First ideas towards BIB subtraction

Episode II

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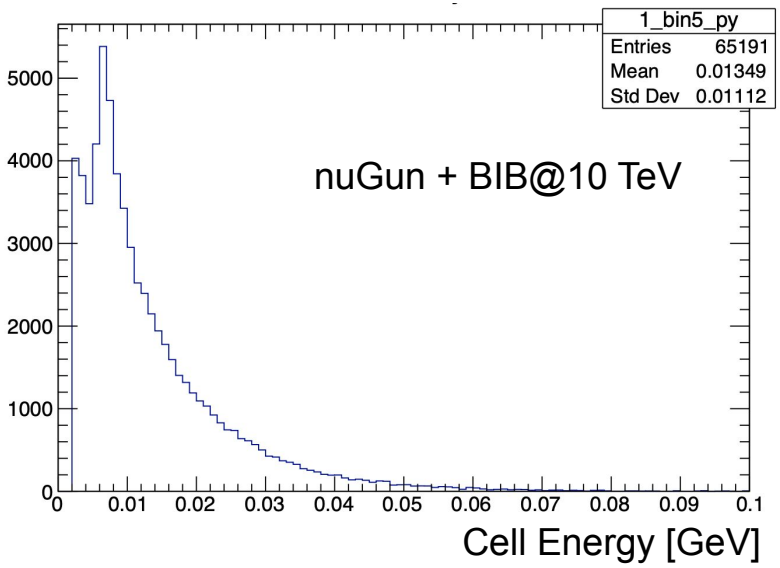
What thresholds are we actually applying?

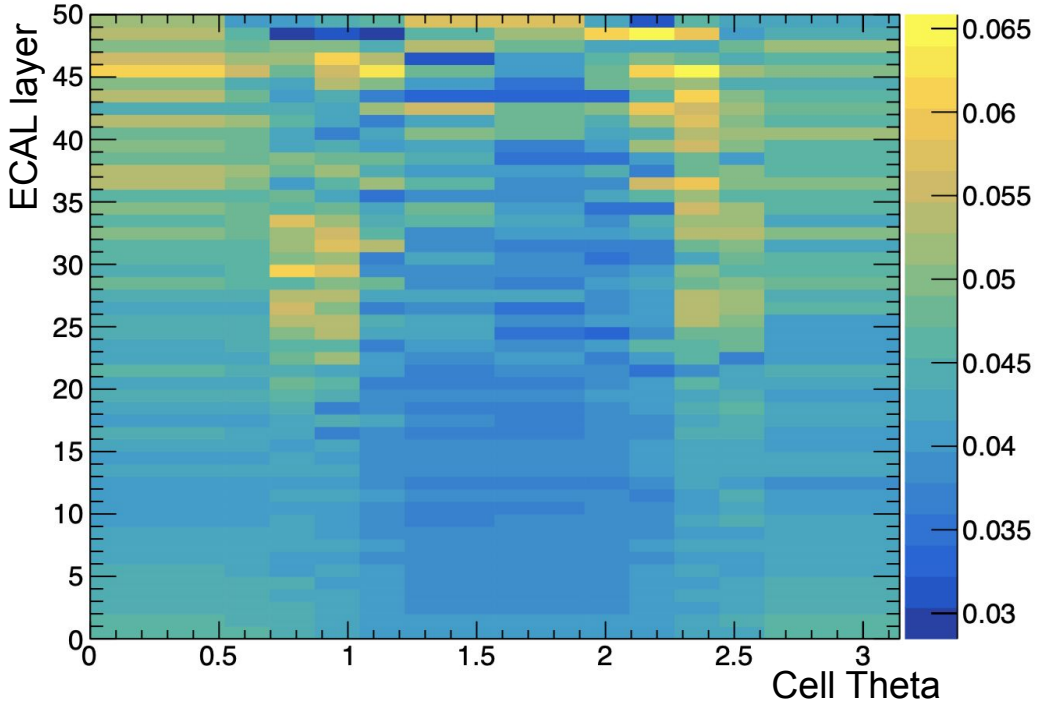
Looked at the thresholds vs theta and layer.

