



August 4, 2021

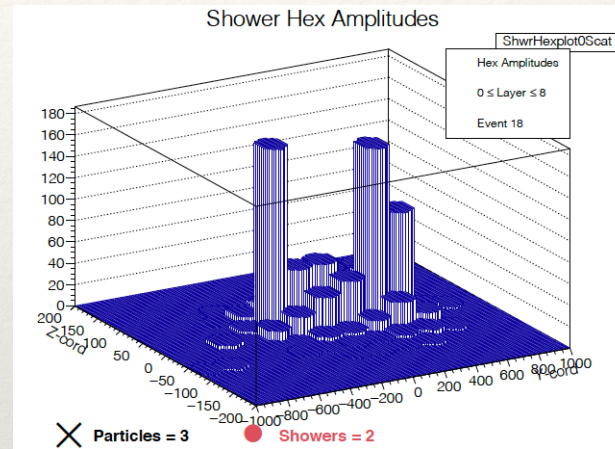
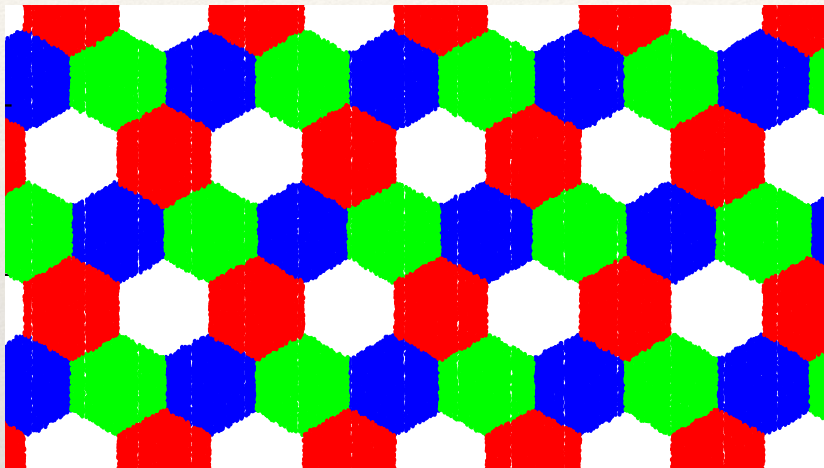
Shower Finding & π^0 Reconstruction
in the
SiD MAPS Digital ECal

Jim Brau
University of Oregon

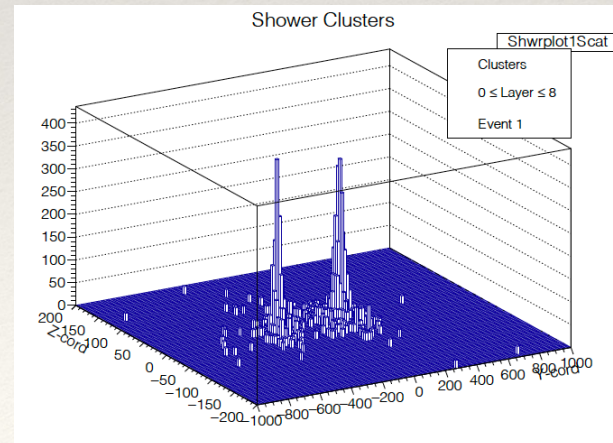
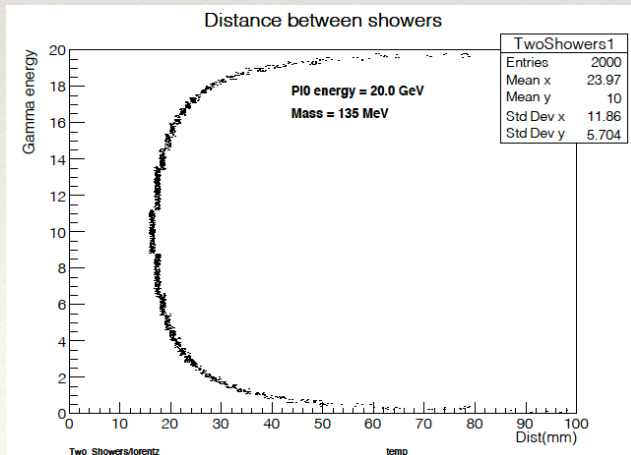
Introduction



- ❖ Comparison to SiD TDR ECal hexagonal pixels.

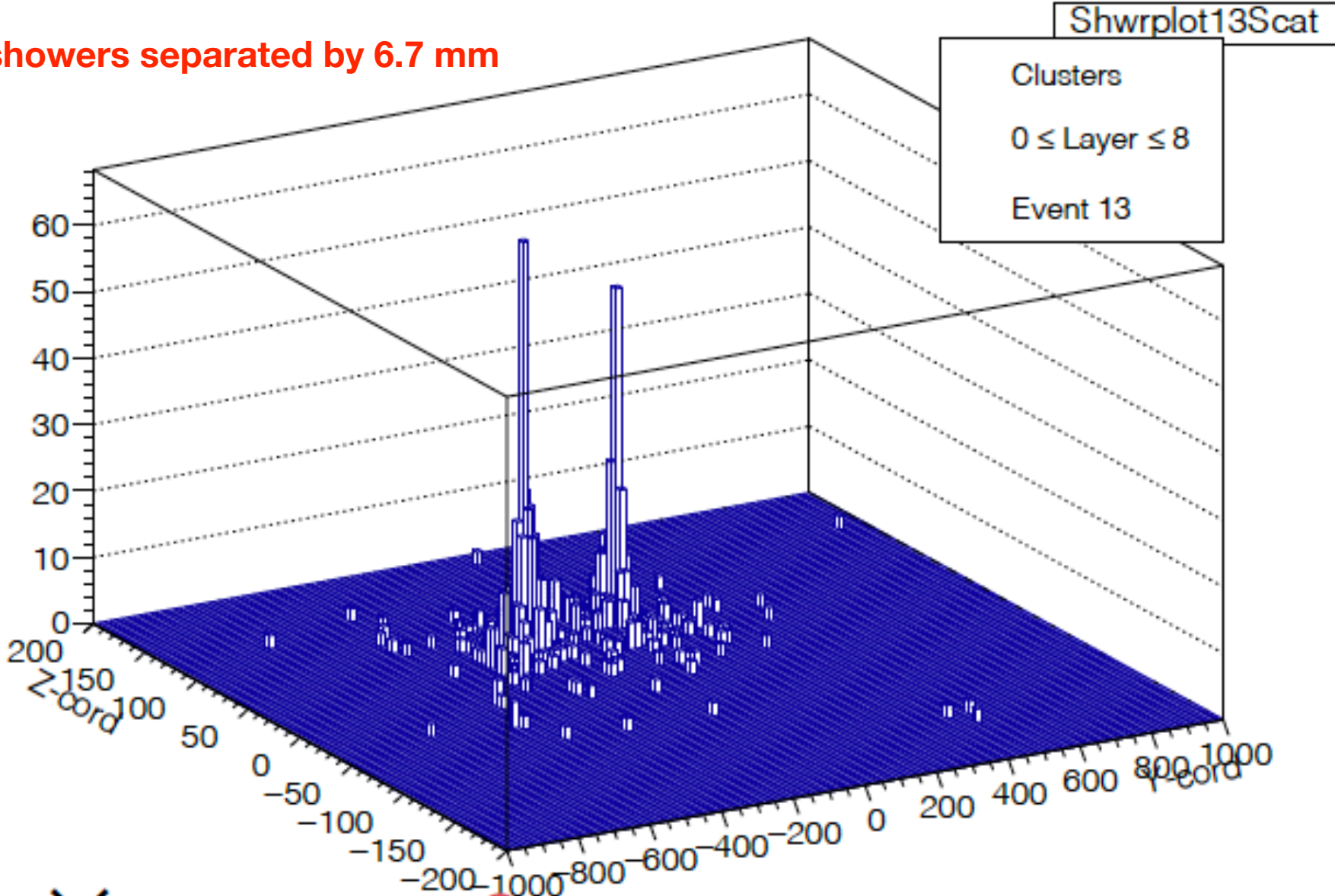


- ❖ Study of reconstructing pi0s in SiD MAPS Digital ECal.



