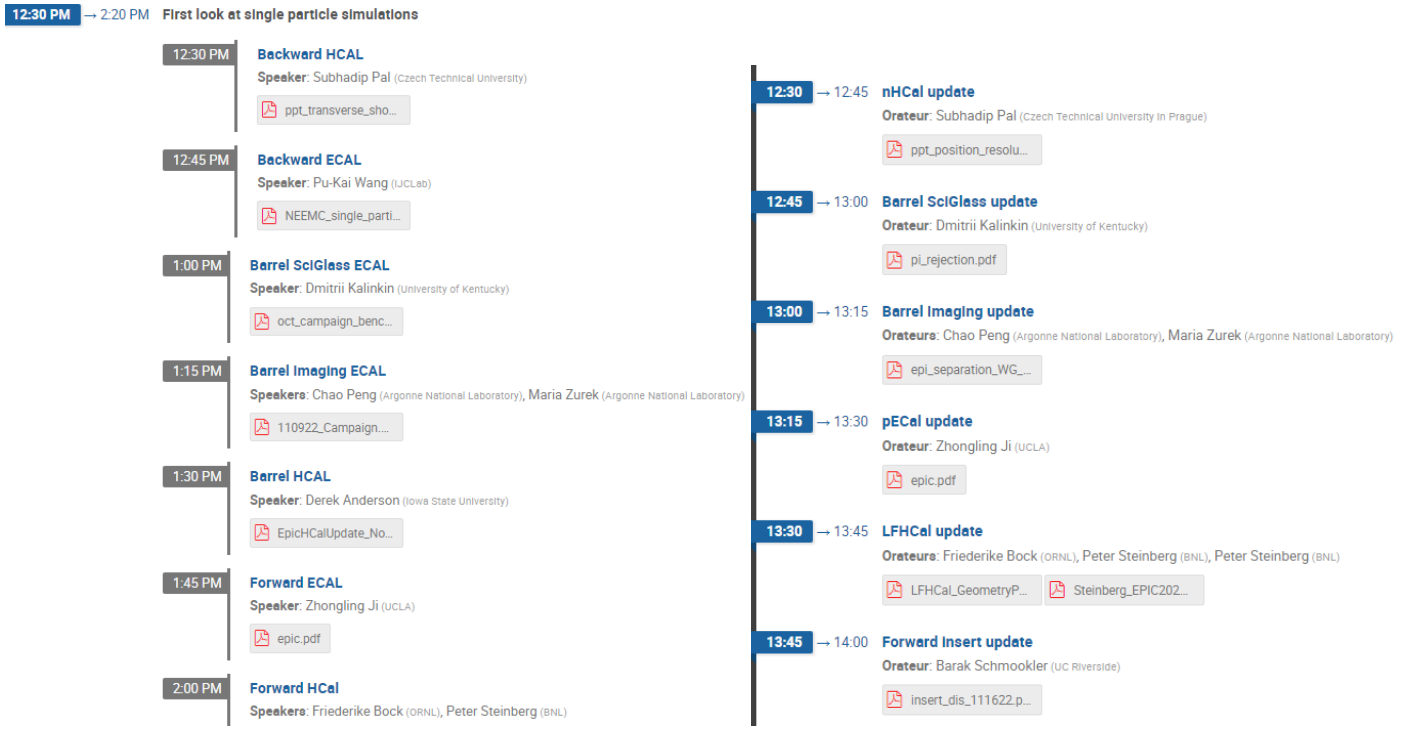
GD/I weekly Meeting
Nov 21, 2022

Calorimetry report:

Summary of EPIC calorimetry meeting on Nov 9 and 16:
https://indico.bnl.gov/event/17705/ & https://indico.bnl.gov/event/17706/

First look at single particle outputs from Simulation WG



C. Munoz, for the EPIC calorimetry WG

October campaign

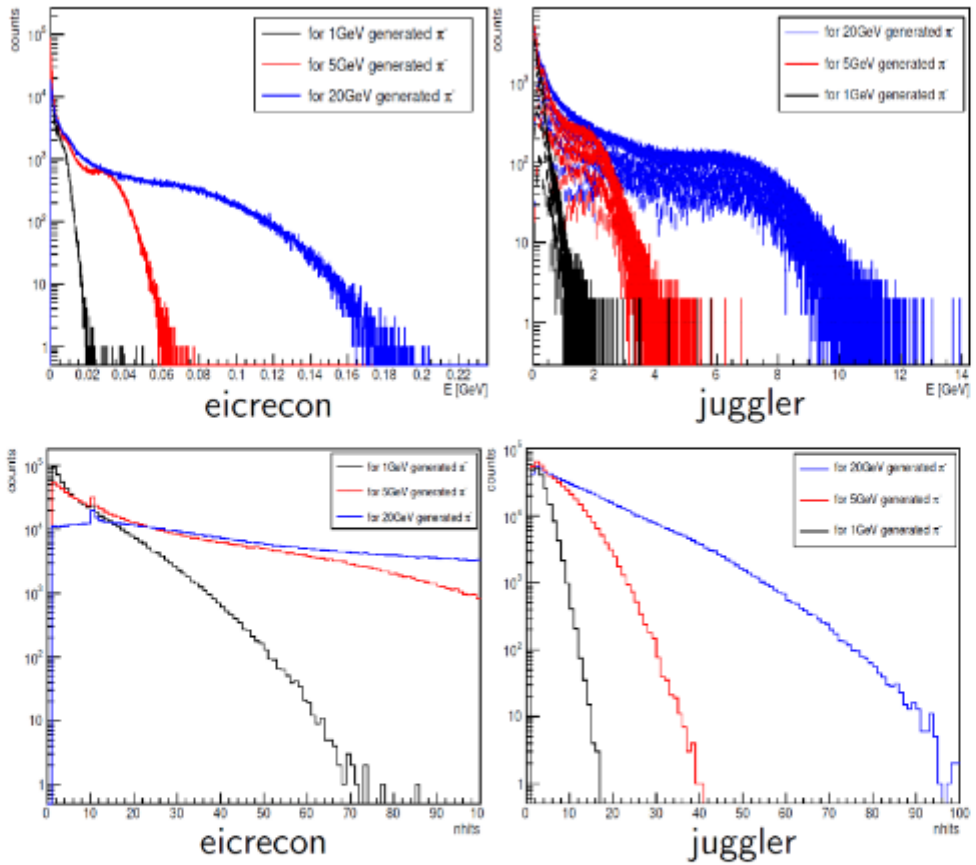
- Particle species are e^- and π^-
- $p_{\text{thrown}} = 100$ MeV, 200 MeV, 500 MeV, 1 GeV, 2 GeV, 5 GeV, 10 GeV, 20 GeV
- Three polar angle ranges: $3 - 50°$, $45 - 135°$ and $130 - 177°$
- Reconstruction with Gaudi+Juggler (Athena) and with JANA2+EICrecon (ePIC)
- Two ePIC detector configurations "Arches" and "Bruce Canyon" with geometry tag 22.10.0
- Certain combinations of energies and angles are currently missing
  Reported on Mattermost

