Simulation plots for Pre-CDR

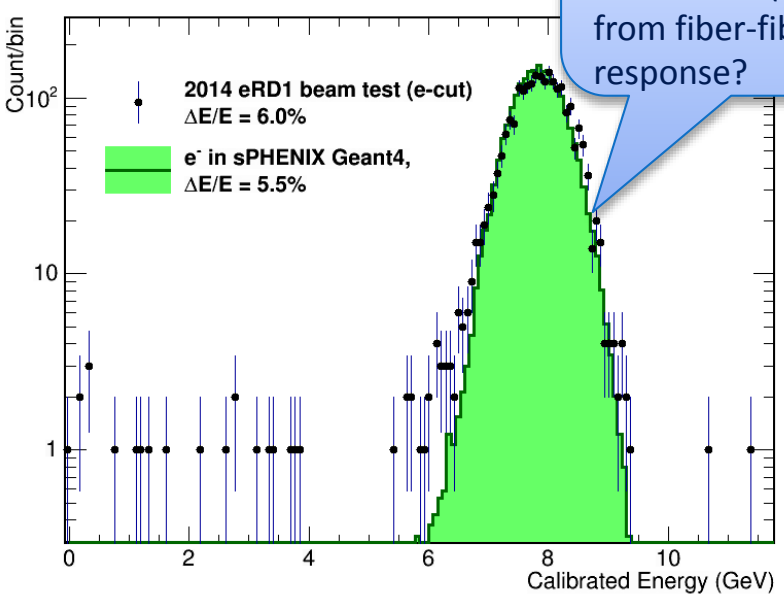
Jin Huang (BNL)
Also for Megan Connors and Stefan Bathe

Pre-CDR plots

- Single particle (e/mu/pi/p/gamma/pi0)
  - Line shapes [Jin] <- Done
  - Sampling fraction [Jin]<- Done
  - Linearity [Jin] <- Checking
  - Energy resolution [Jin] <- Done
  - Lateral extension [Jin] <- Done : Use old plots
  - Dynamic range [Jin] <- Done
- Au+Au HIJING embedded
  - Underlying event energy and fluctuation [Jin]
    <- **Working on it**
  - Rejection vs efficiency for electrons [Jin]
    <- verify track proj. tools and analysis tools
  - Photon resolution [Stefan and Megan]
    <- Promising PHENIX Clusterizer, need embedding
- EM energy trigger performance
  - Turn-on curve [Jin] <- need Pythia production

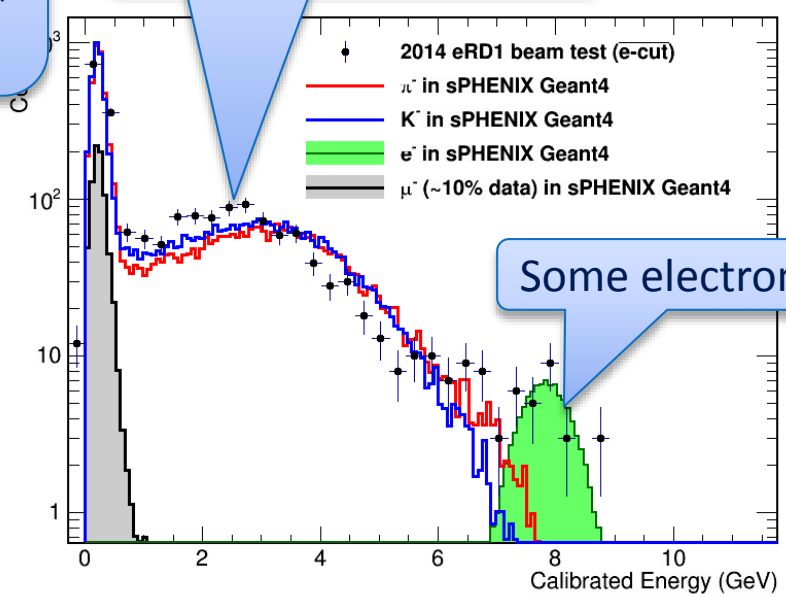
Test beam comparison:
8 GeV beams shower in Geant4 VS data

Very good matching in line shape.
Data: slightly more fluctuation (<10% rel.) from fiber-fiber response?



