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Attachment K

Spreadsheet used to Check MCNP Cases and Data Analysis

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Source Input
Grouping Method : Actual Photon Energies

Nuclide	curies	becquerels	µCi/cm³	Bq/cm³
Co-60	1.5677e+002	5.8005e+012	4.5465e+001	1.6822e+006

Buildup
The material reference is : Source

Integration Parameters

Radial	24
Circumferential	24
Y Direction (axial)	24

Results - Dose Point # 1 - (80.01,91.44,0) cm

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	9.462e+08	9.401e+02	2.379e+03	1.815e+00	4.592e+00
1.1732	5.801e+12	1.244e+07	2.629e+07	2.224e+04	4.698e+04
1.3325	5.801e+12	1.505e+07	3.056e+07	2.611e+04	5.302e+04
TOTALS:	1.160e+13	2.749e+07	5.685e+07	4.835e+04	1.000e+05

Results - Dose Point # 2 - (177.47,91.44,0) cm

Energy MeV	Activity photons/sec	Fluence Rate MeV/cm²/sec No Buildup	Fluence Rate MeV/cm²/sec With Buildup	Exposure Rate mR/hr No Buildup	Exposure Rate mR/hr With Buildup
0.6938	9.462e+08	1.950e+02	4.809e+02	3.766e-01	9.286e-01
1.1732	5.801e+12	2.562e+06	5.279e+06	4.578e+03	9.433e+03
1.3325	5.801e+12	3.090e+06	6.123e+06	5.361e+03	1.062e+04
TOTALS:	1.160e+13	5.652e+06	1.140e+07	9.940e+03	2.006e+04

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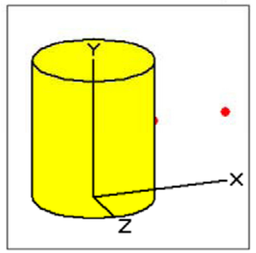
Case Title: QC IRSF Source
Description: Nominal, All Co-60 Source
Geometry: 7 - Cylinder Volume - Side Shields



Source Dimensions

Height	182.88 cm	6 ft
Radius	77.47 cm	2 ft 6.5 in

Dose Points

A	X	Y	Z
# 1	80.01 cm	91.44 cm	0 cm
	2 ft 7.5 in	3 ft	0.0 in
# 2	177.47 cm	91.44 cm	0 cm
	5 ft 9.9 in	3 ft	0.0 in

Shields

Shield Name	Dimension	Material	Density
Source	3.45e+06 cm³	Water	1
Transition		Air	0.00122
Air Gap		Air	0.00122

HIC Dimensions from MicroShield case

Height	**6.00**	ft	Photons/Sec
	182.88	cm	1.16E+13
Radius	**2.54**	ft	
	77.47	cm	

Double Height Stack Dimensions

Height	**150**	in	Photons/Sec
	381.00	cm	2.41667E+13

Number of Stacks	
126	**3.045E+15**

Source Dimensions from the MCNP Case

%	
0.01	
304.8	80%
381	20%

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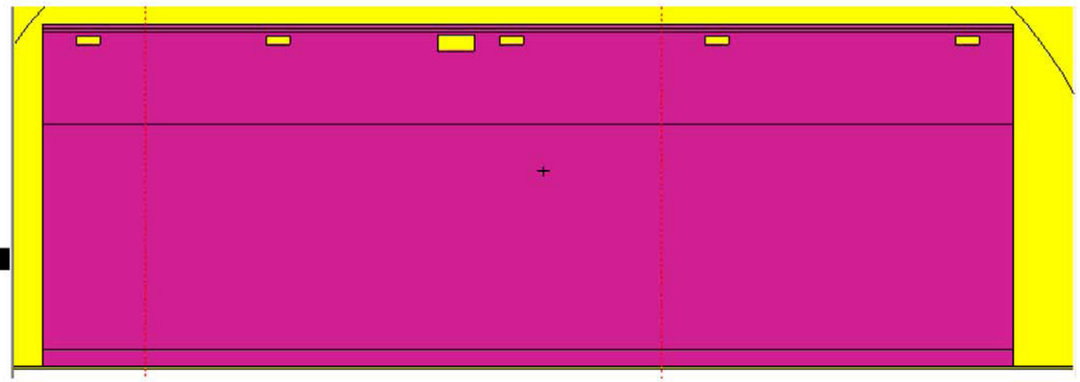
Duct Location Check from left to right on the model



1st						
left	**68.58**					
right	**170.18**	101.6	40 in			
top	**1437.64**					
bottom	**1397**	40.64	16 in			
distance to center from left	195.58		77 in			
distance to slab	76.2		30 in			
2nd						
left	**871.22**					
right	**972.82**	101.6	40 in			
top	**1437.64**					
bottom	**1397**	40.64	16 in			
distance to center from left	998.22		393 in	316	26.33	
distance to slab	76.2		30 in			
3rd						
left	**1595.12**					
right	**1747.52**	152.4	60 in			
top	**1445.26**					
bottom	**1369.06**	76.2	30 in			
distance to center from left	1747.52		688 in	295	24.58	
distance to slab	86.36		34 in			
4th						
left	**1856.74**					
right	**1958.34**	101.6	40 in			
top	**1437.64**					
bottom	**1397**	40.64	16 in			
distance to center from left	1983.74		781 in	93	7.75	
distance to slab	76.2		30 in			
5th						
left	**2720.34**					
right	**2821.94**	101.6	40 in			
top	**1437.64**					
bottom	**1397**	40.64	16 in			
distance to center from left	2847.34		1121 in	340	28.33	
distance to slab	76.2		30 in			
6th						
left	**3776.98**					
right	**3878.58**	101.6	40 in			
top	**1437.64**					
bottom	**1397**	40.64	16 in			
distance to center from left	3903.98		1537 in	416	34.67	
distance to slab	76.2		30 in			

Top of roof slab **1493.52**

Truck Bay Detector (averaged over surface 12371)
F2 Tally

Floor	0	cm
Height	213.36	cm
	84	in
	7	ft

F12 Tally
Rings Around the Building

Surface Descriptions				Radius(cm	vol in circ	SA	from calc	check	
2000	s 1973.58	914.4	-72.6	2800	2.46E+07				Includes under HICS
2001	s 1973.58	914.4	-72.6	4000	5.03E+07	2.564E+07	2.56E+07	1.00E+00	
2002	s 1973.58	914.4	-72.6	7000	1.54E+08	1.037E+08	1.04E+08	1.00E+00	
2003	s 1973.58	914.4	-72.6	10000	3.14E+08	1.602E+08	1.60E+08	1.00E+00	
2004	s 1973.58	914.4	-72.6	15000	7.07E+08	3.927E+08	3.93E+08	1.00E+00	
2005	s 1973.58	914.4	-72.6	20000	1.26E+09	5.498E+08	5.50E+08	1.00E+00	
2006	s 1973.58	914.4	-72.6	25000	1.96E+09	7.069E+08	7.07E+08	1.00E+00	
2007	s 1973.58	914.4	-72.6	30000	2.83E+09	8.639E+08	8.64E+08	1.00E+00	
2008	s 1973.58	914.4	-72.6	37500	4.42E+09	1.590E+09	1.59E+09	1.00E+00	
2009	s 1973.58	914.4	-72.6	45000	6.36E+09	1.944E+09	1.94E+09	1.00E+00	
2010	s 1973.58	914.4	-72.6	55000	9.50E+09	3.142E+09	3.14E+09	1.00E+00	
2011	s 1973.58	914.4	-72.6	65000	1.33E+10	3.770E+09	3.77E+09	1.00E+00	
2012	s 1973.58	914.4	-72.6	75000	1.77E+10	4.398E+09	4.40E+09	1.00E+00	
2013	s 1973.58	914.4	-72.6	85000	2.27E+10	5.027E+09	5.03E+09	1.00E+00	
2014	s 1973.58	914.4	-72.6	95000	2.84E+10	5.655E+09	5.66E+09	1.00E+00	
2015	s 1973.58	914.4	-72.6	120000	4.52E+10	1.689E+10	1.69E+10	1.00E+00	

All surface ratios, calculated over calc are 1

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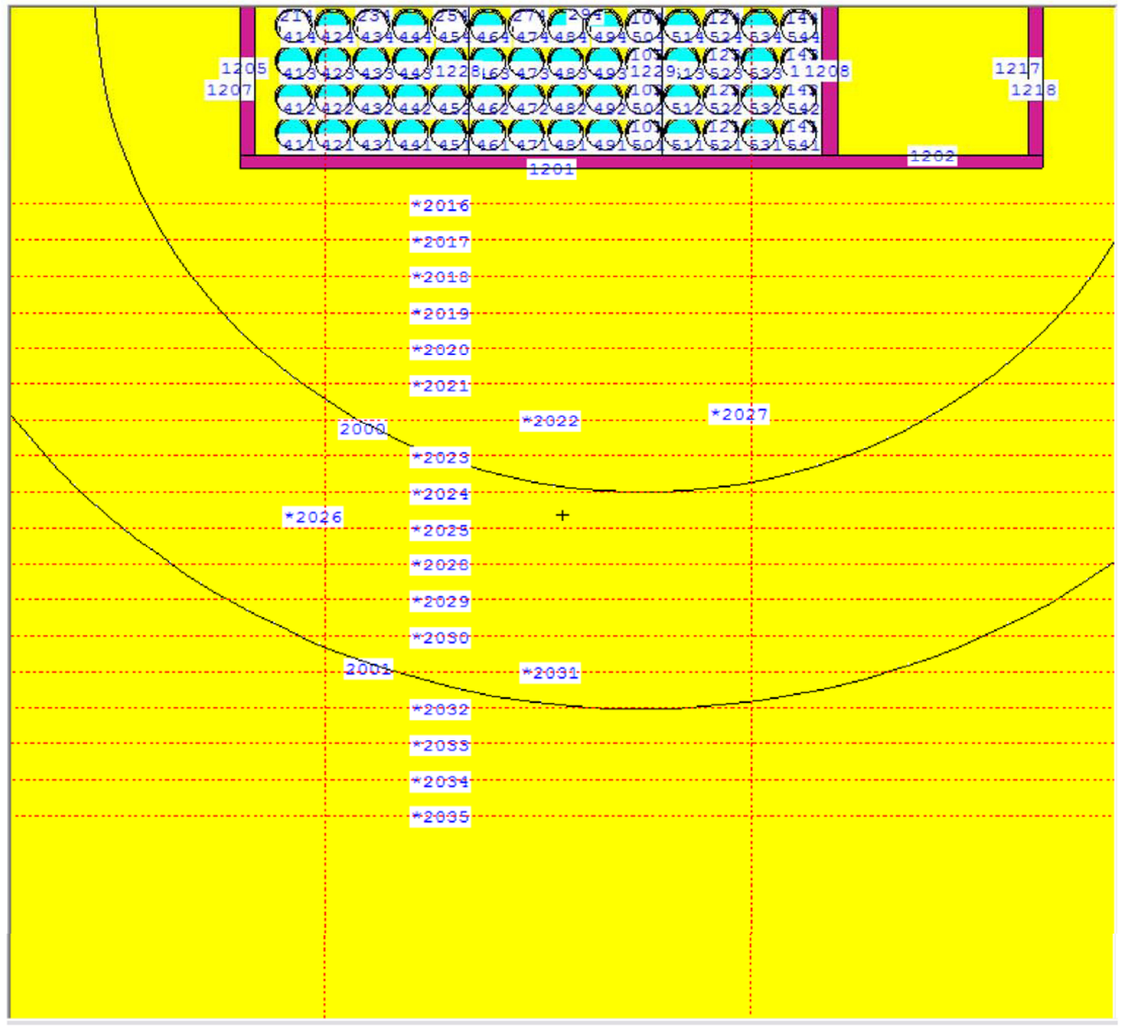
F22 Tally
Slabs Adjacent to Penetration Side

Left of the slab	**359.05**
Right of the slab	**2,535.94**
Width of slab	2,176.89

surf	dist	gap	sa	
2016	-276.2	200	4.35E+05	1
2017	-476.2	200	4.35E+05	2
2018	-676.2	200	4.35E+05	3
2019	-876.2	200	4.35E+05	4
2020	-1076.2	200	4.35E+05	5
2021	-1276.2	200	4.35E+05	6
2022	-1476.2	200	4.35E+05	7
2023	-1676.2	200	4.35E+05	8
2024	-1876.2	200	4.35E+05	9
2025	-2076.2	200	4.35E+05	10
2028	-2276.2	200	4.35E+05	11
2029	-2476.2	200	4.35E+05	12
2030	-2676.2	200	4.35E+05	13
2031	-2876.2	200	4.35E+05	14
2032	-3076.2	200	4.35E+05	15
2033	-3276.2	200	4.35E+05	16
2034	-3476.2	200	4.35E+05	17
2035	-3676.2	200	4.35E+05	18

Same surf areas used in calc so OK



F32 Tally
Dose on Side Wall (Vent side) - 7 ft up

fs32	1231	-2026	2027	-1227	
sd32	1.00E+50	1.00E+50	1.00E+50	1.00E+50	4.64E+05
Height	289.56			1227	-76.2 (1227 to 1231)
Width	2,176.89			1231	213.36
SA	6.30E+05				

F42 Tally
Detectors to North side with HVAC Penetrations
section on spherical surface approximated as a rectangle

surf	rad
2003	10000
2004	15000
2005	20000
2006	25000
2007	30000
2008	37500
2009	45000
2010	55000
2011	65000
2012	75000
2013	85000

Rectangle approximation dimensions

Width	2895.6
Height	1036.32
SA	3.00E+06

F52 Tally
Detectors to North side with HVAC Penetrations
Same as above just on opposite side of the building

F62 Tally
Check of the dose rates above the HICs

Left	0		
Right	2895.6	1140	95
Front	0		
Back	1828.8	720	60
Surface Ar	5.30E+06		

Table H.2
Photon Flux-to-Dose Rate Conversion Factors

ANSI/ANS–6.1.1–1977		ICRP-21	
Energy, E (MeV)	**DF(E) (rem/hr)/(p/cm²-s)**	**Energy, E (MeV)**	**DF(E) (rem/hr)/(p/cm²-s)**
0.01	3.96E–06	0.01	2.78E–06
0.03	5.82E–07	0.015	1.11E–06
0.05	2.90E–07	0.02	5.88E–07
0.07	2.58E–07	0.03	2.56E–07
0.1	2.83E–07	0.04	1.56E–07
0.15	3.79E–07	0.05	1.20E–07
0.2	5.01E–07	0.06	1.11E–07
0.25	6.31E–07	0.08	1.20E–07
0.3	7.59E–07	0.1	1.47E–07
0.35	8.78E–07	0.15	2.38E–07
0.4	9.85E–07	0.2	3.45E–07
0.45	1.08E–06	0.3	5.56E–07
0.5	1.17E–06	0.4	7.69E–07
0.55	1.27E–06	0.5	9.09E–07
0.6	1.36E–06	0.6	1.14E–06
0.65	1.44E–06	0.8	1.47E–06
0.7	1.52E–06	1.	1.79E–06
0.8	1.68E–06	1.5	2.44E–06
1.0	1.98E–06	2.	3.03E–06
1.4	2.51E–06	3.	4.00E–06
1.8	2.99E–06	4.	4.76E–06
2.2	3.42E–06	5.	5.56E–06
2.6	3.82E–06	6.	6.25E–06
2.8	4.01E–06	8.	7.69E–06
3.25	4.41E–06	10.	9.09E–06
3.75	4.83E–06		
4.25	5.23E–06		
4.75	5.60E–06		
5.0	5.80E–06		
5.25	6.01E–06		
5.75	6.37E–06		
6.25	6.74E–06		

Cross Check comparing MCNP values to MCNP values to make sure
there are no transcription errors
all of them a 1 so OK

0.01	3.96E-06	0.01	0.00000396	1	1
0.03	5.82E-07	0.03	0.000000582	1	1
0.05	2.90E-07	0.05	0.00000029	1	1
0.07	2.58E-07	0.07	0.000000258	1	1
0.1	2.83E-07	0.1	0.000000283	1	1
0.15	3.79E-07	0.15	0.000000379	1	1
0.2	5.01E-07	0.2	0.000000501	1	1
0.25	6.31E-07	0.25	0.000000631	1	1
0.3	7.59E-07	0.3	0.000000759	1	1
0.35	8.78E-07	0.35	0.000000878	1	1
0.4	9.85E-07	0.4	0.000000985	1	1
0.45	1.08E-06	0.45	0.00000108	1	1
0.5	1.17E-06	0.5	0.00000117	1	1
0.55	1.27E-06	0.55	0.00000127	1	1
0.6	1.36E-06	0.6	0.00000136	1	1
0.65	1.44E-06	0.65	0.00000144	1	1
0.7	1.52E-06	0.7	0.00000152	1	1
0.8	1.68E-06	0.8	0.00000168	1	1
1	1.98E-06	1	0.00000198	1	1
1.4	2.51E-06	1.4	0.00000251	1	1
1.8	2.99E-06	1.8	0.00000299	1	1
2.2	3.42E-06	2.2	0.00000342	1	1
2.6	3.82E-06	2.6	0.00000382	1	1
2.8	4.01E-06	2.8	0.00000401	1	1
3.25	4.41E-06	3.25	0.00000441	1	1
3.75	4.83E-06	3.75	0.00000483	1	1
4.25	5.23E-06	4.25	0.00000523	1	1
4.75	5.60E-06	4.75	0.0000056	1	1
5	5.80E-06	5	0.0000058	1	1
5.25	6.01E-06	5.25	0.00000601	1	1
5.75	6.37E-06	5.75	0.00000637	1	1
6.25	6.74E-06	6.25	0.00000674	1	1

Wall Thickness (in)	Density (lb/ft^2)	Density (g/cc)	Comment
30	369.2	2.365	Used for walls since it's the lowest value
15	187	2.396	
15	181.7	2.328	Used for the roof, no girders modeled

GENERIC IRSF SHIELDING DENSITY VALUES

Structural Component	Previous Density Value (Feb. 1991 Analysis)	Revised Density Values (Homogenized)
30 inch thick wall	350 lb/ft^2	369.2 lb/ft^2
15 inch thick wall	175 lb/ft^2	187 lb/ft^2
12 to 15 inch roof	157.5 lb/ft^2	181.7 lb/ft^2

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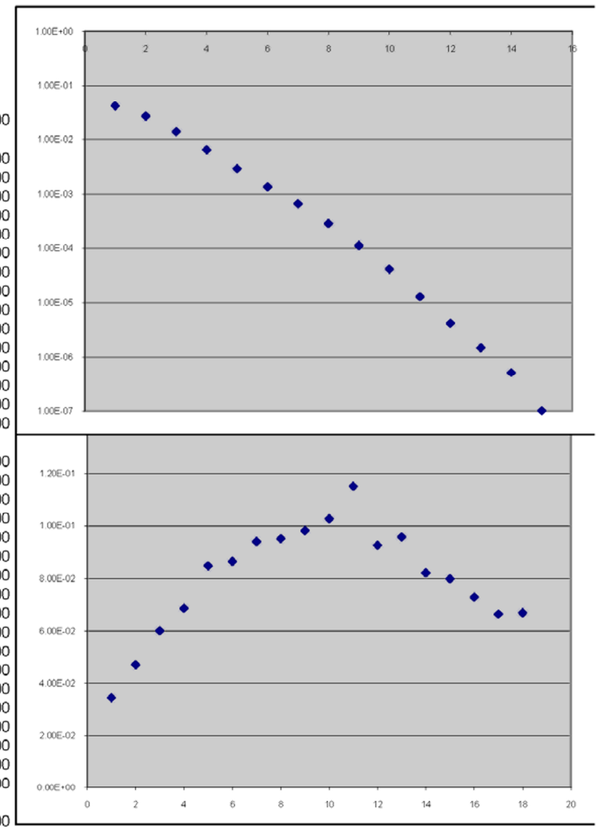
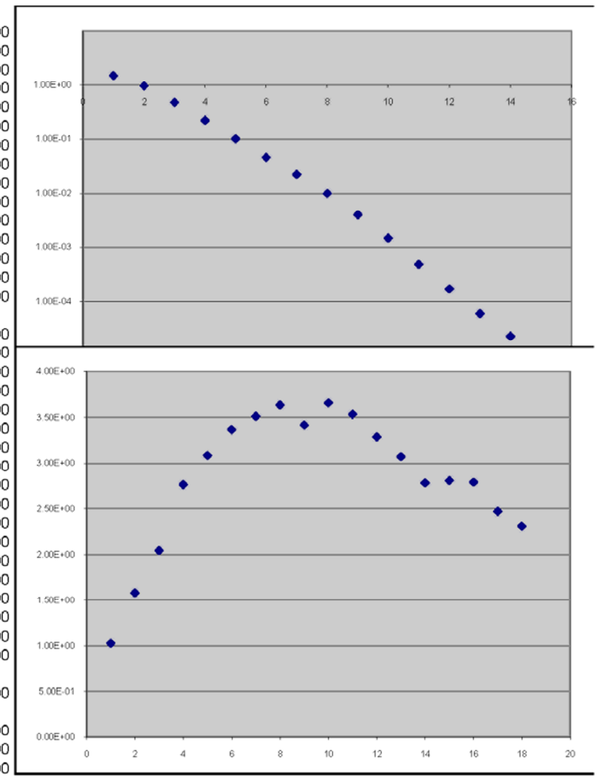
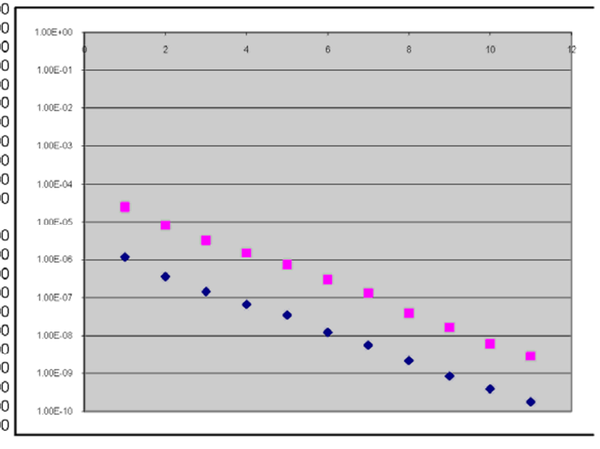
Run #	Bell or No Bell	Tally	Comment	Distance	Dose Rate (rem/hr)	Dose Rate (mrem/hr)		From Calc	
sbnc.o	Bell	F2	Dose rate 7 ft up across the truck bay (no shield slab above)	7 ft up	7.47E-03	7.47E+00		7.47E-03	
sbnc.o	Bell	F62	Dose rate above all the HICs (sanity check tally)	NA	1.56E+00	1.56E+03			
nsbnc.o	No Bell	F2	Dose rate 7 ft up across the truck bay (no shield slab above)	7 ft up	2.39E-01	2.39E+02			
nsbnc.o	No Bell	F62	Dose rate above all the HICs (sanity check tally)	NA	4.90E+01	4.90E+04			
Translated Source Cases									
sbtr.o	Bell	F2	Dose rate 7 ft up across the truck bay (no shield slab above)	7 ft up	1.88E-04	1.88E-01		1.88E-04	1.00E+00
sbtr.o	Bell	F12	Rings around the building		4.15E-05	4.15E-02		4.15E-05	1.00E+00
sbtr.o	Bell	F12	Rings around the building		2.69E-05	2.69E-02		2.69E-05	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.40E-05	1.40E-02		1.40E-05	1.00E+00
sbtr.o	Bell	F12	Rings around the building		6.51E-06	6.51E-03		6.51E-06	1.00E+00
sbtr.o	Bell	F12	Rings around the building		2.94E-06	2.94E-03		2.94E-06	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.37E-06	1.37E-03		1.37E-06	1.00E+00
sbtr.o	Bell	F12	Rings around the building		6.70E-07	6.70E-04		6.70E-07	1.00E+00
sbtr.o	Bell	F12	Rings around the building		2.92E-07	2.92E-04		2.92E-07	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.12E-07	1.12E-04		1.12E-07	1.00E+00
sbtr.o	Bell	F12	Rings around the building		4.12E-08	4.12E-05		4.12E-08	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.28E-08	1.28E-05		1.28E-08	1.00E+00
sbtr.o	Bell	F12	Rings around the building		4.16E-09	4.16E-06		4.16E-09	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.47E-09	1.47E-06		**1.47E-09**	1.00E+00
sbtr.o	Bell	F12	Rings around the building		5.11E-10	5.11E-07		5.11E-10	1.00E+00
sbtr.o	Bell	F12	Rings around the building		1.01E-10	1.01E-07		1.01E-10	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		3.44E-05	3.44E-02		3.44E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		4.70E-05	4.70E-02		4.70E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		6.02E-05	6.02E-02		6.02E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		6.87E-05	6.87E-02		6.87E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		8.47E-05	8.47E-02		8.47E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		8.65E-05	8.65E-02		8.65E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		9.40E-05	9.40E-02		9.40E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		9.51E-05	9.51E-02		9.51E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		9.81E-05	9.81E-02		9.81E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		1.03E-04	1.03E-01		1.03E-04	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		1.15E-04	1.15E-01		**1.15E-04**	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		9.26E-05	9.26E-02		9.26E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		9.57E-05	9.57E-02		9.57E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		8.21E-05	8.21E-02		8.21E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		7.98E-05	7.98E-02		7.98E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		7.29E-05	7.29E-02		7.29E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		6.65E-05	6.65E-02		6.65E-05	1.00E+00
sbtr.o	Bell	F22	Slabs on the penetration side		6.70E-05	6.70E-02		6.70E-05	1.00E+00
sbtr.o	Bell	F32	Dose on Side Wall (Vent side) - 7 ft up		2.75E-05	2.75E-02		2.75E-05	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		2.02E-05	2.02E-02	1.77E+00	2.02E-05	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		6.91E-06	6.91E-03	1.46E+00	6.91E-06	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		3.02E-06	3.02E-03	1.45E+00	3.02E-06	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		1.46E-06	1.46E-03	1.43E+00	1.46E-06	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		6.68E-07	6.68E-04	1.38E+00	6.68E-07	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		2.78E-07	2.78E-04	1.33E+00	2.78E-07	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		1.03E-07	1.03E-04	1.32E+00	1.03E-07	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		3.38E-08	3.38E-05	1.49E+00	3.38E-08	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		1.27E-08	1.27E-05	1.94E+00	1.27E-08	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		4.65E-09	4.65E-06	1.05E+00	4.65E-09	1.00E+00
sbtr.o	Bell	F42	Detectors to North side with HVAC Penetrations		8.02E-10	8.02E-07	8.78E-01	8.02E-10	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		1.14E-05	1.14E-02		1.14E-05	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		4.75E-06	4.75E-03		4.75E-06	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		2.09E-06	2.09E-03		2.09E-06	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		1.02E-06	1.02E-03		1.02E-06	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		4.83E-07	4.83E-04		4.83E-07	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		2.08E-07	2.08E-04		2.08E-07	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		7.82E-08	7.82E-05		7.82E-08	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		2.27E-08	2.27E-05		2.27E-08	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		6.58E-09	6.58E-06		6.58E-09	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		4.43E-09	4.43E-06		4.43E-09	1.00E+00
sbtr.o	Bell	F52	Detectors to North side with HVAC Penetrations		9.14E-10	9.14E-07		9.14E-10	1.00E+00
sbtr.o	Bell	F62	Check of the dose rates above the HICs		1.57E+00	1.57E+03			



nsbtr.o	No Bell	F2	Dose rate 7 ft up across the truck bay (no shield slab above)	7 ft up	6.11E-03	6.11E+00			
nsbtr.o	No Bell	F12	Rings around the building		1.50E-03	1.50E+00		1.50E-03	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		9.52E-04	9.52E-01		9.52E-04	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		4.69E-04	4.69E-01		4.69E-04	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		2.19E-04	2.19E-01		2.19E-04	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		1.01E-04	1.01E-01		1.01E-04	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		4.56E-05	4.56E-02		4.56E-05	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		2.22E-05	2.22E-02		2.22E-05	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		9.93E-06	9.93E-03		9.93E-06	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		3.95E-06	3.95E-03		3.95E-06	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		1.46E-06	1.46E-03		1.46E-06	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		4.80E-07	4.80E-04		4.80E-07	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		1.69E-07	1.69E-04		1.69E-07	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		6.00E-08	6.00E-05		**6.00E-08**	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		2.28E-08	2.28E-05		2.28E-08	1.00E+00
nsbtr.o	No Bell	F12	Rings around the building		4.86E-09	4.86E-06		4.86E-09	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		1.03E-03	1.03E+00		1.03E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		1.58E-03	1.58E+00		1.58E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.04E-03	2.04E+00		2.04E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.76E-03	2.76E+00		2.76E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.08E-03	3.08E+00		3.08E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.37E-03	3.37E+00		3.37E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.51E-03	3.51E+00		3.51E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.63E-03	3.63E+00		3.63E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.42E-03	3.42E+00		3.42E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.66E-03	3.66E+00		**3.66E-03**	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.53E-03	3.53E+00		3.53E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.29E-03	3.29E+00		3.29E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		3.07E-03	3.07E+00		3.07E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.78E-03	2.78E+00		2.78E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.80E-03	2.80E+00		2.80E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.79E-03	2.79E+00		2.79E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.47E-03	2.47E+00		2.47E-03	1.00E+00
nsbtr.o	No Bell	F22	Slabs on the penetration side		2.31E-03	2.31E+00		2.31E-03	1.00E+00
nsbtr.o	No Bell	F32	Dose on Side Wall (Vent side) - 7 ft up		1.09E-03	1.09E+00		1.09E-03	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		6.50E-04	6.50E-01	1.57E+00	6.50E-04	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		2.38E-04	2.38E-01	1.49E+00	2.38E-04	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		1.02E-04	1.02E-01	1.40E+00	1.02E-04	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		4.87E-05	4.87E-02	1.35E+00	4.87E-05	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		2.55E-05	2.55E-02	1.40E+00	2.55E-05	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		9.85E-06	9.85E-03	1.30E+00	9.85E-06	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		3.92E-06	3.92E-03	1.25E+00	3.92E-06	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		1.29E-06	1.29E-03	1.35E+00	1.29E-06	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		4.55E-07	4.55E-04	1.34E+00	4.55E-07	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		1.61E-07	1.61E-04	1.18E+00	1.61E-07	1.00E+00
nsbtr.o	No Bell	F42	Detectors to North side with HVAC Penetrations		6.21E-08	6.21E-05	1.62E+00	6.21E-08	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		4.14E-04	4.14E-01		4.14E-04	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		1.60E-04	1.60E-01		1.60E-04	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		7.30E-05	7.30E-02		7.30E-05	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		3.60E-05	3.60E-02		3.60E-05	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		1.82E-05	1.82E-02		1.82E-05	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		7.60E-06	7.60E-03		7.60E-06	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		3.13E-06	3.13E-03		3.13E-06	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		9.52E-07	9.52E-04		9.52E-07	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		3.39E-07	3.39E-04		3.39E-07	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		1.37E-07	1.37E-04		1.37E-07	1.00E+00
nsbtr.o	No Bell	F52	Detectors to South side without HVAC Penetrations		3.83E-08	3.83E-05		3.83E-08	1.00E+00
nsbtr.o	No Bell	F62	Check of the dose rates above the HICs		4.94E+01	4.94E+04		4.90E+01	1.01E+00



SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	1.17E-06	1.17E-03		1.17E-06	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	3.57E-07	3.57E-04		3.57E-07	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	1.44E-07	1.44E-04		1.44E-07	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	6.66E-08	6.66E-05		6.66E-08	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	3.49E-08	3.49E-05		3.49E-08	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	1.23E-08	1.23E-05		1.23E-08	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	5.65E-09	5.65E-06		5.65E-09	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	2.12E-09	2.12E-06		2.12E-09	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	8.33E-10	8.33E-07		8.33E-10	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	3.87E-10	3.87E-07		3.87E-10	1.00E+00
SBSWt.o	Bell	F42	Detectors to North side with HVAC Penetrations	1.75E-10	1.75E-07		1.75E-10	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	2.55E-05	2.55E-02	22	2.55E-05	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	8.14E-06	8.14E-03	23	8.14E-06	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	3.26E-06	3.26E-03	23	3.26E-06	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	1.50E-06	1.50E-03	22	1.50E-06	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	7.59E-07	7.59E-04	22	7.59E-07	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	3.01E-07	3.01E-04	24	3.01E-07	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	1.32E-07	1.32E-04	23	1.32E-07	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	3.92E-08	3.92E-05	19	3.92E-08	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	1.66E-08	1.66E-05	20	1.66E-08	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	6.12E-09	6.12E-06	16	6.12E-09	1.00E+00
NSBWT.o	No Bell	F42	Detectors to North side with HVAC Penetrations	2.80E-09	2.80E-06	16	2.80E-09	1.00E+00



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HIC Dimensions Check

Radius	76.2 cm	
Diameter	60 in	(61 used in rest of anyalysis, but acceptable given the explenation)
Height	381 cm	(plane 15 to 16)
	150 in	

Shield Bell Dimensions

Inner Radius	86.36 cm
Outer Radius	92.71 cm
Tickness	6.35 cm
	2.5 inches

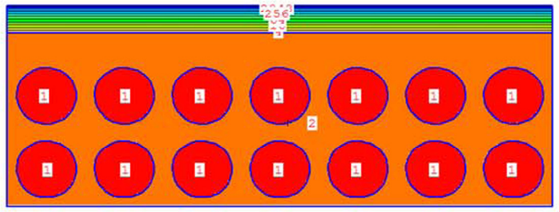
Tops of HICs not modelled, since model ends at that hight, OK since all doses are through the sides

HIC Locations

	0	198.12	396.24	594.36	792.48	990.6	1188.72
		198.12	198.12	198.12	198.12	198.12	198.12
spacing (in)		78	78	78	78	78	78

Materials

280 Water	0.9 g/cc	contents of HIC
228 Concrete	2.366 g/cc	wall density
204 Air	0.0012 g/cc	between the HICs
224 steel	7.872	shield bells (7.86 use for remainer, but OK)



Tally Locations (f2 tally)

f2:p 17 18 19 20 21 22 23 24 25 26 27
fs2 -100 -103 -106 -110 -113 -116 -119 -123 -126 -129 -132 -135 -139 &
-142 -145 -149 -152 -155 -158 -162 -165 -168 -171 -175 -178 -181

17 py	365.76			Total T
18 py	373.38	7.62	3	78.2 cm
19 py	381	7.62	3	30 in
20 py	388.62	7.62	3	
21 py	396.24	7.62	3	
22 py	403.86	7.62	3	
23 py	411.48	7.62	3	
24 py	419.1	7.62	3	
25 py	426.72	7.62	3	
26 py	434.34	7.62	3	
27 py	441.96	7.62	3	

Segmentors

	planes	cm	in		
100 px	**-22.86**	**45.72**	**18**		
103 px	22.86	45.72	18	45.72	22.86
106 px	68.58	60.96	24	91.44	45.72
110 px	129.54	45.72	18	198.12	99.06
113 px	175.26	45.72	18	304.8	152.4
116 px	**220.98**	**45.72**	**18**	**396.24**	**198.12**
119 px	266.7	60.96	24	487.68	243.84
123 px	327.66	45.72	18	594.36	297.18
126 px	373.38	45.72	18	701.04	350.52
129 px	**419.1**	**45.72**	**18**	**792.48**	**396.24**
132 px	464.82	60.96	24	883.92	441.96
136 px	525.78	45.72	18	990.6	495.3
139 px	571.5	45.72	18	1097.28	548.64
142 px	**617.22**	**45.72**	**18**	**1188.72**	**594.36**
145 px	662.94	60.96	24	1280.16	640.08
149 px	723.9	45.72	18	1386.84	693.42
152 px	769.62	45.72	18	1493.52	746.76
155 px	**815.34**	**45.72**	**18**	**1584.96**	**792.48**
158 px	861.06	60.96	24	1676.4	838.2
162 px	922.02	45.72	18	1783.08	891.54
165 px	967.74	45.72	18	1889.76	944.88
168 px	**1013.46**	**45.72**	**18**	**1981.2**	**990.6**
171 px	1059.18	60.96	24	2072.64	1036.32
175 px	1120.14	45.72	18	2179.32	1089.66
178 px	1165.86	45.72	18	2286	1143
181 px	**1211.58**	**-1211.58**			**1188.72**

Bold ones are in front of the HICs, others are between

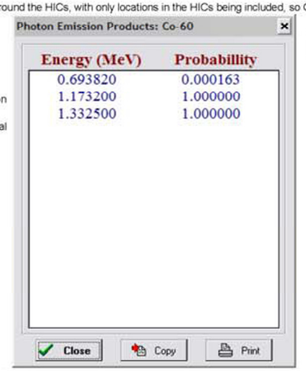
Source Terms

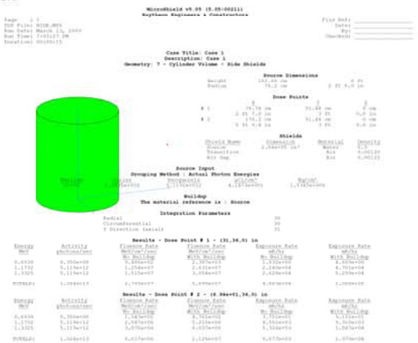
Source is a box around the HICs, with only locations in the HICs being included, so OK.

Energy

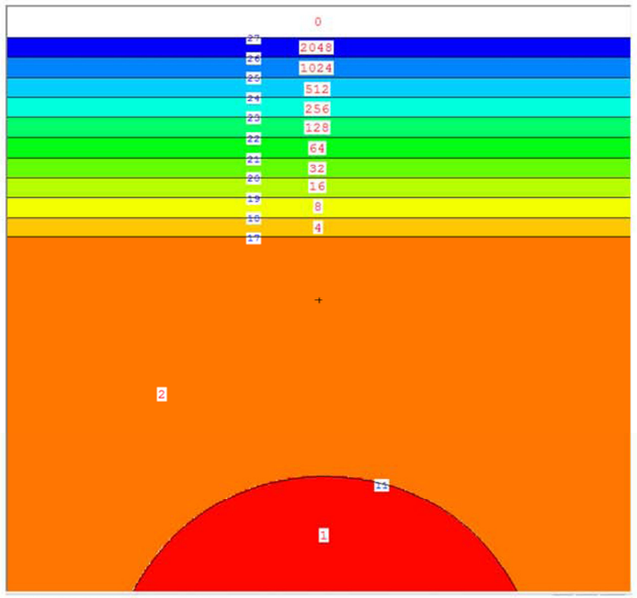
1.173
1.3325

OK
Slight difference on lower energy but inconsequential





Photon Importances



Concrete split about every 1/2 value so OK

Photon Flux to Dose Conversion Factors

Same as used for the remainder of the calc, taken from the MCNP manual so OK

```
de2     0.01    0.03    0.05    0.07    0.1     0.15    0.2 &
        0.25    0.3     0.35    0.4     0.45    0.5     0.55 &
        0.6     0.65    0.7     0.8     1       1.4     1.8 &
        2.2     2.6     2.8     3.25    3.75    4.25    4.75 &
        5       5.25    5.75    6.25    6.75    7.5     9 &
        11      13      15
df2   LIN       3.96E-06 5.82E-07 2.90E-07 2.58E-07 2.83E-07 3.79E-07  5.01E-07 &
        6.31E-07 7.59E-07 8.78E-07 9.85E-07 1.08E-06 1.17E-06 1.27E-06 &
        1.36E-06 1.44E-06 1.52E-06 1.68E-06 1.98E-06 2.51E-06 2.99E-06 &
        3.42E-06 3.82E-06 4.01E-06 4.41E-06 4.83E-06 5.23E-06 5.60E-06 &
        5.80E-06 6.01E-06 6.37E-06 6.74E-06 7.11E-06 7.66E-06 8.77E-06 &
        1.03E-05 1.18E-05 1.33E-05
```

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Results

1. HidD.o Both rows with radioactivity
2. HidDF.o Only the front row with radioactivity
3. HidDB.o Only the back row with radioactivity
4. HidDBb.o Back Row with radioactivity and Front Row with Shield Bells
5. HidDL.o Both rows with radioactivity, Axial Correction Determination

HidDFb.o Fron Row with radioactivity and with Shield Bells

HidD both rows - no shielding						**HidDF.o** front row - no shielding					**HidDB.o** back row - no shielding						**HidDBb.o** Source in back row, bells on front row				**HidDBf.o** Source in front row, bells on front row			
	planes	**MCNP Value**	**Relative Error**	**rem/hr**	**mrem/hr**	**MCNP Value**	**Relative Error**	**rem/hr**	**mrem/hr**	**2 row/f row**	**MCNP Value**	**Relative Error**	**rem/hr**	**mrem/hr**	**B row/ F row**	**F + B/ both**	**MCNP Value**	**Relative Error**	**rem/hr**	**mrem/hr**	**MCNP Value**	**Relative Error**	**rem/hr**	**mrem/hr**
															0.00E+00	0.00E+00							0.00E+00	0.00E+00
100 px	**-22.86**	5.90E-18	0.0218	1.76E-03	1.76E+00	1.20E-17	0.0158	1.79E-03	1.79E+00	99%	3.74E-19	0.0814	5.59E-05	5.59E-02	3%	105%								
103 px	22.86	9.22E-18	0.0227	2.75E-03	2.75E+00	1.69E-17	0.0168	2.52E-03	2.52E+00	109%	1.45E-18	0.0549	2.16E-04	2.16E-01	9%	99%	3.63E-20	0.1411	5.42E-06	5.42E-03	1.16E-18	0.0321	1.73E-04	1.73E-01
106 px	68.58	9.77E-18	0.022	2.92E-03	2.92E+00	1.69E-17	0.0162	2.53E-03	2.53E+00	115%	1.99E-18	0.046	2.98E-04	2.98E-01	12%	97%	4.52E-19	0.0572	6.76E-05	6.76E-02	1.14E-18	0.0308	1.70E-04	1.70E-01
110 px	129.54	9.60E-18	0.0196	2.87E-03	2.87E+00	1.71E-17	0.0143	2.55E-03	2.55E+00	112%	2.05E-18	0.0442	3.06E-04	3.06E-01	12%	100%	2.37E-19	0.0573	3.54E-05	3.54E-02	1.11E-18	0.0269	1.67E-04	1.67E-01
113 px	175.26	1.05E-17	0.0214	3.15E-03	3.15E+00	1.80E-17	0.0157	2.69E-03	2.69E+00	117%	2.56E-18	0.0439	3.83E-04	3.83E-01	14%	98%	4.41E-19	0.0573	6.59E-05	6.59E-02	1.17E-18	0.0307	1.75E-04	1.75E-01
116 px	**220.98**	1.05E-17	0.0207	3.13E-03	3.13E+00	1.86E-17	0.0156	2.77E-03	2.77E+00	113%	2.90E-18	0.0378	4.32E-04	4.32E-01	16%	102%	7.13E-20	0.121	1.06E-05	1.06E-02	1.22E-18	0.0293	1.82E-04	1.82E-01
119 px	266.7	1.04E-17	0.0212	3.09E-03	3.09E+00	1.82E-17	0.0159	2.71E-03	2.71E+00	114%	2.65E-18	0.0437	3.95E-04	3.95E-01	15%	101%	4.02E-19	0.0556	6.01E-05	6.01E-02	1.19E-18	0.0304	1.77E-04	1.77E-01
123 px	327.66	9.67E-18	0.0186	2.89E-03	2.89E+00	1.77E-17	0.0143	2.64E-03	2.64E+00	109%	2.11E-18	0.047	3.14E-04	3.14E-01	12%	102%	2.25E-19	0.0626	3.35E-05	3.35E-02	1.11E-18	0.0268	1.66E-04	1.66E-01
126 px	373.38	1.02E-17	0.0209	3.05E-03	3.05E+00	1.86E-17	0.0158	2.77E-03	2.77E+00	110%	2.67E-18	0.0439	3.98E-04	3.98E-01	14%	104%	4.83E-19	0.0532	7.21E-05	7.21E-02	1.21E-18	0.0305	1.80E-04	1.80E-01
129 px	**419.1**	1.08E-17	0.0207	3.24E-03	3.24E+00	1.99E-17	0.0157	2.97E-03	2.97E+00	109%	2.91E-18	0.0401	4.35E-04	4.35E-01	15%	105%	7.82E-20	0.1105	1.17E-05	1.17E-02	1.31E-18	0.0297	1.96E-04	1.96E-01
132 px	464.82	1.04E-17	0.0207	3.10E-03	3.10E+00	1.85E-17	0.0159	2.76E-03	2.76E+00	112%	2.64E-18	0.0426	3.95E-04	3.95E-01	14%	102%	4.27E-19	0.0562	6.38E-05	6.38E-02	1.17E-18	0.0307	1.74E-04	1.74E-01
136 px	525.78	9.59E-18	0.0189	2.86E-03	2.86E+00	1.76E-17	0.0141	2.63E-03	2.63E+00	109%	1.96E-18	0.0452	2.93E-04	2.93E-01	11%	102%	2.17E-19	0.0565	3.24E-05	3.24E-02	1.18E-18	0.0273	1.76E-04	1.76E-01
139 px	571.5	1.03E-17	0.0207	3.08E-03	3.08E+00	1.84E-17	0.0159	2.75E-03	2.75E+00	112%	2.57E-18	0.0431	3.84E-04	3.84E-01	14%	102%	4.56E-19	0.0543	6.81E-05	6.81E-02	1.22E-18	0.03	1.83E-04	1.83E-01
142 px	**617.22**	1.11E-17	0.0202	3.32E-03	3.32E+00	1.95E-17	0.0157	2.91E-03	2.91E+00	114%	2.91E-18	0.0403	4.35E-04	4.35E-01	15%	101%	7.22E-20	0.1113	1.08E-05	1.08E-02	1.31E-18	0.0301	1.96E-04	1.96E-01
145 px	662.94	1.06E-17	0.0209	3.16E-03	3.16E+00	1.84E-17	0.0159	2.74E-03	2.74E+00	115%	2.68E-18	0.0425	4.00E-04	4.00E-01	15%	99%	4.32E-19	0.0526	6.45E-05	6.45E-02	1.28E-18	0.0299	1.91E-04	1.91E-01
149 px	723.9	9.40E-18	0.0191	2.81E-03	2.81E+00	1.74E-17	0.0142	2.60E-03	2.60E+00	108%	1.97E-18	0.0444	2.94E-04	2.94E-01	11%	103%	2.37E-19	0.0604	3.54E-05	3.54E-02	1.09E-18	0.027	1.62E-04	1.62E-01
152 px	769.62	1.04E-17	0.021	3.10E-03	3.10E+00	1.82E-17	0.016	2.71E-03	2.71E+00	114%	2.77E-18	0.0441	4.14E-04	4.14E-01	15%	101%	4.22E-19	0.0565	6.30E-05	6.30E-02	1.15E-18	0.0306	1.71E-04	1.71E-01
155 px	**815.34**	1.07E-17	0.021	3.21E-03	3.21E+00	1.89E-17	0.0155	2.82E-03	2.82E+00	114%	2.96E-18	0.0392	4.41E-04	4.41E-01	16%	102%	7.82E-20	0.1078	1.17E-05	1.17E-02	1.20E-18	0.0297	1.80E-04	1.80E-01
158 px	861.06	1.03E-17	0.0212	3.08E-03	3.08E+00	1.87E-17	0.0158	2.80E-03	2.80E+00	110%	2.55E-18	0.0428	3.81E-04	3.81E-01	14%	103%	4.26E-19	0.0575	6.36E-05	6.36E-02	1.18E-18	0.0299	1.77E-04	1.77E-01
162 px	922.02	9.73E-18	0.0191	2.90E-03	2.90E+00	1.77E-17	0.014	2.64E-03	2.64E+00	110%	2.17E-18	0.0439	3.24E-04	3.24E-01	12%	102%	1.90E-19	0.0623	2.84E-05	2.84E-02	1.11E-18	0.0271	1.65E-04	1.65E-01
165 px	967.74	1.02E-17	0.0215	3.05E-03	3.05E+00	1.87E-17	0.0158	2.79E-03	2.79E+00	110%	2.51E-18	0.0426	3.75E-04	3.75E-01	13%	104%	4.34E-19	0.0574	6.48E-05	6.48E-02	1.13E-18	0.0297	1.68E-04	1.68E-01
168 px	**1013.46**	1.10E-17	0.0205	3.29E-03	3.29E+00	1.91E-17	0.0158	2.85E-03	2.85E+00	116%	2.82E-18	0.0388	4.22E-04	4.22E-01	15%	99%	6.90E-20	0.1106	1.03E-05	1.03E-02	1.31E-18	0.0298	1.95E-04	1.95E-01
171 px	1059.18	1.03E-17	0.0215	3.06E-03	3.06E+00	1.85E-17	0.0158	2.76E-03	2.76E+00	111%	2.75E-18	0.0417	4.11E-04	4.11E-01	15%	103%	4.24E-19	0.0574	6.33E-05	6.33E-02	1.19E-18	0.0308	1.78E-04	1.78E-01
175 px	1120.14	9.70E-18	0.0193	2.90E-03	2.90E+00	1.72E-17	0.0142	2.57E-03	2.57E+00	113%	2.08E-18	0.0433	3.10E-04	3.10E-01	12%	99%	2.42E-19	0.0581	3.61E-05	3.61E-02	1.14E-18	0.0266	1.70E-04	1.70E-01
178 px	1165.86	9.89E-18	0.0223	2.95E-03	2.95E+00	1.71E-17	0.0164	2.55E-03	2.55E+00	116%	2.22E-18	0.0462	3.32E-04	3.32E-01	13%	97%	4.87E-19	0.0538	7.27E-05	7.27E-02	1.14E-18	0.0314	1.71E-04	1.71E-01
181 px	**1211.58**	9.09E-18	0.023	2.72E-03	2.72E+00	1.72E-17	0.0167	2.58E-03	2.58E+00	105%	1.52E-18	0.0544	2.28E-04	2.28E-01	9%	103%	5.79E-20	0.1547	8.64E-06	8.64E-03	1.14E-18	0.0316	1.70E-04	1.70E-01
		6.41E-18	0.0217	1.92E-03	1.92E+00	1.25E-17	0.0158	1.87E-03	1.87E+00	102%	4.30E-19	0.0869	6.42E-05	6.42E-02	3%	101%			0.00E+00	0.00E+00	7.94E-19	0.0299	1.19E-04	1.19E-01
Average of in front of HIC cases - not end ones				**3.24E+00**				**2.86E+00**		**113%**				**4.35E-01**	**15%**	**102%**				**1.10E-02**				**1.90E-01**
MAX				**3.32E+00**				**2.97E+00**						**4.41E-01**						**7.27E-02**				**1.96E-01**
Average with axial increase				**3.78E+00**				**3.35E+00**						**5.06E-01**						**1.29E-02**				**2.22E-01**

Worked Example
No Shield
Front HIC 25 rem/hr
Back HIC 25 rem/hr

From Front (mrem/hr)	**From Back (mrem/hr)**	**TOTAL (mrem/hr)**
0.63	0.05	**0.68**
0.63	0.07	**0.71**
0.64	0.08	**0.72**
0.67	0.10	**0.77**
0.69	0.11	**0.80**
0.68	0.10	**0.78**
0.66	0.08	**0.74**
0.69	0.10	**0.79**
0.74	0.11	**0.85**
0.69	0.10	**0.79**
0.66	0.07	**0.73**
0.69	0.10	**0.78**
0.73	0.11	**0.84**
0.69	0.10	**0.79**
0.65	0.07	**0.72**
0.68	0.10	**0.78**
0.71	0.11	**0.82**
0.70	0.10	**0.80**
0.66	0.08	**0.74**
0.70	0.09	**0.79**
0.71	0.11	**0.82**
0.69	0.10	**0.79**
0.64	0.08	**0.72**
0.64	0.08	**0.72**
0.64	0.06	**0.70**
		0.82
		0.96

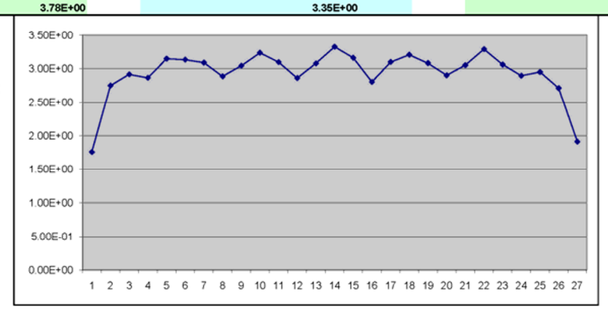
Worked Example
Shield Bell
Front HIC 350 rem/hr
Back HIC 350 rem/hr

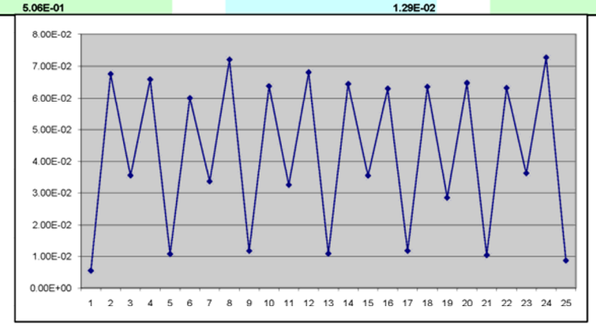
From Front (mrem/hr)	**From Back (mrem/hr)**	**TOTAL (mrem/hr)**
0.60	0.02	**0.62**
0.60	0.24	**0.83**
0.58	0.12	**0.71**
0.61	0.23	**0.84**
0.64	0.04	**0.67**
0.62	0.21	**0.83**
0.58	0.12	**0.70**
0.63	0.25	**0.88**
0.69	0.04	**0.73**
0.61	0.22	**0.83**
0.62	0.11	**0.73**
0.64	0.24	**0.88**
0.69	0.04	**0.72**
0.67	0.23	**0.89**
0.57	0.12	**0.69**
0.60	0.22	**0.82**
0.63	0.04	**0.67**
0.62	0.22	**0.84**
0.58	0.10	**0.68**
0.59	0.23	**0.82**
0.68	0.04	**0.72**
0.62	0.22	**0.84**
0.59	0.13	**0.72**
0.60	0.25	**0.85**
0.60	0.03	**0.63**
		0.85
		0.99

Photons/sec 1.02E+13
Hieght 72 in

Photons/sec 2.13E+13 (for 150 in high HIC stack)

# HIC stacks	**Photons/ sec**
7	1.49E+14
14	2.99E+14





Axial Case							
	0	0%					
182	76.2	20%	20%	7.86E-18	0.0143	2.35E-03	82%
183	152.4	40%	20%	1.06E-17	0.0121	3.17E-03	110%
184	228.6	60%	20%	1.13E-17	0.0117	3.36E-03	117%
185	304.8	80%	20%	1.07E-17	0.0123	3.20E-03	111%
	381	100%	20%	7.77E-18	0.0148	2.32E-03	81%
Average				**9.64E-18**		**2.88E-03**	
Max							**117%**

URS
Washington Division

Distance (cm)	Distance (m)	With HVAC Dose Rate (mrem/hr)	Dose Rate /4 (mrem/hr)	rem/hr	Without HVAC Dose Rate (mrem/hr)	Dose Rate /4 (mrem/hr)	rem/hr
10000	**100**	6.50E-01	1.62E-01	1.62E-04	4.14E-01	1.04E-01	1.04E-04
15000	**150**	2.38E-01	5.95E-02	5.95E-05	1.60E-01	3.99E-02	3.99E-05
20000	**200**	1.02E-01	2.55E-02	2.55E-05	7.30E-02	1.83E-02	1.83E-05
25000	**250**	4.87E-02	1.22E-02	1.22E-05	3.60E-02	9.00E-03	9.00E-06
30000	**300**	2.55E-02	6.38E-03	6.38E-06	1.82E-02	4.55E-03	4.55E-06
37500	**375**	9.85E-03	2.46E-03	2.46E-06	7.60E-03	1.90E-03	1.90E-06
45000	**450**	3.92E-03	9.79E-04	9.79E-07	3.13E-03	7.84E-04	7.84E-07
55000	**550**	1.29E-03	3.21E-04	3.21E-07	9.52E-04	2.38E-04	2.38E-07
65000	**650**	4.55E-04	1.14E-04	1.14E-07	3.39E-04	8.48E-05	8.48E-08
75000	**750**	1.61E-04	4.04E-05	4.04E-08	1.37E-04	3.41E-05	3.41E-08
85000	**850**	6.21E-05	1.55E-05	1.55E-08	3.83E-05	9.57E-06	9.57E-09

From Calc, difference because calc includes relative error, otherwise would be 1

R/hr	R/hr	comparison	comparison
1.69E-08	1.03E-08	0.92	0.93

Above dose rates divided by 4 since the basis is a 25R per hr container compared with the 100R per hour HIC stack modelled

Note in the caluculation R (Roentgen) and rem are intermixed. For gamma they are "essentially" equivalent

Dose Rate Limit to give 1 mR/year	1.14E-04	mrem/hr
	1.14E-07	rem/year

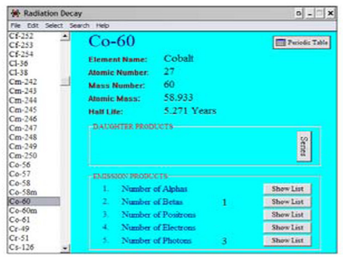
Distance	Hours	Rem/Hr to give 2.5 mrem/year
134	20	**1.25E-04**
201	50	**5.00E-05**

URS
Washington Division

HIC stack location	Spacing (cm)	Spacing (in)	Center Point Location (cm)
121.92			
320.04	198.12	78	99.06
518.16	198.12	78	297.18
716.28	198.12	78	495.3
914.4	198.12	78	693.42
1112.52	198.12	78	891.54
1310.64	198.12	78	1089.66
1508.76	198.12	78	1287.78
	with 100R/hr containers	**with 25R/hr containers**	**doubled for both sides**
Dose Point 1	1.04E-01	2.60E-02	5.20E-02
Dose Point 2	9.34E-02	2.33E-02	4.67E-02
Dose Point 3	7.56E-02	1.89E-02	3.78E-02
Dose Point 4	5.54E-02	1.39E-02	2.77E-02
Dose Point 5	3.71E-02	9.28E-03	1.86E-02
Dose Point 6	2.30E-02	5.75E-03	1.15E-02
Dose Point 7	1.32E-02	3.31E-03	6.62E-03
		1.00E-01	**2.01E-01**

198.12		
396.24	198.12	78
594.36	198.12	78
792.48	198.12	78
990.6	198.12	78
1188.72	198.12	78
1386.84	198.12	78
1584.96	198.12	78
1783.08	198.12	78
1981.2	198.12	78
2179.32	198.12	78
2377.44	198.12	78
2575.56	198.12	78
2773.68	198.12	78

Initial contact dose rate	100 mrem/hr
Number of containers per year	4 /year
Half Life for Co-60	5.271 years



Formulae for half-life in exponential decay

Main article: Exponential decay

An exponential decay process can be described by any of the following three equivalent formulae:

$$N_t = N_0(1/2)^{t/t_{1/2}}$$
$$N_t = N_0 e^{-t/\tau}$$
$$N_t = N_0 e^{-\lambda t}$$

where

- N_0 is the initial quantity of the thing that will decay (this quantity may be measured in grams, moles, number of atoms, etc.),
- N_t is the quantity that still remains and has not yet decayed after a time t,
- $t_{1/2}$ is the half-life of the decaying quantity,
- τ is a positive number called the mean lifetime of the decaying quantity,
- λ is a positive number called the decay constant of the decaying quantity.

The three parameters $t_{1/2}$, τ, and λ are all directly related in the following way:

$$t_{1/2} = \frac{\ln(2)}{\lambda} = \tau \ln(2)$$

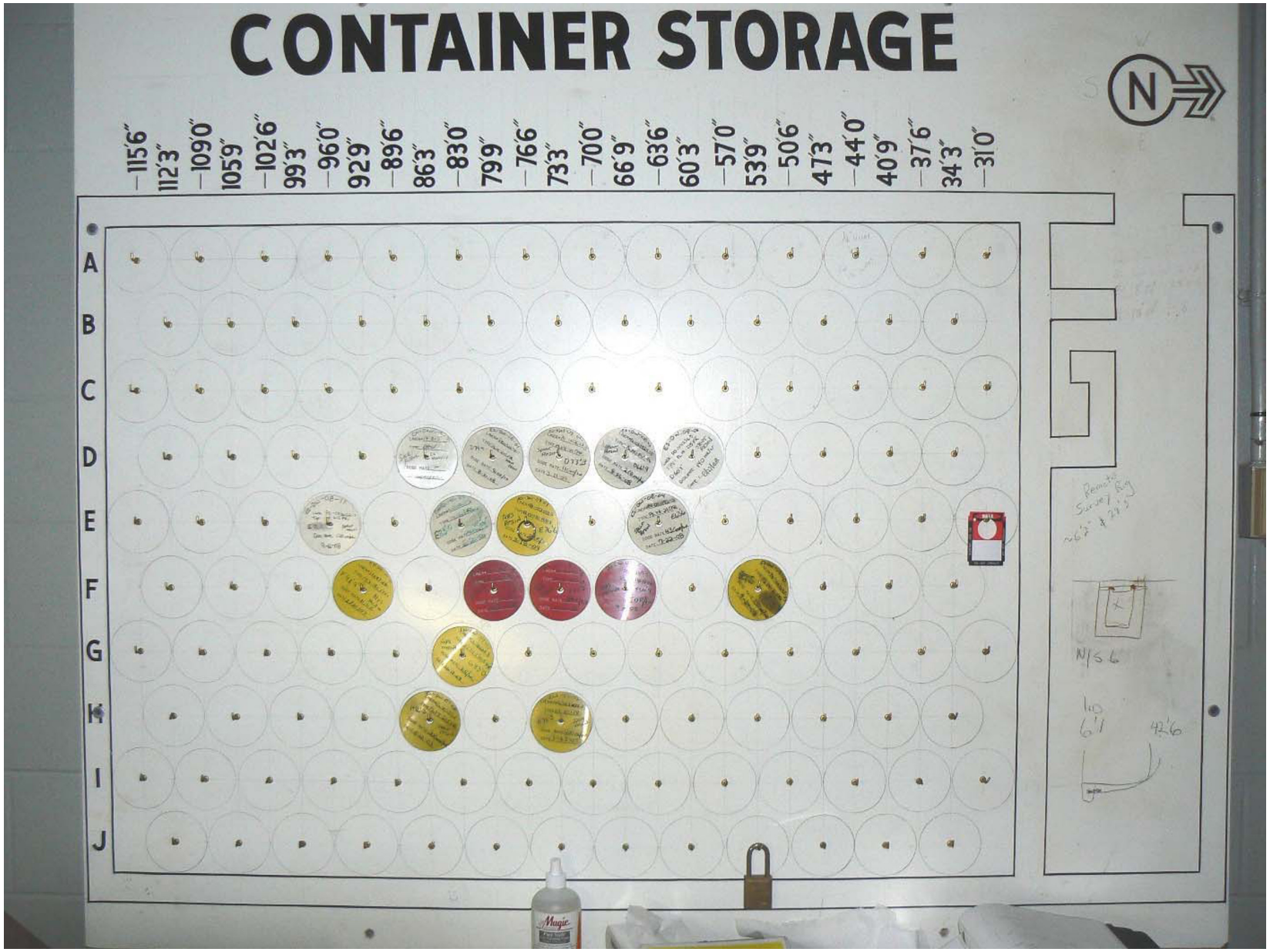
where ln(2) is the natural logarithm of 2 (approximately 0.693).

