Forward detector system for the LUXE experiment

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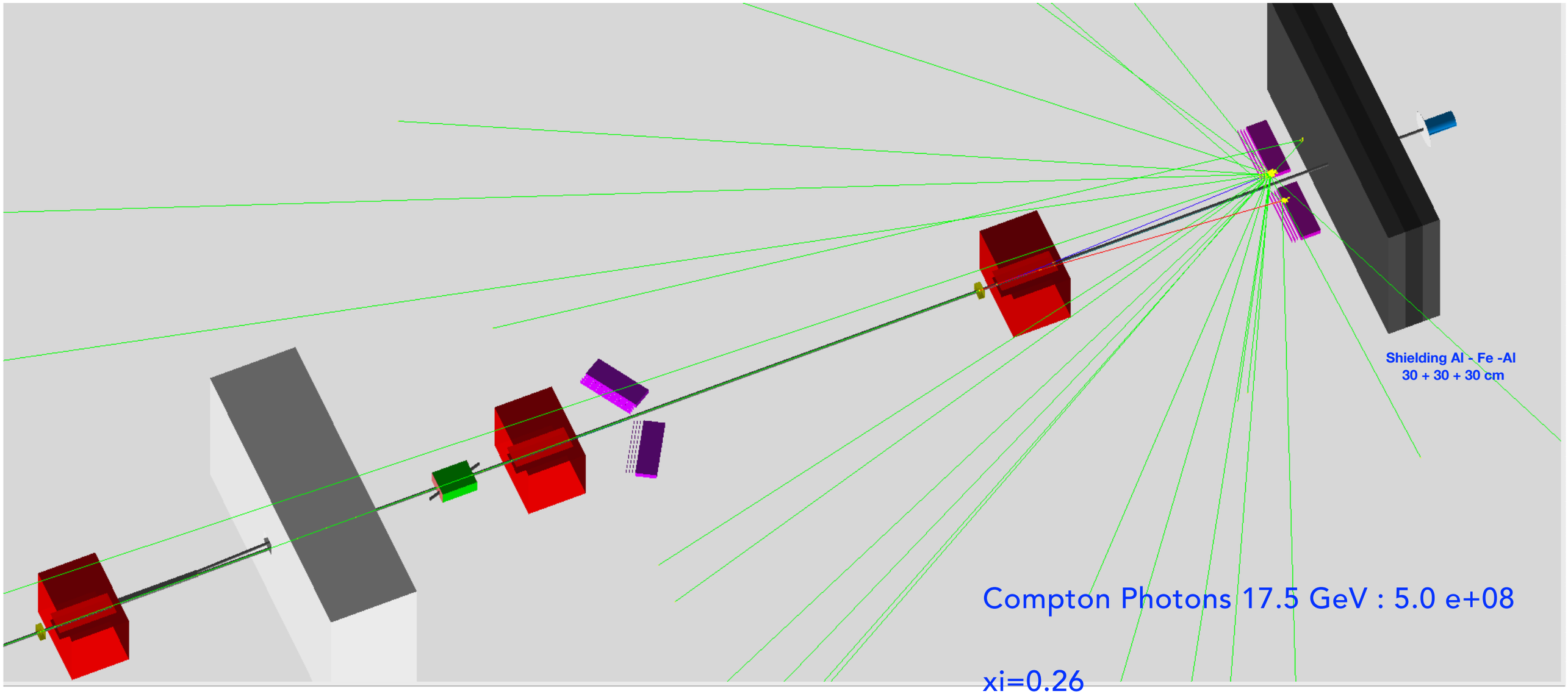
7/11/19