Shower Clusters

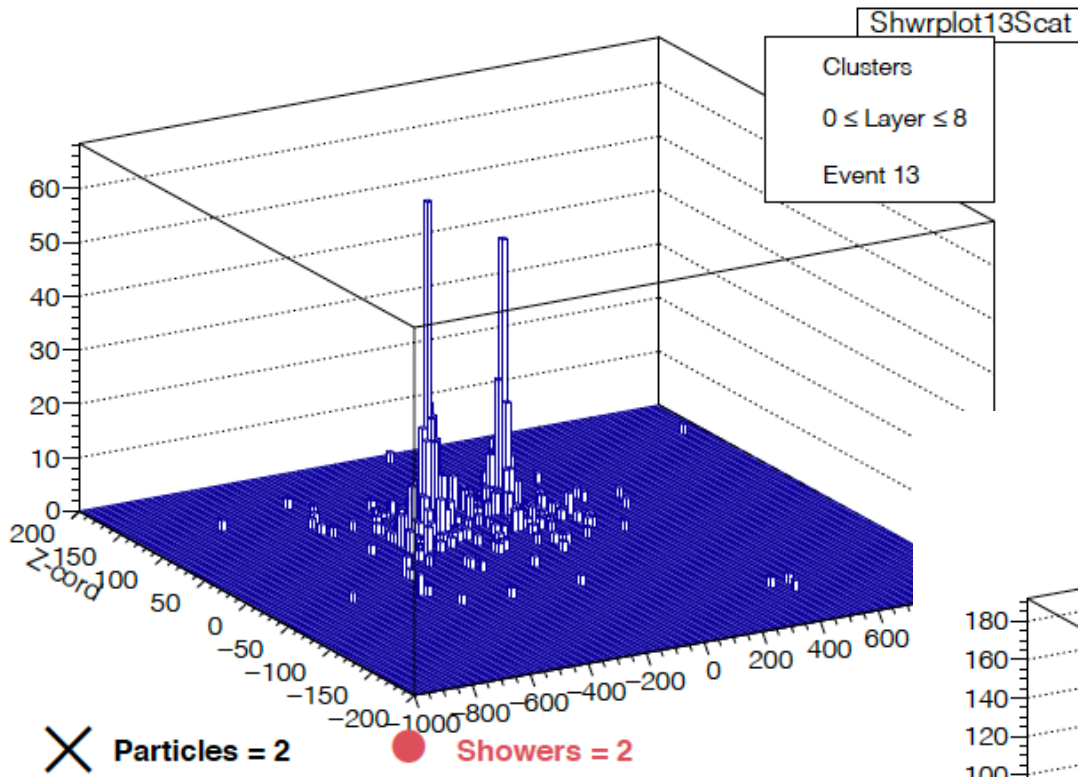
Two showers separated by 6.7 mm



✕ Particles = 2

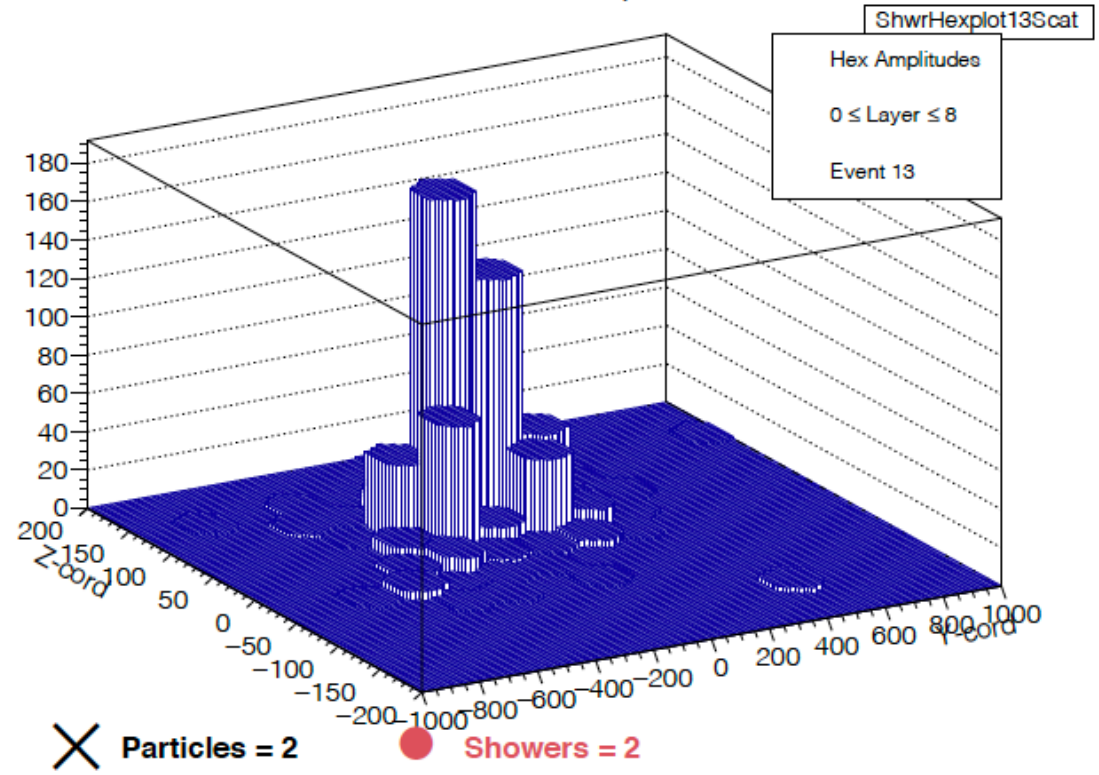
● Showers = 2

Shower Clusters

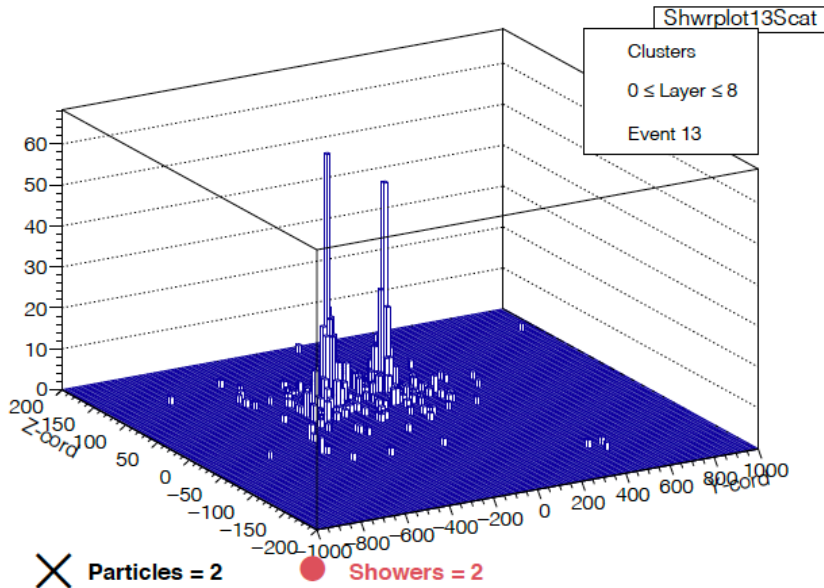


Two showers separated by 6.7 mm

Shower Hex Amplitudes

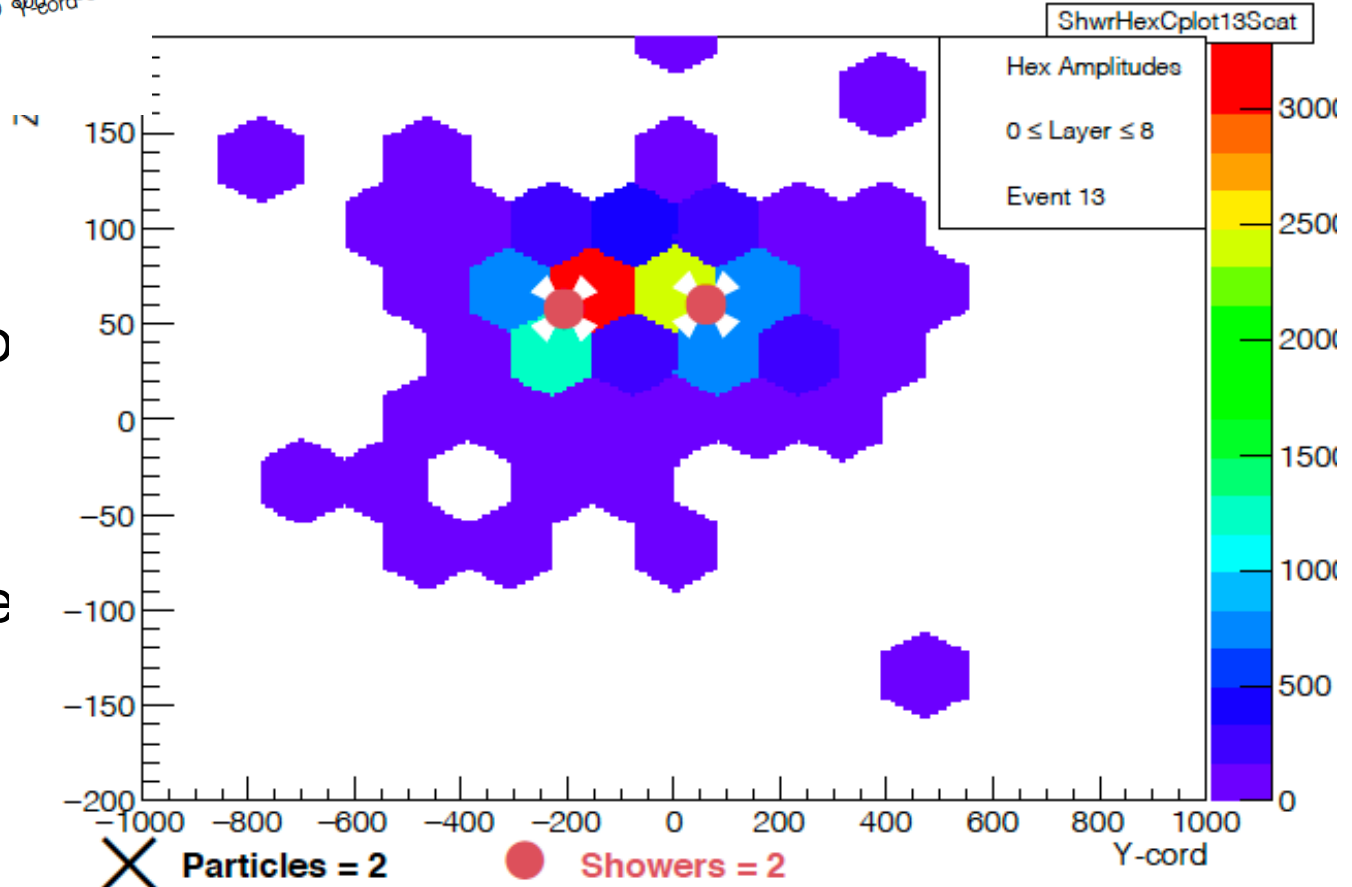


Shower Clusters



Two showers separated by 6.7 mm

Shower Hex Amplitudes



- Beam test demonstrates good probability to “tag” two showers with SiD TDR hexagons for 1cm,
- but how well could one then measure the energies?