Dose			
Storage location	Age (months)	Age (years)	Rate (rem/hr)
1	0	0	100.00
2	3	0.25	96.77
3	6	0.5	93.64
4	9	0.75	90.61
5	12	1	87.68
6	15	1.25	84.84
7	18	1.5	82.10
8	21	1.75	79.44
9	24	2	76.87
10	27	2.25	74.39
11	30	2.5	71.98
12	33	2.75	69.65
13	36	3	67.40
14	39	3.25	65.22
15	42	3.5	63.11
16	45	3.75	61.07
17	48	4	59.10
18	51	4.25	57.18
19	54	4.5	55.34
20	57	4.75	53.55
21	60	5	51.81
22	63	5.25	50.14
23	66	5.5	48.52
24	69	5.75	46.95
25	72	6	45.43
26	75	6.25	43.96
27	78	6.5	42.54
28	81	6.75	41.16
29	84	7	39.83
30	87	7.25	38.54
31	90	7.5	37.30
32	93	7.75	36.09
33	96	8	34.92
34	99	8.25	33.79
35	102	8.5	32.70
36	105	8.75	31.64
37	108	9	30.62
38	111	9.25	29.63
39	114	9.5	28.67
40	117	9.75	27.74
41	120	10	26.85
42	123	10.25	25.98
43	126	10.5	25.14
44	129	10.75	24.33
45	132	11	23.54
46	135	11.25	22.78
47	138	11.5	22.04
48	141	11.75	21.33
49	144	12	20.64
50	147	12.25	19.97
51	150	12.5	19.32
52	153	12.75	18.70
53	156	13	18.10
54	159	13.25	17.51
55	162	13.5	16.94
56	165	13.75	16.40
57	168	14	15.87
58	171	14.25	15.35
59	174	14.5	14.86
60	177	14.75	14.38
61	180	15	13.91
62	183	15.25	13.46
63	186	15.5	13.03
64	189	15.75	12.60
65	192	16	12.20
66	195	16.25	11.80
67	198	16.5	11.42
68	201	16.75	11.05
69	204	17	10.69
70	207	17.25	10.35
71	210	17.5	10.01
72	213	17.75	9.69
73	216	18	9.38
74	219	18.25	9.07
75	222	18.5	8.78
76	225	18.75	8.50
77	228	19	8.22
78	231	19.25	7.95
79	234	19.5	7.70
80	237	19.75	7.45
81	240	20	7.21
82	243	20.25	6.97
83	246	20.5	6.75
84	249	20.75	6.53
85	252	21	6.32
86	255	21.25	6.12
87	258	21.5	5.92
88	261	21.75	5.73
89	264	22	5.54
90	267	22.25	5.36
91	270	22.5	5.19
92	273	22.75	5.02
93	276	23	4.86
94	279	23.25	4.70
95	282	23.5	4.55
96	285	23.75	4.40
97	288	24	4.26
98	291	24.25	4.12
99	294	24.5	3.98
100	297	24.75	3.86
101	300	25	3.73
102	303	25.25	3.61
103	306	25.5	3.50
104	309	25.75	3.38
105	312	26	3.27
106	315	26.25	3.17
107	318	26.5	3.07
108	321	26.75	2.97
109	324	27	2.87
110	327	27.25	2.78
111	330	27.5	2.69
112	333	27.75	2.60
113	336	28	2.52
114	339	28.25	2.44
115	342	28.5	2.36
116	345	28.75	2.28
117	348	29	2.21
118	351	29.25	2.14
119	354	29.5	2.07
120	357	29.75	2.00
121	360	30	1.94
122	363	30.25	1.87
123	366	30.5	1.81
124	369	30.75	1.75
125	372	31	1.70
126	375	31.25	1.64
Average			24.15

Nuclide:	mCi:	Nuclide:	mCi:	Nuclide:	mCi:
H-3	1.43E+01	C-14	7.23E+00	Mn-54	1.74E+04
Fe-55	6.36E+05	Co-58	3.59E+02	Co-60	2.44E+05
Ni-59	2.23E+01	Ni-63	4.04E+03	Sr-89	5.90E+01
Sr-90	3.46E+02	Tc-99	2.03E-01	Cs-137	3.93E+03
Ce-141	1.95E+00	Ce-144	3.59E+01	Pu-238	2.37E+00
Pu-239	5.74E-01	Pu-241	7.23E+01	Am-241	1.89E+00
Cm-242	2.02E+00	Cm-243	2.30E+00		
				Total:	9.07E+05

Attachment L

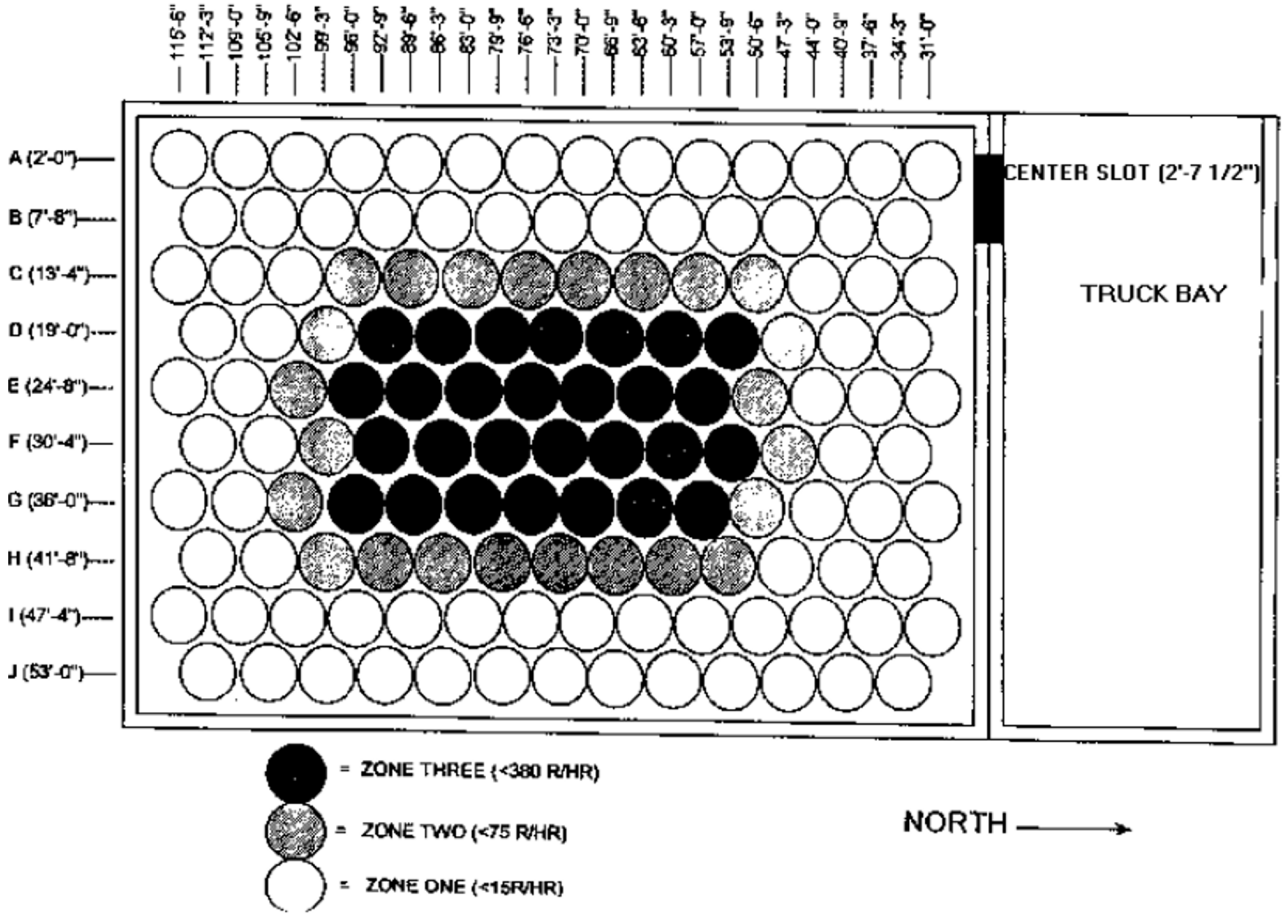
Container Placement Layout, including:
LSCS Photo of Pegboard, LSCS Procedure Figure



Photograph: LSCS IRSF Control Room – Storage Layout Pegboard

FIGURE 1

IRSF LAYOUT



Level of Use
Reference

LOP-WX-32
Revision 10
March 18, 2008

Note: Procedure recognizes potential need for overlying shield containers for skyshine protection

URS
Washington Division

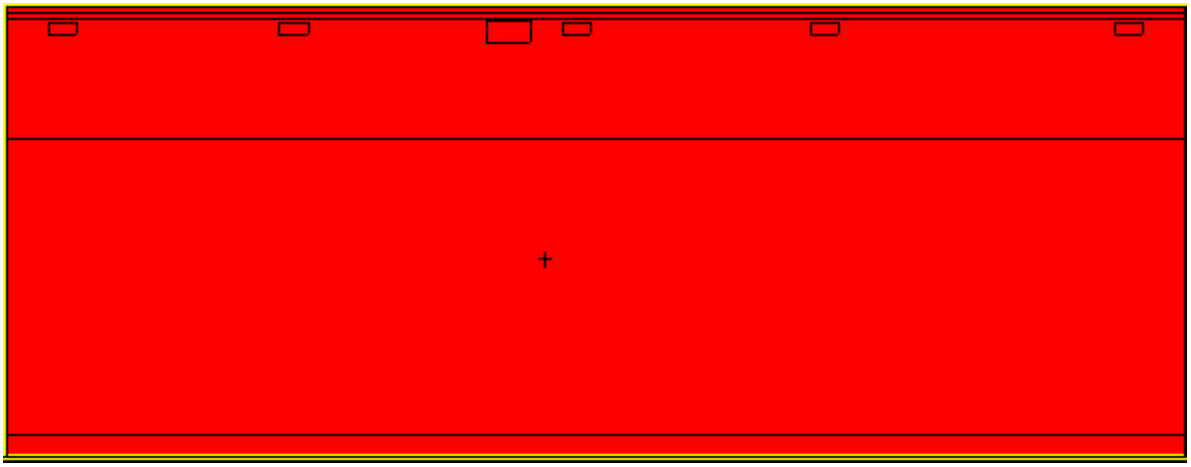
Attachment M

MCNP Cases and Geometry:

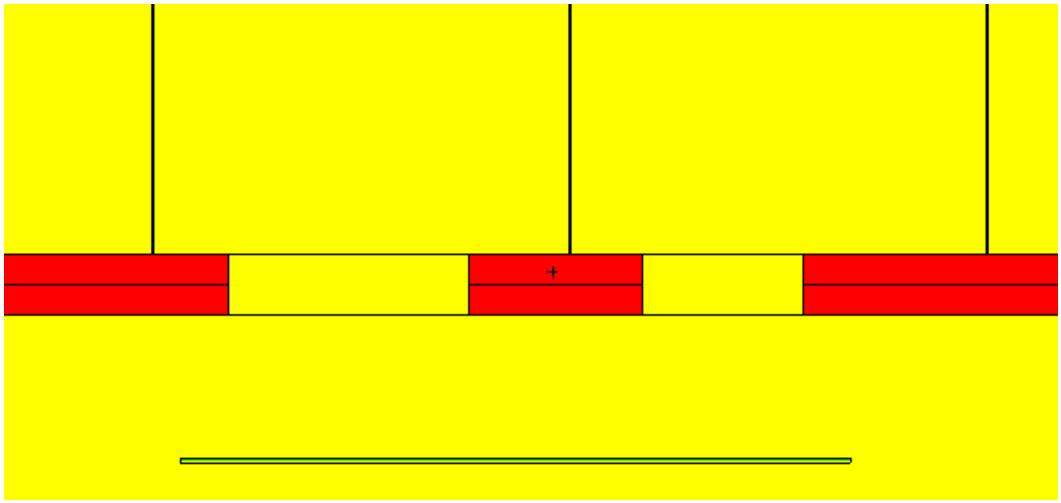
HVAC Shielding

MCNP Side Plot Through Model – No HVAC Penetrations

(HVAC openings filled with concrete)



MCNP Plot of Model with 1” Thick HVAC Shield



MCNP Plot of Model with 2” Thick HVAC Shield

Excel Spreadsheet with MCNP Detector Results – no HVAC Penetrations

	A	B	C	D	E	F	G	H	I	J
1	**MCNP Evaluation of Skyshine (and thin wall to ground scatter) from IRSF**									
2										
3	**Case: HICs without Shield Bells - Hexagonal Arrangement w/ I-Beams (no HVAC openings)**									
4	Single HIC Source Term for 100 R/hr Contact									
5										
6	1.07 factor to adjust number of positions from rectangular to hexagonal arrangement									Fraction of Hex Base
7										
8	**Truck Bay Dose Rate: detector f2 - results from NHVAC.o**									
9	MCNP Output	MCNP Error	Dose Rate	Dose Rate						
10	(Rem/hr)		(mRem/hr)	(mRem/year)						
11	1.54E-01	0.0065	1.66E+02	1.45E+06						1.00
12										
13	**Rings Outside Building: detector f12 - results from NHVAC.o**									
14	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
15	(Rem/hr)		(Rem/hr)	(Rem/year)	(distance from IRSF center)					
16	9.05E-04	0.0053	9.75E-04	8.55E+00	Average in ring between 28.5 and 40 meters					0.73
17	6.05E-04	0.0043	6.51E-04	5.70E+00	Average in ring between 40 and 70 meters					0.77
18	3.14E-04	0.0049	3.38E-04	2.97E+00	Average in ring between 70 and 100 meters					0.81
19	1.52E-04	0.0045	1.63E-04	1.43E+00	Average in ring between 100 and 150 meters					0.84
20	7.06E-05	0.0057	7.60E-05	6.67E-01	Average in ring between 150 and 200 meters					0.85
21	3.32E-05	0.0093	3.58E-05	3.14E-01	Average in ring between 200 and 250 meters					0.87
22	1.62E-05	0.0052	1.74E-05	1.53E-01	Average in ring between 250 and 300 meters					0.87
23	7.28E-06	0.0046	7.83E-06	6.87E-02	Average in ring between 300 and 375 meters					0.87
24	2.90E-06	0.0048	3.12E-06	2.74E-02	Average in ring between 375 and 450 meters					0.87
25	1.07E-06	0.0053	1.15E-06	1.01E-02	Average in ring between 450 and 550 meters					0.87
26	3.53E-07	0.0070	3.81E-07	3.34E-03	Average in ring between 550 and 650 meters					0.84
27	1.22E-07	0.0090	1.31E-07	1.15E-03	Average in ring between 650 and 750 meters					0.86
28	**4.36E-08**	**0.0153**	**4.74E-08**	**4.16E-04**	**Average in ring between 750 and 850 meters**					0.85
29	2.05E-08	0.2087	2.65E-08	2.32E-04	Average in ring between 850 and 950 meters					0.96
30	3.49E-09	0.0200	3.81E-09	3.34E-05	Average in ring between 950 and 1200 meters					0.83
31										
32	**Slabs Adjacent to Ventilation Penetration Side: detector f22 - results from NHVAC.o**									
33	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
34	(Rem/hr)		(Rem/hr)	(Rem/year)						
35	4.22E-04	0.0352	4.68E-04	4.10E+00	Average, at 0 to 2 meters from wall					0.49
36	6.13E-04	0.0278	6.75E-04	5.92E+00	Average, at 2 to 4 meters from wall					0.50
37	7.84E-04	0.0275	8.63E-04	7.57E+00	Average, at 4 to 6 meters from wall					0.47
38	9.32E-04	0.0219	1.02E-03	8.94E+00	Average, at 6 to 8 meters from wall					0.48
39	1.12E-03	0.0252	1.23E-03	1.08E+01	Average, at 8 to 10 meters from wall					0.48
40	1.30E-03	0.0295	1.44E-03	1.26E+01	Average, at 10 to 12 meters from wall					0.46
41	1.38E-03	0.0422	1.54E-03	1.35E+01	Average, at 12 to 14 meters from wall					0.47
42	**1.44E-03**	**0.0299**	**1.58E-03**	**1.39E+01**	**Average, at 14 to 16 meters from wall**					0.47
43	1.41E-03	0.0301	1.55E-03	1.36E+01	Average, at 16 to 18 meters from wall					0.50
44	1.40E-03	0.0313	1.55E-03	1.36E+01	Average, at 18 to 20 meters from wall					0.45
45	1.34E-03	0.0271	1.47E-03	1.29E+01	Average, at 20 to 22 meters from wall					0.50
46	1.30E-03	0.0284	1.43E-03	1.25E+01	Average, at 22 to 24 meters from wall					0.44
47	1.35E-03	0.0470	1.52E-03	1.33E+01	Average, at 24 to 26 meters from wall					0.53
48	1.15E-03	0.0305	1.27E-03	1.12E+01	Average, at 26 to 28 meters from wall					0.48
49	1.18E-03	0.0351	1.31E-03	1.15E+01	Average, at 28 to 30 meters from wall					0.51
50	1.08E-03	0.0395	1.20E-03	1.05E+01	Average, at 30 to 32 meters from wall					0.49
51	1.01E-03	0.0409	1.13E-03	9.90E+00	Average, at 32 to 34 meters from wall					0.47
52	1.01E-03	0.0407	1.12E-03	9.83E+00	Average, at 34 to 36 meters from wall					0.54
53										
54	**Dose Rate on Vent Side Wall 7ft Above Ground: detector f32 - results from NHVAC.o**									
55	MCNP Output	MCNP Error	Dose Rate	Dose Rate						
56	(Rem/hr)		(Rem/hr)	(Rem/year)						
57	4.04E-04	0.0636	4.61E-04	4.04E+00						0.53
58										

	A	B	C	D	E	F	G	H	I	J
59	**Vertical Detectors toward North, w/ HVAC effects: detector f42 - results from NHVAC.o**									
60	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
61	(Rem/hr)		(Rem/hr)	(Rem/year)						
62	3.32E-04	0.0148	3.61E-04	3.17E+00	Average, at ring 2003: 100 m from IRSF center					0.61
63	1.32E-04	0.0164	1.44E-04	1.26E+00	Average, at ring 2004: 150 m from IRSF center					0.66
64	5.99E-05	0.0194	6.54E-05	5.73E-01	Average, at ring 2005: 200 m from IRSF center					0.71
65	2.99E-05	0.0261	3.29E-05	2.88E-01	Average, at ring 2006: 250 m from IRSF center					0.74
66	1.48E-05	0.0295	1.64E-05	1.43E-01	Average, at ring 2007: 300 m from IRSF center					0.74
67	5.92E-06	0.0352	6.57E-06	5.76E-02	Average, at ring 2008: 375 m from IRSF center					0.75
68	2.22E-06	0.0398	2.47E-06	2.17E-02	Average, at ring 2009: 450 m from IRSF center					0.68
69	8.23E-07	0.0910	9.61E-07	8.43E-03	Average, at ring 2010: 550 m from IRSF center					0.74
70	2.54E-07	0.0671	2.90E-07	2.54E-03	Average, at ring 2011: 650 m from IRSF center					0.69
71	8.49E-08	0.0869	9.89E-08	8.67E-04	Average, at ring 2012: 750 m from IRSF center					0.63
72	2.56E-08	0.1099	3.04E-08	2.67E-04	Average, at ring 2013: 850 m from IRSF center					0.45
73										
74	**Vertical Detectors toward South w/out HVAC effects: detector f52 - results from NHVAC.o**									
75	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
76	(Rem/hr)		(Rem/hr)	(Rem/year)						
77	3.43E-04	0.0161	3.74E-04	3.27E+00	Average, at ring 2003: 100 m from IRSF center					0.99
78	1.30E-04	0.0162	1.42E-04	1.24E+00	Average, at ring 2004: 150 m from IRSF center					0.99
79	6.21E-05	0.0228	6.80E-05	5.96E-01	Average, at ring 2005: 200 m from IRSF center					0.97
80	2.97E-05	0.0232	3.25E-05	2.85E-01	Average, at ring 2006: 250 m from IRSF center					1.00
81	1.50E-05	0.0275	1.65E-05	1.45E-01	Average, at ring 2007: 300 m from IRSF center					0.95
82	5.68E-06	0.0337	6.29E-06	5.51E-02	Average, at ring 2008: 375 m from IRSF center					0.95
83	2.30E-06	0.0406	2.57E-06	2.25E-02	Average, at ring 2009: 450 m from IRSF center					0.95
84	7.76E-07	0.0667	8.86E-07	7.77E-03	Average, at ring 2010: 550 m from IRSF center					0.98
85	2.85E-07	0.1027	3.37E-07	2.96E-03	Average, at ring 2011: 650 m from IRSF center					1.05
86	1.01E-07	0.1245	1.22E-07	1.07E-03	Average, at ring 2012: 750 m from IRSF center					1.07
87	4.02E-08	0.2128	5.22E-08	4.57E-04	Average, at ring 2013: 850 m from IRSF center					1.08
88										
89	**Dose above HICs: detector f62 - results from NHVAC.o**									
90	MCNP Output	MCNP Error	Dose Rate	Dose Rate						
91	(Rem/hr)		(Rem/hr)	(Rem/year)						
92	4.55E+01	0.0014	4.89E+01	4.28E+05						1.00
93										

Excel Spreadsheet with MCNP Detector Results – 1" HVAC Shield

	A	B	C	D	E	F	G	H	I	J
1	**MCNP Evaluation of Skyshine (and thin wall to ground scatter) from IRSF**									
2										
3	**Case: HICs without Shield Bells - Hexagonal Arrangement w/ I-Beams (HVAC Shield)**									
4	Single HIC Source Term for 100 R/hr Contact									
5										
6	1.07 factor to adjust number of positions from rectangular to hexagonal arrangement									**Fraction of Hex Base**
7										
8	**Truck Bay Dose Rate: detector f2 - results from HVSLB.o**									
9	**MCNP Output**	**MCNP Error**	**Dose Rate**	**Dose Rate**						
10	**(Rem/hr)**		**(mRem/hr)**	**(mRem/year)**						
11	1.55E-01	0.0059	1.67E+02	1.46E+06						1.00
12										
13	**Rings Outside Building: detector f12 - results from HVSLB.o**									
14	**MCNP Output**	**MCNP Error**	**Dose Rate**	**Dose Rate**	**Detector Description**					
15	**(Rem/hr)**		**(Rem/hr)**	**(Rem/year)**	**(distance from IRSF center)**					
16	1.16E-03	0.0065	1.25E-03	1.10E+01	Average in ring between 28.5 and 40 meters					0.94
17	7.23E-04	0.0048	7.78E-04	6.82E+00	Average in ring between 40 and 70 meters					0.93
18	3.66E-04	0.0060	3.95E-04	3.46E+00	Average in ring between 70 and 100 meters					0.95
19	1.73E-04	0.0061	1.86E-04	1.63E+00	Average in ring between 100 and 150 meters					0.96
20	8.03E-05	0.0057	8.65E-05	7.58E-01	Average in ring between 150 and 200 meters					0.97
21	3.70E-05	0.0055	3.99E-05	3.49E-01	Average in ring between 200 and 250 meters					0.96
22	1.82E-05	0.0050	1.96E-05	1.71E-01	Average in ring between 250 and 300 meters					0.97
23	8.20E-06	0.0053	8.83E-06	7.74E-02	Average in ring between 300 and 375 meters					0.99
24	3.27E-06	0.0058	3.52E-06	3.09E-02	Average in ring between 375 and 450 meters					0.99
25	1.22E-06	0.0061	1.31E-06	1.15E-02	Average in ring between 450 and 550 meters					1.00
26	4.05E-07	0.0074	4.37E-07	3.83E-03	Average in ring between 550 and 650 meters					0.96
27	1.41E-07	0.0085	1.53E-07	1.34E-03	Average in ring between 650 and 750 meters					0.99
28	**5.18E-08**	**0.0106**	**5.60E-08**	**4.91E-04**	**Average in ring between 750 and 850 meters**					1.00
29	1.87E-08	0.0141	2.03E-08	1.78E-04	Average in ring between 850 and 950 meters					0.73
30	3.40E-09	0.1854	4.32E-09	3.78E-05	Average in ring between 950 and 1200 meters					0.94
31										
32	**Slabs Adjacent to Ventilation Penetration Side: detector f22 - results from HVSLB.o**									
33	**MCNP Output**	**MCNP Error**	**Dose Rate**	**Dose Rate**	**Detector Description**					
34	**(Rem/hr)**		**(Rem/hr)**	**(Rem/year)**						
35	8.09E-04	0.0367	8.99E-04	7.88E+00	Average, at 0 to 2 meters from wall					0.94
36	1.18E-03	0.0290	1.30E-03	1.14E+01	Average, at 2 to 4 meters from wall					0.97
37	1.63E-03	0.0349	1.81E-03	1.59E+01	Average, at 4 to 6 meters from wall					0.98
38	2.04E-03	0.0413	2.28E-03	2.00E+01	Average, at 6 to 8 meters from wall					1.06
39	2.36E-03	0.0327	2.61E-03	2.29E+01	Average, at 8 to 10 meters from wall					1.01
40	2.75E-03	0.0426	3.07E-03	2.69E+01	Average, at 10 to 12 meters from wall					0.98
41	2.67E-03	0.0303	2.95E-03	2.59E+01	Average, at 12 to 14 meters from wall					0.91
42	**2.90E-03**	**0.0375**	**3.22E-03**	**2.82E+01**	**Average, at 14 to 16 meters from wall**					0.95
43	2.69E-03	0.0340	2.99E-03	2.62E+01	Average, at 16 to 18 meters from wall					0.97
44	2.50E-03	0.0320	2.76E-03	2.42E+01	Average, at 18 to 20 meters from wall					0.80
45	2.29E-03	0.0258	2.52E-03	2.21E+01	Average, at 20 to 22 meters from wall					0.86
46	2.30E-03	0.0511	2.59E-03	2.27E+01	Average, at 22 to 24 meters from wall					0.80
47	2.08E-03	0.0426	2.33E-03	2.04E+01	Average, at 24 to 26 meters from wall					0.82
48	1.88E-03	0.0381	2.10E-03	1.84E+01	Average, at 26 to 28 meters from wall					0.78
49	1.88E-03	0.0473	2.11E-03	1.85E+01	Average, at 28 to 30 meters from wall					0.82
50	1.63E-03	0.0276	1.79E-03	1.57E+01	Average, at 30 to 32 meters from wall					0.74
51	1.69E-03	0.0424	1.89E-03	1.66E+01	Average, at 32 to 34 meters from wall					0.78
52	1.45E-03	0.0316	1.60E-03	1.41E+01	Average, at 34 to 36 meters from wall					0.77
53										
54	**Dose Rate on Vent Side Wall 7ft Above Ground: detector f32 - results from HVSLB.o**									
55	**MCNP Output**	**MCNP Error**	**Dose Rate**	**Dose Rate**						
56	**(Rem/hr)**		**(Rem/hr)**	**(Rem/year)**						
57	7.11E-04	0.0353	7.89E-04	6.92E+00						0.91
58										

	A	B	C	D	E	F	G	H	I	J
59	**Vertical Detectors toward North, w/ HVAC effects: detector f42 - results from HVSLB.o**									
60	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
61	(Rem/hr)		(Rem/hr)	(Rem/year)						
62	4.62E-04	0.0142	5.02E-04	4.40E+00	Average, at ring 2003: 100 m from IRSF center					0.85
63	1.80E-04	0.0189	1.96E-04	1.72E+00	Average, at ring 2004: 150 m from IRSF center					0.90
64	7.83E-05	0.0195	8.56E-05	7.50E-01	Average, at ring 2005: 200 m from IRSF center					0.93
65	3.81E-05	0.0182	4.16E-05	3.65E-01	Average, at ring 2006: 250 m from IRSF center					0.94
66	1.95E-05	0.0215	2.14E-05	1.87E-01	Average, at ring 2007: 300 m from IRSF center					0.96
67	7.67E-06	0.0316	8.47E-06	7.43E-02	Average, at ring 2008: 375 m from IRSF center					0.97
68	3.24E-06	0.0415	3.62E-06	3.17E-02	Average, at ring 2009: 450 m from IRSF center					1.00
69	1.14E-06	0.0614	1.30E-06	1.14E-02	Average, at ring 2010: 550 m from IRSF center					1.00
70	3.69E-07	0.0539	4.17E-07	3.66E-03	Average, at ring 2011: 650 m from IRSF center					0.99
71	1.37E-07	0.0819	1.59E-07	1.39E-03	Average, at ring 2012: 750 m from IRSF center					1.01
72	6.38E-08	0.1624	7.94E-08	6.96E-04	Average, at ring 2013: 850 m from IRSF center					1.17
73										
74	**Vertical Detectors toward South w/out HVAC effects: detector f52 - results from HVSLB.o**									
75	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
76	(Rem/hr)		(Rem/hr)	(Rem/year)						
77	3.47E-04	0.0141	3.77E-04	3.30E+00	Average, at ring 2003: 100 m from IRSF center					1.00
78	1.39E-04	0.0175	1.51E-04	1.32E+00	Average, at ring 2004: 150 m from IRSF center					1.05
79	6.30E-05	0.0226	6.90E-05	6.05E-01	Average, at ring 2005: 200 m from IRSF center					0.98
80	3.06E-05	0.0252	3.36E-05	2.95E-01	Average, at ring 2006: 250 m from IRSF center					1.03
81	1.65E-05	0.0307	1.83E-05	1.60E-01	Average, at ring 2007: 300 m from IRSF center					1.05
82	6.08E-06	0.0368	6.76E-06	5.92E-02	Average, at ring 2008: 375 m from IRSF center					1.02
83	2.54E-06	0.0504	2.85E-06	2.50E-02	Average, at ring 2009: 450 m from IRSF center					1.05
84	7.90E-07	0.0501	8.89E-07	7.79E-03	Average, at ring 2010: 550 m from IRSF center					0.98
85	2.51E-07	0.0624	2.86E-07	2.50E-03	Average, at ring 2011: 650 m from IRSF center					0.89
86	8.42E-08	0.0666	9.62E-08	8.43E-04	Average, at ring 2012: 750 m from IRSF center					0.84
87	2.92E-08	0.0741	3.37E-08	2.95E-04	Average, at ring 2013: 850 m from IRSF center					0.70
88										
89	**Dose above HICs: detector f62 - results from HVSLB.o**									
90	MCNP Output	MCNP Error	Dose Rate	Dose Rate						
91	(Rem/hr)		(Rem/hr)	(Rem/year)						
92	4.55E+01	0.0013	4.88E+01	4.28E+05						0.99
93										

Excel Spreadsheet with MCNP Detector Results – 2" HVAC Shield

MCNP Evaluation of Skyshine (and thin wall to ground scatter) from IRSF

Case: HICs without Shield Bells - Hexagonal Arrangement w/ I-Beams (HVAC Shield)

Single HIC Source Term for 100 R/hr Contact

1.07 factor to adjust number of positions from rectangular to hexagonal arrangement

Truck Bay Dose Rate: detector f2 - results from HVSL2.o

MCNP Output (Rem/hr)	MCNP Error	Dose Rate (mRem/hr)	Dose Rate (mRem/year)	Fraction of Hex Base
1.54E-01	0.0063	1.66E+02	1.46E+06	1.00

Rings Outside Building: detector f12 - results from HVSL2.o

MCNP Output (Rem/hr)	MCNP Error	Dose Rate (Rem/hr)	Dose Rate (Rem/year)	Detector Description (distance from IRSF center)	Fraction of Hex Base
1.08E-03	0.0066	1.16E-03	1.02E+01	Average in ring between 28.5 and 40 meters	0.87
7.05E-04	0.0052	7.59E-04	6.65E+00	Average in ring between 40 and 70 meters	0.90
3.60E-04	0.0064	3.88E-04	3.40E+00	Average in ring between 70 and 100 meters	0.93
1.71E-04	0.0068	1.84E-04	1.61E+00	Average in ring between 100 and 150 meters	0.95
7.94E-05	0.0061	8.56E-05	7.50E-01	Average in ring between 150 and 200 meters	0.96
3.66E-05	0.0058	3.94E-05	3.45E-01	Average in ring between 200 and 250 meters	0.95
1.80E-05	0.0054	1.94E-05	1.70E-01	Average in ring between 250 and 300 meters	0.96
8.12E-06	0.0057	8.75E-06	7.67E-02	Average in ring between 300 and 375 meters	0.98
3.24E-06	0.0061	3.50E-06	3.06E-02	Average in ring between 375 and 450 meters	0.98
1.20E-06	0.0064	1.30E-06	1.14E-02	Average in ring between 450 and 550 meters	0.98
4.01E-07	0.0076	4.33E-07	3.80E-03	Average in ring between 550 and 650 meters	0.95
1.40E-07	0.0093	1.52E-07	1.33E-03	Average in ring between 650 and 750 meters	0.99
5.13E-08	**0.0114**	**5.56E-08**	**4.87E-04**	**Average in ring between 750 and 850 meters**	0.99
1.85E-08	0.0153	2.01E-08	1.76E-04	Average in ring between 850 and 950 meters	0.73
3.46E-09	0.1967	4.44E-09	3.89E-05	Average in ring between 950 and 1200 meters	0.97

Slabs Adjacent to Ventilation Penetration Side: detector f22 - results from HVSL2.o

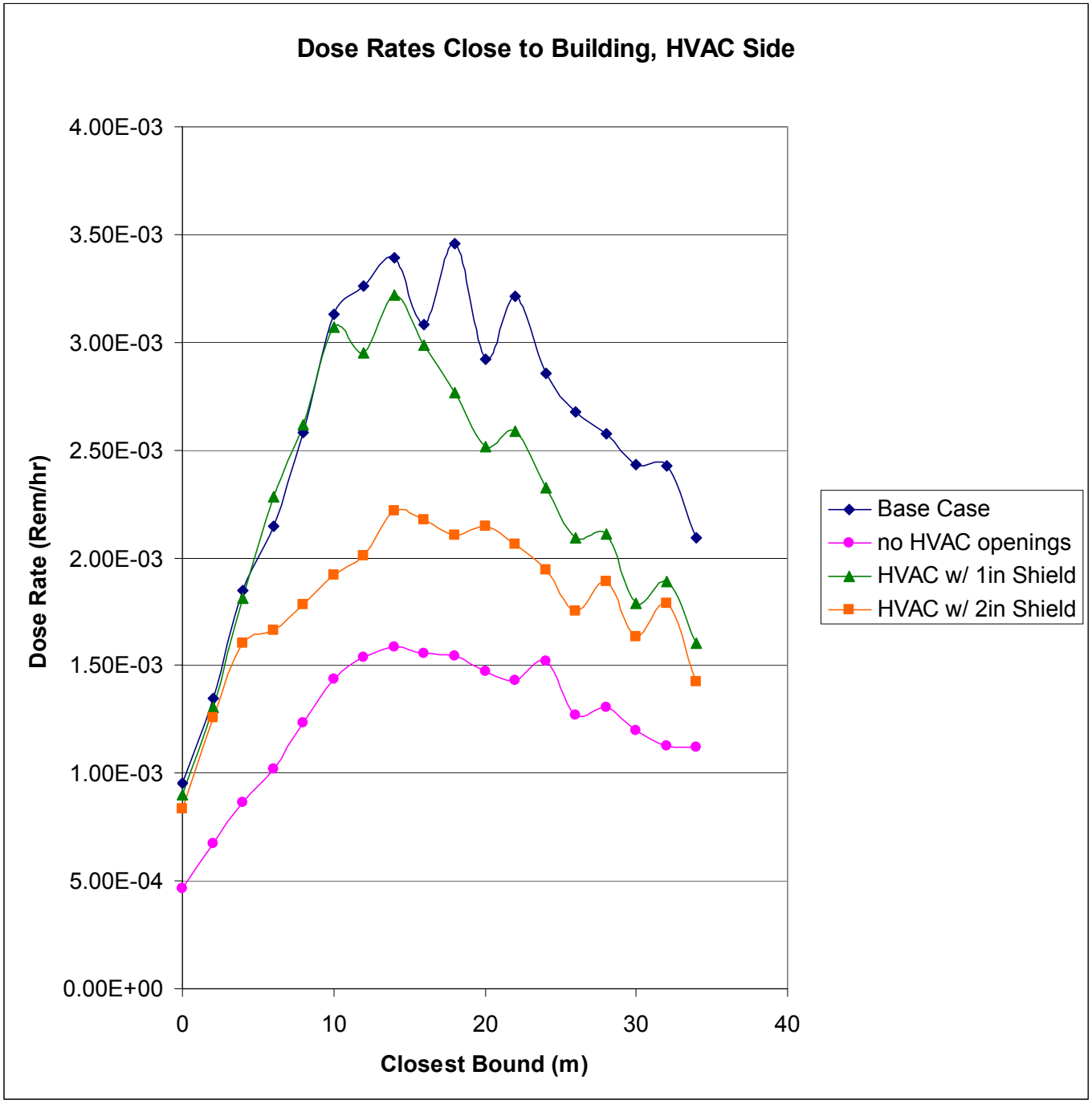
MCNP Output (Rem/hr)	MCNP Error	Dose Rate (Rem/hr)	Dose Rate (Rem/year)	Detector Description	Fraction of Hex Base
7.48E-04	0.0419	8.35E-04	7.32E+00	Average, at 0 to 2 meters from wall	0.88
1.14E-03	0.0300	1.26E-03	1.10E+01	Average, at 2 to 4 meters from wall	0.93
1.45E-03	0.0330	1.60E-03	1.40E+01	Average, at 4 to 6 meters from wall	0.87
1.51E-03	0.0286	1.66E-03	1.46E+01	Average, at 6 to 8 meters from wall	0.78
1.63E-03	0.0238	1.78E-03	1.56E+01	Average, at 8 to 10 meters from wall	0.69
1.75E-03	0.0216	1.92E-03	1.68E+01	Average, at 10 to 12 meters from wall	0.61
1.83E-03	0.0239	2.01E-03	1.76E+01	Average, at 12 to 14 meters from wall	0.62
2.00E-03	**0.0378**	**2.22E-03**	**1.94E+01**	**Average, at 14 to 16 meters from wall**	0.65
1.97E-03	0.0312	2.17E-03	1.91E+01	Average, at 16 to 18 meters from wall	0.71
1.90E-03	0.0329	2.10E-03	1.84E+01	Average, at 18 to 20 meters from wall	0.61
1.92E-03	0.0421	2.14E-03	1.88E+01	Average, at 20 to 22 meters from wall	0.73
1.83E-03	0.0508	2.06E-03	1.81E+01	Average, at 22 to 24 meters from wall	0.64
1.76E-03	0.0334	1.94E-03	1.70E+01	Average, at 24 to 26 meters from wall	0.68
1.59E-03	0.0305	1.75E-03	1.53E+01	Average, at 26 to 28 meters from wall	0.65
1.67E-03	0.0580	1.89E-03	1.66E+01	Average, at 28 to 30 meters from wall	0.73
1.48E-03	0.0319	1.63E-03	1.43E+01	Average, at 30 to 32 meters from wall	0.67
1.59E-03	0.0484	1.79E-03	1.57E+01	Average, at 32 to 34 meters from wall	0.74
1.29E-03	0.0319	1.42E-03	1.25E+01	Average, at 34 to 36 meters from wall	0.68

Dose Rate on Vent Side Wall 7ft Above Ground: detector f32 - results from HVSL2.o

MCNP Output (Rem/hr)	MCNP Error	Dose Rate (Rem/hr)	Dose Rate (Rem/year)	Fraction of Hex Base
6.44E-04	0.0345	7.14E-04	6.26E+00	0.82

	A	B	C	D	E	F	G	H	I	J
59	**Vertical Detectors toward North, w/ HVAC effects: detector f42 - results from HVSL2.o**									
60	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
61	(Rem/hr)		(Rem/hr)	(Rem/year)						
62	4.42E-04	0.0160	4.81E-04	4.22E+00	Average, at ring 2003: 100 m from IRSF center					0.81
63	1.72E-04	0.0211	1.88E-04	1.65E+00	Average, at ring 2004: 150 m from IRSF center					0.86
64	7.59E-05	0.0218	8.31E-05	7.29E-01	Average, at ring 2005: 200 m from IRSF center					0.90
65	3.72E-05	0.0187	4.05E-05	3.55E-01	Average, at ring 2006: 250 m from IRSF center					0.92
66	1.90E-05	0.0225	2.08E-05	1.82E-01	Average, at ring 2007: 300 m from IRSF center					0.94
67	7.47E-06	0.0334	8.27E-06	7.25E-02	Average, at ring 2008: 375 m from IRSF center					0.95
68	3.07E-06	0.0328	3.39E-06	2.97E-02	Average, at ring 2009: 450 m from IRSF center					0.94
69	1.09E-06	0.0648	1.24E-06	1.09E-02	Average, at ring 2010: 550 m from IRSF center					0.96
70	3.74E-07	0.0590	4.24E-07	3.72E-03	Average, at ring 2011: 650 m from IRSF center					1.01
71	1.37E-07	0.0930	1.61E-07	1.41E-03	Average, at ring 2012: 750 m from IRSF center					1.02
72	6.61E-08	0.1778	8.34E-08	7.31E-04	Average, at ring 2013: 850 m from IRSF center					1.23
73										
74	**Vertical Detectors toward South w/out HVAC effects: detector f52 - results from HVSL2.o**									
75	MCNP Output	MCNP Error	Dose Rate	Dose Rate	Detector Description					
76	(Rem/hr)		(Rem/hr)	(Rem/year)						
77	3.48E-04	0.0155	3.79E-04	3.32E+00	Average, at ring 2003: 100 m from IRSF center					1.00
78	1.38E-04	0.0187	1.50E-04	1.32E+00	Average, at ring 2004: 150 m from IRSF center					1.05
79	6.33E-05	0.0249	6.95E-05	6.09E-01	Average, at ring 2005: 200 m from IRSF center					0.99
80	3.09E-05	0.0276	3.40E-05	2.98E-01	Average, at ring 2006: 250 m from IRSF center					1.05
81	1.67E-05	0.0333	1.84E-05	1.62E-01	Average, at ring 2007: 300 m from IRSF center					1.06
82	6.11E-06	0.0373	6.79E-06	5.95E-02	Average, at ring 2008: 375 m from IRSF center					1.02
83	2.45E-06	0.0415	2.74E-06	2.40E-02	Average, at ring 2009: 450 m from IRSF center					1.01
84	7.87E-07	0.0543	8.89E-07	7.79E-03	Average, at ring 2010: 550 m from IRSF center					0.98
85	2.51E-07	0.0688	2.88E-07	2.52E-03	Average, at ring 2011: 650 m from IRSF center					0.90
86	8.38E-08	0.0714	9.61E-08	8.43E-04	Average, at ring 2012: 750 m from IRSF center					0.84
87	2.95E-08	0.0763	3.40E-08	2.98E-04	Average, at ring 2013: 850 m from IRSF center					0.71
88										
89	**Dose above HICs: detector f62 - results from HVSLB.o**									
90	MCNP Output	MCNP Error	Dose Rate	Dose Rate						
91	(Rem/hr)		(Rem/hr)	(Rem/year)						
92	4.55E+01	0.0014	4.88E+01	4.28E+05						0.99
93										
94										

Comparison Plot of Dose Rates Close to IRSF



MCNP Case with Translated Source – no HVAC Penetrations (HVAC openings filled with concrete)

```
         Thread Name & Version = mcnp5VE_RSICC, 1.40

         ._ _    _  ._   ._    |_
         | | |  (_  | |  |_)    _)
                        |
 +---------------------------------------------------------------------+
 |   This program was prepared by the Regents of the University of     |
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 |     liability or responsibility for the use of this software.       |
 +---------------------------------------------------------------------+

1mcnp     version 5     ld=11112005                    06/10/09 15:29:27
 ***********************************************************************                probid =  06/10/09
15:29:27
  inp = NHVAC.i outp = NHVAC.o rssa = bwssa

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    2-       c     Canister Cells
    3-          11     5      -1 -11 1209 -1212
    4-          12     5      -1 -12 1209 -1212
    5-          13     5      -1 -13 1209 -1212
    6-          14     5      -1 -14 1209 -1212
    7-          15     5      -1 -15 1209 -1212
    8-          16     5      -1 -16 1209 -1212
    9-          17     5      -1 -17 1209 -1212
   10-          18     5      -1 -18 1209 -1212
   11-          19     5      -1 -19 1209 -1212
   12-          21     5      -1 -21 1209 -1212
   13-          22     5      -1 -22 1209 -1212
   14-          23     5      -1 -23 1209 -1212
   15-          24     5      -1 -24 1209 -1212
   16-          25     5      -1 -25 1209 -1212
   17-          26     5      -1 -26 1209 -1212
   18-          27     5      -1 -27 1209 -1212
   19-          28     5      -1 -28 1209 -1212
   20-          29     5      -1 -29 1209 -1212
   21-          31     5      -1 -31 1209 -1212
   22-          32     5      -1 -32 1209 -1212
   23-          33     5      -1 -33 1209 -1212
   24-          34     5      -1 -34 1209 -1212
   25-          35     5      -1 -35 1209 -1212
   26-          36     5      -1 -36 1209 -1212
   27-          37     5      -1 -37 1209 -1212
   28-          38     5      -1 -38 1209 -1212
   29-          39     5      -1 -39 1209 -1212
   30-          41     5      -1 -41 1209 -1212
   31-          42     5      -1 -42 1209 -1212
   32-          43     5      -1 -43 1209 -1212
   33-          44     5      -1 -44 1209 -1212
   34-          45     5      -1 -45 1209 -1212
   35-          46     5      -1 -46 1209 -1212
   36-          47     5      -1 -47 1209 -1212
   37-          48     5      -1 -48 1209 -1212
   38-          49     5      -1 -49 1209 -1212
   39-          51     5      -1 -51 1209 -1212
   40-          52     5      -1 -52 1209 -1212
   41-          53     5      -1 -53 1209 -1212
   42-          54     5      -1 -54 1209 -1212
   43-          55     5      -1 -55 1209 -1212
   44-          56     5      -1 -56 1209 -1212
   45-          57     5      -1 -57 1209 -1212
   46-          58     5      -1 -58 1209 -1212
   47-          59     5      -1 -59 1209 -1212
   48-          61     5      -1 -61 1209 -1212
   49-          62     5      -1 -62 1209 -1212
   50-          63     5      -1 -63 1209 -1212
   51-          64     5      -1 -64 1209 -1212
   52-          65     5      -1 -65 1209 -1212
   53-          66     5      -1 -66 1209 -1212
   54-          67     5      -1 -67 1209 -1212
   55-          68     5      -1 -68 1209 -1212
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135-         157      5       -1 -157 1209 -1212
```

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136-         158     5      -1 -158 1209 -1212
137-         159     5      -1 -159 1209 -1212
138-       c Walls
139-        1200     3 -0.001225 1222 -1221 1206 -1208 1220 -1219  $Notch
140-        1201     1  -2.365 1206 -1208 1202 -1203 -1219 1209 #1200  $Inner Wall
141-        1202     1  -2.395 1207 -1233 1219 -990 -991 992  $Top of Left Wall
142-       12021     1  -2.395 1233 -1223 1219 -990 992 -991  $Split in Left Wall
143-        1203     1  -2.365 1207 -1205 -1219 1209 -1203 1202  $Bottom of Left Wall
144-        1204     1  -2.395 1234 -1204 1207 -1218 1219 -990  $Top of Back Wall
145-       12041     1  -2.395 991 -1234 1207 -1218 1219 -990  $Split in Back Wall
146-        1205     1  -2.365 1203 -1204 1207 -1218 -1219 1209  $Bottom of Back Wall
147-        1206     1  -2.395 1235 -1218 -991 992 1219 -990  $Top of Right Wall
148-       12061     1  -2.395 1224 -1235 -991 992 1219 -990  $Split in Right Wall
149-        1207     1  -2.365 1217 -1218 -1203 1202 -1219 1209  $Bottom of Right Wall
150-        1208     1  -2.395 1201 -1236 -1218 1207 1219 -990 #10000 $Top of Front Wall
151-                    #10001 #10002 #10003 #10004 #10005
152-       12081     1  -2.395 -992 1236 -1218 1207 1219 -990 #10000 $Split in Front Wall
153-                    #10001 #10002 #10003 #10004 #10005
154-        1209     1  -2.365 -1202 1201 -1218 1207 -1219 1209  $Bottom of Front Wall
155-        1210     1  -2.365 -1209 1227 1207 -1218 -1204 1201  $Floor
156-        1211     1  -2.328 990 -1237 1207 -1218 -1204 1201  $Roof
157-       12111     1  -2.328 1237 -1216 1207 -1218 -1204 1201  $Split in Roof
158-       c   Air
159-        9999     0         2015  $Outside Model
160-        9998     3 -0.001225 1205 -1228 -1220 1209 -1203 1202 #(-134 1209 -1212 )#
161-                   (-135 1209 -1212 )#(-145 1209 -1212 )#(-146 1209 -1212 )#
162-                   (-147 1209 -1212 )#(-148 1209 -1212 )#(-149 1209 -1212 )#
163-                   (-11 1209 -1212 )#(-12 1209 -1212 )#(-13 1209 -1212 )#
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176-                   (-119 1209 -1212 )#(-131 1209 -1212 )#(-132 1209 -1212 )#
177-                   (-133 1209 -1212 )
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189-                   (-77 1209 -1212 )#(-78 1209 -1212 )#(-79 1209 -1212 )#
190-                   (-81 1209 -1212 )#(-91 1209 -1212 )#(-92 1209 -1212 )#
191-                   (-93 1209 -1212 )#(-94 1209 -1212 )#(-95 1209 -1212 )#
192-                   (-105 1209 -1212 )#(-106 1209 -1212 )#(-107 1209 -1212 )#
193-                   (-108 1209 -1212 )#(-109 1209 -1212 )#(-111 1209 -1212 )#
194-                   (-121 1209 -1212 )#(-122 1209 -1212 )#(-123 1209 -1212 )#
195-                   (-124 1209 -1212 )#(-125 1209 -1212 )#(-135 1209 -1212 )#
196-                   (-136 1209 -1212 )#(-137 1209 -1212 )#(-138 1209 -1212 )
197-        9996     3 -0.001225 1229 -1206 -1220 1209 -1203 1202 #(-142 1209 -1212 )#
198-                   (-143 1209 -1212 )#(-144 1209 -1212 )#(-156 1209 -1212 )#
199-                   (-157 1209 -1212 )#(-158 1209 -1212 )#(-159 1209 -1212 )#
200-                   (-21 1209 -1212 )#(-22 1209 -1212 )#(-23 1209 -1212 )#
201-                   (-24 1209 -1212 )#(-36 1209 -1212 )#(-37 1209 -1212 )#
202-                   (-38 1209 -1212 )#(-39 1209 -1212 )#(-51 1209 -1212 )#
203-                   (-52 1209 -1212 )#(-53 1209 -1212 )#(-54 1209 -1212 )#
204-                   (-66 1209 -1212 )#(-67 1209 -1212 )#(-68 1209 -1212 )#
205-                   (-69 1209 -1212 )#(-81 1209 -1212 )#(-82 1209 -1212 )#
206-                   (-83 1209 -1212 )#(-84 1209 -1212 )#(-96 1209 -1212 )#
207-                   (-97 1209 -1212 )#(-98 1209 -1212 )#(-99 1209 -1212 )#
208-                   (-111 1209 -1212 )#(-112 1209 -1212 )#(-113 1209 -1212 )#
209-                   (-114 1209 -1212 )#(-126 1209 -1212 )#(-127 1209 -1212 )#
210-                   (-128 1209 -1212 )#(-129 1209 -1212 )#(-141 1209 -1212 )
211-        9995     3 -0.001225 1220 -1219 1205 -1206 -1203 1202
212-        9994     3 -0.001225 -990 1219 1223 -1208 -991 992 #200 #201 #202 #203 #204
213-                    #205 #206 #207 #208 #209 #210
214-        9993     3 -0.001225 1209 -1231 1208 -1217 -1203 1202
215-        9992     3 -0.001225 -1230 1231 1208 -1217 -1203 1202
```

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216-         9991     3 -0.001225 -1220 1230 1208 -1217 -1203 1202
217-         9990     3 -0.001225 1220 -1219 1208 -1217 -1203 1202
218-         9989     3 -0.001225 -990 1219 1208 -1224 -991 992 #211 #212 #213 #214
219-         9988     3 -0.001225 (-2000 -1207 1201 -1204 1227 -1216 ):
220-                    (1218 -2000 1201 -1204 1227 -1216 ):(-2000 -1201 1227 -1216 ):
221-                    (1204 -2000 1227 -1216 ):(1216 -2000 )
222-         9987     0          -1232 -2015  $Bottom Void
223-         9986     3 -0.001225 1232 -1227 -2015
224-        c       Ductwork Penetrations
225-        10000     1  -2.395 12441 -12451 12321 -12331 1201 -992
226-        10001     1  -2.395 12441 -12451 12341 -12351 1201 -992
227-        10002     1  -2.395 12461 -12471 12361 -12371 1201 -992
228-        10003     1  -2.395 12441 -12451 12381 -12391 1201 -992
229-        10004     1  -2.395 12401 -12411 12441 -12451 1201 -992
230-        10005     1  -2.395 12441 -12451 12421 -12431 1201 -992
231-        c Sphere Detector Cells
232-         2001     3 -0.001225 2000 -2001 1227
233-         2002     3 -0.001225 2001 -2002 1227
234-         2003     3 -0.001225 -2003 2002 1227
235-         2004     3 -0.001225 2003 -2004 1227
236-         2005     3 -0.001225 2004 -2005 1227
237-         2006     3 -0.001225 2005 -2006 1227
238-         2007     3 -0.001225 2006 -2007 1227
239-         2008     3 -0.001225 2007 -2008 1227
240-         2009     3 -0.001225 2008 -2009 1227
241-         2010     3 -0.001225 2009 -2010 1227
242-         2011     3 -0.001225 2010 -2011 1227
243-         2012     3 -0.001225 2011 -2012 1227
244-         2013     3 -0.001225 2012 -2013 1227
245-         2014     3 -0.001225 2013 -2014 1227
246-         2015     3 -0.001225 2014 -2015 1227
247-        c Roof Beams
248-          200     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
249-                     ):(-209 206 -211 212 992 -991 )
250-          201     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
251-                     ):(-209 206 -211 212 992 -991 ) trcl=(264.16 0 0 )
252-          202     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
253-                     ):(-209 206 -211 212 992 -991 ) trcl=(528.32 0 0 )
254-          203     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
255-                     ):(-209 206 -211 212 992 -991 ) trcl=(792.48 0 0 )
256-          204     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
257-                     ):(-209 206 -211 212 992 -991 ) trcl=(1056.64 0 0 )
258-          205     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
259-                     ):(-209 206 -211 212 992 -991 ) trcl=(1320.8 0 0 )
260-          206     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
261-                     ):(-209 206 -211 212 992 -991 ) trcl=(1584.96 0 0 )
262-          207     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
263-                     ):(-209 206 -211 212 992 -991 ) trcl=(1849.12 0 0 )
264-          208     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
265-                     ):(-209 206 -211 212 992 -991 ) trcl=(2113.28 0 0 )
266-          209     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
267-                     ):(-209 206 -211 212 992 -991 ) trcl=(2377.44 0 0 )
268-          210     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
269-                     ):(-209 206 -211 212 992 -991 ) trcl=(2641.6 0 0 )
270-          211     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
271-                     ):(-209 206 -211 212 992 -991 ) trcl=(2905.76 0 0 )
272-          212     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
273-                     ):(-209 206 -211 212 992 -991 ) trcl=(3169.92 0 0 )
274-          213     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
275-                     ):(-209 206 -211 212 992 -991 ) trcl=(3434.08 0 0 )
276-          214     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
277-                     ):(-209 206 -211 212 992 -991 ) trcl=(3698.24 0 0 )
278-
279-        c     Source Canisters
280-           11       c/z 302.26 121.92 77.47
281-           12       c/z 500.38 121.92 77.47
282-           13       c/z 698.5 121.92 77.47
283-           14       c/z 896.62 121.92 77.47
284-           15       c/z 1094.74 121.92 77.47
285-           16       c/z 1292.86 121.92 77.47
286-           17       c/z 1490.98 121.92 77.47
287-           18       c/z 1689.1 121.92 77.47
288-           19       c/z 1887.22 121.92 77.47
289-           21       c/z 2085.34 121.92 77.47
290-           22       c/z 2283.46 121.92 77.47
291-           23       c/z 2481.58 121.92 77.47
292-           24       c/z 2679.7 121.92 77.47
293-           25       c/z 203.2 294.64 77.47
294-           26       c/z 401.32 294.64 77.47
295-           27       c/z 599.44 294.64 77.47
```

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296-          28       c/z 797.56 294.64 77.47
297-          29       c/z 995.68 294.64 77.47
298-          31       c/z 1193.8 294.64 77.47
299-          32       c/z 1391.92 294.64 77.47
300-          33       c/z 1590.04 294.64 77.47
301-          34       c/z 1788.16 294.64 77.47
302-          35       c/z 1986.28 294.64 77.47
303-          36       c/z 2184.4 294.64 77.47
304-          37       c/z 2382.52 294.64 77.47
305-          38       c/z 2580.64 294.64 77.47
306-          39       c/z 2778.76 294.64 77.47
307-          41       c/z 302.26 467.36 77.47
308-          42       c/z 500.38 467.36 77.47
309-          43       c/z 698.5 467.36 77.47
310-          44       c/z 896.62 467.36 77.47
311-          45       c/z 1094.74 467.36 77.47
312-          46       c/z 1292.86 467.36 77.47
313-          47       c/z 1490.98 467.36 77.47
314-          48       c/z 1689.1 467.36 77.47
315-          49       c/z 1887.22 467.36 77.47
316-          51       c/z 2085.34 467.36 77.47
317-          52       c/z 2283.46 467.36 77.47
318-          53       c/z 2481.58 467.36 77.47
319-          54       c/z 2679.7 467.36 77.47
320-          55       c/z 203.2 640.08 77.47
321-          56       c/z 401.32 640.08 77.47
322-          57       c/z 599.44 640.08 77.47
323-          58       c/z 797.56 640.08 77.47
324-          59       c/z 995.68 640.08 77.47
325-          61       c/z 1193.8 640.08 77.47
326-          62       c/z 1391.92 640.08 77.47
327-          63       c/z 1590.04 640.08 77.47
328-          64       c/z 1788.16 640.08 77.47
329-          65       c/z 1986.28 640.08 77.47
330-          66       c/z 2184.4 640.08 77.47
331-          67       c/z 2382.52 640.08 77.47
332-          68       c/z 2580.64 640.08 77.47
333-          69       c/z 2778.76 640.08 77.47
334-          71       c/z 302.26 812.8 77.47
335-          72       c/z 500.38 812.8 77.47
336-          73       c/z 698.5 812.8 77.47
337-          74       c/z 896.62 812.8 77.47
338-          75       c/z 1094.74 812.8 77.47
339-          76       c/z 1292.86 812.8 77.47
340-          77       c/z 1490.98 812.8 77.47
341-          78       c/z 1689.1 812.8 77.47
342-          79       c/z 1887.22 812.8 77.47
343-          81       c/z 2085.34 812.8 77.47
344-          82       c/z 2283.46 812.8 77.47
345-          83       c/z 2481.58 812.8 77.47
346-          84       c/z 2679.7 812.8 77.47
347-          85       c/z 203.2 985.52 77.47
348-          86       c/z 401.32 985.52 77.47
349-          87       c/z 599.44 985.52 77.47
350-          88       c/z 797.56 985.52 77.47
351-          89       c/z 995.68 985.52 77.47
352-          91       c/z 1193.8 985.52 77.47
353-          92       c/z 1391.92 985.52 77.47
354-          93       c/z 1590.04 985.52 77.47
355-          94       c/z 1788.16 985.52 77.47
356-          95       c/z 1986.28 985.52 77.47
357-          96       c/z 2184.4 985.52 77.47
358-          97       c/z 2382.52 985.52 77.47
359-          98       c/z 2580.64 985.52 77.47
360-          99       c/z 2778.76 985.52 77.47
361-         101       c/z 302.26 1158.24 77.47
362-         102       c/z 500.38 1158.24 77.47
363-         103       c/z 698.5 1158.24 77.47
364-         104       c/z 896.62 1158.24 77.47
365-         105       c/z 1094.74 1158.24 77.47
366-         106       c/z 1292.86 1158.24 77.47
367-         107       c/z 1490.98 1158.24 77.47
368-         108       c/z 1689.1 1158.24 77.47
369-         109       c/z 1887.22 1158.24 77.47
370-         111       c/z 2085.34 1158.24 77.47
371-         112       c/z 2283.46 1158.24 77.47
372-         113       c/z 2481.58 1158.24 77.47
373-         114       c/z 2679.7 1158.24 77.47
374-         115       c/z 203.2 1330.96 77.47
375-         116       c/z 401.32 1330.96 77.47
```

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376-         117       c/z 599.44 1330.96 77.47
377-         118       c/z 797.56 1330.96 77.47
378-         119       c/z 995.68 1330.96 77.47
379-         121       c/z 1193.8 1330.96 77.47
380-         122       c/z 1391.92 1330.96 77.47
381-         123       c/z 1590.04 1330.96 77.47
382-         124       c/z 1788.16 1330.96 77.47
383-         125       c/z 1986.28 1330.96 77.47
384-         126       c/z 2184.4 1330.96 77.47
385-         127       c/z 2382.52 1330.96 77.47
386-         128       c/z 2580.64 1330.96 77.47
387-         129       c/z 2778.76 1330.96 77.47
388-         131       c/z 302.26 1503.68 77.47
389-         132       c/z 500.38 1503.68 77.47
390-         133       c/z 698.5 1503.68 77.47
391-         134       c/z 896.62 1503.68 77.47
392-         135       c/z 1094.74 1503.68 77.47
393-         136       c/z 1292.86 1503.68 77.47
394-         137       c/z 1490.98 1503.68 77.47
395-         138       c/z 1689.1 1503.68 77.47
396-         139       c/z 1887.22 1503.68 77.47
397-         141       c/z 2085.34 1503.68 77.47
398-         142       c/z 2283.46 1503.68 77.47
399-         143       c/z 2481.58 1503.68 77.47
400-         144       c/z 2679.7 1503.68 77.47
401-         145       c/z 203.2 1676.4 77.47
402-         146       c/z 401.32 1676.4 77.47
403-         147       c/z 599.44 1676.4 77.47
404-         148       c/z 797.56 1676.4 77.47
405-         149       c/z 995.68 1676.4 77.47
406-         151       c/z 1193.8 1676.4 77.47
407-         152       c/z 1391.92 1676.4 77.47
408-         153       c/z 1590.04 1676.4 77.47
409-         154       c/z 1788.16 1676.4 77.47
410-         155       c/z 1986.28 1676.4 77.47
411-         156       c/z 2184.4 1676.4 77.47
412-         157       c/z 2382.52 1676.4 77.47
413-         158       c/z 2580.64 1676.4 77.47
414-         159       c/z 2778.76 1676.4 77.47
415-         c    Planes
416-        1201        py -76.2
417-        1202        py 0
418-        1203        py 1828.8
419-        1204        py 1905
420-        1205        px 0
421-        1206        px 2895.6
422-        1207        px -76.2
423-        1208        px 2971.8
424-        1209        pz 0  $Top of Floor
425-        1212        pz 381  $Top of Top HIC
426-         990        pz 1455.42
427-        1216        pz 1493.52
428-        1217        px 3947.16
429-        1218        px 4023.36
430-        1219        pz 1036.32
431-        1220        pz 822.96  $Bottom of Notch
432-        1221        py 1760.22
433-        1222        py 1546.86
434-        1223        px -38.1
435-        1224        px 3985.26
436-         991        py 1866.9
437-         992        py -38.1
438-        1227        pz -76.2  $Bottom of Floor
439-        1228        px 1089.66
440-        1229        px 2080.26
441-        1230        pz 807.72
442-        1231        pz 213.36  $7ft Detector Surface
443-        1232        pz -91.44  $Bottom Void
444-        1233        px -57.15
445-        1234        py 1885.95
446-        1235        px 4004.31
447-        1236        py -57.15
448-        1237        pz 1474.47
449-       c    HVAC Duct Openings
450-       12321        px 68.58  $Duct1S1
451-       12331        px 170.18  $Duct1 S2
452-       12341        px 871.22  $Duct2 S1
453-       12351        px 972.82  $Duct2 S2
454-       12361        px 1595.12  $Duct3 S1
455-       12371        px 1747.52  $Duct3 S2
```

