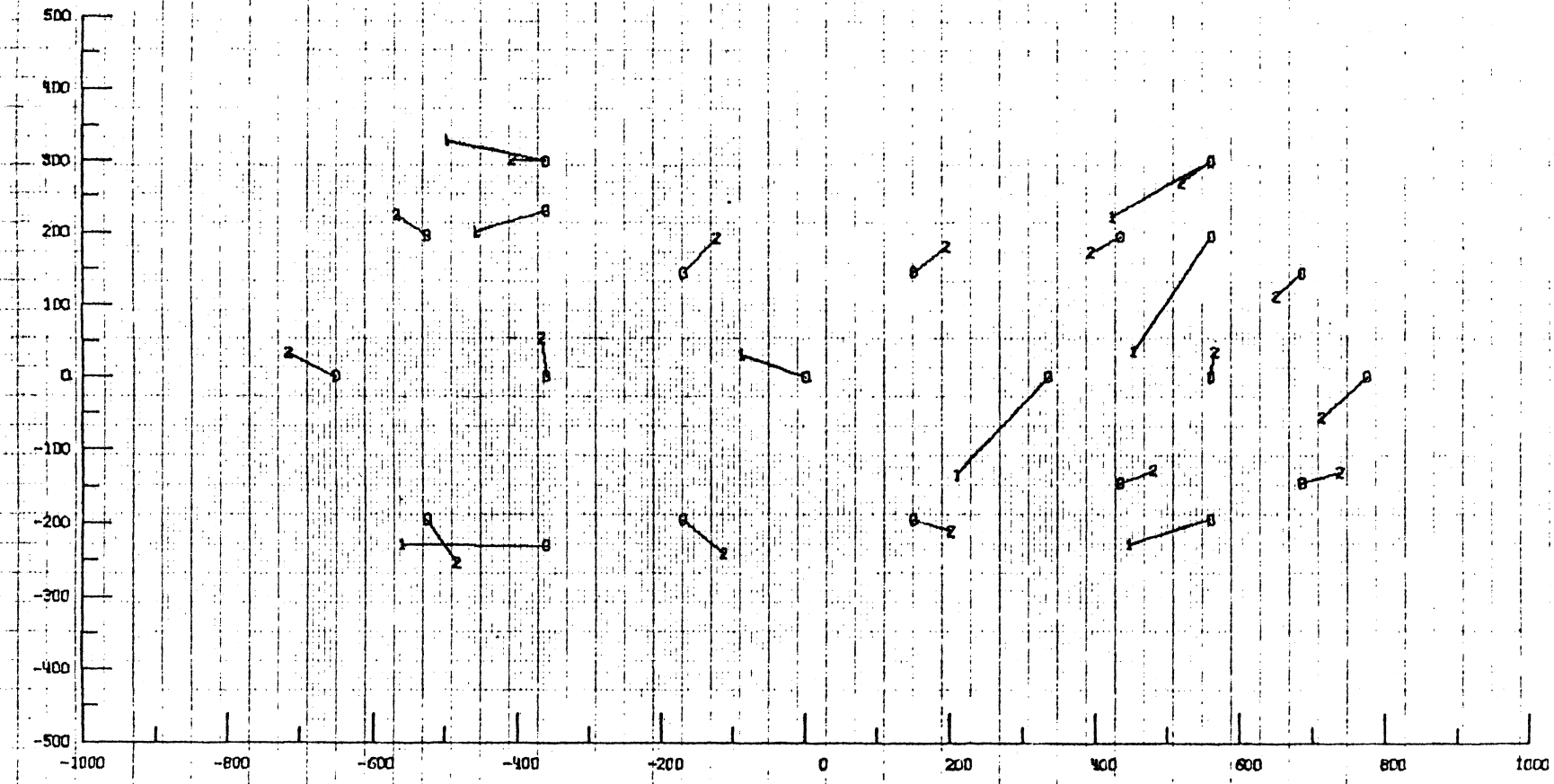
COMPARE 2 METER BUBBLE CHAMBER WINDOWS (1975 NORMAL VS 1975 FLIPPED) NOT SHIFTED
3-PARAMETER LINEAR MAPPING OF VIEW 1 (THE LONGEST VECTOR IS .75 LEAST COUNTS)

APPENDIX C



COMPARE 2 METER BUBBLE CHAMBER WINDOWS (1975 NORMAL VS 1975 FLIPPED) SHIFTED
3-PARAMETER LINEAR MAPPING OF VIEW 1 (THE LONGEST VECTOR IS .05 LEAST COUNTS)

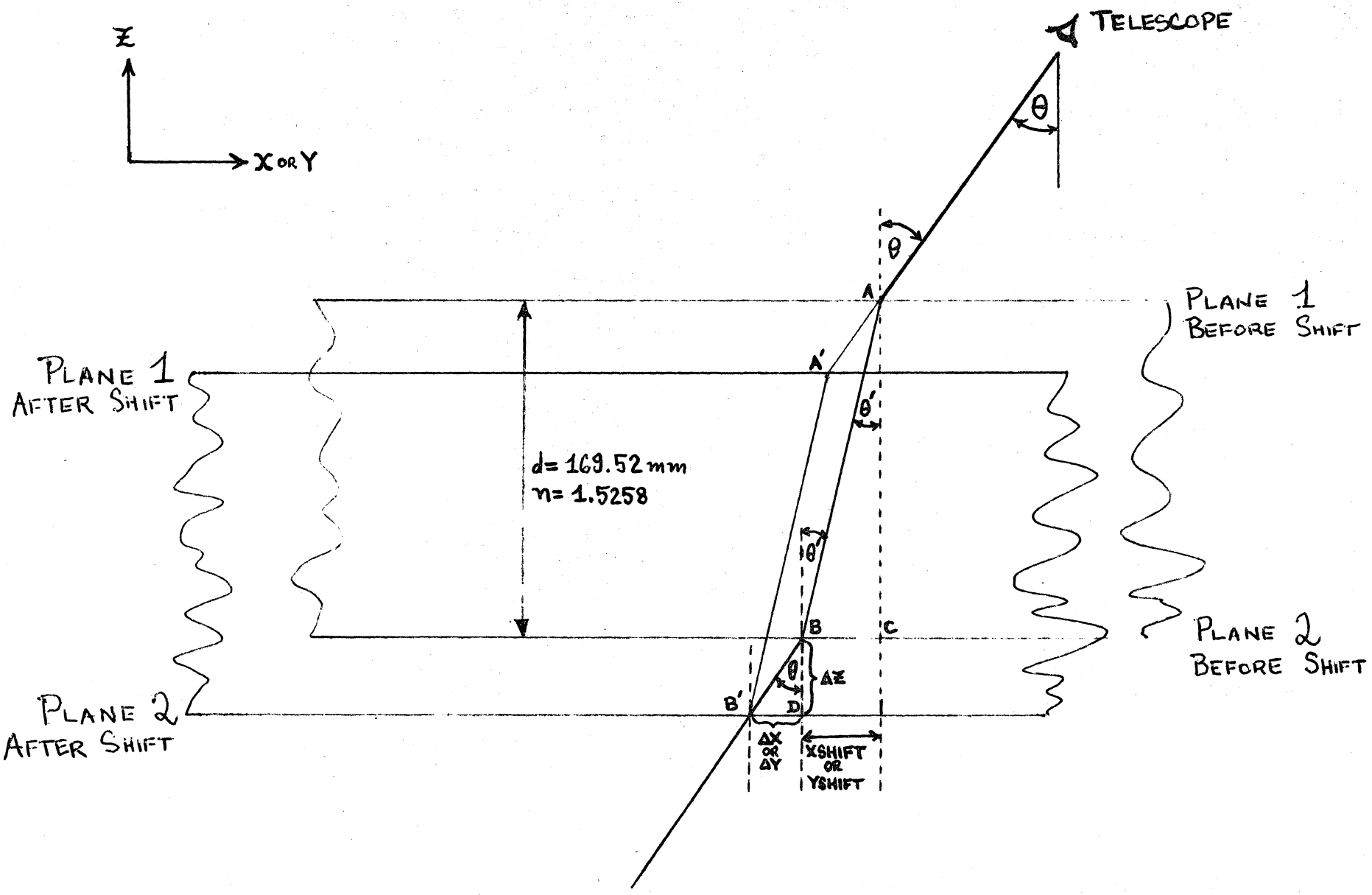
APPENDIX D



COMPARE 2 METER BUBBLE CHAMBER WINDOWS (1970 VS 1975)

LINEAR MAPPING OF VIEW 1 (THE LONGEST VECTOR IS 1.46 LEAST COUNTS)

APPENDIX E


Z
X OR Y
TELESCOPE
θ
θ
A
A'
θ'
θ'
PLANE 1
BEFORE SHIFT
PLANE 1
AFTER SHIFT
d= 169.52 mm
n= 1.5258
B
C
θ'
ΔZ
B'
D
ΔX
OR
ΔY
XSHIFT
OR
YSHIFT
PLANE 2
BEFORE SHIFT
PLANE 2
AFTER SHIFT

```
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT MA5          .05
(A2,A1,7X2F10.5)
   MA5  21   250.648   441.806
   MA5  24   541.065   441.882
   MA5  27   880.575   441.915
EF0
QUOTE,ABC
TAPE,INPUT,0   *COND
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT KP5          .05
(A2,A1,7X2F10.5)
   KP5  21   250.682   441.803
   KP5  24   541.085   441.872
   KP5  27   880.581   441.940
EF0
QUOTE,ABC
TAPE,INPUT,0   *COND
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT RM5          .05
(A2,A1,7X2F10.5)
   RM5  21   250.650   441.795
   RM5  24   541.082   441.865
   RM5  27   880.582   441.927
EF0
QUOTE,ABC
TAPE,INPUT,0   *COND
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT MA6          .05
(A2,A1,7X2F10.5)
   MA6  21   250.663   441.806
   MA6  24   541.073   441.882
   MA6  27   880.559   441.927
EF0
QUOTE,ABC
TAPE,INPUT,0   *COND
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT KP6          .05
(A2,A1,7X2F10.5)
   KP6  21   250.669   441.806
   KP6  24   541.090   441.870
   KP6  27   880.576   441.918
EF0
QUOTE,ABC
TAPE,INPUT,0   *COND
INPUT,CROSS,1     *F     /THREE CROSSES BEFORE 5CM Z-SHIFT RM6          .05
(A2,A1,7X2F10.5)
   RM6  21   250.675   441.802
   RM6  24   541.069   441.892
   RM6  27   880.567   441.939
EF0
QUOTE,ABC
TAPE,INPUT,0
```

```
INPUT,CROSS,1,1.1,21*F          /2M HBC 1975 RAW MEAS, MA1      .05
(A2,A1,7X2F10,5)
   MM1   11    540,630    671,170
   MM1   12    539,922    211,352
   MA1   13    900,722    441,702
   MA1   14   1235,525    440,647
   MM1   15   1460,580    635,519
   MM1   16   1460,688    246,463
