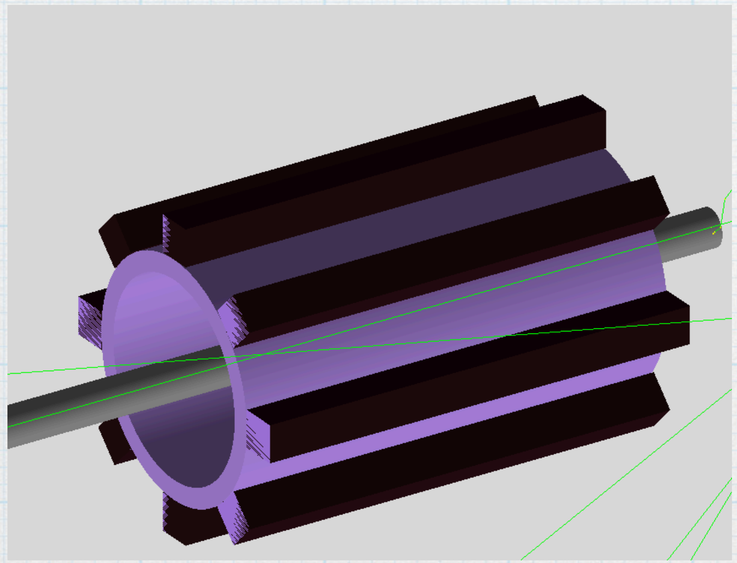
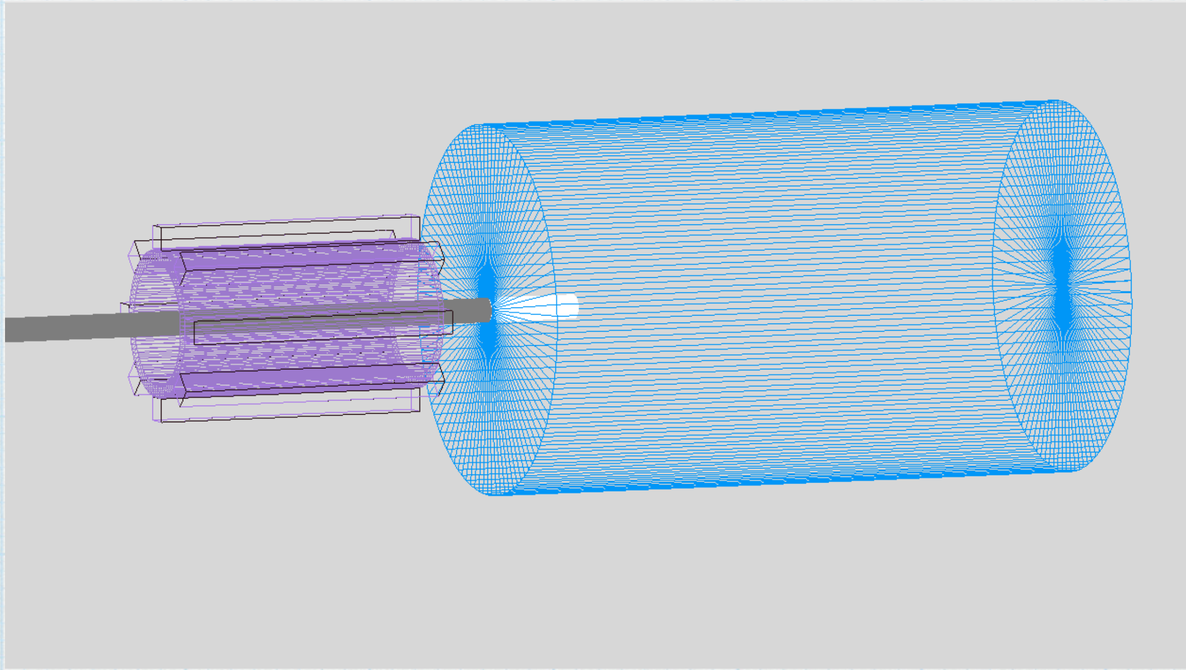
Gamma Flux Monitor & BeamDump

- The implementation of FDS in Luxe geometry with the LG Gamma Monitor made of new LG blocks in front of Cu Dump with a hole of 15 cm,
- LG w/ measures 3.8 × 3.8 cm^2, length is 45 cm
- Wrapped with Aluminium foil of 0.016 mm (typical household foil; no account for air)

- Beam Dump: R=30 cm, L=100 cm
- GM Support: Stainless Steel of 1 cm thickness



- Distance between Monitor and Dump 10 cm

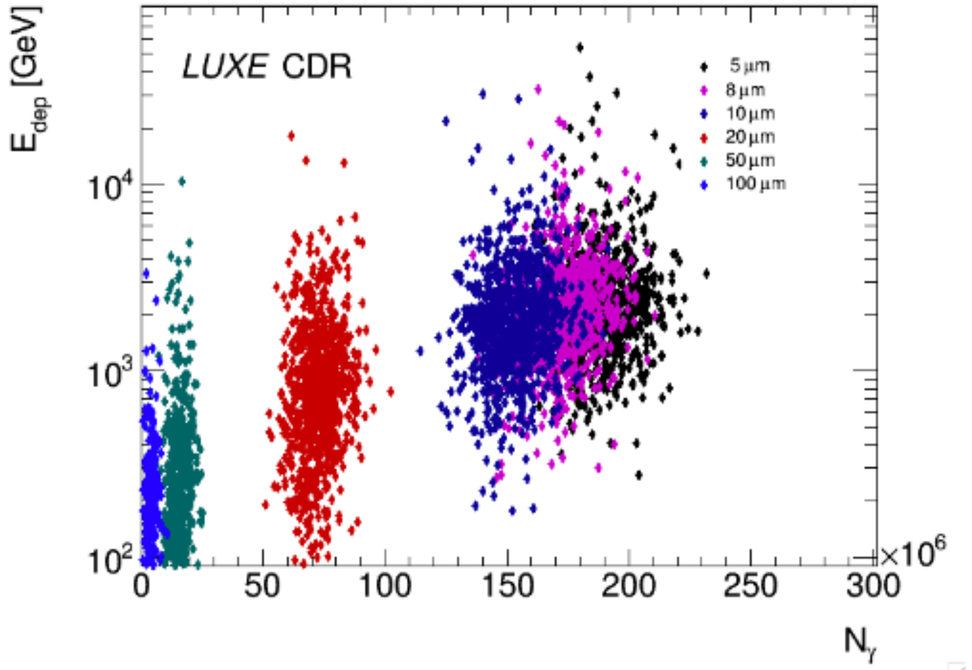


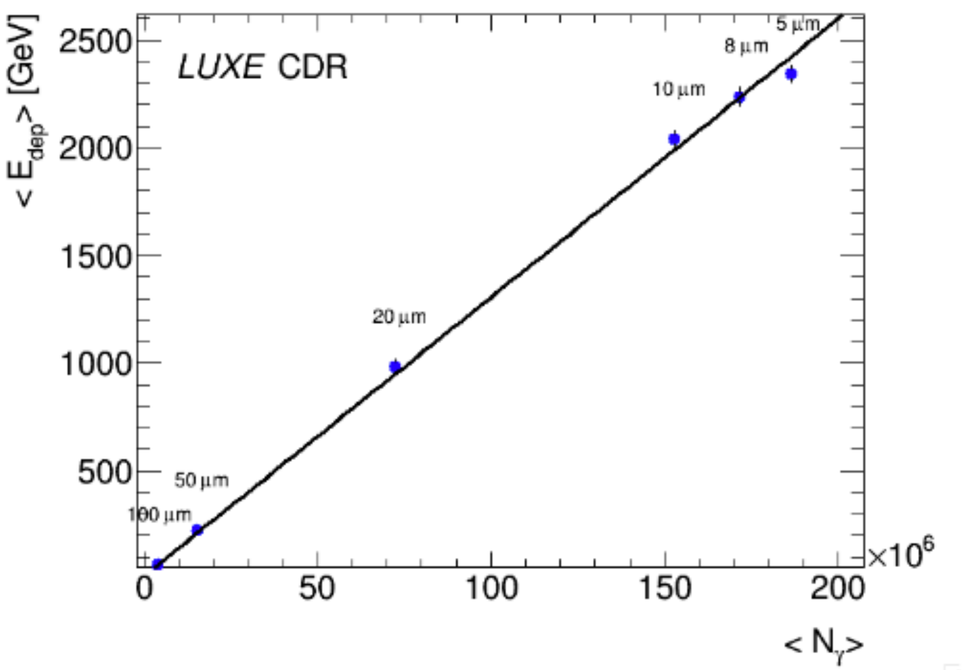
38 mm

38 mm

New MC and weight of the macro-particle

the weight is used from MC: the weight of incident photons is 750000





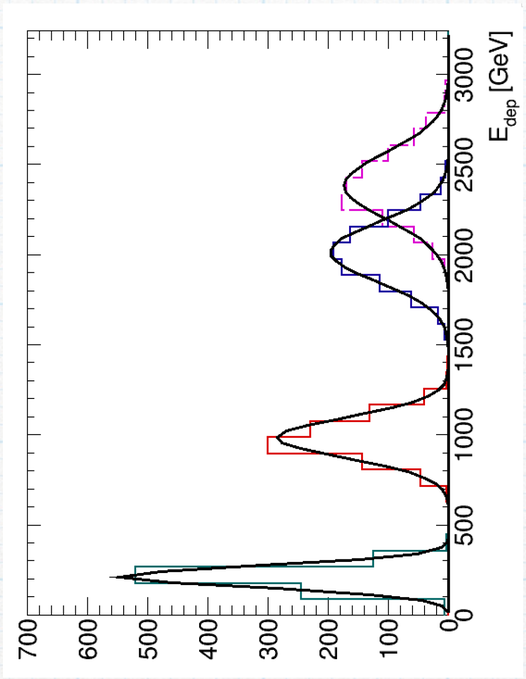
New MC and reduced weight of the macro-particle

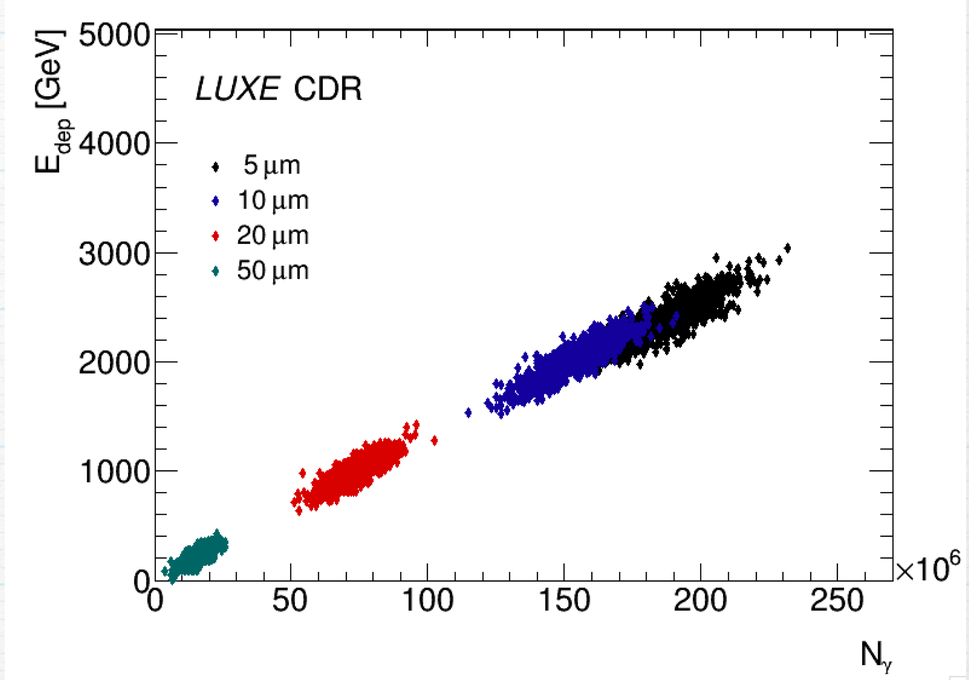
the weight is used explicitly to simulate the same particle 1000 times, which reduced the weight of incident photons from 750000 to 750

