



Simulation Statistics

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Outline

Investigating the energy resolution of pions detected by the calorimeter combination CEMC + HCALIN + HCALOUT. The Magnetic Field is **switched OFF** to study low energy pions that are otherwise deflected.

Simulation Parameters

- Particle: π^-
- Events: 150,000 π^- (100,000 \rightarrow 0-30 GeV/c, 50,000 \rightarrow 0-3 GeV/c)
- Pseudorapidity (η): -0.96 to 0.92
- Azimuth (Φ): $-\pi$ to π

Cuts:

- Detector-wise η cuts, intersection for combinations
- Detector-wise Elliptical cuts in $d\phi$ vs $d\theta$ plots
- Energy cut of 100 MeV on aggregate tower energy
- Theta-parametrized energy cut on individual towers of EMCs*

*The muon simulations which were used to obtain the MIP-characterization equations had magnetic field ON

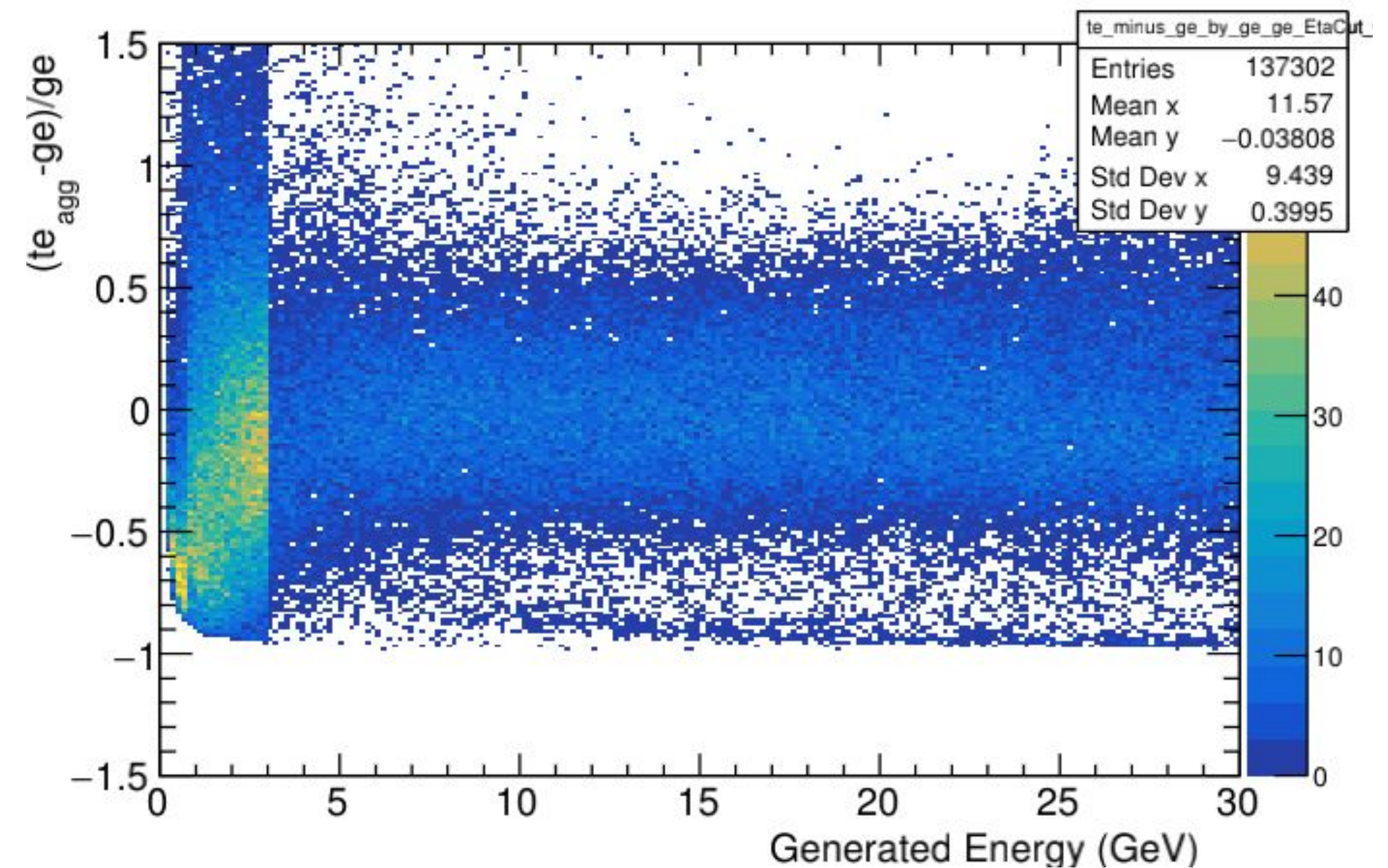
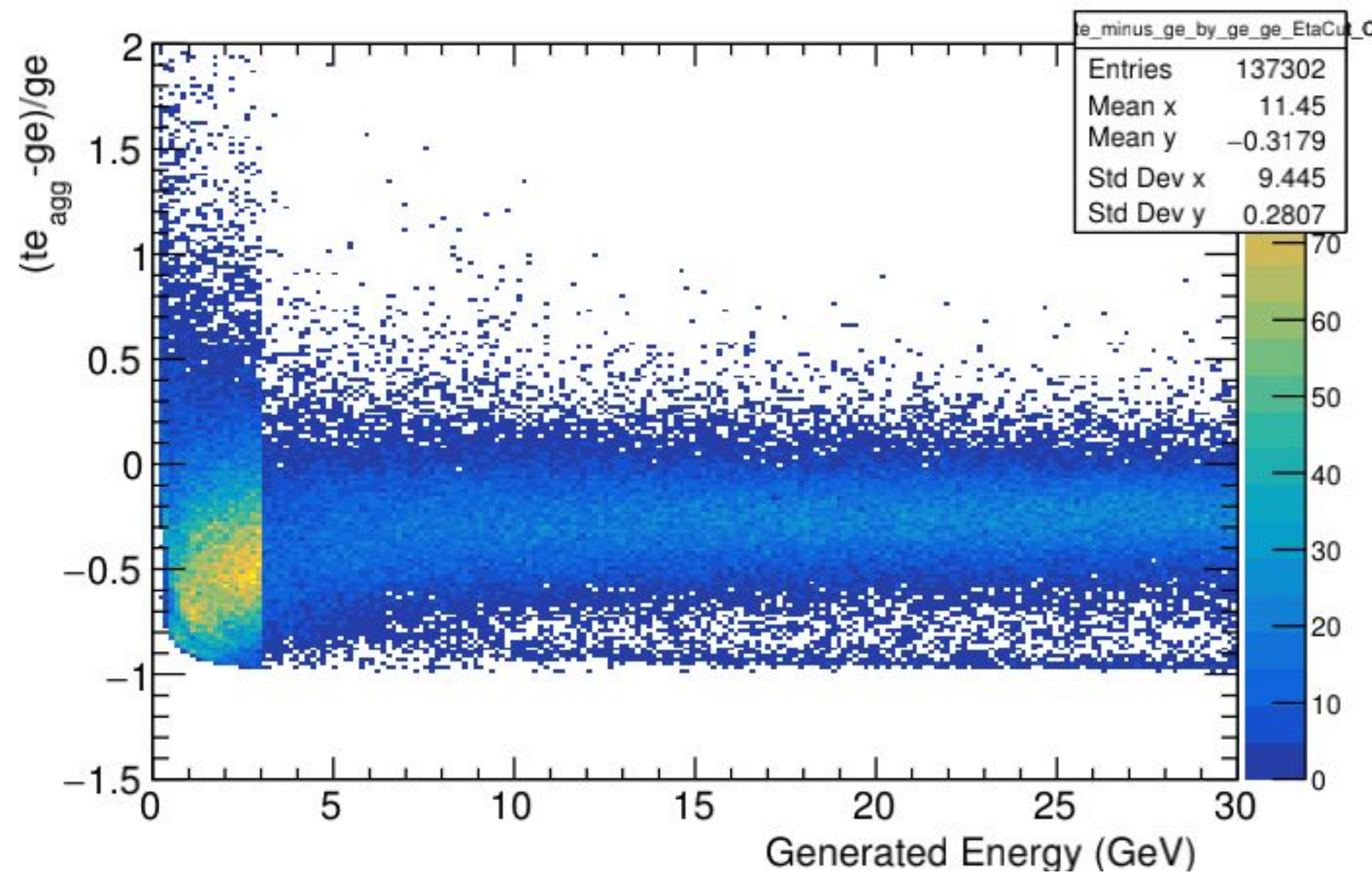
A teal geometric graphic consisting of several overlapping triangles and quadrilaterals, creating a shield-like shape with a pointed bottom.

