

Testing photon reconstruction in ilcsoft v01-18-02

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ILD Analysis/Software Meeting

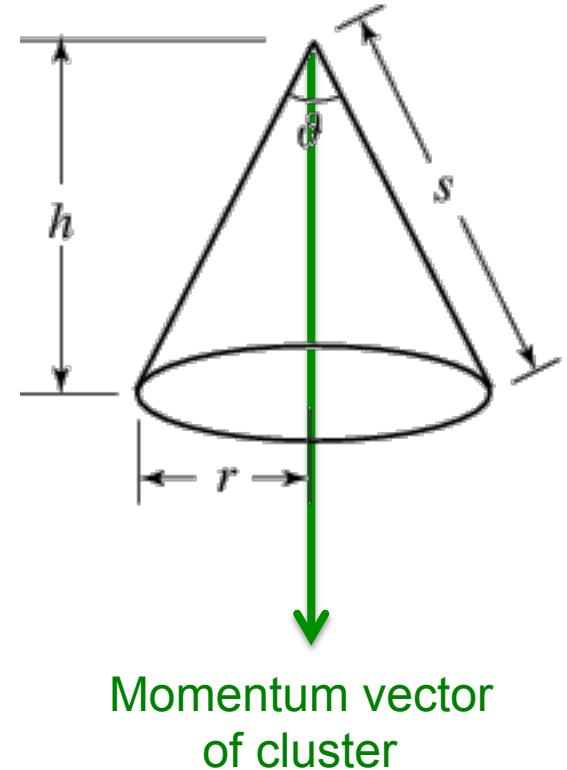
Setup

- First look at photon reconstruction of new software
 - Context: mono-photon analysis for WIMP search
- Sample (generated by WHIZARD 1.95-DBD):
 $e+e- \rightarrow \nu_e \nu_e \gamma$
 $\sqrt{s} = 500 \text{ GeV}$ (left-handed polarization only)
- Detector: ILD_o1_v05, simulated with Mokka
- Reconstruction: compare two versions
 - 1) **v01-16-02** (DBD)
 - 2) **v01-17-08** (improved photon finding in Pandora)

Photon Reclustering

A reclustering step is applied to take care of photon cluster fragmentation.

I use a cone-based reclustering with a fixed cone angle.

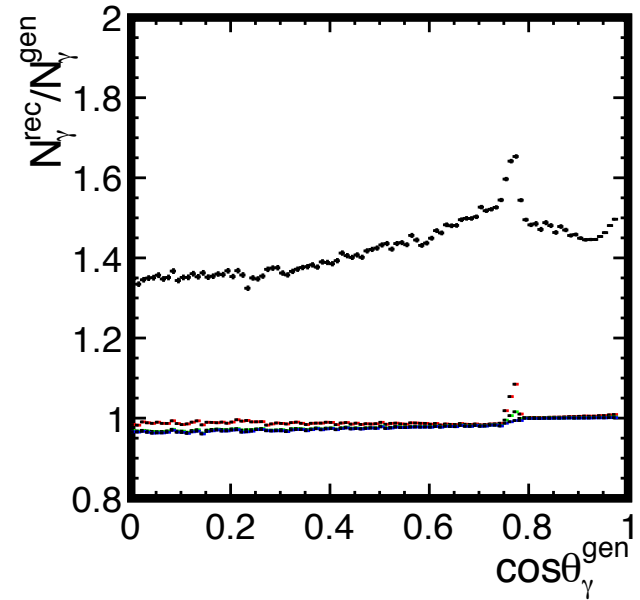
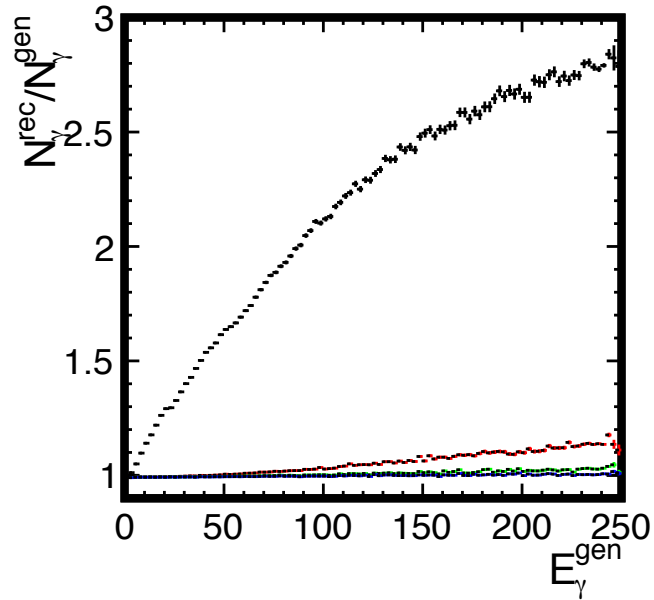


