Beam on target simulation

- To make sure that there is no other reactions that may affect the result, especially no high energy photon that may affect the calculation of GEM efficiency, I decided to still run a beam on target simulation

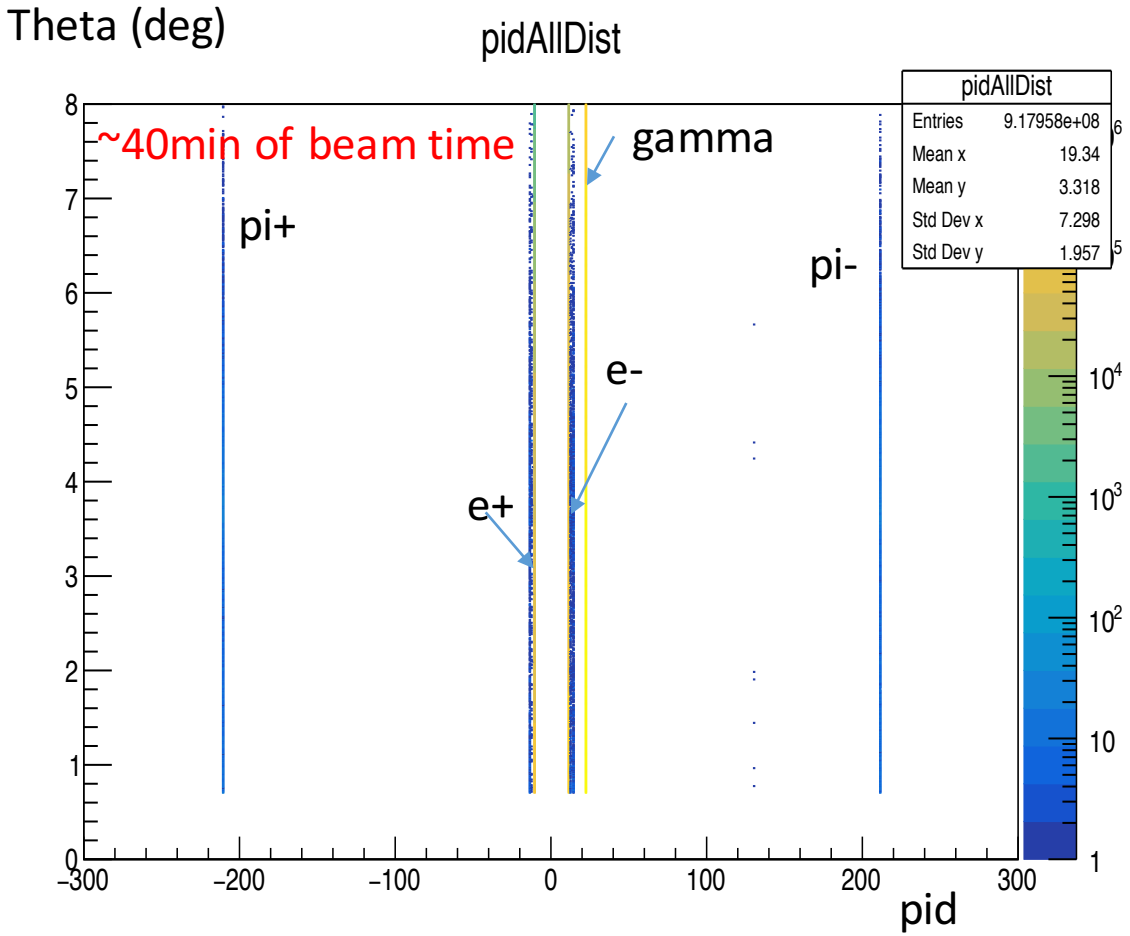
- 2GeV runs mostly use ~50nA beam current, so ~3.1e11 electrons per second

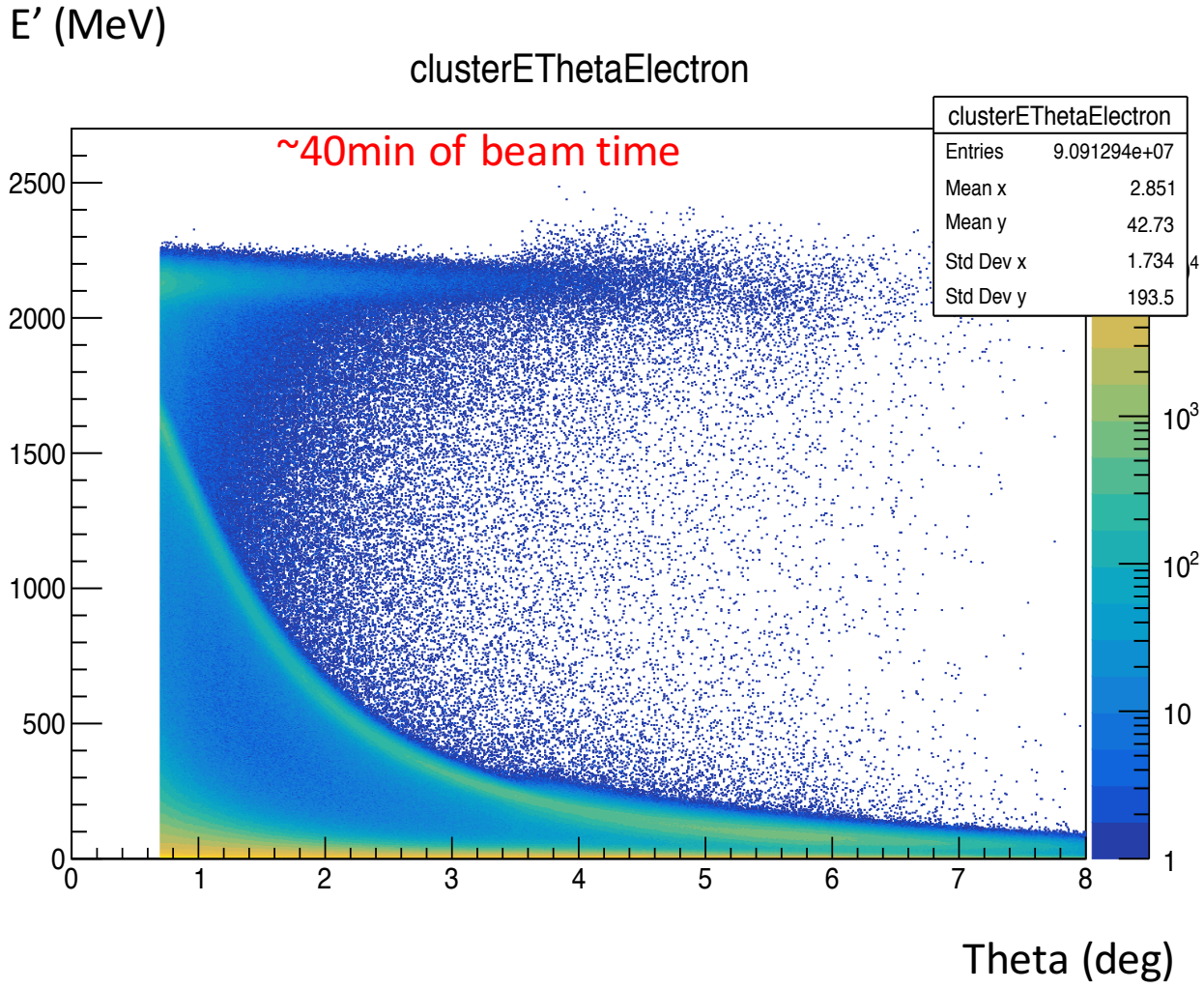
- If I want to have ~2hr of beam on target event then I need 2.2e15 electrons

- At the moment, for saving time, I scale target density by 1000 times, so effectively 1000 times less electrons needed (if the scaling behavior is linear)

