



Update on FCAL and BCAL Efficiencies

Jon Zarling



What's New?

- Calculate more photon gun efficiencies in MC
 - (i.e. at DFCALShower/DBCALShower level)
- BCAL:
 - Efficiency over θ
 - Efficiency over E
- FCAL:
 - Efficiency with/without DIRC
- Geant3 vs geant4 comparisons
- Things generally look quite good

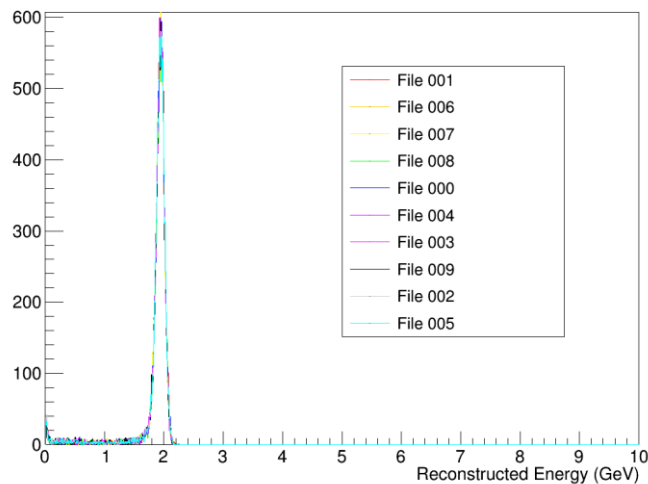


Outstanding BCAL Bug

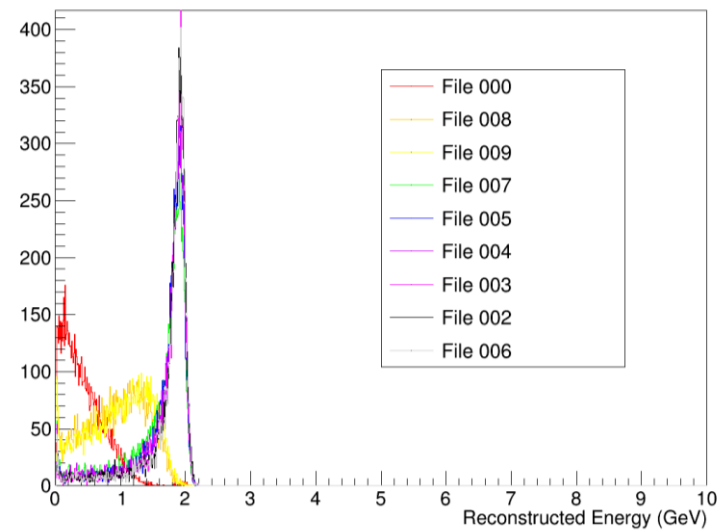
- Don't use geant4 with more than 1 core
- Most recent everything on Jlab farm w/ MCWrapper
- Appears to be BCAL only; FCAL appears fine

1 core

Reconstructed Photon E, Run 70000



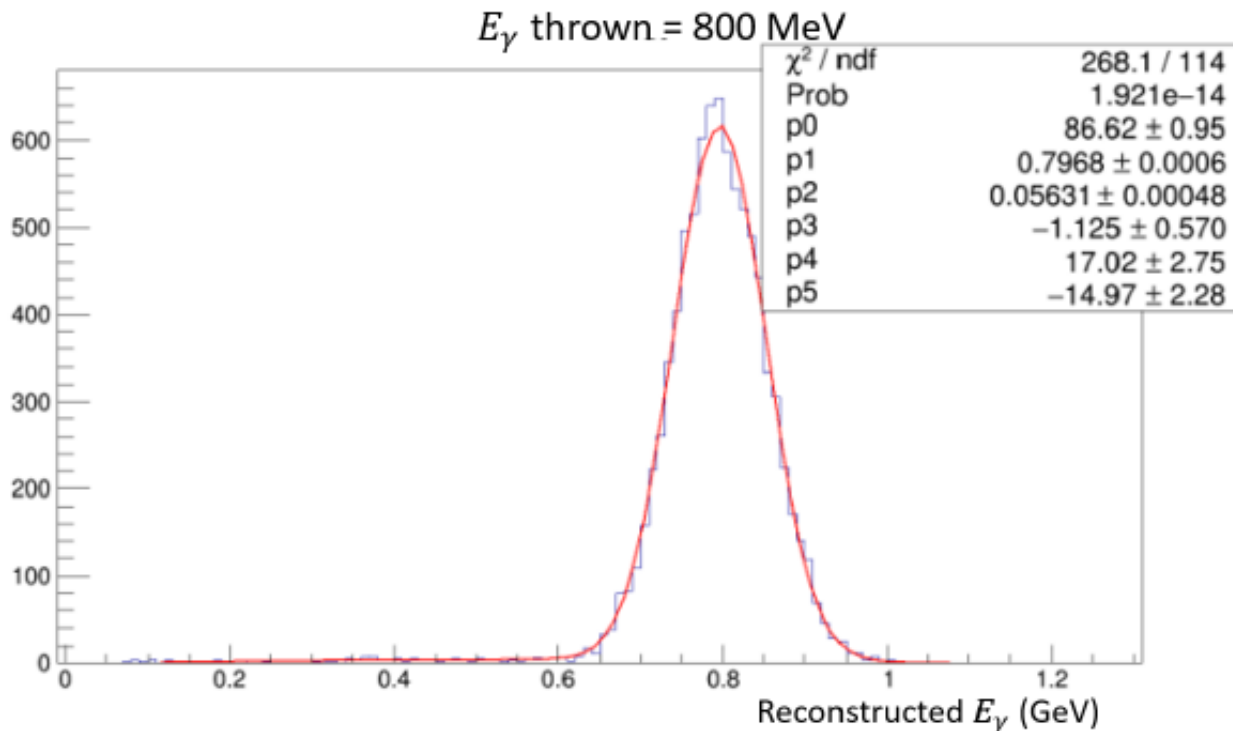
4 cores





Efficiency Definition (for gun)

