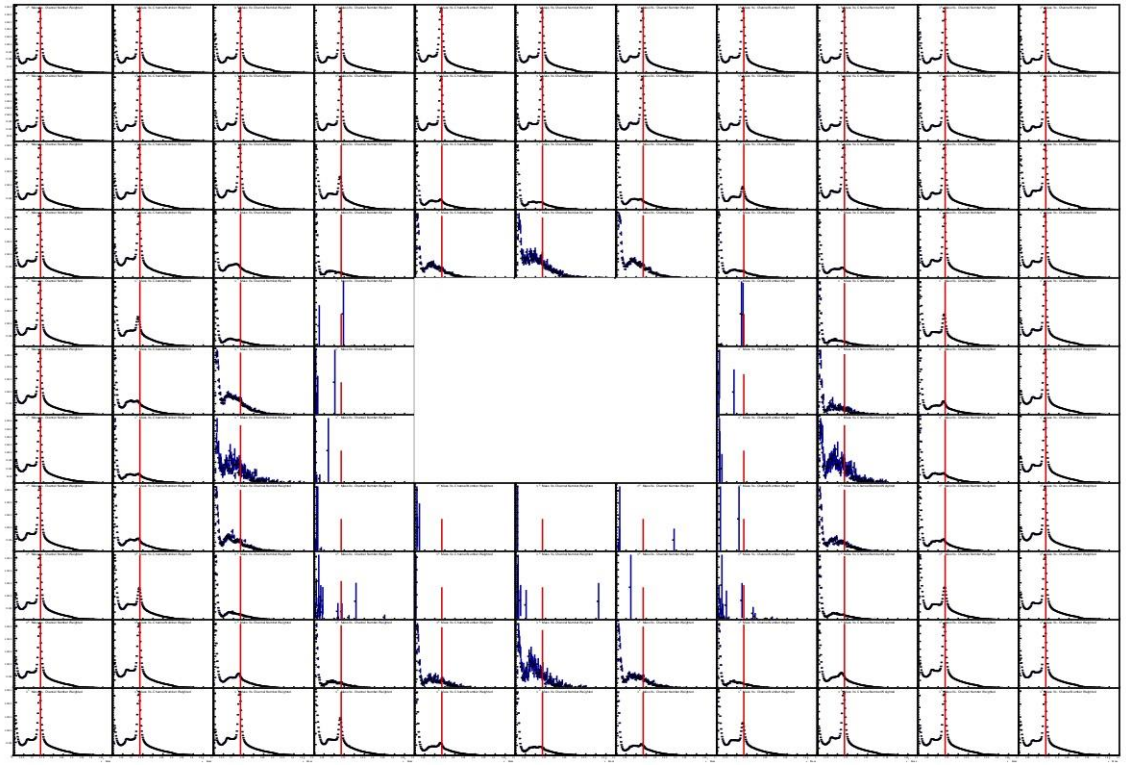
Checking FCAL status before PrimEx-D run

I. Larin, UMass Amherst, 11/16/2018

- The major concern has been triggered by prof. Shepherd report from 11/07/18 about FCAL central area response, which is crucial for Compton events