  Re-run with 22.11.0 in progress

University of Kentucky

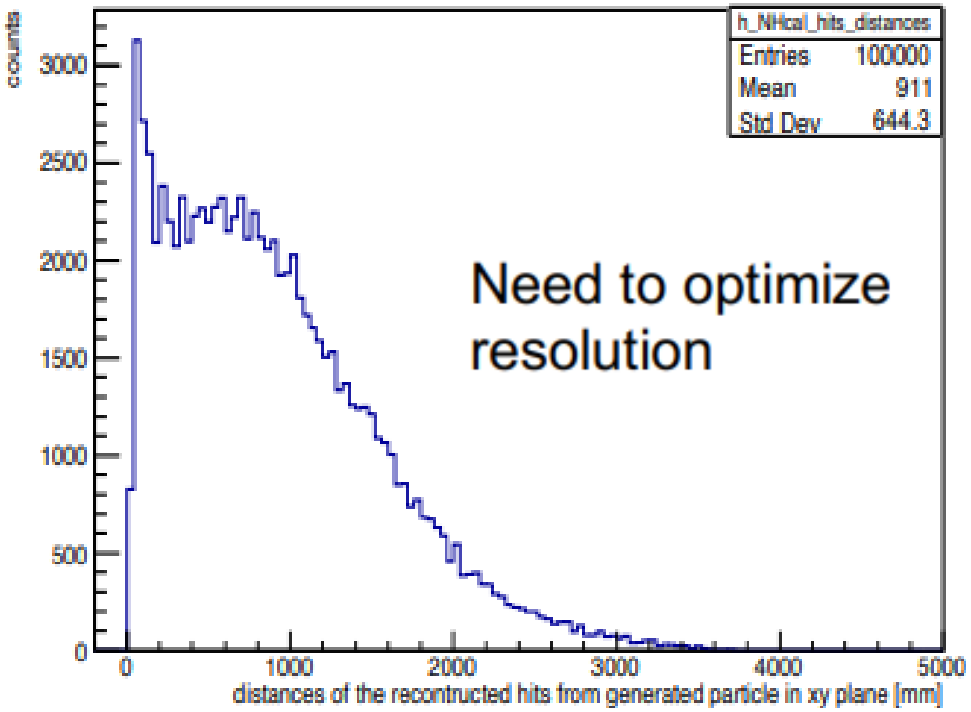
Backward HCal

π^- from geometry version 22.10.0 epic brycecanyon



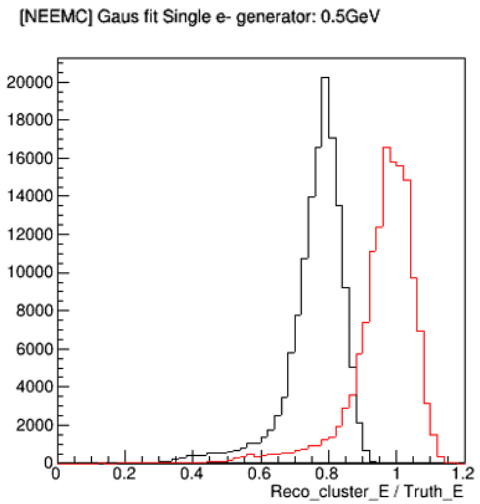
Investigated the reconstructed position of the generated particle, aka center of gravity of the cluster, in single particle events in order to optimise the position resolution.