Beam on target simulation

Events not digitized

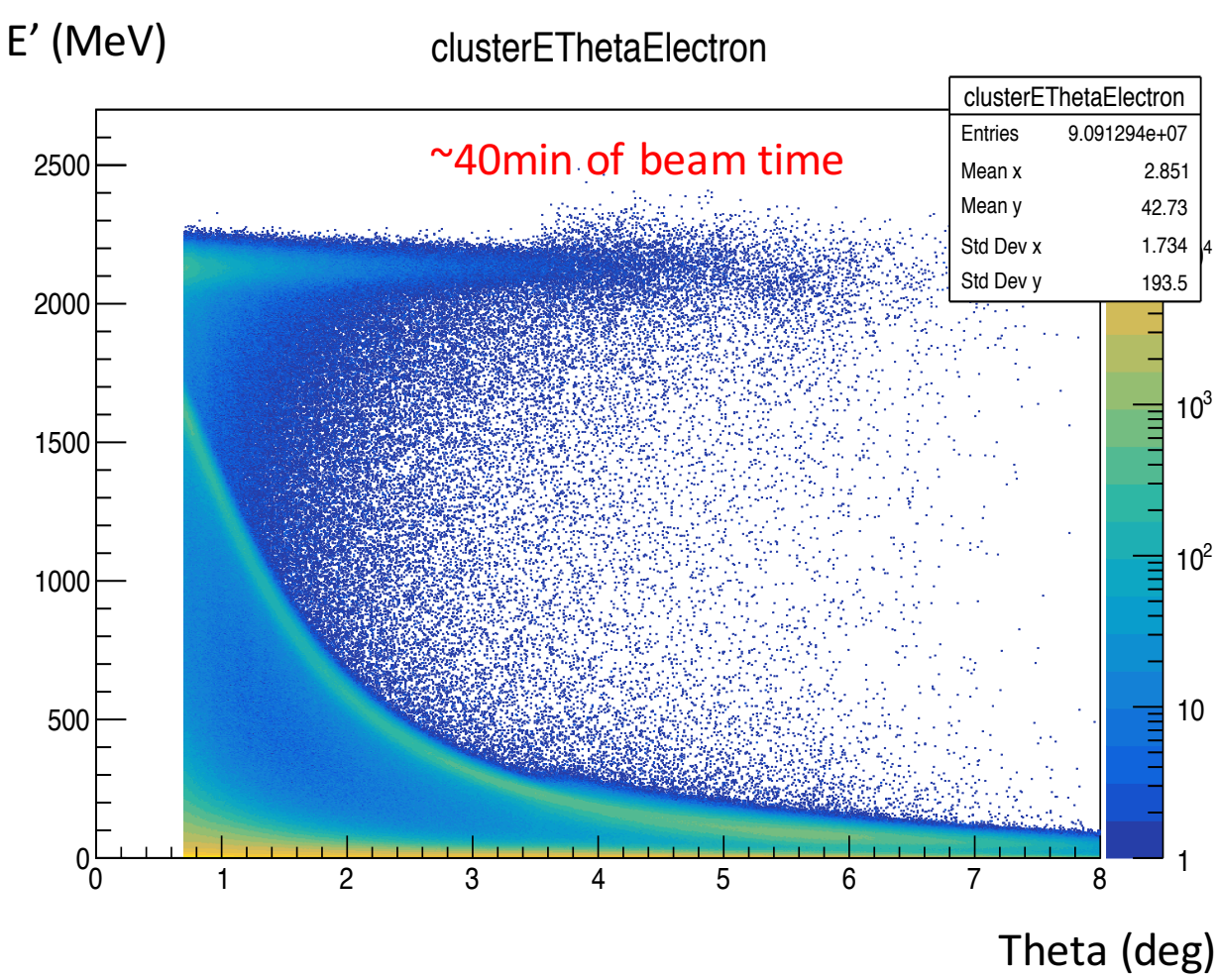




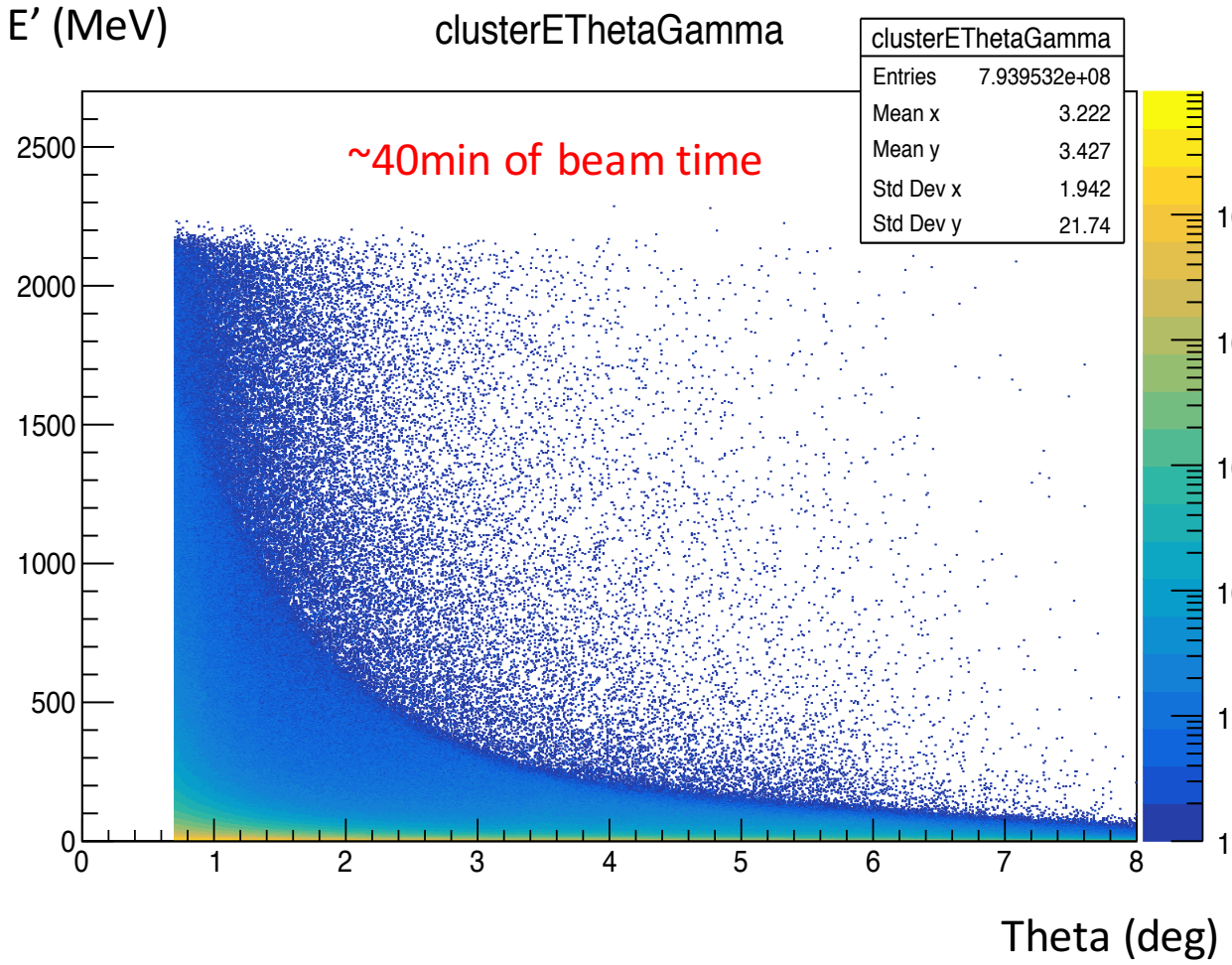
Beam on target simulation

Events not digitized

Electron cluster E vs theta



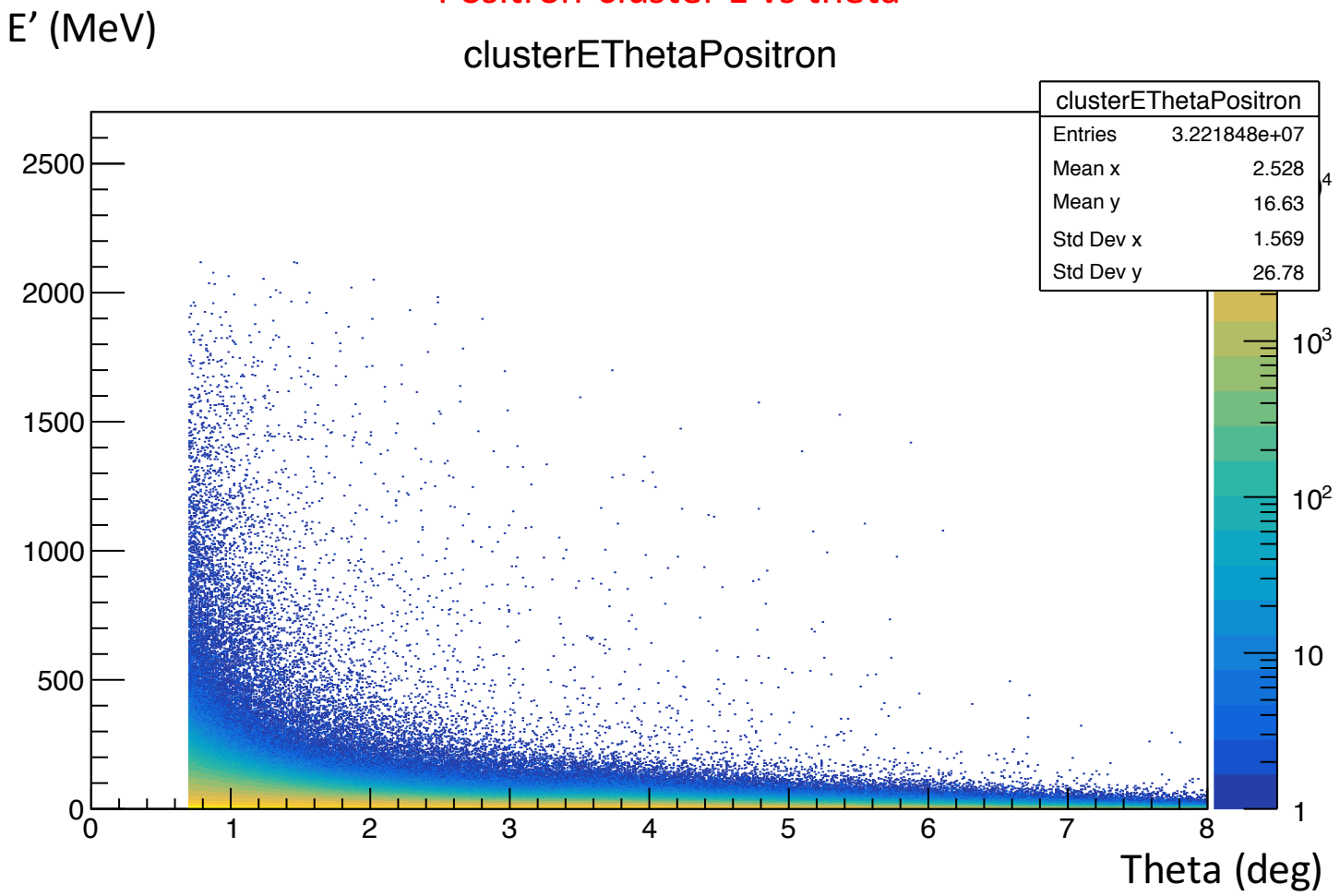
Photon cluster E vs theta



Beam on target simulation