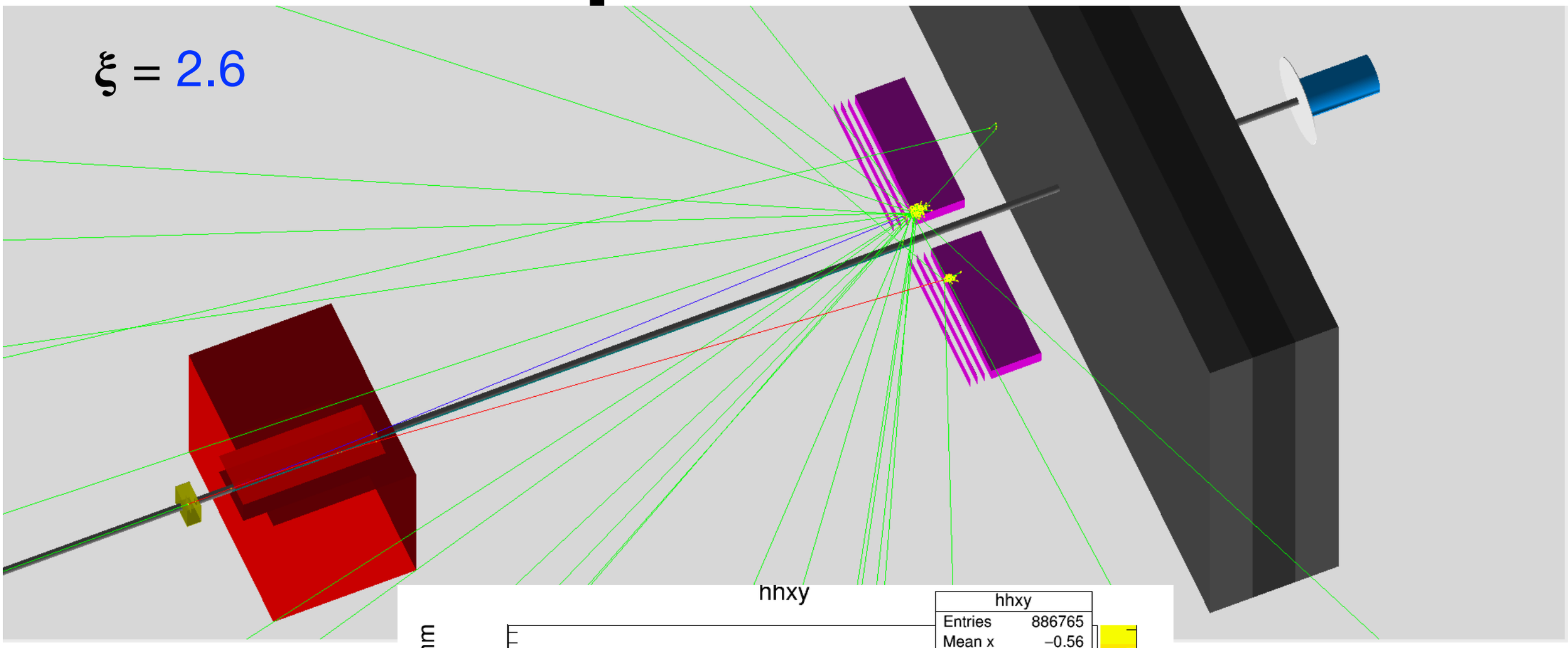
Luxe Technical meeting

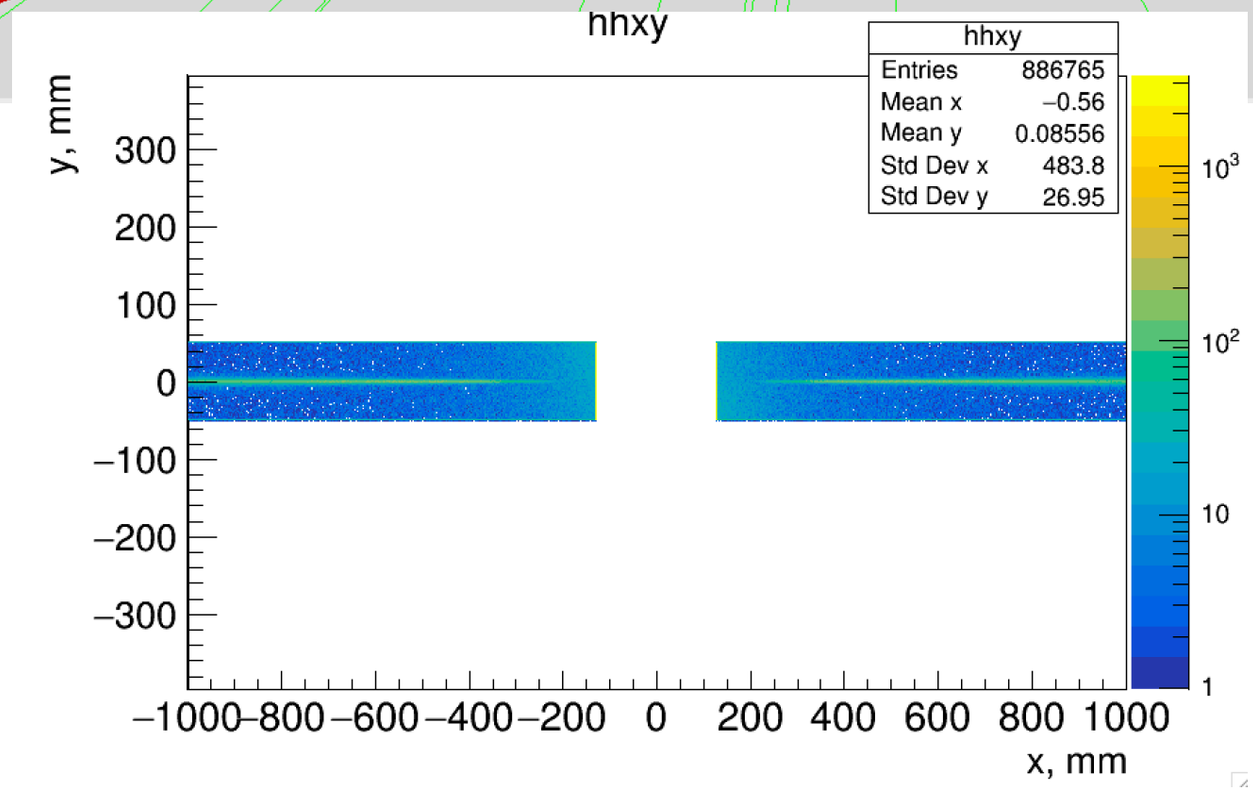
DESY Hamburg

Luxe setup with non-tilted Compton Detector

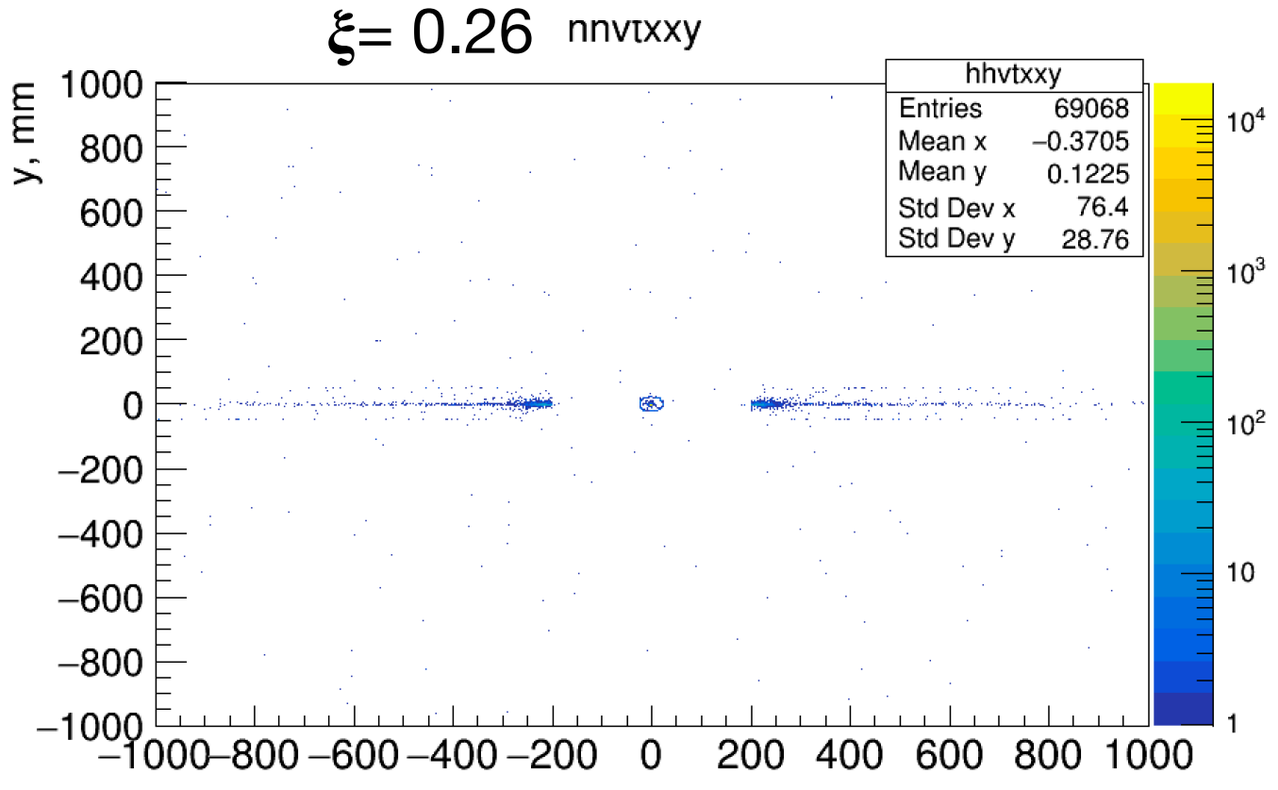


