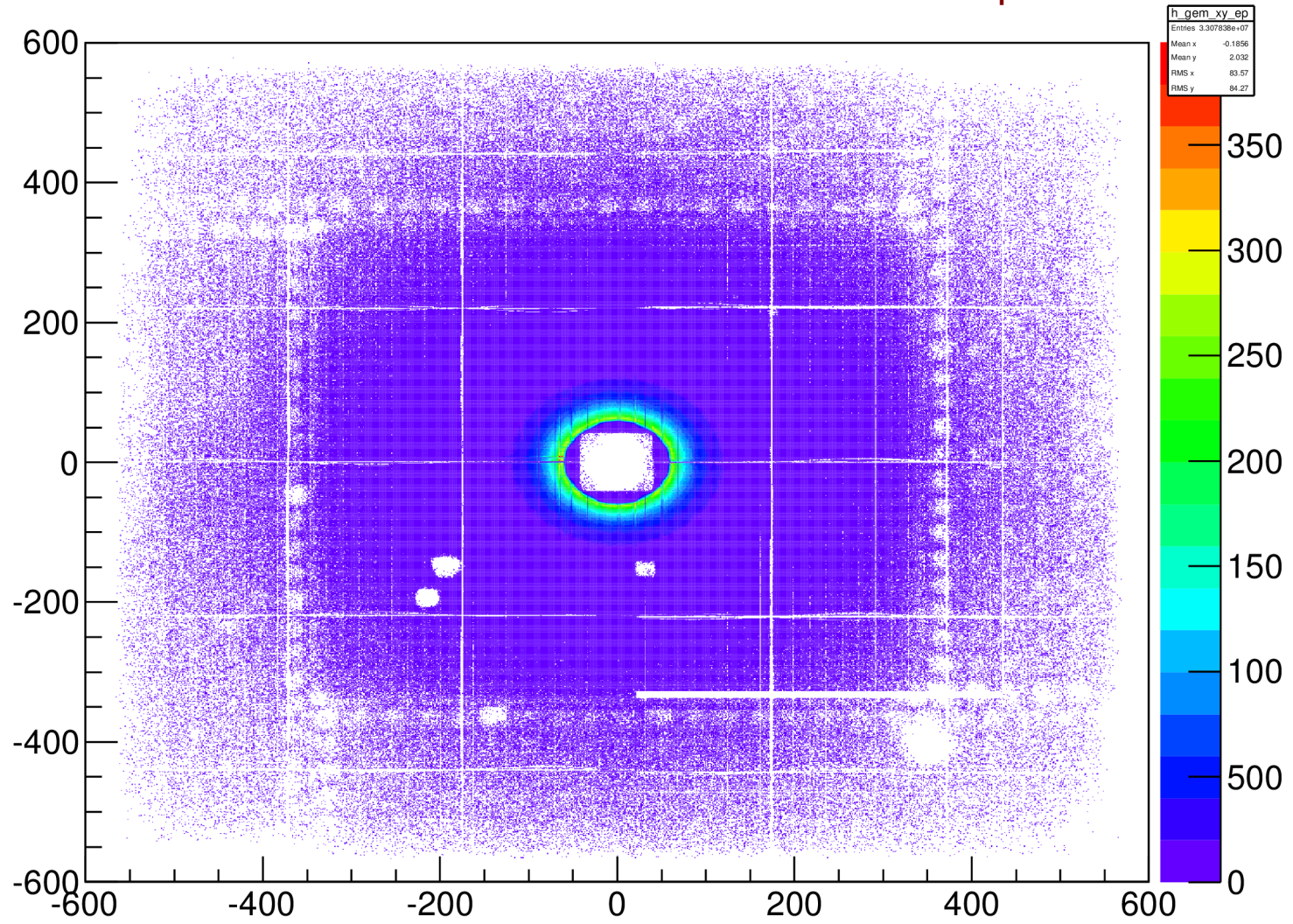
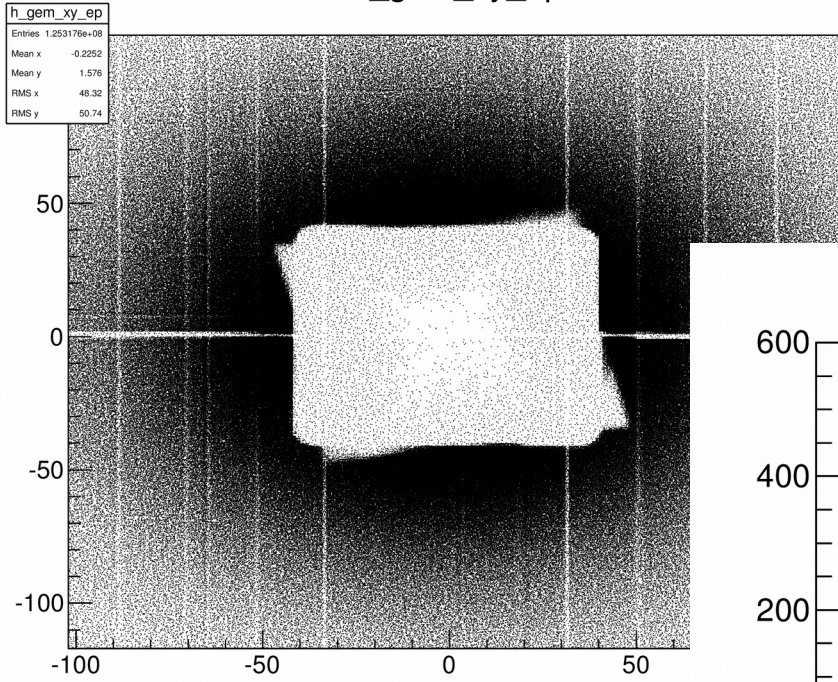


