

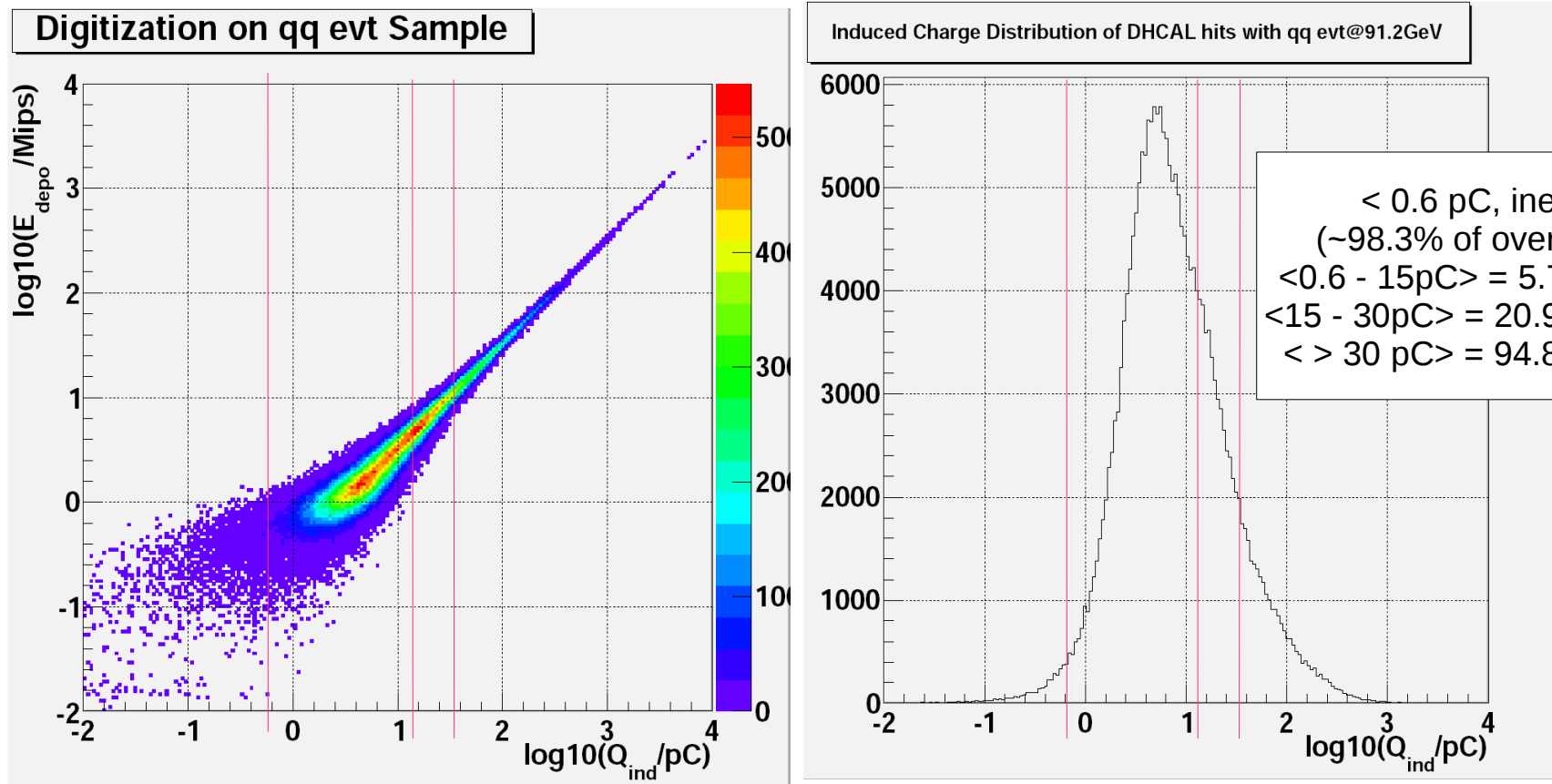
# Playing new Pandora PFA with DHCAL

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- Introduction
  - Mark's generator sample, simulated with ILD00 and ILD00\_dhcal concepts in Mokka 06-07, reconstructed with New PandoraPFA
- Digitization & Calibration
- UDS jet evt at Z Threshold
  - Overall performance
  - Investigating into strange events
- A glance to higher energy
- Summary

- Preliminary DHCAL Digitization module based on latest cosmic ray experiment: convert the energy deposition information into the induced charge
- Specify thresholds (0.6pC, 15pC and 30pC, corresponding to 0.2, 5 and 10 mips) on induced charge. Calibration constant fixed by Klong samples.

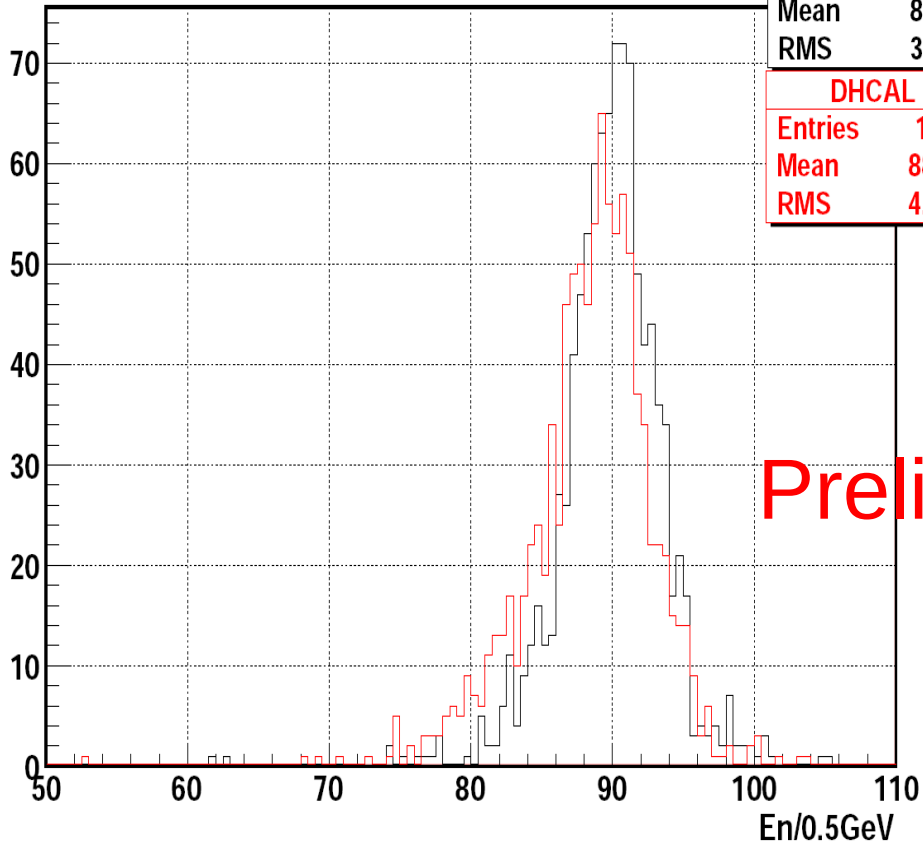


# Overall performance



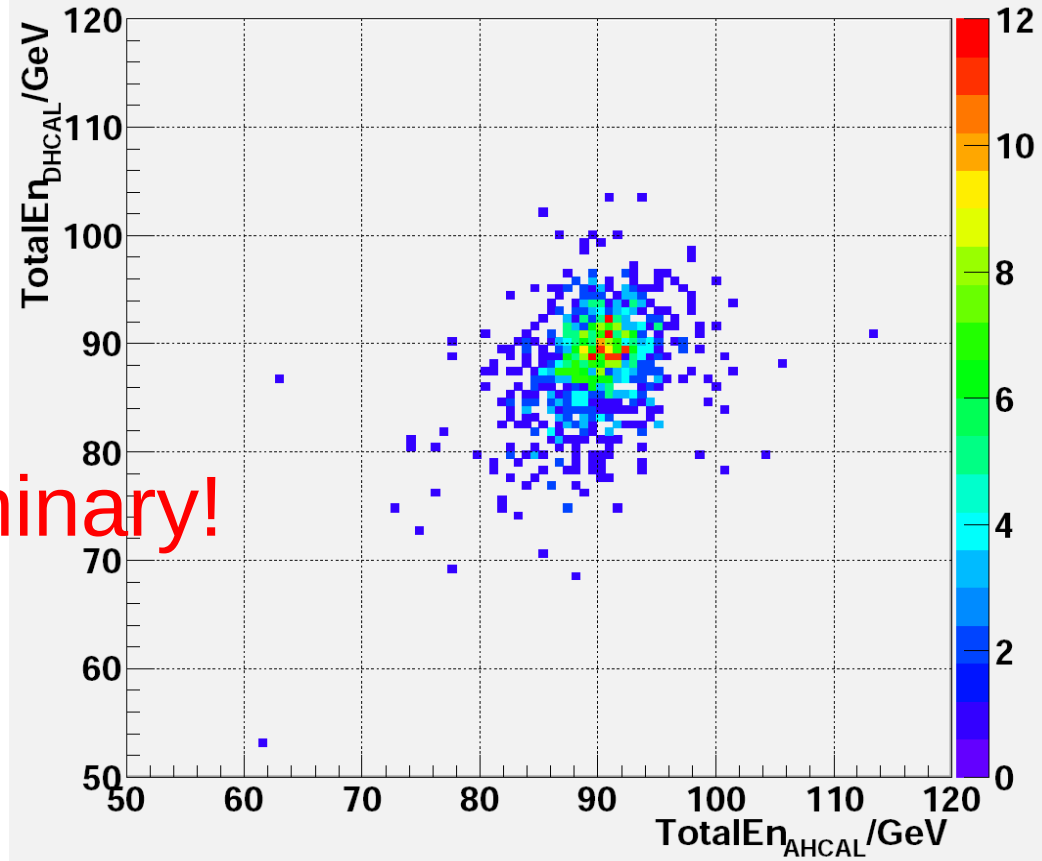
**Total reconstructed energy**

AHCAL	
Entries	999
Mean	89.88
RMS	3.808
DHCAL	
Entries	1000
Mean	88.37
RMS	4.524



Preliminary!