Events not digitized

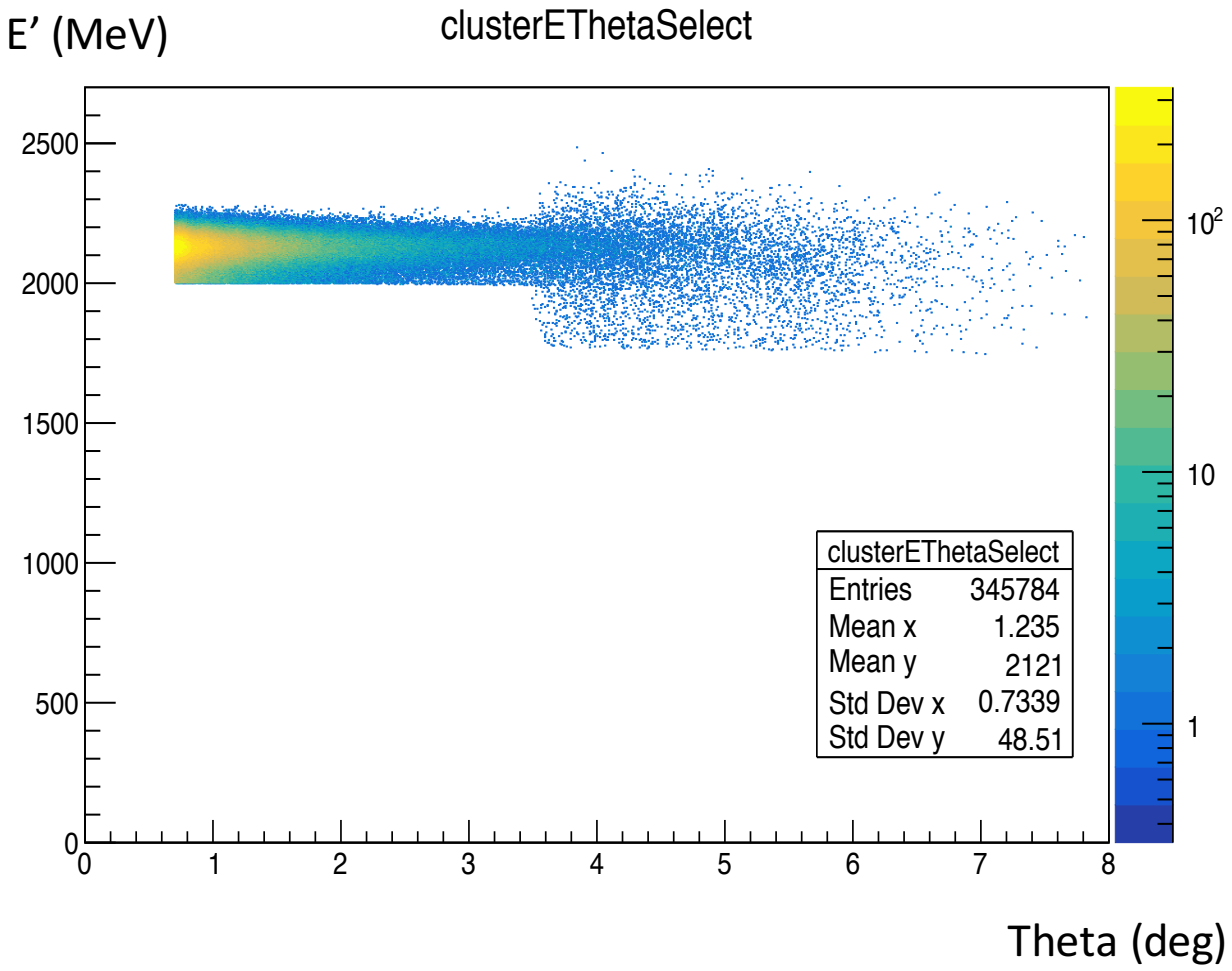
Positron cluster E vs theta



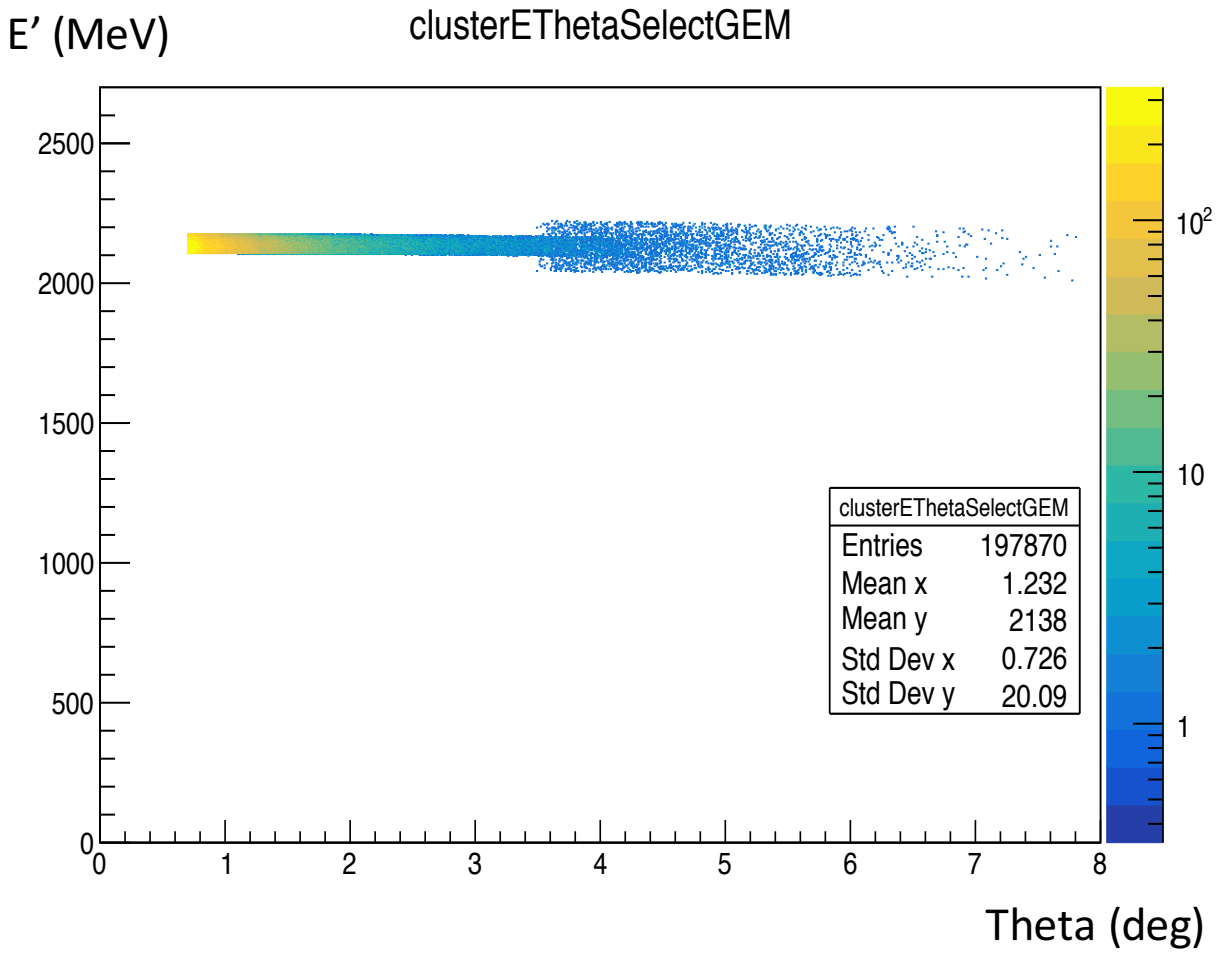
Beam on target simulation

Events not digitized

ep elasticity cut for analysis – 4sigma



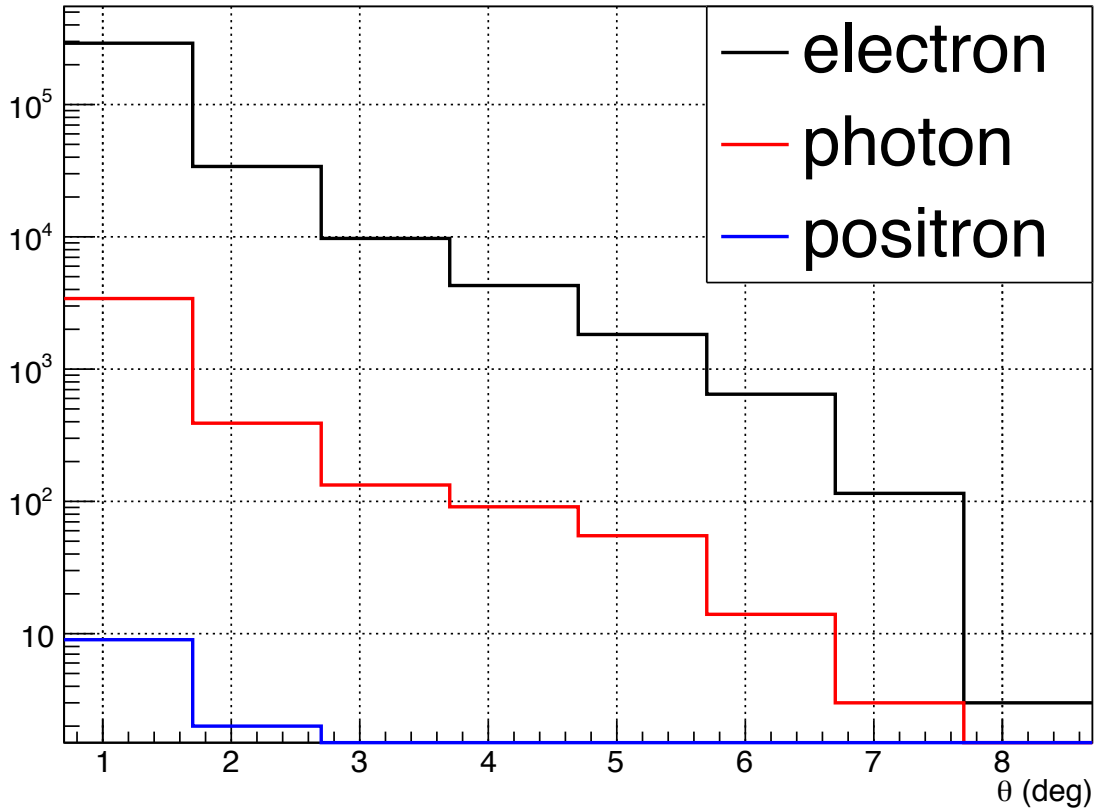
ep elasticity cut for GEM efficiency calculation– 1sigma



