

FCAL Calibration Strategy

- Two leading order items to calibrate: time offsets and gain factors for each channel
- Global alignment: ignore for now
- Time offsets are HV dependent; HV will change with gain balancing
 - two-cluster resolution already good ≈ 5 ns
- Key focus: gain calibration (followed by subsequent hardware gain balancing)

Parallel Strategies

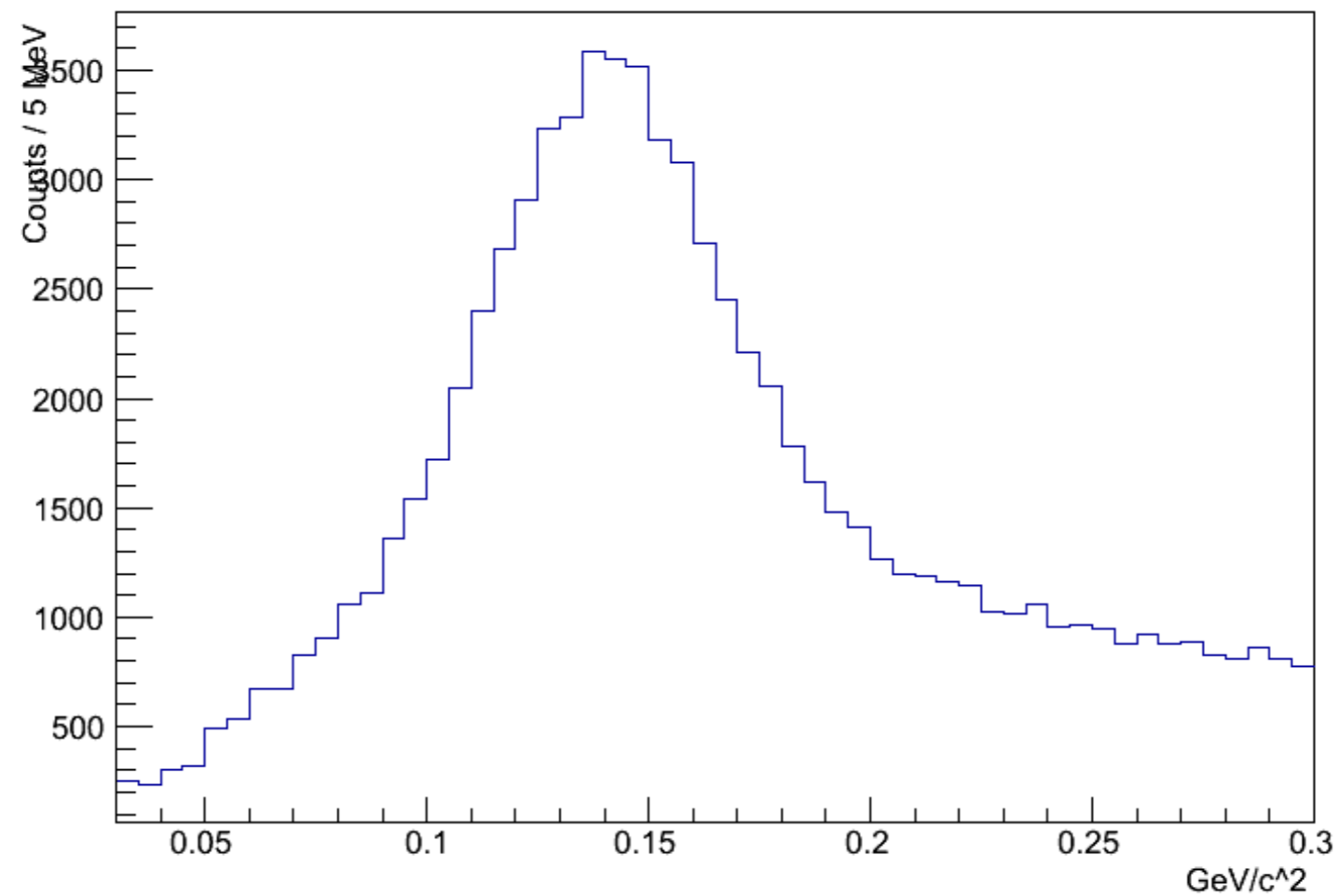
- Minimize width of π^0 using technique implemented in RadPhi (Jon)
 - latches onto statistical fluctuations in background
- Use the fact that $E/p = 1$ for electrons
 - code written by Matt, but having trouble finding electrons (again) in the two-track skim — bug or skim criteria?
- Use the LED monitoring system under the assumption that the response should be smooth (Adesh and Manuel)
 - promising initial results: need to feed back into reconstruction and use π^0 width (or E/p) as a metric

π^0 Skim

(2-track skim; run > 1770)

Before Gain Calibrations

Reconstructed Pi0 Mass (post-cuts)