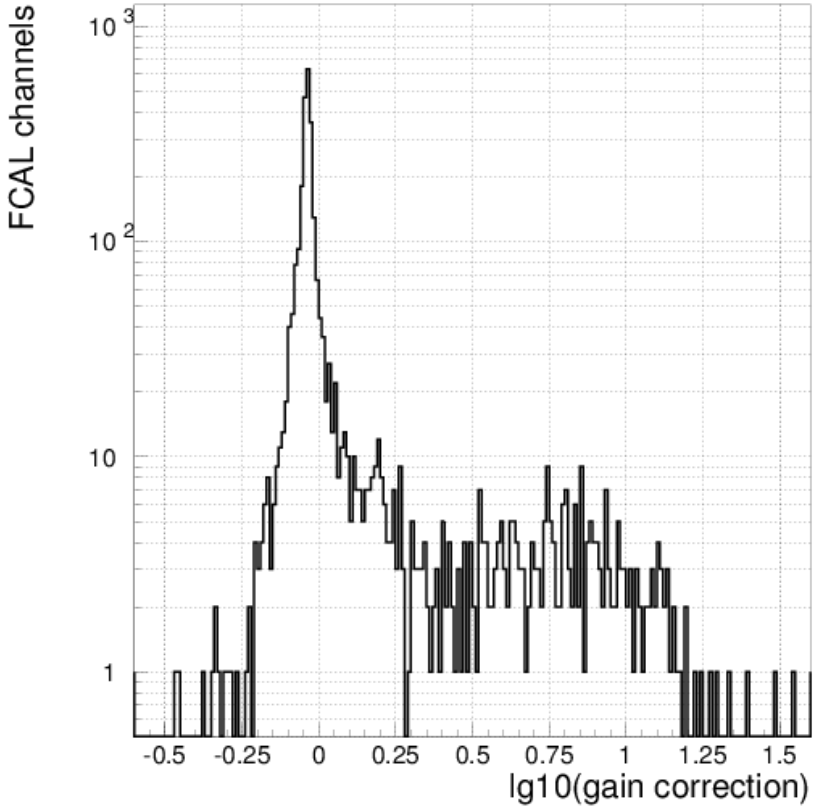


- Charge: to check FCAL performance and central modules status

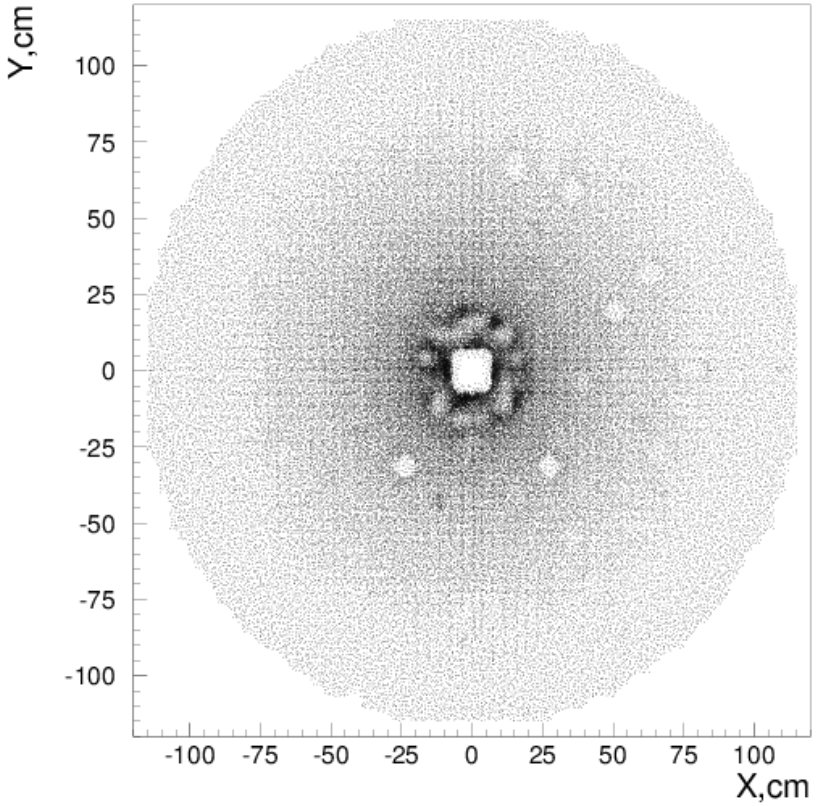
- DST from about 1.5B triggers (one day of running) has been written
- DST events have been analyzed with PrimEx reconstruction algorithm (not tuned, mind slightly different module sizes and possibly LG material, beam energy and distance to the target)
- Cluster separation part has not been tuned, angular correction has been applied based on HyCal data
- The whole FCAL has been calibrated with pi0 (4 iterations, then 1st look at linearity and overall non-linearity correction, then another 3 iterations)

