

Update on LUXE GEANT4 Simulation

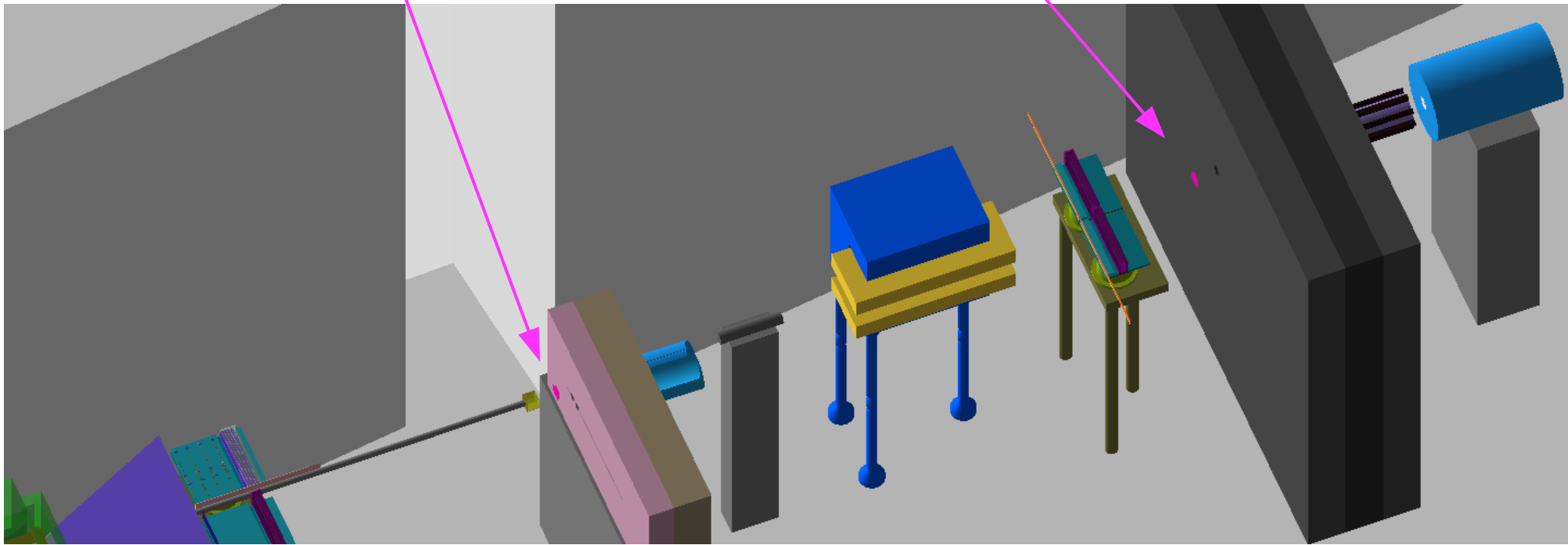
Oleksandr Borysov

LUXE DESY technical Meeting
February 11, 2021

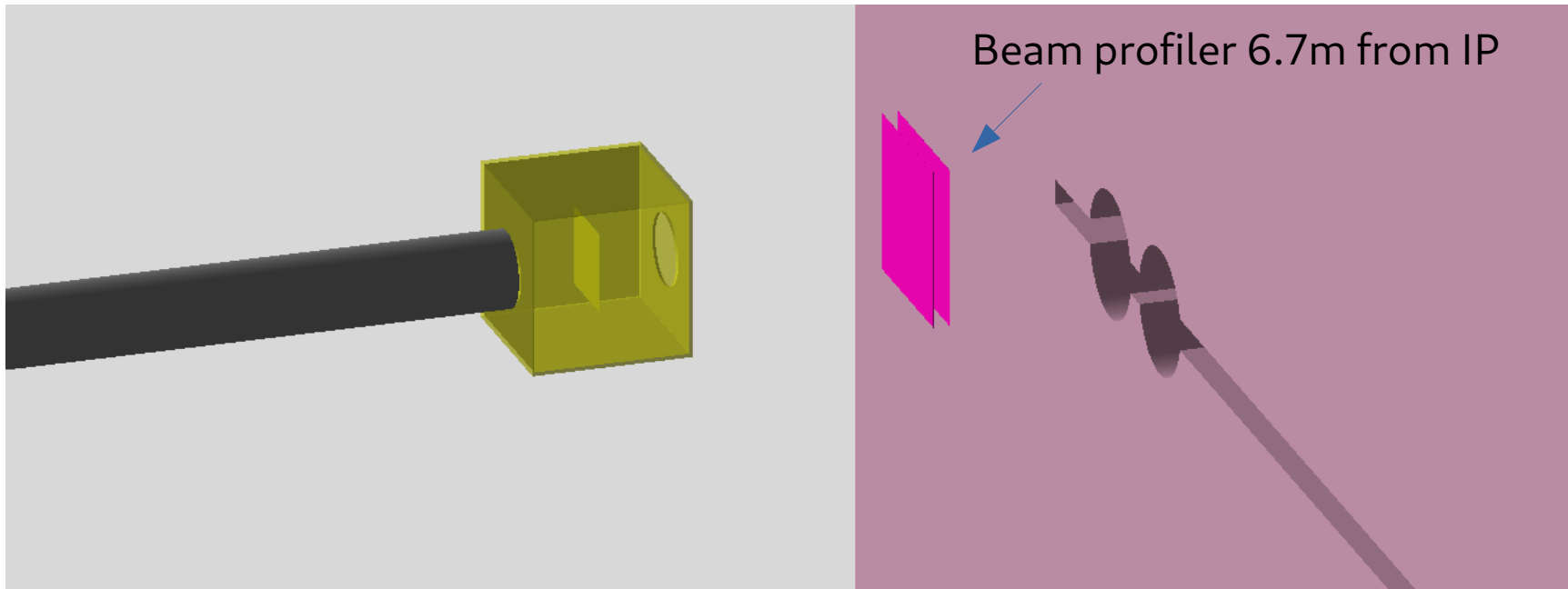
Sapphire planes of beam profiler

Beam profiler 6.7m from IP

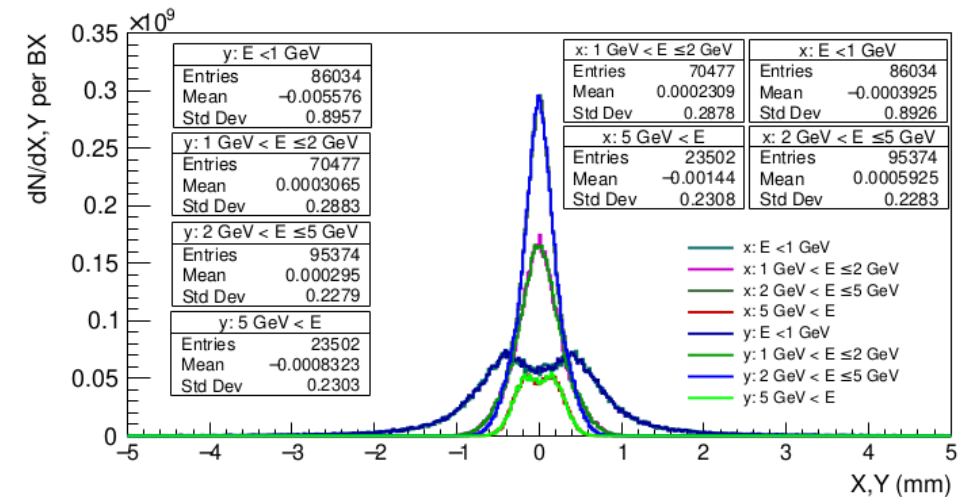
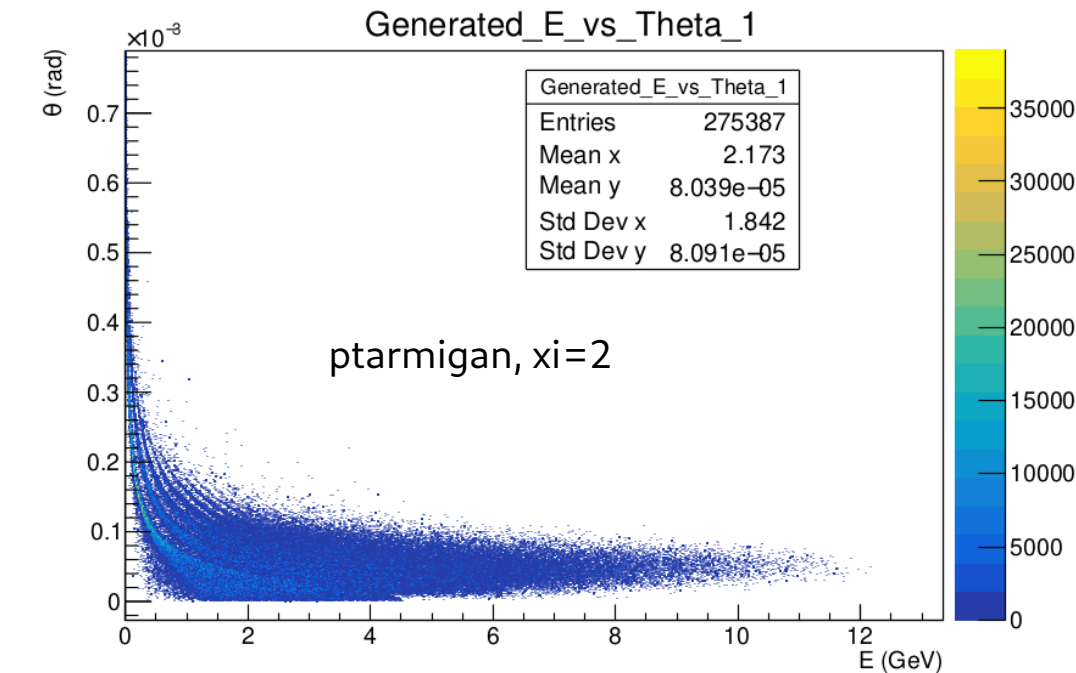
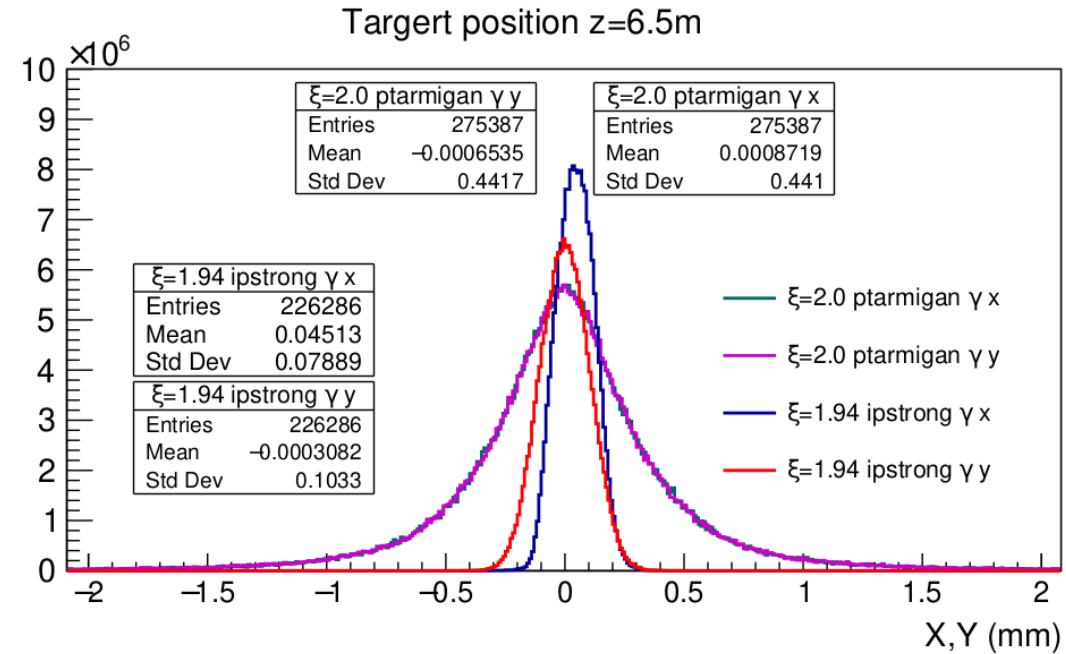
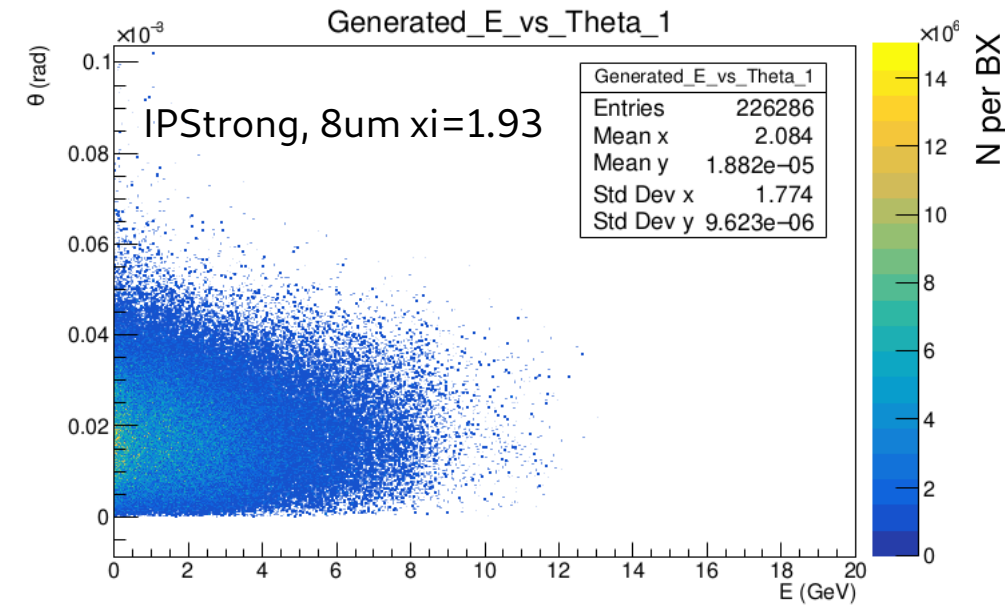
Beam profiler 11.8m from IP