- Efficiency defined as:
- $\epsilon = \text{Gaussian Recon. Yield} / \# \text{Generated}$

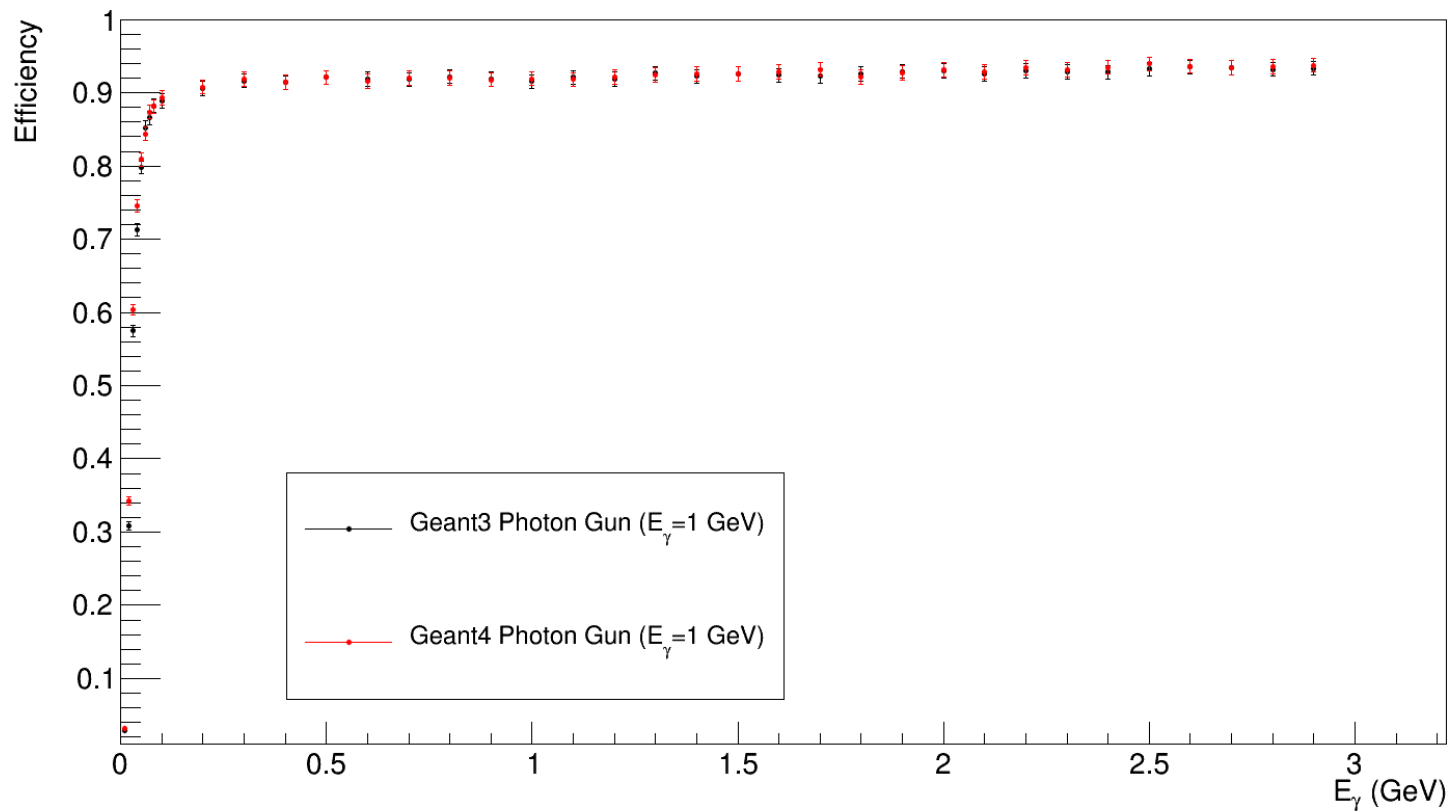




BCAL: Efficiency Over E_γ

Photon Efficiency

$\theta = 30^\circ$

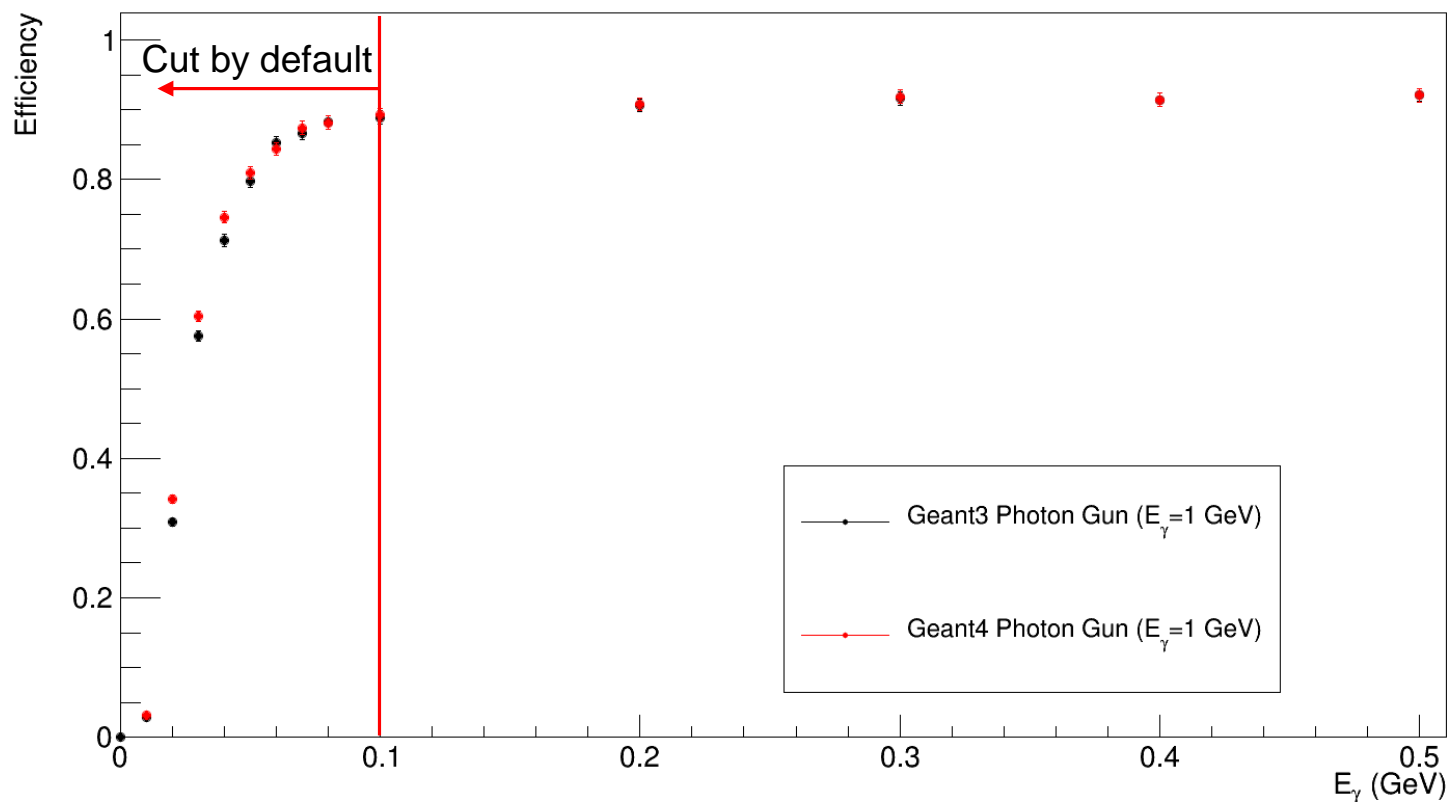