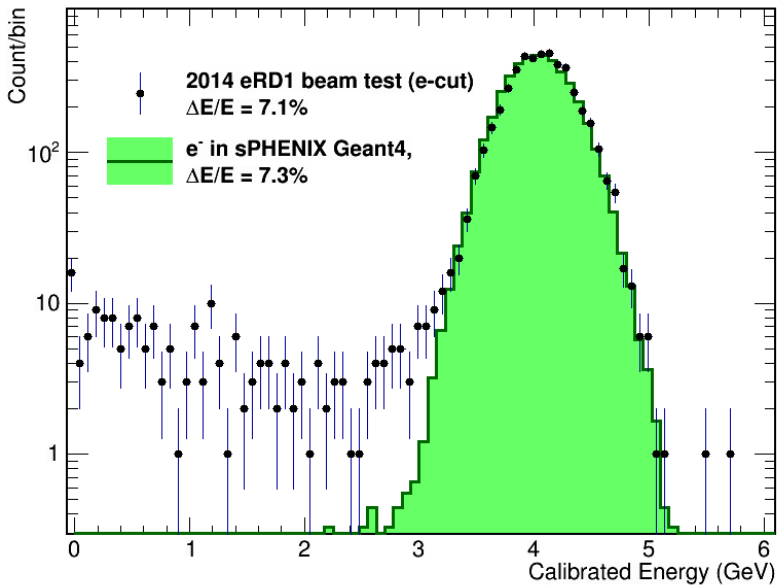
Less response in data?
Proton component?

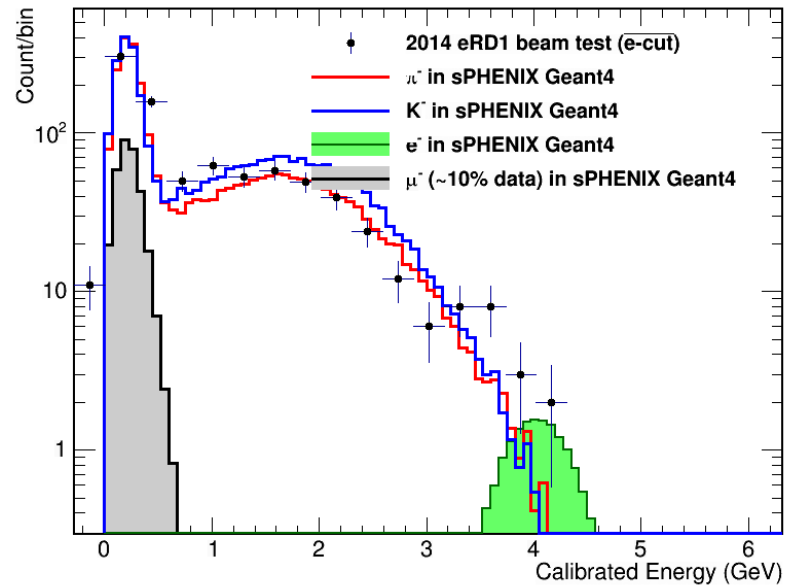
Some electron left



Full Geant4 sim QGSP_BERT_HP + light yield model (Geant4 default Birk)
Pedestal noise (2ADC), photon fluctuation (500e/GeV), NO fiber/fiber response

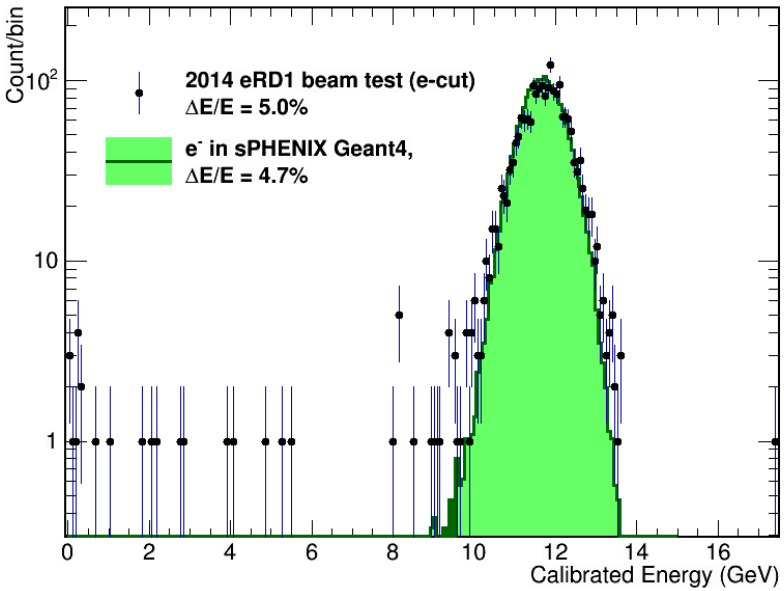
Test beam comparison:
4.12 GeV/c beams shower in Geant4 VS data