- Random placement of multiple electron showers:

- $R_{\text{rms}} = 8 \text{ mm}$

- 393 1 electron -

- 4 no shower found

- 266 2 electrons

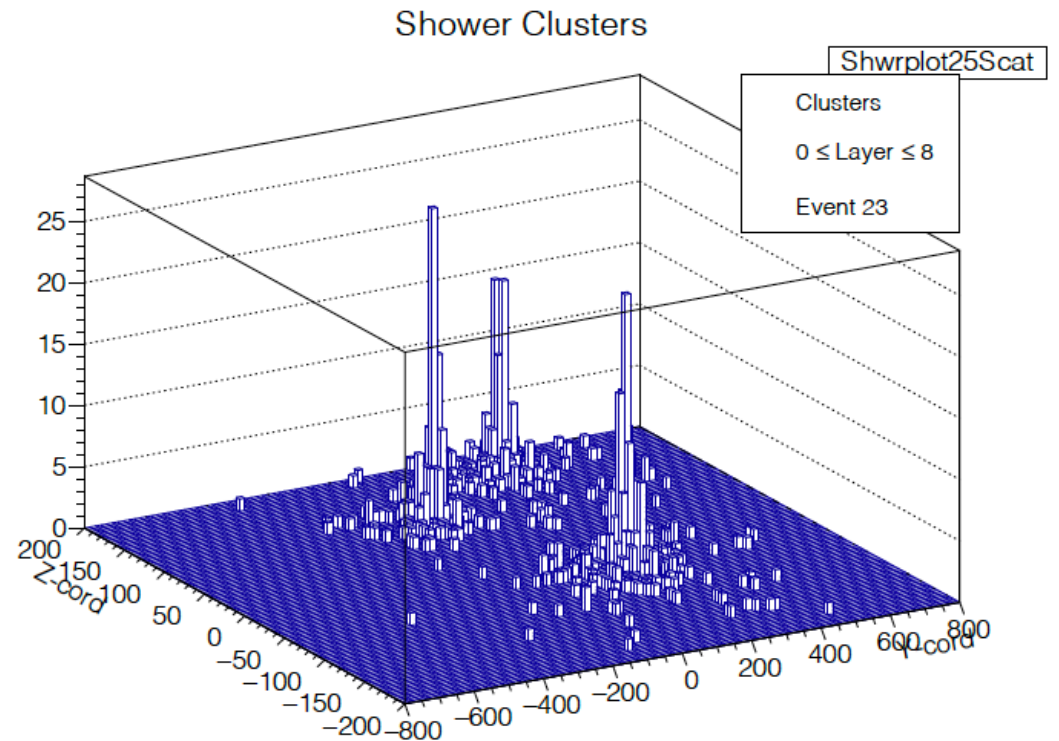
- 4 incorrect counts

- 103 3 electrons

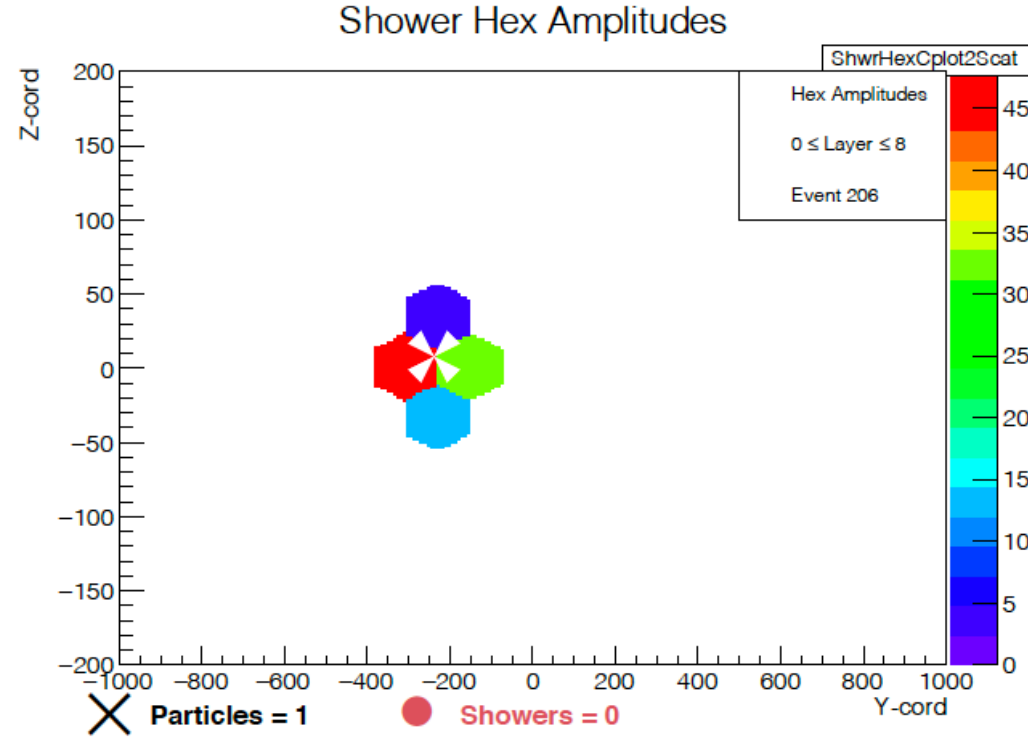
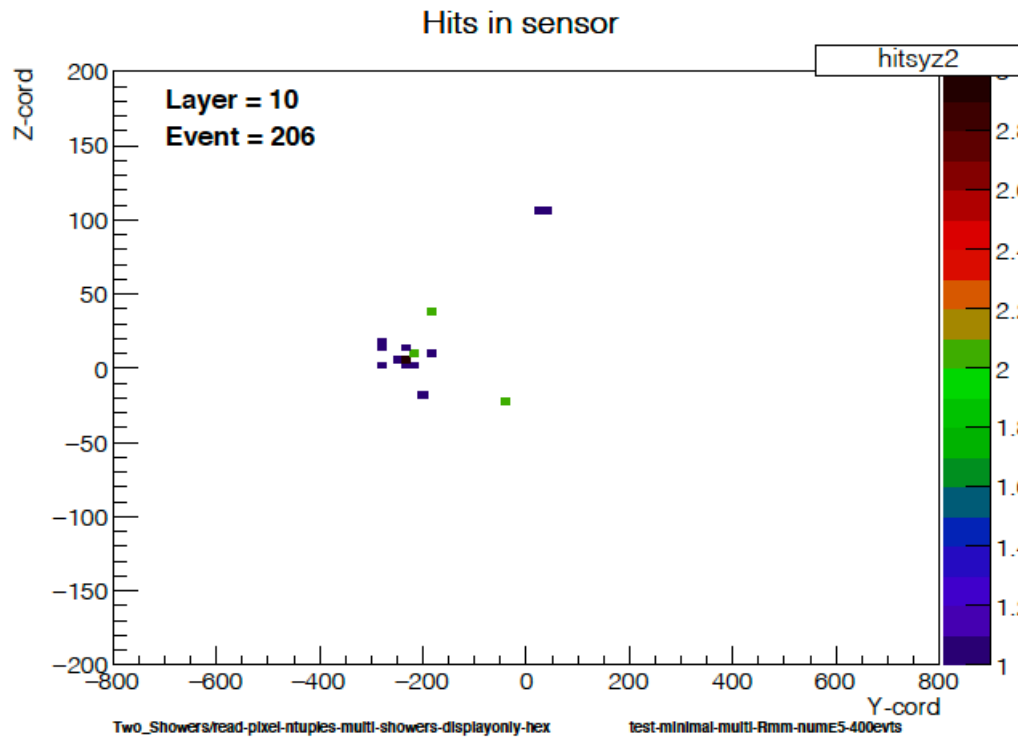
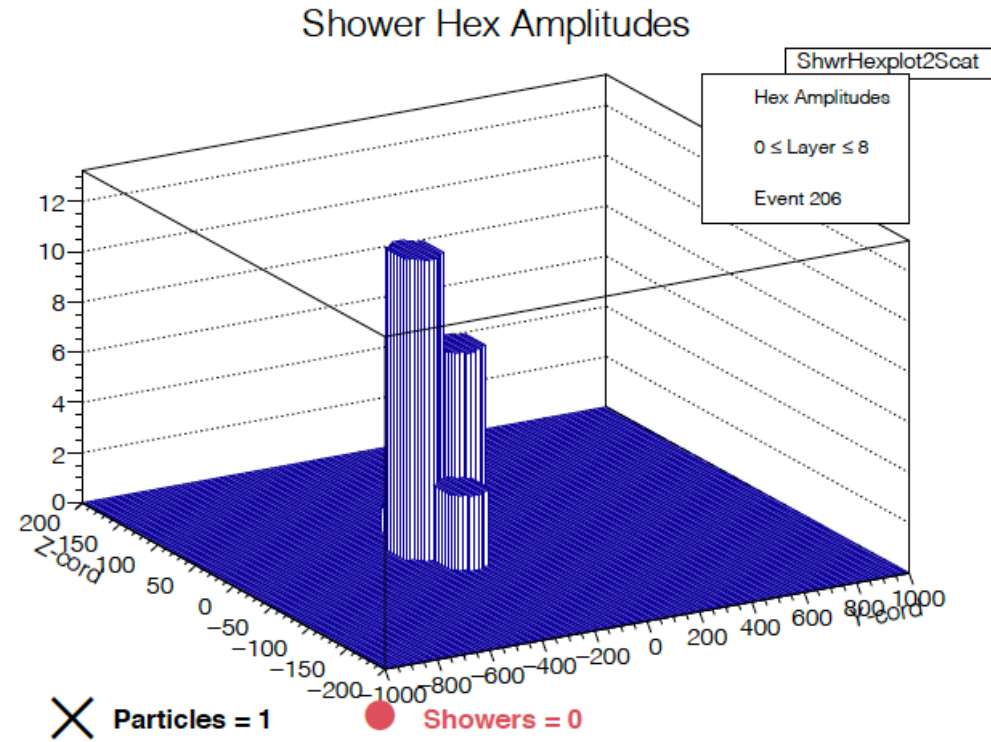
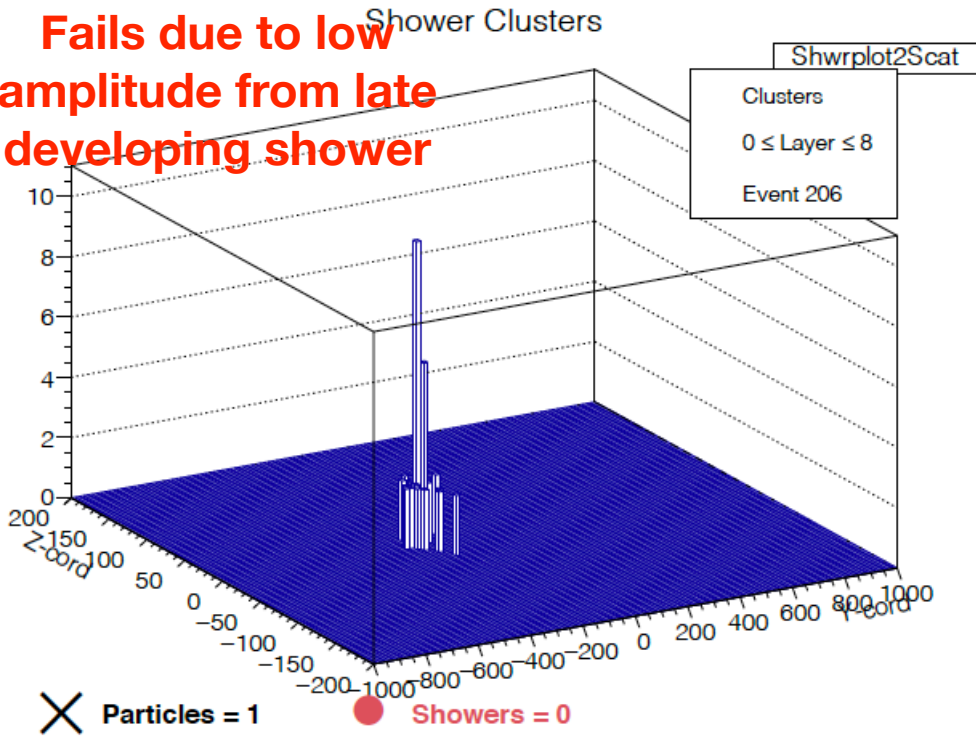
- 3 incorrect counts

