Update on FCAL and BCAL Efficiencies

Jon Zarling

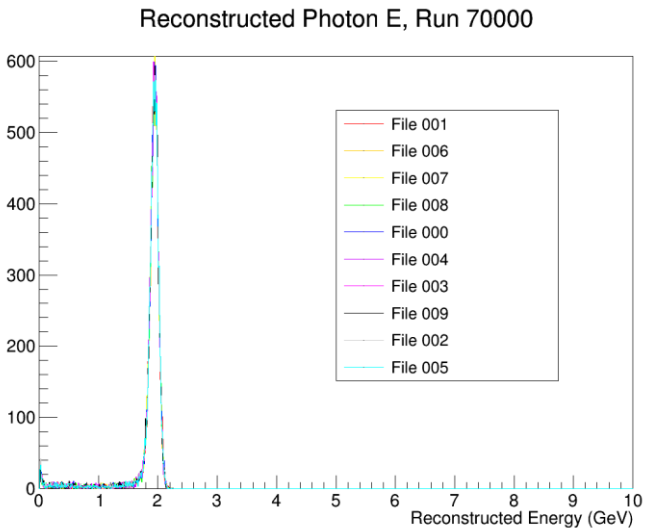
What's New?

- 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

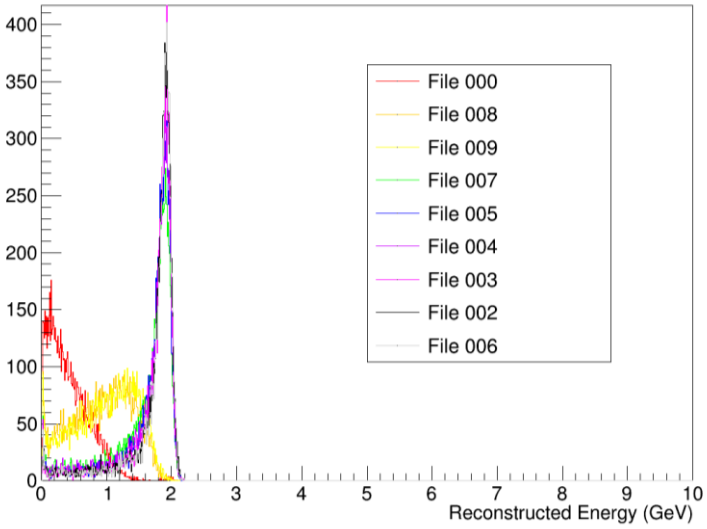
Outstanding BCAL Bug

- 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

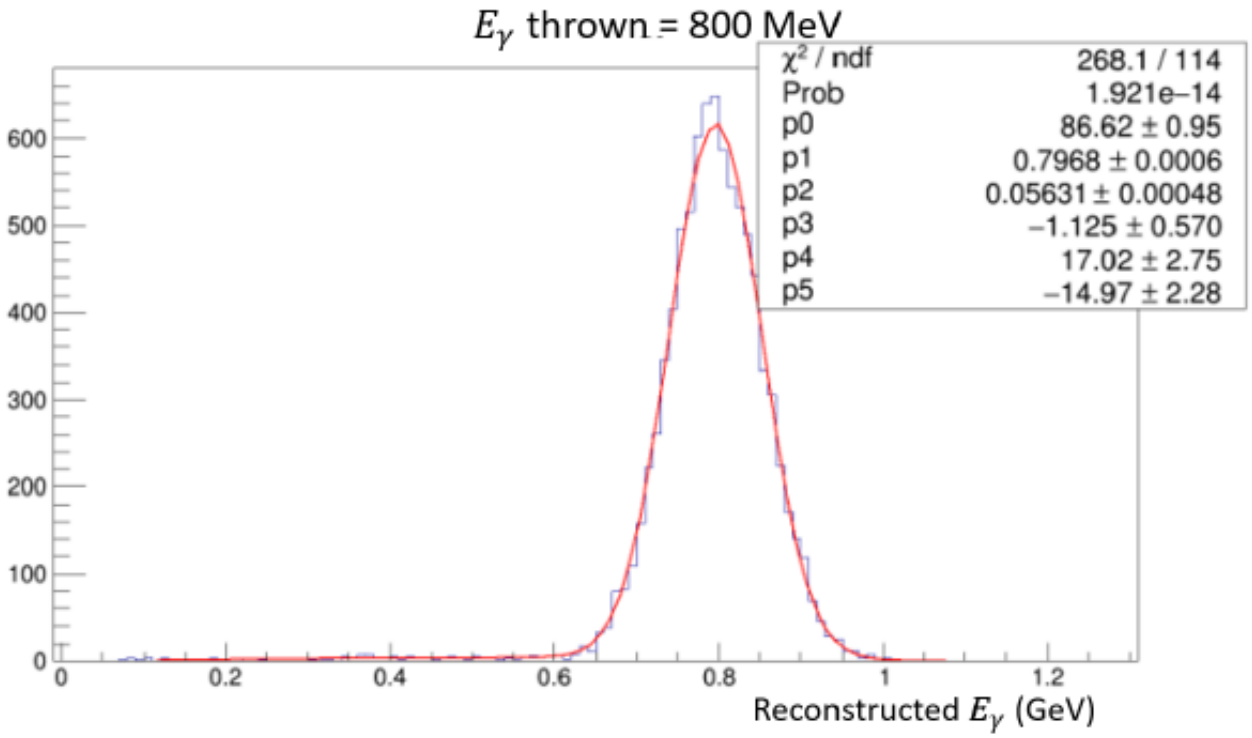


4 cores

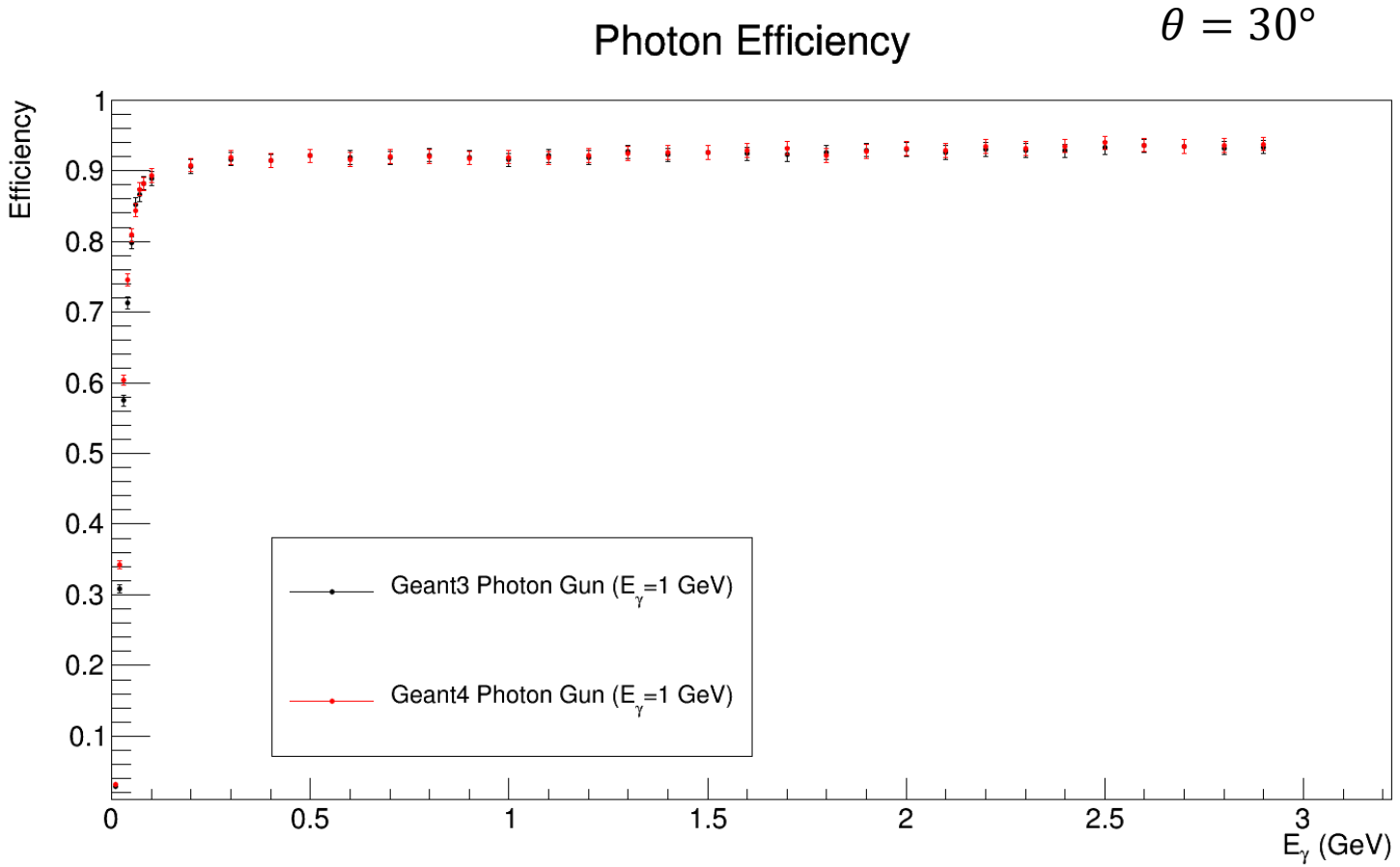


Efficiency Definition (for gun)