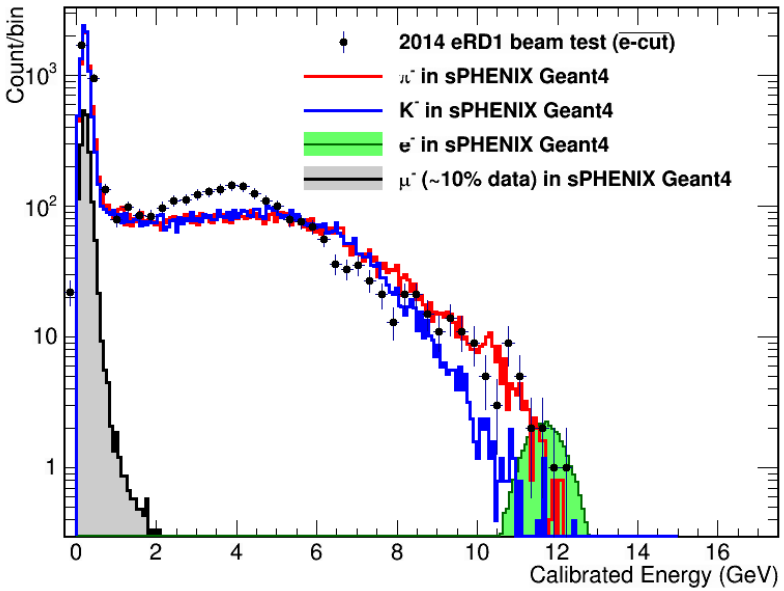




Full Geant4 sim QGSP_BERT_HP + light yield model (Geant4 default Birk)
Pedestal noise (2ADC), photon fluctuation (500e/GeV), NO fiber/fiber response

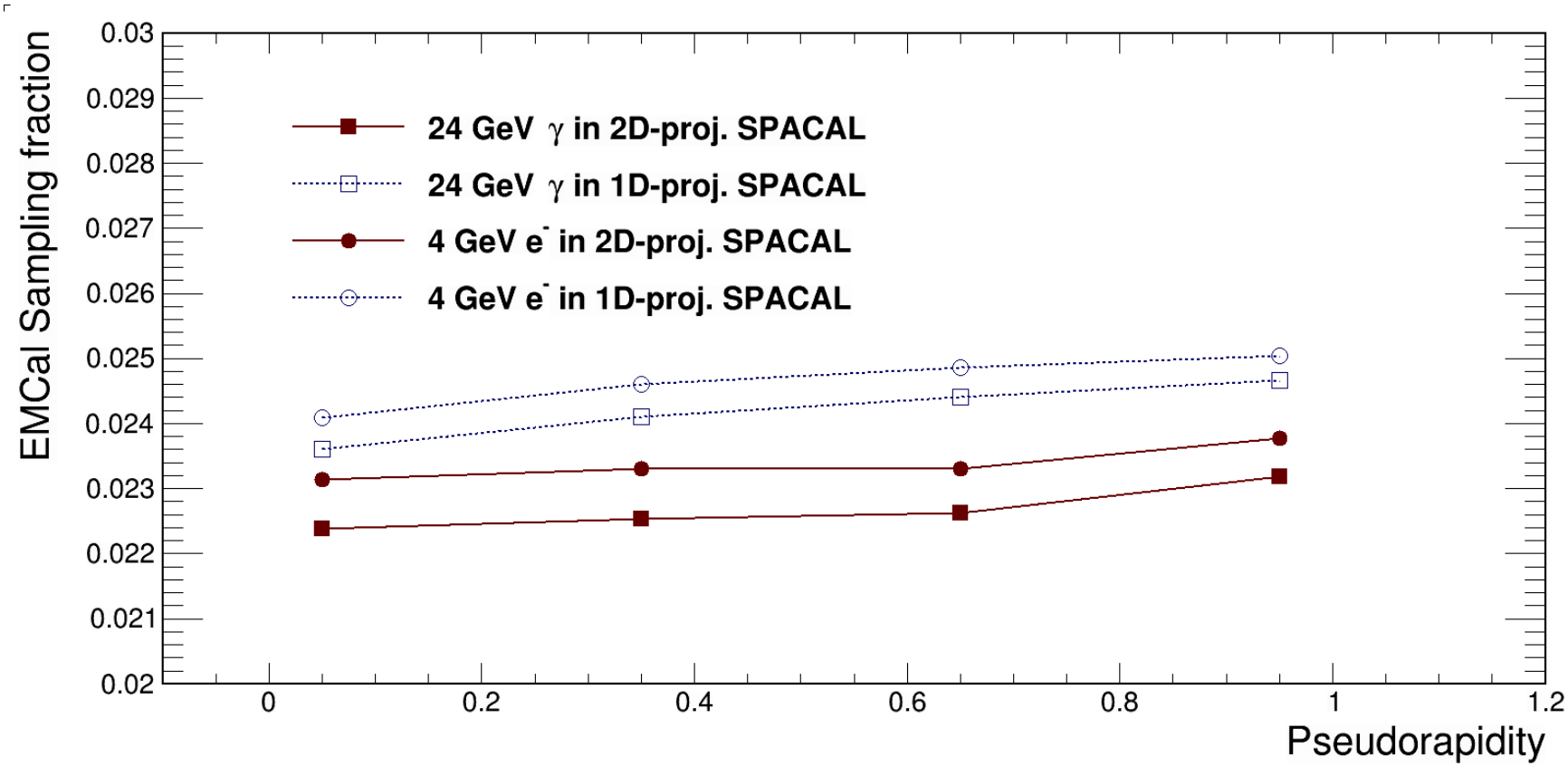
Test beam comparison:
12 GeV/c beams shower in Geant4 VS data