- 36 4 electrons

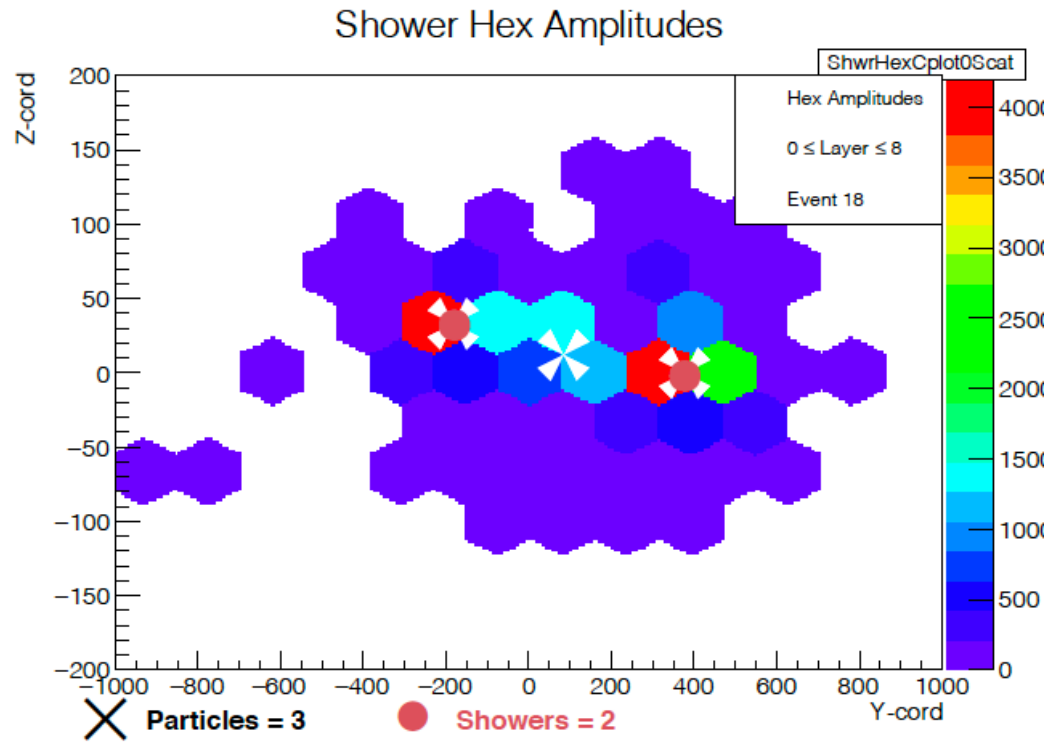
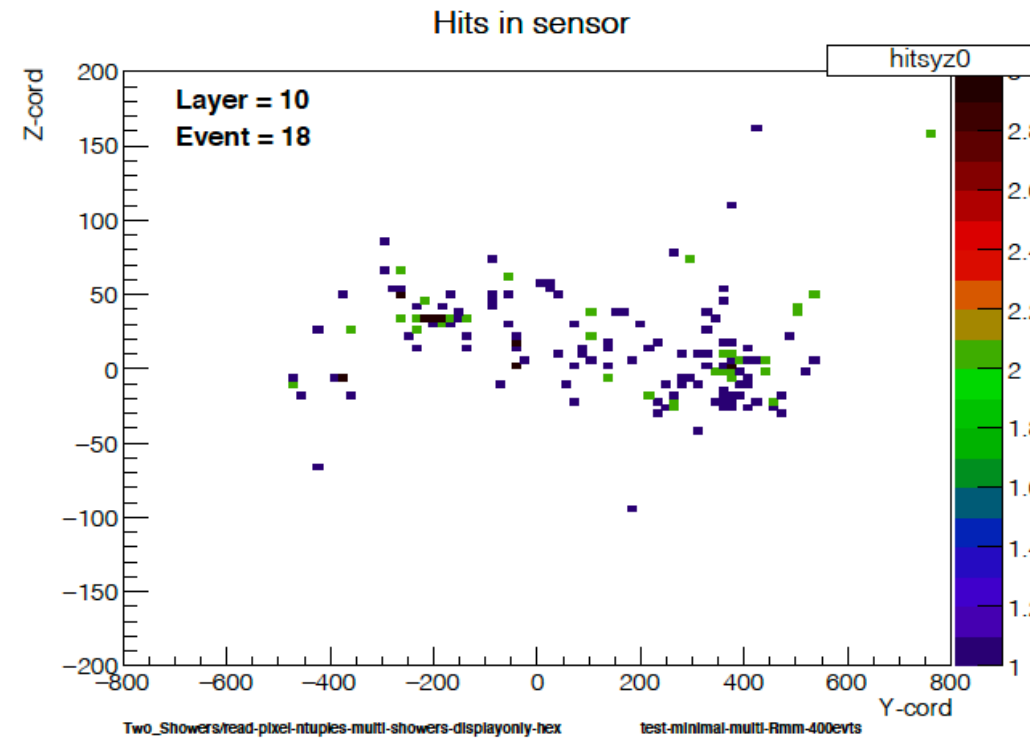
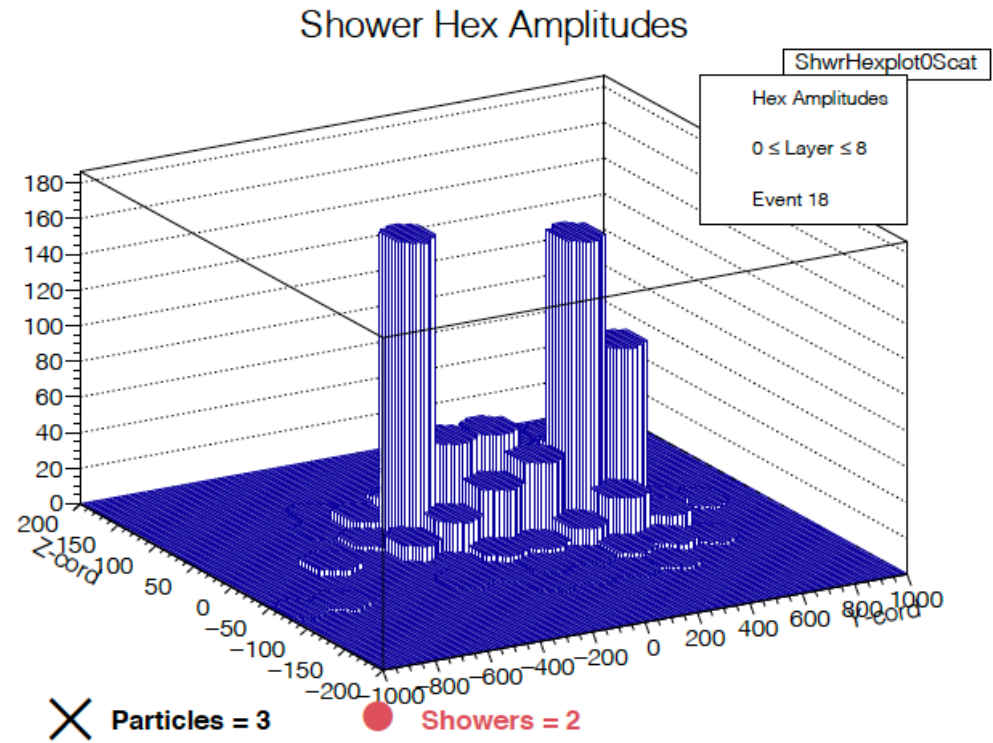
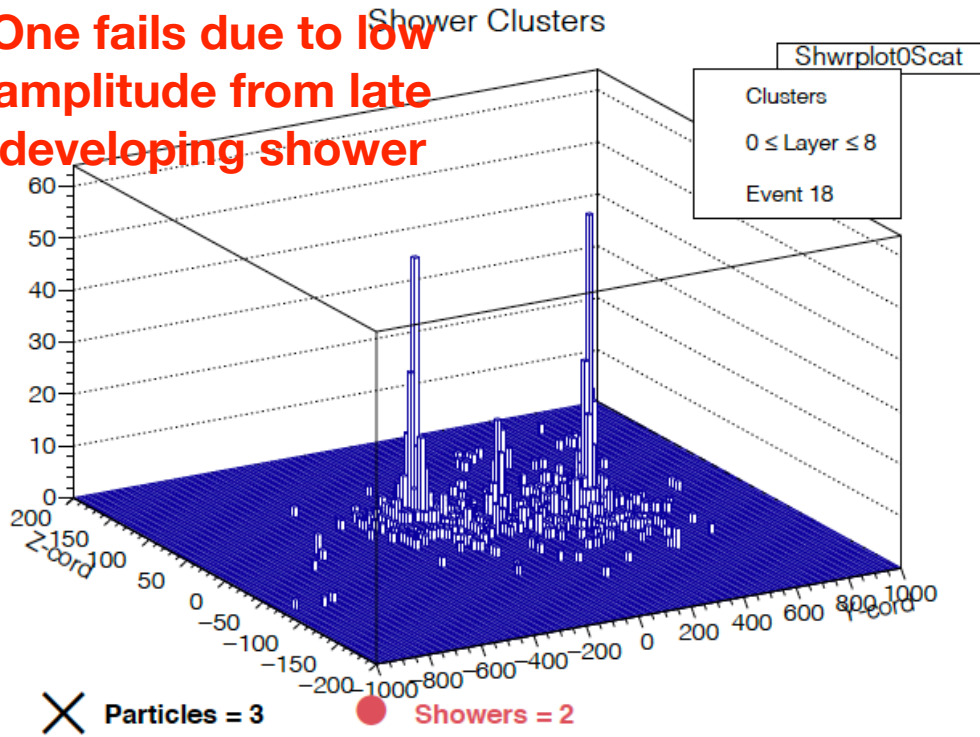
- 3 incorrect counts