Half opening angle = $\theta/2$

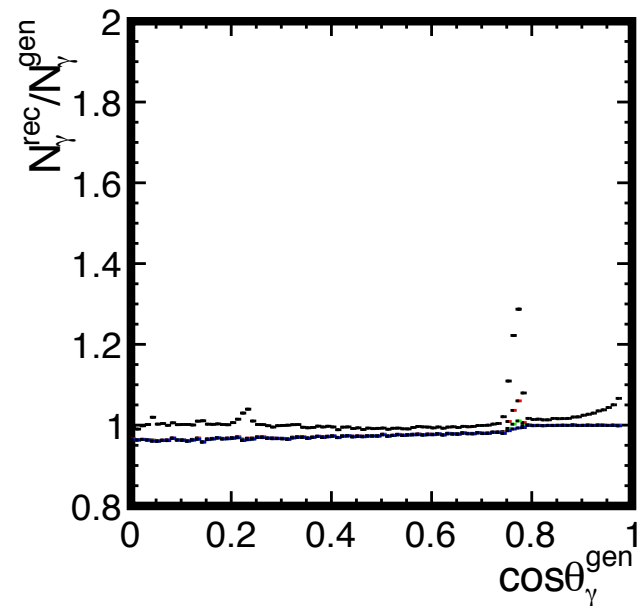
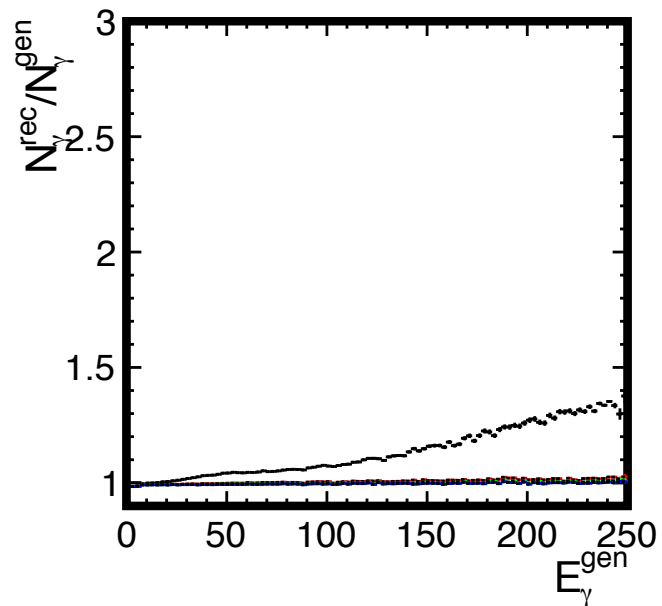
Comparison

Red: half opening angle = 0.03
Green: half opening angle = 0.04
Blue: half opening angle = 0.05

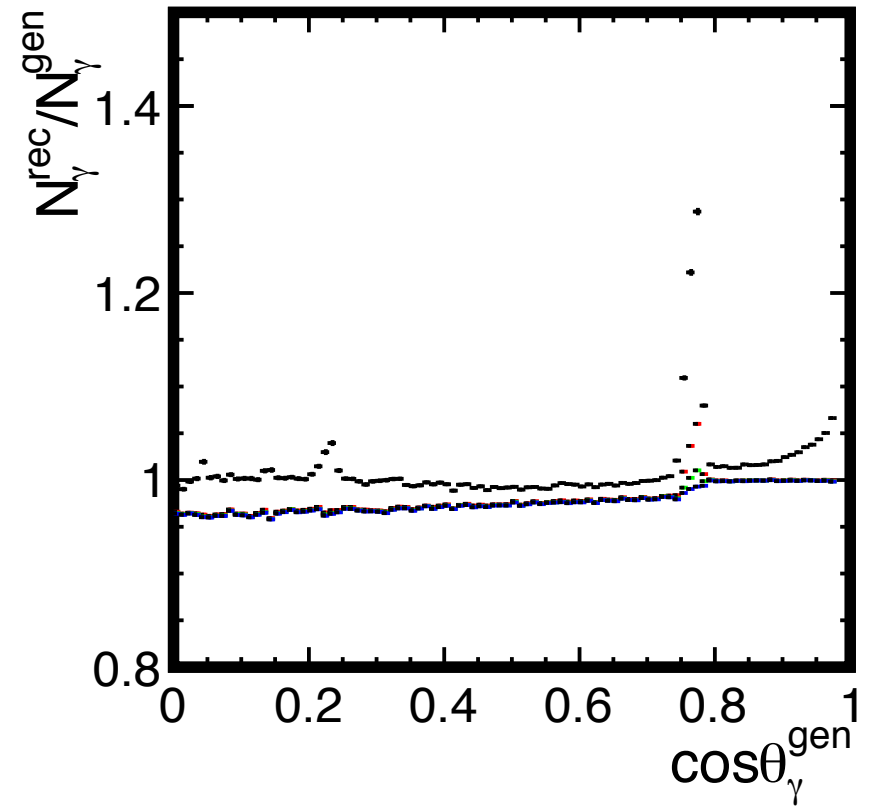
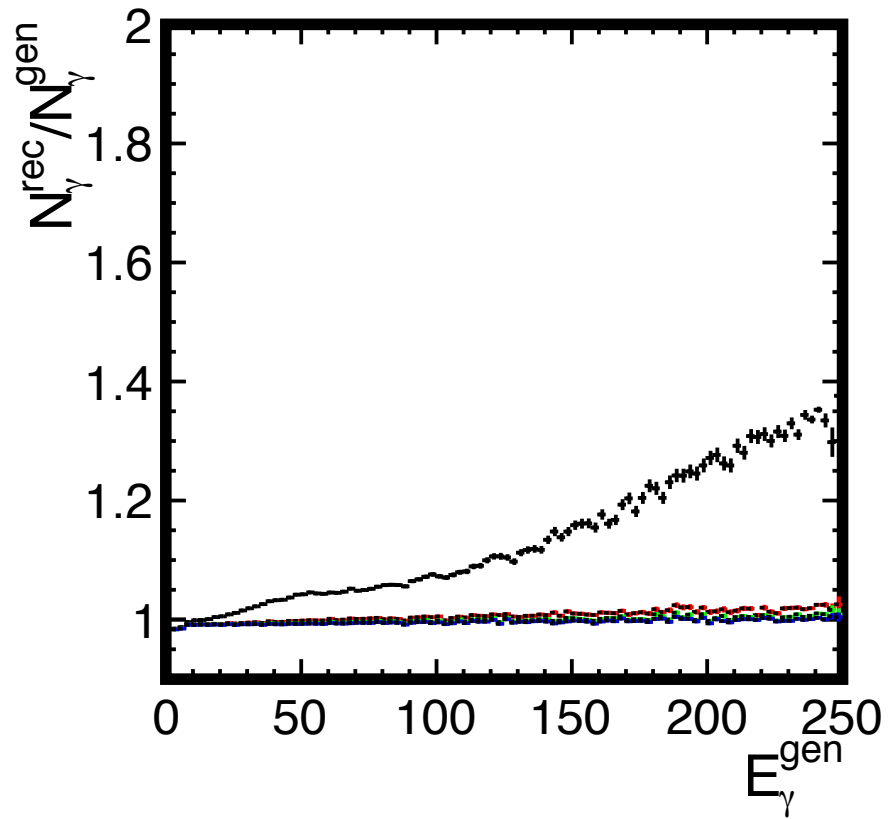
v01-16-02