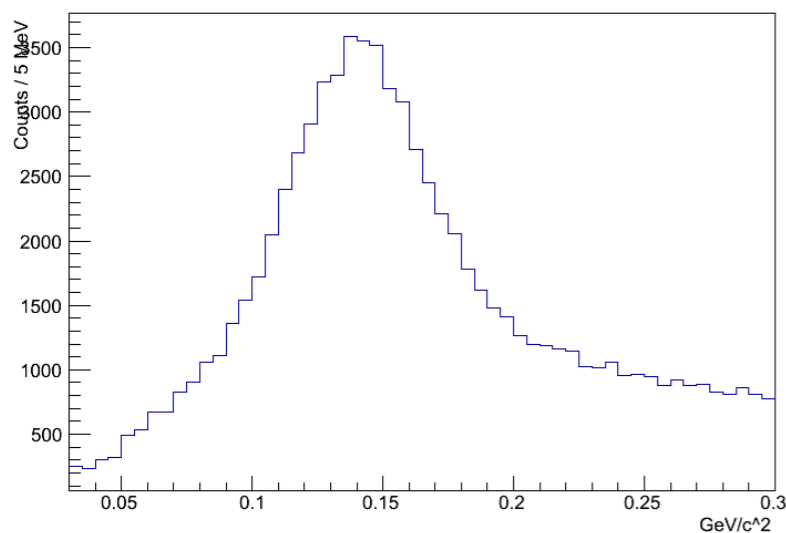


Iterative Adjustment of Gain Factors

Region of minimization: 100 MeV - 190 MeV

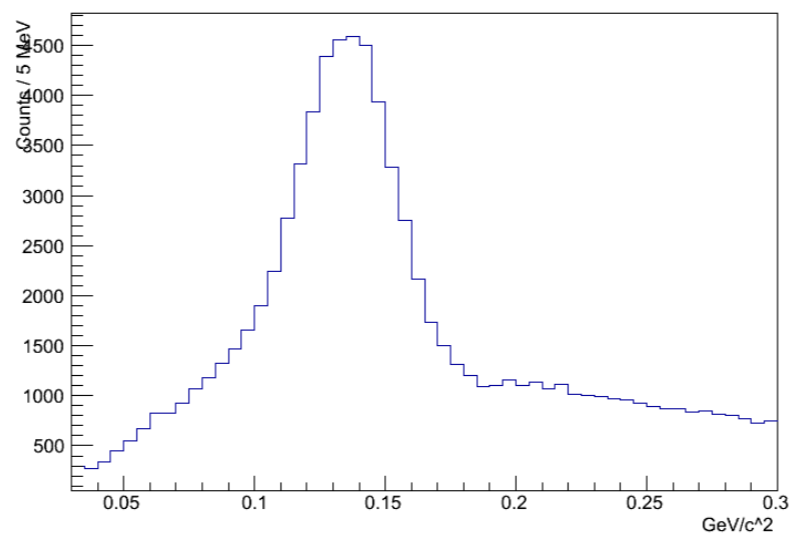
No Gain Balancing

Reconstructed Pi0 Mass (post-cuts)



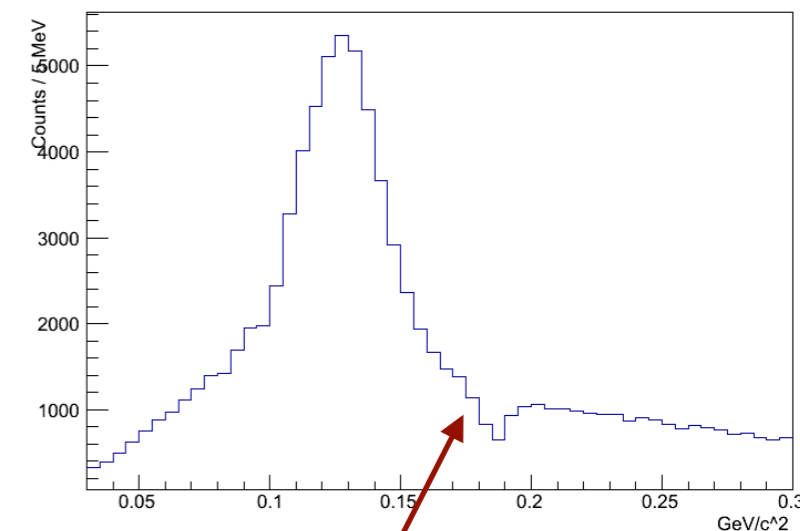
After First Iteration

Reconstructed Pi0 Mass (post-cuts)



After Convergence

Reconstructed Pi0 Mass (post-cuts)