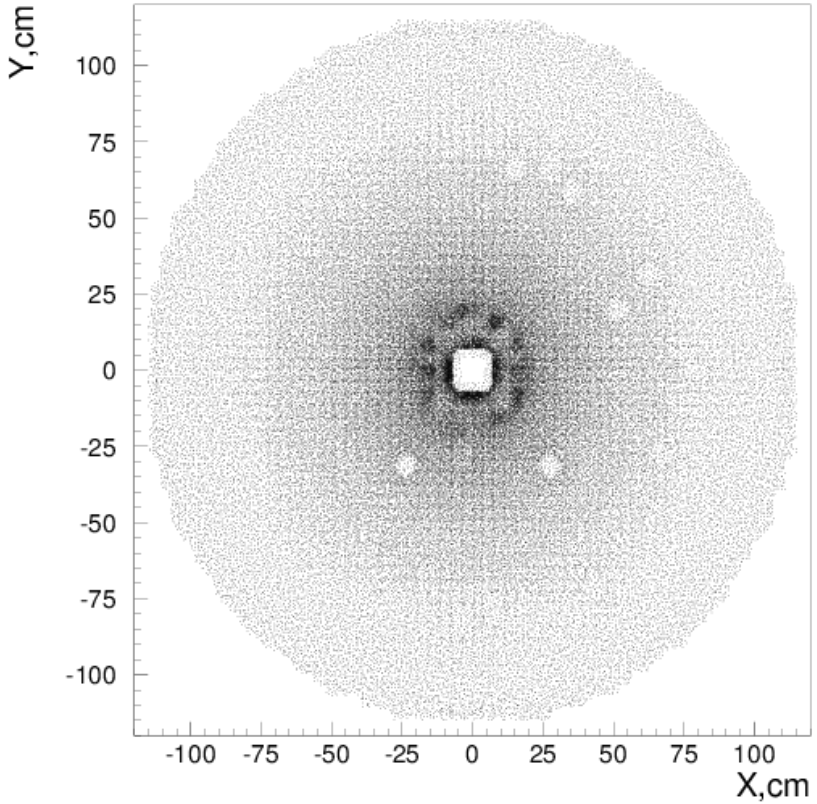
- Overall FCAL and HyCal algorithms give an agreement for most cases
- Central part calibration was off by +/-50% (moderate effect)
- Outer layers have been severely off (many modules off by factor of 2, 10 and more)
- Originally about 20 modules were found dead, but after calibration only about 10 dead channels left

FCAL gain (logarithm of) correction found:



FCAL occupancy before and after gain correction

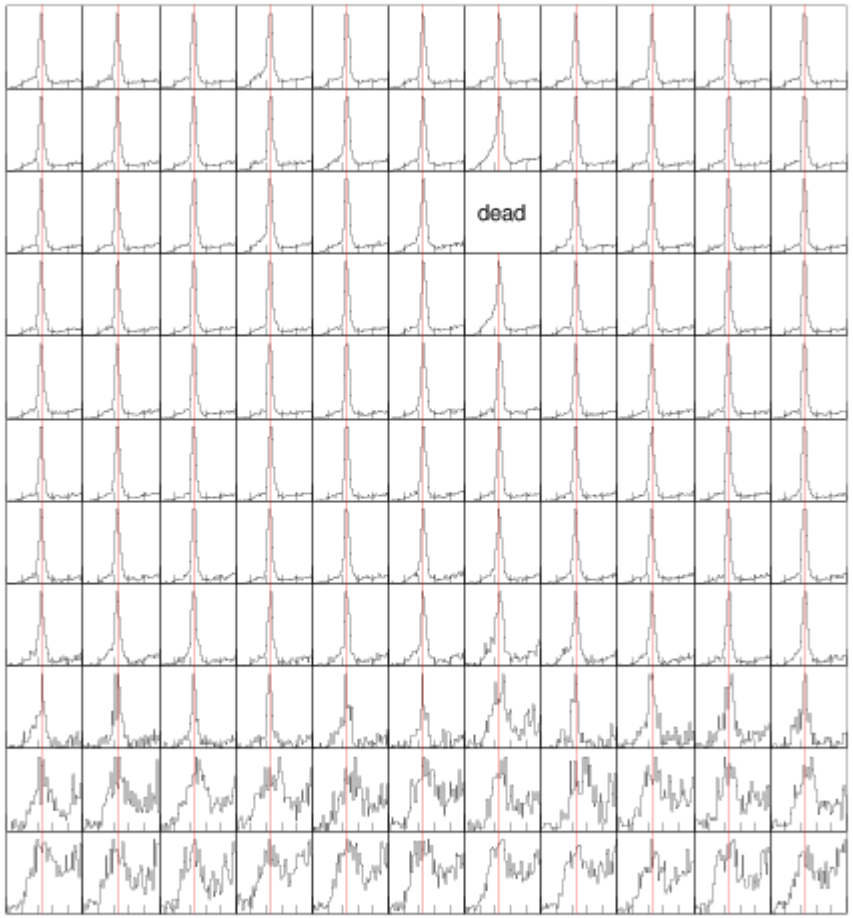




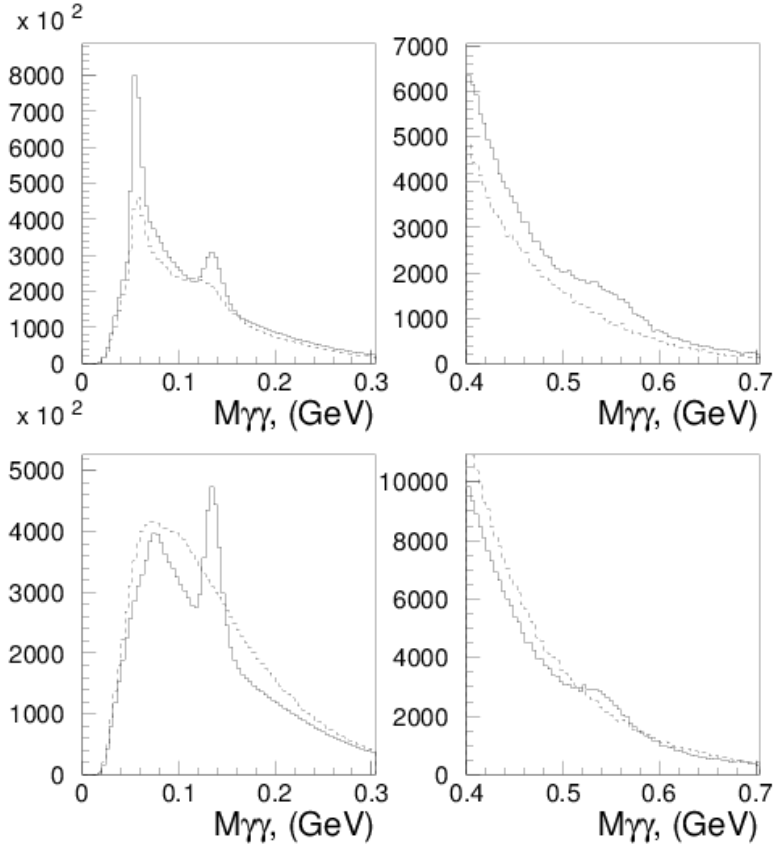
FCAL pi0 peak by module after calibration

