



Monte Carlo Energy Resolution



University of Athens

April 20, 2017

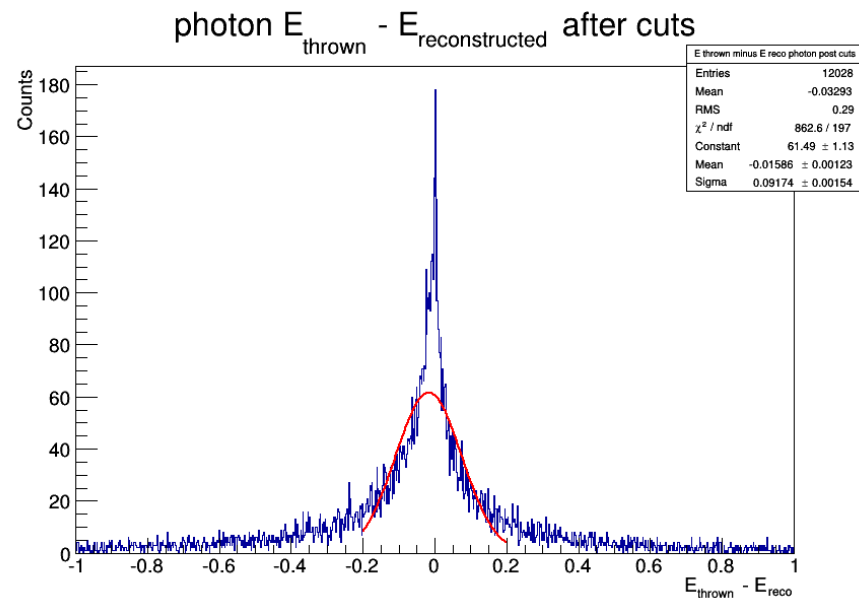
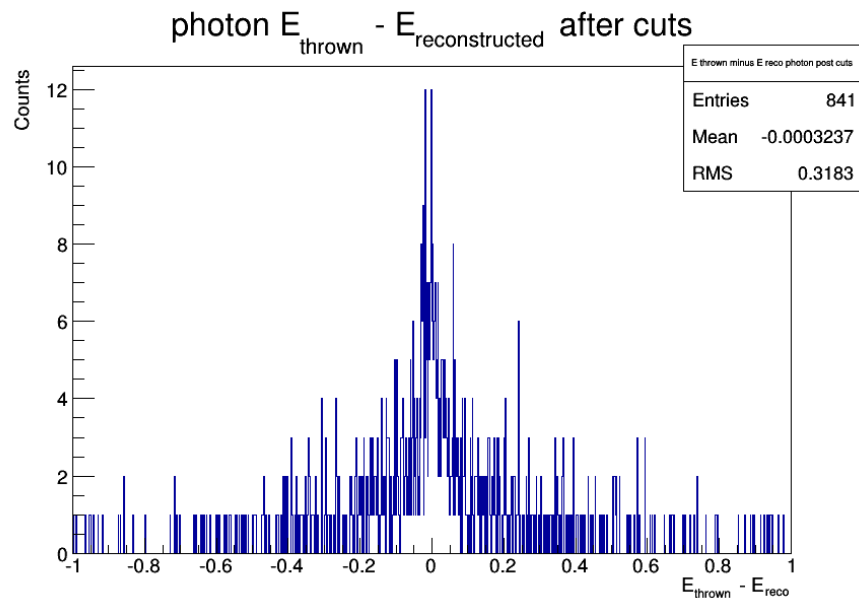
Changes (based on comments from previous meetings):

- Changed the P4 + Vertex KinFit to Vertex KinFit only
- Changed the analysis of the Dalitz decay from exclusive to inclusive (treating the photon as missing)
- Reran the Geant4 Monte Carlo with 1M events (instead of 100k)
- Modified the cut flow to better suit the inclusive analysis

Cut Flow:

- MaxPhotonRFDeltaT = 0.5*dBeamBunchPeriod
- MaxExtraGoodTracks = 4
- $(Missing\ Mass)^2 \in [-0.1, 0.1] (GeV/c^2)^2$
- PID ΔT loose cuts ($\pm 3ns$)
- dE/dx cut
- KinFitFOM cut = 5.73303E-7 (5 σ confidence level cut)
- Missing PT < 0.4 GeV/c
- Proton $|t| > 0.05 (GeV/c^2)^2$
- $M(e^+e^-) < 50 MeV/c^2$
- $\chi^2/NDF < 4$
- $z_{vertex_{p,e^+,e^-}} \in [50, 80] cm$
- $|x_{vertex_{proton}} - x_{production\ vertex}| < 3 cm$, same for y and z coordinates
- Similar vertex cuts for e^+, e^-
- $\theta(e^+\gamma) > 0.5^\circ$, $\theta(e^-\gamma) > 0.5^\circ$, $\theta(e^+e^-) > 0.5^\circ$
- $\theta(e^+) > 2^\circ$, $\theta(e^-) > 2^\circ$
- $M(e^+e^-\gamma) \in [0.11, 0.16] GeV/c^2$

Thrown - Reconstructed photon Energy (before and after the changes):

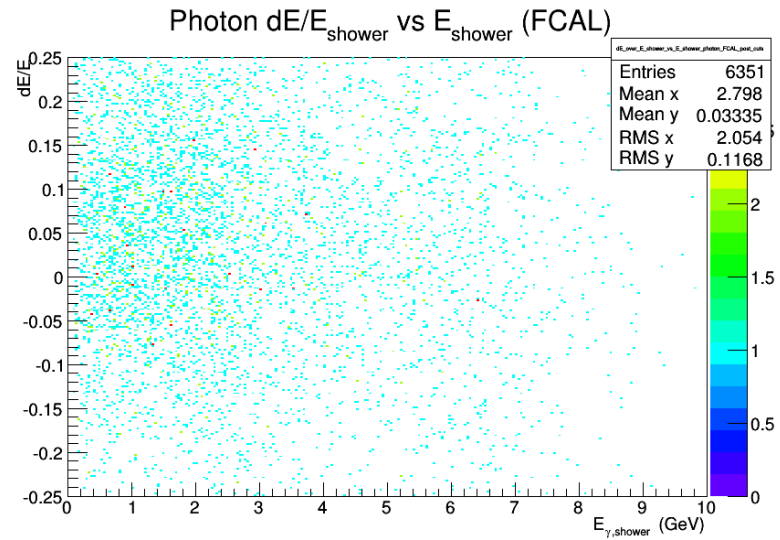
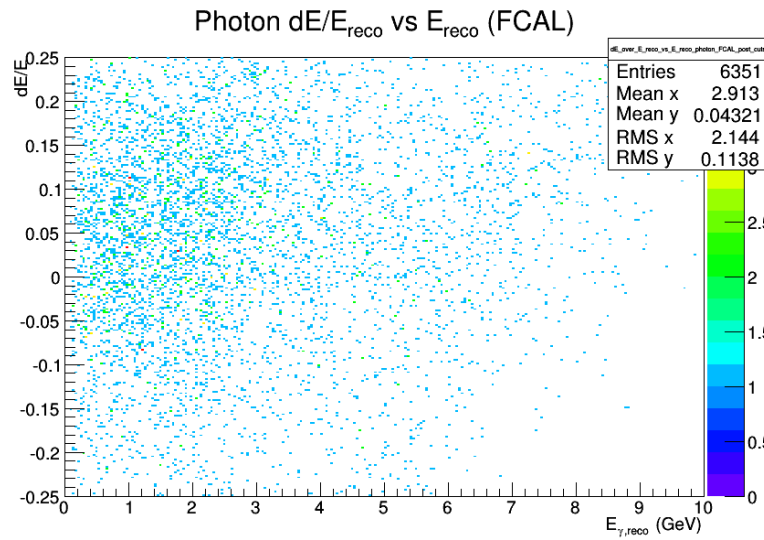
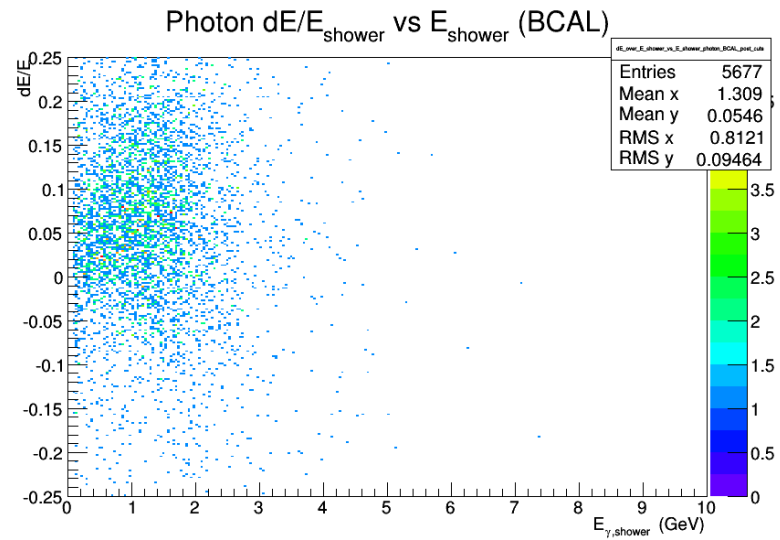
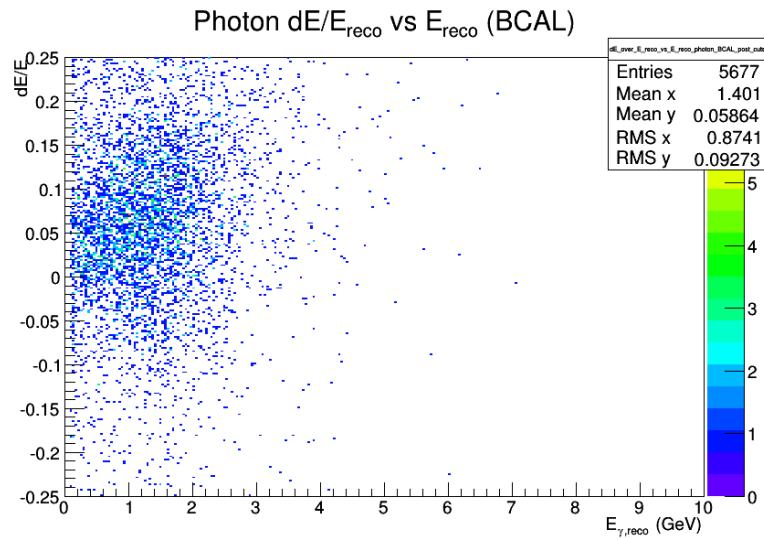


