γ – LASER Mode
Beam Monitoring

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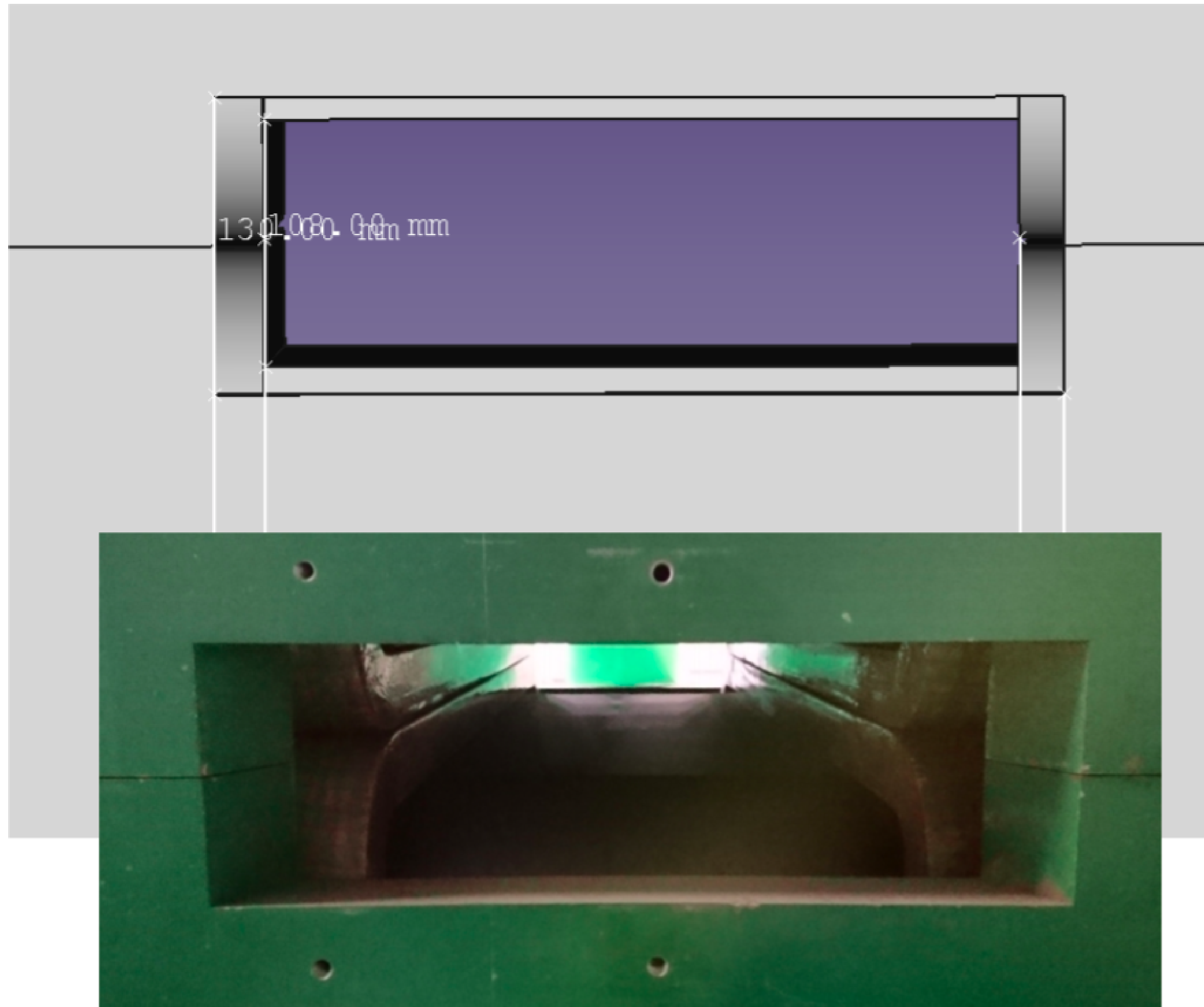
Magnet front (back) plate

Field = 2T
(up to 2.2T)