h_gem_xy_ep 2 GeV ep

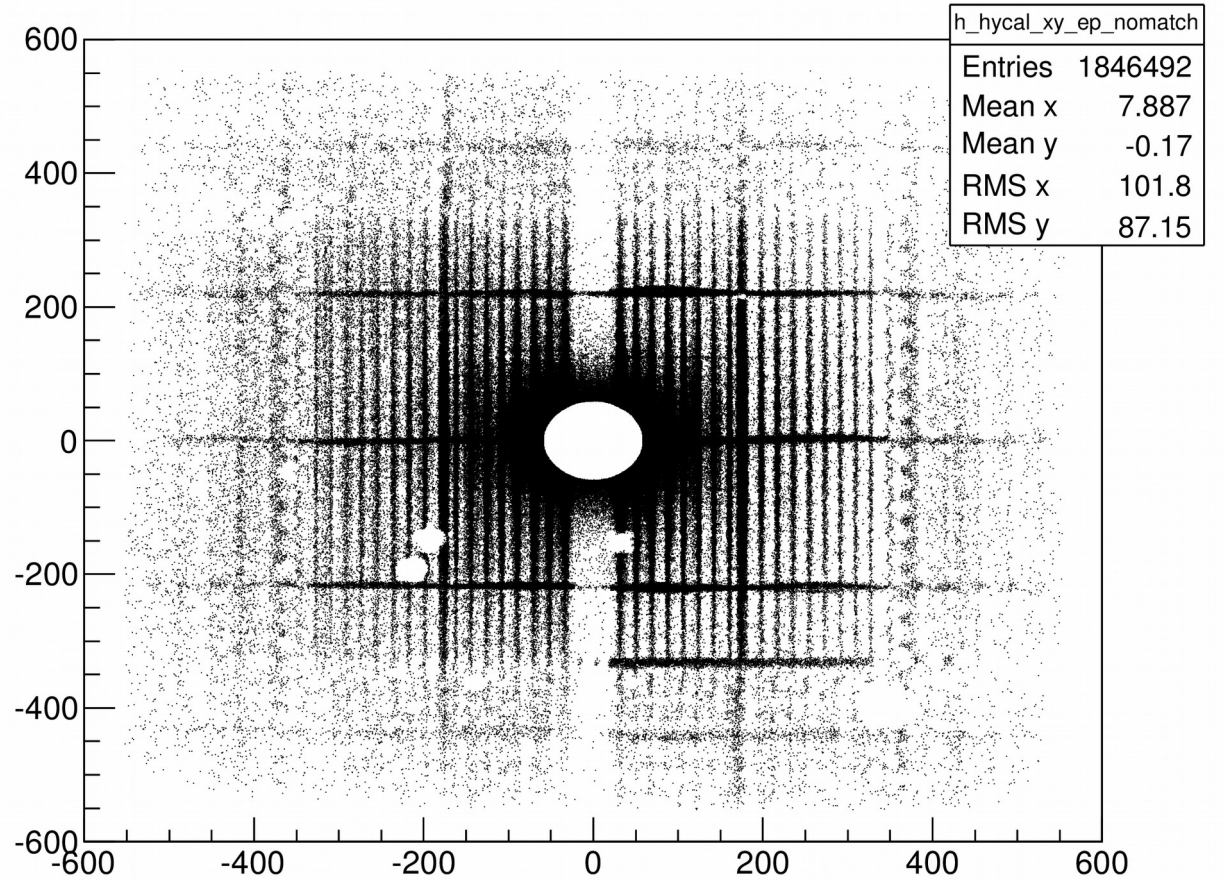


GEM spacers

h_gem_xy_ep

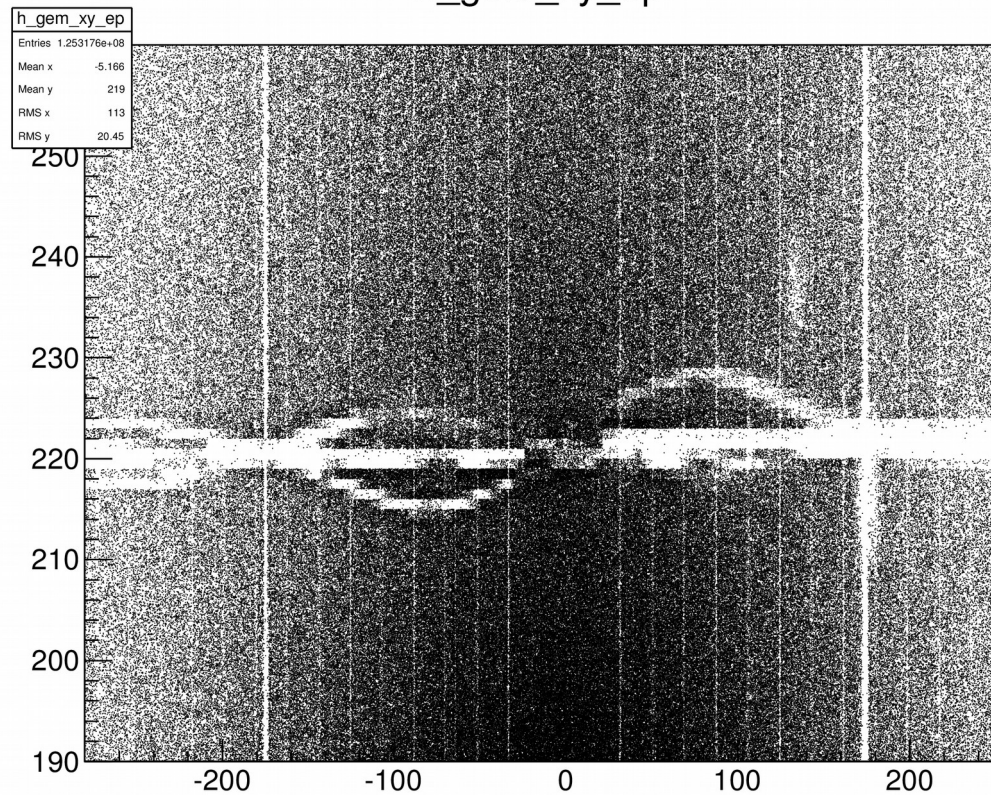


