GEM TN-93-403

GEM Neutron Task Force Meeting - SSCL

April 28, 1993

Abstract:

Agenda, attendees, and presentations of the GEM Neutron Task Force Meeting held at the SSC Laboratory on April 28, 1993.

Neutron task force meeting

Date Wednesday April 28

Time 9.00 to 12.00 AM

Location Bldg 4 Rm 322

900	Opening	M. Diwan
915	Studies at LANL	L. Waters
1015	FCAL studies	B. Moore
1115	Discussion: a) Generation of TNs b) SSC report	

Attendees

1) Y. Fisyak
2) M. Diwan
3) J. Coyne
4) N. Mokhov
5) B. Moore
6) M. Harris
7) M. Marx
8) Norm Gober

Discussion Agenda:

1) Yuri Fisyak's hit rate study.

2) Los Alamos studies:

    a) Neutron, photon fluxes

    b) Activation calculation

3) Central tracker discrepancy.

4) FCAL shielding optimization.

5) Critical details of shielding: Barite, Albedo trap, thickness around quads.

6) Beam gas pretty pictures.

7) SSC report from Chapter 12.

8) Discrete ordinate calculations.

Reminder: Neutron Task force meeting is to be held on
April 28th in the Morning. I will send out an
agenda when we are closer to the meeting date.

Please send me requests for time if you would like to show some new results.

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The TDR Chapter on the radiation environment is complete except for a few details. It has gone through several readings and consistency checks with the rest of the TDR. The consensus is that we have done an excellent and comprehensive job without leaving any obvious gaps.

We do need to finish some studies, recheck some calculations, and gain more detailed understanding of some processes. In the following I have tried to categorize what we need to finish by the PAC meeting.

1) Yuri Fisyak is going to compute hit rates in the entire detector with his simulation pogram. He has to start soon to get sufficient statistics by the end of May. The question is: are there any changes to the shielding geometry between now and the PAC meeting that he should include in his simulation. My personal feeling is that the design in the TDR should be used for three reasons: 1) The design in the TDR has been proven to be good enough for high luminosity. 2) The hit rates calculated in the TDR need to be checked with his simulation. 3) I doubt if we have enough time between now and the end of May to come up with a significantly improved design. Hopefully Yuri will complete his calculations and produce a GEM-TN with neutron, photon fluxes, and the resulting hit rates from his simulation.

2) The Los Alamos effort needs to be completed. This has two parts:

a) Complete description of the neutron and photon fluxes.
b) Complete calculation of activation.

Again I feel that Los Alamos should continue with the TDR design and produce two GEM-TNs addressing each of the above.

3) The discrepancy between Los Alamos calculations and the GEANT-CALOR calculations in the central tracker needs to be understood. And more importantly, the various effects in the tracker due to changes of material need to understood. I suggest breaking up the problem into simpler problems: 1) Number and energy spectrum of albedo neutrons from single particles impinging on the calorimeter, with and without the polyethylene in the front. 2) History of single neutrons bouncing around in the cavity.

There is considerable conceptual information about the central cavity in the Groom report. It needs to be applied to our specific geometry to understand differences at the level of a factor of two, and make specific recommendations about 1) the hydrogen content in the EM calorimeter, 2) thickness of the polyethylene. This is an important topic because the polyethylene is limiting the EM resolution (and thus the Higgs sensitivity) of our calorimeter.

4) Brent Moore has studied the forward calorimeter shielding in some detail. He has varied the Barium and hydrogen content of the shielding, and categorized the particle fluxes. This effort should be completed over the next month and a GEM-TN produced with specific recommendations to the forward calorimeter group.

5) Certain critical details of our shielding need to be understood:
1) How important is the Barium? 2) How important is the thickness in front of the collimator and behind the collimator? 3) How important are the albedo traps ?

Brent's work shows that the barium helps because (it has a high atomic number) it has subtantial cross sections for (n,n'), (n,2n), and (n,3n) processes and is effective in degrading neutrons fast. But the difference between barium and iron is not large. The most effective part of the shield appears to be the hydrogen combined with the boron.

The other two issues for the collimator have not been addressed in detail yet. It is important to answer these because the accelerator group has jumped in this game (I have started attending another set of interminable meetings) to determine the increased load on the floor of the GEM hall. The cost of this shielding, which no one wants to pay for, is also important.

6) We should like to make some pretty pictures of the beam gas rate using the GEANT-CALOR program. This is not very high on the list because I believe the rates are now well understood from Nicolai's work. But we should make sure there are no surprises.

7) There is considerable interest in our radiation work outside the GEM group. I intend to turn our Chapter into an SSC report. During that process we may want to change a few things; perhaps add some new results.

8) What can the Los Alamos finite element guys do for us ?

If I have omitted any items from this menu please tell me; I would like to focus the discussion during the April 28th meeting on these items.

Regards,
Milind

LCS / CINDER
CALCULATIONS

4-28-93
Laurie Waters

1) Residuals

2) Fluences

3) 41 regions - activation
inventory
curies
watts
decay gammas - dose

4) Kerma - Heating

5) temperature dependence

6) high energy gammas

7) A > 1 particles

8) storage

9) 'bump'

10) 100 MeV libraries

11) Sn calculations

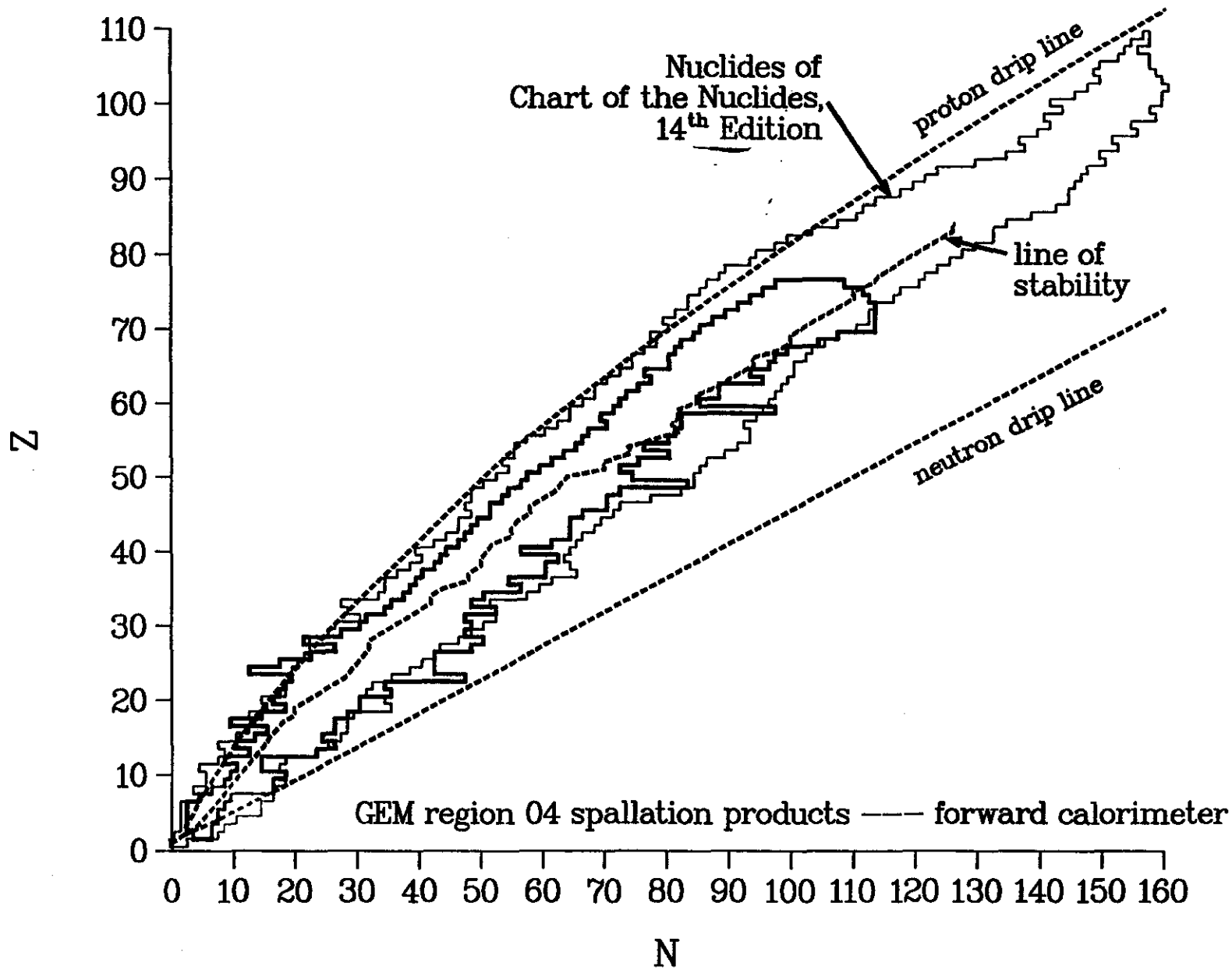


Fig. 1 Nuclide chart

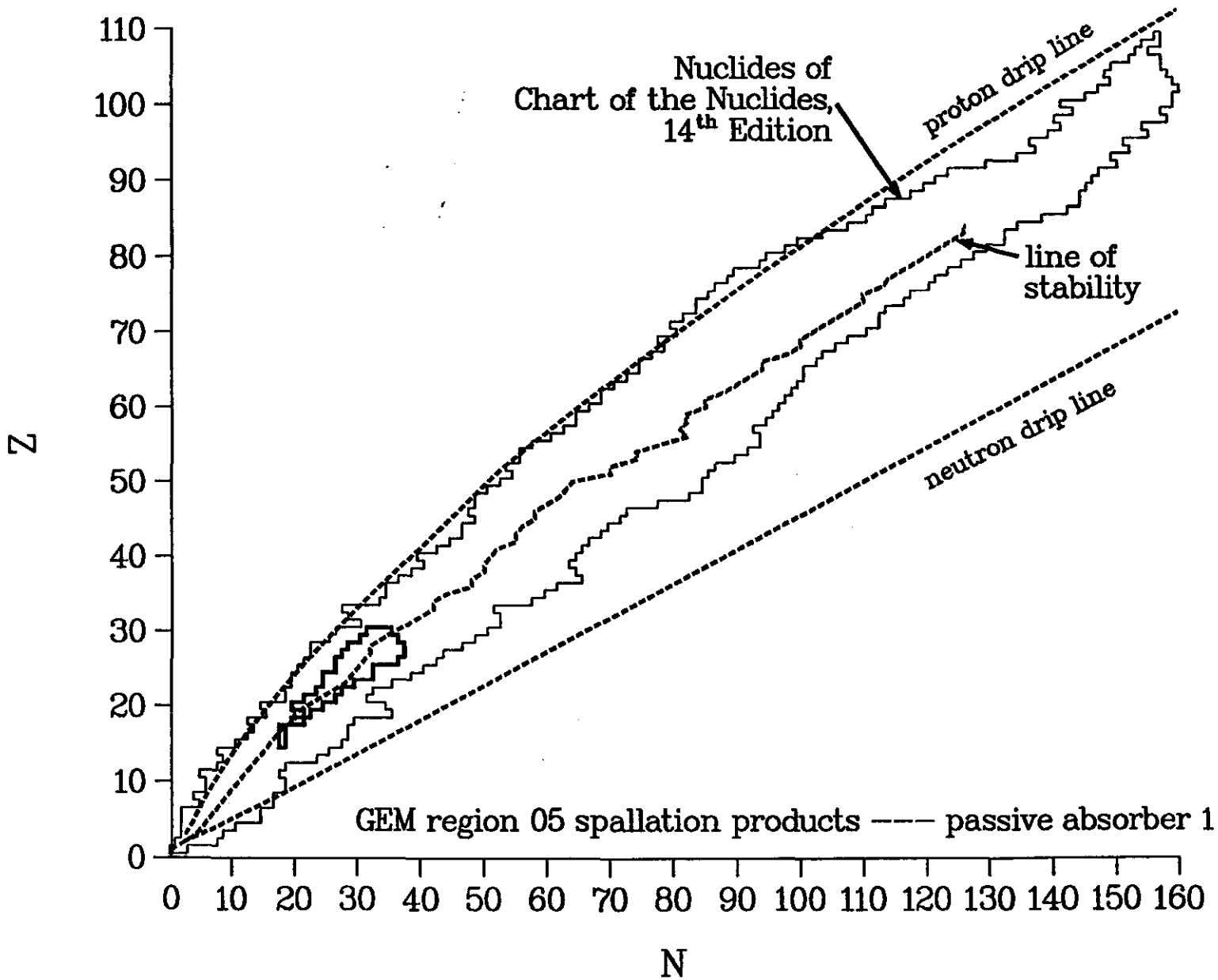
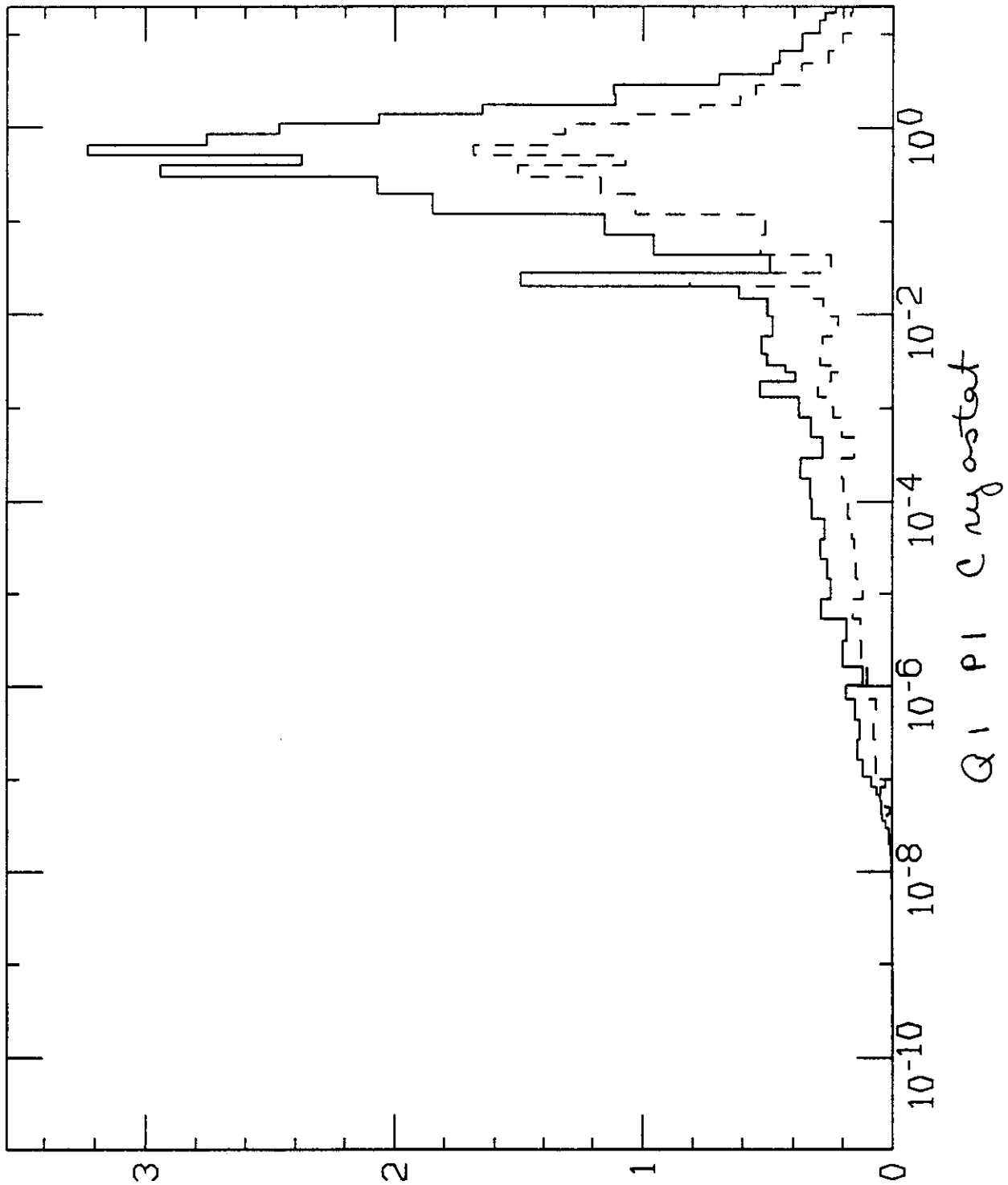
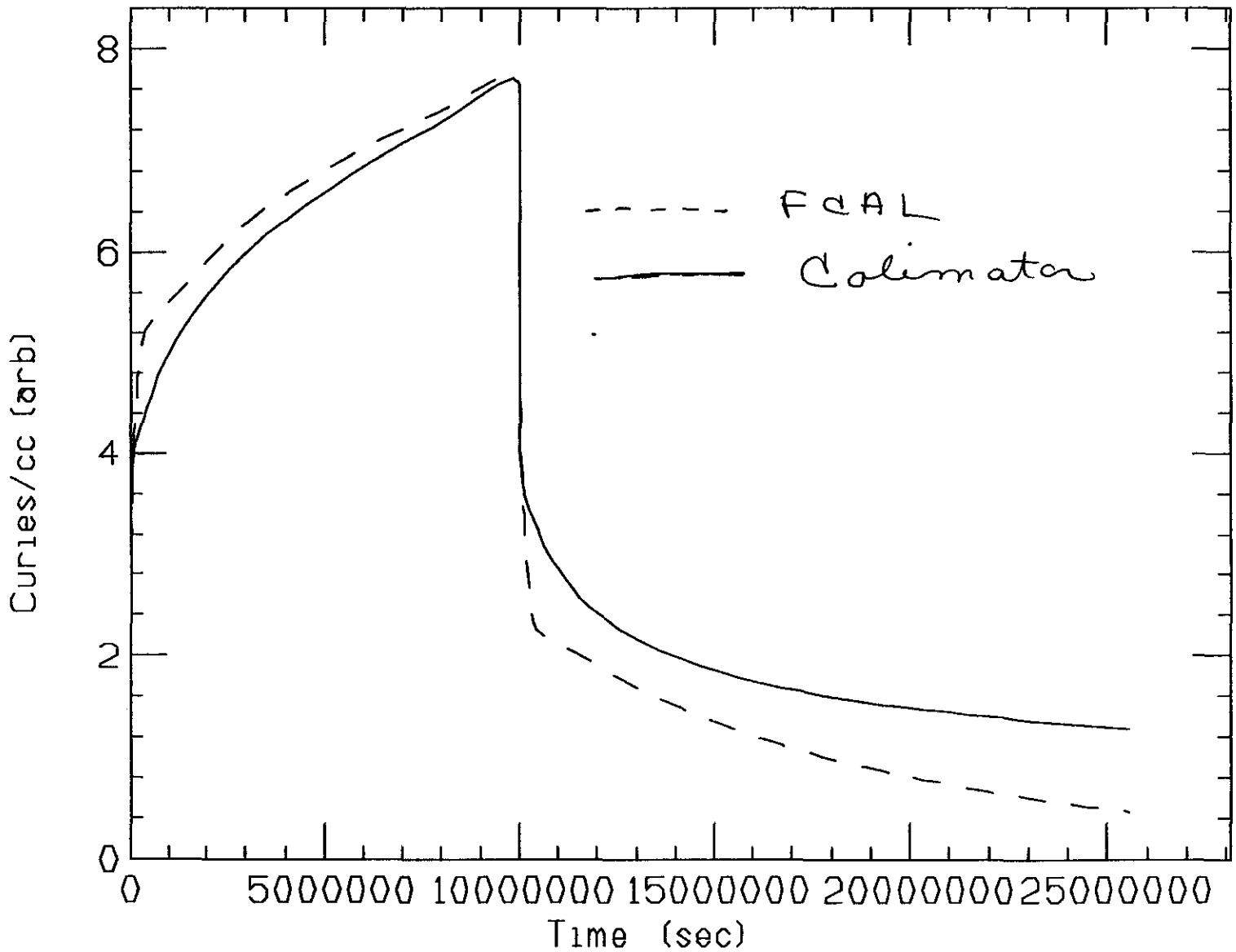
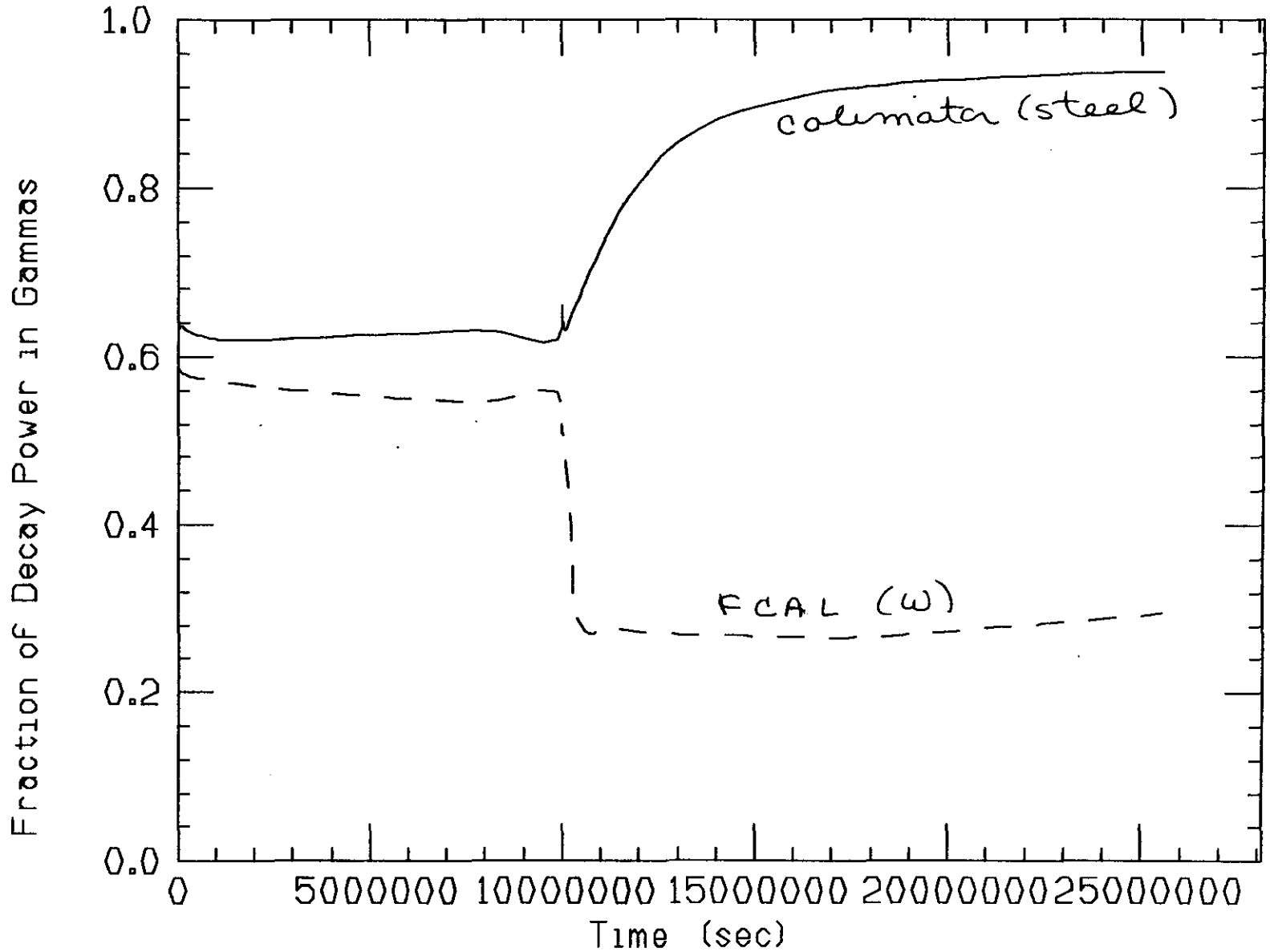
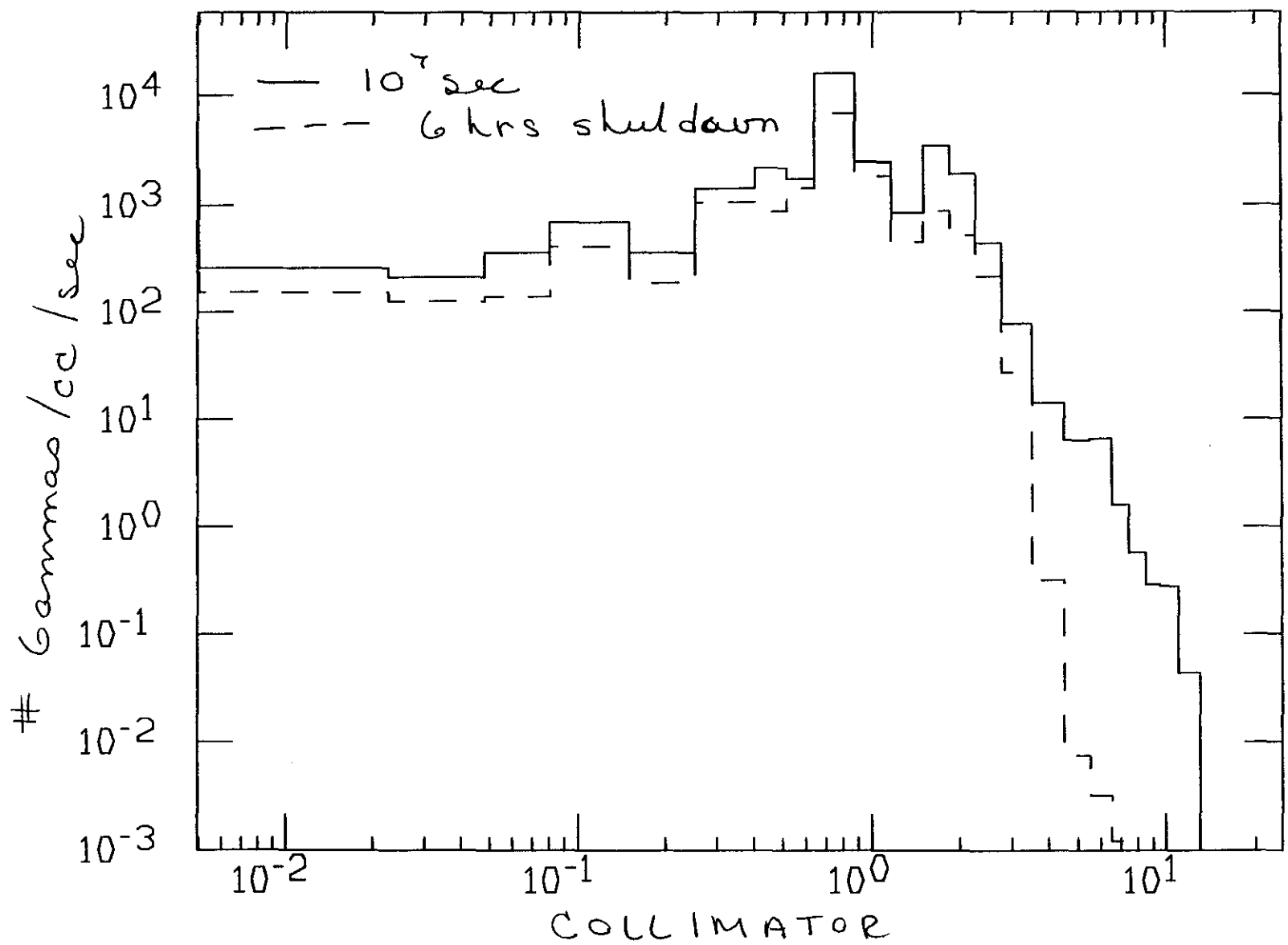