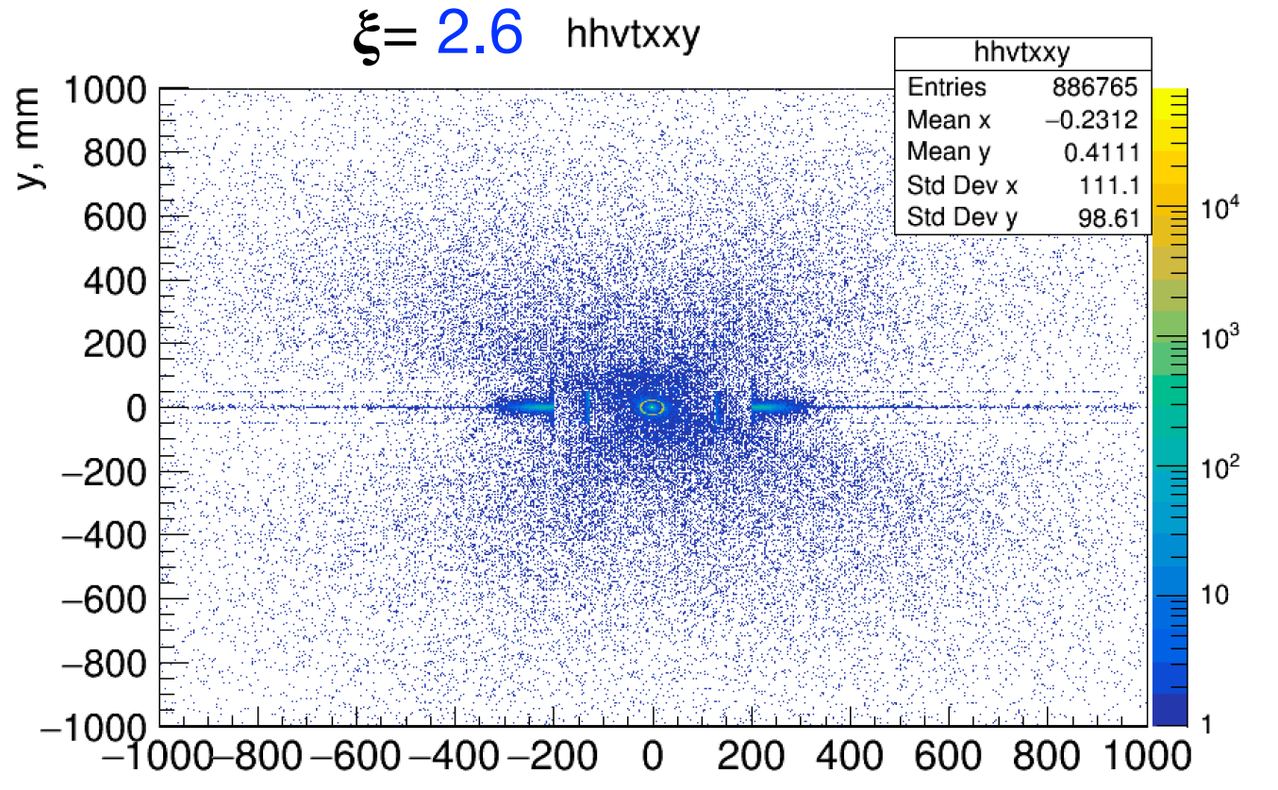
Compton detector

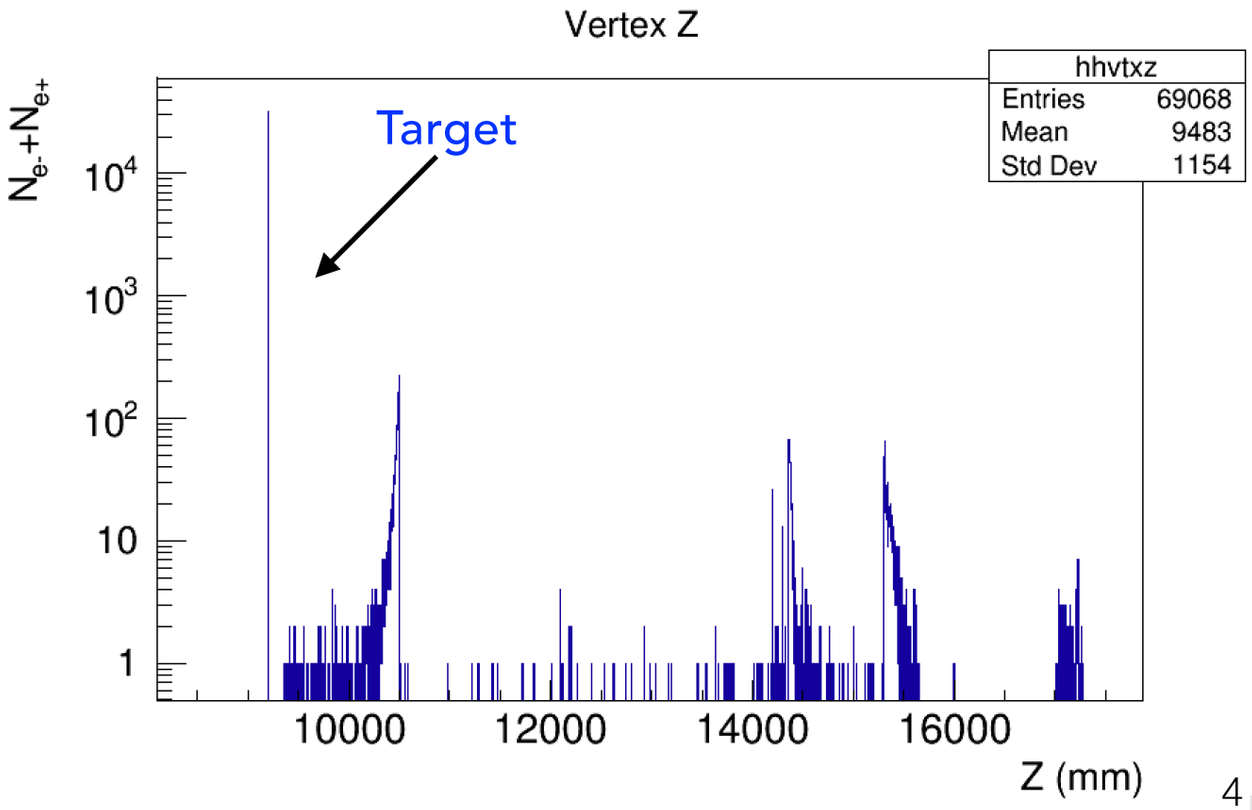


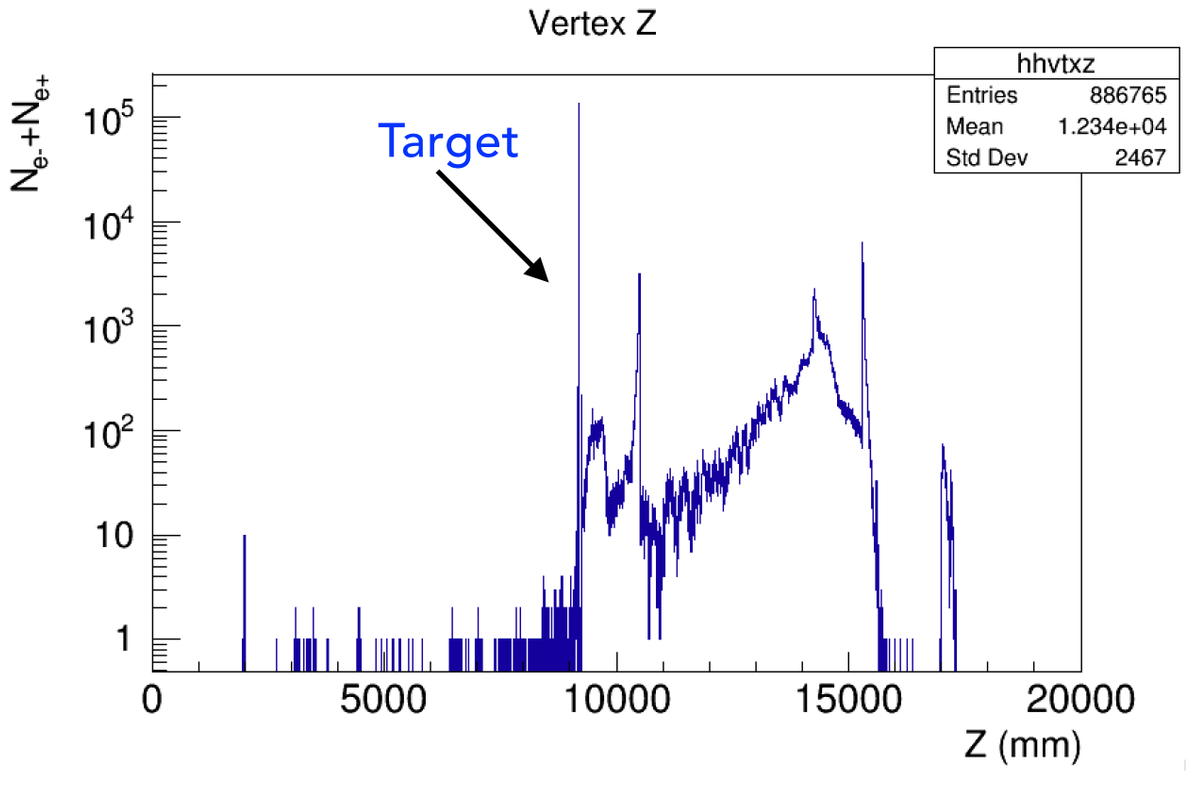


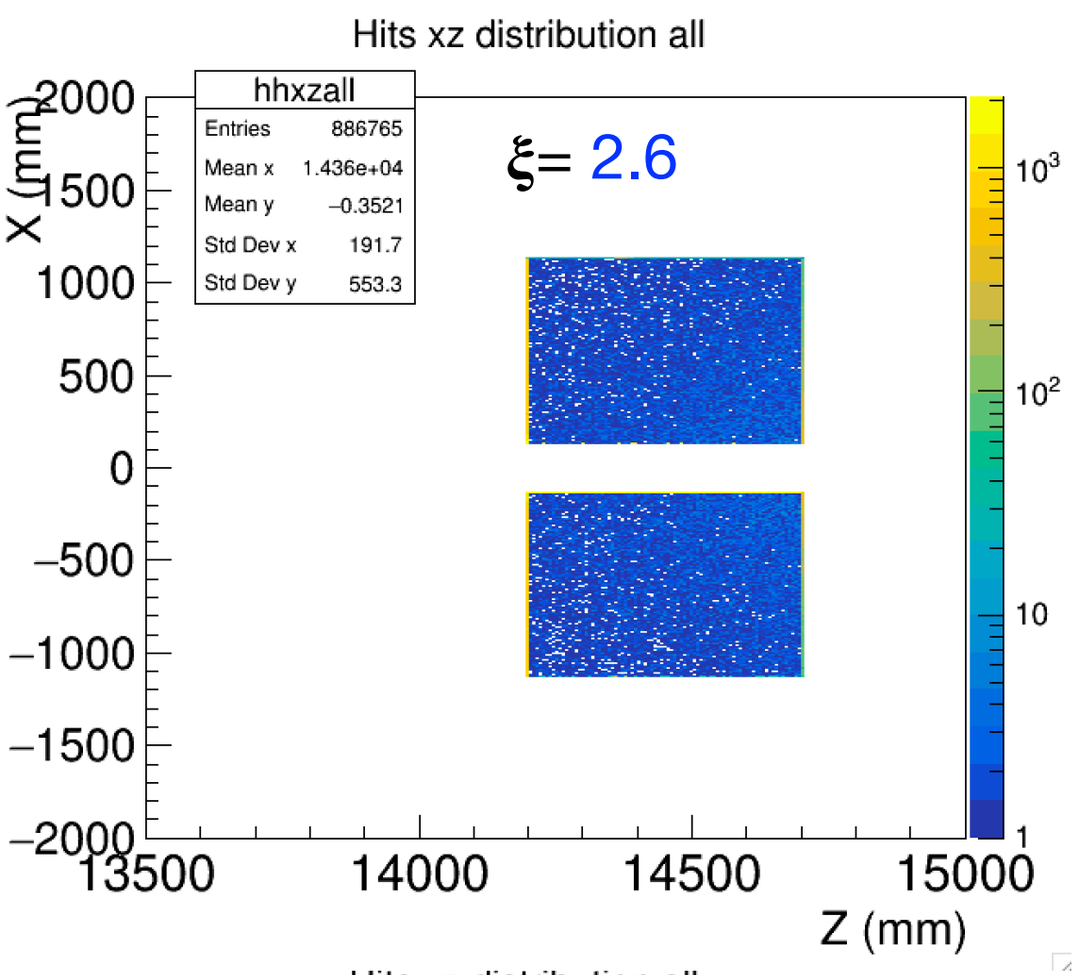
Vertexes in Compton detector

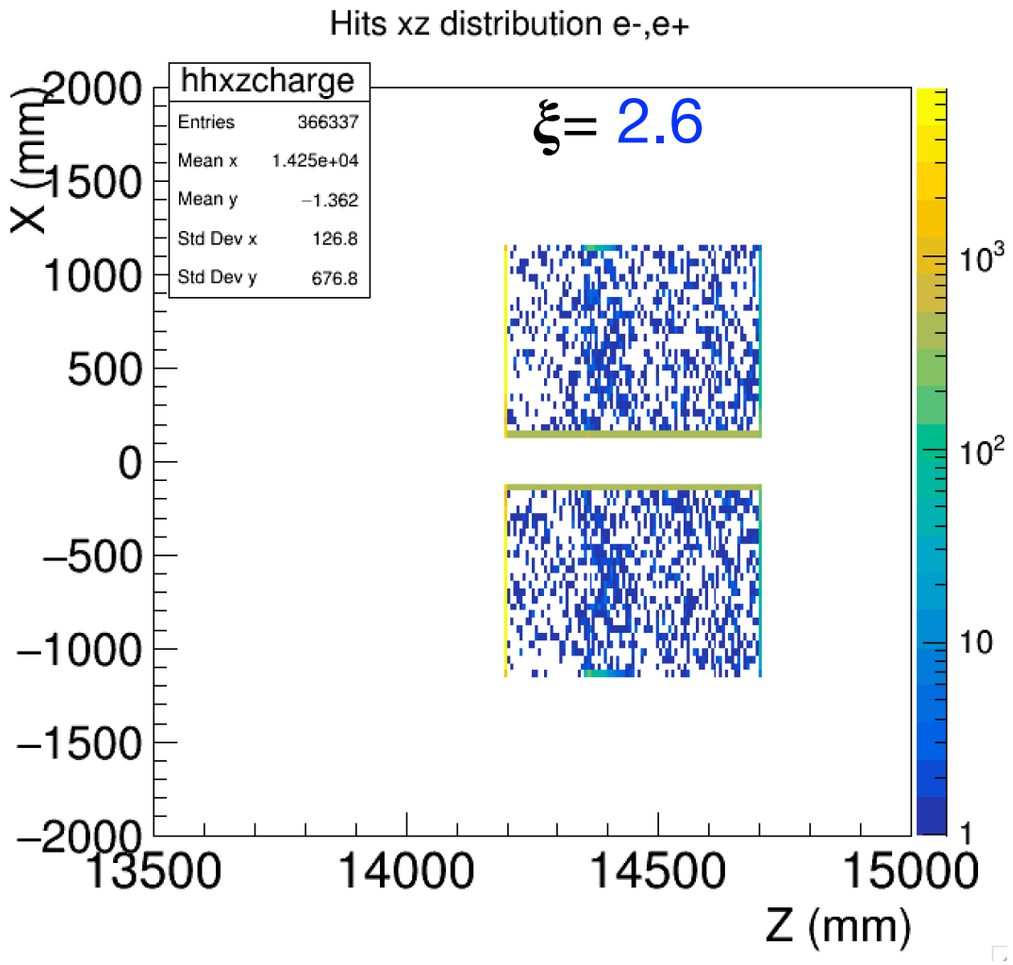