Full Geant4 sim QGSP_BERT_HP + light yield model (Geant4 default Birk)
Pedestal noise (2ADC), photon fluctuation (500e/GeV), NO fiber/fiber response

Sampling Fraction



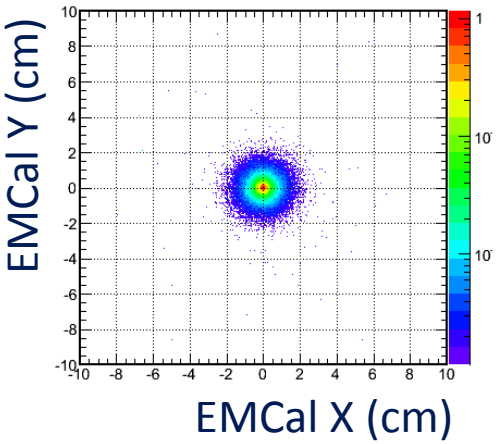
/direct/phenix+sim02/phnxreco/ePHENIX/jinhuang/sPHENIX_work/single_particle/DrawEcal_DrawSF.pdf

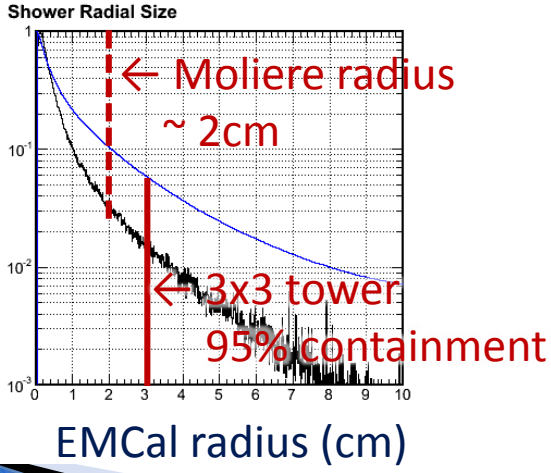
Spatial response

- Spacial containment of showers → size of cluster

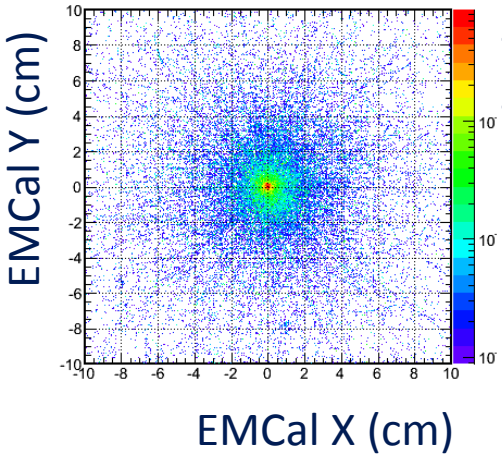
- Energy deposition (A.U.)
- Percentage outside radius