h_hycal_xy_ep_nomatch

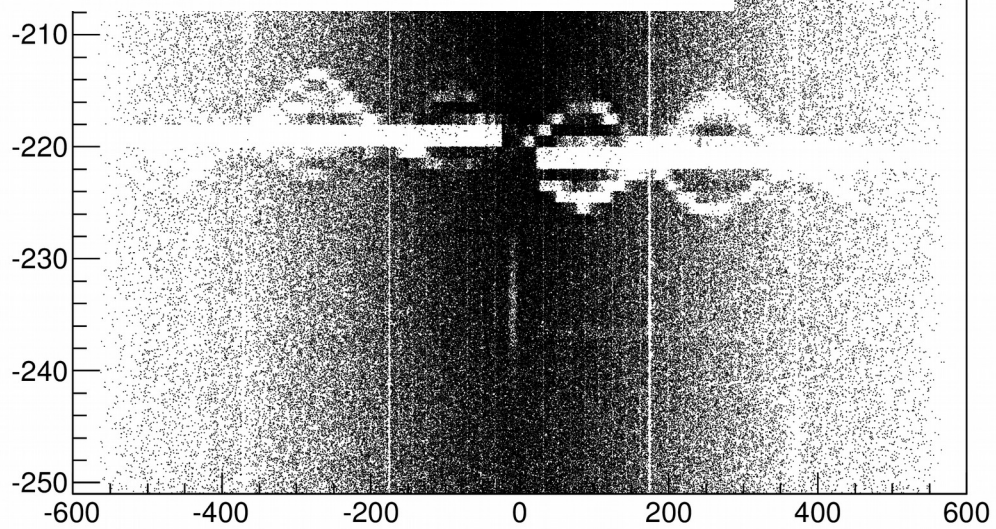
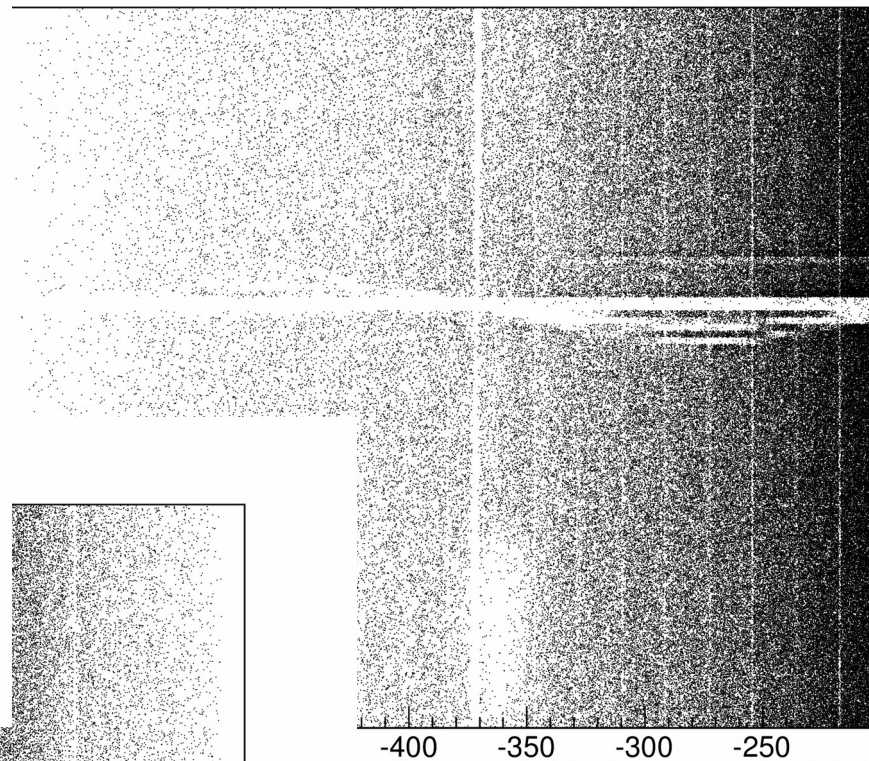


