Simulation Statistics

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Under the guidance of Dr. Ankhi Roy

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IIT Indore

Contents

Histograms for energy resolution of detectors by applying manual clustering, 100 MeV energy cut on aggregate towers, 200 MeV energy cut on EMCs individual towers, and incorporating slice-wise calibration, for the following detector-particle pairs:

- Pion: FHCAL + FEMC
- Pion: CEMC + HCALOUT
- Pion: CEMC + HCALIN + HCALOUT

tphi : tower ϕ, ttheta : tower θ, te_{agg}: tower energies aggregated in an event
gphi : generated ϕ, gtheta : generated θ, ge: generated energy

Simulation Parameters

- Particles: pi^-
- Events: 150,000 pi^- (100,000 → 0-30 GeV/c, 50,000 → 0-2 GeV/c)
- momentum (p): 0 to 30 GeV/c
- Pseudorapidity (η): -4 to 4
- Azimuth (Φ): -π to π

Cuts:

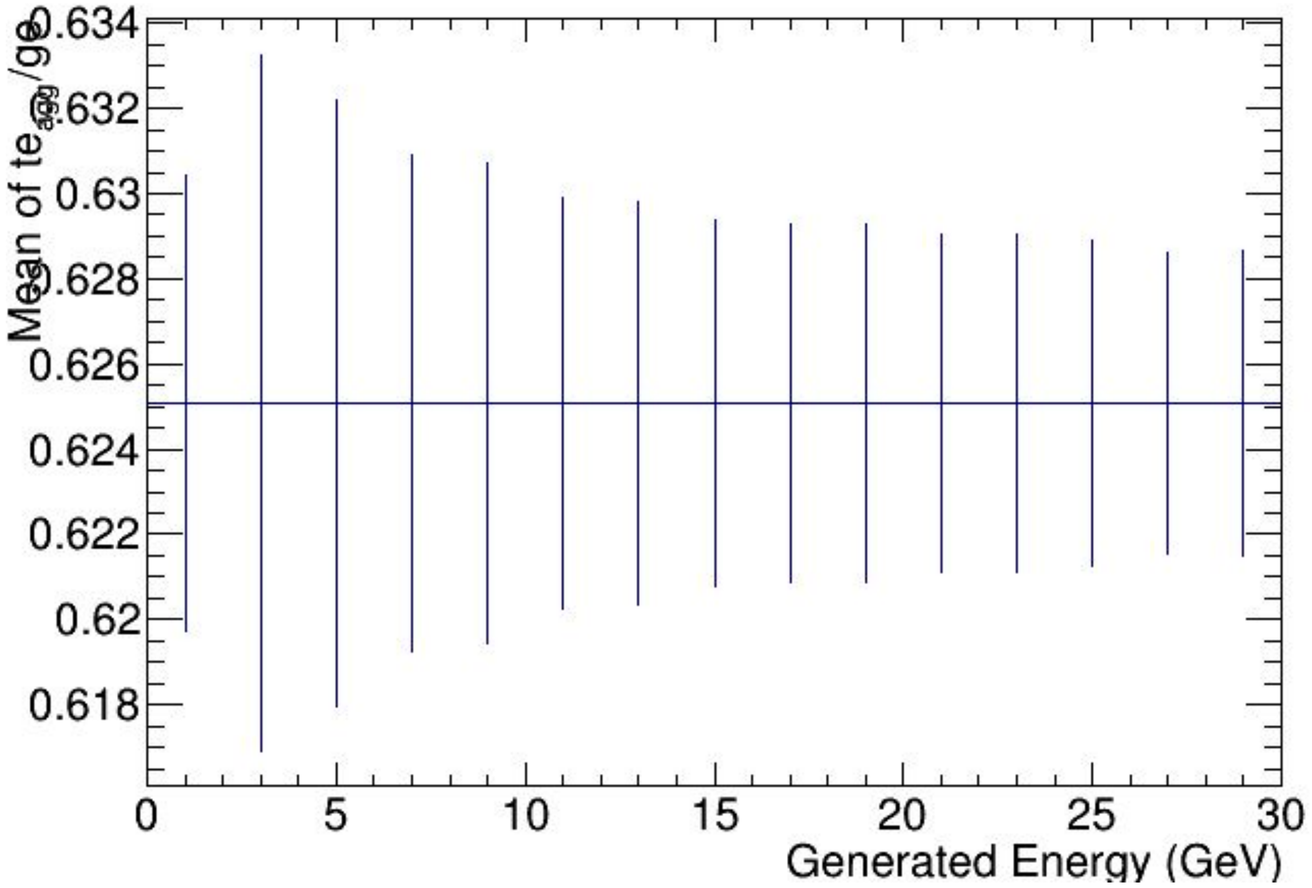
- Detector-wise η cuts, intersection for combinations
- Detector-wise Elliptical cuts in dphi vs dtheta plots
- Energy cut on aggregated Towers (100 MeV)
- Energy cut on individual Towers of EMCs (200 MeV)

FEMC + FHCAL (pi^-)

FEMC + FHCAL (pi^-)

Elliptical cut on dphi vs dtheta
Explicit η cut: 1.3 to 3.3
100 MeV Aggregate Tower Energy Cut
200 MeV Individual Tower Cuts on FEMC Towers

After calibration



(te_{agg} → ∑(weight*te/calibrationFactor)/mean(∑(weight*te/calibrationFactor))

Each slice of $(te_{agg}-ge)/ge$ vs ge plot will be calibrated on the basis of dividing by a calibration factor which equals to the Mean of te_{agg}/ge corresponding to that particular slice in this plot.

FEMC + FHCAL (pi^-)

(te_{agg}-ge)/ge vs ge
Explicit η cut: 1.3 to 3.3
100 MeV Aggregate Tower Energy Cut
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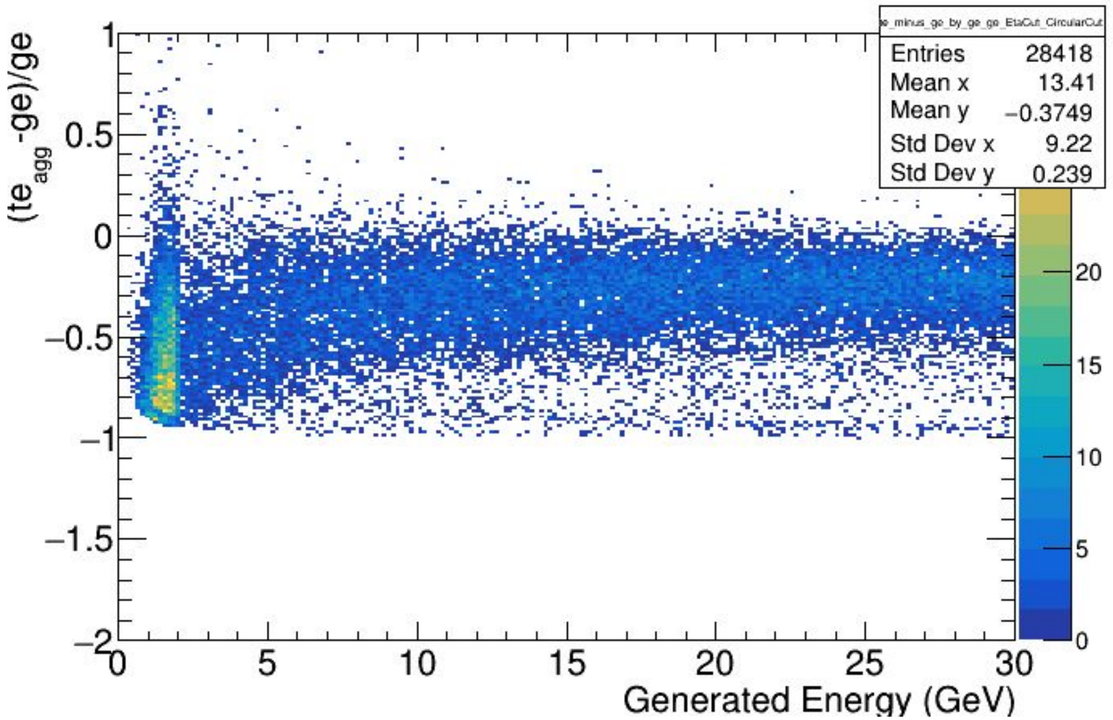

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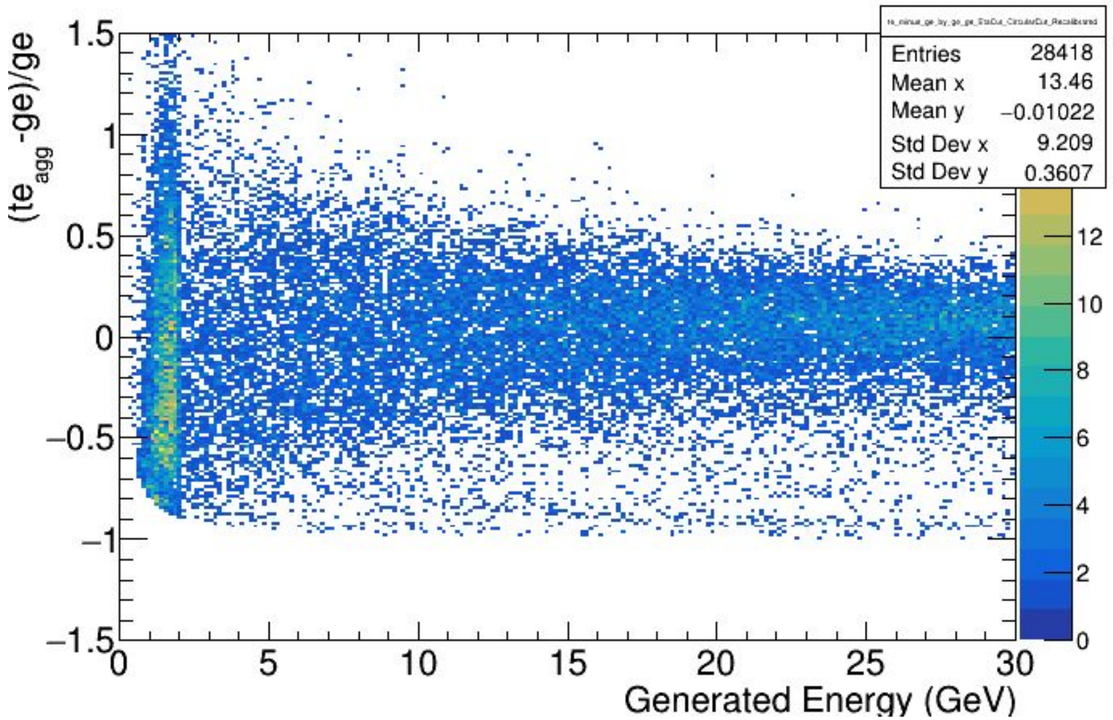

(te_{agg} → ∑(weight*te/calibrationFactor)/mean(∑(weight*te/calibrationFactor))