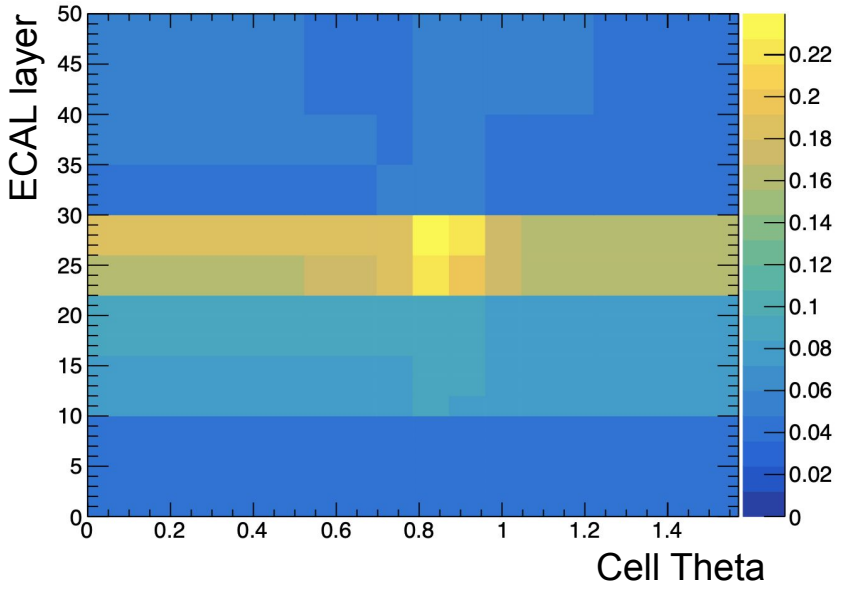
They appear to be higher than I expected

- Intuition completely wrong?
- Adding signal to Cell energy distribution

Following up…







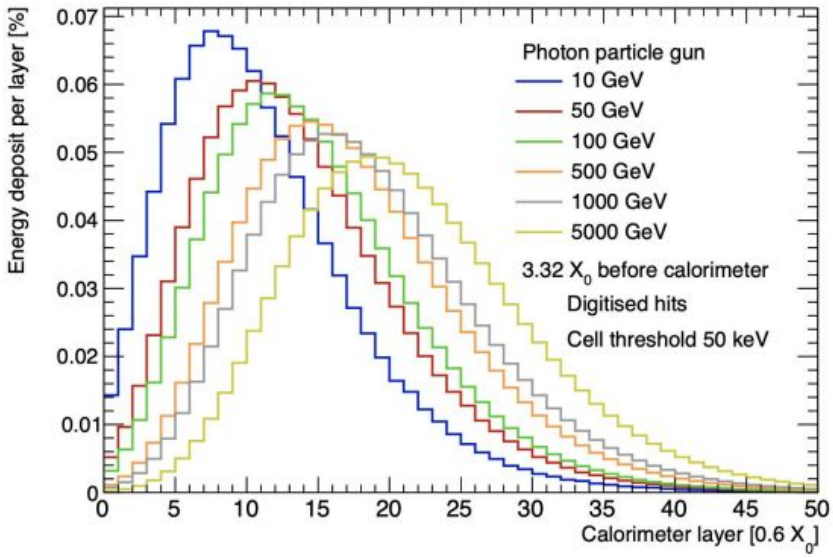
Thank you!