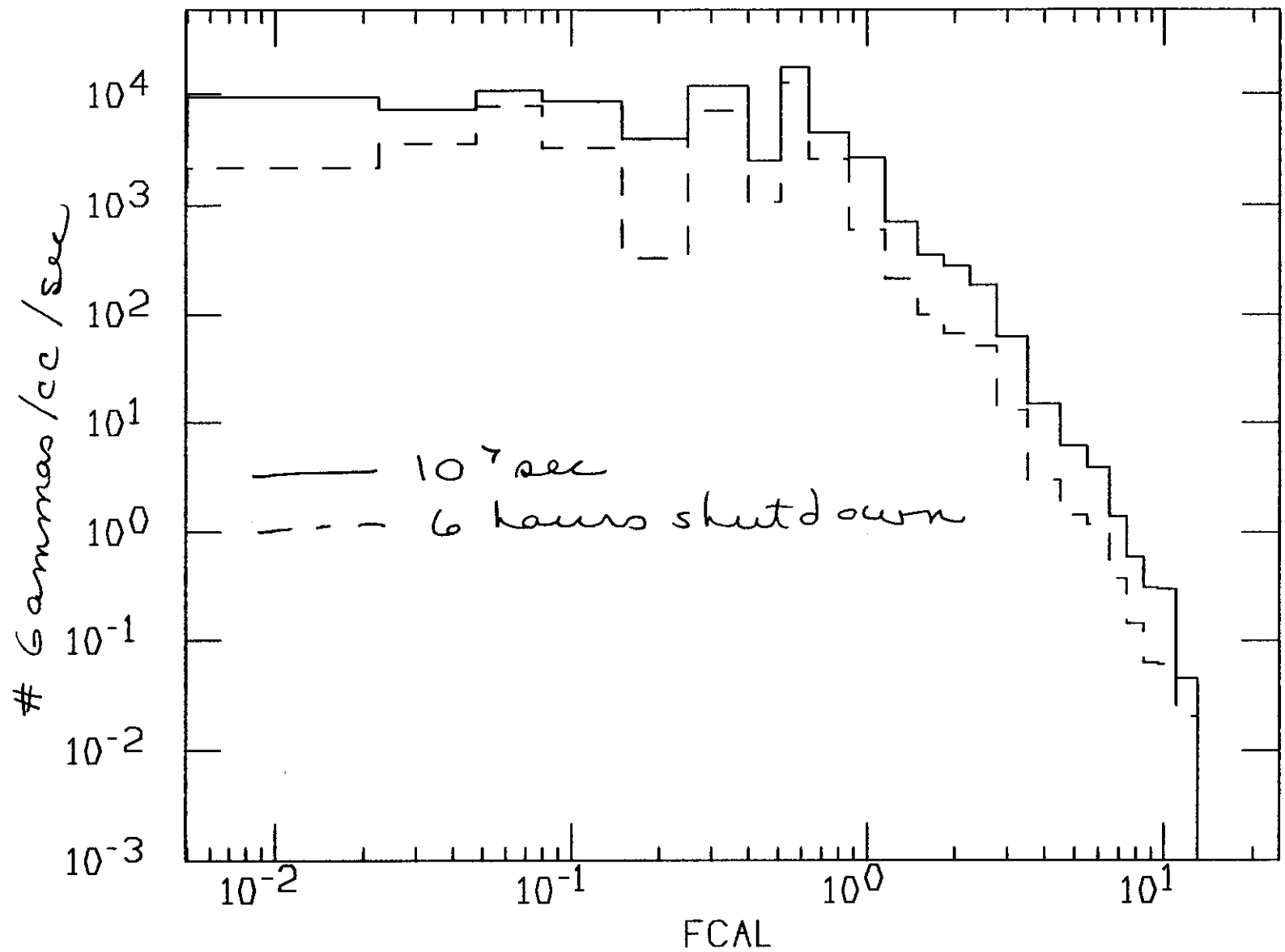
Fig. 1 Nuclide chart

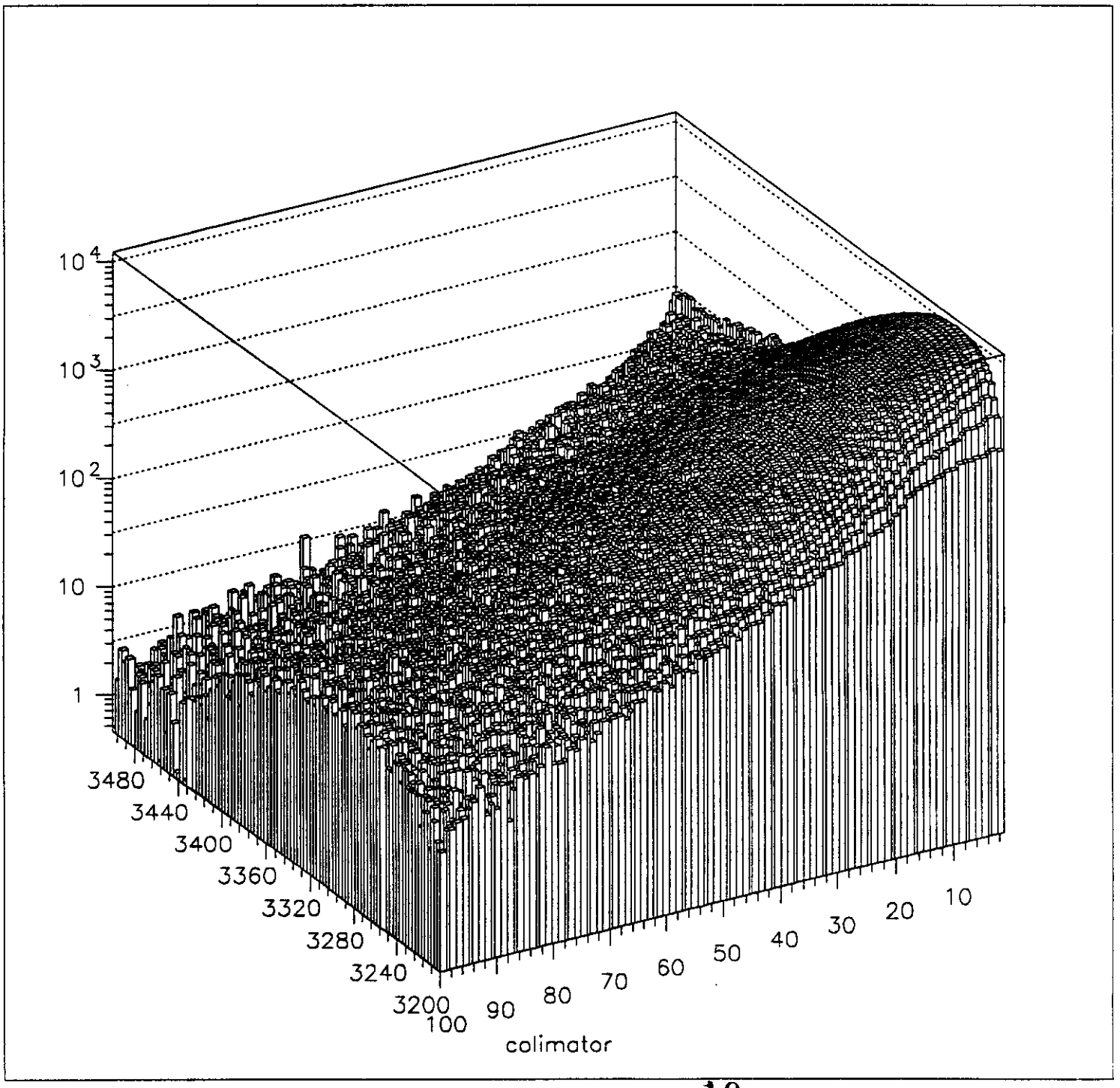

3
2
1
0
10^{-10}
10^{-8}
10^{-6}
10^{-4}
10^{-2}
10^{0}
Q1 P1 C nyostat

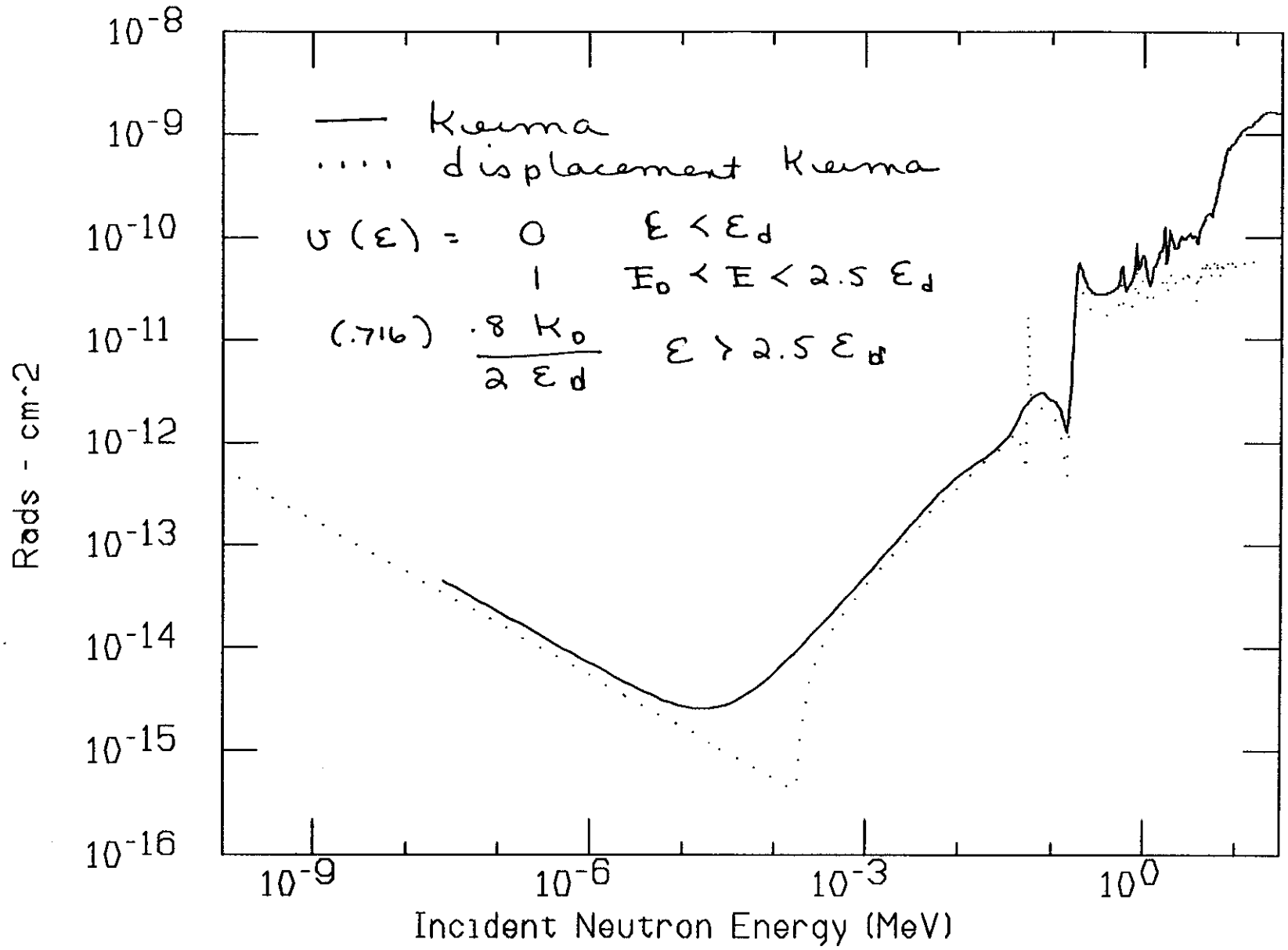

8
6
4
2
0
Curies/cc (arb)
0
5000000
10000000
15000000
20000000
25000000
Time (sec)
FCAL
Colimator

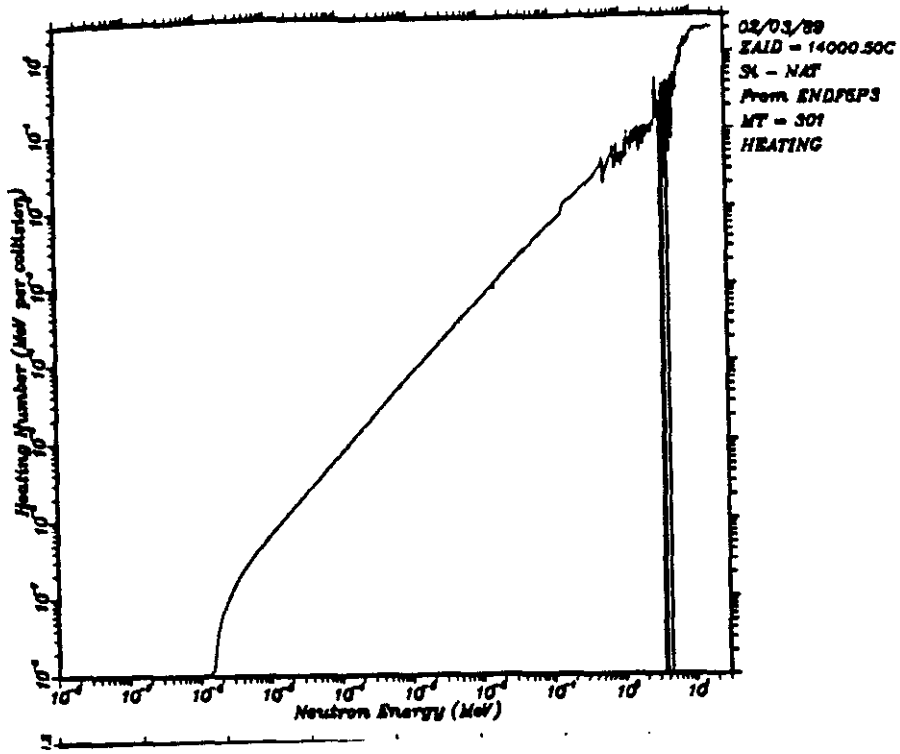

1.0
0.8
0.6
0.4
0.2
0.0
Fraction of Decay Power in Gammas
0
5000000
10000000
15000000
20000000
25000000
Time (sec)
collimator (steel)
FCAL (W)

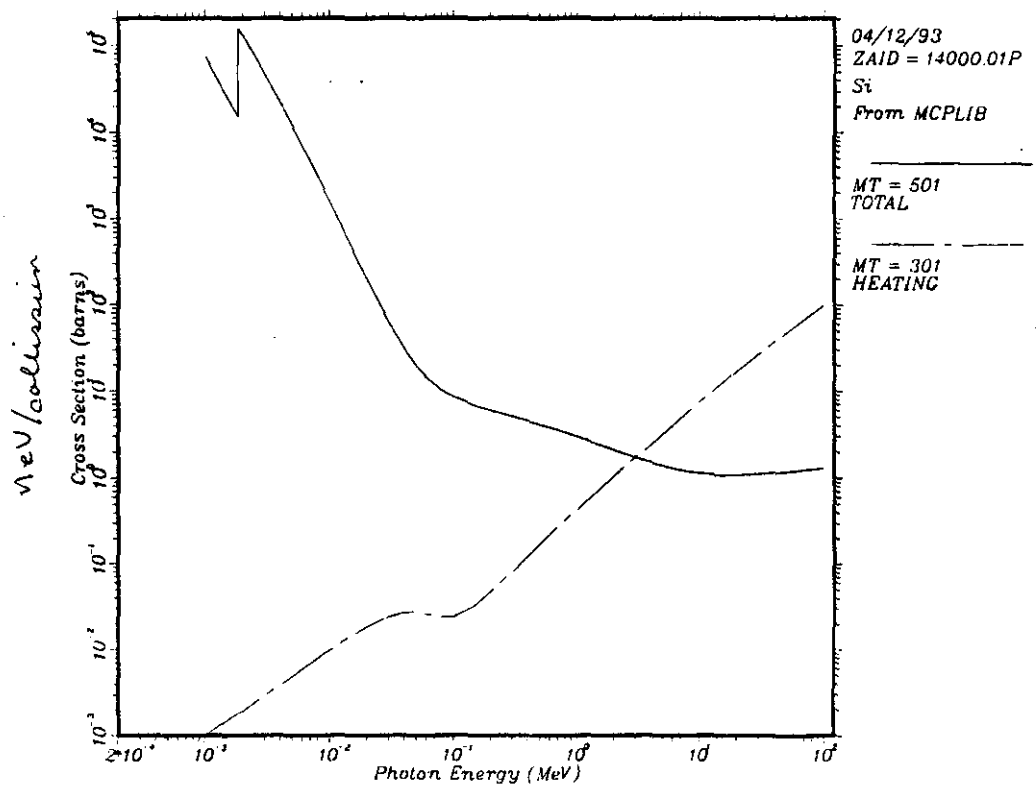

10^7 sec
6 hrs shutdown
Gammas/cc/sec
10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
10^{-2}
10^{-1}
10^0
10^1
COLLIMATOR

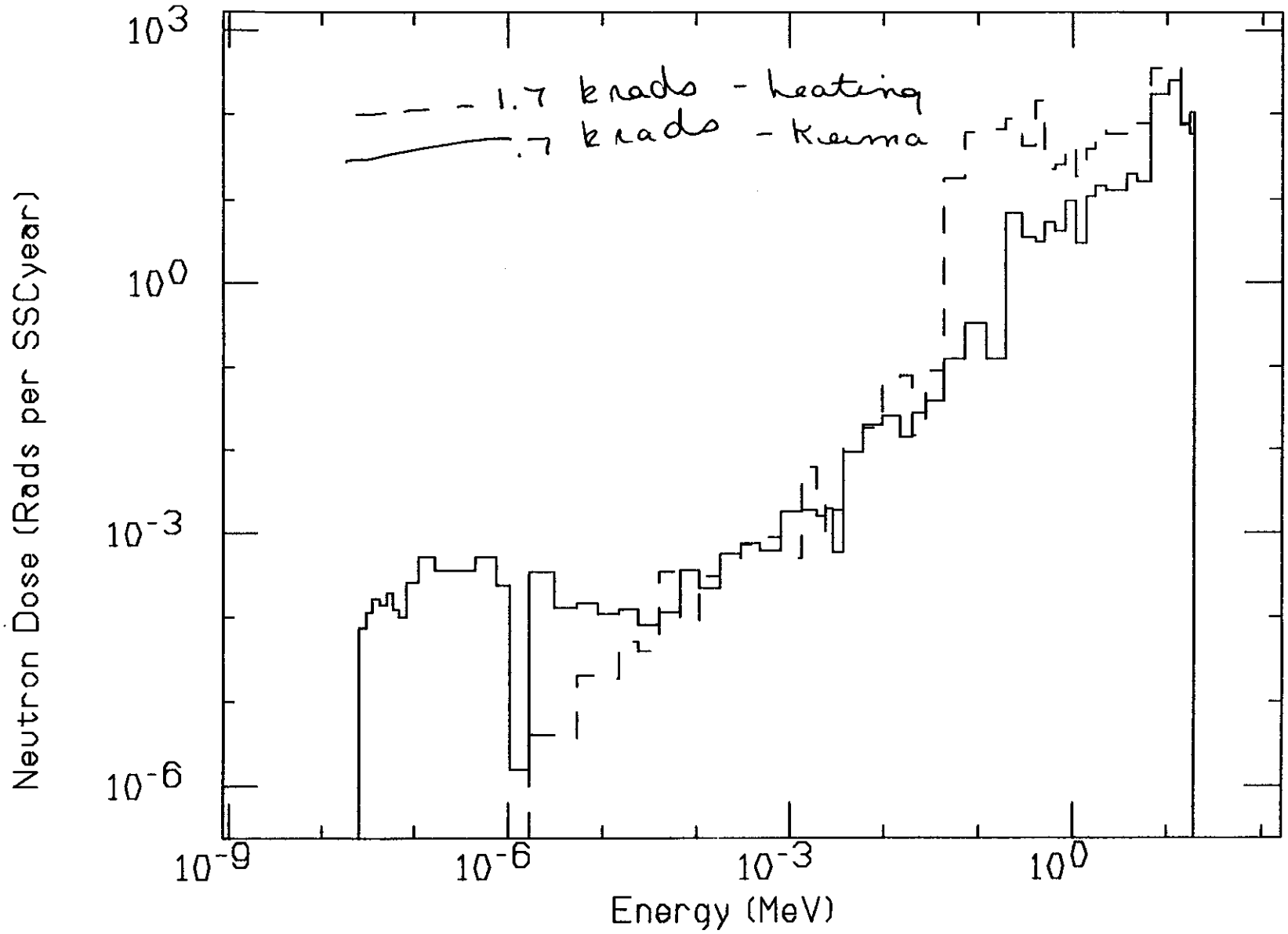

10^4
10^3
10^2
10^1
10^0
10^{-1}
10^{-2}
10^{-3}
Gammas/cc/sec
10^{-2}
10^{-1}
10^0
10^1
FCAL
10^7 sec
6 hours shutdown


10^4
10^3
10^2
10
1
3480
3440
3400
3360
3320
3280
3240
3200
100
90
80
70
60
50
40
30
20
10
colimator


Kerma
displacement Kerma
$\nu(\varepsilon) = 0 \quad \varepsilon < \varepsilon_d$
$1 \quad E_0 < E < 2.5\,\varepsilon_d$
$(.716)\ \frac{.8\,K_0}{2\,\varepsilon_d} \quad \varepsilon > 2.5\,\varepsilon_d$
Rads - cm^2
10^{-8}
10^{-9}
10^{-10}
10^{-11}
10^{-12}
10^{-13}
10^{-14}
10^{-15}
10^{-16}
10^{-9}
10^{-6}
10^{-3}
10^{0}
Incident Neutron Energy (MeV)

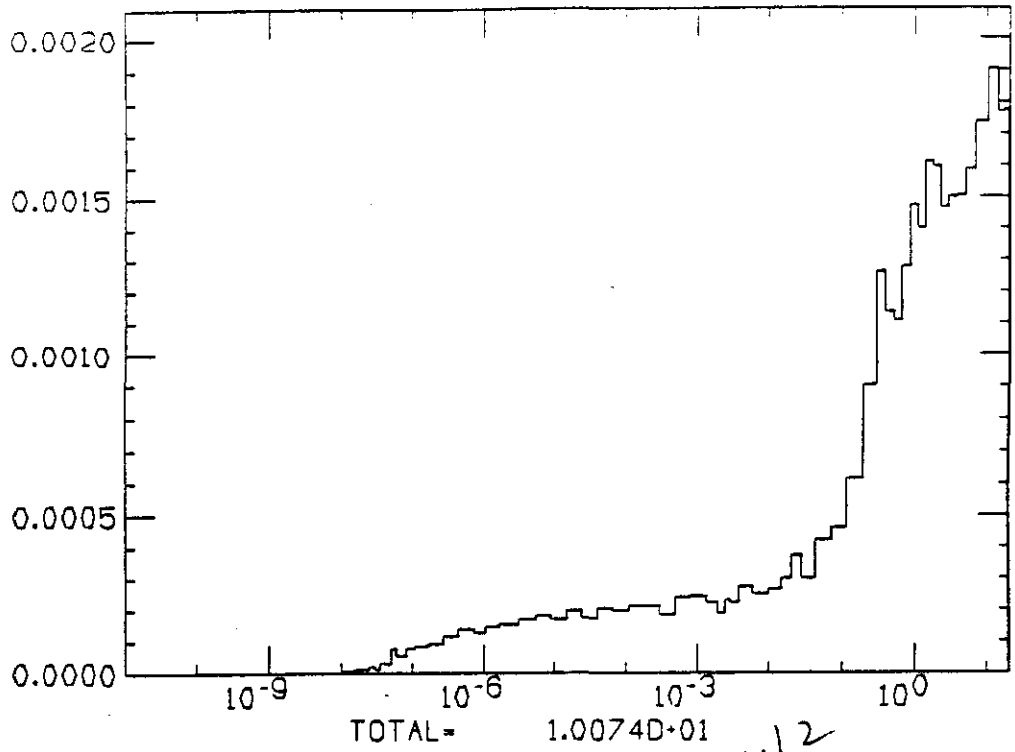

02/03/89
ZAID = 14000.50C
Si - NAT
From ENDF6P3
MT = 301
HEATING
Heating (Number (MeV per collision))
Neutron Energy (MeV)


04/12/93
ZAID = 14000.01P
Si
From MCPLIB
MT = 501
TOTAL
MT = 301
HEATING
Cross Section (barns)
Photon Energy (MeV)
MeV/collision