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

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

FEMC + FHCAL (pi^-)

σ_e_{agg} vs ge
Explicit η cut: 1.3 to 3.3
Elliptical Cut
100 MeV Aggregate Tower Energy Cut
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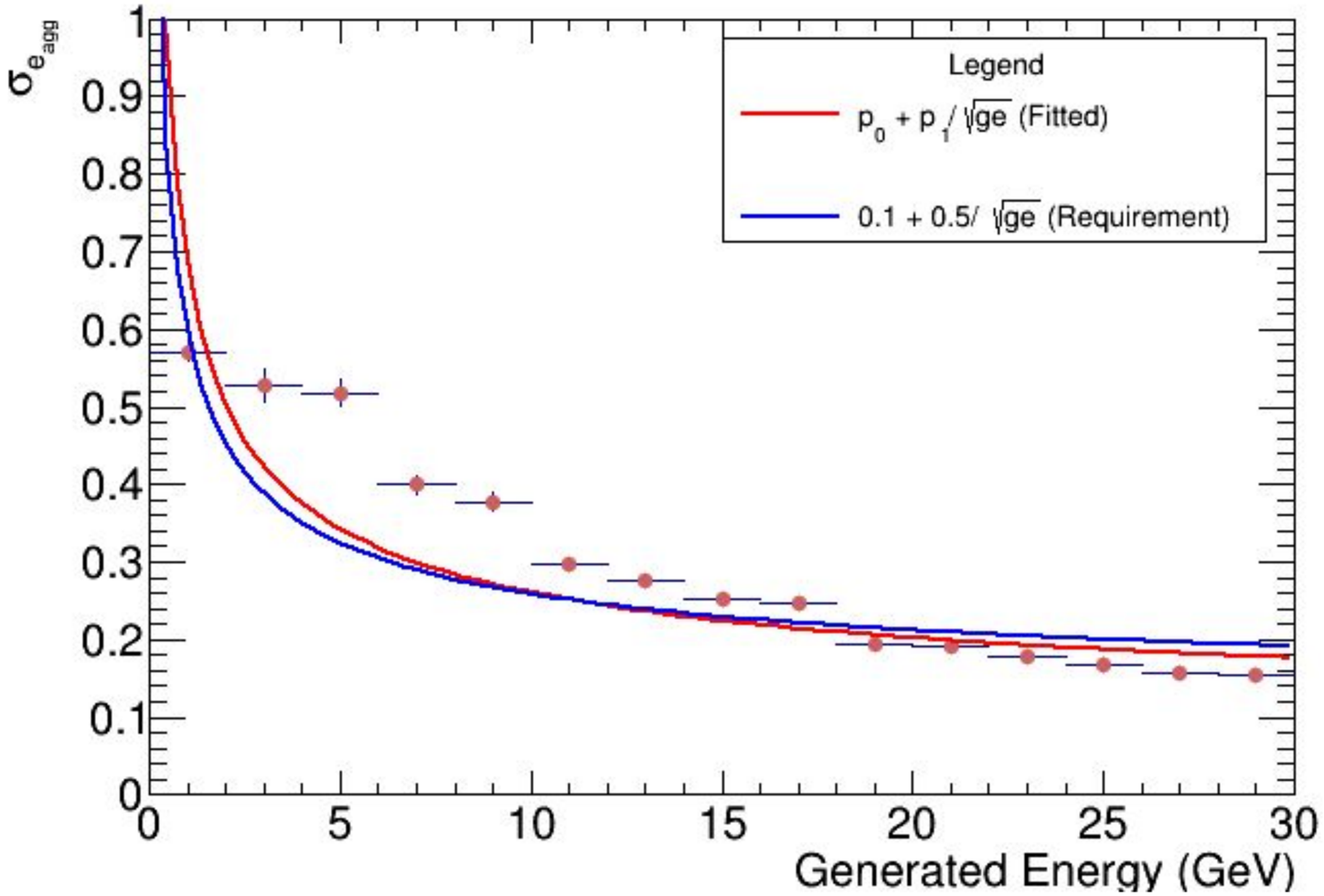

σe refers to the standard deviation of the Gaussian fitted to a slice of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

Number of bins = 15
Bin Width = 2 GeV

Fit Parameters:
p_o = (0.0614881 +- 0.00383392)
p_1 = (0.627599 +- 0.0140564) $GeV^{0.5}$

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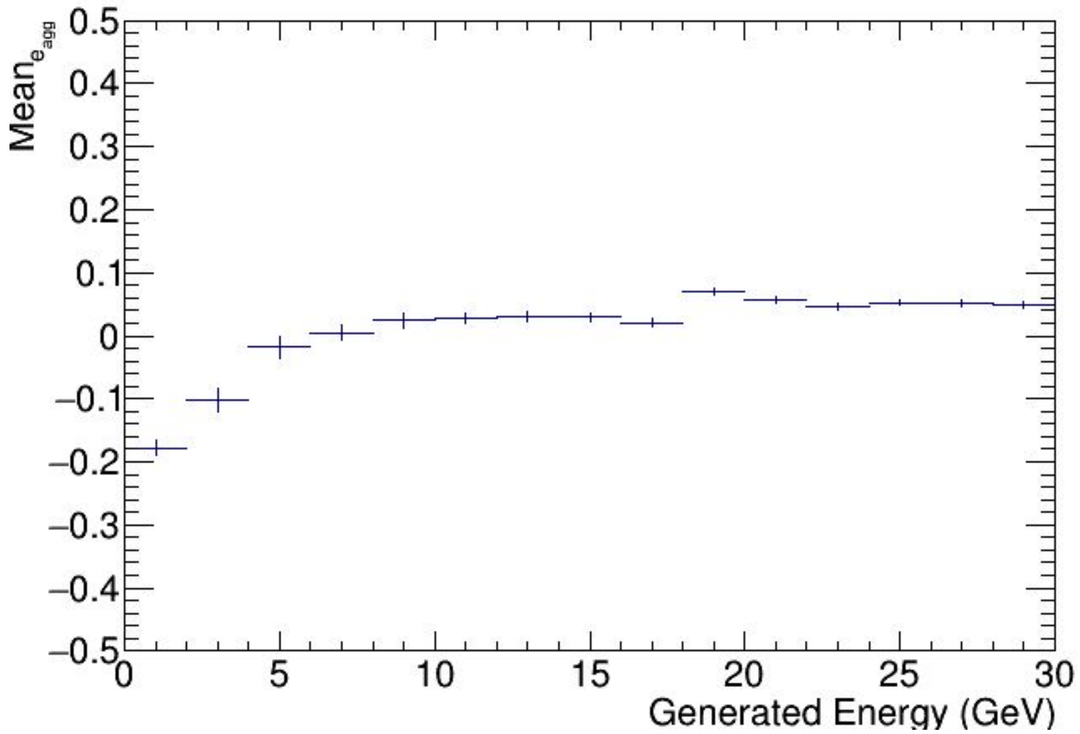
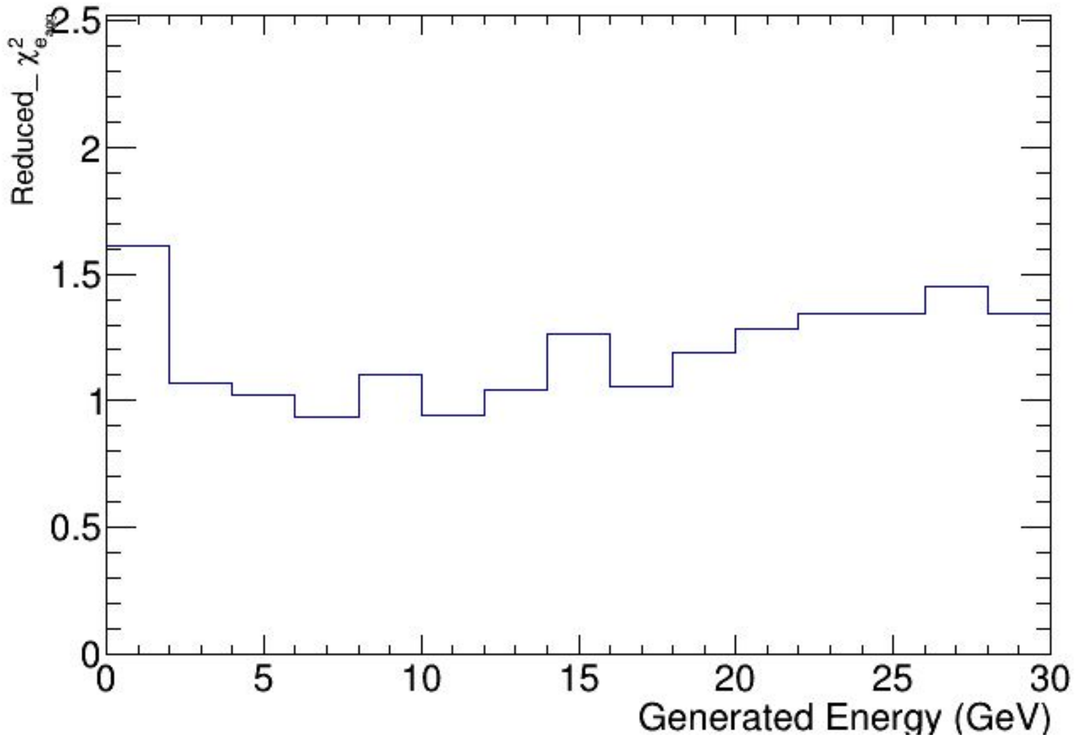


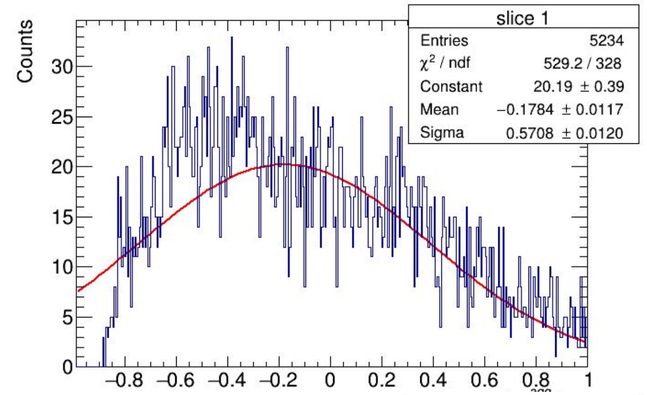
Mean of the Gaussians fitted to the slices of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