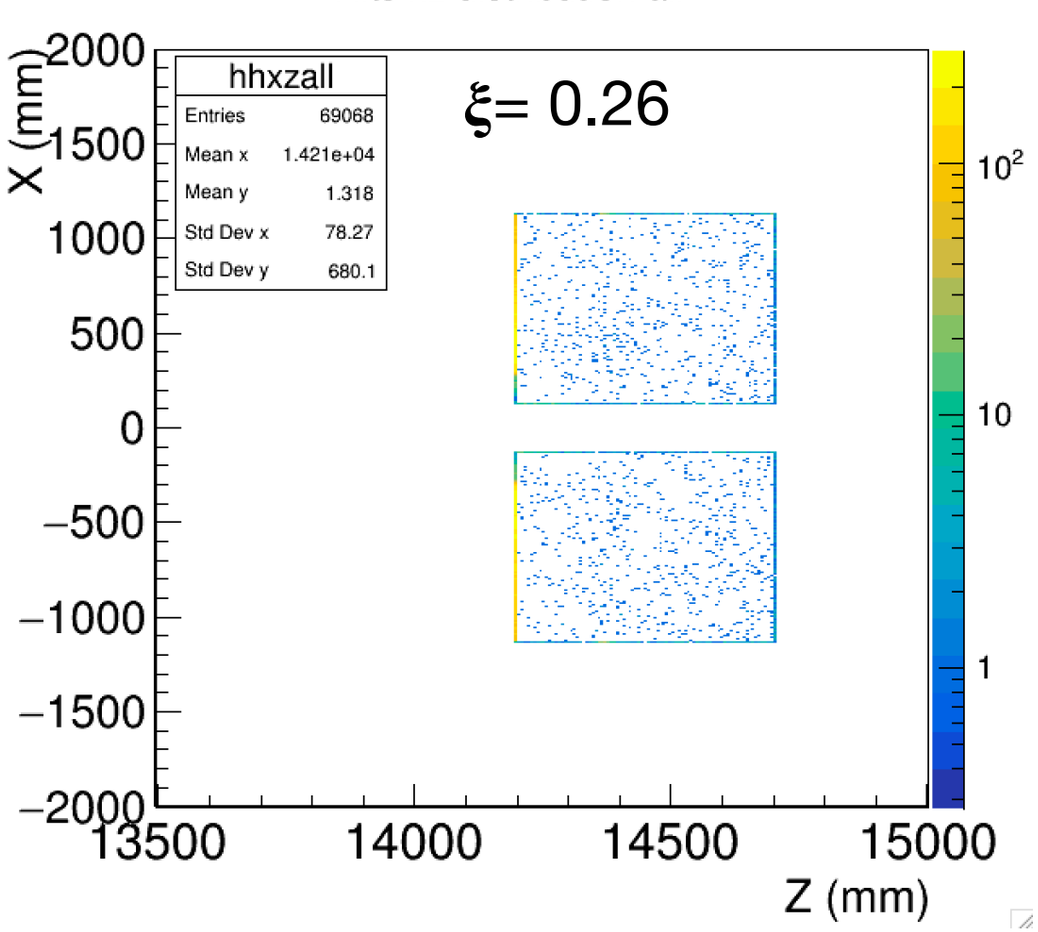


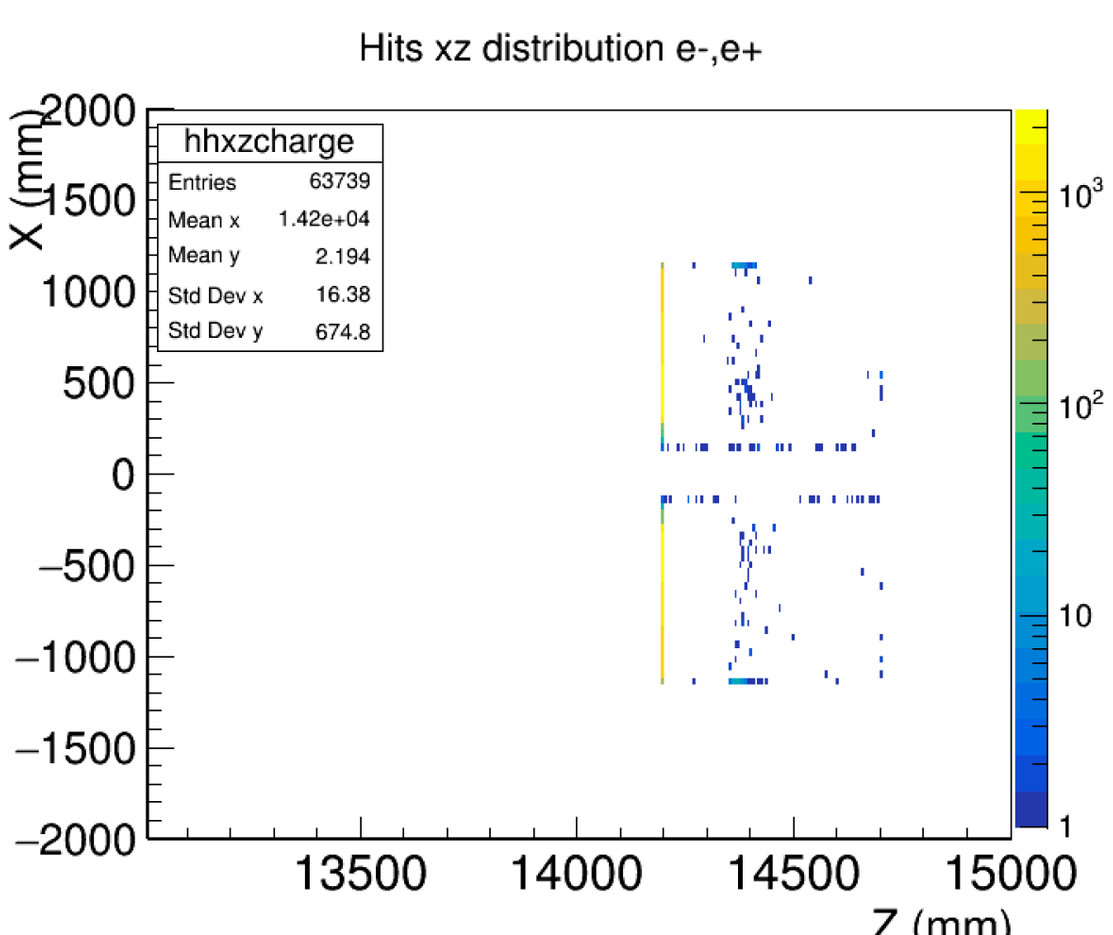




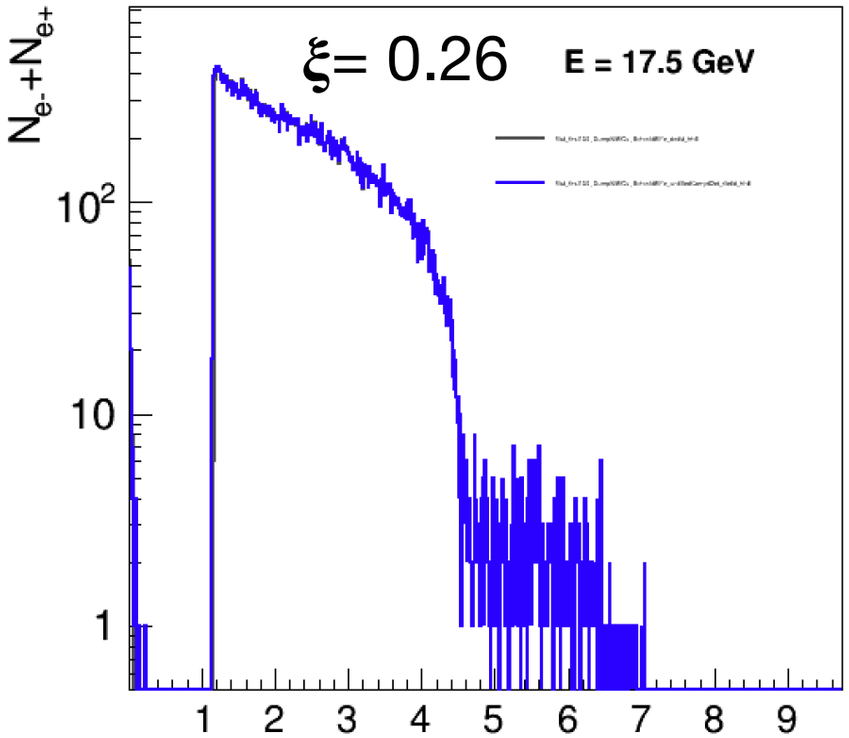

Hits xz distribution all
hhxzall
Entries 886765
Mean x 1.436e+04
Mean y −0.3521