CEMC + HCALIN + HCALOUT (pi⁻)

CEMC + HCALIN + HCALOUT (π^-)

Explicit η cut: -0.96 to 0.92
 Elliptical Cut for Manual Clustering
 gtheta-parametrized Energy Cut on Individual EMC Towers
 100 MeV Aggregate Energy Cut

After calibration



$$(te_{agg} \rightarrow \sum(\text{weight} * te / \text{calibrationFactor}) / \text{mean}(\sum(\text{weight} * te / \text{calibrationFactor}))$$

calibrationFactor(ge) = mean(te/ge) ; detector-wise; function of ge

weight = mean(te/ge) ; detector-wise; independent of ge

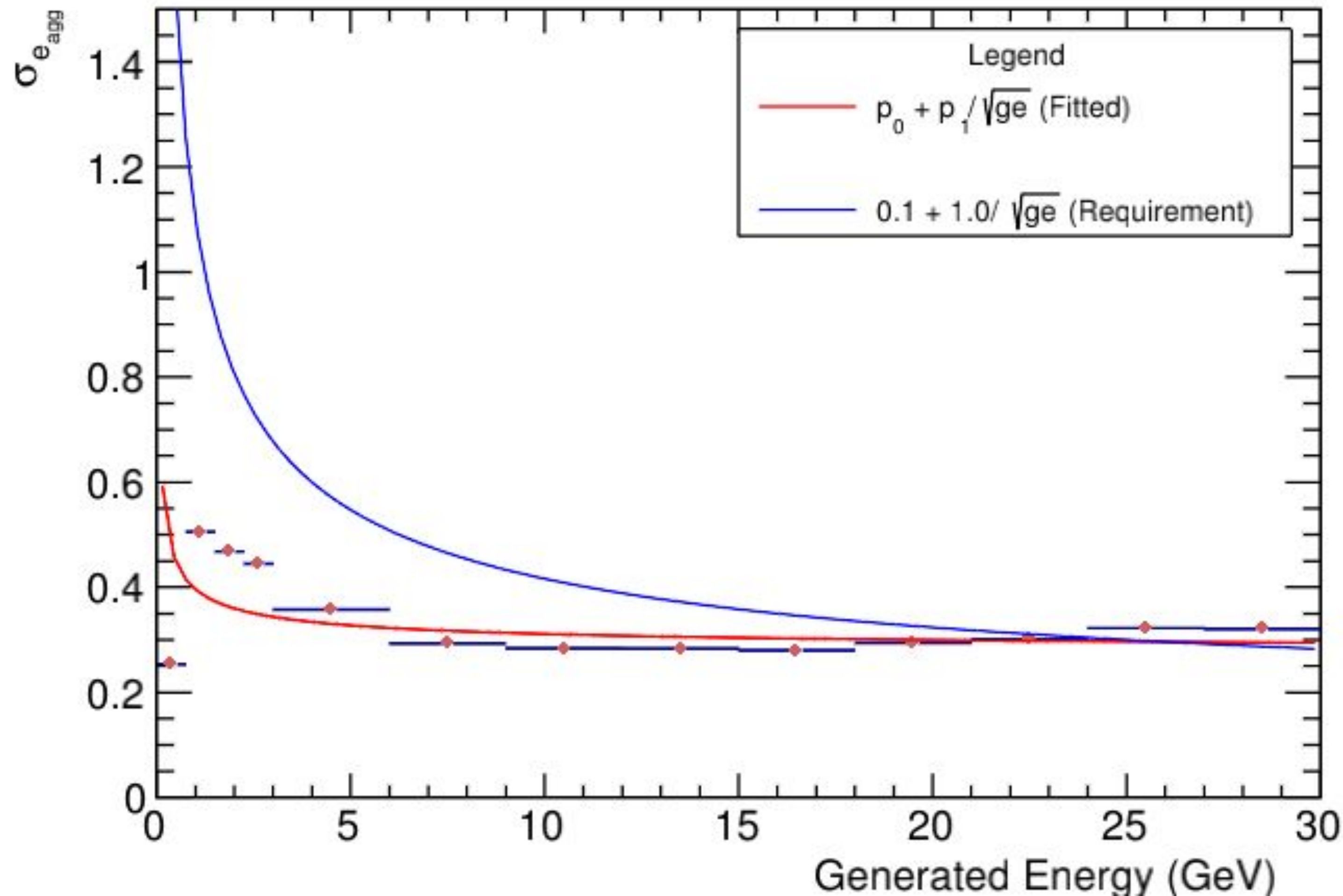
CEMC + HCALIN + HCALOUT (π^-)

Explicit η cut: -0.96 to 0.92

Elliptical Cut for Manual Clustering

gtheta-parametrized Energy Cut on Individual EMC Towers

100 MeV Aggregate Energy Cut



σ_e refers to the standard deviation of the Gaussian fitted to a slice of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

Number of bins = 13

Bin Width = 0.75 GeV

3.0 GeV

$ge \in [0,3)$

$ge \in [3,30]$

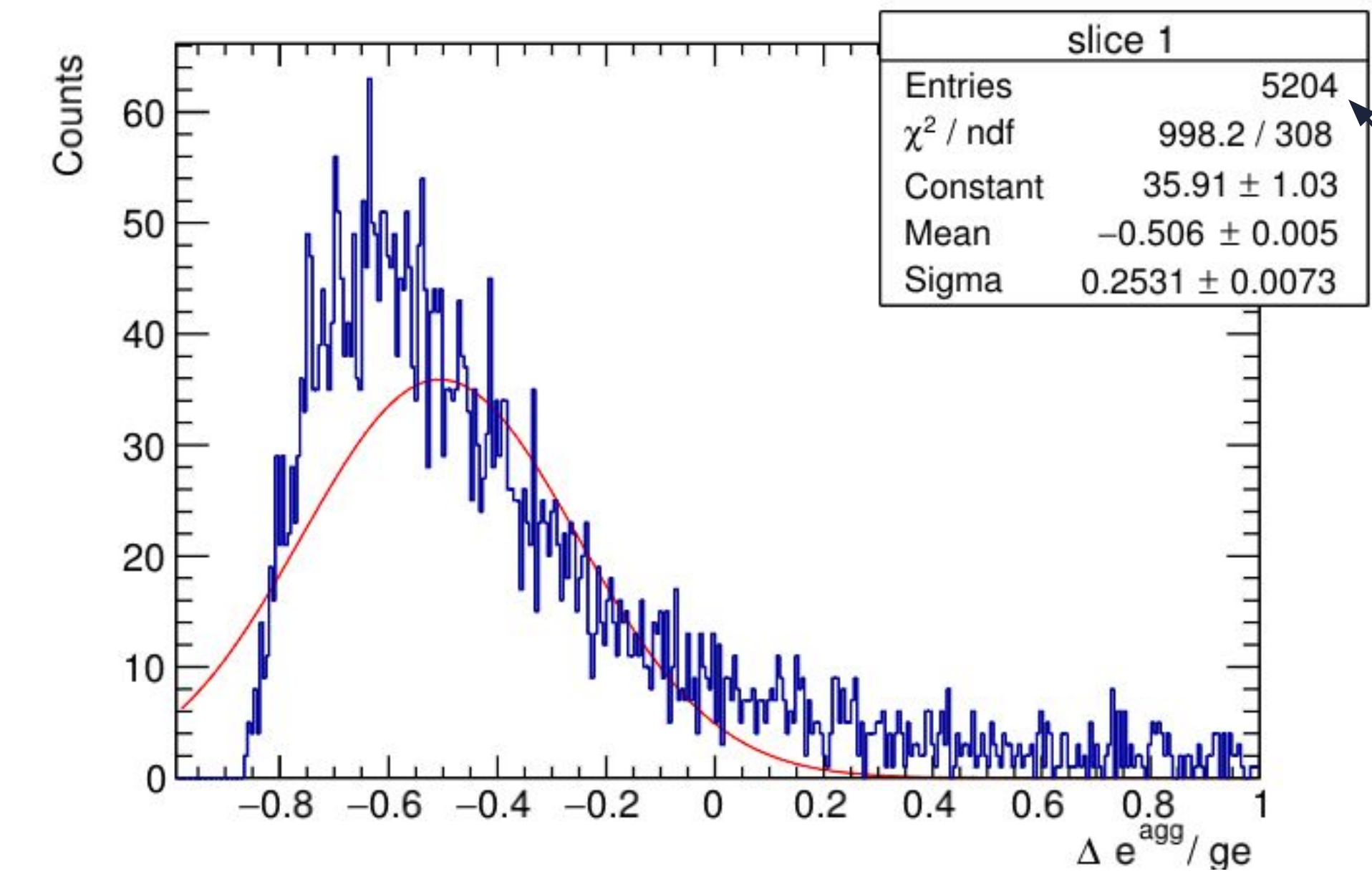
Fit Parameters:

$p_0 = (0.271899 \pm 0.00145082)$

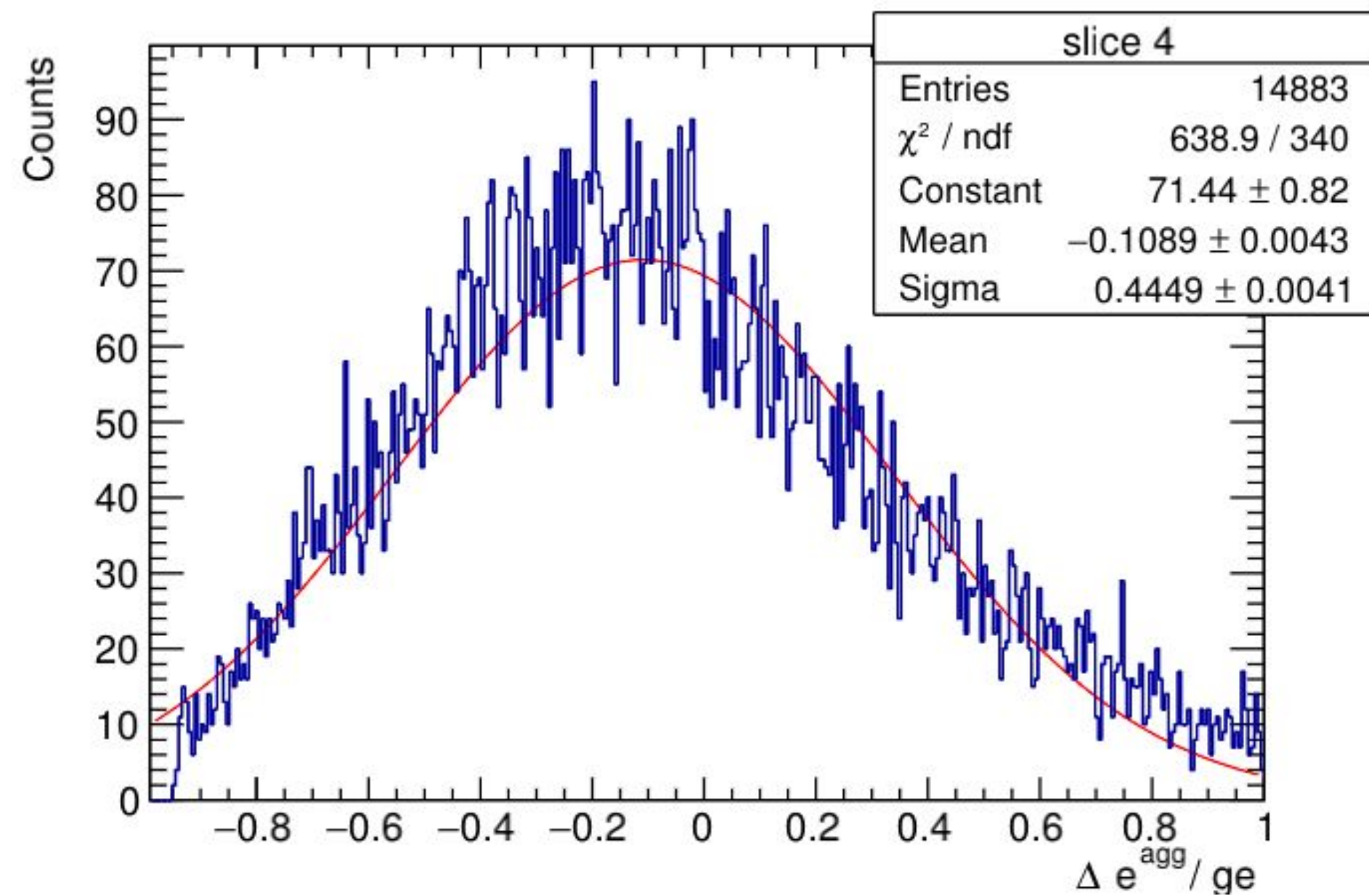
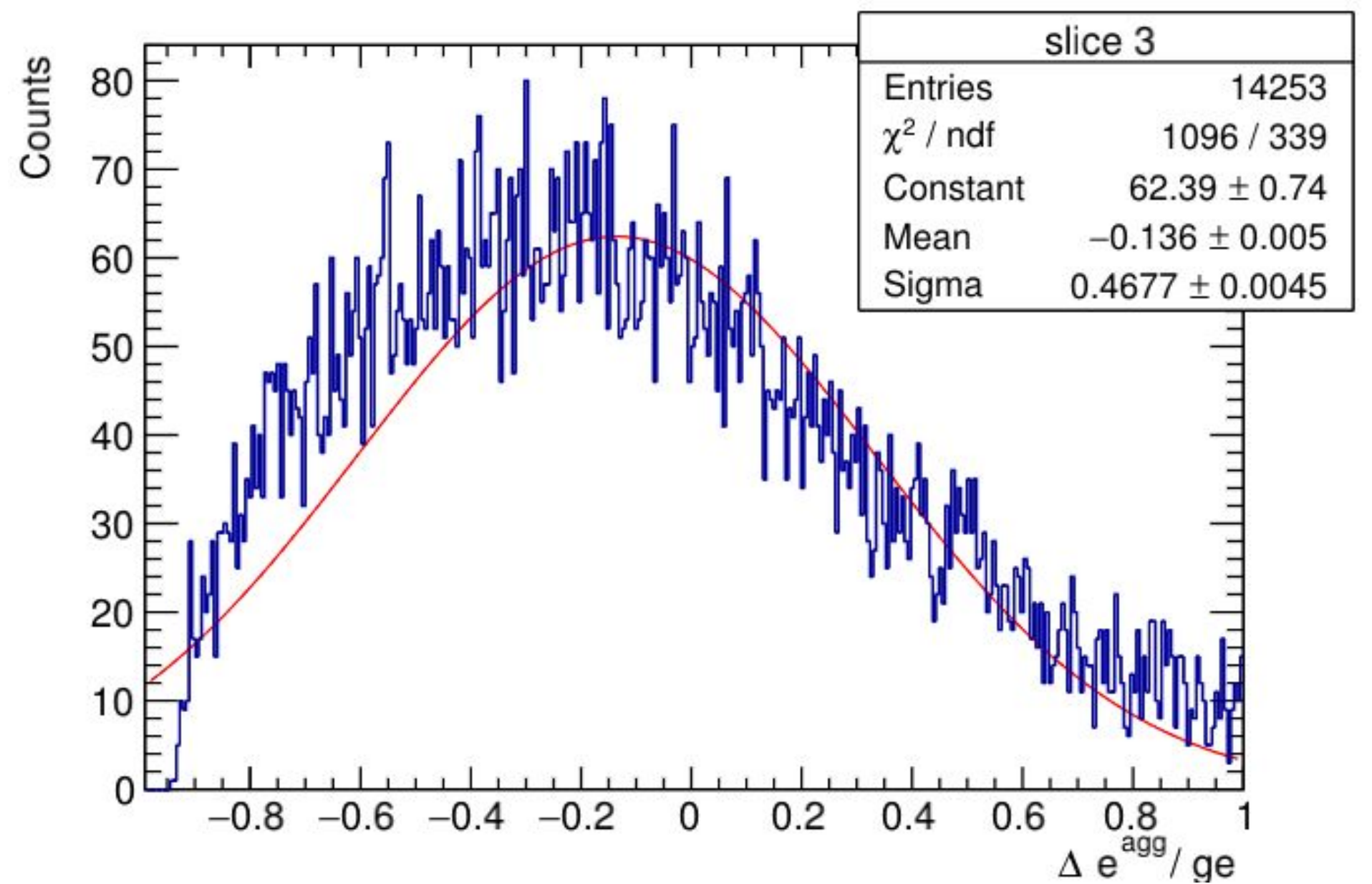