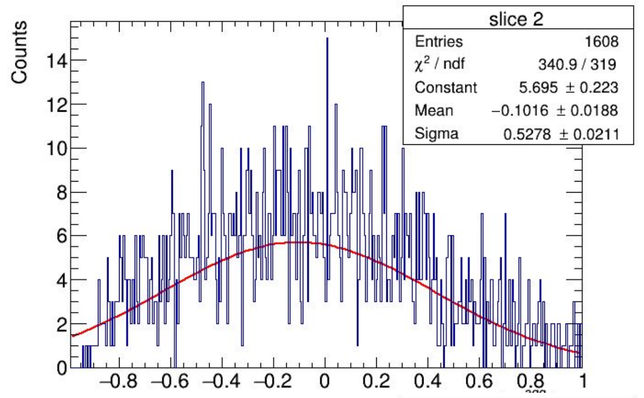


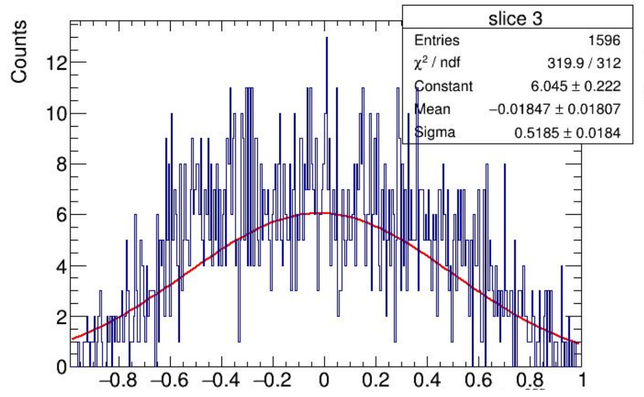
Reduced_χ2 of the Gaussians fitted to the slices of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

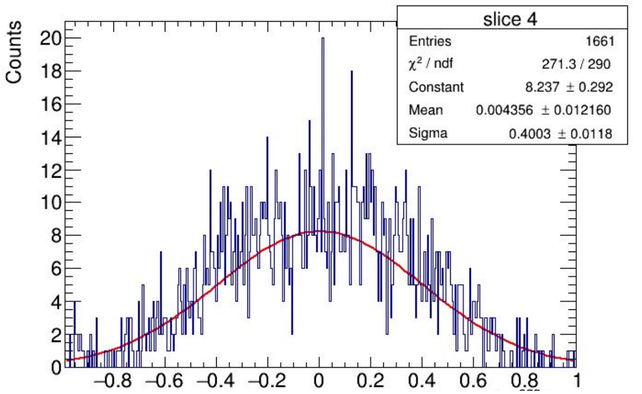
FEMC + FHCAL (pi^-)

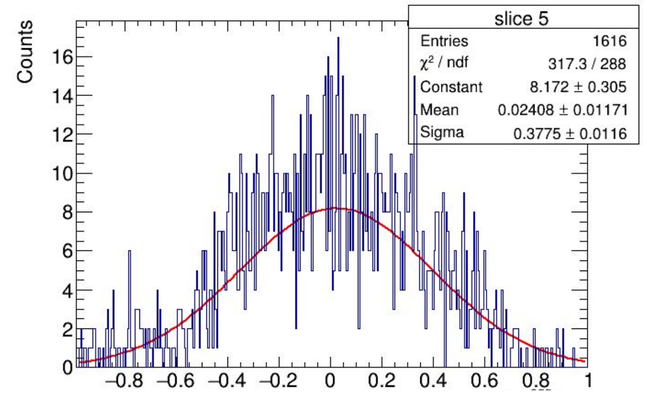
Fitted Gaussians

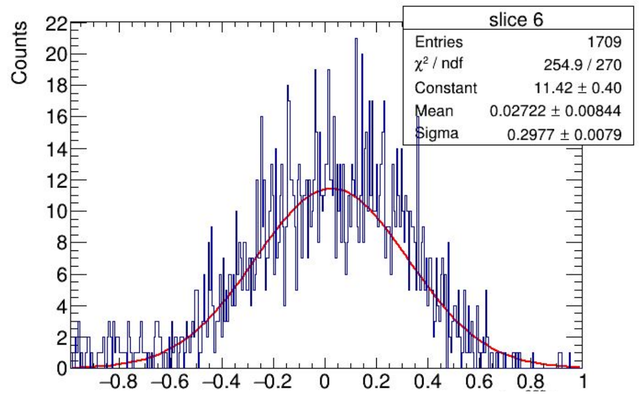


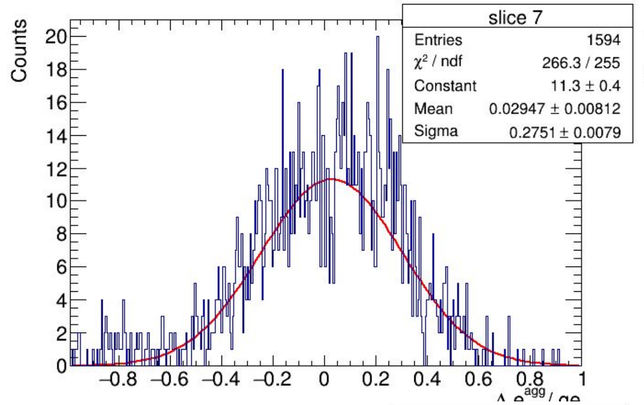


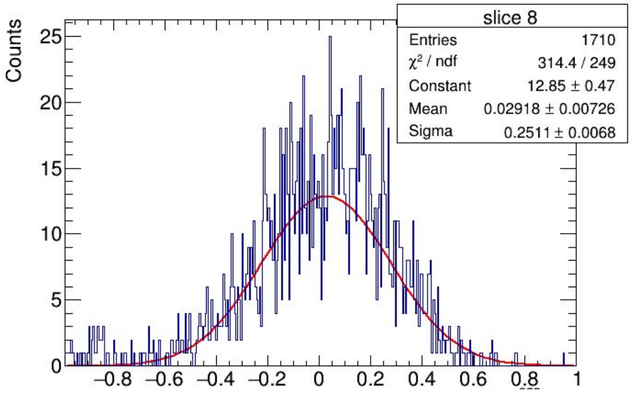


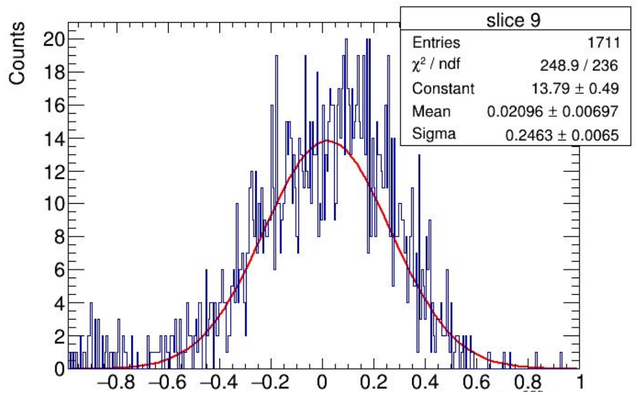


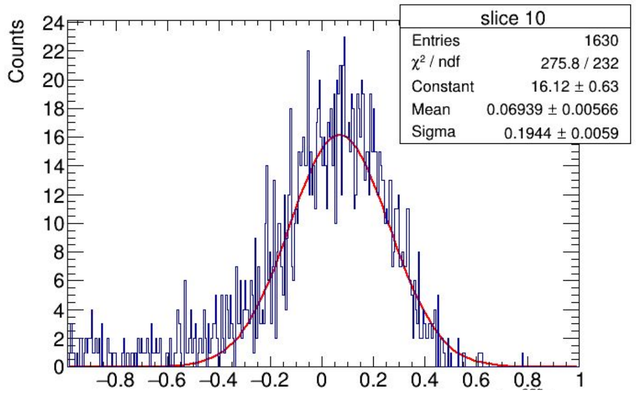


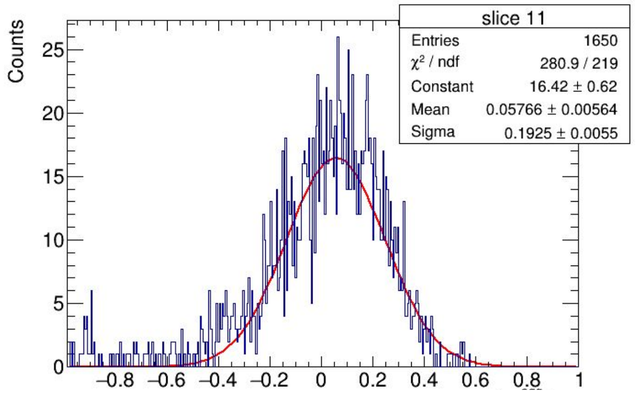


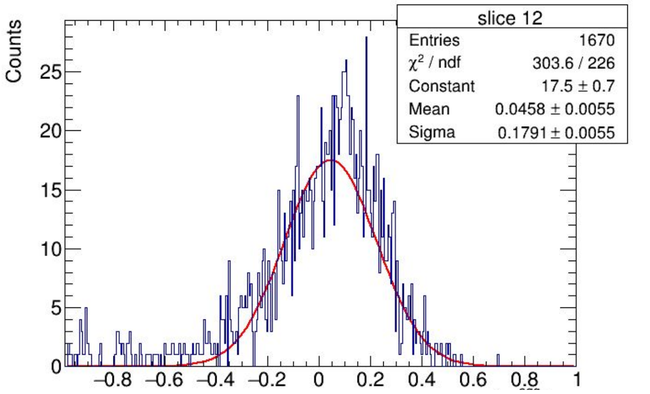








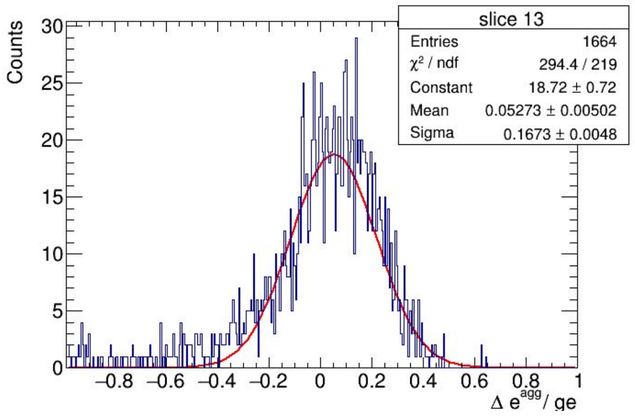


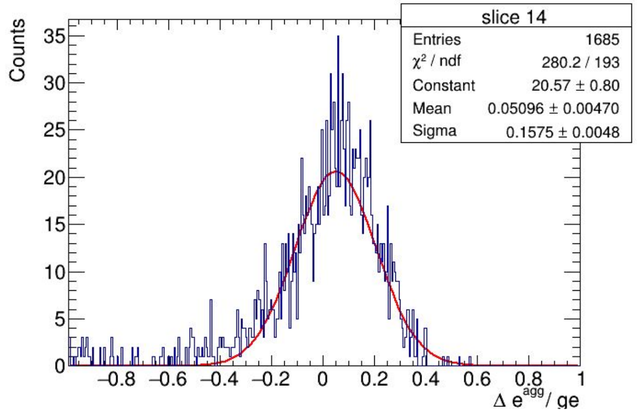


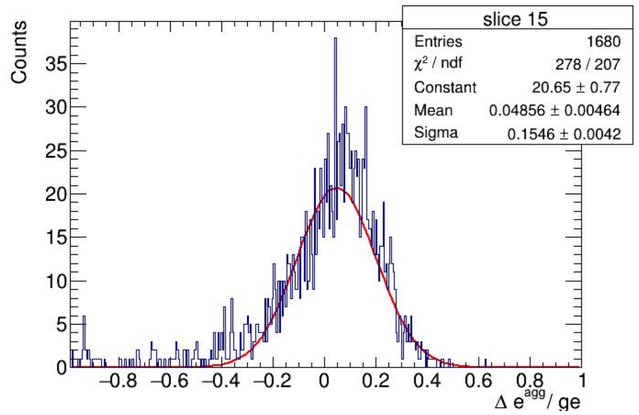
The x-axes denote $\Delta e_{agg}/ge$

FEMC + FHCAL (pi^-)