Fails due to low amplitude from late developing shower

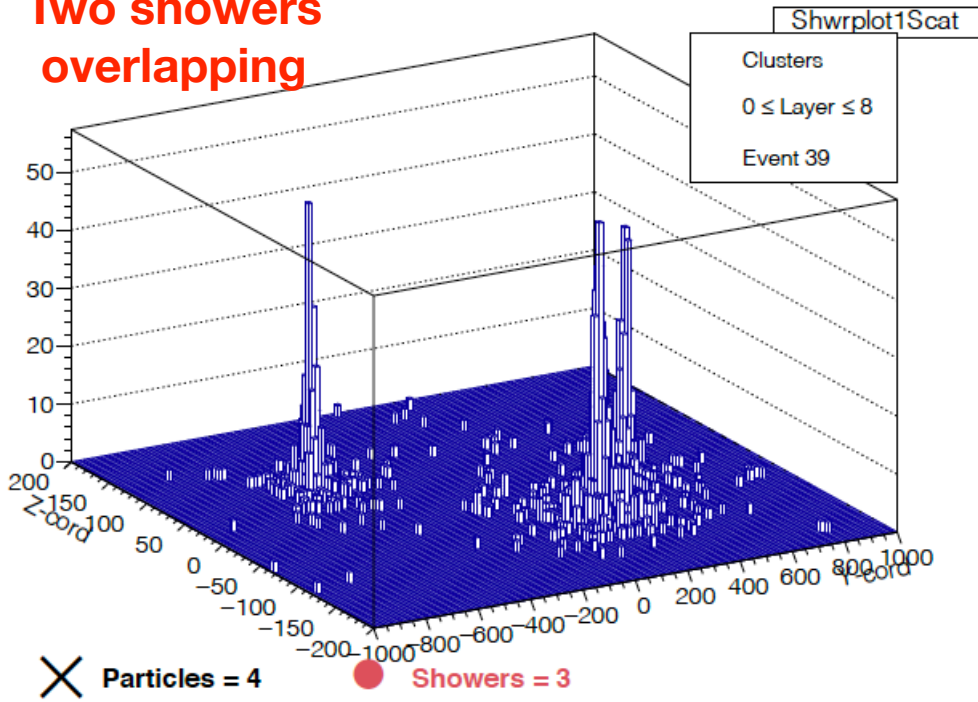


One fails due to low amplitude from late developing shower

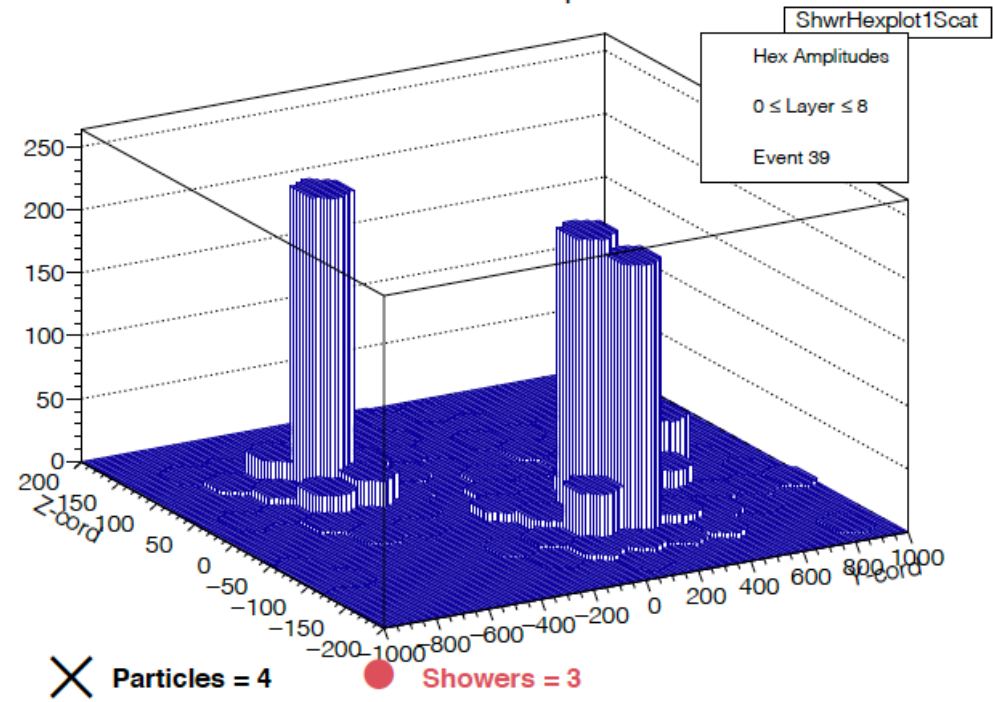


Two showers overlapping

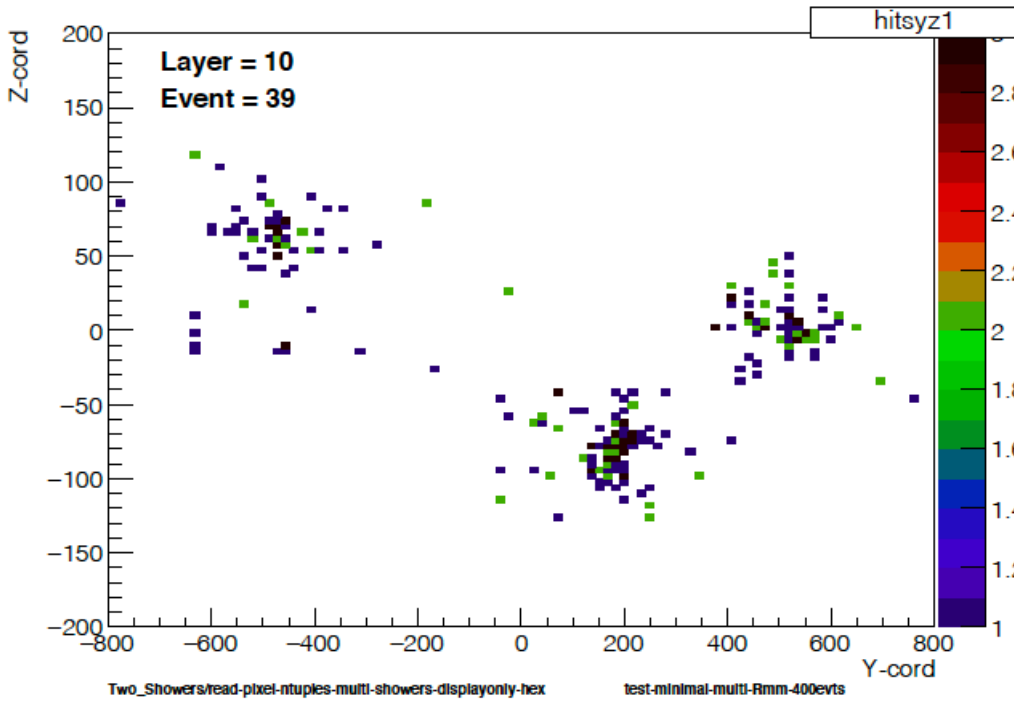
Shower Clusters



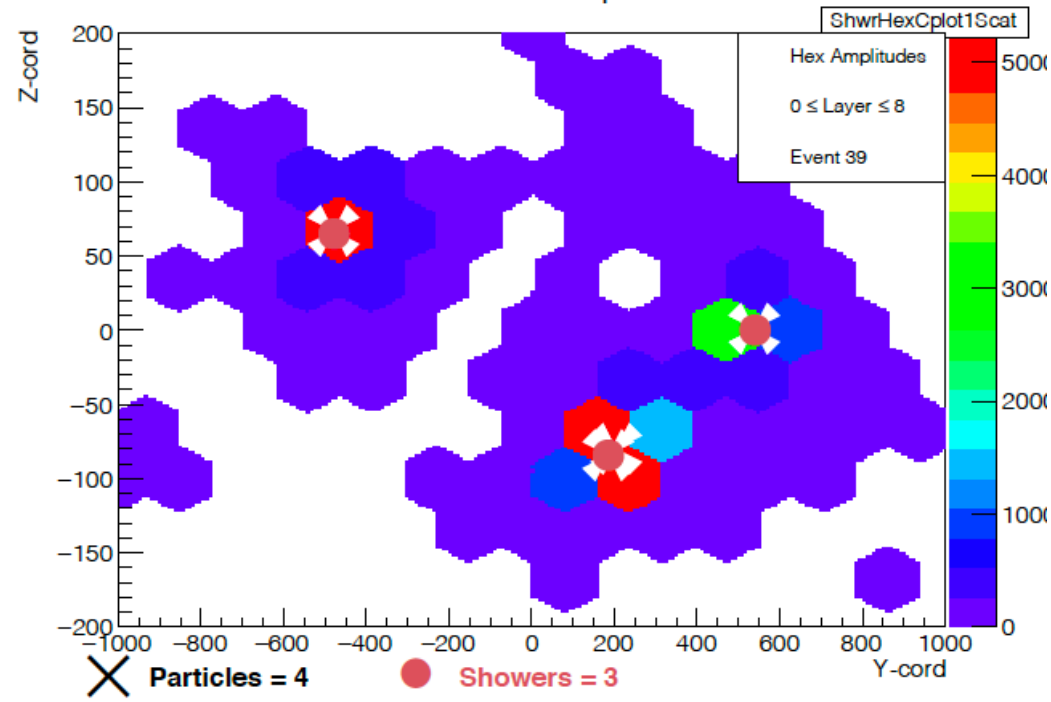
Shower Hex Amplitudes