   MM1   18    540,279    741,444
   MM1   19   1460,227    740,949
EVO
INPUT,CROSS,1,2.1,22 *F         /2M HBC 1975 RAW MEAS, MA1      .05
(A2,A1,7X2F10,5)
   MM1   21    250,626    441,970
   MM1   22    375,863    636,913
   MM1   23    376,309    246,249
   MM1   24    541,068    442,021
   MM1   25    731,419    586,899
   MM1   26    731,373    246,203
   MM1   27    880,565    442,062
   MM1   28   1051,395    586,803
   MM1   29   1051,408    246,462
   MM1   30   1335,805    636,320
   MM1   31   1336,373    296,660
   MA1   32   1461,112    441,746
   MM1   33   1585,809    586,192
   MA1   34   1586,421    296,593
   MA1   35   1675,615    441,028
   MM1   38    540,910    741,546
   MM1   39   1460,852    741,186
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1.1,21 *F         /2M HBC 1975 RAW MEAS, KP1      .05
(A2,A1,7X2F10,5)
   KP1   11    540,616    671,189
   KP1   12    539,926    211,372
   KP1   13    900,738    441,684
   KP1   14   1235,512    440,647
   KP1   15   1460,583    635,526
   KP1   16   1460,670    246,472
   KP1   18    540,270    741,452
   KP1   19   1460,234    740,965
EVO
INPUT,CROSS,1,2.1,22 *F         /2M HBC 1975 RAW MEAS, KP1      .05
(A2,A1,7X2F10,5)
   KP1   21    250,658    441,952
   KP1   22    375,860    636,920
   KP1   23    376,307    246,250
   KP1   24    541,073    442,014
   KP1   25    731,450    586,896
   KP1   26    731,377    246,212
   KP1   27    880,556    442,054
   KP1   28   1051,410    586,815
   KP1   29   1051,396    246,438
   KP1   30   1335,830    636,335
   KP1   31   1336,358    296,645
   KP1   32   1461,129    441,732
   KP1   33   1585,840    586,194
   KP1   34   1586,432    296,587
   KP1   35   1675,612    440,997
   KP1   38    540,919    741,570
   KP1   39   1460,869    741,216
```

```
INPUT,CROSS,1,1,1,21 *F        /2M HBC 1975 RAW MEAS. RM1      .05
(A2,A1,7X2F10.5)
   RM1  11    540.633    671.178
   RM1  12    539.910    211.355
   RM1  13    900.716    441.677
   RM1  14   1235.523    440.648
   RM1  15   1460.589    635.541
   RM1  16   1460.663    246.478
   RM1  18    540.270    741.443
   RM1  19   1460.228    740.970
EVO
INPUT,CROSS,1,2,1,22*F         /2M HBC 1 75 RAW MEAS. RM1      .05
(A2,A1,7X2F10.5)
   RM1  21    250.634    441.958
   RM1  22    375.840    636.900
   RM1  23    376.296    246.246