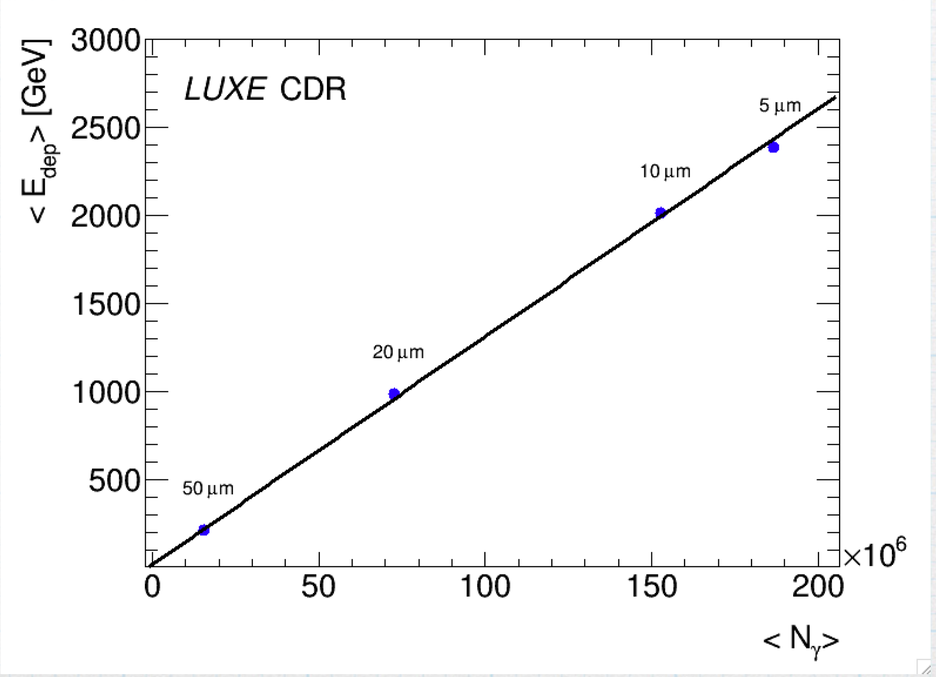
N(E) number of photons

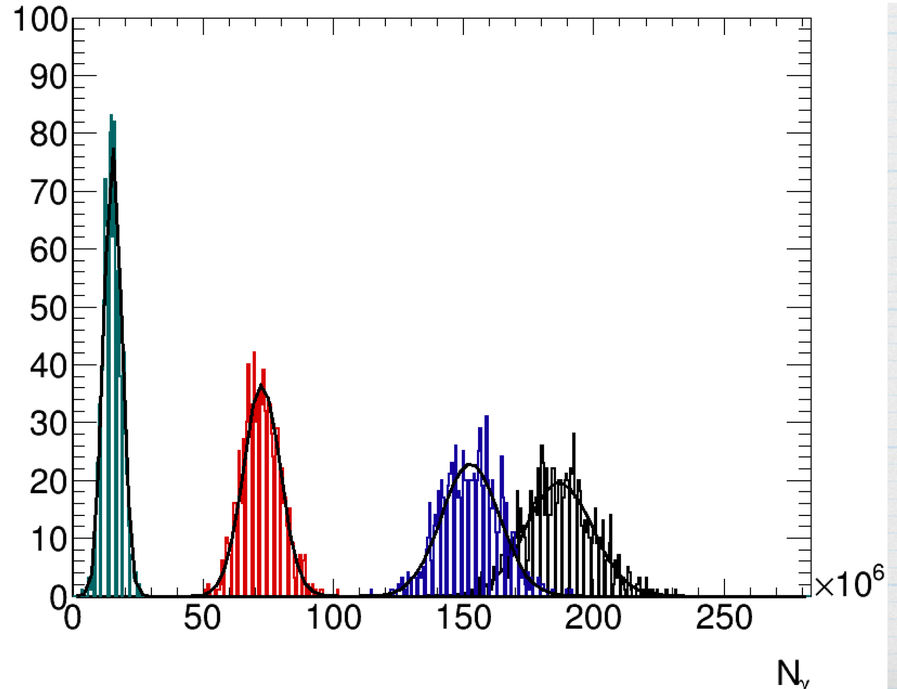
$$\Delta N = \frac{\partial N}{\partial E}\Delta E \quad \Rightarrow \quad \frac{\Delta N}{N} = \frac{1}{N}\frac{\partial N}{\partial E}\Delta E$$

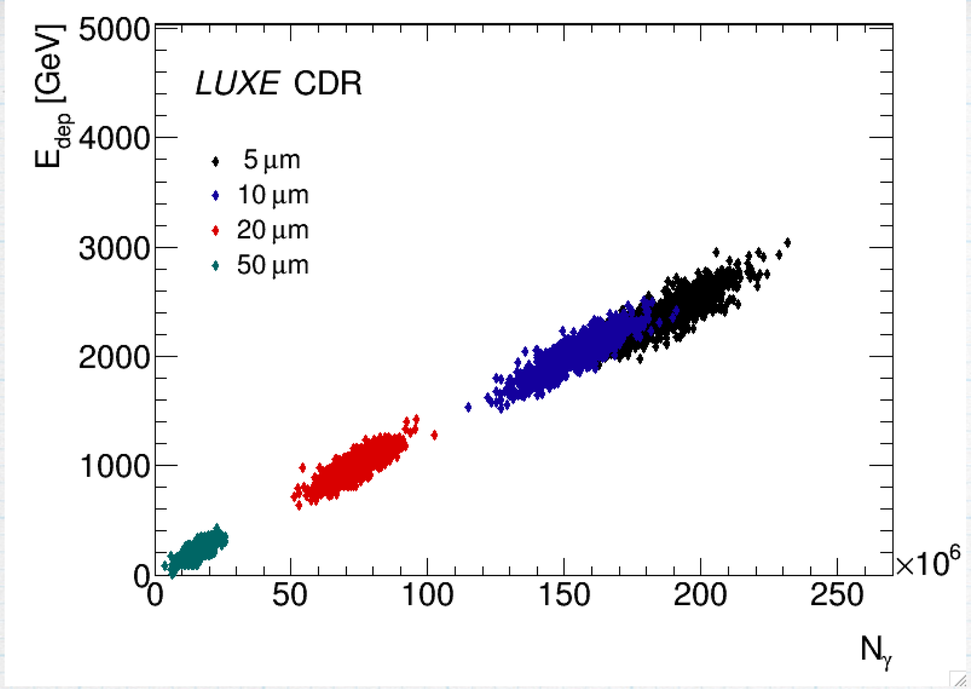
the relative uncertainty of the number of photons does not depend on the slope at all, so estimating it as deltaEdep/<Edep> from Edep distributions

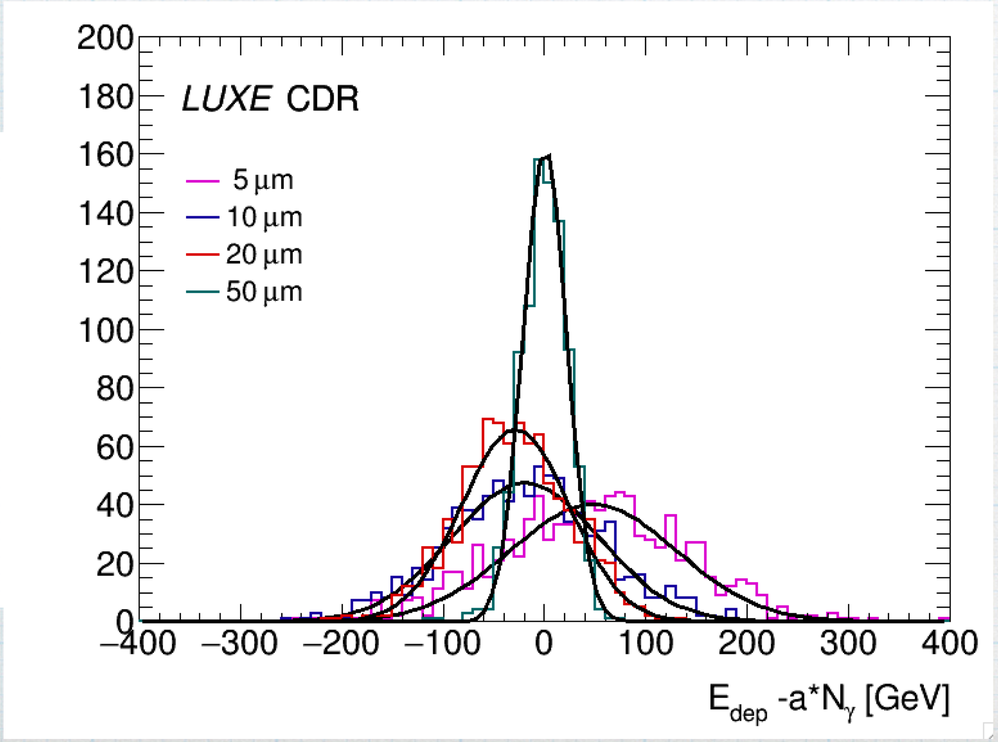












Resudials

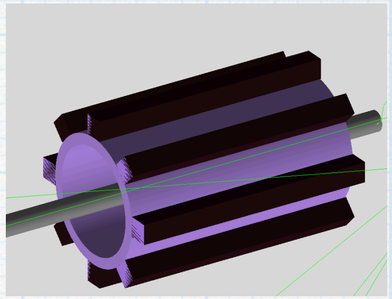
We observe a linear dependence within blobs as the number of photons changes. We need to look at the distribution of "residuals", i.e. the distribution of Edep - (a* Nγ+b) as a function of Edep= a x Ng, where "a" and "b" are the parameters of the linear fit.