v01-17-08



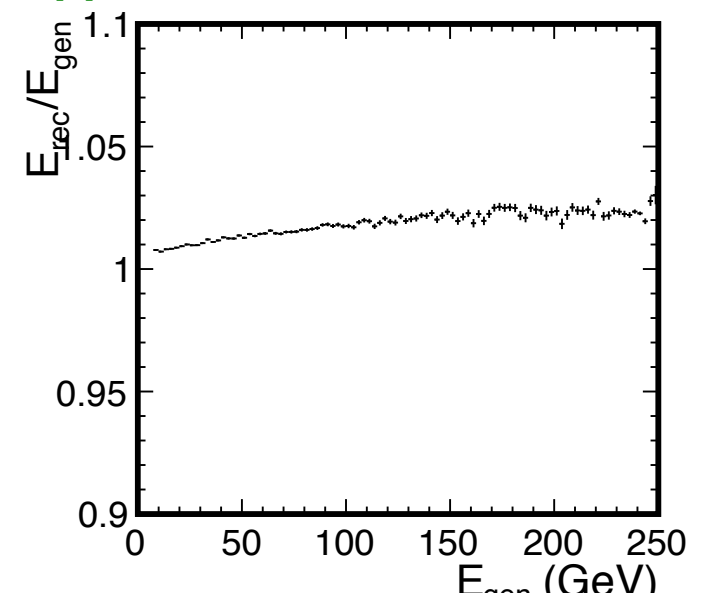
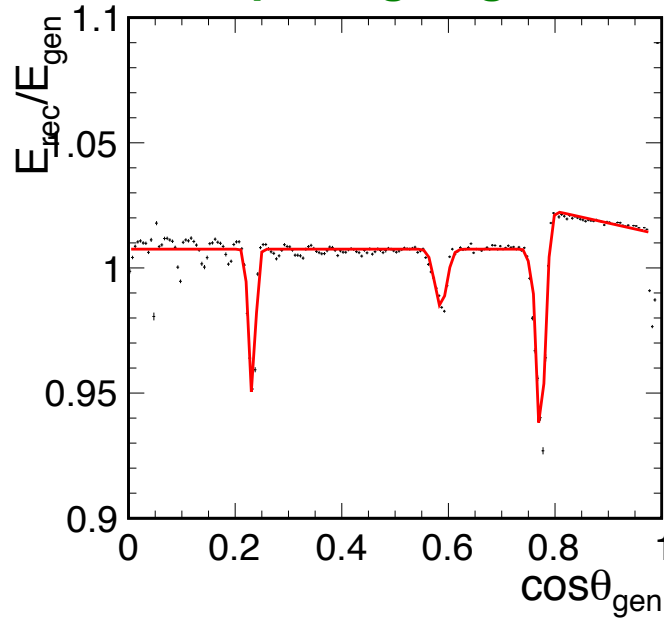
v01-17-08, zoomed in



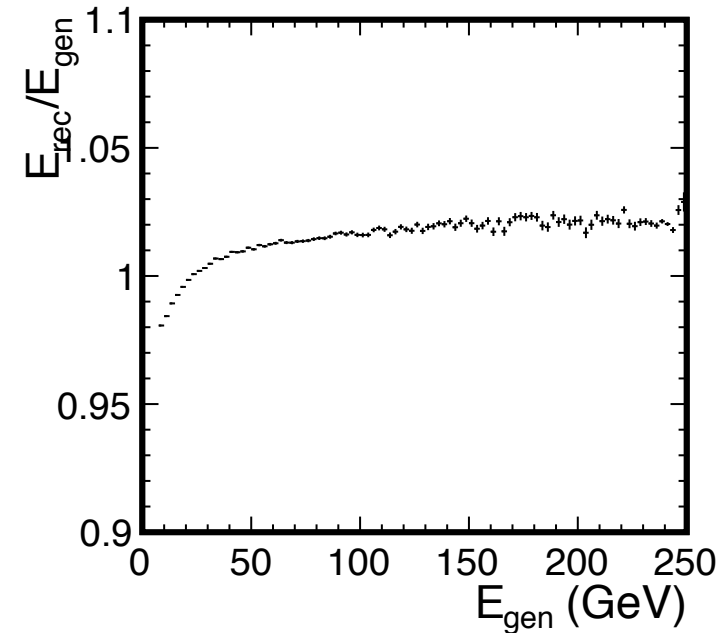
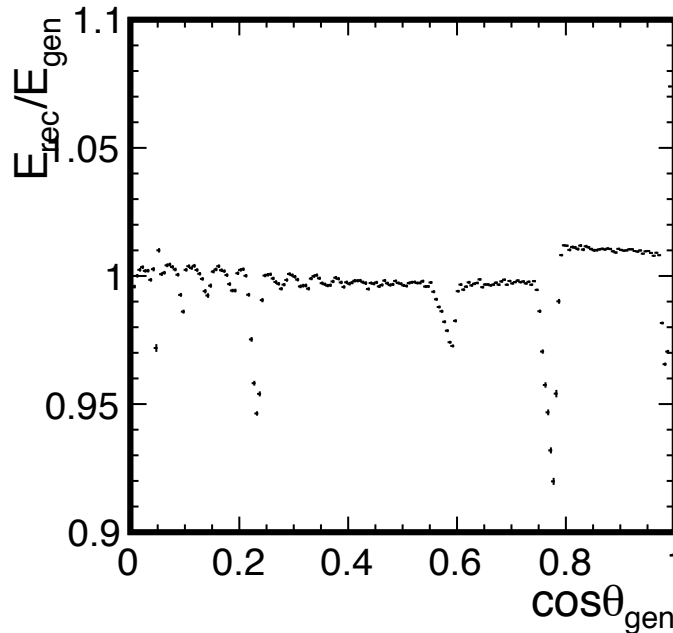
Energy Reconstruction

half opening angle = 0.04 is applied.