BCAL: Efficiency Over E_γ (Zoomed)

$\theta = 30^\circ$

Efficiency at 1 GeV

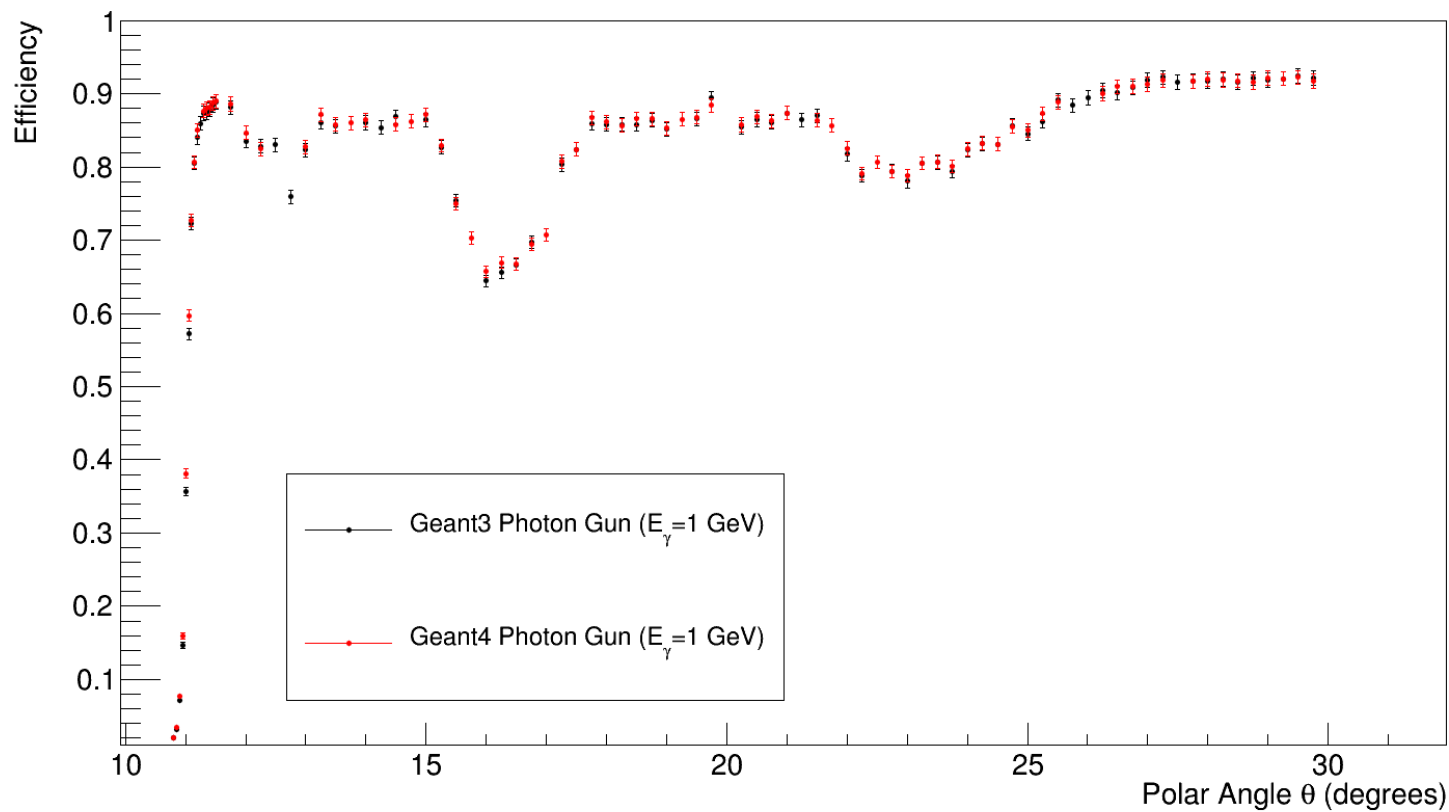


Could get a lot more photons out of BCAL below 100 MeV.
Not sure if practical though.