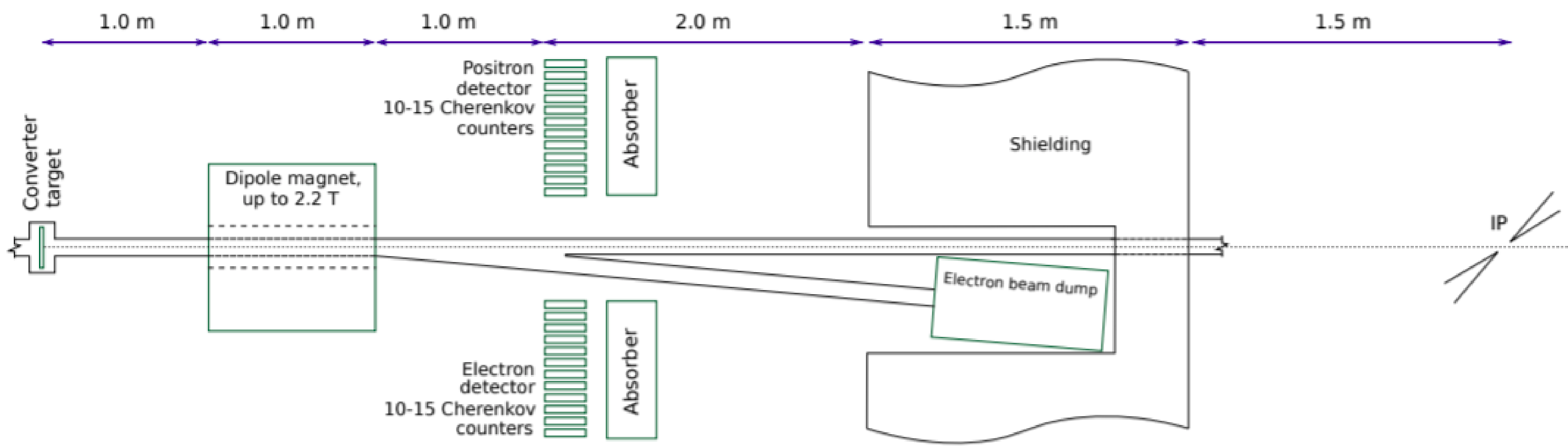
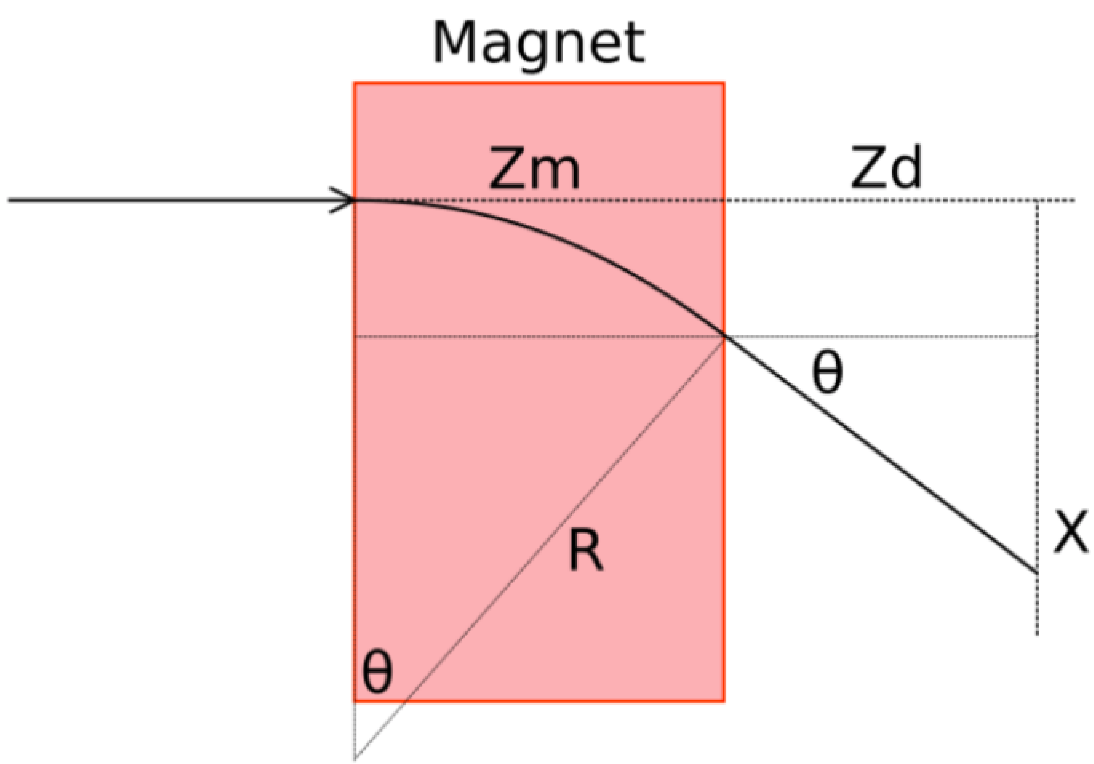


Figure 21. Schematic of the area around the photon target during γ_B–laser running. After the target, a high-field dipole magnet is placed to separate electron–positron pairs produced in the target as well as the electrons from the initial beam which underwent Bremsstrahlung to some degree. Cherenkov counters are foreseen to measure electrons and positrons with absorbers placed behind these to measure the total energy and serve as a dump for the electrons and positrons. An electron beam dump to capture the high energy electrons follows, as well as shielding to protect the IP from stray radiation.

$$x(E)=\frac{B\,c\,z_m}{E}\left(\frac{z_m}{2}+z_d\right)$$

B



Recent figures from Sasha give electron (positron) trajectory

Good for small angles; looking at largest possible angles we could be more precise

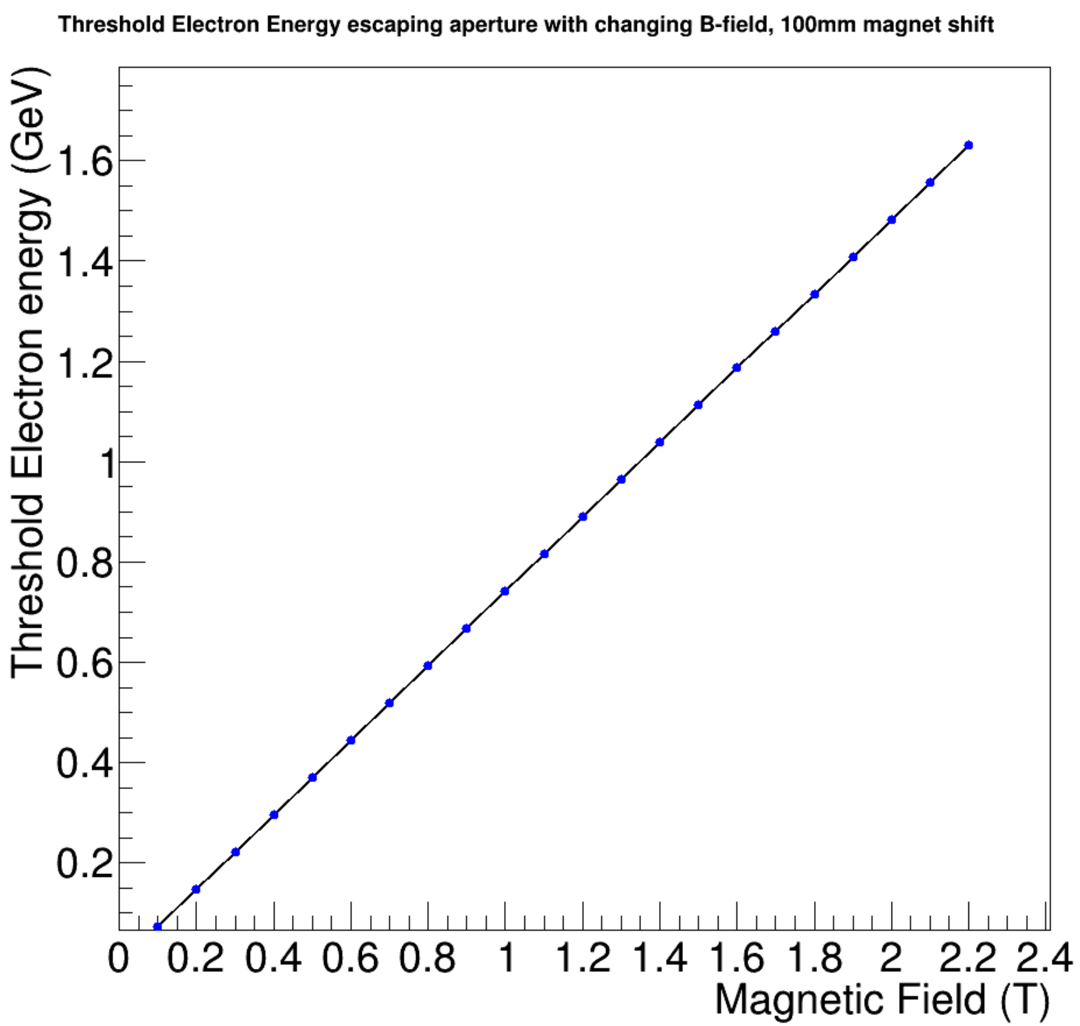
Derived new relation for the trajectory of electrons