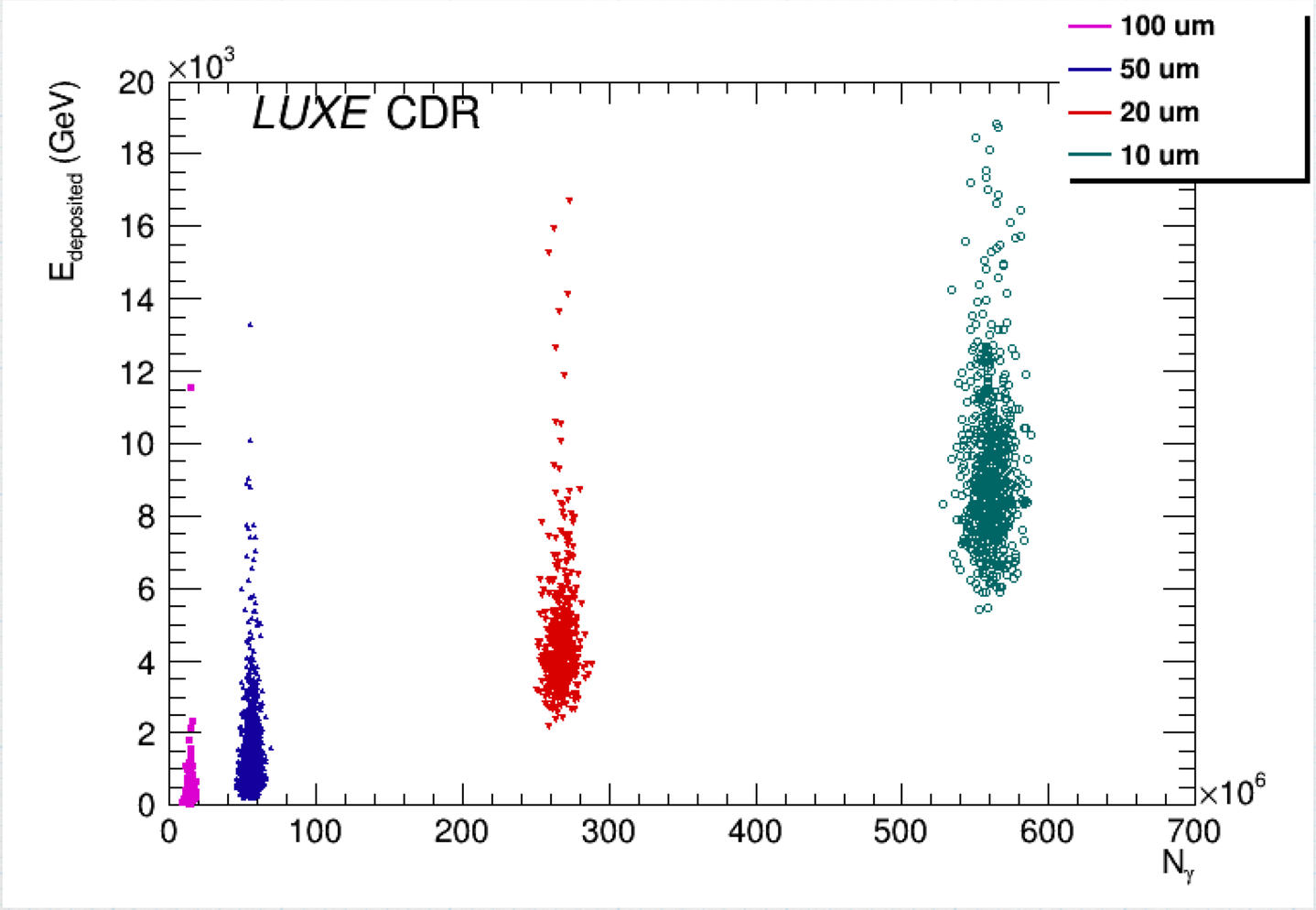
Laser spot	<Edep>	dE	dE/<Edep>
50 um	211	22	0,10
20 um	982	53	0,05
10 um	2012	73	0,04
5 um	2387	82	0,03

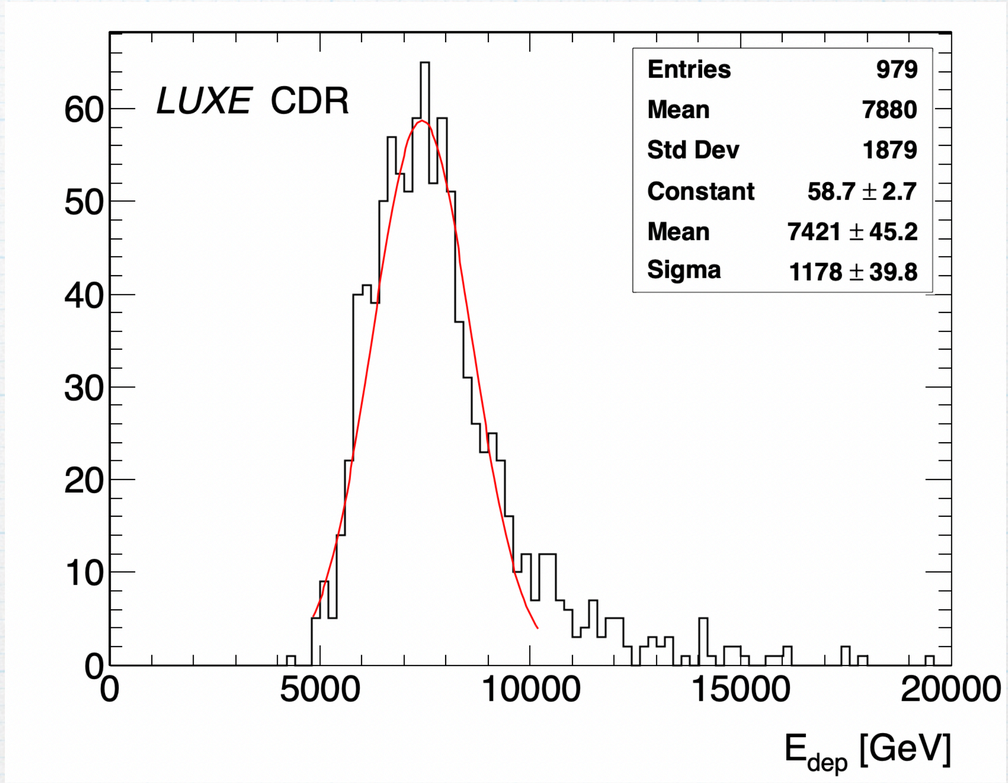
the range of fluctuations is about 3-10%

Backup

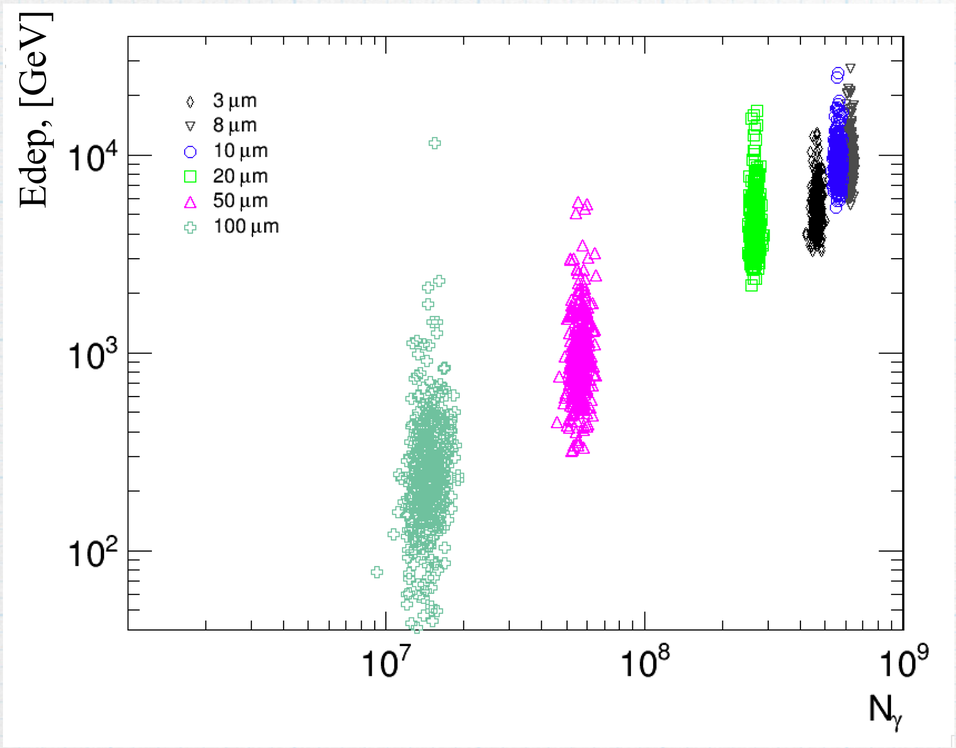
Deposited energy versus true number of photons.