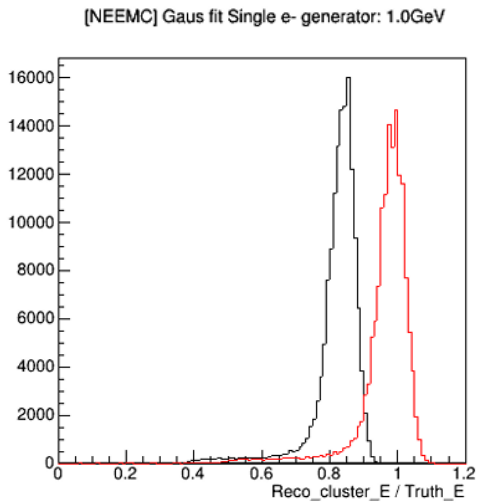
- 1 GeV neutron gun : $\theta = 160^\circ$ and $\phi = 45^\circ$

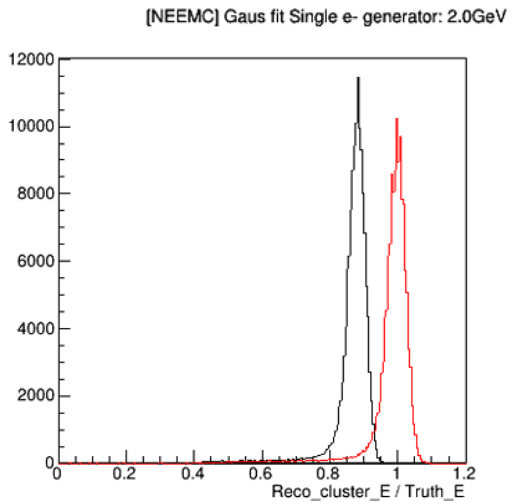


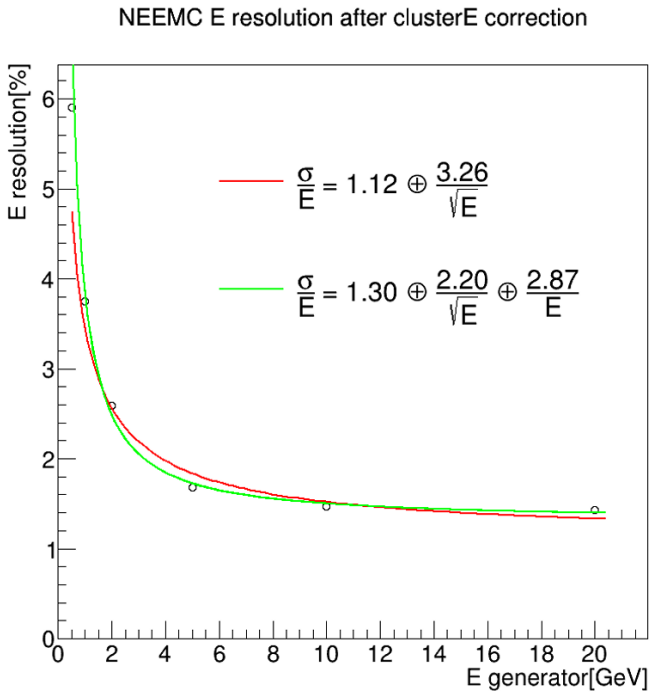
- Low reconstructed cluster energy with EICrecon compared to Juggler
- Much more hits per cluster with EICrecon than Juggler
- Some clusters are located in the middle hole for the beampipe - too large clusters?
- All of it suggest that clustering parameters need to be adjusted