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 456-       12381        px 1856.74  $Duct4 S1
 457-       12391        px 1958.34  $Duct4 S2
 458-       12401        px 2720.34  $Duct5 S1
 459-       12411        px 2821.94  $Duct5 S2
 460-       12421        px 3776.98  $Duct6 S1
 461-       12431        px 3878.58  $Duct6 S2
 462-       12441        pz 1397  $Small Ducts Bottom
 463-       12451        pz 1437.64  $Small Duct Top
 464-       12461        pz 1369.06  $Large Ducts Bottom
 465-       12471        pz 1445.26  $Large Duct Top
 466-       c   Spheres for detectors
 467-        2000         s 1973.58 914.4 -72.6 2800  $Closest Sphere
 468-        2001         s 1973.58 914.4 -72.6 4000
 469-        2002         s 1973.58 914.4 -72.6 7000
 470-        2003         s 1973.58 914.4 -72.6 10000
 471-        2004         s 1973.58 914.4 -72.6 15000
 472-        2005         s 1973.58 914.4 -72.6 20000
 473-        2006         s 1973.58 914.4 -72.6 25000
 474-        2007         s 1973.58 914.4 -72.6 30000
 475-        2008         s 1973.58 914.4 -72.6 37500
 476-        2009         s 1973.58 914.4 -72.6 45000
 477-        2010         s 1973.58 914.4 -72.6 55000
 478-        2011         s 1973.58 914.4 -72.6 65000
 479-        2012         s 1973.58 914.4 -72.6 75000
 480-        2013         s 1973.58 914.4 -72.6 85000
 481-        2014         s 1973.58 914.4 -72.6 95000
 482-        2015         s 1973.58 914.4 -72.6 120000
 483-        2016        py -276.2
 484-        2017        py -476.2
 485-        2018        py -676.2
 486-        2019        py -876.2
 487-        2020        py -1076.2
 488-        2021        py -1276.2
 489-        2022        py -1476.2
 490-        2023        py -1676.2
 491-        2024        py -1876.2
 492-        2025        py -2076.2
 493-        2026        px 359.054
 494-        2027        px 2535.94
 495-        2028        py -2276.2
 496-        2029        py -2476.2
 497-        2030        py -2676.2
 498-        2031        py -2876.2
 499-        2032        py -3076.2
 500-        2033        py -3276.2
 501-        2034        py -3476.2
 502-        2035        py -3676.2
 503-       c    Roof Beams
 504-         206        px 211.49
 505-         207        px 225.37
 506-         208        px 226.76
 507-         209        px 240.64
 508-         210        pz 1453.54
 509-         211        pz 1373.84
 510-         212        pz 1371.96
 511-         213        px 226.065
 512-
 513-       mode  p
 514-       c  Materials
 515-       m1    1000.            -0.015  $MAT1
 516-             8000.            -1.057 11000.           -0.041 12000.           -0.085
 517-             13000.           -0.137 14000.           -0.487 15000.           -0.002
 518-             16000.           -0.002 19000.           -0.015 20000.           -0.295
 519-             22000.           -0.011 25000.           -0.003 26000.           -0.178
 520-       m2    13000.                1  $MAT2
warning. material   2 is not used in the problem.
 521-       m3    7000.           0.78969  $MAT3
 522-             8000.           0.21019 6000.           0.00012
 523-       m4    26000.                1  $MAT4
 524-       m5    1000.                 2  $MAT5
 525-             8000.                 1
 526-       imp:p   1 136r       9           3 1r         9           3 1r          $ 11,
 527-              9           3 1r         9           3 1r         1             $ 1206,
 528-              3           9            0           1 9r         27            $ 1211,
 529-              0           1 6r         27          54 1r        108 1r        $ 9987,
 530-              216 1r      432 1r       864 1r      1728 1r      3456 1r       $ 2006,
 531-              1 14r        $ 200, 214
 532-        phys:p  100 1 0
 533-       c sdef erg=d5 x=d1 y=d2 z=d3 cel=d4 eff=0.0001 wgt=3.045E+15
 534-       c si1  0 2895.6
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 535-       c sp1  0.0 1.0
 536-       c si2  0 1828.8
 537-       c sp2  0.0 1.0
 538-       c si3  0.01 304.8 381.00
 539-       c sp3  0.0 0.8 0.2
 540-       c sb3  0.0 0.2 1.0
 541-       c si4  L 11 12 13 14 15 16 17 18 19 21 22 23 24 25 26 27 28 29 31 32
 542-       c      33 34 35 36 37 38 39 41 42 43 44 45 46 47 48 49 51 52 53 54 55
 543-       c      56 57 58 59 61 62 63 64 65 66 67 68 69 71 72 73 74 75 76 77 78
 544-       c      79 81 82 83 84 85 86 87 88 89 91 92 93 94 95 96 97 98 99 101
 545-       c      102 103 104 105 106 107 108 109 111 112 113 114 115 116 117 118
 546-       c      119 121 122 123 124 125 126 127 128 129 131 132 133 134 135 136
 547-       c      137 138 139 141 142 143 144 145 146 147 148 149 151 152 153 154
 548-       c      155 156 157 158 159
 549-       c sp4  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 550-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 551-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 552-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 553-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 554-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 555-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 556-       c      1  1  1  1  1
 557-       c si5 l 1.1730 1.3325
 558-       c sp5   1      1
 559-       c ssw 1220(9995)
 560-       ssr
 561-       c ===========================================================================
 562-       c ===========================================================================
 563-       c Truck bay dose rate
 564-       f2:p 1231
warning. without bremsstrahlung, flux estimates will be low.
 565-       c ===========================================================================
 566-       c ===========================================================================
 567-       c Rings outside the building
 568-       f12:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 569-       fs12 -2000 -2001 -2002 -2003 -2004 -2005 -2006 -2007 -2008 -2009
 570-            -2010 -2011 -2012 -2013 -2014
 571-       sd12 1e50 2.564E+07 1.037e8 1.602e8 3.927e8 5.498e8 7.069e8 8.639e8 1.590e9
 572-            1.944e9 3.142e9 3.770e9 4.398e9 5.027e9 5.655e9 1.689e10
 573-       c ===========================================================================
 574-       c ===========================================================================
 575-       c Slabs Ajacent to Ventilation Penetration Side
 576-       f22:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 577-       fs22 1201 -2026 2027
 578-            2016 2017 2018 2019 2020
 579-            2021 2022 2023 2024 2025
 580-            2028 2029 2030 2031 2032
 581-            2033 2034 2035
 582-       sd22 1e50 1e50 1e50
 583-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 584-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 585-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 586-            4.35376e5 4.35376e5 4.35376e5 1e50
 587-       c ===========================================================================
 588-       c ===========================================================================
 589-       c Dose Rate on Vent Side Wall 7ft up avg
 590-       f32:p 1201
warning. without bremsstrahlung, flux estimates will be low.
 591-       fs32 1231 -2026 2027 -1227
 592-       sd32 1e50 1e50 1e50 1e50 6.30E+05
 593-       c ===========================================================================
 594-       c ===========================================================================
 595-       c detectors toward north, with HVAC effects
 596-       f42:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 597-       fs42 1219 -1209 1201 -1205 1206
 598-       sd42 1e50 1e50 1e50 1e50 1e50 3.00e06
 599-            1e50 1e50 1e50 1e50 1e50 3.00e06
 600-            1e50 1e50 1e50 1e50 1e50 3.00e06
 601-            1e50 1e50 1e50 1e50 1e50 3.00e06
 602-            1e50 1e50 1e50 1e50 1e50 3.00e06
 603-            1e50 1e50 1e50 1e50 1e50 3.00e06
 604-            1e50 1e50 1e50 1e50 1e50 3.00e06
 605-            1e50 1e50 1e50 1e50 1e50 3.00e06
 606-            1e50 1e50 1e50 1e50 1e50 3.00e06
 607-            1e50 1e50 1e50 1e50 1e50 3.00e06
 608-            1e50 1e50 1e50 1e50 1e50 3.00e06
 609-       c detectors toward sorth, with no HVAC effects
```

```
 610-       f52:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 611-       fs52 1219 -1209 -1201 -1205 1206
 612-       sd52 1e50 1e50 1e50 1e50 1e50 3.00e06
 613-            1e50 1e50 1e50 1e50 1e50 3.00e06
 614-            1e50 1e50 1e50 1e50 1e50 3.00e06
 615-            1e50 1e50 1e50 1e50 1e50 3.00e06
 616-            1e50 1e50 1e50 1e50 1e50 3.00e06
 617-            1e50 1e50 1e50 1e50 1e50 3.00e06
 618-            1e50 1e50 1e50 1e50 1e50 3.00e06
 619-            1e50 1e50 1e50 1e50 1e50 3.00e06
 620-            1e50 1e50 1e50 1e50 1e50 3.00e06
 621-            1e50 1e50 1e50 1e50 1e50 3.00e06
 622-            1e50 1e50 1e50 1e50 1e50 3.00e06
 623-       c ===========================================================================
 624-       c ===========================================================================
 625-       c Detector above the HICS (used as a source check)
 626-       f62:p 1219
warning. without bremsstrahlung, flux estimates will be low.
 627-       fs62 -1205 1206 1203 -1202
 628-       sd62  1e50 1e50 1e50  1e50 5.30E+06
 629-       c ===========================================================================
 630-       c ===========================================================================
 631-       c Photon Flux to Dose Rate Conversion Factors
 632-       de0 0.01 0.03 0.05 0.07 0.10 0.15 0.20
 633-            0.25 0.30 0.35 0.40 0.45 0.50 0.55
 634-            0.60 0.65 0.70 0.80 1.00 1.40 1.80
 635-            2.20 2.60 2.80 3.25 3.75 4.25 4.75
 636-            5.00 5.25 5.75 6.25 6.75 7.50 9.00
 637-            11.0 13.0 15.0
 638-       df0 LIN 3.96E-06 5.82E-07 2.90E-07 2.58E-07 2.83E-07 3.79E-07 5.01E-07
 639-            6.31e-07 7.59E-07 8.78E-07 9.85E-07 1.08E-06 1.17E-06 1.27E-06
 640-            1.36e-06 1.44E-06 1.52E-06 1.68E-06 1.98E-06 2.51E-06 2.99E-06
 641-            3.42e-06 3.82E-06 4.01E-06 4.41E-06 4.83E-06 5.23E-06 5.60E-06
 642-            5.80e-06 6.01E-06 6.37E-06 6.74E-06 7.11E-06 7.66E-06 8.77E-06
 643-            1.03e-05 1.18E-05 1.33E-05
 644-       nps 8.00e08

surface    990   and surface 201990   are the same. 201990   will be deleted.

surface    990   and surface 202990   are the same. 202990   will be deleted.

surface    990   and surface 203990   are the same. 203990   will be deleted.

surface    990   and surface 204990   are the same. 204990   will be deleted.

surface    990   and surface 205990   are the same. 205990   will be deleted.

surface    990   and surface 206990   are the same. 206990   will be deleted.

surface    990   and surface 207990   are the same. 207990   will be deleted.

surface    990   and surface 208990   are the same. 208990   will be deleted.

surface    990   and surface 209990   are the same. 209990   will be deleted.

surface    990   and surface 210990   are the same. 210990   will be deleted.

surface    990   and surface 211990   are the same. 211990   will be deleted.

surface    990   and surface 212990   are the same. 212990   will be deleted.

surface    990   and surface 213990   are the same. 213990   will be deleted.

surface    990   and surface 214990   are the same. 214990   will be deleted.

surface    991   and surface 201991   are the same. 201991   will be deleted.

surface    991   and surface 202991   are the same. 202991   will be deleted.

surface    991   and surface 203991   are the same. 203991   will be deleted.

surface    991   and surface 204991   are the same. 204991   will be deleted.

surface    991   and surface 205991   are the same. 205991   will be deleted.

surface    991   and surface 206991   are the same. 206991   will be deleted.

surface    991   and surface 207991   are the same. 207991   will be deleted.
```

```
surface    991   and surface 208991   are the same. 208991   will be deleted.
surface    991   and surface 209991   are the same. 209991   will be deleted.
surface    991   and surface 210991   are the same. 210991   will be deleted.
surface    991   and surface 211991   are the same. 211991   will be deleted.
surface    991   and surface 212991   are the same. 212991   will be deleted.
surface    991   and surface 213991   are the same. 213991   will be deleted.
surface    991   and surface 214991   are the same. 214991   will be deleted.
surface    992   and surface 201992   are the same. 201992   will be deleted.
surface    992   and surface 202992   are the same. 202992   will be deleted.
surface    992   and surface 203992   are the same. 203992   will be deleted.
surface    992   and surface 204992   are the same. 204992   will be deleted.
surface    992   and surface 205992   are the same. 205992   will be deleted.
surface    992   and surface 206992   are the same. 206992   will be deleted.
surface    992   and surface 207992   are the same. 207992   will be deleted.
surface    992   and surface 208992   are the same. 208992   will be deleted.
surface    992   and surface 209992   are the same. 209992   will be deleted.
surface    992   and surface 210992   are the same. 210992   will be deleted.
surface    992   and surface 211992   are the same. 211992   will be deleted.
surface    992   and surface 212992   are the same. 212992   will be deleted.
surface    992   and surface 213992   are the same. 213992   will be deleted.
surface    992   and surface 214992   are the same. 214992   will be deleted.
surface    210   and surface 201210   are the same. 201210   will be deleted.
surface    210   and surface 202210   are the same. 202210   will be deleted.
surface    210   and surface 203210   are the same. 203210   will be deleted.
surface    210   and surface 204210   are the same. 204210   will be deleted.
surface    210   and surface 205210   are the same. 205210   will be deleted.
surface    210   and surface 206210   are the same. 206210   will be deleted.
surface    210   and surface 207210   are the same. 207210   will be deleted.
surface    210   and surface 208210   are the same. 208210   will be deleted.
surface    210   and surface 209210   are the same. 209210   will be deleted.
surface    210   and surface 210210   are the same. 210210   will be deleted.
surface    210   and surface 211210   are the same. 211210   will be deleted.
surface    210   and surface 212210   are the same. 212210   will be deleted.
surface    210   and surface 213210   are the same. 213210   will be deleted.
surface    210   and surface 214210   are the same. 214210   will be deleted.
surface    211   and surface 201211   are the same. 201211   will be deleted.
surface    211   and surface 202211   are the same. 202211   will be deleted.
surface    211   and surface 203211   are the same. 203211   will be deleted.
surface    211   and surface 204211   are the same. 204211   will be deleted.
surface    211   and surface 205211   are the same. 205211   will be deleted.
```

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 surface    211   and surface 206211   are the same. 206211   will be deleted.

 surface    211   and surface 207211   are the same. 207211   will be deleted.

 surface    211   and surface 208211   are the same. 208211   will be deleted.

 surface    211   and surface 209211   are the same. 209211   will be deleted.

 surface    211   and surface 210211   are the same. 210211   will be deleted.

 surface    211   and surface 211211   are the same. 211211   will be deleted.

 surface    211   and surface 212211   are the same. 212211   will be deleted.

 surface    211   and surface 213211   are the same. 213211   will be deleted.

 surface    211   and surface 214211   are the same. 214211   will be deleted.

 surface    212   and surface 201212   are the same. 201212   will be deleted.

 surface    212   and surface 202212   are the same. 202212   will be deleted.

 surface    212   and surface 203212   are the same. 203212   will be deleted.

 surface    212   and surface 204212   are the same. 204212   will be deleted.

 surface    212   and surface 205212   are the same. 205212   will be deleted.

 surface    212   and surface 206212   are the same. 206212   will be deleted.

 surface    212   and surface 207212   are the same. 207212   will be deleted.

 surface    212   and surface 208212   are the same. 208212   will be deleted.

 surface    212   and surface 209212   are the same. 209212   will be deleted.

 surface    212   and surface 210212   are the same. 210212   will be deleted.

 surface    212   and surface 211212   are the same. 211212   will be deleted.

 surface    212   and surface 212212   are the same. 212212   will be deleted.

 surface    212   and surface 213212   are the same. 213212   will be deleted.

 surface    212   and surface 214212   are the same. 214212   will be deleted.

 comment.   84 surfaces were deleted for being the same as others.


 information from the header of surface-source file bwssa

 the file was written by mcnp     version 5     with probid =  05/13/09 07:42:34  and ending with dump no.     5
 the title of the creation run was     c     Created on: Tuesday, November 11, 2008 at 09:35
 the original number of histories was    25654088
 the total number of tracks recorded was     4352843 from     4229523 independent histories.

 this ssr problem will use the following particles if available: photon

 warning.   2 materials had unnormalized fractions. print table 40.

 warning.   1 of the materials appear at more than one density.

 warning. sum of segment sizes differs from total in  25 cases.
1cells                                                                                                  print
table 60

                     atom        gram                                          photon
        cell  mat    density     density     volume       mass     pieces importance

     1    11    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     2    12    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     3    13    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     4    14    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     5    15    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     6    16    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     7    17    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     8    18    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     9    19    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
    10    21    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
    11    22    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
```

12	23	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
13	24	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
14	25	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
15	26	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
16	27	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
17	28	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
18	29	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
19	31	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
20	32	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
21	33	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
22	34	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
23	35	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
24	36	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
25	37	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
26	38	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
27	39	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
28	41	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
29	42	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
30	43	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
31	44	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
32	45	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
33	46	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
34	47	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
35	48	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
36	49	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
37	51	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
38	52	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
39	53	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
40	54	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
41	55	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
42	56	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
43	57	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
44	58	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
45	59	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
46	61	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
47	62	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
48	63	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
49	64	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
50	65	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
51	66	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
52	67	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
53	68	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
54	69	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
55	71	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
56	72	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
57	73	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
58	74	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
59	75	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
60	76	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
61	77	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
62	78	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
63	79	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
64	81	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
65	82	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
66	83	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
67	84	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
68	85	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
69	86	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
70	87	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
71	88	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
72	89	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
73	91	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
74	92	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
75	93	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
76	94	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
77	95	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
78	96	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
79	97	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
80	98	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
81	99	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
82	101	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
83	102	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
84	103	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
85	104	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
86	105	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
87	106	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
88	107	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
89	108	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
90	109	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
91	111	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00

92	112	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
93	113	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
94	114	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
95	115	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
96	116	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
97	117	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
98	118	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
99	119	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
100	121	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
101	122	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
102	123	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
103	124	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
104	125	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
105	126	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
106	127	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
107	128	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
108	129	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
109	131	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
110	132	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
111	133	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
112	134	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
113	135	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
114	136	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
115	137	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
116	138	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
117	139	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
118	141	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
119	142	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
120	143	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
121	144	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
122	145	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
123	146	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
124	147	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
125	148	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
126	149	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
127	151	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
128	152	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
129	153	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
130	154	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
131	155	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
132	156	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
133	157	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
134	158	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
135	159	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
136	1200	3	5.11393E-05	1.22500E-03	3.46881E+06	4.24930E+03	0	1.0000E+00
137	1201	1	7.34055E-02	2.36500E+00	1.40947E+08	3.33340E+08	0	1.0000E+00
138	1202	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
139	12021	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
140	1203	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
141	1204	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	9.0000E+00
142	12041	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	3.0000E+00
143	1205	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
144	1206	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
145	12061	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
146	1207	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
147	1208	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	9.0000E+00
148	12081	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	3.0000E+00
149	1209	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
150	1210	1	7.34055E-02	2.36500E+00	6.18900E+08	1.46370E+09	0	1.0000E+00
151	1211	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	3.0000E+00
152	12111	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	9.0000E+00
153	9999	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	0.0000E+00
154	9998	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
155	9997	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
156	9996	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
157	9995	3	5.11393E-05	1.22500E-03	1.12984E+09	1.38406E+06	0	1.0000E+00
158	9994	3	5.11393E-05	1.22500E-03	2.39844E+09	2.93809E+06	0	1.0000E+00
159	9993	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
160	9992	3	5.11393E-05	1.22500E-03	1.06018E+09	1.29872E+06	0	1.0000E+00
161	9991	3	5.11393E-05	1.22500E-03	2.71842E+07	3.33006E+04	0	1.0000E+00
162	9990	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
163	9989	3	5.11393E-05	1.22500E-03	8.07452E+08	9.89129E+05	0	1.0000E+00
164	9988	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	2.7000E+01
165	9987	0	0.00000E+00	0.00000E+00	3.61826E+15	0.00000E+00	1	0.0000E+00
166	9986	3	5.11393E-05	1.22500E-03	6.89441E+11	8.44566E+08	1	1.0000E+00
167	10000	1	7.43366E-02	2.39500E+00	1.57316E+05	3.76771E+05	0	1.0000E+00
168	10001	1	7.43366E-02	2.39500E+00	1.57316E+05	3.76771E+05	0	1.0000E+00
169	10002	1	7.43366E-02	2.39500E+00	4.42451E+05	1.05967E+06	0	1.0000E+00
170	10003	1	7.43366E-02	2.39500E+00	1.57316E+05	3.76771E+05	0	1.0000E+00
171	10004	1	7.43366E-02	2.39500E+00	1.57316E+05	3.76771E+05	0	1.0000E+00

```
   172 10005    1  7.43366E-02 2.39500E+00 1.57316E+05 3.76771E+05     0  1.0000E+00
   173  2001    3  5.11393E-05 1.22500E-03 8.81574E+10 1.07993E+08     1  2.7000E+01
   174  2002    3  5.11393E-05 1.22500E-03 5.84709E+11 7.16269E+08     1  5.4000E+01
   175  2003    3  5.11393E-05 1.22500E-03 1.37659E+12 1.68633E+09     1  5.4000E+01
   176  2004    3  5.11393E-05 1.22500E-03 4.97560E+12 6.09511E+09     1  1.0800E+02
   177  2005    3  5.11393E-05 1.22500E-03 9.68856E+12 1.18685E+10     1  1.0800E+02
   178  2006    3  5.11393E-05 1.22500E-03 1.59723E+13 1.95661E+10     1  2.1600E+02
   179  2007    3  5.11393E-05 1.22500E-03 2.38269E+13 2.91879E+10     1  2.1600E+02
   180  2008    3  5.11393E-05 1.22500E-03 5.39037E+13 6.60320E+10     1  4.3200E+02
   181  2009    3  5.11393E-05 1.22500E-03 8.04121E+13 9.85049E+10     1  4.3200E+02
   182  2010    3  5.11393E-05 1.22500E-03 1.57615E+14 1.93078E+11     1  8.6400E+02
   183  2011    3  5.11393E-05 1.22500E-03 2.26732E+14 2.77747E+11     1  8.6400E+02
   184  2012    3  5.11393E-05 1.22500E-03 3.08416E+14 3.77809E+11     1  1.7280E+03
   185  2013    3  5.11393E-05 1.22500E-03 4.02666E+14 4.93265E+11     1  1.7280E+03
   186  2014    3  5.11393E-05 1.22500E-03 5.09482E+14 6.24115E+11     1  3.4560E+03
   187  2015    3  5.11393E-05 1.22500E-03 1.82349E+15 2.23378E+12     1  3.4560E+03
   188   200    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   189   201    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   190   202    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   191   203    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   192   204    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   193   205    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   194   206    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   195   207    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   196   208    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   197   209    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   198   210    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   199   211    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   200   212    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   201   213    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   202   214    4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00

 total                                    7.23819E+15 4.44062E+12

 warning. surface    213 is not used for anything.

 ************************************************
 * Random Number Generator  =                  1 *
 * Random Number Seed       =       19073486328125 *
 * Random Number Multiplier =       19073486328125 *
 * Random Number Adder      =                  0 *
 * Random Number Bits Used  =                 48 *
 * Random Number Stride     =             152917 *
 ************************************************


        12 warning messages so far.
1cross-section tables                                                                    print
table 100

     table    length

                        tables from file mcplib04

   1000.04p    1898  ENDF/B-VI Release 8 Photoatomic Data for 1-H                        mat 100
02/07/03
   6000.04p    3152  ENDF/B-VI Release 8 Photoatomic Data for 6-C                        mat 600
02/07/03
   7000.04p    3194  ENDF/B-VI Release 8 Photoatomic Data for 7-N                        mat 700
02/07/03
   8000.04p    3272  ENDF/B-VI Release 8 Photoatomic Data for 8-O                        mat 800
02/07/03
  11000.04p    3995  ENDF/B-VI Release 8 Photoatomic Data for 11-NA                      mat1100
02/07/03
  12000.04p    3781  ENDF/B-VI Release 8 Photoatomic Data for 12-MG                      mat1200
02/07/03
  13000.04p    4846  ENDF/B-VI Release 8 Photoatomic Data for 13-AL                      mat1300
02/07/03
  14000.04p    4792  ENDF/B-VI Release 8 Photoatomic Data for 14-SI                      mat1400
02/07/03
  15000.04p    4498  ENDF/B-VI Release 8 Photoatomic Data for 15-P                       mat1500
02/07/03
  16000.04p    4654  ENDF/B-VI Release 8 Photoatomic Data for 16-S                       mat1600
02/07/03
  19000.04p    5047  ENDF/B-VI Release 8 Photoatomic Data for 19-K                       mat1900
02/07/03
  20000.04p    5013  ENDF/B-VI Release 8 Photoatomic Data for 20-CA                      mat2000
02/07/03
  22000.04p    5742  ENDF/B-VI Release 8 Photoatomic Data for 22-TI                      mat2200
02/07/03
```

```
  25000.04p     5598  ENDF/B-VI Release 8 Photoatomic Data for 25-MN                                mat2500
02/07/03
  26000.04p     5718  ENDF/B-VI Release 8 Photoatomic Data for 26-FE                                mat2600
02/07/03

  total       65200

 warning. simple physics turned on for photons > 100 mev.

************************************************************************************************************
*******
 dump no.    1 on file runtpe       nps =           0     coll =              0     ctm =        0.00   nrn =
0


        13 warning messages so far.

************************************************************************************************************
*******
 dump no.    2 on file runtpe       nps =      199700     coll =      242490811     ctm =       60.01   nrn =
2973517107


************************************************************************************************************
*******
 dump no.    3 on file runtpe       nps =      397255     coll =      483053785     ctm =      120.01   nrn =
5923858260


************************************************************************************************************
*******
 dump no.    4 on file runtpe       nps =      593172     coll =      723090004     ctm =      180.02   nrn =
8868657591


************************************************************************************************************
*******
 dump no.    5 on file runtpe       nps =      790626     coll =      963057409     ctm =      240.04   nrn =
11811702274


************************************************************************************************************
*******
 dump no.    6 on file runtpe       nps =      988188     coll =     1204316071     ctm =      300.04   nrn =
14771182394


************************************************************************************************************
*******
 dump no.    7 on file runtpe       nps =     1185264     coll =     1444751830     ctm =      360.05   nrn =
17720394891


************************************************************************************************************
*******
 dump no.    8 on file runtpe       nps =     1382384     coll =     1685007964     ctm =      420.07   nrn =
20667442467


************************************************************************************************************
*******
 dump no.    9 on file runtpe       nps =     1578660     coll =     1926372836     ctm =      480.07   nrn =
23629129974


************************************************************************************************************
*******
 dump no.   10 on file runtpe       nps =     1775456     coll =     2167121712     ctm =      540.07   nrn =
26582256718
```

```
************************************************************************************************************************
*******
 dump no.   11 on file runtpe       nps =     1973028     coll =     2407814715     ctm =      600.09   nrn =
29534271406


************************************************************************************************************************
*******
 dump no.   12 on file runtpe       nps =     2170904     coll =     2648838157     ctm =      660.09   nrn =
32490256102


************************************************************************************************************************
*******
 dump no.   13 on file runtpe       nps =     2369232     coll =     2890275868     ctm =      720.09   nrn =
35451631838


************************************************************************************************************************
*******
 dump no.   14 on file runtpe       nps =     2566642     coll =     3131072150     ctm =      780.10   nrn =
38404984120


************************************************************************************************************************
*******
 dump no.   15 on file runtpe       nps =     2762716     coll =     3371528662     ctm =      840.12   nrn =
41354948442


************************************************************************************************************************
*******
 dump no.   16 on file runtpe       nps =     2960126     coll =     3611462423     ctm =      900.13   nrn =
44297394594

1problem summary                                  source particle weight for summary table normalization =
19038449.00

      run terminated when it had used    0  minutes of computer time.
+                                                                                                    06/11/09
07:25:03
      c     Created on: Tuesday, November 11, 2008 at 09:35                              probid =  06/10/09
15:29:27
0
 photon creation     tracks      weight        energy            photon loss         tracks      weight
energy
                                (per source particle)                                            (per source
particle)

 source           100772716    1.7974E+14    4.9650E-01          escape             3581758    3.3066E+11
2.7184E-04
                                                                 energy cutoff            0    0.            0.
                                                                 time cutoff              0    0.            0.
 weight window            0    0.            0.                 weight window            0    0.            0.
 cell importance  481439332    3.0365E+13    2.7080E-02         cell importance  149529286    3.0366E+13
2.7084E-02
 weight cutoff            0    0.            0.                 weight cutoff            0    0.            0.
 e or t importance        0    0.            0.                 e or t importance        0    0.            0.
 dxtran                   0    0.            0.                 dxtran                   0    0.            0.
 forced collisions        0    0.            0.                 forced collisions        0    0.            0.
 exp. transform           0    0.            0.                 exp. transform           0    0.            0.
 from neutrons            0    0.            0.                 compton scatter          0    0.
4.1055E-01
 bremsstrahlung           0    0.            0.                 capture          482483385    2.1510E+14
8.6735E-02
 p-annihilation      125316    6.8440E+10    1.9458E-04         pair production      62658    3.4220E+10
2.4847E-04
 photonuclear             0    0.            0.                 photonuclear abs         0    0.            0.
 electron x-rays          0    0.            0.
 1st fluorescence  53319723    3.5656E+13    1.1140E-03
 2nd fluorescence         0    0.            0.
     total        635657087    2.4583E+14    5.2489E-01             total        635657087    2.4583E+14
5.2489E-01
```

```
   number of photons banked                361457404        average time of (shakes)              cutoffs
   photon tracks per source particle      3.3388E+01          escape            1.0312E+02          tco
1.0000E+33
   photon collisions per source particle  2.0125E+02          capture           6.1100E+00          eco
1.0000E-03
   total photon collisions                3831424048          capture or escape 6.2589E+00          wc1  -
5.0000E-01
                                                              any termination   6.5103E+00          wc2  -
2.5000E-01

 computer time so far in this run   954.89 minutes           maximum number ever in bank        15
 computer time in mcrun             954.81 minutes           bank overflows to backup file       0
 source particles per minute           3.2885E+03
 random numbers generated             46995712351           most random numbers used was      407838 in
history     1000351

 warning.  random number stride   152917 exceeded     4677 times.

 range of sampled source weights = 2.2838E+13 to 4.7148E+14

 warning. importance function may be poor.  see print table 120.
1photon   activity in each cell                                                                    print
table 126
```

cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1 11	47521	46225	253416	4.3491E+11	9.2136E-02	9.2136E-02	3.2392E+13	5.3717E+00
2 12	53611	51821	284722	4.9197E+11	9.1490E-02	9.1490E-02	3.2805E+13	5.3531E+00
3 13	57726	55768	308023	5.2556E+11	9.1365E-02	9.1365E-02	3.2353E+13	5.3499E+00
4 14	60140	58087	318309	5.3586E+11	9.1640E-02	9.1640E-02	3.1792E+13	5.3549E+00
5 15	62171	60048	330883	5.6600E+11	9.1053E-02	9.1053E-02	3.2463E+13	5.3438E+00
6 16	62823	60739	332780	5.7519E+11	9.1612E-02	9.1612E-02	3.2868E+13	5.3575E+00
7 17	63001	60902	335097	5.8763E+11	9.0380E-02	9.0380E-02	3.3263E+13	5.3252E+00
8 18	62560	60477	332012	5.7657E+11	9.0571E-02	9.0571E-02	3.2816E+13	5.3383E+00
9 19	61668	59517	328248	5.7990E+11	9.0940E-02	9.0940E-02	3.3339E+13	5.3422E+00
10 21	58942	56938	312407	5.5061E+11	9.0957E-02	9.0957E-02	3.3394E+13	5.3396E+00
11 22	55954	53969	296083	5.0670E+11	9.2913E-02	9.2913E-02	3.2609E+13	5.3826E+00
12 23	50982	49197	269329	4.6559E+11	9.2470E-02	9.2470E-02	3.2698E+13	5.3737E+00
13 24	42846	41557	230200	3.9756E+11	9.3682E-02	9.3682E-02	3.2452E+13	5.3908E+00
14 25	55921	54449	299746	5.1743E+11	9.2124E-02	9.2124E-02	3.2608E+13	5.3661E+00
15 26	62516	59925	328704	5.6326E+11	9.0757E-02	9.0757E-02	3.2189E+13	5.3277E+00
16 27	69061	66175	361787	6.3010E+11	8.9693E-02	8.9693E-02	3.2963E+13	5.3101E+00
17 28	73074	69936	379936	6.5530E+11	8.9772E-02	8.9772E-02	3.2517E+13	5.3133E+00
18 29	76165	72924	397932	6.8701E+11	8.9654E-02	8.9654E-02	3.2860E+13	5.3156E+00
19 31	77817	74511	407068	6.9047E+11	8.9874E-02	8.9874E-02	3.2146E+13	5.3189E+00
20 32	79573	76311	415584	7.1569E+11	8.9442E-02	8.9442E-02	3.2391E+13	5.3106E+00
21 33	78615	75373	410042	7.0976E+11	8.9617E-02	8.9617E-02	3.2789E+13	5.3107E+00
22 34	77119	73884	404502	6.9346E+11	8.9663E-02	8.9663E-02	3.2453E+13	5.3144E+00
23 35	74582	71442	389440	6.6322E+11	8.9938E-02	8.9938E-02	3.2325E+13	5.3201E+00
24 36	71380	68390	373730	6.3504E+11	8.9821E-02	8.9821E-02	3.2146E+13	5.3164E+00

25	37	66385	63671	349460	5.9951E+11	9.0941E-02	9.0941E-02	3.2519E+13
5.3364E+00								
26	38	59187	56758	310569	5.3585E+11	9.0646E-02	9.0646E-02	3.2520E+13
5.3238E+00								
27	39	47340	45774	253750	4.3246E+11	9.3449E-02	9.3449E-02	3.2171E+13
5.3859E+00								
28	41	64541	62237	340852	5.8589E+11	9.1052E-02	9.1052E-02	3.2525E+13
5.3388E+00								
29	42	72801	69788	381675	6.5119E+11	8.9928E-02	8.9928E-02	3.2253E+13
5.3157E+00								
30	43	78301	75004	408927	7.1384E+11	8.9834E-02	8.9834E-02	3.3056E+13
5.3135E+00								
31	44	82087	78726	426155	7.2737E+11	8.9397E-02	8.9397E-02	3.2205E+13
5.3072E+00								
32	45	84408	80829	437930	7.6255E+11	8.8579E-02	8.8579E-02	3.2897E+13
5.2925E+00								
33	46	85832	82289	448011	7.6854E+11	8.9017E-02	8.9017E-02	3.2428E+13
5.2996E+00								
34	47	86433	82781	451656	7.8419E+11	8.8706E-02	8.8706E-02	3.2928E+13
5.2960E+00								
35	48	85424	81823	444532	7.5491E+11	8.9243E-02	8.9243E-02	3.2150E+13
5.3067E+00								
36	49	83607	80081	436798	7.5245E+11	8.8851E-02	8.8851E-02	3.2679E+13
5.2990E+00								
37	51	80704	77358	421453	7.2153E+11	8.8796E-02	8.8796E-02	3.2212E+13
5.2929E+00								
38	52	76504	73276	400521	6.8952E+11	9.0447E-02	9.0447E-02	3.2793E+13
5.3272E+00								
39	53	70001	67146	368574	6.3050E+11	9.0635E-02	9.0635E-02	3.2312E+13
5.3306E+00								
40	54	58874	56614	311955	5.2492E+11	9.1148E-02	9.1148E-02	3.1739E+13
5.3377E+00								
41	55	64912	63143	346593	5.8898E+11	9.1311E-02	9.1311E-02	3.2247E+13
5.3460E+00								
42	56	72421	69270	379017	6.6063E+11	8.9408E-02	8.9408E-02	3.2929E+13
5.3069E+00								
43	57	79713	76233	417221	7.2143E+11	9.0071E-02	9.0071E-02	3.2722E+13
5.3222E+00								
44	58	84053	80460	437599	7.6101E+11	8.9539E-02	8.9539E-02	3.3124E+13
5.3113E+00								
45	59	88015	84362	460269	7.8876E+11	8.8900E-02	8.8900E-02	3.2368E+13
5.2981E+00								
46	61	89638	85952	470470	8.1246E+11	8.8881E-02	8.8881E-02	3.2525E+13
5.2948E+00								
47	62	90681	86836	469773	8.1044E+11	8.8434E-02	8.8434E-02	3.2721E+13
5.2944E+00								
48	63	89853	85932	467434	8.0860E+11	8.8133E-02	8.8133E-02	3.2628E+13
5.2784E+00								
49	64	88783	85057	461846	7.9708E+11	8.8469E-02	8.8469E-02	3.2616E+13
5.2916E+00								
50	65	85914	82321	447903	7.7638E+11	8.8858E-02	8.8858E-02	3.2951E+13
5.3003E+00								
51	66	82107	78675	428266	7.4573E+11	8.9108E-02	8.9108E-02	3.2930E+13
5.3025E+00								
52	67	76991	73654	403096	6.9015E+11	9.0425E-02	9.0425E-02	3.2298E+13
5.3242E+00								
53	68	68236	65418	357775	6.1463E+11	8.9987E-02	8.9987E-02	3.2499E+13
5.3131E+00								
54	69	55232	53447	295036	5.0569E+11	9.2388E-02	9.2388E-02	3.2374E+13
5.3678E+00								
55	71	69018	66446	362836	6.1158E+11	9.0479E-02	9.0479E-02	3.1774E+13
5.3260E+00								
56	72	78395	75047	410513	7.0123E+11	8.9519E-02	8.9519E-02	3.2377E+13
5.3082E+00								
57	73	83488	79836	434489	7.6197E+11	8.8677E-02	8.8677E-02	3.2974E+13
5.2931E+00								
58	74	86749	83100	454165	7.7630E+11	8.8628E-02	8.8628E-02	3.2376E+13
5.2932E+00								
59	75	89845	86123	470509	8.2462E+11	8.8356E-02	8.8356E-02	3.3053E+13
5.2908E+00								
60	76	91758	87906	477740	8.2312E+11	8.8809E-02	8.8809E-02	3.2596E+13
5.2966E+00								
61	77	92014	88084	479525	8.3641E+11	8.8796E-02	8.8796E-02	3.3163E+13
5.2984E+00								
62	78	91277	87464	474714	8.1842E+11	8.8548E-02	8.8548E-02	3.2821E+13
5.2925E+00								
63	79	89278	85598	465497	7.9984E+11	8.8476E-02	8.8476E-02	3.2429E+13
5.2936E+00								
64	81	84723	81238	444073	7.5849E+11	8.9004E-02	8.9004E-02	3.2366E+13
5.3008E+00								

65	82	80746	77444	422617	7.2662E+11	8.9713E-02	8.9713E-02	3.2633E+13
5.3186E+00								
66	83	73992	70932	388277	6.6553E+11	9.0644E-02	9.0644E-02	3.2419E+13
5.3269E+00								
67	84	63278	60823	333872	5.6520E+11	9.1128E-02	9.1128E-02	3.1823E+13
5.3378E+00								
68	85	66241	64456	353271	6.0201E+11	9.0550E-02	9.0550E-02	3.2094E+13
5.3388E+00								
69	86	73943	70845	388283	6.6976E+11	8.9975E-02	8.9975E-02	3.2833E+13
5.3165E+00								
70	87	81177	77808	423770	7.2526E+11	9.0203E-02	9.0203E-02	3.2348E+13
5.3227E+00								
71	88	86116	82532	447832	7.7923E+11	8.9082E-02	8.9082E-02	3.2960E+13
5.3048E+00								
72	89	89622	85764	470114	8.1072E+11	8.8790E-02	8.8790E-02	3.2813E+13
5.2952E+00								
73	91	91006	87087	474896	8.2203E+11	8.8184E-02	8.8184E-02	3.2589E+13
5.2864E+00								
74	92	91504	87682	474164	8.1836E+11	8.8591E-02	8.8591E-02	3.2636E+13
5.2948E+00								
75	93	91393	87432	475956	8.2647E+11	8.8651E-02	8.8651E-02	3.2812E+13
5.2960E+00								
76	94	90040	86228	469590	8.1784E+11	8.8827E-02	8.8827E-02	3.3027E+13
5.2981E+00								
77	95	87128	83498	453263	7.7441E+11	8.9177E-02	8.9177E-02	3.2474E+13
5.3046E+00								
78	96	83555	80000	435876	7.4669E+11	8.9114E-02	8.9114E-02	3.2447E+13
5.3045E+00								
79	97	77923	74721	406285	6.8845E+11	8.9911E-02	8.9911E-02	3.2098E+13
5.3230E+00								
80	98	69433	66465	363358	6.2819E+11	9.0039E-02	9.0039E-02	3.2787E+13
5.3222E+00								
81	99	56513	54655	303214	5.1649E+11	9.1475E-02	9.1475E-02	3.2236E+13
5.3485E+00								
82	101	67708	65174	356003	6.0048E+11	9.0554E-02	9.0554E-02	3.2052E+13
5.3347E+00								
83	102	75785	72558	395945	6.8595E+11	8.9109E-02	8.9109E-02	3.2819E+13
5.2995E+00								
84	103	81953	78463	428066	7.3558E+11	8.9187E-02	8.9187E-02	3.2591E+13
5.3040E+00								
85	104	85556	82028	448297	7.6443E+11	8.8616E-02	8.8616E-02	3.2305E+13
5.2913E+00								
86	105	88400	84805	461837	8.0661E+11	8.8563E-02	8.8563E-02	3.2932E+13
5.2920E+00								
87	106	90161	86421	468866	7.9477E+11	8.8572E-02	8.8572E-02	3.2009E+13
5.2951E+00								
88	107	89956	86065	469100	8.0680E+11	8.8833E-02	8.8833E-02	3.2662E+13
5.3018E+00								
89	108	89780	86024	468782	7.9942E+11	8.8805E-02	8.8805E-02	3.2449E+13
5.2982E+00								
90	109	87477	83813	458574	7.8737E+11	8.8772E-02	8.8772E-02	3.2564E+13
5.2982E+00								
91	111	84061	80511	437205	7.4041E+11	8.9290E-02	8.9290E-02	3.1917E+13
5.3088E+00								
92	112	79341	75978	415474	7.1824E+11	8.9334E-02	8.9334E-02	3.2763E+13
5.3066E+00								
93	113	72645	69591	378874	6.3764E+11	9.0213E-02	9.0213E-02	3.1691E+13
5.3190E+00								
94	114	61746	59356	326588	5.4774E+11	9.1845E-02	9.1845E-02	3.1776E+13
5.3541E+00								
95	115	61810	60141	329043	5.6338E+11	9.1202E-02	9.1202E-02	3.2310E+13
5.3499E+00								
96	116	69761	66687	366851	6.3762E+11	9.0388E-02	9.0388E-02	3.2811E+13
5.3272E+00								
97	117	77074	73733	401480	6.9322E+11	8.9869E-02	8.9869E-02	3.2638E+13
5.3138E+00								
98	118	81505	78053	426589	7.3212E+11	8.9542E-02	8.9542E-02	3.2459E+13
5.3083E+00								
99	119	84222	80678	440279	7.5713E+11	8.9557E-02	8.9557E-02	3.2516E+13
5.3108E+00								
100	121	86343	82676	452046	7.7932E+11	8.8786E-02	8.8786E-02	3.2488E+13
5.2974E+00								
101	122	86670	82995	452592	7.8930E+11	8.9021E-02	8.9021E-02	3.3047E+13
5.3040E+00								
102	123	86306	82664	450393	7.8654E+11	8.8913E-02	8.8913E-02	3.2946E+13
5.3002E+00								
103	124	84860	81223	440311	7.6301E+11	8.9228E-02	8.9228E-02	3.2854E+13
5.3080E+00								
104	125	82154	78661	428598	7.3335E+11	8.9662E-02	8.9662E-02	3.2405E+13
5.3114E+00								

105	126	78056	74750	406873	6.9767E+11	8.9884E-02	8.9884E-02	3.2472E+13
5.3183E+00								
106	127	73347	70215	384964	6.5401E+11	9.0664E-02	9.0664E-02	3.2144E+13
5.3307E+00								
107	128	65180	62354	342406	5.7862E+11	9.0328E-02	9.0328E-02	3.2064E+13
5.3214E+00								
108	129	53635	51885	286942	4.9443E+11	9.3007E-02	9.3007E-02	3.2686E+13
5.3813E+00								
109	131	60214	57963	319847	5.5404E+11	9.1257E-02	9.1257E-02	3.2737E+13
5.3375E+00								
110	132	67864	64933	355111	6.0199E+11	9.0944E-02	9.0944E-02	3.2155E+13
5.3288E+00								
111	133	72967	69997	383753	6.5814E+11	8.9715E-02	8.9715E-02	3.2520E+13
5.3146E+00								
112	134	76505	73232	400047	6.8964E+11	9.0296E-02	9.0296E-02	3.2675E+13
5.3280E+00								
113	135	78981	75690	411905	7.0831E+11	9.0089E-02	9.0089E-02	3.2705E+13
5.3216E+00								
114	136	79651	76320	417979	7.0872E+11	8.9537E-02	8.9537E-02	3.1935E+13
5.3100E+00								
115	137	79950	76622	416300	7.1497E+11	8.9692E-02	8.9692E-02	3.2639E+13
5.3142E+00								
116	138	79337	76035	415856	7.1787E+11	8.9426E-02	8.9426E-02	3.2618E+13
5.3087E+00								
117	139	76975	73792	403620	6.9878E+11	9.0431E-02	9.0431E-02	3.2895E+13
5.3280E+00								
118	141	74321	71115	387639	6.6219E+11	9.0013E-02	9.0013E-02	3.2283E+13
5.3207E+00								
119	142	69448	66486	364840	6.3184E+11	8.9935E-02	8.9935E-02	3.2935E+13
5.3139E+00								
120	143	63794	61129	335381	5.6802E+11	9.0094E-02	9.0094E-02	3.1976E+13
5.3125E+00								
121	144	54061	51970	285196	5.0027E+11	9.1663E-02	9.1663E-02	3.3242E+13
5.3485E+00								
122	145	48454	47415	262793	4.5103E+11	9.2713E-02	9.2713E-02	3.2412E+13
5.3769E+00								
123	146	53628	51932	285087	4.9845E+11	9.2645E-02	9.2645E-02	3.3121E+13
5.3708E+00								
124	147	58845	56825	312813	5.3894E+11	9.2074E-02	9.2074E-02	3.2614E+13
5.3631E+00								
125	148	62730	60647	333333	5.7232E+11	9.0341E-02	9.0341E-02	3.2553E+13
5.3316E+00								
126	149	64735	62578	343856	5.9005E+11	9.0864E-02	9.0864E-02	3.2517E+13
5.3399E+00								
127	151	66021	63893	351196	6.1535E+11	9.0356E-02	9.0356E-02	3.3057E+13
5.3352E+00								
128	152	66270	64022	349991	5.9643E+11	9.0107E-02	9.0107E-02	3.2302E+13
5.3281E+00								
129	153	66378	64220	351648	6.1626E+11	9.0018E-02	9.0018E-02	3.3291E+13
5.3264E+00								
130	154	65295	63202	347163	6.0167E+11	9.0777E-02	9.0777E-02	3.2692E+13
5.3412E+00								
131	155	63124	60990	333862	5.7985E+11	9.0994E-02	9.0994E-02	3.2958E+13
5.3436E+00								
132	156	60161	58195	319662	5.5228E+11	9.2426E-02	9.2426E-02	3.2772E+13
5.3735E+00								
133	157	56014	54145	301488	5.1455E+11	9.1402E-02	9.1402E-02	3.2247E+13
5.3489E+00								
134	158	49591	47914	264865	4.6092E+11	9.2907E-02	9.2907E-02	3.3064E+13
5.3771E+00								
135	159	40908	39748	221118	3.7855E+11	9.4233E-02	9.4233E-02	3.2292E+13
5.3996E+00								
136	1200	439702	409019	5653	9.5096E+09	4.0212E-01	4.0212E-01	3.1670E+13
7.8242E+03								
137	1201	4880566	4791255	20930518	3.3814E+13	3.5918E-01	3.5918E-01	2.9991E+13
3.6538E+00								
138	1202	2809539	2737377	13878453	2.2767E+12	3.6769E-01	3.6769E-01	2.7913E+13
3.7603E+00								
139	12021	16014866	15825446	69997680	3.8265E+13	3.9399E-01	3.9399E-01	3.0421E+13
3.7987E+00								
140	1203	14665736	14572141	64455544	3.4528E+13	3.6408E-01	3.6408E-01	2.9733E+13
3.6798E+00								
141	1204	3905284	3805068	19152474	3.1740E+12	3.5414E-01	3.5414E-01	2.8234E+13
3.6960E+00								
142	12041	26370488	26096347	114094393	6.2472E+13	3.9226E-01	3.9226E-01	3.0456E+13
3.7857E+00								
143	1205	25326940	25156949	109225339	5.8869E+13	3.6634E-01	3.6634E-01	2.9976E+13
3.6867E+00								
144	1206	140880	137370	669383	1.0672E+11	3.2044E-01	3.2044E-01	2.6852E+13
3.5409E+00								

145	12061	953937	943775	4069035	2.1314E+12	2.5962E-01	2.5962E-01	2.9229E+13
3.1833E+00								
146	1207	1076640	1069565	4357628	2.3427E+12	1.7551E-01	1.7551E-01	3.0263E+13
2.7898E+00								
147	1208	3754812	3659192	18337612	3.0546E+12	3.5299E-01	3.5299E-01	2.8357E+13
3.6911E+00								
148	12081	25632812	25357973	110281533	6.0645E+13	3.9122E-01	3.9122E-01	3.0587E+13
3.7806E+00								
149	1209	25213291	25048319	108362379	5.8849E+13	3.6473E-01	3.6473E-01	3.0162E+13
3.6790E+00								
150	1210	770984	753530	2677394	4.5451E+12	1.2861E-01	1.2861E-01	3.1817E+13
2.3948E+00								
151	1211	168631728	166196168	774383065	4.5417E+14	4.1018E-01	4.1018E-01	3.2706E+13
3.9981E+00								
152	12111	45971353	44785197	231548820	4.3216E+13	3.9567E-01	3.9567E-01	3.1912E+13
4.0024E+00								
154	9998	7965915	5841811	767498	1.3510E+12	1.2141E-01	1.2141E-01	3.3009E+13
5.4303E+03								
155	9997	8862040	6355879	808946	1.4271E+12	1.1868E-01	1.1868E-01	3.3125E+13
5.3888E+03								
156	9996	6085369	4356474	541042	9.4494E+11	1.2235E-01	1.2235E-01	3.2878E+13
5.4427E+03								
157	9995	119282931	109359136	5353556	9.6865E+12	4.1776E-01	4.1776E-01	3.3192E+13
7.9312E+03								
158	9994	114607287	97357203	8125580	1.4902E+13	4.0392E-01	4.0392E-01	3.3717E+13
7.8442E+03								
159	9993	320508	265700	14916	2.4664E+10	1.3386E-01	1.3386E-01	3.1261E+13
5.6608E+03								
160	9992	718644	631735	73356	1.2308E+11	1.4672E-01	1.4672E-01	3.1428E+13
5.8079E+03								
161	9991	655890	609572	3182	5.3889E+09	1.5766E-01	1.5766E-01	3.1640E+13
5.9270E+03								
162	9990	1137331	1048977	61608	1.0351E+11	1.9229E-01	1.9229E-01	3.1391E+13
6.2142E+03								
163	9989	6557787	5300259	345895	5.8476E+11	3.5262E-01	3.5262E-01	3.1110E+13
7.4833E+03								
164	9988	16406970	15682705	2669099	1.6258E+11	4.6201E-01	4.6201E-01	3.1321E+13
8.6198E+03								
166	9986	202693	202692	1107	1.6445E+09	1.6774E-01	1.6774E-01	3.0803E+13
5.9015E+03								
167	10000	22675	22308	88020	1.4569E+11	3.7486E-01	3.7486E-01	3.0776E+13
3.7393E+00								
168	10001	35165	34590	132894	2.2115E+11	3.9671E-01	3.9671E-01	3.1199E+13
3.8210E+00								
169	10002	97144	96057	402123	6.3595E+11	3.9420E-01	3.9420E-01	2.8977E+13
3.7997E+00								
170	10003	34805	34266	132334	2.2321E+11	3.9508E-01	3.9508E-01	3.1613E+13
3.8195E+00								
171	10004	24390	24045	92209	1.5614E+11	4.0533E-01	4.0533E-01	3.1715E+13
3.8584E+00								
172	10005	996	979	3565	5.1872E+09	3.6108E-01	3.6108E-01	2.5781E+13
3.6507E+00								
173	2001	16375245	15460922	3332142	2.0335E+11	4.4019E-01	4.4019E-01	3.1311E+13
8.3946E+03								
174	2002	33488460	30021159	18239141	5.5777E+11	3.8702E-01	3.8702E-01	3.1391E+13
7.8915E+03								
175	2003	32907994	28759415	20610997	6.3079E+11	3.3232E-01	3.3232E-01	3.1425E+13
7.3603E+03								
176	2004	63953150	52751725	74486779	1.1411E+12	2.8576E-01	2.8576E-01	3.1459E+13
6.8894E+03								
177	2005	57601966	47310135	74427256	1.1402E+12	2.4957E-01	2.4957E-01	3.1480E+13
6.5088E+03								
178	2006	99231059	78449336	136840679	1.0477E+12	2.2741E-01	2.2741E-01	3.1473E+13
6.2674E+03								
179	2007	82389213	65954623	118492672	9.0685E+11	2.1321E-01	2.1321E-01	3.1464E+13
6.1089E+03								
180	2008	130273116	101657008	280509225	1.0742E+12	2.0226E-01	2.0226E-01	3.1474E+13
5.9847E+03								
181	2009	90427808	71625013	199383296	7.6293E+11	1.9419E-01	1.9419E-01	3.1463E+13
5.8924E+03								
182	2010	118658917	93112421	340402727	6.5127E+11	1.8921E-01	1.8921E-01	3.1454E+13
5.8347E+03								
183	2011	67333469	53324343	195094545	3.7310E+11	1.8640E-01	1.8640E-01	3.1441E+13
5.8023E+03								
184	2012	74537425	58332143	217283942	2.0762E+11	1.8538E-01	1.8538E-01	3.1421E+13
5.7909E+03								
185	2013	40606166	32033880	118901237	1.1356E+11	1.8525E-01	1.8525E-01	3.1422E+13
5.7903E+03								
186	2014	43760445	33749504	128409879	6.1365E+10	1.8557E-01	1.8557E-01	3.1428E+13
5.7941E+03								

```
   187   2015    19618118     16553015    110201797    5.2595E+10   1.9216E-01   1.9216E-01   3.1381E+13
5.8699E+03
   188    200     2046612      1832682      4056114    7.1466E+12   4.9183E-01   4.9183E-01   3.1973E+13
1.2895E+00
   189    201     2242863      2001415      4461099    7.8300E+12   4.9190E-01   4.9190E-01   3.1847E+13
1.2870E+00
   190    202     2478060      2207383      4941785    8.6613E+12   5.0201E-01   5.0201E-01   3.1992E+13
1.3037E+00
   191    203     2656963      2362221      5305240    9.4087E+12   5.0607E-01   5.0607E-01   3.2521E+13
1.3113E+00
   192    204     2760788      2452392      5519388    9.7015E+12   5.0302E-01   5.0302E-01   3.1860E+13
1.3070E+00
   193    205     2798986      2484606      5594079    1.0013E+13   5.0685E-01   5.0685E-01   3.2688E+13
1.3145E+00
   194    206     2730851      2424779      5469325    9.6864E+12   5.0280E-01   5.0280E-01   3.2393E+13
1.3074E+00
   195    207     2562915      2277818      5113605    9.0008E+12   5.0124E-01   5.0124E-01   3.1885E+13
1.3035E+00
   196    208     2337707      2080387      4661610    8.1771E+12   5.0074E-01   5.0074E-01   3.2070E+13
1.3039E+00
   197    209     2083350      1853699      4126880    7.1985E+12   5.0488E-01   5.0488E-01   3.1894E+13
1.3125E+00
   198    210     1744928      1555919      3436501    5.9392E+12   5.2051E-01   5.2051E-01   3.1597E+13
1.3388E+00
   199    211     1139885      1029376      2210350    3.6242E+12   5.1261E-01   5.1261E-01   2.9418E+13
1.3265E+00
   200    212      559625       512041      1046572    1.6516E+12   4.9720E-01   4.9720E-01   2.8385E+13
1.3030E+00
   201    213      266617       245733       491389    7.5322E+11   4.7678E-01   4.7678E-01   2.7083E+13
1.2682E+00
   202    214      129846       120389       236842    3.6991E+11   4.6000E-01   4.6000E-01   2.7911E+13
1.2305E+00

     total    1659207260   1422635767   3831424048    1.0909E+15

1tally   2        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     1231
                         1.78374E+06

 surface  1231
                1.53794E-01 0.0065


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           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally   2

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)        <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.01      yes          yes             0.00      yes         yes            constant
random       4.00
 passed?        yes          yes      yes          yes               yes      yes         yes               yes
yes         yes


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 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart
to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.

 ----- estimated confidence intervals:  -----
```

```
 estimated asymmetric confidence interval(1,2,3 sigma): 1.5281E-01 to 1.5481E-01; 1.5181E-01 to 1.5582E-01;
1.5081E-01 to 1.5682E-01
 estimated  symmetric confidence interval(1,2,3 sigma): 1.5279E-01 to 1.5480E-01; 1.5179E-01 to 1.5580E-01;
1.5079E-01 to 1.5680E-01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally   2 with nps =     3139919  print
table 160


 normed average tally per history  = 1.53794E-01          unnormed average tally per history  = 2.74328E+05
 estimated tally relative error    = 0.0065               estimated variance of the variance  = 0.0027
 relative error from zero tallies  = 0.0024               relative error from nonzero scores  = 0.0060

 number of nonzero history tallies =      168039          efficiency for the nonzero tallies  = 0.0088
 history number of largest  tally  =     1104723          largest  unnormalized history tally = 5.32503E+09
 (largest  tally)/(average tally)  = 1.94112E+04          (largest  tally)/(avg nonzero tally)= 1.71329E+02

 (confidence interval shift)/mean  = 0.0001               shifted confidence interval center  = 1.53812E-01


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.

      mean                            1.53794E-01             1.54744E-01                    0.006182
      relative error                  6.51550E-03             6.56785E-03                    0.008035
      variance of the variance        2.72463E-03             3.19966E-03                    0.174344
      shifted center                  1.53812E-01             1.53915E-01                    0.000669
      figure of merit                 2.46711E+01             2.42794E+01                   -0.015878

 the estimated inverse power slope of the 200 largest  tallies starting at 1.00460E+09 is 4.0025
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*( 3.518E-02)**2 = (1.994E+04)*(1.237E-
03) = 2.467E+01

1tally  12        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     1227
               segment
                  1       1.00000E+50
                  2       2.56400E+07
                  3       1.03700E+08
                  4       1.60200E+08
                  5       3.92700E+08
                  6       5.49800E+08
                  7       7.06900E+08
                  8       8.63900E+08
                  9       1.59000E+09
                 10       1.94400E+09
                 11       3.14200E+09
                 12       3.77000E+09
                 13       4.39800E+09
                 14       5.02700E+09
                 15       5.65500E+09
                 16       1.68900E+10

 surface  1227
 segment:       -2000
                1.31438E-46 0.0067

 surface  1227
 segment:        2000    -2001
                9.05249E-04 0.0053

 surface  1227
 segment:        2000     2001    -2002
                6.04759E-04 0.0043

 surface  1227
 segment:        2000     2001     2002    -2003
                3.14315E-04 0.0049
```

```
 surface  1227
 segment:        2000     2001     2002     2003    -2004
                 1.51616E-04 0.0045

 surface  1227
 segment:        2000     2001     2002     2003     2004    -2005
                 7.05773E-05 0.0057

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005    -2006
                 3.31501E-05 0.0093

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006    -2007
                 1.61934E-05 0.0052

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007    -2008
                 7.27773E-06 0.0046

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008    -2009
                 2.90070E-06 0.0048

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009    -2010
                 1.06677E-06 0.0053

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
    -2011
                 3.52861E-07 0.0070

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     2011    -2012
                 1.21636E-07 0.0090

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     2011     2012    -2013
                 4.35808E-08 0.0153

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     2011     2012     2013    -2014
                 2.04653E-08 0.2087

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     2011     2012     2013     2014
                 3.48815E-09 0.0200


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          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  12

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)        <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.02      yes          yes             0.32      yes         yes            constant
increase     2.56
 passed?       yes          yes      yes          yes               no      yes         yes               yes
no          no


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 warning.  the tally in the tally fluctuation chart bin did not pass  3 of the 10 statistical checks.
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1analysis of the results in the tally fluctuation chart bin (tfc) for tally 12 with nps = 3139919 print table 160

normed average tally per history	= 3.48815E-09	unnormed average tally per history	= 5.89149E+01
estimated tally relative error	= 0.0200	estimated variance of the variance	= 0.3217
relative error from zero tallies	= 0.0033	relative error from nonzero scores	= 0.0198
number of nonzero history tallies	= 90753	efficiency for the nonzero tallies	= 0.0048
history number of largest tally	= 1000351	largest unnormalized history tally	= 1.68310E+07
(largest tally)/(average tally)	= 2.85683E+05	(largest tally)/(avg nonzero tally)	= 1.36180E+03
(confidence interval shift)/mean	= 0.0046	shifted confidence interval center	= 3.50428E-09

if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	3.48815E-09	3.80552E-09	0.090984
relative error	2.00356E-02	2.46564E-02	0.230627
variance of the variance	3.21716E-01	2.61384E-01	-0.187532
shifted center	3.50428E-09	3.60789E-09	0.029565
figure of merit	2.60903E+00	1.72276E+00	-0.339691

the estimated inverse power slope of the 200 largest tallies starting at 3.10464E+05 is 2.5587
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*(1.144E-02)**2 = (1.994E+04)*(1.308E-04) = 2.609E+00

1unnormed tally density for tally 12 nonzero tally mean(m) = 1.236E+04 nps = 3139919 print table 161

abscissa	ordinate	log plot of tally probability density function in tally fluctuation chart bin(d=decade,slope= 2.6)
tally	number num den	log den:d----------d----------d----------d----------d----------d----------d----------d-
2.00+03	4010 5.13-07	-6.290 ***********|***********|***********|***********|***********|***********|***********|******** |
2.51+03	12066 1.23-06	-5.911 ***********|***********|***********|***********|***********|***********|***********|*********** |*
3.16+03	11639 9.40-07	-6.027 ***********|***********|***********|***********|***********|***********|***********|***********|
3.98+03	10367 6.65-07	-6.177 ***********|***********|***********|***********|***********|***********|***********|********** |
5.01+03	9078 4.63-07	-6.335 ***********|***********|***********|***********|***********|***********|***********|******** |
6.31+03	8377 3.39-07	-6.470 ***********|***********|***********|***********|***********|***********|***********|****** |
7.94+03	7286 2.34-07	-6.630 ***********|***********|***********|***********|***********|***********|***********|**** |
1.00+04	6001 1.53-07	-6.815 ***********|***********|***********|***********|***********|***********|***********|** |
1.26+04	5041 1.02-07	-6.990 mmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm| |
1.58+04	3937 6.34-08	-7.198 ***********|***********|***********|***********|***********|********** | |
2.00+04	3098 3.97-08	-7.402 ***********|***********|***********|***********|***********|******** | |
2.51+04	2300 2.34-08	-7.631 ***********|***********|***********|***********|***********|***********|***********|***** | |
3.16+04	1685 1.36-08	-7.866 ***********|***********|***********|***********|***********|***********|***********|** | |
3.98+04	1461 9.37-09	-8.028 ***********|***********|***********|***********|***********|***********|***********| | |
5.01+04	1225 6.24-09	-8.205 ***********|***********|***********|***********|***********|***********|********** | | |
6.31+04	903 3.65-09	-8.437 ***********|***********|***********|***********|***********|*******| | |
7.94+04	640 2.06-09	-8.687 ***********|***********|***********|***********|***********|****| | |
1.00+05	434 1.11-09	-8.955 ***********|***********|***********|***********|***********|| | |
1.26+05	290 5.88-10	-9.230 ***********|***********|***********|***********|********** | | |

```
 1.58+05    213 3.43-10  -9.464 ***********|************|***********|************|******      |           |
|           |
 2.00+05    206 2.64-10  -9.579 ***********|************|***********|************|*****       |           |
|           |
 2.51+05    174 1.77-10  -9.752 ***********|************|***********|************|**          |           |
|           |
 3.16+05    129 1.04-10  -9.982 ***********|************|***********|************|          s |           |
|           |
 3.98+05     68 4.36-11 -10.360 ***********|************|***********|********    |        s   |           |
|           |
 5.01+05     41 2.09-11 -10.680 ***********|************|***********|****        |     s      |           |
|           |
 6.31+05     30 1.21-11 -10.916 ***********|************|***********|*           |   s        |           |
|           |
 7.94+05     18 5.79-12 -11.238 ***********|************|*********  |            | s          |           |
|           |
 1.00+06     11 2.81-12 -11.551 ***********|************|*****      |            s            |           |
|           |
 1.26+06     10 2.03-12 -11.693 ***********|************|***        |          s |            |           |
|           |
 1.58+06      3 4.83-13 -12.316 ***********|*********   |           |      s     |            |           |
|           |
 2.00+06      5 6.40-13 -12.194 ***********|**********  |           |    s       |            |           |
|           |
 2.51+06      1 1.02-13 -12.993 ***********|            |           | s          |            |           |
|           |
 3.16+06      1 8.08-14 -13.093 ***********|            |          s|            |            |           |
|           |
 3.98+06      1 6.41-14 -13.193 ********** |            |       s   |            |            |           |
|           |
 5.01+06      2 1.02-13 -12.992 ***********|            |    s      |            |            |           |
|           |
 6.31+06      1 4.05-14 -13.393 *******    |            | s         |            |            |           |
|           |
 7.94+06      0 0.00+00   0.000             |           s|           |            |            |           |
|           |
 1.00+07      0 0.00+00   0.000             |        s   |           |            |            |           |
|           |
 1.26+07      0 0.00+00   0.000             |     s      |           |            |            |           |
|           |
 1.58+07      0 0.00+00   0.000             |  s         |           |            |            |           |
|           |
 2.00+07      1 1.28-14 -13.893 *          s            |           |            |            |           |
|           |
  total   90753 4.77-03         d----------d------------d-----------d------------d-----------d-----------d------
------d-----------d-

1tally  22        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     1227
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
                 4       4.35376E+05
                 5       4.35376E+05
                 6       4.35376E+05
                 7       4.35376E+05
                 8       4.35376E+05
                 9       4.35376E+05
                10       4.35376E+05
                11       4.35376E+05
                12       4.35376E+05
                13       4.35376E+05
                14       4.35376E+05
                15       4.35376E+05
                16       4.35376E+05
                17       4.35376E+05
                18       4.35376E+05
                19       4.35376E+05
                20       4.35376E+05
                21       4.35376E+05
                22       1.00000E+50
```

```
surface  1227
segment:        1201
                1.66498E-45 0.0039

surface  1227
segment:       -1201    -2026
                6.74586E-46 0.0045

surface  1227
segment:       -1201     2026     2027
                5.53821E-46 0.0047

surface  1227
segment:       -1201     2026    -2027     2016
                4.21856E-04 0.0352

surface  1227
segment:       -1201     2026    -2027    -2016     2017
                6.13409E-04 0.0278

surface  1227
segment:       -1201     2026    -2027    -2016    -2017     2018
                7.84311E-04 0.0275