1.7 krads - heating
.7 krads - Kerma
Neutron Dose (Rads per SSCyear)
Energy (MeV)
10^{3}
10^{0}
10^{-3}
10^{-6}
10^{-9}
10^{-6}
10^{-3}
10^{0}

n spectra in various locations

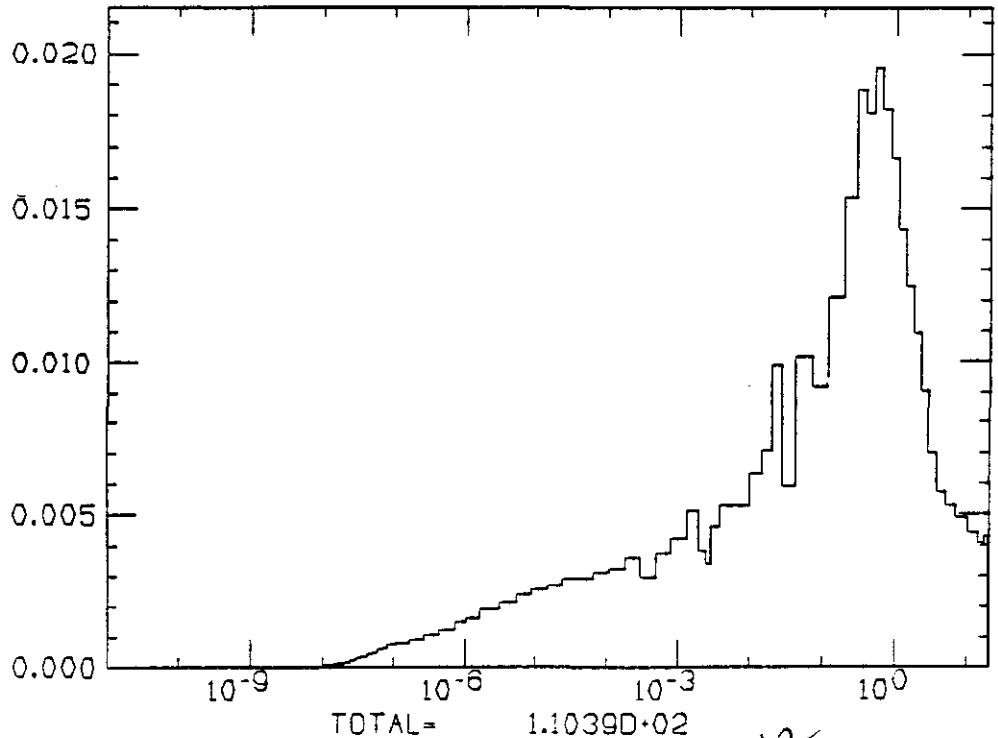
BERYLLIUM BEAMPIPE



10^{12}

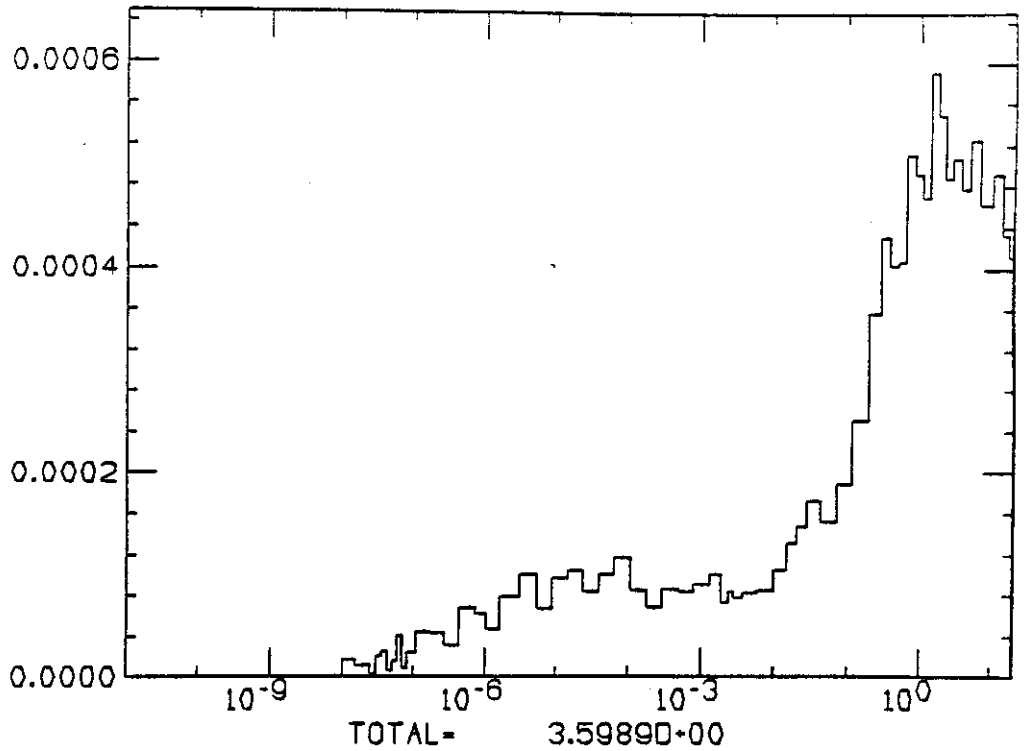
total fluence in 10^{12} n/cm²/SSCY

LARGE DIAMETER BEAMPIPE

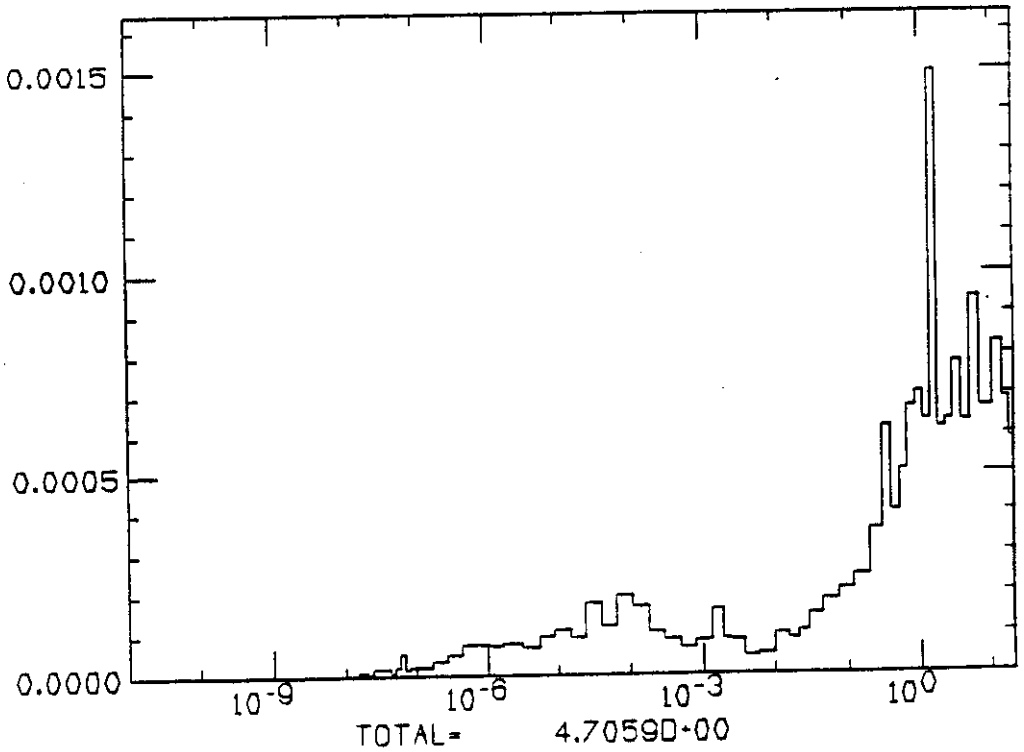


10^{12}

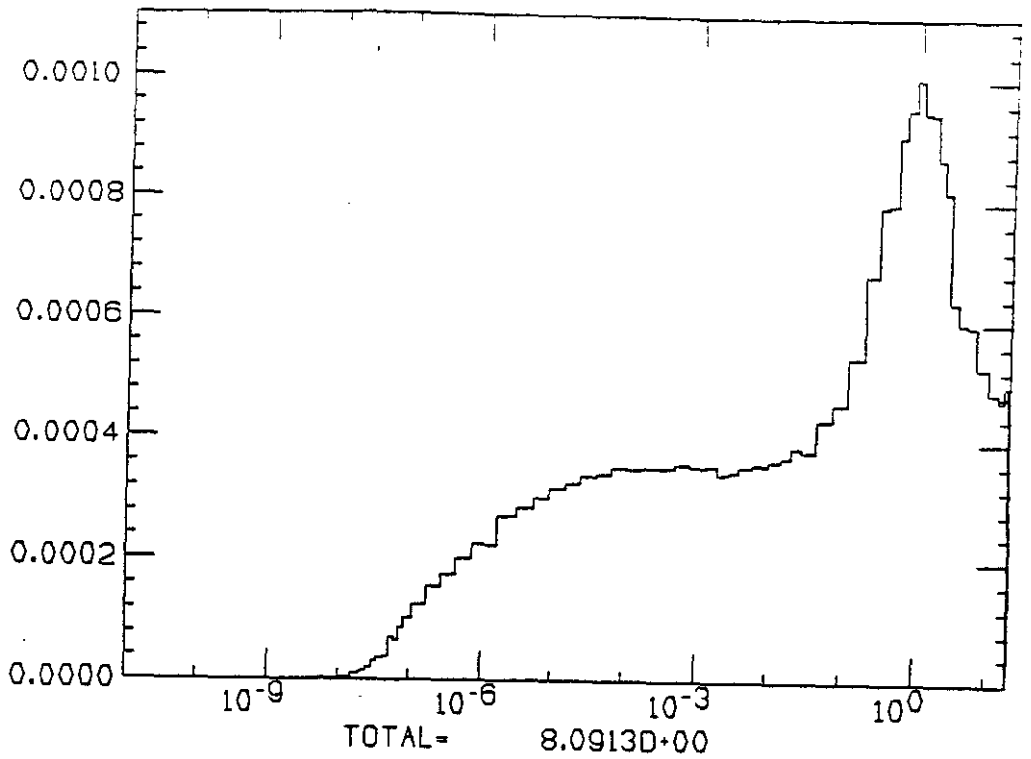
DISK SILICON



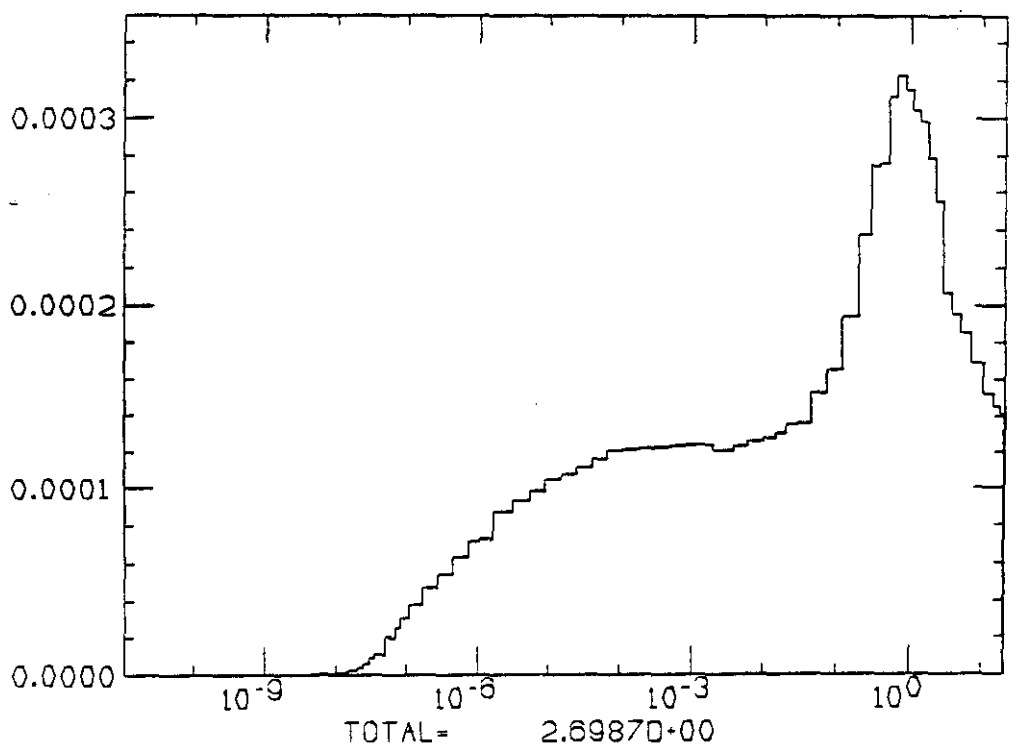
BARREL SILICON



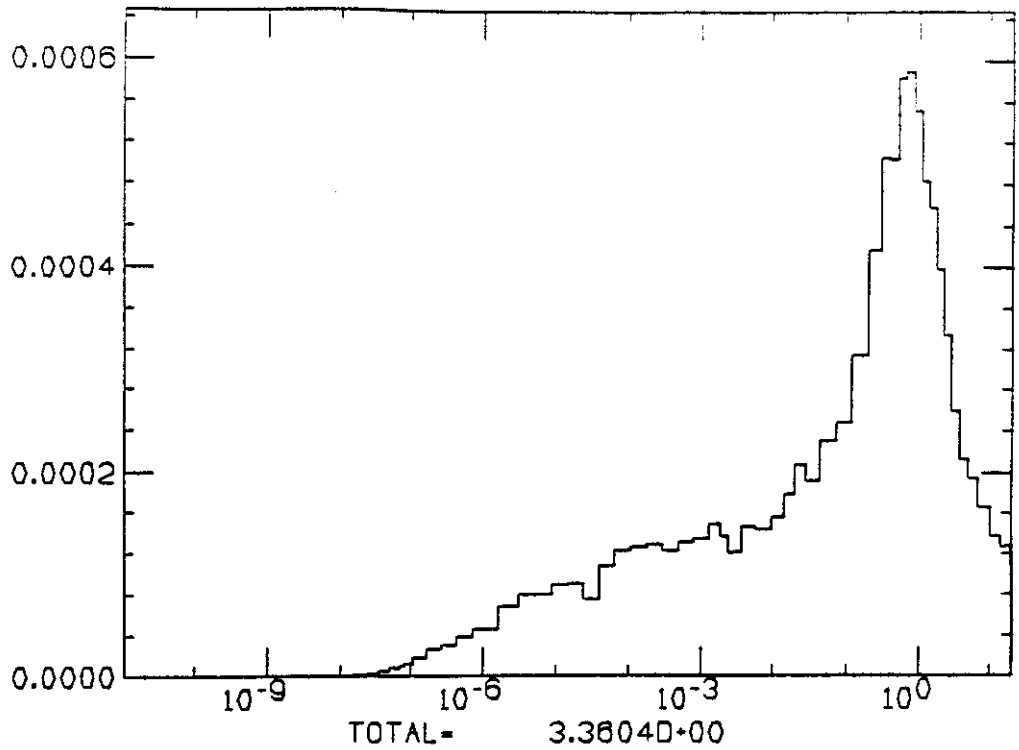
ENDCAP BORATED POLY



BARREL BORATED POLY



BARREL CRYOSTAT 1



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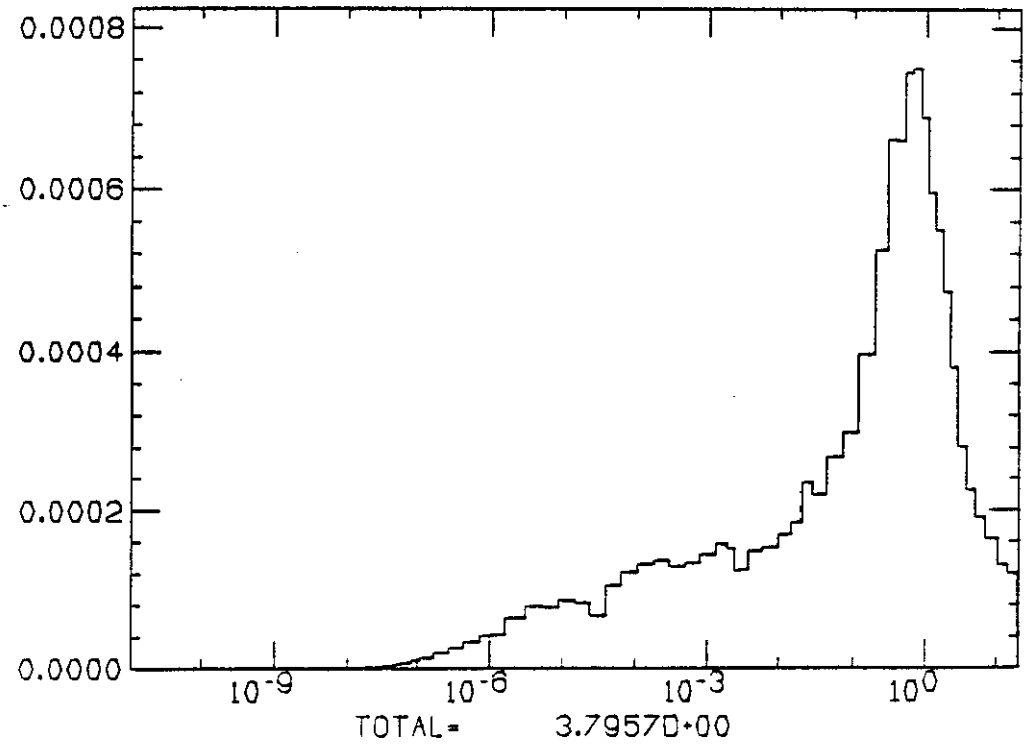
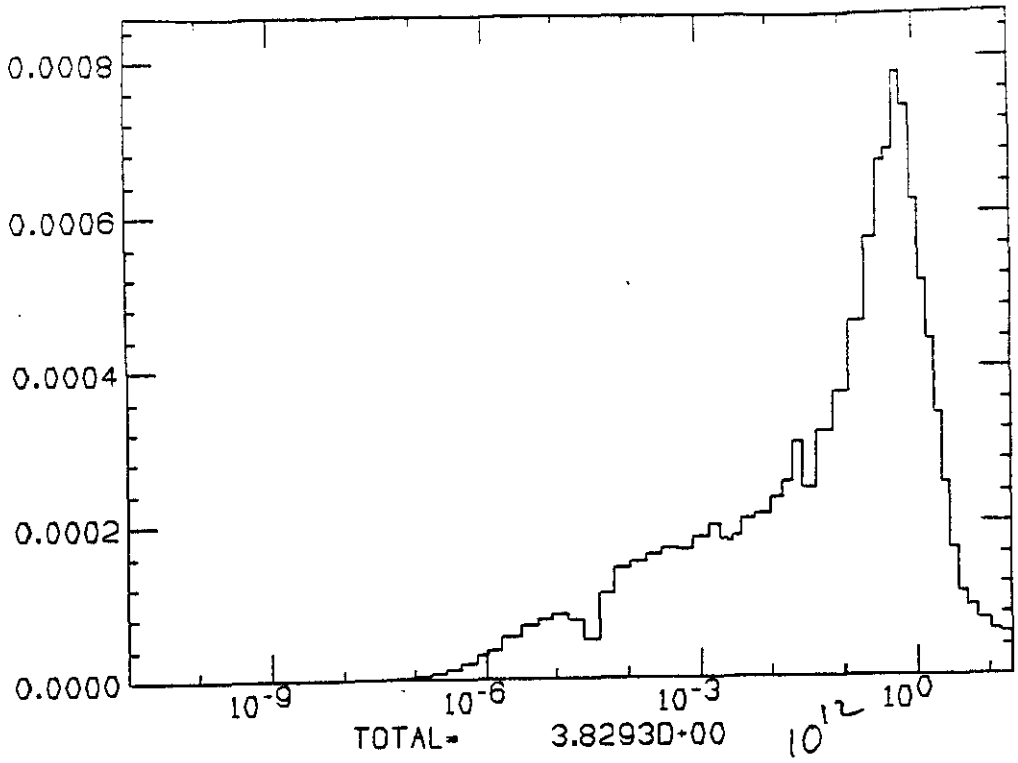
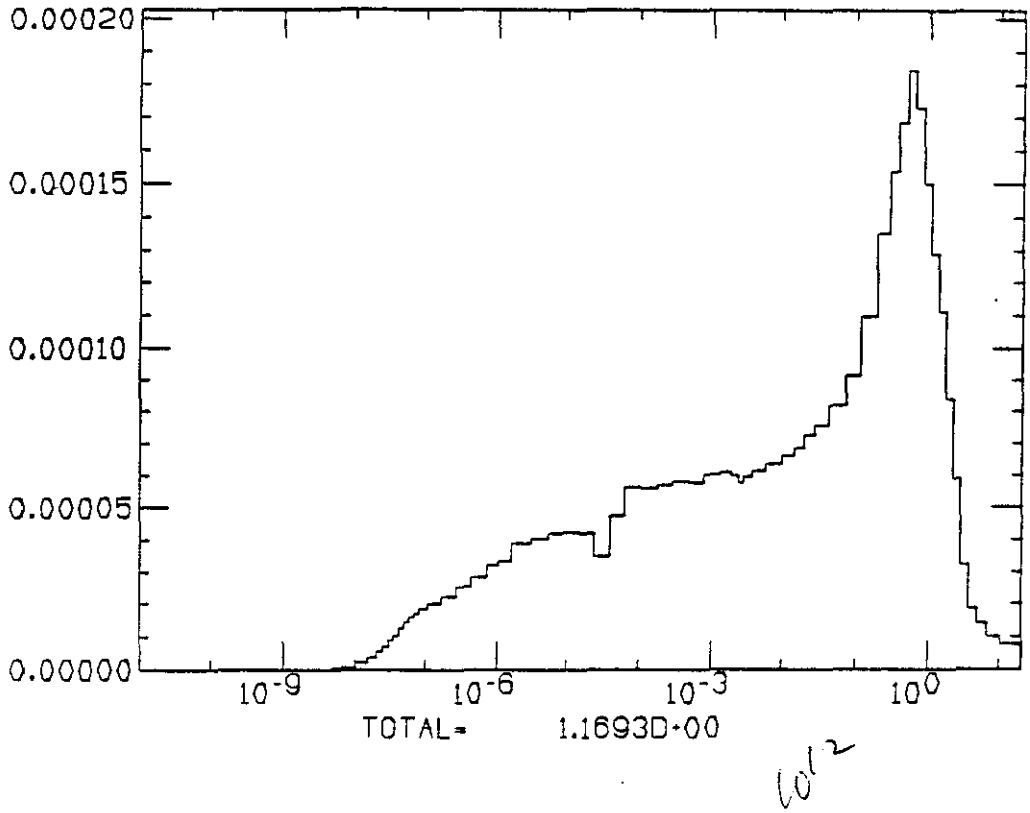


BARREL ELECTROMAGNETIC



BARREL HADRONIC 1



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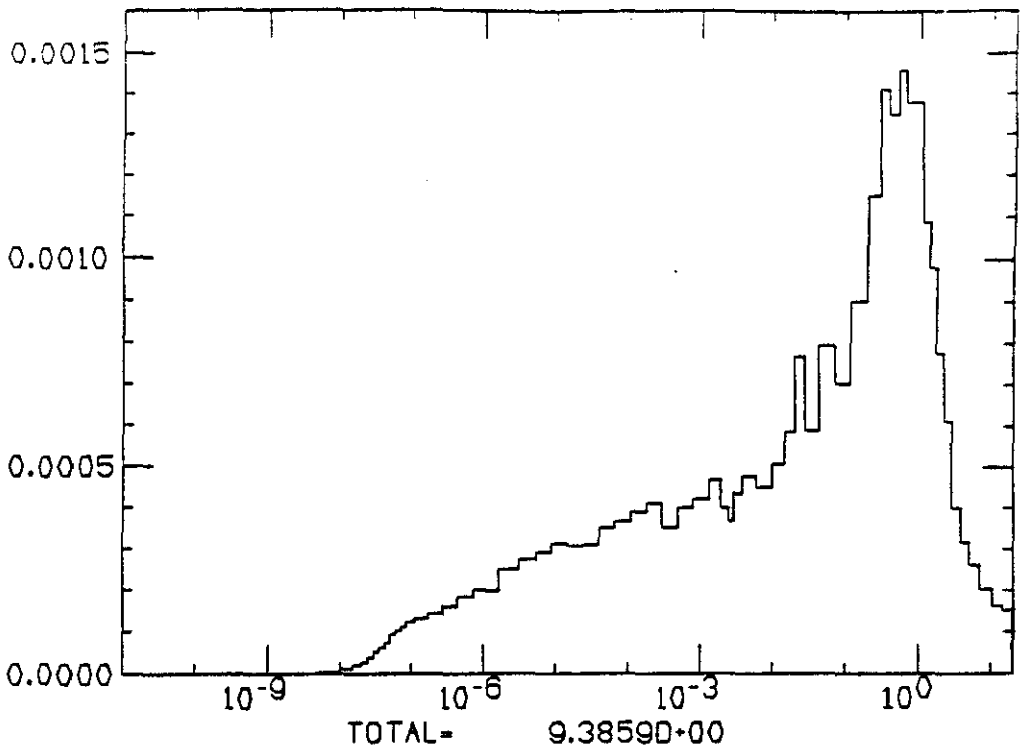