Central area

Center of the bottom edge

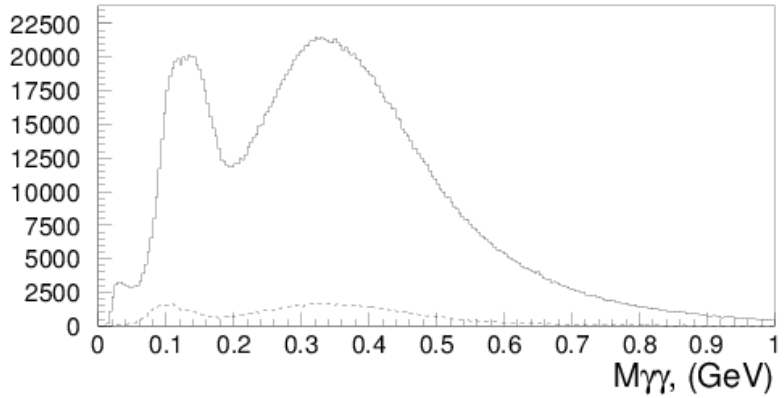


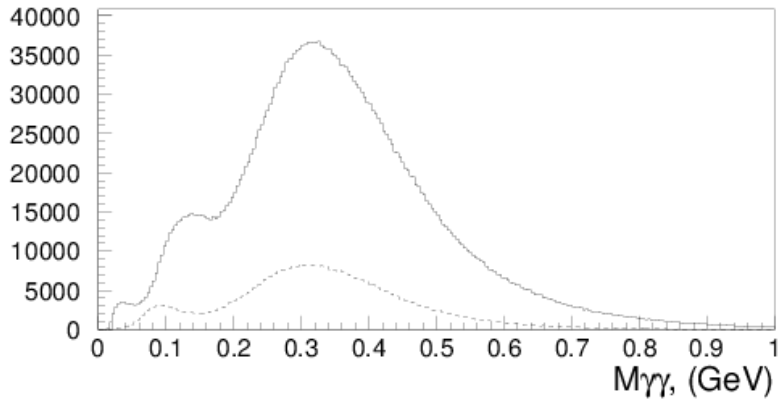
Pi0 and eta two gamma peaks before (dashed) after (solid) calibration