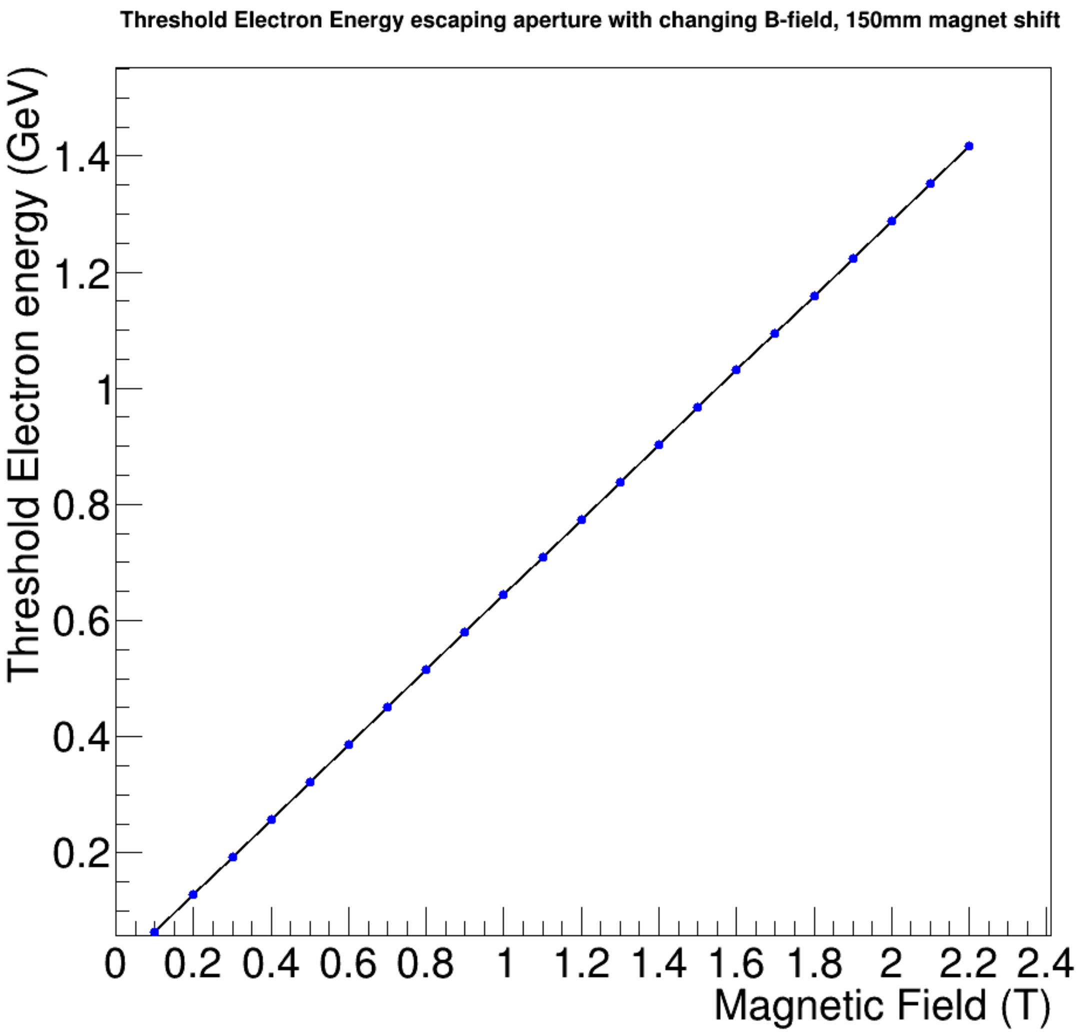
$$x = R(1 - cos(sin^{-1}(\frac{z_m}{R}))) + tan(sin^{-1}(\frac{z_m}{R}))z_d$$