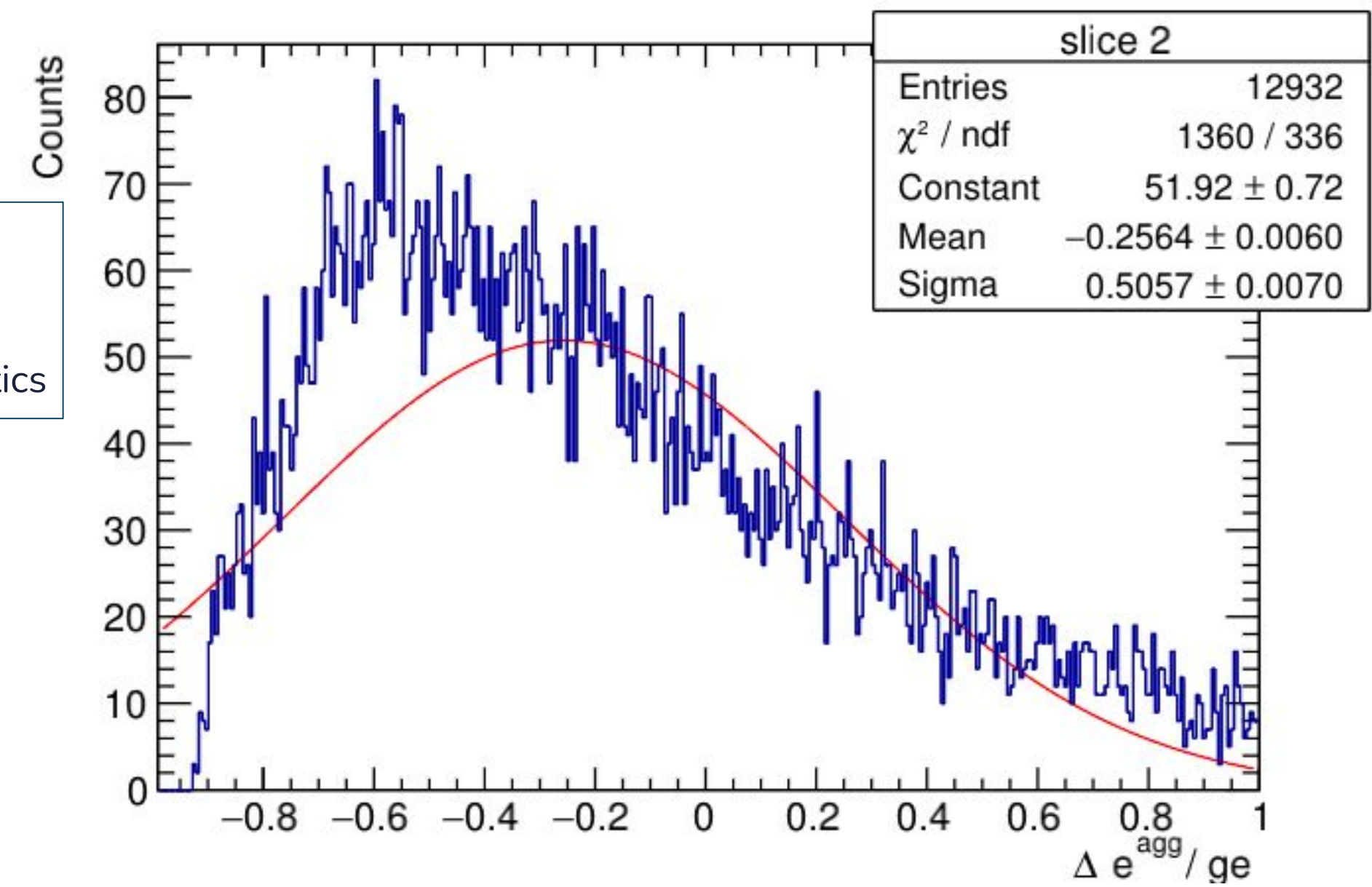
$p_1 = (0.124213 \pm 0.00387178) \text{ GeV}^{0.5}$