2nd inner layer

2nd outer layer

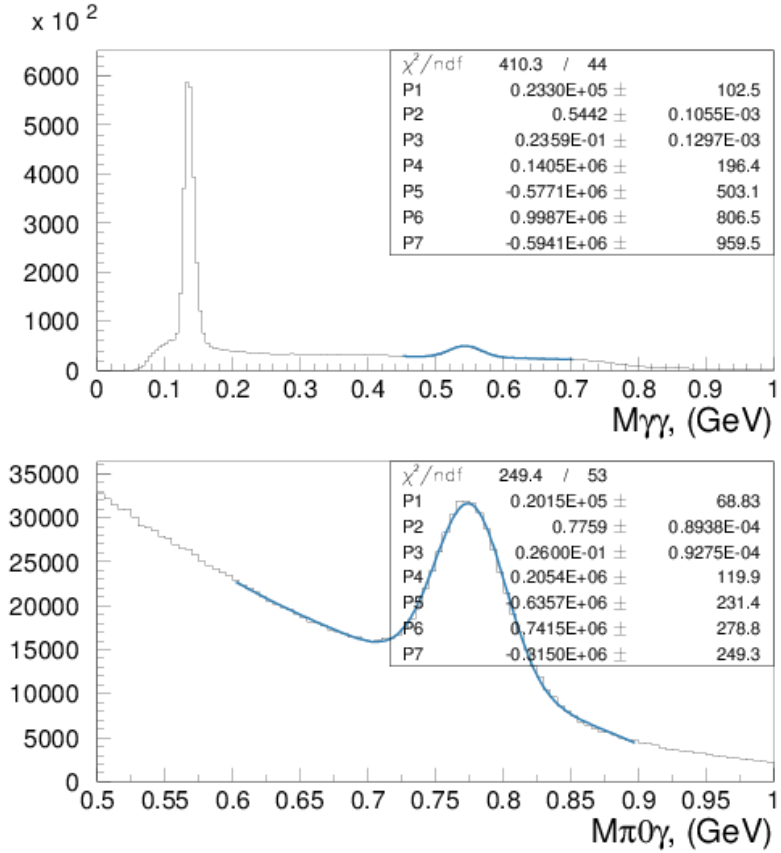


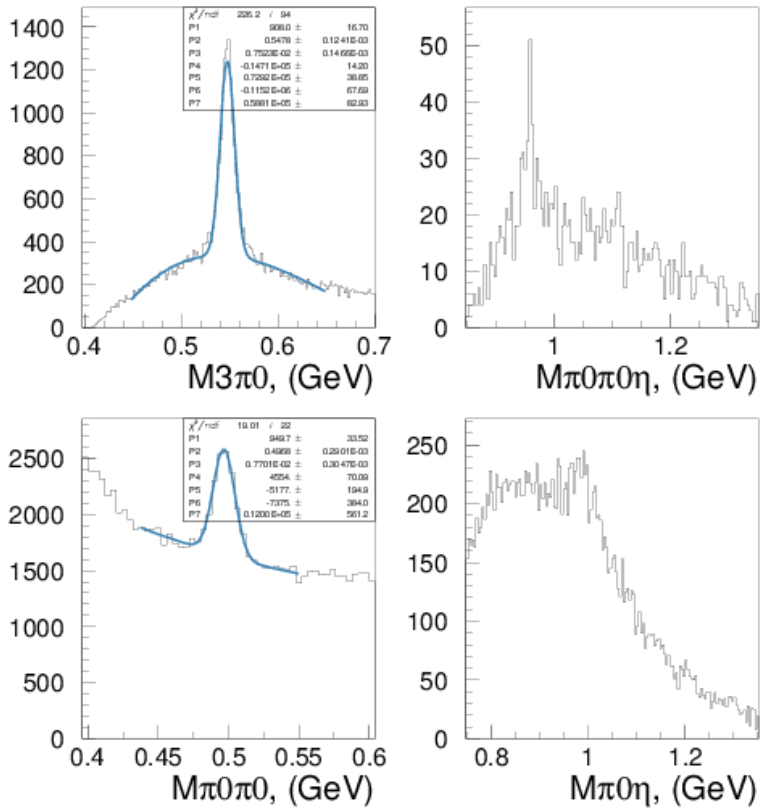


1st outer layer

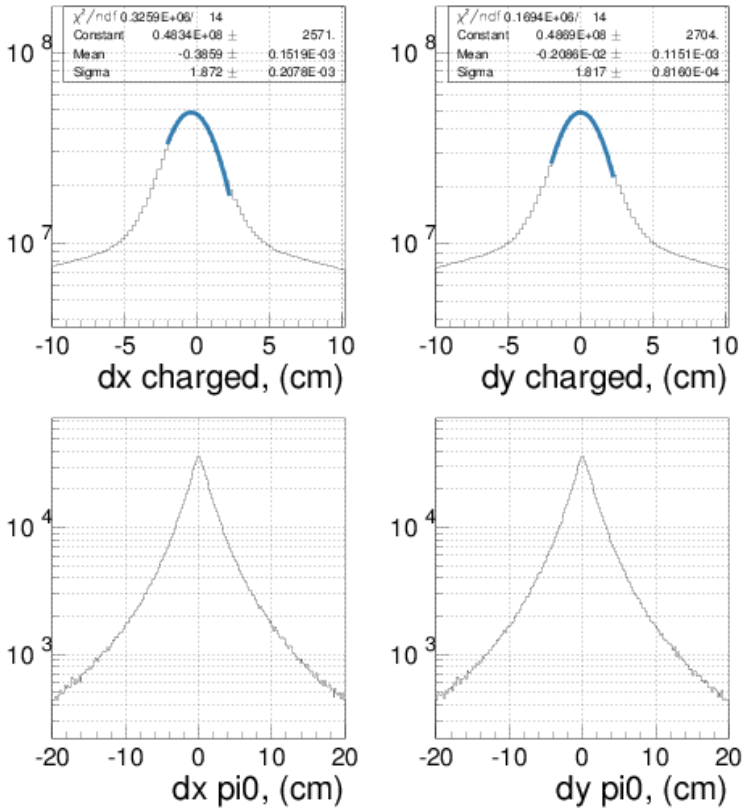
Mind the number of entries change

Other (multi) gamma states (with the corrected gains)





Alignment check with tracks and pi0s



Extrapolated to FCAL track distances to reconstructed cluster gives shift on x (~-4cm)
Alignment with pi0s shows about perfect match with FCAL center

1st Conclusions

- FCAL central area shows normal pi0 signal after calibration
- Both algorithms gives close results for most cases
- FCAL survey data and LG material are needed for further work
- Transferred algorithm needs a lot of tuning work (both with data and MC), especially for cluster separation part
- Tracking alignment is showing small offset (magnetic field orientation, field map,…?)
- I would appreciate the chance to use gluexproj account to submit jobs on farm