EEEMCal gap and background studies

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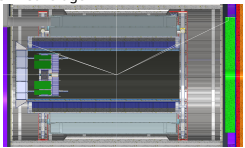
Gap

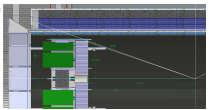
Problem?

EMCAL Coverage



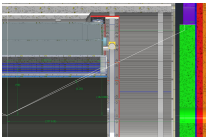
Backward Direction

- 0.58-degree gap between Barrel EMCAL and EEMCAL
- For the EEEMCAL the 1st layer of blocks was ignored, so the top of the second layer was used (174cm in Z, 59.4cm in Y)
- For the Barrel EMCAL the mid point of all the imaging layers was used (255cm in Z, 90cm in Y)



Forward Direction

- 1.25-degree gap between Barrel EMCAL and Hadron EMCAL
- For the Hadron EMCAL the 1st layer of blocks was ignored, so the top of the second layer was used (337.6cm in Z, 162cm in Y)
- For the Barrel EMCAL the mid point of all the imaging layers was used (177.5cm in Z, 90cm in Y)



Prior work by Pu-Kai

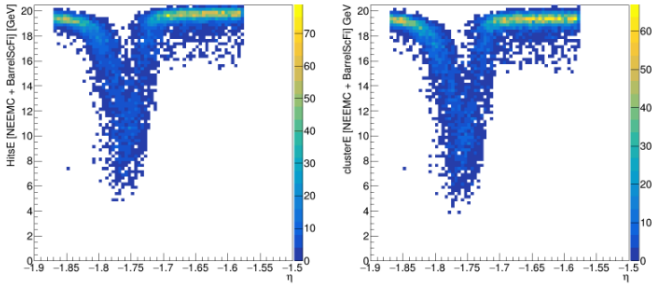
Maria pointed me to

`https://chat.epic-eic.org/main/pl/e176bffaeif4xn4pxbmtzw88aa`

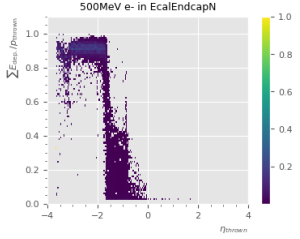
July 07, 2023

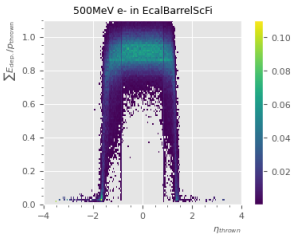
pwang 6:44 AM

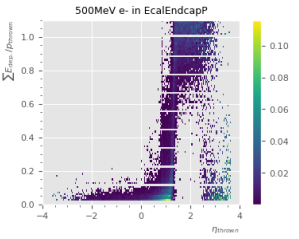
Hi all, I recently ran the standalone simulation (latest epic repo of epic_brycecanyon.xml) to look into the transition area between NEEMC and Barrel calorimeter. I distributed the 20 GeV photon between eta around -1.9 to -1.6 and reconstruct the photon's energy with summation the hits energy (EcalEndcapNRecHits.energy + EcalBarrelScFiRecHits.energy) or clusters energy (EcalEndcapNClusters.energy + EcalBarrelScFiClusters.energy). I found the energy reconstruction in both ways are poor from eta: -1.82 to -1.72. Any thoughts about this?