Fitted Gaussians







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CEMC + HCALOUT (pi^-)

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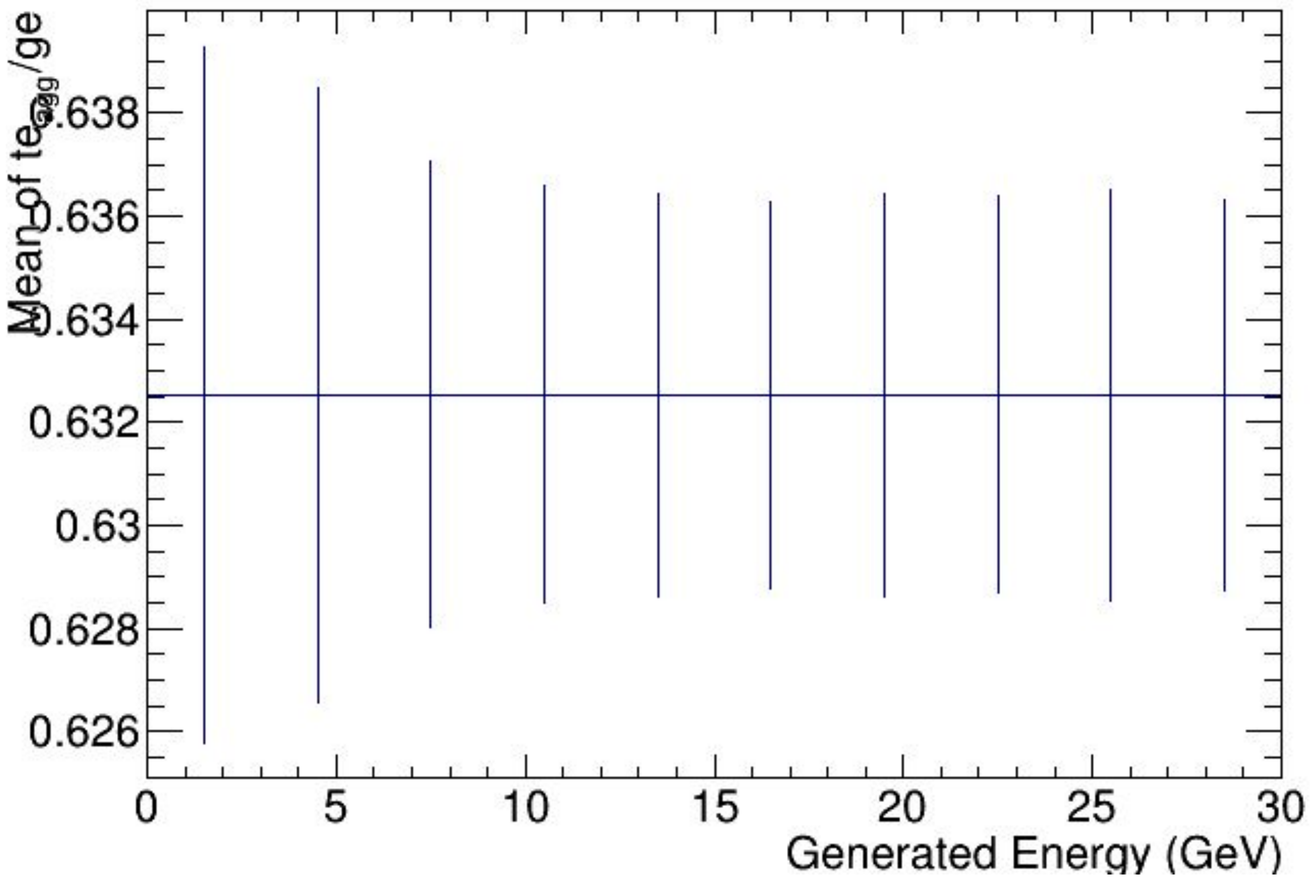
Explicit η cut: -1.1 to 1.1
100 MeV Aggregate Tower Energy Cut
200 MeV Individual Tower Cuts on CEMC Towers

After calibration



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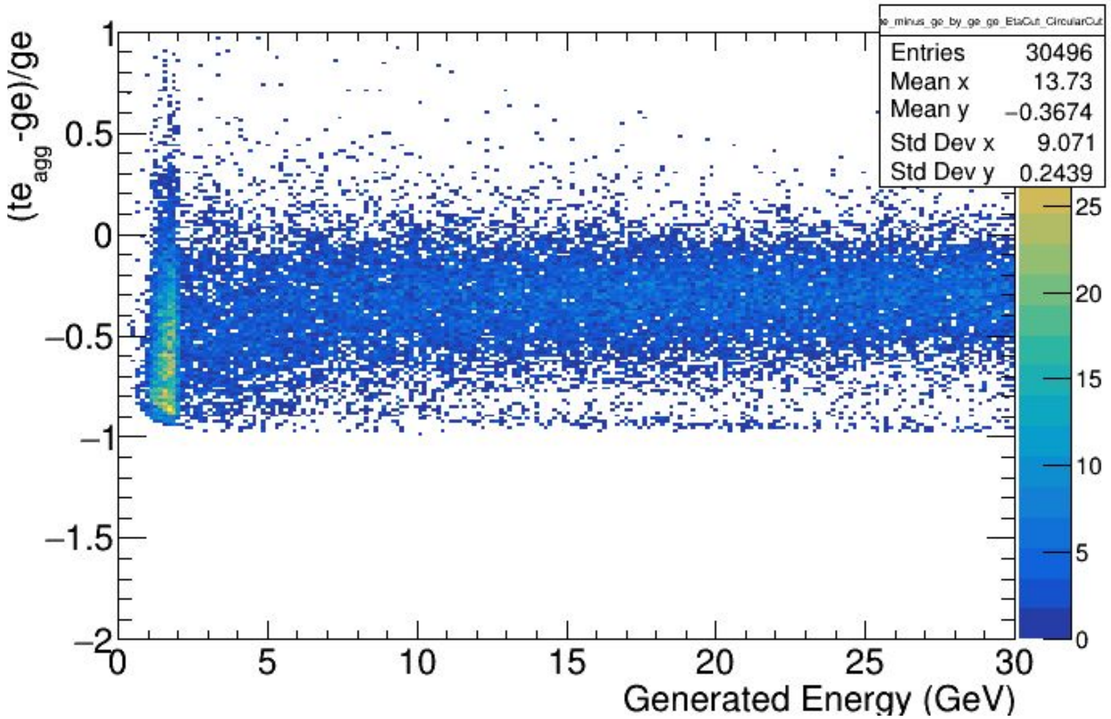

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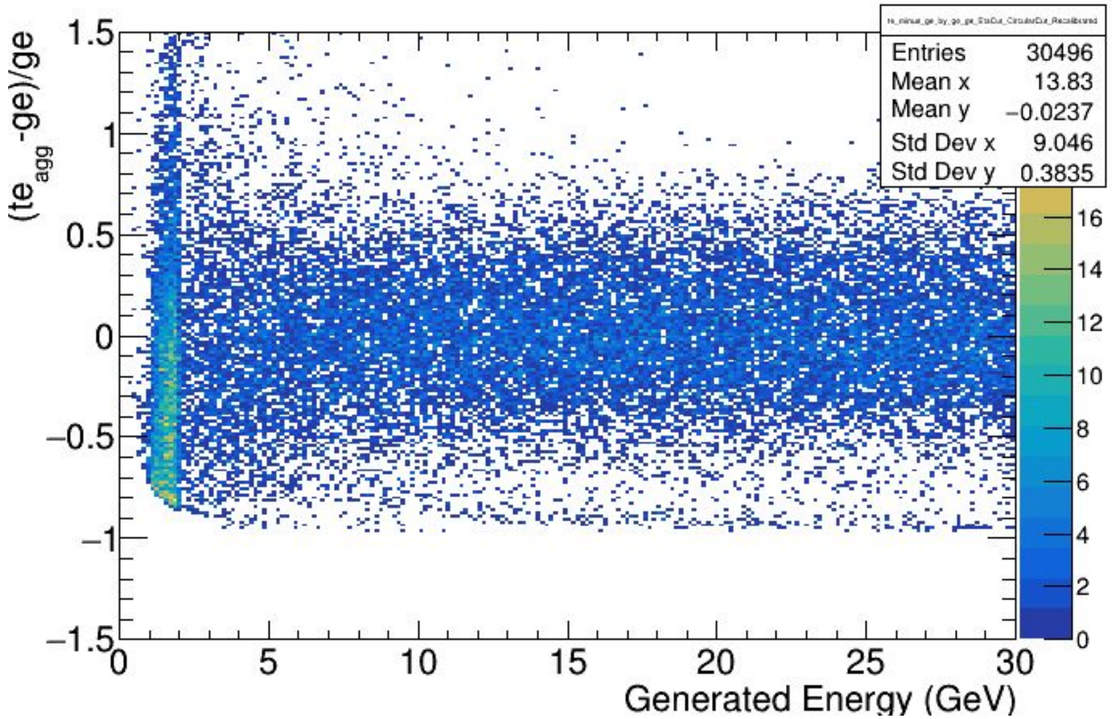