In the following plots:

E_{reco} : Reconstructed photon energy assuming the π^0 mass

$$dE = E_{\text{reco}} - E_{\text{shower}}$$

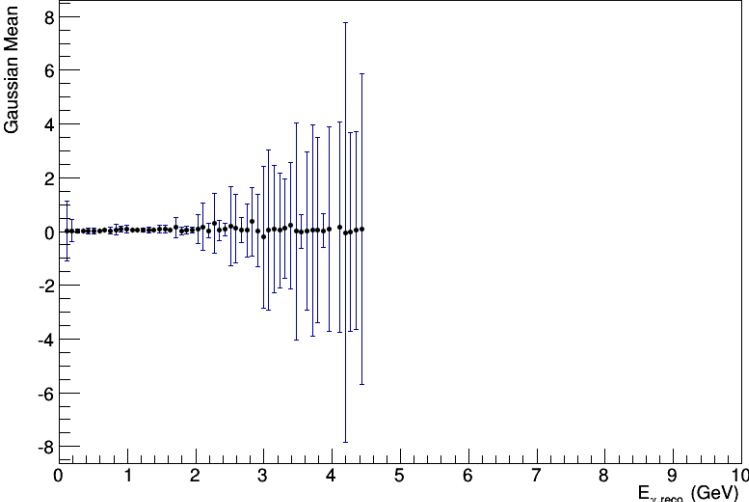
Energy Resolution (using E_{reco} , E_{shower}):