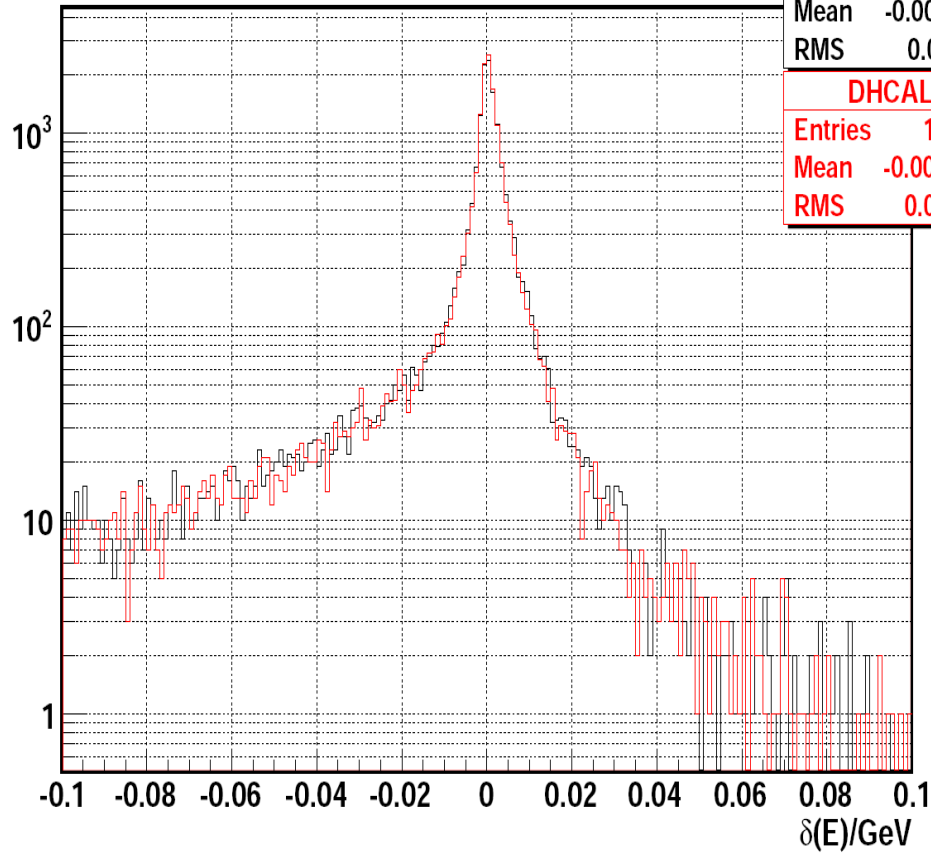
**Total Reconstructed Energy with digitized DHCAL and AHCAL**



Uds jet event at 91.2 GeV

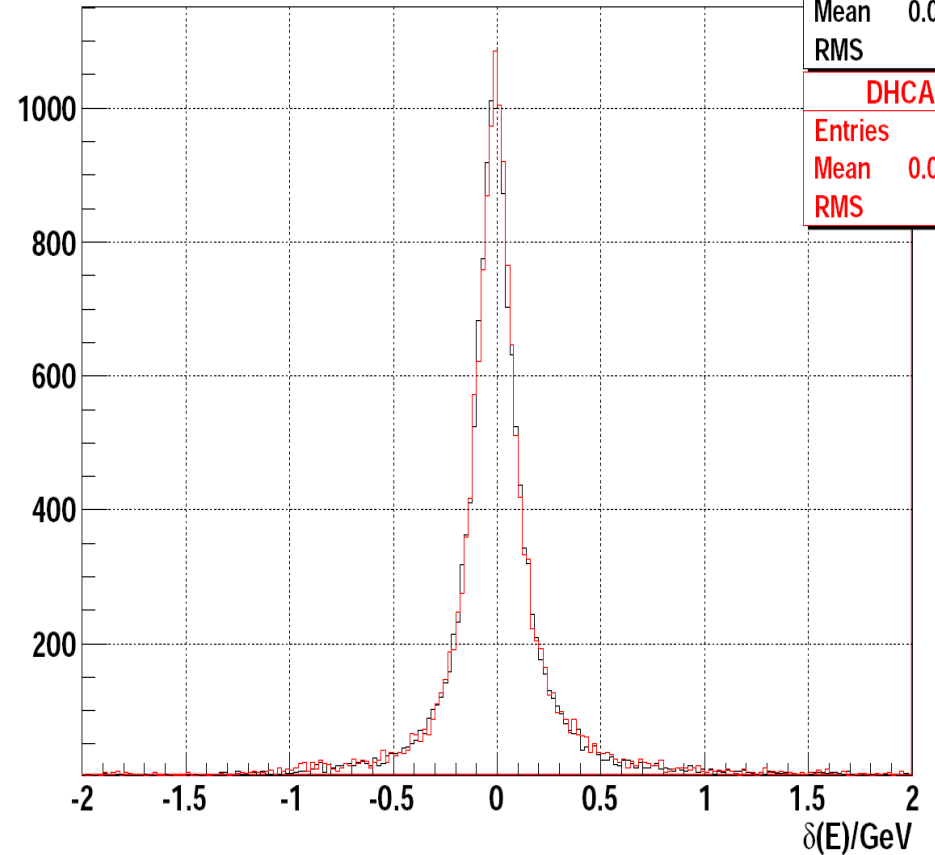
With **only** tuning calibration, performance of **Digitized** DHCAL is not so good comparing to AHCAL, with systematically lower estimated total energy

Difference between reconstructed Energy and MCTruth: Charged Particle



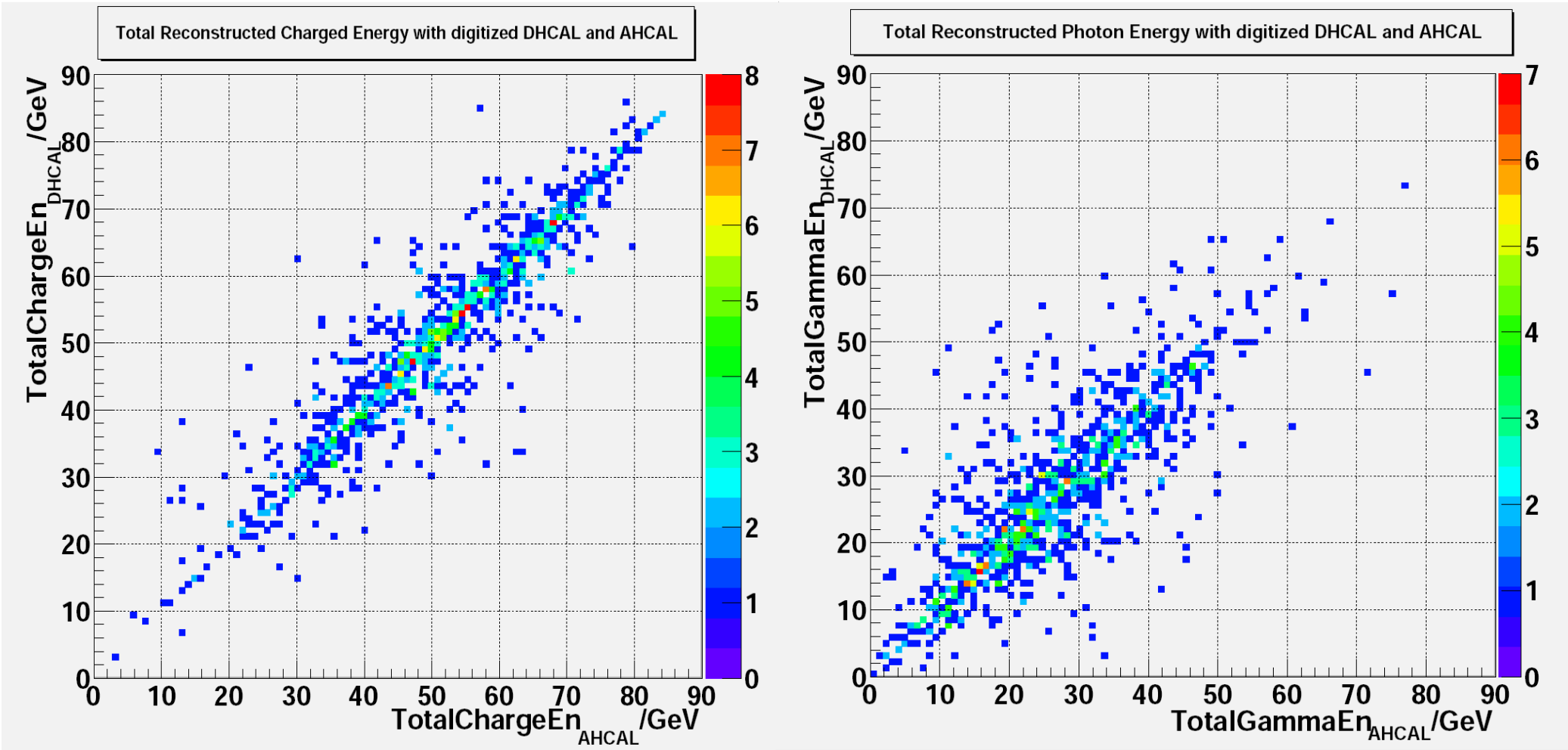
AHCAL	
Entries	17540
Mean	-0.003402
RMS	0.01761
DHCAL	
Entries	17625
Mean	-0.003313
RMS	0.01727