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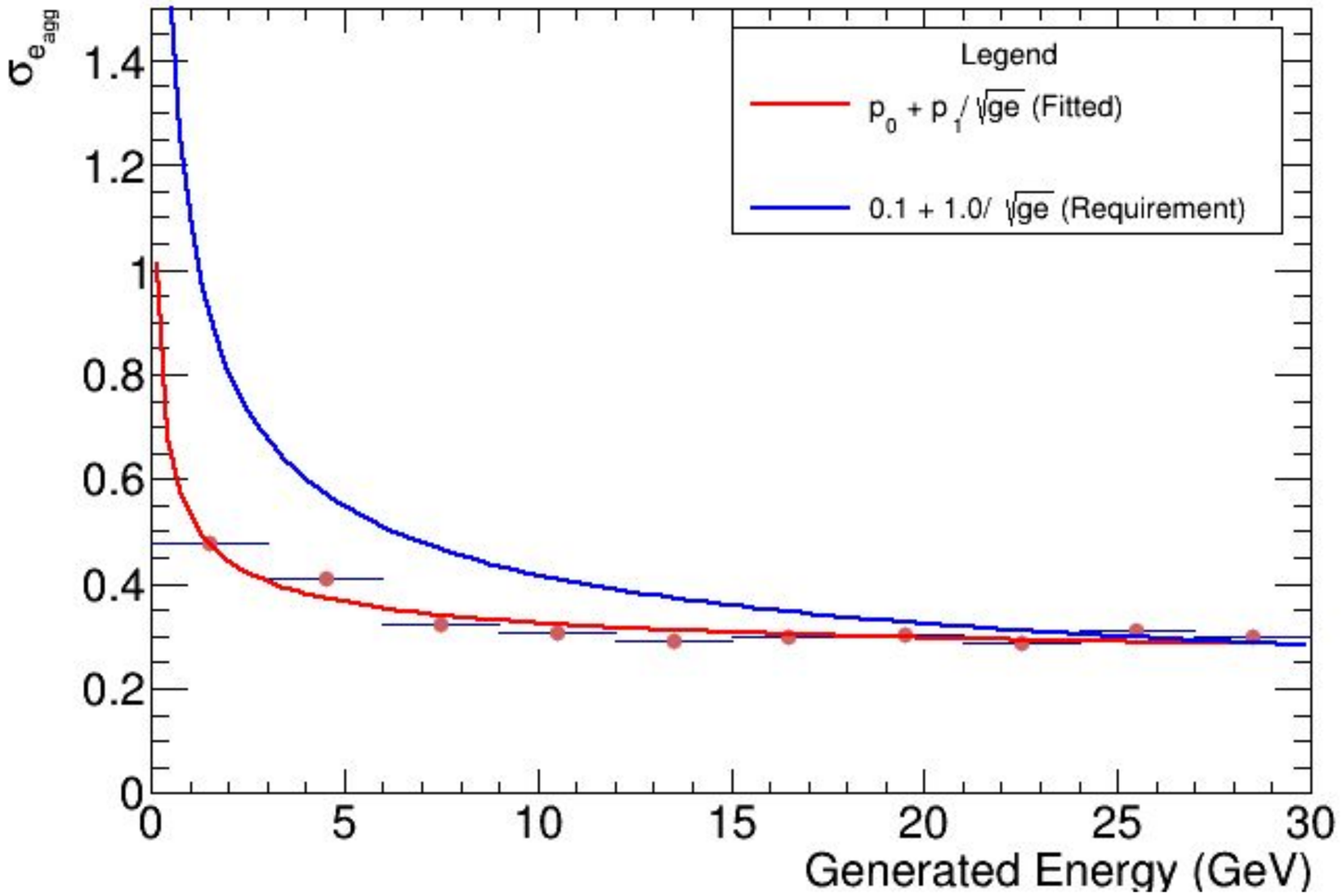

σe refers to the standard deviation of the Gaussian fitted to a slice of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

Number of bins = 10
Bin Width = 3 GeV

Fit Parameters:
p_o = (0.228930 +- 0.00454651)
p_1 = (0.303023 +- 0.0143942) $GeV^{0.5}$

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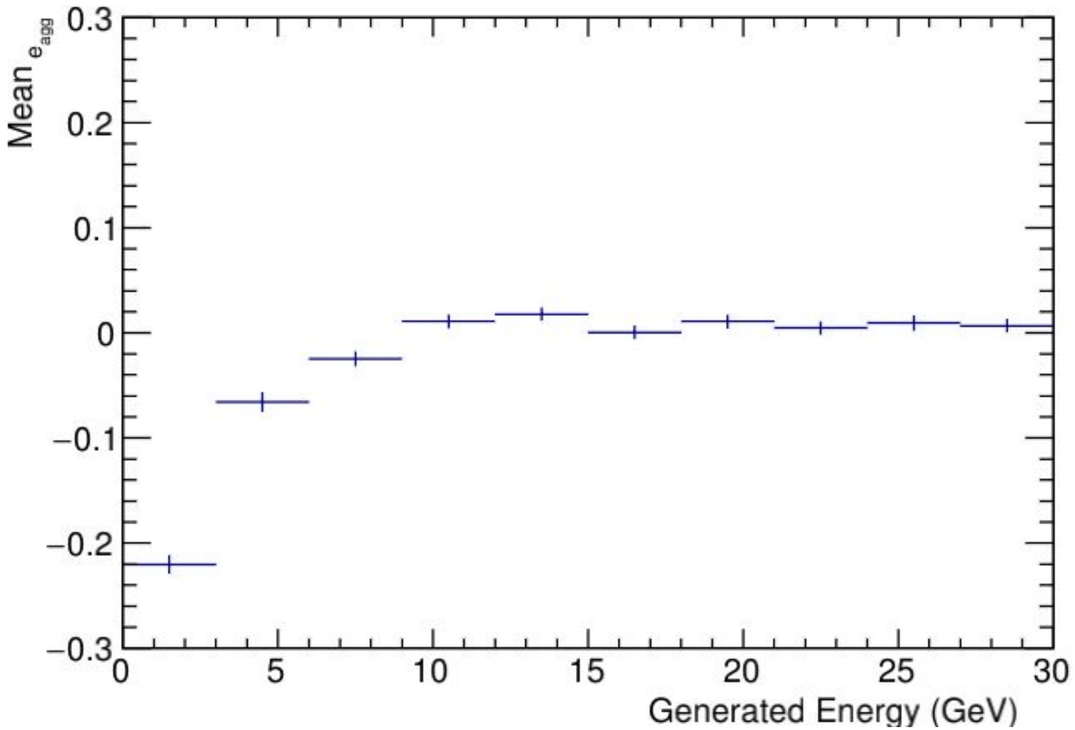

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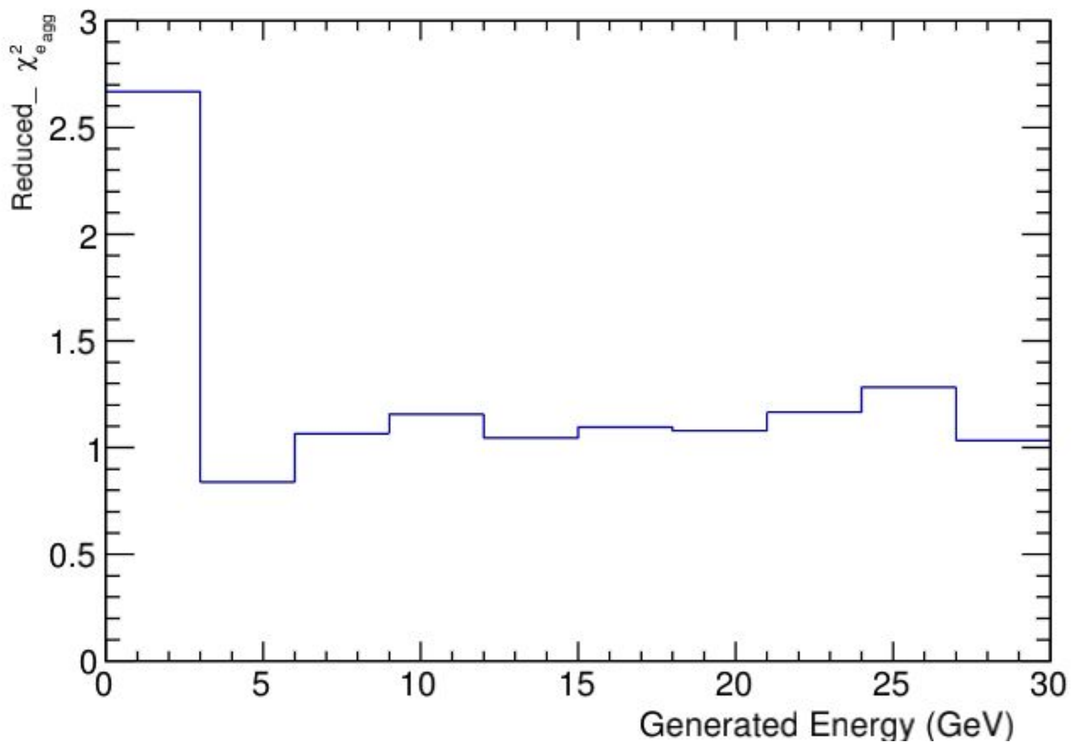

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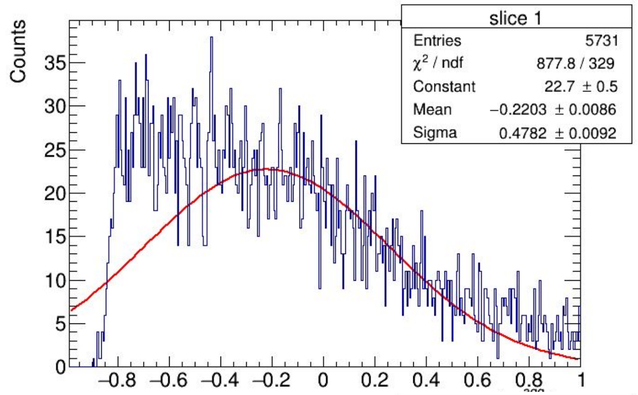