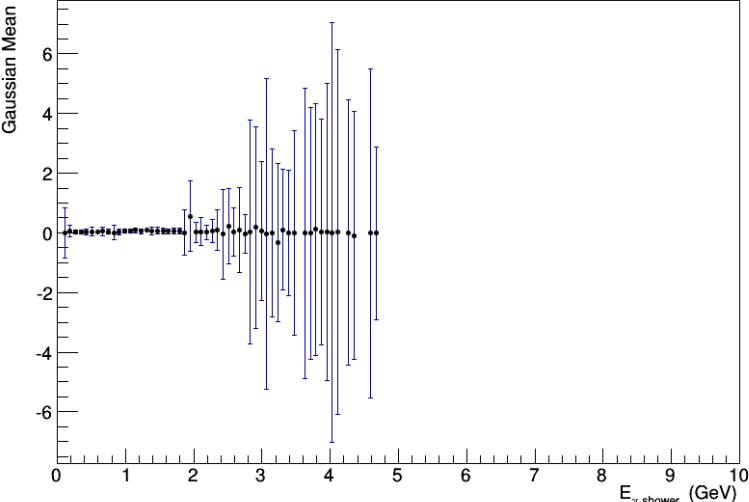
Next slides: Apply FitSlices, fit a gaussian for each slice, plot Mean and Sigma for BCAL, FCAL (using E_{reco} , E_{shower})

BCAL Gaussian Mean using E_{reco} , E_{shower} (bottom plots are zoomed in versions):

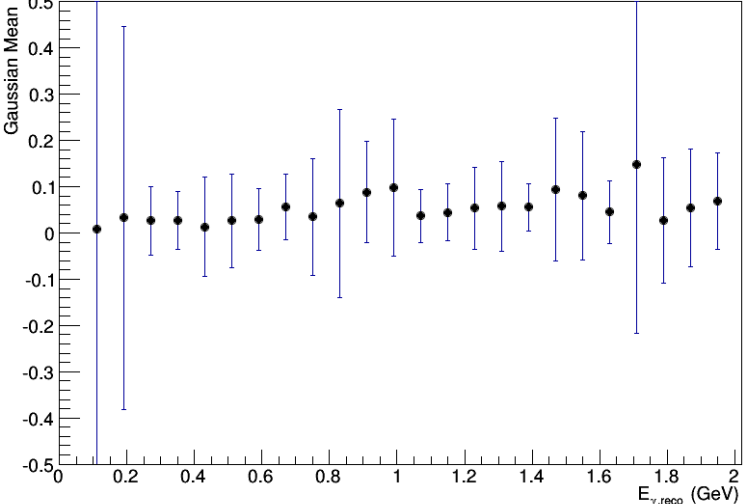
Gaussian Mean vs $E_{\gamma, reco}$ (BCAL)



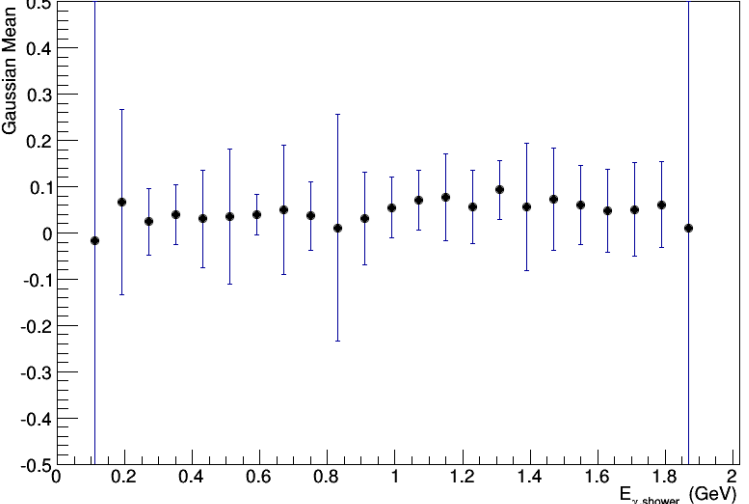
Gaussian Mean vs $E_{\gamma, shower}$ (BCAL)