v01-16-02



v01-17-08



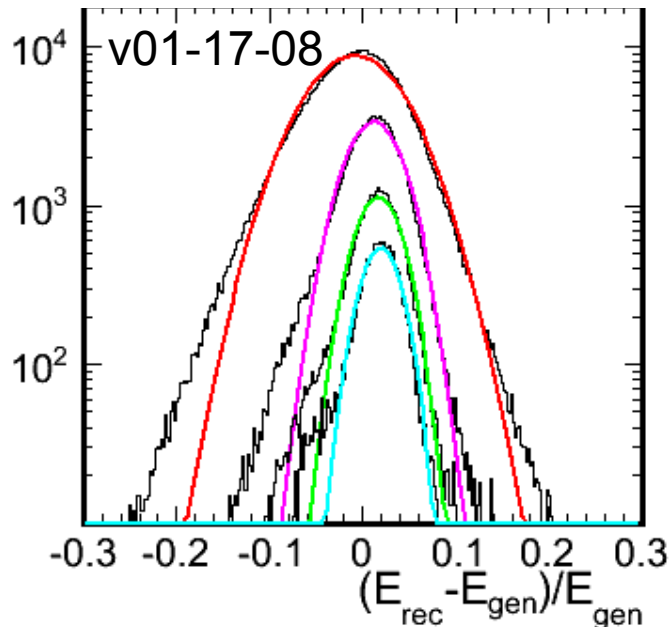
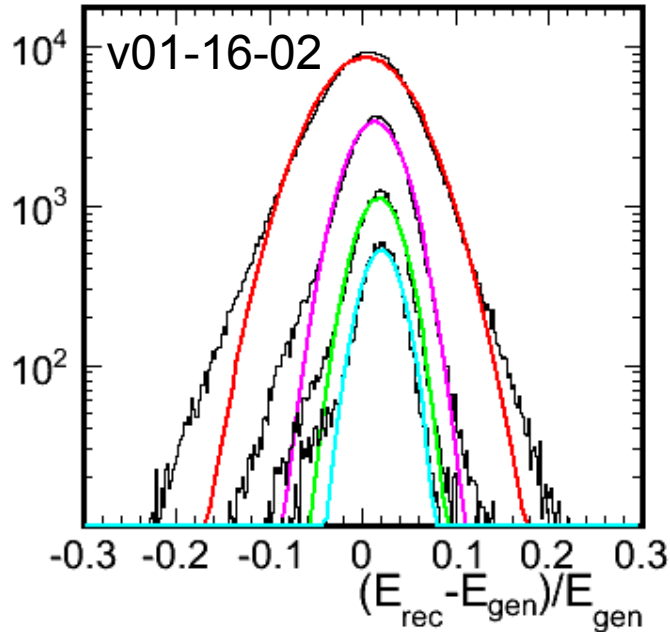
Photon Energy Resolution

half opening angle = 0.04 is applied.

Distribution of photon energy for (Reco-MC)/MC, a measure of photon energy resolution

Preliminary:

- 1) Re-clustering applied but not reoptimized (new)
- 2) Energy rescaling not applied (both)



(Single Gaussian width)

E_{gen}	v01-16-02	v01-17-08
[0,50]	4.66%	4.93%
[50,100]	2.86%	2.88%
[100,150]	2.39%	2.38%
[150,200]	2.00%	2.08%

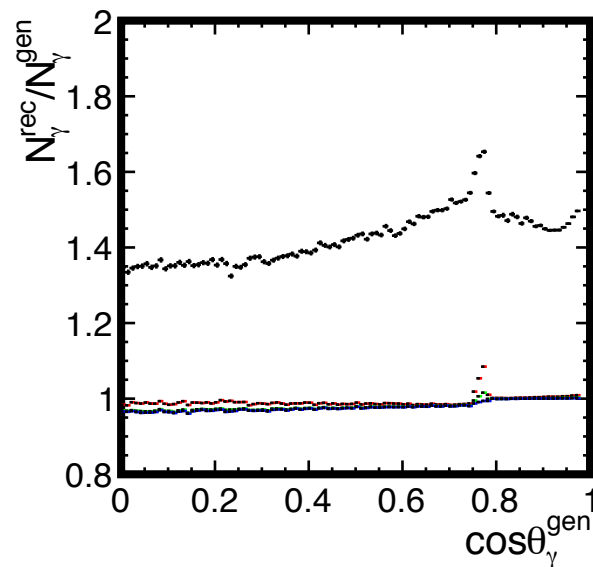
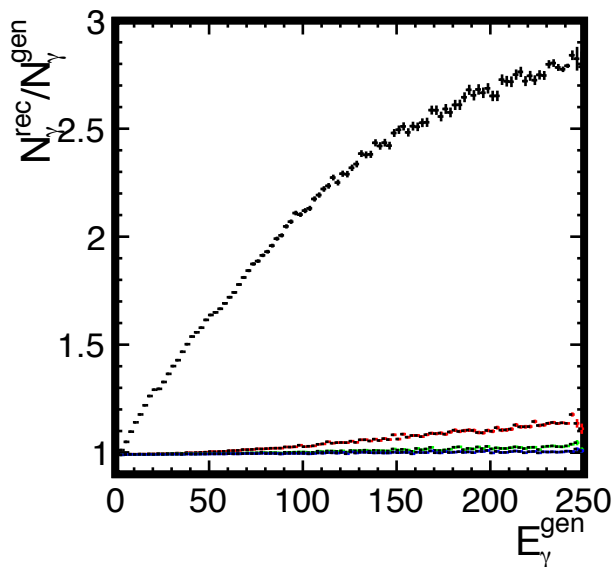
Summary

- First look at photon reconstruction using new software.
- Photon cluster splitting looks much better right off the bat.
- Issues in energy reconstruction in the low energy region.