BCAL: Efficiency Over Lower θ

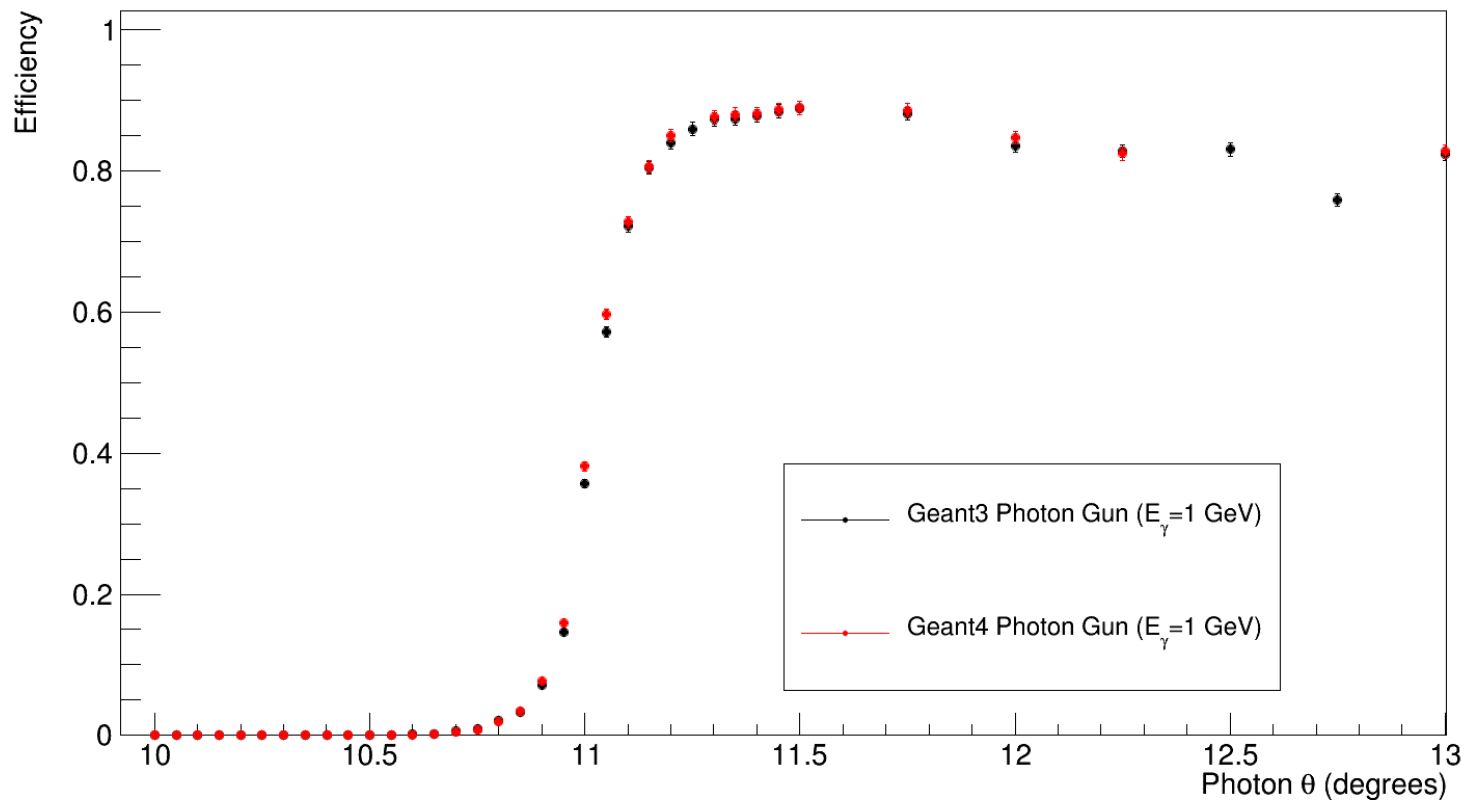
Photon Efficiency





BCAL: Efficiency Over Lower θ (Zoomed)