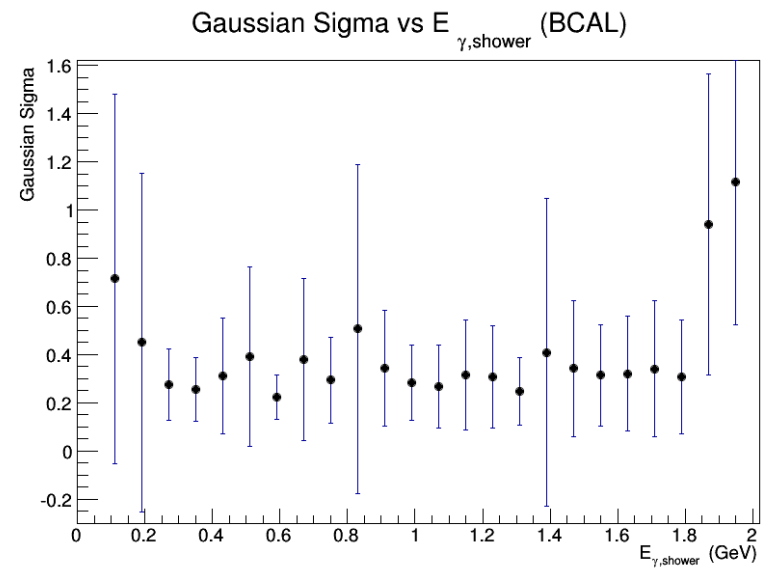
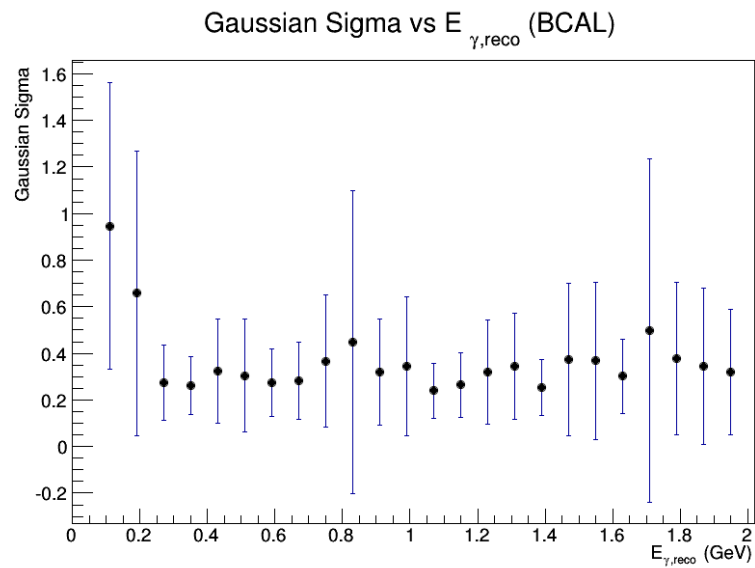
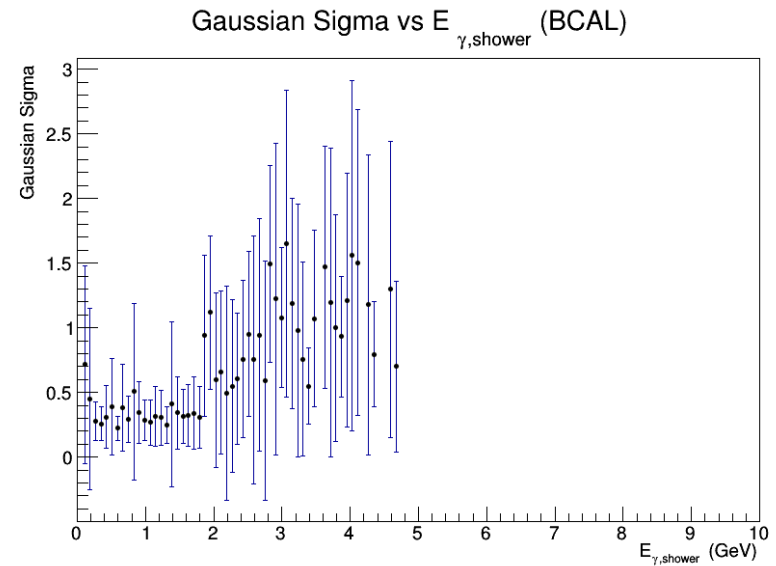
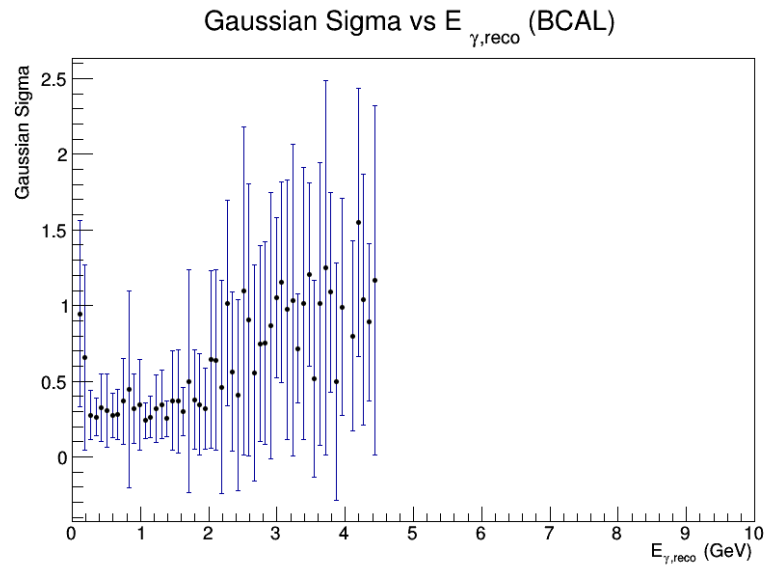
Gaussian Mean vs $E_{\gamma, reco}$ (BCAL)