CEMC + HCALIN + HCALOUT (π^-)

Fitted Gaussians (0 - 3 GeV)

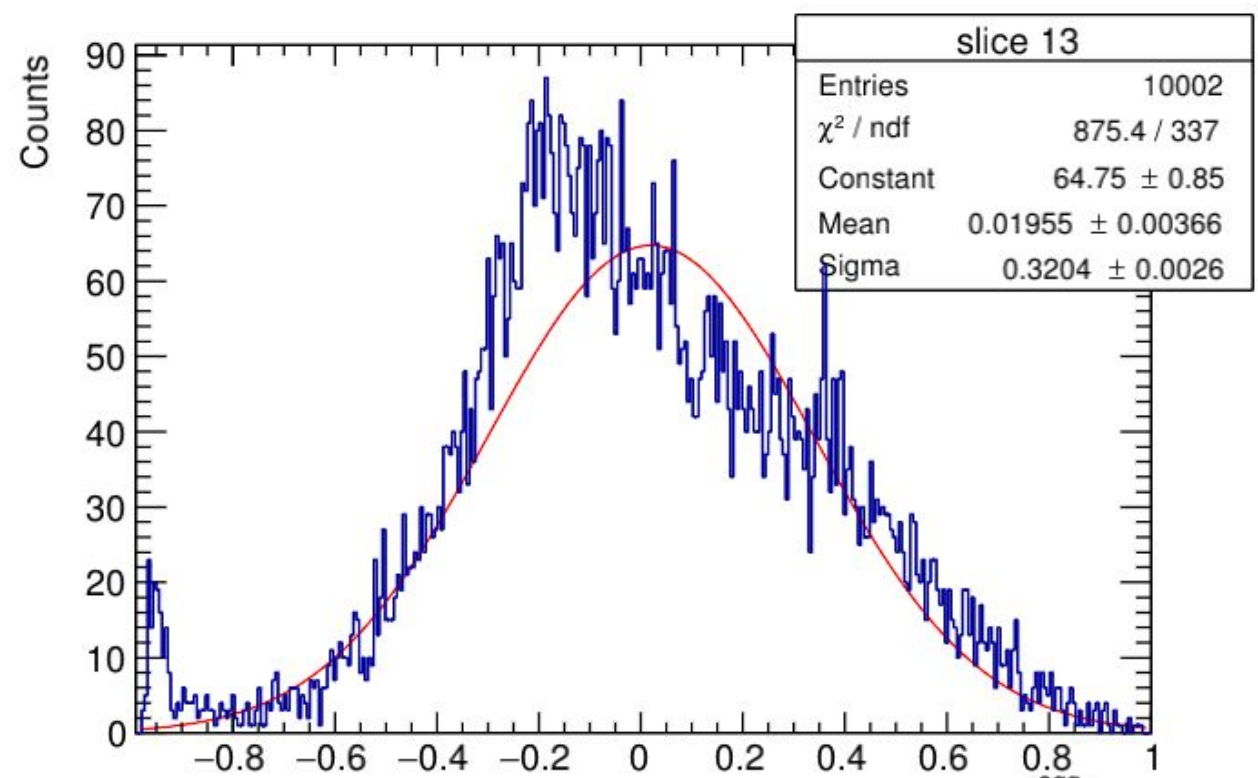
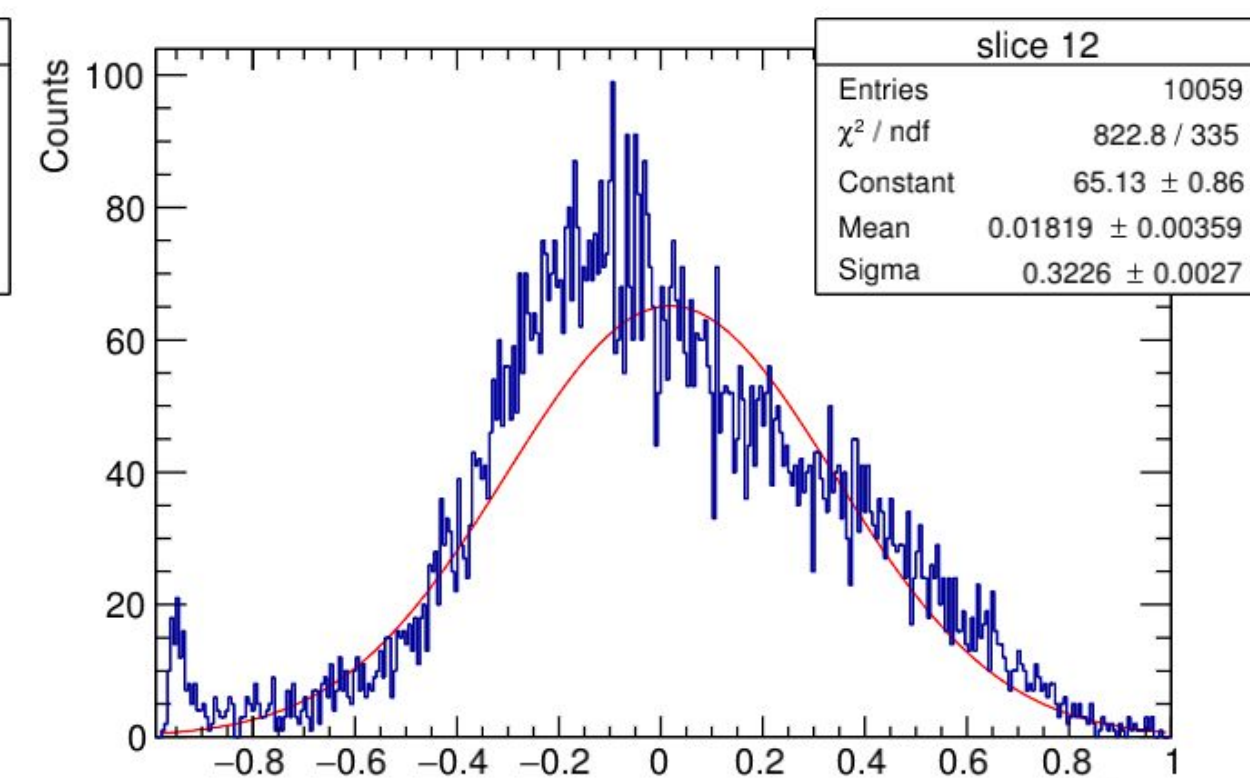