Std Dev x 191.7
Std Dev y 553.3
ξ= 2.6
X (mm)
Z (mm)

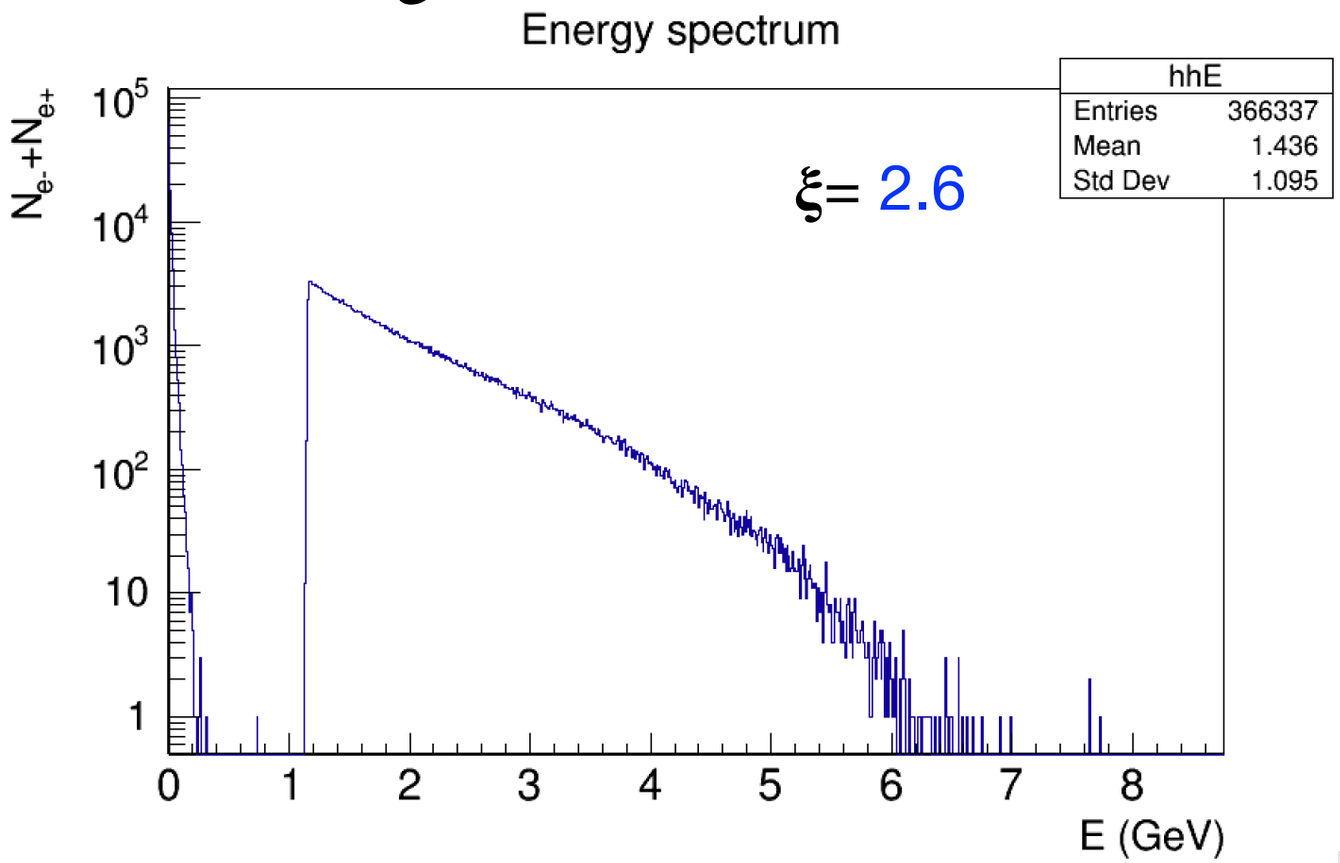

Hits xz distribution e-,e+
hhxzcharge
Entries 366337
Mean x 1.425e+04
Mean y −1.362
Std Dev x 126.8
Std Dev y 676.8
ξ= 2.6
X (mm)
Z (mm)