GEM horizontal spacers

h_gem_xy_ep

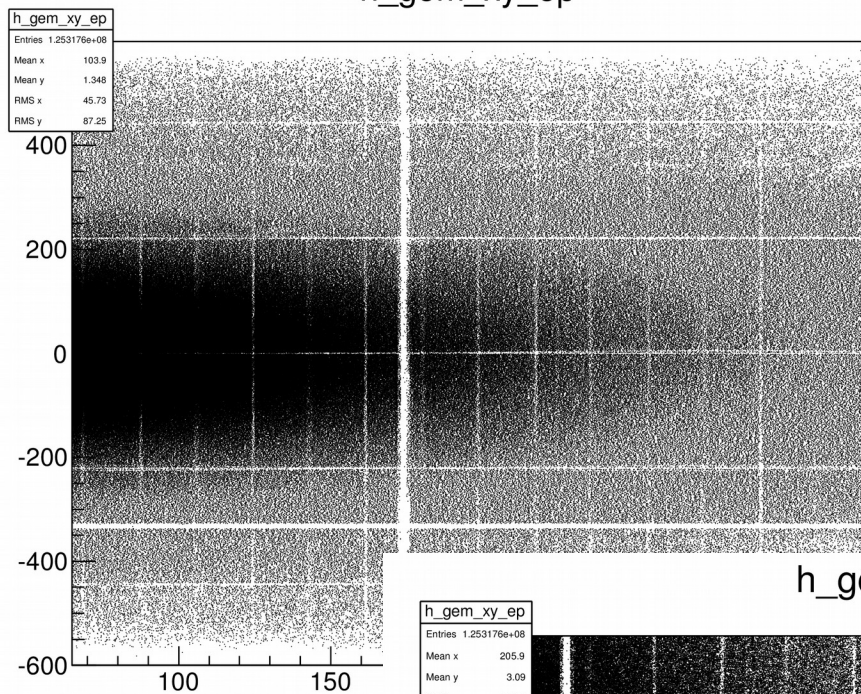


h_gem_xy_ep

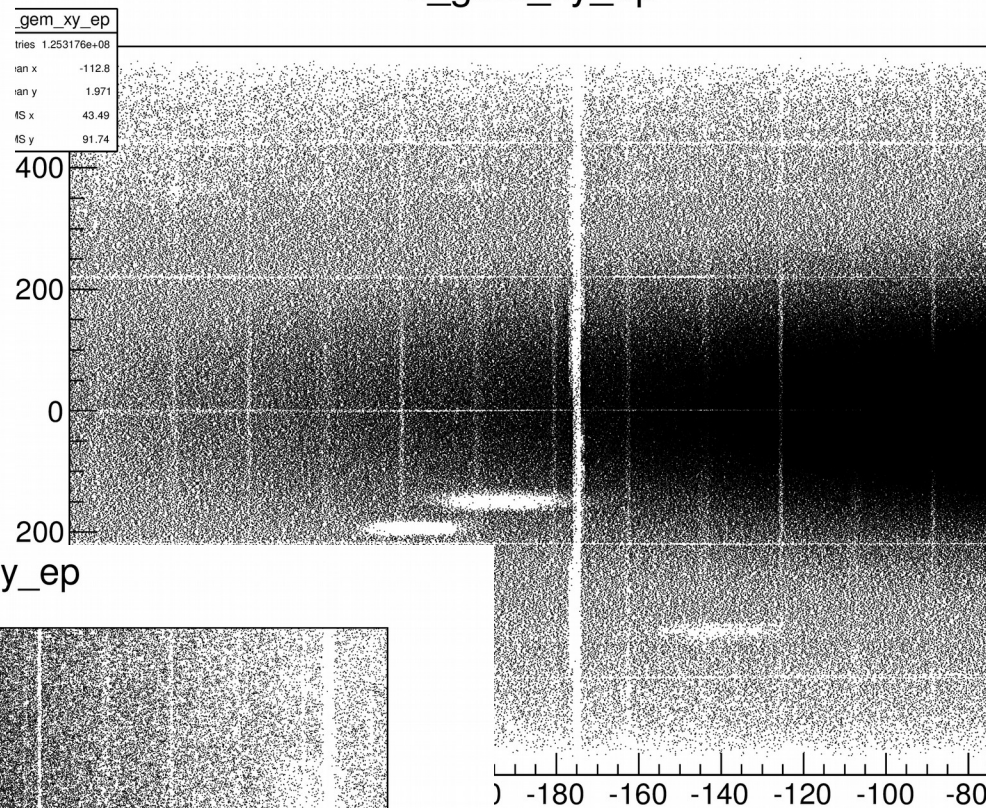


GEM vertical spacers

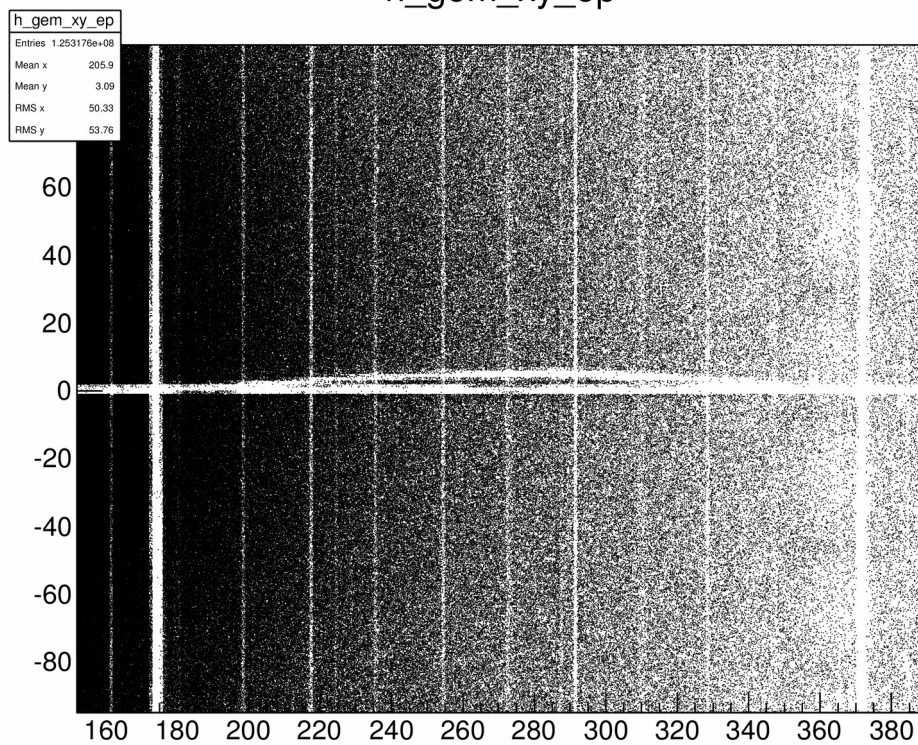
h_gem_xy_ep



h_gem_xy_ep



h_gem_xy_ep

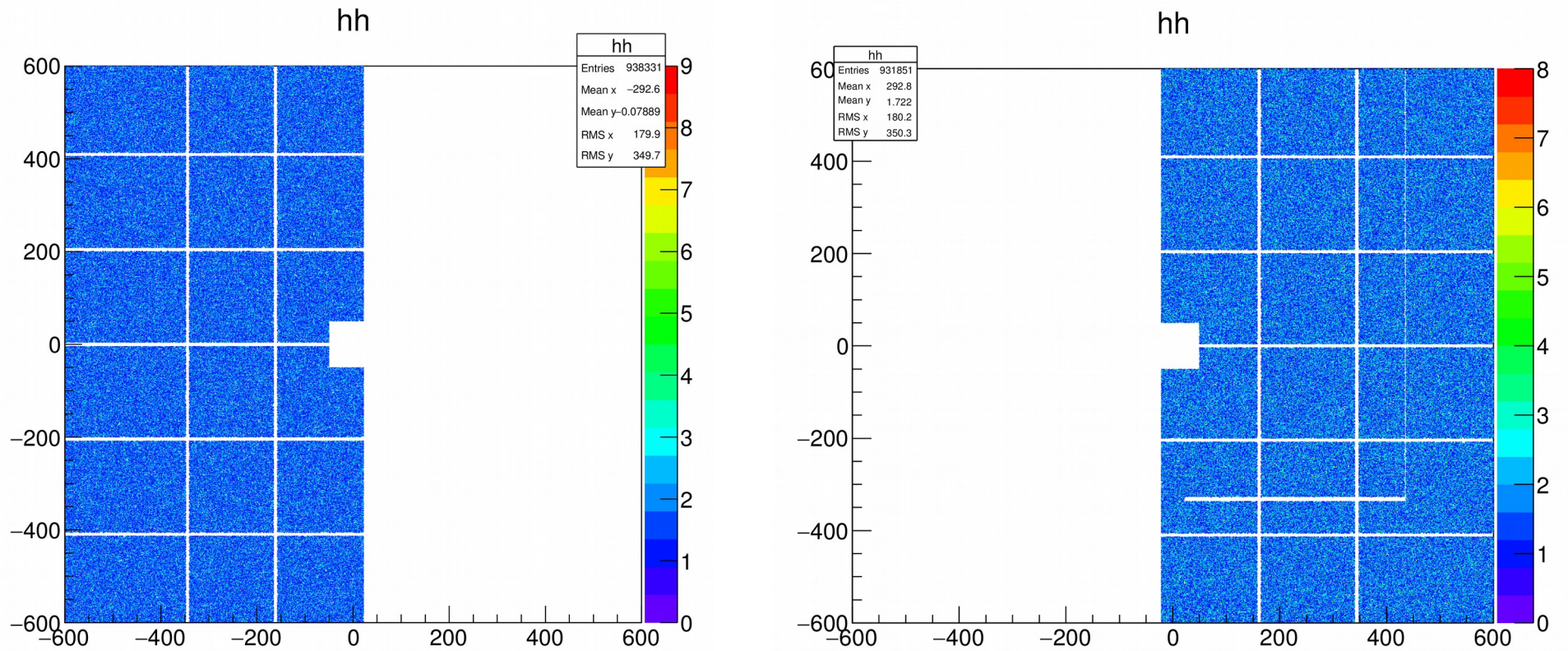


Spacer and dead area effect in simulation

```
# ----- spacer layout -----  
  
#   plane           position (mm)       dead area width (mm)  
#   x               -344.45             10  
#   x               -161.55             10  
#   x               161.55              10  
#   x               