Where radius R = E / Bc

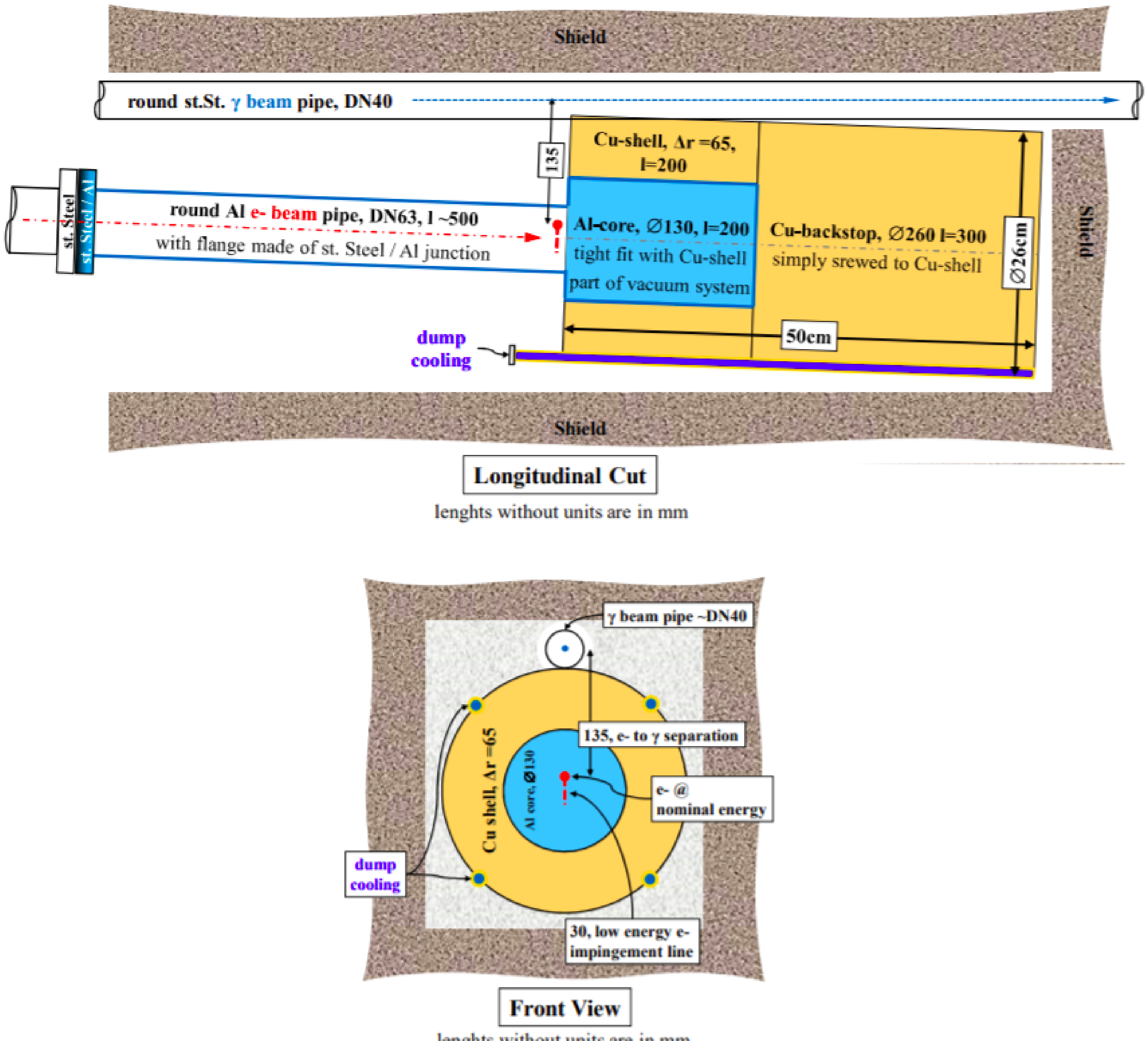
Very difficult to rearrange for R! Obtained values for energy given a fixed x by Numerical Method