Difference between reconstructed Energy and MCTruth: Photons

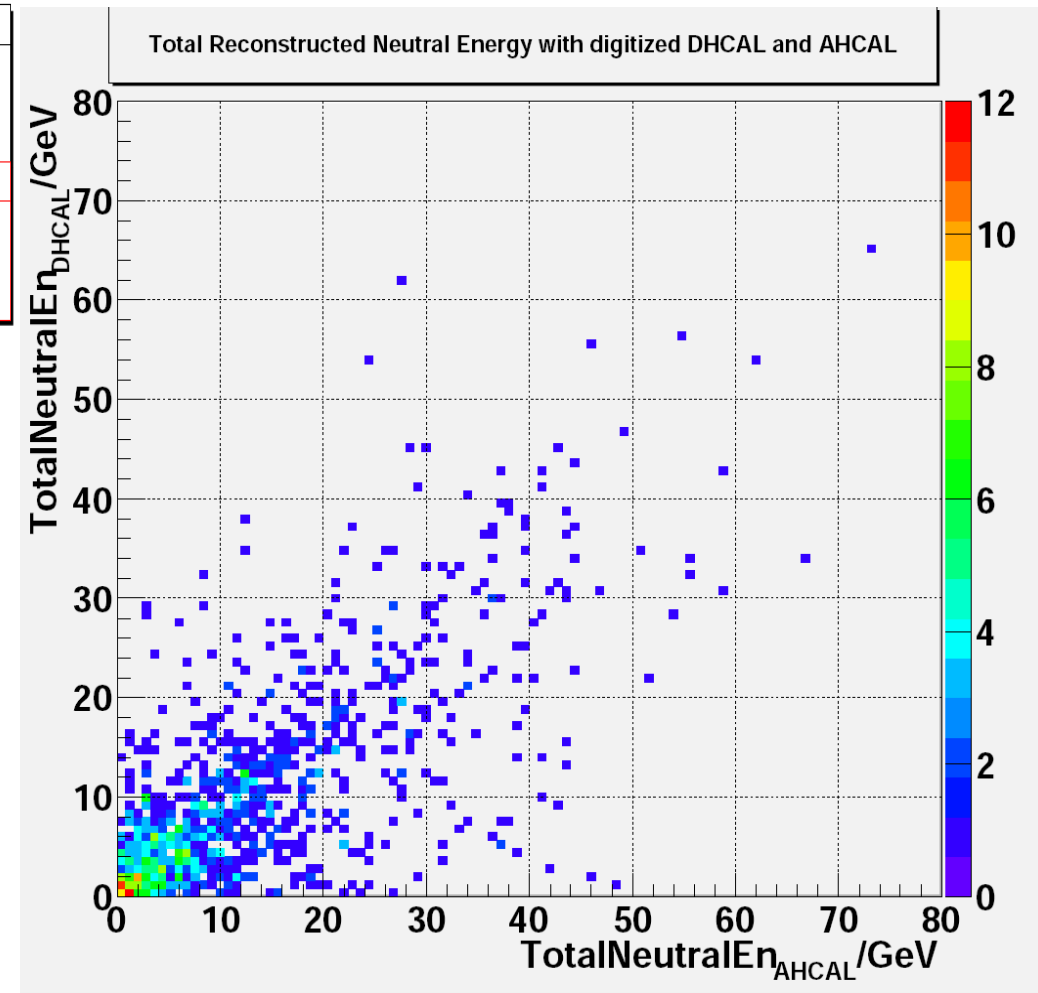
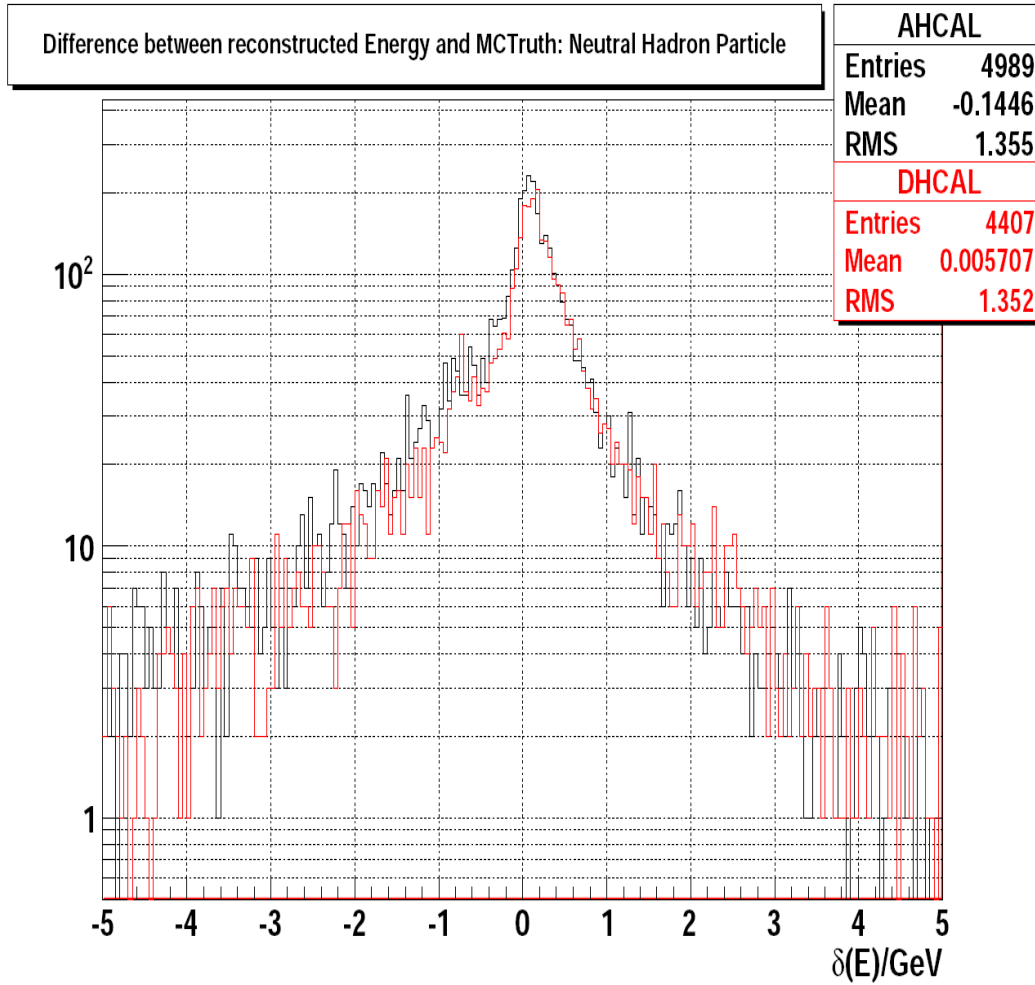


AHCAL	
Entries	16477
Mean	0.002989
RMS	0.344
DHCAL	
Entries	16921
Mean	0.002289
RMS	0.3751

From each reconstructed particle: Reconstructed energy – MC truth Energy  
 Similar performance on charged & Gamma components  
 Charged components: reconstructed energy < MC truth: might caused by FSR



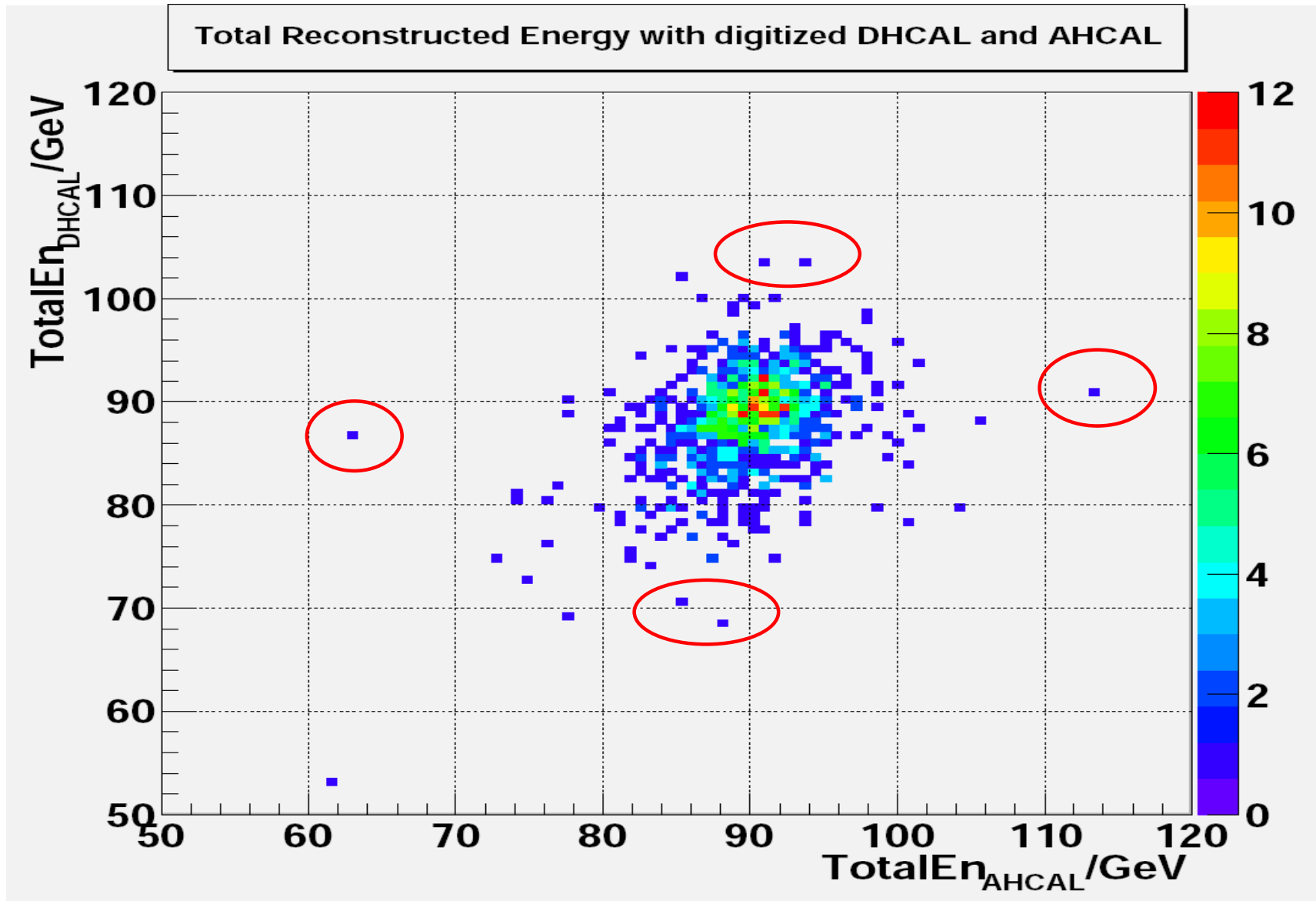
Total measured energy: Comparable....



With Digitized DHCAL: reconstruct less neutral hadrons than the AHCAL...