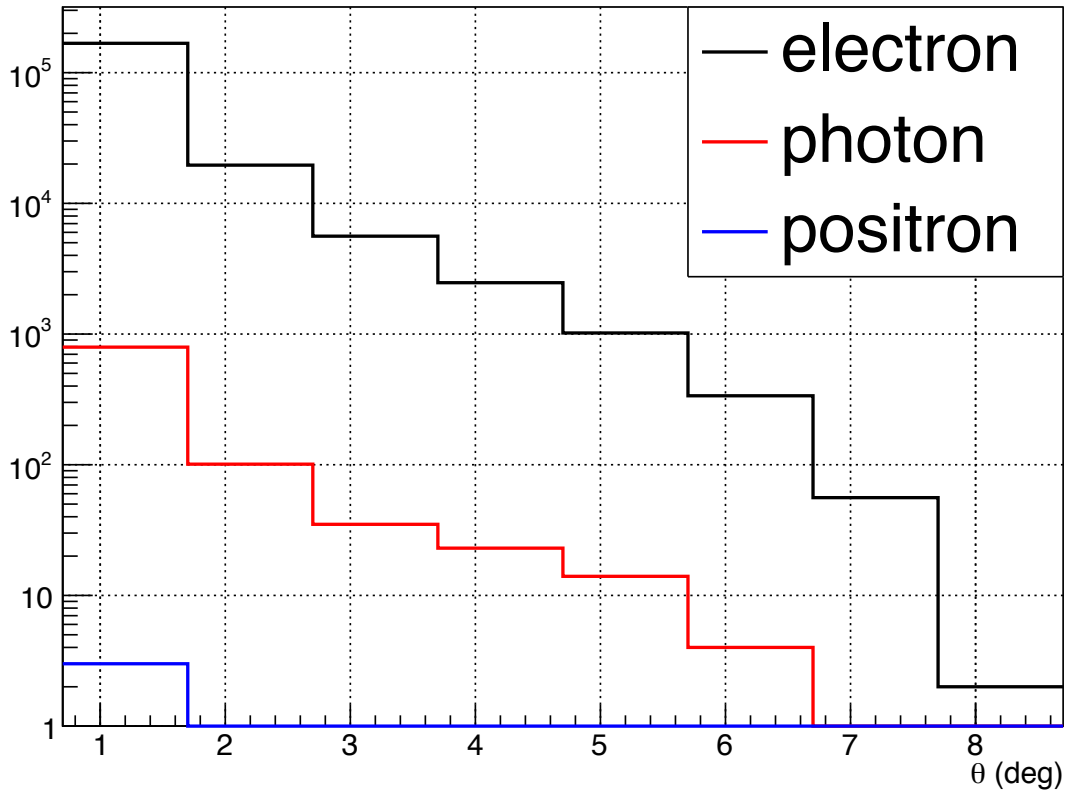
Beam on target simulation

Events not digitized

ep elasticity cut for analysis – 4sigma



ep elasticity cut for GEM efficiency calculation– 1sigma

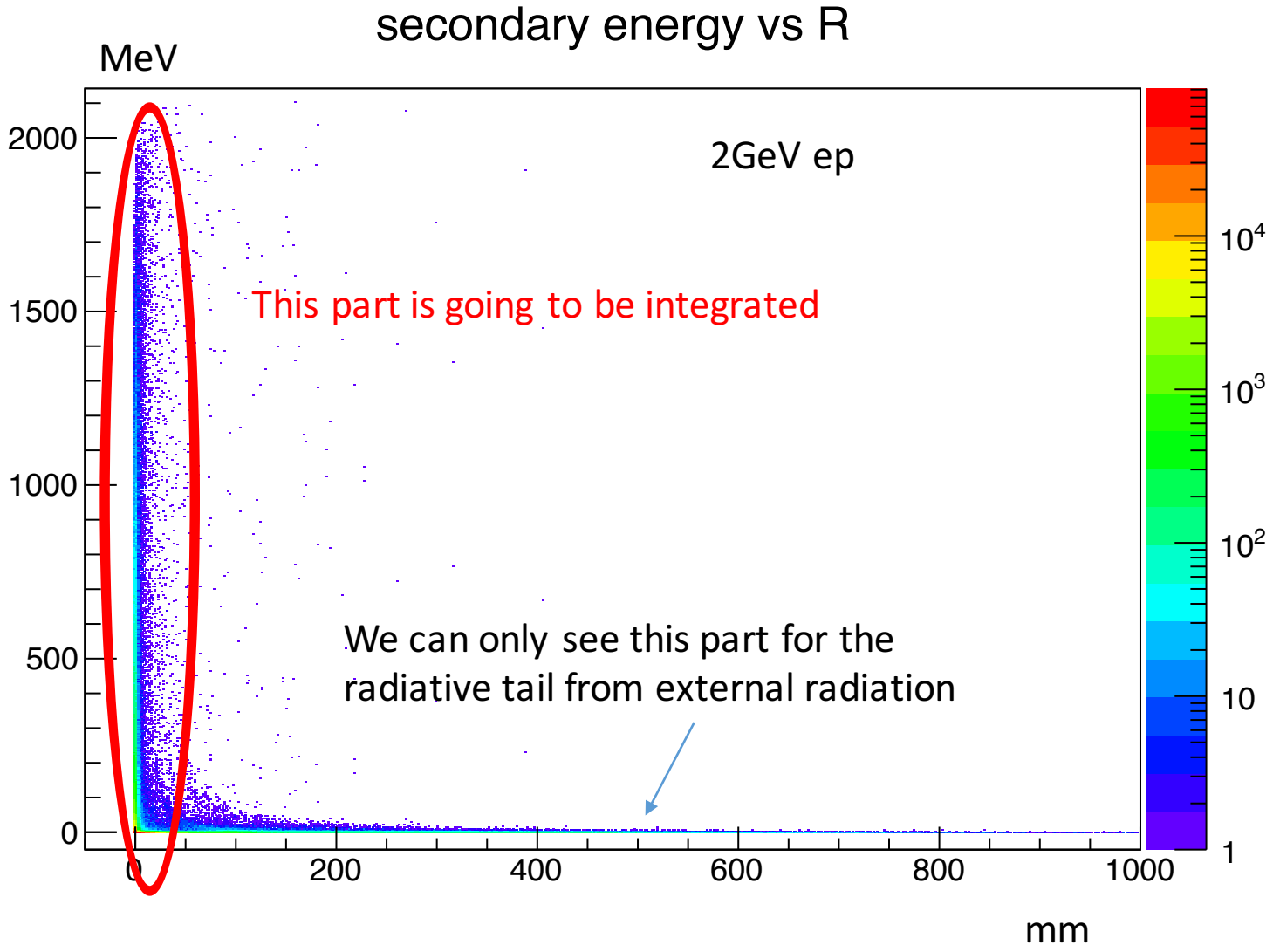


Beam on target simulation

- It seems like if using the cut for analysis, high energy photon is over 1% of high energy electron, if using cut for GEM efficiency calculation the factor is slightly less than 1%
- Are there really that many high energy photons? Where do they come from? Many of them could come from the external radiation of the high energy electron
- What should really counted as photon contamination for the GEM efficiency? What if an electron is very close to a high energy photon?

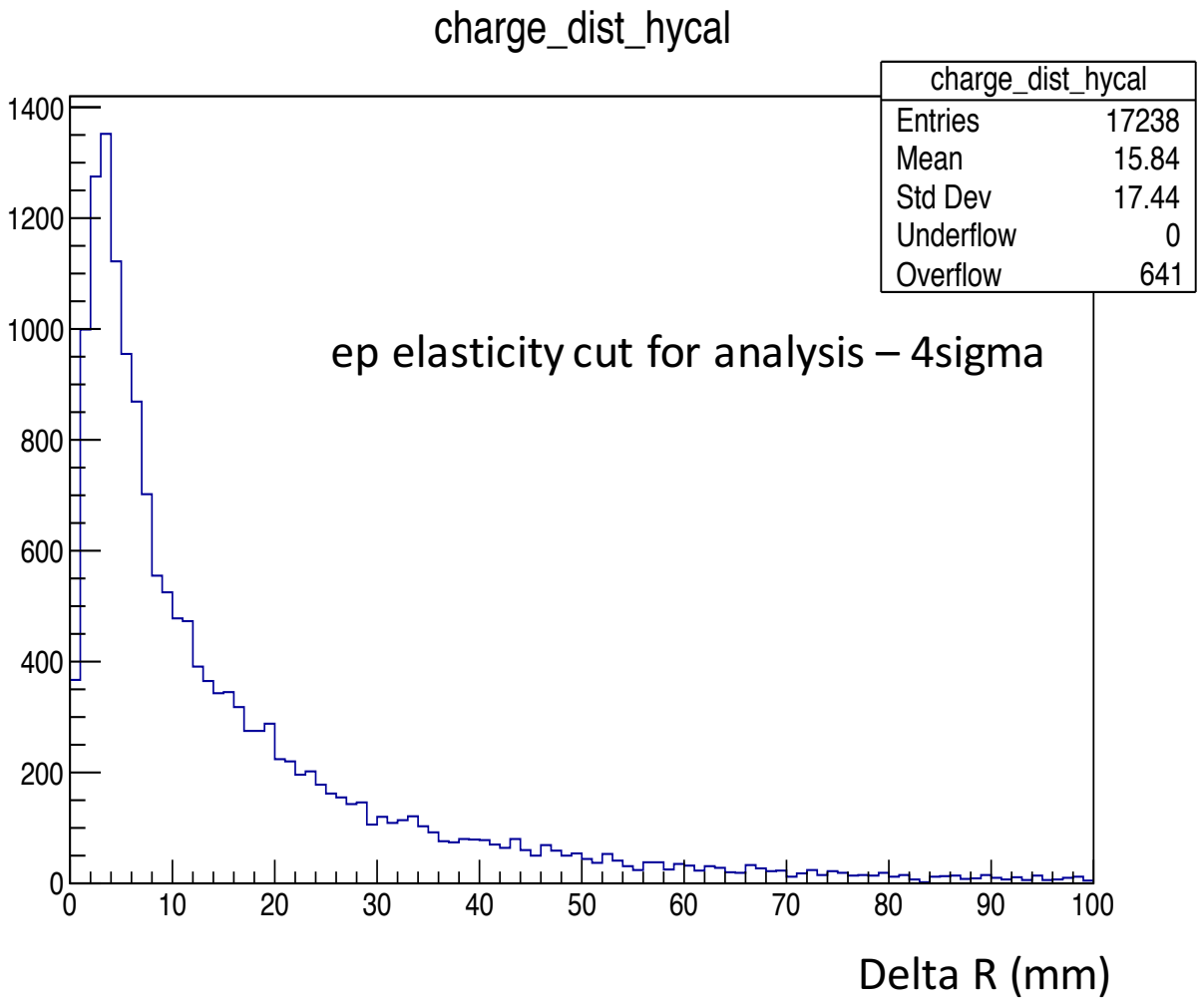
External Radiative effect for ep

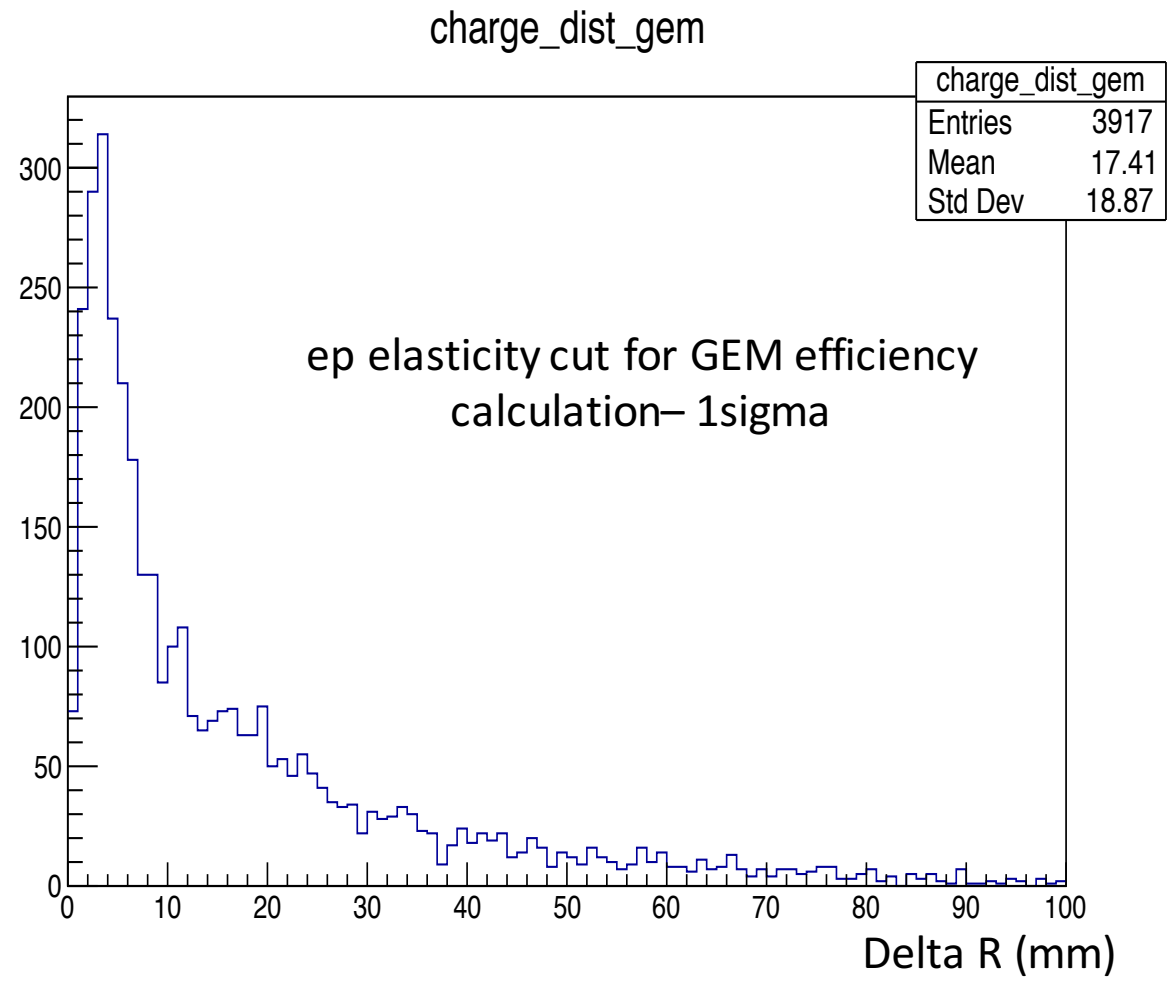
- Plot shows the energy of all particles from external radiation as a function of the distance to the hit position of the scattered electron on HyCal
- Select event that has no internal radiative photon to exclude internal radiation effects
- High energy secondary from the external radiation tend to go very closely with the scattered electron
- High energy ones are going to be integrated into the same cluster as the scattered electron
- Low energy ones can go very far away