For largest theta, E_approx/E ~ 94%

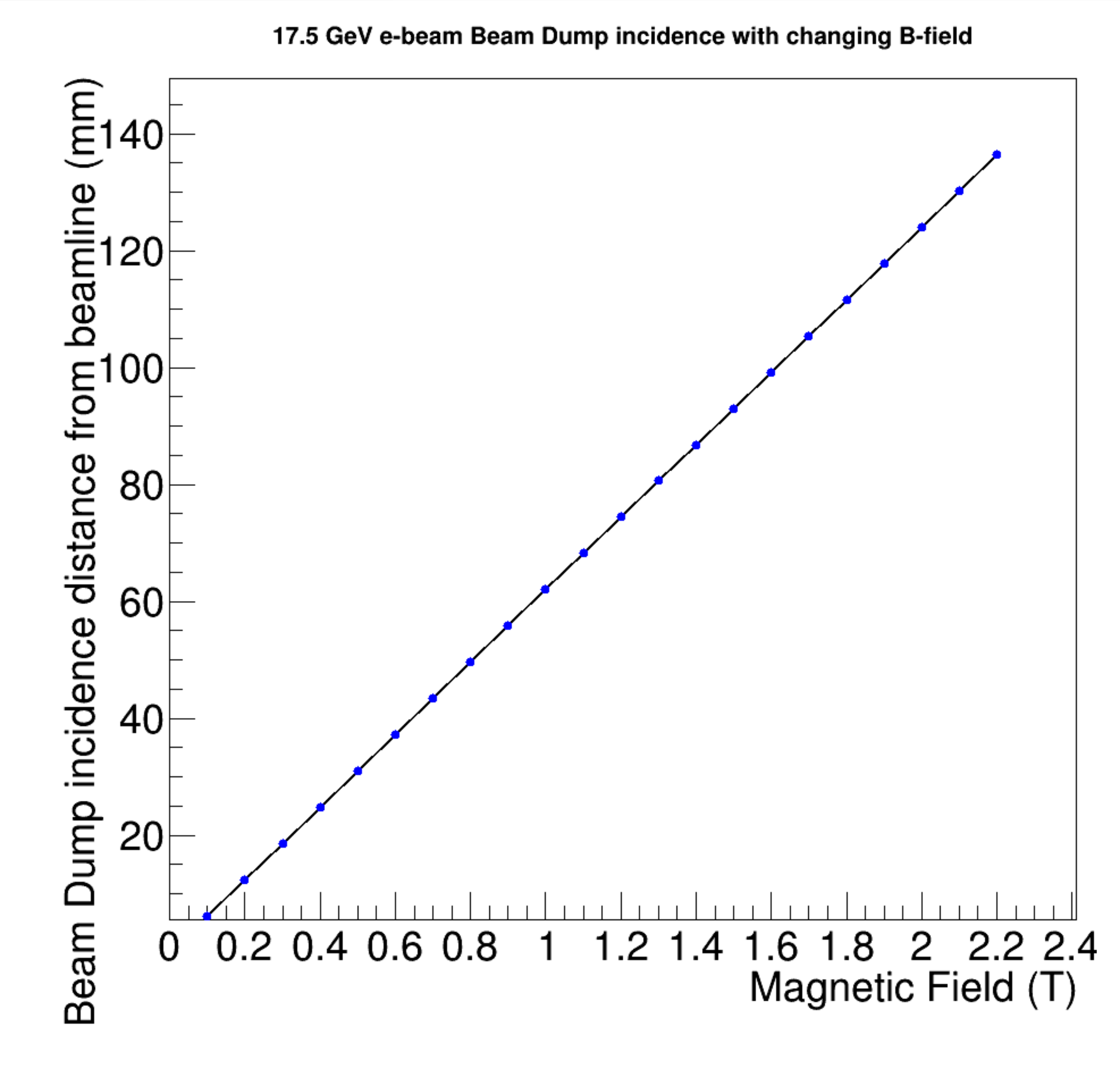




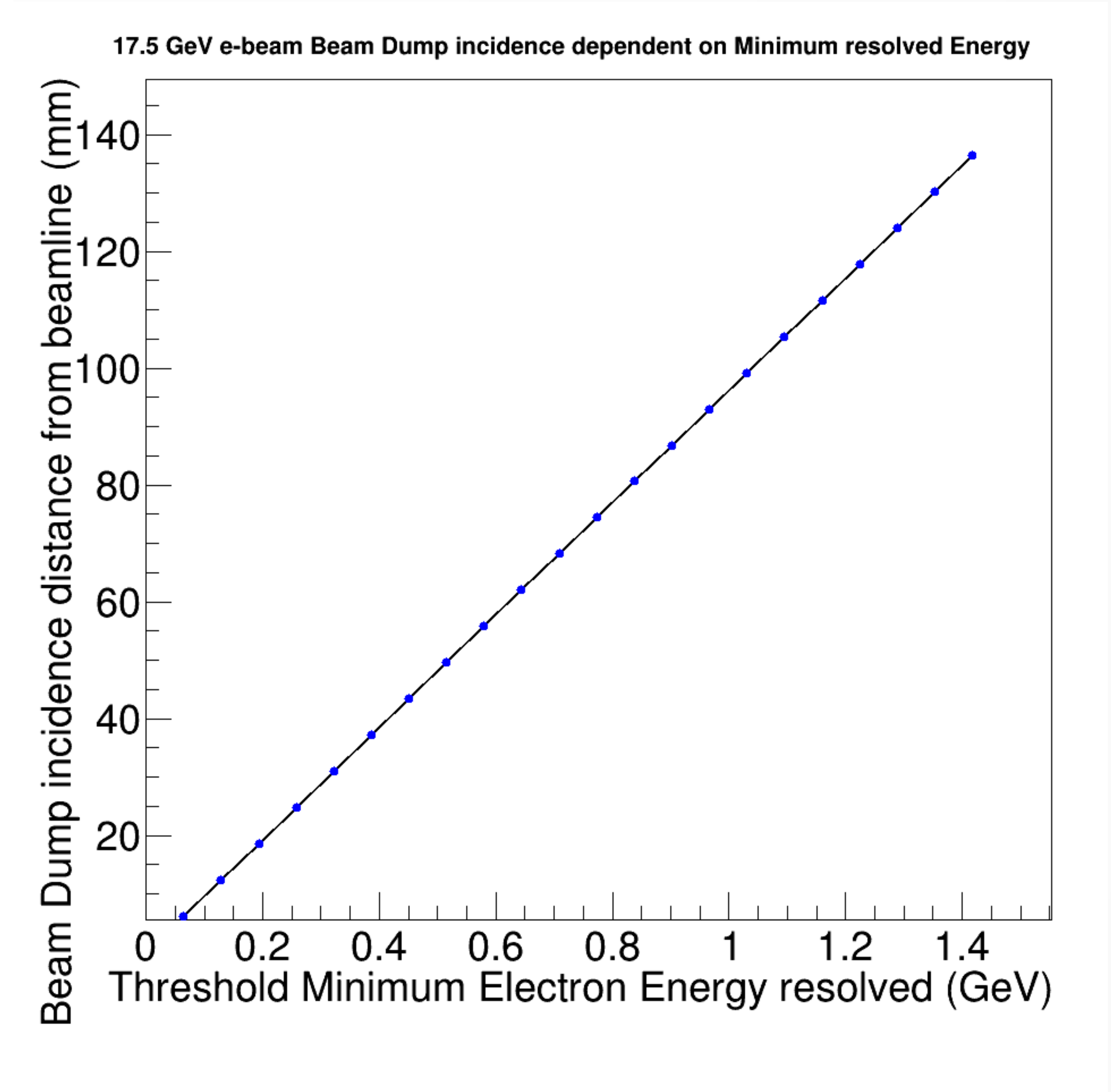
B-field	Magnet off-axis shift	Threshold energy
2.2 T	100 mm	1.631 GeV
2.2 T	150 mm	1.417 GeV



If we are varying B field while we diagnose the low-E electrons we might want to look at the incidence of the Beam on Beam-dump



17.5 GeV e-beam Beam Dump incidence with changing B-field
Beam Dump incidence distance from beamline (mm)
20
40
60
80
100
120
140
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
2.2
2.4
Magnetic Field (T)