*(less sensitive to neutrons?)*

Number of successfully reconstructed neutron/anti neutron: DHCAL 577, AHCAL 764)





# DHCAL Sample, Evt 913

## total energy = 68.5

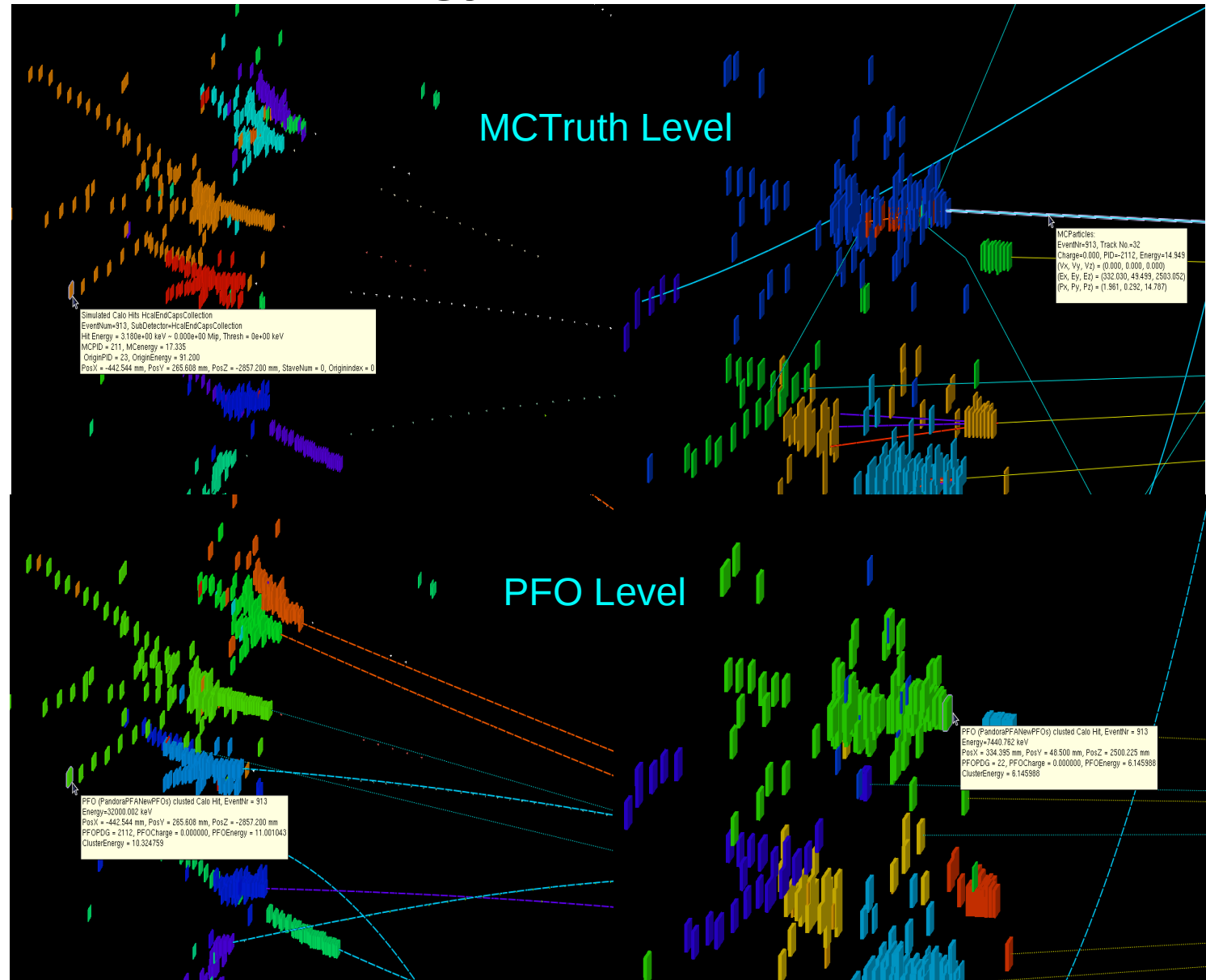


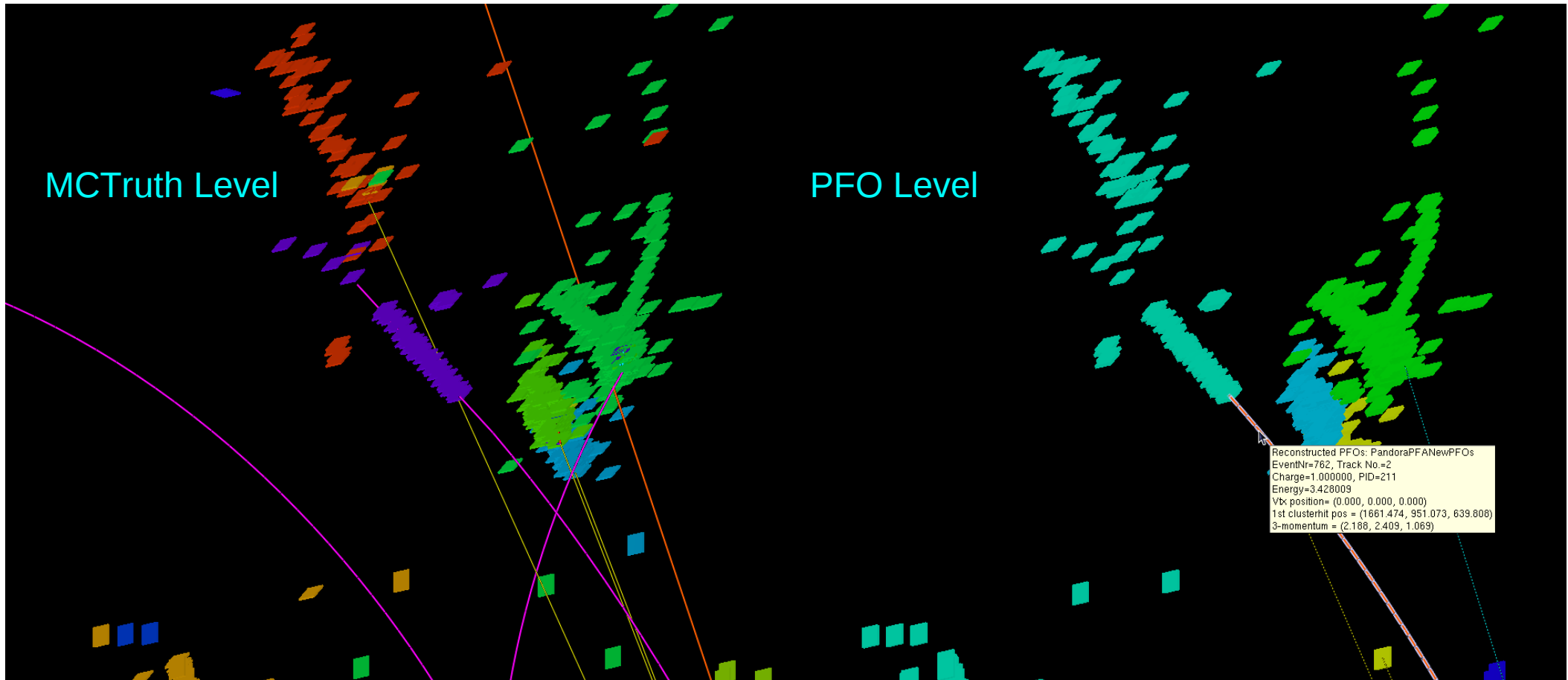
Forward region  
event: 2 failures

Left: misidentify a  
17GeV pion cluster  
as 10GeV neutron  
cluster;