Beam on target simulation

Charge particle distribution around the energy energy photon

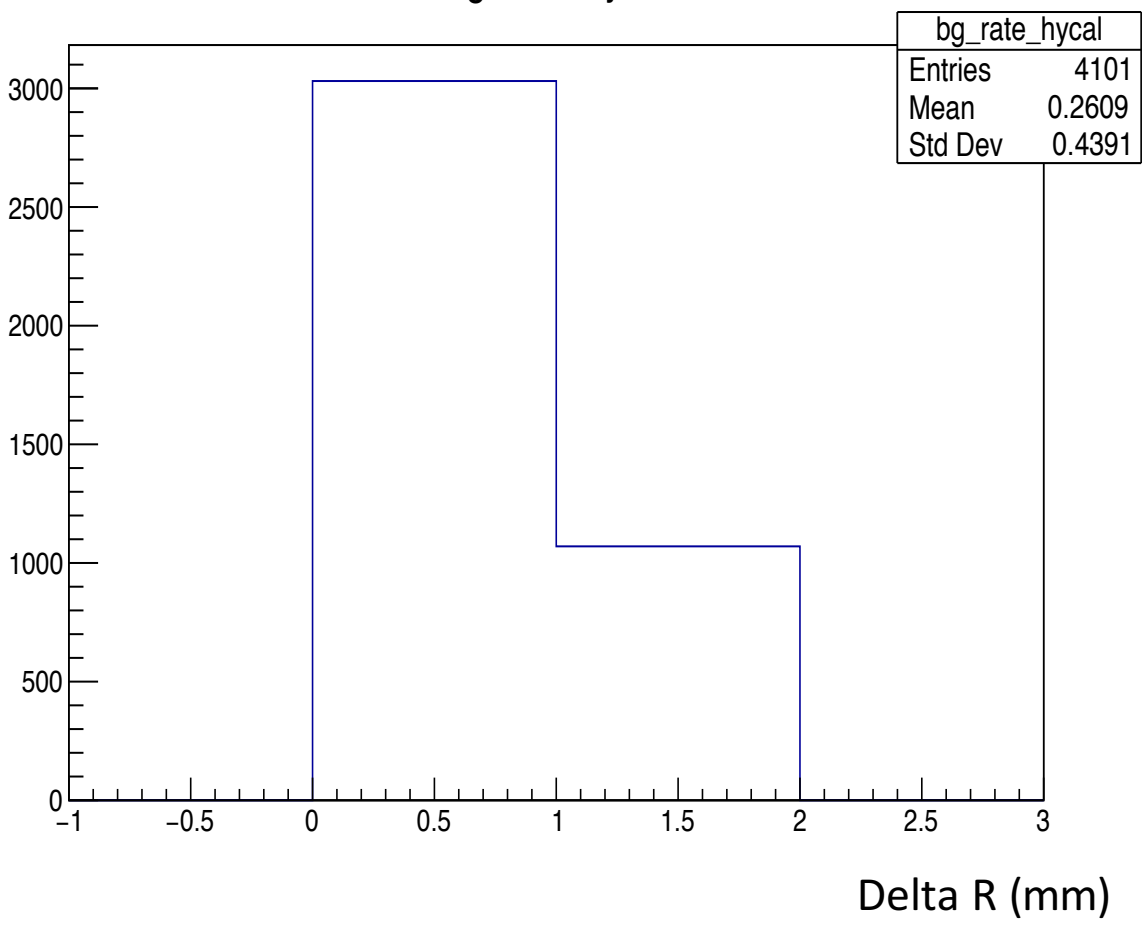




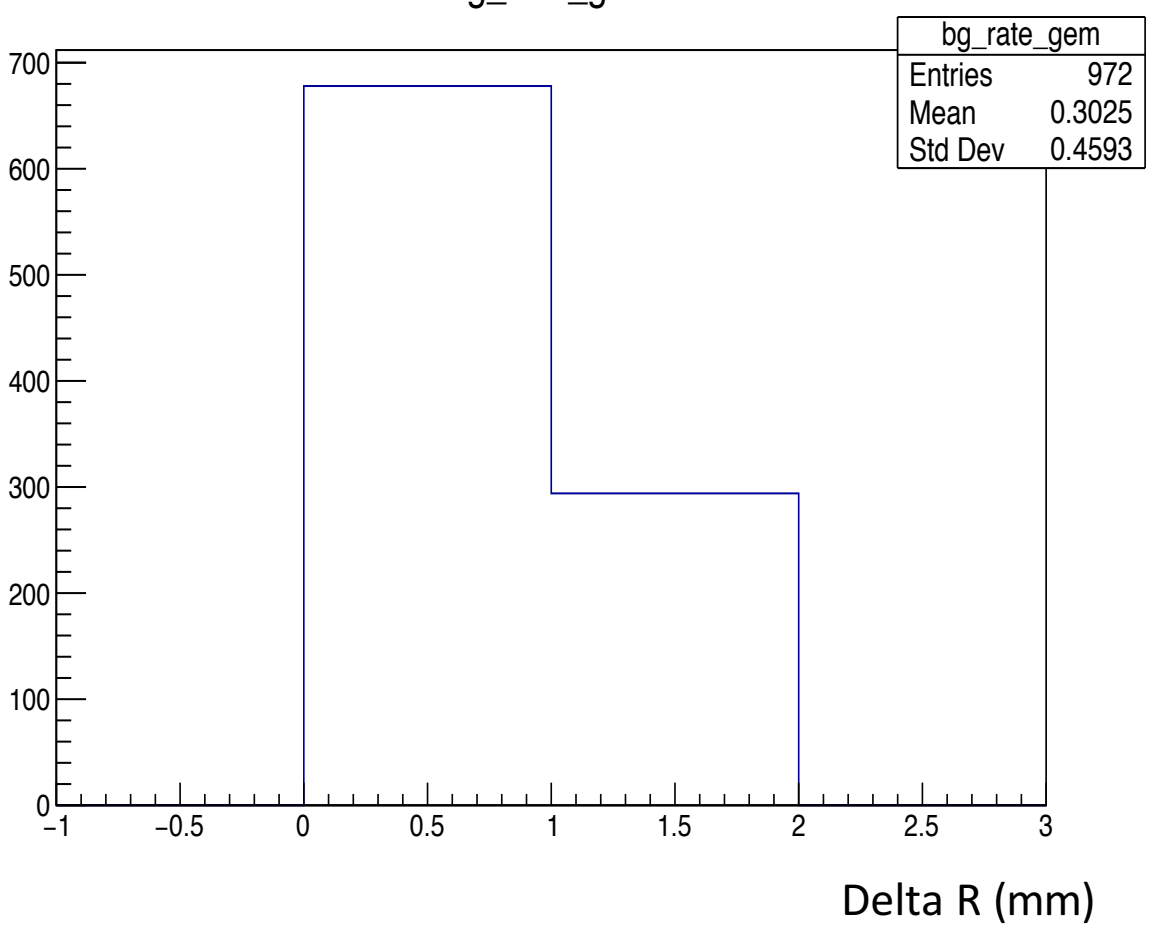
Beam on target simulation

- 0 means there is at least 1 charged particle within 10mm radius around the high energy photon
- 1 means there is no charged particle within 10mm radius around the high energy photon