344.45              10  
  
#   y               -409.3              15  
#   y               -204                 15  
#   y               0                    15  
#   y               204.1                15  
#   y               409.4                15  
  
# ----- accident area layout -----  
  
#   2 square dead areas  
#   showing bottom left and top right coordinates for  
#   the 2 square areas  
  
#1st   (21, -337.05) -> (434, -327.05)  
#2nd   (434, -337.05) -> (436, all the way to the top ~574mm)
```

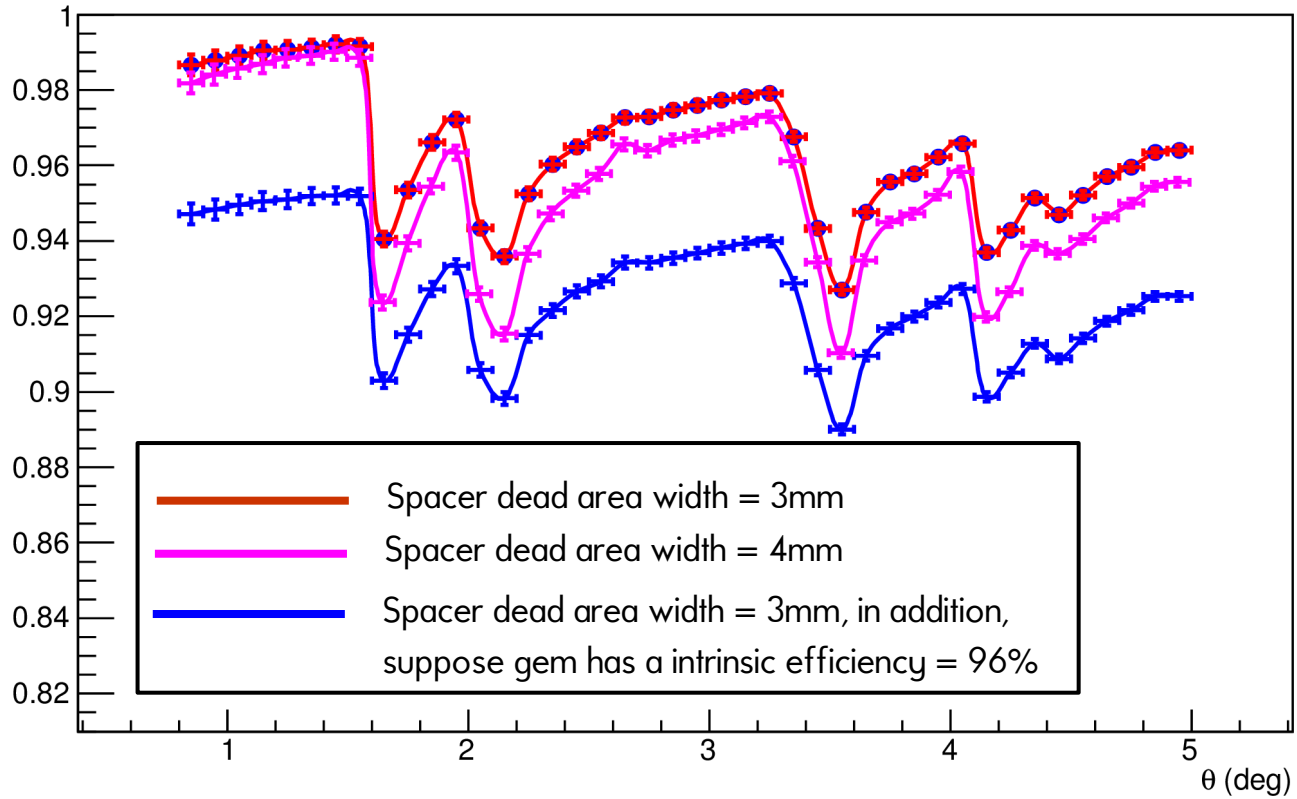
Cross-checked between CAD drawing and data