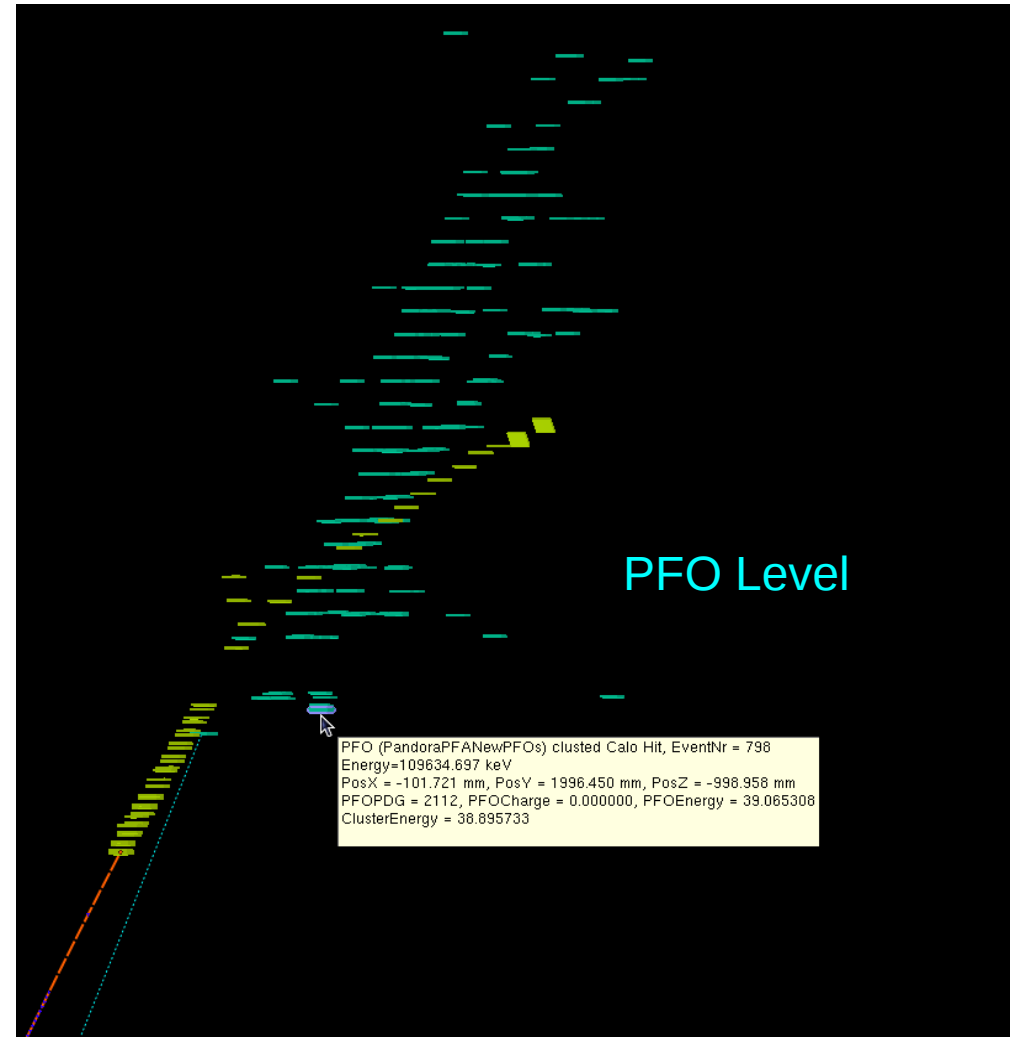
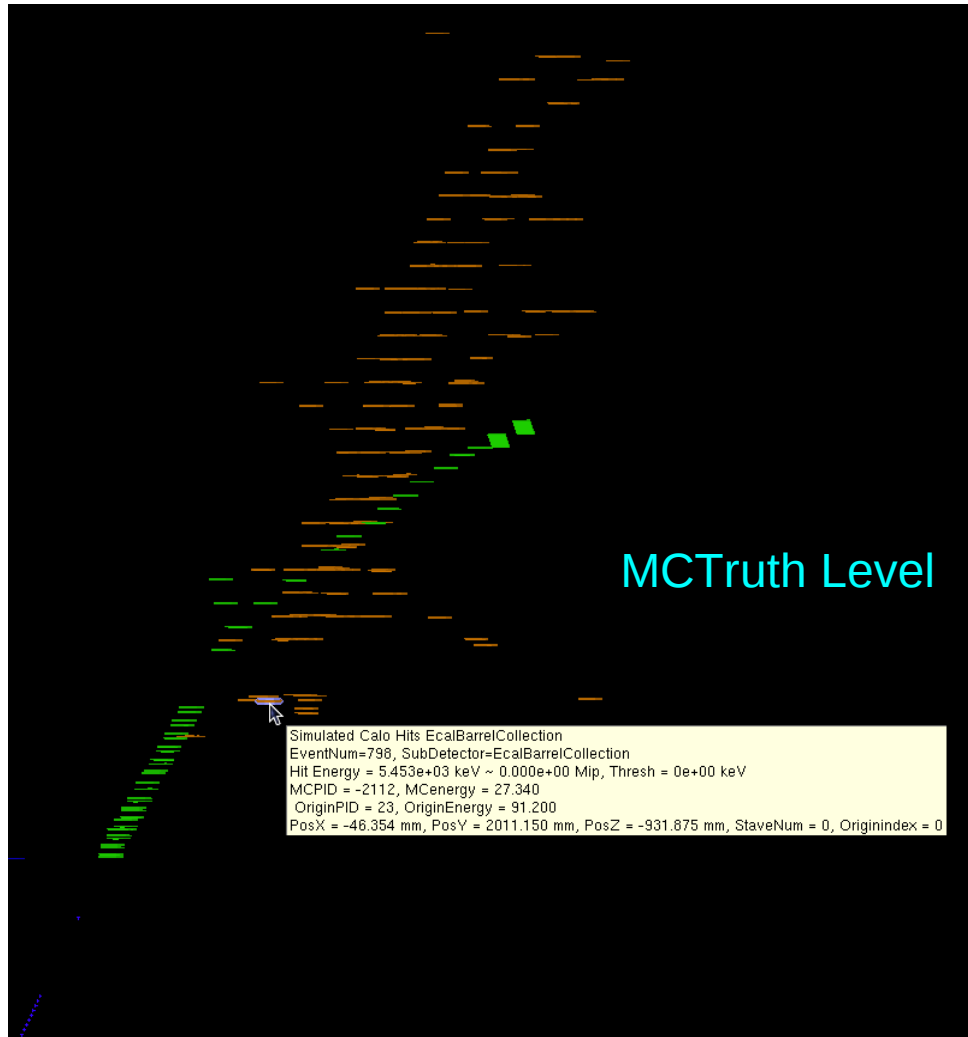
Right: misidentify  
15GeV neutron as  
6GeV photon;

Need to change  
calibration constant  
for DHCAL Endcap?

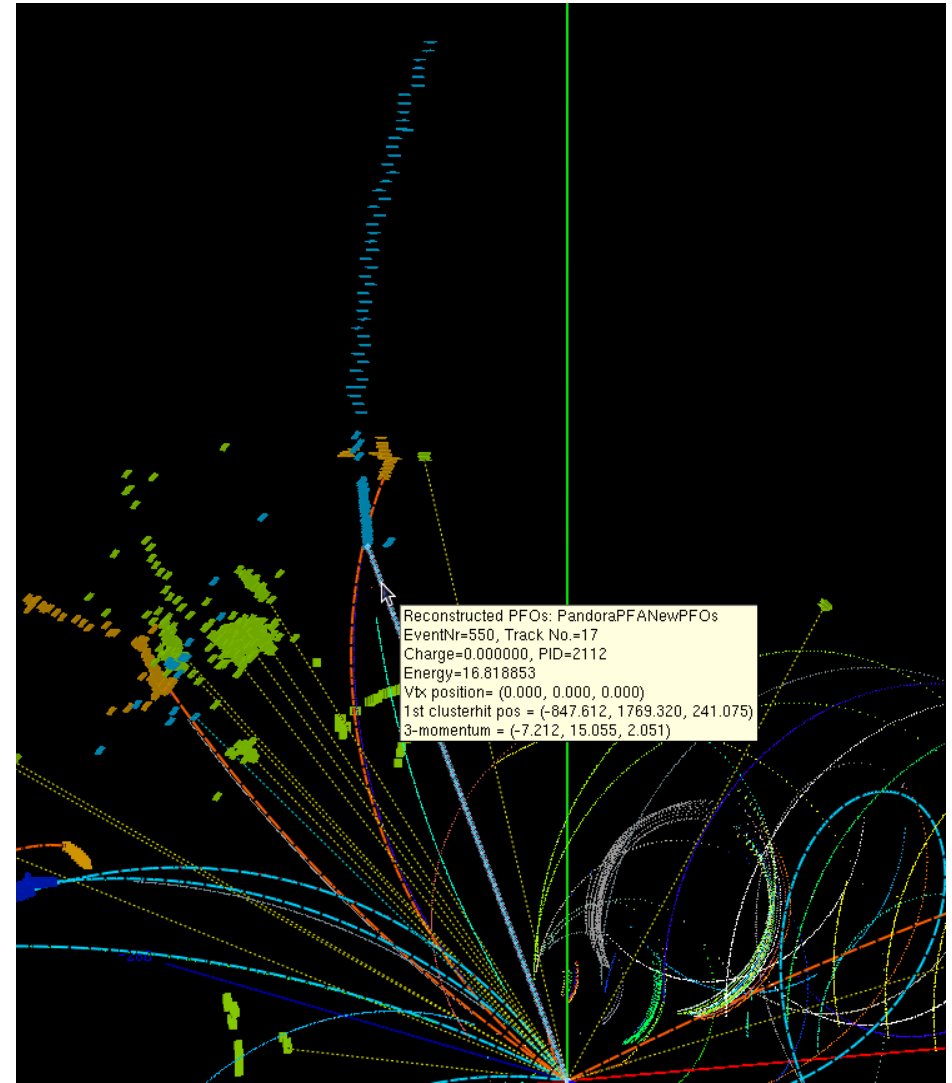
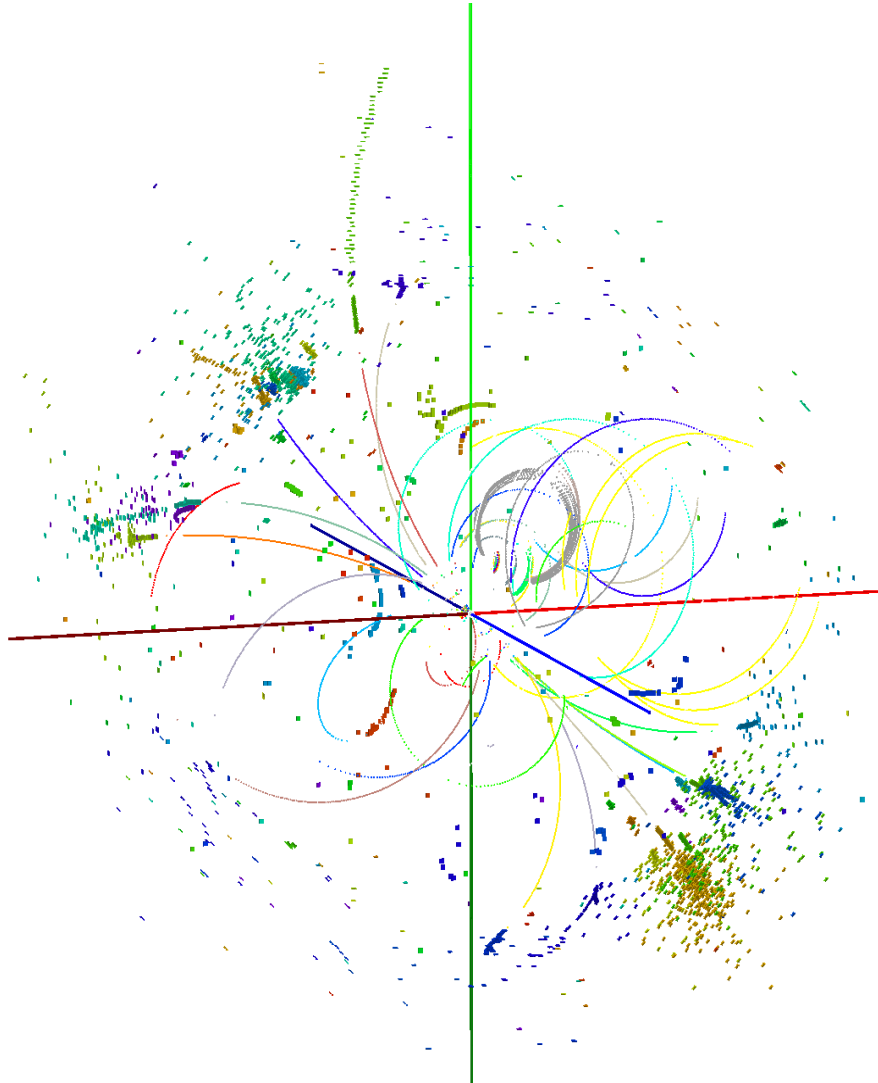