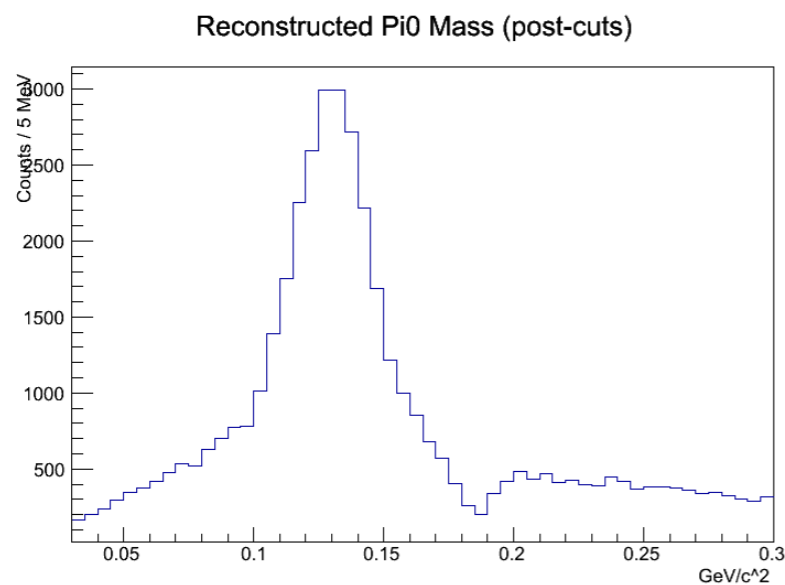


minimizing width
of background near
the upper edge of
the region

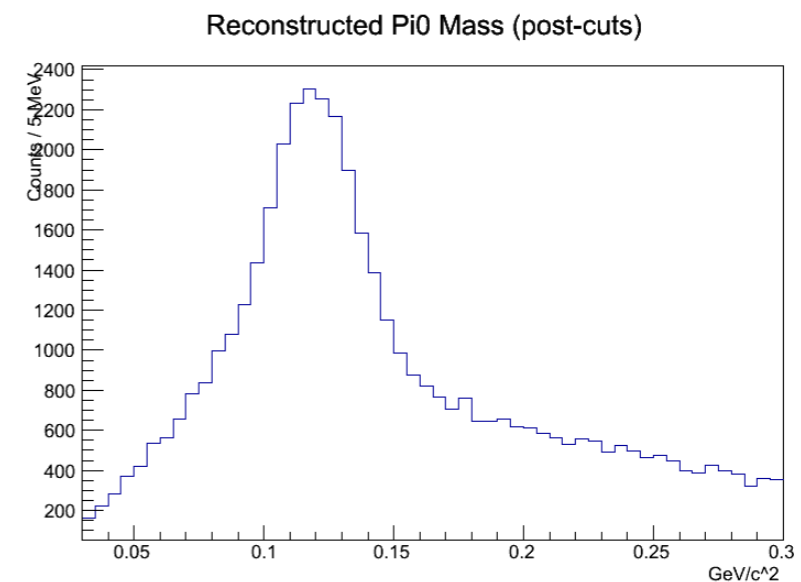
Divide Sample in Half: use one for calibration and one for “analysis”

Test with two statistically independent samples confirm tuning to statistical fluctuations in background and making “proper” gain adjustments to signal.

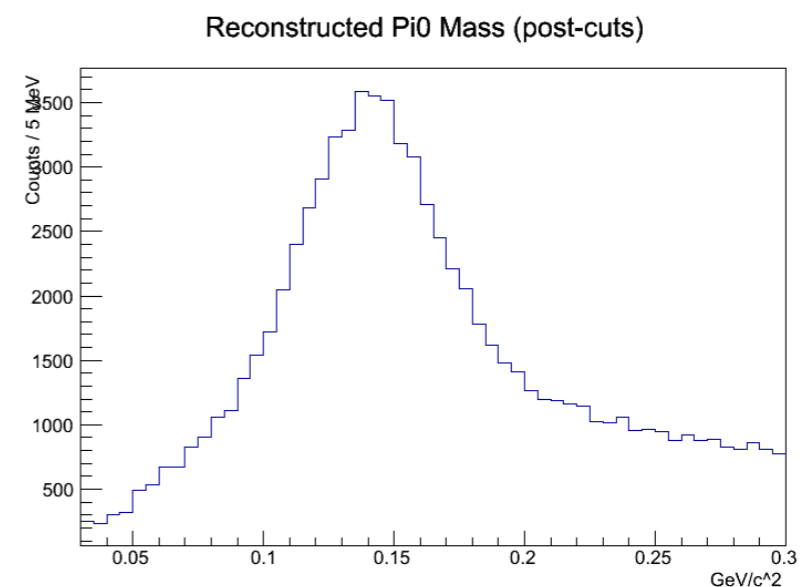
Used for gain factors
(post-convergence)