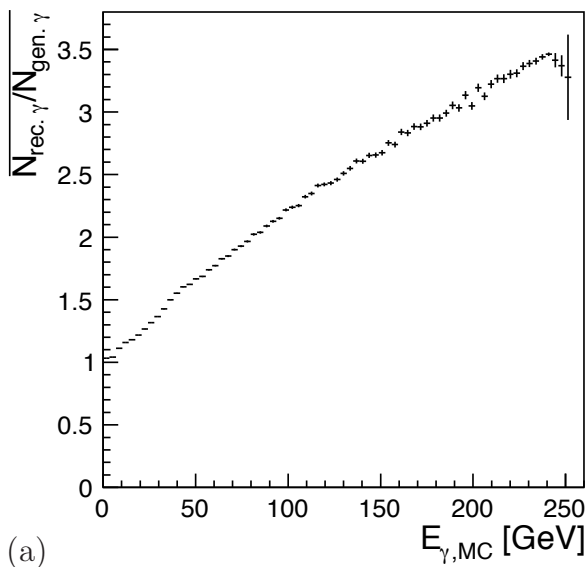
Backup

Photon Reconstruction

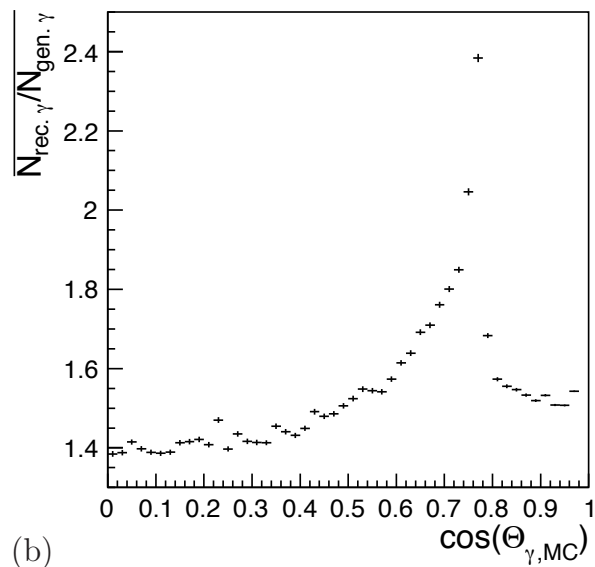
My plots



C. Bartels
Thesis (2011)



(a)

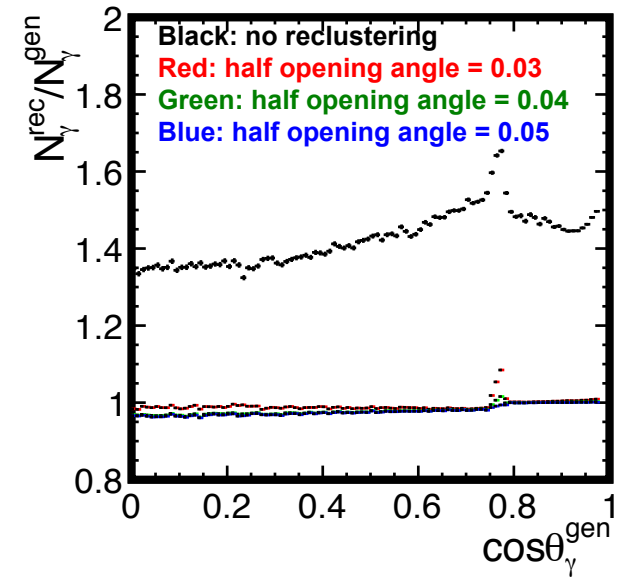
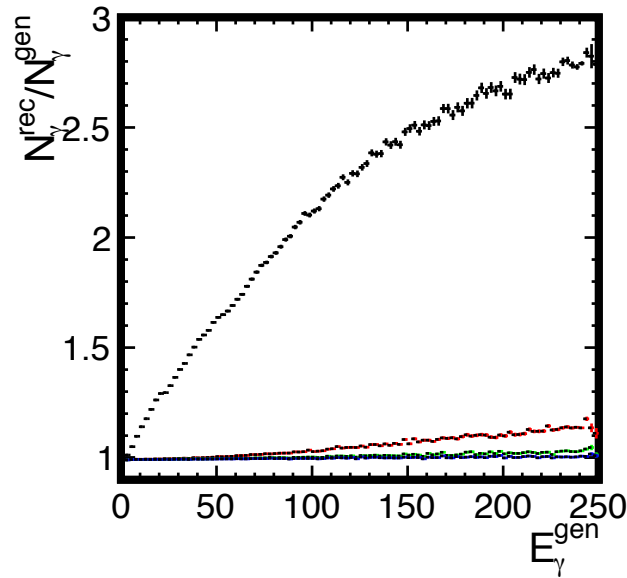


(b)