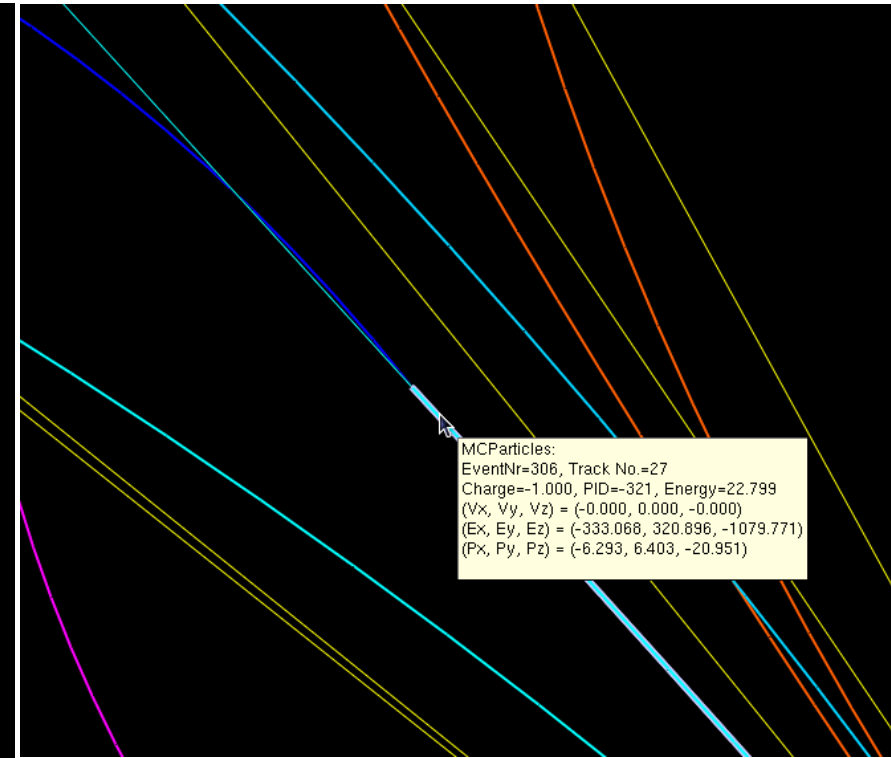
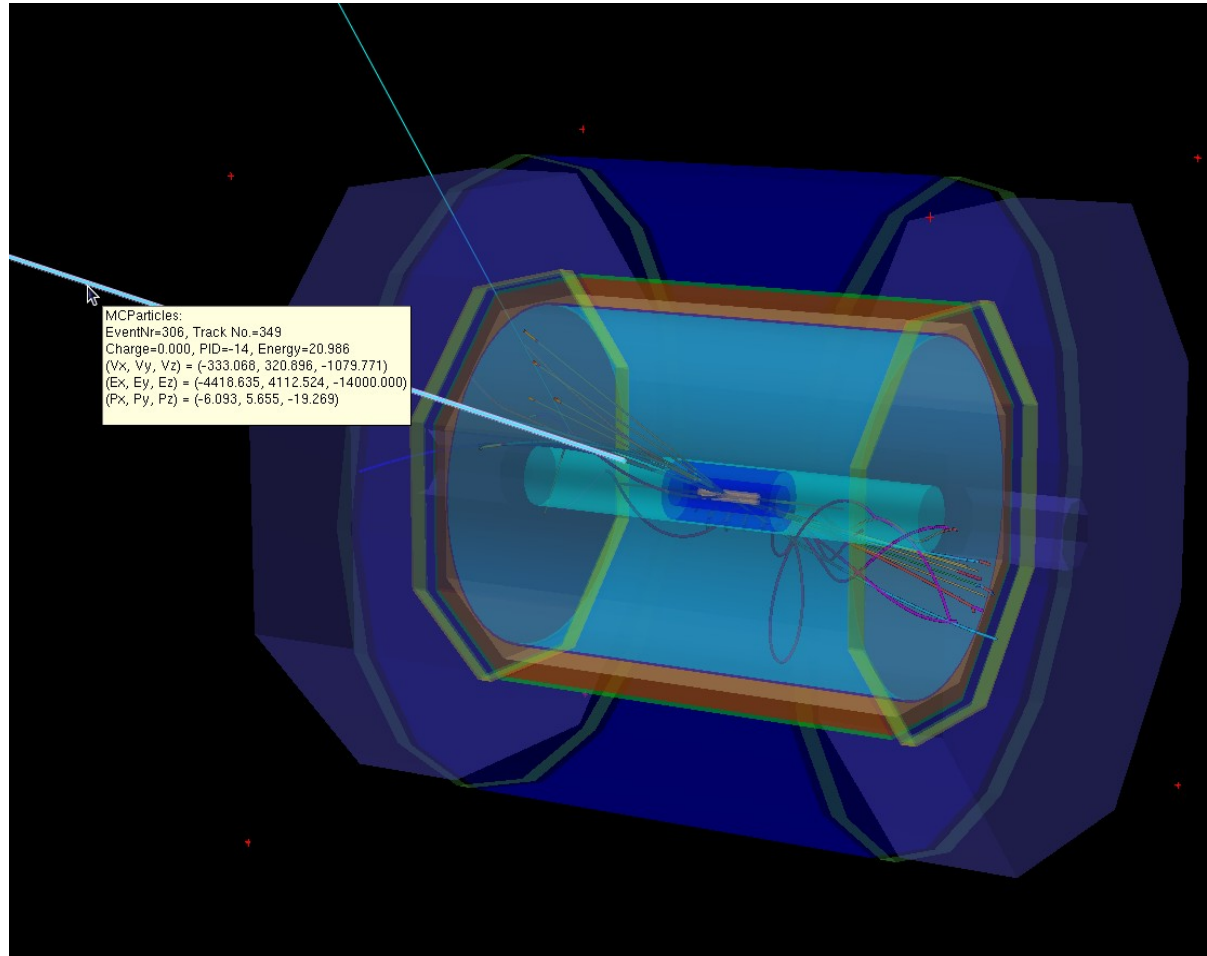
Failed to separate nearby cluster:  
2 nearby clusters (3.5 GeV proton and 7.8 GeV lambda bar), identified as 3.4 GeV pion:



Fluctuation in cluster energy estimation: 27.3 GeV neutron cluster reconstructed as 38.9GeV



Reason: Failed to linking the tracker to cluster.  
Identify a 3GeV Muon cluster as 17GeV neutron. To improve Mip finder?