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018     2019
                9.31937E-04 0.0219

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019     2020
                1.12141E-03 0.0252

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020     2021
                1.30202E-03 0.0295

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021     2022
                1.37535E-03 0.0422

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022     2023
                1.43535E-03 0.0299

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     2024
                1.40791E-03 0.0301

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024     2025
                1.39962E-03 0.0313

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025     2028
                1.33948E-03 0.0271

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028     2029
                1.29741E-03 0.0284

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029     2030
                1.35276E-03 0.0470

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030     2031
                1.15230E-03 0.0305

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031     2032
                1.17936E-03 0.0351

surface  1227
```

```
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     -2024    -2025    -2028    -2029    -2030    -2031    -2032     2033
                1.07801E-03 0.0395

 surface  1227
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033     2034
                1.01225E-03 0.0409

 surface  1227
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034     2035
                1.00598E-03 0.0407

 surface  1227
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034    -2035
                9.87081E-47 0.0116
```

==========

results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally 22

tfc bin	--mean--	---------relative error---------			----variance of the variance----			--figure of merit--
-pdf-								
behavior	behavior	value	decrease	decrease rate	value	decrease	decrease rate	value
behavior	slope							
desired	random	<0.10	yes	1/sqrt(nps)	<0.10	yes	1/nps	constant
random	>3.00							
observed	random	0.01	yes	yes	0.07	yes	yes	constant
random	2.38							
passed?	yes	yes	yes	yes	yes	yes	yes	yes
yes	no							

==========

warning. the tally in the tally fluctuation chart bin did not pass 1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally 22 with nps =   3139919 print table 160

normed average tally per history	= 9.87081E-47	unnormed average tally per history	= 9.87081E+03
estimated tally relative error	= 0.0116	estimated variance of the variance	= 0.0721
relative error from zero tallies	= 0.0018	relative error from nonzero scores	= 0.0114
number of nonzero history tallies	= 289596	efficiency for the nonzero tallies	= 0.0152
history number of largest tally	= 173359	largest unnormalized history tally	= 1.09424E+09
(largest tally)/(average tally)	= 1.10856E+05	(largest tally)/(avg nonzero tally)	= 1.68624E+03
(confidence interval shift)/mean	= 0.0011	shifted confidence interval center	= 9.88148E-47

if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	9.87081E-47	1.02193E-46	0.035305
relative error	1.15796E-02	1.28757E-02	0.111936
variance of the variance	7.21389E-02	8.69497E-02	0.205309
shifted center	9.88148E-47	9.95776E-47	0.007720
figure of merit	7.81087E+00	6.31742E+00	-0.191202

the estimated inverse power slope of the 200 largest tallies starting at 3.75667E+07 is 2.3752
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*(1.979E-02)**2 = (1.994E+04)*(3.917E-04) = 7.811E+00

```
1unnormed tally density for tally  22            nonzero tally mean(m) = 6.489E+05   nps =     3139919  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.4)
  tally  number num den log den:d----------d----------d----------d----------d----------d----------d----------
-d----------d------
 2.00+03     23 2.94-09  -8.531
***********|**********|***********|***********|***********|**********|***********|***         |
 2.51+03     68 6.91-09  -8.160
***********|**********|***********|***********|***********|**********|***********|*******     |
 3.16+03     56 4.52-09  -8.345
***********|**********|***********|***********|***********|**********|***********|*****       |
 3.98+03    133 8.53-09  -8.069
***********|**********|***********|***********|***********|**********|***********|********    |
 5.01+03    280 1.43-08  -7.846
***********|**********|***********|***********|***********|**********|***********|***********|
 6.31+03    255 1.03-08  -7.986
***********|**********|***********|***********|***********|**********|***********|*********   |
 7.94+03    590 1.90-08  -7.722
***********|**********|***********|***********|***********|**********|***********|***********|*
 1.00+04   1339 3.42-08  -7.466
***********|**********|***********|***********|***********|**********|***********|***********|****
 1.26+04   1255 2.55-08  -7.594
***********|**********|***********|***********|***********|**********|***********|***********|**
 1.58+04   2083 3.36-08  -7.474
***********|**********|***********|***********|***********|**********|***********|***********|***
 2.00+04   4050 5.18-08  -7.285
***********|**********|***********|***********|***********|**********|***********|***********|******
 2.51+04   3774 3.84-08  -7.416
***********|**********|***********|***********|***********|**********|***********|***********|****
 3.16+04   4840 3.91-08  -7.408
***********|**********|***********|***********|***********|**********|***********|***********|****
 3.98+04   7808 5.01-08  -7.300
***********|**********|***********|***********|***********|**********|***********|***********|*****
 5.01+04   6983 3.56-08  -7.449
***********|**********|***********|***********|***********|**********|***********|***********|****
 6.31+04   9693 3.92-08  -7.406
***********|**********|***********|***********|***********|**********|***********|***********|****
 7.94+04  17191 5.53-08  -7.258
***********|**********|***********|***********|***********|**********|***********|***********|******
 1.00+05  16484 4.21-08  -7.376
***********|**********|***********|***********|***********|**********|***********|***********|*****
 1.26+05  18461 3.74-08  -7.427
***********|**********|***********|***********|***********|**********|***********|***********|****
 1.58+05  26683 4.30-08  -7.367
***********|**********|***********|***********|***********|**********|***********|***********|*****
 2.00+05  26392 3.38-08  -7.471
***********|**********|***********|***********|***********|**********|***********|***********|***
 2.51+05  25016 2.54-08  -7.595
***********|**********|***********|***********|***********|**********|***********|***********|**
 3.16+05  23244 1.88-08  -7.726
***********|**********|***********|***********|***********|**********|***********|***********|
 3.98+05  19875 1.27-08  -7.894
***********|**********|***********|***********|***********|**********|***********|***********|
 5.01+05  15999 8.15-09  -8.089
***********|**********|***********|***********|***********|**********|***********|********    |
 6.31+05  13069 5.29-09  -8.277
***********|**********|***********|***********|***********|**********|***********|******      |
 7.94+05   9849 3.17-09  -8.499
mmmmmmmmmmmm|mmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmmm|mmmmmmmmmmmm|mmmmmmmmmmmmm|mmm          |
 1.00+06   7484 1.91-09  -8.719
***********|**********|***********|***********|***********|**********|***********|*           |
 1.26+06   5530 1.12-09  -8.950 ***********|**********|***********|***********|***********|**********|**********
|           |
 1.58+06   4190 6.75-10  -9.171 ***********|**********|***********|***********|***********|**********|********
|           |
 2.00+06   2925 3.74-10  -9.427 ***********|**********|***********|***********|***********|**********|*****
|           |
 2.51+06   2347 2.39-10  -9.622 ***********|**********|***********|***********|***********|**********|**
|           |
 3.16+06   2097 1.69-10  -9.771 ***********|**********|***********|***********|***********|**********|
|           |
 3.98+06   1648 1.06-10  -9.976 ***********|**********|***********|***********|***********|********* |
|           |
 5.01+06   1544 7.87-11 -10.104 ***********|**********|***********|***********|***********|********  |
|           |
 6.31+06   1277 5.17-11 -10.287 ***********|**********|***********|***********|***********|*****     |
|           |
```

```
 7.94+06   1151 3.70-11 -10.432 ***********|**********|***********|***********|***********|****      |
|           |
 1.00+07   1097 2.80-11 -10.553 ***********|**********|***********|***********|***********|**        |
|           |
 1.26+07    897 1.82-11 -10.740 ***********|**********|***********|***********|***********|          |
|           |
 1.58+07    736 1.19-11 -10.926 ***********|**********|***********|***********|********** |          |
|           |
 2.00+07    452 5.79-12 -11.238 ***********|**********|***********|***********|******     |          |
|           |
 2.51+07    265 2.69-12 -11.570 ***********|**********|***********|***********|**         |          |
|           |
 3.16+07    185 1.49-12 -11.826 ***********|**********|***********|***********|           |          |
|           |
 3.98+07     97 6.22-13 -12.206 ***********|**********|***********|*******    |    s      |          |
|           |
 5.01+07     68 3.46-13 -12.460 ***********|**********|***********|****       |  s        |          |
|           |
 6.31+07     36 1.46-13 -12.837 ***********|**********|***********|           | s         |          |
|           |
 7.94+07     29 9.32-14 -13.030 ***********|**********|*********  |           s           |          |
|           |
 1.00+08     11 2.81-14 -13.551 ***********|**********|***        |         s  |          |          |
|           |
 1.26+08      5 1.01-14 -13.994 ***********|********* |           |      s    |          |          |
|           |
 1.58+08      8 1.29-14 -13.890 ***********|**********|           |    s      |          |          |
|           |
 2.00+08      5 6.40-15 -14.194 ***********|*******   |           |  s        |          |          |
|           |
 2.51+08      7 7.12-15 -14.148 ***********|*******   |           s           |          |          |
|           |
 3.16+08      5 4.04-15 -14.394 ***********|****      |          s |          |          |          |
|           |
 3.98+08      5 3.21-15 -14.494 ***********|***       |      s    |          |          |          |
|           |
 5.01+08      1 5.10-16 -15.293 ******     |          |   s       |          |          |          |
|           |
 6.31+08      0 0.00+00   0.000            |          | s         |          |          |          |
|           |
 7.94+08      0 0.00+00   0.000            |         s|           |          |          |          |
|           |
 1.00+09      0 0.00+00   0.000            |      s   |           |          |          |          |
|           |
 1.26+09      1 2.03-16 -15.693 *          |    s     |           |          |          |          |
|           |
  total  289596 1.52-02         d----------d----------d-----------d-----------d-----------d----------d----------
-d-----------d------

1tally  32        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     1201
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
                 4       1.00000E+50
                 5       6.30000E+05

 surface  1201
 segment:        1231
                 6.63739E-46 0.0089

 surface  1201
 segment:       -1231    -2026
                 5.10268E-49 0.1273

 surface  1201
 segment:       -1231     2026     2027
                 1.26565E-48 0.0751

 surface  1201
 segment:       -1231     2026    -2027    -1227
                 0.00000E+00 0.0000
```

```
 surface  1201
 segment:       -1231     2026    -2027     1227
                 4.04194E-04 0.0636


================================================================================================================================
==================

          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  32

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value   decrease   decrease rate      value   decrease   decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.06      yes          yes            0.28       no          no            decrease
random       2.77
 passed?        yes          yes      yes          yes              no       no          no                no
yes          no


================================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  5 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  32 with nps =     3139919  print
table 160


 normed average tally per history  = 4.04194E-04          unnormed average tally per history  = 2.54642E+02
 estimated tally relative error    = 0.0636               estimated variance of the variance  = 0.2808
 relative error from zero tallies  = 0.0158               relative error from nonzero scores  = 0.0616

 number of nonzero history tallies =        3998          efficiency for the nonzero tallies  = 0.0002
 history number of largest  tally  =     2800437          largest  unnormalized history tally = 2.21129E+08
 (largest  tally)/(average tally)  = 8.68391E+05          (largest  tally)/(avg nonzero tally)= 1.82359E+02

 (confidence interval shift)/mean  = 0.0139               shifted confidence interval center  = 4.09807E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1          value(nps+1)/value(nps)-1.

      mean                            4.04194E-04            5.15980E-04                   0.276564
      relative error                  6.35562E-02            7.48153E-02                   0.177152
      variance of the variance        2.80801E-01            2.37920E-01                  -0.152712
      shifted center                  4.09807E-04            4.45658E-04                   0.087484
      figure of merit                 2.59279E-01            1.87112E-01                  -0.278336

 the estimated inverse power slope of the 199 largest  tallies starting at 4.37406E+06 is 2.7658
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*( 3.606E-03)**2 = (1.994E+04)*(1.300E-
05) = 2.593E-01

1unnormed tally density for tally  32            nonzero tally mean(m) = 1.213E+06   nps =     3139919  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.8)
  tally  number num den log den:d----------------d----------------d----------------d----------------d----------
-------d------------
 2.51+05    149 1.51-10  -9.820
*****************|****************|****************|****************|****************|****
 3.16+05    569 4.60-10  -9.338
*****************|****************|****************|****************|****************|************
 3.98+05    671 4.30-10  -9.366
*****************|****************|****************|****************|****************|************
```

```
 5.01+05    624 3.18-10  -9.498
****************|****************|****************|****************|****************|*********
 6.31+05    515 2.08-10  -9.681
****************|****************|****************|****************|****************|******
 7.94+05    387 1.24-10  -9.905
****************|****************|****************|****************|****************|**
 1.00+06    290 7.41-11 -10.130
****************|****************|****************|****************|**************** |
 1.26+06    190 3.85-11 -10.414
mmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmm|mmmmmmmmmmmm       |
 1.58+06    144 2.32-11 -10.634 ****************|****************|****************|****************|*******
|
 2.00+06    101 1.29-11 -10.888 ****************|****************|****************|****************|***
|
 2.51+06     70 7.12-12 -11.148 ****************|****************|****************|*************** |
|
 3.16+06     46 3.71-12 -11.430 ****************|****************|****************|**********      |
|
 3.98+06     30 1.92-12 -11.716 ****************|****************|****************|*****           |
|
 5.01+06     54 2.75-12 -11.560 ****************|****************|****************|********        |s
|
 6.31+06     34 1.38-12 -11.861 ****************|****************|****************|***            s|
|
 7.94+06     36 1.16-12 -11.937 ****************|****************|****************|*           s   |
|
 1.00+07     35 8.94-13 -12.049 ****************|****************|****************|         s      |
|
 1.26+07     15 3.04-13 -12.517 ****************|****************|*********       |      s         |
|
 1.58+07     13 2.09-13 -12.679 ****************|****************|*******         |   s            |
|
 2.00+07      6 7.68-14 -13.115 ****************|****************|                s               |
|
 2.51+07      6 6.10-14 -13.215 ****************|**************  |              s  |                |
|
 3.16+07      3 2.42-14 -13.616 ****************|*******         |          s      |                |
|
 3.98+07      3 1.92-14 -13.716 ****************|*****           |      s          |                |
|
 5.01+07      4 2.04-14 -13.691 ****************|******          | s               |                |
|
 6.31+07      1 4.05-15 -14.393 ***********      |              s |                 |                |
|
 7.94+07      0 0.00+00   0.000                  |          s     |                 |                |
|
 1.00+08      0 0.00+00   0.000                  |     s          |                 |                |
|
 1.26+08      1 2.03-15 -14.693 ******           | s              |                 |                |
|
 1.58+08      0 0.00+00   0.000               s  |                |                 |                |
|
 2.00+08      0 0.00+00   0.000          s       |                |                 |                |
|
 2.51+08      1 1.02-15 -14.993 *    s           |                |                 |                |
|
  total    3998 2.10-04         d----------------d----------------d----------------d----------------d----------
-------d------------

1tally  42        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     2003         2004         2005         2006         2007         2008         2009
               segment
                  1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
```

```
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
              surface:     2010         2011         2012         2013
             segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:       1219
                9.82886E-45 0.0031

 surface  2003
 segment:      -1219    -1209
                1.11257E-47 0.0121

 surface  2003
 segment:      -1219     1209     1201
                1.00488E-46 0.0057

 surface  2003
 segment:      -1219     1209    -1201    -1205
                4.27905E-47 0.0077

 surface  2003
 segment:      -1219     1209    -1201     1205     1206
                3.36870E-47 0.0085

 surface  2003
 segment:      -1219     1209    -1201     1205    -1206
                3.32279E-04 0.0148

 surface  2004
 segment:       1219
                8.67136E-45 0.0031

 surface  2004
 segment:      -1219    -1209
                7.03013E-48 0.0125

 surface  2004
 segment:      -1219     1209     1201
                5.96274E-47 0.0056

 surface  2004
 segment:      -1219     1209    -1201    -1205
                2.78894E-47 0.0076

 surface  2004
 segment:      -1219     1209    -1201     1205     1206
                2.23279E-47 0.0082

 surface  2004
 segment:      -1219     1209    -1201     1205    -1206
                1.31890E-04 0.0164

 surface  2005
 segment:       1219
                7.38179E-45 0.0032

 surface  2005
 segment:      -1219    -1209
                4.33830E-48 0.0142

 surface  2005
 segment:      -1219     1209     1201
                3.63117E-47 0.0062

 surface  2005
 segment:      -1219     1209    -1201    -1205
                1.75052E-47 0.0083

 surface  2005
 segment:      -1219     1209    -1201     1205     1206
                1.41761E-47 0.0083

 surface  2005
```

```
segment:       -1219     1209    -1201     1205    -1206
                5.98833E-05 0.0194

surface  2006
segment:        1219
                6.09349E-45 0.0032

surface  2006
segment:       -1219    -1209
                2.69356E-48 0.0141

surface  2006
segment:       -1219     1209     1201
                2.23838E-47 0.0062

surface  2006
segment:       -1219     1209    -1201    -1205
                1.10389E-47 0.0083

surface  2006
segment:       -1219     1209    -1201     1205     1206
                8.98951E-48 0.0087

surface  2006
segment:       -1219     1209    -1201     1205    -1206
                2.99353E-05 0.0261

surface  2007
segment:        1219
                4.90774E-45 0.0032

surface  2007
segment:       -1219    -1209
                1.65170E-48 0.0156

surface  2007
segment:       -1219     1209     1201
                1.38535E-47 0.0069

surface  2007
segment:       -1219     1209    -1201    -1205
                6.84149E-48 0.0085

surface  2007
segment:       -1219     1209    -1201     1205     1206
                5.59710E-48 0.0089

surface  2007
segment:       -1219     1209    -1201     1205    -1206
                1.48256E-05 0.0295

surface  2008
segment:        1219
                3.42195E-45 0.0033

surface  2008
segment:       -1219    -1209
                8.20767E-49 0.0196

surface  2008
segment:       -1219     1209     1201
                6.74201E-48 0.0079

surface  2008
segment:       -1219     1209    -1201    -1205
                3.43769E-48 0.0099

surface  2008
segment:       -1219     1209    -1201     1205     1206
                2.78220E-48 0.0104

surface  2008
segment:       -1219     1209    -1201     1205    -1206
                5.92448E-06 0.0352

surface  2009
segment:        1219
                2.31097E-45 0.0034

surface  2009
```

```
segment:       -1219    -1209
                4.14911E-49 0.0248

surface  2009
segment:       -1219     1209     1201
                3.32104E-48 0.0099

surface  2009
segment:       -1219     1209    -1201    -1205
                1.70908E-48 0.0120

surface  2009
segment:       -1219     1209    -1201     1205     1206
                1.38063E-48 0.0127

surface  2009
segment:       -1219     1209    -1201     1205    -1206
                2.21795E-06 0.0398

surface  2010
segment:        1219
                1.32500E-45 0.0035

surface  2010
segment:       -1219    -1209
                1.61988E-49 0.0335

surface  2010
segment:       -1219     1209     1201
                1.31590E-48 0.0120

surface  2010
segment:       -1219     1209    -1201    -1205
                6.84256E-49 0.0153

surface  2010
segment:       -1219     1209    -1201     1205     1206
                5.37523E-49 0.0168

surface  2010
segment:       -1219     1209    -1201     1205    -1206
                8.22519E-07 0.0910

surface  2011
segment:        1219
                7.41132E-46 0.0036

surface  2011
segment:       -1219    -1209
                6.17330E-50 0.0340

surface  2011
segment:       -1219     1209     1201
                5.11856E-49 0.0147

surface  2011
segment:       -1219     1209    -1201    -1205
                2.80927E-49 0.0274

surface  2011
segment:       -1219     1209    -1201     1205     1206
                2.12740E-49 0.0227

surface  2011
segment:       -1219     1209    -1201     1205    -1206
                2.53600E-07 0.0671

surface  2012
segment:        1219
                4.07240E-46 0.0037

surface  2012
segment:       -1219    -1209
                2.43050E-50 0.0425

surface  2012
segment:       -1219     1209     1201
                2.06228E-49 0.0187

surface  2012
```

```
 segment:       -1219     1209    -1201    -1205
                 1.11686E-49 0.0217

 surface  2012
 segment:       -1219     1209    -1201     1205     1206
                 8.93248E-50 0.0426

 surface  2012
 segment:       -1219     1209    -1201     1205    -1206
                 8.49130E-08 0.0869

 surface  2013
 segment:        1219
                 2.21654E-46 0.0040

 surface  2013
 segment:       -1219    -1209
                 1.16522E-50 0.0729

 surface  2013
 segment:       -1219     1209     1201
                 9.62484E-50 0.0948

 surface  2013
 segment:       -1219     1209    -1201    -1205
                 4.83120E-50 0.0405

 surface  2013
 segment:       -1219     1209    -1201     1205     1206
                 3.51985E-50 0.0387

 surface  2013
 segment:       -1219     1209    -1201     1205    -1206
                 2.55774E-08 0.1099


================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  42

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.01      yes          yes            0.02      yes         yes            constant
random       2.66
 passed?        yes          yes      yes          yes             yes      yes         yes               yes
yes          no


================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  42 with nps =     3139919  print
table 160


 normed average tally per history  = 3.32279E-04          unnormed average tally per history  = 9.96837E+02
 estimated tally relative error    = 0.0148               estimated variance of the variance  = 0.0164
 relative error from zero tallies  = 0.0050               relative error from nonzero scores  = 0.0139

 number of nonzero history tallies =       39234          efficiency for the nonzero tallies  = 0.0021
 history number of largest  tally  =     3135803          largest  unnormalized history tally = 7.63468E+07
 (largest  tally)/(average tally)  = 7.65890E+04          (largest  tally)/(avg nonzero tally)= 1.57833E+02

 (confidence interval shift)/mean  = 0.0007               shifted confidence interval center  = 3.32514E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:
```

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	3.32279E-04	3.40384E-04	0.024392
relative error	1.48146E-02	1.52809E-02	0.031473
variance of the variance	1.63679E-02	1.89485E-02	0.157662
shifted center	3.32514E-04	3.33884E-04	0.004120
figure of merit	4.77202E+00	4.48524E+00	-0.060094

the estimated inverse power slope of the 200 largest tallies starting at 6.31609E+06 is 2.6620
the large score tail of the empirical history score probability density function appears to have no unsampled regions.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*(1.547E-02)**2 = (1.994E+04)*(2.393E-04) = 4.772E+00

1unnormed tally density for tally 42 nonzero tally mean(m) = 4.837E+05 nps = 3139919 print table 161

abscissa ordinate log plot of tally probability density function in tally fluctuation chart bin(d=decade,slope= 2.7)

tally	number	num den	log den:	d	d	d	d	d	d
6.31+04	595	2.41-09	-8.618						
7.94+04	1952	6.28-09	-8.202						*
1.00+05	1941	4.96-09	-8.305						
1.26+05	2737	5.55-09	-8.256						
1.58+05	5287	8.52-09	-8.070						***
2.00+05	4847	6.20-09	-8.207						*
2.51+05	4578	4.65-09	-8.332						
3.16+05	3837	3.10-09	-8.509						
3.98+05	3341	2.14-09	-8.669						
5.01+05	2687	1.37-09	-8.864						
6.31+05	1912	7.74-10	-9.111					**	
7.94+05	1366	4.39-10	-9.357						
1.00+06	851	2.17-10	-9.663						
1.26+06	640	1.30-10	-9.887						
1.58+06	604	9.73-11	-10.012						
2.00+06	435	5.57-11	-10.254						
2.51+06	476	4.84-11	-10.315						
3.16+06	412	3.33-11	-10.478						
3.98+06	260	1.67-11	-10.778						
5.01+06	185	9.43-12	-11.026						
6.31+06	91	3.68-12	-11.434						
7.94+06	72	2.31-12	-11.635					s	
1.00+07	44	1.12-12	-11.949				s		
1.26+07	26	5.27-13	-12.278			s			
1.58+07	19	3.06-13	-12.514			s			
2.00+07	11	1.41-13	-12.851		s				
2.51+07	4	4.07-14	-13.391		s				
3.16+07	12	9.69-14	-13.014	s					
3.98+07	3	1.92-14	-13.716	s					

```
 5.01+07      5 2.55-14 -13.594 ***********    |         s     |               |               |
|               |
 6.31+07      2 8.10-15 -14.092 ***            |     s         |               |               |
|               |
 7.94+07      2 6.43-15 -14.192 *              | s             |               |               |
|               |
  total   39234 2.06-03         d--------------d---------------d---------------d---------------d---------------
d---------------d---

1tally  52        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     2003         2004         2005         2006         2007         2008         2009
               segment
                  1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
                surface:     2010         2011         2012         2013
               segment
                  1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:        1219
                 9.82886E-45 0.0031

 surface  2003
 segment:       -1219    -1209
                 1.11257E-47 0.0121

 surface  2003
 segment:       -1219     1209    -1201
                 8.64459E-47 0.0058

 surface  2003
 segment:       -1219     1209     1201    -1205
                 5.17769E-47 0.0078

 surface  2003
 segment:       -1219     1209     1201     1205     1206
                 3.84188E-47 0.0084

 surface  2003
 segment:       -1219     1209     1201     1205    -1206
                 3.43081E-04 0.0161

 surface  2004
 segment:        1219
                 8.67136E-45 0.0031

 surface  2004
 segment:       -1219    -1209
                 7.03013E-48 0.0125

 surface  2004
 segment:       -1219     1209    -1201
                 5.41740E-47 0.0057

 surface  2004
 segment:       -1219     1209     1201    -1205
                 3.11791E-47 0.0073
```

```
surface  2004
segment:       -1219     1209     1201     1205     1206
                2.45484E-47 0.0083

surface  2004
segment:       -1219     1209     1201     1205    -1206
                1.29996E-04 0.0162

surface  2005
segment:        1219
                7.38179E-45 0.0032

surface  2005
segment:       -1219    -1209
                4.33830E-48 0.0142

surface  2005
segment:       -1219     1209    -1201
                3.34778E-47 0.0060

surface  2005
segment:       -1219     1209     1201    -1205
                1.92743E-47 0.0082

surface  2005
segment:       -1219     1209     1201     1205     1206
                1.51752E-47 0.0086

surface  2005
segment:       -1219     1209     1201     1205    -1206
                6.20728E-05 0.0228

surface  2006
segment:        1219
                6.09349E-45 0.0032

surface  2006
segment:       -1219    -1209
                2.69356E-48 0.0141

surface  2006
segment:       -1219     1209    -1201
                2.09265E-47 0.0062

surface  2006
segment:       -1219     1209     1201    -1205
                1.20344E-47 0.0087

surface  2006
segment:       -1219     1209     1201     1205     1206
                9.45968E-48 0.0082

surface  2006
segment:       -1219     1209     1201     1205    -1206
                2.96577E-05 0.0232

surface  2007
segment:        1219
                4.90774E-45 0.0032

surface  2007
segment:       -1219    -1209
                1.65170E-48 0.0156

surface  2007
segment:       -1219     1209    -1201
                1.28834E-47 0.0064

surface  2007
segment:       -1219     1209     1201    -1205
                7.53238E-48 0.0091

surface  2007
segment:       -1219     1209     1201     1205     1206
                5.87132E-48 0.0100

surface  2007
segment:       -1219     1209     1201     1205    -1206
                1.49923E-05 0.0275
```

```
surface  2008
segment:        1219
                3.42195E-45 0.0033

surface  2008
segment:       -1219    -1209
                8.20767E-49 0.0196

surface  2008
segment:       -1219     1209    -1201
                6.39763E-48 0.0073

surface  2008
segment:       -1219     1209     1201    -1205
                3.66287E-48 0.0106

surface  2008
segment:       -1219     1209     1201     1205     1206
                2.90875E-48 0.0113

surface  2008
segment:       -1219     1209     1201     1205    -1206
                5.67963E-06 0.0337

surface  2009
segment:        1219
                2.31097E-45 0.0034

surface  2009
segment:       -1219    -1209
                4.14911E-49 0.0248

surface  2009
segment:       -1219     1209    -1201
                3.15625E-48 0.0088

surface  2009
segment:       -1219     1209     1201    -1205
                1.81663E-48 0.0141

surface  2009
segment:       -1219     1209     1201     1205     1206
                1.43540E-48 0.0136

surface  2009
segment:       -1219     1209     1201     1205    -1206
                2.30063E-06 0.0406

surface  2010
segment:        1219
                1.32500E-45 0.0035

surface  2010
segment:       -1219    -1209
                1.61988E-49 0.0335

surface  2010
segment:       -1219     1209    -1201
                1.24646E-48 0.0114

surface  2010
segment:       -1219     1209     1201    -1205
                7.23022E-49 0.0143

surface  2010
segment:       -1219     1209     1201     1205     1206
                5.69614E-49 0.0203

surface  2010
segment:       -1219     1209     1201     1205    -1206
                7.75644E-07 0.0667

surface  2011
segment:        1219
                7.41132E-46 0.0036

surface  2011
segment:       -1219    -1209
                6.17330E-50 0.0340
```

```
 surface  2011
 segment:       -1219     1209    -1201
                 5.01275E-49 0.0183

 surface  2011
 segment:       -1219     1209     1201    -1205
                 2.91568E-49 0.0210

 surface  2011
 segment:       -1219     1209     1201     1205     1206
                 2.11727E-49 0.0199

 surface  2011
 segment:       -1219     1209     1201     1205    -1206
                 2.85366E-07 0.1027

 surface  2012
 segment:        1219
                 4.07240E-46 0.0037

 surface  2012
 segment:       -1219    -1209
                 2.43050E-50 0.0425

 surface  2012
 segment:       -1219     1209    -1201
                 2.03558E-49 0.0223

 surface  2012
 segment:       -1219     1209     1201    -1205
                 1.18324E-49 0.0261

 surface  2012
 segment:       -1219     1209     1201     1205     1206
                 8.48598E-50 0.0243

 surface  2012
 segment:       -1219     1209     1201     1205    -1206
                 1.01449E-07 0.1245

 surface  2013
 segment:        1219
                 2.21654E-46 0.0040

 surface  2013
 segment:       -1219    -1209
                 1.16522E-50 0.0729

 surface  2013
 segment:       -1219     1209    -1201
                 8.42778E-50 0.0283

 surface  2013
 segment:       -1219     1209     1201    -1205
                 5.97437E-50 0.1431

 surface  2013
 segment:       -1219     1209     1201     1205     1206
                 3.52999E-50 0.0357

 surface  2013
 segment:       -1219     1209     1201     1205    -1206
                 4.01607E-08 0.2128


================================================================================================================
==================

          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  52

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--      -pdf-
 behavior    behavior      value   decrease   decrease rate      value   decrease   decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
```

```
 observed     random        0.02       no           no            0.04       no          no            constant
random       3.13
 passed?        yes          yes       no           no             yes       no          no               yes
yes         yes
```

==========

```
 warning.  the tally in the tally fluctuation chart bin did not pass  4 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  52 with nps =     3139919  print
table 160


 normed average tally per history  = 3.43081E-04          unnormed average tally per history  = 1.02924E+03
 estimated tally relative error    = 0.0161               estimated variance of the variance  = 0.0448
 relative error from zero tallies  = 0.0050               relative error from nonzero scores  = 0.0153

 number of nonzero history tallies =       39514          efficiency for the nonzero tallies  = 0.0021
 history number of largest  tally  =     1916113          largest  unnormalized history tally = 1.39383E+08
 (largest  tally)/(average tally)  = 1.35422E+05          (largest  tally)/(avg nonzero tally)= 2.81067E+02

 (confidence interval shift)/mean  = 0.0011               shifted confidence interval center  = 3.43475E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1          value(nps+1)/value(nps)-1.

      mean                            3.43081E-04            3.57878E-04                   0.043129
      relative error                  1.60913E-02            1.74614E-02                   0.085149
      variance of the variance        4.47833E-02            5.81493E-02                   0.298458
      shifted center                  3.43475E-04            3.46293E-04                   0.008204
      figure of merit                 4.04486E+00            3.43498E+00                  -0.150779

 the estimated inverse power slope of the 200 largest  tallies starting at 6.48766E+06 is 3.1331
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*( 1.424E-02)**2 = (1.994E+04)*(2.029E-
04) = 4.045E+00

1unnormed tally density for tally  52            nonzero tally mean(m) = 4.959E+05   nps =     3139919  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 3.1)
  tally  number num den log den:d-------------d-------------d-------------d-------------d-------------d------
-------d------------
 6.31+04    544 2.20-09  -8.657
**************|*************|**************|**************|**************|*************|***
 7.94+04   1909 6.14-09  -8.212
**************|*************|**************|**************|**************|*************|**********
 1.00+05   1984 5.07-09  -8.295
**************|*************|**************|**************|**************|*************|*********
 1.26+05   2802 5.68-09  -8.245
**************|*************|**************|**************|**************|*************|*********
 1.58+05   5250 8.46-09  -8.073
**************|*************|**************|**************|**************|*************|************
 2.00+05   4785 6.12-09  -8.213
**************|*************|**************|**************|**************|*************|**********
 2.51+05   4616 4.69-09  -8.329
**************|*************|**************|**************|**************|*************|********
 3.16+05   3963 3.20-09  -8.495
**************|*************|**************|**************|**************|*************|******
 3.98+05   3410 2.19-09  -8.660
**************|*************|**************|**************|**************|*************|***
 5.01+05   2605 1.33-09  -8.877
mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|
 6.31+05   1973 7.99-10  -9.098
**************|*************|**************|**************|**************|***********  |
 7.94+05   1416 4.55-10  -9.342
**************|*************|**************|**************|**************|*******      |
 1.00+06    869 2.22-10  -9.654 **************|*************|**************|**************|**************|***
|
```

```
 1.26+06    711 1.44-10  -9.841 **************|*************|**************|**************|***************|
 1.58+06    565 9.10-11 -10.041 **************|*************|**************|**************|*************  |
 2.00+06    463 5.93-11 -10.227 **************|*************|**************|**************|*********      |
 2.51+06    439 4.46-11 -10.350 **************|*************|**************|**************|*******        |
 3.16+06    432 3.49-11 -10.457 **************|*************|**************|**************|******         |
 3.98+06    275 1.76-11 -10.753 **************|*************|**************|**************|**             |
 5.01+06    182 9.27-12 -11.033 **************|*************|**************|*************  |              |
 6.31+06    108 4.37-12 -11.359 **************|*************|**************|********       |              |
 7.94+06     62 1.99-12 -11.700 **************|*************|**************|***          s |              |
 1.00+07     51 1.30-12 -11.885 **************|*************|**************|           s   |              |
 1.26+07     35 7.10-13 -12.149 **************|*************|************   |         s     |              |
 1.58+07     25 4.03-13 -12.395 **************|*************|*******        |      s        |              |
 2.00+07      6 7.68-14 -13.115 **************|************  |               |  s            |              |
 2.51+07     10 1.02-13 -12.993 **************|*************|               s               |              |
 3.16+07      8 6.46-14 -13.190 **************|***********   |            s  |               |              |
 3.98+07      9 5.77-14 -13.239 **************|*********    |        s      |               |              |
 5.01+07      3 1.53-14 -13.816 **************|             |    s          |               |              |
 6.31+07      3 1.21-14 -13.916 **************|             |s              |               |              |
 7.94+07      0 0.00+00   0.000               |          s  |               |               |              |
 1.00+08      0 0.00+00   0.000               |     s       |               |               |              |
 1.26+08      0 0.00+00   0.000               | s           |               |               |              |
 1.58+08      1 1.61-15 -14.793 *           s |             |               |               |              |
  total   39514 2.08-03         d-------------d-------------d--------------d--------------d--------------d------
-------d------------

1tally  62        nps =     3139919
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     19038449.00

           this tally is modified by a dose function.

           areas
                surface:     1219
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
                 4       1.00000E+50
                 5       5.30000E+06

 surface  1219
 segment:       -1205
                4.17465E-45 0.0207

 surface  1219
 segment:        1205     1206
                 3.03651E-44 0.0078

 surface  1219
 segment:        1205    -1206     1203
                 7.04257E-45 0.0168

 surface  1219
 segment:        1205    -1206    -1203    -1202
                 7.00403E-45 0.0171

 surface  1219
```

segment: 1205 -1206 -1203 1202
4.55403E+01 0.0014

==========

results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally 62

tfc bin behavior	--mean-- behavior	---------relative error--------- value	decrease	decrease rate	----variance of the variance---- value	decrease	decrease rate	--figure of merit-- behavior	-pdf- slope
desired	random	<0.10	yes	1/sqrt(nps)	<0.10	yes	1/nps	constant	random	>3.00
observed	random	0.00	yes	yes	0.00	yes	yes	constant	random	10.00
passed?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

==========

this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart to verify.
the results in other bins associated with this tally may not meet these statistical criteria.

----- estimated confidence intervals: -----

estimated asymmetric confidence interval(1,2,3 sigma): 4.5476E+01 to 4.5605E+01; 4.5411E+01 to 4.5670E+01; 4.5346E+01 to 4.5735E+01
estimated symmetric confidence interval(1,2,3 sigma): 4.5475E+01 to 4.5605E+01; 4.5410E+01 to 4.5670E+01; 4.5345E+01 to 4.5735E+01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally 62 with nps = 3139919 print table 160

normed average tally per history	= 4.55403E+01	unnormed average tally per history	= 2.41364E+08
estimated tally relative error	= 0.0014	estimated variance of the variance	= 0.0000
relative error from zero tallies	= 0.0005	relative error from nonzero scores	= 0.0013
number of nonzero history tallies	= 3116080	efficiency for the nonzero tallies	= 0.1637
history number of largest tally	= 769241	largest unnormalized history tally	= 1.98498E+11
(largest tally)/(average tally)	= 8.22403E+02	(largest tally)/(avg nonzero tally)	= 1.34605E+02
(confidence interval shift)/mean	= 0.0000	shifted confidence interval center	= 4.55405E+01

if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	4.55403E+01	4.55523E+01	0.000262
relative error	1.42673E-03	1.33090E-03	-0.067169
variance of the variance	3.93199E-05	4.76904E-05	0.212881
shifted center	4.55405E+01	4.55416E+01	0.000023
figure of merit	5.14517E+02	5.91281E+02	0.149196

the estimated slope of the 200 largest tallies starting at 7.29700E+10 appears to be decreasing at least exponentially.
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.994E+04)*(1.606E-01)**2 = (1.994E+04)*(2.580E-02) = 5.145E+02

1status of the statistical checks used to form confidence intervals for the mean for each tally bin

tally result of statistical checks for the tfc bin (the first check not passed is listed) and error magnitude check for all bins

```
     2   passed the 10 statistical checks for the tally fluctuation chart bin result
         passed all bin error check:     1 tally bins all have relative errors less than 0.10 with no zero bins

    12   missed  3 of 10 tfc bin checks: the variance of the variance exceeds the recommended value of 0.1
         missed all bin error check:    16 tally bins had     0 bins with zeros and     1 bins with relative
errors exceeding 0.10

    22   missed  1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum
acceptable value of 3.0
         passed all bin error check:    22 tally bins all have relative errors less than 0.10 with no zero bins

    32   missed  5 of 10 tfc bin checks: the variance of the variance exceeds the recommended value of 0.1
         missed all bin error check:     5 tally bins had     1 bins with zeros and     1 bins with relative
errors exceeding 0.10

    42   missed  1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum
acceptable value of 3.0
         missed all bin error check:    66 tally bins had     0 bins with zeros and     1 bins with relative
errors exceeding 0.10

    52   missed  4 of 10 tfc bin checks: the relative error does not monotonically decrease over the last half
of the problem
         missed all bin error check:    66 tally bins had     0 bins with zeros and     4 bins with relative
errors exceeding 0.10

    62   passed the 10 statistical checks for the tally fluctuation chart bin result
         passed all bin error check:     5 tally bins all have relative errors less than 0.10 with no zero bins


 the 10 statistical checks are only for the tally fluctuation chart bin and do not apply to other tally bins.

 the tally bins with zeros may or may not be correct: compare the source, cutoffs, multipliers, et cetera with
the tally bins.

 warning.     5 of the   7 tally fluctuation chart bins did not pass all 10 statistical checks.
 warning.     4 of the   7 tallies had bins with relative errors greater than recommended.
1tally fluctuation charts

                      tally    2                                  tally   12                                  tally
22
          nps      mean     error    vov  slope    fom      mean     error    vov  slope    fom      mean
error    vov  slope    fom
       256000   1.5744E-01 0.0210 0.0095 10.0      29   3.5791E-09 0.0405 0.0805  2.7 7.9E+00   9.6315E-47
0.0770 0.8162  3.1 2.2E+00
       512000   1.5769E-01 0.0164 0.0191  6.7      24   3.4492E-09 0.0273 0.0376  3.7 8.6E+00   9.9373E-47
0.0418 0.5266  2.6 3.7E+00
       768000   1.5404E-01 0.0130 0.0117  5.9      25   3.4380E-09 0.0221 0.0219  4.5 8.8E+00   9.7841E-47
0.0307 0.3875  2.7 4.6E+00
      1024000   1.5394E-01 0.0113 0.0077  6.3      25   3.6460E-09 0.0487 0.6703  3.1 1.4E+00   9.7263E-47
0.0241 0.3279  2.6 5.5E+00
      1280000   1.5415E-01 0.0104 0.0088  4.9      24   3.5521E-09 0.0404 0.6434  2.9 1.6E+00   9.7837E-47
0.0213 0.2234  2.4 5.7E+00
      1536000   1.5327E-01 0.0093 0.0068  5.0      25   3.5567E-09 0.0357 0.5103  2.5 1.7E+00   9.8516E-47
0.0187 0.1780  2.3 6.1E+00
      1792000   1.5385E-01 0.0086 0.0055  4.7      25   3.5284E-09 0.0313 0.4810  2.5 1.9E+00   9.8294E-47
0.0170 0.1448  2.1 6.4E+00
      2048000   1.5417E-01 0.0081 0.0046  4.4      24   3.5079E-09 0.0284 0.4291  2.3 2.0E+00   9.8521E-47
0.0153 0.1266  2.2 6.8E+00
      2304000   1.5450E-01 0.0076 0.0038  4.8      25   3.4939E-09 0.0256 0.4103  2.5 2.2E+00   9.8401E-47
0.0141 0.1119  2.3 7.2E+00
      2560000   1.5484E-01 0.0072 0.0033  4.3      24   3.4708E-09 0.0234 0.3966  2.5 2.3E+00   9.8300E-47
0.0130 0.1010  2.5 7.6E+00
      2816000   1.5442E-01 0.0069 0.0030  4.3      25   3.4909E-09 0.0220 0.3427  2.5 2.4E+00   9.8356E-47
0.0122 0.0887  2.6 7.8E+00
      3072000   1.5397E-01 0.0066 0.0028  3.9      25   3.4868E-09 0.0204 0.3251  2.6 2.6E+00   9.8837E-47
0.0118 0.0731  2.4 7.7E+00
      3139919   1.5379E-01 0.0065 0.0027  4.0      25   3.4882E-09 0.0200 0.3217  2.6 2.6E+00   9.8708E-47
0.0116 0.0721  2.4 7.8E+00


                      tally   32                                  tally   42                                  tally
52
          nps      mean     error    vov  slope    fom      mean     error    vov  slope    fom      mean
error    vov  slope    fom
       256000   4.4203E-04 0.2501 0.7579  0.0 2.1E-01   3.3383E-04 0.0603 0.2322  3.1 3.6E+00   3.4226E-04
0.0577 0.1678  3.1 3.9E+00
       512000   4.2356E-04 0.1574 0.4037  2.5 2.6E-01   3.3046E-04 0.0390 0.1054  3.1 4.2E+00   3.5407E-04
0.0362 0.0700  3.1 4.9E+00
       768000   3.8634E-04 0.1214 0.3272  3.0 2.9E-01   3.3749E-04 0.0334 0.0660  2.7 3.8E+00   3.3926E-04
0.0275 0.0496  3.4 5.7E+00
```

```
      1024000   3.9312E-04 0.0978 0.2331  2.7 3.4E-01   3.3474E-04 0.0275 0.0481  2.6 4.3E+00   3.3314E-04
0.0234 0.0337  3.4 5.9E+00
      1280000   3.8066E-04 0.0830 0.2098  2.7 3.7E-01   3.2643E-04 0.0234 0.0421  2.5 4.7E+00   3.3269E-04
0.0216 0.0263  2.6 5.5E+00
      1536000   3.8631E-04 0.0740 0.1566  2.9 3.9E-01   3.2843E-04 0.0213 0.0342  2.6 4.7E+00   3.3025E-04
0.0195 0.0217  2.8 5.6E+00
      1792000   3.8855E-04 0.0656 0.1346  2.7 4.3E-01   3.2971E-04 0.0194 0.0274  2.9 4.9E+00   3.3139E-04
0.0179 0.0174  3.2 5.7E+00
      2048000   3.9075E-04 0.0607 0.1088  2.7 4.4E-01   3.2975E-04 0.0179 0.0228  2.8 5.0E+00   3.3525E-04
0.0201 0.1032  3.1 4.0E+00
      2304000   3.9593E-04 0.0577 0.0846  2.7 4.3E-01   3.3064E-04 0.0167 0.0191  3.2 5.1E+00   3.3762E-04
0.0187 0.0849  3.1 4.1E+00
      2560000   3.9094E-04 0.0538 0.0775  2.9 4.4E-01   3.3234E-04 0.0162 0.0162  2.9 4.9E+00   3.3927E-04
0.0176 0.0702  3.1 4.1E+00
      2816000   4.1276E-04 0.0689 0.2897  2.6 2.5E-01   3.3109E-04 0.0152 0.0145  2.9 5.0E+00   3.3997E-04
0.0166 0.0602  3.1 4.2E+00
      3072000   4.0575E-04 0.0646 0.2827  2.7 2.6E-01   3.3158E-04 0.0145 0.0129  2.8 5.1E+00   3.3952E-04
0.0158 0.0533  3.1 4.3E+00
      3139919   4.0419E-04 0.0636 0.2808  2.8 2.6E-01   3.3228E-04 0.0148 0.0164  2.7 4.8E+00   3.4308E-04
0.0161 0.0448  3.1 4.0E+00


                    tally   62
         nps      mean     error    vov  slope    fom
       256000   4.5537E+01 0.0050 0.0005 10.0     523
       512000   4.5744E+01 0.0035 0.0002 10.0     517
       768000   4.5659E+01 0.0029 0.0002 10.0     515
      1024000   4.5666E+01 0.0025 0.0001  9.0     514
      1280000   4.5590E+01 0.0022 0.0001  9.4     516
      1536000   4.5602E+01 0.0020 0.0001  7.3     515
      1792000   4.5587E+01 0.0019 0.0001  8.6     515
      2048000   4.5572E+01 0.0018 0.0001  7.8     515
      2304000   4.5582E+01 0.0017 0.0001  8.2     514
      2560000   4.5589E+01 0.0016 0.0000 10.0     514
      2816000   4.5575E+01 0.0015 0.0000 10.0     514
      3072000   4.5552E+01 0.0014 0.0000 10.0     514
      3139919   4.5540E+01 0.0014 0.0000 10.0     515


************************************************************************************************************
*******
 dump no.   17 on file runtpe       nps =     3139919     coll =     3831424048     ctm =      954.81   nrn =
46995712351


        22 warning messages so far.


 run terminated when it had used    0  minutes of computer time.

 computer time =  954.89 minutes

 mcnp     version 5     11112005                     06/11/09 07:25:03                     probid =  06/10/09
15:29:27
```

MCNP Case with Translated Source – 1" HVAC Shield

```
         Thread Name & Version = mcnp5VE_RSICC, 1.40

         ._ _    _  ._   ._    |_
         | | |  (_  | |  |_)    _)
                        |
 +--------------------------------------------------------------------+
 |   This program was prepared by the Regents of the University of    |
 |California at Los Alamos National Laboratory (the University) under |
 |  contract number W-7405-ENG-36 with the U.S. Department of Energy  |
 |(DoE).  The University has certain rights in the program pursuant to|
 |  the contract and the program should not be copied or distributed  |
 | outside your organization.  All rights in the program are reserved |
 |by the DoE and the University.  Neither the U.S. Government nor the |
 | University makes any warranty, express or implied, or assumes any  |
 |     liability or responsibility for the use of this software.      |
 +--------------------------------------------------------------------+

1mcnp     version 5     ld=11112005                    06/23/09 08:50:09
 ***********************************************************************                probid =  06/23/09
08:50:09
  inp = HVSLB.i outp = HVSLB.o rssa = bwssa

    1-       c     Created on: Tuesday, November 11, 2008 at 09:35
    2-       c     Canister Cells
    3-          11     5      -1 -11 1209 -1212
    4-          12     5      -1 -12 1209 -1212
    5-          13     5      -1 -13 1209 -1212
    6-          14     5      -1 -14 1209 -1212
    7-          15     5      -1 -15 1209 -1212
    8-          16     5      -1 -16 1209 -1212
    9-          17     5      -1 -17 1209 -1212
   10-          18     5      -1 -18 1209 -1212
   11-          19     5      -1 -19 1209 -1212
   12-          21     5      -1 -21 1209 -1212
   13-          22     5      -1 -22 1209 -1212
   14-          23     5      -1 -23 1209 -1212
   15-          24     5      -1 -24 1209 -1212
   16-          25     5      -1 -25 1209 -1212
   17-          26     5      -1 -26 1209 -1212
   18-          27     5      -1 -27 1209 -1212
   19-          28     5      -1 -28 1209 -1212
   20-          29     5      -1 -29 1209 -1212
   21-          31     5      -1 -31 1209 -1212
   22-          32     5      -1 -32 1209 -1212
   23-          33     5      -1 -33 1209 -1212
   24-          34     5      -1 -34 1209 -1212
   25-          35     5      -1 -35 1209 -1212
   26-          36     5      -1 -36 1209 -1212
   27-          37     5      -1 -37 1209 -1212
   28-          38     5      -1 -38 1209 -1212
   29-          39     5      -1 -39 1209 -1212
   30-          41     5      -1 -41 1209 -1212
   31-          42     5      -1 -42 1209 -1212
   32-          43     5      -1 -43 1209 -1212
   33-          44     5      -1 -44 1209 -1212
   34-          45     5      -1 -45 1209 -1212
   35-          46     5      -1 -46 1209 -1212
   36-          47     5      -1 -47 1209 -1212
   37-          48     5      -1 -48 1209 -1212
   38-          49     5      -1 -49 1209 -1212
   39-          51     5      -1 -51 1209 -1212
   40-          52     5      -1 -52 1209 -1212
   41-          53     5      -1 -53 1209 -1212
   42-          54     5      -1 -54 1209 -1212
   43-          55     5      -1 -55 1209 -1212
   44-          56     5      -1 -56 1209 -1212
   45-          57     5      -1 -57 1209 -1212
   46-          58     5      -1 -58 1209 -1212
   47-          59     5      -1 -59 1209 -1212
   48-          61     5      -1 -61 1209 -1212
   49-          62     5      -1 -62 1209 -1212
   50-          63     5      -1 -63 1209 -1212
   51-          64     5      -1 -64 1209 -1212
   52-          65     5      -1 -65 1209 -1212
   53-          66     5      -1 -66 1209 -1212
   54-          67     5      -1 -67 1209 -1212
   55-          68     5      -1 -68 1209 -1212
```

```
 56-          69      5       -1 -69 1209 -1212
 57-          71      5       -1 -71 1209 -1212
 58-          72      5       -1 -72 1209 -1212
 59-          73      5       -1 -73 1209 -1212
 60-          74      5       -1 -74 1209 -1212
 61-          75      5       -1 -75 1209 -1212
 62-          76      5       -1 -76 1209 -1212
 63-          77      5       -1 -77 1209 -1212
 64-          78      5       -1 -78 1209 -1212
 65-          79      5       -1 -79 1209 -1212
 66-          81      5       -1 -81 1209 -1212
 67-          82      5       -1 -82 1209 -1212
 68-          83      5       -1 -83 1209 -1212
 69-          84      5       -1 -84 1209 -1212
 70-          85      5       -1 -85 1209 -1212
 71-          86      5       -1 -86 1209 -1212
 72-          87      5       -1 -87 1209 -1212
 73-          88      5       -1 -88 1209 -1212
 74-          89      5       -1 -89 1209 -1212
 75-          91      5       -1 -91 1209 -1212
 76-          92      5       -1 -92 1209 -1212
 77-          93      5       -1 -93 1209 -1212
 78-          94      5       -1 -94 1209 -1212
 79-          95      5       -1 -95 1209 -1212
 80-          96      5       -1 -96 1209 -1212
 81-          97      5       -1 -97 1209 -1212
 82-          98      5       -1 -98 1209 -1212
 83-          99      5       -1 -99 1209 -1212
 84-         101      5       -1 -101 1209 -1212
 85-         102      5       -1 -102 1209 -1212
 86-         103      5       -1 -103 1209 -1212
 87-         104      5       -1 -104 1209 -1212
 88-         105      5       -1 -105 1209 -1212
 89-         106      5       -1 -106 1209 -1212
 90-         107      5       -1 -107 1209 -1212
 91-         108      5       -1 -108 1209 -1212
 92-         109      5       -1 -109 1209 -1212
 93-         111      5       -1 -111 1209 -1212
 94-         112      5       -1 -112 1209 -1212
 95-         113      5       -1 -113 1209 -1212
 96-         114      5       -1 -114 1209 -1212
 97-         115      5       -1 -115 1209 -1212
 98-         116      5       -1 -116 1209 -1212
 99-         117      5       -1 -117 1209 -1212
100-         118      5       -1 -118 1209 -1212
101-         119      5       -1 -119 1209 -1212
102-         121      5       -1 -121 1209 -1212
103-         122      5       -1 -122 1209 -1212
104-         123      5       -1 -123 1209 -1212
105-         124      5       -1 -124 1209 -1212
106-         125      5       -1 -125 1209 -1212
107-         126      5       -1 -126 1209 -1212
108-         127      5       -1 -127 1209 -1212
109-         128      5       -1 -128 1209 -1212
110-         129      5       -1 -129 1209 -1212
111-         131      5       -1 -131 1209 -1212
112-         132      5       -1 -132 1209 -1212
113-         133      5       -1 -133 1209 -1212
114-         134      5       -1 -134 1209 -1212
115-         135      5       -1 -135 1209 -1212
116-         136      5       -1 -136 1209 -1212
117-         137      5       -1 -137 1209 -1212
118-         138      5       -1 -138 1209 -1212
119-         139      5       -1 -139 1209 -1212
120-         141      5       -1 -141 1209 -1212
121-         142      5       -1 -142 1209 -1212
122-         143      5       -1 -143 1209 -1212
123-         144      5       -1 -144 1209 -1212
124-         145      5       -1 -145 1209 -1212
125-         146      5       -1 -146 1209 -1212
126-         147      5       -1 -147 1209 -1212
127-         148      5       -1 -148 1209 -1212
128-         149      5       -1 -149 1209 -1212
129-         151      5       -1 -151 1209 -1212
130-         152      5       -1 -152 1209 -1212
131-         153      5       -1 -153 1209 -1212
132-         154      5       -1 -154 1209 -1212
133-         155      5       -1 -155 1209 -1212
134-         156      5       -1 -156 1209 -1212
135-         157      5       -1 -157 1209 -1212
```

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136-         158     5      -1 -158 1209 -1212
137-         159     5      -1 -159 1209 -1212
138-       c Walls
139-        1200     3 -0.001225 1222 -1221 1206 -1208 1220 -1219  $Notch
140-        1201     1  -2.365 1206 -1208 1202 -1203 -1219 1209 #1200  $Inner Wall
141-        1202     1  -2.395 1207 -1233 1219 -990 -991 992  $Top of Left Wall
142-       12021     1  -2.395 1233 -1223 1219 -990 992 -991  $Split in Left Wall
143-        1203     1  -2.365 1207 -1205 -1219 1209 -1203 1202  $Bottom of Left Wall
144-        1204     1  -2.395 1234 -1204 1207 -1218 1219 -990  $Top of Back Wall
145-       12041     1  -2.395 991 -1234 1207 -1218 1219 -990  $Split in Back Wall
146-        1205     1  -2.365 1203 -1204 1207 -1218 -1219 1209  $Bottom of Back Wall
147-        1206     1  -2.395 1235 -1218 -991 992 1219 -990  $Top of Right Wall
148-       12061     1  -2.395 1224 -1235 -991 992 1219 -990  $Split in Right Wall
149-        1207     1  -2.365 1217 -1218 -1203 1202 -1219 1209  $Bottom of Right Wall
150-        1208     1  -2.395 1201 -1236 -1218 1207 1219 -990 #10000 $Top of Front Wall
151-                    #10001 #10002 #10003 #10004 #10005
152-       12081     1  -2.395 -992 1236 -1218 1207 1219 -990 #10000 $Split in Front Wall
153-                    #10001 #10002 #10003 #10004 #10005
154-        1209     1  -2.365 -1202 1201 -1218 1207 -1219 1209  $Bottom of Front Wall
155-        1210     1  -2.365 -1209 1227 1207 -1218 -1204 1201  $Floor
156-        1211     1  -2.328 990 -1237 1207 -1218 -1204 1201  $Roof
157-       12111     1  -2.328 1237 -1216 1207 -1218 -1204 1201  $Split in Roof
158-       c   Air
159-        9999     0         2015  $Outside Model
160-        9998     3 -0.001225 1205 -1228 -1220 1209 -1203 1202 #(-134 1209 -1212 )#
161-                   (-135 1209 -1212 )#(-145 1209 -1212 )#(-146 1209 -1212 )#
162-                   (-147 1209 -1212 )#(-148 1209 -1212 )#(-149 1209 -1212 )#
163-                   (-11 1209 -1212 )#(-12 1209 -1212 )#(-13 1209 -1212 )#
164-                   (-14 1209 -1212 )#(-15 1209 -1212 )#(-25 1209 -1212 )#
165-                   (-26 1209 -1212 )#(-27 1209 -1212 )#(-28 1209 -1212 )#
166-                   (-29 1209 -1212 )#(-41 1209 -1212 )#(-42 1209 -1212 )#
167-                   (-43 1209 -1212 )#(-44 1209 -1212 )#(-45 1209 -1212 )#
168-                   (-55 1209 -1212 )#(-56 1209 -1212 )#(-57 1209 -1212 )#
169-                   (-58 1209 -1212 )#(-59 1209 -1212 )#(-71 1209 -1212 )#
170-                   (-72 1209 -1212 )#(-73 1209 -1212 )#(-74 1209 -1212 )#
171-                   (-75 1209 -1212 )#(-85 1209 -1212 )#(-86 1209 -1212 )#
172-                   (-87 1209 -1212 )#(-88 1209 -1212 )#(-89 1209 -1212 )#
173-                   (-101 1209 -1212 )#(-102 1209 -1212 )#(-103 1209 -1212 )#
174-                   (-104 1209 -1212 )#(-105 1209 -1212 )#(-115 1209 -1212 )#
175-                   (-116 1209 -1212 )#(-117 1209 -1212 )#(-118 1209 -1212 )#
176-                   (-119 1209 -1212 )#(-131 1209 -1212 )#(-132 1209 -1212 )#
177-                   (-133 1209 -1212 )
178-        9997     3 -0.001225 1228 -1229 -1220 1209 -1203 1202 #(-139 1209 -1212 )#
179-                   (-141 1209 -1212 )#(-151 1209 -1212 )#(-152 1209 -1212 )#
180-                   (-153 1209 -1212 )#(-154 1209 -1212 )#(-155 1209 -1212 )#
181-                   (-15 1209 -1212 )#(-16 1209 -1212 )#(-17 1209 -1212 )#
182-                   (-18 1209 -1212 )#(-19 1209 -1212 )#(-21 1209 -1212 )#
183-                   (-31 1209 -1212 )#(-32 1209 -1212 )#(-33 1209 -1212 )#
184-                   (-34 1209 -1212 )#(-35 1209 -1212 )#(-45 1209 -1212 )#
185-                   (-46 1209 -1212 )#(-47 1209 -1212 )#(-48 1209 -1212 )#
186-                   (-49 1209 -1212 )#(-51 1209 -1212 )#(-61 1209 -1212 )#
187-                   (-62 1209 -1212 )#(-63 1209 -1212 )#(-64 1209 -1212 )#
188-                   (-65 1209 -1212 )#(-75 1209 -1212 )#(-76 1209 -1212 )#
189-                   (-77 1209 -1212 )#(-78 1209 -1212 )#(-79 1209 -1212 )#
190-                   (-81 1209 -1212 )#(-91 1209 -1212 )#(-92 1209 -1212 )#
191-                   (-93 1209 -1212 )#(-94 1209 -1212 )#(-95 1209 -1212 )#
192-                   (-105 1209 -1212 )#(-106 1209 -1212 )#(-107 1209 -1212 )#
193-                   (-108 1209 -1212 )#(-109 1209 -1212 )#(-111 1209 -1212 )#
194-                   (-121 1209 -1212 )#(-122 1209 -1212 )#(-123 1209 -1212 )#
195-                   (-124 1209 -1212 )#(-125 1209 -1212 )#(-135 1209 -1212 )#
196-                   (-136 1209 -1212 )#(-137 1209 -1212 )#(-138 1209 -1212 )
197-        9996     3 -0.001225 1229 -1206 -1220 1209 -1203 1202 #(-142 1209 -1212 )#
198-                   (-143 1209 -1212 )#(-144 1209 -1212 )#(-156 1209 -1212 )#
199-                   (-157 1209 -1212 )#(-158 1209 -1212 )#(-159 1209 -1212 )#
200-                   (-21 1209 -1212 )#(-22 1209 -1212 )#(-23 1209 -1212 )#
201-                   (-24 1209 -1212 )#(-36 1209 -1212 )#(-37 1209 -1212 )#
202-                   (-38 1209 -1212 )#(-39 1209 -1212 )#(-51 1209 -1212 )#
203-                   (-52 1209 -1212 )#(-53 1209 -1212 )#(-54 1209 -1212 )#
204-                   (-66 1209 -1212 )#(-67 1209 -1212 )#(-68 1209 -1212 )#
205-                   (-69 1209 -1212 )#(-81 1209 -1212 )#(-82 1209 -1212 )#
206-                   (-83 1209 -1212 )#(-84 1209 -1212 )#(-96 1209 -1212 )#
207-                   (-97 1209 -1212 )#(-98 1209 -1212 )#(-99 1209 -1212 )#
208-                   (-111 1209 -1212 )#(-112 1209 -1212 )#(-113 1209 -1212 )#
209-                   (-114 1209 -1212 )#(-126 1209 -1212 )#(-127 1209 -1212 )#
210-                   (-128 1209 -1212 )#(-129 1209 -1212 )#(-141 1209 -1212 )
211-        9995     3 -0.001225 1220 -1219 1205 -1206 -1203 1202
212-        9994     3 -0.001225 -990 1219 1223 -1208 -991 992 #200 #201 #202 #203 #204
213-                    #205 #206 #207 #208 #209 #210
214-        9993     3 -0.001225 1209 -1231 1208 -1217 -1203 1202
215-        9992     3 -0.001225 -1230 1231 1208 -1217 -1203 1202
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216-         9991     3 -0.001225 -1220 1230 1208 -1217 -1203 1202
217-         9990     3 -0.001225 1220 -1219 1208 -1217 -1203 1202
218-         9989     3 -0.001225 -990 1219 1208 -1224 -991 992 #211 #212 #213 #214
219-         9988     3 -0.001225 ((-2000 -1207 1201 -1204 1227 -1216 ):
220-                    (1218 -2000 1201 -1204 1227 -1216 ):(-2000 -1201 1227 -1216 ):
221-                    (1204 -2000 1227 -1216 ):(1216 -2000 ))#222
222-         9987     0          -1232 -2015  $Bottom Void
223-         9986     3 -0.001225 1232 -1227 -2015
224-       c       Ductwork Penetrations
225-       10000     3 -0.001225 12441 -12451 12321 -12331 1201 -992
226-       10001     3 -0.001225 12441 -12451 12341 -12351 1201 -992
227-       10002     3 -0.001225 12461 -12471 12361 -12371 1201 -992
228-       10003     3 -0.001225 12441 -12451 12381 -12391 1201 -992
229-       10004     3 -0.001225 12401 -12411 12441 -12451 1201 -992
230-       10005     3 -0.001225 12441 -12451 12421 -12431 1201 -992
231-       c Sphere Detector Cells
232-         2001     3 -0.001225 2000 -2001 1227
233-         2002     3 -0.001225 2001 -2002 1227
234-         2003     3 -0.001225 -2003 2002 1227
235-         2004     3 -0.001225 2003 -2004 1227
236-         2005     3 -0.001225 2004 -2005 1227
237-         2006     3 -0.001225 2005 -2006 1227
238-         2007     3 -0.001225 2006 -2007 1227
239-         2008     3 -0.001225 2007 -2008 1227
240-         2009     3 -0.001225 2008 -2009 1227
241-         2010     3 -0.001225 2009 -2010 1227
242-         2011     3 -0.001225 2010 -2011 1227
243-         2012     3 -0.001225 2011 -2012 1227
244-         2013     3 -0.001225 2012 -2013 1227
245-         2014     3 -0.001225 2013 -2014 1227
246-         2015     3 -0.001225 2014 -2015 1227
247-       c Roof Beams
248-           200     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
249-                    ):(-209 206 -211 212 992 -991 )
250-           201     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
251-                    ):(-209 206 -211 212 992 -991 ) trcl=(264.16 0 0 )
252-           202     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
253-                    ):(-209 206 -211 212 992 -991 ) trcl=(528.32 0 0 )
254-           203     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
255-                    ):(-209 206 -211 212 992 -991 ) trcl=(792.48 0 0 )
256-           204     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
257-                    ):(-209 206 -211 212 992 -991 ) trcl=(1056.64 0 0 )
258-           205     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
259-                    ):(-209 206 -211 212 992 -991 ) trcl=(1320.8 0 0 )
260-           206     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
261-                    ):(-209 206 -211 212 992 -991 ) trcl=(1584.96 0 0 )
262-           207     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
263-                    ):(-209 206 -211 212 992 -991 ) trcl=(1849.12 0 0 )
264-           208     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
265-                    ):(-209 206 -211 212 992 -991 ) trcl=(2113.28 0 0 )
266-           209     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
267-                    ):(-209 206 -211 212 992 -991 ) trcl=(2377.44 0 0 )
268-           210     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
269-                    ):(-209 206 -211 212 992 -991 ) trcl=(2641.6 0 0 )
270-           211     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
271-                    ):(-209 206 -211 212 992 -991 ) trcl=(2905.76 0 0 )
272-           212     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
273-                    ):(-209 206 -211 212 992 -991 ) trcl=(3169.92 0 0 )
274-           213     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
275-                    ):(-209 206 -211 212 992 -991 ) trcl=(3434.08 0 0 )
276-           214     4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
277-                    ):(-209 206 -211 212 992 -991 ) trcl=(3698.24 0 0 )
278-       c HVAC Shield
279-           222     4   -7.86 214 216 -215 -12471 -217 218
280-
281-       c     Source Canisters
282-            11       c/z 302.26 121.92 77.47
283-            12       c/z 500.38 121.92 77.47
284-            13       c/z 698.5 121.92 77.47
285-            14       c/z 896.62 121.92 77.47
286-            15       c/z 1094.74 121.92 77.47
287-            16       c/z 1292.86 121.92 77.47
288-            17       c/z 1490.98 121.92 77.47
289-            18       c/z 1689.1 121.92 77.47
290-            19       c/z 1887.22 121.92 77.47
291-            21       c/z 2085.34 121.92 77.47
292-            22       c/z 2283.46 121.92 77.47
293-            23       c/z 2481.58 121.92 77.47
294-            24       c/z 2679.7 121.92 77.47
295-            25       c/z 203.2 294.64 77.47
```