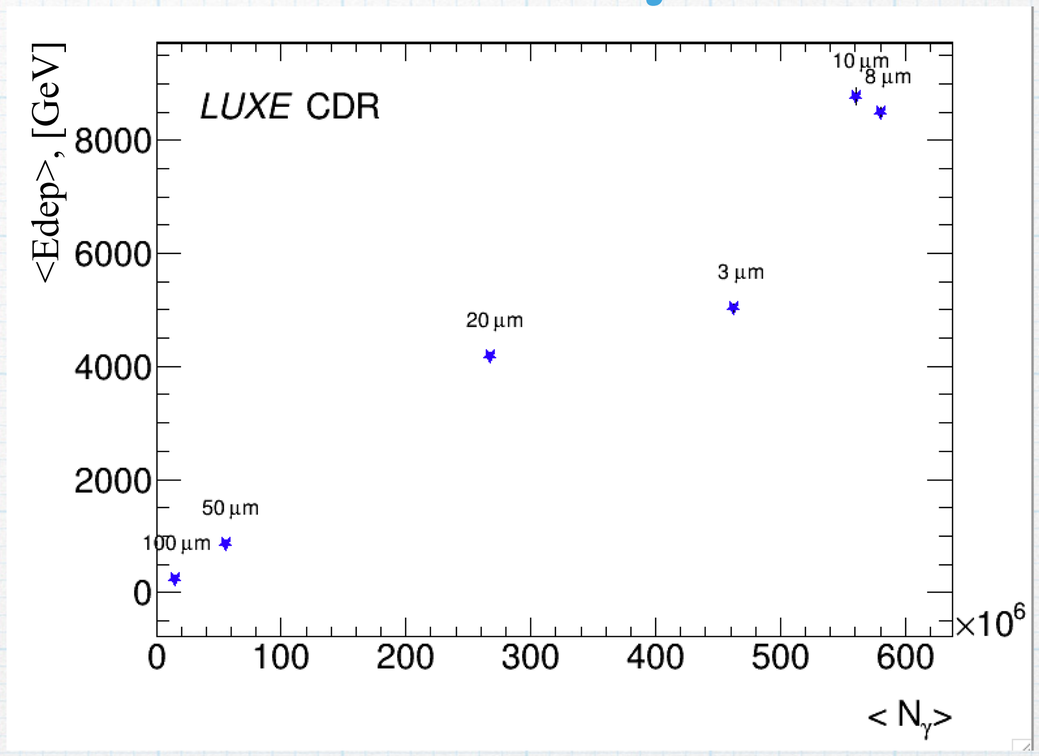


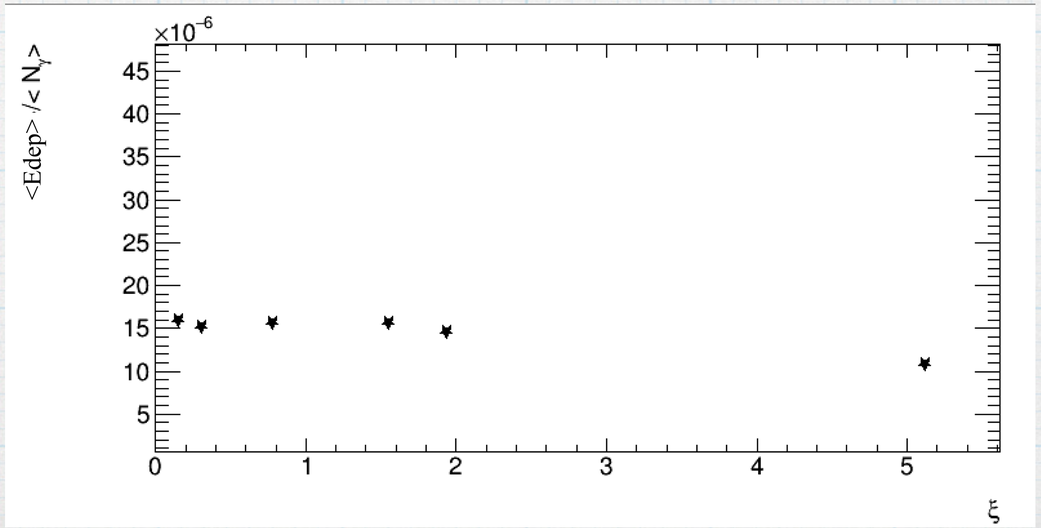


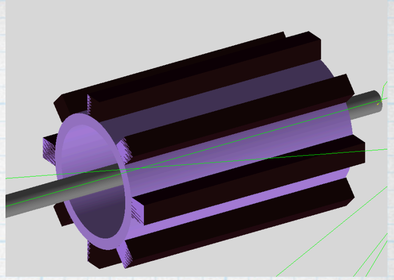


Deposited energy versus true number of photons.





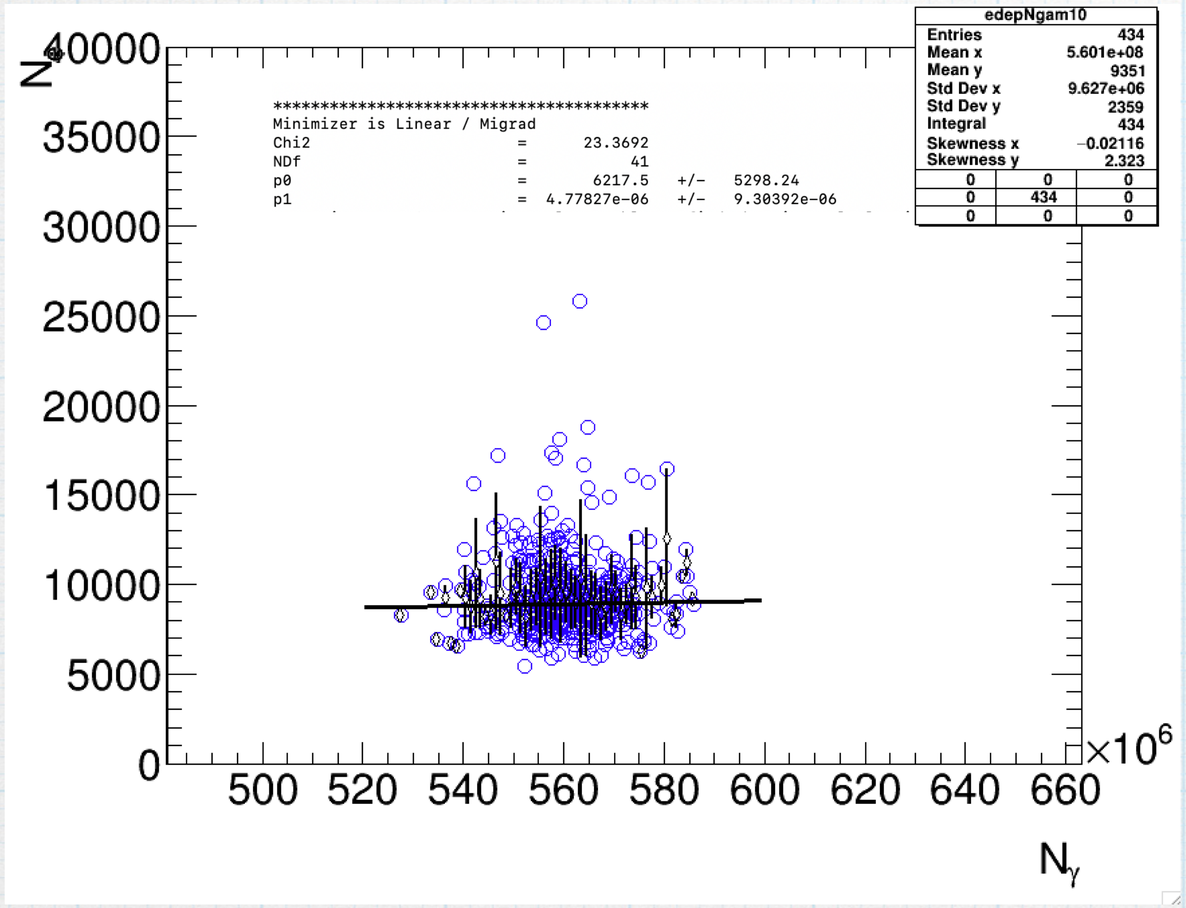




the photon flux

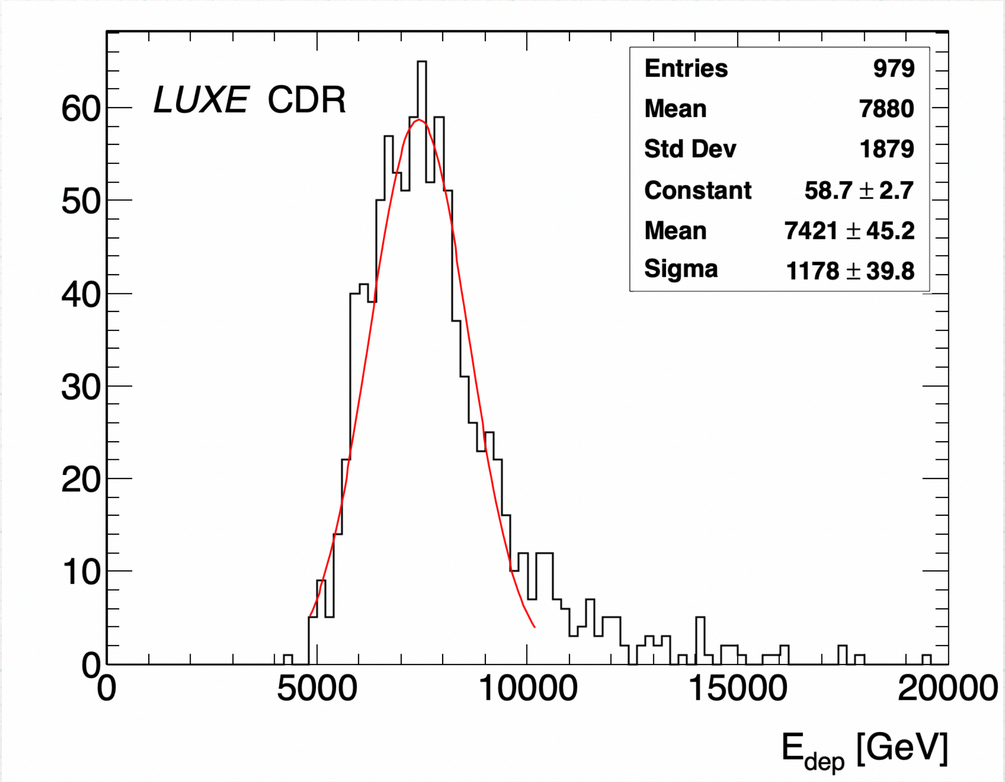
- Old MC
- no threshold
- the errors are small as given as RMS/√<N_BX>

w0, um	xi
100	0.15
50	0.31
20	0.78
10	1.55
8	1.94
3	5.12



N(E) number of photons

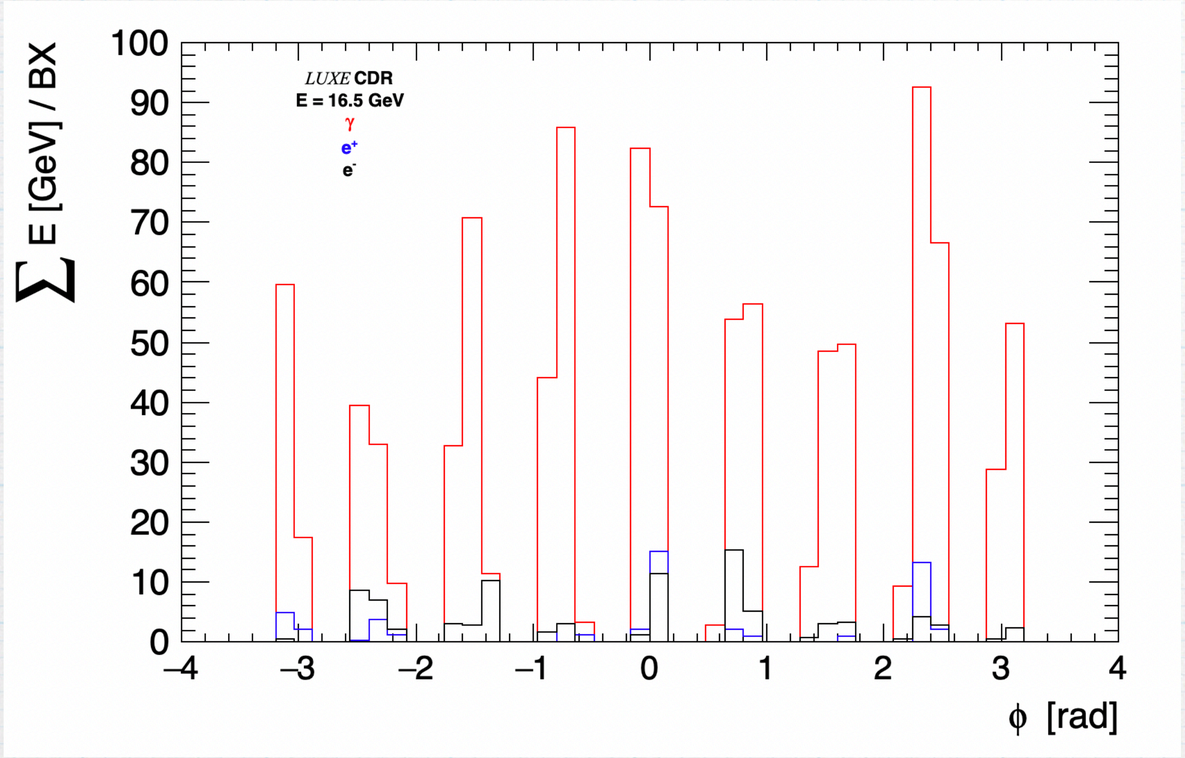
$$\Delta N = \frac{\partial N}{\partial E}\Delta E \quad \Rightarrow \quad \frac{\Delta N}{N} = \frac{1}{N}\frac{\partial N}{\partial E}\Delta E$$