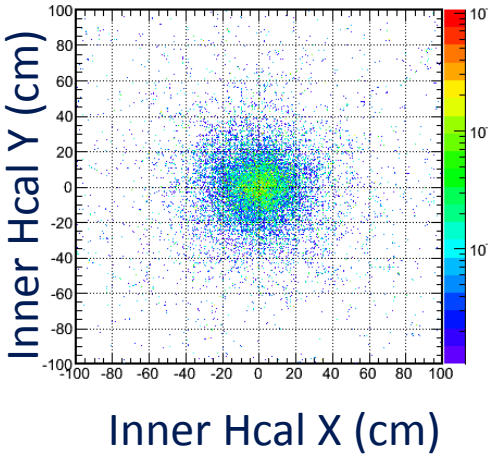
4 GeV Electrons

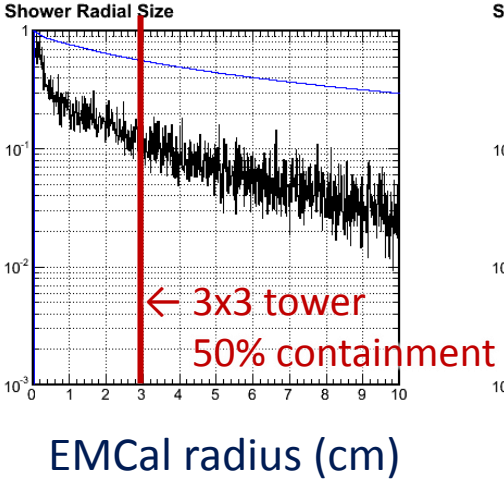


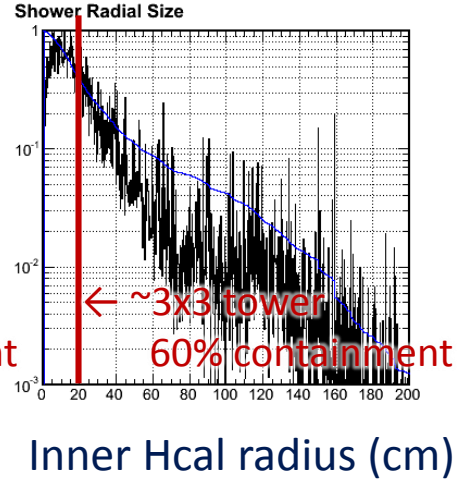


4 GeV Pions, that **passed E/p electron-ID cut**