Sapphire planes of beam profiler



Compton photons IPStrong and Ptarmigan

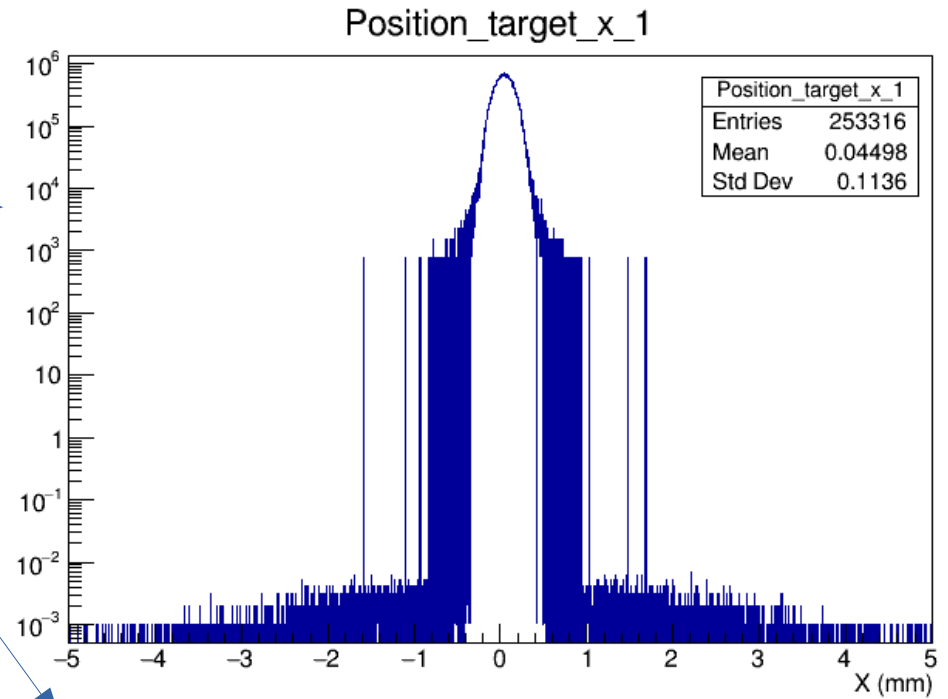


Primary MC photons

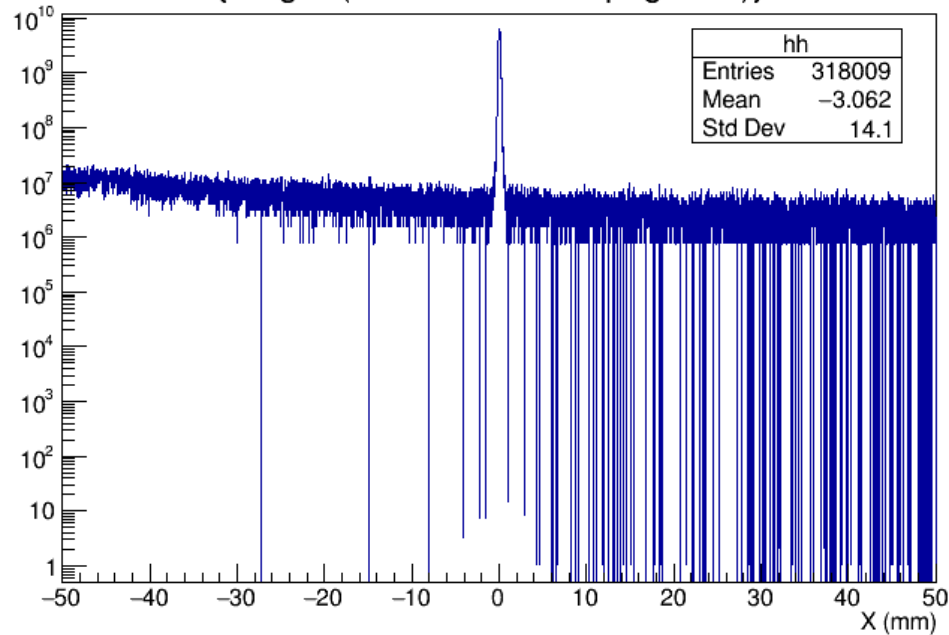
MC: $X = X_0 + p_x/p_z * (Z - Z_0)$ →

Primary photons as they
cross the first profiler plane

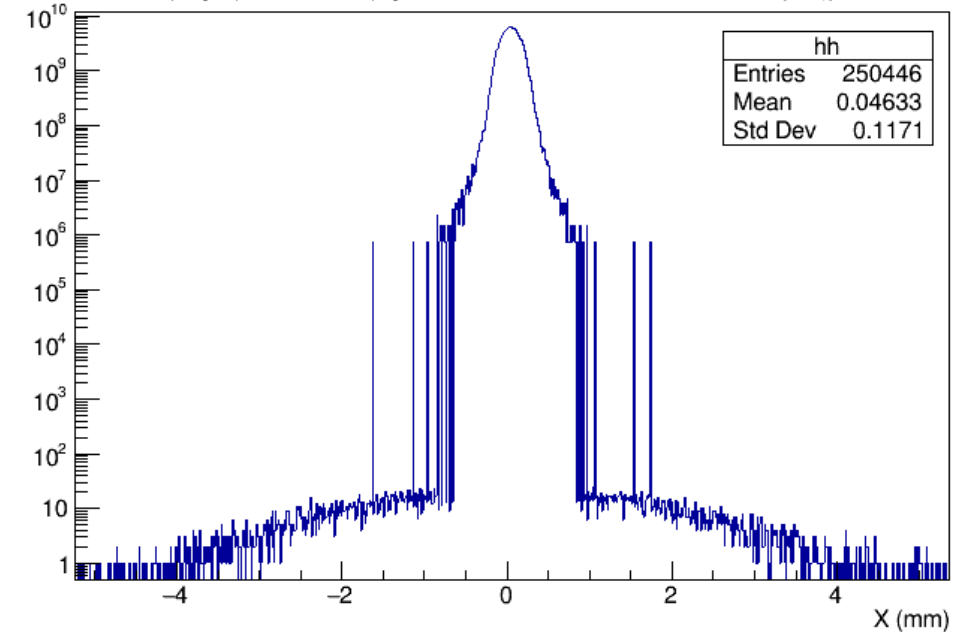
All photons crossing the
first profiler plane