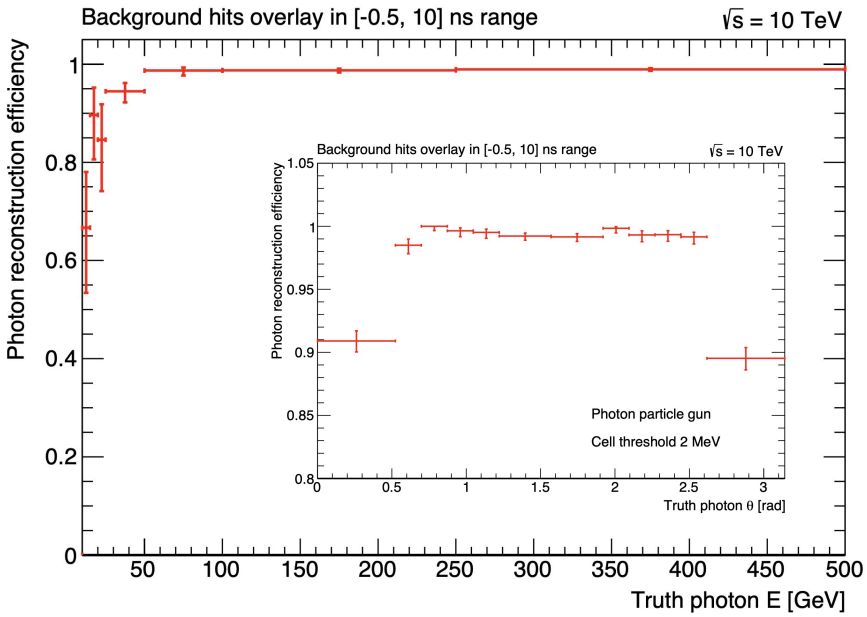
Photon reconstruction

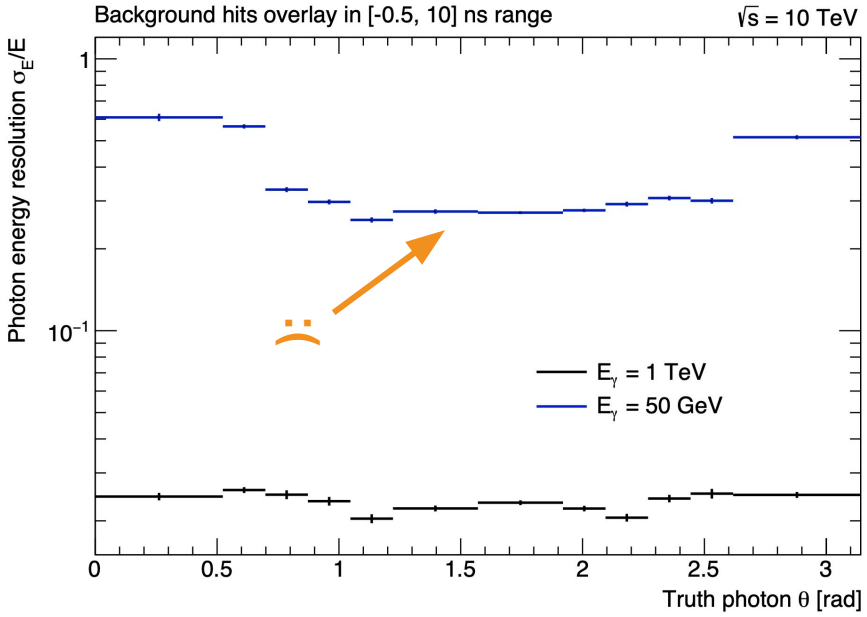
Changes to EM calorimeter:

- Kept same Si-W technology
- 40 → 50 layers
- Tungsten absorber 1.9 → 2.20 mm

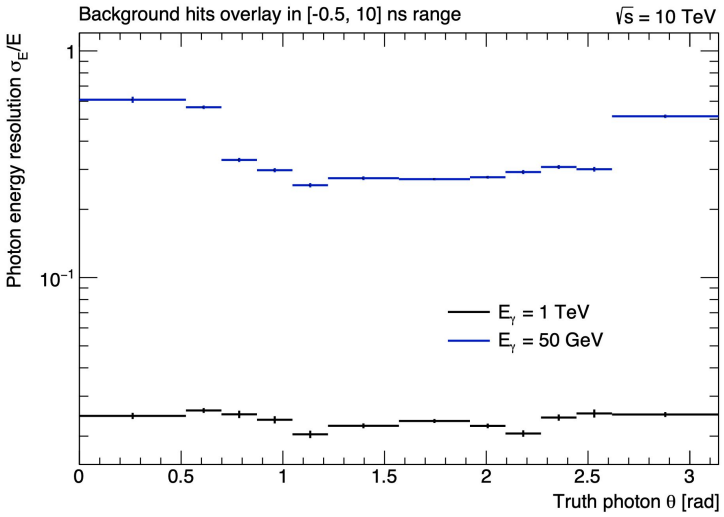
Studied photon reconstruction efficiency and energy resolution





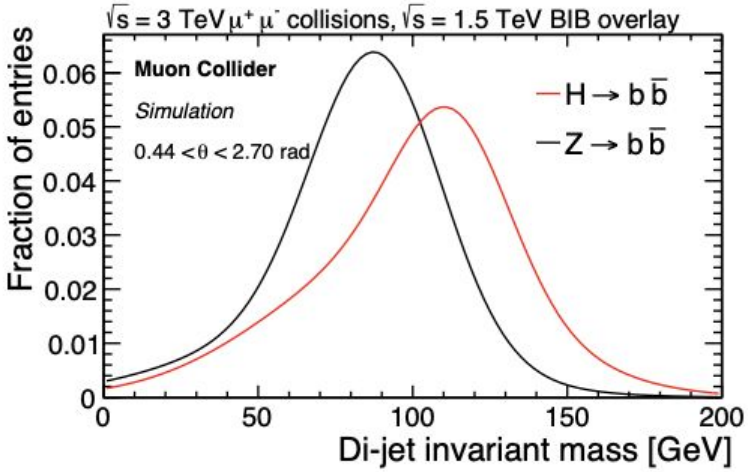


Quick fix?



30% energy resolution for 50 GeV photons is not what we'd like to be remembered for (nor for being unable to tell hadronic Zs and Higgses apart)

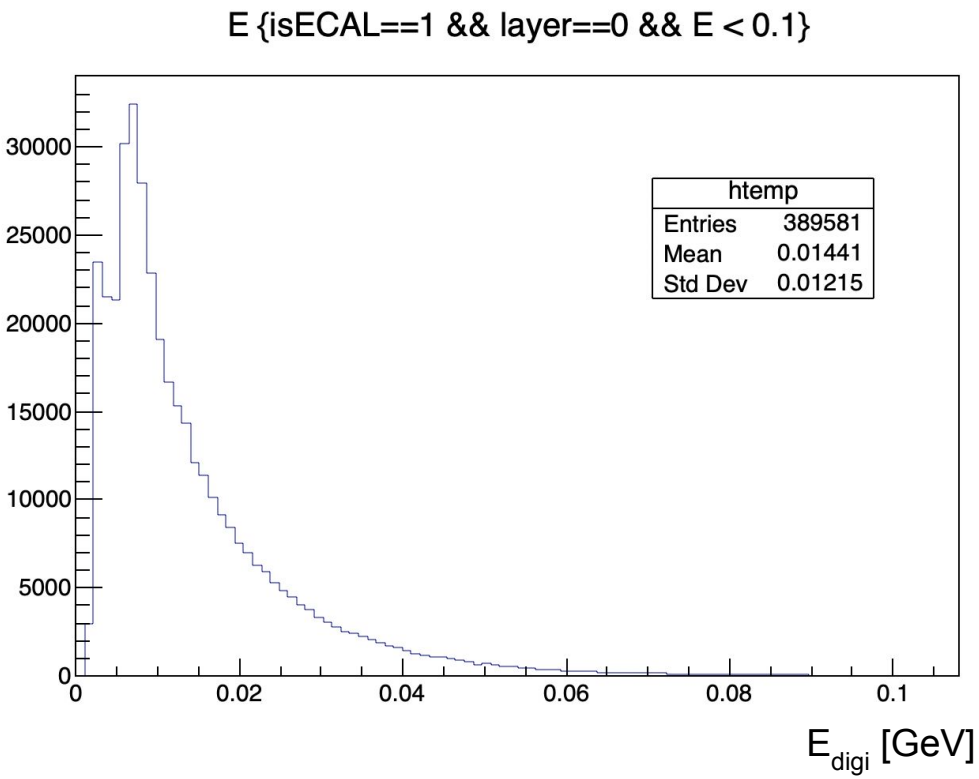
Most likely culprit: very high calo cell thresholds (2 MeV) used in calo digitisation