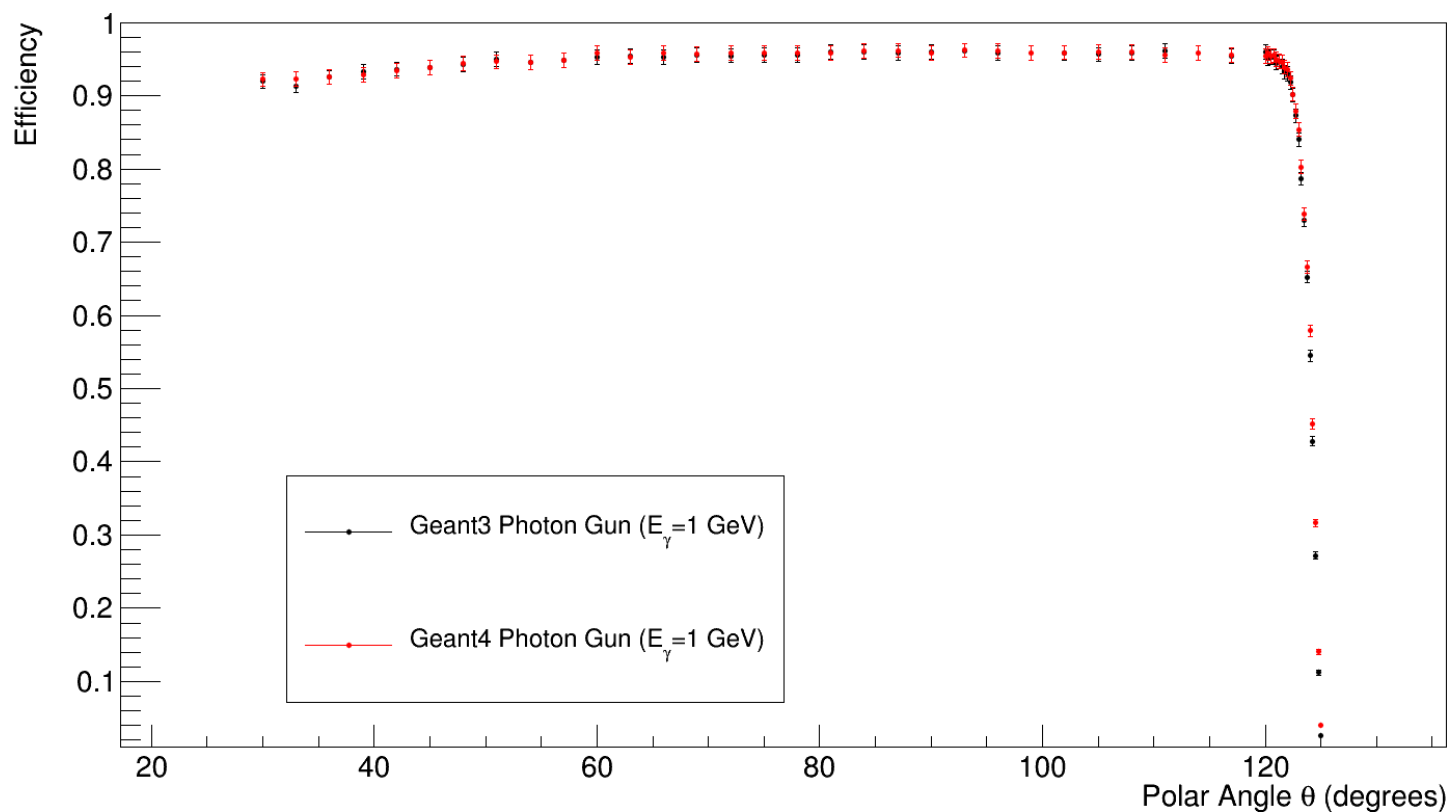
Efficiency at 1 GeV





BCAL: Efficiency Over Higher θ

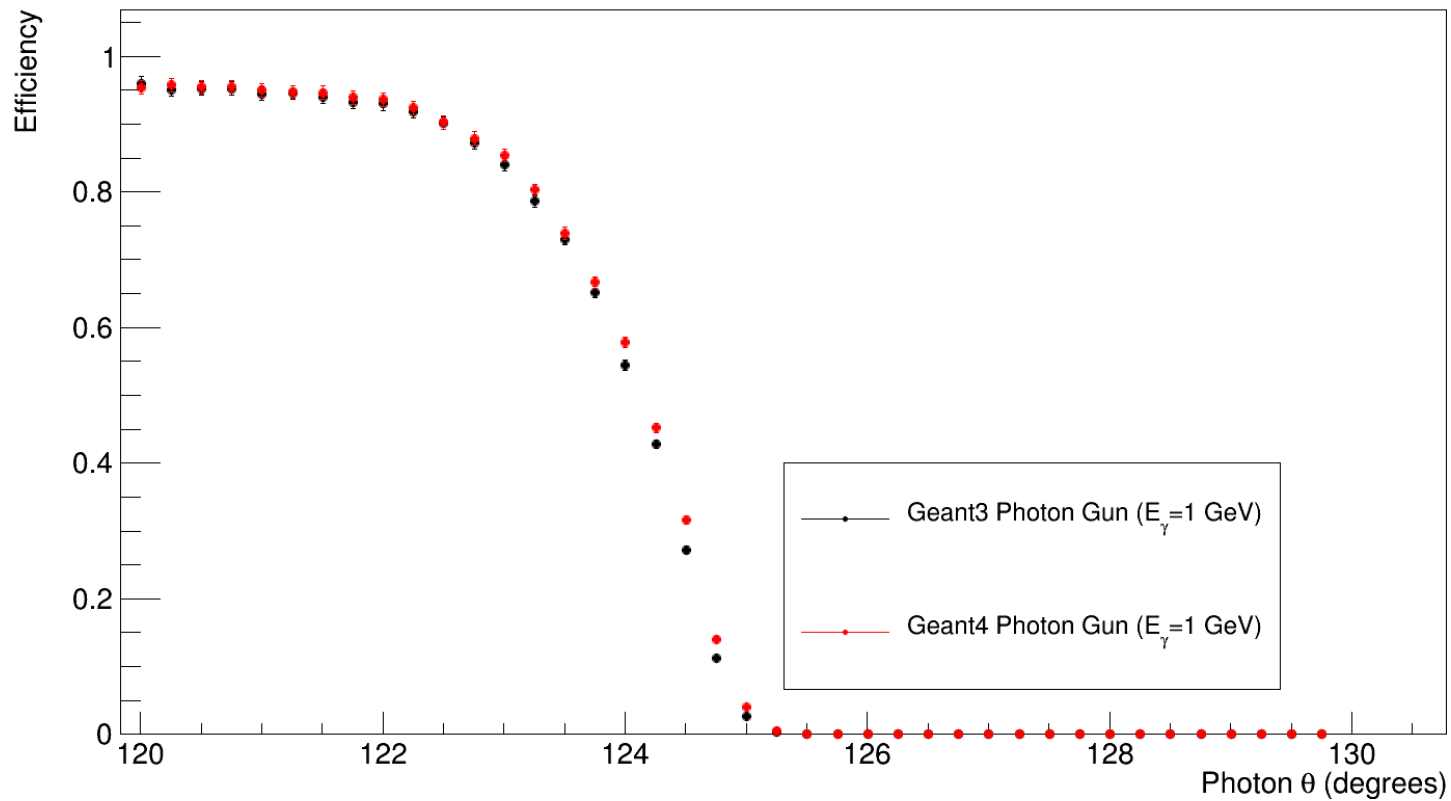
Photon Efficiency





BCAL: Efficiency Over Higher θ (Zoomed)

Efficiency at 1 GeV





FCAL: With and Without DIRC

- Putting the DIRC in adds more material to convert in
- Does adding DIRC lead to any significant loss in efficiency?
 - Conversions in barrel region are not recoverable
 - Conversions in TOF: usually still efficient, still reconstruct single shower (they do shift energy down, however)