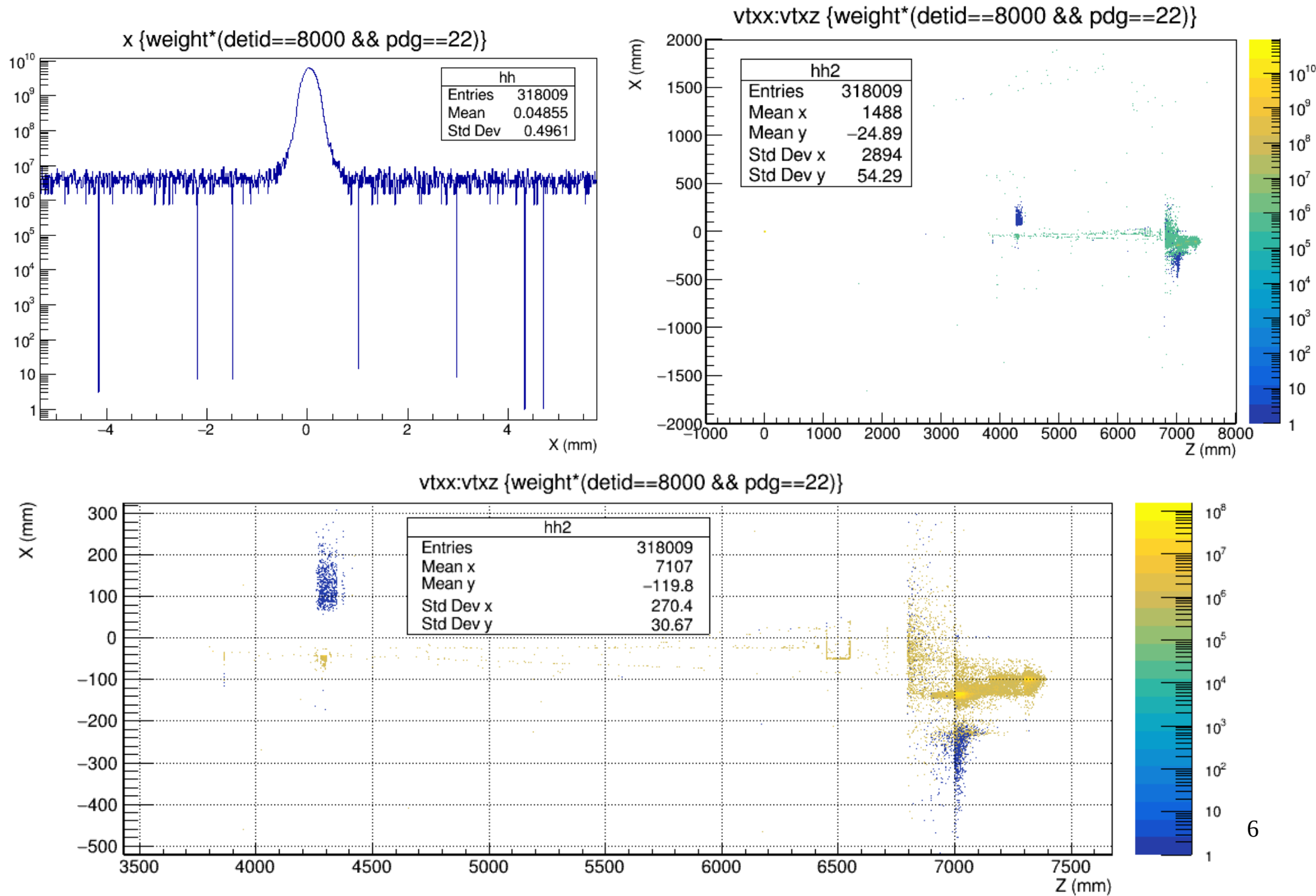
x {weight*(detid==8000 && pdg==22)}



x {weight*(detid==8000 && pdg==22 && vtxz<10.0 && trackid==1 && nsecondary==0)}

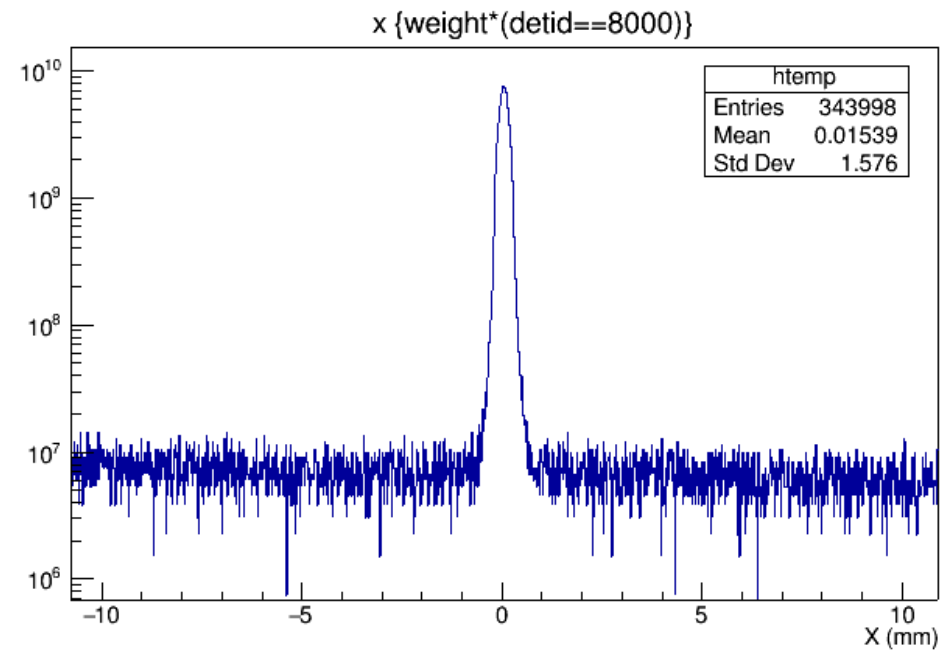
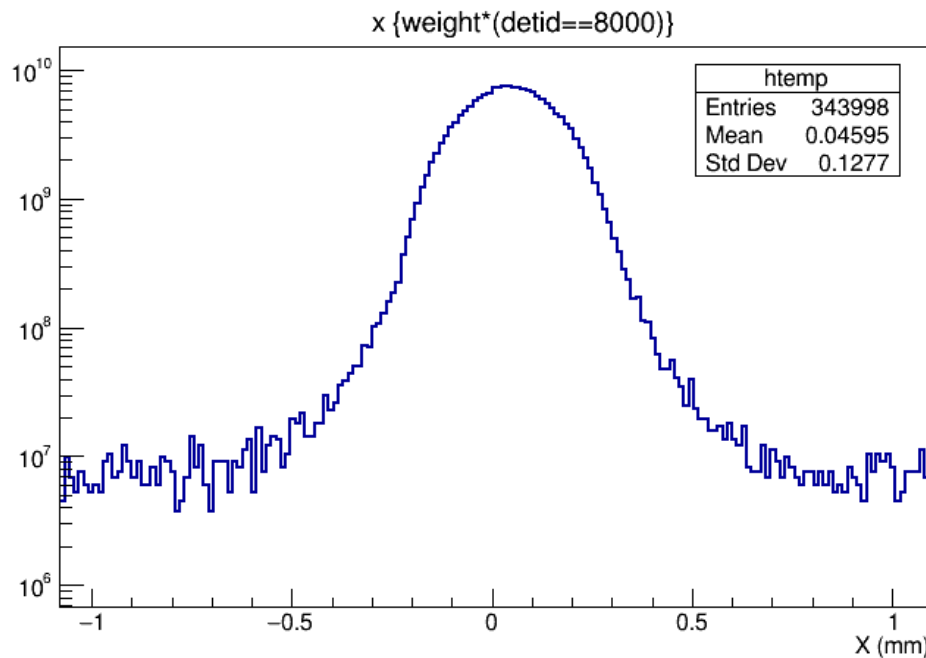
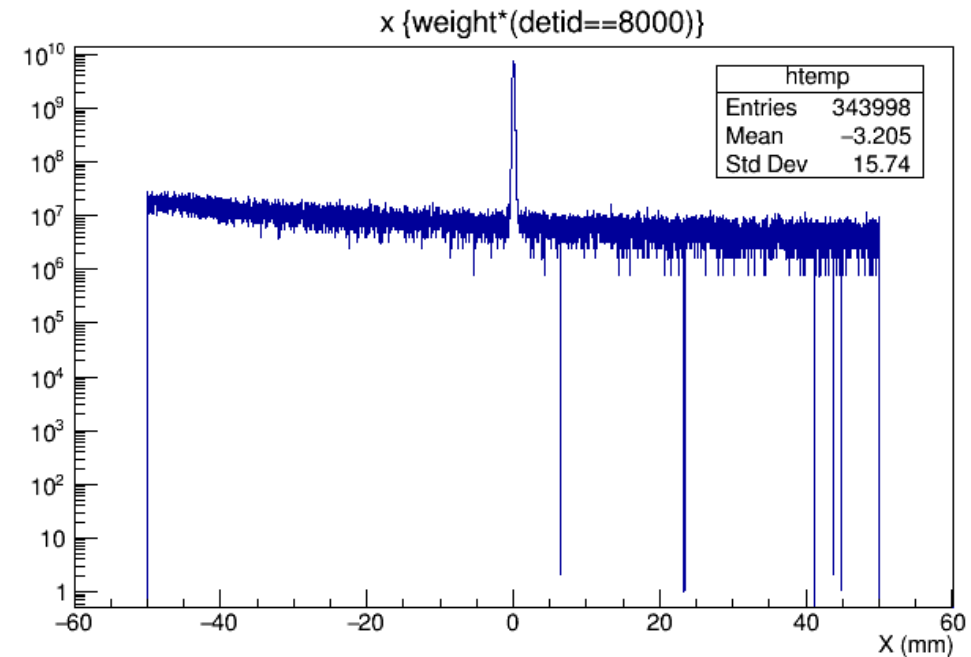


Vertex X,Z distribution of photons crossing first profiler plane



All particles crossing the surface of the first profiler plane

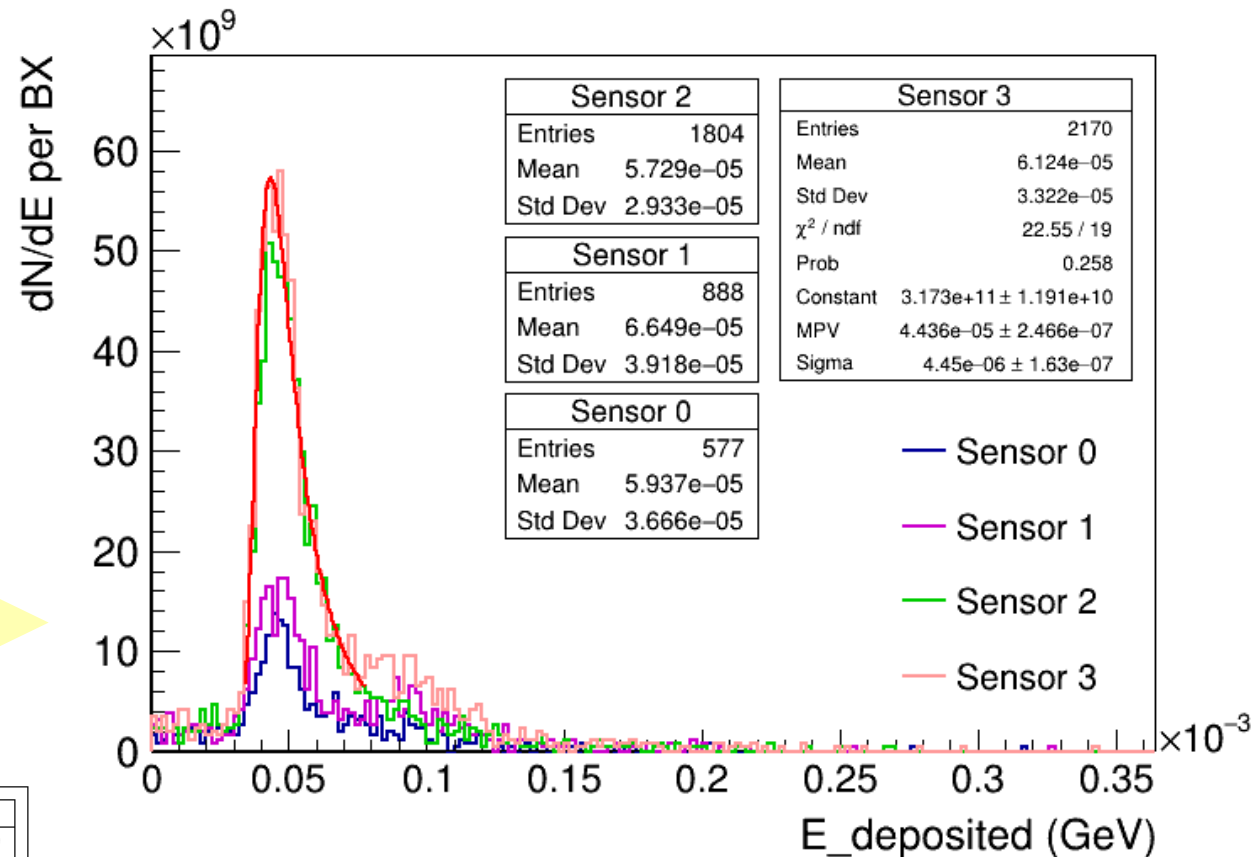
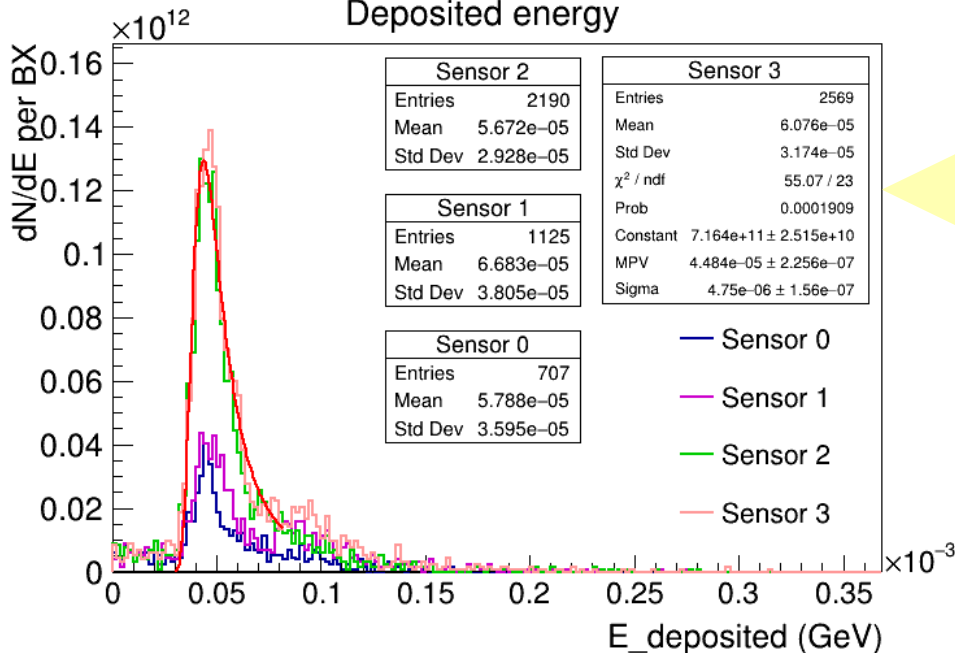
Zoom on X



Deposited energy

- Sensor limited to 2 cm by 2 cm;
- Segmented with strips of $100\mu\text{m}$;
- Deposited energy in strips for primary photon is used;
- Strips with zero deposition are ignored

IPStrong, $8\mu\text{m}$, $\xi = 1.9$



ptarmigan, $\xi = 2.0$

Simple standalone test:

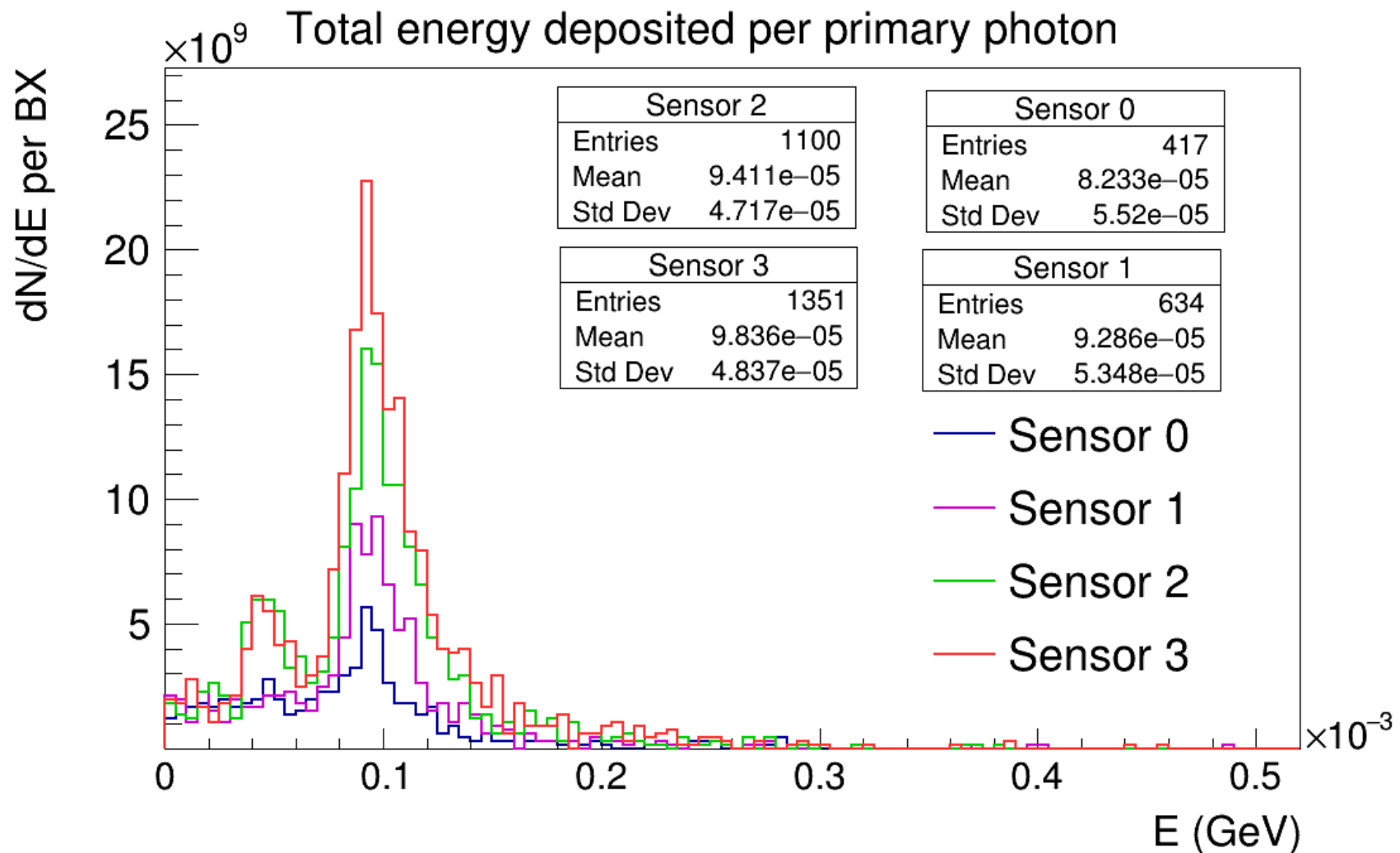
The run was 100000 e- of 10 GeV through $100\mu\text{m}$ of G4_ALUMINUM_OXIDE (density: 3.97 g/cm^3)