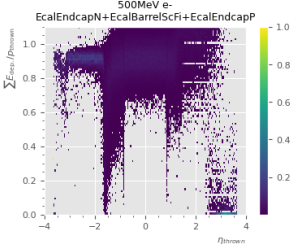


Total energy deposition vs φ



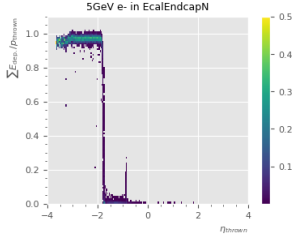


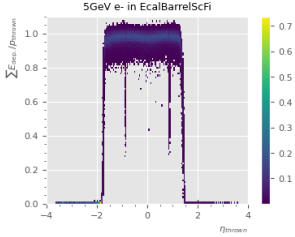


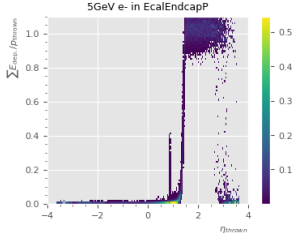


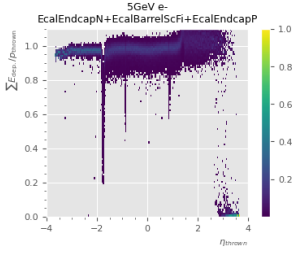
Tracker cone visible at $\eta \approx \pm 1$

Total energy deposition vs φ



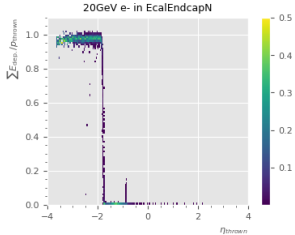


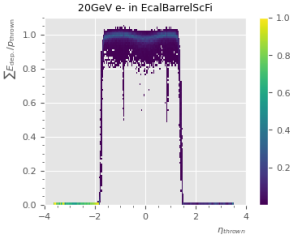


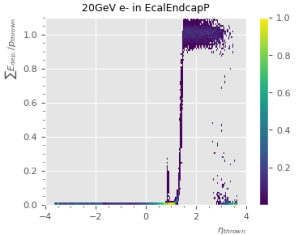


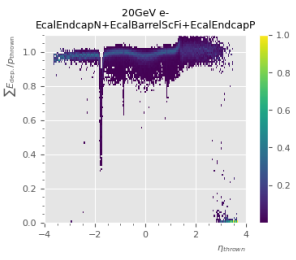
Tracker cone visible at $\eta \approx \pm 1$

Total energy deposition vs φ









Tracker cone visible at $\eta \approx \pm 1$

Conclusion

Looks like there is a significant gap in acceptance between negative and barrel ecals, vanishes at low $|\vec{p}|$. This might be partially "remedied" by introducing missing material into the simulation geometry.

Background embedding

HepMC embedding

This is a continuation of a study from September 2023
Slides 7 & 8 from here

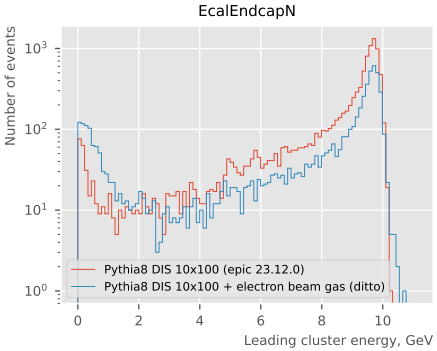
During my second attempt to perform embedding, I've reached out to Kolja, turns out their script takes inverse of frequencies for "Freq" parameters. New command:

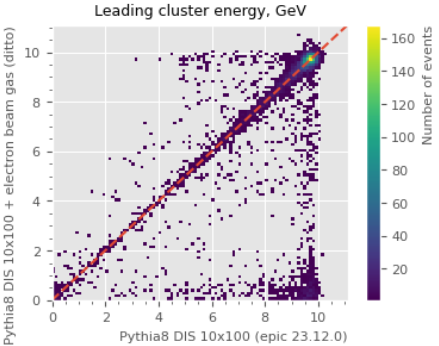
```
python signal_background_merger.py -i
"pythia8NCDIS_10x100_minQ2=1_beamEffects_xAngle=-
0.025_hiDiv_1.hepmc" -bg1 "100GeV.hepmc" -bg2
"../beam_gas_ep_10GeV_foam_emin10keV_10Mevt_vtx.hepmc" -bg3 ""
-sf 0 -bf1 31347.96238244514 -bf2 314.7375875363915
```

where
bg1_freq=1e9 / 31900., # last number in Hz, 1e9 converts to ns
bg2_freq=1e9 / 3177250., # last number in Hz, 1e9 converts to ns
with frequencies taken from the Background Wiki page

2 picosecond integration window used, but TOF is not synced with beam

First results





Still work in progress...