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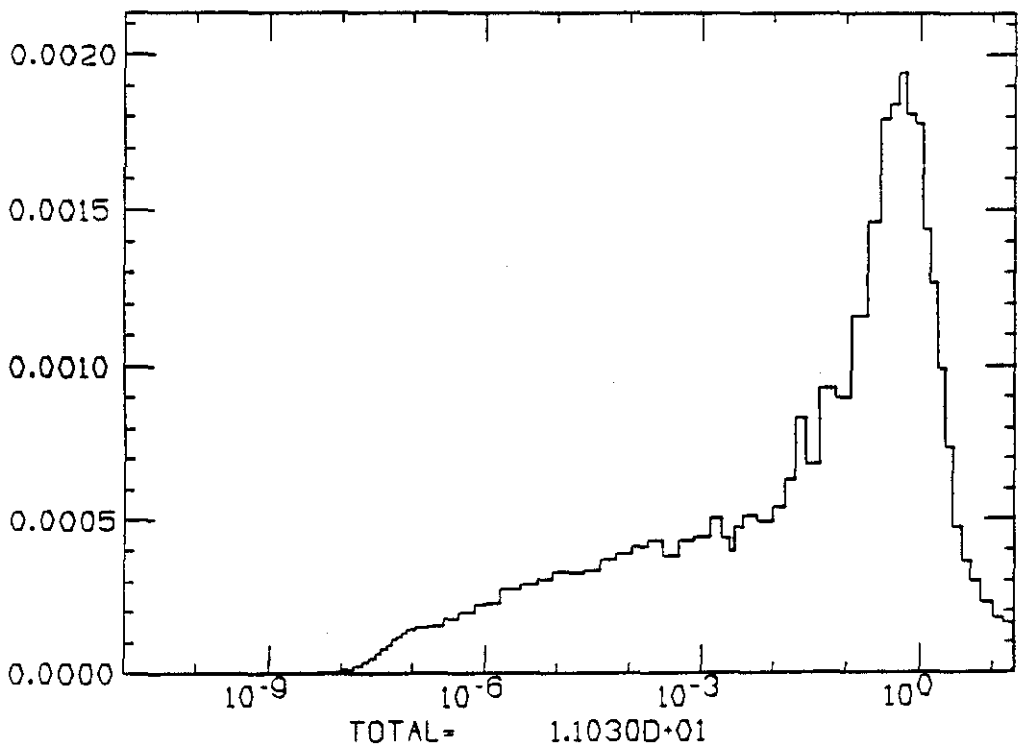

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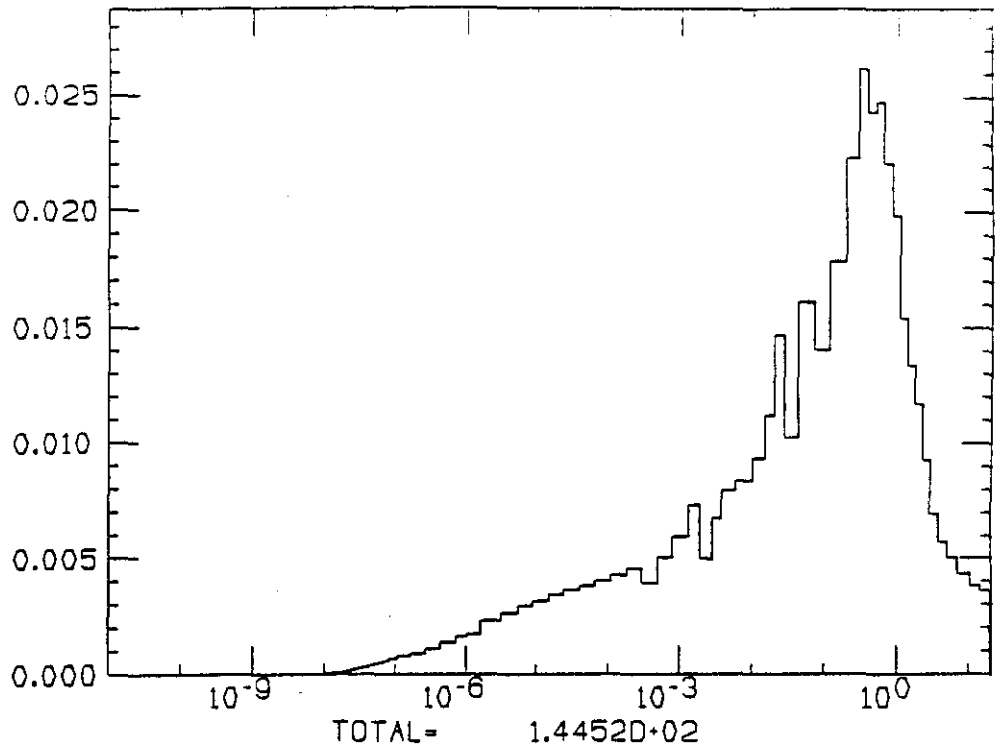

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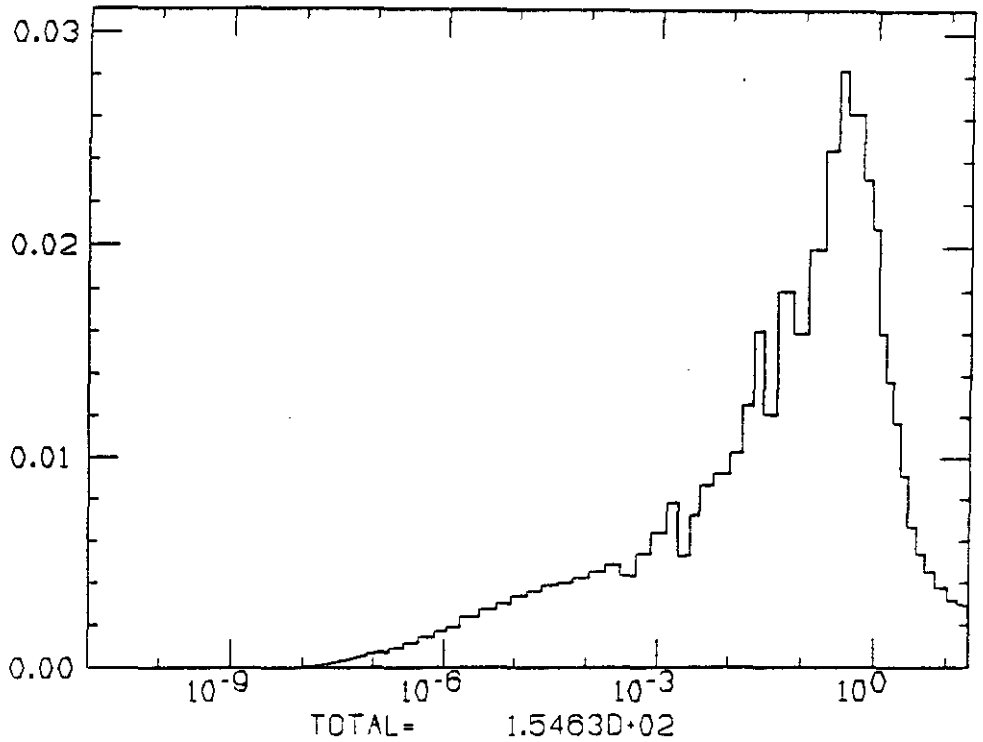

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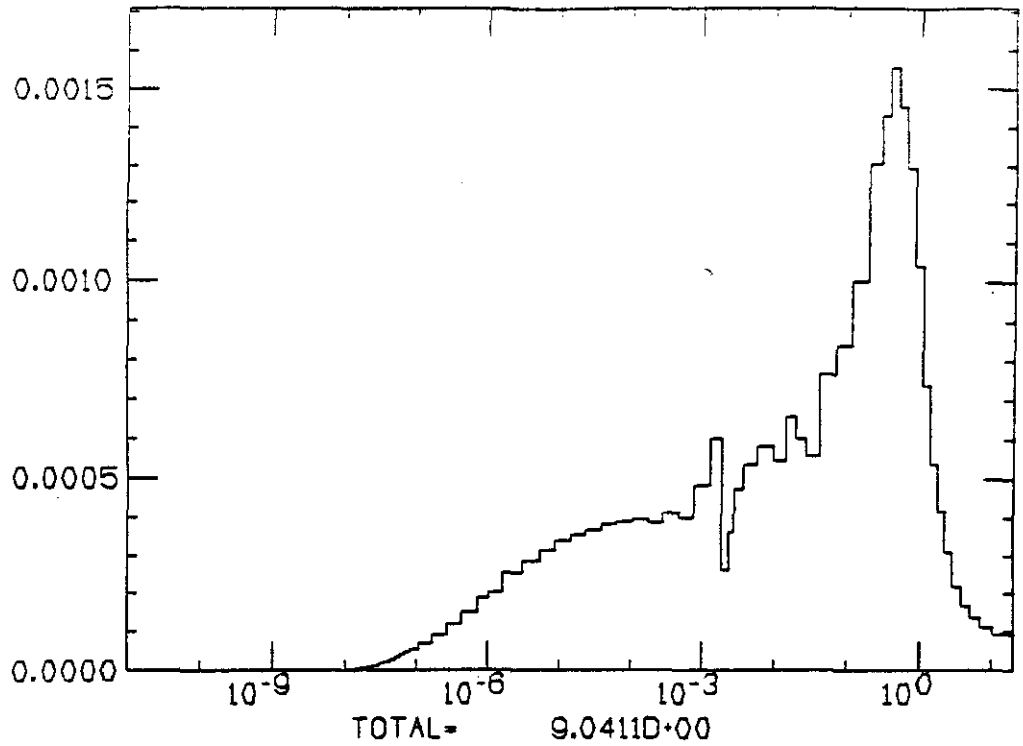

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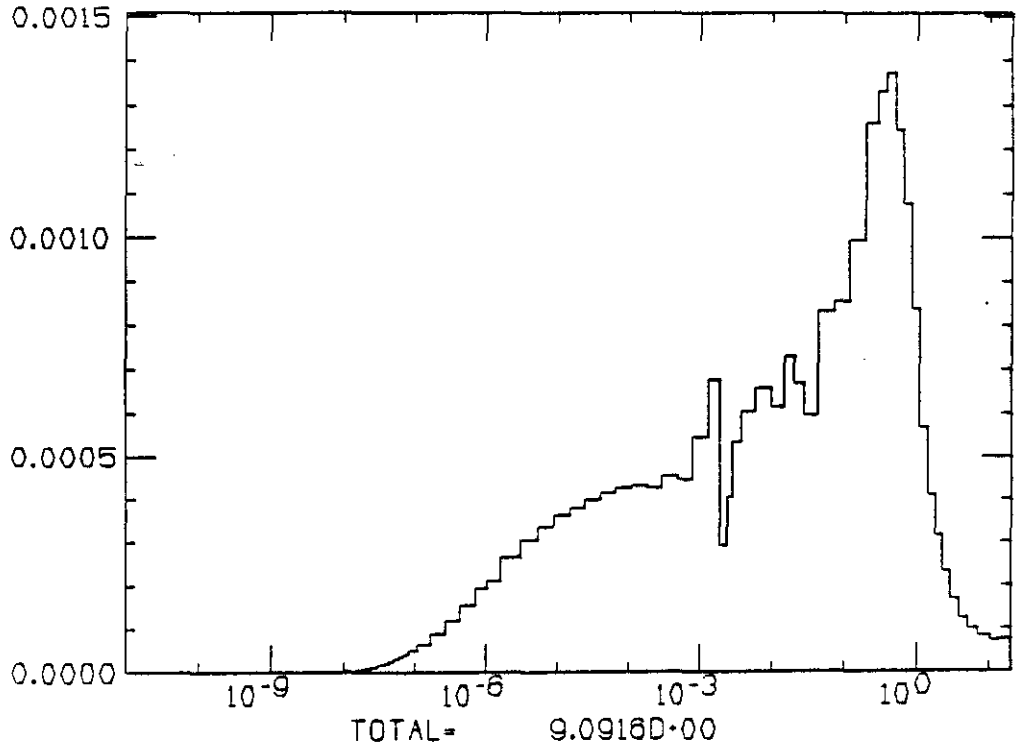
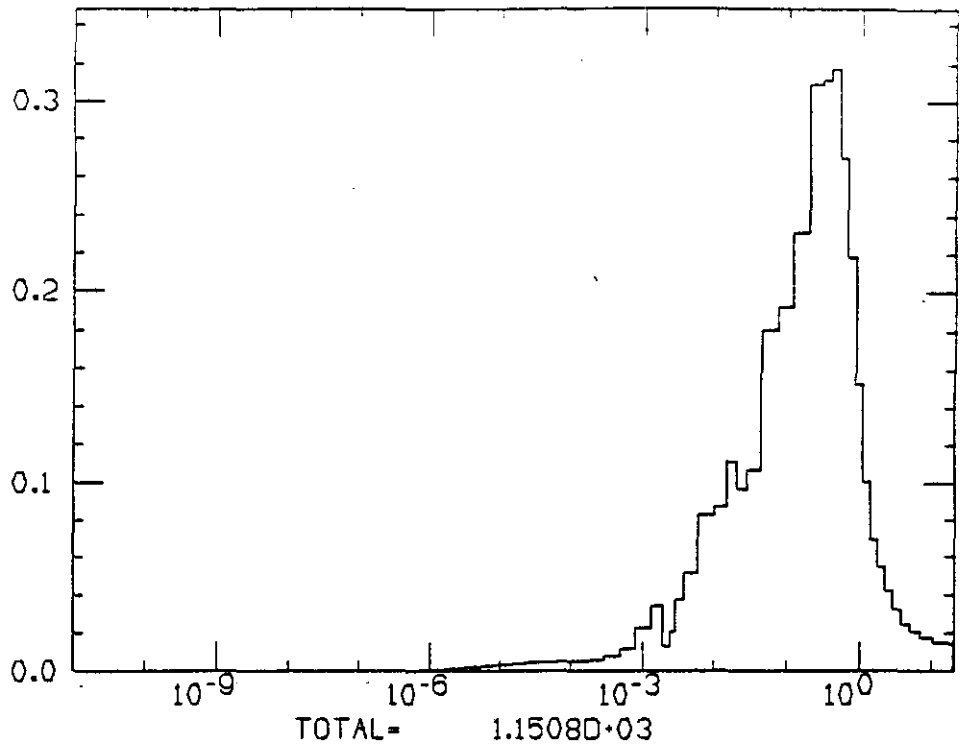
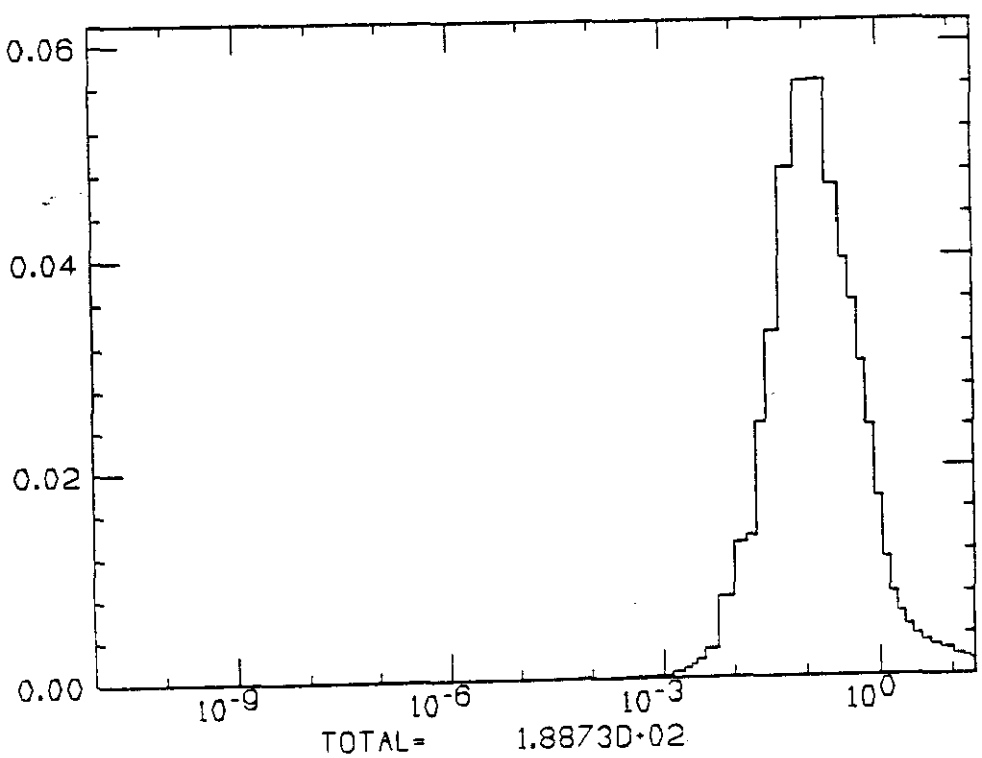


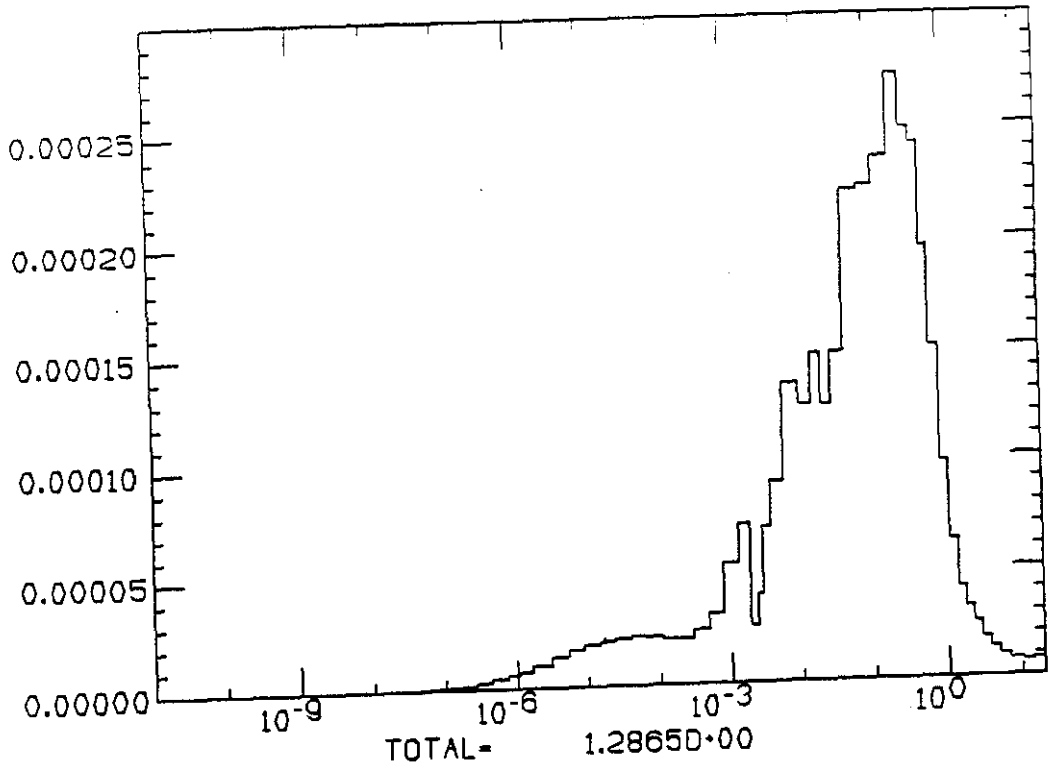
FCAL EM


0.3
0.2
0.1
0.0
10^{-9}
10^{-6}
10^{-3}
10^{0}
TOTAL= 1.1508D+03

FCAL


0.06
0.04
0.02
0.00
10^{-9}
10^{-6}
10^{-3}
10^{0}
TOTAL= 1.8873D+02

PASSIVE ABSORBER 1



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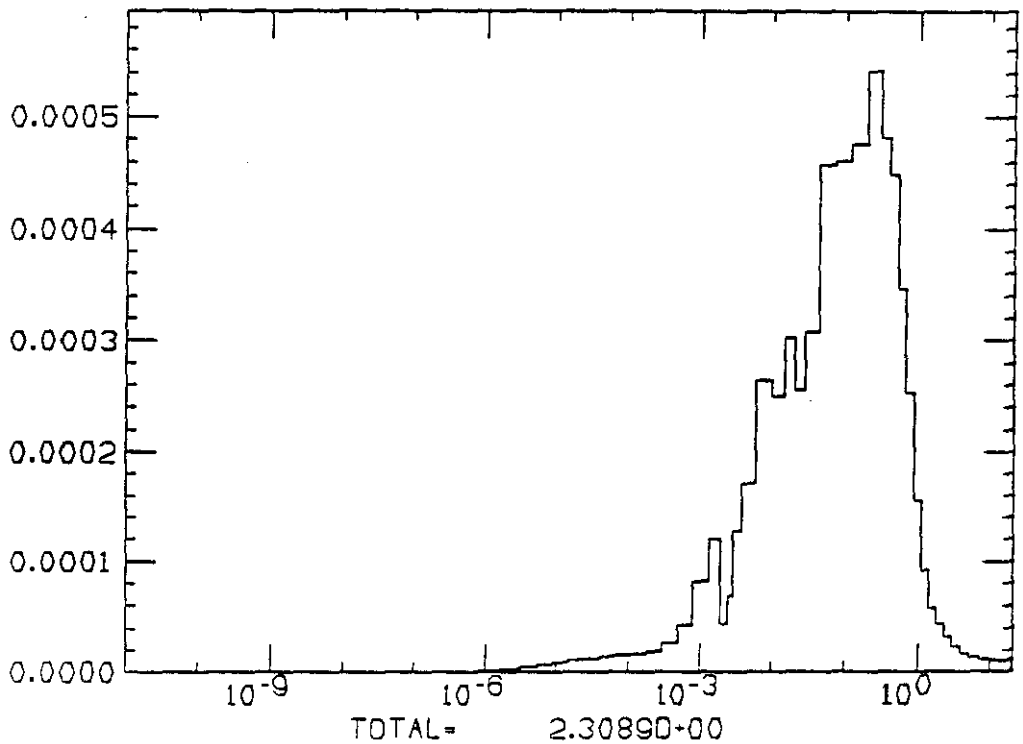
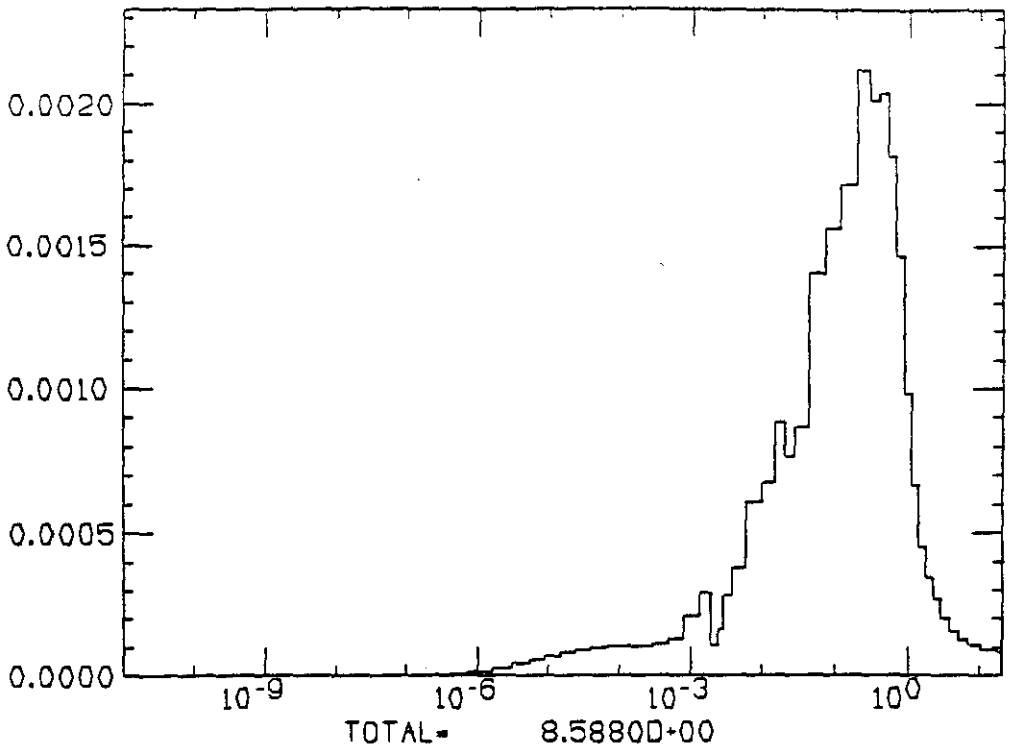
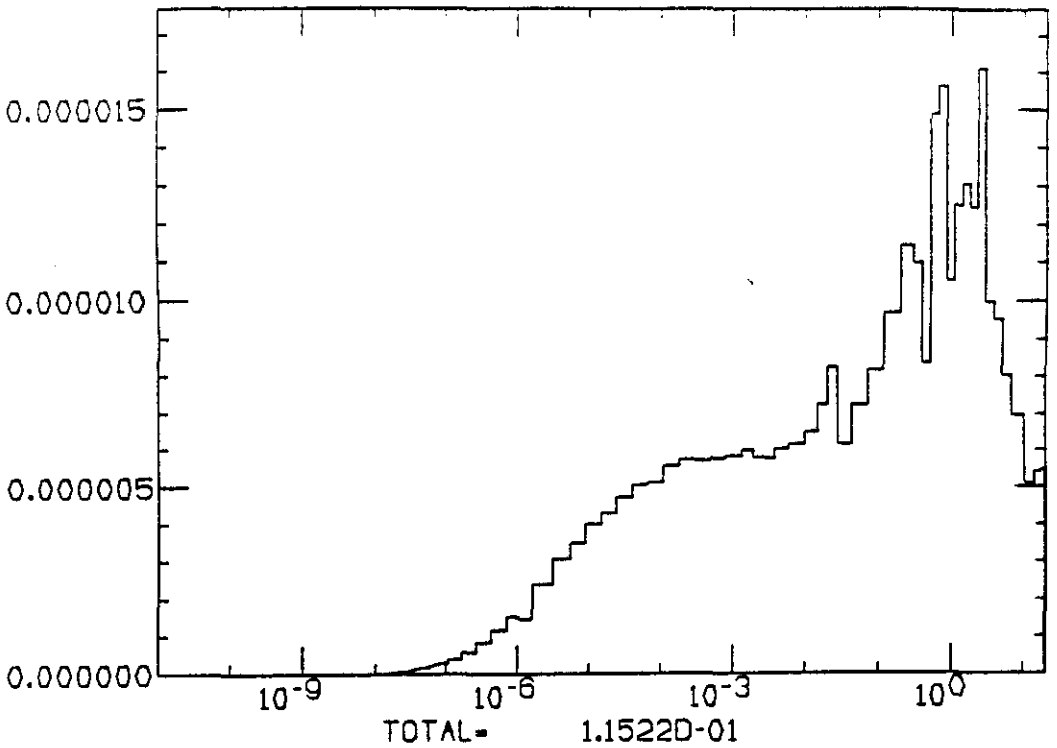