Spacer and dead area effect in simulation



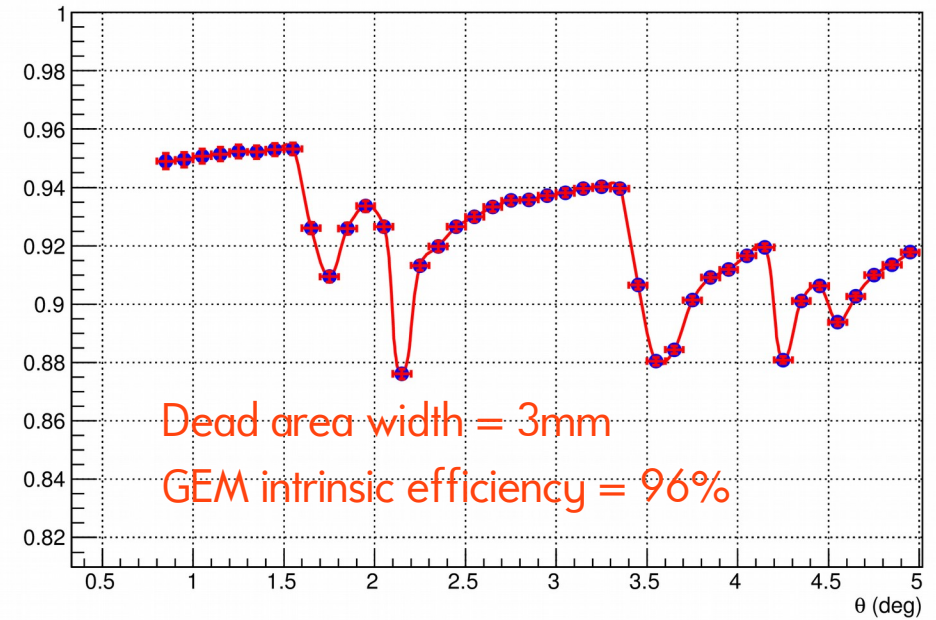
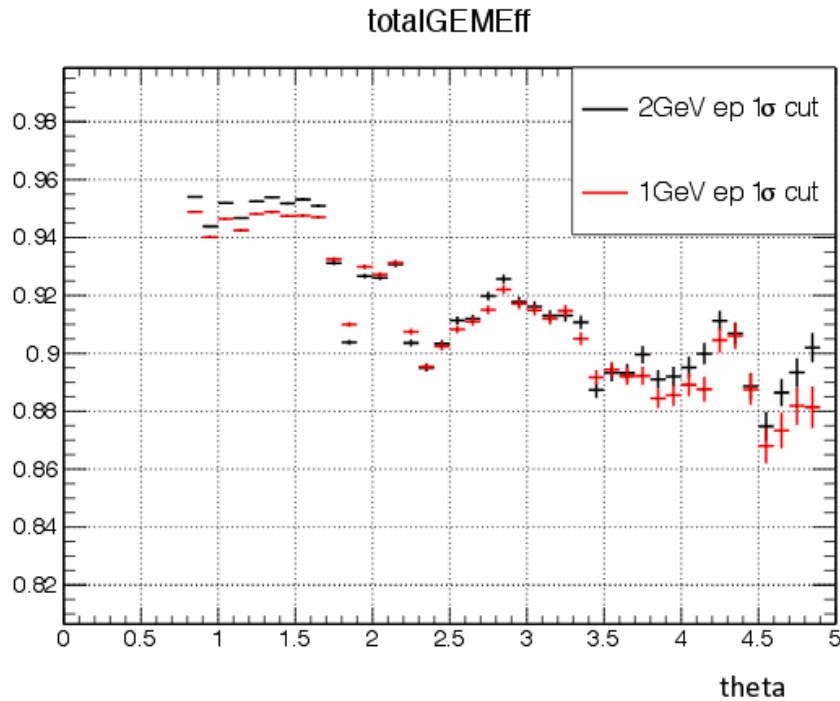
GEM detector spacer and dead area layout

Spacer and dead area effect on efficiency in simulation



GEM efficiency by angle bin

Efficiency drop due to spacer and dead area



Not exactly match

Possible reason:

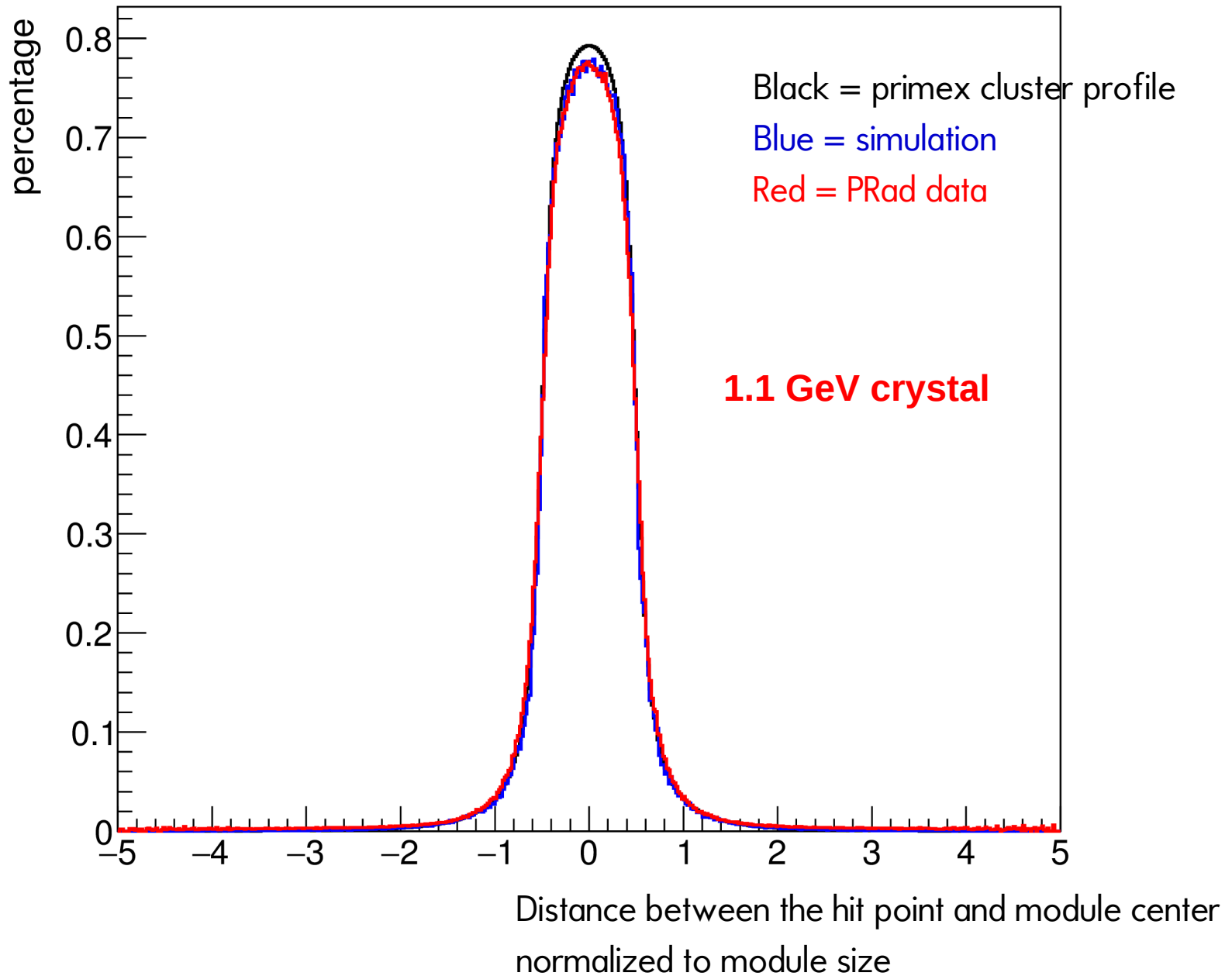
- 1) dead area width (3mm in simulation) not correct
- 2) dead area from HV sectors not yet included