Half not used for gain factors



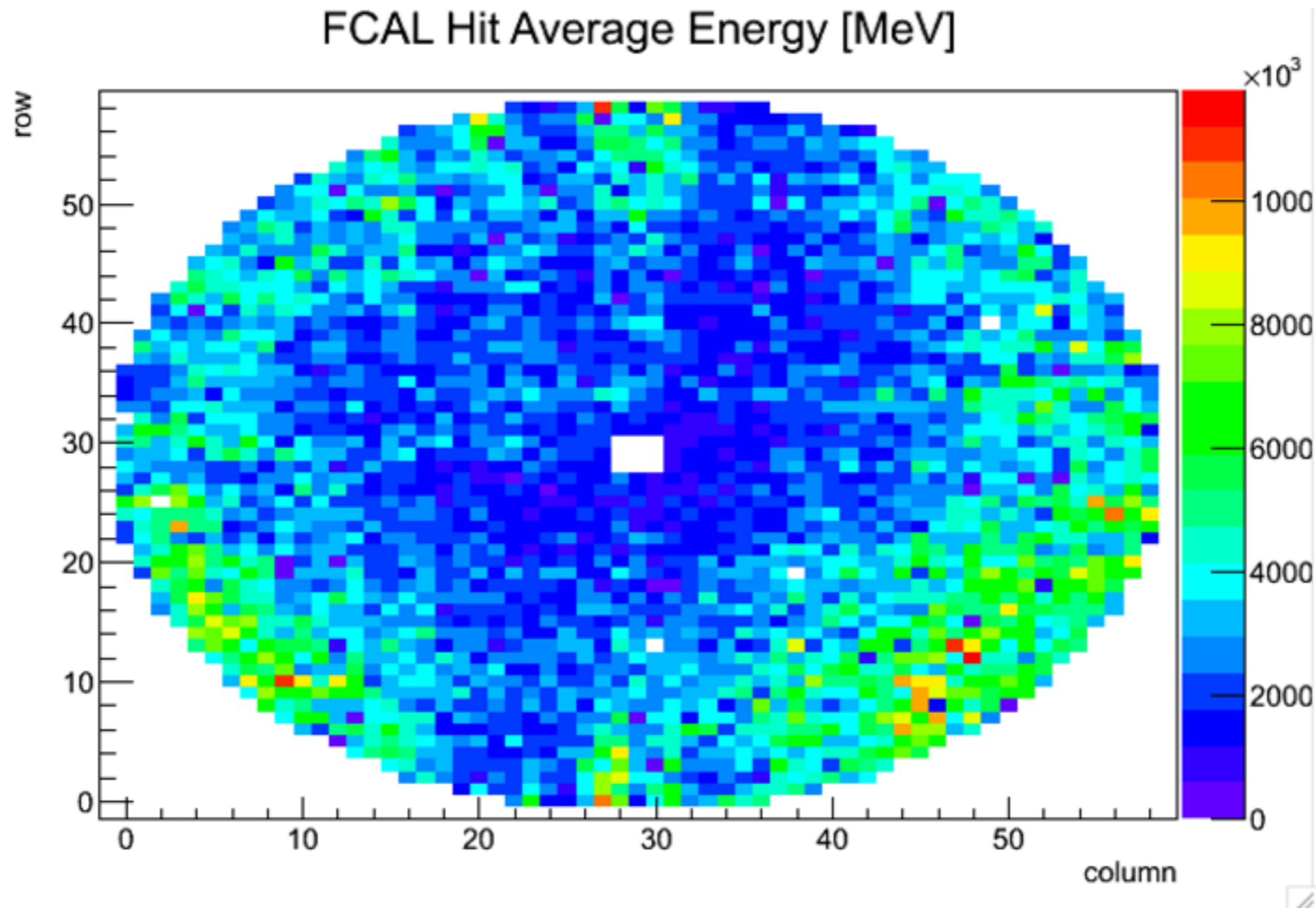
No Gain Balancing



π^0 Width Technique

- Need:
 - More statistics
 - minimize ability of the algorithm to latch onto statistical fluctuations in the background
 - Or Better purity
 - minimize probability that a channel's gain will be set by how it behaves when used in background events
 - working on trying to quantify each of these
- May be able to enhance purity by using a different technique to determine the gains of elements