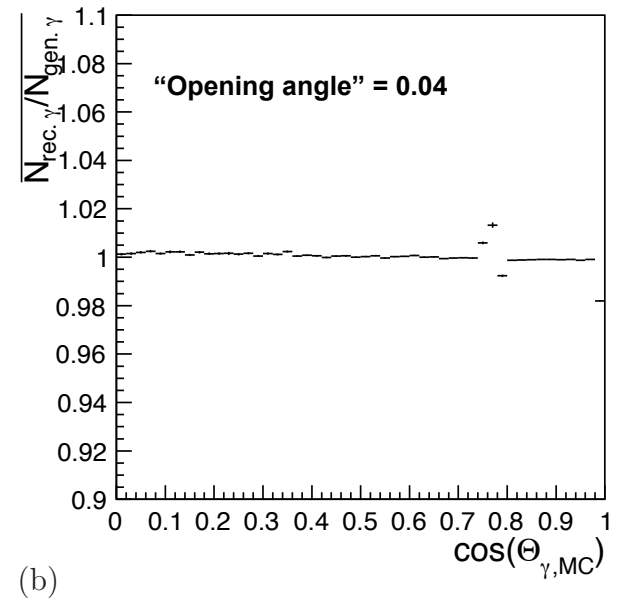
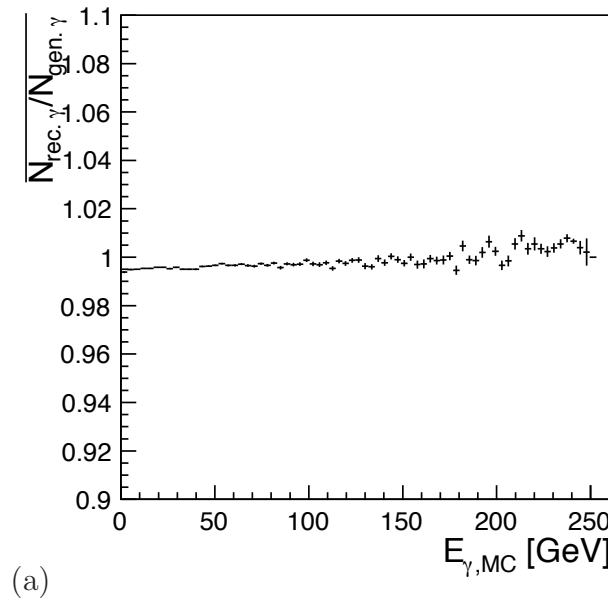
Similar features observed.

Comparison After Reclustering

My plots



C. Bartels
Thesis (2011)



Optimizing Reclustering

The efficiency and purity are defined as:

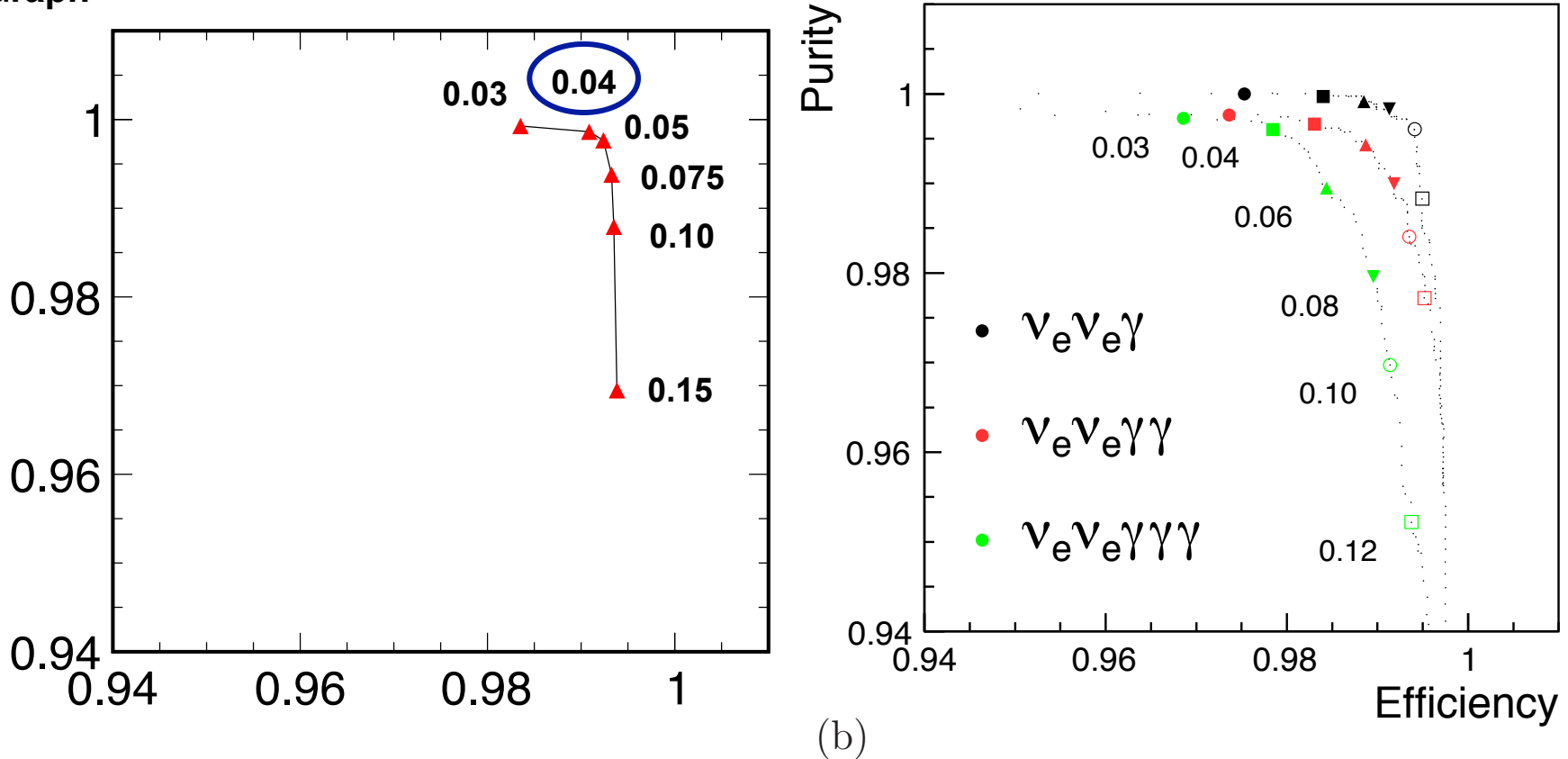
$$\varepsilon = \frac{\# \text{ Found and correct matches}}{\# \text{ Correct matches}} \quad (6.1)$$

$$p = \frac{\# \text{ Found and correct matches}}{\# \text{ Found matches}}, \quad (6.2)$$

where $\# \text{ Found and correct matches}$ is the number of photon candidates within the cone which are also related to the generated photon, $\# \text{ Correct matches}$ is the number of all reconstructed photons related to the generated photon and $\# \text{ Found matches}$ gives the number of photon objects within the cone. Efficiency and purity of the merging procedure for different cone