   RM1  24    541.037    442.028
   RM1  25    731.422    586.879
   RM1  26    731.370    246.224
   RM1  27    880.553    442.066
   RM1  28   1051.420    586.803
   RM1  29   1051.400    246.438
   RM1  30   1335.821    636.325
   RM1  31   1336.368    296.602
   RM1  32   1461.100    441.745
   RM1  33   1585.797    586.184
   RM1  34   1586.399    296.584
   RM1  35   1675.593    441.030
   RM1  38    540.900    741.587
   RM1  39   1460.857    741.244
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1,1,21 *F        /2M HBC 1975 RAW MEAS. MA2      .05
(A2,A1,7X2F10.5)
   MM2  11    540.632    671.190
   MM2  12    539.917    211.363
   MA2  13    900.712    441.699
   MA2  14   1235.522    440.660
   MM2  15   1460.577    635.515
   MM2  16   1460.664    246.485
   MM2  18    540.265    741.444
   MM2  19   1460.243    740.954
EVO
INPUT,CROSS,1,2,1,22 *F        /2M HBC 1975 RAW MEAS. MA2.     .05
(A2,A1,7X2F10.5)
   MM2  21    250.655    441.965
   MM2  22    375.845    636.893
   MM2  23    376.311    246.253
   MM2  24    541.067    442.022
   MM2  25    731.425    586.889
   MM2  26    731.360    246.203
   MM2  27    880.556    442.067
   MM2  28   1051.380    586.805
   MM2  29   1051.396    246.440
   MM2  30   1335.819    636.318
   MM2  31   1336.373    296.638
   MA2  32   1461.112    441.739
   MM2  33   1585.810    586.176
   MA2  34   1586.411    296.591
   MA2  35   1675.593    441.035
   MM2  38    540.916    741.573
   MM2  39   1460.856    741.211
```

```
INPUT,CROSS,1,1.1,21 *F        /2M HBC 1975 RAW MEAS. KP2      .05
(A2,A1,7X2F10.5)
   KP2  11    540.633    671.183
   KP2  12    539.910    211.354
   KP2  13    900.735    441.689
   KP2  14   1235.526    440.642
   KP2  15   1460.572    635.530
   KP2  16   1460.670    246.480
   KP2  18    540.285    741.445
   KP2  19   1460.233    740.945
EVO
INPUT,CROSS,1,2.1,22 *F        /2M HBC 1975 RAW MEAS. KP2      .05
(A2,A1,7X2F10.5)
   KP2  21    250.652    441.952
   KP2  22    375.857    636.923
   KP2  23    376.318    246.248
   KP2  24    541.063    442.016
   KP2  25    731.460    586.898
   KP2  26    731.381    246.198
   KP2  27    880.578    442.065
   KP2  28   1051.402    586.814
   KP2  29   1051.388    246.446
   KP2  30   1335.830    636.334
   KP2  31   1336.354    296.620
   KP2  32   1461.124    441.743