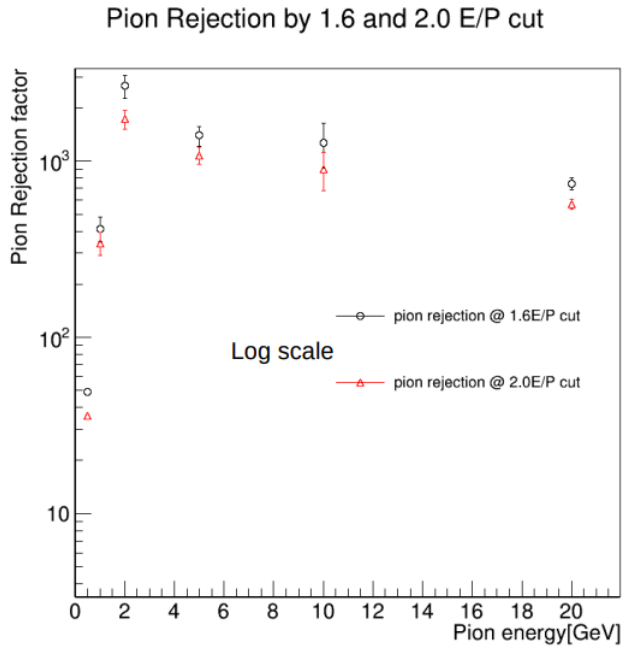
Backward ECal





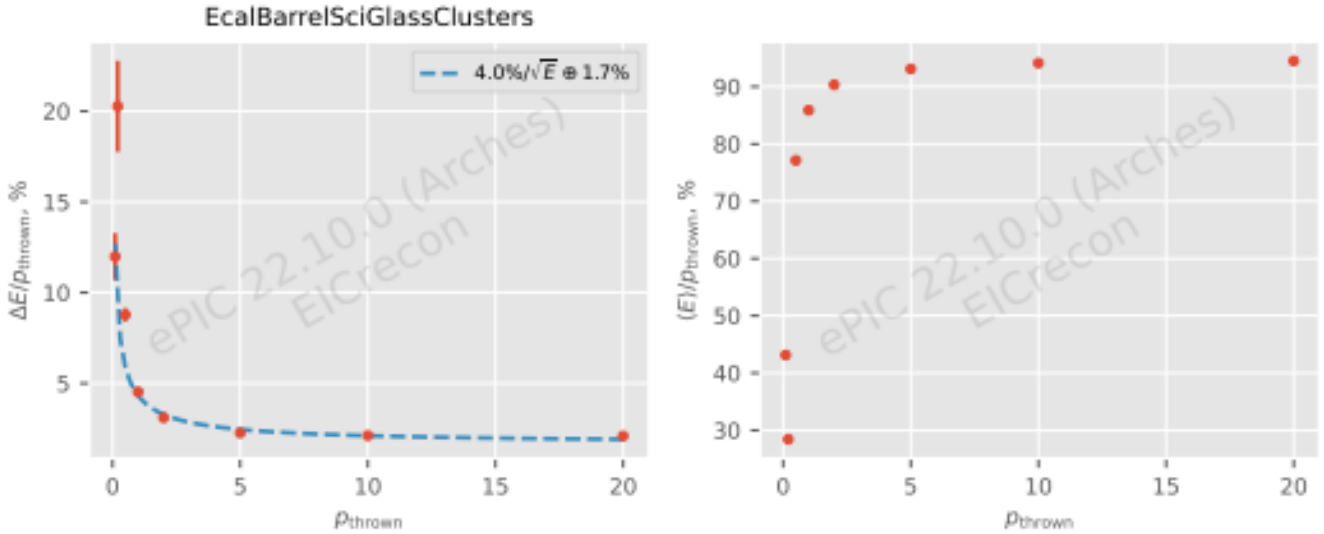


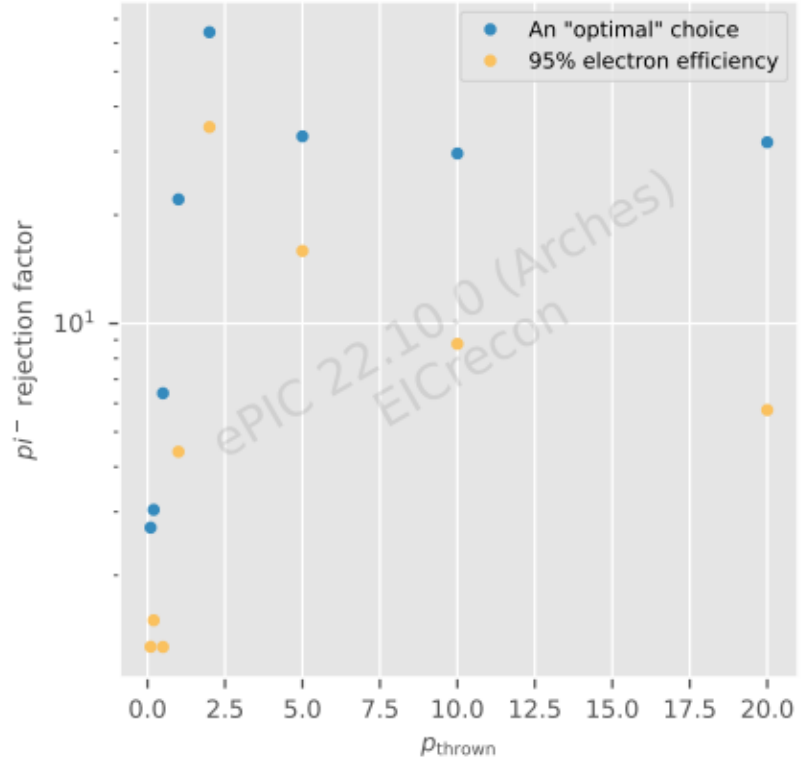


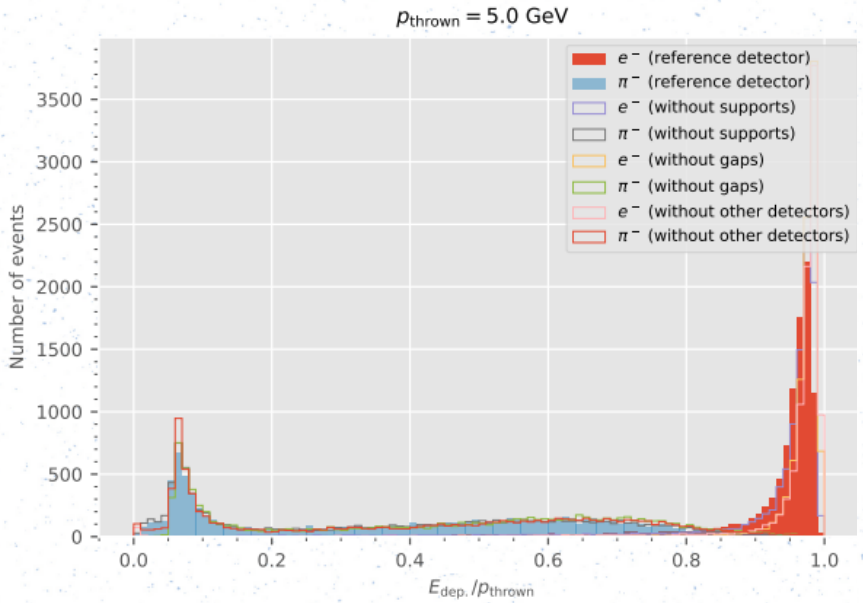


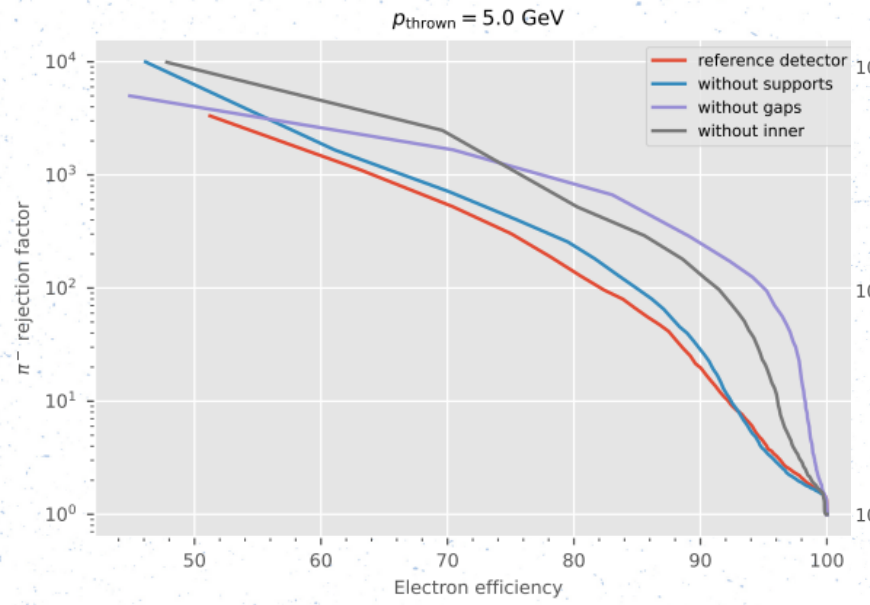
- First look at single particle simulations
- Energy resolution and pion rejection values as expected
- No issue identified so far

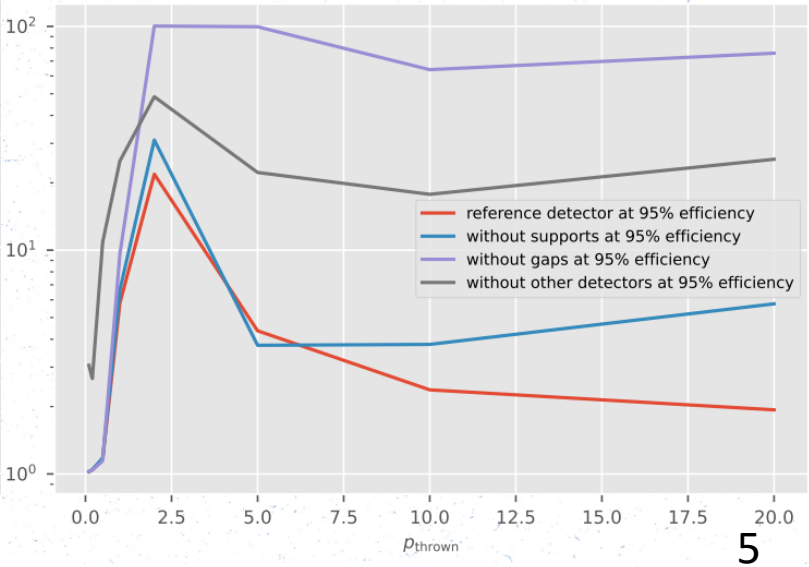
Barrel Ecal SciGlass





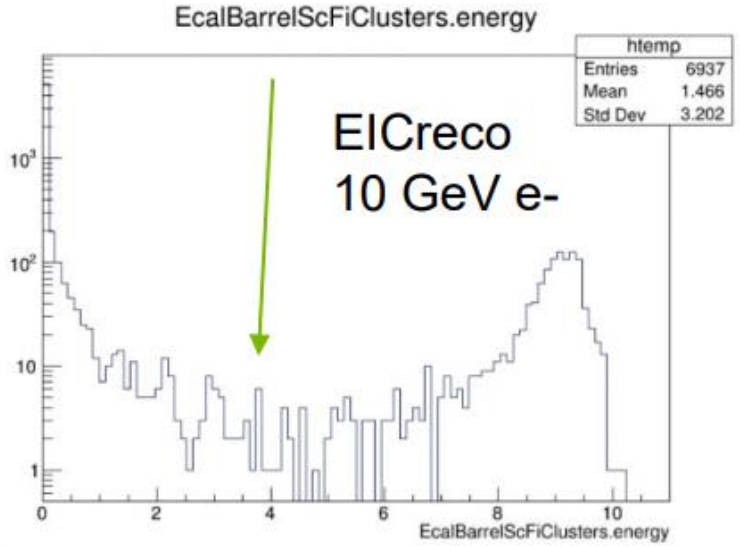


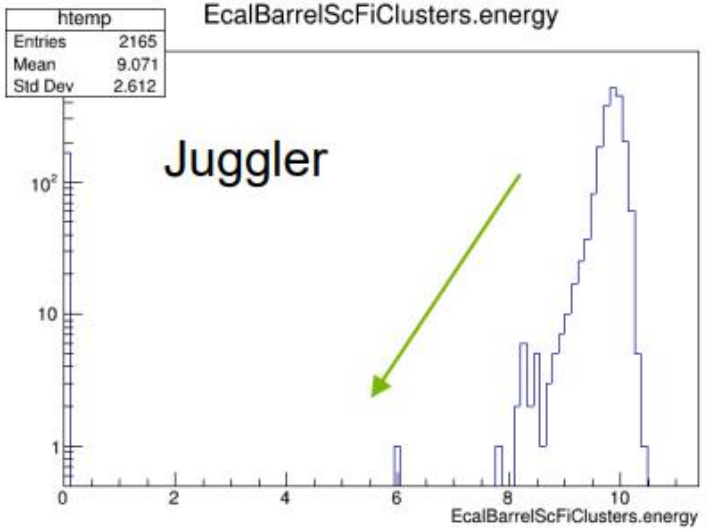




Barrel Ecal Imaging

- **Issue with wrong reconstructed** hit energy from AstroPix layers **solved (yay!)**
  - Problem: the dynamic range units were not passed to the reco algorithm (assumed GeV, should have been MeV)
- **Issue with topological clusters** form imaging layers
  - Issue is being worked on, clusters are reconstructed, but found that the min cluster energy was not adjusted (this has to be corrected): https://github.com/eic/EICrecon/issues/351
- **Open issue: Example SciFi Cluster energy plots from EICreco show much more low-energy outliers:**