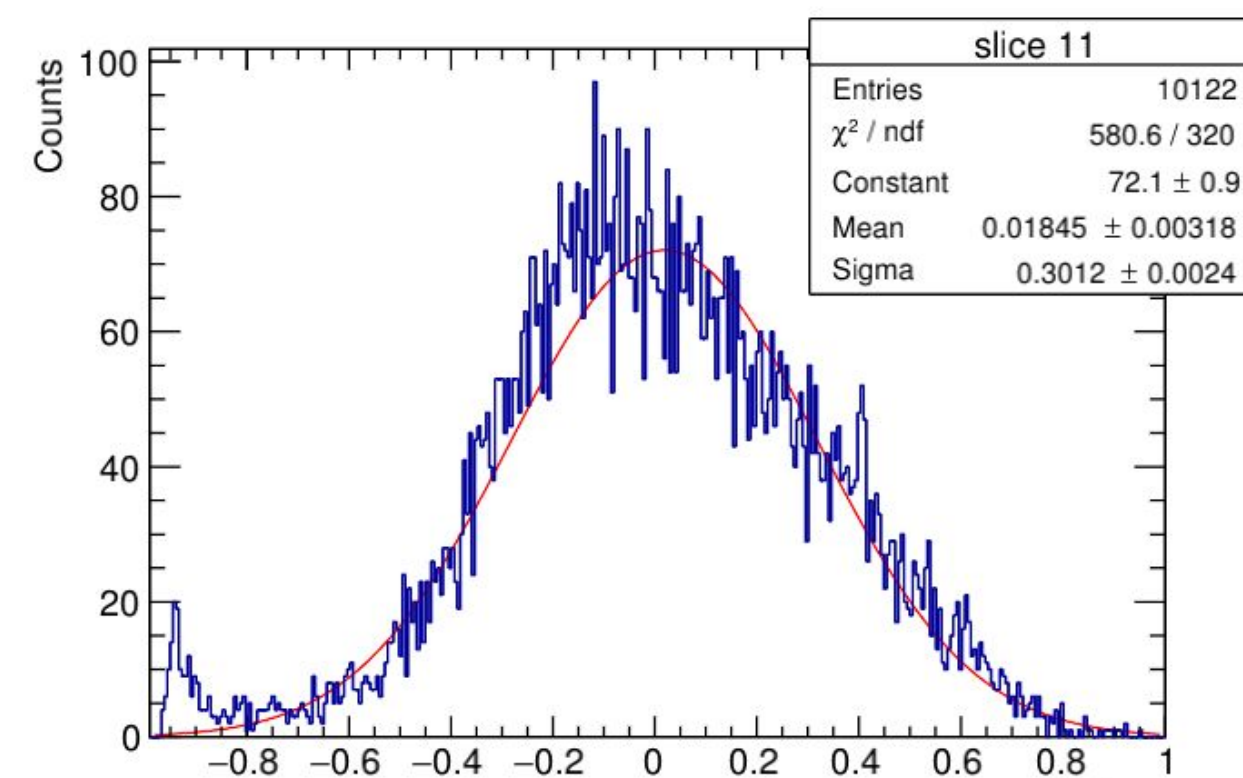
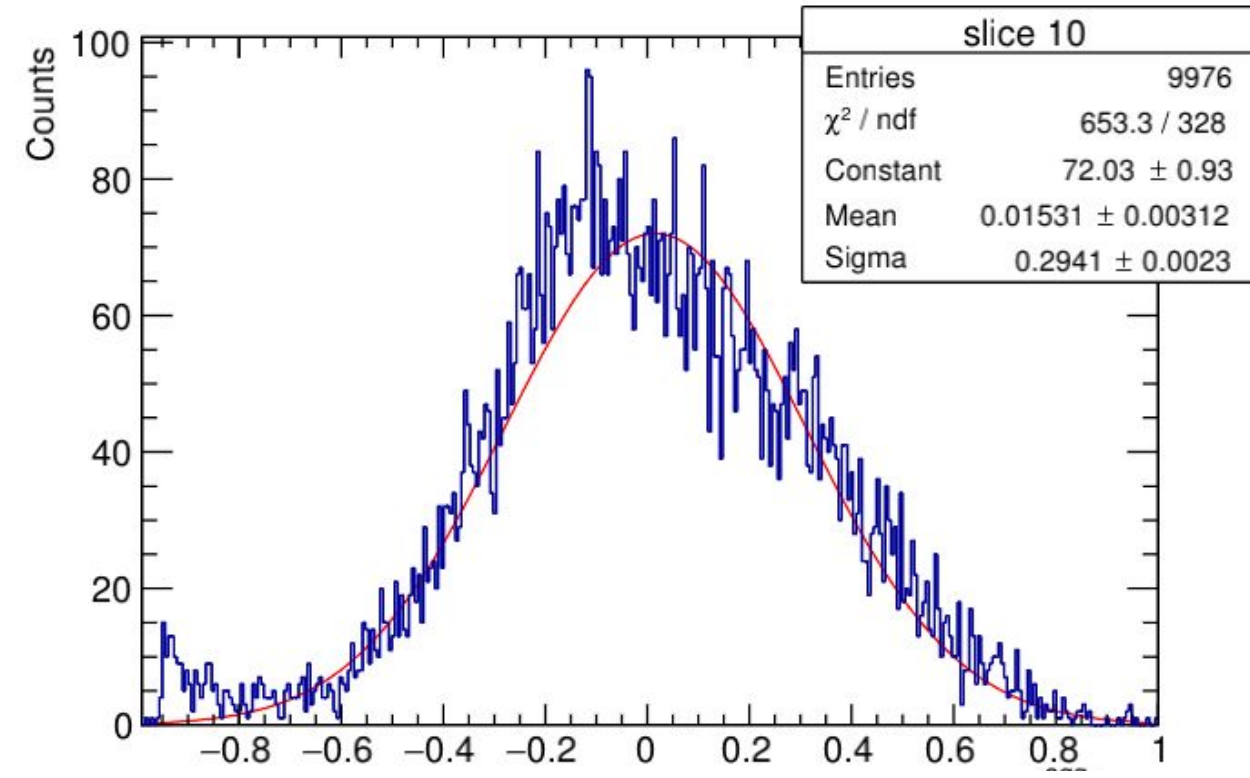
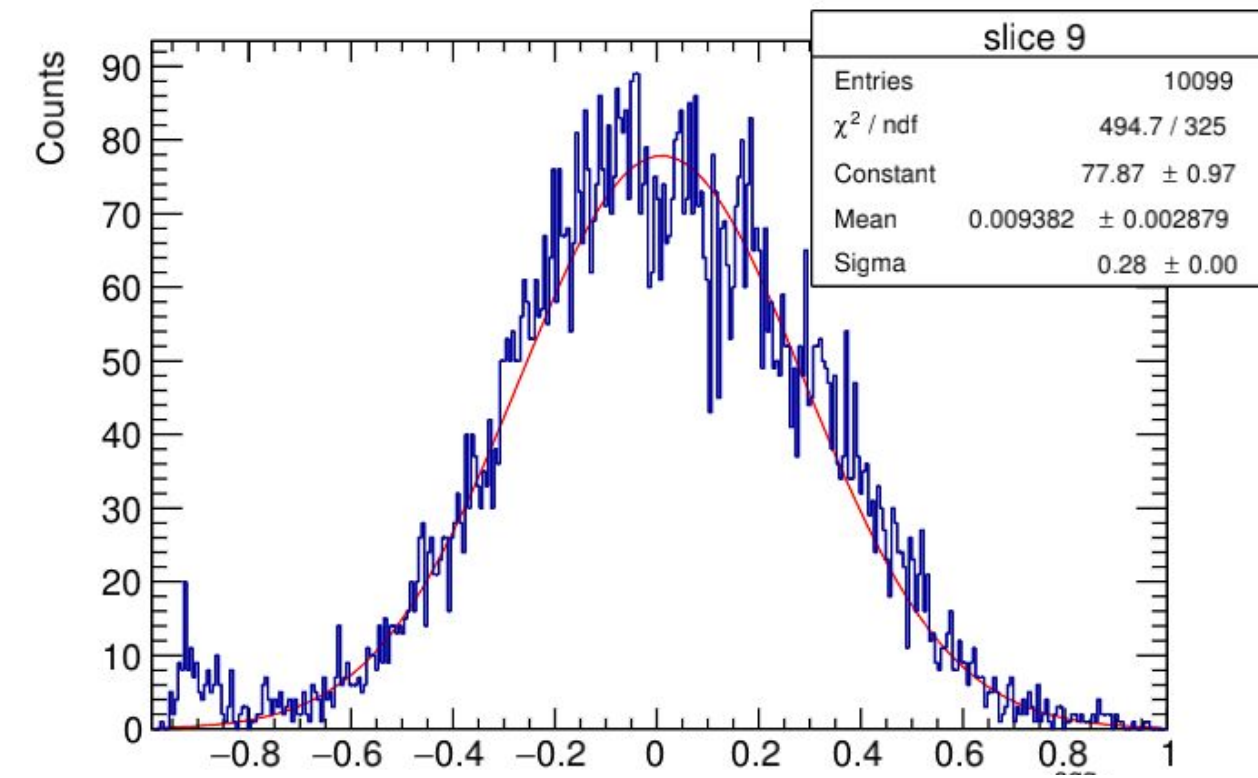
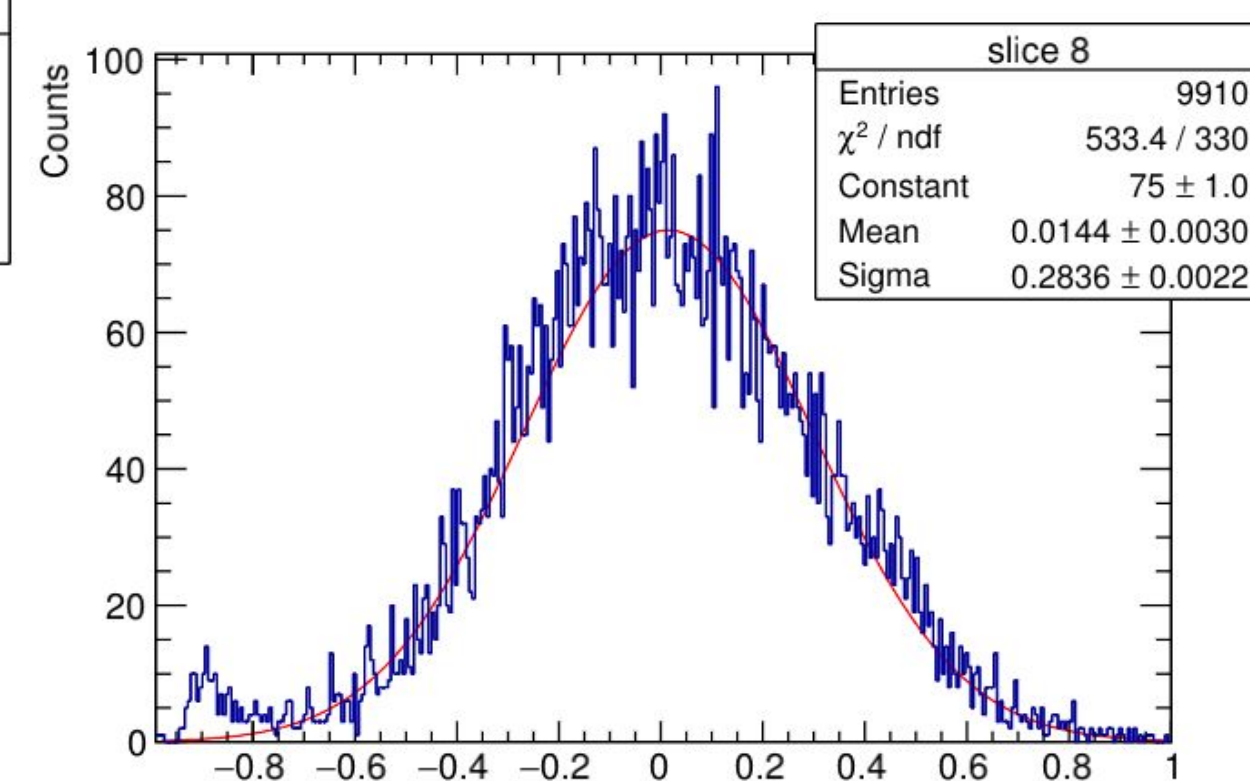