HyCal digitization

Energy deposition in one module
divided by energy of incident electron

cluster profile

Only with elasticity cut: 4 sigma

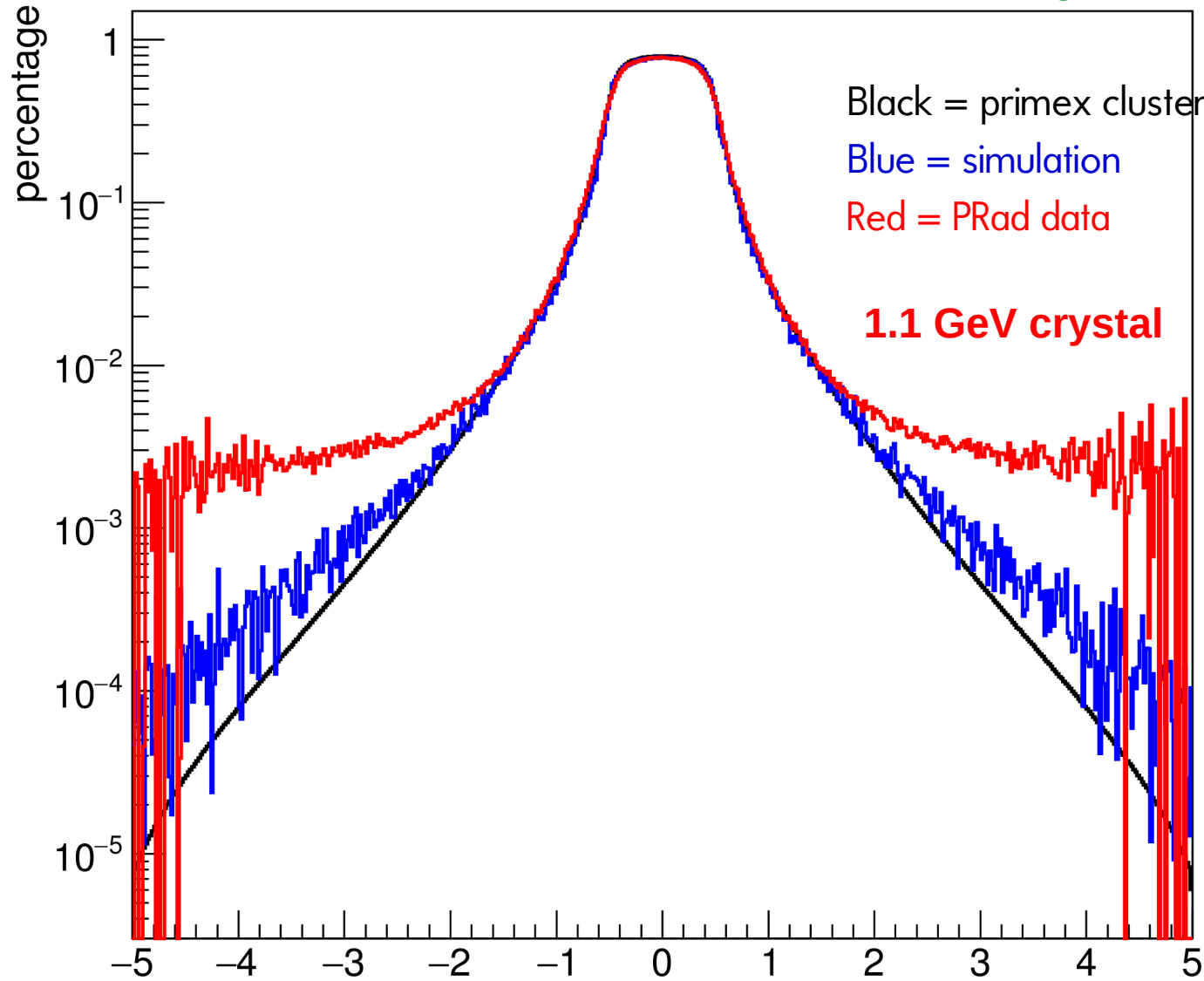


HyCal digitization

Energy deposition in one module
divided by energy of incident electron

cluster profile

Only with elasticity cut: 4 sigma

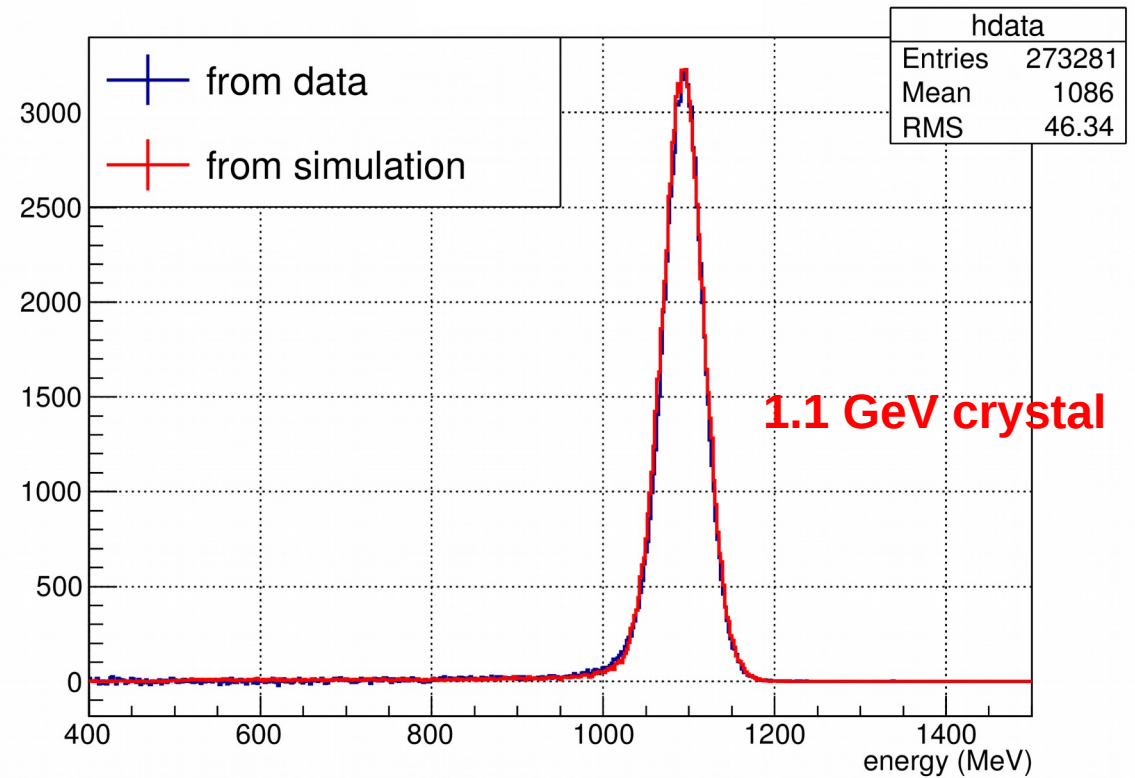


Distance between the hit point and module center
normalized to module size