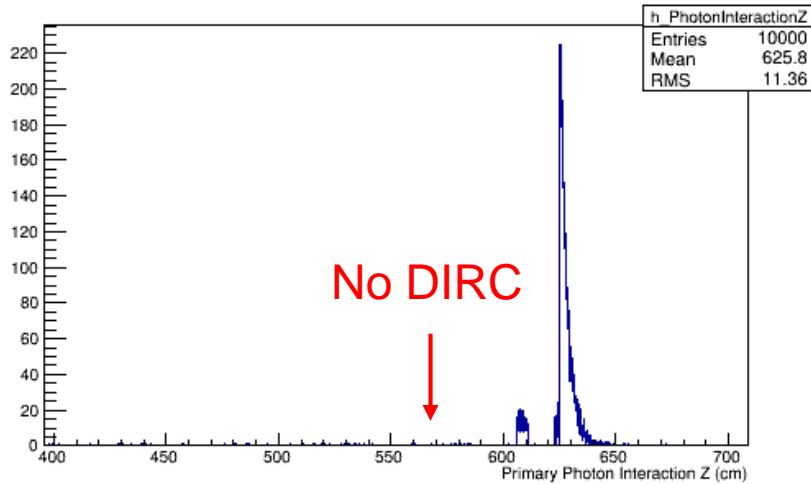


Implementation

- Geant4 with runs 30000 and 60000

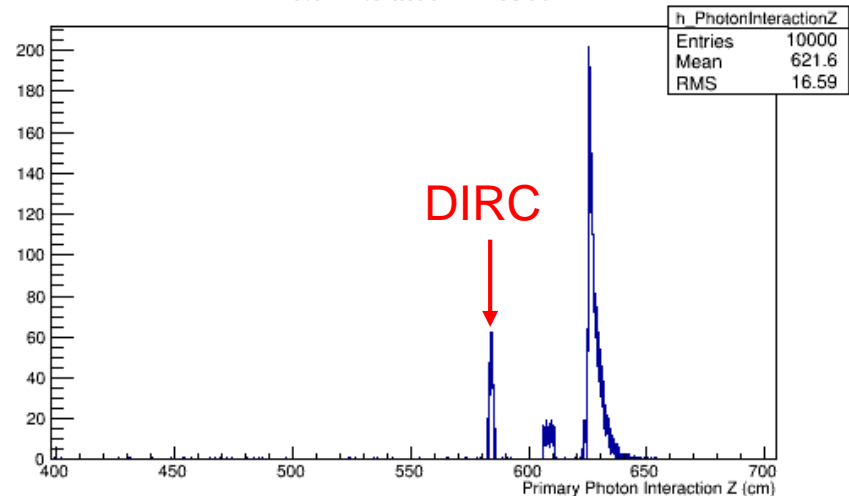
Run 30000

Photon Interaction Z Position



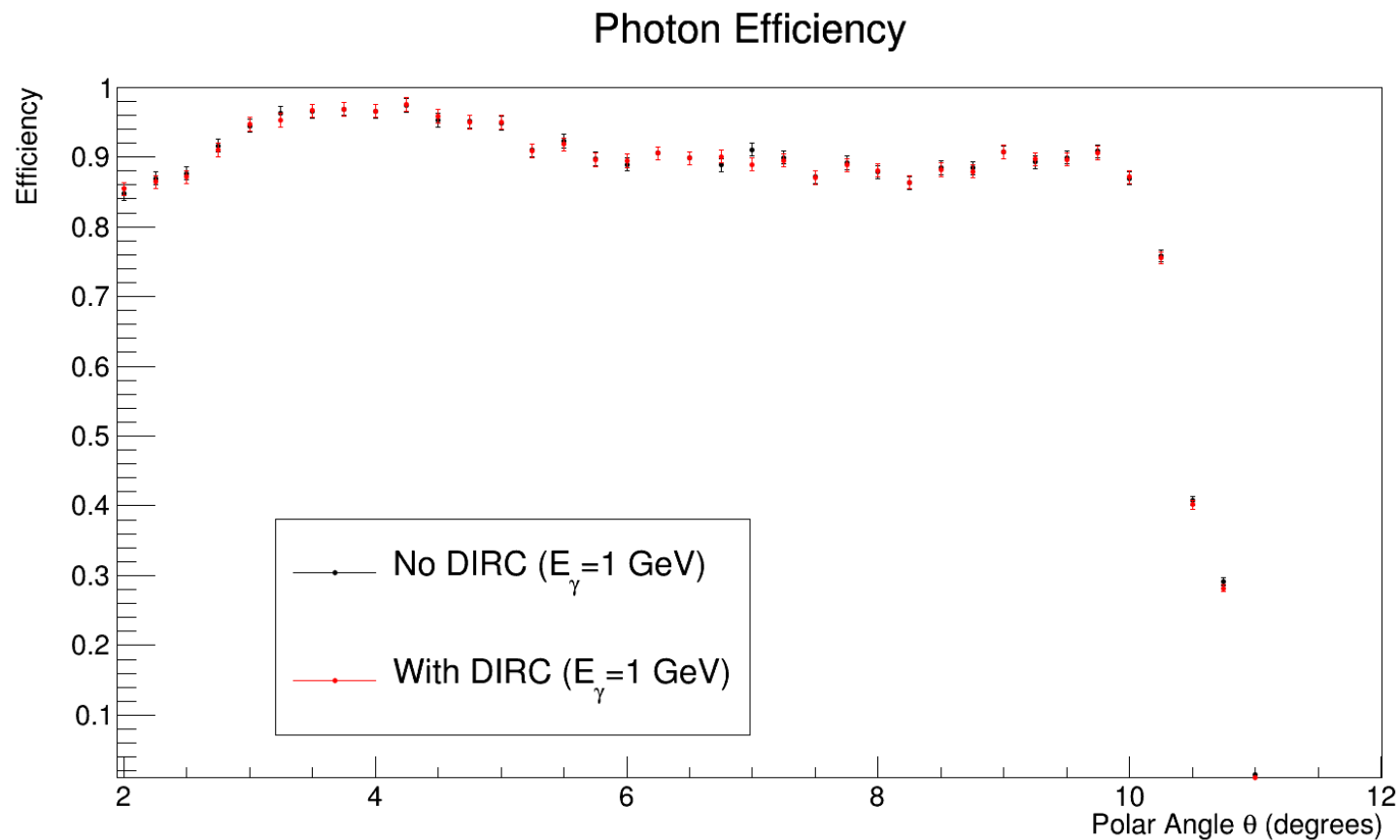
Run 60000

Photon Interaction Z Position





FCAL Efficiency

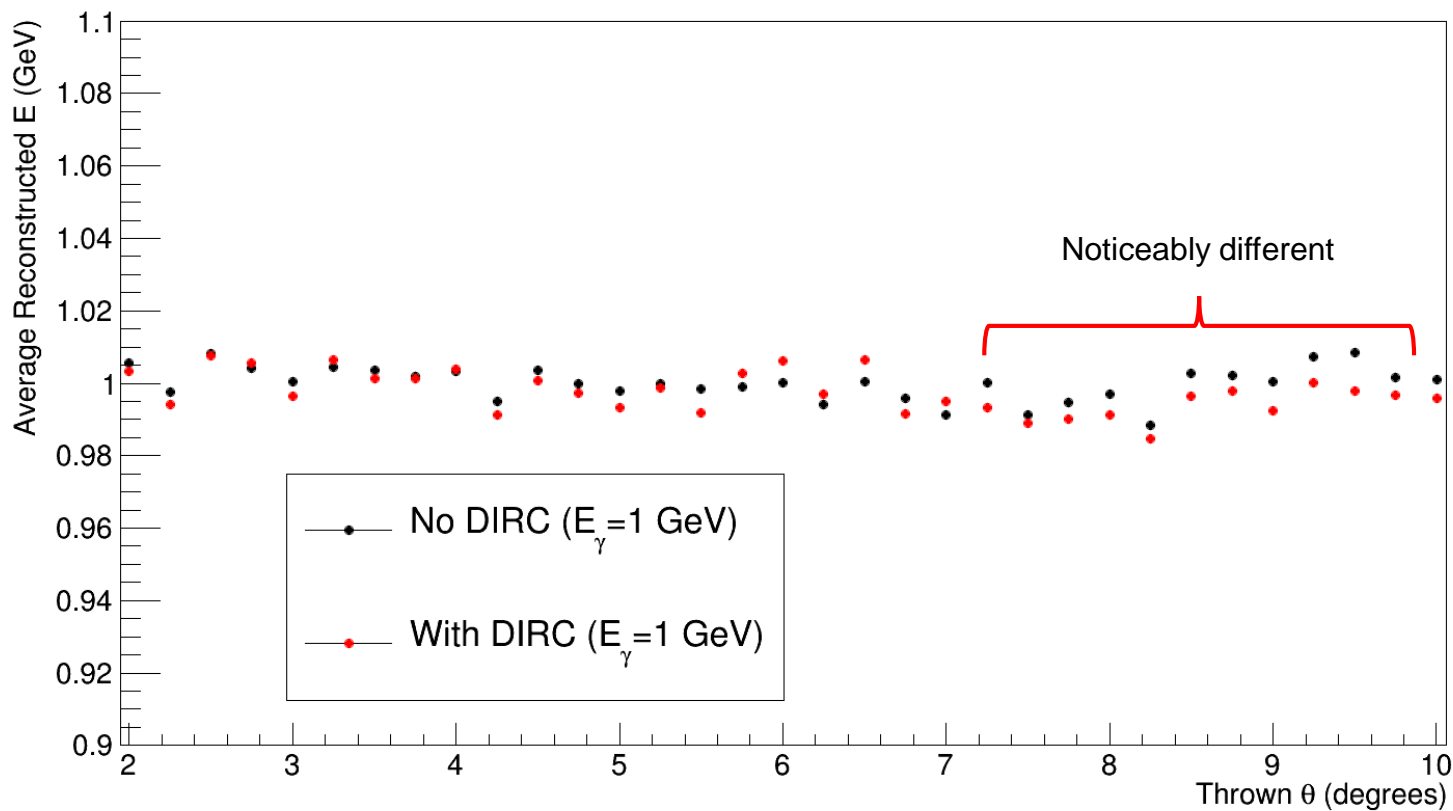


Virtually indistinguishable with/without DIRC



FCAL Average Energy