   KP2  33   1585.833    586.179
   KP2  34   1586.430    296.574
   KP2  35   1675.621    441.035
   KP2  38    540.931    741.578
   KP2  39   1460.865    741.199
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1.1,21 *F        /2M HBC 1975 RAW MEAS. RM2      .05
(A2,A1,7X2F10.5)
   RM2  11    540.625    671.170
   RM2  12    539.903    211.383
   RM2  13    900.725    441.699
   RM2  14   1235.494    440.637
   RM2  15   1460.587    635.529
   RM2  16   1460.659    246.488
   RM2  18    540.269    741.436
   RM2  19   1460.237    740.959
EVO
INPUT,CROSS,1,2.1,22 *F        /2M HBC 1975 RAW MEAS. RM2      .05
(A2,A1,7X2F10.5)
   RM2  21    250.637    441.960
   RM2  22    375.840    636.890
   RM2  23    376.283    246.238
   RM2  24    541.043    442.034
   RM2  25    731.430    586.882
   RM2  26    731.364    246.175
   RM2  27    880.548    442.069
   RM2  28   1051.412    586.813
   RM2  29   1051.385    246.413
   RM2  30   1335.813    636.326
   RM2  31   1336.348    296.636
   RM2  32   1461.104    441.731
   RM2  33   1585.806    586.181
   RM2  34   1586.421    296.578
   RM2  35   1675.571    441.030
   RM2  38    540.906    741.598
   RM2  39   1460.845    741.243
```

```
INPUT,CROSS,1,1.1,21 *F        /2M HBC 1975 RAW MEAS, MA3      .05
(A2,A1,7X2F10.5)
   MM3  11  1367.650   671.950
   MM3  12  1368.405   212.091
   MM3  13  1007.600   442.398
   MM3  14   672.811   441.297
   MM3  15   447.725   636.162
   MM3  16   447.700   247.100
   MM3  18  1367.998   742.207
   MM3  19   448.055   741.592
EVO
INPUT,CROSS,1,2.1,22 *F        /2M HBC 1975 RAW MEAS, MA3      .05
(A2,A1,7X2F10.5)
   MP3  21  1657.710   442.024
   MM3  22  1532.488   636.940
   MP3  23  1532.054   246.313
   MP3  24  1367.272   442.051
   MM3  25  1176.858   586.885
   MP3  26  1176.976   246.206
   MP3  27  1027.752   442.054
   MM3  28   856.875   586.758
   MP3  29   856.950   246.394
   MM3  30   572.454   636.231
   MP3  31   571.978   296.552
   MP3  32   447.282   441.675
   MM3  33   322.499   586.080
   MP3  34   321.955   296.498
   MP3  35   232.781   440.937
   MM3  38  1367.383   741.633
   MM3  39   447.432   741.104
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1.1,21 *F        /2M HBC 1975 RAW MEAS, KP3      .05
(A2,A1,7X2F10.5)
   KP3  11  1367.643   671.933
   KP3  12  1368.420   212.082