Using the LED Monitoring System



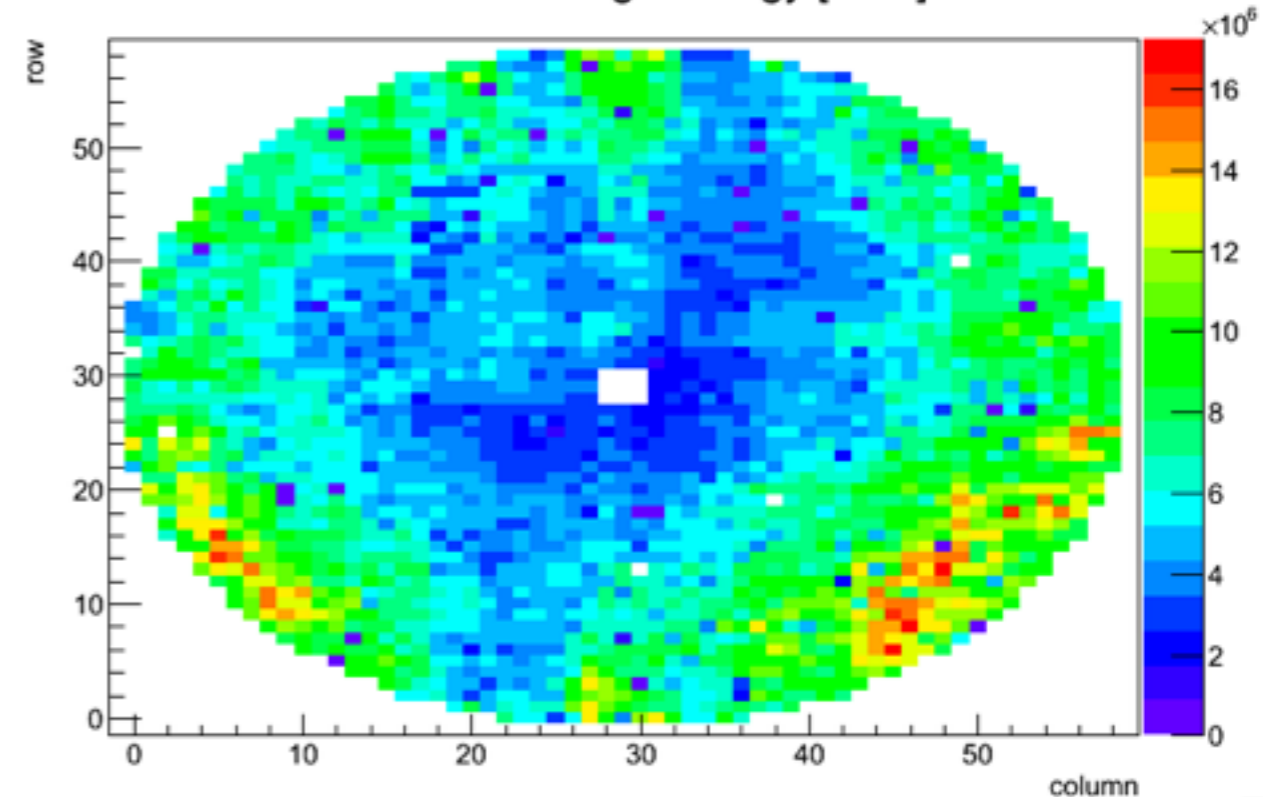
We know the light output of the monitoring system is likely smooth but not constant. Introduce gain factors to minimize local fluctuations.

How to Smooth?

- The best methods we have developed set the expected value of the light intensity equal to the average of the
 - 8 surrounding blocks
 - 24 surrounding blocks
- or one or the other above and iterating n times
 - optimal n is not yet determined
 - large n is not optimal