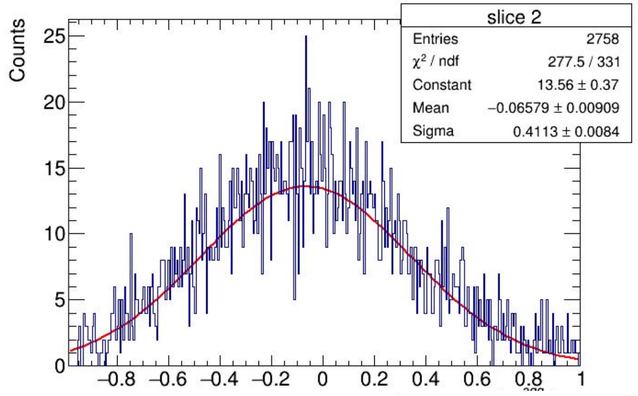

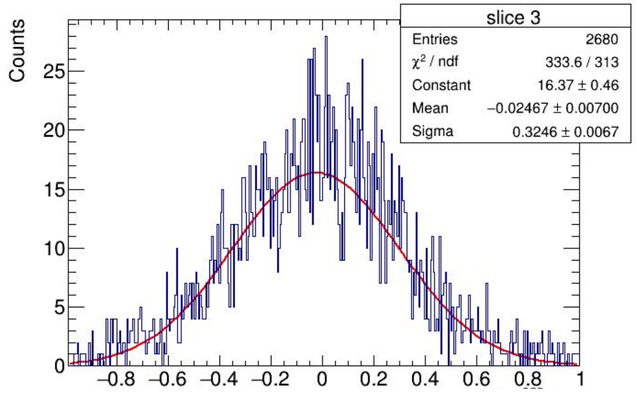

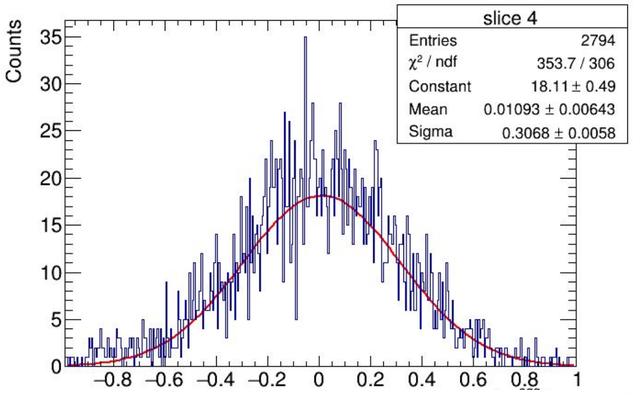

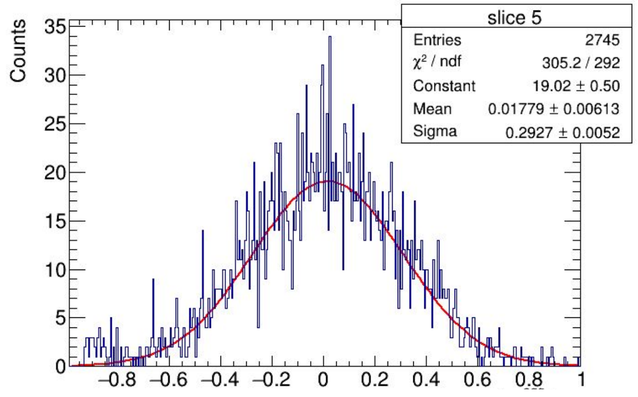

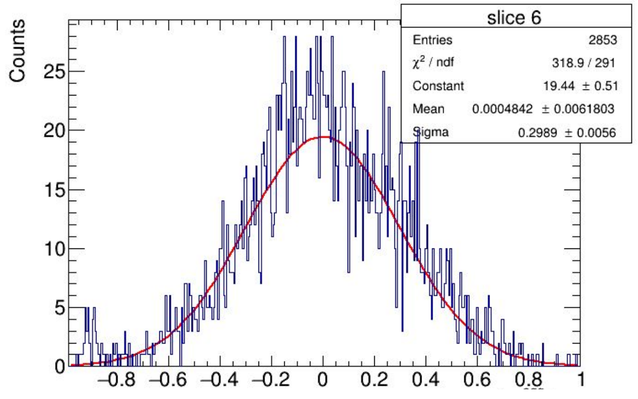

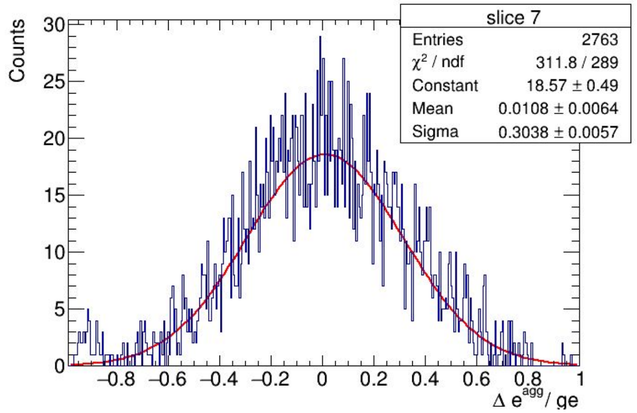

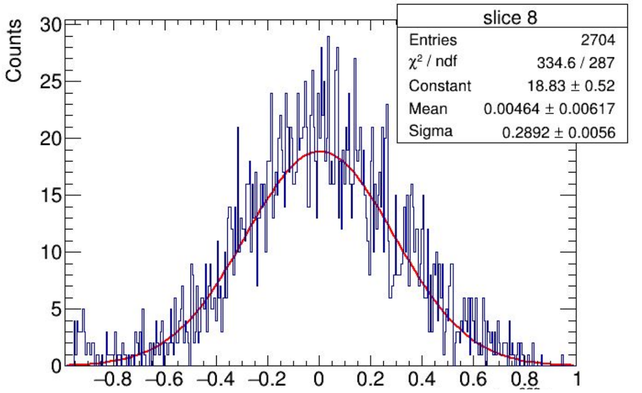

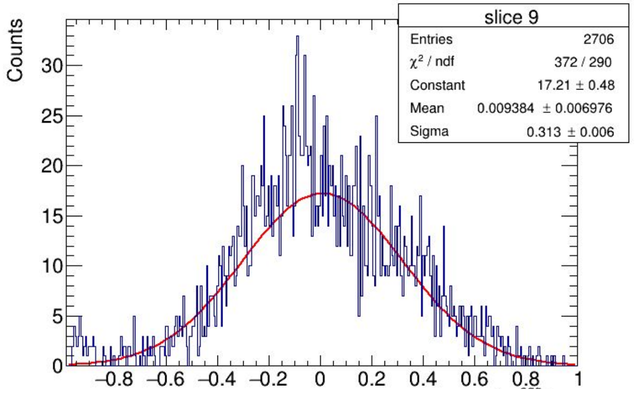

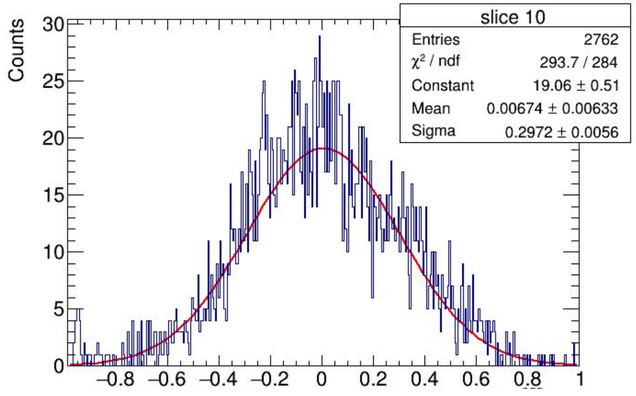

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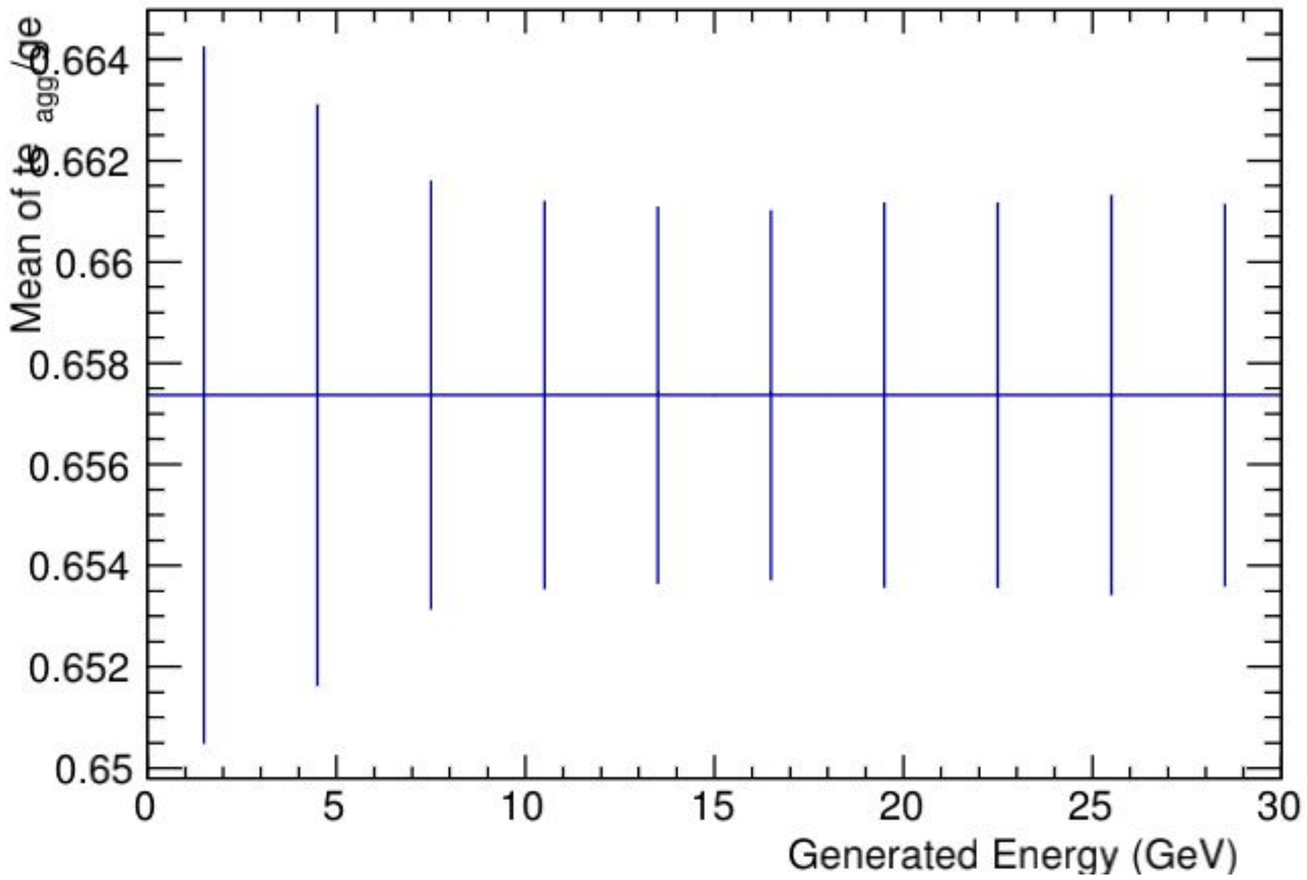