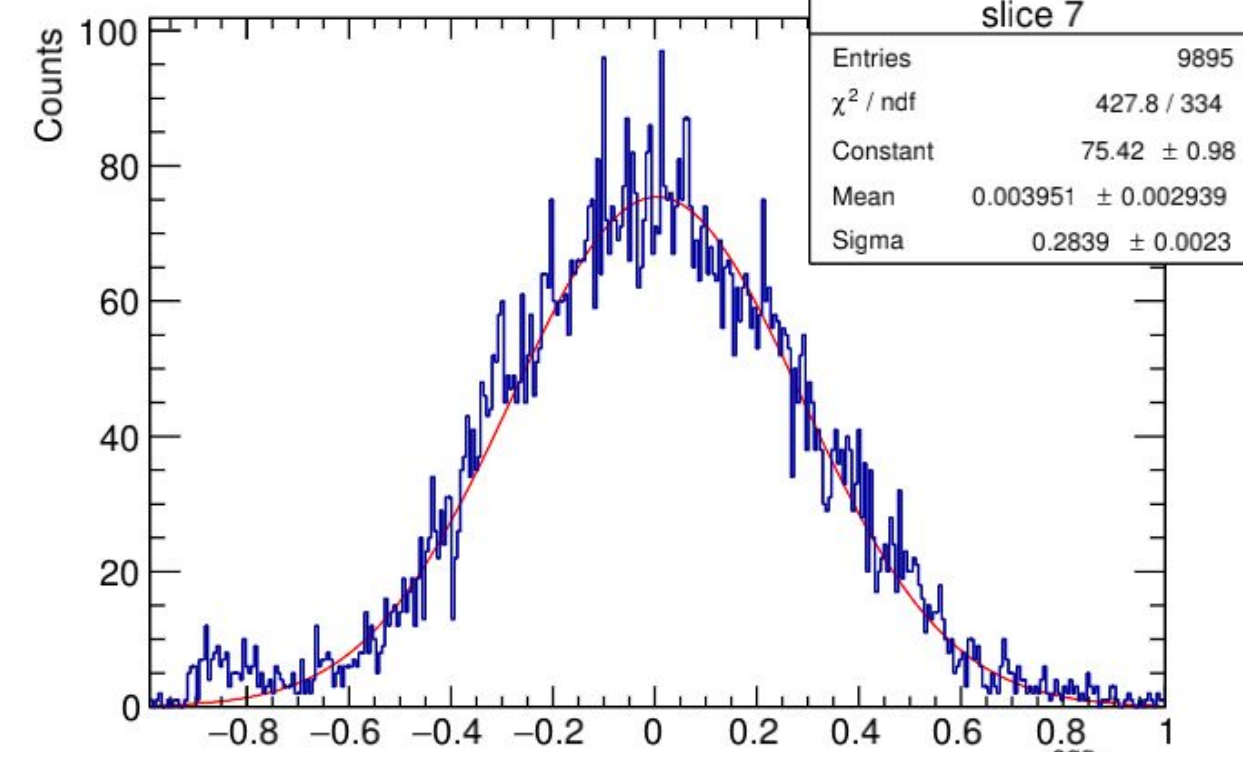
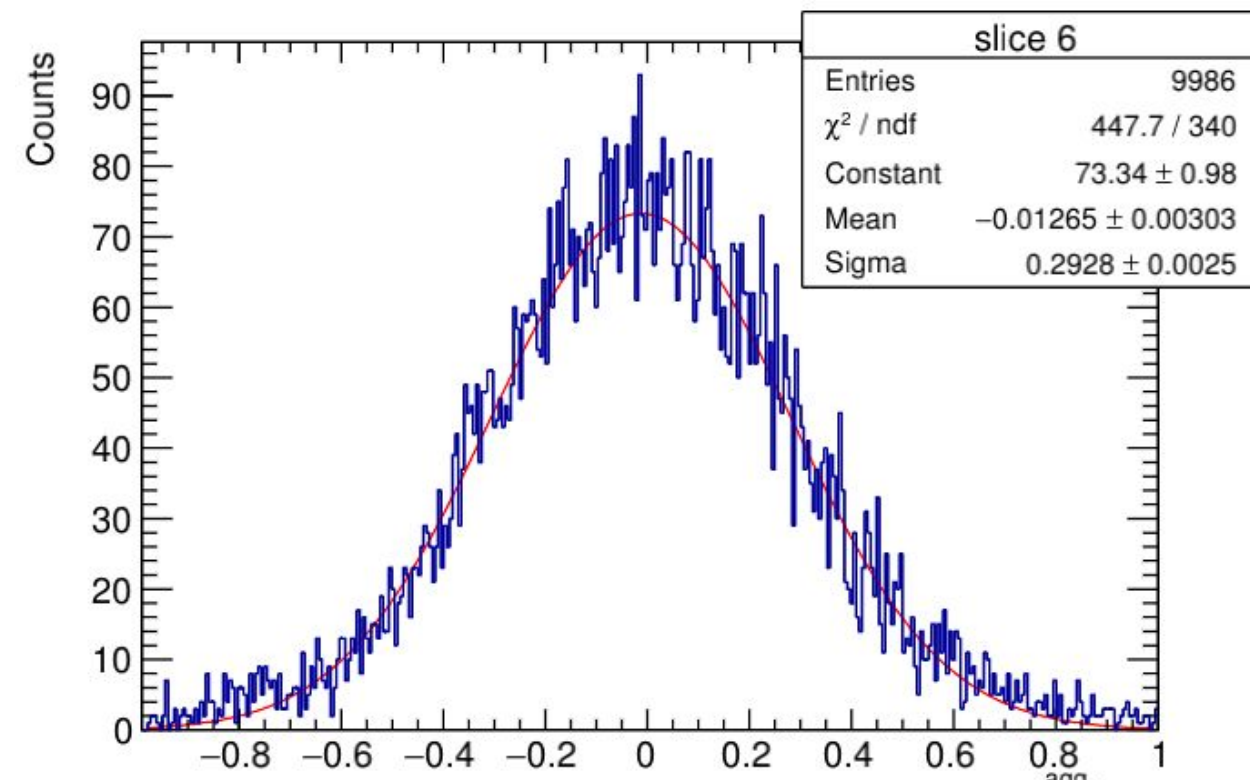
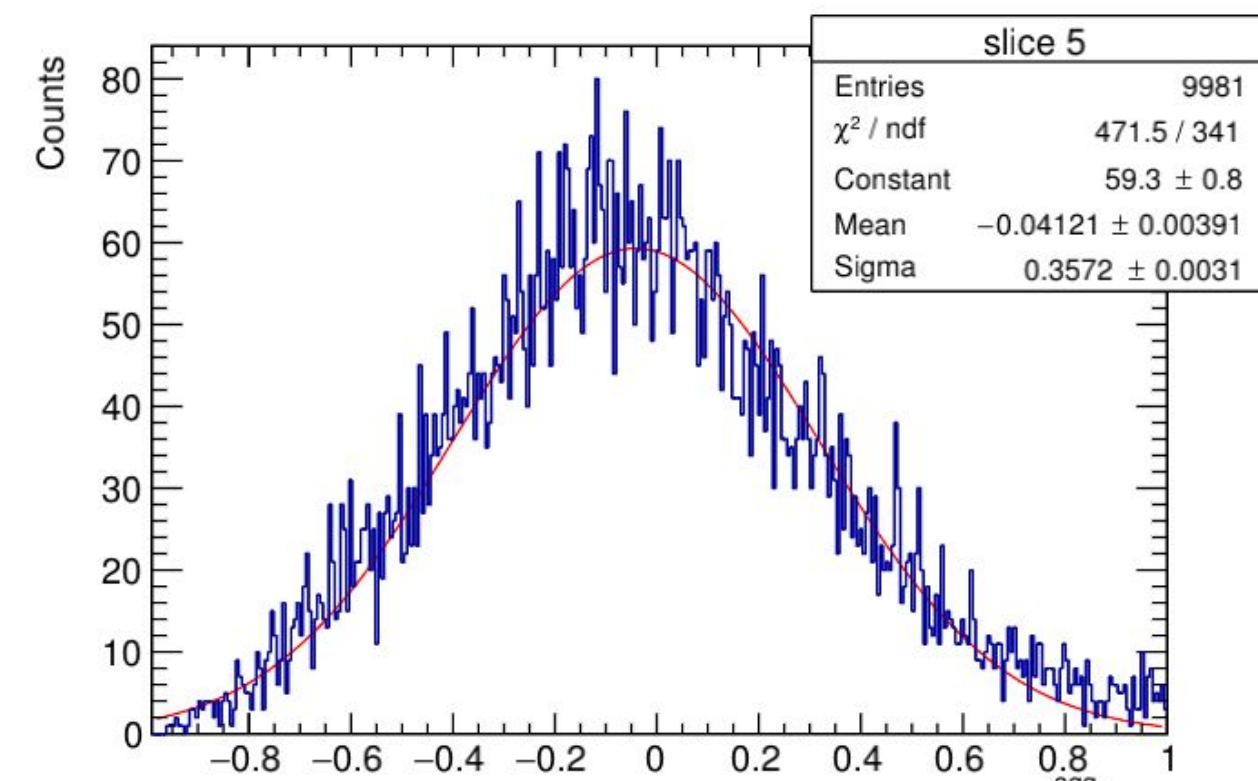