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

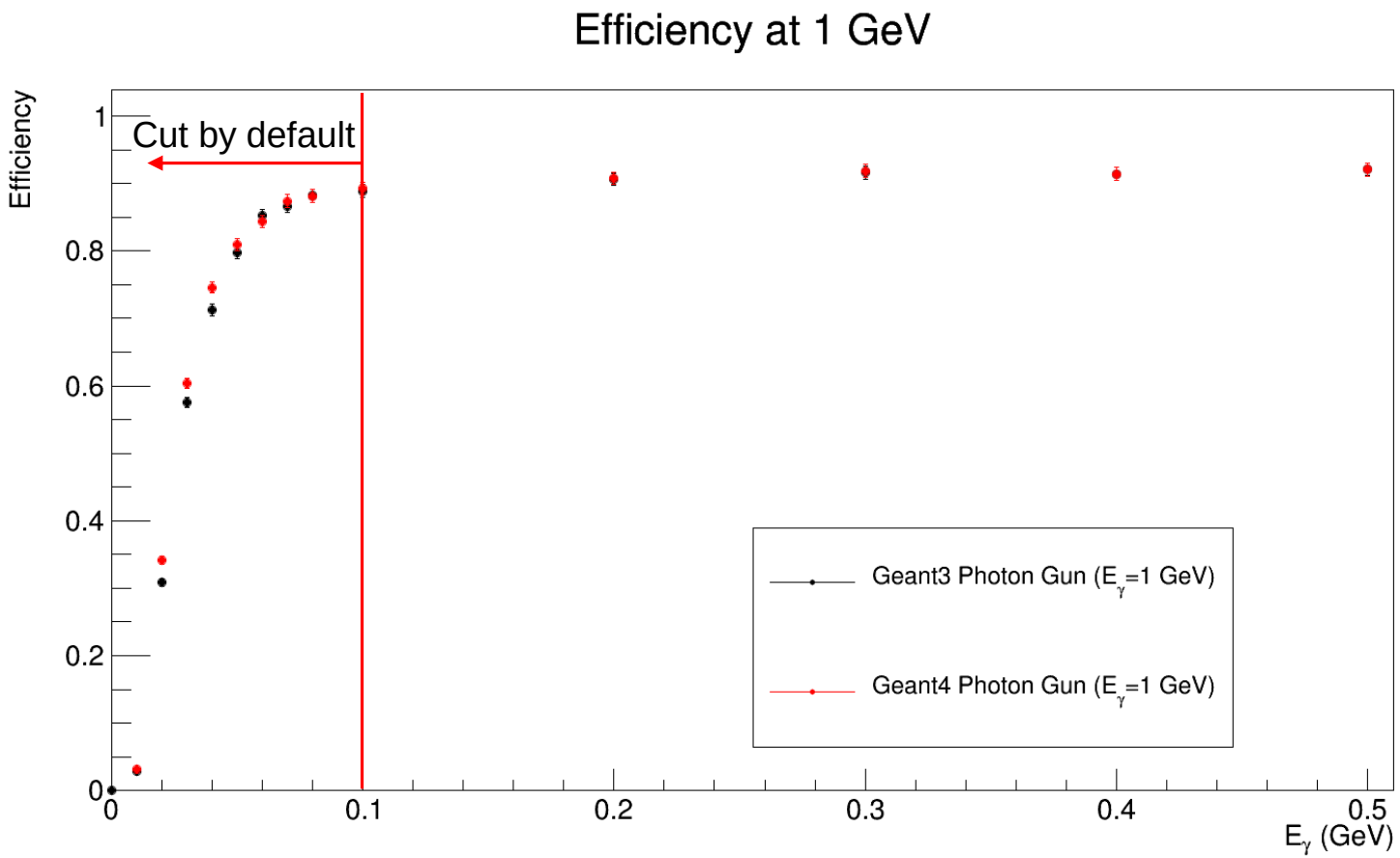


BCAL: Efficiency Over E_γ



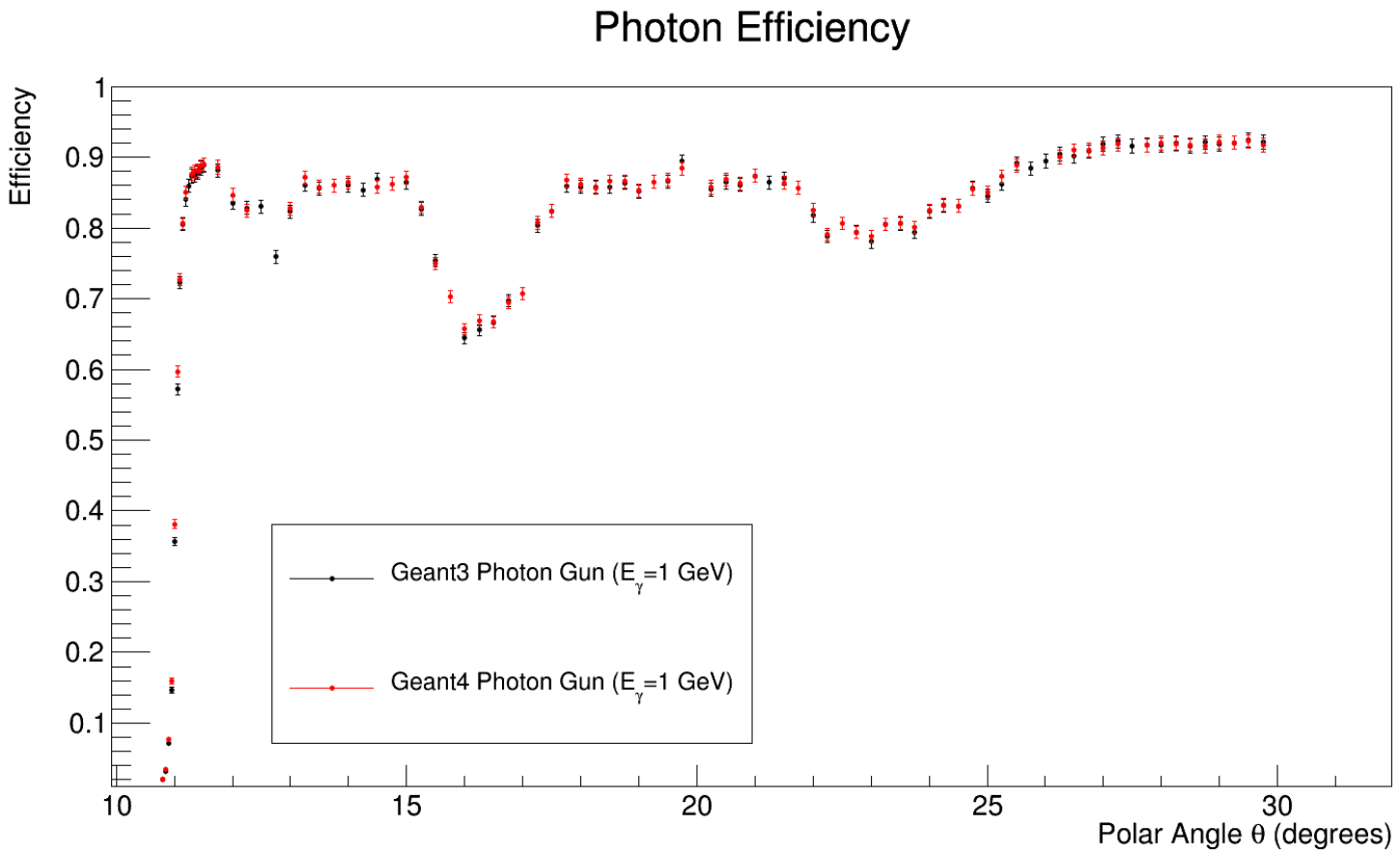
BCAL: Efficiency Over E_γ (Zoomed)