Total energy deposit in absorber per event = **56.44 keV** +- 87.46 eV

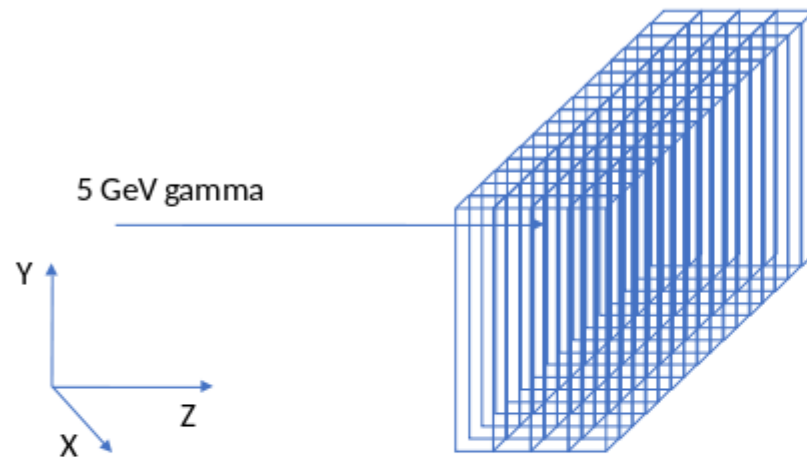
Deposited energy in sensor

- Sensor limited to 2 cm by 2 cm;
- Events with zero deposition are ignored

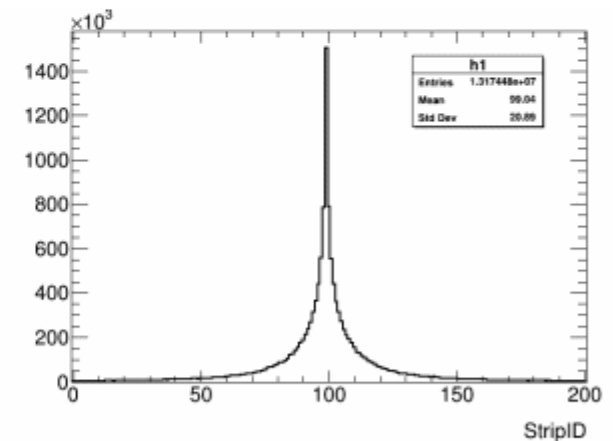
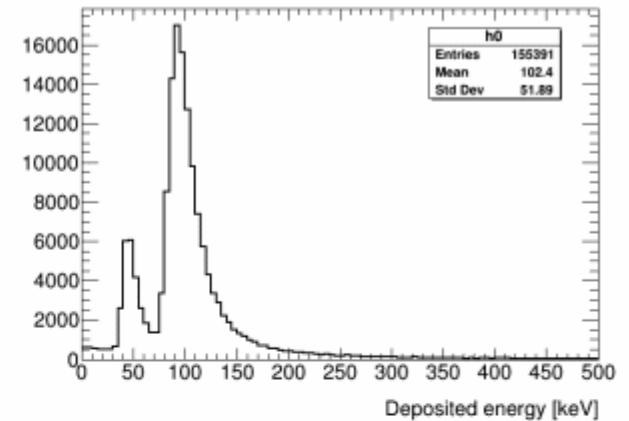
IPStrong, 8 μ m, $\xi = 1.9$



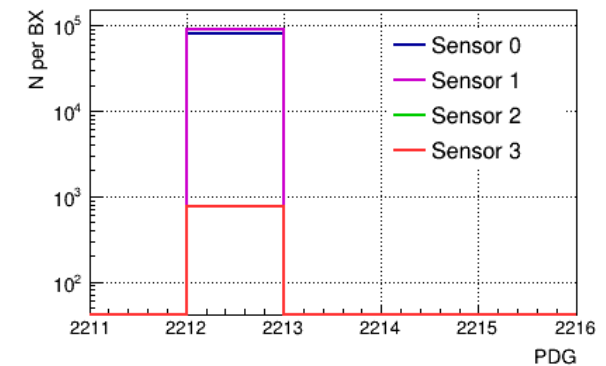
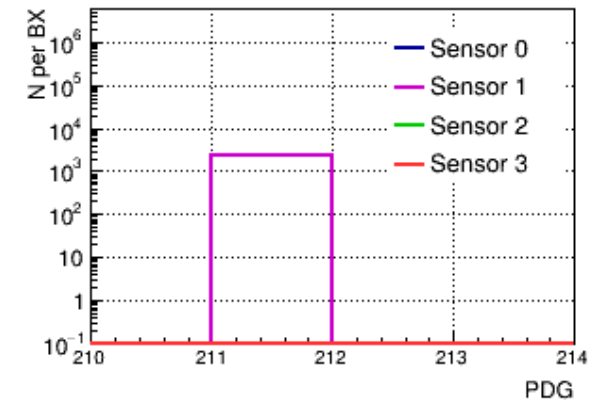
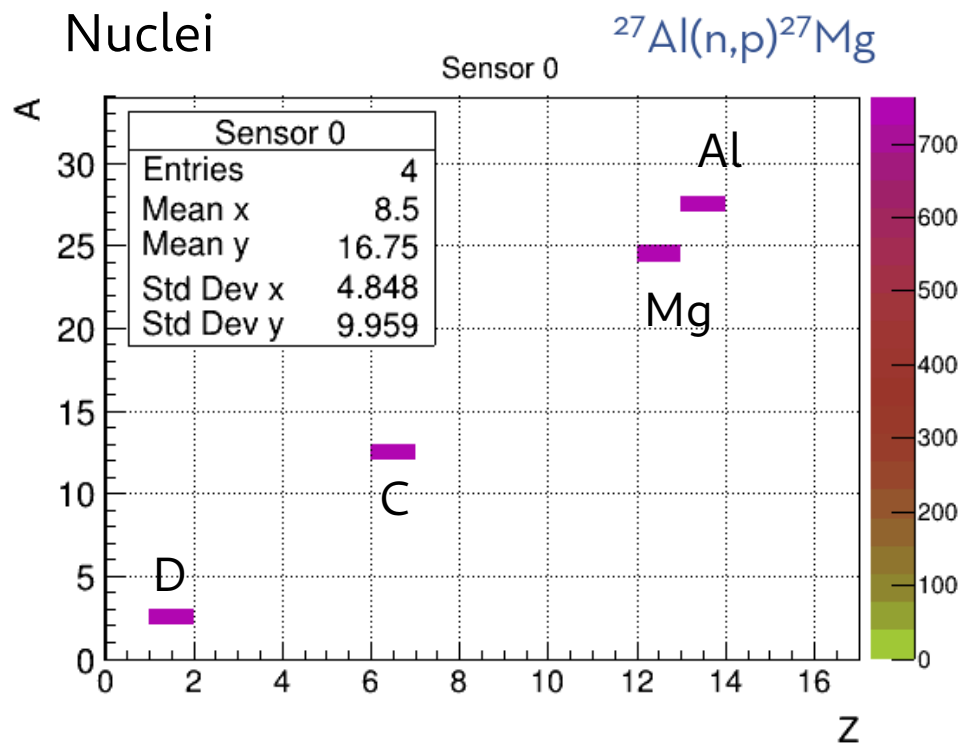
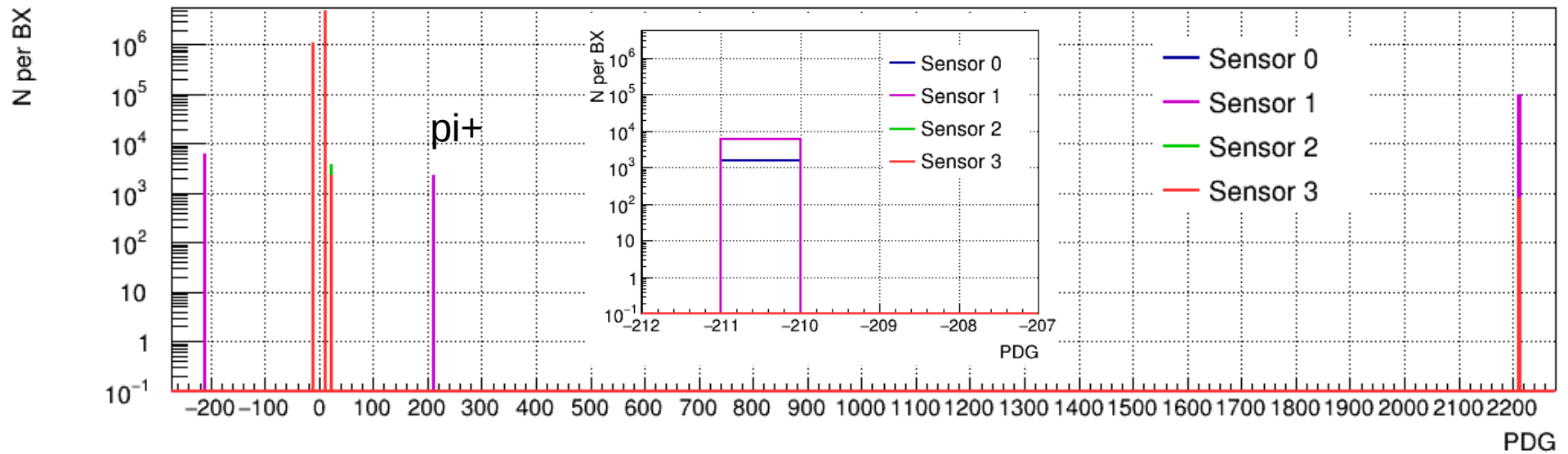
MC Standalone



- A standalone Geant4 MC simulation of the detector is being developed to study systematic effects
- First tests performed with a pencil beam of 5 GeV and 6m of air show a non negligible beam width spread