   KP3  13  1007.600   442.393
   KP3  14   672.832   441.325
   KP3  15   447.720   636.187
   KP3  16   447.723   247.086
   KP3  18  1368.010   742.195
   KP3  19   448.092   741.592
EVO
INPUT,CROSS,1,2.1,22 *F        /2M HBC 1975 RAW MEAS, KP3      .05
(A2,A1,7X2F10.5)
   KP3  21  1657.692   442.030
   KP3  22  1532.500   636.934
   KP3  23  1532.060   246.289
   KP3  24  1367.283   442.040
   KP3  25  1176.877   586.864
   KP3  26  1176.988   246.220
   KP3  27  1027.745   442.047
   KP3  28   856.880   586.766
   KP3  29   856.943   246.396
   KP3  30   572.489   636.231
   KP3  31   571.965   296.544
   KP3  32   447.282   441.615
   KP3  33   322.523   586.088
   KP3  34   321.974   296.498
   KP3  35   232.782   440.944
   KP3  38  1367.391   741.625
   KP3  39   447.470   741.138
```

```
INPUT,CROSS,1,1,1,21 *F        /2M HBC 1975 R1W M5AS= RM3      .05
(A2,A1,7X2F10.5)
   RM3  11  1367.651   671.970
   RM3  12  1368.410   212.115
   RM3  13  1007.603   442.401
   RM3  14   672.839   441.322
   RM3  15   447.725   636.189
   RM3  16   447.722   247.101
   RM3  18  1368.005   742.213
   RM3  19   448.091   741.598
EVO
INPUT,CROSS,1,2,1,22 *F        /2M HBC 1975 RAW MEAS, RM3      .05
(A2,A1,7X2F10.5)
   RM3  21  1657.688   442.037
   RM3  22  1532.515   636.925
   RM3  23  1532.052   246.287
   RM3  24  1367.270   442.057
   RM3  25  1176.864   586.894
   RM3  26  1176.975   246.216
   RM3  27  1027.737   442.052
   RM3  28   856.883   586.765
   RM3  29   856.934   246.403
   RM3  30   572.468   636.240
   RM3  31   571.975   296.552
   RM3  32   447.272   441.670
   RM3  33   322.516   586.072
   RM3  34   321.949   296.468
   RM3  35   232.761   440.915
   RM3  38  1367.388   741.609
   RM3  39   447.450   741.136
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1,1,21 *F        /2M HBC 1975 RAW MEAS, MA4      .05
(A2,A1,7X2F10.5)
   MM4  11  1367.650   671.950
   MM4  12  1368.405   212.091
   MM4  13  1007.600   442.398
   MM4  14   672.811   441.297
   MM4  15   447.725   636.162
   MM4  16   447.700   247.100
   MM4  18  1367.998   742.207
   MM4  19   448.055   741.592
EVO
INPUT,CROSS,1,2,1,22 *F        /2M HBC 1975 RAW MEAS, MA4      .05
(A2,A1,7X2F10.5)
   MP4  21  1657.690   442.008
   MM4  22  1532.486   636.939
   MP4  23  1532.047   246.305
   MP4  24  1367.274   442.058