ep elasticity cut for analysis – 4sigma

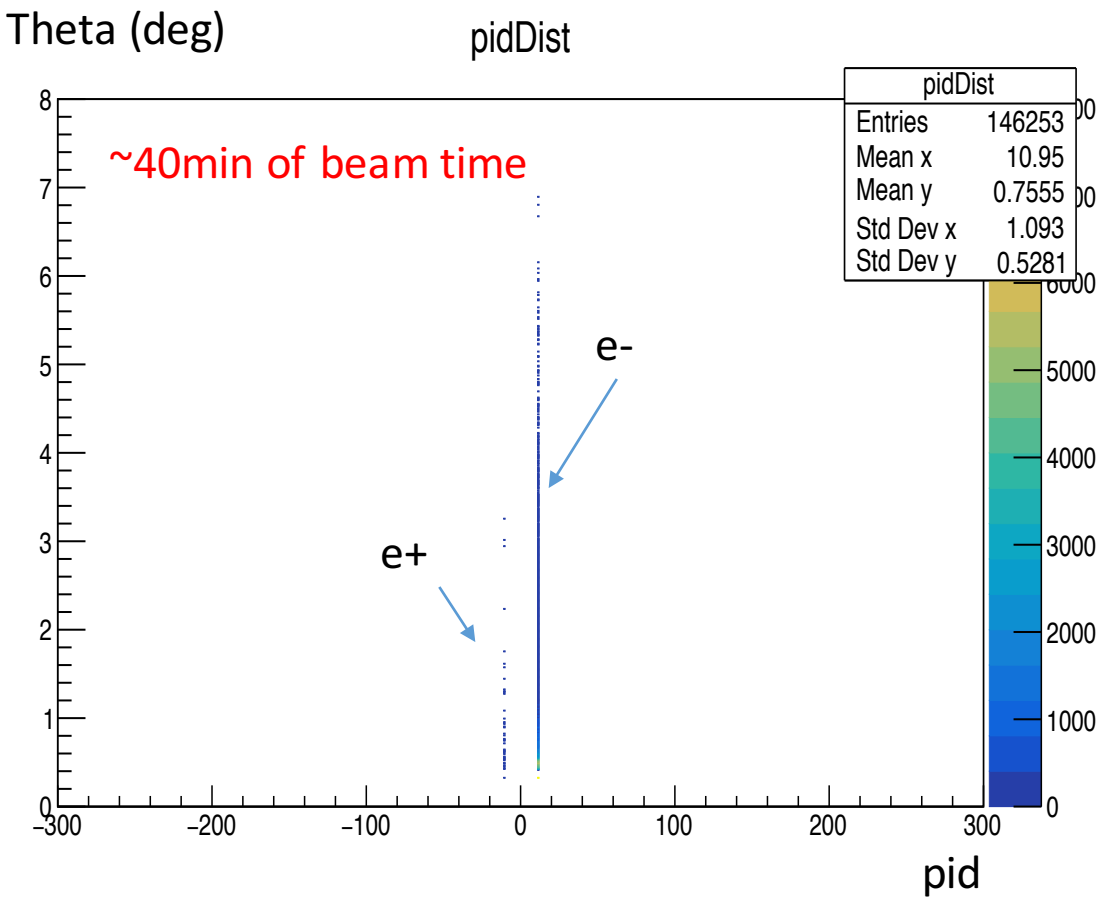


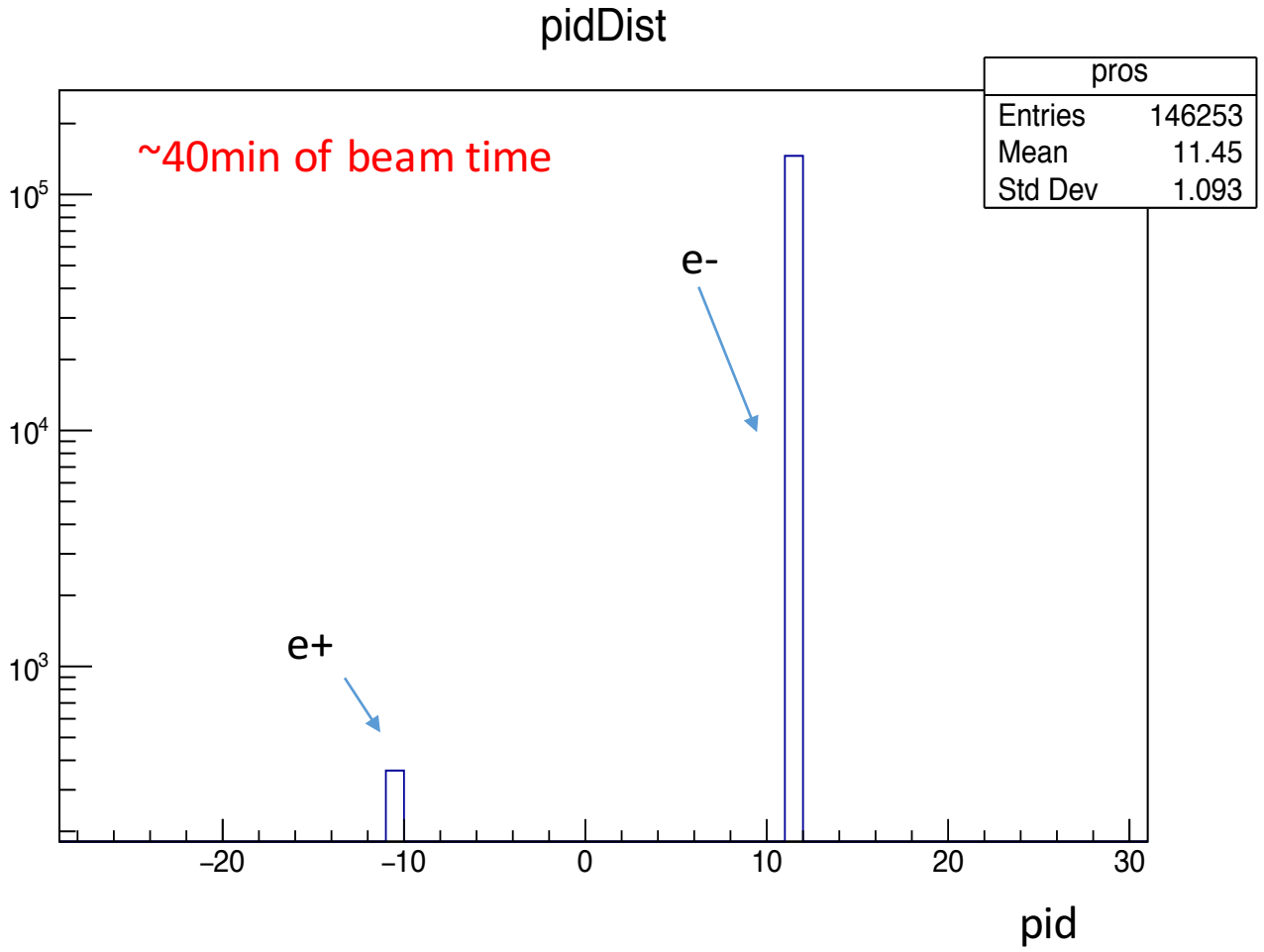
ep elasticity cut for GEM efficiency calculation– 1sigma