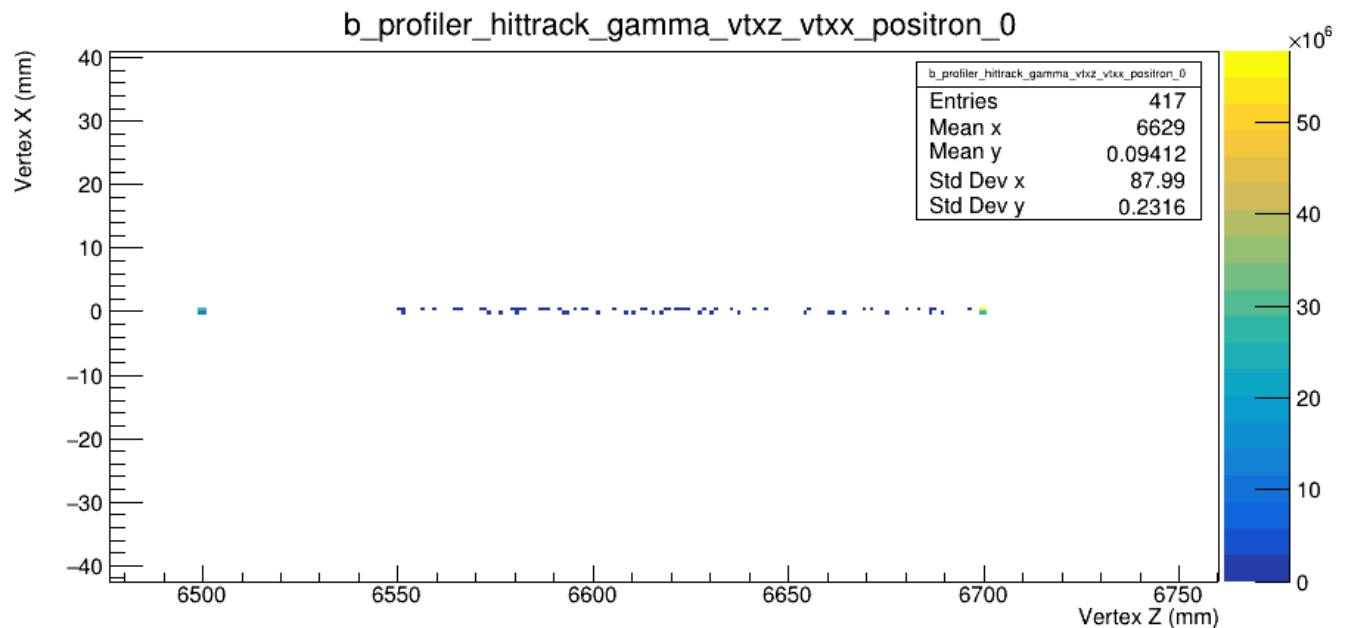
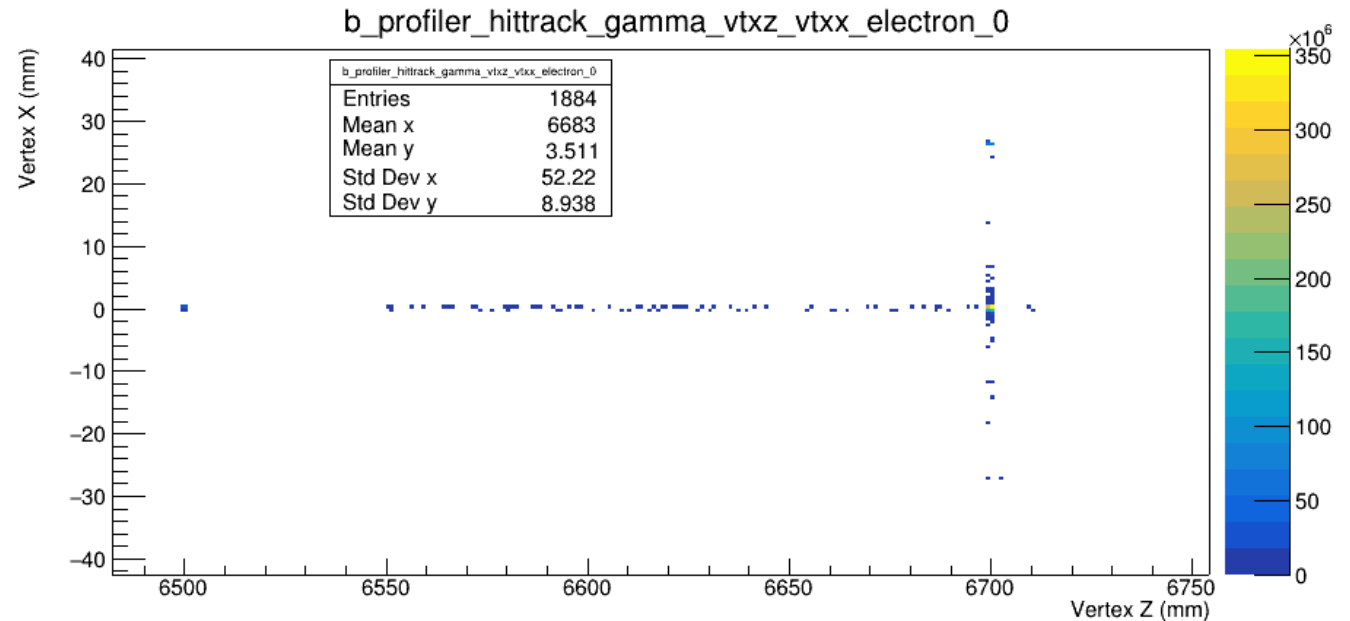
Particles deposited energy in profiler



Production vertices

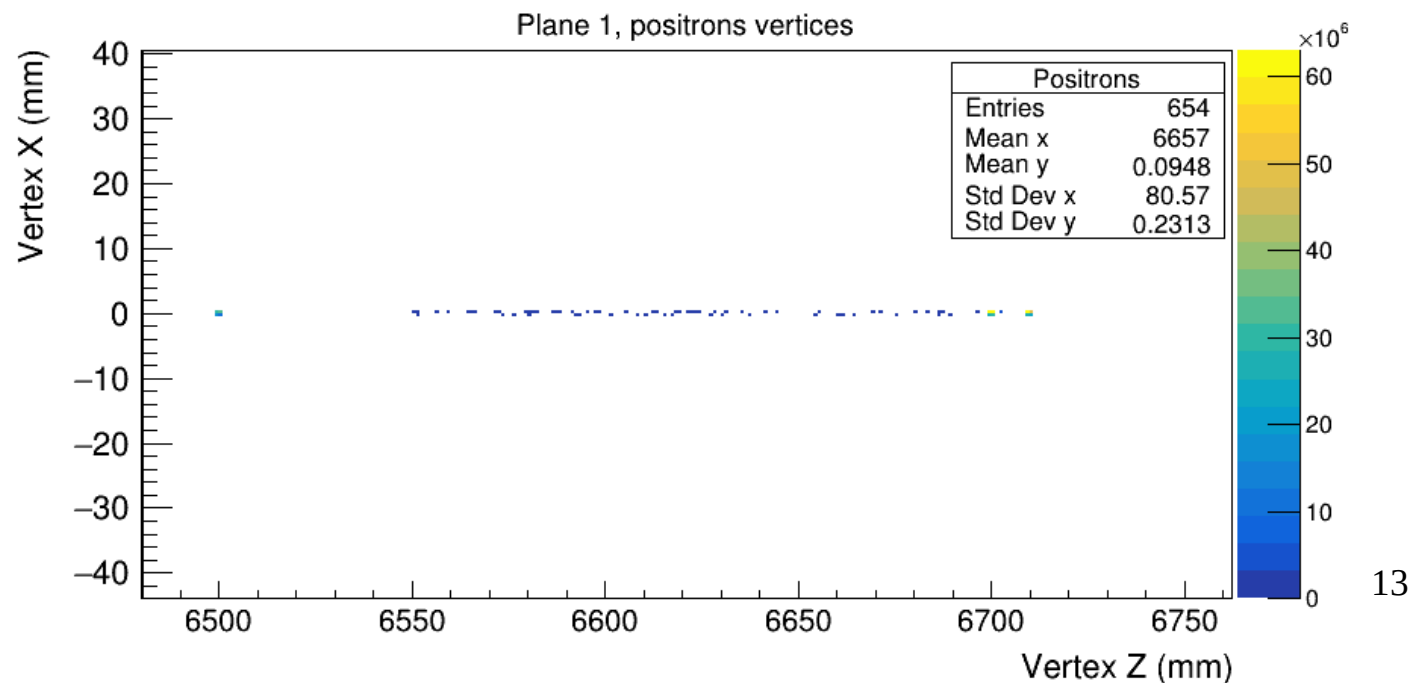
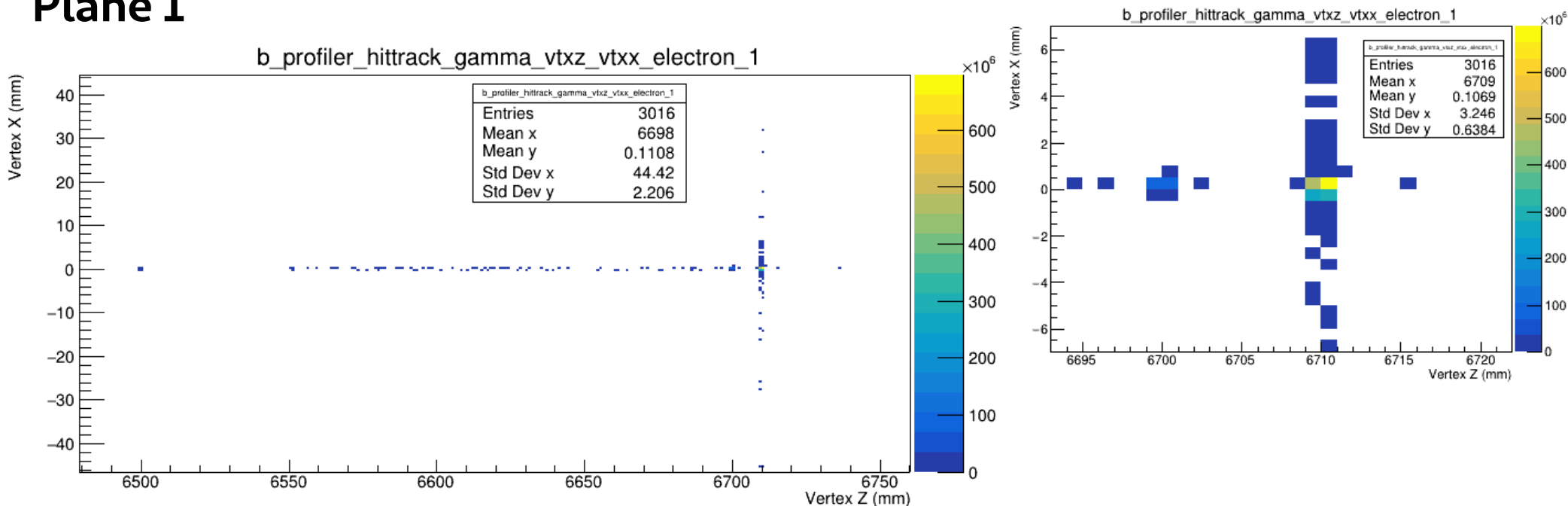
Plane 0

Production vertices:
electrons and positrons
which deposited energy
in profiler planes
for events with primary
(signal) photons



Production vertices

Plane 1

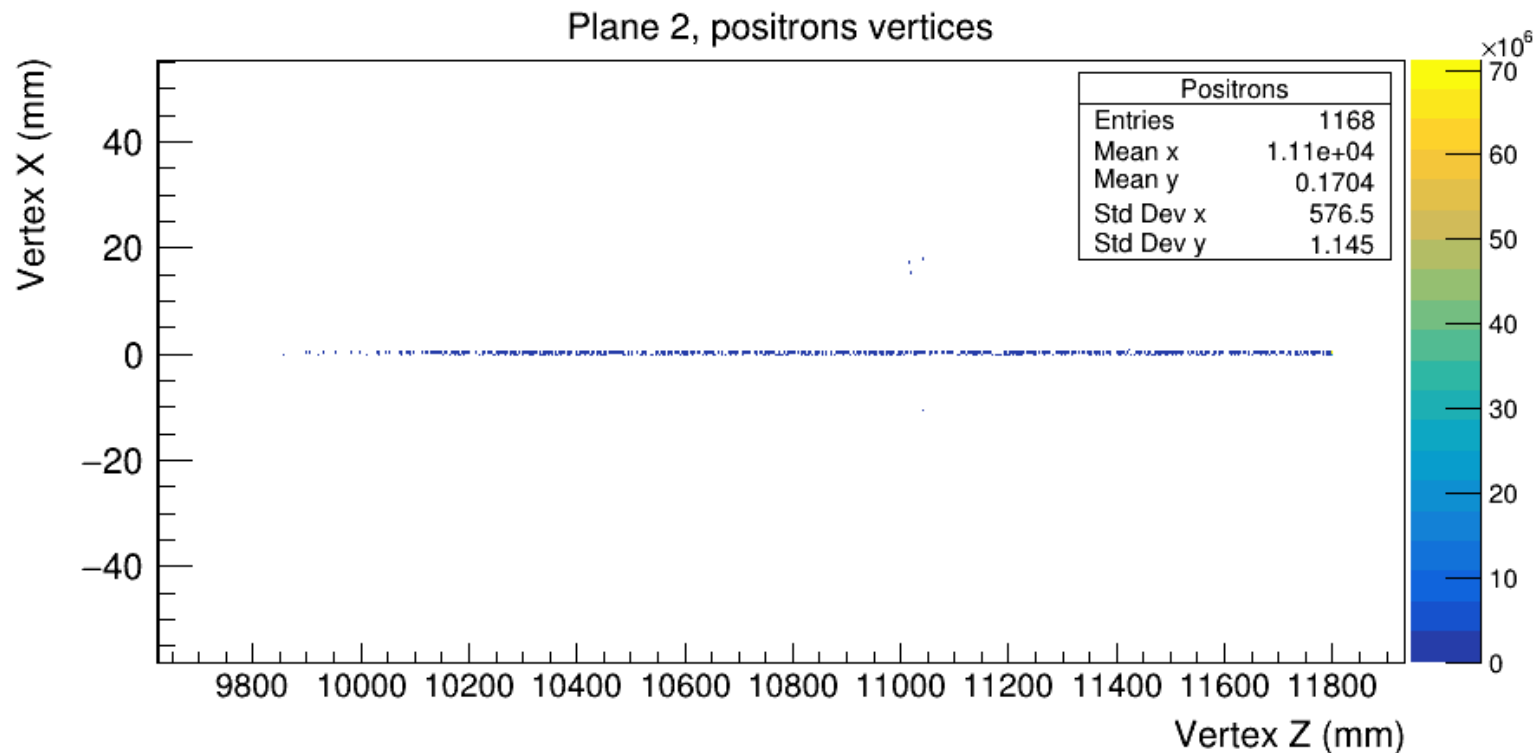
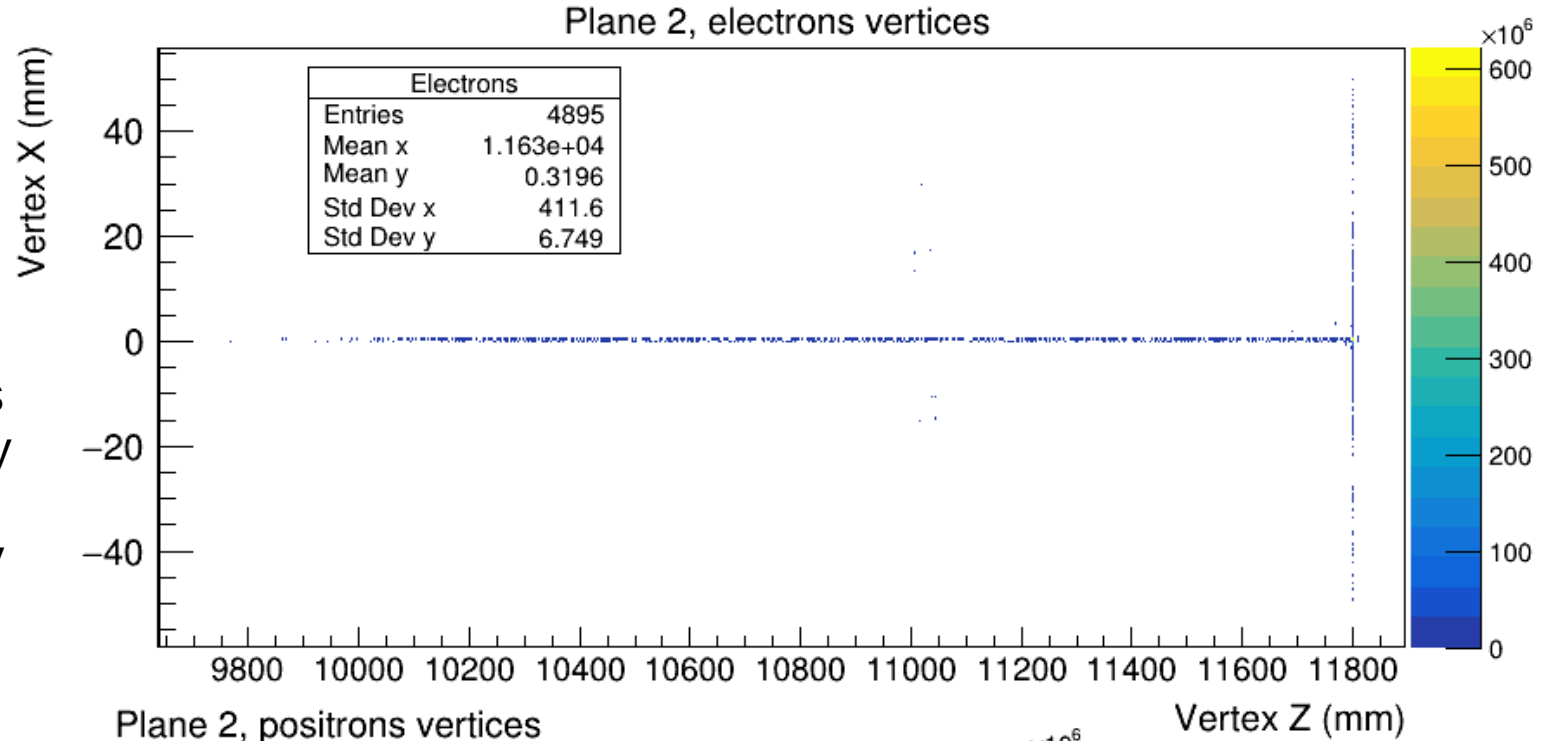