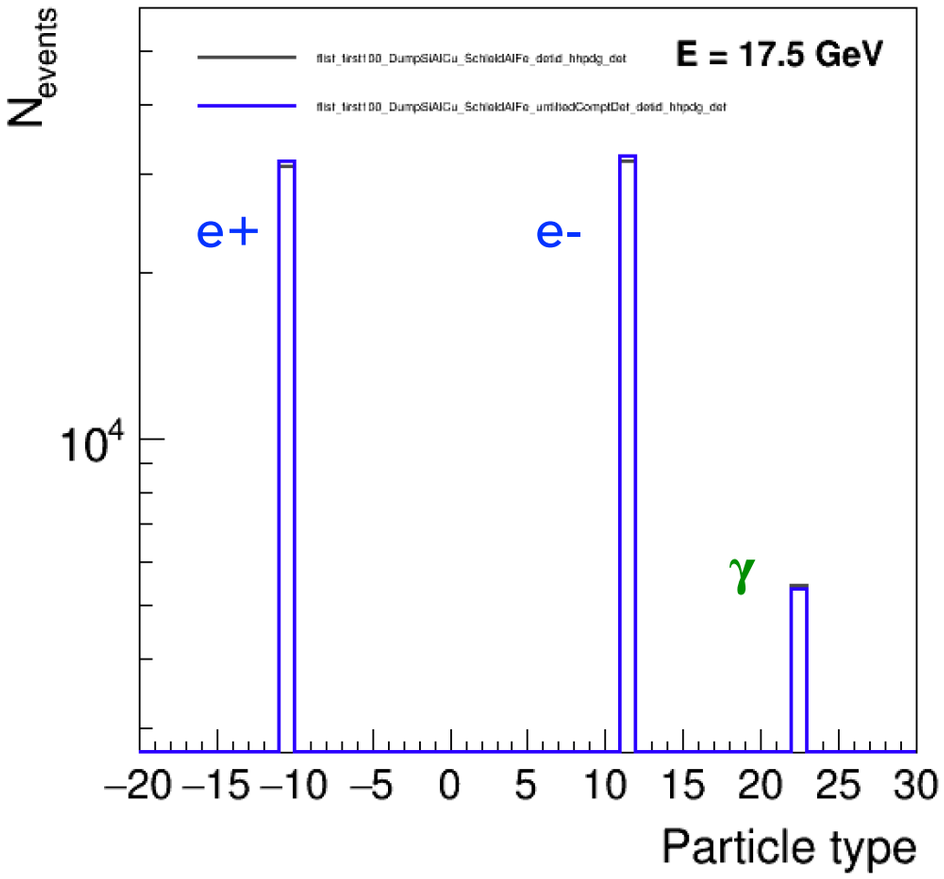

Hits xz distribution all
hhxzall
Entries 69068
Mean x 1.421e+04
Mean y 1.318
Std Dev x 78.27
Std Dev y 680.1
ξ= 0.26
X (mm)
Z (mm)


Hits xz distribution e-,e+
hhxzcharge
Entries 63739
Mean x 1.42e+04
Mean y 2.194
Std Dev x 16.38
Std Dev y 674.8
X (mm)
Z (mm)