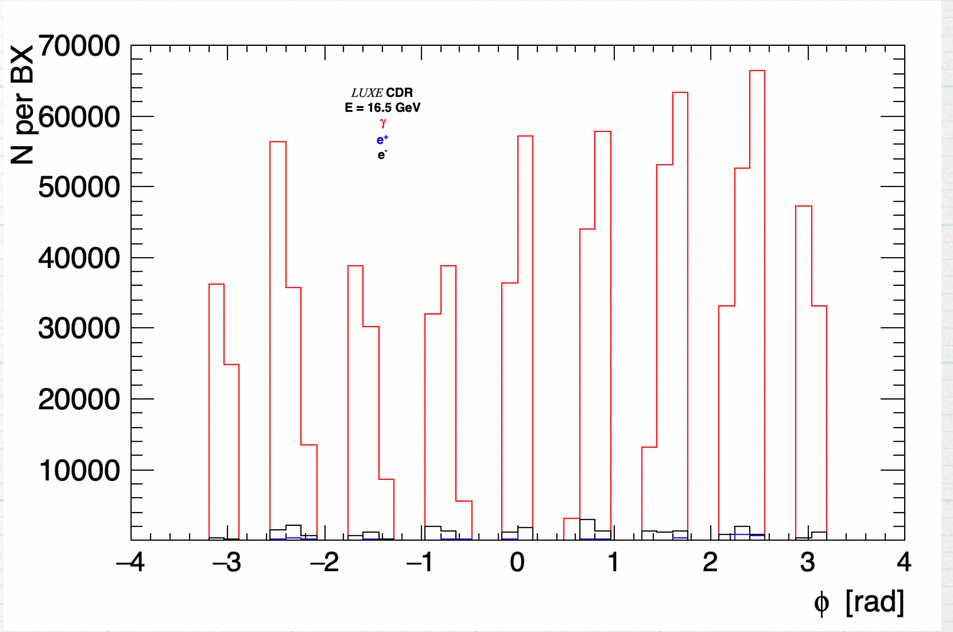


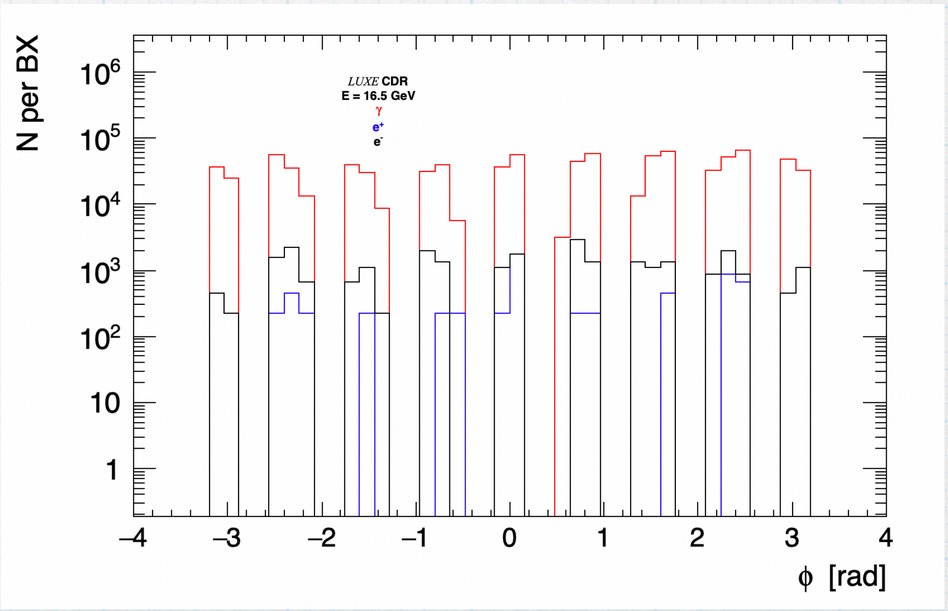
w0 = 10 um : $\Delta N/N = (1/1.5)*10^5*1.2*10^3/5.6*10^8 = 1*10^{-2}$

the uncertainty on number of measured photons will be ~ 10%.