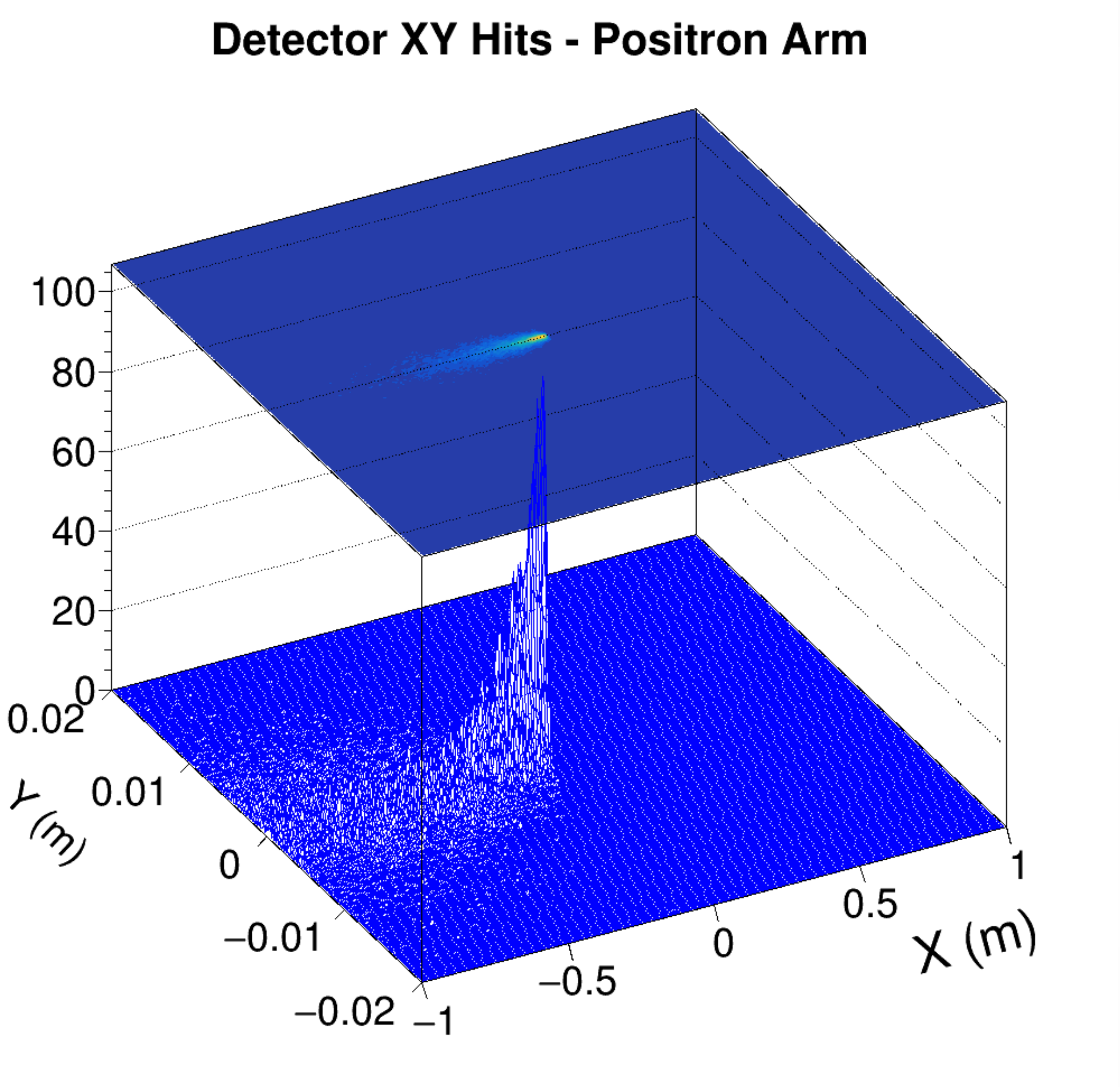


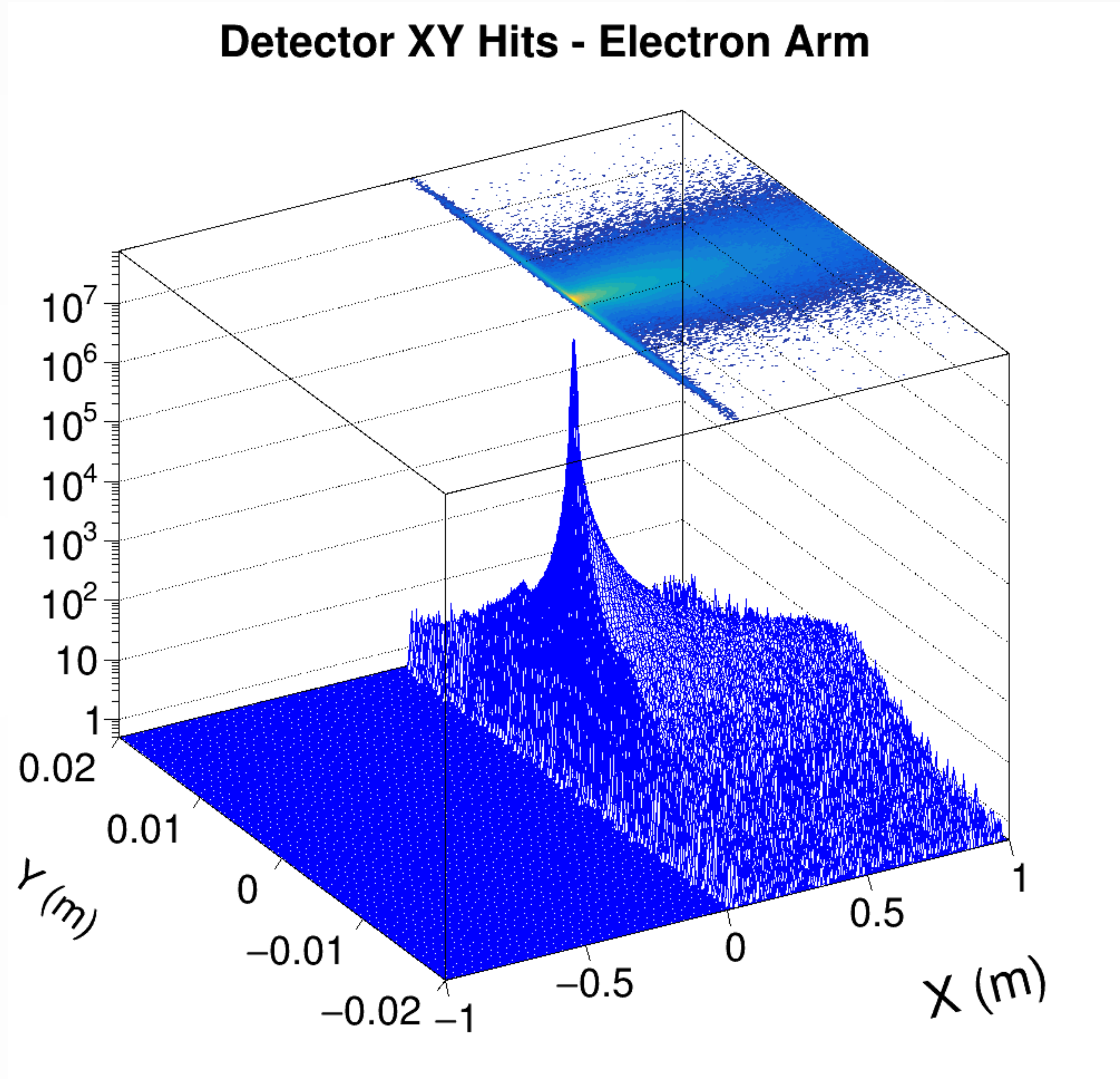
17.5 GeV e-beam Beam Dump incidence dependent on Minimum resolved Energy
Beam Dump incidence distance from beamline (mm)
20
40
60
80
100
120
140
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Threshold Minimum Electron Energy resolved (GeV)