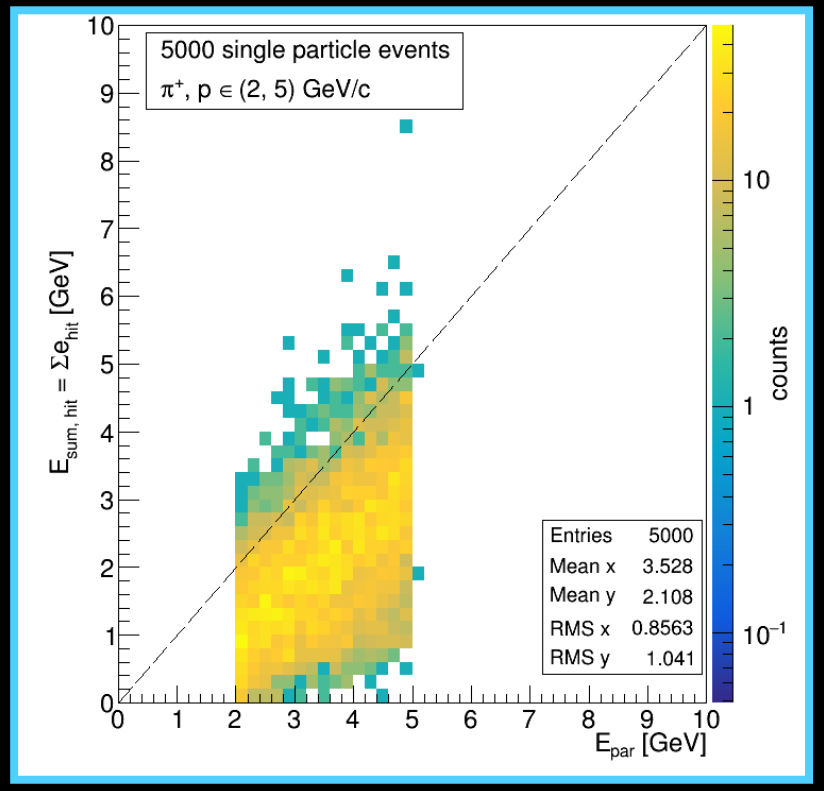


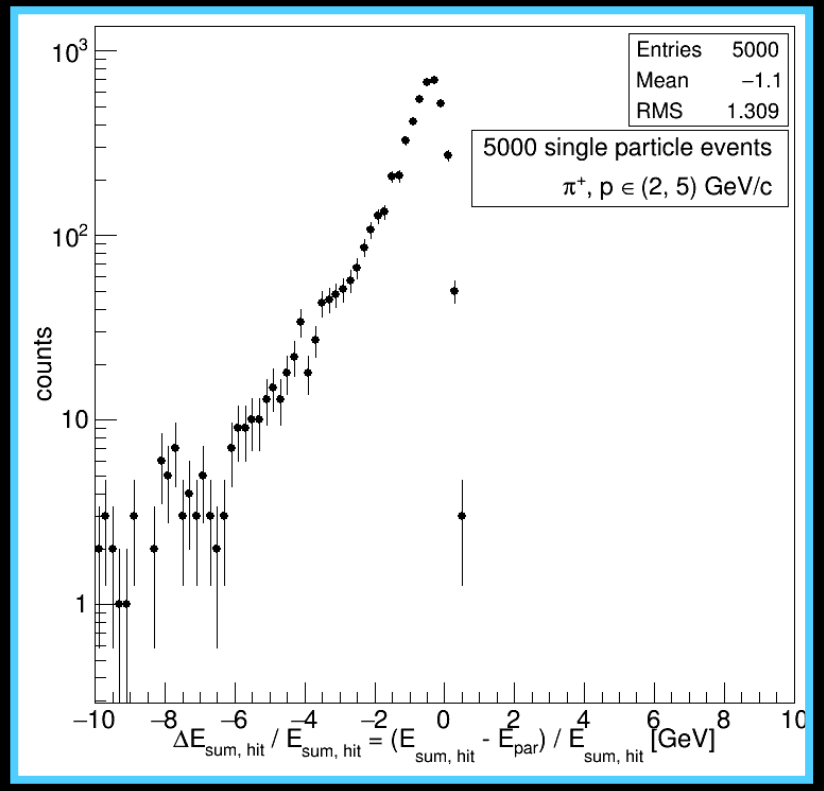


Cluster thresholds quite low (for both reconstructions):