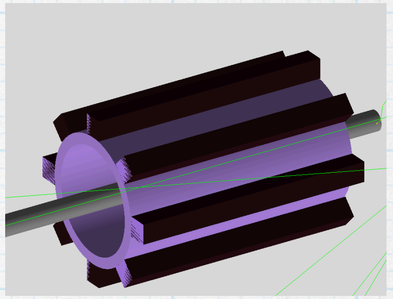
Background for Gamma Monitor

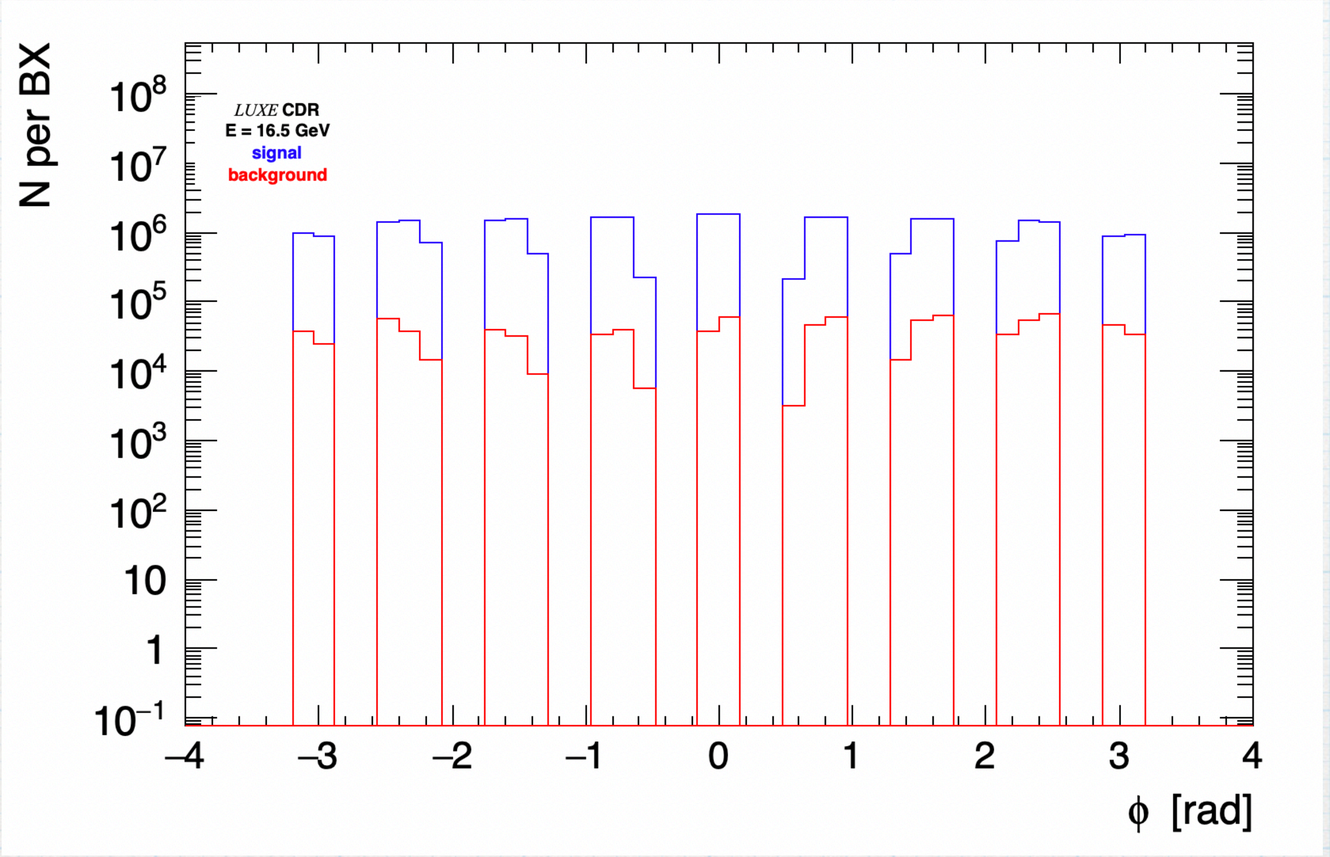




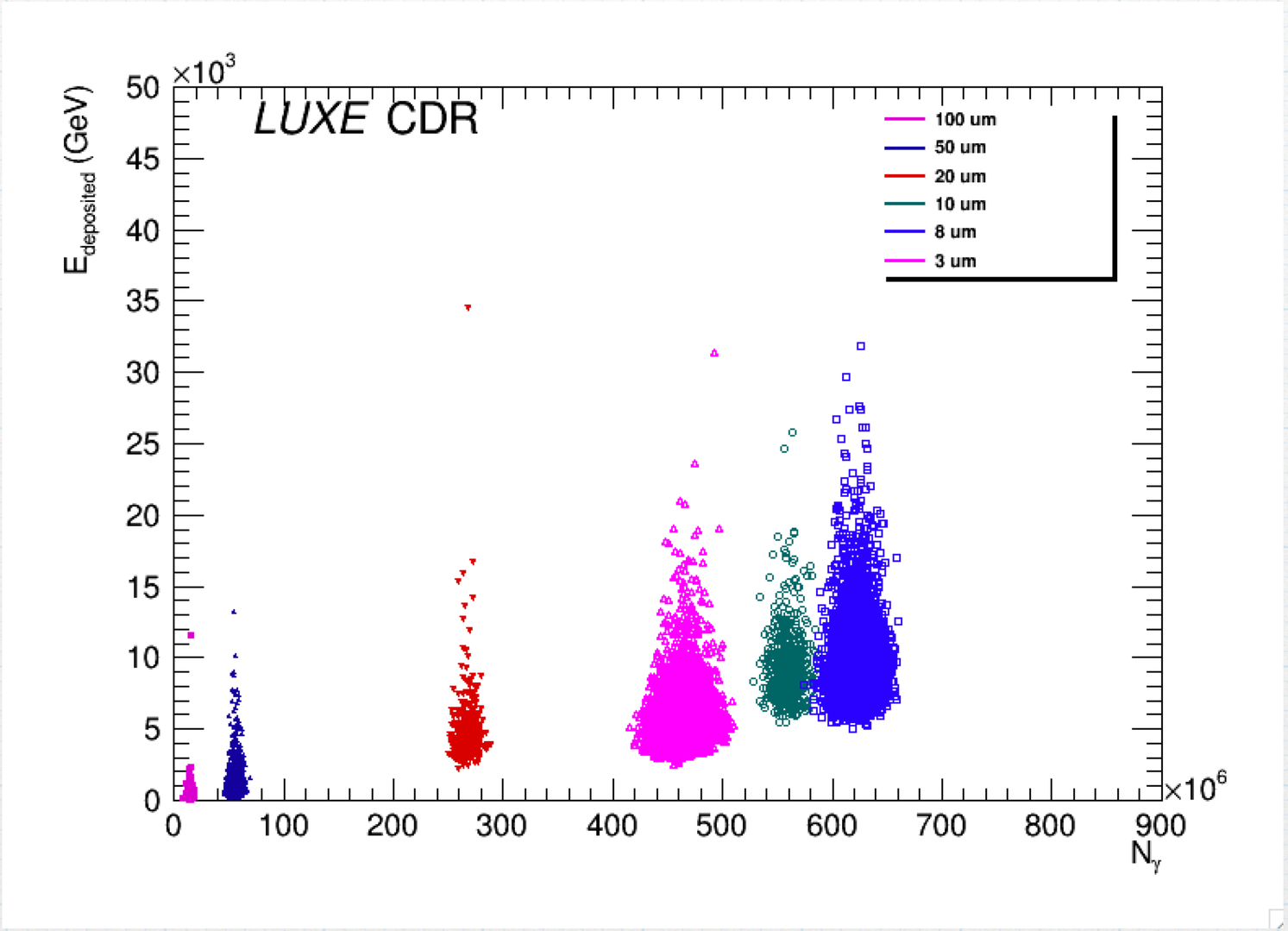


Signal/background



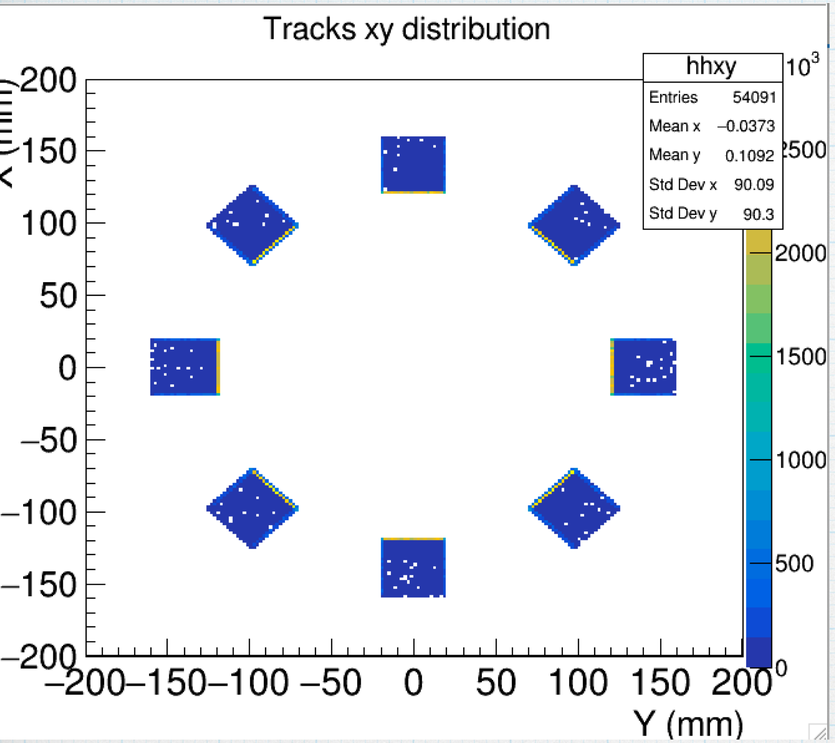


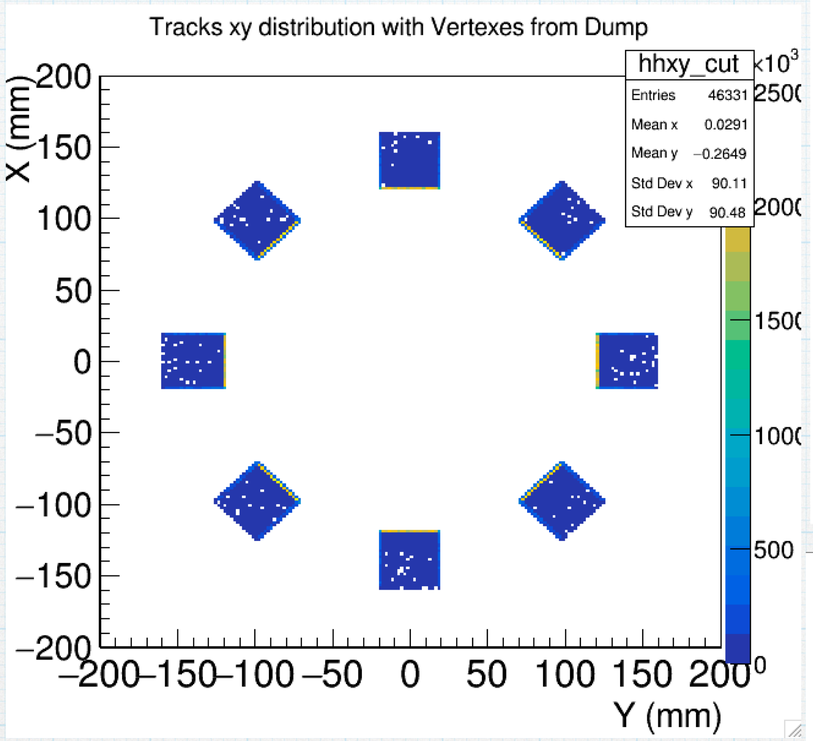
Deposited energy versus N of incident photons