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296-          26       c/z 401.32 294.64 77.47
297-          27       c/z 599.44 294.64 77.47
298-          28       c/z 797.56 294.64 77.47
299-          29       c/z 995.68 294.64 77.47
300-          31       c/z 1193.8 294.64 77.47
301-          32       c/z 1391.92 294.64 77.47
302-          33       c/z 1590.04 294.64 77.47
303-          34       c/z 1788.16 294.64 77.47
304-          35       c/z 1986.28 294.64 77.47
305-          36       c/z 2184.4 294.64 77.47
306-          37       c/z 2382.52 294.64 77.47
307-          38       c/z 2580.64 294.64 77.47
308-          39       c/z 2778.76 294.64 77.47
309-          41       c/z 302.26 467.36 77.47
310-          42       c/z 500.38 467.36 77.47
311-          43       c/z 698.5 467.36 77.47
312-          44       c/z 896.62 467.36 77.47
313-          45       c/z 1094.74 467.36 77.47
314-          46       c/z 1292.86 467.36 77.47
315-          47       c/z 1490.98 467.36 77.47
316-          48       c/z 1689.1 467.36 77.47
317-          49       c/z 1887.22 467.36 77.47
318-          51       c/z 2085.34 467.36 77.47
319-          52       c/z 2283.46 467.36 77.47
320-          53       c/z 2481.58 467.36 77.47
321-          54       c/z 2679.7 467.36 77.47
322-          55       c/z 203.2 640.08 77.47
323-          56       c/z 401.32 640.08 77.47
324-          57       c/z 599.44 640.08 77.47
325-          58       c/z 797.56 640.08 77.47
326-          59       c/z 995.68 640.08 77.47
327-          61       c/z 1193.8 640.08 77.47
328-          62       c/z 1391.92 640.08 77.47
329-          63       c/z 1590.04 640.08 77.47
330-          64       c/z 1788.16 640.08 77.47
331-          65       c/z 1986.28 640.08 77.47
332-          66       c/z 2184.4 640.08 77.47
333-          67       c/z 2382.52 640.08 77.47
334-          68       c/z 2580.64 640.08 77.47
335-          69       c/z 2778.76 640.08 77.47
336-          71       c/z 302.26 812.8 77.47
337-          72       c/z 500.38 812.8 77.47
338-          73       c/z 698.5 812.8 77.47
339-          74       c/z 896.62 812.8 77.47
340-          75       c/z 1094.74 812.8 77.47
341-          76       c/z 1292.86 812.8 77.47
342-          77       c/z 1490.98 812.8 77.47
343-          78       c/z 1689.1 812.8 77.47
344-          79       c/z 1887.22 812.8 77.47
345-          81       c/z 2085.34 812.8 77.47
346-          82       c/z 2283.46 812.8 77.47
347-          83       c/z 2481.58 812.8 77.47
348-          84       c/z 2679.7 812.8 77.47
349-          85       c/z 203.2 985.52 77.47
350-          86       c/z 401.32 985.52 77.47
351-          87       c/z 599.44 985.52 77.47
352-          88       c/z 797.56 985.52 77.47
353-          89       c/z 995.68 985.52 77.47
354-          91       c/z 1193.8 985.52 77.47
355-          92       c/z 1391.92 985.52 77.47
356-          93       c/z 1590.04 985.52 77.47
357-          94       c/z 1788.16 985.52 77.47
358-          95       c/z 1986.28 985.52 77.47
359-          96       c/z 2184.4 985.52 77.47
360-          97       c/z 2382.52 985.52 77.47
361-          98       c/z 2580.64 985.52 77.47
362-          99       c/z 2778.76 985.52 77.47
363-         101       c/z 302.26 1158.24 77.47
364-         102       c/z 500.38 1158.24 77.47
365-         103       c/z 698.5 1158.24 77.47
366-         104       c/z 896.62 1158.24 77.47
367-         105       c/z 1094.74 1158.24 77.47
368-         106       c/z 1292.86 1158.24 77.47
369-         107       c/z 1490.98 1158.24 77.47
370-         108       c/z 1689.1 1158.24 77.47
371-         109       c/z 1887.22 1158.24 77.47
372-         111       c/z 2085.34 1158.24 77.47
373-         112       c/z 2283.46 1158.24 77.47
374-         113       c/z 2481.58 1158.24 77.47
375-         114       c/z 2679.7 1158.24 77.47
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376-         115       c/z 203.2 1330.96 77.47
377-         116       c/z 401.32 1330.96 77.47
378-         117       c/z 599.44 1330.96 77.47
379-         118       c/z 797.56 1330.96 77.47
380-         119       c/z 995.68 1330.96 77.47
381-         121       c/z 1193.8 1330.96 77.47
382-         122       c/z 1391.92 1330.96 77.47
383-         123       c/z 1590.04 1330.96 77.47
384-         124       c/z 1788.16 1330.96 77.47
385-         125       c/z 1986.28 1330.96 77.47
386-         126       c/z 2184.4 1330.96 77.47
387-         127       c/z 2382.52 1330.96 77.47
388-         128       c/z 2580.64 1330.96 77.47
389-         129       c/z 2778.76 1330.96 77.47
390-         131       c/z 302.26 1503.68 77.47
391-         132       c/z 500.38 1503.68 77.47
392-         133       c/z 698.5 1503.68 77.47
393-         134       c/z 896.62 1503.68 77.47
394-         135       c/z 1094.74 1503.68 77.47
395-         136       c/z 1292.86 1503.68 77.47
396-         137       c/z 1490.98 1503.68 77.47
397-         138       c/z 1689.1 1503.68 77.47
398-         139       c/z 1887.22 1503.68 77.47
399-         141       c/z 2085.34 1503.68 77.47
400-         142       c/z 2283.46 1503.68 77.47
401-         143       c/z 2481.58 1503.68 77.47
402-         144       c/z 2679.7 1503.68 77.47
403-         145       c/z 203.2 1676.4 77.47
404-         146       c/z 401.32 1676.4 77.47
405-         147       c/z 599.44 1676.4 77.47
406-         148       c/z 797.56 1676.4 77.47
407-         149       c/z 995.68 1676.4 77.47
408-         151       c/z 1193.8 1676.4 77.47
409-         152       c/z 1391.92 1676.4 77.47
410-         153       c/z 1590.04 1676.4 77.47
411-         154       c/z 1788.16 1676.4 77.47
412-         155       c/z 1986.28 1676.4 77.47
413-         156       c/z 2184.4 1676.4 77.47
414-         157       c/z 2382.52 1676.4 77.47
415-         158       c/z 2580.64 1676.4 77.47
416-         159       c/z 2778.76 1676.4 77.47
417-         c    Planes
418-        1201        py -76.2
419-        1202        py 0
420-        1203        py 1828.8
421-        1204        py 1905
422-        1205        px 0
423-        1206        px 2895.6
424-        1207        px -76.2
425-        1208        px 2971.8
426-        1209        pz 0  $Top of Floor
427-        1212        pz 381  $Top of Top HIC
428-         990        pz 1455.42
429-        1216        pz 1493.52
430-        1217        px 3947.16
431-        1218        px 4023.36
432-        1219        pz 1036.32
433-        1220        pz 822.96  $Bottom of Notch
434-        1221        py 1760.22
435-        1222        py 1546.86
436-        1223        px -38.1
437-        1224        px 3985.26
438-         991        py 1866.9
439-         992        py -38.1
440-        1227        pz -76.2  $Bottom of Floor
441-        1228        px 1089.66
442-        1229        px 2080.26
443-        1230        pz 807.72
444-        1231        pz 213.36  $7ft Detector Surface
445-        1232        pz -91.44  $Bottom Void
446-        1233        px -57.15
447-        1234        py 1885.95
448-        1235        px 4004.31
449-        1236        py -57.15
450-        1237        pz 1474.47
451-       c    HVAC Duct Openings
452-       12321        px 68.58  $Duct1S1
453-       12331        px 170.18  $Duct1 S2
454-       12341        px 871.22  $Duct2 S1
455-       12351        px 972.82  $Duct2 S2
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 456-       12361        px 1595.12  $Duct3 S1
 457-       12371        px 1747.52  $Duct3 S2
 458-       12381        px 1856.74  $Duct4 S1
 459-       12391        px 1958.34  $Duct4 S2
 460-       12401        px 2720.34  $Duct5 S1
 461-       12411        px 2821.94  $Duct5 S2
 462-       12421        px 3776.98  $Duct6 S1
 463-       12431        px 3878.58  $Duct6 S2
 464-       12441        pz 1397  $Small Ducts Bottom
 465-       12451        pz 1437.64  $Small Duct Top
 466-       12461        pz 1369.06  $Large Ducts Bottom
 467-       12471        pz 1445.26  $Large Duct Top
 468-       c   Spheres for detectors
 469-        2000         s 1973.58 914.4 -72.6 2800  $Closest Sphere
 470-        2001         s 1973.58 914.4 -72.6 4000
 471-        2002         s 1973.58 914.4 -72.6 7000
 472-        2003         s 1973.58 914.4 -72.6 10000
 473-        2004         s 1973.58 914.4 -72.6 15000
 474-        2005         s 1973.58 914.4 -72.6 20000
 475-        2006         s 1973.58 914.4 -72.6 25000
 476-        2007         s 1973.58 914.4 -72.6 30000
 477-        2008         s 1973.58 914.4 -72.6 37500
 478-        2009         s 1973.58 914.4 -72.6 45000
 479-        2010         s 1973.58 914.4 -72.6 55000
 480-        2011         s 1973.58 914.4 -72.6 65000
 481-        2012         s 1973.58 914.4 -72.6 75000
 482-        2013         s 1973.58 914.4 -72.6 85000
 483-        2014         s 1973.58 914.4 -72.6 95000
 484-        2015         s 1973.58 914.4 -72.6 120000
 485-        2016        py -276.2
 486-        2017        py -476.2
 487-        2018        py -676.2
 488-        2019        py -876.2
 489-        2020        py -1076.2
 490-        2021        py -1276.2
 491-        2022        py -1476.2
 492-        2023        py -1676.2
 493-        2024        py -1876.2
 494-        2025        py -2076.2
 495-        2026        px 359.054
 496-        2027        px 2535.94
 497-        2028        py -2276.2
 498-        2029        py -2476.2
 499-        2030        py -2676.2
 500-        2031        py -2876.2
 501-        2032        py -3076.2
 502-        2033        py -3276.2
 503-        2034        py -3476.2
 504-        2035        py -3676.2
 505-       c    Roof Beams
 506-         206        px 211.49
 507-         207        px 225.37
 508-         208        px 226.76
 509-         209        px 240.64
 510-         210        pz 1453.54
 511-         211        pz 1373.84
 512-         212        pz 1371.96
 513-         213        px 226.065
 514-        c HVAC Shield
 515-         214        px 1564.64
 516-         215        px 1988.82
 517-         216        pz 1338.58
 518-         217        py -167.64
 519-         218        py -170.18
 520-
 521-       mode  p
 522-       c  Materials
 523-       m1    1000.           -0.015  $MAT1
 524-             8000.           -1.057 11000.          -0.041 12000.          -0.085
 525-             13000.          -0.137 14000.          -0.487 15000.          -0.002
 526-             16000.          -0.002 19000.          -0.015 20000.          -0.295
 527-             22000.          -0.011 25000.          -0.003 26000.          -0.178
 528-       m2    13000.               1  $MAT2
warning. material   2 is not used in the problem.
 529-       m3    7000.          0.78969  $MAT3
 530-             8000.          0.21019 6000.          0.00012
 531-       m4    26000.               1  $MAT4
 532-       m5    1000.                2  $MAT5
 533-             8000.                1
 534-       imp:p   1 136r       9           3 1r         9           3 1r          $ 11,
```

```
 535-              9            3 1r         9            3 1r         1            $ 1206,
 536-              3            9            0            1 9r         27           $ 1211,
 537-              0            1 6r         54 1r        108 1r       216 1r       $ 9987,
 538-              432 1r       864 1r       1728 1r      3456 1r      1 13r        $ 2007,
 539-              27           1            27            $ 213, 222
 540-        phys:p  100 1 0
 541-       c sdef erg=d5 x=d1 y=d2 z=d3 cel=d4 eff=0.0001 wgt=3.045E+15
 542-       c si1  0 2895.6
 543-       c sp1  0.0 1.0
 544-       c si2  0 1828.8
 545-       c sp2  0.0 1.0
 546-       c si3  0.01 304.8 381.00
 547-       c sp3  0.0 0.8 0.2
 548-       c sb3  0.0 0.2 1.0
 549-       c si4  L 11 12 13 14 15 16 17 18 19 21 22 23 24 25 26 27 28 29 31 32
 550-       c      33 34 35 36 37 38 39 41 42 43 44 45 46 47 48 49 51 52 53 54 55
 551-       c      56 57 58 59 61 62 63 64 65 66 67 68 69 71 72 73 74 75 76 77 78
 552-       c      79 81 82 83 84 85 86 87 88 89 91 92 93 94 95 96 97 98 99 101
 553-       c      102 103 104 105 106 107 108 109 111 112 113 114 115 116 117 118
 554-       c      119 121 122 123 124 125 126 127 128 129 131 132 133 134 135 136
 555-       c      137 138 139 141 142 143 144 145 146 147 148 149 151 152 153 154
 556-       c      155 156 157 158 159
 557-       c sp4  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 558-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 559-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 560-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 561-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 562-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 563-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 564-       c      1  1  1  1  1
 565-       c si5 l 1.1730 1.3325
 566-       c sp5   1      1
 567-       c ssw 1220(9995)
 568-       ssr
 569-       c ===========================================================================
 570-       c ===========================================================================
 571-       c Truck bay dose rate
 572-       f2:p 1231
warning. without bremsstrahlung, flux estimates will be low.
 573-       c ===========================================================================
 574-       c ===========================================================================
 575-       c Rings outside the building
 576-       f12:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 577-       fs12 -2000 -2001 -2002 -2003 -2004 -2005 -2006 -2007 -2008 -2009
 578-            -2010 -2011 -2012 -2013 -2014
 579-       sd12 1e50 2.564E+07 1.037e8 1.602e8 3.927e8 5.498e8 7.069e8 8.639e8 1.590e9
 580-            1.944e9 3.142e9 3.770e9 4.398e9 5.027e9 5.655e9 1.689e10
 581-       c ===========================================================================
 582-       c ===========================================================================
 583-       c Slabs Ajacent to Ventilation Penetration Side
 584-       f22:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 585-       fs22 1201 -2026 2027
 586-            2016 2017 2018 2019 2020
 587-            2021 2022 2023 2024 2025
 588-            2028 2029 2030 2031 2032
 589-            2033 2034 2035
 590-       sd22 1e50 1e50 1e50
 591-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 592-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 593-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 594-            4.35376e5 4.35376e5 4.35376e5 1e50
 595-       c ===========================================================================
 596-       c ===========================================================================
 597-       c Dose Rate on Vent Side Wall 7ft up avg
 598-       f32:p 1201
warning. without bremsstrahlung, flux estimates will be low.
 599-       fs32 1231 -2026 2027 -1227
 600-       sd32 1e50 1e50 1e50 1e50 6.30E+05
 601-       c ===========================================================================
 602-       c ===========================================================================
 603-       c detectors toward north, with HVAC effects
 604-       f42:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 605-       fs42 1219 -1209 1201 -1205 1206
 606-       sd42 1e50 1e50 1e50 1e50 1e50 3.00e06
 607-            1e50 1e50 1e50 1e50 1e50 3.00e06
 608-            1e50 1e50 1e50 1e50 1e50 3.00e06
 609-            1e50 1e50 1e50 1e50 1e50 3.00e06
```

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 610-            1e50 1e50 1e50 1e50 1e50 3.00e06
 611-            1e50 1e50 1e50 1e50 1e50 3.00e06
 612-            1e50 1e50 1e50 1e50 1e50 3.00e06
 613-            1e50 1e50 1e50 1e50 1e50 3.00e06
 614-            1e50 1e50 1e50 1e50 1e50 3.00e06
 615-            1e50 1e50 1e50 1e50 1e50 3.00e06
 616-            1e50 1e50 1e50 1e50 1e50 3.00e06
 617-       c detectors toward sorth, with no HVAC effects
 618-       f52:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 619-       fs52 1219 -1209 -1201 -1205 1206
 620-       sd52 1e50 1e50 1e50 1e50 1e50 3.00e06
 621-            1e50 1e50 1e50 1e50 1e50 3.00e06
 622-            1e50 1e50 1e50 1e50 1e50 3.00e06
 623-            1e50 1e50 1e50 1e50 1e50 3.00e06
 624-            1e50 1e50 1e50 1e50 1e50 3.00e06
 625-            1e50 1e50 1e50 1e50 1e50 3.00e06
 626-            1e50 1e50 1e50 1e50 1e50 3.00e06
 627-            1e50 1e50 1e50 1e50 1e50 3.00e06
 628-            1e50 1e50 1e50 1e50 1e50 3.00e06
 629-            1e50 1e50 1e50 1e50 1e50 3.00e06
 630-            1e50 1e50 1e50 1e50 1e50 3.00e06
 631-       c ===========================================================================
 632-       c ===========================================================================
 633-       c Detector above the HICS (used as a source check)
 634-       f62:p 1219
warning. without bremsstrahlung, flux estimates will be low.
 635-       fs62 -1205 1206 1203 -1202
 636-       sd62  1e50 1e50 1e50  1e50 5.30E+06
 637-       c ===========================================================================
 638-       c ===========================================================================
 639-       c Photon Flux to Dose Rate Conversion Factors
 640-       de0 0.01 0.03 0.05 0.07 0.10 0.15 0.20
 641-            0.25 0.30 0.35 0.40 0.45 0.50 0.55
 642-            0.60 0.65 0.70 0.80 1.00 1.40 1.80
 643-            2.20 2.60 2.80 3.25 3.75 4.25 4.75
 644-            5.00 5.25 5.75 6.25 6.75 7.50 9.00
 645-            11.0 13.0 15.0
 646-       df0 LIN 3.96E-06 5.82E-07 2.90E-07 2.58E-07 2.83E-07 3.79E-07 5.01E-07
 647-            6.31e-07 7.59E-07 8.78E-07 9.85E-07 1.08E-06 1.17E-06 1.27E-06
 648-            1.36e-06 1.44E-06 1.52E-06 1.68E-06 1.98E-06 2.51E-06 2.99E-06
 649-            3.42e-06 3.82E-06 4.01E-06 4.41E-06 4.83E-06 5.23E-06 5.60E-06
 650-            5.80e-06 6.01E-06 6.37E-06 6.74E-06 7.11E-06 7.66E-06 8.77E-06
 651-            1.03e-05 1.18E-05 1.33E-05
 652-       nps 8.00e08

surface    990   and surface 201990   are the same. 201990   will be deleted.

surface    990   and surface 202990   are the same. 202990   will be deleted.

surface    990   and surface 203990   are the same. 203990   will be deleted.

surface    990   and surface 204990   are the same. 204990   will be deleted.

surface    990   and surface 205990   are the same. 205990   will be deleted.

surface    990   and surface 206990   are the same. 206990   will be deleted.

surface    990   and surface 207990   are the same. 207990   will be deleted.

surface    990   and surface 208990   are the same. 208990   will be deleted.

surface    990   and surface 209990   are the same. 209990   will be deleted.

surface    990   and surface 210990   are the same. 210990   will be deleted.

surface    990   and surface 211990   are the same. 211990   will be deleted.

surface    990   and surface 212990   are the same. 212990   will be deleted.

surface    990   and surface 213990   are the same. 213990   will be deleted.

surface    990   and surface 214990   are the same. 214990   will be deleted.

surface    991   and surface 201991   are the same. 201991   will be deleted.

surface    991   and surface 202991   are the same. 202991   will be deleted.

surface    991   and surface 203991   are the same. 203991   will be deleted.
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surface    991   and surface 204991   are the same. 204991   will be deleted.
surface    991   and surface 205991   are the same. 205991   will be deleted.
surface    991   and surface 206991   are the same. 206991   will be deleted.
surface    991   and surface 207991   are the same. 207991   will be deleted.
surface    991   and surface 208991   are the same. 208991   will be deleted.
surface    991   and surface 209991   are the same. 209991   will be deleted.
surface    991   and surface 210991   are the same. 210991   will be deleted.
surface    991   and surface 211991   are the same. 211991   will be deleted.
surface    991   and surface 212991   are the same. 212991   will be deleted.
surface    991   and surface 213991   are the same. 213991   will be deleted.
surface    991   and surface 214991   are the same. 214991   will be deleted.
surface    992   and surface 201992   are the same. 201992   will be deleted.
surface    992   and surface 202992   are the same. 202992   will be deleted.
surface    992   and surface 203992   are the same. 203992   will be deleted.
surface    992   and surface 204992   are the same. 204992   will be deleted.
surface    992   and surface 205992   are the same. 205992   will be deleted.
surface    992   and surface 206992   are the same. 206992   will be deleted.
surface    992   and surface 207992   are the same. 207992   will be deleted.
surface    992   and surface 208992   are the same. 208992   will be deleted.
surface    992   and surface 209992   are the same. 209992   will be deleted.
surface    992   and surface 210992   are the same. 210992   will be deleted.
surface    992   and surface 211992   are the same. 211992   will be deleted.
surface    992   and surface 212992   are the same. 212992   will be deleted.
surface    992   and surface 213992   are the same. 213992   will be deleted.
surface    992   and surface 214992   are the same. 214992   will be deleted.
surface    210   and surface 201210   are the same. 201210   will be deleted.
surface    210   and surface 202210   are the same. 202210   will be deleted.
surface    210   and surface 203210   are the same. 203210   will be deleted.
surface    210   and surface 204210   are the same. 204210   will be deleted.
surface    210   and surface 205210   are the same. 205210   will be deleted.
surface    210   and surface 206210   are the same. 206210   will be deleted.
surface    210   and surface 207210   are the same. 207210   will be deleted.
surface    210   and surface 208210   are the same. 208210   will be deleted.
surface    210   and surface 209210   are the same. 209210   will be deleted.
surface    210   and surface 210210   are the same. 210210   will be deleted.
surface    210   and surface 211210   are the same. 211210   will be deleted.
surface    210   and surface 212210   are the same. 212210   will be deleted.
surface    210   and surface 213210   are the same. 213210   will be deleted.
surface    210   and surface 214210   are the same. 214210   will be deleted.
surface    211   and surface 201211   are the same. 201211   will be deleted.
```

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 surface    211   and surface 202211   are the same. 202211   will be deleted.

 surface    211   and surface 203211   are the same. 203211   will be deleted.

 surface    211   and surface 204211   are the same. 204211   will be deleted.

 surface    211   and surface 205211   are the same. 205211   will be deleted.

 surface    211   and surface 206211   are the same. 206211   will be deleted.

 surface    211   and surface 207211   are the same. 207211   will be deleted.

 surface    211   and surface 208211   are the same. 208211   will be deleted.

 surface    211   and surface 209211   are the same. 209211   will be deleted.

 surface    211   and surface 210211   are the same. 210211   will be deleted.

 surface    211   and surface 211211   are the same. 211211   will be deleted.

 surface    211   and surface 212211   are the same. 212211   will be deleted.

 surface    211   and surface 213211   are the same. 213211   will be deleted.

 surface    211   and surface 214211   are the same. 214211   will be deleted.

 surface    212   and surface 201212   are the same. 201212   will be deleted.

 surface    212   and surface 202212   are the same. 202212   will be deleted.

 surface    212   and surface 203212   are the same. 203212   will be deleted.

 surface    212   and surface 204212   are the same. 204212   will be deleted.

 surface    212   and surface 205212   are the same. 205212   will be deleted.

 surface    212   and surface 206212   are the same. 206212   will be deleted.

 surface    212   and surface 207212   are the same. 207212   will be deleted.

 surface    212   and surface 208212   are the same. 208212   will be deleted.

 surface    212   and surface 209212   are the same. 209212   will be deleted.

 surface    212   and surface 210212   are the same. 210212   will be deleted.

 surface    212   and surface 211212   are the same. 211212   will be deleted.

 surface    212   and surface 212212   are the same. 212212   will be deleted.

 surface    212   and surface 213212   are the same. 213212   will be deleted.

 surface    212   and surface 214212   are the same. 214212   will be deleted.

 comment.   84 surfaces were deleted for being the same as others.


 information from the header of surface-source file bwssa

 the file was written by mcnp     version 5     with probid =  05/13/09 07:42:34  and ending with dump no.     5
 the title of the creation run was     c     Created on: Tuesday, November 11, 2008 at 09:35
 the original number of histories was    25654088
 the total number of tracks recorded was     4352843 from     4229523 independent histories.

 this ssr problem will use the following particles if available: photon

 warning.   2 materials had unnormalized fractions. print table 40.

 warning.   1 of the materials appear at more than one density.

 warning. sum of segment sizes differs from total in  25 cases.
1cells                                                                                                  print
table 60

                      atom        gram                                        photon
        cell  mat    density     density     volume       mass     pieces importance

     1    11    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     2    12    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     3    13    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
```

4	14	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
5	15	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
6	16	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
7	17	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
8	18	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
9	19	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
10	21	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
11	22	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
12	23	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
13	24	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
14	25	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
15	26	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
16	27	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
17	28	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
18	29	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
19	31	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
20	32	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
21	33	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
22	34	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
23	35	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
24	36	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
25	37	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
26	38	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
27	39	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
28	41	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
29	42	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
30	43	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
31	44	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
32	45	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
33	46	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
34	47	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
35	48	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
36	49	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
37	51	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
38	52	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
39	53	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
40	54	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
41	55	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
42	56	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
43	57	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
44	58	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
45	59	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
46	61	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
47	62	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
48	63	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
49	64	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
50	65	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
51	66	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
52	67	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
53	68	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
54	69	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
55	71	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
56	72	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
57	73	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
58	74	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
59	75	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
60	76	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
61	77	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
62	78	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
63	79	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
64	81	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
65	82	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
66	83	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
67	84	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
68	85	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
69	86	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
70	87	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
71	88	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
72	89	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
73	91	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
74	92	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
75	93	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
76	94	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
77	95	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
78	96	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
79	97	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
80	98	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
81	99	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
82	101	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
83	102	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00

84	103	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
85	104	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
86	105	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
87	106	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
88	107	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
89	108	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
90	109	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
91	111	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
92	112	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
93	113	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
94	114	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
95	115	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
96	116	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
97	117	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
98	118	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
99	119	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
100	121	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
101	122	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
102	123	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
103	124	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
104	125	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
105	126	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
106	127	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
107	128	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
108	129	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
109	131	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
110	132	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
111	133	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
112	134	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
113	135	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
114	136	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
115	137	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
116	138	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
117	139	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
118	141	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
119	142	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
120	143	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
121	144	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
122	145	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
123	146	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
124	147	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
125	148	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
126	149	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
127	151	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
128	152	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
129	153	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
130	154	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
131	155	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
132	156	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
133	157	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
134	158	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
135	159	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
136	1200	3	5.11393E-05	1.22500E-03	3.46881E+06	4.24930E+03	0	1.0000E+00
137	1201	1	7.34055E-02	2.36500E+00	1.40947E+08	3.33340E+08	0	1.0000E+00
138	1202	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
139	12021	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
140	1203	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
141	1204	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	9.0000E+00
142	12041	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	3.0000E+00
143	1205	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
144	1206	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
145	12061	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
146	1207	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
147	1208	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	9.0000E+00
148	12081	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	3.0000E+00
149	1209	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
150	1210	1	7.34055E-02	2.36500E+00	6.18900E+08	1.46370E+09	0	1.0000E+00
151	1211	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	3.0000E+00
152	12111	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	9.0000E+00
153	9999	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	0.0000E+00
154	9998	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
155	9997	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
156	9996	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
157	9995	3	5.11393E-05	1.22500E-03	1.12984E+09	1.38406E+06	0	1.0000E+00
158	9994	3	5.11393E-05	1.22500E-03	2.39844E+09	2.93809E+06	0	1.0000E+00
159	9993	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
160	9992	3	5.11393E-05	1.22500E-03	1.06018E+09	1.29872E+06	0	1.0000E+00
161	9991	3	5.11393E-05	1.22500E-03	2.71842E+07	3.33006E+04	0	1.0000E+00
162	9990	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
163	9989	3	5.11393E-05	1.22500E-03	8.07452E+08	9.89129E+05	0	1.0000E+00

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   164   9988     3  5.11393E-05 1.22500E-03 0.00000E+00 0.00000E+00     0  2.7000E+01
   165   9987     0  0.00000E+00 0.00000E+00 3.61826E+15 0.00000E+00     1  0.0000E+00
   166   9986     3  5.11393E-05 1.22500E-03 6.89441E+11 8.44566E+08     1  1.0000E+00
   167  10000     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   168  10001     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   169  10002     3  5.11393E-05 1.22500E-03 4.42451E+05 5.42002E+02     0  1.0000E+00
   170  10003     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   171  10004     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   172  10005     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   173   2001     3  5.11393E-05 1.22500E-03 8.81574E+10 1.07993E+08     1  5.4000E+01
   174   2002     3  5.11393E-05 1.22500E-03 5.84709E+11 7.16269E+08     1  5.4000E+01
   175   2003     3  5.11393E-05 1.22500E-03 1.37659E+12 1.68633E+09     1  1.0800E+02
   176   2004     3  5.11393E-05 1.22500E-03 4.97560E+12 6.09511E+09     1  1.0800E+02
   177   2005     3  5.11393E-05 1.22500E-03 9.68856E+12 1.18685E+10     1  2.1600E+02
   178   2006     3  5.11393E-05 1.22500E-03 1.59723E+13 1.95661E+10     1  2.1600E+02
   179   2007     3  5.11393E-05 1.22500E-03 2.38269E+13 2.91879E+10     1  4.3200E+02
   180   2008     3  5.11393E-05 1.22500E-03 5.39037E+13 6.60320E+10     1  4.3200E+02
   181   2009     3  5.11393E-05 1.22500E-03 8.04121E+13 9.85049E+10     1  8.6400E+02
   182   2010     3  5.11393E-05 1.22500E-03 1.57615E+14 1.93078E+11     1  8.6400E+02
   183   2011     3  5.11393E-05 1.22500E-03 2.26732E+14 2.77747E+11     1  1.7280E+03
   184   2012     3  5.11393E-05 1.22500E-03 3.08416E+14 3.77809E+11     1  1.7280E+03
   185   2013     3  5.11393E-05 1.22500E-03 4.02666E+14 4.93265E+11     1  3.4560E+03
   186   2014     3  5.11393E-05 1.22500E-03 5.09482E+14 6.24115E+11     1  3.4560E+03
   187   2015     3  5.11393E-05 1.22500E-03 1.82349E+15 2.23378E+12     1  1.0000E+00
   188    200     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   189    201     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   190    202     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   191    203     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   192    204     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   193    205     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   194    206     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   195    207     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   196    208     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   197    209     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   198    210     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   199    211     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   200    212     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   201    213     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  2.7000E+01
   202    214     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   203    222     4  8.47555E-02 7.86000E+00 1.14939E+05 9.03419E+05     0  2.7000E+01

 total                                    7.23819E+15 4.44062E+12

 warning. surface    213 is not used for anything.

 ************************************************
 * Random Number Generator  =                   1 *
 * Random Number Seed       =       19073486328125 *
 * Random Number Multiplier =       19073486328125 *
 * Random Number Adder      =                    0 *
 * Random Number Bits Used  =                   48 *
 * Random Number Stride     =               152917 *
 ************************************************


        12 warning messages so far.
1cross-section tables                                                                                print
table 100

     table    length

                        tables from file mcplib04

   1000.04p    1898  ENDF/B-VI Release 8 Photoatomic Data for 1-H                                    mat 100
02/07/03
   6000.04p    3152  ENDF/B-VI Release 8 Photoatomic Data for 6-C                                    mat 600
02/07/03
   7000.04p    3194  ENDF/B-VI Release 8 Photoatomic Data for 7-N                                    mat 700
02/07/03
   8000.04p    3272  ENDF/B-VI Release 8 Photoatomic Data for 8-O                                    mat 800
02/07/03
  11000.04p    3995  ENDF/B-VI Release 8 Photoatomic Data for 11-NA                                  mat1100
02/07/03
  12000.04p    3781  ENDF/B-VI Release 8 Photoatomic Data for 12-MG                                  mat1200
02/07/03
  13000.04p    4846  ENDF/B-VI Release 8 Photoatomic Data for 13-AL                                  mat1300
02/07/03
  14000.04p    4792  ENDF/B-VI Release 8 Photoatomic Data for 14-SI                                  mat1400
02/07/03
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  15000.04p    4498  ENDF/B-VI Release 8 Photoatomic Data for 15-P                                mat1500
02/07/03
  16000.04p    4654  ENDF/B-VI Release 8 Photoatomic Data for 16-S                                mat1600
02/07/03
  19000.04p    5047  ENDF/B-VI Release 8 Photoatomic Data for 19-K                                mat1900
02/07/03
  20000.04p    5013  ENDF/B-VI Release 8 Photoatomic Data for 20-CA                               mat2000
02/07/03
  22000.04p    5742  ENDF/B-VI Release 8 Photoatomic Data for 22-TI                               mat2200
02/07/03
  25000.04p    5598  ENDF/B-VI Release 8 Photoatomic Data for 25-MN                               mat2500
02/07/03
  26000.04p    5718  ENDF/B-VI Release 8 Photoatomic Data for 26-FE                               mat2600
02/07/03

  total       65200

 warning. simple physics turned on for photons > 100 mev.

************************************************************************************************************
*******
 dump no.    1 on file runtpe       nps =           0     coll =              0     ctm =        0.00   nrn =
0


        13 warning messages so far.

************************************************************************************************************
*******
 dump no.    2 on file runtpe       nps =      172985     coll =      259335572     ctm =       60.01   nrn =
3226676562


************************************************************************************************************
*******
 dump no.    3 on file runtpe       nps =      345372     coll =      516322971     ctm =      120.02   nrn =
6423023946


************************************************************************************************************
*******
 dump no.    4 on file runtpe       nps =      514162     coll =      772448831     ctm =      180.03   nrn =
9611888916


************************************************************************************************************
*******
 dump no.    5 on file runtpe       nps =      684133     coll =     1027162836     ctm =      240.04   nrn =
12781215860


************************************************************************************************************
*******
 dump no.    6 on file runtpe       nps =      856064     coll =     1284343352     ctm =      300.04   nrn =
15981078134


************************************************************************************************************
*******
 dump no.    7 on file runtpe       nps =     1028277     coll =     1541553357     ctm =      360.05   nrn =
19180960399


************************************************************************************************************
*******
 dump no.    8 on file runtpe       nps =     1201726     coll =     1801000571     ctm =      420.06   nrn =
22408401808


************************************************************************************************************
*******
```

```
 dump no.    9 on file runtpe       nps =     1375034     coll =     2061479636     ctm =      480.06   nrn =
25649812656


*****************************************************************************************************************
*******
 dump no.   10 on file runtpe       nps =     1547045     coll =     2320745950     ctm =      540.07   nrn =
28875936431


*****************************************************************************************************************
*******
 dump no.   11 on file runtpe       nps =     1720588     coll =     2579023702     ctm =      600.09   nrn =
32087940632


*****************************************************************************************************************
*******
 dump no.   12 on file runtpe       nps =     1893896     coll =     2836315415     ctm =      660.09   nrn =
35287367558


*****************************************************************************************************************
*******
 dump no.   13 on file runtpe       nps =     2067881     coll =     3094523266     ctm =      720.10   nrn =
38498054428


*****************************************************************************************************************
*******
 dump no.   14 on file runtpe       nps =     2240390     coll =     3354153834     ctm =      780.14   nrn =
41728893894


*****************************************************************************************************************
*******
 dump no.   15 on file runtpe       nps =     2413745     coll =     3613399173     ctm =      840.15   nrn =
44954133046


*****************************************************************************************************************
*******
 dump no.   16 on file runtpe       nps =     2587495     coll =     3873481243     ctm =      900.15   nrn =
48189563856


*****************************************************************************************************************
*******
 dump no.   17 on file runtpe       nps =     2760126     coll =     4133349455     ctm =      960.16   nrn =
51423605233


*****************************************************************************************************************
*******
 dump no.   18 on file runtpe       nps =     2933829     coll =     4392494906     ctm =     1020.18   nrn =
54646999602


*****************************************************************************************************************
*******
 dump no.   19 on file runtpe       nps =     3106404     coll =     4653318723     ctm =     1080.19   nrn =
57893284960


*****************************************************************************************************************
*******
 dump no.   20 on file runtpe       nps =     3279458     coll =     4913957752     ctm =     1140.19   nrn =
61137061720
```

```
************************************************************************************************************************
*******
 dump no.   21 on file runtpe       nps =     3453725     coll =     5172473329     ctm =     1200.19   nrn =
64351311273


************************************************************************************************************************
*******
 dump no.   22 on file runtpe       nps =     3628039     coll =     5430544945     ctm =     1260.21   nrn =
67560182698


************************************************************************************************************************
*******
 dump no.   23 on file runtpe       nps =     3802339     coll =     5689728165     ctm =     1320.21   nrn =
70783302727

1problem summary                                  source particle weight for summary table normalization =
23995456.00

      run terminated when it had used    0  minutes of computer time.
+                                                                                                    06/24/09
07:47:07
      c     Created on: Tuesday, November 11, 2008 at 09:35                              probid =  06/23/09
08:50:09
0
 photon creation     tracks      weight        energy            photon loss         tracks      weight
energy
                                (per source particle)                                            (per source
particle)

 source           126972150    1.7977E+14    4.9622E-01          escape              298366    3.8374E+11
3.1547E-04
                                                                 energy cutoff            0    0.            0.
                                                                 time cutoff              0    0.            0.
 weight window            0    0.            0.                 weight window            0    0.            0.
 cell importance  775759627    3.0682E+13    2.7676E-02         cell importance  275244534    3.0685E+13
2.7687E-02
 weight cutoff            0    0.            0.                 weight cutoff            0    0.            0.
 e or t importance        0    0.            0.                 e or t importance        0    0.            0.
 dxtran                   0    0.            0.                 dxtran                   0    0.            0.
 forced collisions        0    0.            0.                 forced collisions        0    0.            0.
 exp. transform           0    0.            0.                 exp. transform           0    0.            0.
 from neutrons            0    0.            0.                 compton scatter          0    0.
4.1029E-01
 bremsstrahlung           0    0.            0.                 capture          696001091    2.1506E+14
8.6665E-02
 p-annihilation      168442    6.8747E+10    1.9542E-04         pair production      84221    3.4374E+10
2.4959E-04
 photonuclear             0    0.            0.                 photonuclear abs         0    0.            0.
 electron x-rays          0    0.            0.
 1st fluorescence  68727993    3.5638E+13    1.1133E-03
 2nd fluorescence         0    0.            0.
     total        971628212    2.4616E+14    5.2521E-01             total        971628212    2.4616E+14
5.2521E-01

   number of photons banked                603522376        average time of (shakes)              cutoffs
   photon tracks per source particle      4.0492E+01          escape            9.8707E+01          tco
1.0000E+33
   photon collisions per source particle  2.4681E+02          capture           6.1602E+00          eco
1.0000E-03
   total photon collisions                5922400034          capture or escape 6.3250E+00          wc1  -
5.0000E-01
                                                              any termination   6.6163E+00          wc2  -
2.5000E-01

 computer time so far in this run  1373.81 minutes            maximum number ever in bank        15
 computer time in mcrun            1373.75 minutes            bank overflows to backup file       0
 source particles per minute            2.8800E+03
 random numbers generated              73678780645           most random numbers used was     4198223 in
history     1591124

 warning.  random number stride   152917 exceeded    28369 times.

 range of sampled source weights = 2.2838E+13 to 4.7148E+14
```

warning. importance function may be poor. see print table 120.
1photon activity in each cell print table 126

cell	tracks entering	population	collisions	collisions * weight (per history)	number weighted energy	flux weighted energy	average track weight (relative)	average track mfp (cm)
1 11	60119	58460	321386	4.3536E+11	9.2538E-02	9.2538E-02	3.2284E+13	5.3744E+00
2 12	67242	64997	356705	4.8556E+11	9.1824E-02	9.1824E-02	3.2564E+13	5.3607E+00
3 13	72829	70377	387583	5.2544E+11	9.1385E-02	9.1385E-02	3.2262E+13	5.3521E+00
4 14	76061	73457	403640	5.4042E+11	9.1235E-02	9.1235E-02	3.1854E+13	5.3475E+00
5 15	77893	75286	412806	5.6470E+11	9.0778E-02	9.0778E-02	3.2751E+13	5.3395E+00
6 16	79052	76378	420223	5.7345E+11	9.1293E-02	9.1293E-02	3.2680E+13	5.3515E+00
7 17	79098	76466	420633	5.8598E+11	9.0119E-02	9.0119E-02	3.3200E+13	5.3229E+00
8 18	78756	76080	418237	5.7514E+11	9.0672E-02	9.0672E-02	3.2758E+13	5.3382E+00
9 19	77496	74901	413269	5.7440E+11	9.1084E-02	9.1084E-02	3.3179E+13	5.3469E+00
10 21	74167	71648	393478	5.4472E+11	9.0707E-02	9.0707E-02	3.3003E+13	5.3323E+00
11 22	70349	67869	372435	5.0888E+11	9.2222E-02	9.2222E-02	3.2678E+13	5.3701E+00
12 23	64071	61922	339532	4.6230E+11	9.2606E-02	9.2606E-02	3.2647E+13	5.3747E+00
13 24	54159	52484	291502	3.9529E+11	9.3539E-02	9.3539E-02	3.2257E+13	5.3891E+00
14 25	70292	68421	377625	5.1444E+11	9.2331E-02	9.2331E-02	3.2626E+13	5.3694E+00
15 26	79184	75894	417271	5.6877E+11	9.0776E-02	9.0776E-02	3.2381E+13	5.3302E+00
16 27	87560	83927	460289	6.2832E+11	9.0144E-02	9.0144E-02	3.2627E+13	5.3175E+00
17 28	92168	88239	481266	6.5755E+11	9.0170E-02	9.0170E-02	3.2594E+13	5.3222E+00
18 29	96180	92185	505413	7.0010E+11	9.0264E-02	9.0264E-02	3.3077E+13	5.3226E+00
19 31	97691	93612	512249	6.9265E+11	8.9741E-02	8.9741E-02	3.2239E+13	5.3169E+00
20 32	99791	95589	522085	7.1299E+11	8.9965E-02	8.9965E-02	3.2515E+13	5.3177E+00
21 33	98694	94586	513590	7.0558E+11	8.9425E-02	8.9425E-02	3.2796E+13	5.3072E+00
22 34	97339	93343	509812	6.9334E+11	9.0158E-02	9.0158E-02	3.2456E+13	5.3246E+00
23 35	94049	90144	491766	6.6997E+11	8.9467E-02	8.9467E-02	3.2492E+13	5.3089E+00
24 36	89800	86008	469809	6.3600E+11	9.0011E-02	9.0011E-02	3.2169E+13	5.3195E+00
25 37	83530	80015	438206	5.9061E+11	9.0273E-02	9.0273E-02	3.2227E+13	5.3221E+00
26 38	74375	71371	389946	5.3172E+11	9.1060E-02	9.1060E-02	3.2529E+13	5.3348E+00
27 39	59771	57786	320162	4.3181E+11	9.3110E-02	9.3110E-02	3.2136E+13	5.3819E+00
28 41	81290	78430	429652	5.8718E+11	9.1134E-02	9.1134E-02	3.2547E+13	5.3394E+00
29 42	91795	87944	481653	6.5442E+11	9.0225E-02	9.0225E-02	3.2467E+13	5.3204E+00
30 43	98722	94527	514044	7.1396E+11	8.9838E-02	8.9838E-02	3.3045E+13	5.3129E+00
31 44	103238	98953	536594	7.3311E+11	8.9359E-02	8.9359E-02	3.2430E+13	5.3049E+00
32 45	106871	102362	555375	7.6707E+11	8.8868E-02	8.8868E-02	3.2951E+13	5.2985E+00
33 46	108275	103769	562885	7.6752E+11	8.8819E-02	8.8819E-02	3.2487E+13	5.2962E+00
34 47	108787	104223	569124	7.8121E+11	8.8721E-02	8.8721E-02	3.2921E+13	5.2969E+00

35	48	107706	103156	563591	7.5556E+11	8.9100E-02	8.9100E-02	3.1936E+13
5.3043E+00								
36	49	105602	101094	552477	7.5269E+11	8.8780E-02	8.8780E-02	3.2500E+13
5.2980E+00								
37	51	101908	97586	529999	7.2311E+11	8.9020E-02	8.9020E-02	3.2606E+13
5.3005E+00								
38	52	96027	92008	503819	6.8085E+11	8.9806E-02	8.9806E-02	3.2323E+13
5.3172E+00								
39	53	87851	84194	460992	6.2957E+11	9.0452E-02	9.0452E-02	3.2496E+13
5.3256E+00								
40	54	74395	71555	396383	5.2982E+11	9.1526E-02	9.1526E-02	3.1806E+13
5.3452E+00								
41	55	81911	79628	437057	5.9274E+11	9.1078E-02	9.1078E-02	3.2366E+13
5.3423E+00								
42	56	91165	87268	478489	6.5400E+11	8.9399E-02	8.9399E-02	3.2474E+13
5.3071E+00								
43	57	100708	96388	527171	7.1117E+11	8.9945E-02	8.9945E-02	3.2332E+13
5.3194E+00								
44	58	106217	101645	552218	7.6069E+11	8.9481E-02	8.9481E-02	3.3019E+13
5.3096E+00								
45	59	110268	105691	576529	7.8892E+11	8.8888E-02	8.8888E-02	3.2654E+13
5.2994E+00								
46	61	112643	107978	590905	8.1011E+11	8.8965E-02	8.8965E-02	3.2525E+13
5.2993E+00								
47	62	113726	108966	590815	8.0428E+11	8.8647E-02	8.8647E-02	3.2499E+13
5.2960E+00								
48	63	113493	108547	591180	8.1868E+11	8.8510E-02	8.8510E-02	3.2940E+13
5.2856E+00								
49	64	111595	106981	580071	7.8919E+11	8.8286E-02	8.8286E-02	3.2338E+13
5.2860E+00								
50	65	108460	103869	564915	7.7929E+11	8.8866E-02	8.8866E-02	3.3019E+13
5.2992E+00								
51	66	103853	99449	541954	7.4201E+11	8.9261E-02	8.9261E-02	3.2622E+13
5.3061E+00								
52	67	96735	92552	505565	6.8968E+11	9.0101E-02	9.0101E-02	3.2511E+13
5.3213E+00								
53	68	85824	82220	449958	6.1995E+11	9.0103E-02	9.0103E-02	3.2926E+13
5.3144E+00								
54	69	69774	67478	373918	5.0971E+11	9.2128E-02	9.2128E-02	3.2452E+13
5.3627E+00								
55	71	86910	83797	456375	6.0839E+11	9.0321E-02	9.0321E-02	3.1680E+13
5.3240E+00								
56	72	98414	94202	514423	7.0114E+11	8.9561E-02	8.9561E-02	3.2469E+13
5.3056E+00								
57	73	104982	100489	549139	7.5691E+11	8.8815E-02	8.8815E-02	3.2769E+13
5.2965E+00								
58	74	109605	104980	573407	7.8137E+11	8.8913E-02	8.8913E-02	3.2465E+13
5.2997E+00								
59	75	113587	108835	592687	8.2100E+11	8.8249E-02	8.8249E-02	3.2996E+13
5.2891E+00								
60	76	115902	110914	602694	8.2763E+11	8.9110E-02	8.9110E-02	3.2846E+13
5.3036E+00								
61	77	116061	111136	604686	8.3833E+11	8.8651E-02	8.8651E-02	3.3095E+13
5.2940E+00								
62	78	114661	109867	596630	8.1757E+11	8.8237E-02	8.8237E-02	3.2839E+13
5.2856E+00								
63	79	112366	107725	585498	8.0475E+11	8.9113E-02	8.9113E-02	3.2761E+13
5.3053E+00								
64	81	106865	102430	558691	7.5349E+11	8.8669E-02	8.8669E-02	3.2150E+13
5.2943E+00								
65	82	101767	97551	532767	7.3234E+11	8.9482E-02	8.9482E-02	3.2878E+13
5.3115E+00								
66	83	93504	89628	491121	6.6647E+11	9.0661E-02	9.0661E-02	3.2379E+13
5.3287E+00								
67	84	79695	76562	421950	5.7276E+11	9.0800E-02	9.0800E-02	3.2251E+13
5.3322E+00								
68	85	83702	81408	445008	6.0437E+11	9.0887E-02	9.0887E-02	3.2188E+13
5.3461E+00								
69	86	92939	89028	488315	6.6601E+11	9.0083E-02	9.0083E-02	3.2757E+13
5.3228E+00								
70	87	101868	97688	531028	7.1558E+11	9.0276E-02	9.0276E-02	3.2173E+13
5.3265E+00								
71	88	108406	103913	562722	7.6949E+11	8.9014E-02	8.9014E-02	3.2652E+13
5.3022E+00								
72	89	112664	107806	588244	8.0856E+11	8.8996E-02	8.8996E-02	3.2980E+13
5.3020E+00								
73	91	114778	109858	598356	8.1952E+11	8.8368E-02	8.8368E-02	3.2477E+13
5.2888E+00								
74	92	115700	110806	602728	8.2414E+11	8.8487E-02	8.8487E-02	3.2532E+13
5.2910E+00								

75	93	115158	110227	597993	8.3232E+11	8.8588E-02	8.8588E-02	3.3084E+13
5.2950E+00								
76	94	113266	108582	589834	8.2018E+11	8.8643E-02	8.8643E-02	3.3136E+13
5.2953E+00								
77	95	109700	105145	570756	7.7826E+11	8.8853E-02	8.8853E-02	3.2664E+13
5.2983E+00								
78	96	105186	100778	547781	7.3864E+11	8.9451E-02	8.9451E-02	3.2285E+13
5.3102E+00								
79	97	98452	94349	513890	6.9608E+11	9.0417E-02	9.0417E-02	3.2341E+13
5.3275E+00								
80	98	87348	83672	456534	6.2268E+11	8.9821E-02	8.9821E-02	3.2491E+13
5.3140E+00								
81	99	71305	68906	380079	5.1170E+11	9.1554E-02	9.1554E-02	3.2141E+13
5.3499E+00								
82	101	85672	82496	450930	6.1152E+11	9.0746E-02	9.0746E-02	3.2404E+13
5.3383E+00								
83	102	96014	91894	502188	6.9143E+11	8.9591E-02	8.9591E-02	3.2857E+13
5.3072E+00								
84	103	103107	98769	537977	7.3812E+11	8.8890E-02	8.8890E-02	3.2652E+13
5.2970E+00								
85	104	108137	103602	563576	7.6458E+11	8.8953E-02	8.8953E-02	3.2292E+13
5.3001E+00								
86	105	111652	107074	582849	8.0234E+11	8.8337E-02	8.8337E-02	3.2758E+13
5.2865E+00								
87	106	113311	108569	588502	7.9680E+11	8.8547E-02	8.8547E-02	3.2189E+13
5.2908E+00								
88	107	113119	108307	589550	8.0349E+11	8.8846E-02	8.8846E-02	3.2607E+13
5.3010E+00								
89	108	112809	108153	588815	8.0372E+11	8.8787E-02	8.8787E-02	3.2661E+13
5.2984E+00								
90	109	110263	105655	578569	7.9087E+11	8.8660E-02	8.8660E-02	3.2535E+13
5.2935E+00								
91	111	105785	101290	550515	7.4996E+11	8.9332E-02	8.9332E-02	3.2424E+13
5.3115E+00								
92	112	99628	95386	521893	7.1753E+11	8.9256E-02	8.9256E-02	3.2865E+13
5.3029E+00								
93	113	91567	87707	478684	6.4136E+11	9.0052E-02	9.0052E-02	3.1945E+13
5.3178E+00								
94	114	77856	74821	411708	5.4650E+11	9.1418E-02	9.1418E-02	3.1596E+13
5.3442E+00								
95	115	77966	75854	416607	5.6286E+11	9.1106E-02	9.1106E-02	3.2046E+13
5.3463E+00								
96	116	87795	83938	461583	6.3552E+11	9.0265E-02	9.0265E-02	3.2798E+13
5.3255E+00								
97	117	96673	92616	504937	6.9445E+11	8.9710E-02	8.9710E-02	3.2751E+13
5.3115E+00								
98	118	102847	98417	536980	7.3730E+11	8.9432E-02	8.9432E-02	3.2734E+13
5.3050E+00								
99	119	106279	101820	555934	7.5380E+11	8.9435E-02	8.9435E-02	3.2316E+13
5.3104E+00								
100	121	108501	103932	567676	7.7025E+11	8.8662E-02	8.8662E-02	3.2187E+13
5.2923E+00								
101	122	109263	104646	570567	7.8691E+11	8.8544E-02	8.8544E-02	3.2941E+13
5.2940E+00								
102	123	108827	104257	569888	7.8250E+11	8.8982E-02	8.8982E-02	3.2659E+13
5.3017E+00								
103	124	106841	102347	556840	7.6160E+11	8.9113E-02	8.9113E-02	3.2757E+13
5.3043E+00								
104	125	103675	99340	542241	7.4129E+11	8.9205E-02	8.9205E-02	3.2573E+13
5.3047E+00								
105	126	98964	94737	517755	7.1026E+11	8.9921E-02	8.9921E-02	3.2787E+13
5.3187E+00								
106	127	92859	88873	488276	6.6214E+11	9.0781E-02	9.0781E-02	3.2267E+13
5.3329E+00								
107	128	82063	78536	431238	5.8119E+11	9.0070E-02	9.0070E-02	3.2112E+13
5.3137E+00								
108	129	67304	65095	359304	4.8967E+11	9.2371E-02	9.2371E-02	3.2460E+13
5.3689E+00								
109	131	75583	72827	401896	5.4990E+11	9.0885E-02	9.0885E-02	3.2508E+13
5.3310E+00								
110	132	85836	82115	450519	6.0932E+11	9.0951E-02	9.0951E-02	3.2374E+13
5.3321E+00								
111	133	91974	88127	483481	6.5616E+11	8.9874E-02	8.9874E-02	3.2440E+13
5.3174E+00								
112	134	96573	92437	505850	6.9358E+11	9.0014E-02	9.0014E-02	3.2698E+13
5.3226E+00								
113	135	99276	95094	519304	7.1138E+11	8.9784E-02	8.9784E-02	3.2715E+13
5.3118E+00								
114	136	100227	96056	525656	7.0875E+11	8.9605E-02	8.9605E-02	3.2110E+13
5.3107E+00								

115	137	100994	96689	527565	7.2044E+11	8.9285E-02	8.9285E-02	3.2602E+13
5.3064E+00								
116	138	99555	95341	520110	7.1395E+11	8.9412E-02	8.9412E-02	3.2681E+13
5.3103E+00								
117	139	96799	92777	507530	7.0145E+11	9.0221E-02	9.0221E-02	3.3007E+13
5.3248E+00								
118	141	93675	89649	489694	6.6517E+11	8.9985E-02	8.9985E-02	3.2460E+13
5.3200E+00								
119	142	87727	84001	461528	6.2726E+11	9.0204E-02	9.0204E-02	3.2493E+13
5.3206E+00								
120	143	80264	76990	421298	5.6188E+11	9.0620E-02	9.0620E-02	3.1786E+13
5.3236E+00								
121	144	67985	65364	360007	4.9898E+11	9.1766E-02	9.1766E-02	3.3121E+13
5.3543E+00								
122	145	60910	59594	331268	4.5244E+11	9.2681E-02	9.2681E-02	3.2381E+13
5.3730E+00								
123	146	67465	65259	358087	4.8961E+11	9.2358E-02	9.2358E-02	3.2550E+13
5.3643E+00								
124	147	74090	71594	393657	5.3275E+11	9.1967E-02	9.1967E-02	3.2356E+13
5.3616E+00								
125	148	78960	76314	418349	5.7513E+11	9.0788E-02	9.0788E-02	3.2727E+13
5.3413E+00								
126	149	81982	79194	433332	5.9677E+11	9.0354E-02	9.0354E-02	3.2749E+13
5.3338E+00								
127	151	82997	80299	440698	6.1479E+11	9.0199E-02	9.0199E-02	3.3139E+13
5.3317E+00								
128	152	83411	80628	441747	6.1202E+11	9.0282E-02	9.0282E-02	3.2993E+13
5.3330E+00								
129	153	83494	80825	443168	6.1444E+11	9.0116E-02	9.0116E-02	3.3219E+13
5.3284E+00								
130	154	81988	79332	435602	5.9637E+11	9.0093E-02	9.0093E-02	3.2599E+13
5.3261E+00								
131	155	79491	76795	420550	5.8070E+11	9.1183E-02	9.1183E-02	3.3032E+13
5.3471E+00								
132	156	75490	72988	401373	5.5085E+11	9.2017E-02	9.2017E-02	3.2746E+13
5.3651E+00								
133	157	70068	67728	374402	5.0056E+11	9.1619E-02	9.1619E-02	3.1827E+13
5.3565E+00								
134	158	62308	60246	332126	4.5810E+11	9.2987E-02	9.2987E-02	3.3005E+13
5.3762E+00								
135	159	51721	50252	278567	3.7922E+11	9.4410E-02	9.4410E-02	3.2470E+13
5.4028E+00								
136	1200	554369	515690	7113	9.4346E+09	4.0347E-01	4.0347E-01	3.1648E+13
7.8383E+03								
137	1201	6153224	6040900	26392003	3.3771E+13	3.5908E-01	3.5908E-01	2.9912E+13
3.6532E+00								
138	1202	3526952	3436066	17414733	2.2593E+12	3.6750E-01	3.6750E-01	2.7832E+13
3.7592E+00								
139	12021	20135966	19896849	87988065	3.8019E+13	3.9420E-01	3.9420E-01	3.0316E+13
3.7998E+00								
140	1203	18457415	18340066	81118967	3.4516E+13	3.6433E-01	3.6433E-01	2.9759E+13
3.6805E+00								
141	1204	4924229	4798206	24127973	3.1786E+12	3.5382E-01	3.5382E-01	2.8282E+13
3.6945E+00								
142	12041	33253167	32907233	143873991	6.2610E+13	3.9247E-01	3.9247E-01	3.0500E+13
3.7869E+00								
143	1205	31911191	31697258	137654698	5.8834E+13	3.6608E-01	3.6608E-01	2.9947E+13
3.6853E+00								
144	1206	177559	173171	843368	1.0644E+11	3.1801E-01	3.1801E-01	2.6781E+13
3.5319E+00								
145	12061	1202236	1189203	5124342	2.1199E+12	2.5834E-01	2.5834E-01	2.9068E+13
3.1781E+00								
146	1207	1358768	1349832	5499326	2.3558E+12	1.7561E-01	1.7561E-01	3.0348E+13
2.7909E+00								
147	1208	5585855	5448346	25885263	3.4561E+12	3.5831E-01	3.5831E-01	2.8601E+13
3.7071E+00								
148	12081	32559497	32198657	139821953	6.1025E+13	3.9143E-01	3.9143E-01	3.0580E+13
3.7811E+00								
149	1209	31777952	31569534	136630319	5.8861E+13	3.6458E-01	3.6458E-01	3.0124E+13
3.6778E+00								
150	1210	971519	949739	3373560	4.5301E+12	1.2862E-01	1.2862E-01	3.1780E+13
2.3956E+00								
151	1211	212441064	209375629	975665783	4.5433E+14	4.1023E-01	4.1023E-01	3.2723E+13
3.9983E+00								
152	12111	57948851	56464890	291827151	4.3224E+13	3.9557E-01	3.9557E-01	3.1918E+13
4.0018E+00								
154	9998	10038973	7360727	967023	1.3511E+12	1.2142E-01	1.2142E-01	3.3015E+13
5.4306E+03								
155	9997	11157834	8002166	1017235	1.4259E+12	1.1858E-01	1.1858E-01	3.3165E+13
5.3872E+03								