minClusterHitEdep: 1.0*MeV
minClusterCenterEdep: 10.0*MeV

Barrel HCal

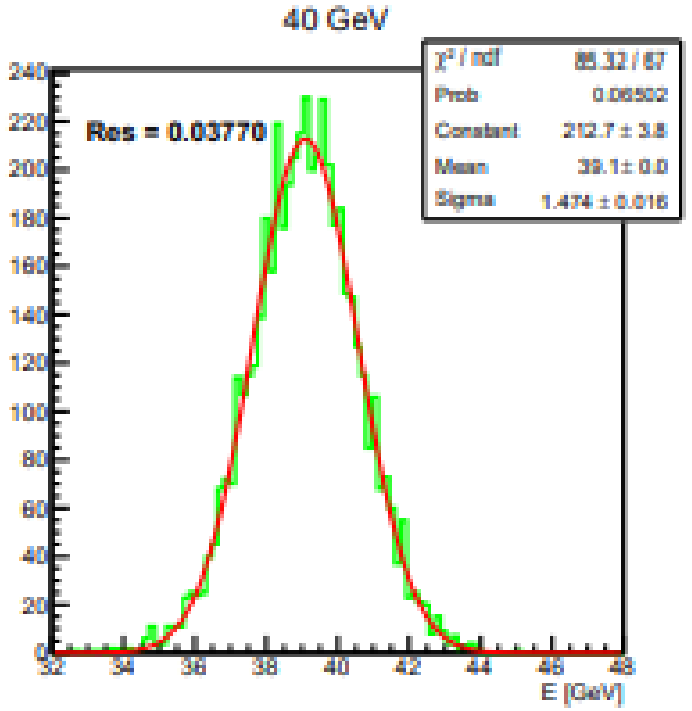


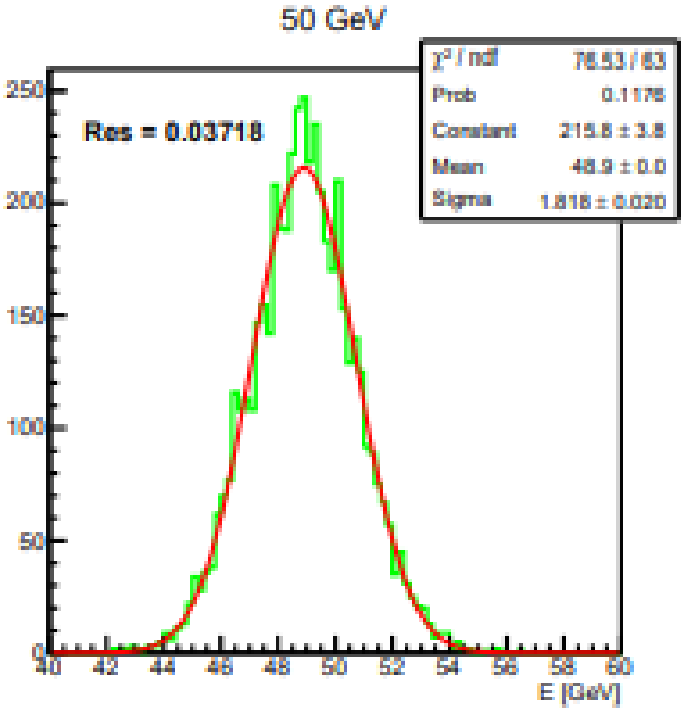


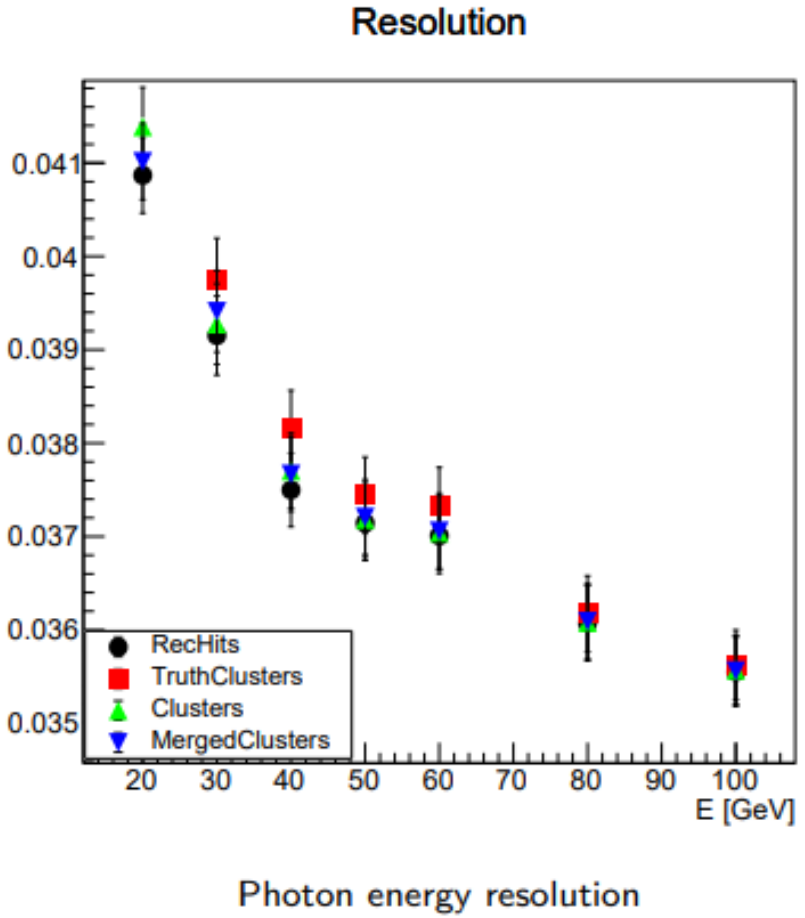
- Checked current implementation of sPHENIX Barrel Hcal with standalone single particle simulation
  - 2D distribution of particle vs. summed hit energy **(left)**
  - Difference b/n sum hit energy and particle **(right)**