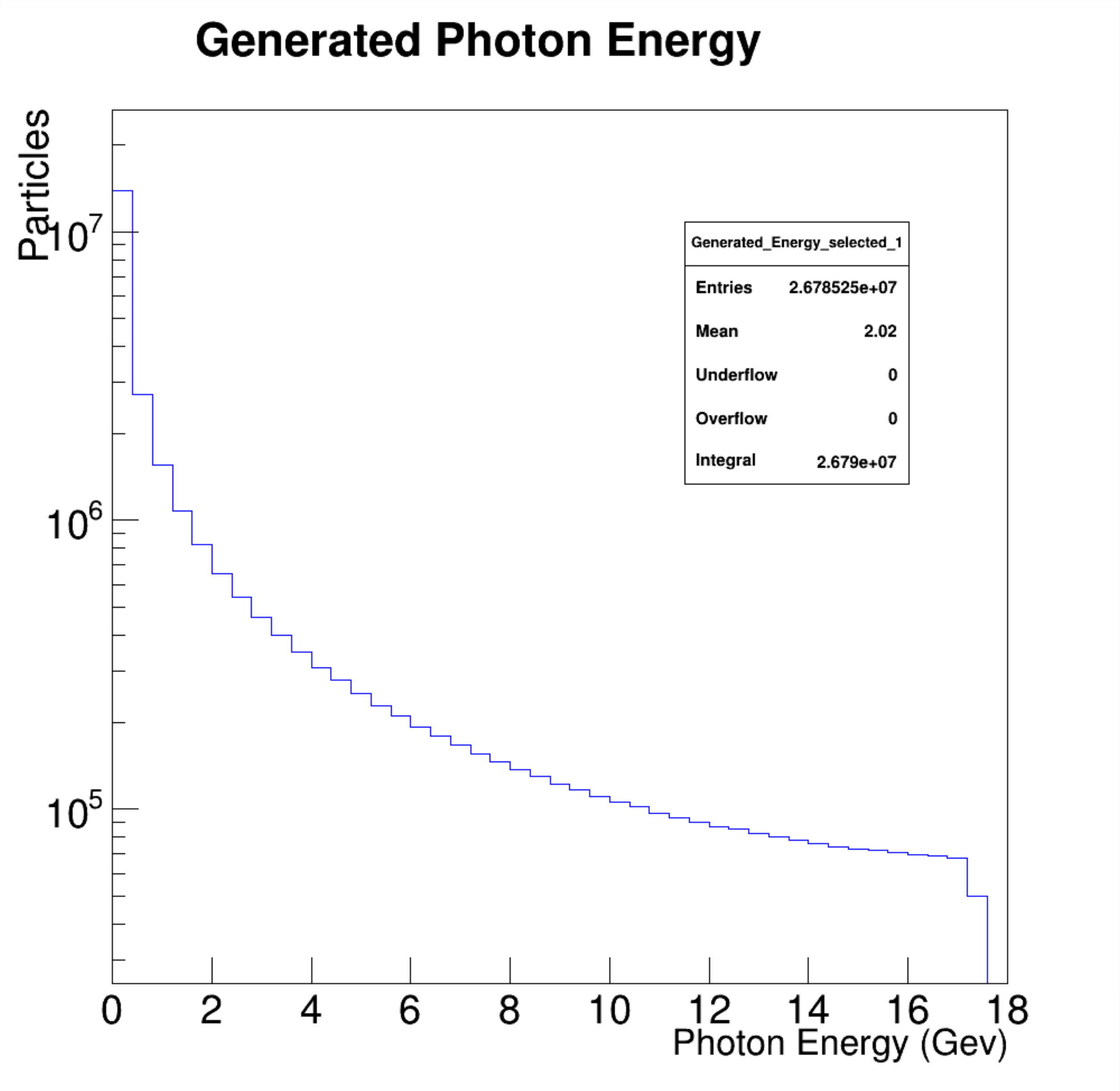
To do: compare with simulation which will show the spread of an angular distribution

Simulate effect on this changing beam position on radiation escaping Beam-dump? Is this important as we should not have the experiment collecting signal