PASSIVE ABSORBER 3



BARIUM CONCRETE CONE



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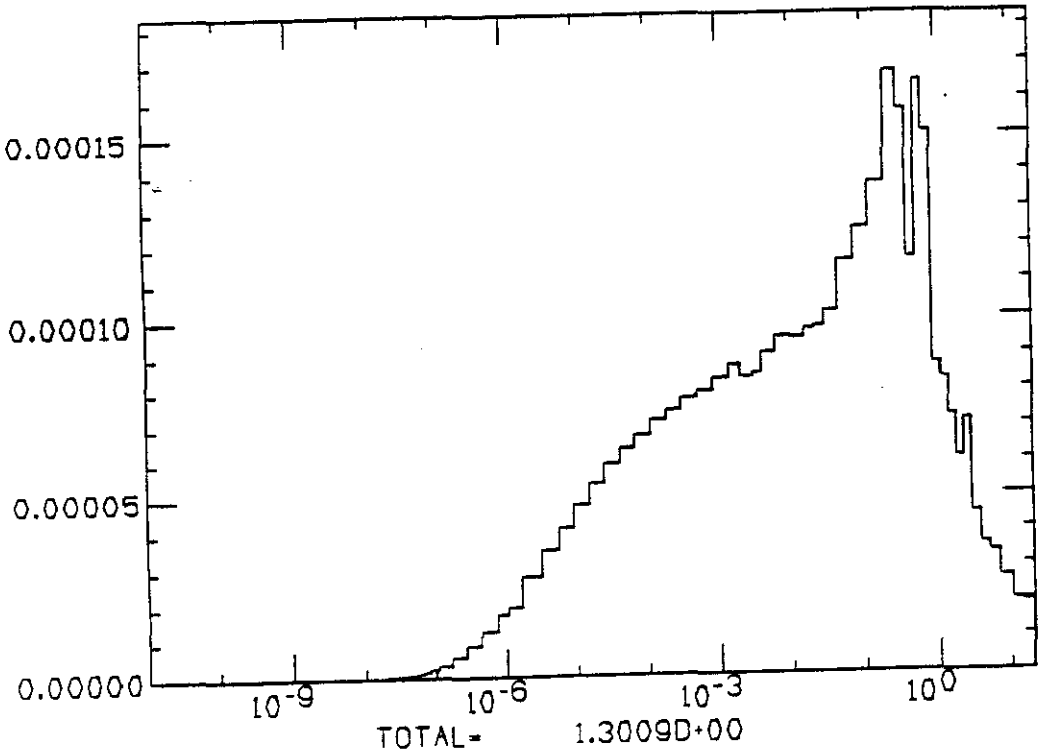
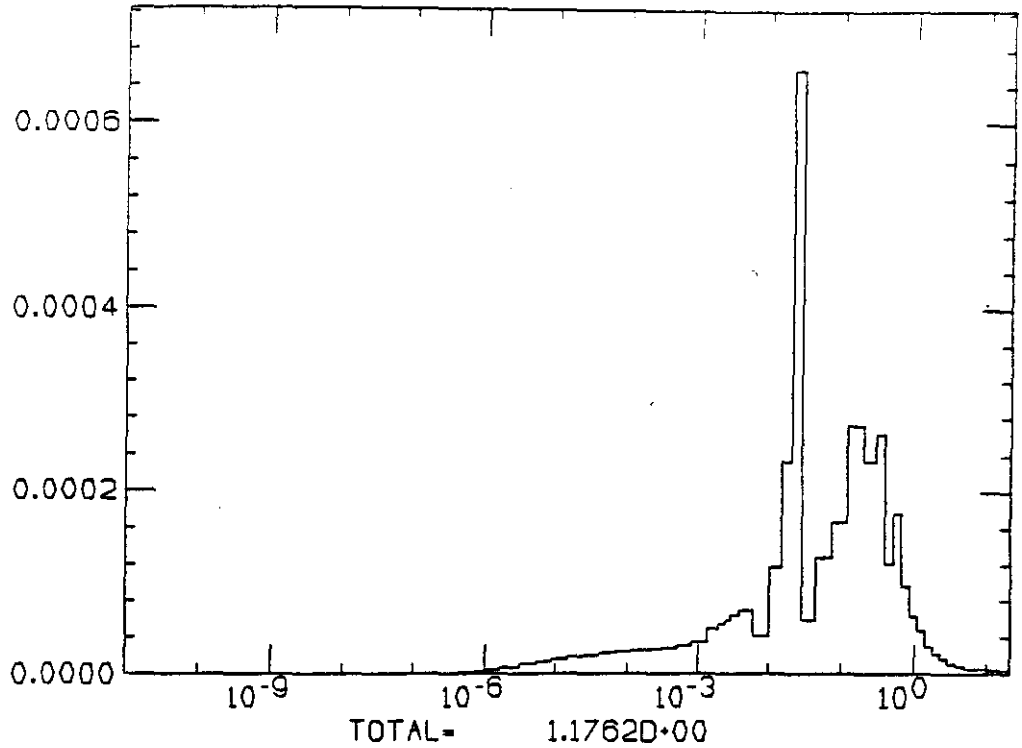
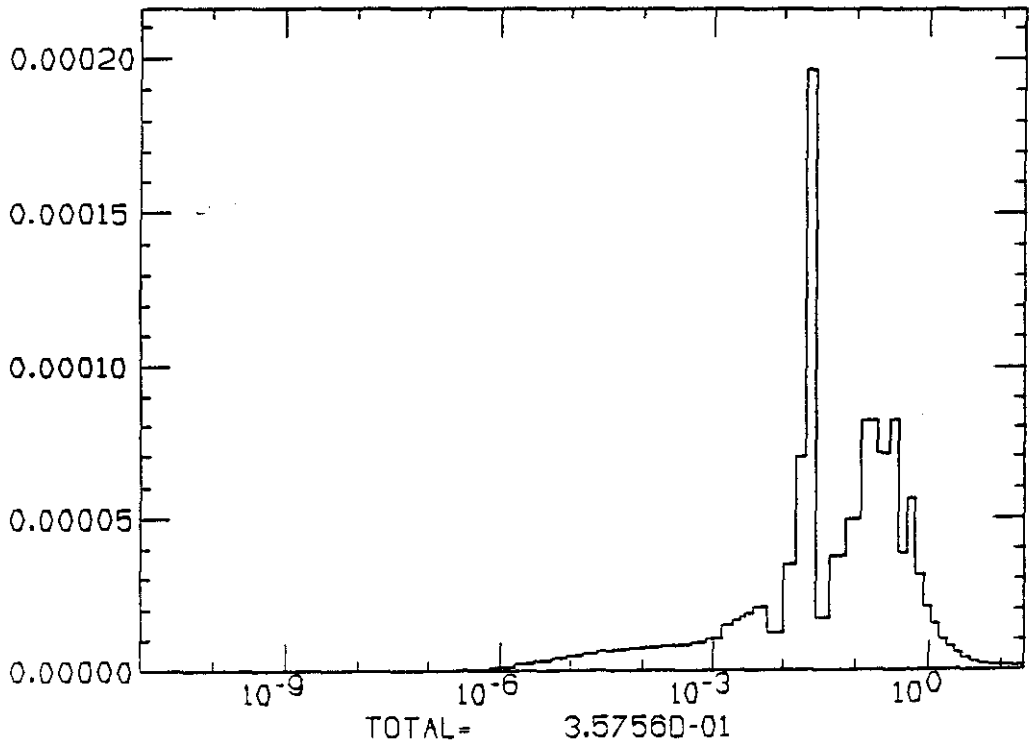


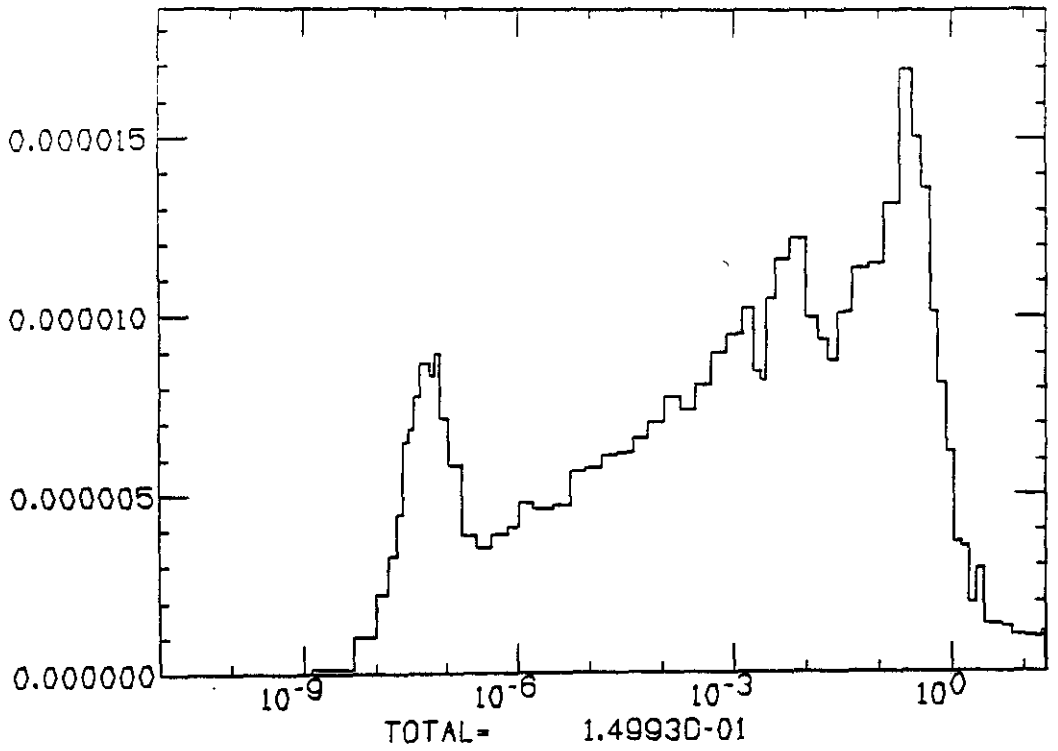
FIELD SHAPER 1



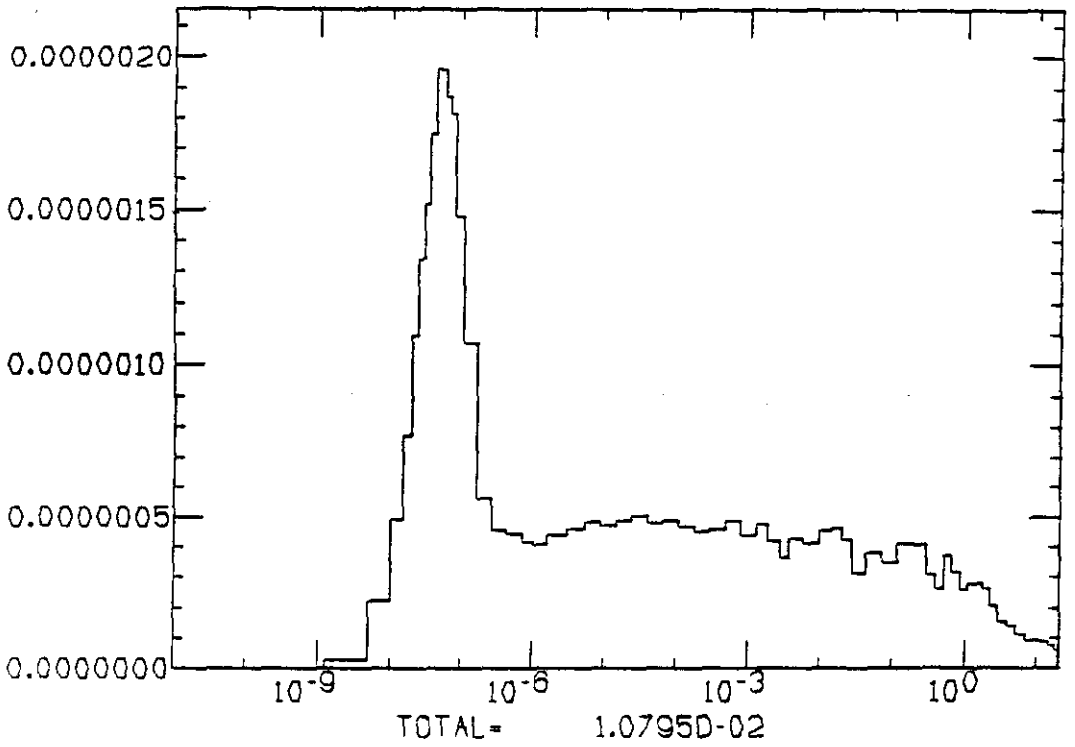
FIELD SHAPER 2



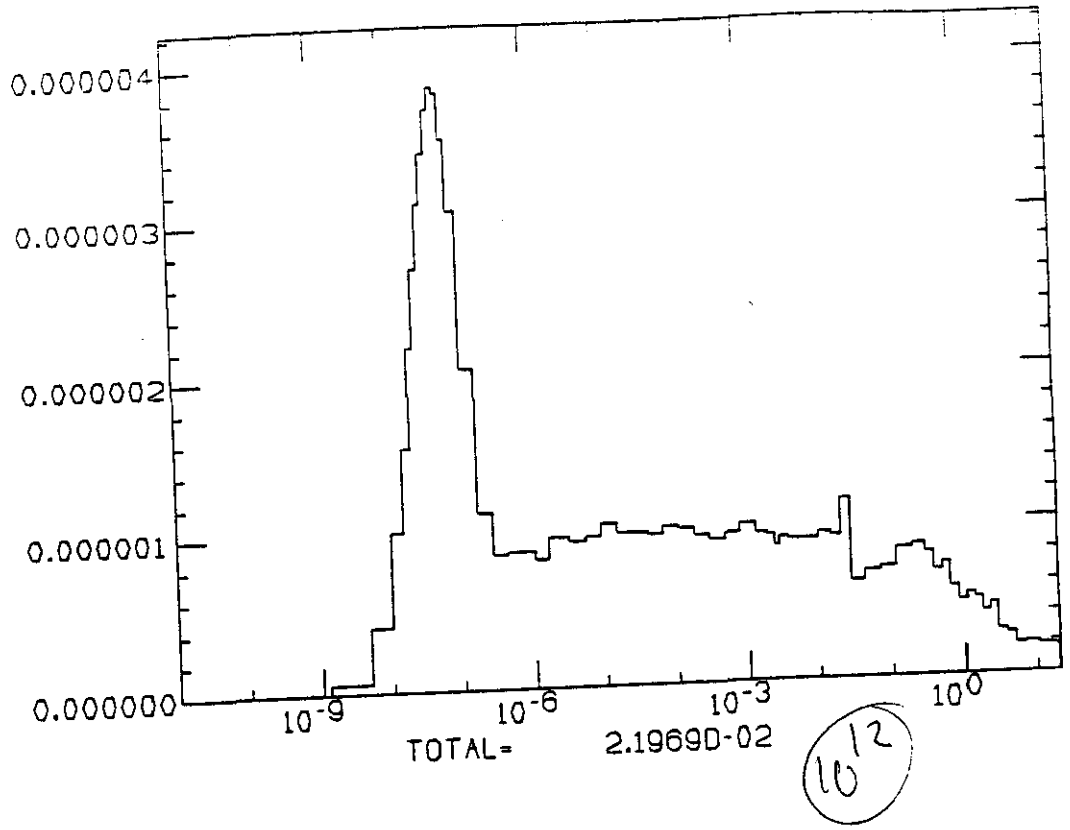
FORWARD CHAMBER 1



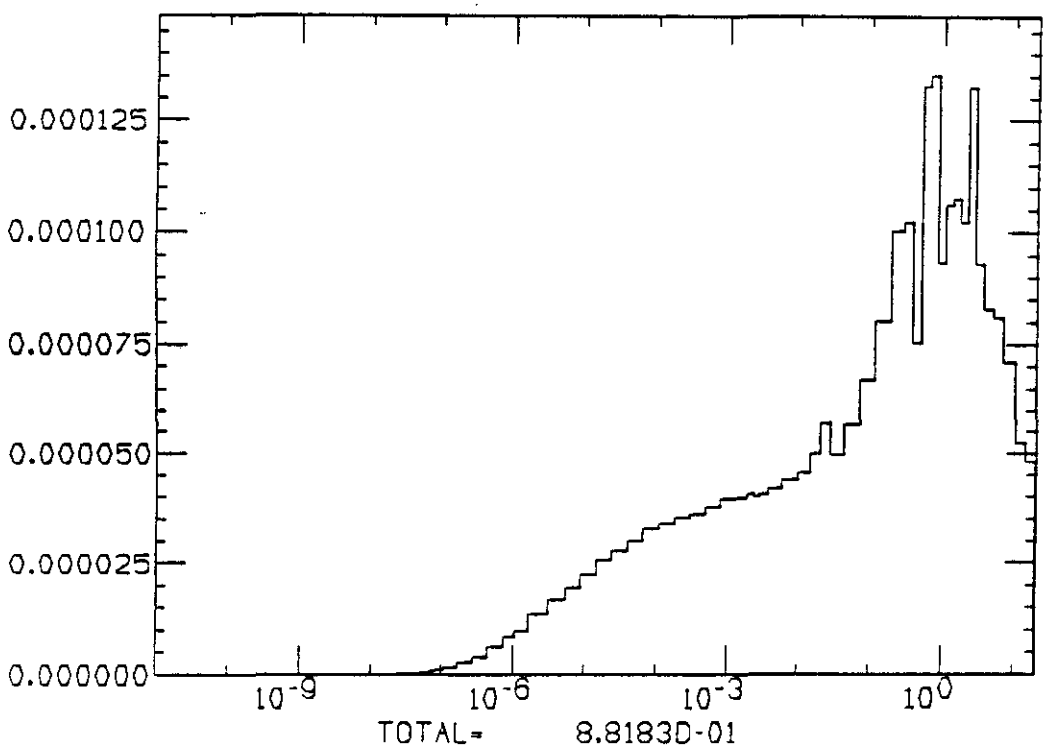
FORWARD CHAMBER 12



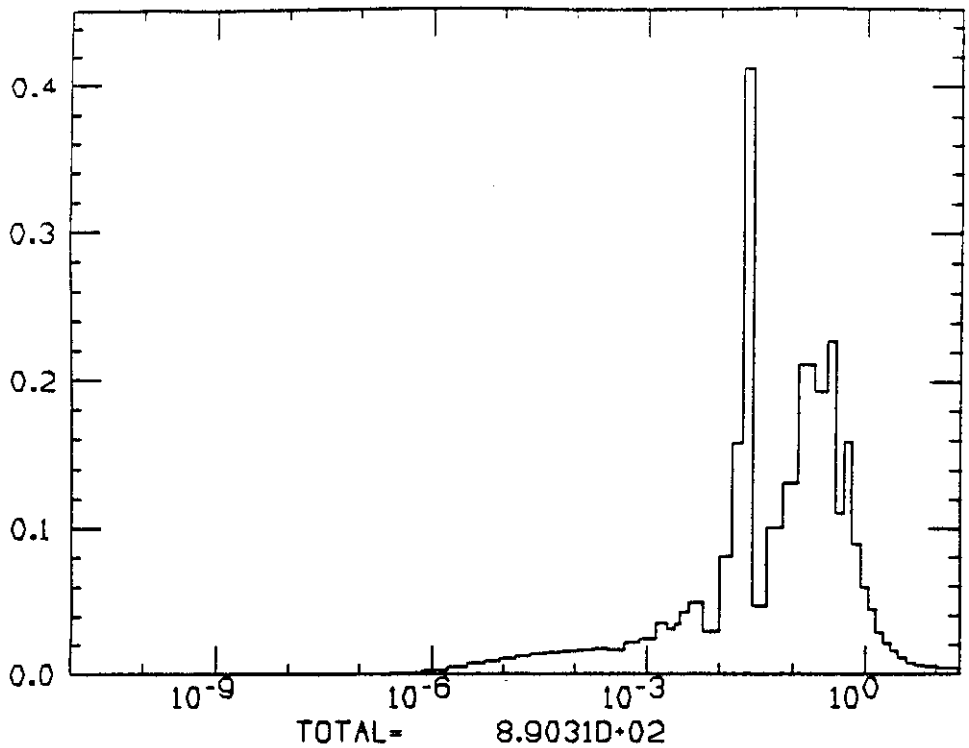
BARREL CHAMBER 1



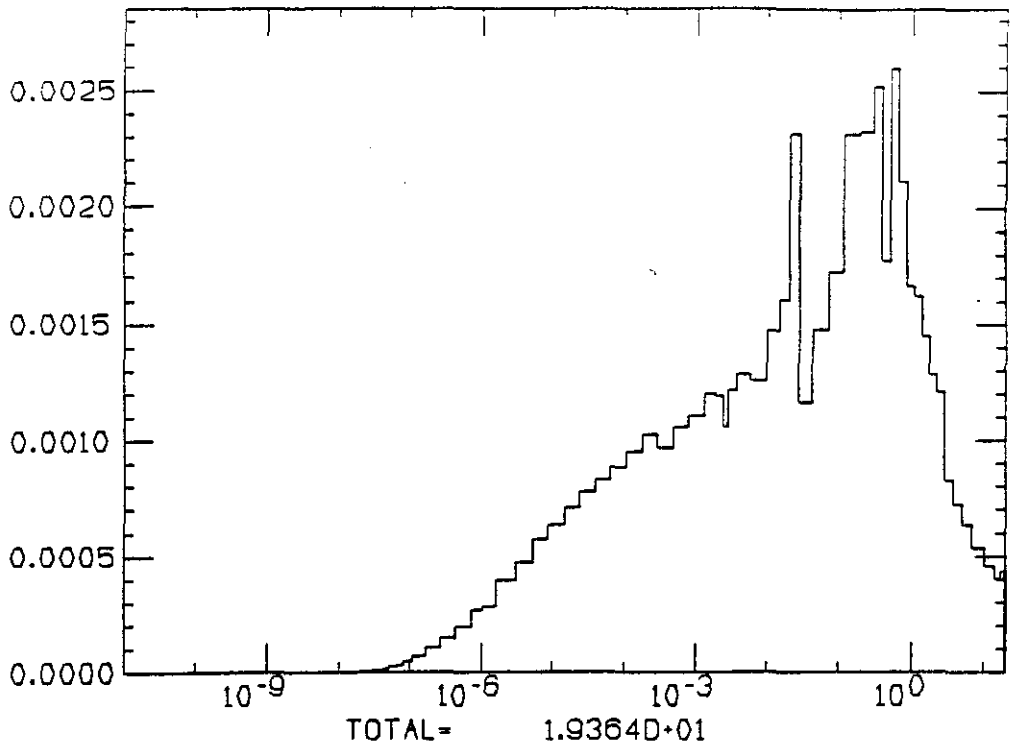
BARIUM CONCRETE TRAP



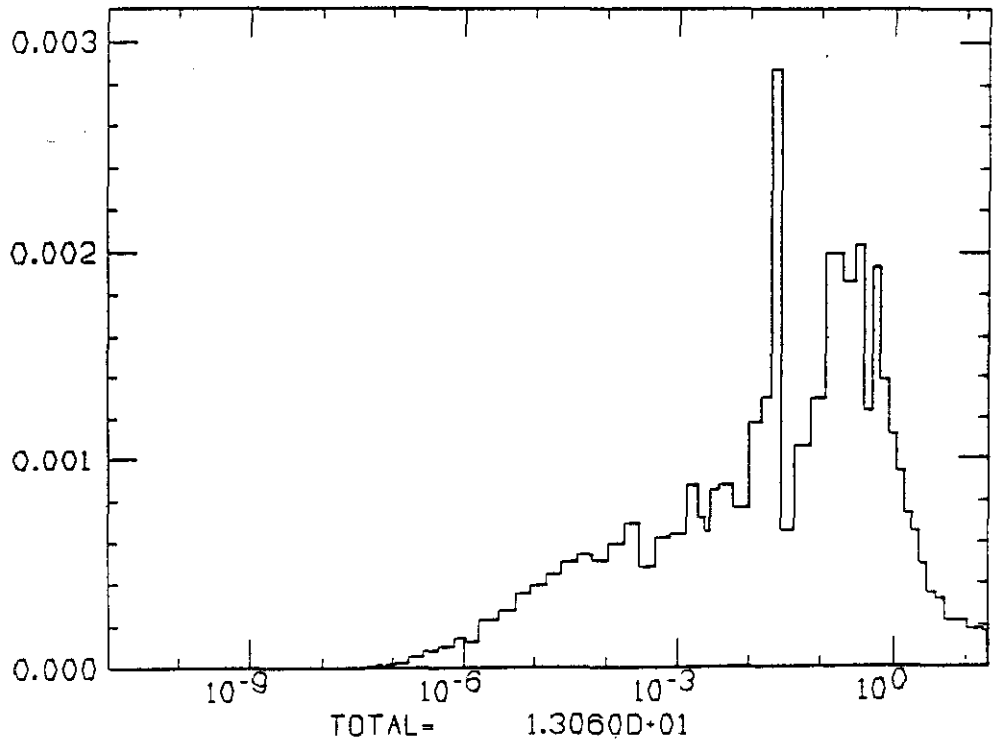
COLIMATOR



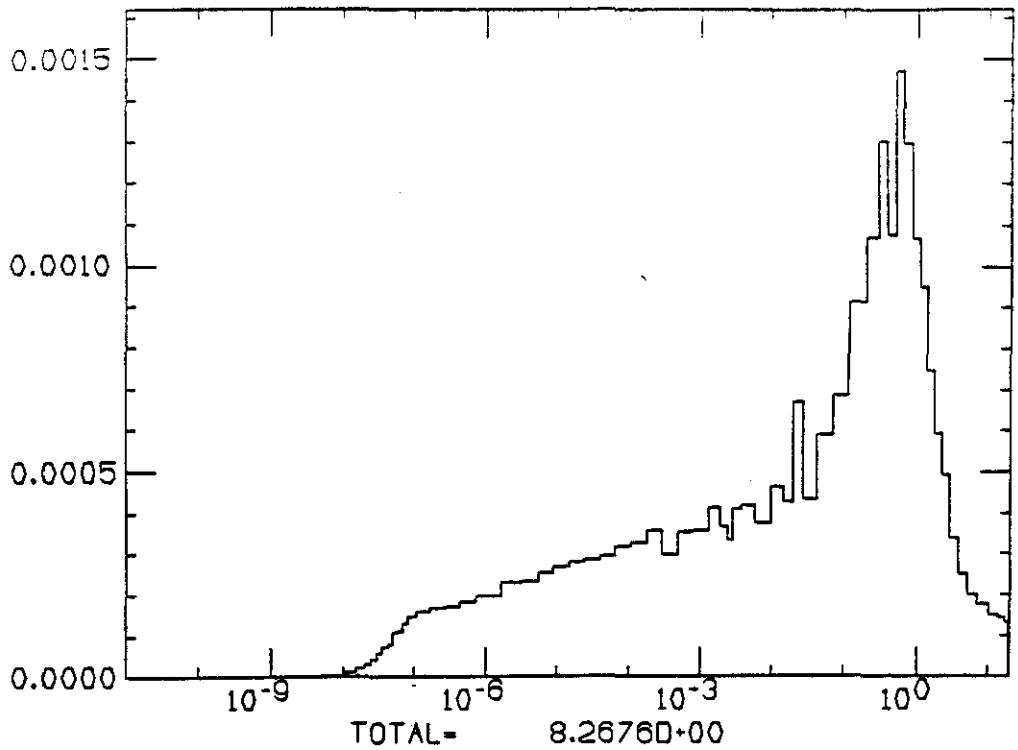
QUAD 1 ENDPIECE



QUAD ENDPIECE CRYOSTAT



QUAD 1 POST 1 INSULATION



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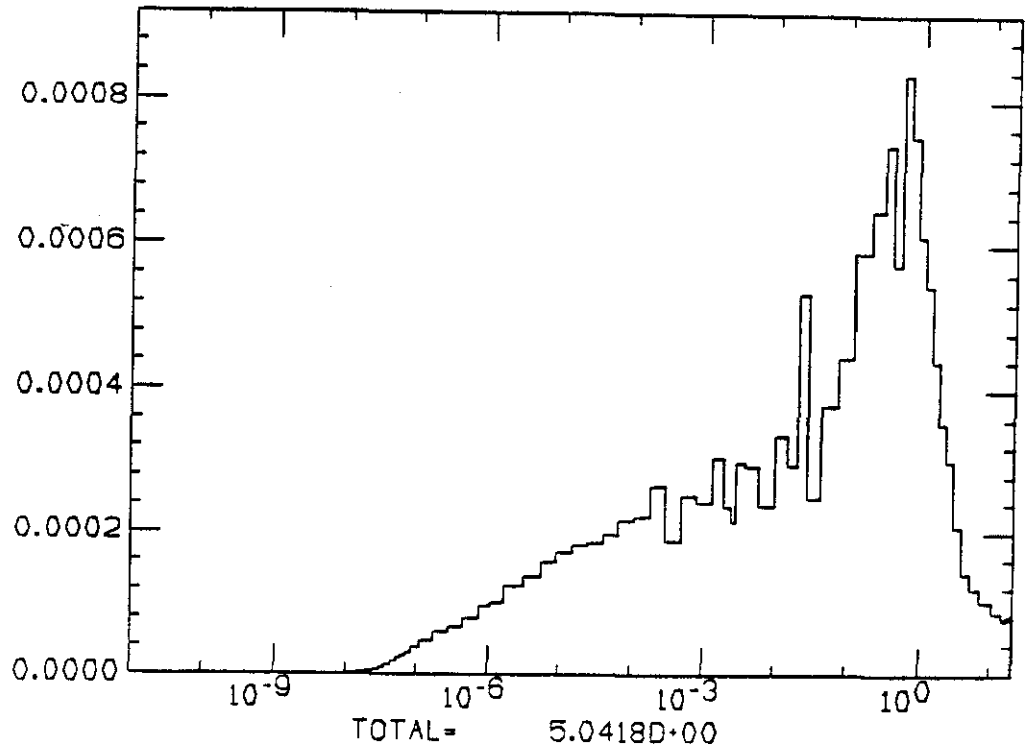