Thrown $E_\gamma = 1$ GeV



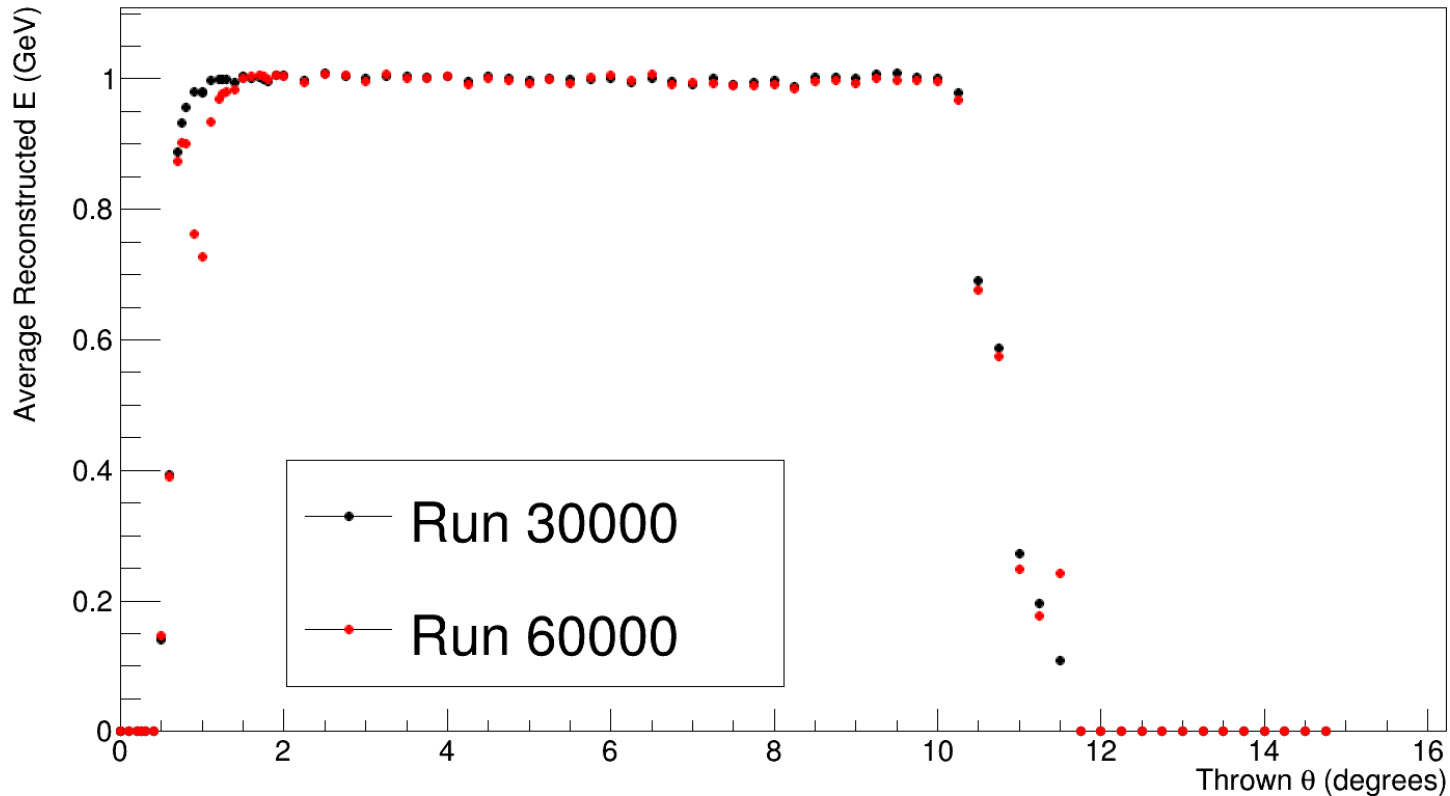
Above about 7.5° **overall** energy shifted down 5-10 MeV



FCAL: Calibration issue in run 60000?

E_γ thrown = 1 GeV
 ϕ near 90°

Average Reconstructed E

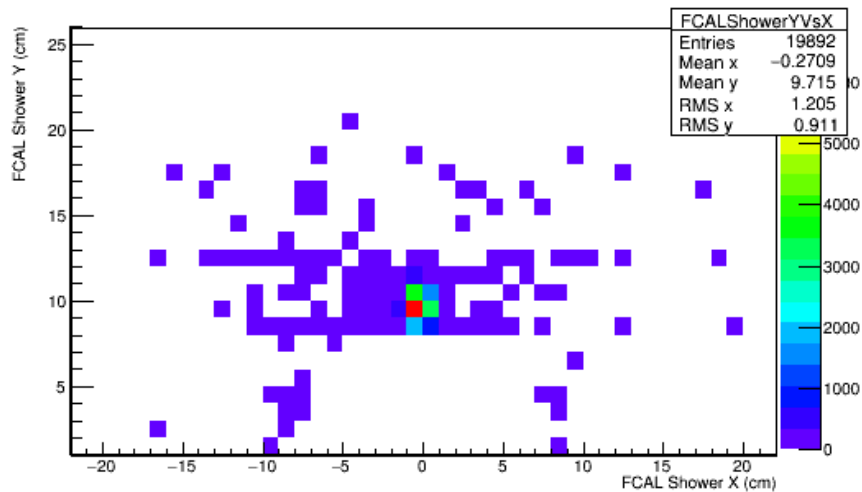




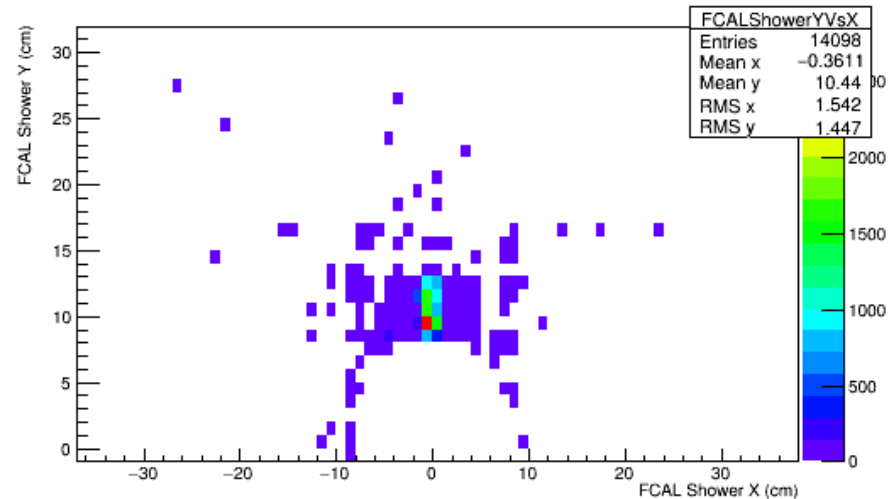
FCAL Shower Position

- Doesn't look like it's due to any block being turned off

Run 30000



Run 60000





Summary

- BCAL efficiency:
 - Over E: good down to 100 MeV or even below
 - Over θ : beware a few wiggles $10 < \theta < 30^\circ$
 - Over θ : flat above 30°
- Excellent geant3 and geant4 agreement except at edge cases (that are not reconstructed by default anyways)
- FCAL efficiency unaffected with DIRC
- FCAL energy might be shifted few MeV down with DIRC