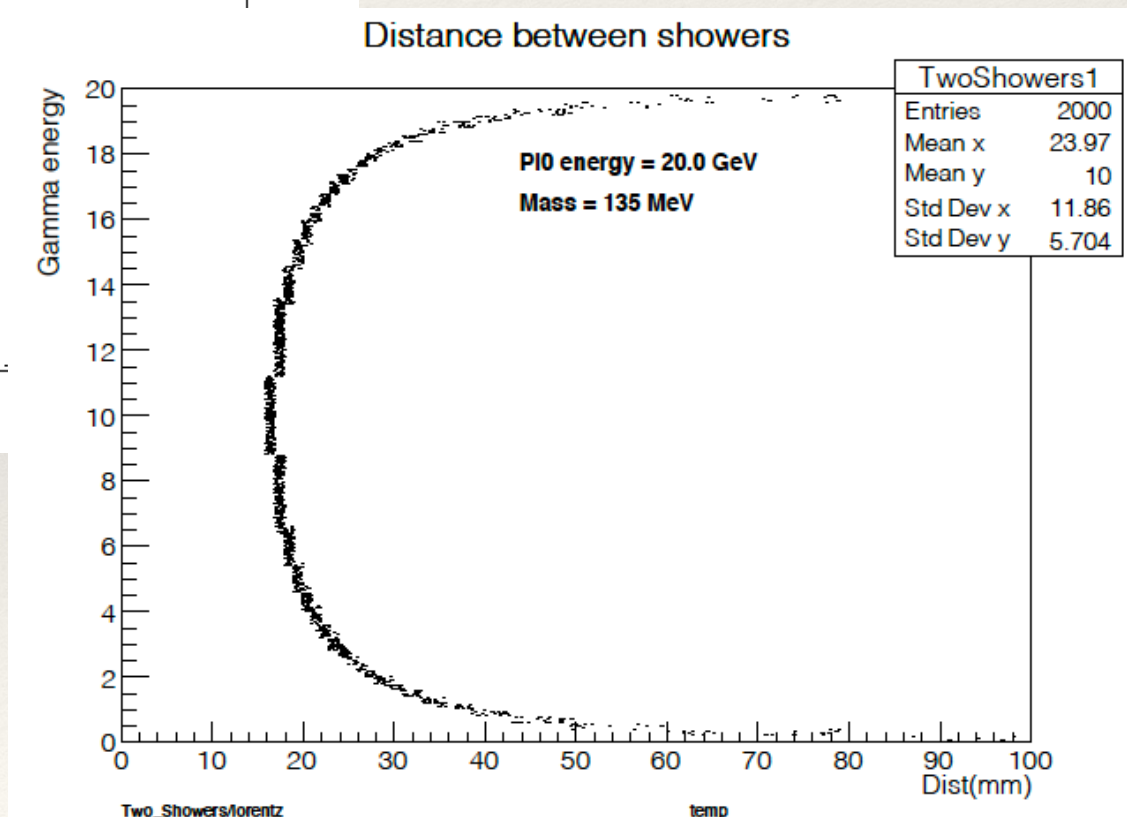
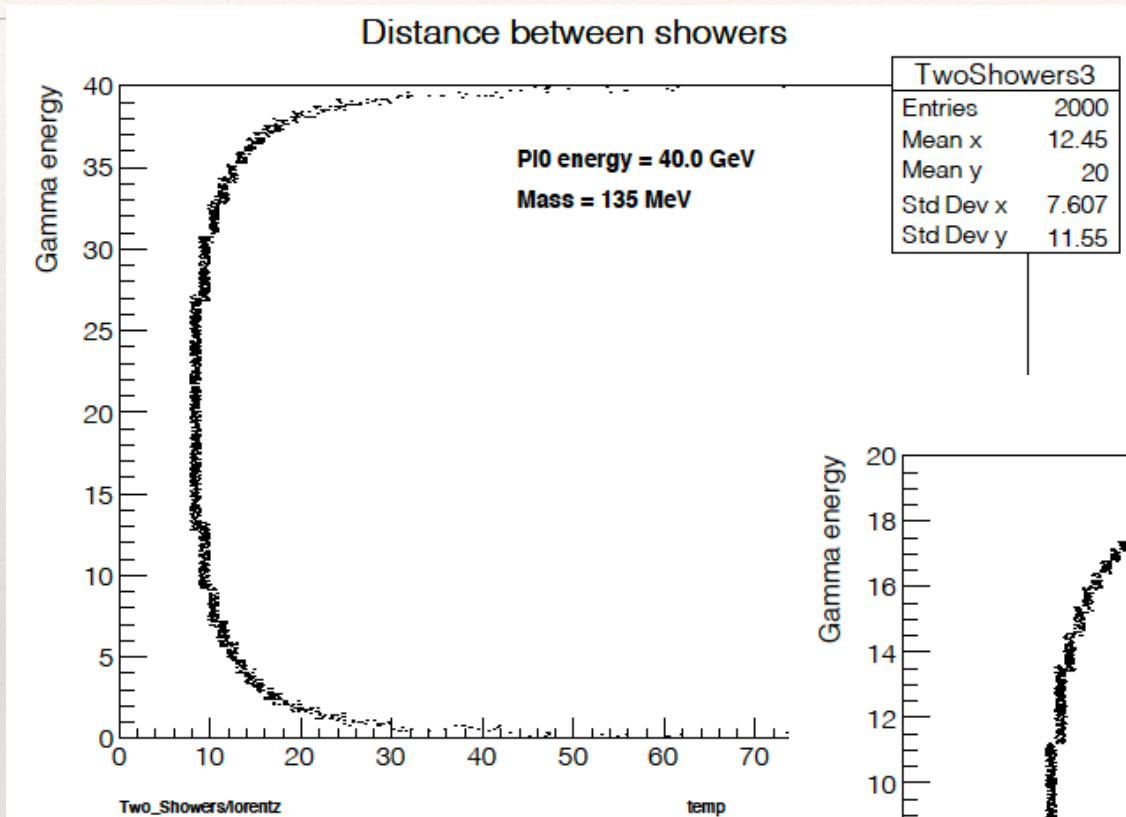
Hits in sensor



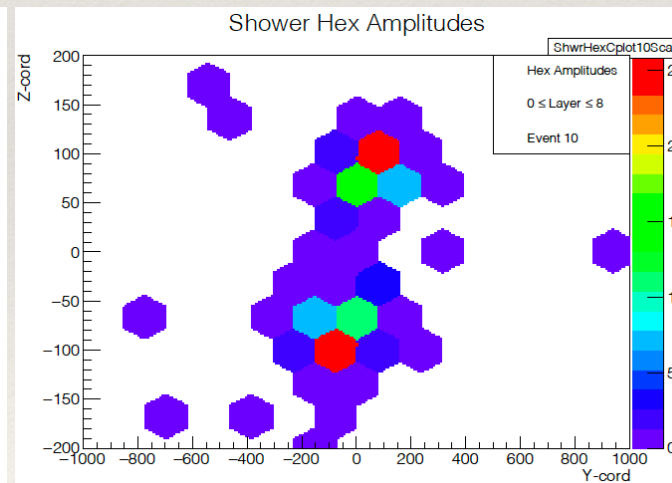
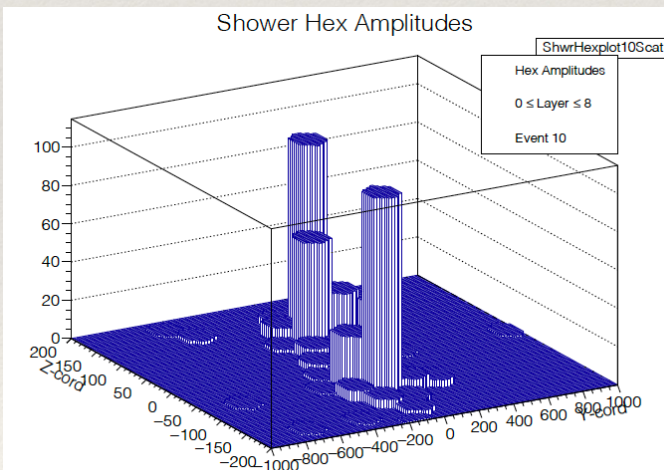
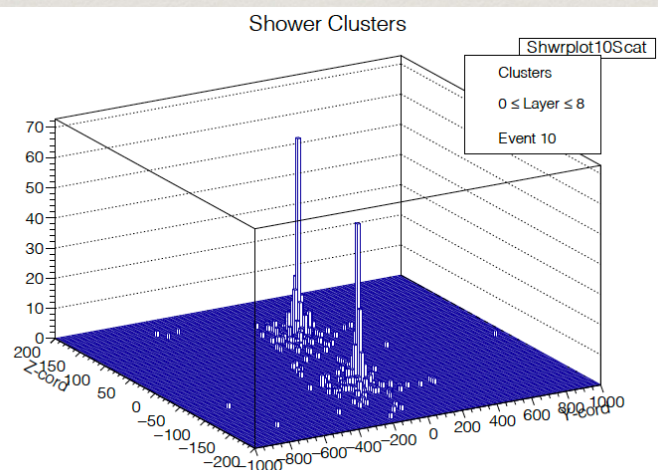
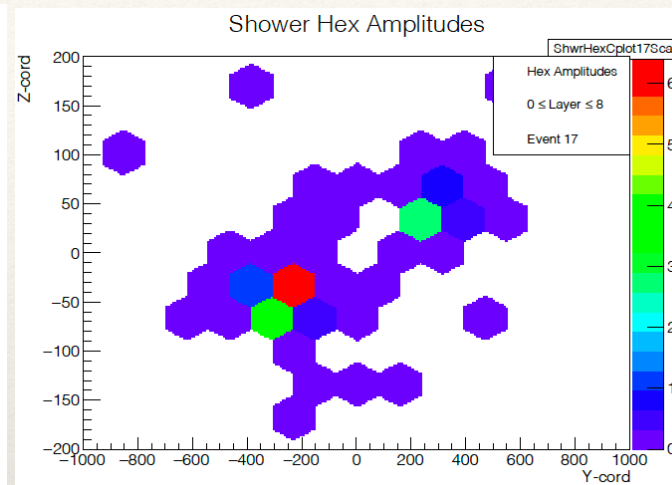
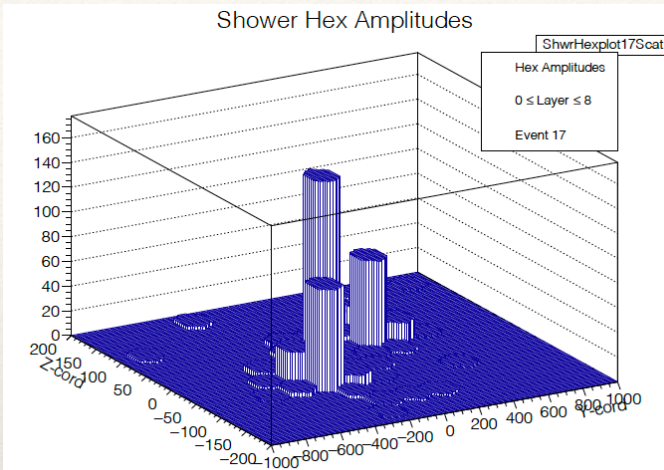
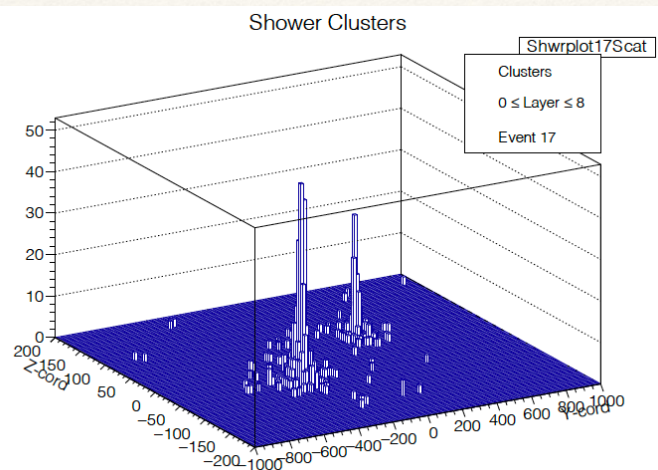
Shower Hex Amplitudes