C. Bartels, Thesis (2011)

Graph

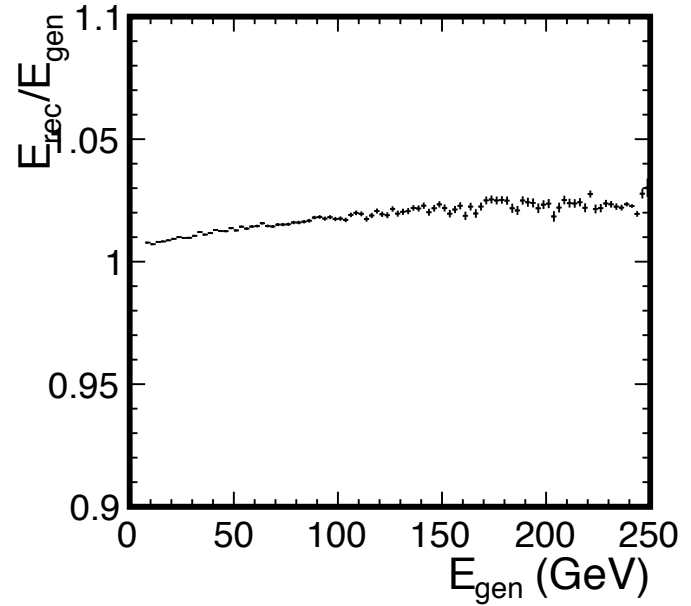
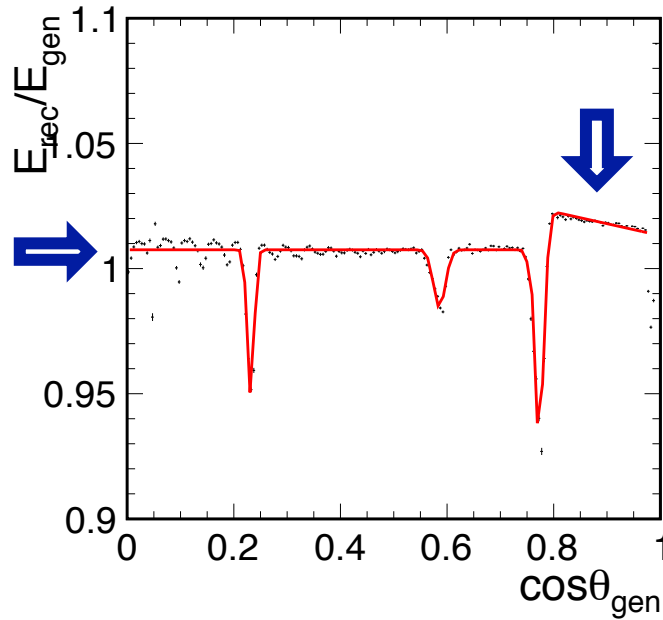


Differences observed in:

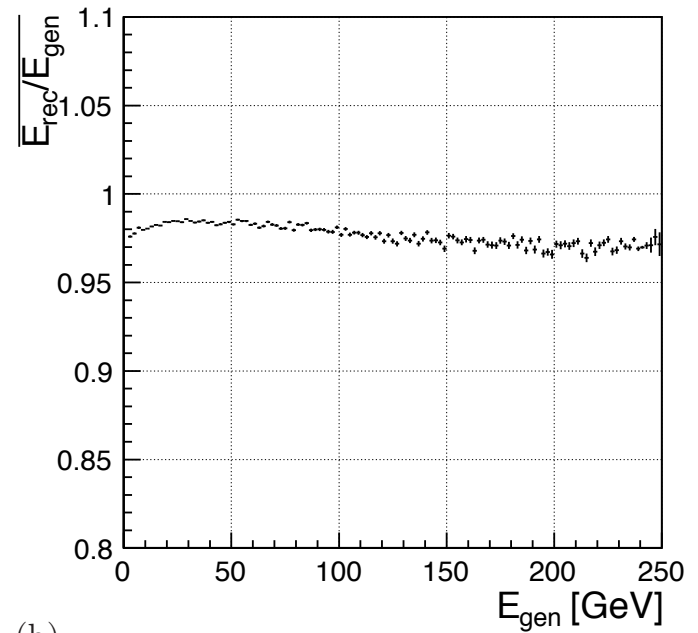
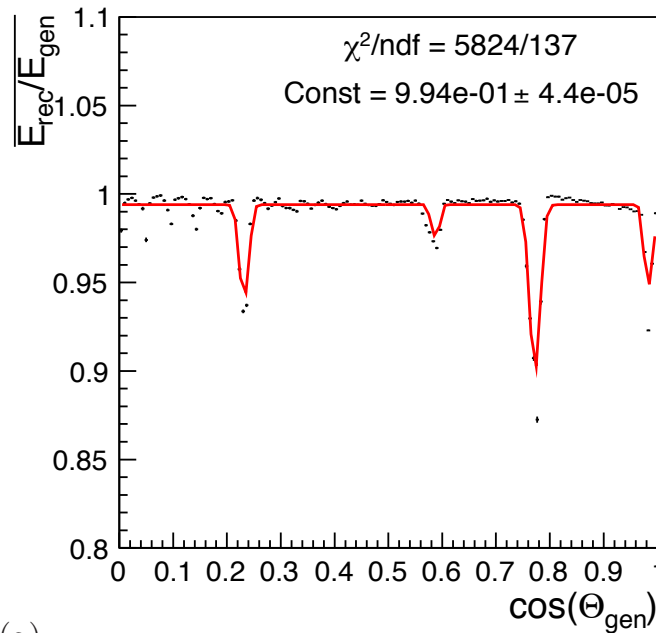
- maximum efficiency lower \rightarrow recheck definition / veto criteria