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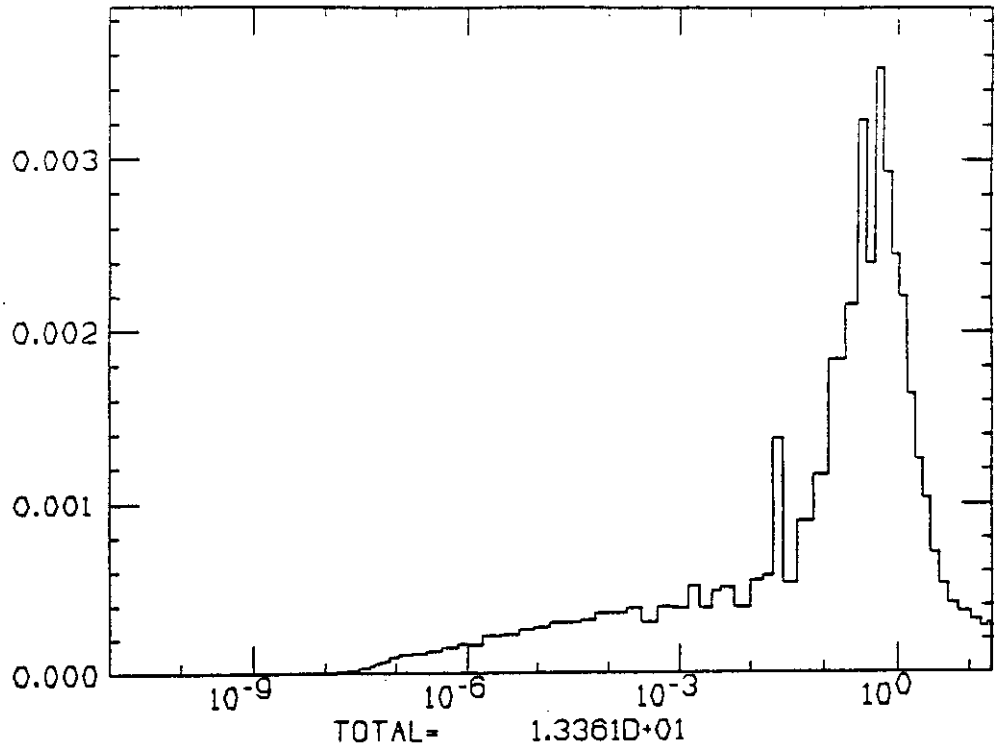

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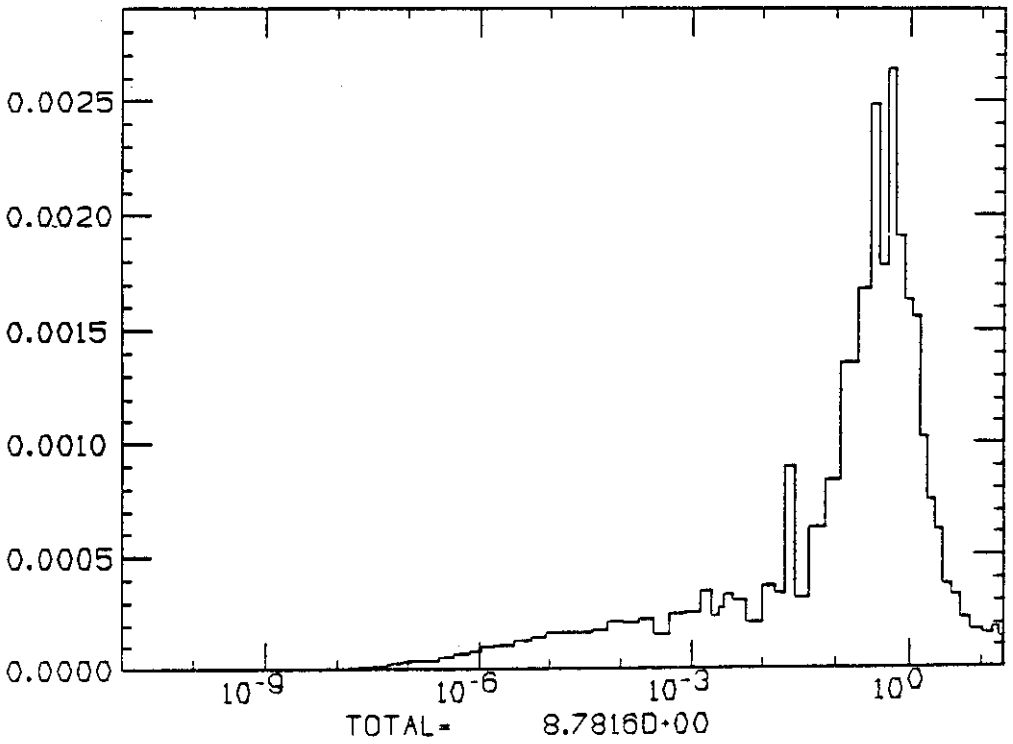

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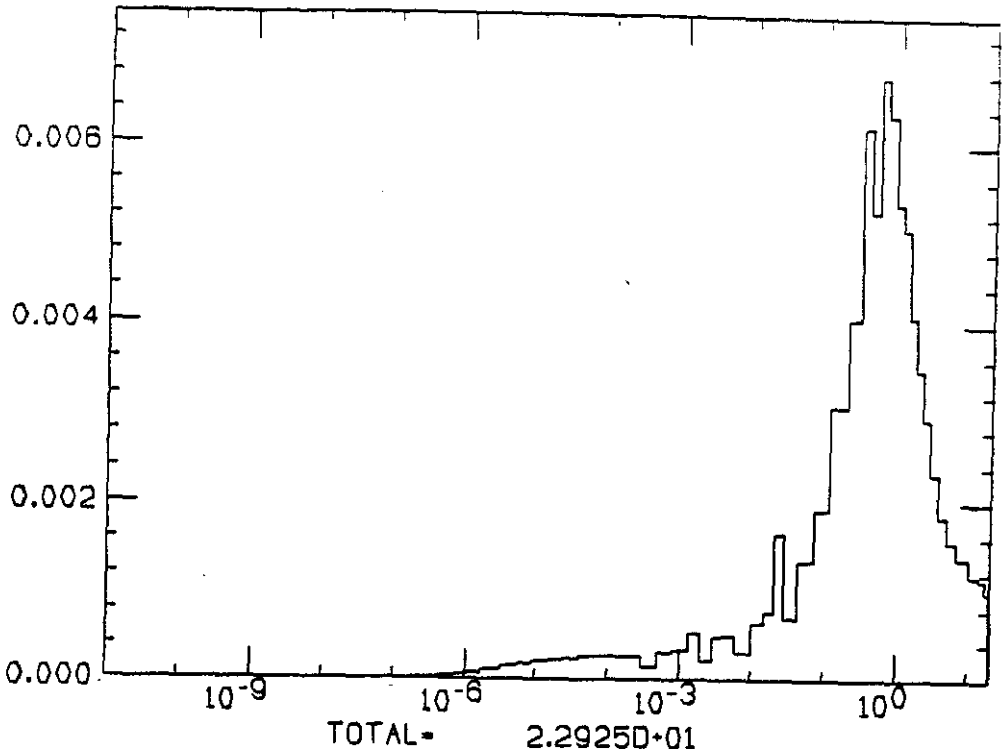

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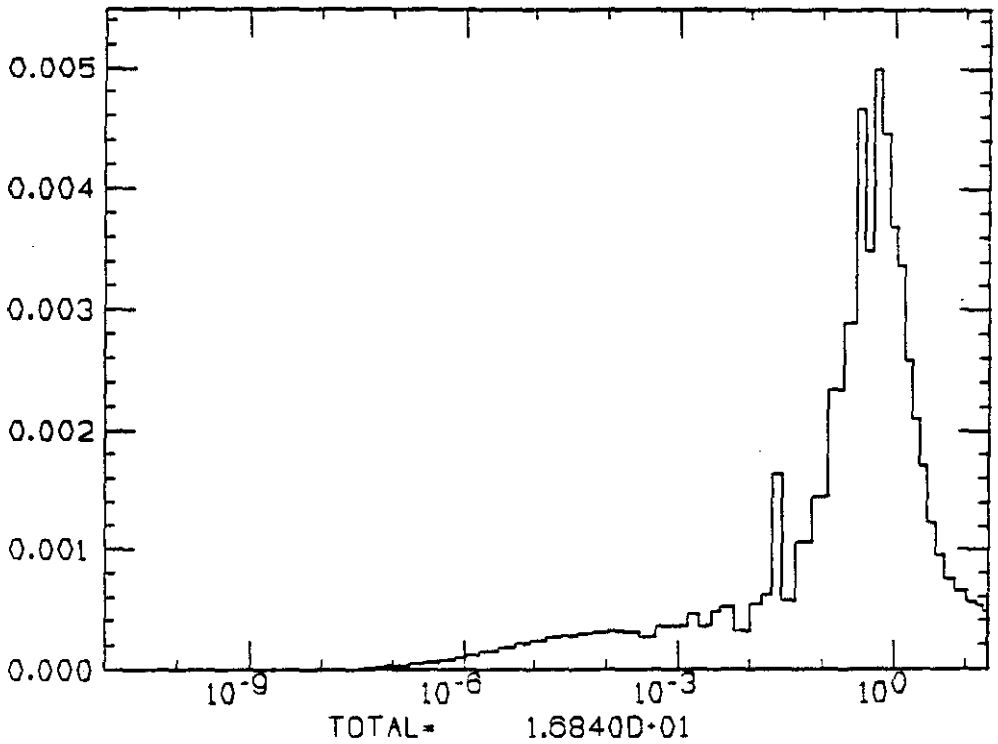
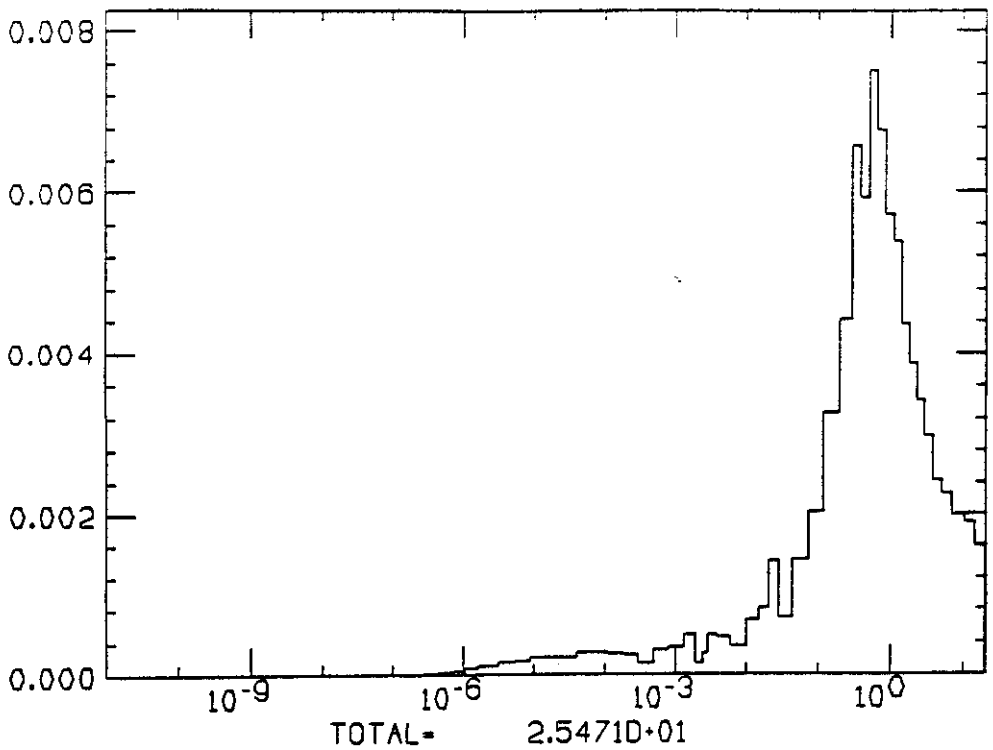
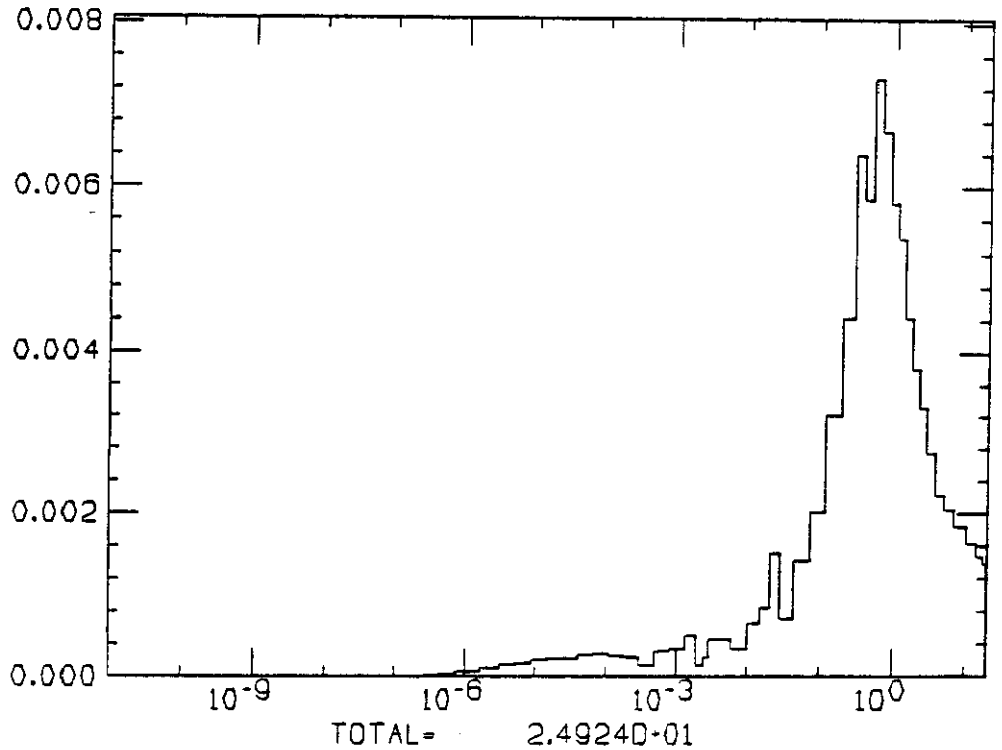


QUAD 1 POST 1 COIL



QUAD 1 POST 1 BRASS



/home/dssg1/gem2/waters/allsh/outp

SREGWX.DAT

Table 32

Major Nuclide Contributors to Activity in Forward Calorimeter, Region 4 of the GEM Detector for the SSC with 1.E+08 DTUJET Minimum Bias Events/sec for 1E7s (~116d) Calculated with CINDER'90 using April '93 Libraries, Spallation Product Yields from SUPERHET, and Neutron Fluxes from HMCNP

Percent of Total (curies)

	Irradiation Time												Cooling Time												
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
Ar 41	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Fe 55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2
Co 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
Co 57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.4	0.4	0.5	0.8	1.1
Co 58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.1	1.5	1.7	1.6	1.6	1.6	1.4
Co 58*	0.0	0.0	0.0	0.1	0.3	0.5	0.9	0.9	0.8	0.8	0.6	0.6	0.7	0.8	0.8	0.8	0.8	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Cu 62	0.0	0.1	0.3	0.4	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu 64	0.0	0.0	0.1	0.2	0.6	1.0	1.9	2.1	1.9	1.9	1.5	1.4	1.7	1.8	1.9	1.9	1.9	1.6	0.8	0.1	0.0	0.0	0.0	0.0	0.0
Cu 66	0.0	0.2	0.9	0.9	0.9	0.8	0.6	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu165	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu166	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu167	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu168	0.0	0.0	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu169	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Lu171	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0
Lu173	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.3
Hf166	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf167	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf168	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf169	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf170	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hf171	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf172	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Hf173	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hf175	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.5	0.6	0.8	0.9	0.9	0.9	0.9	0.8
Hf181	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0
Ta169	0.0	0.0	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta170	0.0	0.1	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta171	0.0	0.0	0.2	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta172	0.0	0.0	0.1	0.3	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta173	0.0	0.0	0.0	0.1	0.3	0.4	0.4	0.4	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta174	0.0	0.0	0.1	0.3	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta175	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.5	0.4	0.4	0.6	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Ta176	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.8	0.7	0.9	1.0	1.0	1.0	1.0	0.7	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Ta177	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.9	0.8	1.0	1.1	1.1	1.2	1.2	1.3	1.3	1.0	0.4	0.0	0.0	0.0	0.0
Ta178	0.0	0.2	0.8	1.1	1.0	0.9	0.7	0.6	0.5	0.5	1.5	1.5	1.9	1.9	1.0	0.2	0.0	0.0	0.0	0.0	0.0	2.7	1.0	0.0	0.0
Ta179	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.7	0.8	0.8	1.2	2.0	3.1
Ta182	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.9	1.0	1.2
Ta183	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	0.5	0.5	0.4	0.5	0.6	0.6	0.6	0.6	0.7	0.8	0.8	0.6	0.2	0.0	0.0	0.0
Ta184	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Ta185	0.0	0.0	0.2	0.4	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 172	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 173	0.0	0.0	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 174	0.0	0.0	0.2	0.4	0.5	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 175	0.0	0.0	0.2	0.5	0.6	0.6	0.4	0.4	0.3	0.3	0.2	0.2	0.3	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 176	0.0	0.0	0.1	0.4	0.7	0.9	0.9	0.7	0.6	0.6	0.5	0.4	0.5	0.6	0.6	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 177	0.0	0.0	0.2	0.5	1.0	1.2	1.1	0.9	0.8	0.8	0.6	0.6	0.7	0.8	0.8	0.7	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 178	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	1.2	1.2	1.5	1.6	1.7	1.7	1.8	2.0	2.4	3.2	3.3	2.7	1.0	0.2	0.1
W 179	0.0	0.2	1.5	3.4	4.4	4.2	3.2	2.7	2.3	2.2	1.8	1.6	2.0	2.2	1.9	1.4	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 181	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	1.8	2.7	3.3	3.6	3.8	3.9	4.0	4.5	5.7	7.8	8.9	9.1	10.9	13.2	15.5
W 183*	99.2	95.8	86.3	79.0	71.2	65.1	49.4	42.3	36.3	34.8	28.3	25.4	8.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

W 185	0.0	0.0	0.0	0.0	0.1	0.2	0.7	1.1	3.4	6.2	17.8	24.7	30.4	33.4	34.9	36.1	37.0	41.2	52.0	70.6	80.1	79.5	80.9	79.3	75.5
W 185*	0.3	1.7	3.1	2.9	2.6	2.4	1.8	1.5	1.3	1.3	1.0	0.9	1.1	0.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Percent of Total

	Irradiation Time												Cooling Time												
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
W 187	0.0	0.1	0.8	2.7	7.0	12.3	29.2	37.4	42.4	40.9	33.4	29.9	36.9	40.5	42.1	43.1	43.6	42.1	31.7	10.9	0.8	0.0	0.0	0.0	0.0
Re179	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re180	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
all 779 others	0.3	1.0	2.8	3.6	3.9	3.9	3.4	3.1	2.9	2.9	2.5	2.3	2.7	2.8	2.2	1.9	1.7	1.3	1.1	1.1	0.8	0.6	0.4	0.4	0.4
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Major Nuclide Contributors to Decay Power in Forward Calorimeter, Region 4 of the GEM Detector for the SSC with 1.E+08 DTUJET Minimum Bias Events/sec for 1E7s (~116d) Calculated with CINDER'90 using April '93 Libraries, Spallation Product Yields from SUPERHET, and Neutron Fluxes from HMCNP

Percent of Total

	Irradiation Time												Cooling Time												
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
Cl 38	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 39	0.0	0.0	0.2	0.4	0.6	0.6	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 40	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 41	0.0	0.0	0.1	0.2	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 48	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.4	0.3	0.1	0.0	0.0
Mn 52	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.5	0.5	0.2	0.0	0.0	0.0
Mn 54	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.4	0.6
Fe 53	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.5	0.6	0.6	0.7	0.7	0.7	0.9	1.4	2.9	4.5	3.9	4.6	4.9	4.8
Co 57	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.3	0.3	0.4	0.7	1.0
Co 58	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.6	1.1	1.3	1.4	1.5	1.6	1.7	2.0	3.1	6.5	10.1	8.8	9.9	10.1	9.4
Co 60	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.5
Co 62	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co 63	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ni 57	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.1	0.0	0.0	0.0	0.0
Cu 61	0.0	0.0	0.1	0.2	0.4	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu 62	0.1	0.4	2.0	2.4	2.1	1.8	1.2	1.0	0.8	0.8	0.7	0.7	0.8	0.8	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cu 64	0.0	0.0	0.1	0.2	0.4	0.6	1.1	1.2	1.1	1.1	1.0	0.9	1.0	1.1	1.2	1.3	1.3	1.2	0.7	0.1	0.0	0.0	0.0	0.0	0.0
Cu 66	0.1	0.8	2.8	2.6	2.2	1.9	1.3	1.1	0.9	0.9	0.8	0.8	0.8	0.8	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
As 73	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2
As 74	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Br 77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Rb 82	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Y 88	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2
Ag104	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ag105	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.3	0.2	0.1
Ag106	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sb114	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sb116	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I 120	0.0	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I 122	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cs124	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cs126	0.0	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ba127	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
La129	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
La130	0.0	0.0	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pr136	0.0	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pm139	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Pm140	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pm142	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sm141	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eu143	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eu144	0.3	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eu145	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Eu146	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
Gd145	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dy149	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dy150	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dy151	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ho150	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ho151	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ho152	0.0	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ho154	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tm157	0.0	0.3	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Percent of Total