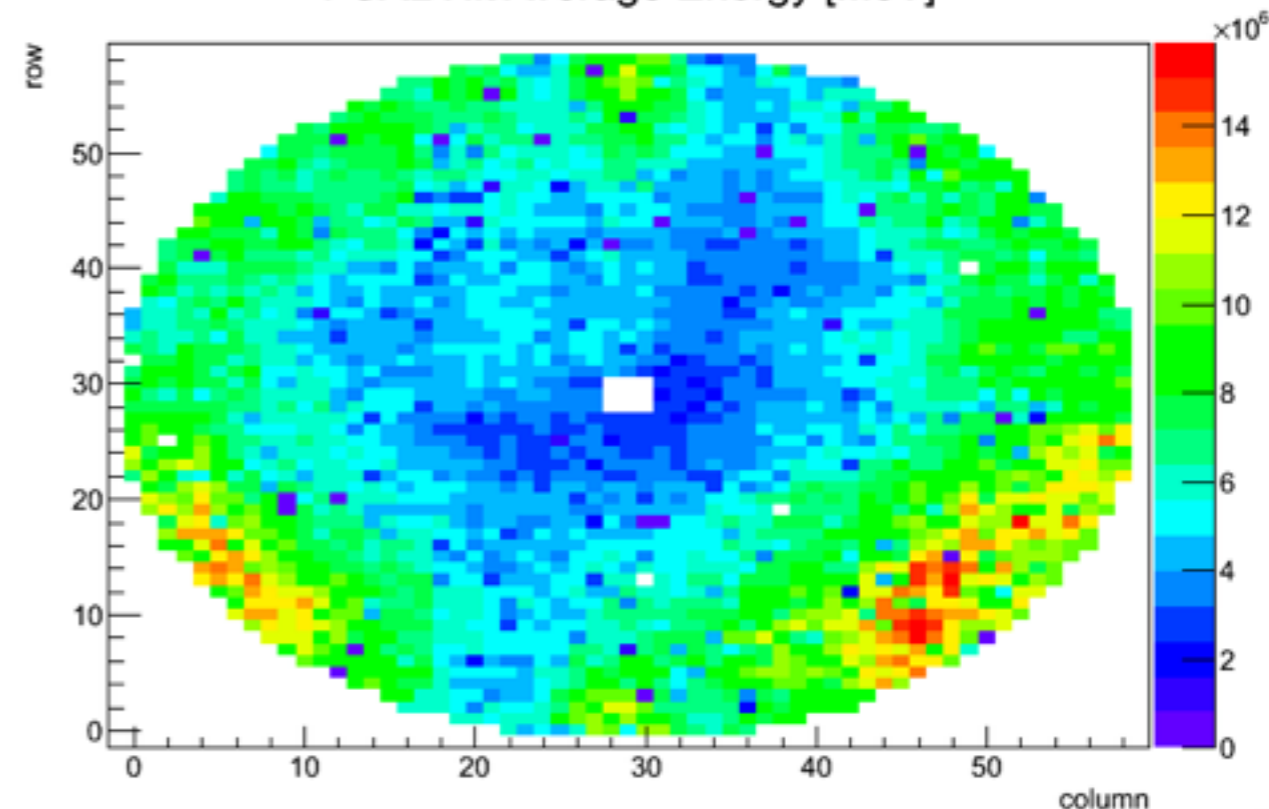
1 iteration averaging 8

FCAL Hit Average Energy [MeV]