Production vertices:
electrons and positrons
which deposited energy
in profiler planes
for events with primary
(signal) photons

Production vertices

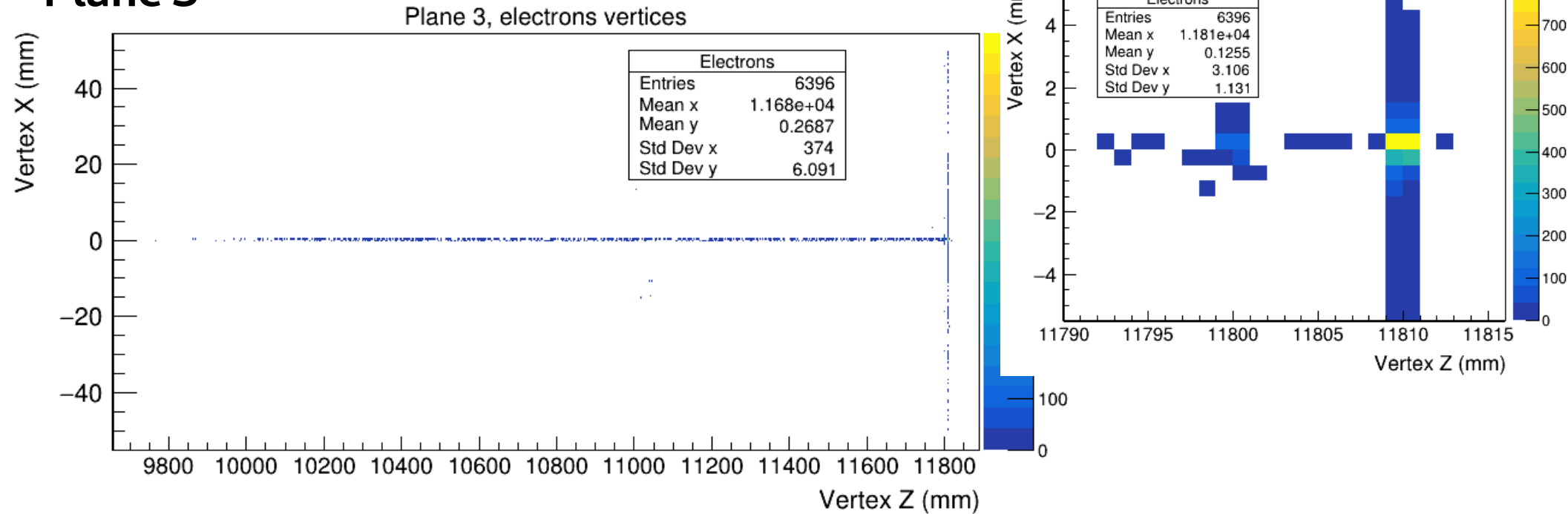
Plane 2

Production vertices:
electrons and positrons
which deposited energy
in profiler planes
for events with primary
(signal) photons

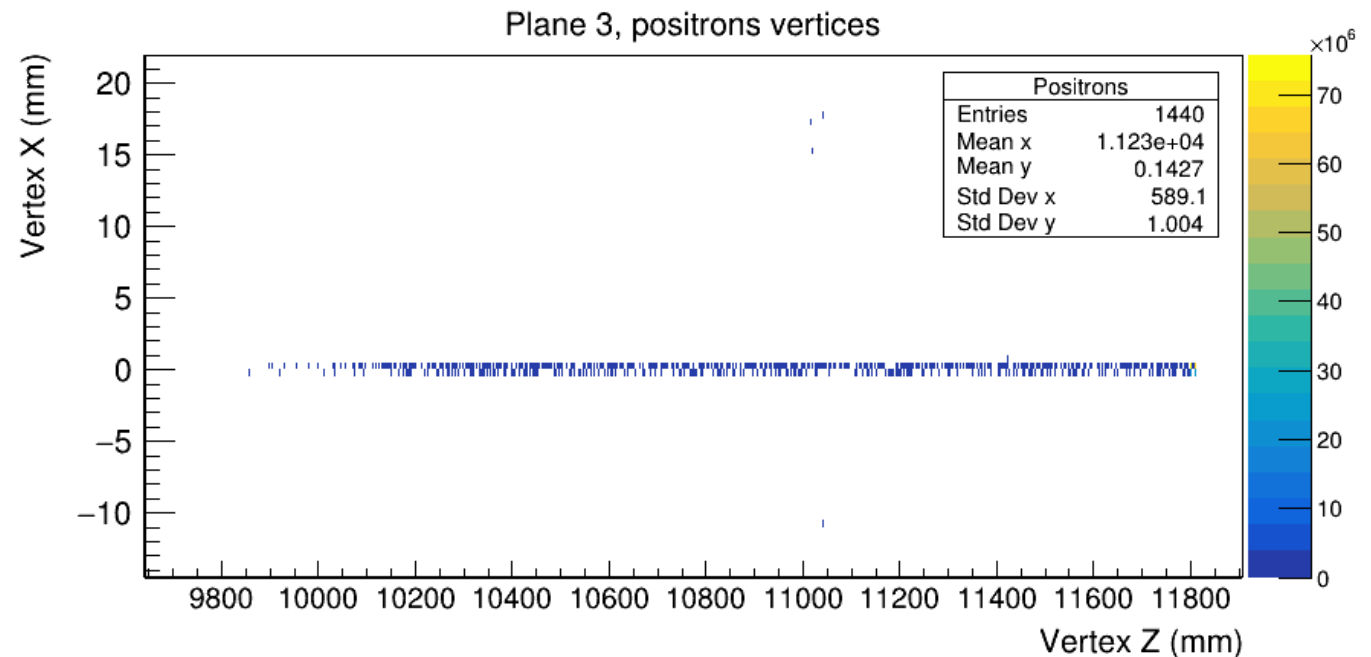


Production vertices

Plane 3



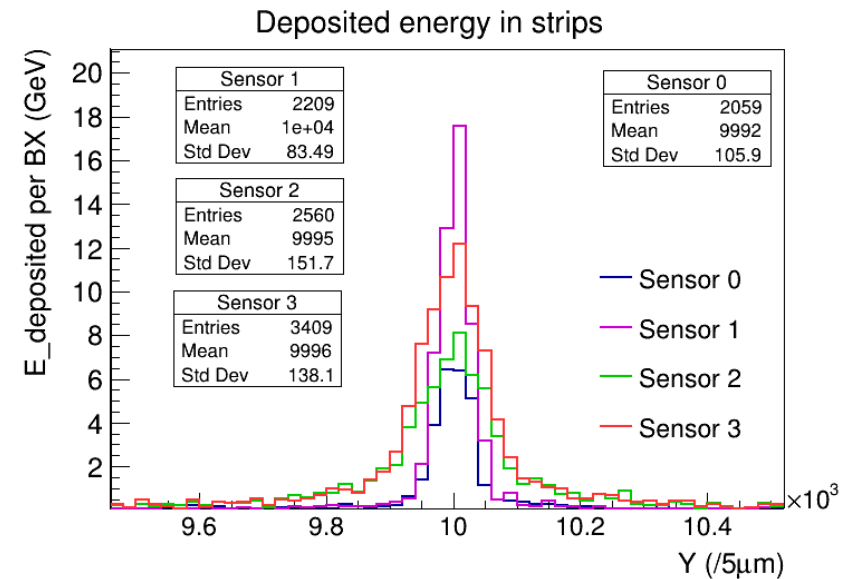
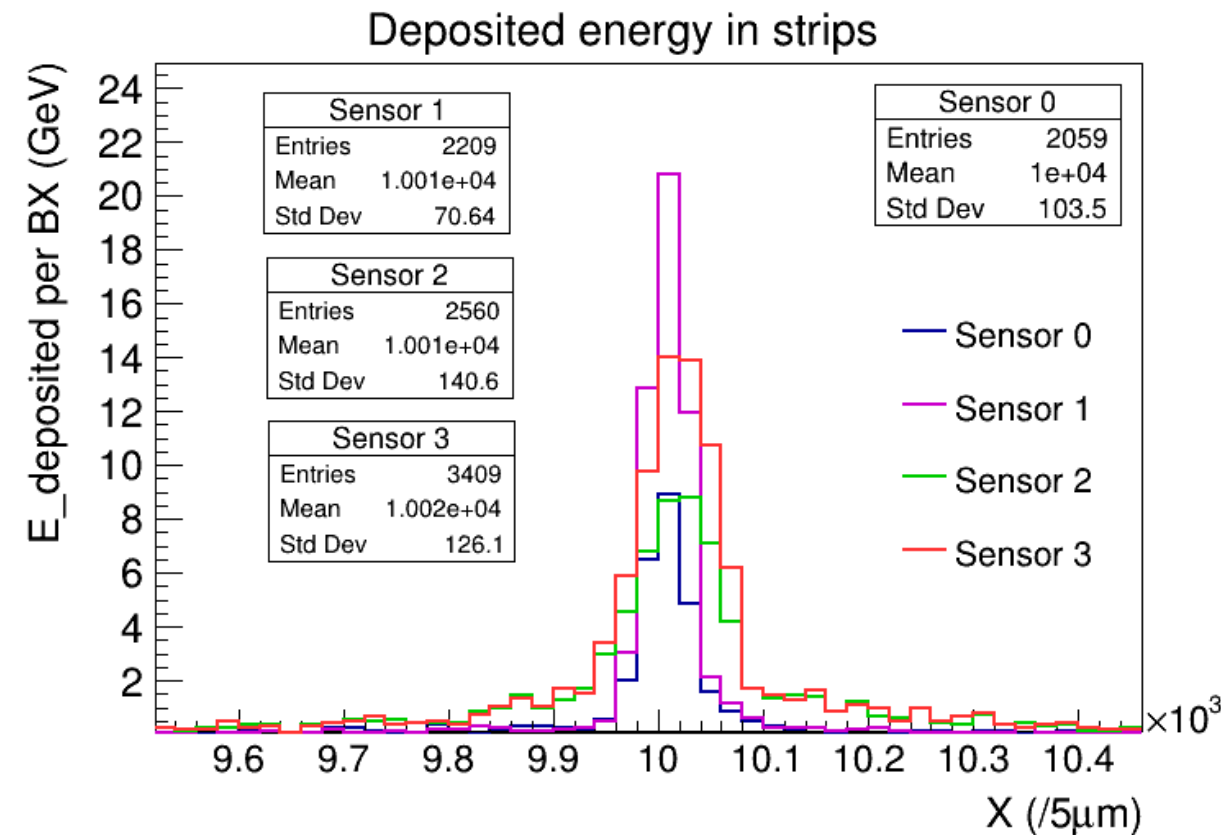
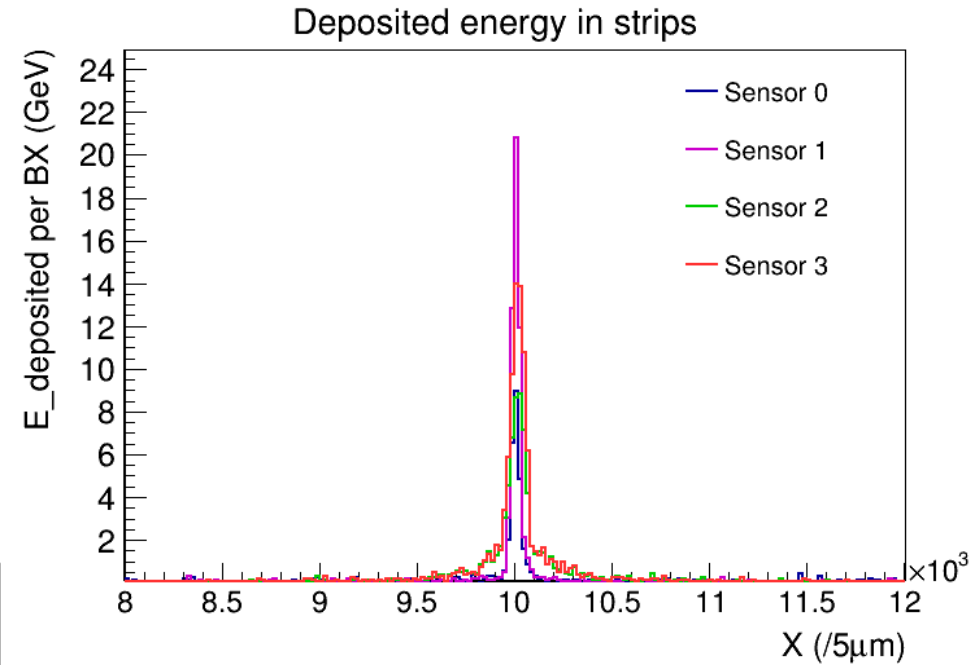
Production vertices:
electrons and positrons
which deposited energy
in profiler planes
for events with primary
(signal) photons