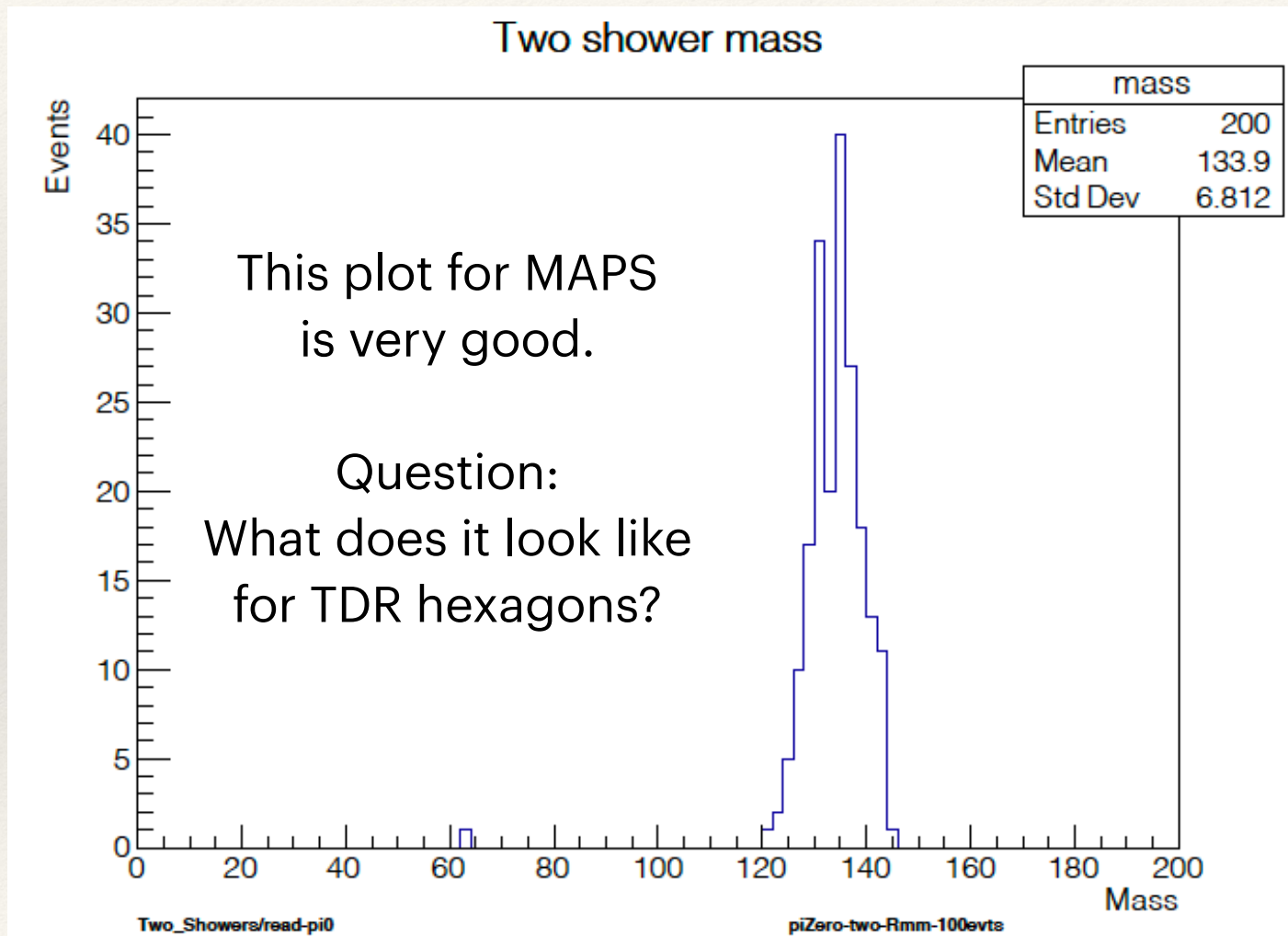
Pi0s in the SiD ECal at 90 degrees



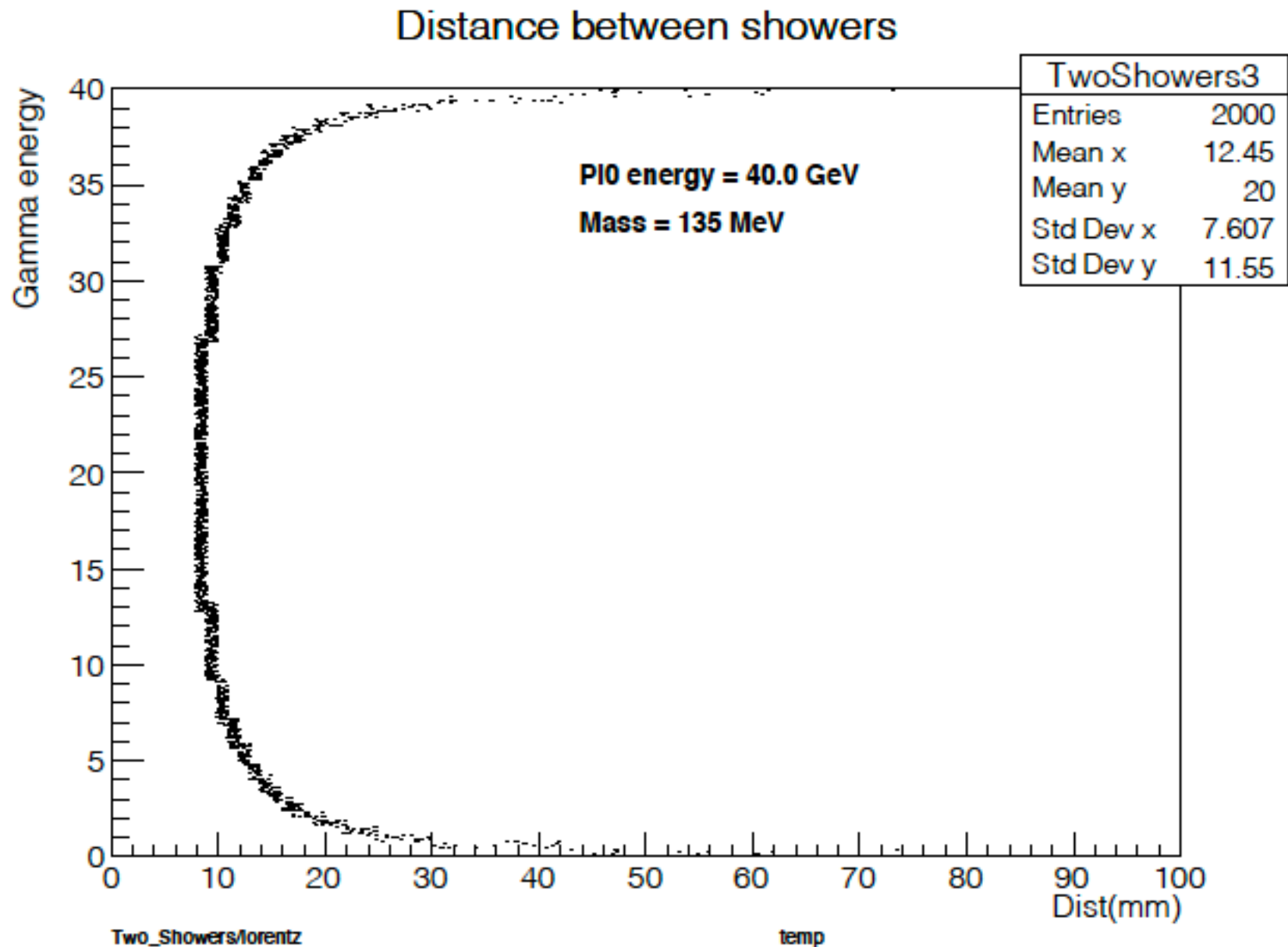
$$20 \text{ GeV } \pi^0 \rightarrow 10 \text{ GeV } \gamma + 10 \text{ GeV } \gamma$$