156	9996	7665526	5487072	681025	9.4236E+11	1.2227E-01	1.2227E-01	3.2840E+13
5.4413E+03								
157	9995	150282669	137796243	6745696	9.6924E+12	4.1760E-01	4.1760E-01	3.3200E+13
7.9294E+03								
158	9994	144340754	122669697	10233910	1.4893E+13	4.0396E-01	4.0396E-01	3.3725E+13
7.8442E+03								
159	9993	405584	336105	18881	2.4523E+10	1.3409E-01	1.3409E-01	3.1183E+13
5.6648E+03								
160	9992	906296	796762	92126	1.2210E+11	1.4689E-01	1.4689E-01	3.1450E+13
5.8108E+03								
161	9991	826706	768508	3973	5.2517E+09	1.5783E-01	1.5783E-01	3.1623E+13
5.9292E+03								
162	9990	1435219	1324348	77823	1.0456E+11	1.9175E-01	1.9175E-01	3.1393E+13
6.2096E+03								
163	9989	8269326	6824182	436926	5.8506E+11	3.5294E-01	3.5294E-01	3.1066E+13
7.4891E+03								
164	9988	23796384	22988372	3870244	1.8797E+11	4.4808E-01	4.4808E-01	3.1297E+13
8.4796E+03								
166	9986	297700	297698	1637	2.1003E+09	1.6817E-01	1.6817E-01	3.0721E+13
5.9068E+03								
167	10000	32870	31419	143	1.5833E+08	4.0767E-01	4.0767E-01	3.1300E+13
7.9964E+03								
168	10001	50135	48197	210	2.2397E+08	3.9539E-01	3.9539E-01	3.2603E+13
7.8233E+03								
169	10002	134763	130842	817	1.1699E+09	4.1171E-01	4.1171E-01	3.1276E+13
7.9318E+03								
170	10003	50199	48200	255	3.4164E+08	3.7857E-01	3.7857E-01	3.2004E+13
7.7024E+03								
171	10004	34647	33162	168	2.0069E+08	3.9954E-01	3.9954E-01	3.4850E+13
7.8671E+03								
172	10005	1511	1452	10	9.7937E+06	3.6418E-01	3.6418E-01	2.5895E+13
7.6262E+03								
173	2001	46064503	42770107	9468648	2.2937E+11	4.3163E-01	4.3163E-01	3.1266E+13
8.3006E+03								
174	2002	46816779	42866577	25661394	6.2211E+11	3.8194E-01	3.8194E-01	3.1314E+13
7.8287E+03								
175	2003	91371488	77939525	57475055	6.9688E+11	3.2964E-01	3.2964E-01	3.1337E+13
7.3210E+03								
176	2004	88365023	75186260	103014656	1.2487E+12	2.8491E-01	2.8491E-01	3.1340E+13
6.8694E+03								
177	2005	158417233	127383462	204628258	1.2395E+12	2.4981E-01	2.4981E-01	3.1334E+13
6.5016E+03								
178	2006	136008751	110042299	187196467	1.1328E+12	2.2837E-01	2.2837E-01	3.1307E+13
6.2694E+03								
179	2007	225447130	174064044	323485091	9.7736E+11	2.1456E-01	2.1456E-01	3.1283E+13
6.1163E+03								
180	2008	178100378	142960763	382443322	1.1548E+12	2.0390E-01	2.0390E-01	3.1257E+13
5.9962E+03								
181	2009	247261595	190569011	543563845	8.1954E+11	1.9609E-01	1.9609E-01	3.1222E+13
5.9074E+03								
182	2010	162445197	129516472	464678044	6.9981E+11	1.9125E-01	1.9125E-01	3.1188E+13
5.8522E+03								
183	2011	184879519	144923228	534258874	4.0164E+11	1.8858E-01	1.8858E-01	3.1135E+13
5.8220E+03								
184	2012	102723318	81307476	298737347	2.2421E+11	1.8753E-01	1.8753E-01	3.1087E+13
5.8106E+03								
185	2013	112424155	88906451	328326594	1.2299E+11	1.8741E-01	1.8741E-01	3.1033E+13
5.8100E+03								
186	2014	60622307	52664835	177603539	6.6412E+10	1.8816E-01	1.8816E-01	3.1017E+13
5.8224E+03								
187	2015	7794	7793	43588	5.6689E+10	1.9498E-01	1.9498E-01	3.1173E+13
5.9064E+03								
188	200	2579195	2309053	5110562	7.1232E+12	4.9063E-01	4.9063E-01	3.1842E+13
1.2872E+00								
189	201	2824055	2520541	5610488	7.8130E+12	4.9327E-01	4.9327E-01	3.1926E+13
1.2895E+00								
190	202	3120834	2779046	6222259	8.6316E+12	5.0249E-01	5.0249E-01	3.1862E+13
1.3040E+00								
191	203	3341368	2969797	6671846	9.3670E+12	5.0396E-01	5.0396E-01	3.2380E+13
1.3083E+00								
192	204	3478338	3088728	6955964	9.7373E+12	5.0278E-01	5.0278E-01	3.2023E+13
1.3062E+00								
193	205	3512851	3119975	7018543	9.9148E+12	5.0671E-01	5.0671E-01	3.2554E+13
1.3141E+00								
194	206	3429099	3044398	6866310	9.6367E+12	5.0471E-01	5.0471E-01	3.2346E+13
1.3102E+00								
195	207	3237801	2876215	6457490	9.0241E+12	5.0220E-01	5.0220E-01	3.1886E+13
1.3053E+00								
196	208	2951532	2626583	5883780	8.1685E+12	4.9705E-01	4.9705E-01	3.1849E+13
1.2982E+00								

```
   197   209      2629912      2339985      5207359    7.1908E+12   5.0514E-01   5.0514E-01   3.1773E+13
1.3127E+00
   198   210      2204486      1966107      4343382    5.9423E+12   5.1838E-01   5.1838E-01   3.1497E+13
1.3355E+00
   199   211      1436876      1296926      2782291    3.6279E+12   5.1423E-01   5.1423E-01   2.9642E+13
1.3302E+00
   200   212       706024       646462      1322996    1.6444E+12   4.9815E-01   4.9815E-01   2.8343E+13
1.3055E+00
   201   213      9109107      9076894     16774153    7.5078E+11   4.7470E-01   4.7470E-01   2.7024E+13
1.2647E+00
   202   214       165197       152989       300695    3.7143E+11   4.5870E-01   4.5870E-01   2.7884E+13
1.2319E+00
   203   222       517777       516705      1255951    6.0407E+10   2.6915E-01   2.6915E-01   2.9882E+13
9.3518E-01

     total    2721371498   2305741962   5922400034    1.0909E+15

1tally   2        nps =     3956466
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     23995456.00

           this tally is modified by a dose function.

           areas
                surface:     1231
                         1.78374E+06

 surface  1231
                1.54862E-01 0.0059


================================================================================================================
====================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally   2

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.01      yes          yes            0.00      yes         yes            constant
random       4.68
 passed?        yes          yes      yes          yes              yes      yes         yes               yes
yes         yes


================================================================================================================
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 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart
to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.

 ----- estimated confidence intervals:  -----

 estimated asymmetric confidence interval(1,2,3 sigma): 1.5397E-01 to 1.5579E-01; 1.5305E-01 to 1.5670E-01;
1.5214E-01 to 1.5761E-01
 estimated  symmetric confidence interval(1,2,3 sigma): 1.5395E-01 to 1.5577E-01; 1.5304E-01 to 1.5669E-01;
1.5213E-01 to 1.5760E-01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally   2 with nps =     3956466  print
table 160


 normed average tally per history  = 1.54862E-01          unnormed average tally per history  = 2.76233E+05
 estimated tally relative error    = 0.0059              estimated variance of the variance  = 0.0024
 relative error from zero tallies  = 0.0022              relative error from nonzero scores  = 0.0055

 number of nonzero history tallies =      211947         efficiency for the nonzero tallies  = 0.0088
 history number of largest  tally  =     1104723         largest  unnormalized history tally = 5.32503E+09
 (largest  tally)/(average tally)  = 1.92773E+04         (largest  tally)/(avg nonzero tally)= 1.70273E+02

 (confidence interval shift)/mean  = 0.0001              shifted confidence interval center  = 1.54878E-01
```

```
 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1          value(nps+1)/value(nps)-1.

      mean                            1.54862E-01            1.55616E-01                   0.004872
      relative error                  5.88907E-03            5.92104E-03                   0.005429
      variance of the variance        2.40921E-03            2.68237E-03                   0.113378
      shifted center                  1.54878E-01            1.54964E-01                   0.000555
      figure of merit                 2.09893E+01            2.07632E+01                  -0.010770

 the estimated inverse power slope of the 200 largest  tallies starting at 1.10862E+09 is 4.6773
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*( 3.466E-02)**2 = (1.747E+04)*(1.202E-
03) = 2.099E+01

1tally  12        nps =     3956466
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     23995456.00

           this tally is modified by a dose function.

           areas
                surface:     1227
               segment
                  1       1.00000E+50
                  2       2.56400E+07
                  3       1.03700E+08
                  4       1.60200E+08
                  5       3.92700E+08
                  6       5.49800E+08
                  7       7.06900E+08
                  8       8.63900E+08
                  9       1.59000E+09
                 10       1.94400E+09
                 11       3.14200E+09
                 12       3.77000E+09
                 13       4.39800E+09
                 14       5.02700E+09
                 15       5.65500E+09
                 16       1.68900E+10

 surface  1227
 segment:       -2000
                1.88612E-46 0.0103

 surface  1227
 segment:        2000    -2001
                 1.15835E-03 0.0065

 surface  1227
 segment:        2000     2001    -2002
                 7.22578E-04 0.0048

 surface  1227
 segment:        2000     2001     2002    -2003
                 3.66297E-04 0.0060

 surface  1227
 segment:        2000     2001     2002     2003    -2004
                 1.72962E-04 0.0061

 surface  1227
 segment:        2000     2001     2002     2003     2004    -2005
                 8.02955E-05 0.0057

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005    -2006
                 3.70071E-05 0.0055

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006    -2007
                 1.81661E-05 0.0050

 surface  1227
```

```
 segment:        2000     2001     2002     2003     2004     2005     2006     2007    -2008
                 8.19861E-06 0.0053

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008    -2009
                 3.27097E-06 0.0058

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009    -2010
                 1.21658E-06 0.0061

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     -2011
                 4.04809E-07 0.0074

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011    -2012
                 1.41260E-07 0.0085

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012    -2013
                 5.17636E-08 0.0106

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012     2013    -2014
                 1.86672E-08 0.0141

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012     2013     2014
                 3.39904E-09 0.1854
```

==========

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally 12

tfc bin --mean--		---------relative error---------			----variance of the variance----			--figure of merit-- -pdf-	
behavior	behavior	value	decrease	decrease rate	value	decrease	decrease rate	value	behavior slope
desired	random	<0.10	yes	1/sqrt(nps)	<0.10	yes	1/nps	constant	random >3.00
observed	random	0.19	yes	yes	0.07	yes	yes	constant	random 0.00
passed?	yes	no	yes	yes	yes	yes	yes	yes	yes no

==========

 warning. the tally in the tally fluctuation chart bin did not pass 2 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally 12 with nps =   3956466 print table 160

```
 normed average tally per history  = 3.39904E-09          unnormed average tally per history  = 5.74098E+01
 estimated tally relative error    = 0.1854               estimated variance of the variance  = 0.0655
 relative error from zero tallies  = 0.1429               relative error from nonzero scores  = 0.1182

 number of nonzero history tallies =          49          efficiency for the nonzero tallies  = 0.0000
 history number of largest  tally  =       36466          largest  unnormalized history tally = 9.43903E+07
 (largest  tally)/(average tally)  = 1.64415E+06          (largest  tally)/(avg nonzero tally)= 3.35744E+00

 (confidence interval shift)/mean  = 0.0223               shifted confidence interval center  = 3.47484E-09
```

 if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	3.39904E-09	4.81155E-09	0.415560
relative error	1.85412E-01	1.84992E-01	-0.002268
variance of the variance	6.55013E-02	6.51434E-02	-0.005464
shifted center	3.47484E-09	3.88835E-09	0.119003
figure of merit	2.11746E-02	2.12709E-02	0.004551

there is not enough information in the largest history scores (usually less than 500 scores) for a reliable estimate of the slope.
the large score tail of the empirical history score probability density function appears to have no unsampled regions.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*(1.101E-03)**2 = (1.747E+04)*(1.212E-06) = 2.117E-02

1unnormed tally density for tally 12 nonzero tally mean(m) = 2.811E+07 nps = 3956466 print table 161

abscissa ordinate log plot of tally probability density function in tally fluctuation chart bin(d=decade,slope= 0.0)

tally	number	num den	log den	d---------- log plot ----------d
7.94+06	8	2.04-13	-12.690	
1.00+07	6	1.22-13	-12.915	
1.26+07	4	6.44-14	-13.191	
1.58+07	4	5.11-14	-13.291	
2.00+07	2	2.03-14	-13.692	
2.51+07	6	4.84-14	-13.315	
3.16+07	3	1.92-14	-13.716	
3.98+07	3	1.53-14	-13.816	
5.01+07	4	1.62-14	-13.791	
6.31+07	3	9.63-15	-14.016	
7.94+07	4	1.02-14	-13.991	
1.00+08	2	4.05-15	-14.392	
total	49	2.04-06		d---------- log plot ----------d

1tally 22 nps = 3956466
tally type 2 particle flux averaged over a surface.
tally for photons
number of histories used for normalizing tallies = 23995456.00

this tally is modified by a dose function.

areas

surface:	1227
segment	
1	1.00000E+50
2	1.00000E+50
3	1.00000E+50
4	4.35376E+05
5	4.35376E+05
6	4.35376E+05
7	4.35376E+05
8	4.35376E+05
9	4.35376E+05
10	4.35376E+05
11	4.35376E+05
12	4.35376E+05
13	4.35376E+05
14	4.35376E+05
15	4.35376E+05
16	4.35376E+05
17	4.35376E+05
18	4.35376E+05
19	4.35376E+05
20	4.35376E+05
21	4.35376E+05
22	1.00000E+50

surface 1227
segment: 1201
1.70513E-45 0.0032

surface 1227
segment: -1201 -2026

```
               8.63750E-46 0.0063

surface  1227
segment:       -1201     2026     2027
               7.47108E-46 0.0075

surface  1227
segment:       -1201     2026    -2027     2016
               8.08986E-04 0.0367

surface  1227
segment:       -1201     2026    -2027    -2016     2017
               1.18227E-03 0.0290

surface  1227
segment:       -1201     2026    -2027    -2016    -2017     2018
               1.63234E-03 0.0349

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018     2019
               2.04487E-03 0.0413

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019     2020
               2.36299E-03 0.0327

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020     2021
               2.75091E-03 0.0426

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021     2022
               2.67286E-03 0.0303

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022     2023
               2.89620E-03 0.0375

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     2024
               2.69459E-03 0.0340

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024     2025
               2.49903E-03 0.0320

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025     2028
               2.29133E-03 0.0258

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028     2029
               2.29680E-03 0.0511

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029     2030
               2.08354E-03 0.0426

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030     2031
               1.88371E-03 0.0381

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031     2032
               1.88320E-03 0.0473

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032     2033
               1.62633E-03 0.0276

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
```

```
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033     2034
                1.69096E-03 0.0424

 surface  1227
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034     2035
                1.45046E-03 0.0316

 surface  1227
 segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034    -2035
                1.42847E-46 0.0148


================================================================================================================================
====================

          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  22

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps            constant
random      >3.00
 observed     random        0.01      yes          yes            0.07      yes         yes             constant
random       2.56
 passed?        yes          yes      yes          yes              yes      yes         yes                yes
yes          no


================================================================================================================================
====================


 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  22 with nps =     3956466  print
table 160


 normed average tally per history  = 1.42847E-46          unnormed average tally per history  = 1.42847E+04
 estimated tally relative error    = 0.0148               estimated variance of the variance  = 0.0737
 relative error from zero tallies  = 0.0015               relative error from nonzero scores  = 0.0147

 number of nonzero history tallies =      463718          efficiency for the nonzero tallies  = 0.0193
 history number of largest  tally  =      962952          largest  unnormalized history tally = 1.97606E+09
 (largest  tally)/(average tally)  = 1.38334E+05          (largest  tally)/(avg nonzero tally)= 2.67333E+03

 (confidence interval shift)/mean  = 0.0017               shifted confidence interval center  = 1.43085E-46


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities          value at nps           value at nps+1          value(nps+1)/value(nps)-1.

      mean                           1.42847E-46            1.47842E-46                   0.034964
      relative error                 1.47710E-02            1.57585E-02                   0.066858
      variance of the variance       7.36600E-02            7.30586E-02                  -0.008164
      shifted center                 1.43085E-46            1.44429E-46                   0.009397
      figure of merit                3.33637E+00            2.93130E+00                  -0.121409

 the estimated inverse power slope of the 200 largest  tallies starting at 6.98666E+07 is 2.5574
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*( 1.382E-02)**2 = (1.747E+04)*(1.910E-
04) = 3.336E+00

1unnormed tally density for tally  22           nonzero tally mean(m) = 7.392E+05   nps =     3956466  print
table 161

 abscissa             ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.6)
```

```
  tally  number num den log den:d---------d----------d----------d----------d----------d----------d----------d---
-------d----------d-
 2.51+03    211 9.49-09  -8.023
**********|**********|**********|**********|**********|**********|**********|**         |
 3.98+03    477 1.35-08  -7.869
**********|**********|**********|**********|**********|**********|**********|****       |
 6.31+03   1467 2.63-08  -7.581
**********|**********|**********|**********|**********|**********|**********|*******    |
 1.00+04   4854 5.48-08  -7.261
**********|**********|**********|**********|**********|**********|**********|**********|
 1.58+04   7661 5.46-08  -7.263
**********|**********|**********|**********|**********|**********|**********|**********|
 2.51+04  15642 7.03-08  -7.153
**********|**********|**********|**********|**********|**********|**********|**********|*
 3.98+04  26662 7.56-08  -7.121
**********|**********|**********|**********|**********|**********|**********|**********|*
 6.31+04  35387 6.33-08  -7.198
**********|**********|**********|**********|**********|**********|**********|**********|
 1.00+05  63712 7.19-08  -7.143
**********|**********|**********|**********|**********|**********|**********|**********|*
 1.58+05  68965 4.91-08  -7.309
**********|**********|**********|**********|**********|**********|**********|**********|
 2.51+05  71147 3.20-08  -7.495
**********|**********|**********|**********|**********|**********|**********|********   |
 3.98+05  60100 1.70-08  -7.768
**********|**********|**********|**********|**********|**********|**********|*****      |
 6.31+05  40992 7.34-09  -8.135
**********|**********|**********|**********|**********|**********|**********|*          |
 1.00+06  24071 2.72-09  -8.566
mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmm    |           |
 1.58+06  13710 9.77-10  -9.010 **********|**********|**********|**********|**********|**********|**********|**
|          |
 2.51+06   8224 3.70-10  -9.432 **********|**********|**********|**********|**********|**********|********* |
|          |
 3.98+06   5769 1.64-10  -9.786 **********|**********|**********|**********|**********|**********|*****      |
|          |
 6.31+06   4518 8.09-11 -10.092 **********|**********|**********|**********|**********|**********|*          |
|          |
 1.00+07   4230 4.78-11 -10.321 **********|**********|**********|**********|**********|**********|           |
|          |
 1.58+07   3202 2.28-11 -10.642 **********|**********|**********|**********|**********|******     |           |
|          |
 2.51+07   1610 7.24-12 -11.140 **********|**********|**********|**********|**********|*          |           |
|          |
 3.98+07    612 1.74-12 -11.760 **********|**********|**********|**********|*****      |           |           |
|          |
 6.31+07    263 4.71-13 -12.327 **********|**********|**********|**********|           |           |           |
|          |
 1.00+08    113 1.28-13 -12.894 **********|**********|**********|****       |  s        |           |           |
|          |
 1.58+08     45 3.21-14 -13.494 **********|**********|********  |           s           |           |           |
|          |
 2.51+08     37 1.66-14 -13.779 **********|**********|*****     |        s  |           |           |           |
|          |
 3.98+08     24 6.81-15 -14.167 **********|**********|*         |  s        |           |           |           |
|          |
 6.31+08      7 1.25-15 -14.902 **********|****       |          s|           |           |           |           |
|          |
 1.00+09      1 1.13-16 -15.947 ***        |           |    s      |           |           |           |           |
|          |
 1.58+09      1 7.13-17 -16.147 *          |           s           |           |           |           |           |
|          |
 2.00+09      4 4.06-16 -15.391 *********  |       s   |           |           |           |           |           |
|          |
  total  463718 1.93-02          d---------d----------d----------d----------d----------d----------d----------d---
-------d----------d-

1tally  32        nps =     3956466
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     23995456.00

           this tally is modified by a dose function.

           areas
                surface:     1201
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
```

```
                4       1.00000E+50
                5       6.30000E+05

 surface  1201
 segment:       1231
                2.47957E-45 0.0230

 surface  1201
 segment:      -1231    -2026
                7.06051E-49 0.0586

 surface  1201
 segment:      -1231     2026     2027
                2.63314E-48 0.0714

 surface  1201
 segment:      -1231     2026    -2027    -1227
                0.00000E+00 0.0000

 surface  1201
 segment:      -1231     2026    -2027     1227
                7.11182E-04 0.0353


================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  32

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.04      yes          yes            0.03      yes         yes            constant
random       2.74
 passed?        yes          yes      yes          yes              yes      yes         yes               yes
yes          no


================================================================================================================
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 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  32 with nps =     3956466  print
table 160


 normed average tally per history  = 7.11182E-04          unnormed average tally per history  = 4.48045E+02
 estimated tally relative error    = 0.0353               estimated variance of the variance  = 0.0337
 relative error from zero tallies  = 0.0109               relative error from nonzero scores  = 0.0336

 number of nonzero history tallies =        8379          efficiency for the nonzero tallies  = 0.0003
 history number of largest  tally  =     3749140          largest  unnormalized history tally = 1.21775E+08
 (largest  tally)/(average tally)  = 2.71792E+05          (largest  tally)/(avg nonzero tally)= 9.49072E+01

 (confidence interval shift)/mean  = 0.0027               shifted confidence interval center  = 7.13071E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities          value at nps          value at nps+1          value(nps+1)/value(nps)-1.

      mean                           7.11182E-04            7.60037E-04                   0.068695
      relative error                 3.52869E-02            3.66422E-02                   0.038410
      variance of the variance       3.37151E-02            3.64437E-02                   0.080931
      shifted center                 7.13071E-04            7.23851E-04                   0.015118
      figure of merit                5.84609E-01            5.42160E-01                  -0.072611

 the estimated inverse power slope of the 200 largest  tallies starting at 7.85431E+06 is 2.7402
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.
```

```
 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*( 5.785E-03)**2 = (1.747E+04)*(3.347E-
05) = 5.846E-01

1unnormed tally density for tally  32            nonzero tally mean(m) = 1.283E+06   nps =     3956466  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.7)
  tally  number num den log den:d----------------d-----------------d----------------d-----------------d------
-----------d--------
 2.51+05    315 2.54-10  -9.595
*****************|******************|*****************|******************|*****************|
 3.16+05   1193 7.64-10  -9.117
*****************|******************|*****************|******************|*****************|********
 3.98+05   1348 6.86-10  -9.164
*****************|******************|*****************|******************|*****************|*******
 5.01+05   1211 4.90-10  -9.310
*****************|******************|*****************|******************|*****************|****
 6.31+05    959 3.08-10  -9.511
*****************|******************|*****************|******************|*****************|*
 7.94+05    820 2.09-10  -9.679
*****************|******************|*****************|******************|*****************
 1.00+06    583 1.18-10  -9.928
*****************|******************|*****************|******************|***********       |
 1.26+06    482 7.76-11 -10.110
*****************|******************|*****************|******************|********          |
 1.58+06    377 4.82-11 -10.317 mmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmmmmm|mmmm
|
 2.00+06    253 2.57-11 -10.590 *****************|******************|*****************|******************|
|
 2.51+06    177 1.43-11 -10.845 *****************|******************|*****************|*************     |
|
 3.16+06    114 7.30-12 -11.136 *****************|******************|*****************|********          |
|
 3.98+06     73 3.72-12 -11.430 *****************|******************|*****************|**                |
|
 5.01+06    123 4.97-12 -11.303 *****************|******************|*****************|*****             |
|
 6.31+06     79 2.54-12 -11.596 *****************|******************|*****************|                  |
|
 7.94+06     75 1.91-12 -11.718 *****************|******************|***************  |      s           |
|
 1.00+07     62 1.26-12 -11.901 *****************|******************|************     |    s             |
|
 1.26+07     40 6.44-13 -12.191 *****************|******************|******           | s                |
|
 1.58+07     30 3.84-13 -12.416 *****************|******************|**              s|                  |
|
 2.00+07     22 2.23-13 -12.651 *****************|***************** |             s   |                  |
|
 2.51+07     12 9.68-14 -13.014 *****************|**********        |          s      |                  |
|
 3.16+07      5 3.20-14 -13.494 *****************|*                 |      s          |                  |
|
 3.98+07      9 4.58-14 -13.339 *****************|****              |  s              |                  |
|
 5.01+07      7 2.83-14 -13.548 *****************|                 s|                 |                  |
|
 6.31+07      4 1.28-14 -13.891 ************     |             s    |                 |                  |
|
 7.94+07      0 0.00+00   0.000                 |        s         |                 |                  |
|
 1.00+08      4 8.11-15 -14.091 ********        |    s             |                 |                  |
|
 1.26+08      2 3.22-15 -14.492 *               s                  |                 |                  |
|
  total    8379 3.49-04         d----------------d-----------------d----------------d-----------------d------
-----------d--------

1tally  42        nps =     3956466
          tally type 2    particle flux averaged over a surface.
          tally for  photons
 number of histories used for normalizing tallies =     23995456.00

          this tally is modified by a dose function.

          areas
               surface:     2003         2004         2005         2006         2007         2008         2009
              segment
```

```
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
              surface:     2010         2011         2012         2013
             segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:        1219
                 1.06829E-44 0.0040

 surface  2003
 segment:       -1219    -1209
                 1.32269E-47 0.0197

 surface  2003
 segment:       -1219     1209     1201
                 1.02844E-46 0.0045

 surface  2003
 segment:       -1219     1209    -1201    -1205
                 5.31580E-47 0.0081

 surface  2003
 segment:       -1219     1209    -1201     1205     1206
                 4.35107E-47 0.0085

 surface  2003
 segment:       -1219     1209    -1201     1205    -1206
                 4.62187E-04 0.0142

 surface  2004
 segment:        1219
                 9.40693E-45 0.0040

 surface  2004
 segment:       -1219    -1209
                 8.11769E-48 0.0112

 surface  2004
 segment:       -1219     1209     1201
                 6.18095E-47 0.0052

 surface  2004
 segment:       -1219     1209    -1201    -1205
                 3.37751E-47 0.0074

 surface  2004
 segment:       -1219     1209    -1201     1205     1206
                 2.80852E-47 0.0079

 surface  2004
 segment:       -1219     1209    -1201     1205    -1206
                 1.79945E-04 0.0189

 surface  2005
 segment:        1219
                 7.99713E-45 0.0041

 surface  2005
 segment:       -1219    -1209
                 4.86841E-48 0.0096

 surface  2005
 segment:       -1219     1209     1201
                 3.75755E-47 0.0048
```

```
surface  2005
segment:       -1219     1209    -1201    -1205
                2.11521E-47 0.0074

surface  2005
segment:       -1219     1209    -1201     1205     1206
                1.77859E-47 0.0079

surface  2005
segment:       -1219     1209    -1201     1205    -1206
                7.83271E-05 0.0195

surface  2006
segment:        1219
                6.59431E-45 0.0042

surface  2006
segment:       -1219    -1209
                2.96689E-48 0.0109

surface  2006
segment:       -1219     1209     1201
                2.30901E-47 0.0051

surface  2006
segment:       -1219     1209    -1201    -1205
                1.32516E-47 0.0076

surface  2006
segment:       -1219     1209    -1201     1205     1206
                1.11326E-47 0.0087

surface  2006
segment:       -1219     1209    -1201     1205    -1206
                3.81178E-05 0.0182

surface  2007
segment:        1219
                5.30702E-45 0.0042

surface  2007
segment:       -1219    -1209
                1.89703E-48 0.0120

surface  2007
segment:       -1219     1209     1201
                1.41739E-47 0.0054

surface  2007
segment:       -1219     1209    -1201    -1205
                8.31057E-48 0.0084

surface  2007
segment:       -1219     1209    -1201     1205     1206
                7.03901E-48 0.0092

surface  2007
segment:       -1219     1209    -1201     1205    -1206
                1.95083E-05 0.0215

surface  2008
segment:        1219
                3.69923E-45 0.0044

surface  2008
segment:       -1219    -1209
                9.26181E-49 0.0163

surface  2008
segment:       -1219     1209     1201
                6.92497E-48 0.0064

surface  2008
segment:       -1219     1209    -1201    -1205
                4.16015E-48 0.0094

surface  2008
segment:       -1219     1209    -1201     1205     1206
                3.53718E-48 0.0110
```

```
surface  2008
segment:       -1219     1209    -1201     1205    -1206
                7.66735E-06 0.0316

surface  2009
segment:        1219
                2.50082E-45 0.0047

surface  2009
segment:       -1219    -1209
                4.64298E-49 0.0183

surface  2009
segment:       -1219     1209     1201
                3.38362E-48 0.0074

surface  2009
segment:       -1219     1209    -1201    -1205
                2.08661E-48 0.0103

surface  2009
segment:       -1219     1209    -1201     1205     1206
                1.77753E-48 0.0110

surface  2009
segment:       -1219     1209    -1201     1205    -1206
                3.24227E-06 0.0415

surface  2010
segment:        1219
                1.43740E-45 0.0049

surface  2010
segment:       -1219    -1209
                1.81054E-49 0.0267

surface  2010
segment:       -1219     1209     1201
                1.31304E-48 0.0083

surface  2010
segment:       -1219     1209    -1201    -1205
                8.59258E-49 0.0141

surface  2010
segment:       -1219     1209    -1201     1205     1206
                7.15230E-49 0.0181

surface  2010
segment:       -1219     1209    -1201     1205    -1206
                1.14378E-06 0.0614

surface  2011
segment:        1219
                8.05942E-46 0.0052

surface  2011
segment:       -1219    -1209
                7.64126E-50 0.0276

surface  2011
segment:       -1219     1209     1201
                5.24590E-49 0.0115

surface  2011
segment:       -1219     1209    -1201    -1205
                3.48138E-49 0.0151

surface  2011
segment:       -1219     1209    -1201     1205     1206
                2.90961E-49 0.0235

surface  2011
segment:       -1219     1209    -1201     1205    -1206
                3.69484E-07 0.0539

surface  2012
segment:        1219
                4.44603E-46 0.0056
```

```
 surface  2012
 segment:       -1219    -1209
                 3.21934E-50 0.0405

 surface  2012
 segment:       -1219     1209     1201
                 2.06880E-49 0.0131

 surface  2012
 segment:       -1219     1209    -1201    -1205
                 1.44561E-49 0.0186

 surface  2012
 segment:       -1219     1209    -1201     1205     1206
                 1.20127E-49 0.0222

 surface  2012
 segment:       -1219     1209    -1201     1205    -1206
                 1.37244E-07 0.0819

 surface  2013
 segment:        1219
                 2.42621E-46 0.0062

 surface  2013
 segment:       -1219    -1209
                 1.15281E-50 0.0335

 surface  2013
 segment:       -1219     1209     1201
                 8.81488E-50 0.0229

 surface  2013
 segment:       -1219     1209    -1201    -1205
                 6.09825E-50 0.0275

 surface  2013
 segment:       -1219     1209    -1201     1205     1206
                 4.94585E-50 0.0279

 surface  2013
 segment:       -1219     1209    -1201     1205    -1206
                 6.37596E-08 0.1624


================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  42

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.01       no           no            0.12       no          no             decrease
random       2.89
 passed?        yes          yes       no           no              no       no          no                 no
yes          no


================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  7 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  42 with nps =     3956466  print
table 160


 normed average tally per history  = 4.62187E-04          unnormed average tally per history  = 1.38656E+03
 estimated tally relative error    = 0.0142               estimated variance of the variance  = 0.1161
 relative error from zero tallies  = 0.0035               relative error from nonzero scores  = 0.0138
```

```
 number of nonzero history tallies =       81300          efficiency for the nonzero tallies  = 0.0034
 history number of largest  tally  =     3231029          largest  unnormalized history tally = 2.73077E+08
 (largest  tally)/(average tally)  = 1.96945E+05          (largest  tally)/(avg nonzero tally)= 6.67279E+02

 (confidence interval shift)/mean  = 0.0016               shifted confidence interval center  = 4.62948E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.

      mean                            4.62187E-04             4.85193E-04                    0.049778
      relative error                  1.41974E-02             1.62591E-02                    0.145218
      variance of the variance        1.16095E-01             1.28153E-01                    0.103865
      shifted center                  4.62948E-04             4.68535E-04                    0.012068
      figure of merit                 3.61140E+00             2.75359E+00                   -0.237528

 the estimated inverse power slope of the 200 largest  tallies starting at 9.50231E+06 is 2.8915
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*( 1.438E-02)**2 = (1.747E+04)*(2.068E-
04) = 3.611E+00

1unnormed tally density for tally  42            nonzero tally mean(m) = 4.092E+05   nps =     3956466  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.9)
  tally  number num den log den:d----------d----------d----------d----------d----------d----------d--
----------d---------
 6.31+04   2836 9.11-09  -8.041
************|************|************|************|************|************|************|***
 7.94+04   9638 2.46-08  -7.609
************|************|************|************|************|************|************|*********
 1.00+05   9847 2.00-08  -7.700
************|************|************|************|************|************|************|********
 1.26+05   9431 1.52-08  -7.819
************|************|************|************|************|************|************|******
 1.58+05   9853 1.26-08  -7.900
************|************|************|************|************|************|************|*****
 2.00+05   8343 8.47-09  -8.072
************|************|************|************|************|************|************|***
 2.51+05   7012 5.66-09  -8.247
************|************|************|************|************|************|************|*
 3.16+05   5610 3.59-09  -8.444
************|************|************|************|************|************|************ |
 3.98+05   4429 2.25-09  -8.647
************|************|************|************|************|************|********     |
 5.01+05   3175 1.28-09  -8.892
mmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmm        |
 6.31+05   2229 7.16-10  -9.145 ************|************|************|************|************|************|**
|
 7.94+05   1475 3.76-10  -9.425 ************|************|************|************|************|************ |
|
 1.00+06   1144 2.32-10  -9.635 ************|************|************|************|************|*********   |
|
 1.26+06   1159 1.87-10  -9.729 ************|************|************|************|************|*******     |
|
 1.58+06   1151 1.47-10  -9.832 ************|************|************|************|************|******      |
|
 2.00+06   1001 1.02-10  -9.993 ************|************|************|************|************|****        |
|
 2.51+06    895 7.22-11 -10.141 ************|************|************|************|************|**          |
|
 3.16+06    700 4.49-11 -10.348 ************|************|************|************|************|            |
|
 3.98+06    526 2.68-11 -10.572 ************|************|************|************|*********   |            |
|
 5.01+06    290 1.17-11 -10.931 ************|************|************|************|*****       |            |
|
 6.31+06    174 5.59-12 -11.253 ************|************|************|************|            |            |
|
 7.94+06    116 2.96-12 -11.529 ************|************|************|**********  |            |            |
|
 1.00+07     92 1.86-12 -11.730 ************|************|************|*******     |   s        |            |
|
```

```
 1.26+07     58 9.34-13 -12.030 ************|************|************|***         | s          |            |
|
 1.58+07     35 4.47-13 -12.349 ************|************|************|            s            |            |
|
 2.00+07     26 2.64-13 -12.578 ************|************|*********   |          s |            |            |
|
 2.51+07     16 1.29-13 -12.889 ************|************|*****       |       s    |            |            |
|
 3.16+07     15 9.61-14 -13.017 ************|************|***         |     s      |            |            |
|
 3.98+07      9 4.58-14 -13.339 ************|************|            |  s         |            |            |
|
 5.01+07      8 3.23-14 -13.490 ************|**********  |            s            |            |            |
|
 6.31+07      4 1.28-14 -13.891 ************|*****       |         s  |            |            |            |
|
 7.94+07      1 2.55-15 -14.593 *********   |            |     s      |            |            |            |
|
 1.00+08      1 2.03-15 -14.693 ********    |            |  s         |            |            |            |
|
 1.26+08      0 0.00+00   0.000             |            s            |            |            |            |
|
 1.58+08      0 0.00+00   0.000             |        s   |            |            |            |            |
|
 2.00+08      0 0.00+00   0.000             |     s      |            |            |            |            |
|
 2.51+08      0 0.00+00   0.000             | s          |            |            |            |            |
|
 3.16+08      1 6.41-16 -15.193 *         s |            |            |            |            |            |
|
  total   81300 3.39-03         d-----------d------------d------------d------------d------------d------------d--
----------d---------

1tally  52        nps =     3956466
          tally type 2    particle flux averaged over a surface.
          tally for  photons
 number of histories used for normalizing tallies =     23995456.00

          this tally is modified by a dose function.

          areas
               surface:     2003         2004         2005         2006         2007         2008         2009
              segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
               surface:     2010         2011         2012         2013
              segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:        1219
                 1.06829E-44 0.0040

 surface  2003
 segment:       -1219    -1209
                 1.32269E-47 0.0197

 surface  2003
 segment:       -1219     1209    -1201
                 1.10534E-46 0.0064

 surface  2003
 segment:       -1219     1209     1201    -1205
                 5.30223E-47 0.0059
```

```
surface  2003
segment:       -1219     1209     1201     1205     1206
                3.94239E-47 0.0062

surface  2003
segment:       -1219     1209     1201     1205    -1206
                3.46600E-04 0.0141

surface  2004
segment:        1219
                9.40693E-45 0.0040

surface  2004
segment:       -1219    -1209
                8.11769E-48 0.0112

surface  2004
segment:       -1219     1209    -1201
                6.72587E-47 0.0062

surface  2004
segment:       -1219     1209     1201    -1205
                3.21959E-47 0.0073

surface  2004
segment:       -1219     1209     1201     1205     1206
                2.54562E-47 0.0065

surface  2004
segment:       -1219     1209     1201     1205    -1206
                1.38580E-04 0.0175

surface  2005
segment:        1219
                7.99713E-45 0.0041

surface  2005
segment:       -1219    -1209
                4.86841E-48 0.0096

surface  2005
segment:       -1219     1209    -1201
                4.12878E-47 0.0062

surface  2005
segment:       -1219     1209     1201    -1205
                1.97243E-47 0.0062

surface  2005
segment:       -1219     1209     1201     1205     1206
                1.59622E-47 0.0065

surface  2005
segment:       -1219     1209     1201     1205    -1206
                6.29684E-05 0.0226

surface  2006
segment:        1219
                6.59431E-45 0.0042

surface  2006
segment:       -1219    -1209
                2.96689E-48 0.0109

surface  2006
segment:       -1219     1209    -1201
                2.55277E-47 0.0065

surface  2006
segment:       -1219     1209     1201    -1205
                1.22144E-47 0.0065

surface  2006
segment:       -1219     1209     1201     1205     1206
                9.95784E-48 0.0073

surface  2006
segment:       -1219     1209     1201     1205    -1206
                3.05952E-05 0.0252
```

```
surface  2007
segment:        1219
                5.30702E-45 0.0042

surface  2007
segment:       -1219    -1209
                1.89703E-48 0.0120

surface  2007
segment:       -1219     1209    -1201
                1.59348E-47 0.0072

surface  2007
segment:       -1219     1209     1201    -1205
                7.56164E-48 0.0070

surface  2007
segment:       -1219     1209     1201     1205     1206
                6.11599E-48 0.0073

surface  2007
segment:       -1219     1209     1201     1205    -1206
                1.65422E-05 0.0307

surface  2008
segment:        1219
                3.69923E-45 0.0044

surface  2008
segment:       -1219    -1209
                9.26181E-49 0.0163

surface  2008
segment:       -1219     1209    -1201
                7.92735E-48 0.0082

surface  2008
segment:       -1219     1209     1201    -1205
                3.68366E-48 0.0079

surface  2008
segment:       -1219     1209     1201     1205     1206
                3.05884E-48 0.0097

surface  2008
segment:       -1219     1209     1201     1205    -1206
                6.08223E-06 0.0368

surface  2009
segment:        1219
                2.50082E-45 0.0047

surface  2009
segment:       -1219    -1209
                4.64298E-49 0.0183

surface  2009
segment:       -1219     1209    -1201
                3.96141E-48 0.0087

surface  2009
segment:       -1219     1209     1201    -1205
                1.83406E-48 0.0102

surface  2009
segment:       -1219     1209     1201     1205     1206
                1.47347E-48 0.0100

surface  2009
segment:       -1219     1209     1201     1205    -1206
                2.53661E-06 0.0504

surface  2010
segment:        1219
                1.43740E-45 0.0049

surface  2010
segment:       -1219    -1209
                1.81054E-49 0.0267
```

```
surface  2010
segment:       -1219     1209    -1201
                1.60880E-48 0.0126

surface  2010
segment:       -1219     1209     1201    -1205
                7.21883E-49 0.0111

surface  2010
segment:       -1219     1209     1201     1205     1206
                5.67463E-49 0.0122

surface  2010
segment:       -1219     1209     1201     1205    -1206
                7.89778E-07 0.0501

surface  2011
segment:        1219
                8.05942E-46 0.0052

surface  2011
segment:       -1219    -1209
                7.64126E-50 0.0276

surface  2011
segment:       -1219     1209    -1201
                6.50183E-49 0.0150

surface  2011
segment:       -1219     1209     1201    -1205
                2.93860E-49 0.0168

surface  2011
segment:       -1219     1209     1201     1205     1206
                2.23205E-49 0.0147

surface  2011
segment:       -1219     1209     1201     1205    -1206
                2.50847E-07 0.0624

surface  2012
segment:        1219
                4.44603E-46 0.0056

surface  2012
segment:       -1219    -1209
                3.21934E-50 0.0405

surface  2012
segment:       -1219     1209    -1201
                2.68805E-49 0.0156

surface  2012
segment:       -1219     1209     1201    -1205
                1.18603E-49 0.0180

surface  2012
segment:       -1219     1209     1201     1205     1206
                8.57520E-50 0.0190

surface  2012
segment:       -1219     1209     1201     1205    -1206
                8.41536E-08 0.0666

surface  2013
segment:        1219
                2.42621E-46 0.0062

surface  2013
segment:       -1219    -1209
                1.15281E-50 0.0335

surface  2013
segment:       -1219     1209    -1201
                1.12354E-49 0.0208

surface  2013
segment:       -1219     1209     1201    -1205
                4.92324E-50 0.0294
```

```
 surface  2013
 segment:       -1219     1209     1201     1205     1206
                 3.80392E-50 0.0369

 surface  2013
 segment:       -1219     1209     1201     1205    -1206
                 2.92441E-08 0.0741


================================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  52

 tfc bin      --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--      -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.01      yes          yes            0.03      yes         yes            constant
random       2.27
 passed?        yes          yes      yes          yes              yes      yes         yes               yes
yes          no

================================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  52 with nps =     3956466  print
table 160


 normed average tally per history  = 3.46600E-04          unnormed average tally per history  = 1.03980E+03
 estimated tally relative error    = 0.0141               estimated variance of the variance  = 0.0345
 relative error from zero tallies  = 0.0037               relative error from nonzero scores  = 0.0136

 number of nonzero history tallies =       72256          efficiency for the nonzero tallies  = 0.0030
 history number of largest  tally  =     1916113          largest  unnormalized history tally = 1.14019E+08
 (largest  tally)/(average tally)  = 1.09654E+05          (largest  tally)/(avg nonzero tally)= 3.30195E+02

 (confidence interval shift)/mean  = 0.0010               shifted confidence interval center  = 3.46951E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.

      mean                            3.46600E-04            3.56206E-04                    0.027715
      relative error                  1.41259E-02            1.47720E-02                    0.045738
      variance of the variance        3.44611E-02            3.72793E-02                    0.081780
      shifted center                  3.46951E-04            3.48987E-04                    0.005867
      figure of merit                 3.64805E+00            3.33591E+00                   -0.085563

 the estimated inverse power slope of the 198 largest  tallies starting at 6.72866E+06 is 2.2692
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*( 1.445E-02)**2 = (1.747E+04)*(2.089E-
04) = 3.648E+00

1unnormed tally density for tally  52            nonzero tally mean(m) = 3.453E+05   nps =     3956466  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.3)
  tally  number num den log den:d------------d-------------d------------d-------------d-------------d-----------
--d-------------d---
 6.31+04   2574 8.27-09  -8.083
*************|*************|************|*************|*************|*************|***********  |
 7.94+04   9068 2.31-08  -7.636
*************|*************|************|*************|*************|*************|*************|***
```

```
 1.00+05   9211 1.87-08  -7.729
*************|*************|************|*************|*************|*************|*************|**
 1.26+05   8695 1.40-08  -7.854
*************|*************|************|*************|*************|*************|*************|
 1.58+05   9338 1.19-08  -7.923
*************|*************|************|*************|*************|*************|*************|
 2.00+05   7588 7.71-09  -8.113
*************|*************|************|*************|*************|*************|**********   |
 2.51+05   6414 5.17-09  -8.286
*************|*************|************|*************|*************|*************|********     |
 3.16+05   4974 3.19-09  -8.497
*************|*************|************|*************|*************|*************|*****        |
 3.98+05   3898 1.98-09  -8.702
mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmmm|mm             |
 5.01+05   2574 1.04-09  -8.983
*************|*************|************|*************|*************|*************|************ |              |
 6.31+05   1735 5.57-10  -9.254 *************|*************|************|*************|*************|*********
|              |
 7.94+05   1166 2.97-10  -9.527 *************|*************|************|*************|*************|*****
|              |
 1.00+06    746 1.51-10  -9.821 *************|*************|************|*************|*************|*
|              |
 1.26+06    750 1.21-10  -9.918 *************|*************|************|*************|*************|
|              |
 1.58+06    768 9.82-11 -10.008 *************|*************|************|*************|************ |
|              |
 2.00+06    757 7.69-11 -10.114 *************|*************|************|*************|***********  |
|              |
 2.51+06    602 4.86-11 -10.314 *************|*************|************|*************|********     |
|              |
 3.16+06    515 3.30-11 -10.481 *************|*************|************|*************|******       |
|              |
 3.98+06    379 1.93-11 -10.715 *************|*************|************|*************|**           |
|              |
 5.01+06    182 7.36-12 -11.133 *************|*************|************|***********  |             |
|              |
 6.31+06    109 3.50-12 -11.456 *************|*************|************|******       |             |
|              |
 7.94+06     79 2.02-12 -11.696 *************|*************|************|***          s|             |
|              |
 1.00+07     57 1.15-12 -11.937 *************|*************|************|           s  |             |
|              |
 1.26+07     18 2.90-13 -12.538 *************|*************|****        |         s    |             |
|              |
 1.58+07     20 2.56-13 -12.592 *************|*************|***         |      s       |             |
|              |
 2.00+07      5 5.08-14 -13.294 *************|********     |            |   s          |             |
|              |
 2.51+07     12 9.68-14 -13.014 *************|************ |            |s             |             |
|              |
 3.16+07      7 4.49-14 -13.348 *************|*******      |          s |              |             |
|              |
 3.98+07      5 2.54-14 -13.594 *************|****         |       s    |              |             |
|              |
 5.01+07      3 1.21-14 -13.916 *************|             |    s       |              |             |
|              |
 6.31+07      1 3.21-15 -14.493 *****        |             |  s         |              |             |
|              |
 7.94+07      1 2.55-15 -14.593 ****         |             s            |              |             |
|              |
 1.00+08      4 8.11-15 -14.091 ***********  |          s  |            |              |             |
|              |
 1.26+08      1 1.61-15 -14.793 *            |       s     |            |              |             |
|              |
  total   72256 3.01-03         d------------d-------------d------------d-------------d-------------d-----------
--d-------------d---

1tally  62        nps =     3956466
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     23995456.00

           this tally is modified by a dose function.

           areas
                surface:     1219
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
```

```
                4       1.00000E+50
                5       5.30000E+06

 surface  1219
 segment:       -1205
                4.14843E-45 0.0180

 surface  1219
 segment:        1205     1206
                3.04040E-44 0.0068

 surface  1219
 segment:        1205    -1206     1203
                7.01613E-45 0.0148

 surface  1219
 segment:        1205    -1206    -1203    -1202
                7.01039E-45 0.0145

 surface  1219
 segment:        1205    -1206    -1203     1202
                4.55248E+01 0.0013


================================================================================================================================
====================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  62

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.00      yes          yes            0.00      yes         yes            constant
random       7.44
 passed?        yes          yes      yes          yes              yes      yes         yes               yes
yes         yes


================================================================================================================================
====================


 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart
to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.

 ----- estimated confidence intervals:  -----

 estimated asymmetric confidence interval(1,2,3 sigma): 4.5467E+01 to 4.5583E+01; 4.5409E+01 to 4.5641E+01;
4.5352E+01 to 4.5698E+01
 estimated  symmetric confidence interval(1,2,3 sigma): 4.5467E+01 to 4.5583E+01; 4.5409E+01 to 4.5640E+01;
4.5351E+01 to 4.5698E+01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  62 with nps =     3956466  print
table 160


 normed average tally per history  = 4.55248E+01          unnormed average tally per history  = 2.41282E+08
 estimated tally relative error    = 0.0013              estimated variance of the variance  = 0.0000
 relative error from zero tallies  = 0.0005              relative error from nonzero scores  = 0.0012

 number of nonzero history tallies =     3926364         efficiency for the nonzero tallies  = 0.1636
 history number of largest  tally  =      769241         largest  unnormalized history tally = 1.98498E+11
 (largest  tally)/(average tally)  = 8.22683E+02         (largest  tally)/(avg nonzero tally)= 1.34615E+02

 (confidence interval shift)/mean  = 0.0000              shifted confidence interval center  = 4.55250E+01


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.

      mean                            4.55248E+01             4.55343E+01                    0.000208
```

relative error	1.27013E-03	1.18457E-03	-0.067360
variance of the variance	3.09081E-05	3.73236E-05	0.207565
shifted center	4.55250E+01	4.55258E+01	0.000019
figure of merit	4.51229E+02	5.18763E+02	0.149667

the estimated inverse power slope of the 200 largest tallies starting at 7.44577E+10 is 7.4432
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.747E+04)*(1.607E-01)**2 = (1.747E+04)*(2.583E-02) = 4.512E+02

1status of the statistical checks used to form confidence intervals for the mean for each tally bin

tally result of statistical checks for the tfc bin (the first check not passed is listed) and error magnitude check for all bins

2 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 1 tally bins all have relative errors less than 0.10 with no zero bins

12 missed 2 of 10 tfc bin checks: the relative error exceeds the recommended value of 0.1 for nonpoint detector tallies
missed all bin error check: 16 tally bins had 0 bins with zeros and 1 bins with relative errors exceeding 0.10

22 missed 1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
passed all bin error check: 22 tally bins all have relative errors less than 0.10 with no zero bins

32 missed 1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
passed all bin error check: 5 tally bins had 1 bins with zeros and 0 bins with relative errors exceeding 0.10

42 missed 7 of 10 tfc bin checks: the relative error does not monotonically decrease over the last half of the problem
missed all bin error check: 66 tally bins had 0 bins with zeros and 1 bins with relative errors exceeding 0.10

52 missed 1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
passed all bin error check: 66 tally bins all have relative errors less than 0.10 with no zero bins

62 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 5 tally bins all have relative errors less than 0.10 with no zero bins

the 10 statistical checks are only for the tally fluctuation chart bin and do not apply to other tally bins.

the tally bins with zeros may or may not be correct: compare the source, cutoffs, multipliers, et cetera with the tally bins.

warning. 5 of the 7 tally fluctuation chart bins did not pass all 10 statistical checks.
warning. 2 of the 7 tallies had bins with relative errors greater than recommended.
1tally fluctuation charts

	tally 2					tally 12					tally 22				
nps	mean	error	vov	slope	fom	mean	error	vov	slope	fom	mean	error	vov	slope	fom
256000	1.6065E-01	0.0214	0.0092	10.0	25	6.2474E-09	0.7153	0.5446	0.0	2.2E-02	1.4033E-46	0.0339	0.0690	3.0	9.8E+00
512000	1.6026E-01	0.0166	0.0144	8.9	20	3.1275E-09	0.7153	0.5446	0.0	1.1E-02	1.4524E-46	0.0304	0.0762	2.3	6.0E+00
768000	1.5605E-01	0.0131	0.0089	8.6	22	3.7694E-09	0.4879	0.3027	0.0	1.6E-02	1.4383E-46	0.0246	0.0509	2.1	6.2E+00
1024000	1.5515E-01	0.0115	0.0065	7.6	21	2.9087E-09	0.4746	0.3005	0.0	1.2E-02	1.4571E-46	0.0296	0.3060	2.2	3.2E+00
1280000	1.5514E-01	0.0107	0.0080	5.6	20	3.1098E-09	0.3776	0.2428	0.0	1.6E-02	1.4315E-46	0.0251	0.2589	2.1	3.5E+00
1536000	1.5424E-01	0.0098	0.0079	4.8	20	2.9643E-09	0.3395	0.2178	0.0	1.6E-02	1.4325E-46	0.0227	0.1932	2.0	3.6E+00
1792000	1.5408E-01	0.0089	0.0064	5.1	20	2.5805E-09	0.3347	0.2170	0.0	1.4E-02	1.4260E-46	0.0202	0.1699	2.2	3.9E+00
2048000	1.5416E-01	0.0082	0.0053	5.1	21	2.6395E-09	0.2973	0.1899	0.0	1.6E-02	1.4175E-46	0.0183	0.1540	2.5	4.2E+00
2304000	1.5482E-01	0.0077	0.0044	4.5	21	3.1888E-09	0.2573	0.1368	0.0	1.9E-02	1.4114E-46	0.0166	0.1438	2.6	4.5E+00

```
      2560000   1.5522E-01 0.0073 0.0037  5.9      21   3.3348E-09 0.2328 0.1149  0.0 2.1E-02   1.4266E-46
0.0171 0.1144  2.5 3.8E+00
      2816000   1.5463E-01 0.0069 0.0032  6.6      21   3.2735E-09 0.2259 0.1031  0.0 2.0E-02   1.4205E-46
0.0159 0.1069  2.4 4.0E+00
      3072000   1.5438E-01 0.0066 0.0030  5.8      21   3.3479E-09 0.2116 0.0910  0.0 2.1E-02   1.4158E-46
0.0148 0.1023  2.5 4.3E+00
      3328000   1.5421E-01 0.0064 0.0028  4.7      21   3.5499E-09 0.1995 0.0768  0.0 2.2E-02   1.4317E-46
0.0160 0.0873  2.4 3.4E+00
      3584000   1.5426E-01 0.0061 0.0028  4.5      21   3.5306E-09 0.1910 0.0710  0.0 2.2E-02   1.4327E-46
0.0160 0.0781  2.4 3.1E+00
      3840000   1.5466E-01 0.0060 0.0025  4.6      21   3.5024E-09 0.1854 0.0655  0.0 2.2E-02   1.4291E-46
0.0151 0.0753  2.5 3.3E+00
      3956466   1.5486E-01 0.0059 0.0024  4.7      21   3.3990E-09 0.1854 0.0655  0.0 2.1E-02   1.4285E-46
0.0148 0.0737  2.6 3.3E+00


                     tally   32                                tally   42                                tally
52
         nps      mean     error   vov  slope    fom      mean     error   vov  slope    fom      mean
error   vov  slope    fom
       256000   7.3380E-04 0.1119 0.1014 10.0 9.0E-01   4.6439E-04 0.0469 0.0744  3.0 5.1E+00   3.3472E-04
0.0463 0.0990  4.0 5.3E+00
       512000   7.5028E-04 0.0966 0.2330  4.2 6.0E-01   4.5671E-04 0.0322 0.0364  2.7 5.4E+00   3.5526E-04
0.0328 0.0448  2.8 5.2E+00
       768000   7.5926E-04 0.0878 0.1543  3.5 4.8E-01   4.4826E-04 0.0257 0.0260  2.3 5.6E+00   3.5203E-04
0.0270 0.0415  2.6 5.1E+00
      1024000   7.7166E-04 0.0758 0.1105  3.1 4.9E-01   4.4971E-04 0.0217 0.0177  2.7 5.9E+00   3.5035E-04
0.0230 0.0296  2.4 5.3E+00
      1280000   7.3108E-04 0.0656 0.1002  3.2 5.2E-01   4.5233E-04 0.0193 0.0142  2.7 6.0E+00   3.4556E-04
0.0197 0.0238  2.4 5.7E+00
      1536000   7.1923E-04 0.0576 0.0872  3.2 5.6E-01   4.5425E-04 0.0185 0.0191  2.8 5.5E+00   3.4227E-04
0.0175 0.0195  3.0 6.1E+00
      1792000   7.2300E-04 0.0538 0.0745  2.9 5.5E-01   4.5391E-04 0.0169 0.0157  2.9 5.6E+00   3.4173E-04
0.0174 0.0460  3.0 5.3E+00
      2048000   7.1735E-04 0.0493 0.0650  2.9 5.8E-01   4.4935E-04 0.0156 0.0137  3.3 5.8E+00   3.4564E-04
0.0187 0.0729  2.7 4.0E+00
      2304000   7.1389E-04 0.0460 0.0559  3.0 5.9E-01   4.4954E-04 0.0146 0.0118  3.1 5.9E+00   3.4594E-04
0.0183 0.0657  2.6 3.7E+00
      2560000   7.0834E-04 0.0437 0.0481  2.9 5.9E-01   4.5305E-04 0.0142 0.0110  3.3 5.6E+00   3.4700E-04
0.0180 0.0570  2.5 3.5E+00
      2816000   7.1152E-04 0.0409 0.0428  3.0 6.1E-01   4.5279E-04 0.0134 0.0097  3.7 5.7E+00   3.4764E-04
0.0168 0.0517  2.5 3.6E+00
      3072000   7.1506E-04 0.0390 0.0369  3.1 6.2E-01   4.5489E-04 0.0128 0.0084  3.7 5.7E+00   3.5043E-04
0.0169 0.0436  2.4 3.3E+00
      3328000   7.0648E-04 0.0372 0.0343  3.1 6.3E-01   4.6297E-04 0.0157 0.1508  2.9 3.5E+00   3.4905E-04
0.0160 0.0408  2.4 3.4E+00
      3584000   7.0546E-04 0.0361 0.0318  2.9 6.2E-01   4.6325E-04 0.0153 0.1282  2.9 3.5E+00   3.4761E-04
0.0151 0.0386  2.5 3.5E+00
      3840000   7.0812E-04 0.0361 0.0352  2.8 5.8E-01   4.6239E-04 0.0145 0.1194  2.8 3.6E+00   3.4668E-04
0.0144 0.0361  2.3 3.6E+00
      3956466   7.1118E-04 0.0353 0.0337  2.7 5.8E-01   4.6219E-04 0.0142 0.1161  2.9 3.6E+00   3.4660E-04
0.0141 0.0345  2.3 3.6E+00
1tally fluctuation charts

                     tally   62
         nps      mean     error   vov  slope    fom
       256000   4.5521E+01 0.0050 0.0005 10.0     454
       512000   4.5736E+01 0.0035 0.0002 10.0     448
       768000   4.5648E+01 0.0029 0.0002 10.0     445
      1024000   4.5660E+01 0.0025 0.0001  8.0     446
      1280000   4.5586E+01 0.0022 0.0001  7.5     448
      1536000   4.5597E+01 0.0020 0.0001  8.4     448
      1792000   4.5583E+01 0.0019 0.0001  8.3     449
      2048000   4.5569E+01 0.0018 0.0001  9.0     449
      2304000   4.5577E+01 0.0017 0.0001  8.9     449
      2560000   4.5585E+01 0.0016 0.0000  8.3     449
      2816000   4.5571E+01 0.0015 0.0000 10.0     449
      3072000   4.5546E+01 0.0014 0.0000  8.9     450
      3328000   4.5499E+01 0.0014 0.0000  9.4     451
      3584000   4.5506E+01 0.0013 0.0000  9.9     451
      3840000   4.5525E+01 0.0013 0.0000  7.7     451
      3956466   4.5525E+01 0.0013 0.0000  7.4     451

************************************************************************************************************
*******
 dump no.   24 on file runtpe       nps =     3956466     coll =     5922400034     ctm =     1373.75   nrn =
73678780645
```

```
       22 warning messages so far.

 run terminated when it had used    0  minutes of computer time.

 computer time = 1373.81 minutes

 mcnp     version 5     11112005                    06/24/09 07:47:07                    probid =  06/23/09
08:50:09
```