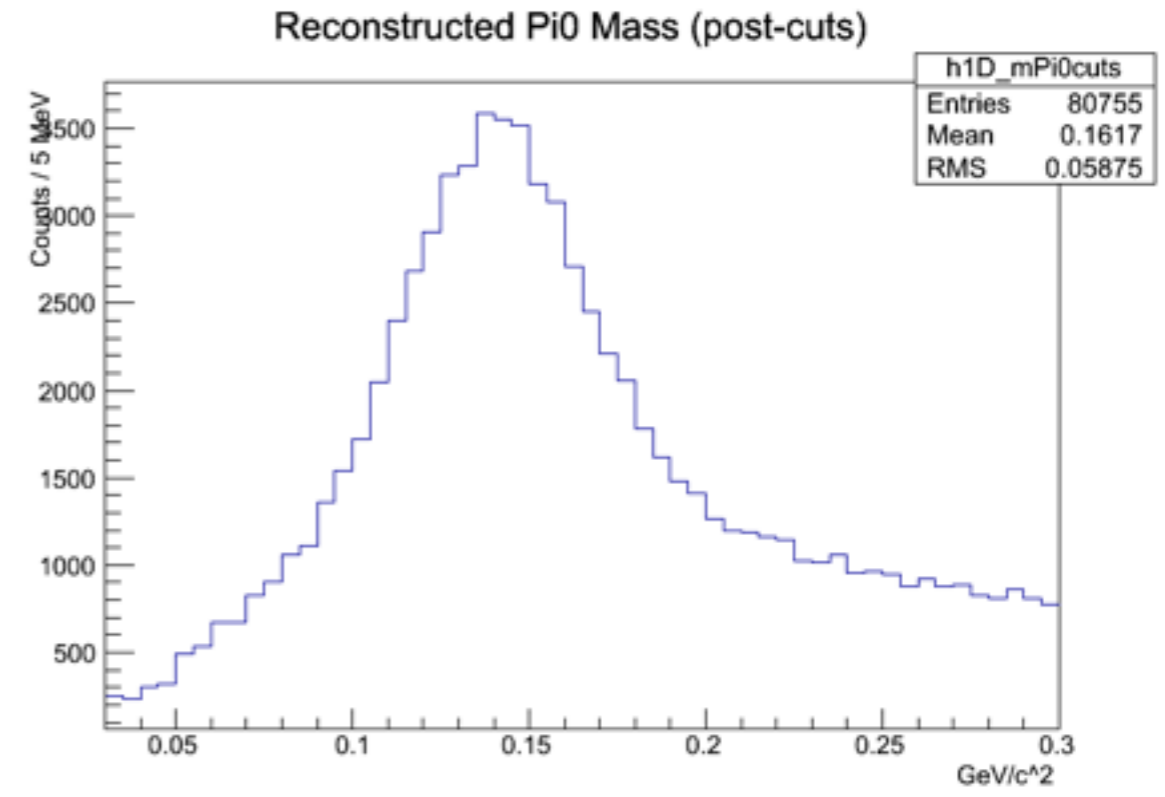
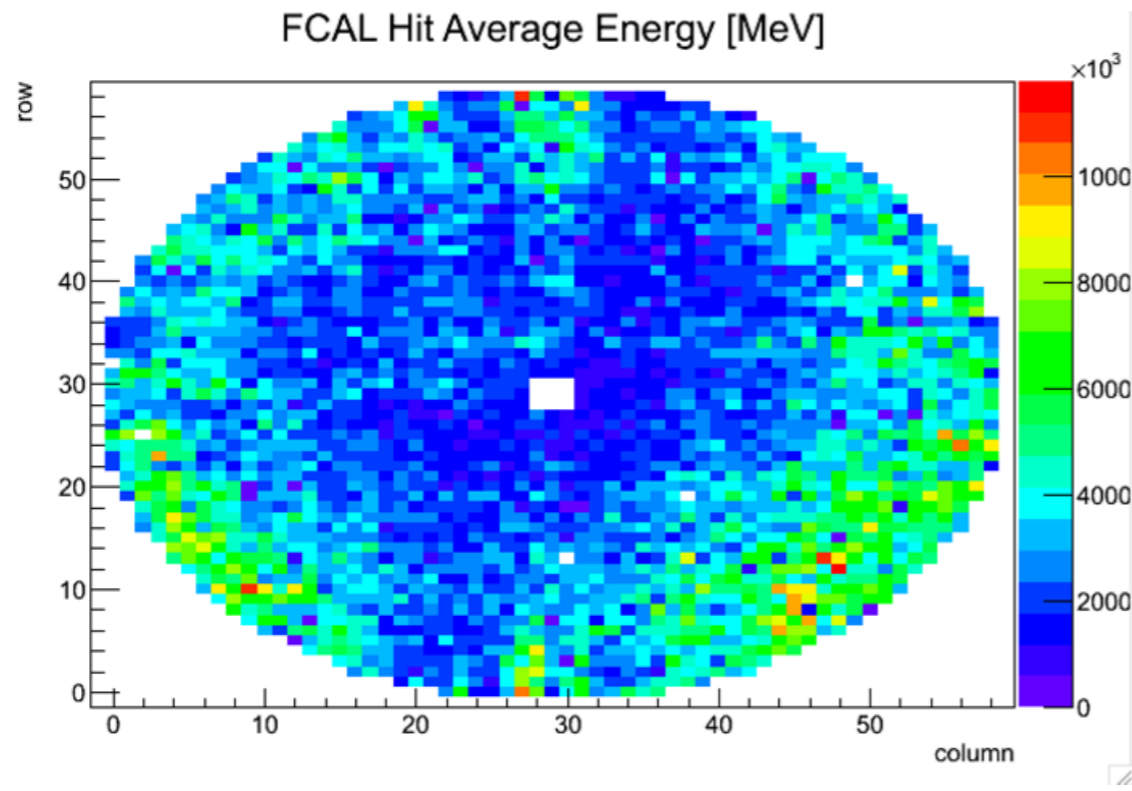