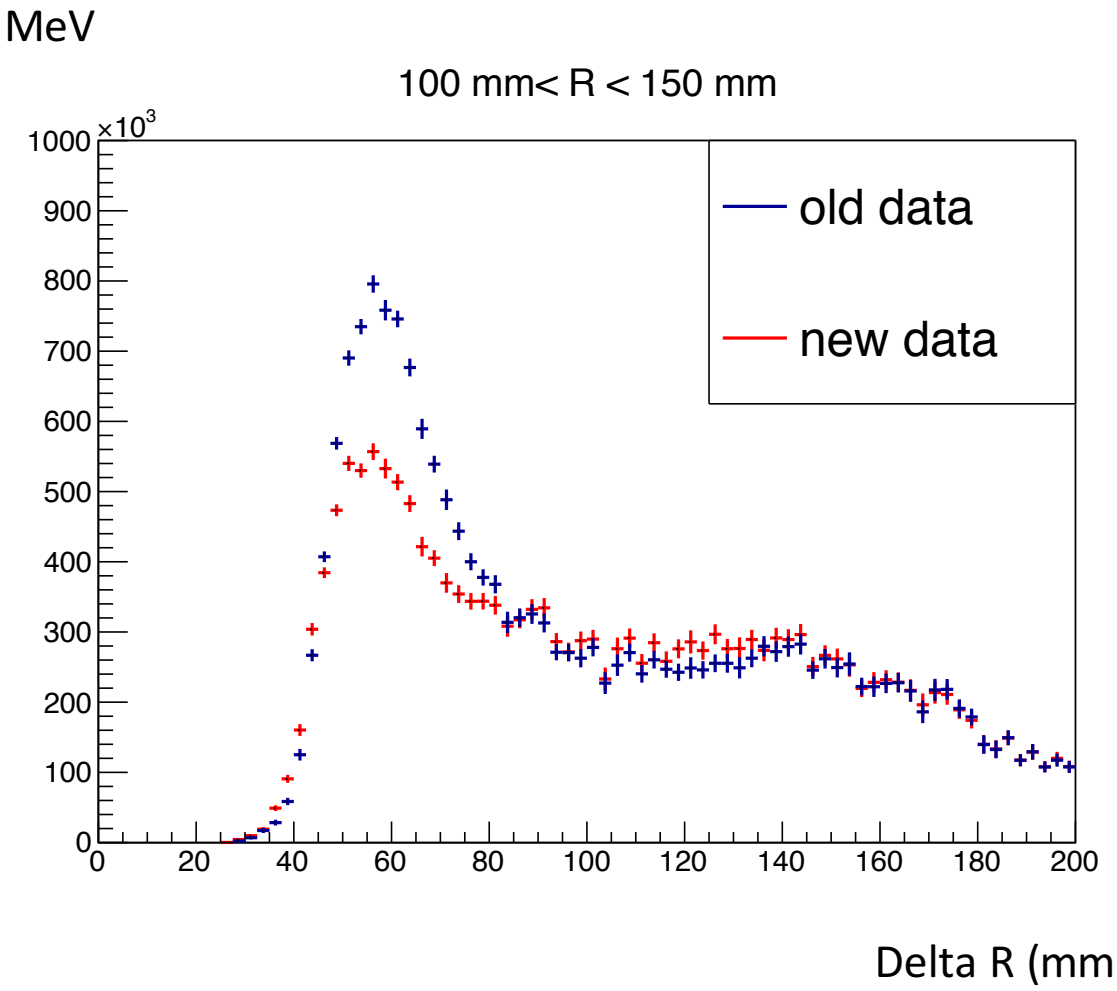
Beam on target simulation

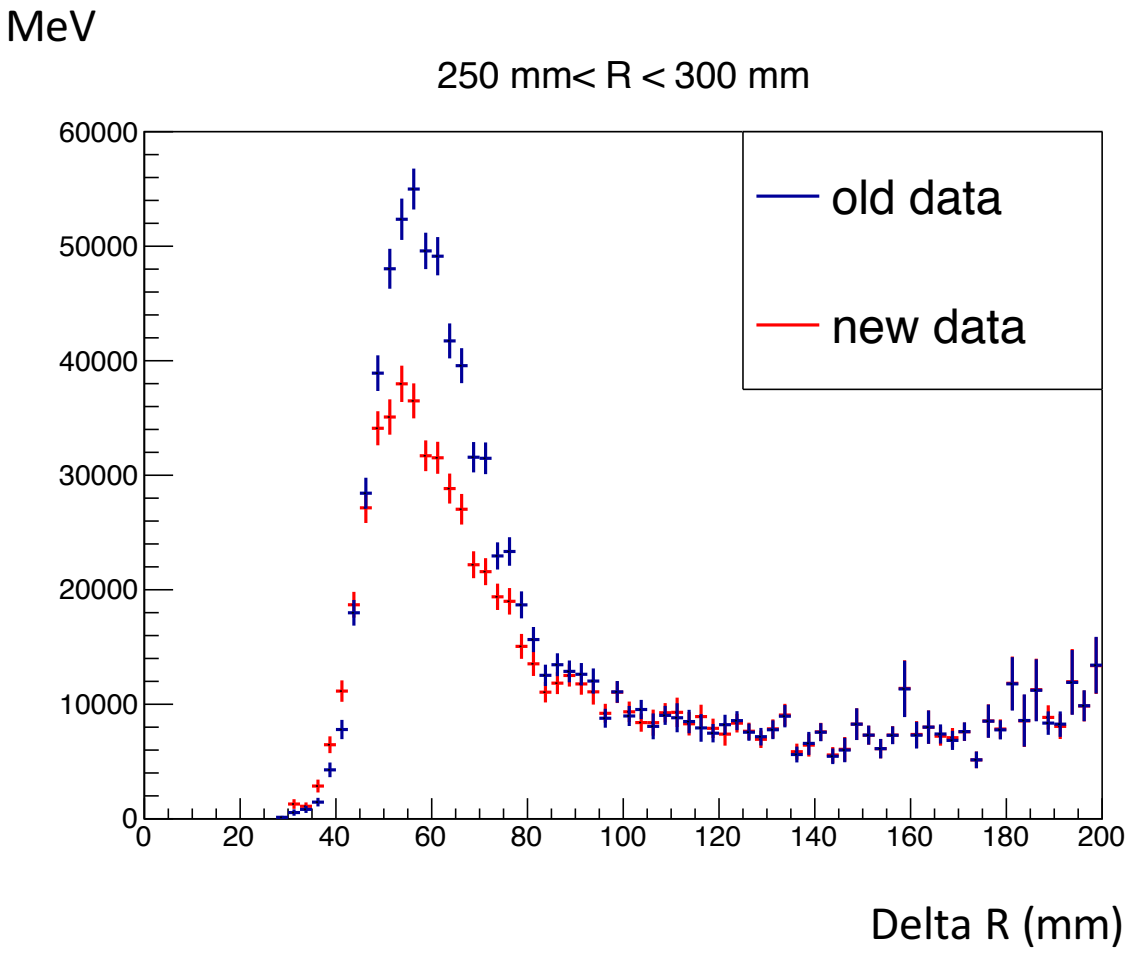
Require 1800 MeV < E <2500 MeV





Cluster position distribution (weighted by energy) around the ep cluster





Major changes in early this year

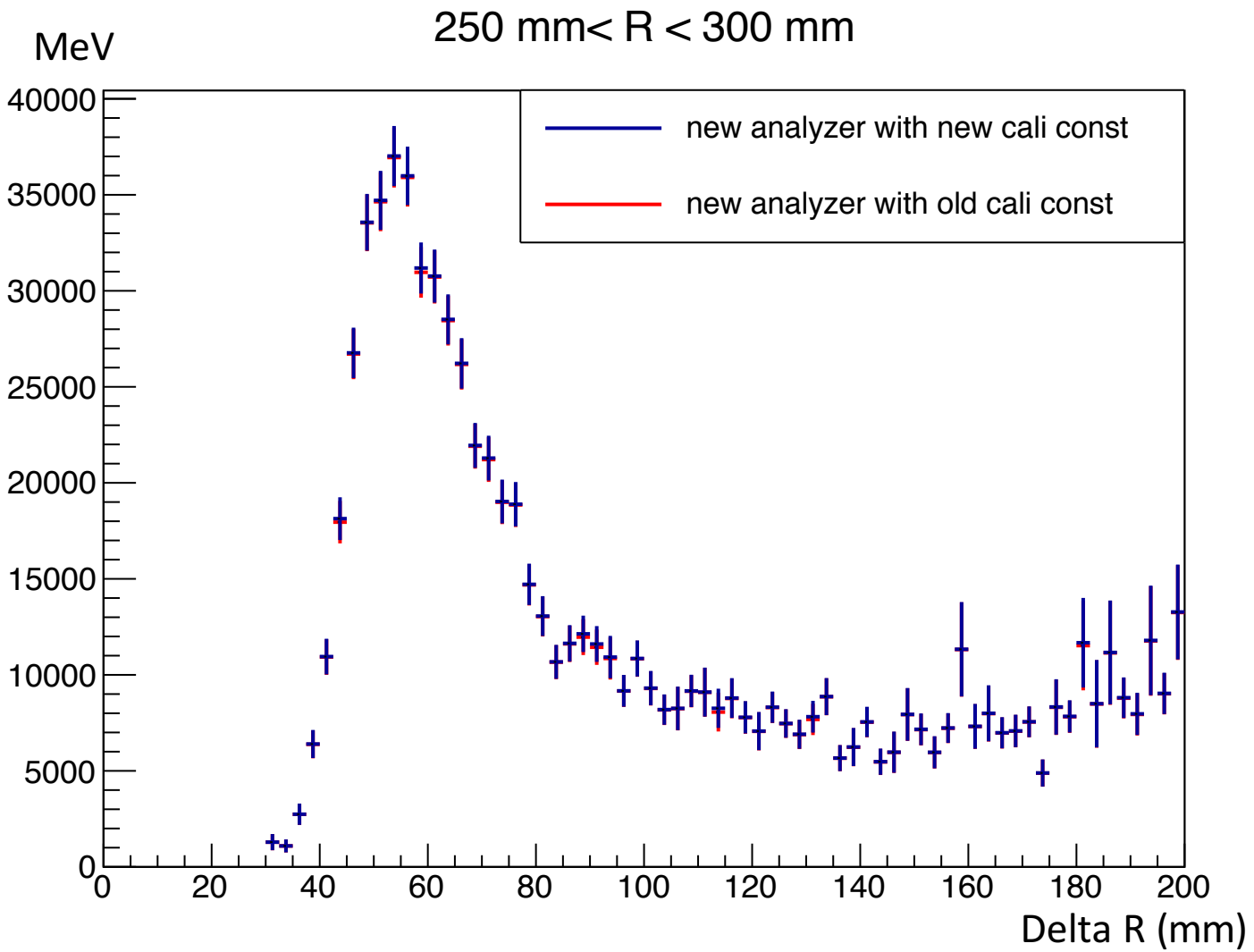
- Switch to a new version of PRad analyzer
  1. New cluster profile used for cluster splitting and leakage
  2. New nonlinearity constants

- S-shape correction

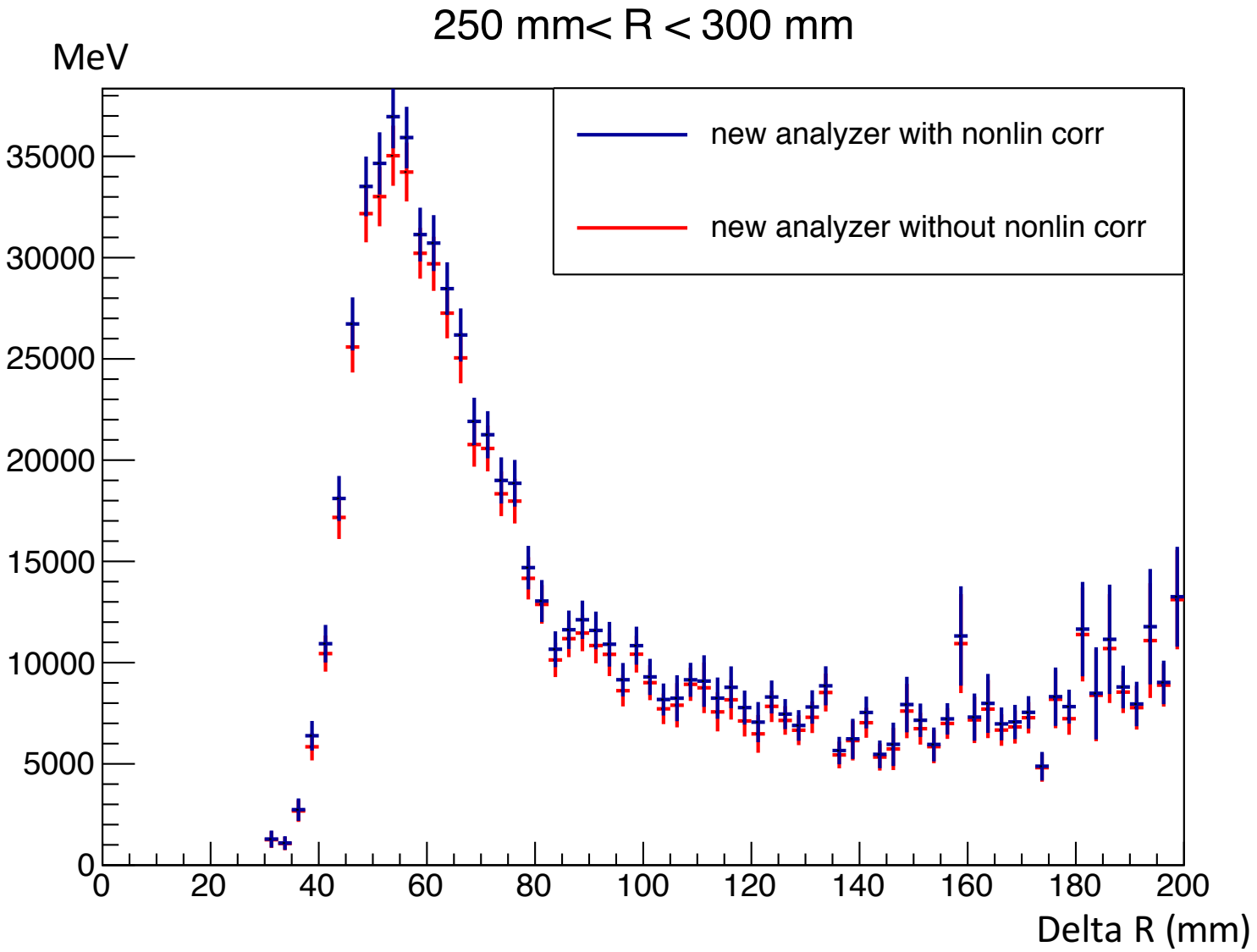
- Non-linearity correction in the simulation (simulation only)

- Introduce the gap between modules (simulation only)

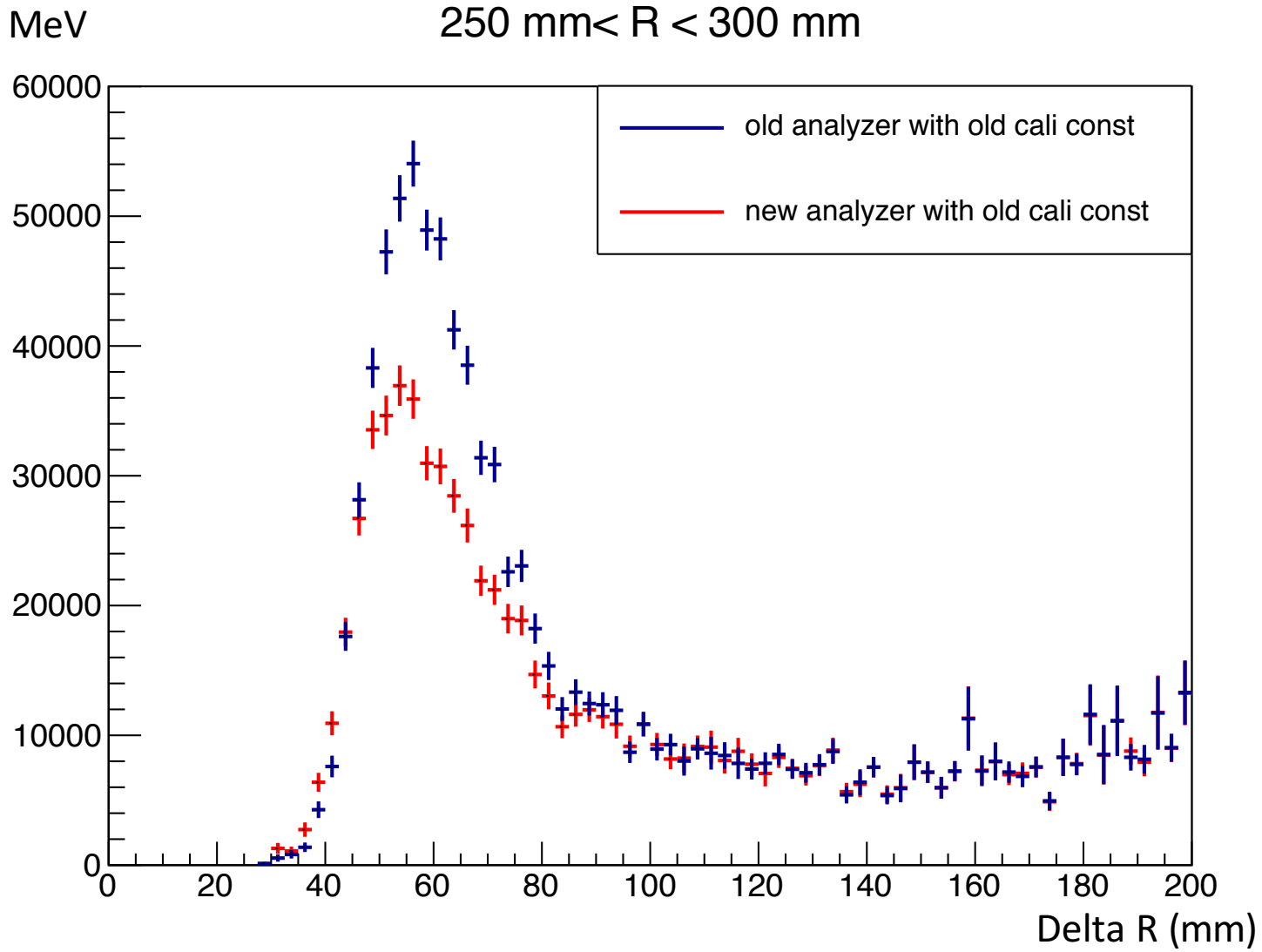
Cluster position distribution (weighted by energy) around the ep cluster