Energy deposited in strips 100 μm

IPStrong, 8 μm , $\xi = 1.9$

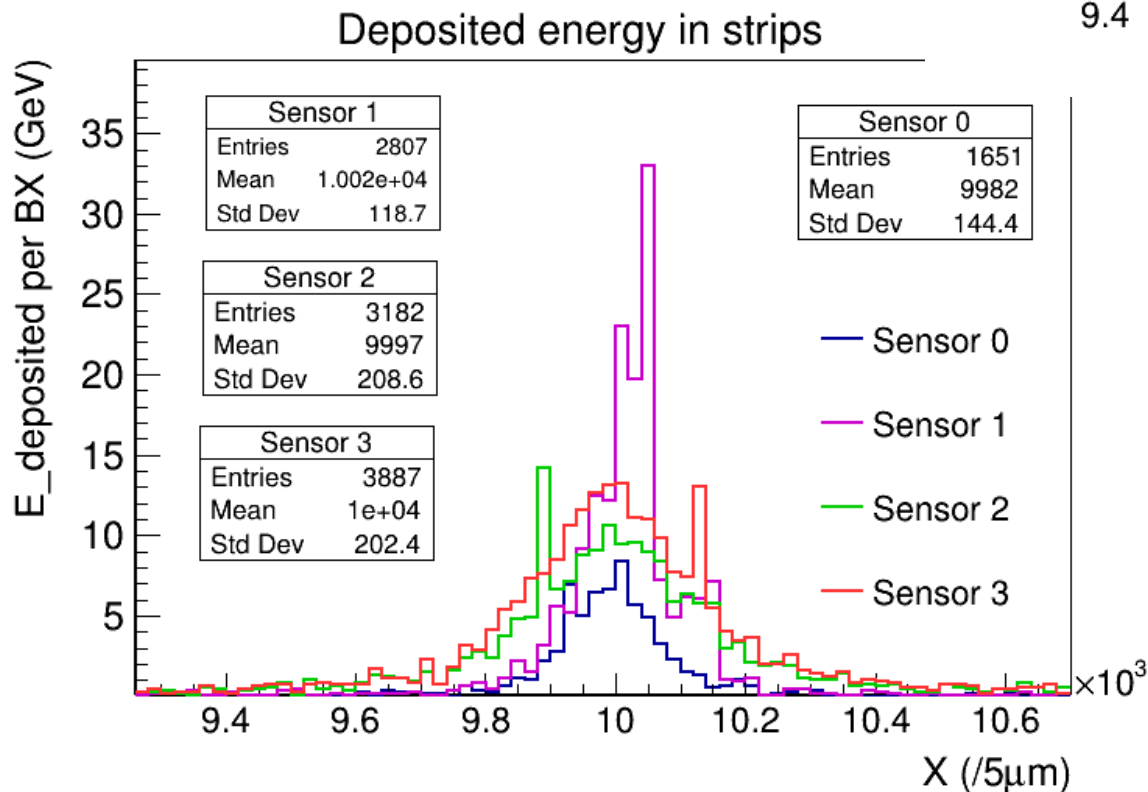
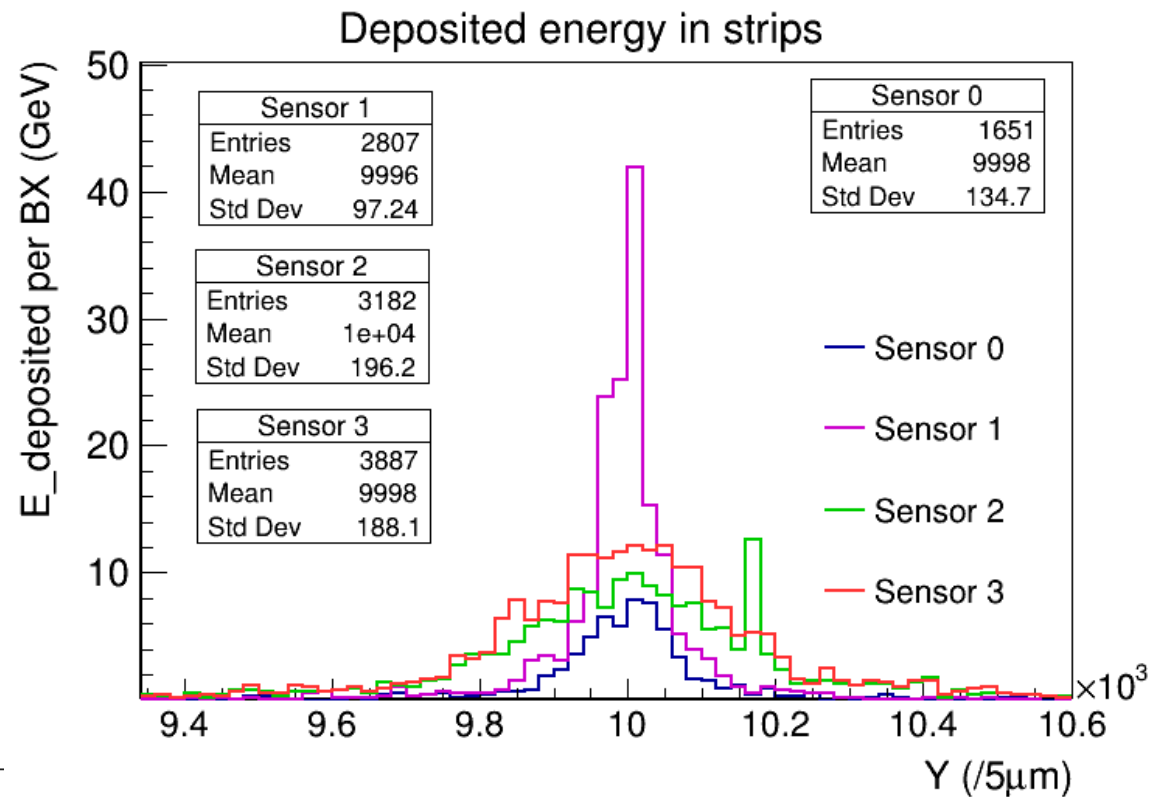
Selected area 2cm by 2cm



Energy deposited in strips 100 μm

ptarmigan, $\xi = 2.0$

Selected area 2cm by 2cm

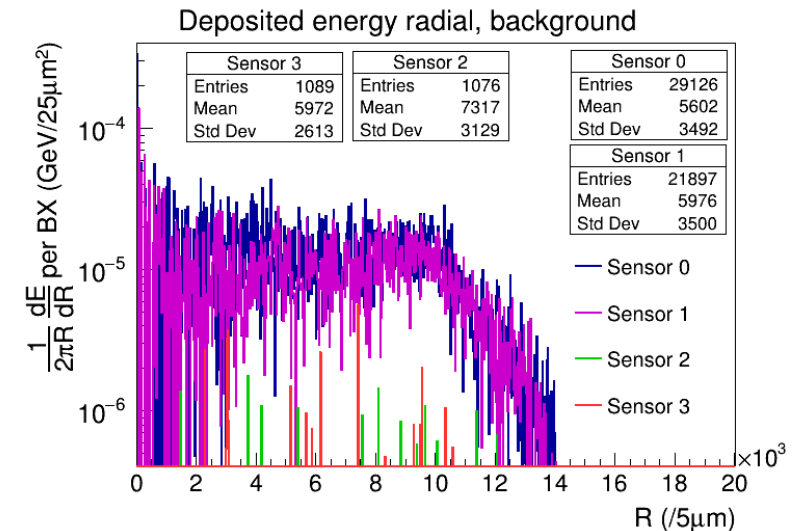
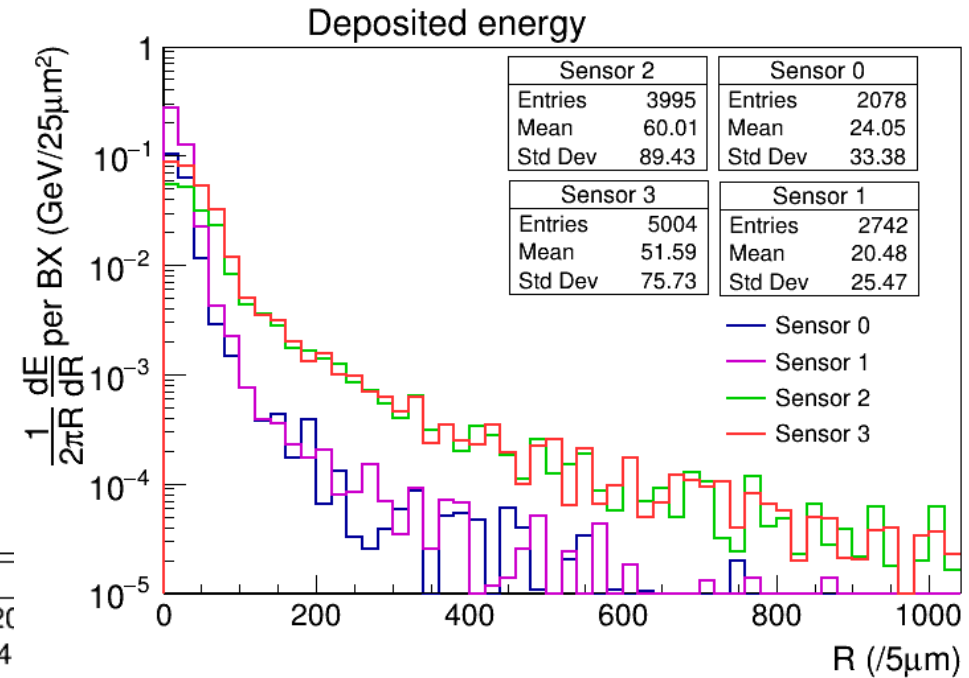
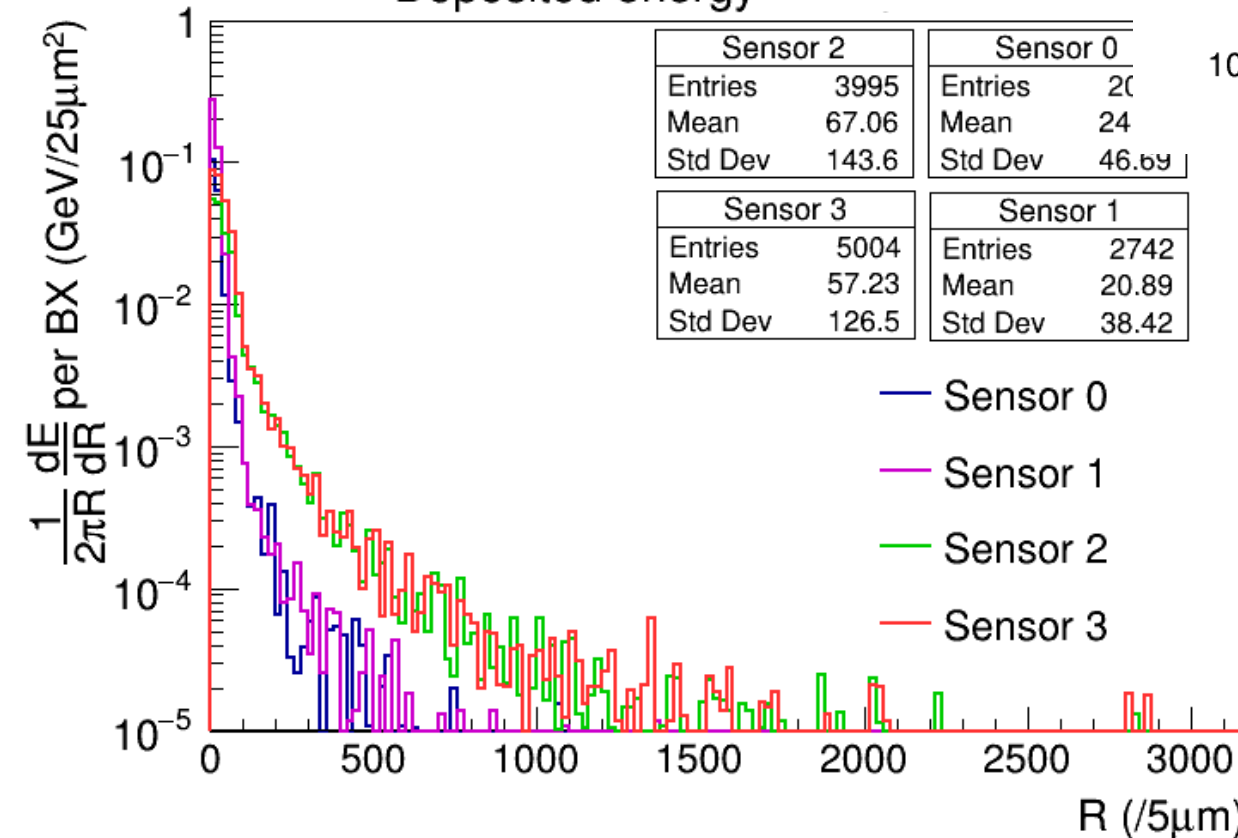