HyCal digitization

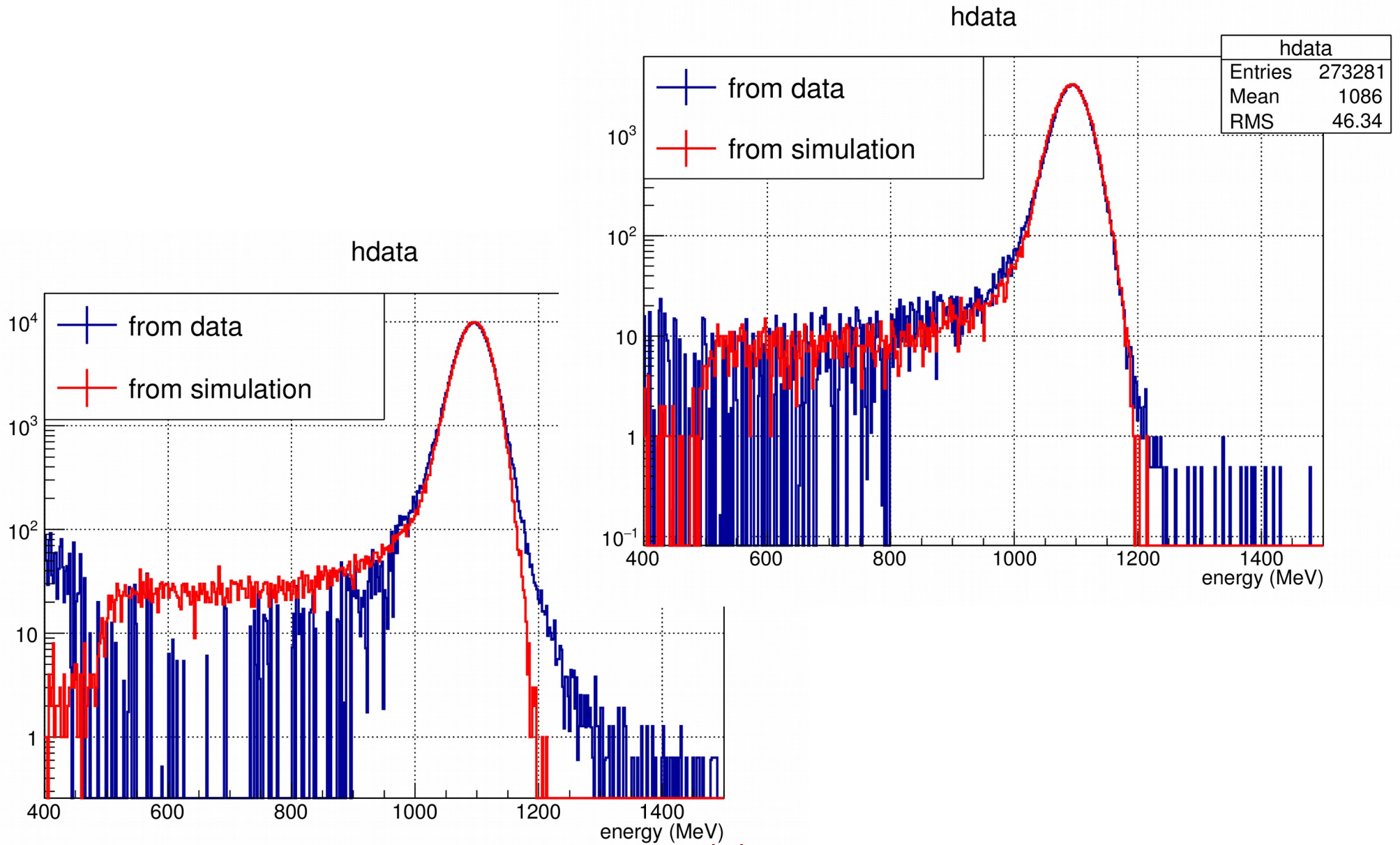
Only with elasticity cut: 4 sigma

- directly get energy deposition in each crystal module in Geant
- During digitization, smear energy deposition for crystal by $0.026/\sqrt{E_{dep}}$
- Smear energy deposition for lg by $0.065/\sqrt{E_{dep}}$



Reconstructed cluster energy,
Compare between simulation and data

HyCal digitization



Reconstructed cluster energy,
Compare between simulation and data