Cluster position distribution (weighted by energy) around the ep cluster

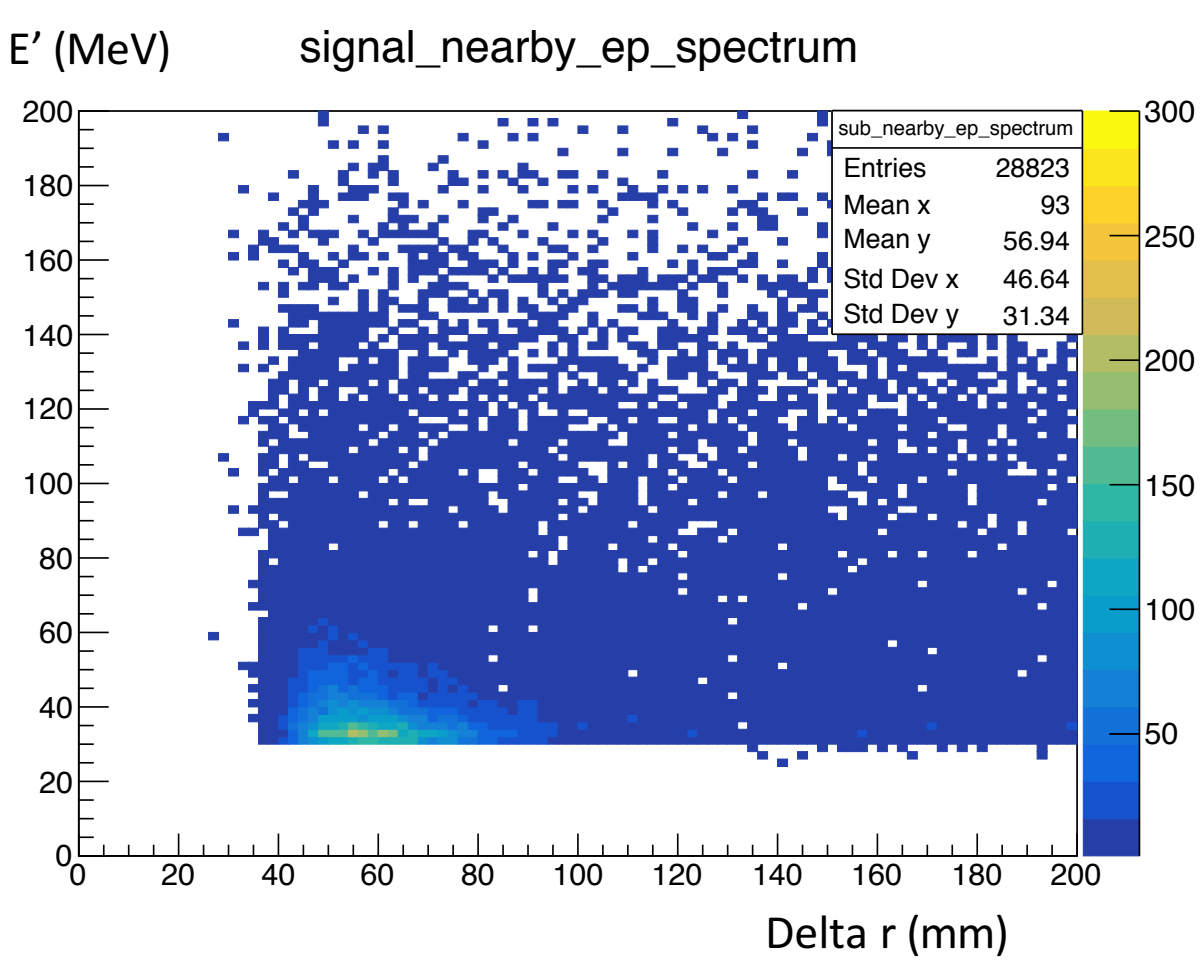


Cluster position distribution (weighted by energy) around the ep cluster

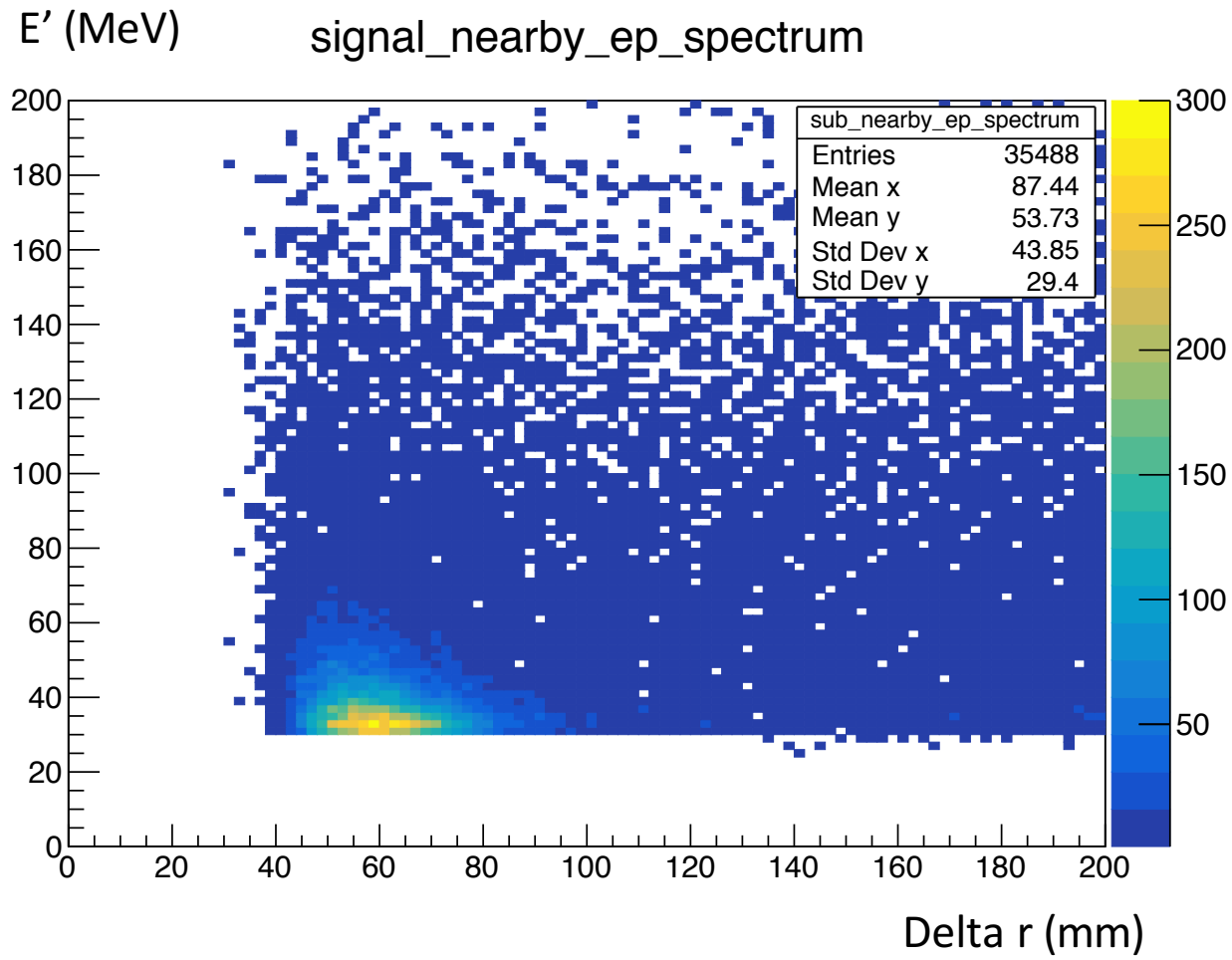


Cluster position vs energy around the ep cluster

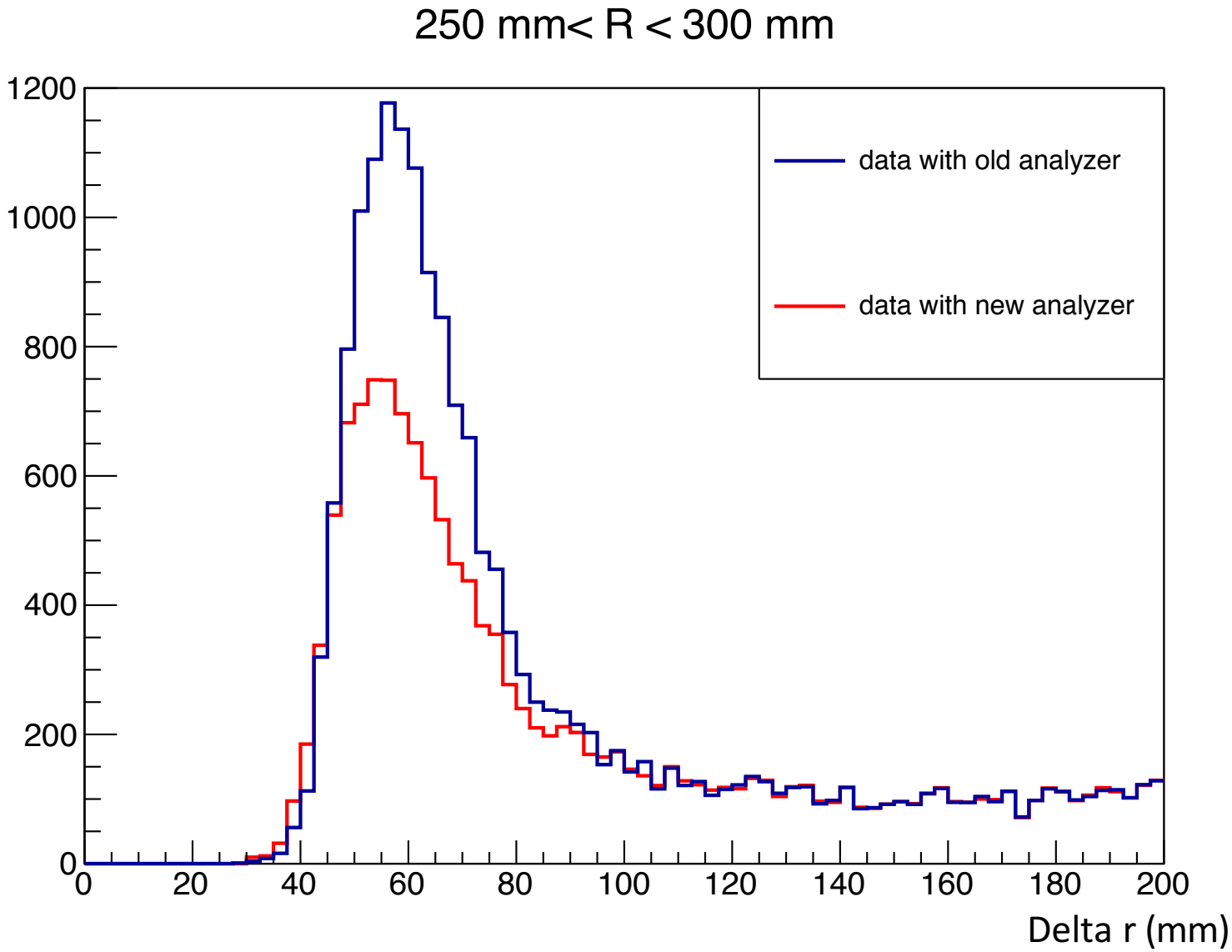
New analyzer



Old analyzer



Cluster position around the ep cluster



ep yield ratio with old analyzer / ep yield with new analyzer