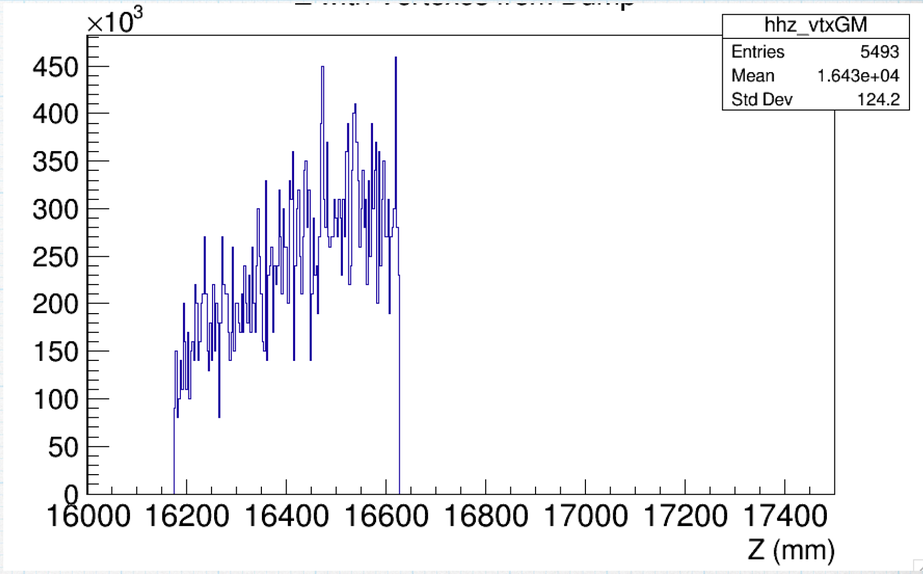


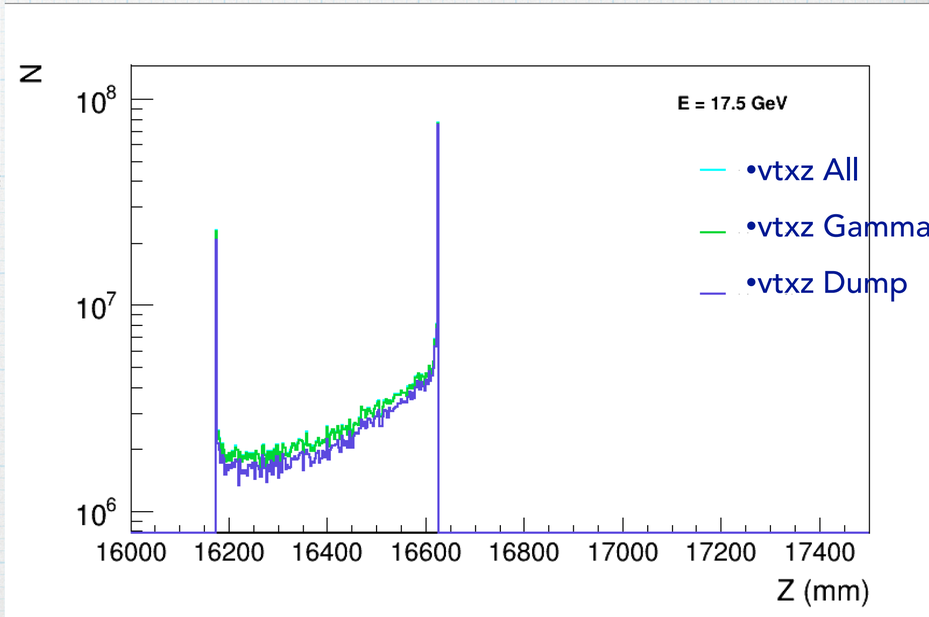
Background

- Z distributions
- Tracks with vertexes only from the GM





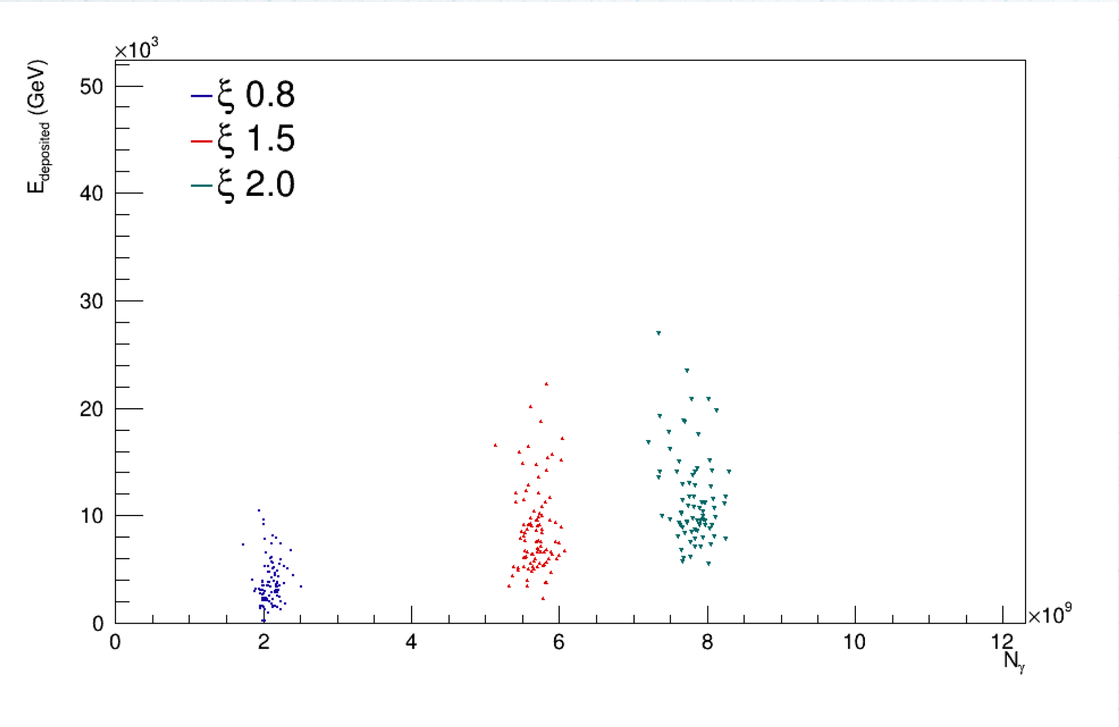




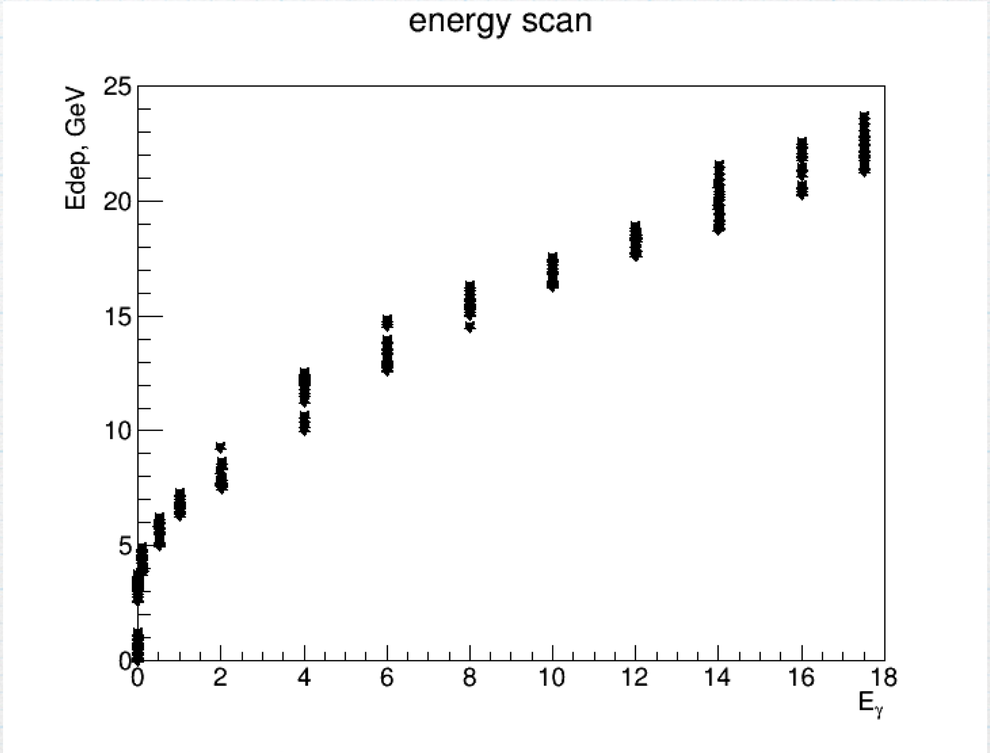
- Background events 54091- 46331 -5493 =2267
- Background per BX ~ 4%

Simulation and Performance

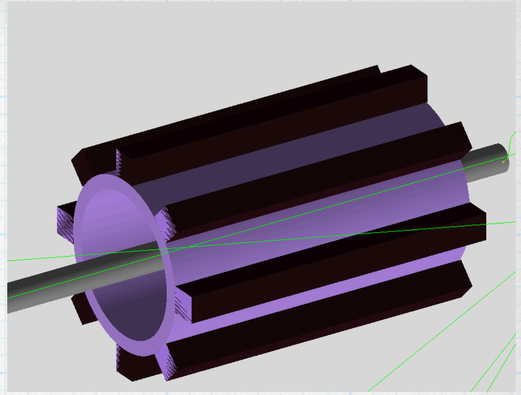
Deposited energy versus true number of photons. Each point is one BX



- The (almost) linear dependence of deposited energy on number of incoming photons in GM allows the usage of backscatters for monitoring the photon flux
- For small ξ the HICS spectrum is softer and soft photons produce less back-scatters. This is the reason of small deviation from linearity in Edep on Eγ dependence



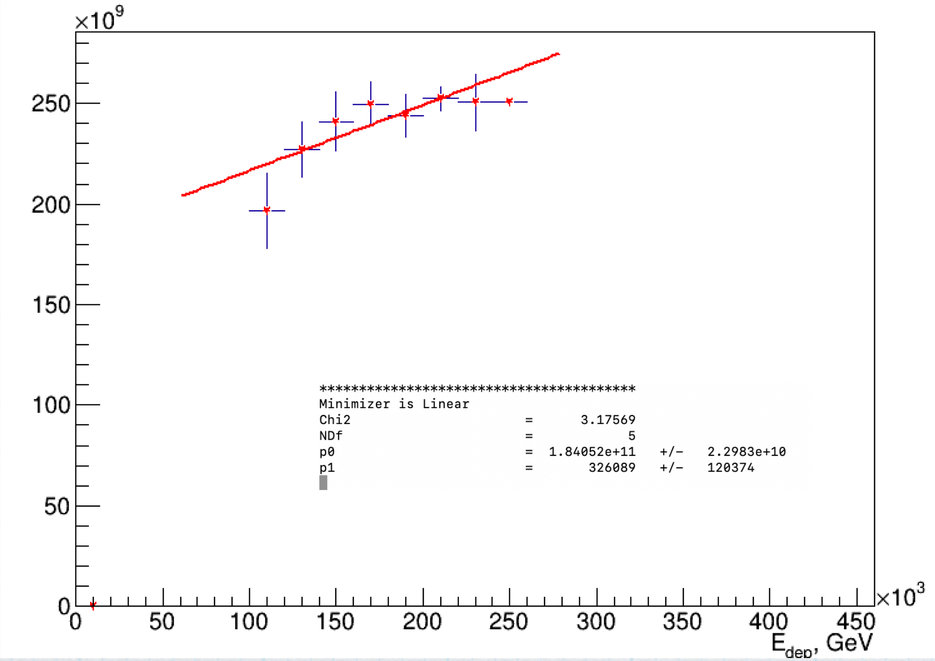
Uncertainties estimation on Number of photons

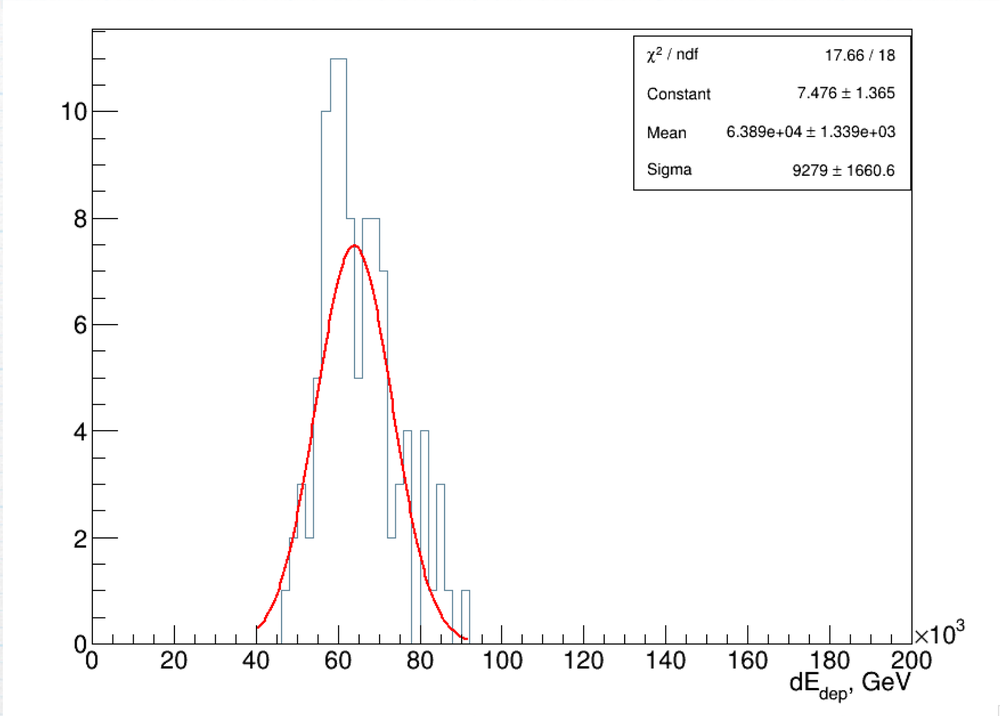


N(E) number of photons

$$\Delta N = \frac{\partial N}{\partial E}\Delta E \quad \Rightarrow \quad \frac{\Delta N}{N} = \frac{1}{N}\frac{\partial N}{\partial E}\Delta E$$

- ξ = 2.0





ξ = 2.0 : $\Delta N/N = 9.3*10^3*3.3*10^5/4.3*10^{10} = 7.1*10^{-2}$

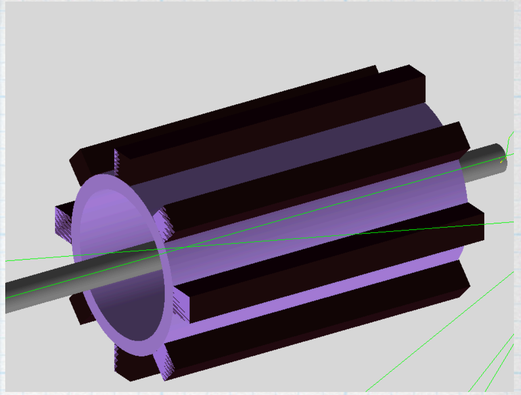
ξ = 2.6 : $\Delta N/N = 3.3*10^4*3.3*10^5/2.5*10^{11} = 4.4*10^{-2}$

the uncertainty on number of measured photons will be ~ $3.5*10^{-3}$ - $7.1*10^{-2}$.

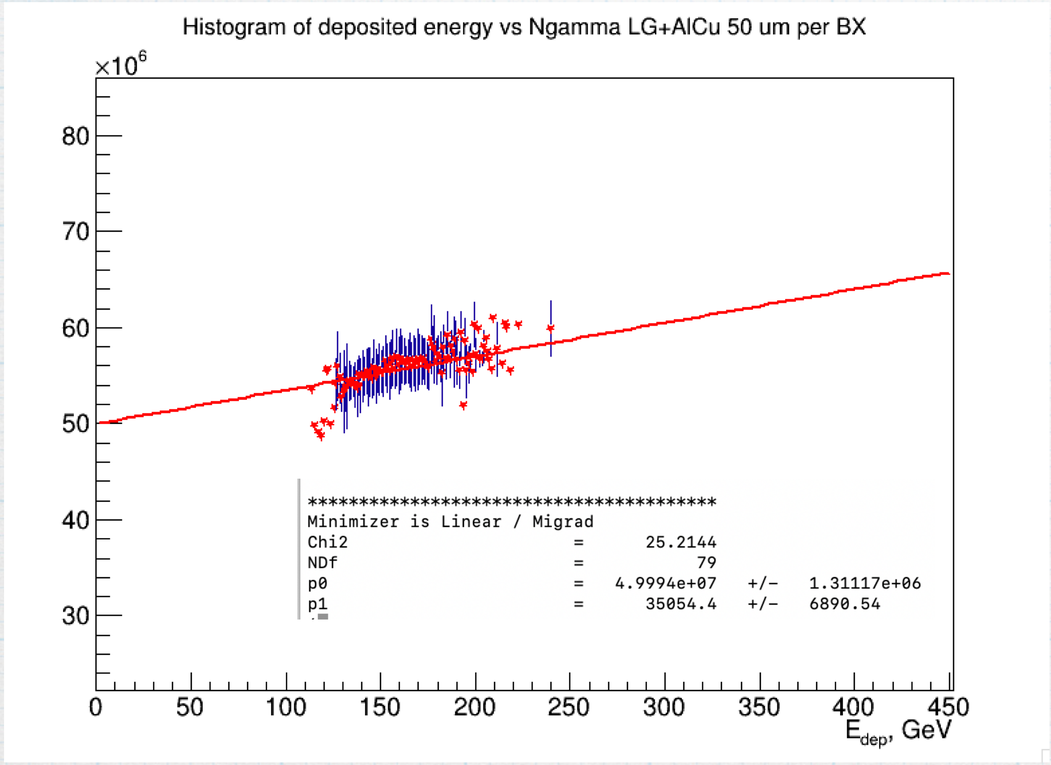
Uncertainties estimation on Number of photons