MCNP Case with Translated Source – 2" HVAC Shield

```
            Thread Name & Version = mcnp5VE_RSICC, 1.40

          ._ _    _  ._   ._    |_
          | | |  (_  | |  |_)    _)
                          |

 +---------------------------------------------------------------------+
 |   This program was prepared by the Regents of the University of     |
 |California at Los Alamos National Laboratory (the University) under  |
 |  contract number W-7405-ENG-36 with the U.S. Department of Energy   |
 |(DoE).  The University has certain rights in the program pursuant to|
 |  the contract and the program should not be copied or distributed   |
 | outside your organization.  All rights in the program are reserved  |
 |by the DoE and the University.  Neither the U.S. Government nor the  |
 | University makes any warranty, express or implied, or assumes any   |
 |     liability or responsibility for the use of this software.       |
 +---------------------------------------------------------------------+

1mcnp     version 5     ld=11112005                    06/24/09 11:02:50
 ***********************************************************************                probid =  06/24/09
11:02:50
  inp = HVSL2.i outp = HVSL2.o rssa = bwssa

    1-       c     Created on: Tuesday, November 11, 2008 at 09:35
    2-       c     Canister Cells
    3-          11     5      -1 -11 1209 -1212
    4-          12     5      -1 -12 1209 -1212
    5-          13     5      -1 -13 1209 -1212
    6-          14     5      -1 -14 1209 -1212
    7-          15     5      -1 -15 1209 -1212
    8-          16     5      -1 -16 1209 -1212
    9-          17     5      -1 -17 1209 -1212
   10-          18     5      -1 -18 1209 -1212
   11-          19     5      -1 -19 1209 -1212
   12-          21     5      -1 -21 1209 -1212
   13-          22     5      -1 -22 1209 -1212
   14-          23     5      -1 -23 1209 -1212
   15-          24     5      -1 -24 1209 -1212
   16-          25     5      -1 -25 1209 -1212
   17-          26     5      -1 -26 1209 -1212
   18-          27     5      -1 -27 1209 -1212
   19-          28     5      -1 -28 1209 -1212
   20-          29     5      -1 -29 1209 -1212
   21-          31     5      -1 -31 1209 -1212
   22-          32     5      -1 -32 1209 -1212
   23-          33     5      -1 -33 1209 -1212
   24-          34     5      -1 -34 1209 -1212
   25-          35     5      -1 -35 1209 -1212
   26-          36     5      -1 -36 1209 -1212
   27-          37     5      -1 -37 1209 -1212
   28-          38     5      -1 -38 1209 -1212
   29-          39     5      -1 -39 1209 -1212
   30-          41     5      -1 -41 1209 -1212
   31-          42     5      -1 -42 1209 -1212
   32-          43     5      -1 -43 1209 -1212
   33-          44     5      -1 -44 1209 -1212
   34-          45     5      -1 -45 1209 -1212
   35-          46     5      -1 -46 1209 -1212
   36-          47     5      -1 -47 1209 -1212
   37-          48     5      -1 -48 1209 -1212
   38-          49     5      -1 -49 1209 -1212
   39-          51     5      -1 -51 1209 -1212
   40-          52     5      -1 -52 1209 -1212
   41-          53     5      -1 -53 1209 -1212
   42-          54     5      -1 -54 1209 -1212
   43-          55     5      -1 -55 1209 -1212
   44-          56     5      -1 -56 1209 -1212
   45-          57     5      -1 -57 1209 -1212
   46-          58     5      -1 -58 1209 -1212
   47-          59     5      -1 -59 1209 -1212
   48-          61     5      -1 -61 1209 -1212
   49-          62     5      -1 -62 1209 -1212
   50-          63     5      -1 -63 1209 -1212
   51-          64     5      -1 -64 1209 -1212
   52-          65     5      -1 -65 1209 -1212
   53-          66     5      -1 -66 1209 -1212
   54-          67     5      -1 -67 1209 -1212
   55-          68     5      -1 -68 1209 -1212
```

```
 56-          69      5       -1 -69 1209 -1212
 57-          71      5       -1 -71 1209 -1212
 58-          72      5       -1 -72 1209 -1212
 59-          73      5       -1 -73 1209 -1212
 60-          74      5       -1 -74 1209 -1212
 61-          75      5       -1 -75 1209 -1212
 62-          76      5       -1 -76 1209 -1212
 63-          77      5       -1 -77 1209 -1212
 64-          78      5       -1 -78 1209 -1212
 65-          79      5       -1 -79 1209 -1212
 66-          81      5       -1 -81 1209 -1212
 67-          82      5       -1 -82 1209 -1212
 68-          83      5       -1 -83 1209 -1212
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 76-          92      5       -1 -92 1209 -1212
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 78-          94      5       -1 -94 1209 -1212
 79-          95      5       -1 -95 1209 -1212
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 86-         103      5       -1 -103 1209 -1212
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 92-         109      5       -1 -109 1209 -1212
 93-         111      5       -1 -111 1209 -1212
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 95-         113      5       -1 -113 1209 -1212
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118-         138      5       -1 -138 1209 -1212
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122-         143      5       -1 -143 1209 -1212
123-         144      5       -1 -144 1209 -1212
124-         145      5       -1 -145 1209 -1212
125-         146      5       -1 -146 1209 -1212
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127-         148      5       -1 -148 1209 -1212
128-         149      5       -1 -149 1209 -1212
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130-         152      5       -1 -152 1209 -1212
131-         153      5       -1 -153 1209 -1212
132-         154      5       -1 -154 1209 -1212
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134-         156      5       -1 -156 1209 -1212
135-         157      5       -1 -157 1209 -1212
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136-         158     5      -1 -158 1209 -1212
137-         159     5      -1 -159 1209 -1212
138-       c Walls
139-        1200     3 -0.001225 1222 -1221 1206 -1208 1220 -1219  $Notch
140-        1201     1  -2.365 1206 -1208 1202 -1203 -1219 1209 #1200  $Inner Wall
141-        1202     1  -2.395 1207 -1233 1219 -990 -991 992  $Top of Left Wall
142-       12021     1  -2.395 1233 -1223 1219 -990 992 -991  $Split in Left Wall
143-        1203     1  -2.365 1207 -1205 -1219 1209 -1203 1202  $Bottom of Left Wall
144-        1204     1  -2.395 1234 -1204 1207 -1218 1219 -990  $Top of Back Wall
145-       12041     1  -2.395 991 -1234 1207 -1218 1219 -990  $Split in Back Wall
146-        1205     1  -2.365 1203 -1204 1207 -1218 -1219 1209  $Bottom of Back Wall
147-        1206     1  -2.395 1235 -1218 -991 992 1219 -990  $Top of Right Wall
148-       12061     1  -2.395 1224 -1235 -991 992 1219 -990  $Split in Right Wall
149-        1207     1  -2.365 1217 -1218 -1203 1202 -1219 1209  $Bottom of Right Wall
150-        1208     1  -2.395 1201 -1236 -1218 1207 1219 -990 #10000 $Top of Front Wall
151-                    #10001 #10002 #10003 #10004 #10005
152-       12081     1  -2.395 -992 1236 -1218 1207 1219 -990 #10000 $Split in Front Wall
153-                    #10001 #10002 #10003 #10004 #10005
154-        1209     1  -2.365 -1202 1201 -1218 1207 -1219 1209  $Bottom of Front Wall
155-        1210     1  -2.365 -1209 1227 1207 -1218 -1204 1201  $Floor
156-        1211     1  -2.328 990 -1237 1207 -1218 -1204 1201  $Roof
157-       12111     1  -2.328 1237 -1216 1207 -1218 -1204 1201  $Split in Roof
158-       c   Air
159-        9999     0         2015  $Outside Model
160-        9998     3 -0.001225 1205 -1228 -1220 1209 -1203 1202 #(-134 1209 -1212 )#
161-                   (-135 1209 -1212 )#(-145 1209 -1212 )#(-146 1209 -1212 )#
162-                   (-147 1209 -1212 )#(-148 1209 -1212 )#(-149 1209 -1212 )#
163-                   (-11 1209 -1212 )#(-12 1209 -1212 )#(-13 1209 -1212 )#
164-                   (-14 1209 -1212 )#(-15 1209 -1212 )#(-25 1209 -1212 )#
165-                   (-26 1209 -1212 )#(-27 1209 -1212 )#(-28 1209 -1212 )#
166-                   (-29 1209 -1212 )#(-41 1209 -1212 )#(-42 1209 -1212 )#
167-                   (-43 1209 -1212 )#(-44 1209 -1212 )#(-45 1209 -1212 )#
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176-                   (-119 1209 -1212 )#(-131 1209 -1212 )#(-132 1209 -1212 )#
177-                   (-133 1209 -1212 )
178-        9997     3 -0.001225 1228 -1229 -1220 1209 -1203 1202 #(-139 1209 -1212 )#
179-                   (-141 1209 -1212 )#(-151 1209 -1212 )#(-152 1209 -1212 )#
180-                   (-153 1209 -1212 )#(-154 1209 -1212 )#(-155 1209 -1212 )#
181-                   (-15 1209 -1212 )#(-16 1209 -1212 )#(-17 1209 -1212 )#
182-                   (-18 1209 -1212 )#(-19 1209 -1212 )#(-21 1209 -1212 )#
183-                   (-31 1209 -1212 )#(-32 1209 -1212 )#(-33 1209 -1212 )#
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185-                   (-46 1209 -1212 )#(-47 1209 -1212 )#(-48 1209 -1212 )#
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188-                   (-65 1209 -1212 )#(-75 1209 -1212 )#(-76 1209 -1212 )#
189-                   (-77 1209 -1212 )#(-78 1209 -1212 )#(-79 1209 -1212 )#
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196-                   (-136 1209 -1212 )#(-137 1209 -1212 )#(-138 1209 -1212 )
197-        9996     3 -0.001225 1229 -1206 -1220 1209 -1203 1202 #(-142 1209 -1212 )#
198-                   (-143 1209 -1212 )#(-144 1209 -1212 )#(-156 1209 -1212 )#
199-                   (-157 1209 -1212 )#(-158 1209 -1212 )#(-159 1209 -1212 )#
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205-                   (-69 1209 -1212 )#(-81 1209 -1212 )#(-82 1209 -1212 )#
206-                   (-83 1209 -1212 )#(-84 1209 -1212 )#(-96 1209 -1212 )#
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208-                   (-111 1209 -1212 )#(-112 1209 -1212 )#(-113 1209 -1212 )#
209-                   (-114 1209 -1212 )#(-126 1209 -1212 )#(-127 1209 -1212 )#
210-                   (-128 1209 -1212 )#(-129 1209 -1212 )#(-141 1209 -1212 )
211-        9995     3 -0.001225 1220 -1219 1205 -1206 -1203 1202
212-        9994     3 -0.001225 -990 1219 1223 -1208 -991 992 #200 #201 #202 #203 #204
213-                    #205 #206 #207 #208 #209 #210
214-        9993     3 -0.001225 1209 -1231 1208 -1217 -1203 1202
215-        9992     3 -0.001225 -1230 1231 1208 -1217 -1203 1202
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216-         9991     3 -0.001225 -1220 1230 1208 -1217 -1203 1202
217-         9990     3 -0.001225 1220 -1219 1208 -1217 -1203 1202
218-         9989     3 -0.001225 -990 1219 1208 -1224 -991 992 #211 #212 #213 #214
219-         9988     3 -0.001225 ((-2000 -1207 1201 -1204 1227 -1216 ):
220-                    (1218 -2000 1201 -1204 1227 -1216 ):(-2000 -1201 1227 -1216 ):
221-                    (1204 -2000 1227 -1216 ):(1216 -2000 ))#222
222-         9987     0          -1232 -2015  $Bottom Void
223-         9986     3 -0.001225 1232 -1227 -2015
224-       c       Ductwork Penetrations
225-       10000     3 -0.001225 12441 -12451 12321 -12331 1201 -992
226-       10001     3 -0.001225 12441 -12451 12341 -12351 1201 -992
227-       10002     3 -0.001225 12461 -12471 12361 -12371 1201 -992
228-       10003     3 -0.001225 12441 -12451 12381 -12391 1201 -992
229-       10004     3 -0.001225 12401 -12411 12441 -12451 1201 -992
230-       10005     3 -0.001225 12441 -12451 12421 -12431 1201 -992
231-       c Sphere Detector Cells
232-         2001     3 -0.001225 2000 -2001 1227
233-         2002     3 -0.001225 2001 -2002 1227
234-         2003     3 -0.001225 -2003 2002 1227
235-         2004     3 -0.001225 2003 -2004 1227
236-         2005     3 -0.001225 2004 -2005 1227
237-         2006     3 -0.001225 2005 -2006 1227
238-         2007     3 -0.001225 2006 -2007 1227
239-         2008     3 -0.001225 2007 -2008 1227
240-         2009     3 -0.001225 2008 -2009 1227
241-         2010     3 -0.001225 2009 -2010 1227
242-         2011     3 -0.001225 2010 -2011 1227
243-         2012     3 -0.001225 2011 -2012 1227
244-         2013     3 -0.001225 2012 -2013 1227
245-         2014     3 -0.001225 2013 -2014 1227
246-         2015     3 -0.001225 2014 -2015 1227
247-       c Roof Beams
248-         200      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
249-                    ):(-209 206 -211 212 992 -991 )
250-         201      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
251-                    ):(-209 206 -211 212 992 -991 ) trcl=(264.16 0 0 )
252-         202      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
253-                    ):(-209 206 -211 212 992 -991 ) trcl=(528.32 0 0 )
254-         203      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
255-                    ):(-209 206 -211 212 992 -991 ) trcl=(792.48 0 0 )
256-         204      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
257-                    ):(-209 206 -211 212 992 -991 ) trcl=(1056.64 0 0 )
258-         205      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
259-                    ):(-209 206 -211 212 992 -991 ) trcl=(1320.8 0 0 )
260-         206      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
261-                    ):(-209 206 -211 212 992 -991 ) trcl=(1584.96 0 0 )
262-         207      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
263-                    ):(-209 206 -211 212 992 -991 ) trcl=(1849.12 0 0 )
264-         208      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
265-                    ):(-209 206 -211 212 992 -991 ) trcl=(2113.28 0 0 )
266-         209      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
267-                    ):(-209 206 -211 212 992 -991 ) trcl=(2377.44 0 0 )
268-         210      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
269-                    ):(-209 206 -211 212 992 -991 ) trcl=(2641.6 0 0 )
270-         211      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
271-                    ):(-209 206 -211 212 992 -991 ) trcl=(2905.76 0 0 )
272-         212      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
273-                    ):(-209 206 -211 212 992 -991 ) trcl=(3169.92 0 0 )
274-         213      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
275-                    ):(-209 206 -211 212 992 -991 ) trcl=(3434.08 0 0 )
276-         214      4   -7.86 (206 -209 -990 210 992 -991 ):(-210 211 207 -208 992 -991
277-                    ):(-209 206 -211 212 992 -991 ) trcl=(3698.24 0 0 )
278-       c HVAC Shield
279-         222      4   -7.86 214 216 -215 -12471 -217 218
280-
281-       c     Source Canisters
282-          11       c/z 302.26 121.92 77.47
283-          12       c/z 500.38 121.92 77.47
284-          13       c/z 698.5 121.92 77.47
285-          14       c/z 896.62 121.92 77.47
286-          15       c/z 1094.74 121.92 77.47
287-          16       c/z 1292.86 121.92 77.47
288-          17       c/z 1490.98 121.92 77.47
289-          18       c/z 1689.1 121.92 77.47
290-          19       c/z 1887.22 121.92 77.47
291-          21       c/z 2085.34 121.92 77.47
292-          22       c/z 2283.46 121.92 77.47
293-          23       c/z 2481.58 121.92 77.47
294-          24       c/z 2679.7 121.92 77.47
295-          25       c/z 203.2 294.64 77.47
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296-          26       c/z 401.32 294.64 77.47
297-          27       c/z 599.44 294.64 77.47
298-          28       c/z 797.56 294.64 77.47
299-          29       c/z 995.68 294.64 77.47
300-          31       c/z 1193.8 294.64 77.47
301-          32       c/z 1391.92 294.64 77.47
302-          33       c/z 1590.04 294.64 77.47
303-          34       c/z 1788.16 294.64 77.47
304-          35       c/z 1986.28 294.64 77.47
305-          36       c/z 2184.4 294.64 77.47
306-          37       c/z 2382.52 294.64 77.47
307-          38       c/z 2580.64 294.64 77.47
308-          39       c/z 2778.76 294.64 77.47
309-          41       c/z 302.26 467.36 77.47
310-          42       c/z 500.38 467.36 77.47
311-          43       c/z 698.5 467.36 77.47
312-          44       c/z 896.62 467.36 77.47
313-          45       c/z 1094.74 467.36 77.47
314-          46       c/z 1292.86 467.36 77.47
315-          47       c/z 1490.98 467.36 77.47
316-          48       c/z 1689.1 467.36 77.47
317-          49       c/z 1887.22 467.36 77.47
318-          51       c/z 2085.34 467.36 77.47
319-          52       c/z 2283.46 467.36 77.47
320-          53       c/z 2481.58 467.36 77.47
321-          54       c/z 2679.7 467.36 77.47
322-          55       c/z 203.2 640.08 77.47
323-          56       c/z 401.32 640.08 77.47
324-          57       c/z 599.44 640.08 77.47
325-          58       c/z 797.56 640.08 77.47
326-          59       c/z 995.68 640.08 77.47
327-          61       c/z 1193.8 640.08 77.47
328-          62       c/z 1391.92 640.08 77.47
329-          63       c/z 1590.04 640.08 77.47
330-          64       c/z 1788.16 640.08 77.47
331-          65       c/z 1986.28 640.08 77.47
332-          66       c/z 2184.4 640.08 77.47
333-          67       c/z 2382.52 640.08 77.47
334-          68       c/z 2580.64 640.08 77.47
335-          69       c/z 2778.76 640.08 77.47
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337-          72       c/z 500.38 812.8 77.47
338-          73       c/z 698.5 812.8 77.47
339-          74       c/z 896.62 812.8 77.47
340-          75       c/z 1094.74 812.8 77.47
341-          76       c/z 1292.86 812.8 77.47
342-          77       c/z 1490.98 812.8 77.47
343-          78       c/z 1689.1 812.8 77.47
344-          79       c/z 1887.22 812.8 77.47
345-          81       c/z 2085.34 812.8 77.47
346-          82       c/z 2283.46 812.8 77.47
347-          83       c/z 2481.58 812.8 77.47
348-          84       c/z 2679.7 812.8 77.47
349-          85       c/z 203.2 985.52 77.47
350-          86       c/z 401.32 985.52 77.47
351-          87       c/z 599.44 985.52 77.47
352-          88       c/z 797.56 985.52 77.47
353-          89       c/z 995.68 985.52 77.47
354-          91       c/z 1193.8 985.52 77.47
355-          92       c/z 1391.92 985.52 77.47
356-          93       c/z 1590.04 985.52 77.47
357-          94       c/z 1788.16 985.52 77.47
358-          95       c/z 1986.28 985.52 77.47
359-          96       c/z 2184.4 985.52 77.47
360-          97       c/z 2382.52 985.52 77.47
361-          98       c/z 2580.64 985.52 77.47
362-          99       c/z 2778.76 985.52 77.47
363-         101       c/z 302.26 1158.24 77.47
364-         102       c/z 500.38 1158.24 77.47
365-         103       c/z 698.5 1158.24 77.47
366-         104       c/z 896.62 1158.24 77.47
367-         105       c/z 1094.74 1158.24 77.47
368-         106       c/z 1292.86 1158.24 77.47
369-         107       c/z 1490.98 1158.24 77.47
370-         108       c/z 1689.1 1158.24 77.47
371-         109       c/z 1887.22 1158.24 77.47
372-         111       c/z 2085.34 1158.24 77.47
373-         112       c/z 2283.46 1158.24 77.47
374-         113       c/z 2481.58 1158.24 77.47
375-         114       c/z 2679.7 1158.24 77.47
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376-         115       c/z 203.2 1330.96 77.47
377-         116       c/z 401.32 1330.96 77.47
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383-         123       c/z 1590.04 1330.96 77.47
384-         124       c/z 1788.16 1330.96 77.47
385-         125       c/z 1986.28 1330.96 77.47
386-         126       c/z 2184.4 1330.96 77.47
387-         127       c/z 2382.52 1330.96 77.47
388-         128       c/z 2580.64 1330.96 77.47
389-         129       c/z 2778.76 1330.96 77.47
390-         131       c/z 302.26 1503.68 77.47
391-         132       c/z 500.38 1503.68 77.47
392-         133       c/z 698.5 1503.68 77.47
393-         134       c/z 896.62 1503.68 77.47
394-         135       c/z 1094.74 1503.68 77.47
395-         136       c/z 1292.86 1503.68 77.47
396-         137       c/z 1490.98 1503.68 77.47
397-         138       c/z 1689.1 1503.68 77.47
398-         139       c/z 1887.22 1503.68 77.47
399-         141       c/z 2085.34 1503.68 77.47
400-         142       c/z 2283.46 1503.68 77.47
401-         143       c/z 2481.58 1503.68 77.47
402-         144       c/z 2679.7 1503.68 77.47
403-         145       c/z 203.2 1676.4 77.47
404-         146       c/z 401.32 1676.4 77.47
405-         147       c/z 599.44 1676.4 77.47
406-         148       c/z 797.56 1676.4 77.47
407-         149       c/z 995.68 1676.4 77.47
408-         151       c/z 1193.8 1676.4 77.47
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410-         153       c/z 1590.04 1676.4 77.47
411-         154       c/z 1788.16 1676.4 77.47
412-         155       c/z 1986.28 1676.4 77.47
413-         156       c/z 2184.4 1676.4 77.47
414-         157       c/z 2382.52 1676.4 77.47
415-         158       c/z 2580.64 1676.4 77.47
416-         159       c/z 2778.76 1676.4 77.47
417-         c    Planes
418-        1201        py -76.2
419-        1202        py 0
420-        1203        py 1828.8
421-        1204        py 1905
422-        1205        px 0
423-        1206        px 2895.6
424-        1207        px -76.2
425-        1208        px 2971.8
426-        1209        pz 0  $Top of Floor
427-        1212        pz 381  $Top of Top HIC
428-         990        pz 1455.42
429-        1216        pz 1493.52
430-        1217        px 3947.16
431-        1218        px 4023.36
432-        1219        pz 1036.32
433-        1220        pz 822.96  $Bottom of Notch
434-        1221        py 1760.22
435-        1222        py 1546.86
436-        1223        px -38.1
437-        1224        px 3985.26
438-         991        py 1866.9
439-         992        py -38.1
440-        1227        pz -76.2  $Bottom of Floor
441-        1228        px 1089.66
442-        1229        px 2080.26
443-        1230        pz 807.72
444-        1231        pz 213.36  $7ft Detector Surface
445-        1232        pz -91.44  $Bottom Void
446-        1233        px -57.15
447-        1234        py 1885.95
448-        1235        px 4004.31
449-        1236        py -57.15
450-        1237        pz 1474.47
451-       c    HVAC Duct Openings
452-       12321        px 68.58  $Duct1S1
453-       12331        px 170.18  $Duct1 S2
454-       12341        px 871.22  $Duct2 S1
455-       12351        px 972.82  $Duct2 S2
```

```
 456-       12361        px 1595.12  $Duct3 S1
 457-       12371        px 1747.52  $Duct3 S2
 458-       12381        px 1856.74  $Duct4 S1
 459-       12391        px 1958.34  $Duct4 S2
 460-       12401        px 2720.34  $Duct5 S1
 461-       12411        px 2821.94  $Duct5 S2
 462-       12421        px 3776.98  $Duct6 S1
 463-       12431        px 3878.58  $Duct6 S2
 464-       12441        pz 1397  $Small Ducts Bottom
 465-       12451        pz 1437.64  $Small Duct Top
 466-       12461        pz 1369.06  $Large Ducts Bottom
 467-       12471        pz 1445.26  $Large Duct Top
 468-       c   Spheres for detectors
 469-        2000         s 1973.58 914.4 -72.6 2800  $Closest Sphere
 470-        2001         s 1973.58 914.4 -72.6 4000
 471-        2002         s 1973.58 914.4 -72.6 7000
 472-        2003         s 1973.58 914.4 -72.6 10000
 473-        2004         s 1973.58 914.4 -72.6 15000
 474-        2005         s 1973.58 914.4 -72.6 20000
 475-        2006         s 1973.58 914.4 -72.6 25000
 476-        2007         s 1973.58 914.4 -72.6 30000
 477-        2008         s 1973.58 914.4 -72.6 37500
 478-        2009         s 1973.58 914.4 -72.6 45000
 479-        2010         s 1973.58 914.4 -72.6 55000
 480-        2011         s 1973.58 914.4 -72.6 65000
 481-        2012         s 1973.58 914.4 -72.6 75000
 482-        2013         s 1973.58 914.4 -72.6 85000
 483-        2014         s 1973.58 914.4 -72.6 95000
 484-        2015         s 1973.58 914.4 -72.6 120000
 485-        2016        py -276.2
 486-        2017        py -476.2
 487-        2018        py -676.2
 488-        2019        py -876.2
 489-        2020        py -1076.2
 490-        2021        py -1276.2
 491-        2022        py -1476.2
 492-        2023        py -1676.2
 493-        2024        py -1876.2
 494-        2025        py -2076.2
 495-        2026        px 359.054
 496-        2027        px 2535.94
 497-        2028        py -2276.2
 498-        2029        py -2476.2
 499-        2030        py -2676.2
 500-        2031        py -2876.2
 501-        2032        py -3076.2
 502-        2033        py -3276.2
 503-        2034        py -3476.2
 504-        2035        py -3676.2
 505-       c    Roof Beams
 506-         206        px 211.49
 507-         207        px 225.37
 508-         208        px 226.76
 509-         209        px 240.64
 510-         210        pz 1453.54
 511-         211        pz 1373.84
 512-         212        pz 1371.96
 513-         213        px 226.065
 514-        c HVAC Shield
 515-         214        px 1564.64
 516-         215        px 1988.82
 517-         216        pz 1186.18
 518-         217        py -167.64
 519-         218        py -172.72
 520-
 521-       mode  p
 522-       c  Materials
 523-       m1    1000.           -0.015  $MAT1
 524-             8000.           -1.057 11000.          -0.041 12000.          -0.085
 525-             13000.          -0.137 14000.          -0.487 15000.          -0.002
 526-             16000.          -0.002 19000.          -0.015 20000.          -0.295
 527-             22000.          -0.011 25000.          -0.003 26000.          -0.178
 528-       m2    13000.               1  $MAT2
warning. material   2 is not used in the problem.
 529-       m3    7000.          0.78969  $MAT3
 530-             8000.          0.21019 6000.          0.00012
 531-       m4    26000.               1  $MAT4
 532-       m5    1000.                2  $MAT5
 533-             8000.                1
 534-       imp:p   1 136r       9           3 1r         9           3 1r          $ 11,
```

```
 535-              9            3 1r         9            3 1r         1            $ 1206,
 536-              3            9            0            1 9r         27           $ 1211,
 537-              0            1 6r         54 1r        108 1r       216 1r       $ 9987,
 538-              432 1r       864 1r       1728 1r      3456 1r      1 13r        $ 2007,
 539-              27           1            27            $ 213, 222
 540-         phys:p  100 1 0
 541-       c sdef erg=d5 x=d1 y=d2 z=d3 cel=d4 eff=0.0001 wgt=3.045E+15
 542-       c si1  0 2895.6
 543-       c sp1  0.0 1.0
 544-       c si2  0 1828.8
 545-       c sp2  0.0 1.0
 546-       c si3  0.01 304.8 381.00
 547-       c sp3  0.0 0.8 0.2
 548-       c sb3  0.0 0.2 1.0
 549-       c si4  L 11 12 13 14 15 16 17 18 19 21 22 23 24 25 26 27 28 29 31 32
 550-       c      33 34 35 36 37 38 39 41 42 43 44 45 46 47 48 49 51 52 53 54 55
 551-       c      56 57 58 59 61 62 63 64 65 66 67 68 69 71 72 73 74 75 76 77 78
 552-       c      79 81 82 83 84 85 86 87 88 89 91 92 93 94 95 96 97 98 99 101
 553-       c      102 103 104 105 106 107 108 109 111 112 113 114 115 116 117 118
 554-       c      119 121 122 123 124 125 126 127 128 129 131 132 133 134 135 136
 555-       c      137 138 139 141 142 143 144 145 146 147 148 149 151 152 153 154
 556-       c      155 156 157 158 159
 557-       c sp4  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 558-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 559-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 560-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 561-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 562-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 563-       c      1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1  1
 564-       c      1  1  1  1  1
 565-       c si5 l 1.1730 1.3325
 566-       c sp5   1      1
 567-       c ssw 1220(9995)
 568-       ssr
 569-       c ===========================================================================
 570-       c ===========================================================================
 571-       c Truck bay dose rate
 572-       f2:p 1231
warning. without bremsstrahlung, flux estimates will be low.
 573-       c ===========================================================================
 574-       c ===========================================================================
 575-       c Rings outside the building
 576-       f12:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 577-       fs12 -2000 -2001 -2002 -2003 -2004 -2005 -2006 -2007 -2008 -2009
 578-            -2010 -2011 -2012 -2013 -2014
 579-       sd12 1e50 2.564E+07 1.037e8 1.602e8 3.927e8 5.498e8 7.069e8 8.639e8 1.590e9
 580-            1.944e9 3.142e9 3.770e9 4.398e9 5.027e9 5.655e9 1.689e10
 581-       c ===========================================================================
 582-       c ===========================================================================
 583-       c Slabs Ajacent to Ventilation Penetration Side
 584-       f22:p 1227
warning. without bremsstrahlung, flux estimates will be low.
 585-       fs22 1201 -2026 2027
 586-            2016 2017 2018 2019 2020
 587-            2021 2022 2023 2024 2025
 588-            2028 2029 2030 2031 2032
 589-            2033 2034 2035
 590-       sd22 1e50 1e50 1e50
 591-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 592-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 593-            4.35376e5 4.35376e5 4.35376e5 4.35376e5 4.35376e5
 594-            4.35376e5 4.35376e5 4.35376e5 1e50
 595-       c ===========================================================================
 596-       c ===========================================================================
 597-       c Dose Rate on Vent Side Wall 7ft up avg
 598-       f32:p 1201
warning. without bremsstrahlung, flux estimates will be low.
 599-       fs32 1231 -2026 2027 -1227
 600-       sd32 1e50 1e50 1e50 1e50 6.30E+05
 601-       c ===========================================================================
 602-       c ===========================================================================
 603-       c detectors toward north, with HVAC effects
 604-       f42:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 605-       fs42 1219 -1209 1201 -1205 1206
 606-       sd42 1e50 1e50 1e50 1e50 1e50 3.00e06
 607-            1e50 1e50 1e50 1e50 1e50 3.00e06
 608-            1e50 1e50 1e50 1e50 1e50 3.00e06
 609-            1e50 1e50 1e50 1e50 1e50 3.00e06
```

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 610-            1e50 1e50 1e50 1e50 1e50 3.00e06
 611-            1e50 1e50 1e50 1e50 1e50 3.00e06
 612-            1e50 1e50 1e50 1e50 1e50 3.00e06
 613-            1e50 1e50 1e50 1e50 1e50 3.00e06
 614-            1e50 1e50 1e50 1e50 1e50 3.00e06
 615-            1e50 1e50 1e50 1e50 1e50 3.00e06
 616-            1e50 1e50 1e50 1e50 1e50 3.00e06
 617-       c detectors toward sorth, with no HVAC effects
 618-       f52:p 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013
warning. without bremsstrahlung, flux estimates will be low.
 619-       fs52 1219 -1209 -1201 -1205 1206
 620-       sd52 1e50 1e50 1e50 1e50 1e50 3.00e06
 621-            1e50 1e50 1e50 1e50 1e50 3.00e06
 622-            1e50 1e50 1e50 1e50 1e50 3.00e06
 623-            1e50 1e50 1e50 1e50 1e50 3.00e06
 624-            1e50 1e50 1e50 1e50 1e50 3.00e06
 625-            1e50 1e50 1e50 1e50 1e50 3.00e06
 626-            1e50 1e50 1e50 1e50 1e50 3.00e06
 627-            1e50 1e50 1e50 1e50 1e50 3.00e06
 628-            1e50 1e50 1e50 1e50 1e50 3.00e06
 629-            1e50 1e50 1e50 1e50 1e50 3.00e06
 630-            1e50 1e50 1e50 1e50 1e50 3.00e06
 631-       c ===========================================================================
 632-       c ===========================================================================
 633-       c Detector above the HICS (used as a source check)
 634-       f62:p 1219
warning. without bremsstrahlung, flux estimates will be low.
 635-       fs62 -1205 1206 1203 -1202
 636-       sd62  1e50 1e50 1e50  1e50 5.30E+06
 637-       c ===========================================================================
 638-       c ===========================================================================
 639-       c Photon Flux to Dose Rate Conversion Factors
 640-       de0 0.01 0.03 0.05 0.07 0.10 0.15 0.20
 641-            0.25 0.30 0.35 0.40 0.45 0.50 0.55
 642-            0.60 0.65 0.70 0.80 1.00 1.40 1.80
 643-            2.20 2.60 2.80 3.25 3.75 4.25 4.75
 644-            5.00 5.25 5.75 6.25 6.75 7.50 9.00
 645-            11.0 13.0 15.0
 646-       df0 LIN 3.96E-06 5.82E-07 2.90E-07 2.58E-07 2.83E-07 3.79E-07 5.01E-07
 647-            6.31e-07 7.59E-07 8.78E-07 9.85E-07 1.08E-06 1.17E-06 1.27E-06
 648-            1.36e-06 1.44E-06 1.52E-06 1.68E-06 1.98E-06 2.51E-06 2.99E-06
 649-            3.42e-06 3.82E-06 4.01E-06 4.41E-06 4.83E-06 5.23E-06 5.60E-06
 650-            5.80e-06 6.01E-06 6.37E-06 6.74E-06 7.11E-06 7.66E-06 8.77E-06
 651-            1.03e-05 1.18E-05 1.33E-05
 652-       nps 8.00e08

surface    990   and surface 201990   are the same. 201990   will be deleted.

surface    990   and surface 202990   are the same. 202990   will be deleted.

surface    990   and surface 203990   are the same. 203990   will be deleted.

surface    990   and surface 204990   are the same. 204990   will be deleted.

surface    990   and surface 205990   are the same. 205990   will be deleted.

surface    990   and surface 206990   are the same. 206990   will be deleted.

surface    990   and surface 207990   are the same. 207990   will be deleted.

surface    990   and surface 208990   are the same. 208990   will be deleted.

surface    990   and surface 209990   are the same. 209990   will be deleted.

surface    990   and surface 210990   are the same. 210990   will be deleted.

surface    990   and surface 211990   are the same. 211990   will be deleted.

surface    990   and surface 212990   are the same. 212990   will be deleted.

surface    990   and surface 213990   are the same. 213990   will be deleted.

surface    990   and surface 214990   are the same. 214990   will be deleted.

surface    991   and surface 201991   are the same. 201991   will be deleted.

surface    991   and surface 202991   are the same. 202991   will be deleted.

surface    991   and surface 203991   are the same. 203991   will be deleted.
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surface    991   and surface 204991   are the same. 204991   will be deleted.
surface    991   and surface 205991   are the same. 205991   will be deleted.
surface    991   and surface 206991   are the same. 206991   will be deleted.
surface    991   and surface 207991   are the same. 207991   will be deleted.
surface    991   and surface 208991   are the same. 208991   will be deleted.
surface    991   and surface 209991   are the same. 209991   will be deleted.
surface    991   and surface 210991   are the same. 210991   will be deleted.
surface    991   and surface 211991   are the same. 211991   will be deleted.
surface    991   and surface 212991   are the same. 212991   will be deleted.
surface    991   and surface 213991   are the same. 213991   will be deleted.
surface    991   and surface 214991   are the same. 214991   will be deleted.
surface    992   and surface 201992   are the same. 201992   will be deleted.
surface    992   and surface 202992   are the same. 202992   will be deleted.
surface    992   and surface 203992   are the same. 203992   will be deleted.
surface    992   and surface 204992   are the same. 204992   will be deleted.
surface    992   and surface 205992   are the same. 205992   will be deleted.
surface    992   and surface 206992   are the same. 206992   will be deleted.
surface    992   and surface 207992   are the same. 207992   will be deleted.
surface    992   and surface 208992   are the same. 208992   will be deleted.
surface    992   and surface 209992   are the same. 209992   will be deleted.
surface    992   and surface 210992   are the same. 210992   will be deleted.
surface    992   and surface 211992   are the same. 211992   will be deleted.
surface    992   and surface 212992   are the same. 212992   will be deleted.
surface    992   and surface 213992   are the same. 213992   will be deleted.
surface    992   and surface 214992   are the same. 214992   will be deleted.
surface    210   and surface 201210   are the same. 201210   will be deleted.
surface    210   and surface 202210   are the same. 202210   will be deleted.
surface    210   and surface 203210   are the same. 203210   will be deleted.
surface    210   and surface 204210   are the same. 204210   will be deleted.
surface    210   and surface 205210   are the same. 205210   will be deleted.
surface    210   and surface 206210   are the same. 206210   will be deleted.
surface    210   and surface 207210   are the same. 207210   will be deleted.
surface    210   and surface 208210   are the same. 208210   will be deleted.
surface    210   and surface 209210   are the same. 209210   will be deleted.
surface    210   and surface 210210   are the same. 210210   will be deleted.
surface    210   and surface 211210   are the same. 211210   will be deleted.
surface    210   and surface 212210   are the same. 212210   will be deleted.
surface    210   and surface 213210   are the same. 213210   will be deleted.
surface    210   and surface 214210   are the same. 214210   will be deleted.
surface    211   and surface 201211   are the same. 201211   will be deleted.
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 surface    211   and surface 202211   are the same. 202211   will be deleted.

 surface    211   and surface 203211   are the same. 203211   will be deleted.

 surface    211   and surface 204211   are the same. 204211   will be deleted.

 surface    211   and surface 205211   are the same. 205211   will be deleted.

 surface    211   and surface 206211   are the same. 206211   will be deleted.

 surface    211   and surface 207211   are the same. 207211   will be deleted.

 surface    211   and surface 208211   are the same. 208211   will be deleted.

 surface    211   and surface 209211   are the same. 209211   will be deleted.

 surface    211   and surface 210211   are the same. 210211   will be deleted.

 surface    211   and surface 211211   are the same. 211211   will be deleted.

 surface    211   and surface 212211   are the same. 212211   will be deleted.

 surface    211   and surface 213211   are the same. 213211   will be deleted.

 surface    211   and surface 214211   are the same. 214211   will be deleted.

 surface    212   and surface 201212   are the same. 201212   will be deleted.

 surface    212   and surface 202212   are the same. 202212   will be deleted.

 surface    212   and surface 203212   are the same. 203212   will be deleted.

 surface    212   and surface 204212   are the same. 204212   will be deleted.

 surface    212   and surface 205212   are the same. 205212   will be deleted.

 surface    212   and surface 206212   are the same. 206212   will be deleted.

 surface    212   and surface 207212   are the same. 207212   will be deleted.

 surface    212   and surface 208212   are the same. 208212   will be deleted.

 surface    212   and surface 209212   are the same. 209212   will be deleted.

 surface    212   and surface 210212   are the same. 210212   will be deleted.

 surface    212   and surface 211212   are the same. 211212   will be deleted.

 surface    212   and surface 212212   are the same. 212212   will be deleted.

 surface    212   and surface 213212   are the same. 213212   will be deleted.

 surface    212   and surface 214212   are the same. 214212   will be deleted.

 comment.   84 surfaces were deleted for being the same as others.


 information from the header of surface-source file bwssa

 the file was written by mcnp     version 5     with probid =  05/13/09 07:42:34  and ending with dump no.     5
 the title of the creation run was     c     Created on: Tuesday, November 11, 2008 at 09:35
 the original number of histories was    25654088
 the total number of tracks recorded was     4352843 from     4229523 independent histories.

 this ssr problem will use the following particles if available: photon

 warning.   2 materials had unnormalized fractions. print table 40.

 warning.   1 of the materials appear at more than one density.

 warning. sum of segment sizes differs from total in  25 cases.
1cells                                                                                                  print
table 60

                      atom        gram                                        photon
        cell  mat    density     density     volume       mass     pieces importance

     1    11    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     2    12    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
     3    13    5  1.00282E-01 1.00000E+00 7.18360E+06 7.18360E+06     1  1.0000E+00
```

4	14	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
5	15	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
6	16	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
7	17	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
8	18	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
9	19	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
10	21	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
11	22	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
12	23	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
13	24	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
14	25	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
15	26	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
16	27	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
17	28	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
18	29	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
19	31	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
20	32	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
21	33	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
22	34	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
23	35	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
24	36	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
25	37	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
26	38	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
27	39	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
28	41	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
29	42	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
30	43	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
31	44	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
32	45	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
33	46	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
34	47	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
35	48	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
36	49	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
37	51	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
38	52	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
39	53	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
40	54	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
41	55	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
42	56	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
43	57	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
44	58	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
45	59	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
46	61	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
47	62	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
48	63	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
49	64	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
50	65	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
51	66	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
52	67	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
53	68	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
54	69	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
55	71	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
56	72	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
57	73	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
58	74	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
59	75	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
60	76	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
61	77	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
62	78	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
63	79	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
64	81	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
65	82	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
66	83	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
67	84	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
68	85	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
69	86	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
70	87	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
71	88	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
72	89	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
73	91	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
74	92	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
75	93	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
76	94	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
77	95	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
78	96	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
79	97	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
80	98	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
81	99	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
82	101	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
83	102	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00

84	103	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
85	104	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
86	105	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
87	106	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
88	107	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
89	108	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
90	109	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
91	111	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
92	112	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
93	113	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
94	114	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
95	115	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
96	116	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
97	117	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
98	118	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
99	119	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
100	121	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
101	122	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
102	123	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
103	124	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
104	125	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
105	126	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
106	127	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
107	128	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
108	129	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
109	131	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
110	132	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
111	133	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
112	134	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
113	135	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
114	136	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
115	137	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
116	138	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
117	139	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
118	141	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
119	142	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
120	143	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
121	144	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
122	145	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
123	146	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
124	147	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
125	148	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
126	149	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
127	151	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
128	152	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
129	153	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
130	154	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
131	155	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
132	156	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
133	157	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
134	158	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
135	159	5	1.00282E-01	1.00000E+00	7.18360E+06	7.18360E+06	1	1.0000E+00
136	1200	3	5.11393E-05	1.22500E-03	3.46881E+06	4.24930E+03	0	1.0000E+00
137	1201	1	7.34055E-02	2.36500E+00	1.40947E+08	3.33340E+08	0	1.0000E+00
138	1202	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
139	12021	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
140	1203	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
141	1204	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	9.0000E+00
142	12041	1	7.43366E-02	2.39500E+00	3.27303E+07	7.83891E+07	0	3.0000E+00
143	1205	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
144	1206	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	9.0000E+00
145	12061	1	7.43366E-02	2.39500E+00	1.52092E+07	3.64261E+07	0	3.0000E+00
146	1207	1	7.34055E-02	2.36500E+00	1.44416E+08	3.41544E+08	0	3.0000E+00
147	1208	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	9.0000E+00
148	12081	1	7.43366E-02	2.39500E+00	3.21158E+07	7.69173E+07	0	3.0000E+00
149	1209	1	7.34055E-02	2.36500E+00	3.23732E+08	7.65627E+08	0	3.0000E+00
150	1210	1	7.34055E-02	2.36500E+00	6.18900E+08	1.46370E+09	0	1.0000E+00
151	1211	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	3.0000E+00
152	12111	1	7.22571E-02	2.32800E+00	1.54725E+08	3.60200E+08	0	9.0000E+00
153	9999	0	0.00000E+00	0.00000E+00	0.00000E+00	0.00000E+00	0	0.0000E+00
154	9998	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
155	9997	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
156	9996	3	5.11393E-05	1.22500E-03	0.00000E+00	0.00000E+00	0	1.0000E+00
157	9995	3	5.11393E-05	1.22500E-03	1.12984E+09	1.38406E+06	0	1.0000E+00
158	9994	3	5.11393E-05	1.22500E-03	2.39844E+09	2.93809E+06	0	1.0000E+00
159	9993	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
160	9992	3	5.11393E-05	1.22500E-03	1.06018E+09	1.29872E+06	0	1.0000E+00
161	9991	3	5.11393E-05	1.22500E-03	2.71842E+07	3.33006E+04	0	1.0000E+00
162	9990	3	5.11393E-05	1.22500E-03	3.80578E+08	4.66209E+05	0	1.0000E+00
163	9989	3	5.11393E-05	1.22500E-03	8.07452E+08	9.89129E+05	0	1.0000E+00

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   164   9988     3  5.11393E-05 1.22500E-03 0.00000E+00 0.00000E+00     0  2.7000E+01
   165   9987     0  0.00000E+00 0.00000E+00 3.61826E+15 0.00000E+00     1  0.0000E+00
   166   9986     3  5.11393E-05 1.22500E-03 6.89441E+11 8.44566E+08     1  1.0000E+00
   167  10000     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   168  10001     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   169  10002     3  5.11393E-05 1.22500E-03 4.42451E+05 5.42002E+02     0  1.0000E+00
   170  10003     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   171  10004     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   172  10005     3  5.11393E-05 1.22500E-03 1.57316E+05 1.92712E+02     0  1.0000E+00
   173   2001     3  5.11393E-05 1.22500E-03 8.81574E+10 1.07993E+08     1  5.4000E+01
   174   2002     3  5.11393E-05 1.22500E-03 5.84709E+11 7.16269E+08     1  5.4000E+01
   175   2003     3  5.11393E-05 1.22500E-03 1.37659E+12 1.68633E+09     1  1.0800E+02
   176   2004     3  5.11393E-05 1.22500E-03 4.97560E+12 6.09511E+09     1  1.0800E+02
   177   2005     3  5.11393E-05 1.22500E-03 9.68856E+12 1.18685E+10     1  2.1600E+02
   178   2006     3  5.11393E-05 1.22500E-03 1.59723E+13 1.95661E+10     1  2.1600E+02
   179   2007     3  5.11393E-05 1.22500E-03 2.38269E+13 2.91879E+10     1  4.3200E+02
   180   2008     3  5.11393E-05 1.22500E-03 5.39037E+13 6.60320E+10     1  4.3200E+02
   181   2009     3  5.11393E-05 1.22500E-03 8.04121E+13 9.85049E+10     1  8.6400E+02
   182   2010     3  5.11393E-05 1.22500E-03 1.57615E+14 1.93078E+11     1  8.6400E+02
   183   2011     3  5.11393E-05 1.22500E-03 2.26732E+14 2.77747E+11     1  1.7280E+03
   184   2012     3  5.11393E-05 1.22500E-03 3.08416E+14 3.77809E+11     1  1.7280E+03
   185   2013     3  5.11393E-05 1.22500E-03 4.02666E+14 4.93265E+11     1  3.4560E+03
   186   2014     3  5.11393E-05 1.22500E-03 5.09482E+14 6.24115E+11     1  3.4560E+03
   187   2015     3  5.11393E-05 1.22500E-03 1.82349E+15 2.23378E+12     1  1.0000E+00
   188    200     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   189    201     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   190    202     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   191    203     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   192    204     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   193    205     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   194    206     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   195    207     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   196    208     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   197    209     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   198    210     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   199    211     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   200    212     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   201    213     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  2.7000E+01
   202    214     4  8.47555E-02 7.86000E+00 4.19837E+05 3.29992E+06     0  1.0000E+00
   203    222     4  8.47555E-02 7.86000E+00 5.58274E+05 4.38804E+06     0  2.7000E+01

 total                                    7.23819E+15 4.44062E+12

 warning. surface    213 is not used for anything.

 ************************************************
 * Random Number Generator  =                   1 *
 * Random Number Seed       =       19073486328125 *
 * Random Number Multiplier =       19073486328125 *
 * Random Number Adder      =                    0 *
 * Random Number Bits Used  =                   48 *
 * Random Number Stride     =               152917 *
 ************************************************


        12 warning messages so far.
1cross-section tables                                                                                print
table 100

     table    length

                        tables from file mcplib04

   1000.04p    1898  ENDF/B-VI Release 8 Photoatomic Data for 1-H                                    mat 100
02/07/03
   6000.04p    3152  ENDF/B-VI Release 8 Photoatomic Data for 6-C                                    mat 600
02/07/03
   7000.04p    3194  ENDF/B-VI Release 8 Photoatomic Data for 7-N                                    mat 700
02/07/03
   8000.04p    3272  ENDF/B-VI Release 8 Photoatomic Data for 8-O                                    mat 800
02/07/03
  11000.04p    3995  ENDF/B-VI Release 8 Photoatomic Data for 11-NA                                  mat1100
02/07/03
  12000.04p    3781  ENDF/B-VI Release 8 Photoatomic Data for 12-MG                                  mat1200
02/07/03
  13000.04p    4846  ENDF/B-VI Release 8 Photoatomic Data for 13-AL                                  mat1300
02/07/03
  14000.04p    4792  ENDF/B-VI Release 8 Photoatomic Data for 14-SI                                  mat1400
02/07/03
```

```
  15000.04p    4498  ENDF/B-VI Release 8 Photoatomic Data for 15-P                                  mat1500
02/07/03
  16000.04p    4654  ENDF/B-VI Release 8 Photoatomic Data for 16-S                                  mat1600
02/07/03
  19000.04p    5047  ENDF/B-VI Release 8 Photoatomic Data for 19-K                                  mat1900
02/07/03
  20000.04p    5013  ENDF/B-VI Release 8 Photoatomic Data for 20-CA                                 mat2000
02/07/03
  22000.04p    5742  ENDF/B-VI Release 8 Photoatomic Data for 22-TI                                 mat2200
02/07/03
  25000.04p    5598  ENDF/B-VI Release 8 Photoatomic Data for 25-MN                                 mat2500
02/07/03
  26000.04p    5718  ENDF/B-VI Release 8 Photoatomic Data for 26-FE                                 mat2600
02/07/03

  total       65200

 warning. simple physics turned on for photons > 100 mev.

************************************************************************************************************
*******
 dump no.    1 on file runtpe       nps =           0     coll =              0     ctm =        0.00   nrn =
0

        13 warning messages so far.

************************************************************************************************************
*******
 dump no.    2 on file runtpe       nps =      168878     coll =      252891492     ctm =       60.01   nrn =
3146087664


************************************************************************************************************
*******
 dump no.    3 on file runtpe       nps =      335134     coll =      499859791     ctm =      120.02   nrn =
6217027520


************************************************************************************************************
*******
 dump no.    4 on file runtpe       nps =      505024     coll =      757831024     ctm =      180.03   nrn =
9428644566


************************************************************************************************************
*******
 dump no.    5 on file runtpe       nps =      676340     coll =     1014123647     ctm =      240.04   nrn =
12617109333


************************************************************************************************************
*******
 dump no.    6 on file runtpe       nps =      849625     coll =     1272386378     ctm =      300.06   nrn =
15829556937


************************************************************************************************************
*******
 dump no.    7 on file runtpe       nps =     1023873     coll =     1532486155     ctm =      360.08   nrn =
19064950012


************************************************************************************************************
*******
 dump no.    8 on file runtpe       nps =     1197919     coll =     1792220962     ctm =      420.08   nrn =
22295384082


************************************************************************************************************
*******
```

```
 dump no.    9 on file runtpe       nps =     1370992     coll =     2051306146     ctm =      480.09   nrn =
25518541796


*****************************************************************************************************************
*******
 dump no.   10 on file runtpe       nps =     1543003     coll =     2310882822     ctm =      540.09   nrn =
28748387270


*****************************************************************************************************************
*******
 dump no.   11 on file runtpe       nps =     1716264     coll =     2568366734     ctm =      600.10   nrn =
31950043325


*****************************************************************************************************************
*******
 dump no.   12 on file runtpe       nps =     1889666     coll =     2825954320     ctm =      660.10   nrn =
35153035473


*****************************************************************************************************************
*******
 dump no.   13 on file runtpe       nps =     2064309     coll =     3084639080     ctm =      720.10   nrn =
38369077756


*****************************************************************************************************************
*******
 dump no.   14 on file runtpe       nps =     2236254     coll =     3343118271     ctm =      780.12   nrn =
41585211716


*****************************************************************************************************************
*******
 dump no.   15 on file runtpe       nps =     2409233     coll =     3601948598     ctm =      840.13   nrn =
44805043160


*****************************************************************************************************************
*******
 dump no.   16 on file runtpe       nps =     2582231     coll =     3860794838     ctm =      900.15   nrn =
48024796884


*****************************************************************************************************************
*******
 dump no.   17 on file runtpe       nps =     2754392     coll =     4119301102     ctm =      960.16   nrn =
51241078474


*****************************************************************************************************************
*******
 dump no.   18 on file runtpe       nps =     2928236     coll =     4378321920     ctm =     1020.16   nrn =
54462536061


*****************************************************************************************************************
*******
 dump no.   19 on file runtpe       nps =     3100388     coll =     4638306241     ctm =     1080.18   nrn =
57697898350


*****************************************************************************************************************
*******
 dump no.   20 on file runtpe       nps =     3273442     coll =     4898666058     ctm =     1140.19   nrn =
60937816401
```

```
********************************************************************************************************************
*******
 dump no.   21 on file runtpe       nps =     3447427     coll =     5156325682     ctm =     1200.20   nrn =
64140943199

1problem summary                                  source particle weight for summary table normalization =
21054865.00

      run terminated when it had used    0  minutes of computer time.
+                                                                                                        06/25/09
07:13:47
      c     Created on: Tuesday, November 11, 2008 at 09:35                                  probid =  06/24/09
11:02:50
0
 photon creation     tracks      weight        energy           photon loss         tracks      weight
energy
                                (per source particle)                                          (per source
particle)

 source           111424160    1.7972E+14    4.9624E-01          escape              256202    3.7455E+11
3.0683E-04
                                                                 energy cutoff            0    0.             0.
                                                                 time cutoff              0    0.             0.
 weight window            0    0.            0.                weight window            0    0.             0.
 cell importance  679794176    3.0666E+13    2.7673E-02          cell importance  240900539    3.0669E+13
2.7682E-02
 weight cutoff            0    0.            0.                weight cutoff            0    0.             0.
 e or t importance        0    0.            0.                e or t importance        0    0.             0.
 dxtran                   0    0.            0.                dxtran                   0    0.             0.
 forced collisions        0    0.            0.                forced collisions        0    0.             0.
 exp. transform           0    0.            0.                exp. transform           0    0.             0.
 from neutrons            0    0.            0.                compton scatter          0    0.
4.1030E-01
 bremsstrahlung           0    0.            0.                capture          610501921    2.1502E+14
8.6682E-02
 p-annihilation      147980    6.8653E+10    1.9520E-04          pair production      73990    3.4327E+10
2.4929E-04
 photonuclear             0    0.            0.                photonuclear abs         0    0.             0.
 electron x-rays          0    0.            0.
 1st fluorescence  60366336    3.5638E+13    1.1136E-03
 2nd fluorescence         0    0.            0.
     total        851732652    2.4609E+14    5.2522E-01              total        851732652    2.4609E+14
5.2522E-01

   number of photons banked                528682667        average time of (shakes)              cutoffs
   photon tracks per source particle      4.0453E+01          escape            1.0004E+02          tco
1.0000E+33
   photon collisions per source particle  2.4656E+02          capture           6.1577E+00          eco
1.0000E-03
   total photon collisions                5191353148          capture or escape 6.3209E+00          wc1  -
5.0000E-01
                                                              any termination   6.6107E+00          wc2  -
2.5000E-01

 computer time so far in this run  1208.77 minutes           maximum number ever in bank        15
 computer time in mcrun            1208.70 minutes           bank overflows to backup file       0
 source particles per minute            2.8724E+03
 random numbers generated              64575546929          most random numbers used was     4898696 in
history     2201502

 warning.  random number stride   152917 exceeded    24888 times.

 range of sampled source weights = 2.2838E+13 to 4.7148E+14

 warning. importance function may be poor.  see print table 120.
1photon   activity in each cell                                                                    print
table 126

                tracks     population   collisions   collisions     number        flux        average
average
       cell    entering                              * weight     weighted     weighted   track weight   track
mfp
                                                   (per history)    energy       energy     (relative)
(cm)

     1    11       52863        51413       282548    4.3542E+11   9.2521E-02   9.2521E-02   3.2278E+13
5.3763E+00
```

2	12	59093	57127	314121	4.8556E+11	9.1648E-02	9.1648E-02	3.2425E+13
5.3566E+00								
3	13	63952	61794	340765	5.2518E+11	9.1268E-02	9.1268E-02	3.2205E+13
5.3500E+00								
4	14	66600	64309	352681	5.3663E+11	9.1378E-02	9.1378E-02	3.1741E+13
5.3491E+00								
5	15	68270	65996	362317	5.6581E+11	9.0881E-02	9.0881E-02	3.2789E+13
5.3412E+00								
6	16	69415	67078	369352	5.7344E+11	9.1571E-02	9.1571E-02	3.2649E+13
5.3563E+00								
7	17	69460	67139	368827	5.8249E+11	9.0189E-02	9.0189E-02	3.3086E+13
5.3246E+00								
8	18	69093	66730	367200	5.7430E+11	9.0668E-02	9.0668E-02	3.2702E+13
5.3384E+00								
9	19	68186	65888	364129	5.8072E+11	9.1075E-02	9.1075E-02	3.3426E+13
5.3467E+00								
10	21	65055	62851	344279	5.4240E+11	9.0687E-02	9.0687E-02	3.2996E+13
5.3329E+00								
11	22	61951	59757	327975	5.1361E+11	9.2261E-02	9.2261E-02	3.2927E+13
5.3710E+00								
12	23	56348	54432	298647	4.6213E+11	9.2298E-02	9.2298E-02	3.2509E+13
5.3692E+00								
13	24	47456	45975	255165	3.9406E+11	9.3546E-02	9.3546E-02	3.2151E+13
5.3879E+00								
14	25	61625	59984	331009	5.1824E+11	9.2208E-02	9.2208E-02	3.2855E+13
5.3661E+00								
15	26	69403	66498	365359	5.6830E+11	9.0826E-02	9.0826E-02	3.2365E+13
5.3309E+00								
16	27	76758	73586	402927	6.2812E+11	9.0021E-02	9.0021E-02	3.2712E+13
5.3147E+00								
17	28	80922	77452	421757	6.5687E+11	9.0205E-02	9.0205E-02	3.2580E+13
5.3246E+00								
18	29	84411	80861	443102	6.9747E+11	9.0277E-02	9.0277E-02	3.3065E+13
5.3237E+00								
19	31	85597	82015	448957	6.9328E+11	8.9535E-02	8.9535E-02	3.2310E+13
5.3117E+00								
20	32	87705	84053	458711	7.1024E+11	8.9813E-02	8.9813E-02	3.2321E+13
5.3144E+00								
21	33	86553	82970	450459	7.0305E+11	8.9412E-02	8.9412E-02	3.2727E+13
5.3072E+00								
22	34	85472	81959	447549	6.9024E+11	9.0090E-02	9.0090E-02	3.2278E+13
5.3231E+00								
23	35	82405	78997	430801	6.6607E+11	8.9559E-02	8.9559E-02	3.2457E+13
5.3120E+00								
24	36	79035	75693	413071	6.3393E+11	9.0319E-02	9.0319E-02	3.2020E+13
5.3259E+00								
25	37	73403	70290	385311	5.9551E+11	9.0210E-02	9.0210E-02	3.2425E+13
5.3205E+00								
26	38	65239	62567	341725	5.3444E+11	9.0956E-02	9.0956E-02	3.2762E+13
5.3331E+00								
27	39	52328	50560	279976	4.3115E+11	9.3096E-02	9.3096E-02	3.2159E+13
5.3819E+00								
28	41	71272	68768	377160	5.8557E+11	9.1063E-02	9.1063E-02	3.2451E+13
5.3377E+00								
29	42	80570	77186	421975	6.5443E+11	9.0072E-02	9.0072E-02	3.2508E+13
5.3171E+00								
30	43	86733	83054	452638	7.1845E+11	8.9615E-02	8.9615E-02	3.3144E+13
5.3076E+00								
31	44	90594	86817	470484	7.3175E+11	8.9394E-02	8.9394E-02	3.2398E+13
5.3058E+00								
32	45	93614	89692	486505	7.6387E+11	8.8863E-02	8.8863E-02	3.2863E+13
5.2990E+00								
33	46	95016	91103	494094	7.6867E+11	8.8962E-02	8.8962E-02	3.2467E+13
5.2978E+00								
34	47	95561	91539	500699	7.8196E+11	8.8963E-02	8.8963E-02	3.2856E+13
5.3021E+00								
35	48	94520	90537	495164	7.5363E+11	8.9267E-02	8.9267E-02	3.1803E+13
5.3079E+00								
36	49	92656	88718	484847	7.5285E+11	8.8921E-02	8.8921E-02	3.2545E+13
5.3027E+00								
37	51	89411	85629	465939	7.2661E+11	8.9144E-02	8.9144E-02	3.2657E+13
5.3017E+00								
38	52	84327	80814	441603	6.8151E+11	8.9893E-02	8.9893E-02	3.2445E+13
5.3185E+00								
39	53	77236	74032	406142	6.3120E+11	9.0307E-02	9.0307E-02	3.2410E+13
5.3225E+00								
40	54	65188	62677	347074	5.2746E+11	9.1342E-02	9.1342E-02	3.1716E+13
5.3409E+00								
41	55	71862	69870	383276	5.9224E+11	9.1157E-02	9.1157E-02	3.2333E+13
5.3437E+00								

42	56	80128	76681	420450	6.5647E+11	8.9533E-02	8.9533E-02	3.2540E+13
5.3102E+00								
43	57	88240	84441	461784	7.0999E+11	9.0068E-02	9.0068E-02	3.2236E+13
5.3221E+00								
44	58	92994	88986	483800	7.6269E+11	8.9460E-02	8.9460E-02	3.3178E+13
5.3087E+00								
45	59	97007	92954	507591	7.9260E+11	8.8952E-02	8.8952E-02	3.2670E+13
5.3005E+00								
46	61	98722	94640	517969	8.1357E+11	8.8970E-02	8.8970E-02	3.2677E+13
5.2996E+00								
47	62	100015	95805	519719	8.1038E+11	8.8609E-02	8.8609E-02	3.2702E+13
5.2959E+00								
48	63	99425	95075	517453	8.1383E+11	8.8569E-02	8.8569E-02	3.2881E+13
5.2873E+00								
49	64	97841	93801	507659	7.8618E+11	8.8368E-02	8.8368E-02	3.2316E+13
5.2885E+00								
50	65	95088	91083	496234	7.7826E+11	8.9078E-02	8.9078E-02	3.2974E+13
5.3059E+00								
51	66	91087	87263	475335	7.4043E+11	8.9357E-02	8.9357E-02	3.2592E+13
5.3075E+00								
52	67	84964	81293	444817	6.9004E+11	9.0145E-02	9.0145E-02	3.2428E+13
5.3217E+00								
53	68	75280	72114	394451	6.1954E+11	8.9946E-02	8.9946E-02	3.2896E+13
5.3100E+00								
54	69	61217	59240	327941	5.1024E+11	9.2045E-02	9.2045E-02	3.2455E+13
5.3602E+00								
55	71	76052	73312	399826	6.0964E+11	9.0187E-02	9.0187E-02	3.1770E+13
5.3209E+00								
56	72	86460	82727	452117	7.0013E+11	8.9677E-02	8.9677E-02	3.2381E+13
5.3086E+00								
57	73	92173	88214	482373	7.6210E+11	8.8674E-02	8.8674E-02	3.2927E+13
5.2918E+00								
58	74	96008	91981	501686	7.7868E+11	8.8977E-02	8.8977E-02	3.2482E+13
5.3011E+00								
59	75	99673	95546	520284	8.2434E+11	8.8225E-02	8.8225E-02	3.3083E+13
5.2889E+00								
60	76	101580	97235	528340	8.2958E+11	8.8964E-02	8.8964E-02	3.2936E+13
5.3012E+00								
61	77	101660	97321	529778	8.4035E+11	8.8643E-02	8.8643E-02	3.3245E+13
5.2947E+00								
62	78	100762	96509	522984	8.1510E+11	8.8063E-02	8.8063E-02	3.2755E+13
5.2823E+00								
63	79	98580	94513	513818	8.0257E+11	8.9100E-02	8.9100E-02	3.2669E+13
5.3063E+00								
64	81	93688	89816	489923	7.5482E+11	8.8532E-02	8.8532E-02	3.2201E+13
5.2919E+00								
65	82	89279	85595	466253	7.3077E+11	8.9574E-02	8.9574E-02	3.2929E+13
5.3158E+00								
66	83	81911	78521	429534	6.6723E+11	9.0484E-02	9.0484E-02	3.2557E+13
5.3269E+00								
67	84	69875	67115	369261	5.7094E+11	9.0997E-02	9.0997E-02	3.2175E+13
5.3361E+00								
68	85	73497	71482	390625	6.0757E+11	9.0965E-02	9.0965E-02	3.2356E+13
5.3468E+00								
69	86	81567	78129	428203	6.6347E+11	8.9849E-02	8.9849E-02	3.2626E+13
5.3181E+00								
70	87	89360	85679	465628	7.1478E+11	9.0139E-02	9.0139E-02	3.2135E+13
5.3224E+00								
71	88	95171	91252	493633	7.6993E+11	8.9007E-02	8.9007E-02	3.2701E+13
5.3020E+00								
72	89	98932	94686	517640	8.1051E+11	8.8867E-02	8.8867E-02	3.3028E+13
5.2990E+00								
73	91	100823	96474	524486	8.1781E+11	8.8325E-02	8.8325E-02	3.2392E+13
5.2872E+00								
74	92	101689	97368	528946	8.2114E+11	8.8316E-02	8.8316E-02	3.2416E+13
5.2877E+00								
75	93	101105	96761	524812	8.3561E+11	8.8487E-02	8.8487E-02	3.3194E+13
5.2914E+00								
76	94	99354	95265	517822	8.2025E+11	8.8645E-02	8.8645E-02	3.3136E+13
5.2961E+00								
77	95	96106	92124	499122	7.7342E+11	8.8772E-02	8.8772E-02	3.2580E+13
5.2958E+00								
78	96	92177	88327	479886	7.3925E+11	8.9455E-02	8.9455E-02	3.2352E+13
5.3105E+00								
79	97	86477	82905	451845	7.0152E+11	9.0337E-02	9.0337E-02	3.2506E+13
5.3259E+00								
80	98	76558	73328	399961	6.2084E+11	8.9744E-02	8.9744E-02	3.2448E+13
5.3120E+00								
81	99	62530	60451	333473	5.1146E+11	9.1595E-02	9.1595E-02	3.2138E+13
5.3500E+00								

82	101	75370	72536	395716	6.1257E+11	9.0708E-02	9.0708E-02	3.2484E+13
5.3373E+00								
83	102	84193	80563	440545	6.9301E+11	8.9687E-02	8.9687E-02	3.2962E+13
5.3085E+00								
84	103	90458	86638	472104	7.3910E+11	8.8918E-02	8.8918E-02	3.2726E+13
5.2964E+00								
85	104	94859	90865	494379	7.6565E+11	8.8734E-02	8.8734E-02	3.2357E+13
5.2948E+00								
86	105	97892	93898	511352	8.0712E+11	8.8332E-02	8.8332E-02	3.2918E+13
5.2872E+00								
87	106	99539	95367	517129	7.9754E+11	8.8652E-02	8.8652E-02	3.2179E+13
5.2937E+00								
88	107	99221	94958	516985	8.0515E+11	8.8825E-02	8.8825E-02	3.2712E+13
5.3005E+00								
89	108	99012	94899	517987	8.0372E+11	8.8607E-02	8.8607E-02	3.2574E+13
5.2944E+00								
90	109	96773	92742	507935	7.9013E+11	8.8774E-02	8.8774E-02	3.2495E+13
5.2964E+00								
91	111	92807	88901	482932	7.4851E+11	8.9454E-02	8.9454E-02	3.2421E+13
5.3127E+00								
92	112	87399	83705	458265	7.1910E+11	8.9202E-02	8.9202E-02	3.2860E+13
5.3027E+00								
93	113	80304	76938	419907	6.3667E+11	9.0191E-02	9.0191E-02	3.1674E+13
5.3192E+00								
94	114	68281	65640	361768	5.4542E+11	9.1620E-02	9.1620E-02	3.1564E+13
5.3489E+00								
95	115	68466	66614	365795	5.6105E+11	9.1107E-02	9.1107E-02	3.1979E+13
5.3469E+00								
96	116	77083	73698	405149	6.3899E+11	9.0397E-02	9.0397E-02	3.2966E+13
5.3281E+00								
97	117	84707	81151	442052	6.9594E+11	8.9600E-02	8.9600E-02	3.2889E+13
5.3089E+00								
98	118	90389	86496	471845	7.3557E+11	8.9604E-02	8.9604E-02	3.2643E+13
5.3100E+00								
99	119	93238	89322	487370	7.5814E+11	8.9436E-02	8.9436E-02	3.2478E+13
5.3102E+00								
100	121	95129	91105	497957	7.6701E+11	8.8656E-02	8.8656E-02	3.2040E+13
5.2921E+00								
101	122	95831	91786	499372	7.8771E+11	8.8656E-02	8.8656E-02	3.3043E+13
5.2962E+00								
102	123	95393	91423	499325	7.8226E+11	8.8998E-02	8.8998E-02	3.2696E+13
5.3021E+00								
103	124	93765	89815	487210	7.6221E+11	8.9253E-02	8.9253E-02	3.2846E+13
5.3079E+00								
104	125	91000	87175	475449	7.4084E+11	8.9126E-02	8.9126E-02	3.2529E+13
5.3019E+00								
105	126	86675	82991	453210	7.0246E+11	9.0143E-02	9.0143E-02	3.2522E+13
5.3230E+00								
106	127	81256	77787	427960	6.6301E+11	9.0732E-02	9.0732E-02	3.2387E+13
5.3317E+00								
107	128	71810	68711	377380	5.7592E+11	9.0175E-02	9.0175E-02	3.1891E+13
5.3159E+00								
108	129	58952	57003	315007	4.8655E+11	9.2483E-02	9.2483E-02	3.2309E+13
5.3736E+00								
109	131	66299	63851	352107	5.4823E+11	9.0730E-02	9.0730E-02	3.2404E+13
5.3293E+00								
110	132	75369	72086	395786	6.0630E+11	9.1011E-02	9.1011E-02	3.2215E+13
5.3330E+00								
111	133	80671	77281	424263	6.5745E+11	8.9713E-02	8.9713E-02	3.2471E+13
5.3146E+00								
112	134	84843	81213	443737	6.9463E+11	9.0064E-02	9.0064E-02	3.2780E+13
5.3235E+00								
113	135	87084	83440	455232	7.1063E+11	8.9922E-02	8.9922E-02	3.2741E+13
5.3143E+00								
114	136	87920	84242	460452	7.1145E+11	8.9700E-02	8.9700E-02	3.2253E+13
5.3126E+00								
115	137	88584	84850	463126	7.2026E+11	8.9334E-02	8.9334E-02	3.2583E+13
5.3066E+00								
116	138	87403	83722	458128	7.1817E+11	8.9292E-02	8.9292E-02	3.2709E+13
5.3073E+00								
117	139	84978	81442	446126	6.9931E+11	9.0186E-02	9.0186E-02	3.2904E+13
5.3240E+00								
118	141	82209	78657	429195	6.6173E+11	8.9908E-02	8.9908E-02	3.2304E+13
5.3194E+00								
119	142	76673	73444	403562	6.2300E+11	9.0192E-02	9.0192E-02	3.2445E+13
5.3197E+00								
120	143	70225	67339	368831	5.6012E+11	9.0858E-02	9.0858E-02	3.1789E+13
5.3270E+00								
121	144	59590	57282	315128	5.0001E+11	9.1858E-02	9.1858E-02	3.3339E+13
5.3558E+00								