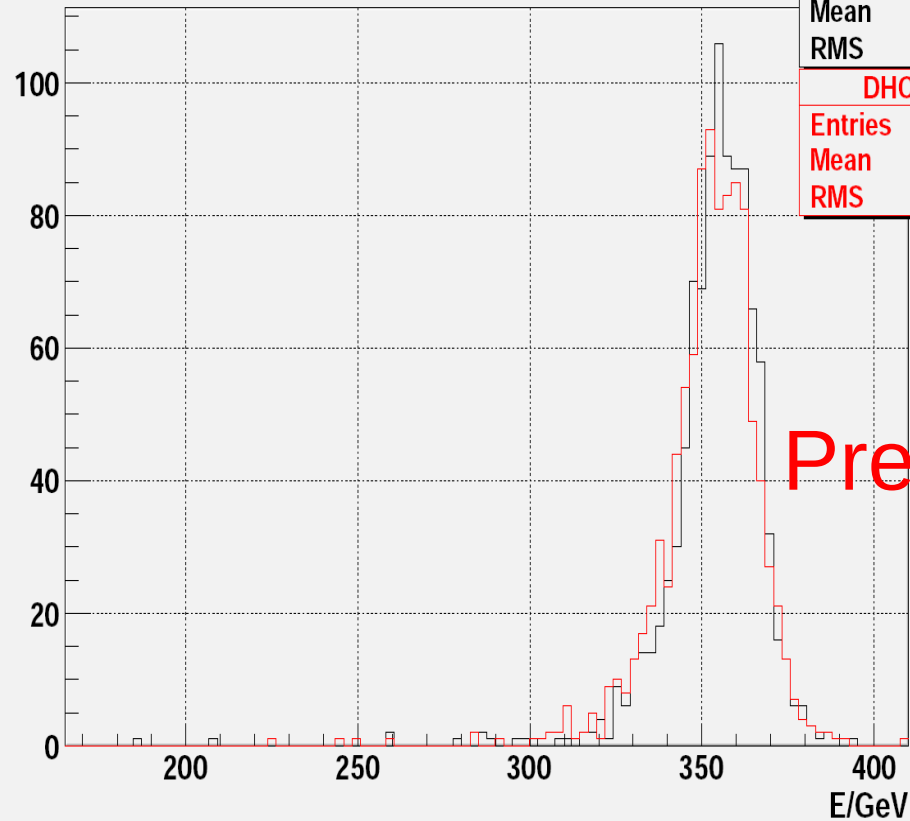


High Energy Neutrino (21GeV) generated in uds jet event: Kaon decay

# At higher energy

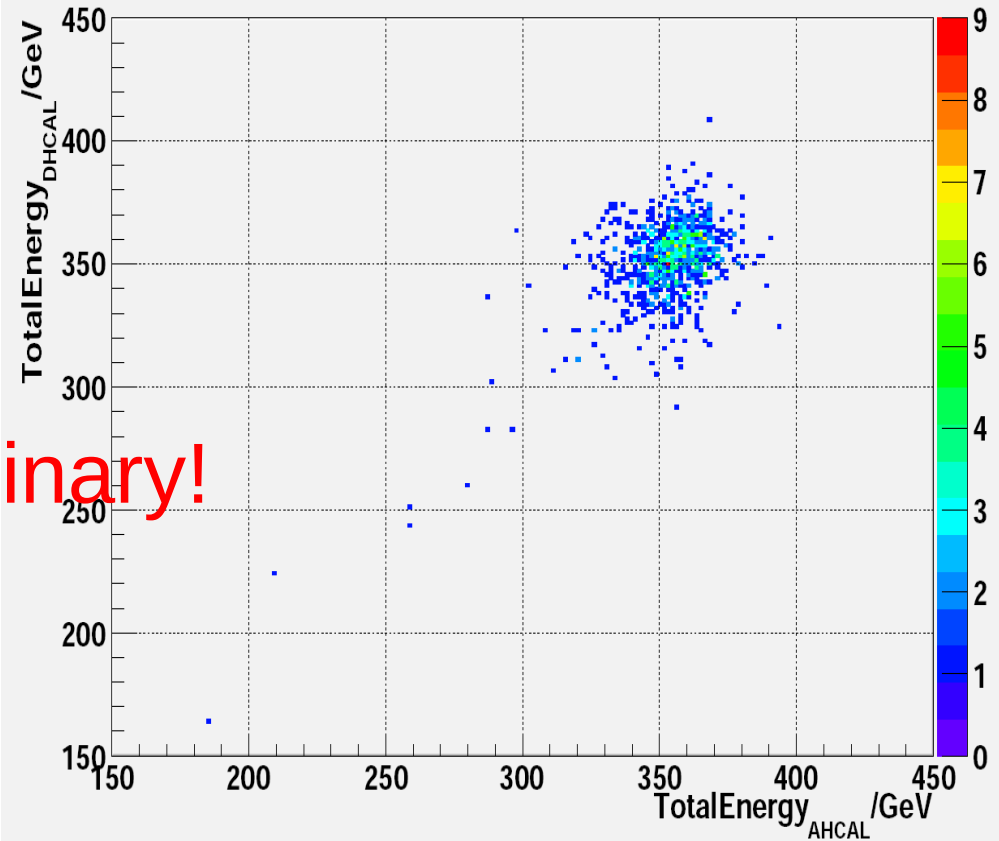


Total Reconstructed Energy for uds event at 360GeV



AHCAL	
Entries	999
Mean	353.8
RMS	14.96
DHCAL	
Entries	1000
Mean	352.1
RMS	15.03

Reconstructed Energy with DHCAL and AHCAL



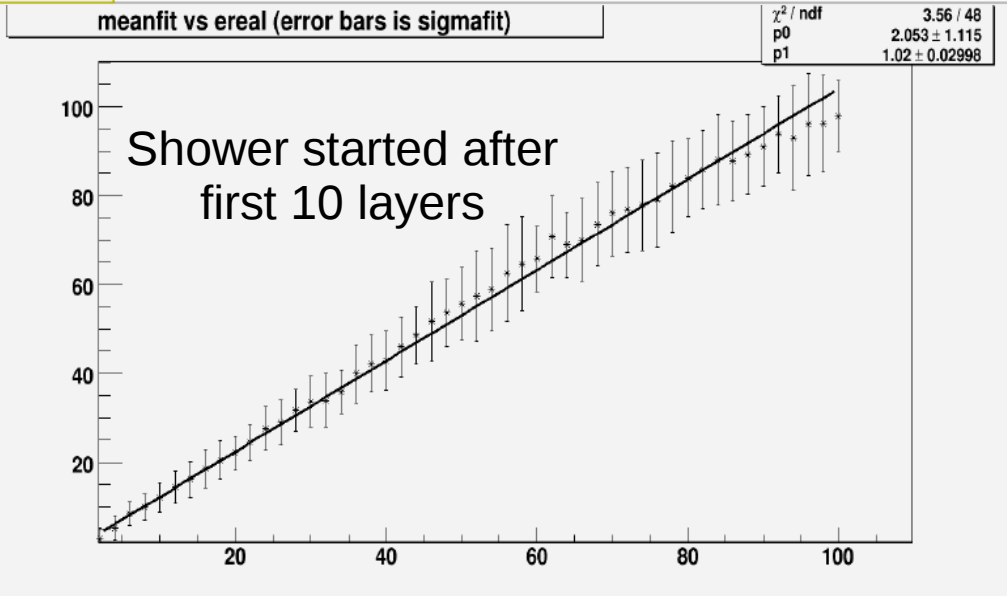
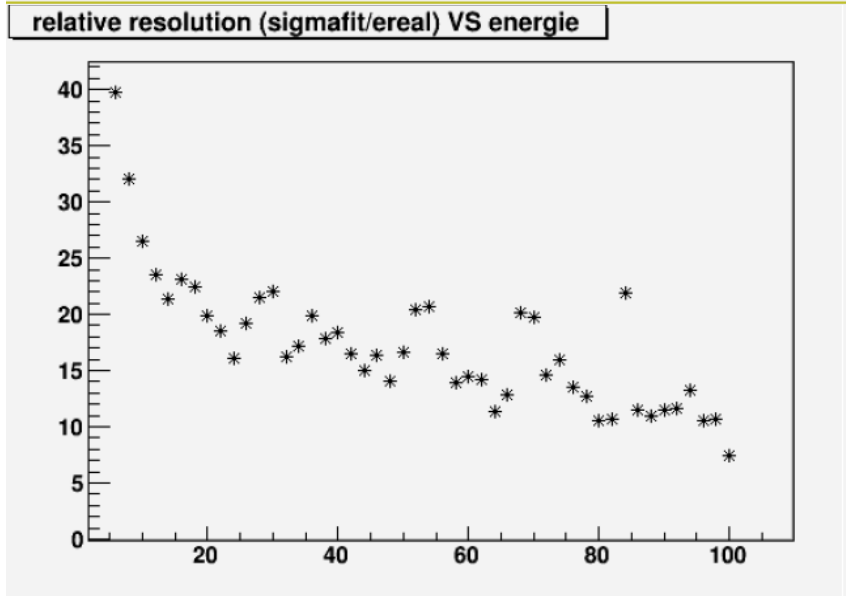
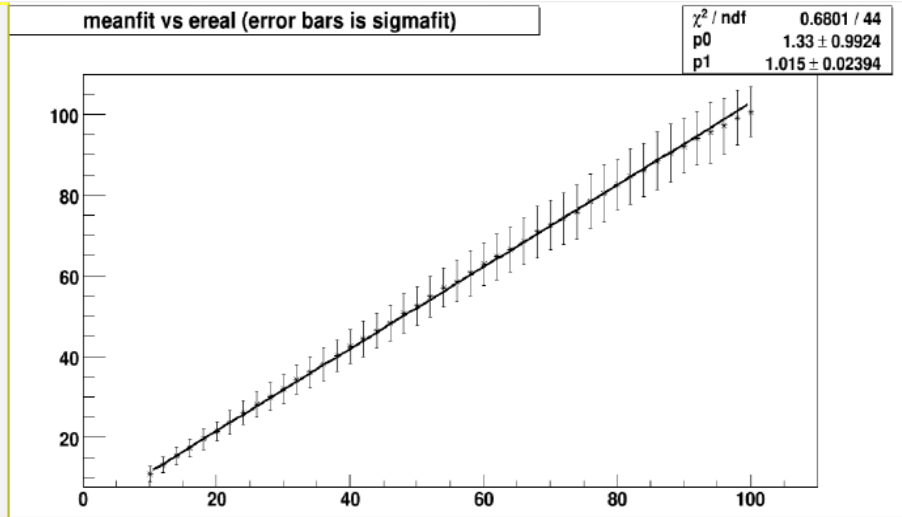
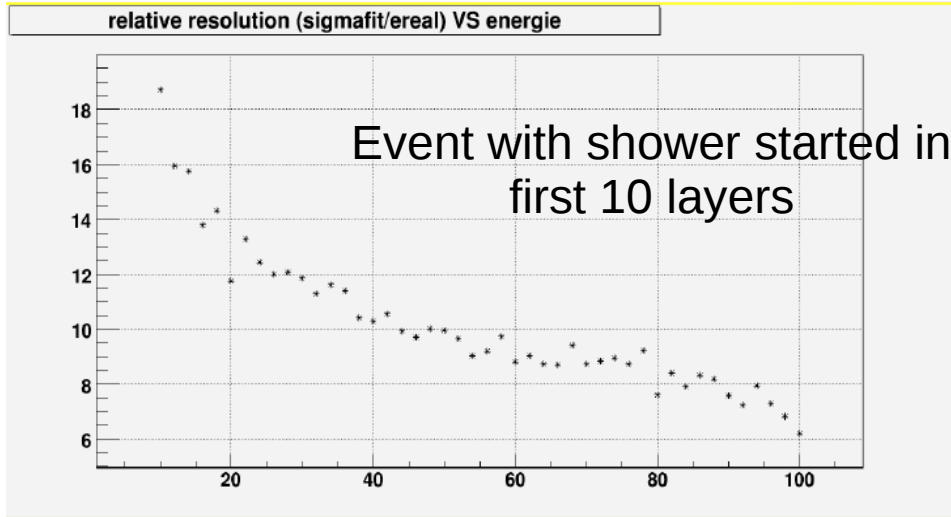
Preliminary!

360GeV uds event: performance of DHCAL and AHCAL are similar

- PandoraPFA has been test with ILD00\_Dhcal model.
  - Pandora clustering works well for both DHCAL and AHCAL
  - With preliminary digitization and tuning the calibration constant, for qqbar event at Z threshold, the performance is not so good as AHCAL; but much closed at 360GeV – ( *granularity is more powerful at higher energy* )
  - Parameter & orders of algorithms need also to be optimized