Radial distribution of deposited energy

IPStrong, 8 μ m, $\xi = 1.9$

Signal events $\rightarrow$

Deposited energy

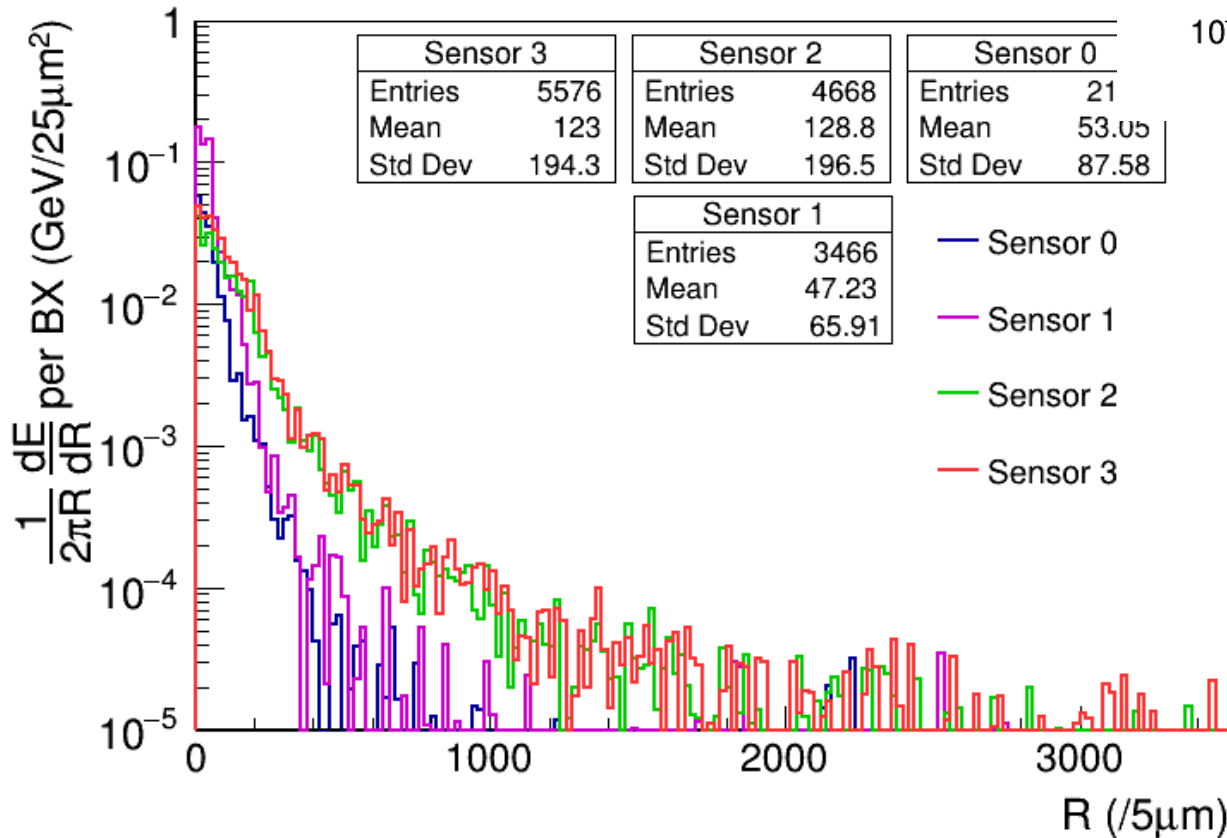


Radial distribution of deposited energy

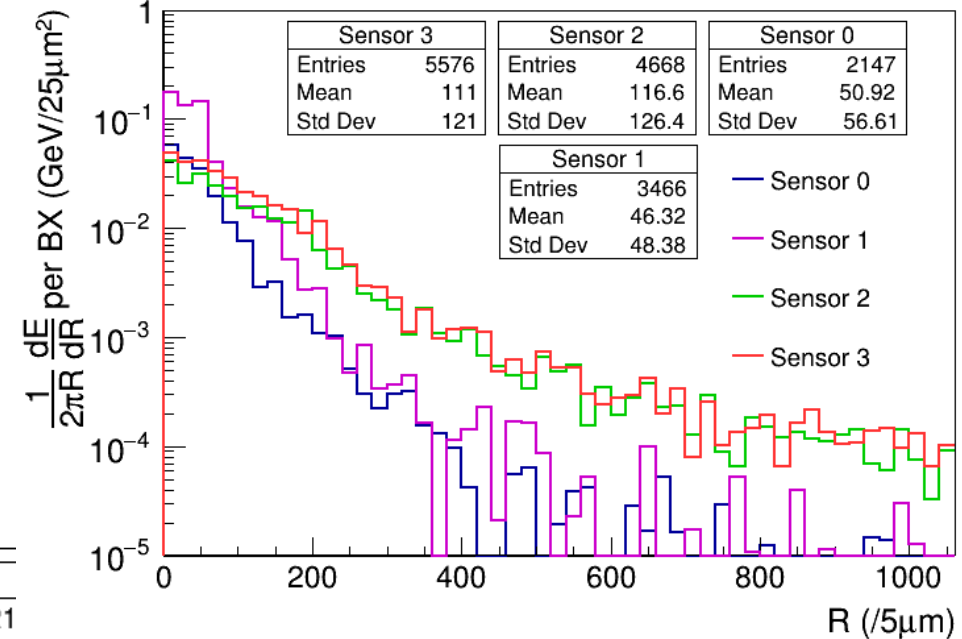
ptarmigan, $\xi = 2.0$

Signal events

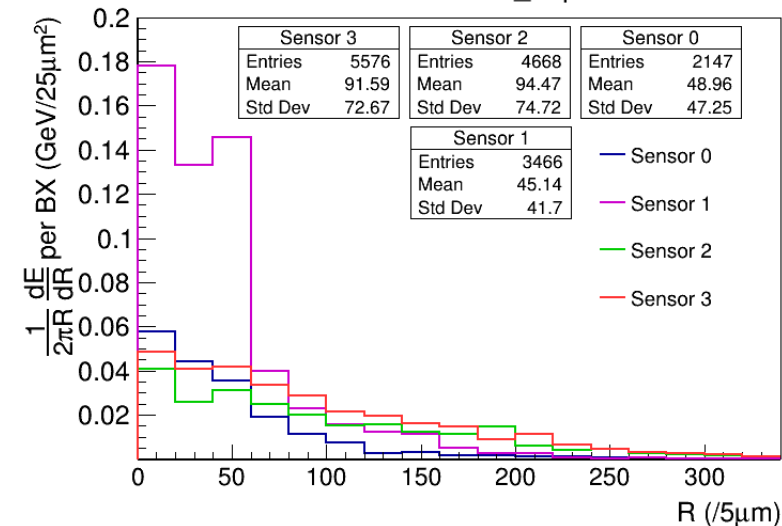
Radial distribution E_dep



Radial distribution E_dep



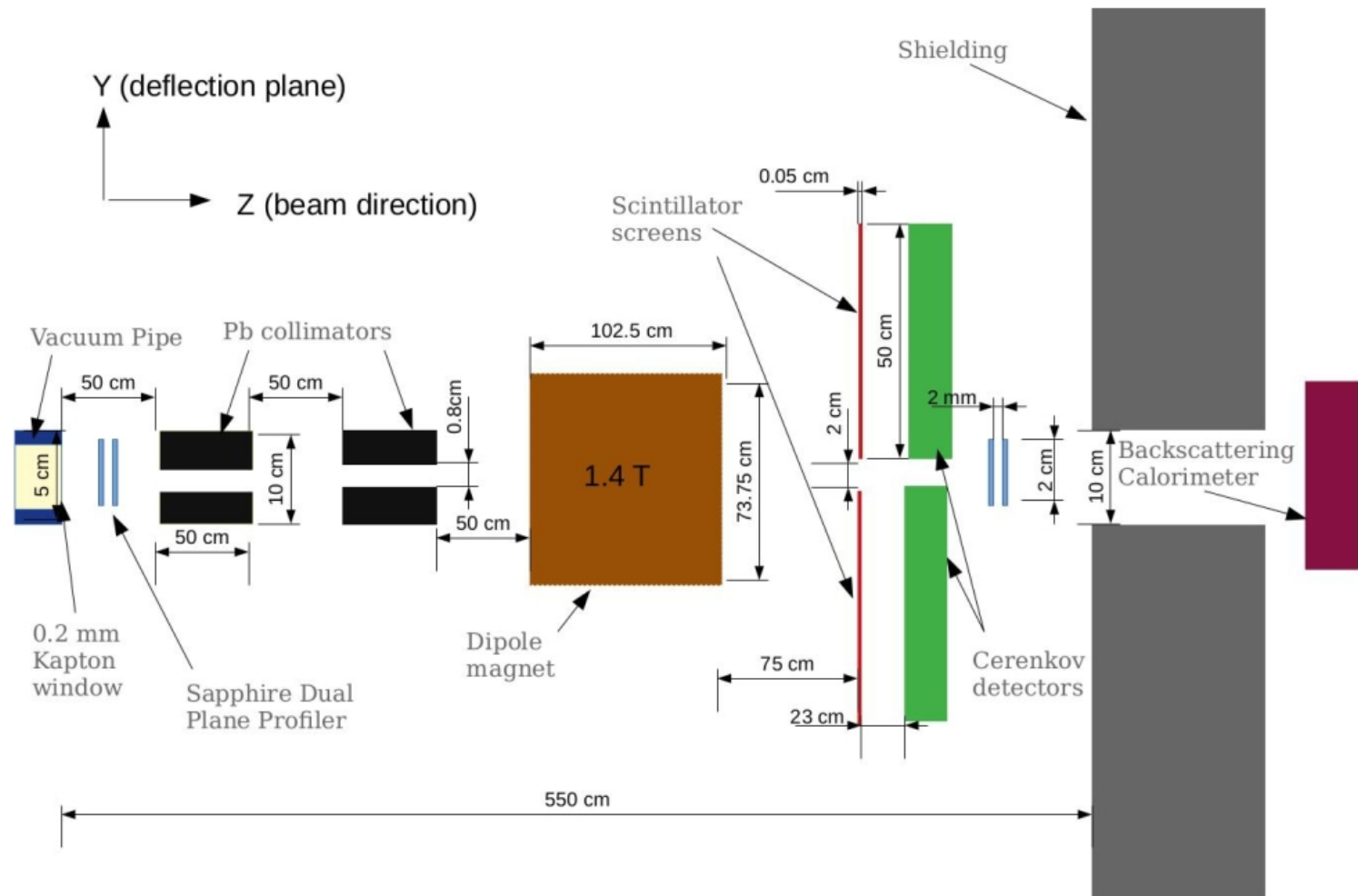
Radial distribution E_dep



Gamma Ray Profiler Simulation Status

Dr. Gianluca Sarri, Kyle Fleck and Niall Cavanagh

Geometry Diagram



Deposited energy

IPStrong, 5um, $\xi = 3.1$