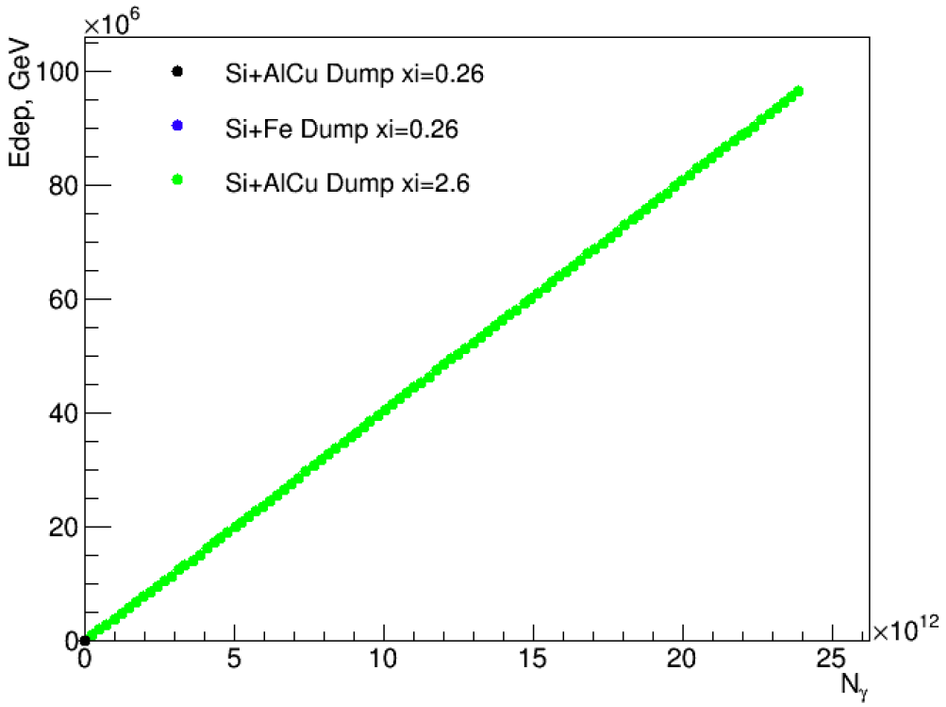
Compton detector: ξ= 2.6 vs 0.26



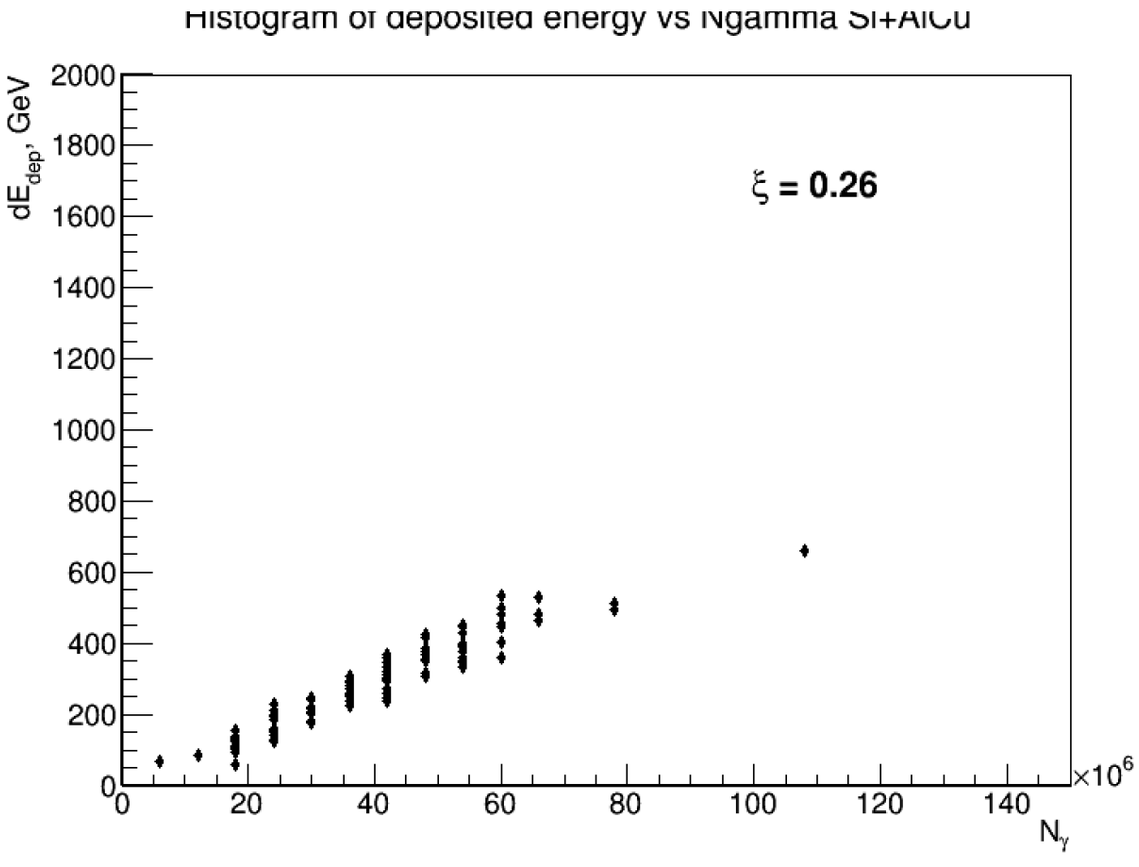


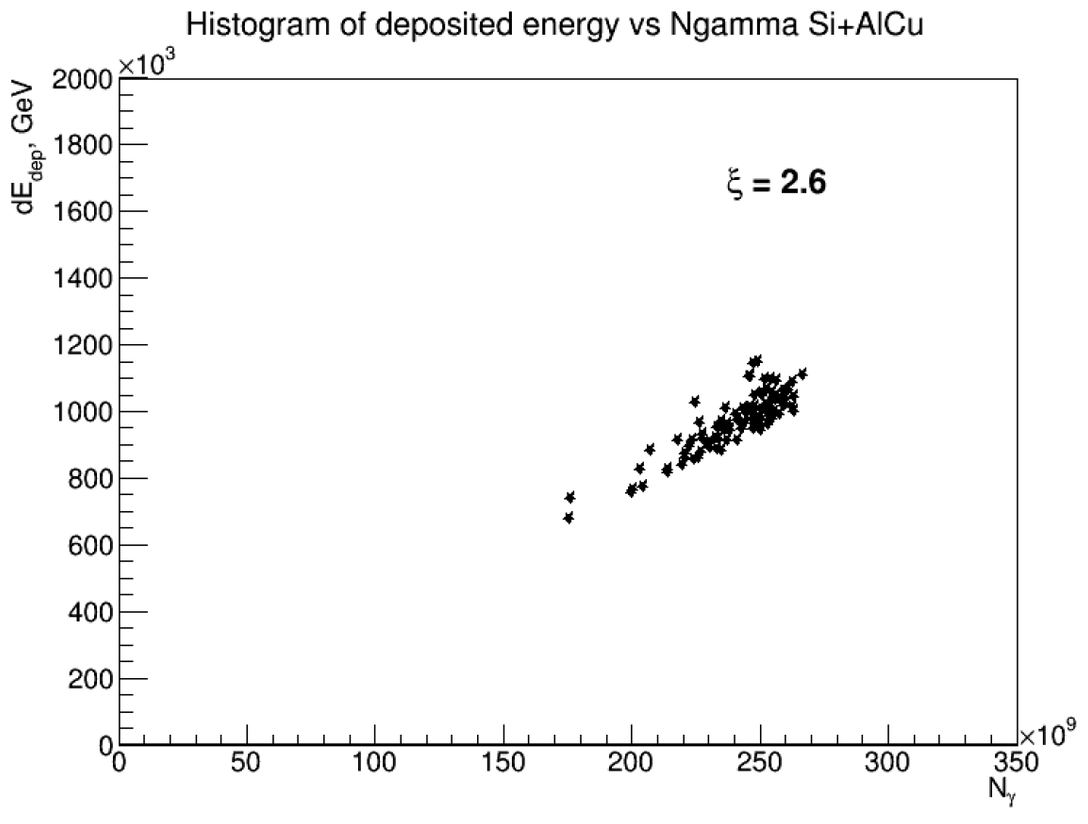


The dependence of deposited energy on number of incoming photons for Si Gamma monitor and AlCu dump for different laser intensities