	Irradiation Time												Cooling Time												
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
Tm158	0.0	0.1	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tm161	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tm162	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tm163	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tm164	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yb161	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yb163	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu163	0.1	0.4	1.1	1.0	0.8	0.7	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu164	0.0	0.1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu166	0.0	0.3	0.6	0.5	0.4	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu167	0.0	0.0	0.1	0.3	0.4	0.4	0.3	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu168	0.1	0.6	2.0	1.9	1.6	1.4	1.0	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lu169	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0
Lu170	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.3	0.0	0.0	0.0	0.0
Lu171	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.4	0.5	0.2	0.0	0.0	0.0
Lu172	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.5	0.8	0.9	0.4	0.0	0.0	0.0
Lu173	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4
Hf167	0.1	0.4	0.7	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf168	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf169	0.1	0.4	0.9	0.8	0.6	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hf170	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Hf172	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2
Hf173	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0
Hf175	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.7	1.5	2.3	2.0	2.3	2.3	2.1
Hf181	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.4	0.3	0.2	0.1
Ta167	0.0	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta168	0.0	0.3	0.5	0.4	0.4	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta170	0.1	0.4	1.6	1.7	1.4	1.2	0.8	0.7	0.6	0.6	0.5	0.5	0.5	0.5	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta172	0.0	0.1	0.8	1.7	2.1	1.9	1.3	1.0	0.9	0.9	0.8	0.7	0.8	0.9	0.8	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta173	0.0	0.0	0.1	0.2	0.4	0.6	0.5	0.4	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta174	0.0	0.1	0.5	1.3	2.1	2.1	1.5	1.2	1.0	1.0	0.9	0.9	1.0	1.0	1.0	0.9	0.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta175	0.0	0.0	0.0	0.1	0.3	0.5	0.8	0.8	0.7	0.7	1.1	0.6	0.7	0.7	0.8	0.8	0.8	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Ta176	0.0	0.0	0.1	0.4	0.8	1.3	1.9	1.7	1.5	1.5	3.5	3.4	3.8	4.1	4.4	4.6	4.6	3.6	1.2	0.0	0.0	0.0	0.0	0.0	0.0
Ta177	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4	0.2	0.0	0.0	0.0	0.0
Ta178	0.1	0.6	2.8	3.2	2.7	2.4	1.6	1.3	1.1	1.1	3.9	4.2	4.7	4.7	2.6	0.6	0.1	0.0	0.0	0.0	0.0	18.3	7.5	0.0	0.0
Ta179	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.2	0.4	0.7
Ta182	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.7	0.8	0.9	0.9	1.0	1.1	1.3	1.9	4.1	6.6	5.9	7.8	10.0	11.7
Ta183	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.4	0.6	0.6	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.4	2.4	2.2	0.7	0.0	0.0	0.0
Ta184	0.0	0.0	0.1	0.2	0.5	0.8	1.2	1.1	1.0	1.0	0.8	0.8	0.9	1.0	1.1	1.1	1.1	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Ta185	0.0	0.1	0.4	0.8	1.1	1.0	0.7	0.6	0.5	0.5	0.4	0.4	0.5	0.5	0.5	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ta186	0.0	0.0	0.2	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 173	0.0	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 174	0.0	0.2	1.3	2.5	2.7	2.4	1.6	1.3	1.1	1.1	1.0	1.0	1.1	1.1	1.0	0.7	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 176	0.0	0.0	0.1	0.2	0.4	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

W 177	0.0	0.1	0.4	1.1	2.1	2.5	2.0	1.7	1.4	1.4	1.2	1.2	1.4	1.5	1.5	1.5	1.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 178	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.3	0.4	0.3	0.1	0.0	0.0
W 179	0.0	0.0	0.2	0.5	0.6	0.5	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 181	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.8	1.6	2.6	2.3	3.1	4.0	4.8
W 183*	96.6	88.2	66.7	56.2	47.2	40.9	27.7	22.7	19.2	18.9	16.8	16.2	4.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 185	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.8	1.4	4.5	6.8	7.7	8.2	8.9	9.6	10.0	12.0	18.5	39.0	60.9	53.5	61.5	64.9	62.5
W 185*	0.2	1.0	1.5	1.3	1.1	0.9	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
W 187	0.0	0.2	1.5	4.6	11.3	18.8	39.9	49.1	54.9	54.3	48.3	46.7	53.3	56.9	61.4	65.0	66.9	69.7	64.1	34.3	3.4	0.0	0.0	0.0	0.0
Re177	0.0	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re178	0.0	0.1	0.3	0.4	0.4	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re179	0.0	0.0	0.2	0.3	0.3	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re180	0.0	0.2	0.5	0.4	0.3	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Re181	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Re184	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.0
all 724 others	1.2	1.8	3.2	4.2	4.7	4.7	3.8	3.3	3.0	3.0	2.8	2.7	2.9	3.0	2.7	2.4	2.2	1.5	1.3	1.5	1.5	0.9	0.7	0.7	0.7
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 88

Major Nuclide Contributors to Activity in Collimator, Region 12
of the GEM Detector for the SSC with 1.E+08 DTUJET Minimum Bias Events/sec
for 1E7s (~116d) Calculated with CINDER'90 using April '93 Libraries,
Spallation Product Yields from SUPERHET, and Neutron Fluxes from HMCNP

Percent of Total

	Irradiation Time												Cooling Time											
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
He 6	3.9	1.8	0.6	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
He 8	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Li 8	3.0	1.3	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Li 9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be 7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.3	0.3	0.2	0.1	0.1
Be 8	1.7	0.8	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 8	1.8	0.8	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 9	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 12	1.9	0.9	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 13	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C 9	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C 10	0.2	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C 11	0.1	0.4	1.0	0.9	0.6	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 12	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 13	0.0	0.1	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 16	0.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 17	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O 15	0.1	0.5	0.4	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 18	0.0	0.1	0.3	0.5	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 20	4.2	4.1	1.3	0.6	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 21	6.4	3.7	1.1	0.6	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 22	4.2	2.4	0.7	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 23	5.8	2.7	0.9	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 24	13.8	6.3	1.9	1.0	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ne 19	0.3	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ne 25	3.2	1.5	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ne 26	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na 25	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mg 23	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mg 27	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 28	1.2	4.4	3.4	1.7	0.9	0.7	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 29	0.1	0.6	1.0	0.6	0.3	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 30	1.2	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 31	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si 27	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si 31	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si 33	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si 34	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 29	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 30	1.1	4.0	3.3	1.6	0.9	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 32	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.6	0.9	0.8	0.8	0.8	0.9	0.9	1.0	1.4	1.6	1.6	1.4	1.1	0.2	0.0	0.0
P 33	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.5	0.6	0.5	0.5	0.2	0.1	0.0
P 34	1.5	1.6	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 35	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 37	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 31	1.0	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 35	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.2
Cl 33	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 34	5.0	2.3	0.7	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 38	0.0	0.1	0.2	0.3	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 33	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 34	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Ar 35	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.6	0.6	0.6	0.6	0.7	0.7	1.0	1.2	1.3	1.3	1.3	0.8	0.3	0.1
K 35	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 36	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 37	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 38	0.1	0.3	0.5	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 42	0.0	0.0	0.1	0.1	0.2	0.2	0.4	0.5	0.5	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0
K 43	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
K 44	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 36	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 37	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 38	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 39	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 45	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Sc 38	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 39	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 40	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 41	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 42	2.1	1.0	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 43	0.0	0.0	0.1	0.2	0.3	0.3	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 44	0.1	0.3	1.0	1.7	2.4	2.8	3.4	3.3	2.9	2.6	2.0	1.8	1.8	1.8	1.8	1.8	1.8	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Sc 46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.8	0.8	0.8	0.9	0.9	1.0	1.4	1.7	1.8	1.9	2.1	2.1	1.6	1.1
Sc 47	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.5	1.0	1.1	0.9	0.8	0.8	0.8	0.9	0.9	1.0	1.3	1.4	1.0	0.5	0.1	0.0	0.0	0.0
Sc 48	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0
Sc 49	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 39	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 40	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 41	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 42	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 43	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 45	0.0	0.1	0.3	0.5	0.7	0.8	0.8	0.8	0.7	0.6	0.5	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 51	0.0	0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 42	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 43	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 44	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 45	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 46	4.1	1.8	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 47	0.1	0.6	1.7	2.0	1.5	1.1	0.9	0.9	0.8	0.7	0.5	0.5	0.5	0.5	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 48	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.5	1.5	2.4	3.7	3.5	3.5	3.6	3.7	3.9	4.2	5.9	6.9	6.8	6.3	5.2	1.1	0.1	0.0
V 49	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.8	1.2	1.2	1.3	1.3	1.4	1.5	2.1	2.6	2.7	3.0	3.4	4.5	5.0	5.1
V 52	1.9	7.6	8.5	4.4	2.3	1.7	1.4	1.3	1.2	1.1	0.8	0.7	0.7	0.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 53	1.1	3.8	2.3	1.2	0.6	0.5	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 54	0.2	0.6	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 43	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 44	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 45	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 46	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 47	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 48	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Cr 49	0.2	0.7	2.0	2.6	2.1	1.6	1.3	1.3	1.1	1.0	0.8	0.7	0.7	0.7	0.6	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 51	0.0	0.0	0.0	0.1	0.1	0.2	0.5	1.0	3.0	5.0	10.1	10.7	10.8	10.9	11.4	12.0	12.7	18.2	21.6	22.0	22.1	20.9	9.9	2.8	0.7
Cr 55	0.8	3.2	3.4	1.7	0.9	0.7	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 56	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 50	3.4	1.5	0.5	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 51	0.2	0.7	2.0	2.6	2.2	1.7	1.4	1.3	1.2	1.1	0.8	0.7	0.7	0.7	0.7	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 52	0.0	0.0	0.1	0.2	0.4	0.6	1.8	3.2	7.5	9.6	9.0	7.9	7.9	8.0	8.4	8.8	9.3	13.0	14.4	12.0	8.1	3.5	0.0	0.0	0.0
Mn 54	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	1.3	2.3	7.2	11.3	11.4	11.5	12.0	12.7	13.5	19.3	23.4	24.9	27.4	31.1	41.1	45.0	45.0
Mn 56	2.6	11.7	35.3	57.1	71.7	76.5	76.3	73.6	65.4	59.3	45.8	39.8	40.2	40.4	40.6	39.1	36.4	13.6	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Mn 57	2.0	6.7	3.8	1.9	1.0	0.7	0.6	0.6	0.5	0.5	0.4	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 58	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 51	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 52	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 53	1.7	7.3	13.3	8.8	4.7	3.5	2.8	2.7	2.4	2.2	1.7	1.5	1.4	1.4	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 55	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.3	0.9	1.6	5.4	8.8	8.9	9.0	9.4	9.9	10.5	15.1	18.3	19.5	21.6	24.8	35.2	42.2	46.2
Fe 59	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.7	1.6	1.9	2.0	2.0	2.1	2.2	2.3	3.3	3.9	4.1	4.3	4.4	3.2	1.6	0.7
Co 53	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Co 54	1.7	0.8	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co 55	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Co 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.5	0.6	0.7	0.7	0.8	0.7	0.5	0.4
all 349 others	5.8	3.5	1.4	0.8	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 89

Major Nuclide Contributors to Decay Power in Collimator, Region 12
of the GEM Detector for the SSC with 1.E+08 DTUJET Minimum Bias Events/sec
for 1E7s (~116d) Calculated with CINDER'90 using April '93 Libraries,
Spallation Product Yields from SUPERHET, and Neutron Fluxes from HMCNP

Percent of Total

	Irradiation Time												Cooling Time												
nucl	10 s	E2 s	E3 s	1 h	3 h	6 h	1 d	2 d	7 d	14 d	60 d	E+7s	10 s	1 m	10 m	30 m	1 h	6 h	1 d	3 d	7 d	15 d	60 d	120d	180d
He 6	1.7	0.9	0.3	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Li 8	8.5	4.2	1.4	0.8	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Be 11	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 12	3.4	1.7	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B 13	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C 11	0.0	0.2	0.4	0.5	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
C 15	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 12	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 13	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
N 16	1.5	1.2	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
O 15	0.1	0.3	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 18	0.0	0.0	0.1	0.2	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 20	4.8	5.1	1.7	0.9	0.5	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 21	6.9	4.3	1.4	0.8	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 22	10.7	6.6	2.2	1.2	0.7	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
F 23	8.2	4.3	1.4	0.8	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ne 19	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ne 25	3.4	1.7	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Na 22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.5
Na 24	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Mg 23	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 28	1.0	4.1	3.3	1.8	1.0	0.8	0.6	0.6	0.6	0.5	0.5	0.4	0.4	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 29	0.2	1.1	1.8	1.2	0.7	0.5	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Al 30	2.9	1.7	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Si 27	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 28	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 29	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 30	0.7	3.0	2.7	1.4	0.8	0.6	0.5	0.5	0.4	0.4	0.4	0.4	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 32	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.7	1.0	1.1	1.2	1.1	0.3	0.0	0.0
P 34	1.1	1.3	0.4	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 35	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 36	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 39	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
P 40	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 28	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 31	0.8	0.4	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 41	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
S 42	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 30	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 32	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 33	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 34	4.3	2.2	0.7	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 38	0.0	0.1	0.2	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 39	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 40	0.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cl 41	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Ar 33	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 34	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ar 35	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 34	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 35	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 36	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 37	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 38	0.1	0.4	0.7	0.5	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
K 42	0.0	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0
K 43	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0
K 44	0.0	0.1	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 36	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 37	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 38	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ca 39	0.7	0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 38	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 39	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 40	0.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 41	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 42	2.1	1.0	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 43	0.0	0.0	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sc 44	0.1	0.3	0.9	1.7	2.4	2.9	3.5	3.5	3.2	3.0	2.7	2.6	2.6	2.7	2.8	2.9	2.9	2.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Sc 46	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.6	0.9	1.0	1.0	1.0	1.1	1.2	2.2	3.3	3.8	4.7	6.4	8.8	7.3	5.5
Sc 47	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.3	0.3	0.3	0.1	0.0	0.0	0.0	0.0
Sc 48	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.9	1.0	0.5	0.1	0.0	0.0	0.0	0.0
Ti 39	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 40	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 41	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 42	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 43	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ti 45	0.0	0.0	0.1	0.2	0.3	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 41	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 42	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 43	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 45	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 46	4.3	2.2	0.7	0.4	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 47	0.1	0.3	1.0	1.3	1.0	0.8	0.6	0.6	0.5	0.5	0.5	0.4	0.5	0.5	0.4	0.3	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 48	0.0	0.0	0.0	0.0	0.1	0.1	0.3	0.6	1.9	3.0	5.6	5.8	5.9	6.0	6.4	7.0	7.6	13.7	19.7	21.1	22.7	23.0	6.6	0.7	0.1
V 52	1.3	5.8	7.0	3.9	2.2	1.7	1.4	1.3	1.2	1.1	1.0	1.0	1.0	0.8	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 53	0.7	2.4	1.6	0.8	0.5	0.4	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V 54	0.4	1.2	0.5	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 42	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 43	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 44	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 45	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 46	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 47	0.3	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 48	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0
Cr 49	0.1	0.4	1.1	1.5	1.3	1.0	0.8	0.8	0.7	0.7	0.6	0.6	0.6	0.6	0.6	0.5	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 51	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.5	0.7	0.8	1.0	1.1	0.7	0.2	0.1
Cr 55	0.9	4.0	4.6	2.6	1.4	1.1	0.9	0.8	0.8	0.7	0.7	0.6	0.6	0.5	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Cr 56	0.0	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 46	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 47	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 49	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 50	3.9	1.9	0.6	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 51	0.1	0.4	1.2	1.8	1.6	1.3	1.0	1.0	0.9	0.9	0.8	0.7	0.8	0.8	0.7	0.6	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 52	0.0	0.0	0.2	0.3	0.5	0.8	2.4	4.4	10.6	14.2	15.5	15.0	15.3	15.5	16.7	18.1	19.8	34.9	47.3	43.1	33.6	17.9	0.1	0.0	0.0
Mn 54	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.8	2.9	5.1	5.2	5.3	5.7	6.2	6.8	12.2	18.2	21.1	26.8	37.9	69.1	82.2	88.1
Mn 56	1.8	9.0	29.2	51.5	68.4	74.2	74.9	72.7	66.2	62.0	56.1	54.0	55.2	55.9	57.7	57.3	54.9	25.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Mn 57	0.7	2.4	1.5	0.8	0.5	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mn 58	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 51	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 52	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 53	2.5	11.7	22.8	16.4	9.4	7.0	5.7	5.5	5.0	4.7	4.2	4.1	4.1	3.9	2.0	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fe 53*	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Fe 55	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.4	0.5	0.6
Fe 59	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.4	1.0	1.4	1.4	1.4	1.5	1.6	1.8	3.2	4.8	5.4	6.5	8.2	8.2	4.4	2.1
Co 53	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co 54	3.1	1.6	0.5	0.3	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Co 55	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Co 56	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	0.6	0.6	0.6	0.6	0.7	0.8	1.4	2.0	2.3	2.9	3.8	5.1	4.1	2.9
all 352 others	4.5	3.0	1.4	0.9	0.6	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Rem/hr error

X Y Z

FCAL hadronic region 4 r=4.1-75 z=512.4-643.8

0.0	0.0	450.0	1.47693E-03	.0641	5.65864E-04	.0482
0.0	0.0	512.4	8.68532E-01	.0376	5.78445E-01	.0287
0.0	0.0	575.0	8.53213E-01	.0326	6.03450E-01	.0295
0.0	0.0	645.0	2.68798E-01	.0532	1.90610E-01	.0460
0.0	0.0	750.0	6.18778E-04	.0521	3.25392E-04	.0462
0.0	0.0	999.0	4.71289E-05	.0913	1.58345E-05	.0576
25.0	0.0	645.0	1.72498E-03	.3105	1.26964E-03	.2639
50.0	0.0	645.0	5.61062E-04	.6075	4.77285E-04	.7122
74.0	0.0	645.0	1.11623E-04	.3853	7.60587E-05	.5479
25.0	0.0	750.0	9.00621E-04	.0501	5.57219E-04	.0405
50.0	0.0	750.0	1.01410E-03	.2173	4.89618E-04	.0420
74.0	0.0	750.0	6.14016E-04	.0584	3.77435E-04	.0442
25.0	0.0	999.0	8.80414E-05	.0777	4.26789E-05	.0453
50.0	0.0	999.0	1.03040E-04	.1088	4.96399E-05	.0413
74.0	0.0	999.0	1.00612E-04	.1269	5.13829E-05	.0408
76.0	0.0	450.0	1.78158E-09	.4637	1.43391E-09	.4192
76.0	0.0	511.0	1.80846E-04	.6377	1.39312E-04	.8077
76.0	0.0	575.0	5.56894E-09	.7523	5.56126E-09	.7533
25.0	0.0	511.0	2.83114E-02	.2183	1.76676E-02	.2550
50.0	0.0	511.0	7.48833E-03	.3113	5.33562E-03	.3694

FFS1-iron abbreviated region 8 r=60.0-154.0 z=1000.0-1646.0

7.40000E+01	0.00000E+00	6.45000E+02	3.84818E-05	.0182	1.64120E-05	.0059
7.40000E+01	0.00000E+00	7.50000E+02	7.55590E-05	.0213	3.21329E-05	.0057
7.40000E+01	0.00000E+00	9.99000E+02	1.35504E-03	.1223	7.45082E-04	.1009
5.00000E+01	0.00000E+00	6.45000E+02	5.21440E-05	.1717	1.71565E-05	.0253
5.00000E+01	0.00000E+00	7.50000E+02	8.03367E-05	.0097	3.37588E-05	.0057
5.00000E+01	0.00000E+00	9.99000E+02	1.79775E-03	.0141	9.64881E-04	.0138
2.50000E+01	0.00000E+00	6.45000E+02	4.25694E-05	.0319	1.70201E-05	.0060
2.50000E+01	0.00000E+00	7.50000E+02	8.16602E-05	.0088	3.48978E-05	.0057
2.50000E+01	0.00000E+00	9.99000E+02	1.71909E-03	.0061	9.11079E-04	.0056
0.00000E+00	0.00000E+00	6.45000E+02	3.87760E-05	.1900	1.33363E-05	.0068
0.00000E+00	0.00000E+00	7.50000E+02	6.62067E-05	.0102	2.92664E-05	.0060
0.00000E+00	0.00000E+00	9.99000E+02	1.63759E-03	.0086	8.44763E-04	.0047
0.00000E+00	0.00000E+00	1.20000E+03	2.55281E-03	.0098	1.30688E-03	.0039
0.00000E+00	0.00000E+00	1.20000E+03	2.55281E-03	.0098	1.30688E-03	.0039
0.00000E+00	0.00000E+00	1.40000E+03	2.11337E-03	.0093	1.08958E-03	.0043
0.00000E+00	0.00000E+00	1.60000E+03	1.46240E-03	.0119	7.60374E-04	.0053
0.00000E+00	0.00000E+00	1.80000E+03	6.66819E-05	.0259	2.87113E-05	.0074
5.90000E+01	0.00000E+00	9.99000E+02	1.92429E-03	.0590	1.03682E-03	.0705
5.90000E+01	0.00000E+00	1.20000E+03	3.06528E-03	.0576	1.71097E-03	.0699
5.90000E+01	0.00000E+00	1.40000E+03	2.61676E-03	.1746	1.53037E-03	.1863
5.90000E+01	0.00000E+00	1.60000E+03	1.79894E-03	.0685	1.10250E-03	.0932

barium concrete cylinder region 11 r=85.01-110.0 z=675.0-1000.0

7.40000E+01	0.00000E+00	6.45000E+02	3.35815E-06	.0467	8.90855E-07	.0544
7.40000E+01	0.00000E+00	7.50000E+02	1.45150E-05	.1312	4.82703E-06	.0478
7.40000E+01	0.00000E+00	9.99000E+02	5.87108E-06	.0798	1.99363E-06	.0829
1.11000E+02	0.00000E+00	5.68500E+02	5.28884E-07	.1058	4.21152E-10	.3259
1.55000E+02	0.00000E+00	5.68500E+02	3.52681E-06	.0492	1.32919E-06	.0381
2.00000E+02	0.00000E+00	5.68500E+02	3.89110E-05	.8420	2.53865E-06	.0226
1.11000E+02	0.00000E+00	6.06000E+02	8.76045E-07	.1846	2.93888E-09	.4643
1.11000E+02	0.00000E+00	6.45000E+02	1.35389E-06	.0887	8.31469E-08	.3903
1.21000E+02	0.00000E+00	7.80000E+02	3.93448E-05	.1265	1.75332E-05	.0551
1.31000E+02	0.00000E+00	8.85000E+02	5.18651E-06	.0931	2.54957E-06	.0568
1.42000E+02	0.00000E+00	9.99000E+02	8.91447E-07	.2980	2.46865E-07	.0730
1.75000E+02	0.00000E+00	1.20000E+03	1.20925E-07	.0528	2.65085E-10	.4613
2.08500E+02	0.00000E+00	1.40000E+03	8.90007E-08	.0426	3.32592E-10	.3321
2.42000E+02	0.00000E+00	1.60000E+03	7.26436E-08	.0888	3.16548E-10	.2607
2.50000E+01	0.00000E+00	9.99000E+02	1.38351E-05	.0904	4.59600E-06	.1410
5.00000E+01	0.00000E+00	6.45000E+02	6.11358E-06	.0848	1.93546E-06	.2076

2.50000E+01	0.00000E+00	6.45000E-02	1.01439E-05	.1711	2.60326E-06	.0399
5.00000E+01	0.00000E+00	7.50000E+02	2.84427E-05	.0443	8.62669E-06	.0420
2.50000E+01	0.00000E+00	7.50000E+02	3.57564E-05	.0361	1.17309E-05	.0449
5.00000E+01	0.00000E+00	9.99000E+02	1.17558E-05	.0914	3.65262E-06	.1709

PA1-copper region 5 r=75.0-200.0 z=517.4-567.4

7.40000E+01	0.00000E+00	6.45000E+02	1.71172E-17	.4033	1.56291E-17	.4318
7.40000E+01	0.00000E+00	7.50000E+02	1.85958E-16	.3216	1.76769E-16	.3366
7.40000E+01	0.00000E+00	9.99000E+02	5.35922E-15	.9302	5.35882E-15	.9303
1.11000E+02	0.00000E+00	5.68500E+02	1.65362E-04	.2875	1.03307E-04	.3821
1.55000E+02	0.00000E+00	5.68500E+02	2.58986E-05	.3734	1.33884E-05	.5254
2.00000E+02	0.00000E+00	5.68500E+02	3.54324E-06	.2552	1.05879E-06	.4209
1.11000E+02	0.00000E+00	6.06000E+02	5.86828E-05	.2625	2.25476E-05	.0618
1.11000E+02	0.00000E+00	6.45000E+02	2.05093E-05	.0566	9.25637E-06	.0483
1.21000E+02	0.00000E+00	7.80000E+02	5.00634E-06	.0529	2.10820E-06	.0372
1.31000E+02	0.00000E+00	8.85000E+02	2.41778E-06	.0450	1.01000E-06	.0361
1.42000E+02	0.00000E+00	9.99000E+02	1.52797E-06	.1037	5.63681E-07	.0356
1.75000E+02	0.00000E+00	1.20000E+03	8.57283E-07	.0410	3.32279E-07	.0318
2.08500E+02	0.00000E+00	1.40000E+03	5.13715E-07	.0403	1.91608E-07	.0313
2.42000E+02	0.00000E+00	1.60000E+03	3.27571E-07	.0435	1.18069E-07	.0315
2.67000E+02	0.00000E+00	1.74900E+03	2.60711E-07	.0662	8.70384E-08	.0316
5.42000E+02	0.00000E+00	2.02000E+02	2.11449E-08	.1052	4.45479E-37	.9990
1.16000E+02	0.00000E+00	5.11000E+02	2.84647E-03	.1766	6.31731E-04	.0436
1.56000E+02	0.00000E+00	5.11000E+02	6.69557E-04	.2684	1.57604E-04	.0824
1.96000E+02	0.00000E+00	5.11000E+02	5.77433E-05	.2434	1.87984E-05	.1805
7.60000E+01	0.00000E+00	5.11000E+02	3.32543E-03	.1132	1.02320E-03	.0338