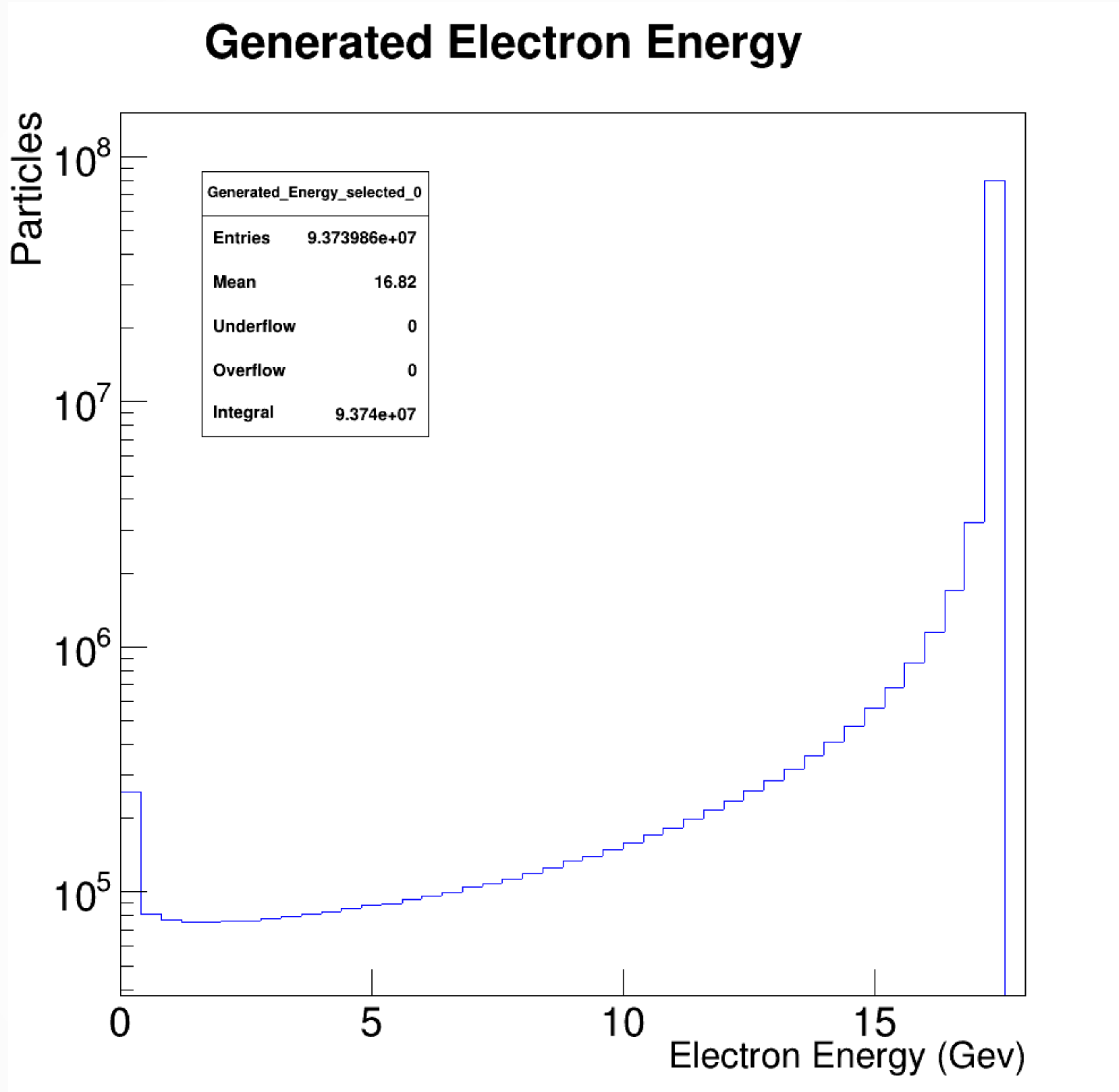
Backup


Detector XY Hits - Positron Arm
100
80
60
40
20
0
0.02
0.01
0
−0.01
−0.02
Y (m)
−1
−0.5
0
0.5
1
X (m)

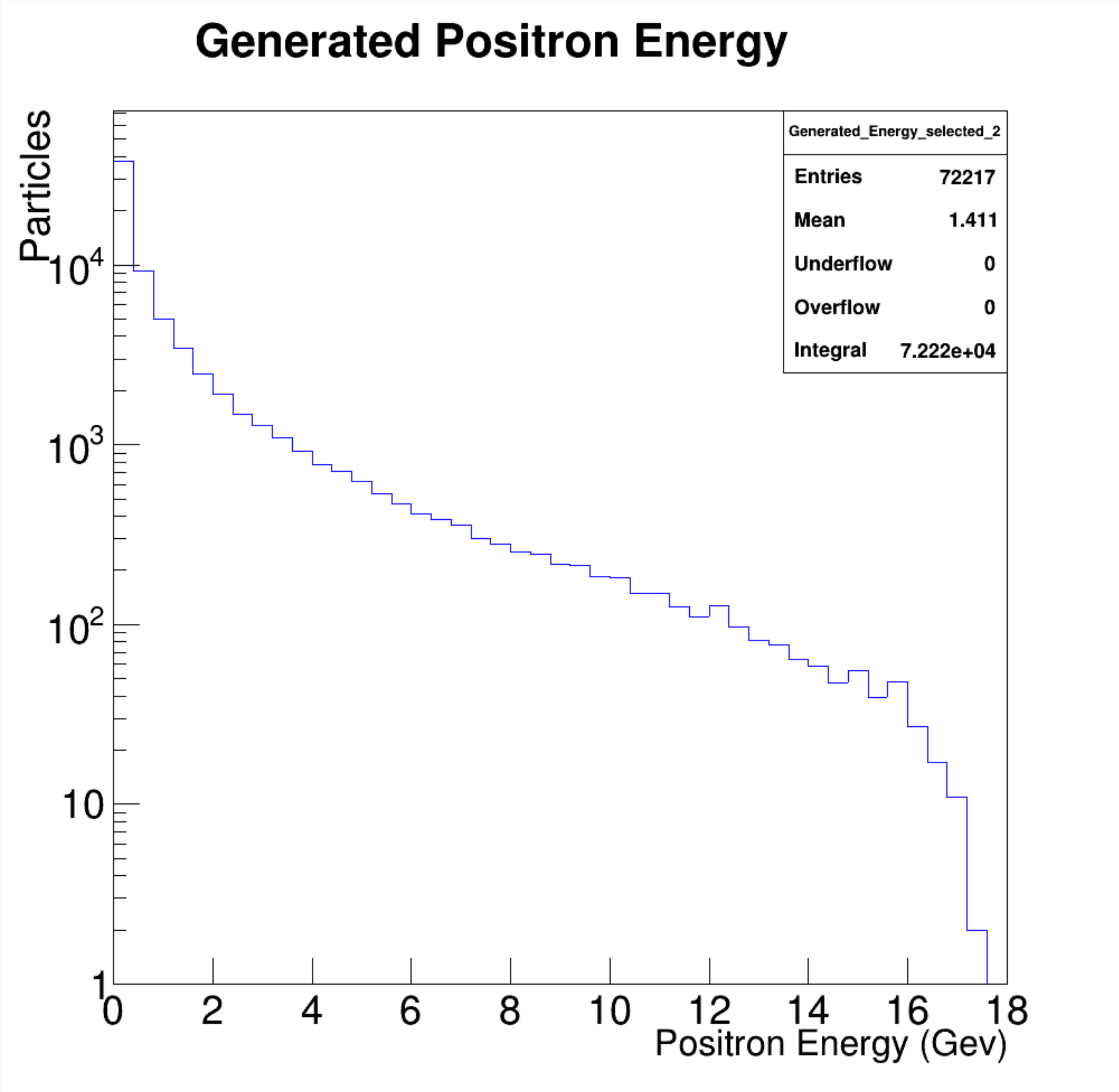

Detector XY Hits - Electron Arm
10^7
10^6
10^5
10^4
10^3
10^2
10
1
0.02
0.01
0
−0.01
−0.02
Y (m)
−1
−0.5
0
0.5
1
X (m)



Generated Photon Energy
Particles
10^7
10^6
10^5
Generated_Energy_selected_1
Entries 2.678525e+07
Mean 2.02
Underflow 0
Overflow 0
Integral 2.679e+07
0 2 4 6 8 10 12 14 16 18
Photon Energy (Gev)



Generated Electron Energy
Particles
10^8
10^7
10^6
10^5
Generated_Energy_selected_0
Entries 9.373986e+07
Mean 16.82
Underflow 0
Overflow 0
Integral 9.374e+07
0
5
10
15
Electron Energy (Gev)



Generated Positron Energy
Generated_Energy_selected_2
Entries 72217
Mean 1.411
Underflow 0
Overflow 0
Integral 7.222e+04
Particles
10^4
10^3
10^2
10
1
0 2 4 6 8 10 12 14 16 18
Positron Energy (Gev)

Scintillation light output with limited steel aperture