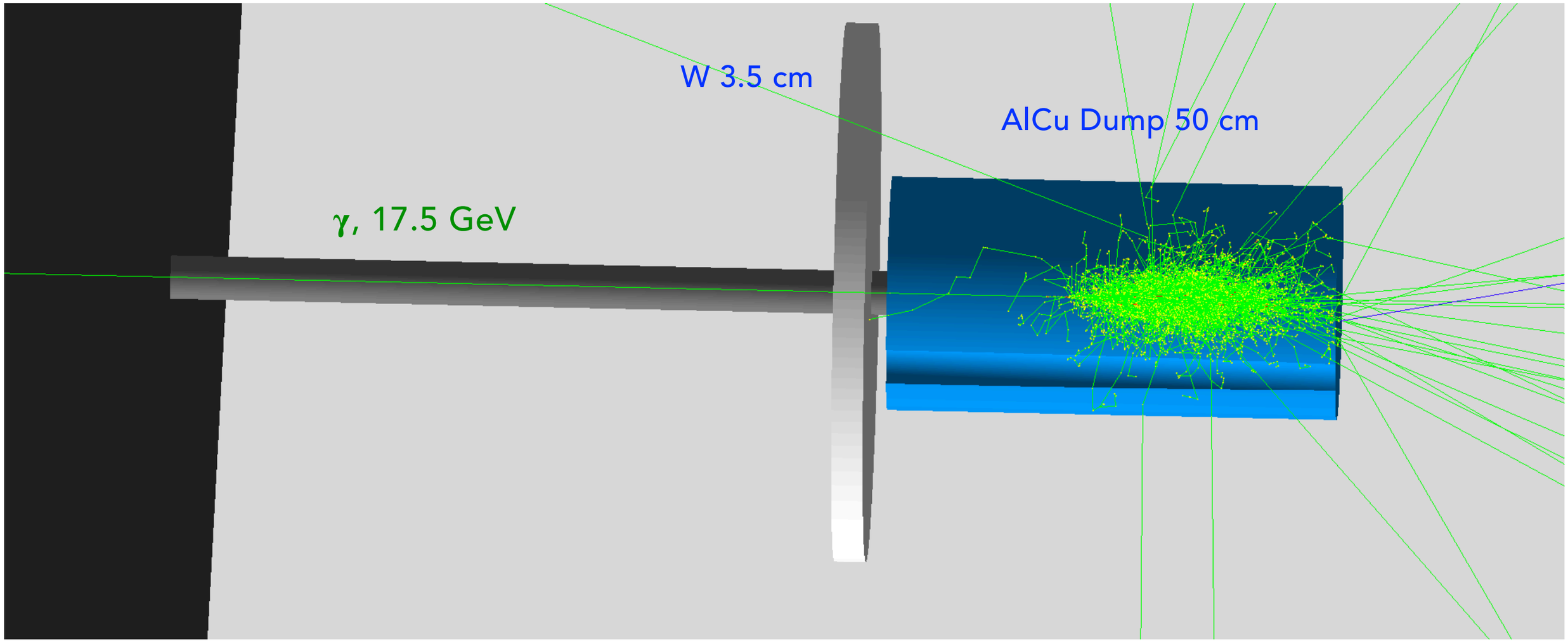


Energy deposit on Nphotons
Each point is one BX





Tungsten Gamma Monitor in Luxe setup

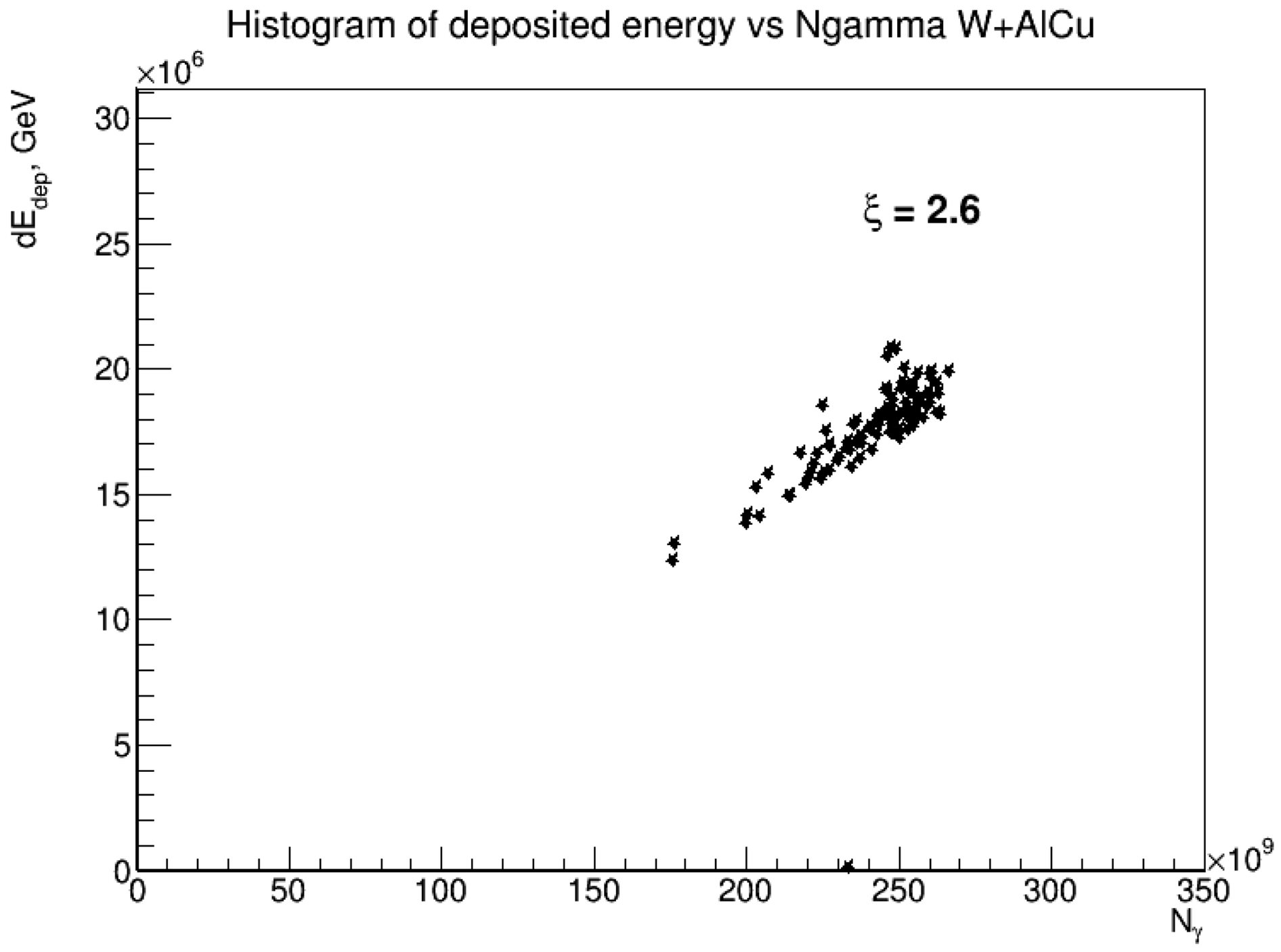


Compton Photons, 100 BX

ξ = 2.6

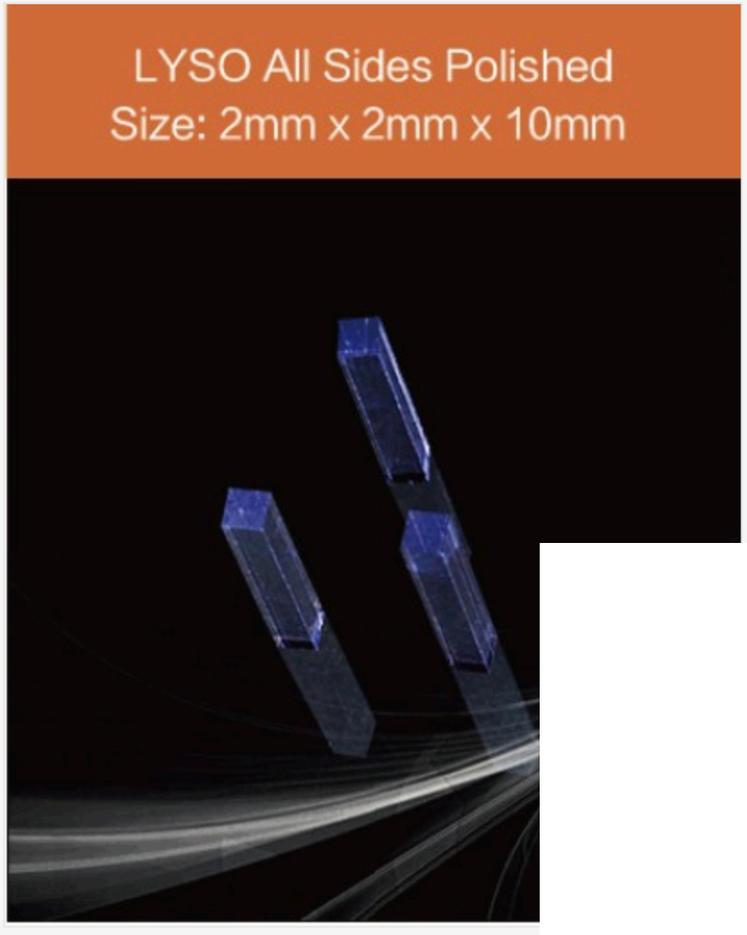
Target: W foil 10 um

The deposited energy on number of incoming photons for W Gamma monitor and AlCu dump



LYSO CRYSTAL

LYSO crystal is an ideal generation scintillator crystal. LYSO (Cerium-doped Lutetium Yttrium Orthosilicate.) LYSO crystal has the advantages of high light output and density, quick decay time, excellent energy resolution and low cost. These properties make LYSO an ideal candidate for a range of ray detection applications in nuclear physics and nuclear medicine, which require higher, improved timing resolution and superior energy revolution.



LYSO Ce Scintilltion Crystal, Cerium Doped Lutetium Yttrium Silicate Scintillation Crystal, LYSO Ce Scintillator Crystal, 2 X 2 X 10mm

Brand : EPIC Crystal
Product Code : 2 x 2 x 10 mm all sides polished
Availability : In Stock

$24.00

Ex Tax :$24.00

5 or more $20.00

10 or more $18.00

Properties	BGO	LYSO
Density (g/m^3)	7.13	7.3
Melting Point (°C)	1050	2047
Index of Refraction	2.15	1.82
Radiation Length (cm)	1.10	1.16
Attenuation (cm-1)	0.96	0.87
Decay Constant (ns)	300	50
Light Yield (%) Nal (TI)	25	75
Photofraction (%)	40	30
Energy Resolution (511 kev,%)	16	20
Radioactivity	No	Yes

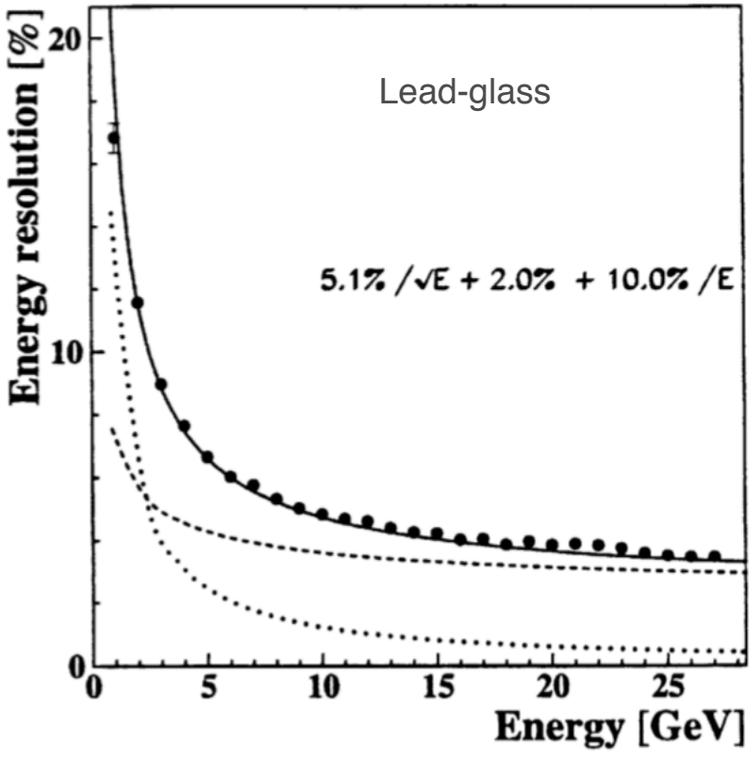


Fig. 5. Energy resolution of the calorimeter; the circles correspond to the 1996 data, the solid curve is the sum of the contributions from the lead-glass (dashed curve) and from the pre-shower (dotted curve) provided at test beam measurement [7].

Outlook

- **Compton detector studies:**
- **Gamma monitor studies:**

✴ **Gamma Monitor is studied in simple configuration in GEANT4 w/ Si Monitor in front of different Dumps (W, Fe, Al-Cu) for different intensities**

✴ **The linear dependence of deposited energy on number of incoming photons allows the usage of backscatters for counting the photon flux for all the configurations**

✴ **The energy spectrum of backscatters is below 1 GeV and for the vast majority is below critical energy for the most detector materials**

Further studies:

To consider BGO or Sapphire (Al2O3) for Gamma Monitor

To study background