π^0 Reconstruction



Coming Soon: 40 GeV π^0 decays

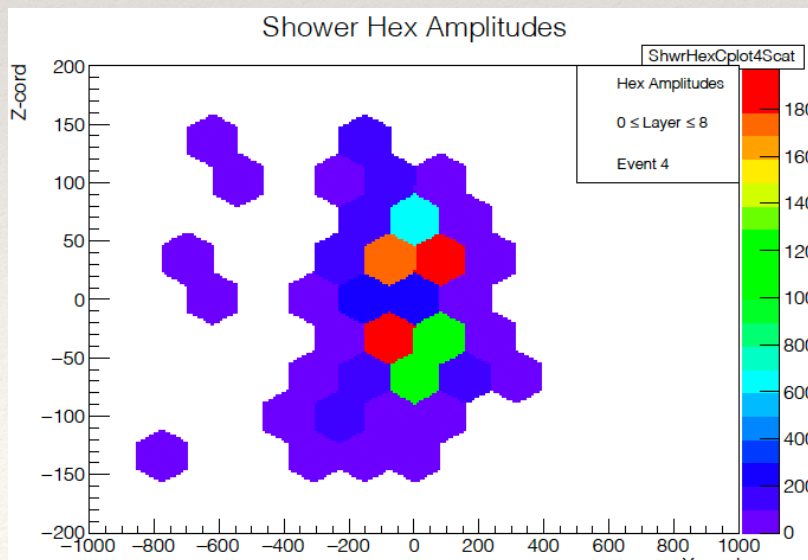
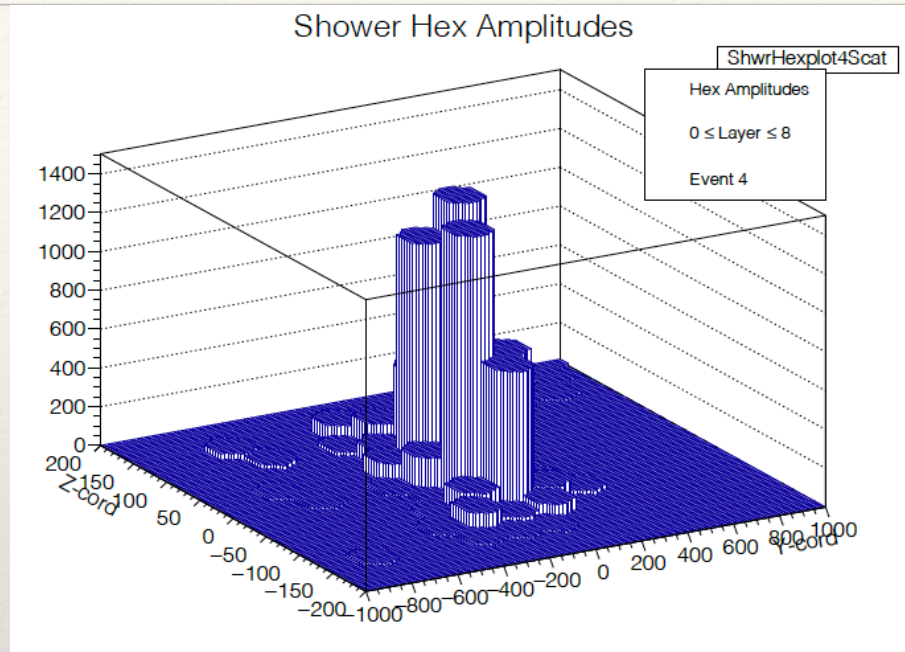
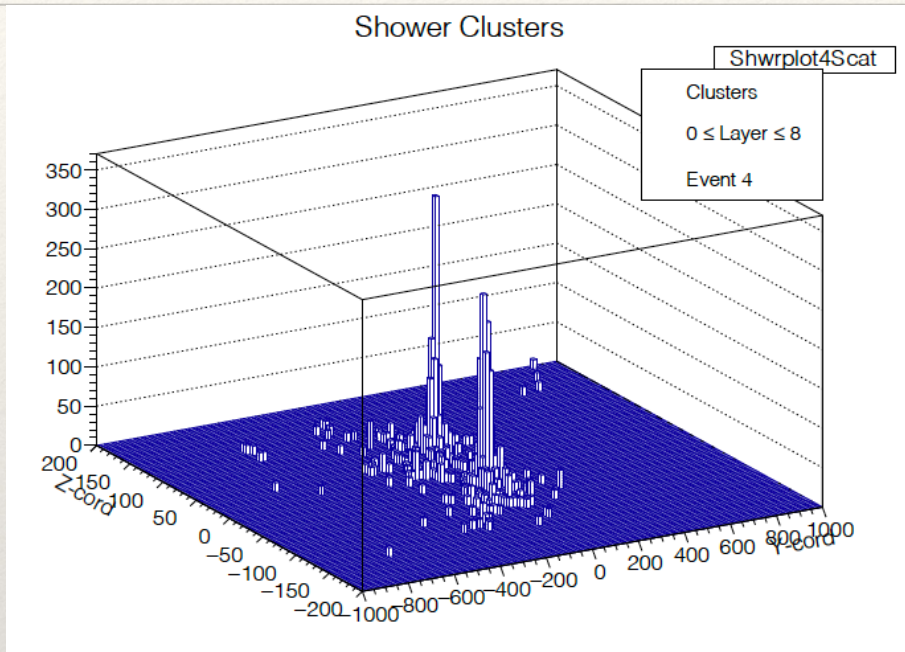


40 GeV $\pi^0 \rightarrow 20 \text{ GeV } \gamma + 20 \text{ GeV } \gamma$

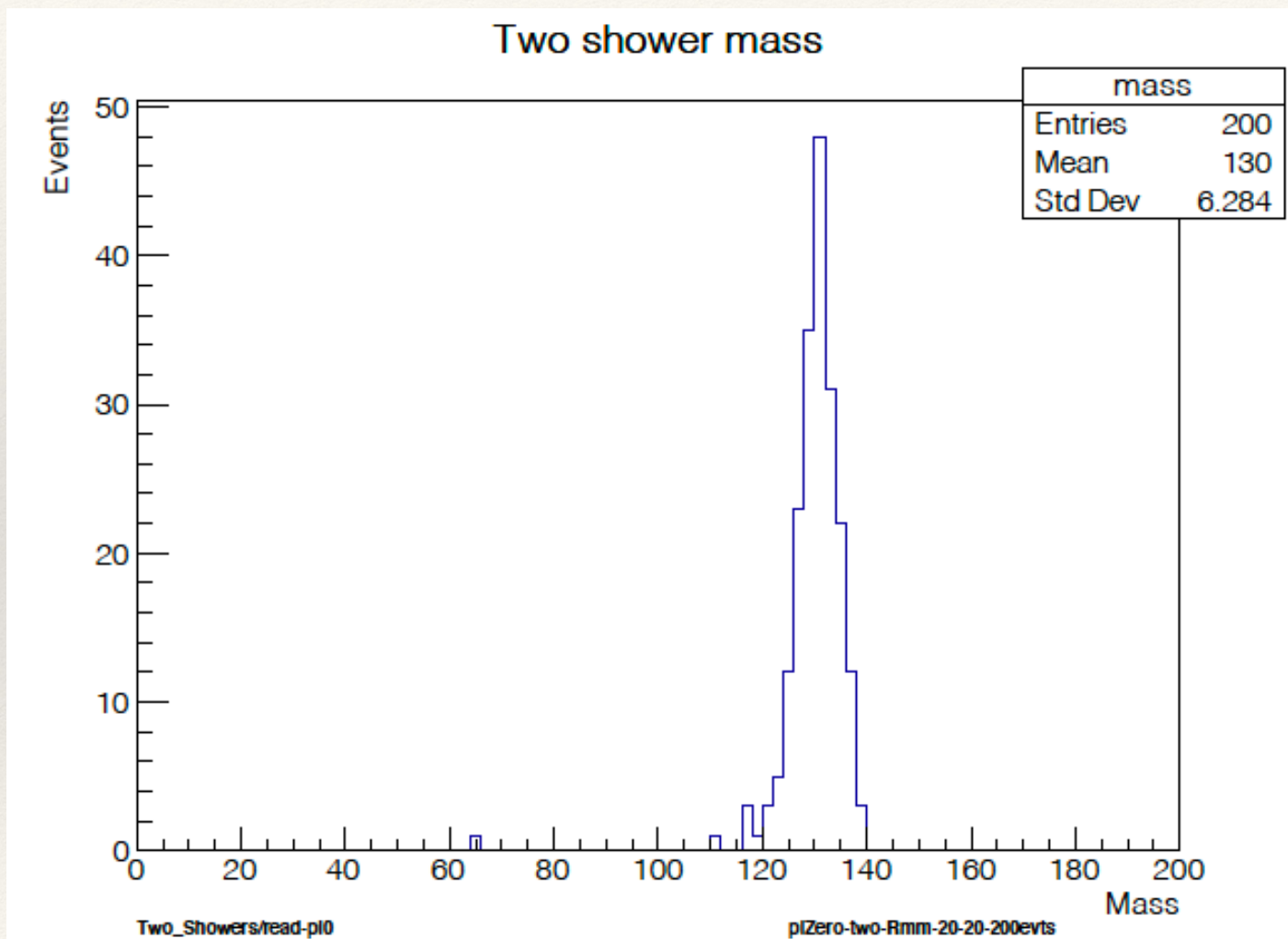


J. Brau - 4 August 2021

SiD MAPS Digital ECal



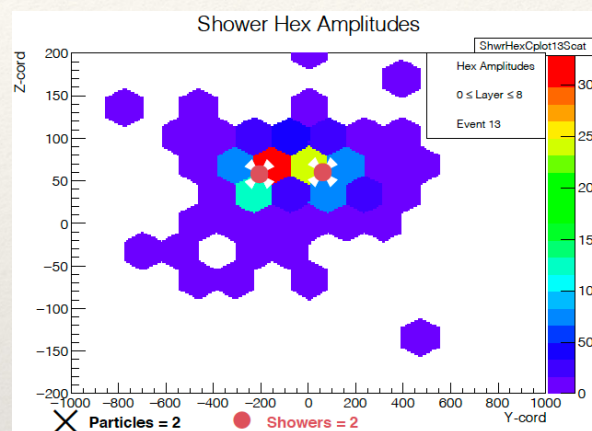
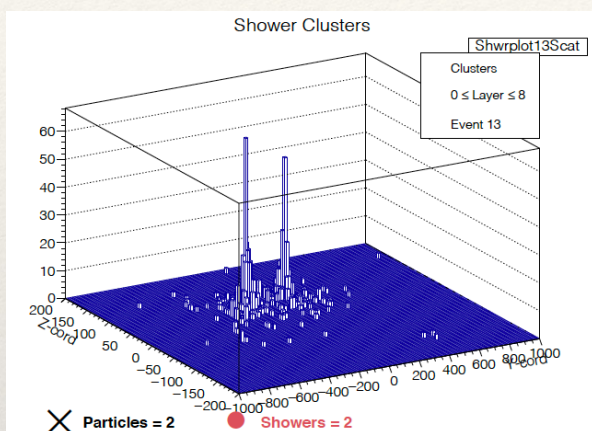
40 GeV π^0 Reconstruction



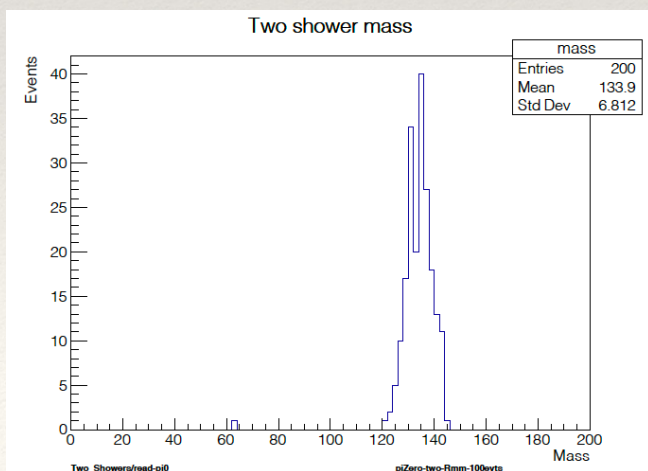
Conclusion



- ❖ Comparison to SiD TDR ECal hexagonal pixels.



- ❖ Study of reconstructing π^0 s in SiD MAPS Digital ECal.



How does this affect jet performance?