$\theta = 30°$

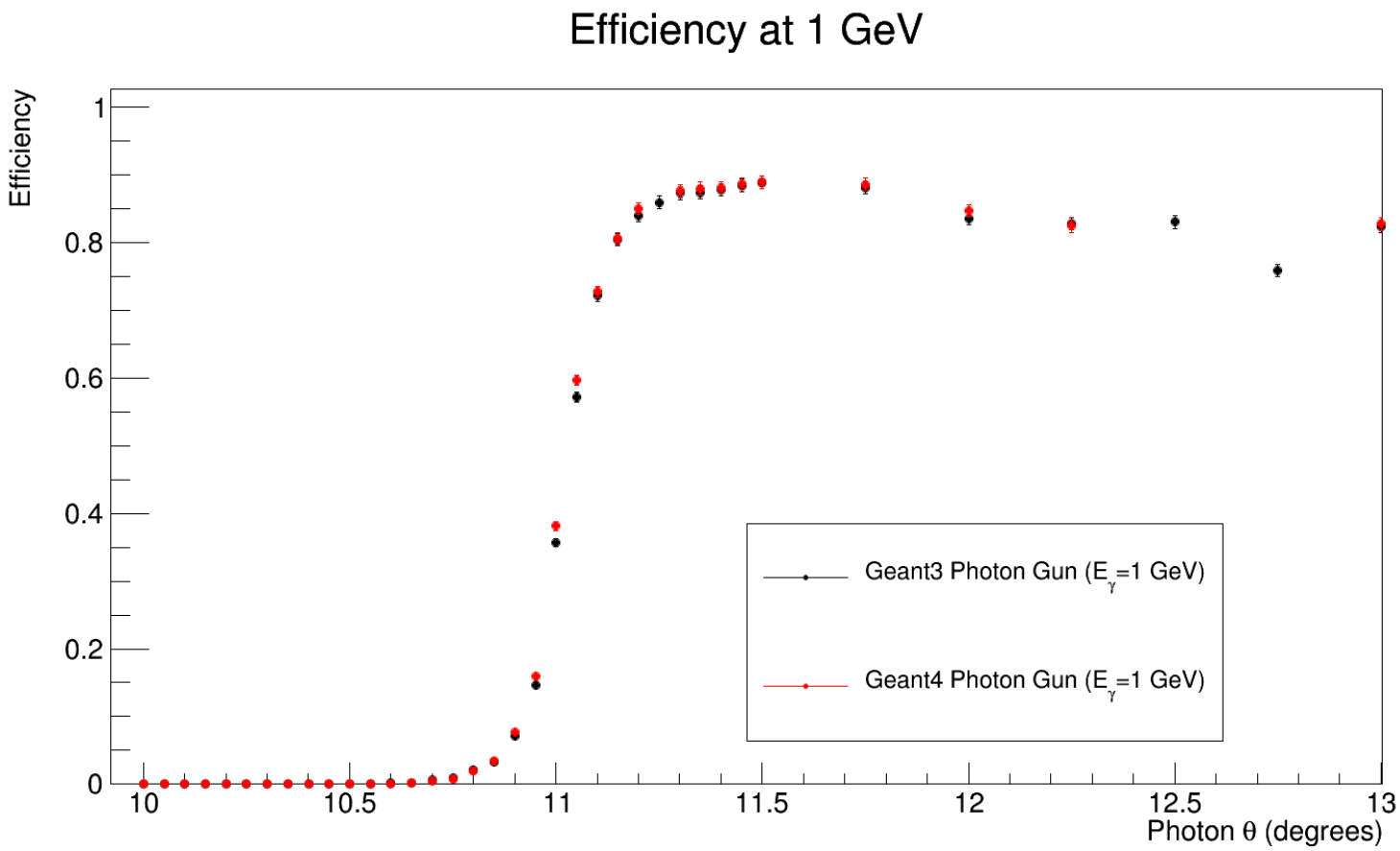


Worth revisiting default 100 MeV cut?