122	145	53444	52271	290441	4.5102E+11	9.2764E-02	9.2764E-02	3.2316E+13
5.3740E+00								
123	146	59284	57359	314519	4.8965E+11	9.2260E-02	9.2260E-02	3.2523E+13
5.3637E+00								
124	147	65117	62890	346395	5.3515E+11	9.2120E-02	9.2120E-02	3.2429E+13
5.3644E+00								
125	148	69194	66865	366247	5.7144E+11	9.0682E-02	9.0682E-02	3.2591E+13
5.3388E+00								
126	149	71915	69470	379669	5.9476E+11	9.0393E-02	9.0393E-02	3.2727E+13
5.3342E+00								
127	151	72707	70339	386725	6.1462E+11	9.0132E-02	9.0132E-02	3.3091E+13
5.3309E+00								
128	152	73350	70893	387865	6.0765E+11	9.0336E-02	9.0336E-02	3.2812E+13
5.3342E+00								
129	153	73259	70933	388620	6.1310E+11	9.0172E-02	9.0172E-02	3.3208E+13
5.3294E+00								
130	154	72028	69677	382122	5.9415E+11	9.0011E-02	9.0011E-02	3.2448E+13
5.3243E+00								
131	155	69766	67412	369447	5.8533E+11	9.0755E-02	9.0755E-02	3.3197E+13
5.3385E+00								
132	156	66250	64048	352451	5.4722E+11	9.2096E-02	9.2096E-02	3.2567E+13
5.3672E+00								
133	157	61678	59604	330298	5.0095E+11	9.1638E-02	9.1638E-02	3.1752E+13
5.3571E+00								
134	158	54673	52861	291334	4.5994E+11	9.2993E-02	9.2993E-02	3.3092E+13
5.3752E+00								
135	159	45456	44152	244574	3.8043E+11	9.4385E-02	9.4385E-02	3.2497E+13
5.4029E+00								
136	1200	485746	452097	6237	9.5009E+09	4.0293E-01	4.0293E-01	3.1585E+13
7.8336E+03								
137	1201	5396032	5297668	23142049	3.3789E+13	3.5908E-01	3.5908E-01	2.9952E+13
3.6531E+00								
138	1202	3098377	3018566	15300302	2.2638E+12	3.6731E-01	3.6731E-01	2.7850E+13
3.7584E+00								
139	12021	17686267	17476446	77293431	3.8125E+13	3.9408E-01	3.9408E-01	3.0361E+13
3.7992E+00								
140	1203	16211523	16108358	71246039	3.4549E+13	3.6445E-01	3.6445E-01	2.9774E+13
3.6815E+00								
141	1204	4320330	4209831	21169224	3.1758E+12	3.5422E-01	3.5422E-01	2.8265E+13
3.6963E+00								
142	12041	29172805	28869803	126200984	6.2475E+13	3.9258E-01	3.9258E-01	3.0447E+13
3.7869E+00								
143	1205	27986955	27799184	120731992	5.8948E+13	3.6634E-01	3.6634E-01	3.0037E+13
3.6868E+00								
144	1206	155958	152071	740180	1.0648E+11	3.1832E-01	3.1832E-01	2.6790E+13
3.5330E+00								
145	12061	1054645	1043185	4496332	2.1148E+12	2.5905E-01	2.5905E-01	2.9002E+13
3.1807E+00								
146	1207	1190796	1182962	4820726	2.3497E+12	1.7576E-01	1.7576E-01	3.0290E+13
2.7919E+00								
147	1208	4906448	4785018	22738454	3.4579E+12	3.5872E-01	3.5872E-01	2.8607E+13
3.7085E+00								
148	12081	28598420	28280897	122807298	6.0977E+13	3.9117E-01	3.9117E-01	3.0527E+13
3.7803E+00								
149	1209	27881328	27698645	119865254	5.8897E+13	3.6477E-01	3.6477E-01	3.0166E+13
3.6791E+00								
150	1210	852872	833781	2961597	4.5307E+12	1.2864E-01	1.2864E-01	3.1787E+13
2.3958E+00								
151	1211	186414615	183724941	856085236	4.5399E+14	4.1017E-01	4.1017E-01	3.2696E+13
3.9979E+00								
152	12111	50851234	49548802	256082111	4.3176E+13	3.9565E-01	3.9565E-01	3.1879E+13
4.0021E+00								
154	9998	8809654	6458943	848547	1.3527E+12	1.2141E-01	1.2141E-01	3.3025E+13
5.4304E+03								
155	9997	9790965	7022046	892507	1.4249E+12	1.1863E-01	1.1863E-01	3.3156E+13
5.3881E+03								
156	9996	6725473	4814869	597549	9.4162E+11	1.2230E-01	1.2230E-01	3.2827E+13
5.4416E+03								
157	9995	131878039	120922322	5920778	9.6902E+12	4.1762E-01	4.1762E-01	3.3187E+13
7.9297E+03								
158	9994	126670063	107654895	8980767	1.4894E+13	4.0384E-01	4.0384E-01	3.3710E+13
7.8432E+03								
159	9993	355507	294715	16574	2.4429E+10	1.3406E-01	1.3406E-01	3.1113E+13
5.6640E+03								
160	9992	794701	698759	80818	1.2220E+11	1.4689E-01	1.4689E-01	3.1400E+13
5.8107E+03								
161	9991	724856	673988	3489	5.3197E+09	1.5783E-01	1.5783E-01	3.1608E+13
5.9292E+03								
162	9990	1257637	1160608	68419	1.0483E+11	1.9185E-01	1.9185E-01	3.1371E+13
6.2105E+03								

163	9989	7249163	5983061	382819	5.8411E+11	3.5262E-01	3.5262E-01	3.1032E+13
7.4848E+03								
164	9988	20876540	20184214	3340156	1.8445E+11	4.5082E-01	4.5082E-01	3.1234E+13
8.5029E+03								
166	9986	255615	255614	1396	2.1048E+09	1.6805E-01	1.6805E-01	3.0644E+13
5.9025E+03								
167	10000	29143	27867	127	1.4139E+08	4.0074E-01	4.0074E-01	3.0920E+13
7.9446E+03								
168	10001	43877	42195	185	2.2757E+08	4.0898E-01	4.0898E-01	3.2427E+13
7.9434E+03								
169	10002	118264	114833	731	1.2583E+09	4.0176E-01	4.0176E-01	3.0985E+13
7.8574E+03								
170	10003	44006	42227	217	3.2648E+08	3.8336E-01	3.8336E-01	3.2205E+13
7.7476E+03								
171	10004	30651	29354	150	1.8747E+08	4.0553E-01	4.0553E-01	3.3853E+13
7.8826E+03								
172	10005	1345	1295	9	1.0042E+07	3.9257E-01	3.9257E-01	2.5126E+13
7.8725E+03								
173	2001	40178358	37301018	8262178	2.2787E+11	4.3196E-01	4.3196E-01	3.1215E+13
8.3034E+03								
174	2002	40907258	37454399	22422859	6.1874E+11	3.8192E-01	3.8192E-01	3.1264E+13
7.8284E+03								
175	2003	79913919	68161038	50270165	6.9374E+11	3.2953E-01	3.2953E-01	3.1284E+13
7.3199E+03								
176	2004	77317270	65779542	90135596	1.2434E+12	2.8477E-01	2.8477E-01	3.1284E+13
6.8680E+03								
177	2005	138651439	111480499	179106435	1.2345E+12	2.4968E-01	2.4968E-01	3.1274E+13
6.5002E+03								
178	2006	119055092	96321495	163865135	1.1278E+12	2.2829E-01	2.2829E-01	3.1236E+13
6.2685E+03								
179	2007	197371477	152382862	283201469	9.7293E+11	2.1450E-01	2.1450E-01	3.1206E+13
6.1155E+03								
180	2008	155949292	125173023	334892090	1.1496E+12	2.0386E-01	2.0386E-01	3.1175E+13
5.9956E+03								
181	2009	216546085	166886756	476054876	8.1583E+11	1.9606E-01	1.9606E-01	3.1133E+13
5.9069E+03								
182	2010	142298814	113446605	407046258	6.9651E+11	1.9124E-01	1.9124E-01	3.1093E+13
5.8520E+03								
183	2011	161975939	126967621	468084939	3.9982E+11	1.8856E-01	1.8856E-01	3.1038E+13
5.8217E+03								
184	2012	90000812	71238656	261763420	2.2314E+11	1.8754E-01	1.8754E-01	3.0983E+13
5.8105E+03								
185	2013	98501060	77890856	287662754	1.2230E+11	1.8751E-01	1.8751E-01	3.0909E+13
5.8110E+03								
186	2014	53102091	46126705	155581027	6.5913E+10	1.8847E-01	1.8847E-01	3.0838E+13
5.8254E+03								
187	2015	6777	6777	38077	5.5786E+10	1.9322E-01	1.9322E-01	3.0590E+13
5.8812E+03								
188	200	2260197	2023858	4478132	7.1336E+12	4.9207E-01	4.9207E-01	3.1994E+13
1.2897E+00								
189	201	2477716	2211541	4922290	7.8122E+12	4.9302E-01	4.9302E-01	3.1924E+13
1.2890E+00								
190	202	2738440	2438725	5461110	8.6630E+12	5.0257E-01	5.0257E-01	3.2033E+13
1.3046E+00								
191	203	2932989	2607798	5857291	9.3688E+12	5.0381E-01	5.0381E-01	3.2373E+13
1.3081E+00								
192	204	3055050	2713111	6107709	9.7349E+12	5.0304E-01	5.0304E-01	3.1988E+13
1.3070E+00								
193	205	3085716	2739832	6164800	9.9434E+12	5.0685E-01	5.0685E-01	3.2629E+13
1.3145E+00								
194	206	3009797	2672404	6028525	9.6513E+12	5.0284E-01	5.0284E-01	3.2331E+13
1.3073E+00								
195	207	2836942	2520639	5659911	9.0107E+12	5.0279E-01	5.0279E-01	3.1870E+13
1.3058E+00								
196	208	2588420	2303232	5158858	8.1563E+12	4.9862E-01	4.9862E-01	3.1845E+13
1.3003E+00								
197	209	2307879	2053466	4569276	7.2000E+12	5.0545E-01	5.0545E-01	3.1836E+13
1.3135E+00								
198	210	1932357	1723128	3807293	5.9328E+12	5.1912E-01	5.1912E-01	3.1561E+13
1.3369E+00								
199	211	1260266	1138089	2440761	3.6178E+12	5.1232E-01	5.1232E-01	2.9447E+13
1.3263E+00								
200	212	618640	566393	1157891	1.6406E+12	4.9844E-01	4.9844E-01	2.8312E+13
1.3054E+00								
201	213	7981011	7952600	14696192	7.4979E+11	4.7781E-01	4.7781E-01	2.6983E+13
1.2697E+00								
202	214	144210	133605	262369	3.6978E+11	4.6172E-01	4.6172E-01	2.7902E+13
1.2359E+00								
203	222	624686	622310	1788531	9.5834E+10	2.8891E-01	2.8891E-01	2.9421E+13
9.7690E-01								

```
     total    2384521833   2020437415   5191353148    1.0906E+15

1tally   2        nps =     3471888
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     21054865.00

           this tally is modified by a dose function.

           areas
                surface:     1231
                         1.78374E+06

 surface  1231
                1.54329E-01 0.0063


========================================================================================================================
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           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally   2

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps            constant
random      >3.00
 observed     random        0.01      yes          yes            0.00      yes         yes             constant
random       4.26
 passed?        yes          yes      yes          yes              yes      yes         yes                yes
yes          yes

========================================================================================================================
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 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart
to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.

 ----- estimated confidence intervals:  -----

 estimated asymmetric confidence interval(1,2,3 sigma): 1.5338E-01 to 1.5531E-01; 1.5241E-01 to 1.5628E-01;
1.5145E-01 to 1.5725E-01
 estimated  symmetric confidence interval(1,2,3 sigma): 1.5336E-01 to 1.5530E-01; 1.5240E-01 to 1.5626E-01;
1.5143E-01 to 1.5723E-01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally   2 with nps =     3471888  print
table 160


 normed average tally per history  = 1.54329E-01          unnormed average tally per history  = 2.75283E+05
 estimated tally relative error    = 0.0063               estimated variance of the variance  = 0.0029
 relative error from zero tallies  = 0.0023               relative error from nonzero scores  = 0.0058

 number of nonzero history tallies =      185942          efficiency for the nonzero tallies  = 0.0088
 history number of largest  tally  =     1104723          largest  unnormalized history tally = 5.32503E+09
 (largest  tally)/(average tally)  = 1.93439E+04          (largest  tally)/(avg nonzero tally)= 1.70832E+02

 (confidence interval shift)/mean  = 0.0001               shifted confidence interval center  = 1.54347E-01


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities          value at nps          value at nps+1          value(nps+1)/value(nps)-1.

      mean                          1.54329E-01           1.55189E-01                  0.005571
      relative error                6.26125E-03           6.30343E-03                  0.006737
      variance of the variance      2.91363E-03           3.26923E-03                  0.122049
      shifted center                1.54347E-01           1.54447E-01                  0.000646
      figure of merit               2.11037E+01           2.08222E+01                 -0.013338

 the estimated inverse power slope of the 200 largest  tallies starting at 1.05500E+09 is 4.2602
```

```
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*( 3.481E-02)**2 = (1.742E+04)*(1.212E-
03) = 2.110E+01

1tally  12        nps =     3471888
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     21054865.00

           this tally is modified by a dose function.

           areas
                surface:     1227
               segment
                 1       1.00000E+50
                 2       2.56400E+07
                 3       1.03700E+08
                 4       1.60200E+08
                 5       3.92700E+08
                 6       5.49800E+08
                 7       7.06900E+08
                 8       8.63900E+08
                 9       1.59000E+09
                10       1.94400E+09
                11       3.14200E+09
                12       3.77000E+09
                13       4.39800E+09
                14       5.02700E+09
                15       5.65500E+09
                16       1.68900E+10

 surface  1227
 segment:       -2000
                1.62696E-46 0.0073

 surface  1227
 segment:        2000    -2001
                1.07879E-03 0.0066

 surface  1227
 segment:        2000     2001    -2002
                7.04819E-04 0.0052

 surface  1227
 segment:        2000     2001     2002    -2003
                3.59720E-04 0.0064

 surface  1227
 segment:        2000     2001     2002     2003    -2004
                1.70746E-04 0.0068

 surface  1227
 segment:        2000     2001     2002     2003     2004    -2005
                7.93705E-05 0.0061

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005    -2006
                3.65581E-05 0.0058

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006    -2007
                1.79787E-05 0.0054

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007    -2008
                8.12092E-06 0.0057

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008    -2009
                3.24277E-06 0.0061

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009    -2010
                1.20156E-06 0.0064

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
     -2011
```

```
                4.01105E-07 0.0076

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011    -2012
                1.40319E-07 0.0093

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012    -2013
                5.12743E-08 0.0114

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012     2013    -2014
                1.84857E-08 0.0153

 surface  1227
 segment:        2000     2001     2002     2003     2004     2005     2006     2007     2008     2009     2010
      2011     2012     2013     2014
                3.46127E-09 0.1967


================================================================================================================================
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           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  12

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10       yes       1/sqrt(nps)       <0.10       yes         1/nps           constant
random       >3.00
 observed     random        0.20       yes           yes            0.08       yes          yes            constant
random       0.00
 passed?        yes           no       yes           yes             yes       yes          yes               yes
yes          no


================================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  2 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  12 with nps =     3471888  print
table 160


 normed average tally per history  = 3.46127E-09          unnormed average tally per history  = 5.84609E+01
 estimated tally relative error    = 0.1967               estimated variance of the variance  = 0.0760
 relative error from zero tallies  = 0.1491               relative error from nonzero scores  = 0.1283

 number of nonzero history tallies =          45          efficiency for the nonzero tallies  = 0.0000
 history number of largest  tally  =       36466          largest  unnormalized history tally = 9.43903E+07
 (largest  tally)/(average tally)  = 1.61459E+06          (largest  tally)/(avg nonzero tally)= 3.45082E+00

 (confidence interval shift)/mean  = 0.0255               shifted confidence interval center  = 3.54939E-09


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities          value at nps          value at nps+1          value(nps+1)/value(nps)-1.

      mean                          3.46127E-09            5.07092E-09                  0.465046
      relative error                1.96671E-01            1.96057E-01                 -0.003121
      variance of the variance      7.59717E-02            7.46583E-02                 -0.017289
      shifted center                3.54939E-09            4.03134E-09                  0.135784
      figure of merit               2.13894E-02            2.15236E-02                  0.006271

 there is not enough information in the largest  history scores (usually less than 500 scores) for a reliable
estimate of the slope.
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.
```

```
 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*( 1.108E-03)**2 = (1.742E+04)*(1.228E-
06) = 2.139E-02

1unnormed tally density for tally  12            nonzero tally mean(m) = 2.735E+07   nps =     3471888  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 0.0)
  tally  number num den log den:d-----------------------------------------------------------d--------------------
--------------------
 7.94+06      7 2.04-13 -12.691
**********************************************************|**************************************
 1.00+07      7 1.62-13 -12.791
**********************************************************|**********************************
 1.26+07      4 7.34-14 -13.134 ************************************************************|*************
 1.58+07      4 5.83-14 -13.234 ************************************************************|*******
 2.00+07      1 1.16-14 -13.937 ************************                                     |
 2.51+07      5 4.60-14 -13.338 *************************************************************|*
 3.16+07      3 2.19-14 -13.659 mmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmmm                  |
 3.98+07      3 1.74-14 -13.759 ***********************************                          |
 5.01+07      3 1.38-14 -13.859 ******************************                               |
 6.31+07      2 7.32-15 -14.135 *************                                                |
 7.94+07      4 1.16-14 -13.934 ************************                                     |
 1.00+08      2 4.62-15 -14.335 *                                                          |
  total      45 2.14-06         d-----------------------------------------------------------d--------------------
--------------------

1tally  22        nps =     3471888
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     21054865.00

           this tally is modified by a dose function.

           areas
                surface:     1227
               segment
                  1       1.00000E+50
                  2       1.00000E+50
                  3       1.00000E+50
                  4       4.35376E+05
                  5       4.35376E+05
                  6       4.35376E+05
                  7       4.35376E+05
                  8       4.35376E+05
                  9       4.35376E+05
                 10       4.35376E+05
                 11       4.35376E+05
                 12       4.35376E+05
                 13       4.35376E+05
                 14       4.35376E+05
                 15       4.35376E+05
                 16       4.35376E+05
                 17       4.35376E+05
                 18       4.35376E+05
                 19       4.35376E+05
                 20       4.35376E+05
                 21       4.35376E+05
                 22       1.00000E+50

 surface  1227
 segment:        1201
                 1.70441E-45 0.0035

 surface  1227
 segment:       -1201    -2026
                 8.39982E-46 0.0067

 surface  1227
 segment:       -1201     2026     2027
                 7.15974E-46 0.0083

 surface  1227
 segment:       -1201     2026    -2027     2016
                 7.48350E-04 0.0419

 surface  1227
 segment:       -1201     2026    -2027    -2016     2017
                 1.13910E-03 0.0300
```

```
surface  1227
segment:       -1201     2026    -2027    -2016    -2017     2018
                1.44639E-03 0.0330

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018     2019
                1.50886E-03 0.0286

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019     2020
                1.62669E-03 0.0238

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020     2021
                1.75284E-03 0.0216

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021     2022
                1.83295E-03 0.0239

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022     2023
                1.99544E-03 0.0378

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
     2024
                1.96752E-03 0.0312

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024     2025
                1.89957E-03 0.0329

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025     2028
                1.92035E-03 0.0421

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028     2029
                1.83072E-03 0.0508

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029     2030
                1.75506E-03 0.0334

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030     2031
                1.58519E-03 0.0305

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031     2032
                1.66784E-03 0.0580

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032     2033
                1.47593E-03 0.0319

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033     2034
                1.58996E-03 0.0484

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034     2035
                1.28614E-03 0.0319

surface  1227
segment:       -1201     2026    -2027    -2016    -2017    -2018    -2019    -2020    -2021    -2022    -2023
    -2024    -2025    -2028    -2029    -2030    -2031    -2032    -2033    -2034    -2035
                1.35776E-46 0.0171
```

```
================================================================================================================================
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          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  22

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--     -pdf-
 behavior    behavior      value    decrease   decrease rate      value    decrease   decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.02      yes          yes            0.08      yes         yes            constant
random       2.22
 passed?        yes          yes      yes          yes             yes      yes         yes               yes
yes          no


================================================================================================================================
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 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  22 with nps =     3471888  print
table 160


 normed average tally per history  = 1.35776E-46          unnormed average tally per history  = 1.35776E+04
 estimated tally relative error    = 0.0171               estimated variance of the variance  = 0.0843
 relative error from zero tallies  = 0.0016               relative error from nonzero scores  = 0.0171

 number of nonzero history tallies =      402174          efficiency for the nonzero tallies  = 0.0191
 history number of largest  tally  =      962952          largest  unnormalized history tally = 1.97606E+09
 (largest  tally)/(average tally)  = 1.45538E+05          (largest  tally)/(avg nonzero tally)= 2.77995E+03

 (confidence interval shift)/mean  = 0.0021               shifted confidence interval center  = 1.36064E-46


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1           value(nps+1)/value(nps)-1.

      mean                            1.35776E-46            1.41468E-46                    0.041919
      relative error                  1.71351E-02            1.83434E-02                    0.070515
      variance of the variance        8.42946E-02            8.20421E-02                   -0.026722
      shifted center                  1.36064E-46            1.37675E-46                    0.011845
      figure of merit                 2.81779E+00            2.45880E+00                   -0.127401

 the estimated inverse power slope of the 200 largest  tallies starting at 6.17067E+07 is 2.2187
 the history score probability density function appears to have an unsampled region at the largest  history
scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*( 1.272E-02)**2 = (1.742E+04)*(1.618E-
04) = 2.818E+00

1unnormed tally density for tally  22            nonzero tally mean(m) = 7.108E+05   nps =     3471888  print
table 161

 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.2)
  tally  number num den log den:d---------d----------d----------d----------d----------d----------d----------d---
-------d----------d-
 2.51+03    180 9.22-09  -8.035
**********|**********|**********|**********|**********|**********|**********|**********|**        |
 3.98+03    404 1.31-08  -7.884
**********|**********|**********|**********|**********|**********|**********|**********|****      |
 6.31+03   1283 2.62-08  -7.582
**********|**********|**********|**********|**********|**********|**********|**********|*******   |
 1.00+04   4231 5.45-08  -7.264
**********|**********|**********|**********|**********|**********|**********|**********|**********|
 1.58+04   6707 5.45-08  -7.264
**********|**********|**********|**********|**********|**********|**********|**********|**********|
 2.51+04  13731 7.04-08  -7.153
**********|**********|**********|**********|**********|**********|**********|**********|**********|*
```

```
 3.98+04  23281 7.53-08  -7.123
**********|**********|**********|**********|**********|**********|**********|**********|**********|*
 6.31+04  30887 6.30-08  -7.201
**********|**********|**********|**********|**********|**********|**********|**********|**********|
 1.00+05  55603 7.16-08  -7.145
**********|**********|**********|**********|**********|**********|**********|**********|**********|*
 1.58+05  60339 4.90-08  -7.310
**********|**********|**********|**********|**********|**********|**********|**********|**********|
 2.51+05  62150 3.18-08  -7.497
**********|**********|**********|**********|**********|**********|**********|**********|********  |
 3.98+05  52244 1.69-08  -7.772
**********|**********|**********|**********|**********|**********|**********|**********|*****     |
 6.31+05  35503 7.24-09  -8.140
**********|**********|**********|**********|**********|**********|**********|**********|*         |
 1.00+06  20588 2.65-09  -8.577
mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmmmm|mmmmmmmm    |          |
 1.58+06  11484 9.33-10  -9.030 **********|**********|**********|**********|**********|**********|**********|**
|          |
 2.51+06   6857 3.51-10  -9.454 **********|**********|**********|**********|**********|**********|********  |
|          |
 3.98+06   4783 1.55-10  -9.811 **********|**********|**********|**********|**********|**********|****      |
|          |
 6.31+06   3691 7.53-11 -10.123 **********|**********|**********|**********|**********|**********|*         |
|          |
 1.00+07   3453 4.44-11 -10.352 **********|**********|**********|**********|**********|********* |          |
|          |
 1.58+07   2612 2.12-11 -10.673 **********|**********|**********|**********|**********|******    |          |
|          |
 2.51+07   1274 6.53-12 -11.185 **********|**********|**********|**********|**********|          |          |
|          |
 3.98+07    472 1.53-12 -11.816 **********|**********|**********|**********|****      |          |          |
|          |
 6.31+07    227 4.63-13 -12.334 **********|**********|**********|********* |       s  |          |          |
|          |
 1.00+08     97 1.25-13 -12.904 **********|**********|**********|***       |    s     |          |          |
|          |
 1.58+08     31 2.52-14 -13.599 **********|**********|******    |          | s        |          |          |
|          |
 2.51+08     30 1.54-14 -13.813 **********|**********|****      |        s |          |          |          |
|          |
 3.98+08     20 6.47-15 -14.189 **********|**********|          |    s     |          |          |          |
|          |
 6.31+08      6 1.22-15 -14.912 **********|***       |          |s         |          |          |          |
|          |
 1.00+09      1 1.29-16 -15.890 ***       |          |      s   |          |          |          |          |
|          |
 1.58+09      1 8.12-17 -16.090 *         |          |  s       |          |          |          |          |
|          |
 2.00+09      4 4.63-16 -15.334 ********* |         s|          |          |          |          |          |
|          |
  total  402174 1.91-02         d---------d----------d----------d----------d----------d----------d----------d---
-------d----------d-

1tally  32        nps =     3471888
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     21054865.00

           this tally is modified by a dose function.

           areas
                surface:     1201
               segment
                 1       1.00000E+50
                 2       1.00000E+50
                 3       1.00000E+50
                 4       1.00000E+50
                 5       6.30000E+05

 surface  1201
 segment:        1231
                 2.45657E-45 0.0218

 surface  1201
 segment:       -1231    -2026
                 6.77660E-49 0.0613

 surface  1201
 segment:       -1231     2026     2027
                 2.50543E-48 0.0790
```

```
 surface  1201
 segment:       -1231     2026    -2027    -1227
                 0.00000E+00 0.0000

 surface  1201
 segment:       -1231     2026    -2027     1227
                 6.43805E-04 0.0345
```

==========

results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin of tally 32

tfc bin behavior	--mean-- behavior	---------relative error--------- value	decrease	decrease rate	----variance of the variance---- value	decrease	decrease rate	--figure of merit-- -pdf- value	behavior	slope
desired	random	<0.10	yes	1/sqrt(nps)	<0.10	yes	1/nps	constant	random	>3.00
observed	random	0.03	yes	yes	0.03	yes	yes	constant	random	3.21
passed?	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes

==========

this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart to verify.
the results in other bins associated with this tally may not meet these statistical criteria.

----- estimated confidence intervals: -----

estimated asymmetric confidence interval(1,2,3 sigma): 6.2305E-04 to 6.6753E-04; 6.0082E-04 to 6.8977E-04; 5.7858E-04 to 7.1200E-04
estimated symmetric confidence interval(1,2,3 sigma): 6.2162E-04 to 6.6599E-04; 5.9943E-04 to 6.8818E-04; 5.7725E-04 to 7.1036E-04

1analysis of the results in the tally fluctuation chart bin (tfc) for tally 32 with nps = 3471888 print table 160

normed average tally per history	= 6.43805E-04	unnormed average tally per history	= 4.05597E+02
estimated tally relative error	= 0.0345	estimated variance of the variance	= 0.0286
relative error from zero tallies	= 0.0121	relative error from nonzero scores	= 0.0323
number of nonzero history tallies	= 6785	efficiency for the nonzero tallies	= 0.0003
history number of largest tally	= 831702	largest unnormalized history tally	= 9.21577E+07
(largest tally)/(average tally)	= 2.27215E+05	(largest tally)/(avg nonzero tally)	= 7.32207E+01
(confidence interval shift)/mean	= 0.0023	shifted confidence interval center	= 6.45292E-04

if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	6.43805E-04	6.85938E-04	0.065444
relative error	3.44612E-02	3.57225E-02	0.036600
variance of the variance	2.86443E-02	3.17399E-02	0.108068
shifted center	6.45292E-04	6.53899E-04	0.013338
figure of merit	6.96658E-01	6.48333E-01	-0.069368

the estimated inverse power slope of the 200 largest tallies starting at 7.01684E+06 is 3.2135
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*(6.324E-03)**2 = (1.742E+04)*(3.999E-05) = 6.967E-01

1tally 42 nps = 3471888

```
          tally type 2    particle flux averaged over a surface.
          tally for  photons
 number of histories used for normalizing tallies =     21054865.00

          this tally is modified by a dose function.

          areas
               surface:     2003         2004         2005         2006         2007         2008         2009
              segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
               surface:     2010         2011         2012         2013
              segment
                1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:        1219
                 1.06318E-44 0.0040

 surface  2003
 segment:       -1219    -1209
                 1.30384E-47 0.0223

 surface  2003
 segment:       -1219     1209     1201
                 1.02687E-46 0.0049

 surface  2003
 segment:       -1219     1209    -1201    -1205
                 5.21262E-47 0.0088

 surface  2003
 segment:       -1219     1209    -1201     1205     1206
                 4.24620E-47 0.0094

 surface  2003
 segment:       -1219     1209    -1201     1205    -1206
                 4.41942E-04 0.0160

 surface  2004
 segment:        1219
                 9.36368E-45 0.0040

 surface  2004
 segment:       -1219    -1209
                 8.02083E-48 0.0119

 surface  2004
 segment:       -1219     1209     1201
                 6.17446E-47 0.0056

 surface  2004
 segment:       -1219     1209    -1201    -1205
                 3.32255E-47 0.0079

 surface  2004
 segment:       -1219     1209    -1201     1205     1206
                 2.74207E-47 0.0085

 surface  2004
 segment:       -1219     1209    -1201     1205    -1206
                 1.72028E-04 0.0211

 surface  2005
 segment:        1219
```

```
               7.95821E-45 0.0041

surface  2005
segment:       -1219    -1209
               4.78468E-48 0.0099

surface  2005
segment:       -1219     1209     1201
               3.75671E-47 0.0052

surface  2005
segment:       -1219     1209    -1201    -1205
               2.08055E-47 0.0079

surface  2005
segment:       -1219     1209    -1201     1205     1206
               1.75481E-47 0.0091

surface  2005
segment:       -1219     1209    -1201     1205    -1206
               7.59261E-05 0.0218

surface  2006
segment:       1219
               6.56184E-45 0.0042

surface  2006
segment:       -1219    -1209
               2.95330E-48 0.0118

surface  2006
segment:       -1219     1209     1201
               2.30787E-47 0.0055

surface  2006
segment:       -1219     1209    -1201    -1205
               1.30485E-47 0.0081

surface  2006
segment:       -1219     1209    -1201     1205     1206
               1.09506E-47 0.0097

surface  2006
segment:       -1219     1209    -1201     1205    -1206
               3.71508E-05 0.0187

surface  2007
segment:       1219
               5.28183E-45 0.0043

surface  2007
segment:       -1219    -1209
               1.87321E-48 0.0128

surface  2007
segment:       -1219     1209     1201
               1.41381E-47 0.0057

surface  2007
segment:       -1219     1209    -1201    -1205
               8.15175E-48 0.0089

surface  2007
segment:       -1219     1209    -1201     1205     1206
               6.91528E-48 0.0101

surface  2007
segment:       -1219     1209    -1201     1205    -1206
               1.89925E-05 0.0225

surface  2008
segment:       1219
               3.68143E-45 0.0044

surface  2008
segment:       -1219    -1209
               9.27239E-49 0.0179

surface  2008
segment:       -1219     1209     1201
```

```
                6.90690E-48 0.0065

surface  2008
segment:       -1219     1209    -1201    -1205
                4.09048E-48 0.0100

surface  2008
segment:       -1219     1209    -1201     1205     1206
                3.47724E-48 0.0119

surface  2008
segment:       -1219     1209    -1201     1205    -1206
                7.47195E-06 0.0334

surface  2009
segment:        1219
                2.48899E-45 0.0046

surface  2009
segment:       -1219    -1209
                4.58855E-49 0.0198

surface  2009
segment:       -1219     1209     1201
                3.36258E-48 0.0075

surface  2009
segment:       -1219     1209    -1201    -1205
                2.04726E-48 0.0110

surface  2009
segment:       -1219     1209    -1201     1205     1206
                1.75327E-48 0.0118

surface  2009
segment:       -1219     1209    -1201     1205    -1206
                3.06551E-06 0.0328

surface  2010
segment:        1219
                1.43074E-45 0.0049

surface  2010
segment:       -1219    -1209
                1.80967E-49 0.0302

surface  2010
segment:       -1219     1209     1201
                1.30976E-48 0.0088

surface  2010
segment:       -1219     1209    -1201    -1205
                8.47877E-49 0.0153

surface  2010
segment:       -1219     1209    -1201     1205     1206
                7.03576E-49 0.0184

surface  2010
segment:       -1219     1209    -1201     1205    -1206
                1.08522E-06 0.0648

surface  2011
segment:        1219
                8.02150E-46 0.0052

surface  2011
segment:       -1219    -1209
                7.62332E-50 0.0298

surface  2011
segment:       -1219     1209     1201
                5.25997E-49 0.0126

surface  2011
segment:       -1219     1209    -1201    -1205
                3.42031E-49 0.0161

surface  2011
segment:       -1219     1209    -1201     1205     1206
```

```
                2.85542E-49 0.0258

 surface  2011
 segment:       -1219     1209    -1201     1205    -1206
                3.73926E-07 0.0590

 surface  2012
 segment:        1219
                4.42367E-46 0.0055

 surface  2012
 segment:       -1219    -1209
                3.31868E-50 0.0457

 surface  2012
 segment:       -1219     1209     1201
                2.08297E-49 0.0143

 surface  2012
 segment:       -1219     1209    -1201    -1205
                1.42011E-49 0.0187

 surface  2012
 segment:       -1219     1209    -1201     1205     1206
                1.17423E-49 0.0229

 surface  2012
 segment:       -1219     1209    -1201     1205    -1206
                1.37374E-07 0.0930

 surface  2013
 segment:        1219
                2.41340E-46 0.0061

 surface  2013
 segment:       -1219    -1209
                1.13793E-50 0.0363

 surface  2013
 segment:       -1219     1209     1201
                8.84605E-50 0.0254

 surface  2013
 segment:       -1219     1209    -1201    -1205
                5.83531E-50 0.0215

 surface  2013
 segment:       -1219     1209    -1201     1205     1206
                4.81825E-50 0.0282

 surface  2013
 segment:       -1219     1209    -1201     1205    -1206
                6.60848E-08 0.1778


================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  42

 tfc bin      --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--      -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)       <0.10      yes        1/nps           constant
random      >3.00
 observed     random        0.02       no           no            0.15       no          no             decrease
random       2.95
 passed?        yes          yes       no           no              no       no          no                 no
yes          no


================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  7 of the 10 statistical checks.
```

1analysis of the results in the tally fluctuation chart bin (tfc) for tally 42 with nps =   3471888 print table 160

 normed average tally per history = 4.41942E-04   unnormed average tally per history = 1.32583E+03
 estimated tally relative error   = 0.0160   estimated variance of the variance = 0.1452
 relative error from zero tallies = 0.0038   relative error from nonzero scores = 0.0155

 number of nonzero history tallies =   69696   efficiency for the nonzero tallies = 0.0033
 history number of largest tally =   3231029   largest unnormalized history tally = 2.73077E+08
 (largest tally)/(average tally) = 2.05967E+05   (largest tally)/(avg nonzero tally)= 6.81794E+02

 (confidence interval shift)/mean = 0.0022   shifted confidence interval center = 4.42893E-04

 if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	4.41942E-04	4.68160E-04	0.059324
relative error	1.59860E-02	1.85535E-02	0.160611
variance of the variance	1.45236E-01	1.51299E-01	0.041744
shifted center	4.42893E-04	4.49715E-04	0.015403
figure of merit	3.23743E+00	2.40340E+00	-0.257620

 the estimated inverse power slope of the 200 largest tallies starting at 8.57788E+06 is 2.9510
 the history score probability density function appears to have an unsampled region at the largest history scores:
 please examine. see print table 161.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*(1.363E-02)**2 = (1.742E+04)*(1.859E-04) = 3.237E+00

1unnormed tally density for tally 42   nonzero tally mean(m) = 4.005E+05   nps =   3471888 print table 161

 abscissa   ordinate   log plot of tally probability density function in tally fluctuation chart bin(d=decade,slope= 3.0)
  tally number num den log den:d----------d----------d----------d----------d----------d----------d----------d--------
 6.31+04   2453 8.98-09 -8.047
**********|**********|**********|**********|**********|**********|**********|**
 7.94+04   8313 2.42-08 -7.617
**********|**********|**********|**********|**********|**********|**********|********
 1.00+05   8562 1.98-08 -7.704
**********|**********|**********|**********|**********|**********|**********|*******
 1.26+05   8193 1.50-08 -7.823
**********|**********|**********|**********|**********|**********|**********|*****
 1.58+05   8518 1.24-08 -7.906
**********|**********|**********|**********|**********|**********|**********|****
 2.00+05   7129 8.25-09 -8.083
**********|**********|**********|**********|**********|**********|**********|**
 2.51+05   6002 5.52-09 -8.258
**********|**********|**********|**********|**********|**********|**********|
 3.16+05   4822 3.52-09 -8.453
**********|**********|**********|**********|**********|**********|********** |
 3.98+05   3781 2.19-09 -8.659
**********|**********|**********|**********|**********|**********|******* |
 5.01+05   2692 1.24-09 -8.906
mmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmmmmmmmmmmmm|mmmm |
 6.31+05   1861 6.81-10 -9.167 **********|**********|**********|**********|**********|**********|*
|
 7.94+05   1253 3.64-10 -9.439 **********|**********|**********|**********|**********|********** |
|
 1.00+06   952 2.20-10 -9.658 **********|**********|**********|**********|**********|******* |
|
 1.26+06   961 1.76-10 -9.754 **********|**********|**********|**********|**********|****** |
|
 1.58+06   968 1.41-10 -9.851 **********|**********|**********|**********|**********|***** |
|
 2.00+06   824 9.54-11 -10.021 **********|**********|**********|**********|**********|** |
|
 2.51+06   707 6.50-11 -10.187 **********|**********|**********|**********|**********| |
|
 3.16+06   595 4.34-11 -10.362 **********|**********|**********|**********|********** | |
|
 3.98+06   417 2.42-11 -10.616 **********|**********|**********|**********|******** | |
|

```
 5.01+06    234 1.08-11 -10.967 ************|************|************|*************|***          |             |
|
 6.31+06    141 5.16-12 -11.287 ************|************|************|*************|             |             |
|
 7.94+06     93 2.70-12 -11.568 ************|************|************|*********    |             |             |
|
 1.00+07     78 1.80-12 -11.744 ************|************|************|*******      |  s          |             |
|
 1.26+07     49 8.99-13 -12.046 ************|************|************|***          |s            |             |
|
 1.58+07     29 4.23-13 -12.374 ************|************|***********  |            s|             |             |
|
 2.00+07     21 2.43-13 -12.614 ************|************|********    |          s  |             |             |
|
 2.51+07     12 1.10-13 -12.957 ************|************|****        |       s     |             |             |
|
 3.16+07     18 1.31-13 -12.881 ************|************|*****       |    s        |             |             |
|
 3.98+07      6 3.48-14 -13.458 ************|**********  |            | s           |             |             |
|
 5.01+07      6 2.76-14 -13.558 ************|*********   |           s|             |             |             |
|
 6.31+07      3 1.10-14 -13.959 ************|***         |        s   |             |             |             |
|
 7.94+07      1 2.91-15 -14.537 *********   |            |     s      |             |             |             |
|
 1.00+08      1 2.31-15 -14.637 ********    |            | s          |             |             |             |
|
 1.26+08      0 0.00+00   0.000             |           s|            |             |             |             |
|
 1.58+08      0 0.00+00   0.000             |       s    |            |             |             |             |
|
 2.00+08      0 0.00+00   0.000             |   s        |            |             |             |             |
|
 2.51+08      0 0.00+00   0.000             |s           |            |             |             |             |
|
 3.16+08      1 7.30-16 -15.137 *        s  |            |            |             |             |             |
|
  total   69696 3.31-03         d-----------d------------d------------d-------------d------------d------------d-
-----------d--------

1tally  52        nps =     3471888
           tally type 2    particle flux averaged over a surface.
           tally for  photons
 number of histories used for normalizing tallies =     21054865.00

           this tally is modified by a dose function.

           areas
                surface:     2003         2004         2005         2006         2007         2008         2009
               segment
                  1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
1.00000E+50
                  6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06
3.00000E+06
                surface:     2010         2011         2012         2013
               segment
                  1       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  2       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  3       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  4       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  5       1.00000E+50  1.00000E+50  1.00000E+50  1.00000E+50
                  6       3.00000E+06  3.00000E+06  3.00000E+06  3.00000E+06

 surface  2003
 segment:        1219
                 1.06318E-44 0.0040

 surface  2003
 segment:       -1219    -1209
                 1.30384E-47 0.0223
```

```
surface  2003
segment:       -1219     1209    -1201
                1.07846E-46 0.0070

surface  2003
segment:       -1219     1209     1201    -1205
                5.28566E-47 0.0063

surface  2003
segment:       -1219     1209     1201     1205     1206
                3.93904E-47 0.0066

surface  2003
segment:       -1219     1209     1201     1205    -1206
                3.47994E-04 0.0155

surface  2004
segment:        1219
                9.36368E-45 0.0040

surface  2004
segment:       -1219    -1209
                8.02083E-48 0.0119

surface  2004
segment:       -1219     1209    -1201
                6.58070E-47 0.0066

surface  2004
segment:       -1219     1209     1201    -1205
                3.22309E-47 0.0079

surface  2004
segment:       -1219     1209     1201     1205     1206
                2.53799E-47 0.0069

surface  2004
segment:       -1219     1209     1201     1205    -1206
                1.37790E-04 0.0187

surface  2005
segment:        1219
                7.95821E-45 0.0041

surface  2005
segment:       -1219    -1209
                4.78468E-48 0.0099

surface  2005
segment:       -1219     1209    -1201
                4.06314E-47 0.0069

surface  2005
segment:       -1219     1209     1201    -1205
                1.96837E-47 0.0065

surface  2005
segment:       -1219     1209     1201     1205     1206
                1.59841E-47 0.0071

surface  2005
segment:       -1219     1209     1201     1205    -1206
                6.33094E-05 0.0249

surface  2006
segment:        1219
                6.56184E-45 0.0042

surface  2006
segment:       -1219    -1209
                2.95330E-48 0.0118

surface  2006
segment:       -1219     1209    -1201
                2.51136E-47 0.0071

surface  2006
segment:       -1219     1209     1201    -1205
                1.22001E-47 0.0069
```

```
surface  2006
segment:       -1219     1209     1201     1205     1206
                9.95114E-48 0.0078

surface  2006
segment:       -1219     1209     1201     1205    -1206
                3.09163E-05 0.0276

surface  2007
segment:        1219
                5.28183E-45 0.0043

surface  2007
segment:       -1219    -1209
                1.87321E-48 0.0128

surface  2007
segment:       -1219     1209    -1201
                1.56368E-47 0.0078

surface  2007
segment:       -1219     1209     1201    -1205
                7.52577E-48 0.0073

surface  2007
segment:       -1219     1209     1201     1205     1206
                6.11254E-48 0.0079

surface  2007
segment:       -1219     1209     1201     1205    -1206
                1.66609E-05 0.0333

surface  2008
segment:        1219
                3.68143E-45 0.0044

surface  2008
segment:       -1219    -1209
                9.27239E-49 0.0179

surface  2008
segment:       -1219     1209    -1201
                7.79188E-48 0.0086

surface  2008
segment:       -1219     1209     1201    -1205
                3.67878E-48 0.0083

surface  2008
segment:       -1219     1209     1201     1205     1206
                3.04481E-48 0.0096

surface  2008
segment:       -1219     1209     1201     1205    -1206
                6.11052E-06 0.0373

surface  2009
segment:        1219
                2.48899E-45 0.0046

surface  2009
segment:       -1219    -1209
                4.58855E-49 0.0198

surface  2009
segment:       -1219     1209    -1201
                3.89250E-48 0.0092

surface  2009
segment:       -1219     1209     1201    -1205
                1.82080E-48 0.0100

surface  2009
segment:       -1219     1209     1201     1205     1206
                1.46823E-48 0.0107

surface  2009
segment:       -1219     1209     1201     1205    -1206
                2.45176E-06 0.0415
```

```
surface  2010
segment:        1219
                1.43074E-45 0.0049

surface  2010
segment:       -1219    -1209
                1.80967E-49 0.0302

surface  2010
segment:       -1219     1209    -1201
                1.58401E-48 0.0131

surface  2010
segment:       -1219     1209     1201    -1205
                7.20080E-49 0.0118

surface  2010
segment:       -1219     1209     1201     1205     1206
                5.66080E-49 0.0130

surface  2010
segment:       -1219     1209     1201     1205    -1206
                7.86603E-07 0.0543

surface  2011
segment:        1219
                8.02150E-46 0.0052

surface  2011
segment:       -1219    -1209
                7.62332E-50 0.0298

surface  2011
segment:       -1219     1209    -1201
                6.38791E-49 0.0163

surface  2011
segment:       -1219     1209     1201    -1205
                2.94845E-49 0.0185

surface  2011
segment:       -1219     1209     1201     1205     1206
                2.23609E-49 0.0157

surface  2011
segment:       -1219     1209     1201     1205    -1206
                2.51420E-07 0.0688

surface  2012
segment:        1219
                4.42367E-46 0.0055

surface  2012
segment:       -1219    -1209
                3.31868E-50 0.0457

surface  2012
segment:       -1219     1209    -1201
                2.63555E-49 0.0154

surface  2012
segment:       -1219     1209     1201    -1205
                1.19416E-49 0.0197

surface  2012
segment:       -1219     1209     1201     1205     1206
                8.63680E-50 0.0206

surface  2012
segment:       -1219     1209     1201     1205    -1206
                8.37579E-08 0.0714

surface  2013
segment:        1219
                2.41340E-46 0.0061

surface  2013
segment:       -1219    -1209
                1.13793E-50 0.0363
```

```
 surface  2013
 segment:       -1219     1209    -1201
                 1.08518E-49 0.0189

 surface  2013
 segment:       -1219     1209     1201    -1205
                 4.94570E-50 0.0325

 surface  2013
 segment:       -1219     1209     1201     1205     1206
                 3.81178E-50 0.0412

 surface  2013
 segment:       -1219     1209     1201     1205    -1206
                 2.95207E-08 0.0763


================================================================================================================
==================

           results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  52

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--      -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10      yes      1/sqrt(nps)        <0.10      yes        1/nps            constant
random      >3.00
 observed     random        0.02      yes          yes             0.04      yes         yes             constant
random       2.48
 passed?        yes          yes      yes          yes               yes      yes         yes                yes
yes          no


================================================================================================================
==================


 warning.  the tally in the tally fluctuation chart bin did not pass  1 of the 10 statistical checks.

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  52 with nps =     3471888  print
table 160


 normed average tally per history  = 3.47994E-04          unnormed average tally per history  = 1.04398E+03
 estimated tally relative error    = 0.0155               estimated variance of the variance  = 0.0395
 relative error from zero tallies  = 0.0040               relative error from nonzero scores  = 0.0150

 number of nonzero history tallies =       63428          efficiency for the nonzero tallies  = 0.0030
 history number of largest  tally  =     1916113          largest  unnormalized history tally = 1.14019E+08
 (largest  tally)/(average tally)  = 1.09215E+05          (largest  tally)/(avg nonzero tally)= 3.29011E+02

 (confidence interval shift)/mean  = 0.0012               shifted confidence interval center  = 3.48416E-04


 if the largest  history score sampled so far were to occur on the next history, the tfc bin quantities would
change as follows:

      estimated quantities           value at nps           value at nps+1          value(nps+1)/value(nps)-1.

      mean                            3.47994E-04            3.58941E-04                   0.031457
      relative error                  1.54717E-02            1.62265E-02                   0.048783
      variance of the variance        3.94984E-02            4.21964E-02                   0.068306
      shifted center                  3.48416E-04            3.50847E-04                   0.006979
      figure of merit                 3.45623E+00            3.14218E+00                  -0.090864

 the estimated inverse power slope of the 200 largest  tallies starting at 5.99770E+06 is 2.4847
 the large score tail of the empirical history score probability density function appears to have no unsampled
regions.

 fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*( 1.409E-02)**2 = (1.742E+04)*(1.984E-
04) = 3.456E+00

1unnormed tally density for tally  52            nonzero tally mean(m) = 3.465E+05   nps =     3471888  print
table 161
```

```
 abscissa              ordinate   log plot of tally probability density function in tally fluctuation chart
bin(d=decade,slope= 2.5)
  tally  number num den log den:d------------d-------------d------------d------------d-------------d----------
---d-------------d--
 6.31+04   2253 8.25-09  -8.084
*************|*************|*************|*************|*************|*************|**********   |
 7.94+04   7947 2.31-08  -7.636
*************|*************|*************|*************|*************|*************|*************|**
 1.00+05   8088 1.87-08  -7.729
*************|*************|*************|*************|*************|*************|*************|*
 1.26+05   7622 1.40-08  -7.854
*************|*************|*************|*************|*************|*************|*************|
 1.58+05   8187 1.19-08  -7.923
*************|*************|*************|*************|*************|*************|************ |
 2.00+05   6683 7.73-09  -8.112
*************|*************|*************|*************|*************|*************|*********    |
 2.51+05   5682 5.22-09  -8.282
*************|*************|*************|*************|*************|*************|*******      |
 3.16+05   4364 3.19-09  -8.497
*************|*************|*************|*************|*************|*************|****         |
 3.98+05   3379 1.96-09  -8.708
mmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|mmmmmmmmmmmmmmm|m            |
 5.01+05   2263 1.04-09  -8.982
*************|*************|*************|*************|*************|************  |             |
 6.31+05   1519 5.56-10  -9.255 *************|*************|*************|*************|*************|*******
|             |
 7.94+05   1026 2.98-10  -9.525 *************|*************|*************|*************|*************|****
|             |
 1.00+06    655 1.51-10  -9.820 *************|*************|*************|*************|*************|
|             |
 1.26+06    663 1.22-10  -9.915 *************|*************|*************|*************|************ |
|             |
 1.58+06    673 9.81-11 -10.009 *************|*************|*************|*************|************  |
|             |
 2.00+06    660 7.64-11 -10.117 *************|*************|*************|*************|*********    |
|             |
 2.51+06    536 4.93-11 -10.307 *************|*************|*************|*************|*******      |
|             |
 3.16+06    444 3.24-11 -10.489 *************|*************|*************|*************|****         |
|             |
 3.98+06    336 1.95-11 -10.710 *************|*************|*************|*************|*            |
|             |
 5.01+06    165 7.60-12 -11.119 *************|*************|*************|*********    |             |
|             |
 6.31+06     97 3.55-12 -11.450 *************|*************|*************|*****        |s            |
|             |
 7.94+06     70 2.04-12 -11.691 *************|*************|*************|*           s|             |
|             |
 1.00+07     49 1.13-12 -11.946 *************|*************|************ |          s  |             |
|             |
 1.26+07     16 2.93-13 -12.532 *************|*************|****         |        s    |             |
|             |
 1.58+07     16 2.33-13 -12.632 *************|*************|**           |     s       |             |
|             |
 2.00+07      4 4.63-14 -13.334 *************|*******      |             |  s          |             |
|             |
 2.51+07     12 1.10-13 -12.957 *************|************ |             |s            |             |
|             |
 3.16+07      5 3.65-14 -13.438 *************|*****        |           s |             |             |
|             |
 3.98+07      4 2.32-14 -13.634 *************|**           |        s    |             |             |
|             |
 5.01+07      3 1.38-14 -13.859 *************|             |     s       |             |             |
|             |
 6.31+07      1 3.66-15 -14.437 *****        |             | s           |             |             |
|             |
 7.94+07      1 2.91-15 -14.537 ****         |            s|             |             |             |
|             |
 1.00+08      4 9.24-15 -14.034 ***********  |         s   |             |             |             |
|             |
 1.26+08      1 1.83-15 -14.737 *            |      s      |             |             |             |
|             |
  total   63428 3.01-03         d------------d-------------d------------d------------d-------------d----------
---d-------------d--

1tally  62        nps =     3471888
          tally type 2    particle flux averaged over a surface.
          tally for  photons
 number of histories used for normalizing tallies =     21054865.00
```

```
          this tally is modified by a dose function.

          areas
               surface:     1219
              segment
                1       1.00000E+50
                2       1.00000E+50
                3       1.00000E+50
                4       1.00000E+50
                5       5.30000E+06

 surface  1219
 segment:       -1205
                4.17053E-45 0.0196

 surface  1219
 segment:        1205     1206
                3.03713E-44 0.0074

 surface  1219
 segment:        1205    -1206     1203
                7.01034E-45 0.0157

 surface  1219
 segment:        1205    -1206    -1203    -1202
                6.96859E-45 0.0156

 surface  1219
 segment:        1205    -1206    -1203     1202
                4.54993E+01 0.0014


================================================================================================================
====================

          results of 10 statistical checks for the estimated answer for the tally fluctuation chart (tfc) bin
of tally  62

 tfc bin     --mean--      ---------relative error---------      ----variance of the variance----      --figure
of merit--      -pdf-
 behavior    behavior      value    decrease    decrease rate      value    decrease    decrease rate       value
behavior     slope

 desired      random       <0.10       yes       1/sqrt(nps)       <0.10       yes         1/nps           constant
random      >3.00
 observed     random        0.00       yes           yes            0.00       yes          yes            constant
random       9.82
 passed?        yes           yes      yes           yes              yes      yes          yes               yes
yes          yes


================================================================================================================
====================


 this tally meets the statistical criteria used to form confidence intervals: check the tally fluctuation chart
to verify.
 the results in other bins associated with this tally may not meet these statistical criteria.

 ----- estimated confidence intervals:  -----

 estimated asymmetric confidence interval(1,2,3 sigma): 4.5438E+01 to 4.5561E+01; 4.5376E+01 to 4.5623E+01;
4.5315E+01 to 4.5684E+01
 estimated  symmetric confidence interval(1,2,3 sigma): 4.5438E+01 to 4.5561E+01; 4.5376E+01 to 4.5623E+01;
4.5314E+01 to 4.5684E+01

1analysis of the results in the tally fluctuation chart bin (tfc) for tally  62 with nps =     3471888  print
table 160


 normed average tally per history  = 4.54993E+01          unnormed average tally per history  = 2.41147E+08
 estimated tally relative error    = 0.0014              estimated variance of the variance  = 0.0000
 relative error from zero tallies  = 0.0005              relative error from nonzero scores  = 0.0013

 number of nonzero history tallies =     3445451         efficiency for the nonzero tallies  = 0.1636
 history number of largest  tally  =      769241         largest  unnormalized history tally = 1.98498E+11
 (largest  tally)/(average tally)  = 8.23144E+02         (largest  tally)/(avg nonzero tally)= 1.34701E+02

 (confidence interval shift)/mean  = 0.0000              shifted confidence interval center  = 4.54995E+01
```

if the largest history score sampled so far were to occur on the next history, the tfc bin quantities would change as follows:

estimated quantities	value at nps	value at nps+1	value(nps+1)/value(nps)-1.
mean	4.54993E+01	4.55101E+01	0.000237
relative error	1.35483E-03	1.26350E-03	-0.067416
variance of the variance	3.54975E-05	4.30057E-05	0.211512
shifted center	4.54995E+01	4.55005E+01	0.000021
figure of merit	4.50722E+02	5.18243E+02	0.149805

the estimated inverse power slope of the 198 largest tallies starting at 7.33843E+10 is 9.8181
the history score probability density function appears to have an unsampled region at the largest history scores:
please examine. see print table 161.

fom = (histories/minute)*(f(x) signal-to-noise ratio)**2 = (1.742E+04)*(1.609E-01)**2 = (1.742E+04)*(2.587E-02) = 4.507E+02

1status of the statistical checks used to form confidence intervals for the mean for each tally bin

tally result of statistical checks for the tfc bin (the first check not passed is listed) and error magnitude check for all bins

2 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 1 tally bins all have relative errors less than 0.10 with no zero bins

12 missed 2 of 10 tfc bin checks: the relative error exceeds the recommended value of 0.1 for nonpoint detector tallies
missed all bin error check: 16 tally bins had 0 bins with zeros and 1 bins with relative errors exceeding 0.10

22 missed 1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
passed all bin error check: 22 tally bins all have relative errors less than 0.10 with no zero bins

32 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 5 tally bins had 1 bins with zeros and 0 bins with relative errors exceeding 0.10

42 missed 7 of 10 tfc bin checks: the relative error does not monotonically decrease over the last half of the problem
missed all bin error check: 66 tally bins had 0 bins with zeros and 1 bins with relative errors exceeding 0.10

52 missed 1 of 10 tfc bin checks: the slope of decrease of largest tallies is less than the minimum acceptable value of 3.0
passed all bin error check: 66 tally bins all have relative errors less than 0.10 with no zero bins

62 passed the 10 statistical checks for the tally fluctuation chart bin result
passed all bin error check: 5 tally bins all have relative errors less than 0.10 with no zero bins

the 10 statistical checks are only for the tally fluctuation chart bin and do not apply to other tally bins.

the tally bins with zeros may or may not be correct: compare the source, cutoffs, multipliers, et cetera with the tally bins.

warning. 4 of the 7 tally fluctuation chart bins did not pass all 10 statistical checks.
warning. 2 of the 7 tallies had bins with relative errors greater than recommended.
1tally fluctuation charts

	tally 2					tally 12					tally 22				
nps	mean	error	vov	slope	fom	mean	error	vov	slope	fom	mean	error	vov	slope	fom
256000	1.6070E-01	0.0214	0.0092	10.0	24	6.2474E-09	0.7153	0.5446	0.0	2.1E-02	1.3390E-46	0.0360	0.0733	2.9	8.4E+00
512000	1.6026E-01	0.0166	0.0144	8.9	20	3.1275E-09	0.7153	0.5446	0.0	1.1E-02	1.3871E-46	0.0320	0.0753	2.4	5.3E+00
768000	1.5605E-01	0.0131	0.0089	8.6	21	3.7694E-09	0.4879	0.3027	0.0	1.5E-02	1.3618E-46	0.0257	0.0532	2.1	5.6E+00
1024000	1.5518E-01	0.0115	0.0065	7.6	21	2.9087E-09	0.4746	0.3005	0.0	1.2E-02	1.3809E-46	0.0313	0.3040	2.2	2.8E+00
1280000	1.5517E-01	0.0107	0.0080	5.6	20	3.1098E-09	0.3776	0.2428	0.0	1.6E-02	1.3561E-46	0.0264	0.2646	2.1	3.2E+00

```
      1536000   1.5429E-01 0.0098 0.0079  4.8      20   2.9643E-09 0.3395 0.2178  0.0 1.6E-02   1.3573E-46
0.0239 0.1964  2.0 3.3E+00
      1792000   1.5412E-01 0.0089 0.0064  5.1      20   2.5805E-09 0.3347 0.2170  0.0 1.4E-02   1.3551E-46
0.0212 0.1735  2.1 3.6E+00
      2048000   1.5421E-01 0.0082 0.0053  5.1      21   2.6395E-09 0.2973 0.1899  0.0 1.6E-02   1.3404E-46
0.0190 0.1640  2.3 3.9E+00
      2304000   1.5486E-01 0.0077 0.0044  4.5      21   3.1150E-09 0.2624 0.1390  0.0 1.8E-02   1.3364E-46
0.0173 0.1518  2.5 4.2E+00
      2560000   1.5525E-01 0.0073 0.0037  5.9      21   3.2684E-09 0.2366 0.1165  0.0 2.0E-02   1.3528E-46
0.0179 0.1196  2.3 3.5E+00
      2816000   1.5466E-01 0.0069 0.0032  6.6      21   3.2131E-09 0.2294 0.1045  0.0 1.9E-02   1.3468E-46
0.0166 0.1119  2.3 3.7E+00
      3072000   1.5440E-01 0.0066 0.0030  5.8      21   3.2926E-09 0.2145 0.0920  0.0 2.0E-02   1.3406E-46
0.0154 0.1077  2.2 3.9E+00
      3328000   1.5423E-01 0.0064 0.0028  4.7      21   3.4988E-09 0.2019 0.0776  0.0 2.1E-02   1.3559E-46
0.0167 0.0918  2.3 3.1E+00
      3471888   1.5433E-01 0.0063 0.0029  4.3      21   3.4613E-09 0.1967 0.0760  0.0 2.1E-02   1.3578E-46
0.0171 0.0843  2.2 2.8E+00


                      tally   32                                  tally   42                                  tally
52
         nps      mean     error   vov  slope    fom      mean     error   vov  slope    fom      mean
error   vov  slope    fom
       256000   7.4555E-04 0.1173 0.0909 10.0 7.9E-01   4.3235E-04 0.0428 0.0516  3.5 6.0E+00   3.3411E-04
0.0463 0.0992  4.0 5.1E+00
       512000   6.9438E-04 0.0792 0.0607  8.3 8.7E-01   4.3543E-04 0.0318 0.0311  2.8 5.4E+00   3.5466E-04
0.0328 0.0448  2.8 5.1E+00
       768000   6.8125E-04 0.0668 0.0604  5.5 8.2E-01   4.2608E-04 0.0258 0.0237  2.3 5.5E+00   3.5160E-04
0.0270 0.0416  2.6 5.0E+00
      1024000   6.9033E-04 0.0637 0.1052  4.6 6.8E-01   4.2975E-04 0.0220 0.0160  2.6 5.7E+00   3.4995E-04
0.0230 0.0296  2.5 5.2E+00
      1280000   6.5104E-04 0.0557 0.0933  4.4 7.2E-01   4.3245E-04 0.0196 0.0133  2.8 5.8E+00   3.4494E-04
0.0198 0.0239  2.5 5.7E+00
      1536000   6.5064E-04 0.0493 0.0752  4.4 7.6E-01   4.3238E-04 0.0186 0.0197  2.9 5.4E+00   3.4183E-04
0.0176 0.0195  3.0 6.0E+00
      1792000   6.5319E-04 0.0483 0.0750  3.8 6.8E-01   4.3334E-04 0.0170 0.0161  3.1 5.5E+00   3.4126E-04
0.0175 0.0460  2.8 5.2E+00
      2048000   6.5079E-04 0.0449 0.0627  3.7 6.9E-01   4.2910E-04 0.0157 0.0140  3.5 5.7E+00   3.4522E-04
0.0187 0.0729  2.7 4.0E+00
      2304000   6.5476E-04 0.0421 0.0513  3.3 7.0E-01   4.2861E-04 0.0147 0.0121  3.7 5.8E+00   3.4555E-04
0.0184 0.0657  2.5 3.7E+00
      2560000   6.5385E-04 0.0406 0.0430  3.3 6.8E-01   4.3226E-04 0.0144 0.0114  3.7 5.4E+00   3.4662E-04
0.0180 0.0570  2.5 3.4E+00
      2816000   6.5345E-04 0.0383 0.0377  3.3 6.9E-01   4.3154E-04 0.0136 0.0101  3.9 5.5E+00   3.4724E-04
0.0168 0.0517  2.5 3.6E+00
      3072000   6.5392E-04 0.0367 0.0327  3.4 6.9E-01   4.3277E-04 0.0129 0.0088  3.8 5.6E+00   3.5000E-04
0.0170 0.0436  2.4 3.3E+00
      3328000   6.4863E-04 0.0354 0.0297  3.4 6.9E-01   4.4112E-04 0.0161 0.1640  2.9 3.3E+00   3.4869E-04
0.0160 0.0408  2.5 3.4E+00
      3471888   6.4381E-04 0.0345 0.0286  3.2 7.0E-01   4.4194E-04 0.0160 0.1452  3.0 3.2E+00   3.4799E-04
0.0155 0.0395  2.5 3.5E+00


                      tally   62
         nps      mean     error   vov  slope    fom
       256000   4.5521E+01 0.0050 0.0005 10.0     441
       512000   4.5736E+01 0.0035 0.0002 10.0     440
       768000   4.5649E+01 0.0029 0.0002 10.0     441
      1024000   4.5661E+01 0.0025 0.0001  8.2     444
      1280000   4.5587E+01 0.0022 0.0001  7.2     447
      1536000   4.5598E+01 0.0020 0.0001  8.6     447
      1792000   4.5584E+01 0.0019 0.0001  8.2     448
      2048000   4.5569E+01 0.0018 0.0001  8.6     448
      2304000   4.5578E+01 0.0017 0.0001  8.7     448
      2560000   4.5585E+01 0.0016 0.0000  8.2     448
      2816000   4.5572E+01 0.0015 0.0000 10.0     448
      3072000   4.5547E+01 0.0014 0.0000  8.8     449
      3328000   4.5499E+01 0.0014 0.0000  9.4     450
      3471888   4.5499E+01 0.0014 0.0000  9.8     451

*****************************************************************************************************
*******
 dump no.   22 on file runtpe       nps =     3471888     coll =     5191353148     ctm =     1208.70   nrn =
64575546929


        21 warning messages so far.
```

```
 run terminated when it had used    0  minutes of computer time.

 computer time = 1208.77 minutes

 mcnp     version 5     11112005                    06/25/09 07:13:47                    probid =  06/24/09
11:02:50
```