- **Take-aways:**
  - Hits look reasonable
  - Summed hit energies get close to particle energy
  - ⇒ Current implementation will work for this simulation campaign

Forward Ecal





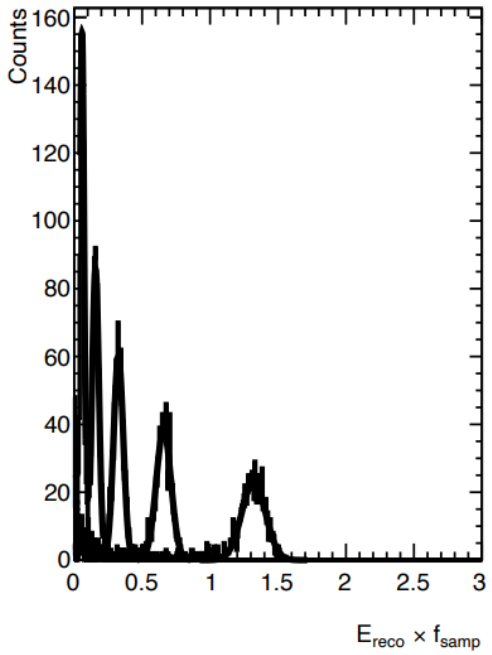


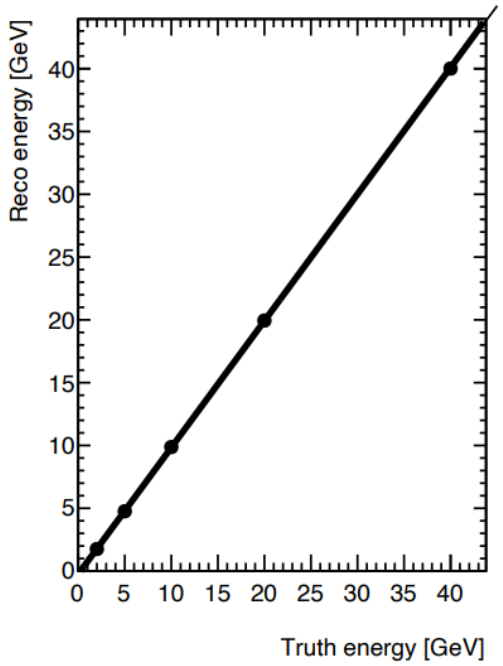
Photon energy resolution

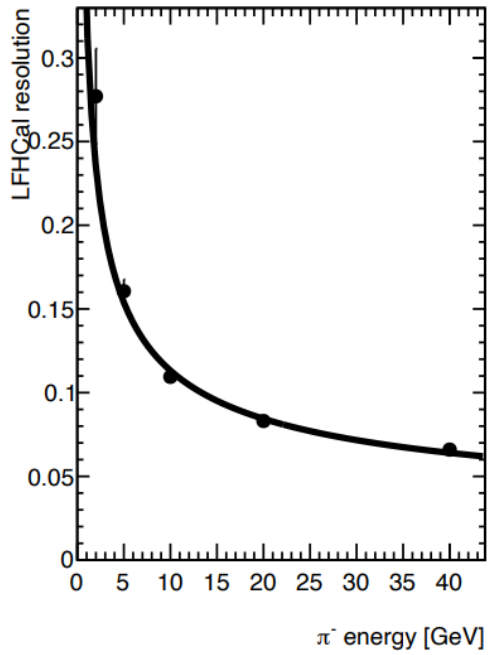
- The energy responses look reasonable except 3% energy loss, which comes from DD4hep and may be due to the finite detector length.
- The energy resolutions are consistent with previous Geant4 simulations.
- Truth, island, and merged clustering algorithms work as expected for single particle input.

Forward HCal

- **Running standalone using stripped-down geometry & steering setup from David L**
  - RICH still there but pECal disabled (fix TBD)





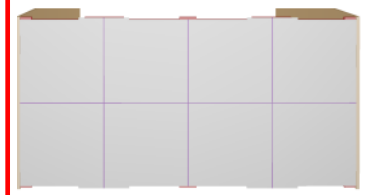


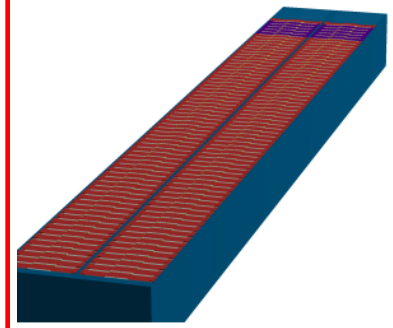
Sum all energies in calo after digi/reco. f_{samp} of 3.3% works.

Ideal resolution fit to $30\%/\sqrt{E}$

A lot of zero energies - inefficiencies introduced in clustering process: under investigation!

Progress in geometry implementation for next campaign





- First implementation of detailed 4M & 8M geometries doen with internal tower structures
- Correct dead area implementation according to technical drawing (small modifications in inactive area)
- Left out WLS fibers for now, computation time as is already extensive
- Currently working on placements of $\sim$ 1100 modules in right places
- Next: Hit $\rightarrow$ Tower/Segment association & cluster finding

Forward calorimeter insert

- Ran standalone DD4HEP+Juggler simulation using 18x275GeV DIS generator input.
- Reconstructed relevant physics variables using the reconstructed hits (not clusters) in the forward endcap calorimeters – both with and without inserts included.
- Currently working to repeat studies using official DIS files on S3.