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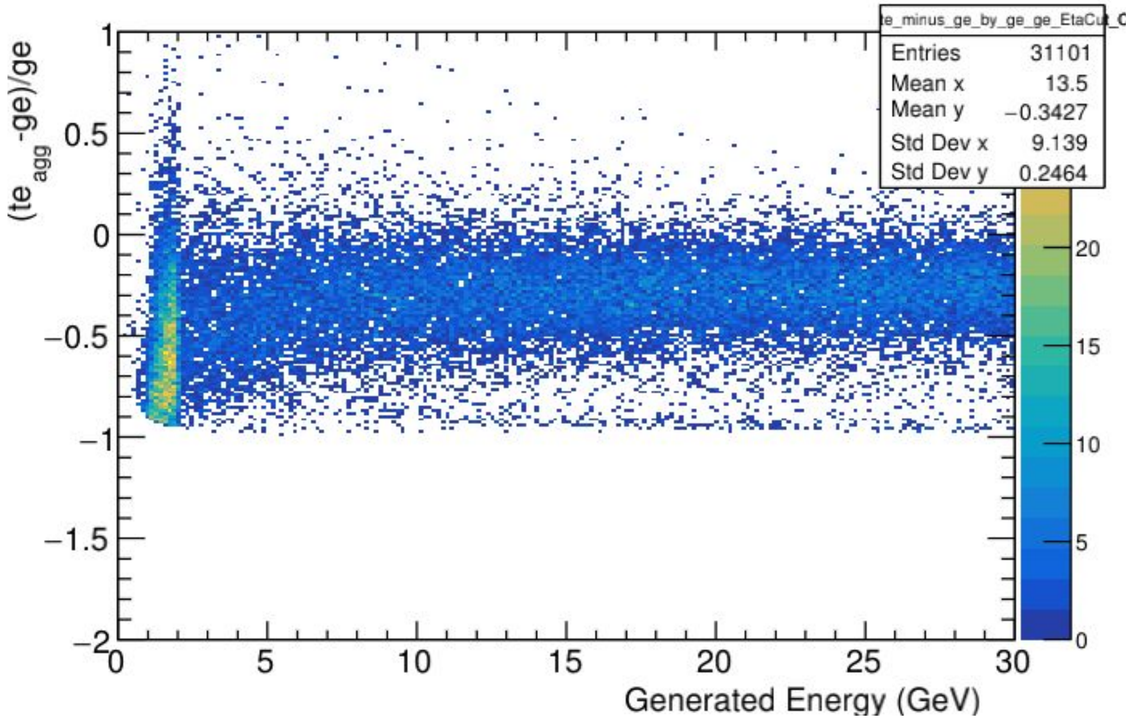

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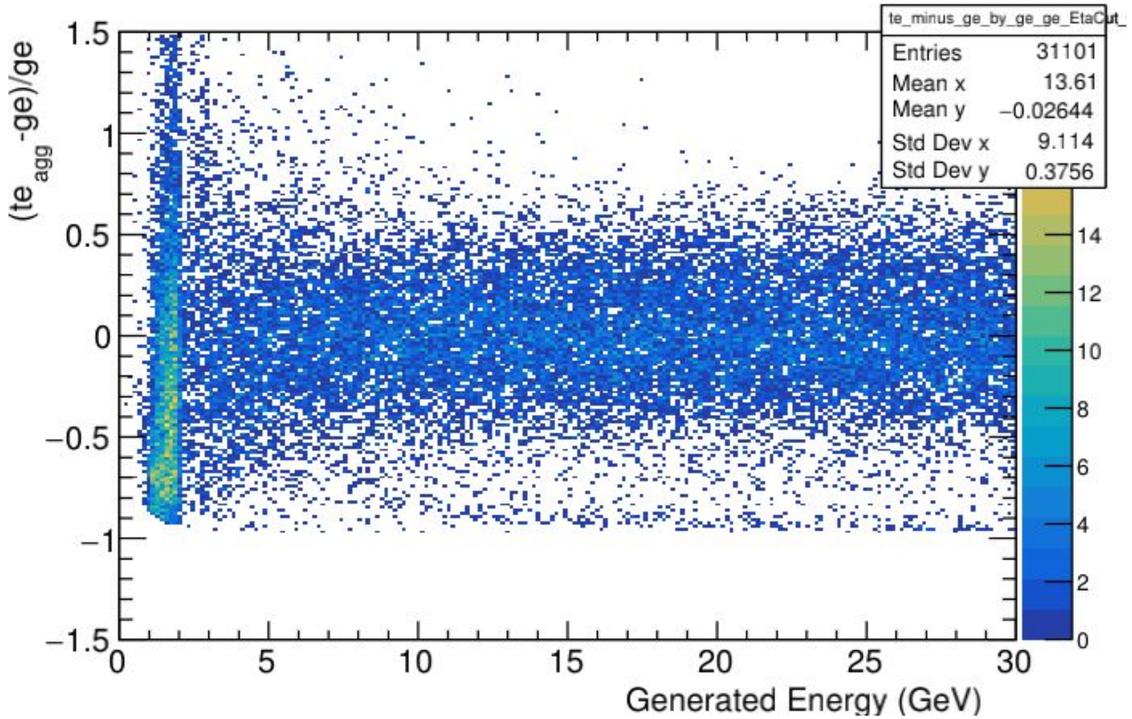

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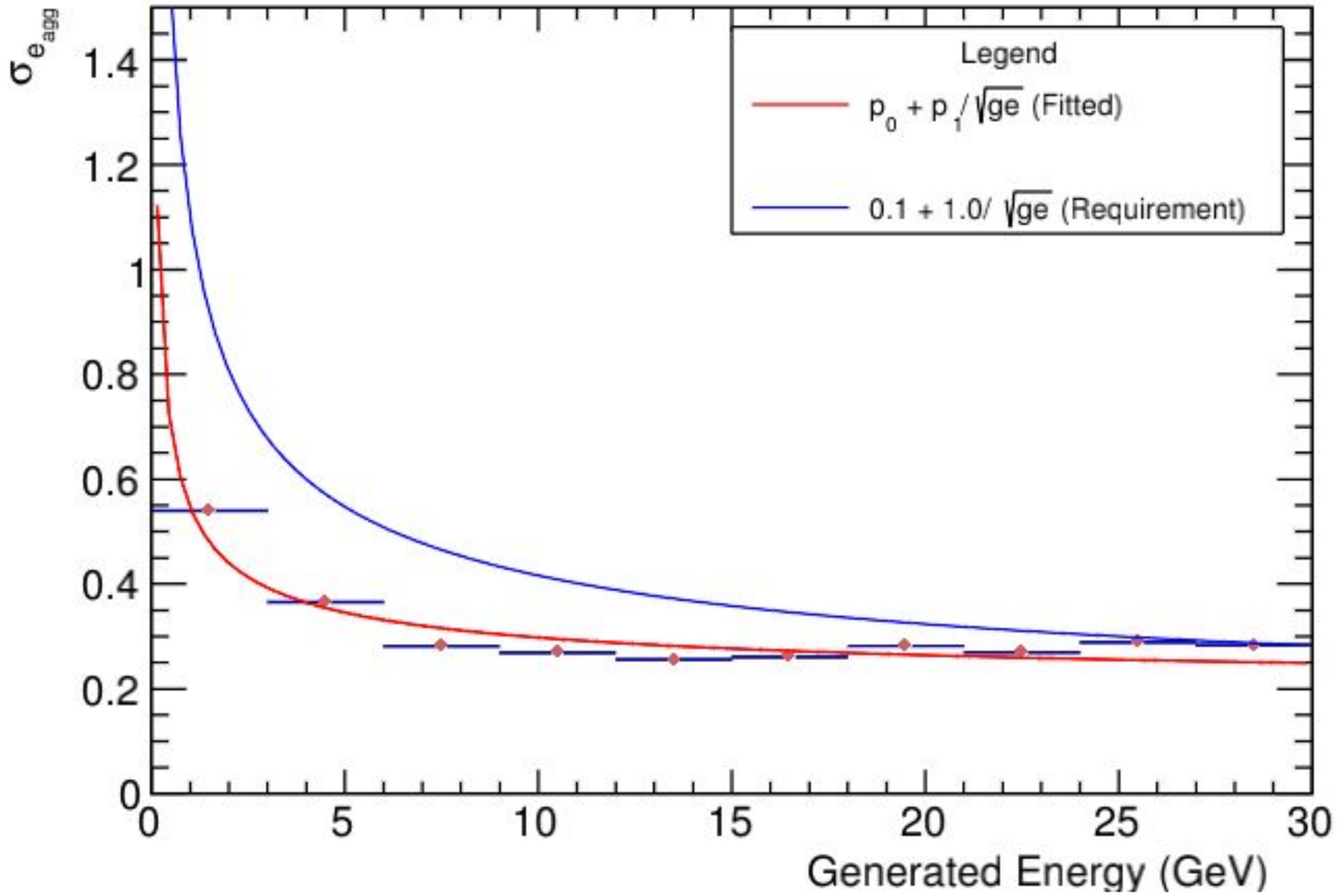

σe refers to the standard deviation of the Gaussian fitted to a slice of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

Number of bins = 10
Bin Width = 3 GeV

Fit Parameters:
p_o = (0.182869 +- 0.00442540)
p_1 = (0.363749 +- 0.0147909)$GeV^{0.5}$

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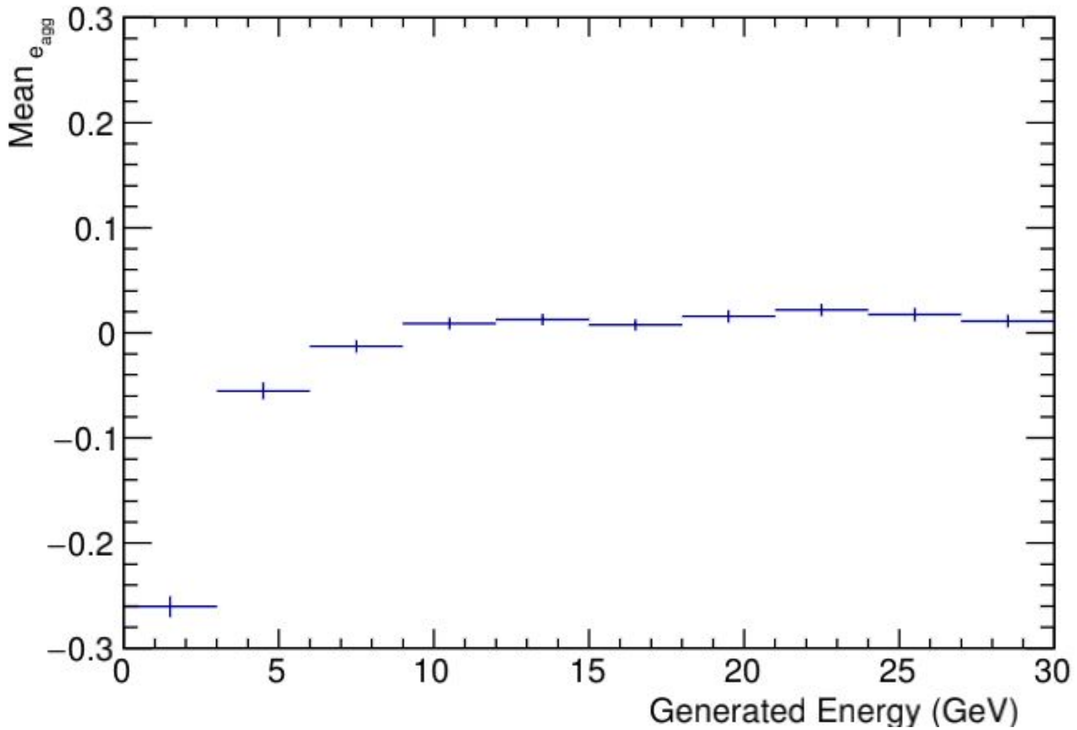