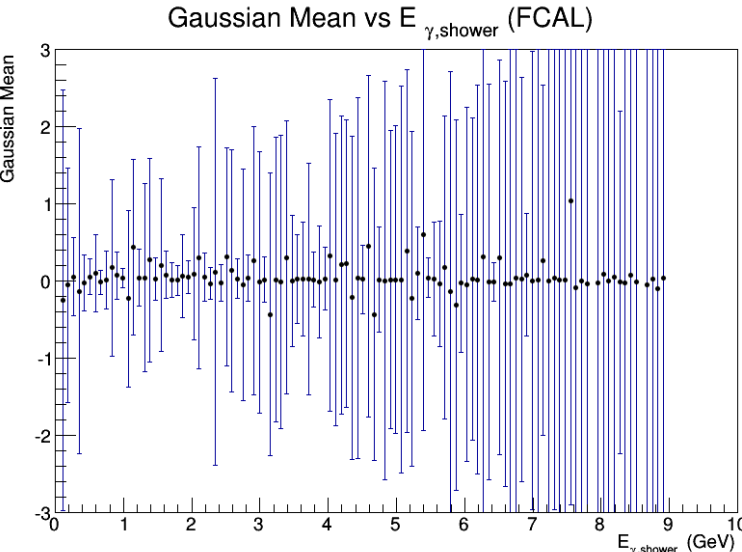
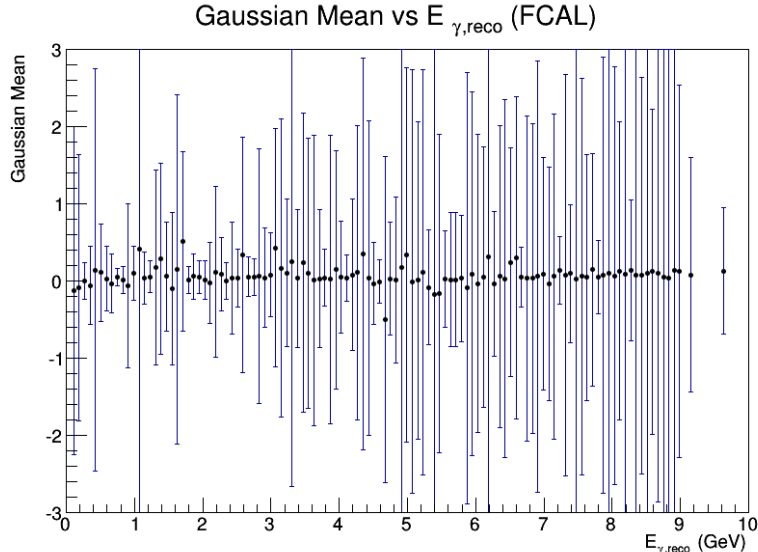
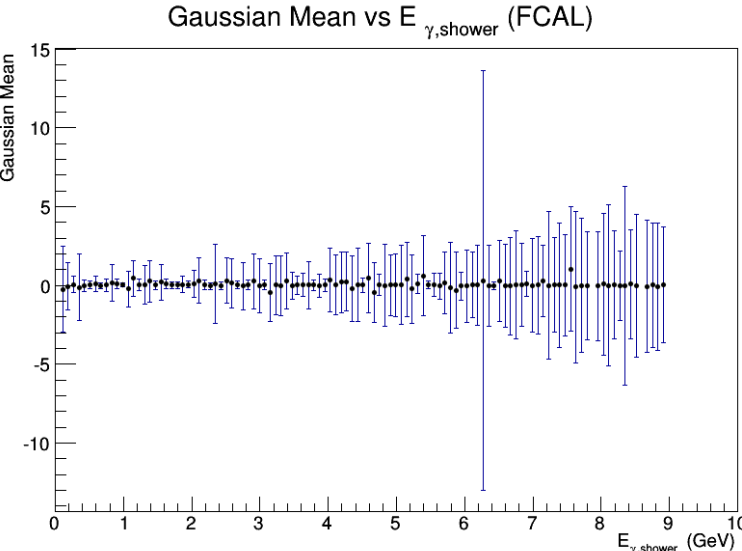
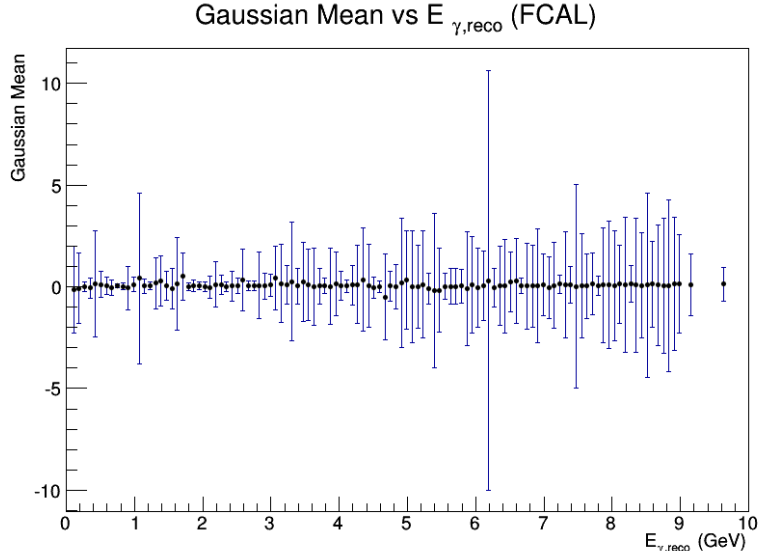
Gaussian Mean vs $E_{\gamma, shower}$ (BCAL)



BCAL Gaussian Sigma using E_{reco} , E_{shower} (bottom plots are zoomed in versions):



FCAL Gaussian Mean using E_{reco} , E_{shower} (bottom plots are zoomed in versions):



FCAL Gaussian Sigma using E_{reco} , E_{shower} :