1 iteration averaging 24

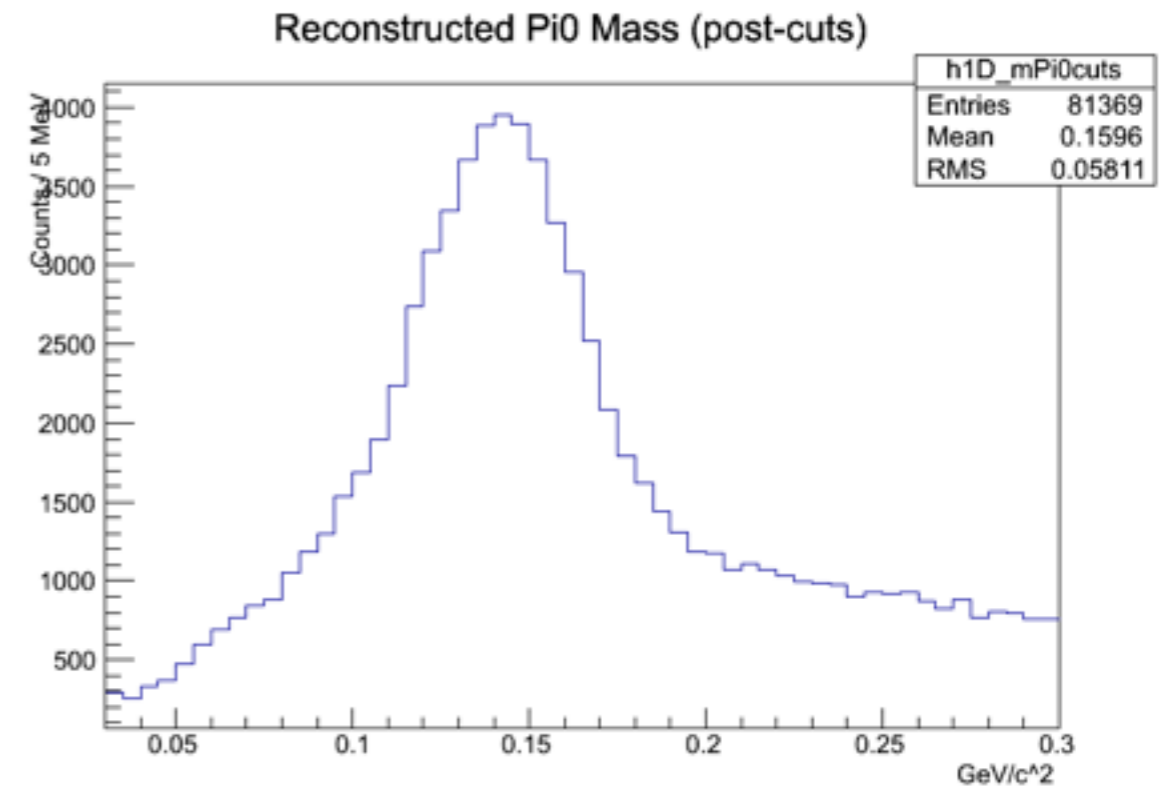
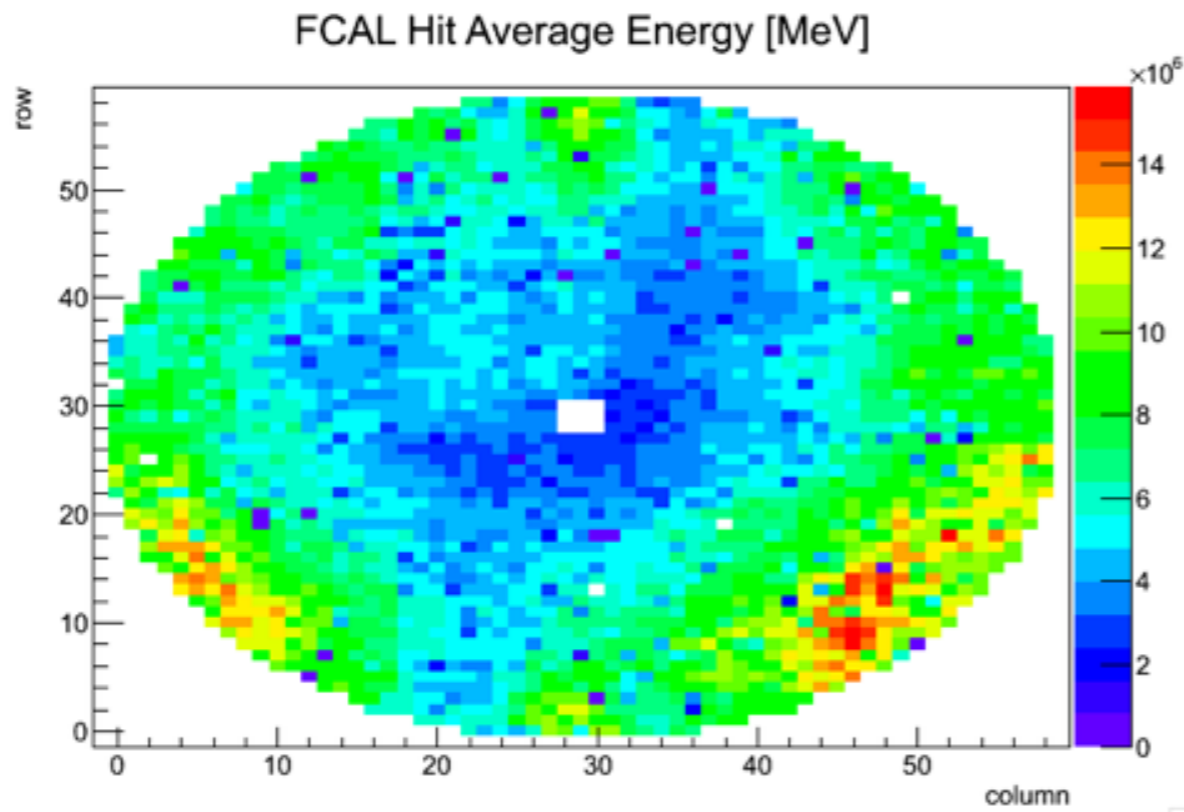
FCAL Hit Average Energy [MeV]



Initial Response



Smoothing
24 block Average



(Caution: z scales are different/arbitrary)

Summary

- FCAL gain calibration is top FCAL calibration priority
- RadPhi proven and GlueX-MC-tested technique using π^0 's is turning out to be challenging
 - more statistics would be extremely beneficial — need to quantify this
- We can use the monitoring system to do some initial gain smoothing that would help enhance the purity of the π^0 sample