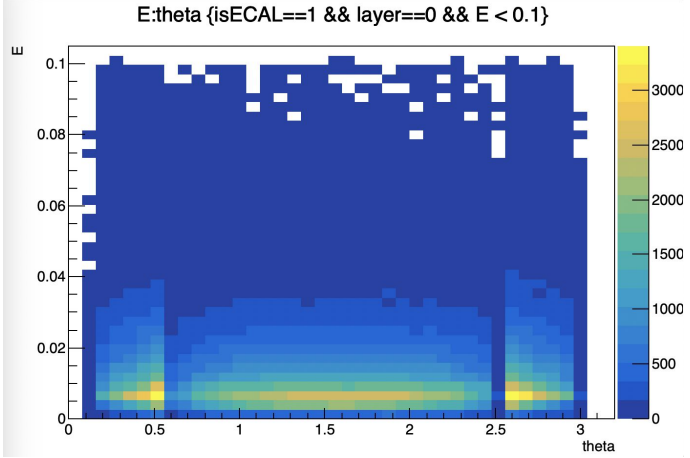


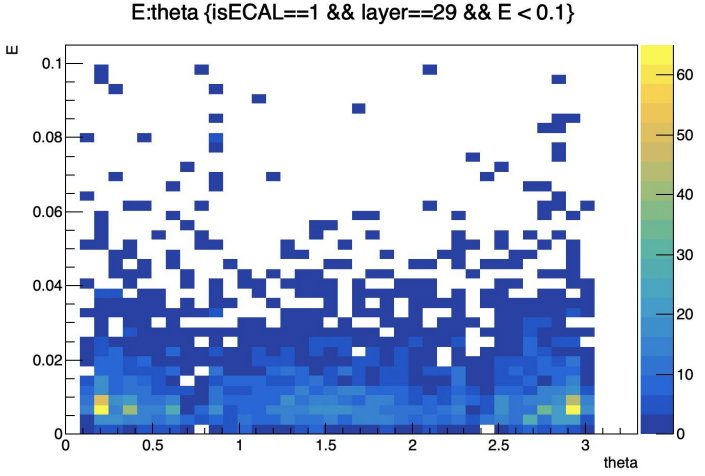
Trying to just lower the threshold back to 50 keV results in Pandora reco needing days to process one event (and returning ~bogus results)

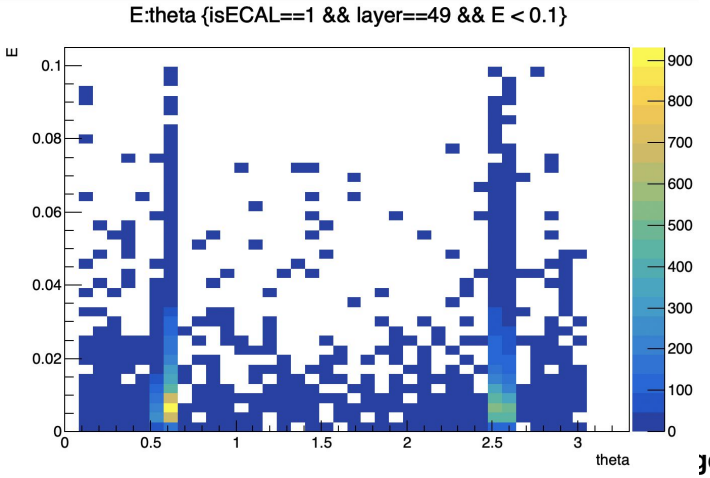
- Can we do something smarter?