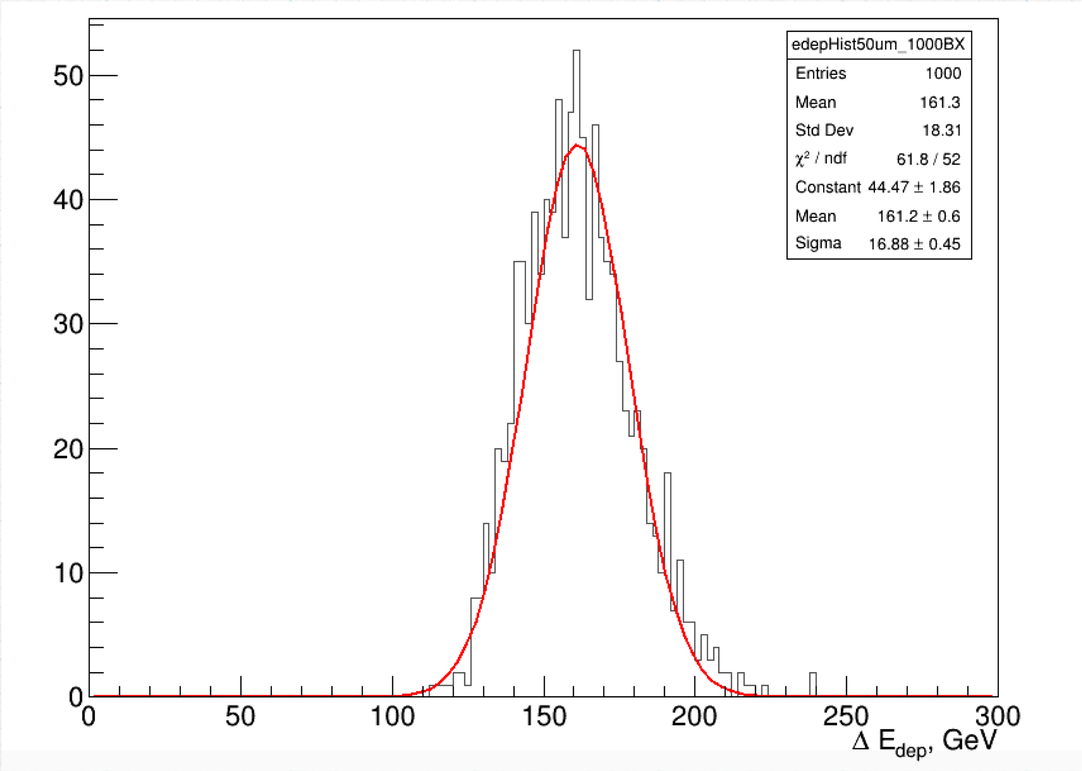
N(E) number of photons

$$\Delta N = \frac{\partial N}{\partial E}\Delta E \quad \Rightarrow \quad \frac{\Delta N}{N} = \frac{1}{N}\frac{\partial N}{\partial E}\Delta E$$



- ξ = 0.31, 50 um laser spot

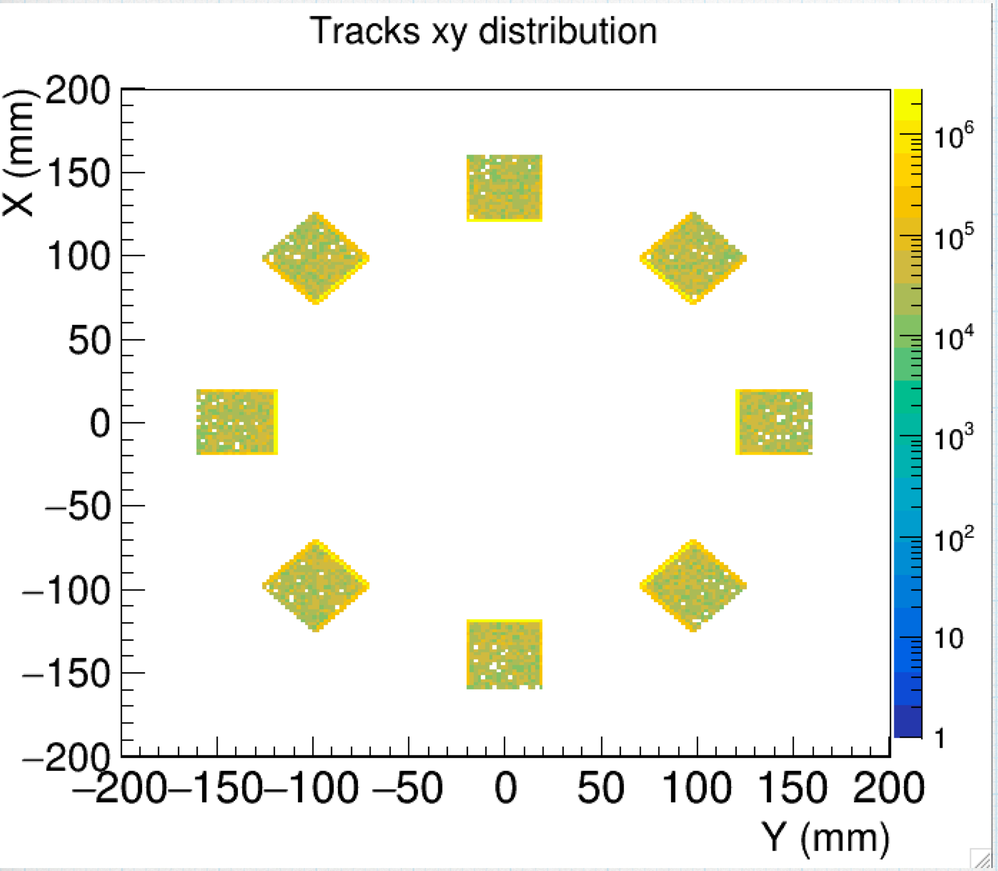


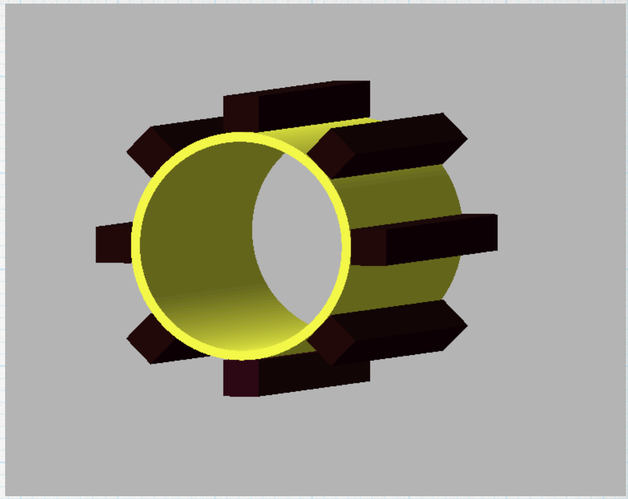


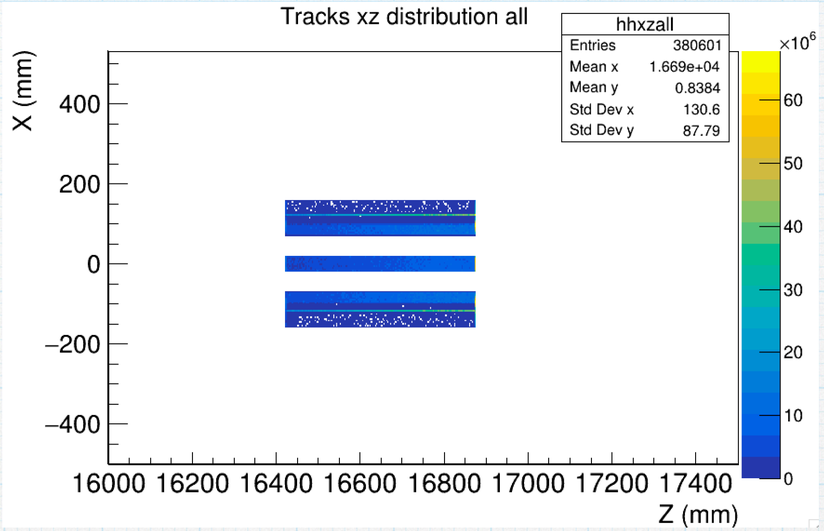
ξ = 0.3 : $\Delta N/N = 3.5*10^4*16.88/5.67*10^7 = 1*10^{-2}$

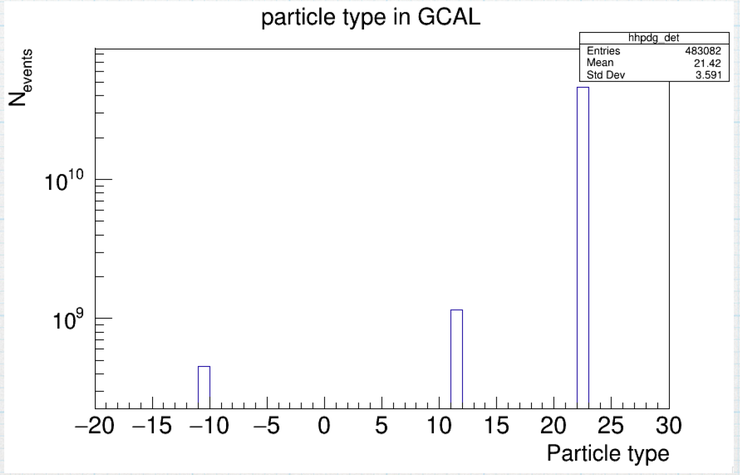
the uncertainty on number of measured photons will be ~ 10^{-2}.

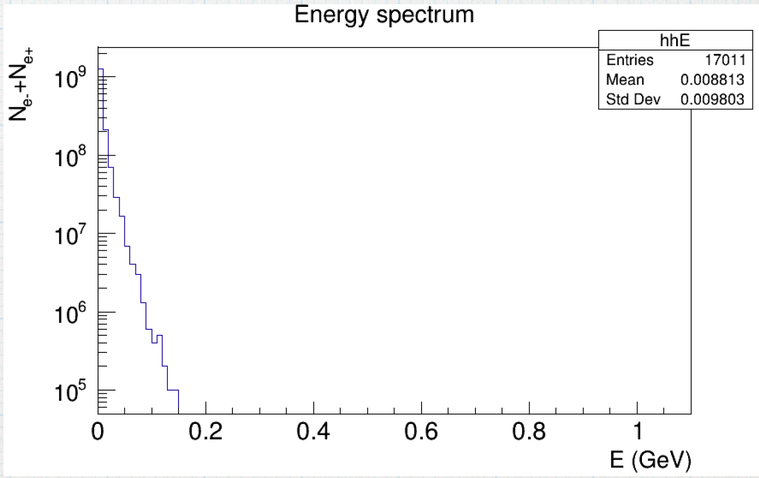
Gamma Flux Monitor











✳ **At high laser intensities ξ =2.6 (1J)**