Energy Calibration

My plots



C. Bartels
Thesis (2011)

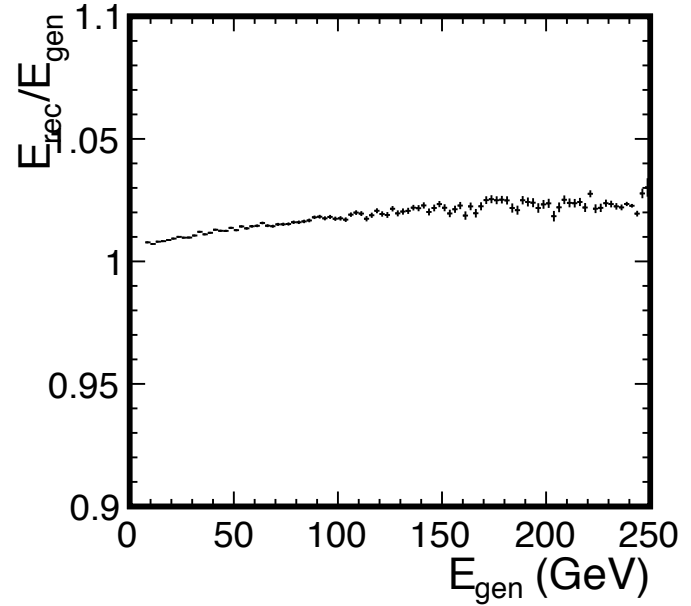
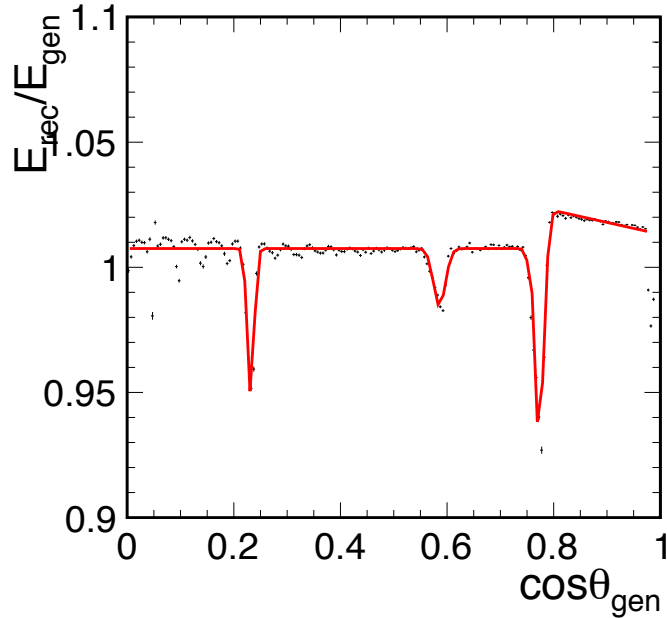


(a)

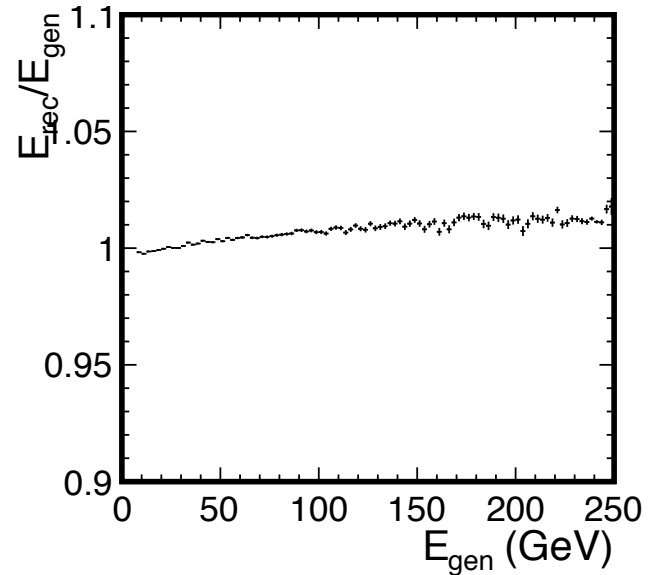
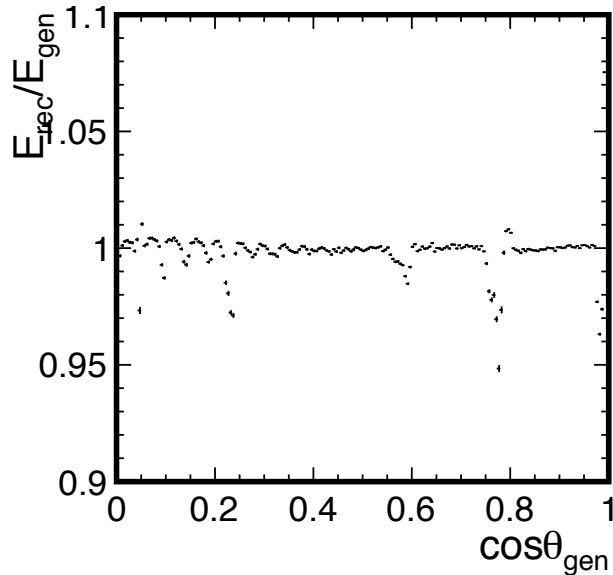
(b)

Correct the reconstructed photon energy using the reconstructed photon angle

My plots
BEFORE
calibration



My plots
AFTER
calibration



TODO: (1) compare reco/mc variables (2) resolution and reco. efficiency after calibration