PA2-copper region 6 r=75.0-110.0 z=567.4-675.0

7.40000E+01	0.00000E+00	6.45000E+02	6.73865E-03	.0691	3.70024E-03	.0854
7.40000E+01	0.00000E+00	7.50000E+02	7.32753E-04	.0353	3.09801E-04	.0046
7.40000E+01	0.00000E+00	9.99000E+02	5.22148E-05	.0187	2.05758E-05	.0063
1.11000E+02	0.00000E+00	5.68500E+02	2.97544E-04	.3648	9.79309E-05	.2442
1.55000E+02	0.00000E+00	5.68500E+02	7.46765E-05	.1766	2.66099E-05	.0326
2.00000E+02	0.00000E+00	5.68500E+02	3.77884E-05	.0354	1.55940E-05	.0219
1.11000E+02	0.00000E+00	6.06000E+02	5.42463E-05	.2396	3.38625E-05	.3131
1.11000E+02	0.00000E+00	6.45000E+02	3.01219E-04	.3454	1.20525E-04	.2695
1.21000E+02	0.00000E+00	7.80000E+02	3.28046E-06	.0648	6.69429E-07	.1096
1.31000E+02	0.00000E+00	8.85000E+02	1.50910E-06	.0712	2.19080E-07	.0997
1.42000E+02	0.00000E+00	9.99000E+02	8.49592E-07	.0419	1.05039E-07	.0947
1.75000E+02	0.00000E+00	1.20000E+03	5.61448E-07	.0441	9.13468E-08	.0608
2.08500E+02	0.00000E+00	1.40000E+03	3.72474E-07	.0390	6.19618E-08	.0541
2.42000E+02	0.00000E+00	1.60000E+03	2.65922E-07	.0522	4.38757E-08	.0504
2.67000E+02	0.00000E+00	1.74900E+03	1.99385E-07	.0638	3.40715E-08	.0487
5.00000E+01	0.00000E+00	6.45000E+02	5.28431E-03	.0104	2.62942E-03	.0052
2.50000E+01	0.00000E+00	6.45000E+02	4.35688E-03	.0108	2.14203E-03	.0034
5.00000E+01	0.00000E+00	7.50000E+02	1.03100E-03	.0057	4.87866E-04	.0042
2.50000E+01	0.00000E+00	7.50000E+02	1.27032E-03	.0068	6.07449E-04	.0038
5.00000E+01	0.00000E+00	9.99000E+02	6.11351E-05	.0171	2.20520E-05	.0062

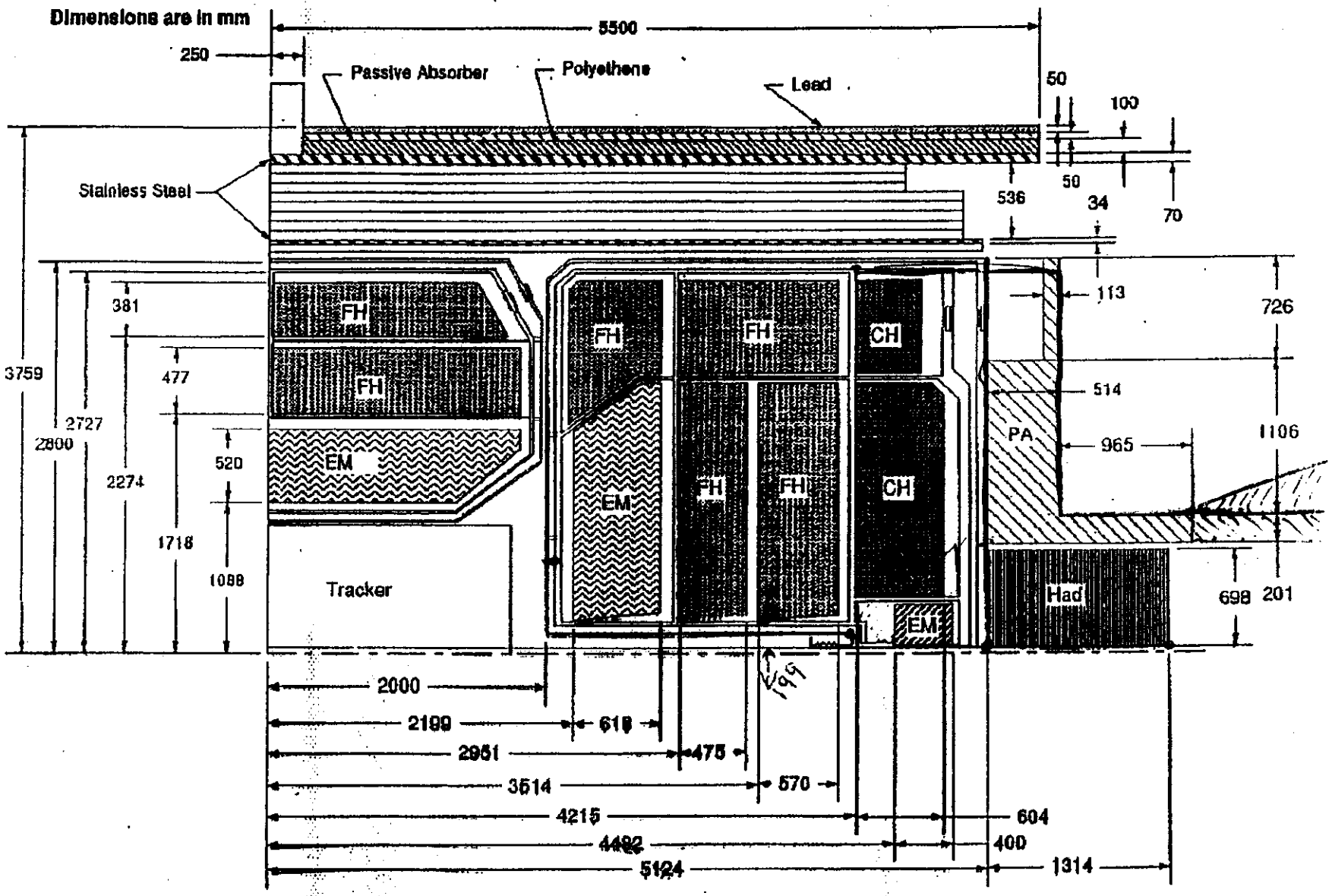
PA3-copper region 7 r=75.0-85.01 z=675.0-1000.0
in process

collimator-steel region12 r=1.25-100.0 z=3200.0-3500.0

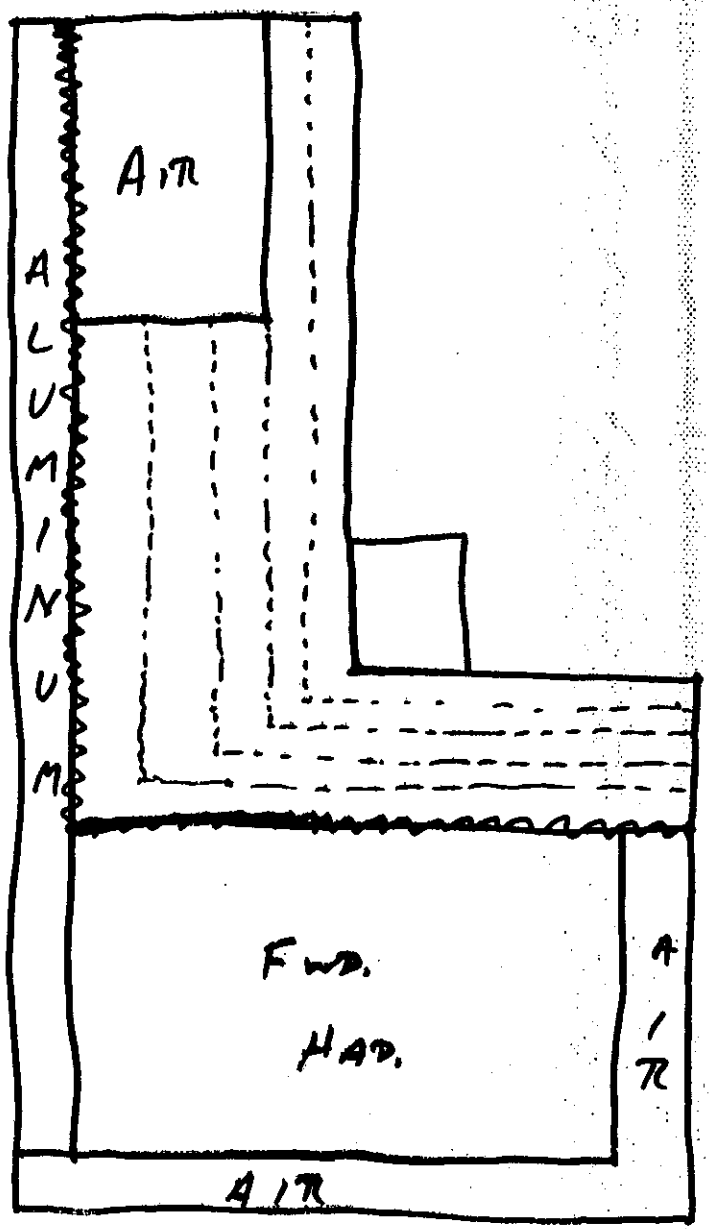
0.00000E+00	0.00000E+00	3.20000E+03	8.39003E+00	.0469	4.91759E+00	.0448
0.00000E+00	0.00000E+00	3.21500E+03	5.31091E+01	.0187	3.28942E+01	.0194
0.00000E+00	0.00000E+00	3.30000E+03	3.34836E+01	.0232	1.98401E+01	.0237
0.00000E+00	0.00000E+00	3.40000E+03	3.41582E+00	.0750	2.03601E+00	.0721
0.00000E+00	0.00000E+00	3.50000E+03	6.97750E-01	.1451	5.13607E-01	.1459
2.50000E+01	0.00000E+00	3.19900E+03	3.79867E-01	.5219	5.82618E-02	.0953
2.50000E+01	0.00000E+00	3.50100E+03	1.45115E-02	.4127	9.16888E-03	.3463
5.00000E+01	0.00000E+00	3.19900E+03	5.21131E-03	.2797	2.05785E-03	.1867
5.00000E+01	0.00000E+00	3.50100E+03	2.16836E-03	.5523	1.64513E-03	.7031

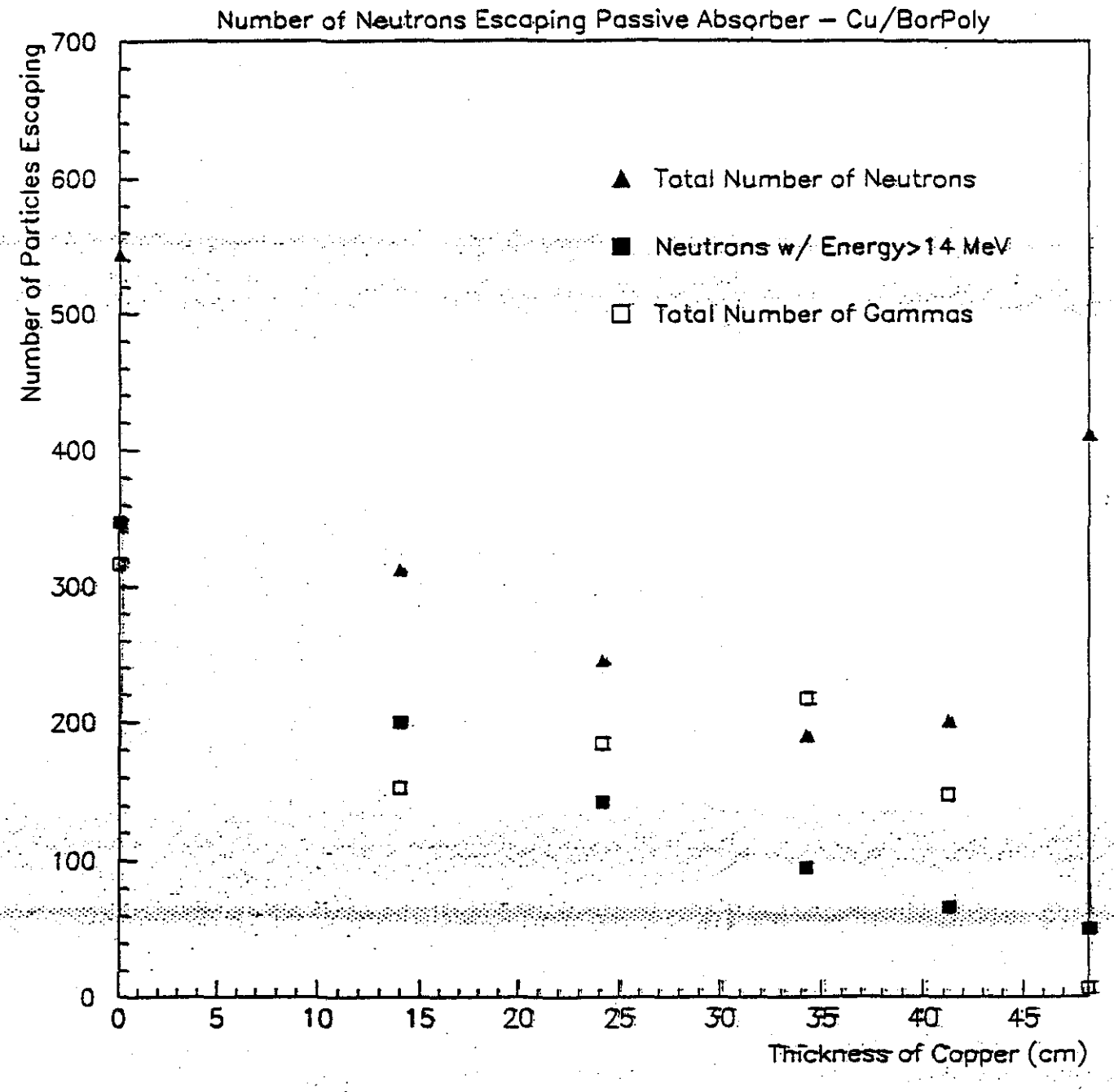
7.50000E+01	0.00000E+00	3.19900E+03	6.50721E-04	.6376	5.70129E-04	.7204
7.50000E+01	0.00000E+00	3.50100E+03	5.18913E-04	.8403	4.69841E-04	.8958
9.90000E+01	0.00000E+00	3.19900E+03	2.12034E-06	.4965	1.93421E-06	.5371
9.90000E+01	0.00000E+00	3.50100E+03	3.00541E-06	.7002	9.85267E-07	.7033
1.01000E+02	0.00000E+00	3.30000E+03	6.01537E-04	.8311	5.24048E-04	.9422
1.01000E+02	0.00000E+00	3.40000E+03	2.13679E-04	.7369	2.12795E-04	.7379
2.50000E+01	0.00000E+00	3.10000E+03	1.78272E-02	.0468	7.53133E-03	.0162
5.00000E+01	0.00000E+00	3.10000E+03	1.58723E-05	.0806	1.11453E-05	.0476
2.50000E+01	0.00000E+00	3.00000E+03	3.91880E-03	.2542	1.25857E-03	.0173
5.00000E+01	0.00000E+00	3.00000E+03	1.70489E-07	.4451	5.67678E-08	.1141
5.00000E+01	0.00000E+00	3.54900E+03	4.20839E-03	.0795	2.13261E-03	.0647

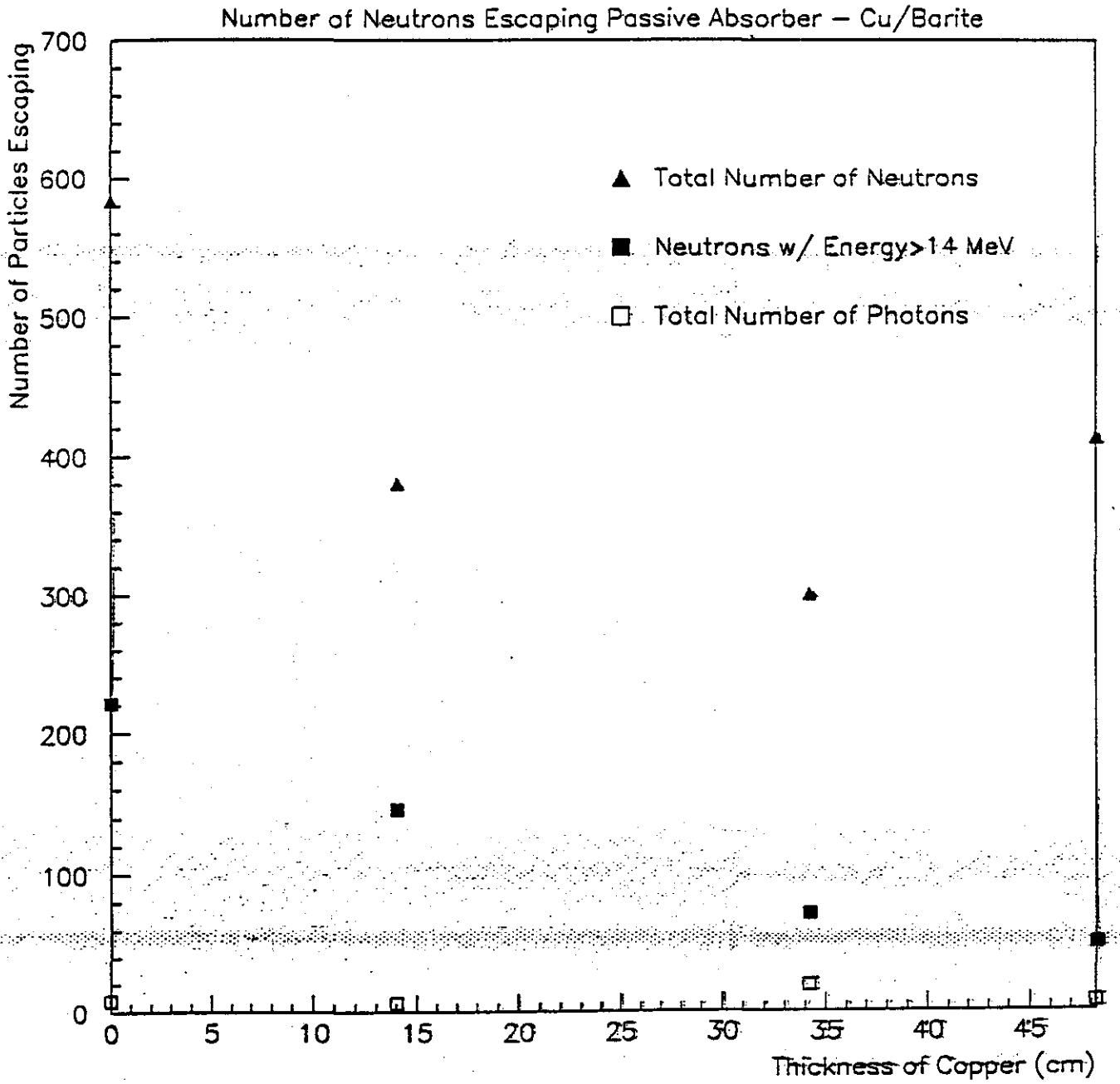
GEM Calorimeter - Dimensions



STUDY OF PASSIVE ABSORBER



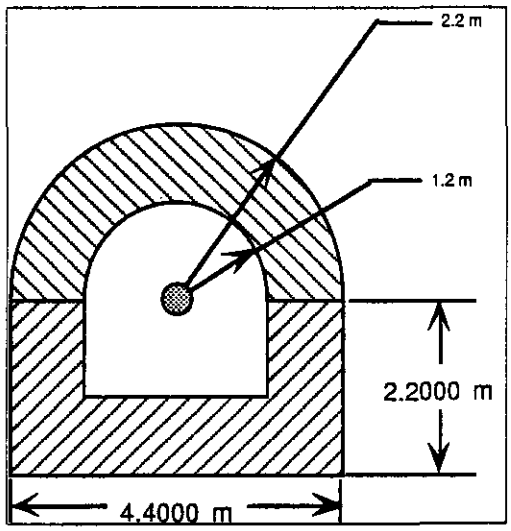

Number of Neutrons Escaping Passive Absorber – Cu/BorPoly
Number of Particles Escaping
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
45
Thickness of Copper (cm)
Total Number of Neutrons
Neutrons w/ Energy>14 MeV
Total Number of Gammas


Number of Neutrons Escaping Passive Absorber – Cu/Barite
Number of Particles Escaping
700
600
500
400
300
200
100
0
Total Number of Neutrons
Neutrons w/ Energy>14 MeV
Total Number of Photons
0
5
10
15
20
25
30
35
40
45
Thickness of Copper (cm)

RUN	n > 14 MeV	0.1 MeV < n < 14	Total n	γ > 1 MeV	0.1 < γ < 1 MeV	Total γ
Baseline Cu - No Block	59	379	540	5	15	20
Cu 48.2	50	286	411	3	4	7
Barite 48.2	221	274	584	2	7	8
B. Poly. 48.2	348	166	544	5	197	316
Cu 34.2 Barite 14.0	71	130	299	1	19	19
Cu 14.0 Barite 34.2	146	176	380	1	5	6
Cu 14.0 B. Poly 34.2	200	103	312	11	142	153
Cu 24.1 B. Poly. 24.1	142	95	245	9	175	185
Cu 34.2 B. Poly. 14.0	92	84	190	9	208	217
Cu 41.2 B. Poly 7.0	66	82	201	7	141	148
Cu 14.0 Barite 20.2 B. Poly 14.0	177	108	303	4	128	131
Cu 14.0 B. Poly. 20.2 Barite 14.0	163	188	397	6	11	18
Cu 34.2 B. Poly 11.0 Cu 3.0	* 73	125	225	10	35	45
Cu 31.2 B. Poly. 14.0 Cu 3.0	87	143	253	8	57	65

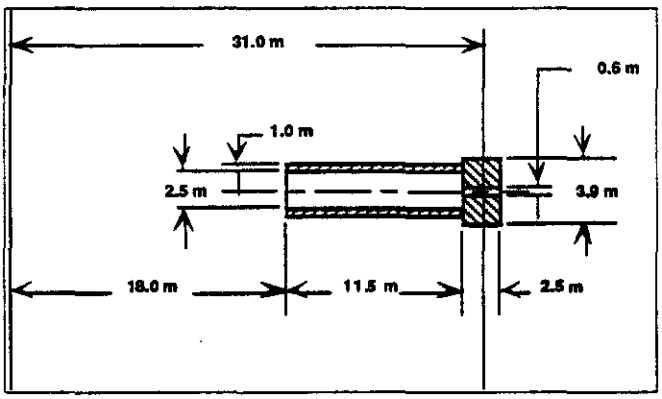
GEM NEUTRON SHIELD (18 m - 29.5 m)

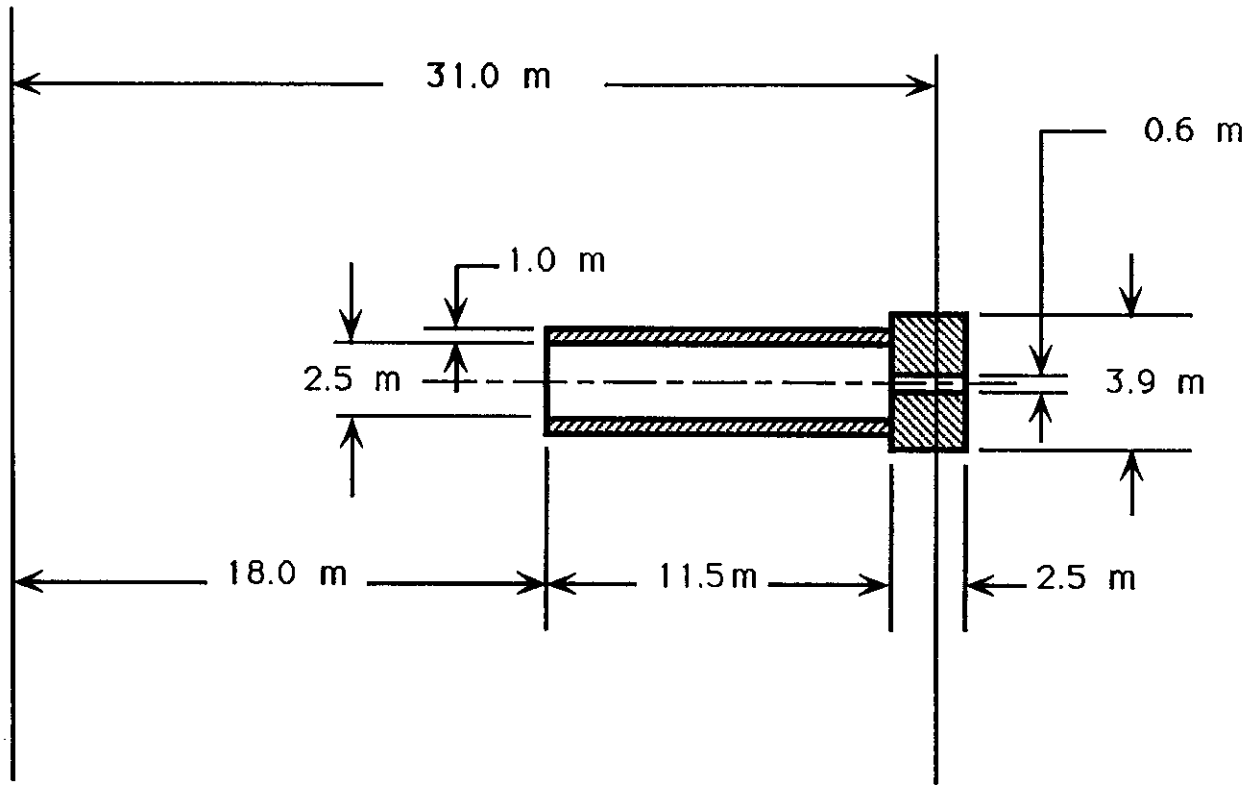
BASE PLATE						
Z Dimensions	Width	Height	Thick	Volume	Density	Mass (Mg)
18 m - 29.5 m	4.40	2.20	1.00	80.96	3.20	259.07
Mass per Linear Meter						22.53
CAP						
Z Dimensions	Outer Rad	Inner Rad	Thick	Volume	Density	Mass (Mg)
18 m - 29.5 m	2.20	1.20	1.00	61.42	3.20	196.54
Mass per Linear Meter						17.09
Total Mass per Linear Meter						39.62



LOW-BETA QUAD SHIELDING

Z-Dimensions	Outer Radius	Inner Radius	Length	Volume	Density	Mass (Mg)
18.0 m - 29.5 m	1.75	1.25	11.50	54.19	3.20	173.42
29.5 m - 31.0 m	2.25	0.30	1.50	23.43	3.20	74.98
TOTAL MASS						248.40
31.0 m - 32.0 m	2.45	0.50	1.00	18.07	3.20	57.83





GEM NEUTRON SHIELD
(18 - 31 meters)

jng
4/27/93