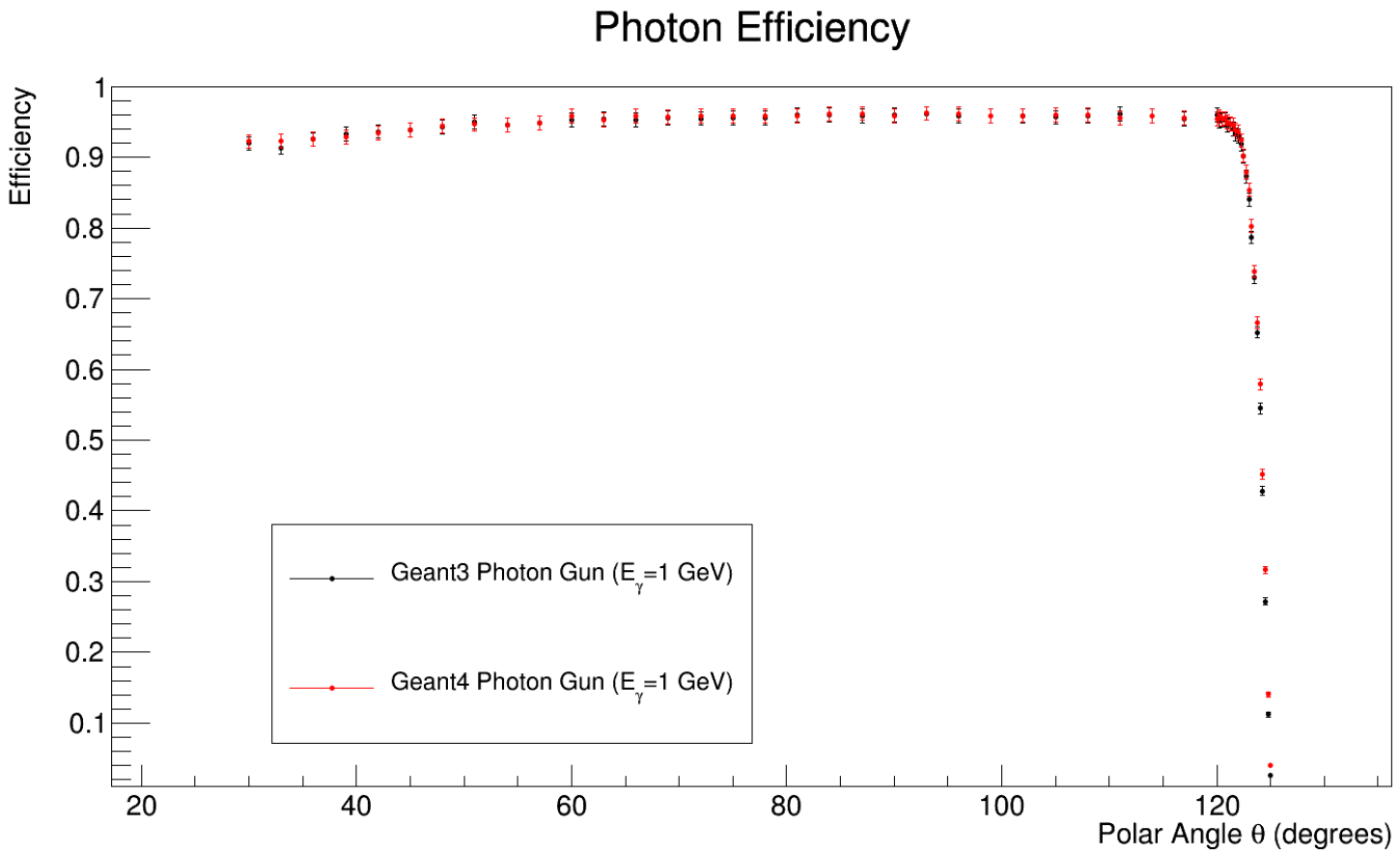
BCAL: Efficiency Over Lower θ



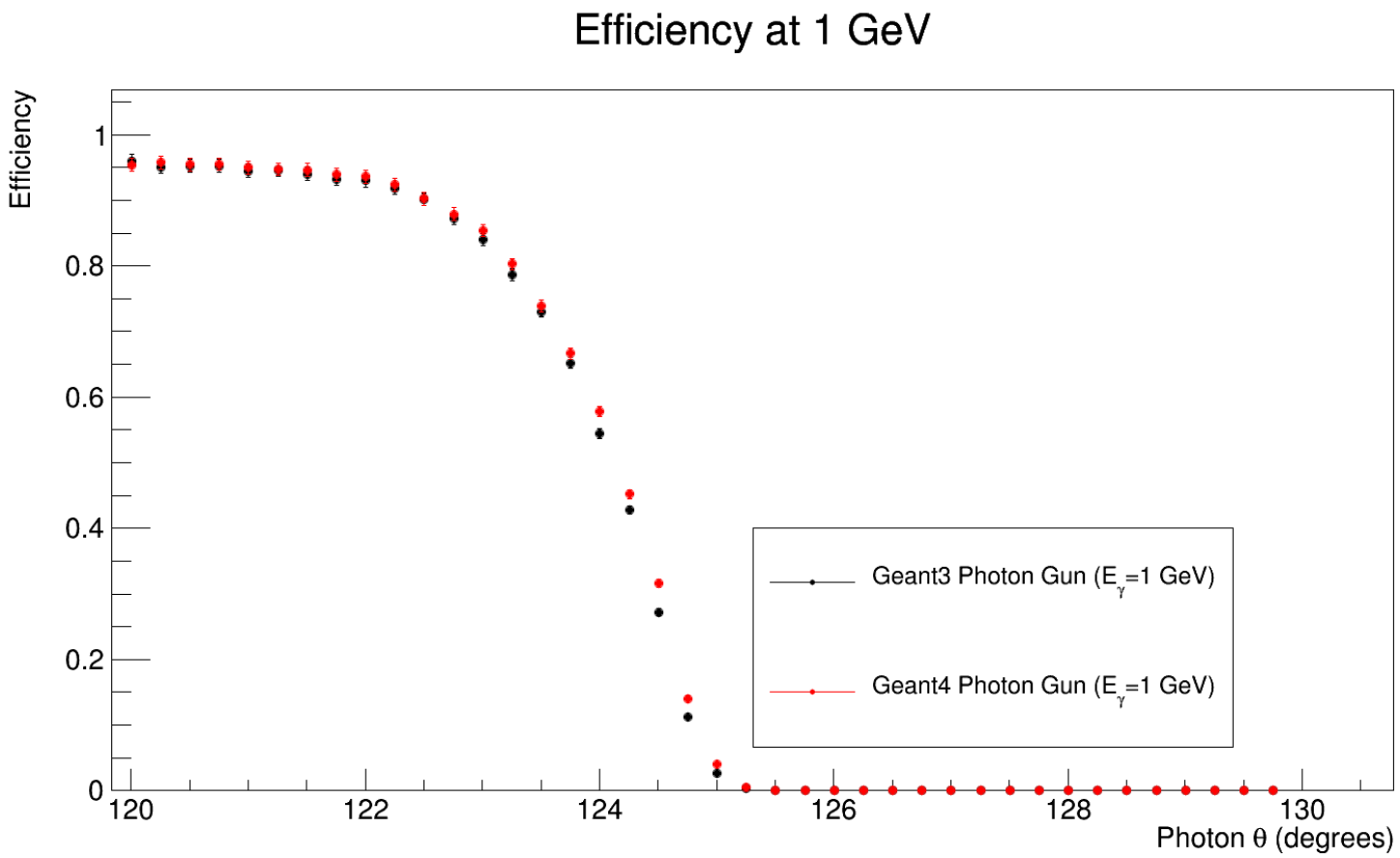
BCAL: Efficiency Over Lower θ (Zoomed)



BCAL: Efficiency Over Higher θ



BCAL: Efficiency Over Higher θ (Zoomed)