## To do

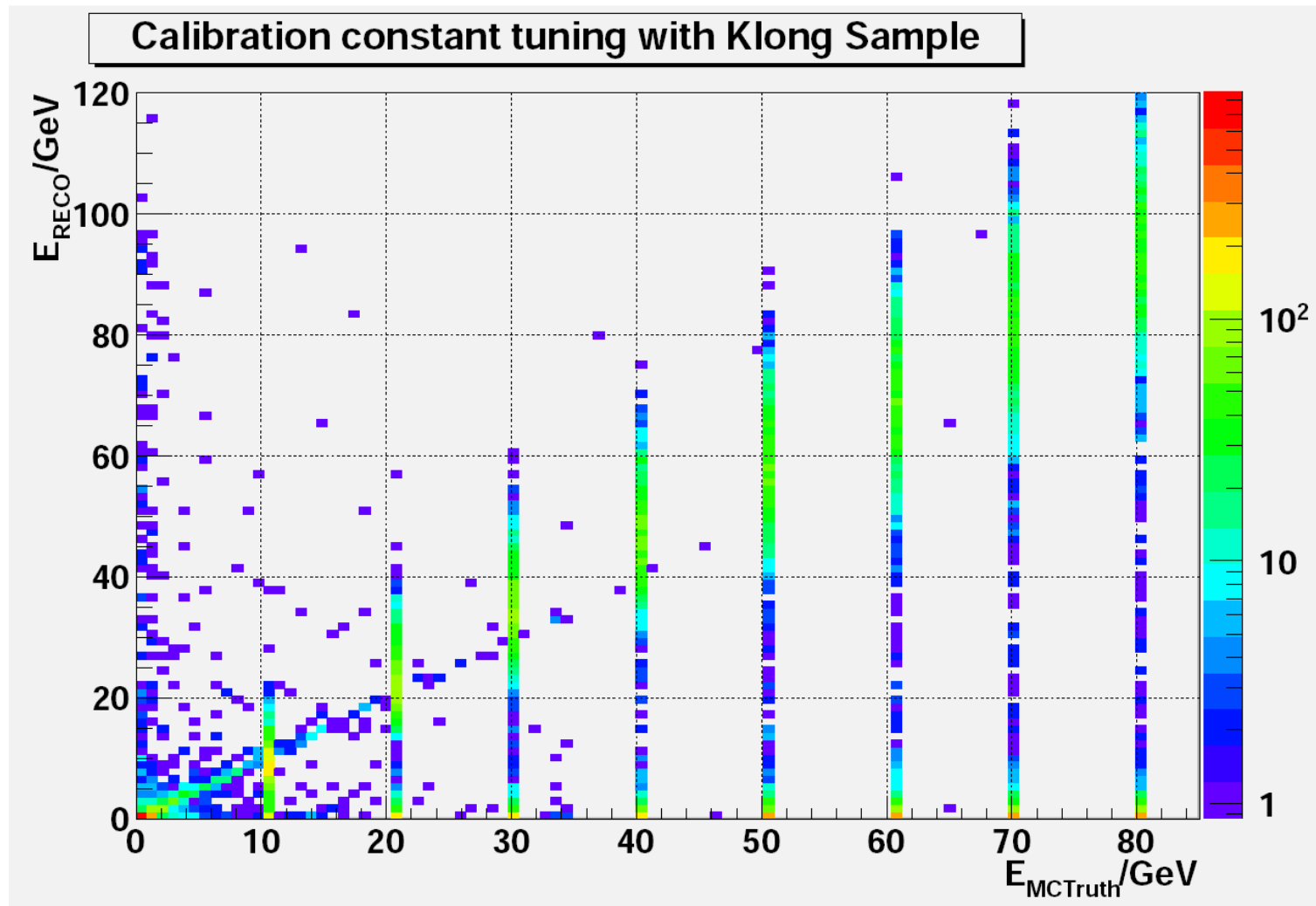
- Systematically study the performance with more samples
- Developing/Integrating better energy estimator of DHCAL hadronic cluster.



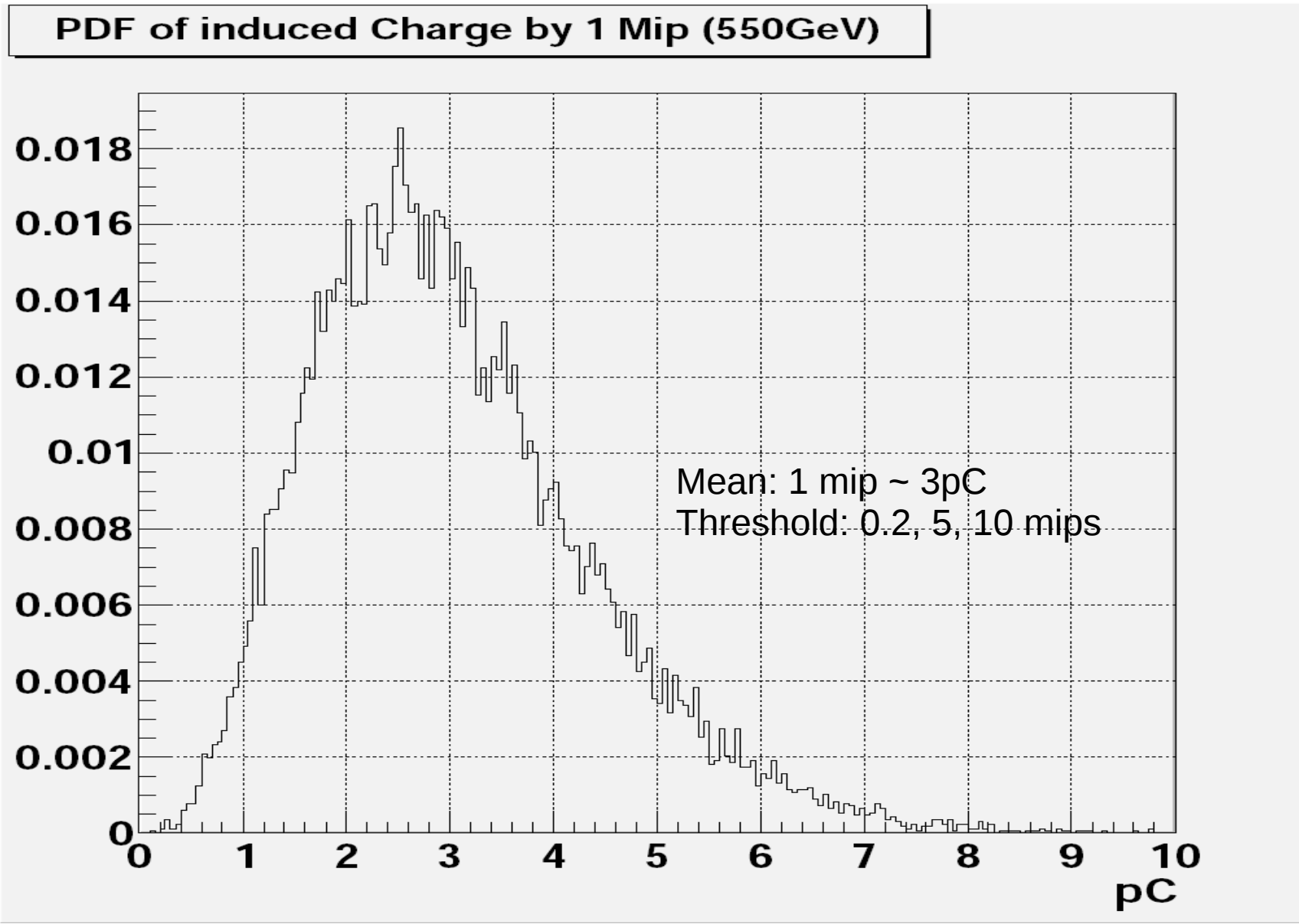
Yohan RICCI: Preliminary result of NN energy resolution for DHCAL.  
Improved for ~15% comparing to counting method.

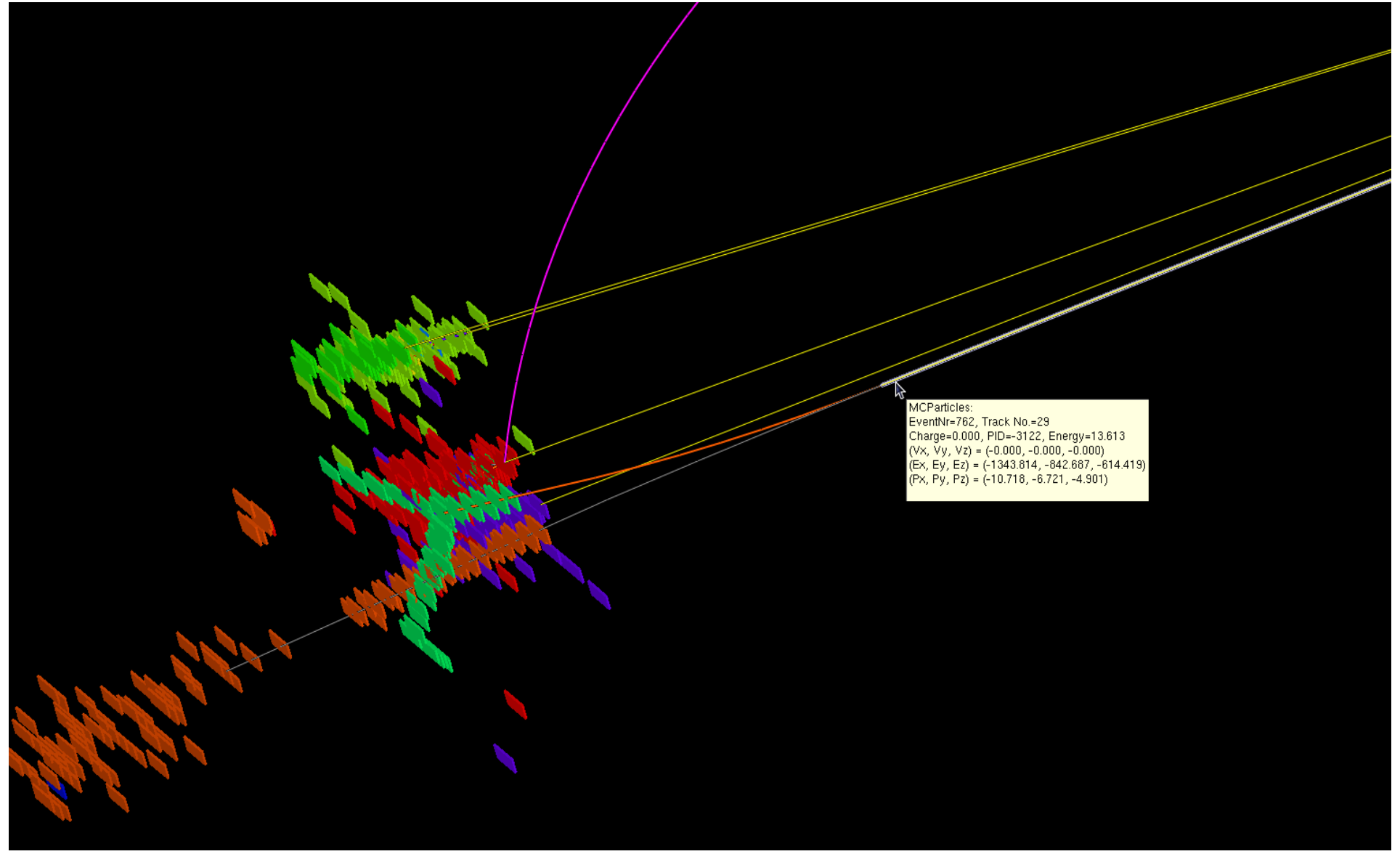


- Fix calibration constant with Klong/Pion samples. Increase a bit the calibration constant to correct the systematic ( $\sigma/E \sim 11\% @ 70\text{GeV}$ )



# Induced charge spectrum





Lambda pair generation: with back scattered pion