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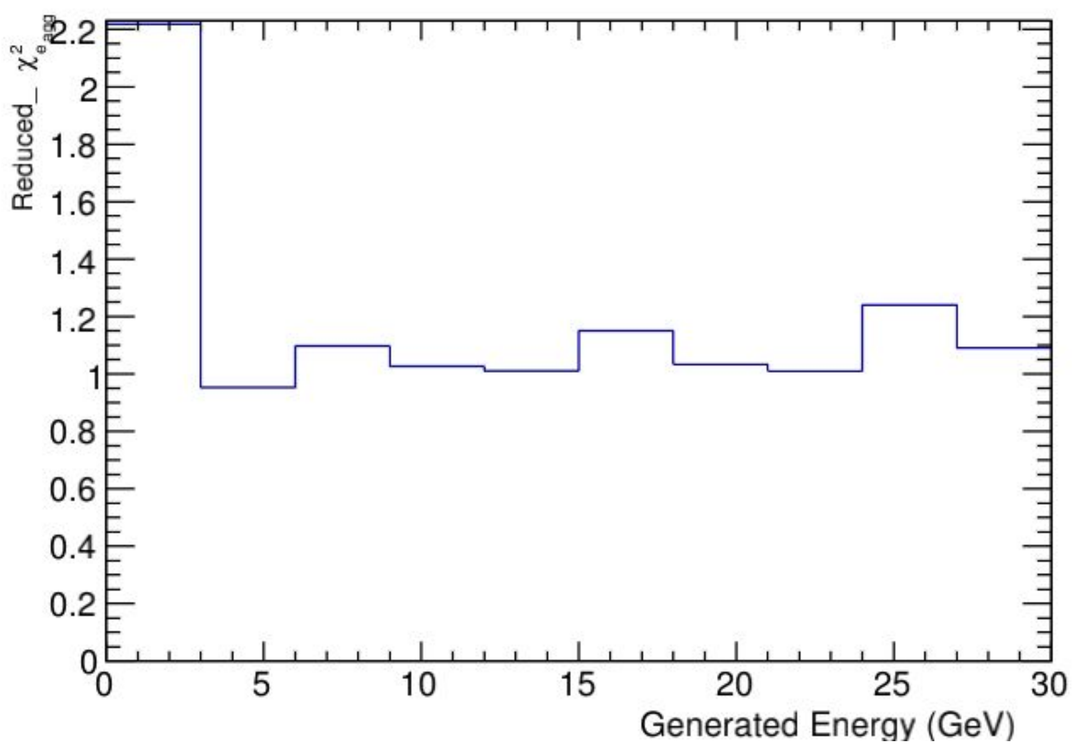

Reduced_χ2 of the Gaussians fitted to the slices of the calibrated $(te_{agg}-ge)/ge$ vs ge plot.

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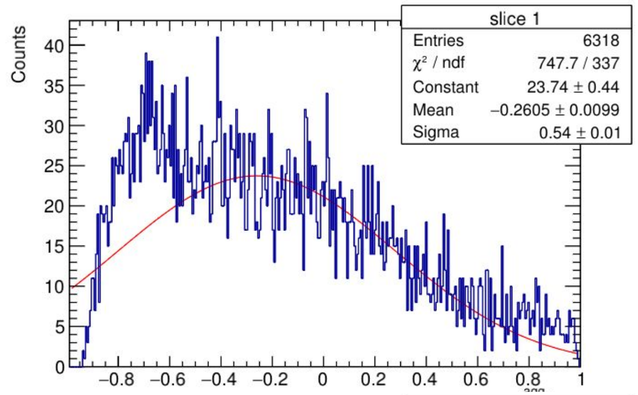

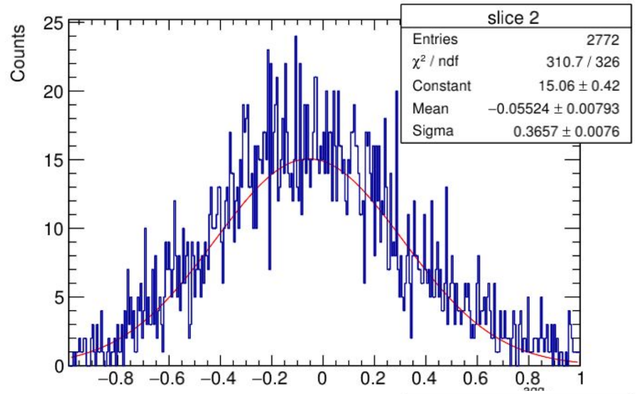

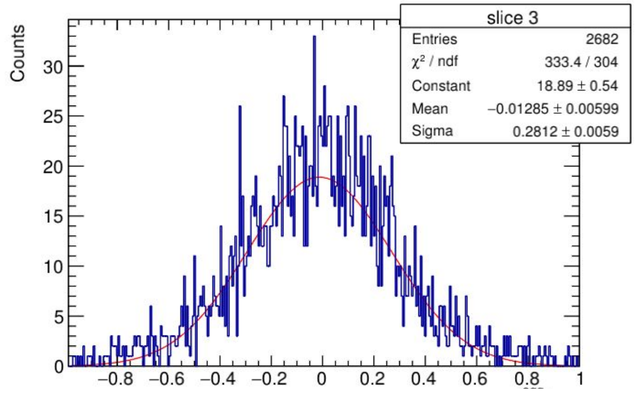

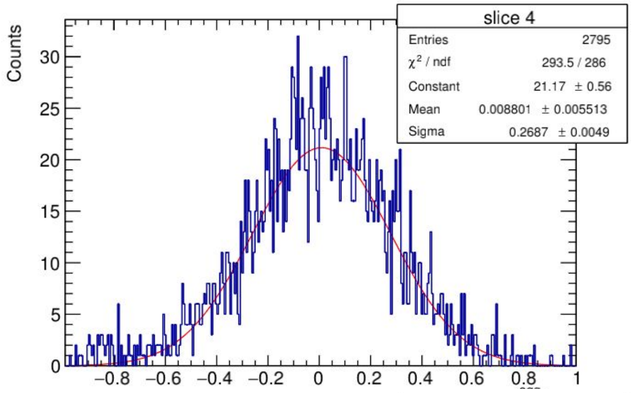

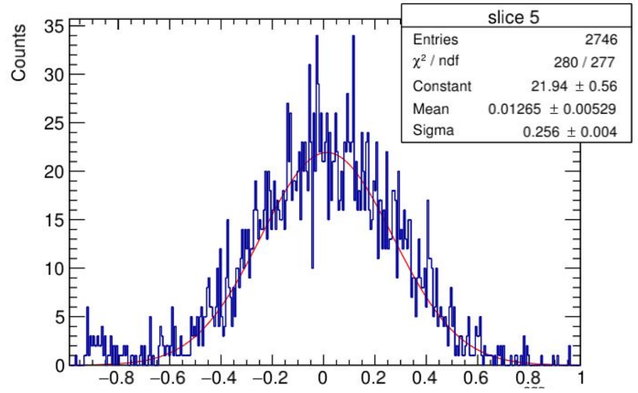

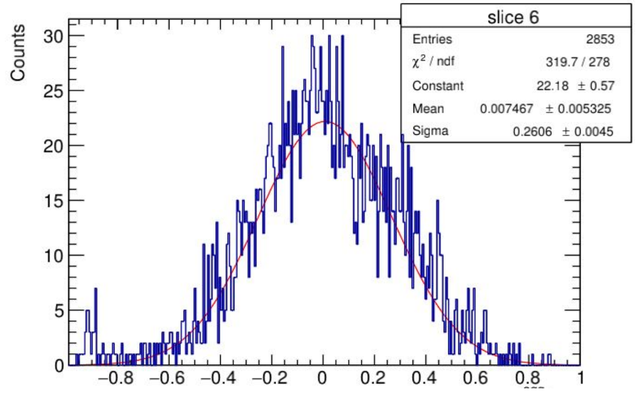

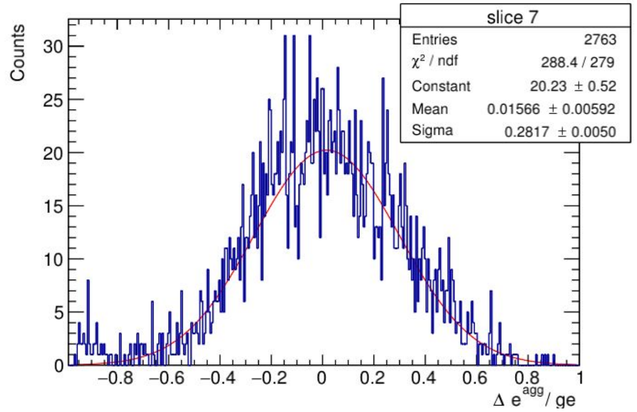

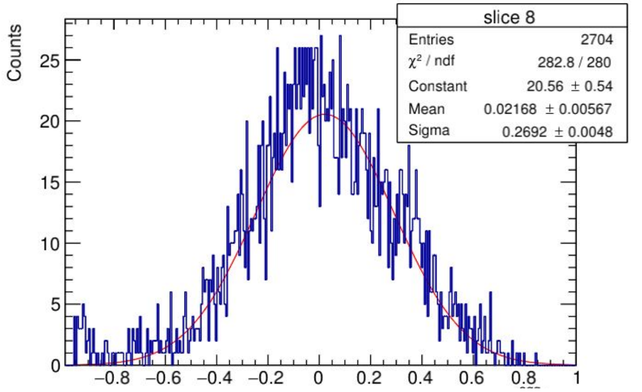

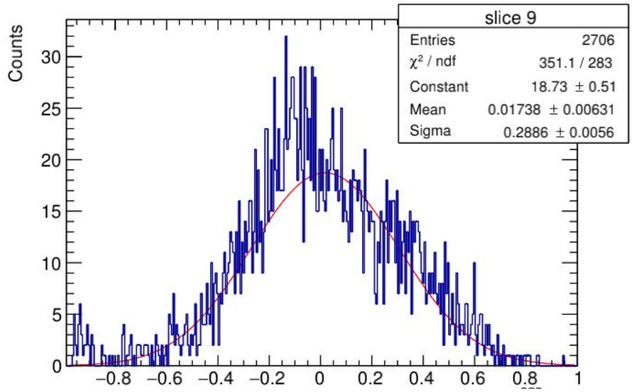

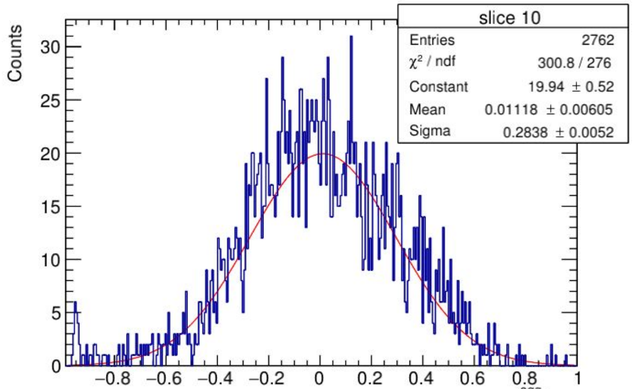

The x-axes denote $\Delta e_{agg}/ge$