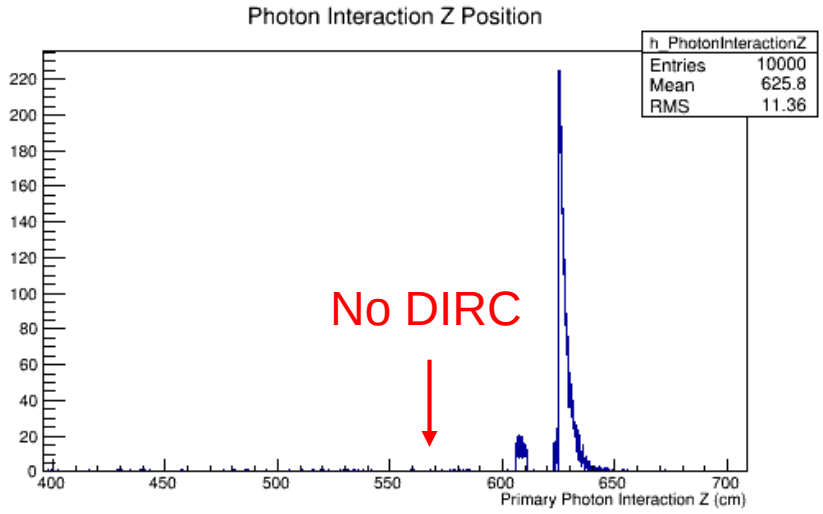
FCAL: With and Without DIRC

- Putting the DIRC in adds more material to convert in
- Does adding DIRC lead to any significant loss in efficiency?
  - TOF experience: conversions don't necessarily mean inefficient! (they do shift energy down, however)