Calo cell studies based on nuGun sample







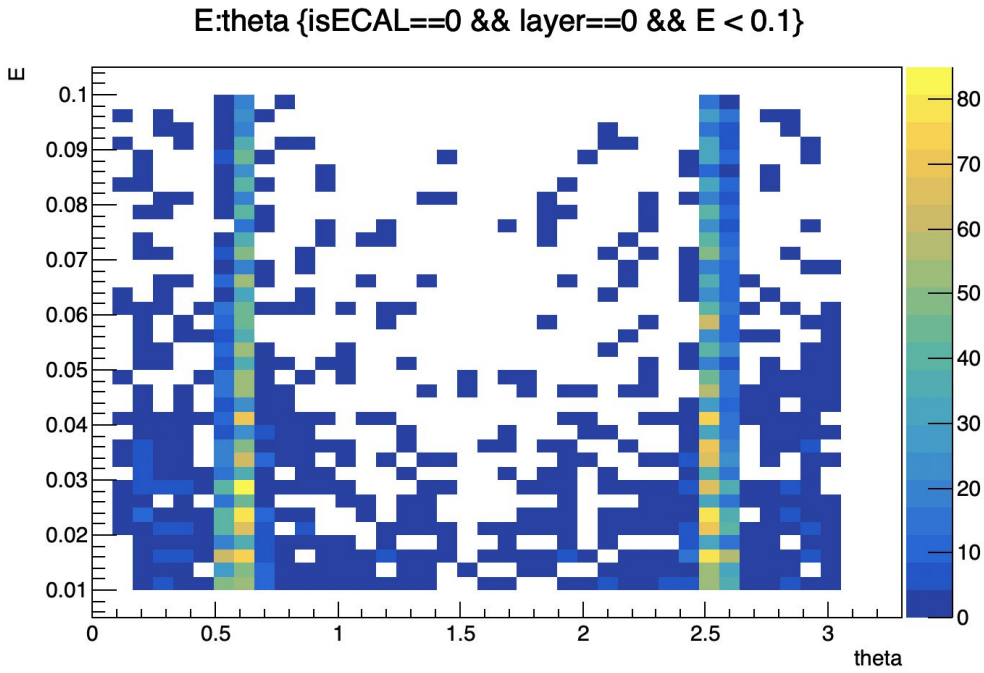


Bonus: BIB and calo cracks?

To be investigated further.

Most BIB in “deep” ECAL layers (and HCAL) localised in crack region

- Left too much space in geometry?
- Could also be correct like this…



Dynamical thresholds and BIB subtraction

1. Digitise hits with 50 keV cell energy thresholds
2. Build histograms of the digitised cell energies vs theta, calo layer
   Theta binning (0., 30., 40., 50., 60., 70., 90., 110., 120., 130., 140., 150., 180.)
3. For each layer, theta bin, select cells with E_{digi} > <E>+3 sigma
4. Subtract <E> to the E_{digi}
5. Proceed with pandora reconstruction as usual

Implemented steps 2-4 in a dedicated Marlin processor

Results

Applied calo cluster selection and BIB subtraction to single photon particle gun samples (iso_photonGun_50, i.e. fixed energy, uniform in theta)

- Can use Pandora reconstruction without setting cell thresholds to 2 MeV
- Drastic improvement in energy resolution
- TODO: add line to compare with “no BIB” resolutions