   MM4  25  1176.854   586.881
   MP4  26  1176.962   246.184
   MP4  27  1027.766   442.054
   MM4  28   856.880   586.764
   MP4  29   856.950   246.405
   MM4  30   572.490   636.230
   MP4  31   571.980   296.565
   MP4  32   447.287   441.667
   MM4  33   322.497   586.070
   MP4  34   321.965   296.525
   MP4  35   232.774   440.949
   MM4  38  1367.375   741.585
   MM4  39   447.443   741.084
```

```
INPUT,CROSS,1,1,1,21 *F        /2M HBC 1975 RAW MEAS, KP4      ,05
(A2,A1,7X2F10,5)
   KP4  11  1367,643   671,933
   KP4  12  1368,420   212,082
   KP4  13  1007,600   442,393
   KP4  14   672,832   441,325
   KP4  15   447,720   636,187
   KP4  16   447,723   247,086
   KP4  18  1368,010   742,195
   KP4  19   448,092   741,592
EVO
INPUT,CROSS,1,2,1,22 *F        /2M HBC 1975 RAW MEAS, KP4      ,05
(A2,A1,7X2F10,5)
   KP4  21  1657,692   442,022
   KP4  22  1532,518   636,935
   KP4  23  1532,046   246,290
   KP4  24  1367,267   442,058
   KP4  25  1176,875   586,855
   KP4  26  1176,972   246,214
   KP4  27  1027,756   442,044
   KP4  28   856,903   586,750
   KP4  29   856,943   246,400
   KP4  30   572,483   636,207
   KP4  31   571,969   296,535
   KP4  32   447,274   441,620
   KP4  33   322,523   586,095
   KP4  34   321,967   296,492
   KP4  35   232,782   440,936
   KP4  38  1367,409   741,611
   KP4  39   447,476   741,120
EVO
QUOTE,ABC
TAPE,INPUT,0  *COND
INPUT,CROSS,1,1,1,21*F         /2M HBC 1975 RAW MEAS, RM4      ,05
(A2,A1,7X2F10,5)
   RM4  11  1367,651   671,970
   RM4  12  1368,410   212,115
   RM4  13  1007,603   442,401
   RM4  14   672,839   441,322
   RM4  15   447,725   636,189
   RM4  16   447,722   247,101
   RM4  18  1368,005   742,213
   RM4  19   448,091   741,598
EVO
INPUT,CROSS,1,2,1,22 *F        /2M HBC 1975 RAW MEAS, RM4      ,05
(A2,A1,7X2F10,5)
   RM4  21  1657,693   442,012
   RM4  22  1532,500   636,940
   RM4  23  1532,055   246,304
   RM4  24  1367,255   442,076
   RM4  25  1176,874   586,898
   RM4  26  1176,975   246,216
   RM4  27  1027,766   442,052
   RM4  28   856,883   586,768
   RM4  29   856,925   246,399
   RM4  30   572,486   636,247
   RM4  31   571,974   296,555
   RM4  32   447,272   441,664
   RM4  33   322,526   586,067
   RM4  34   321,957   296,486
   RM4  35   232,735   440,912
   RM4  38  1367,398   741,614
   RM4  39   447,453   741,144
```