80 entries when the magnetic field is switched ON for the same number of statistics



CEMC + HCALIN + HCALOUT (π^-)

Fitted Gaussians (3 - 30 GeV)



There is some shouldering visible from slice 12 onwards ($g_e > 24$ GeV). This is not seen when the magnetic field is switched ON.

The x-axes denote $\Delta e_{\text{agg}}/g_e$

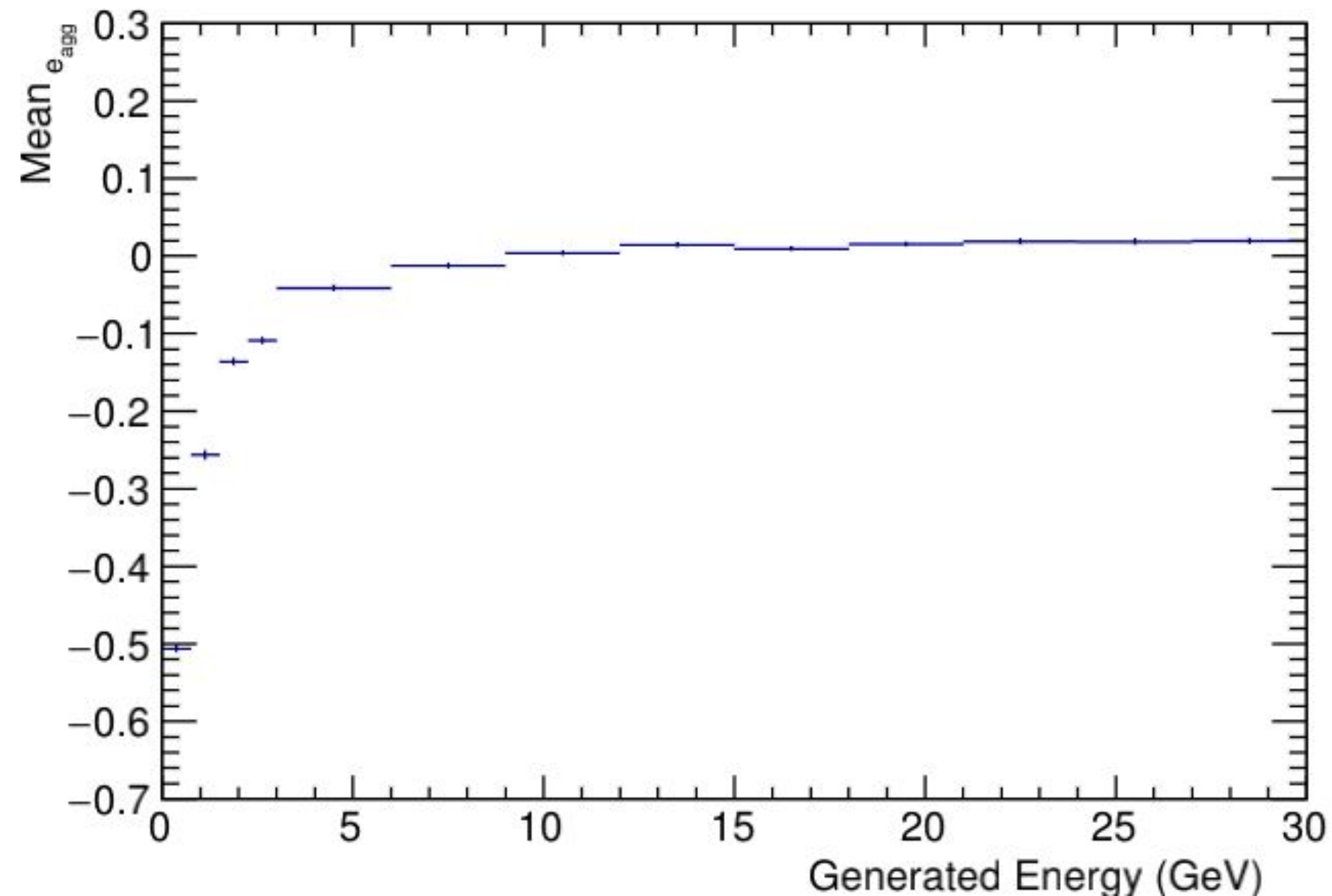
CEMC + HCALIN + HCALOUT (π^-)

Explicit η cut: -0.96 to 0.92

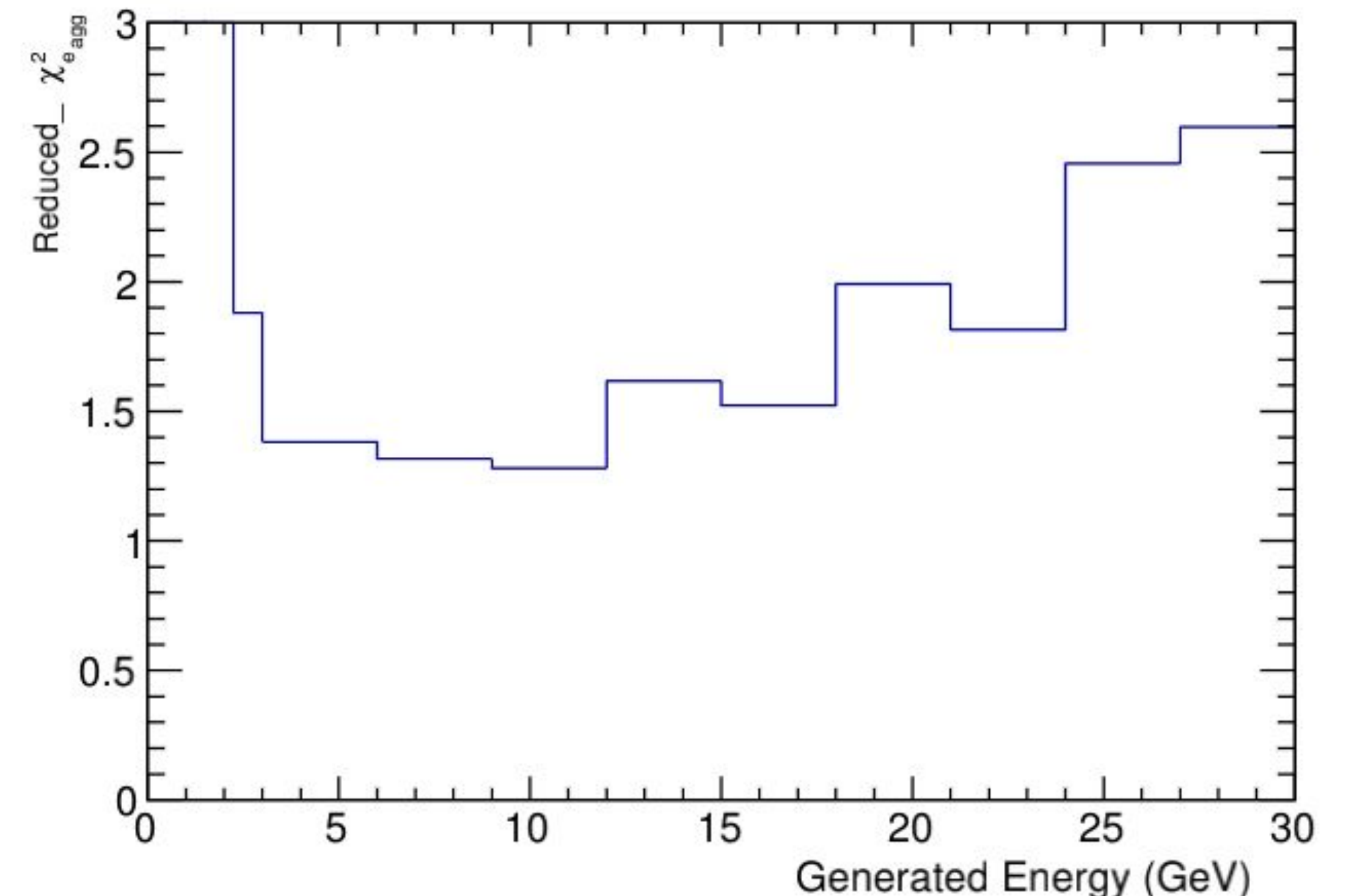
Elliptical Cut for Manual Clustering

gtheta-parametrized Energy Cut on Individual EMC Towers

100 MeV Aggregate Energy Cut



Mean of the Gaussians fitted to the slices of the calibrated $(te_{agg} - ge)/ge$ vs ge plot.



Reduced_ χ^2 of the Gaussians fitted to the slices of the calibrated $(te_{agg} - ge)/ge$ vs ge plot.