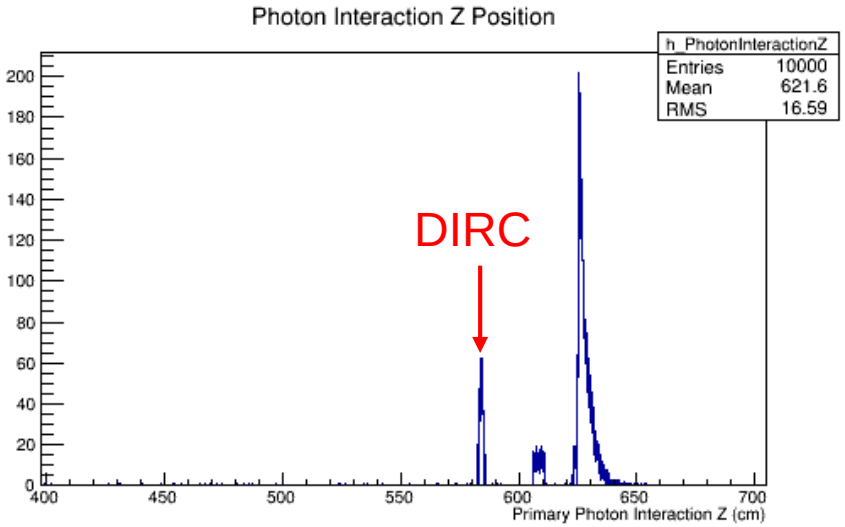
Implementation

- Geant4 with runs 30000 and 60000

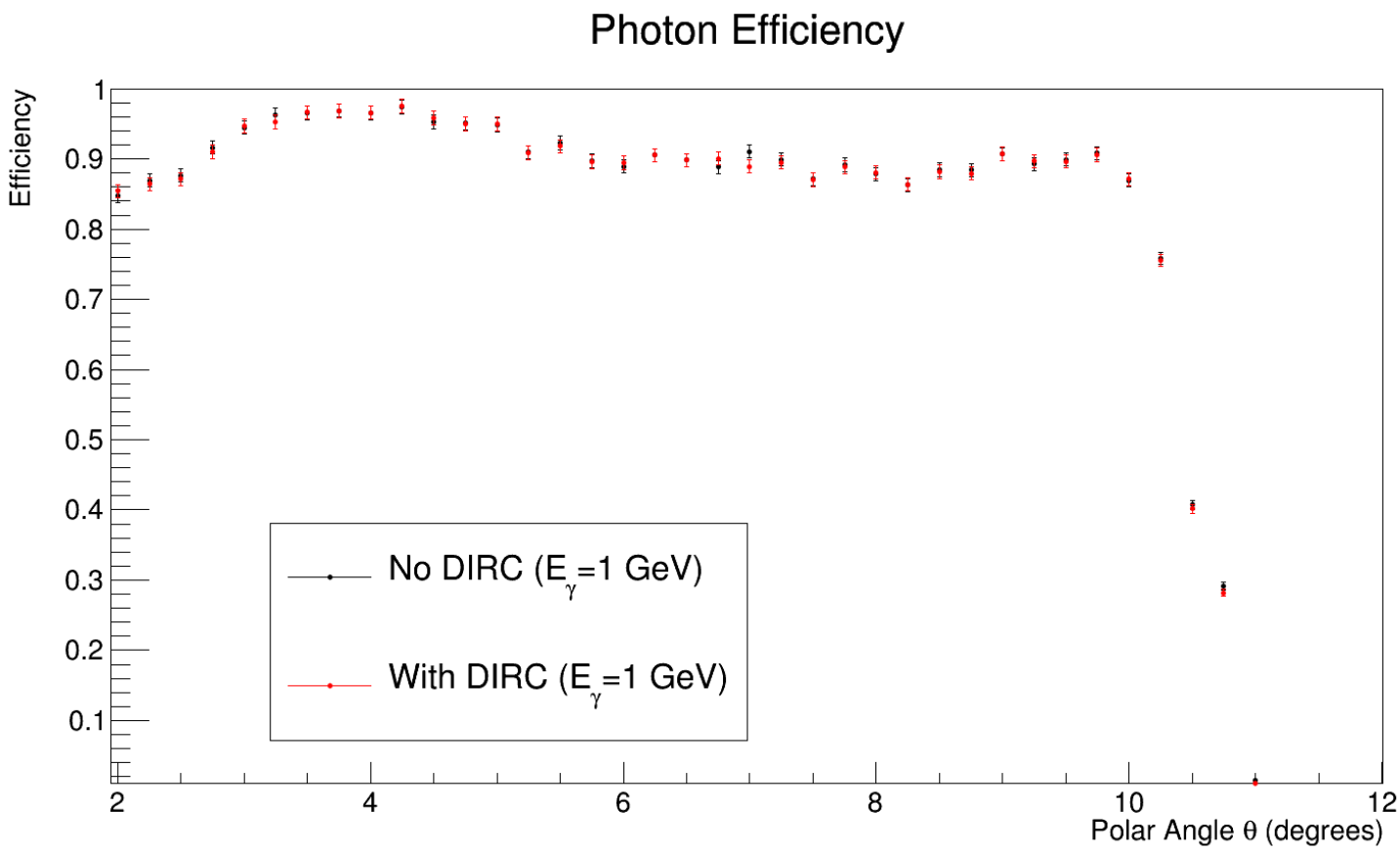
Run 30000



Run 60000

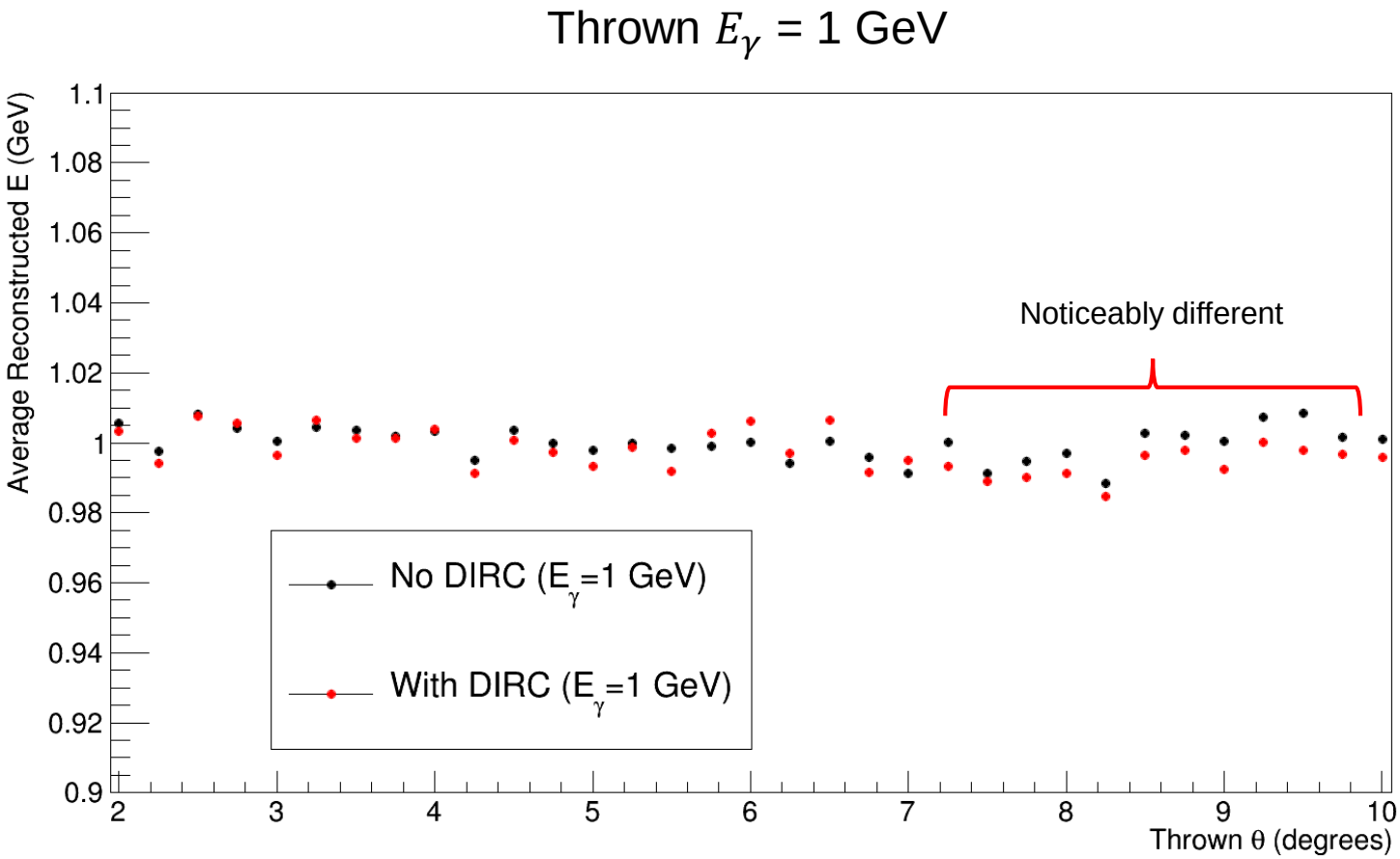


FCAL Efficiency



Virtually indistinguishable with/without DIRC

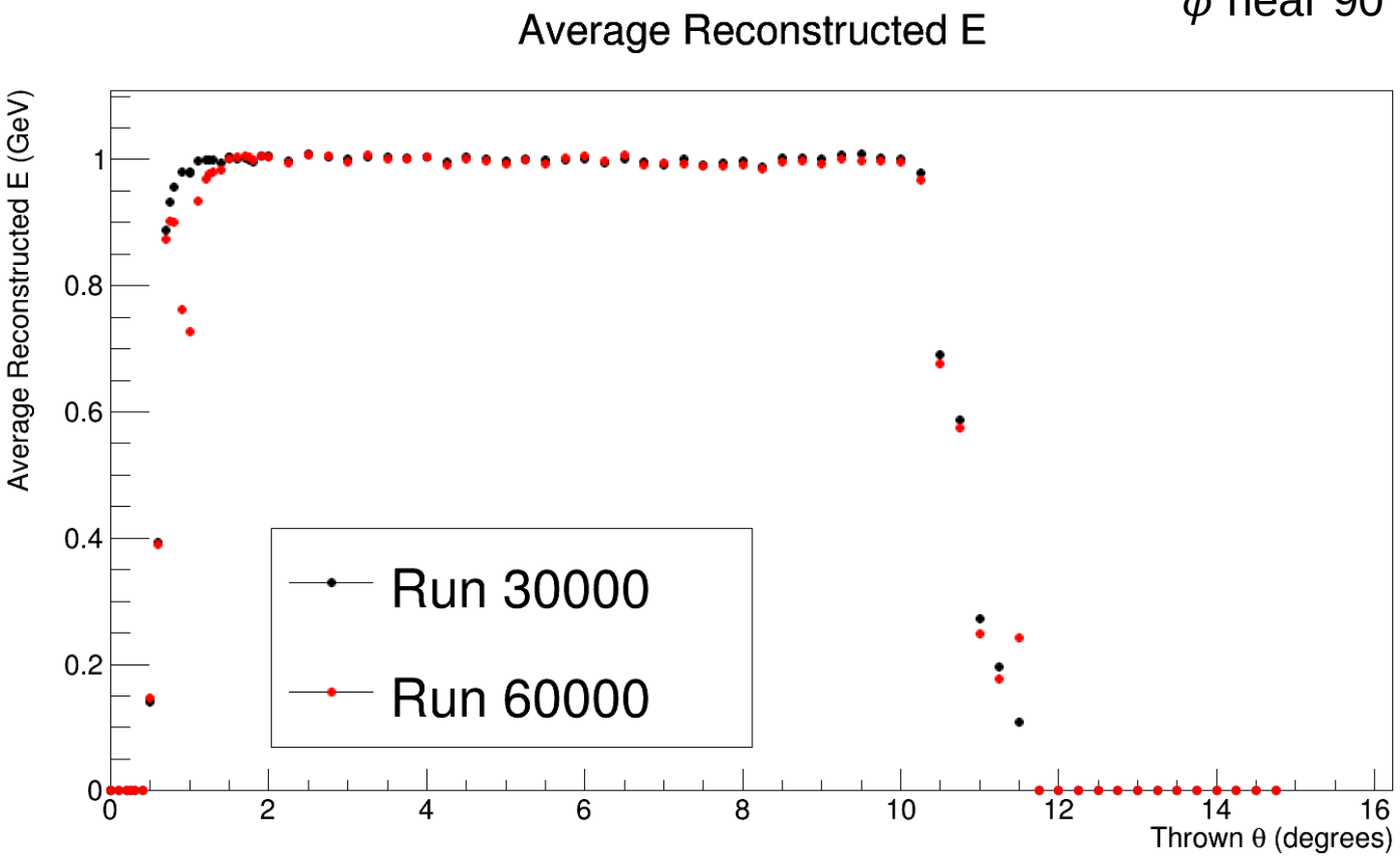
FCAL Average Energy



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

FCAL: Calibration issue in run 60000?

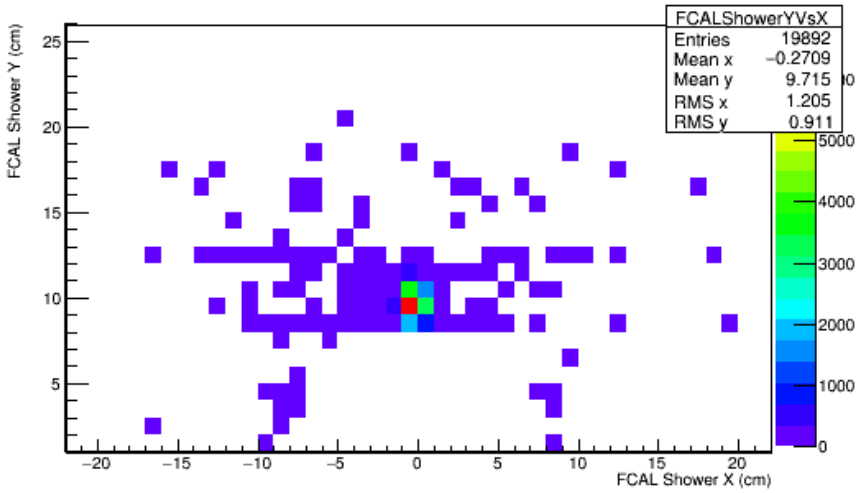
E_γ thrown = 1 GeV
ϕ near 90°



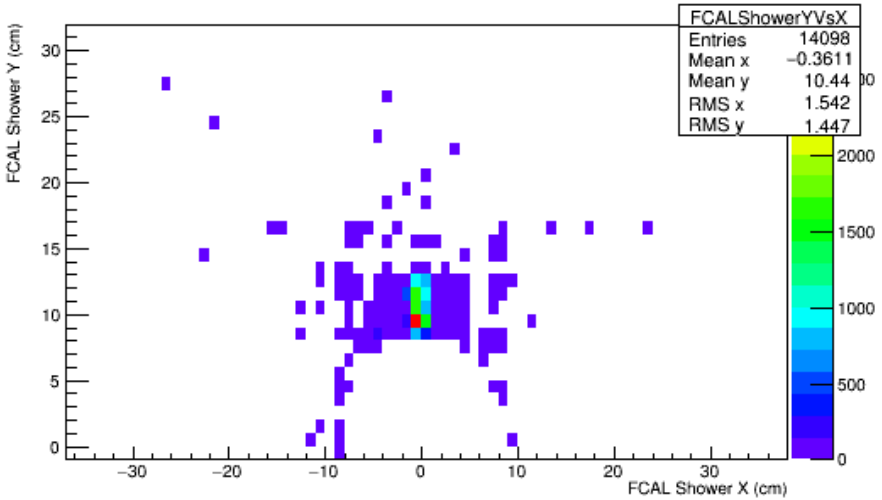
FCAL Shower Position

- Doesn't looks 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 $10 < \theta < 30°$
  - 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

Discussion point

- Is 100 MeV minimum BCAL shower energy too strict? I worry we may be losing a lot of potentially interesting physics (e.g. neutrons, $\Sigma^0 \rightarrow \gamma\Lambda$, …)