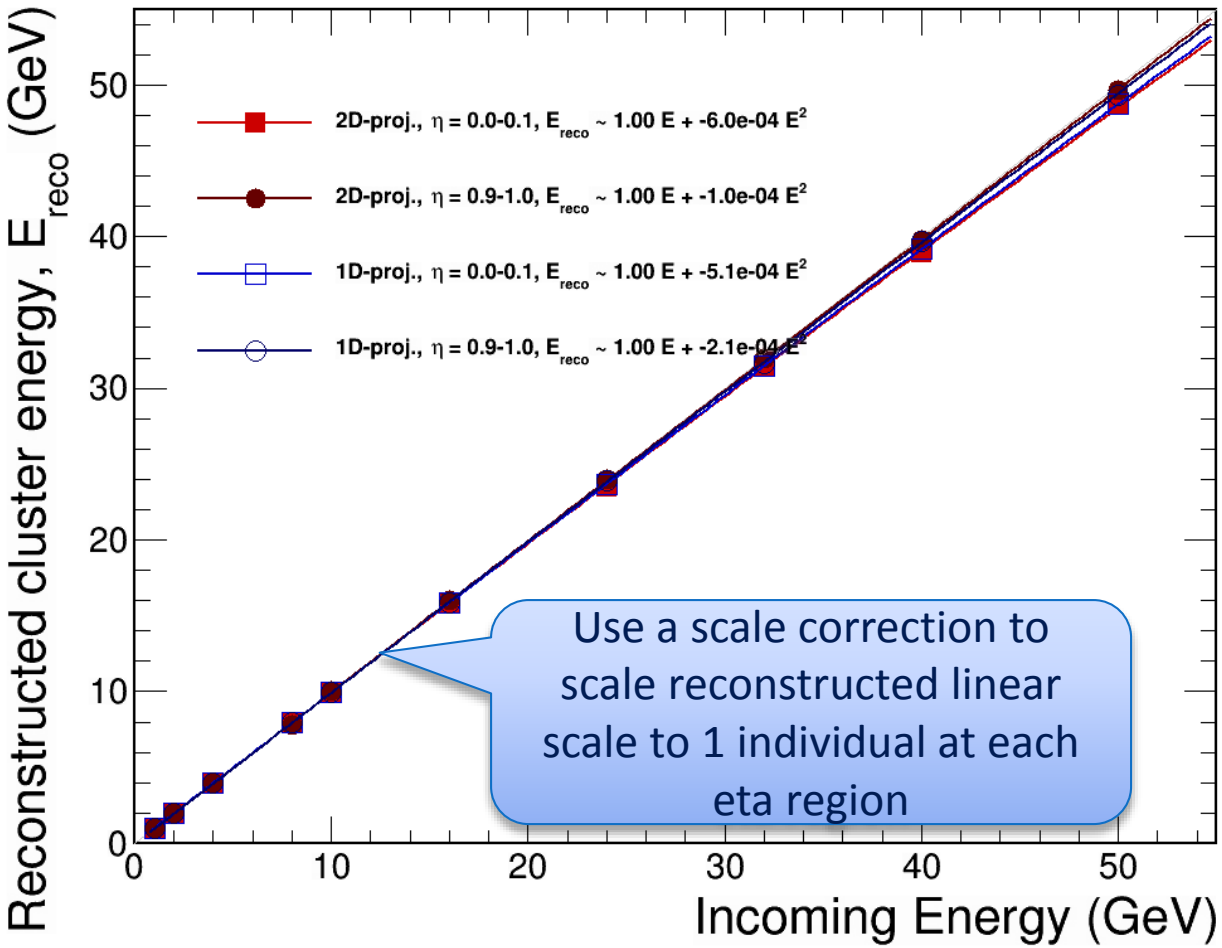








Linearality – double checking

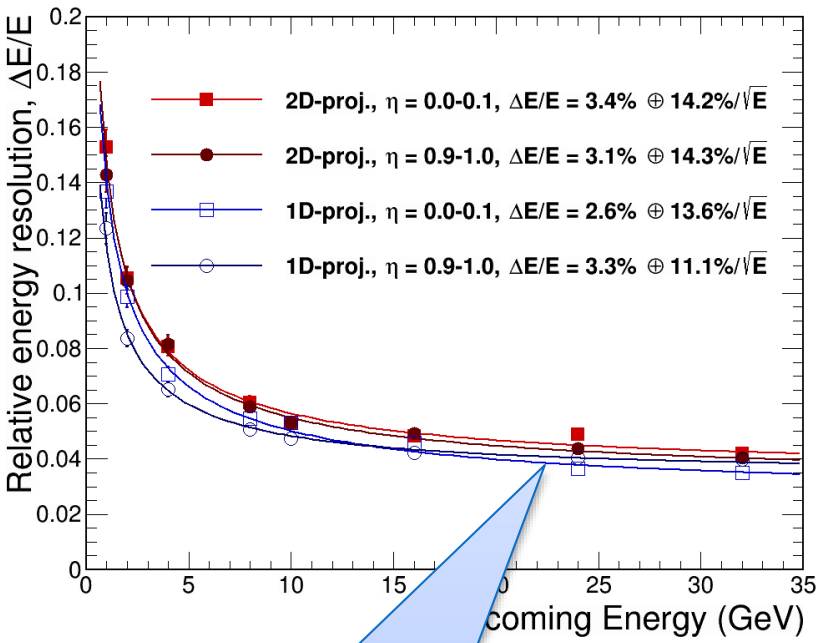


Use a scale correction to scale reconstructed linear scale to 1 individual at each eta region

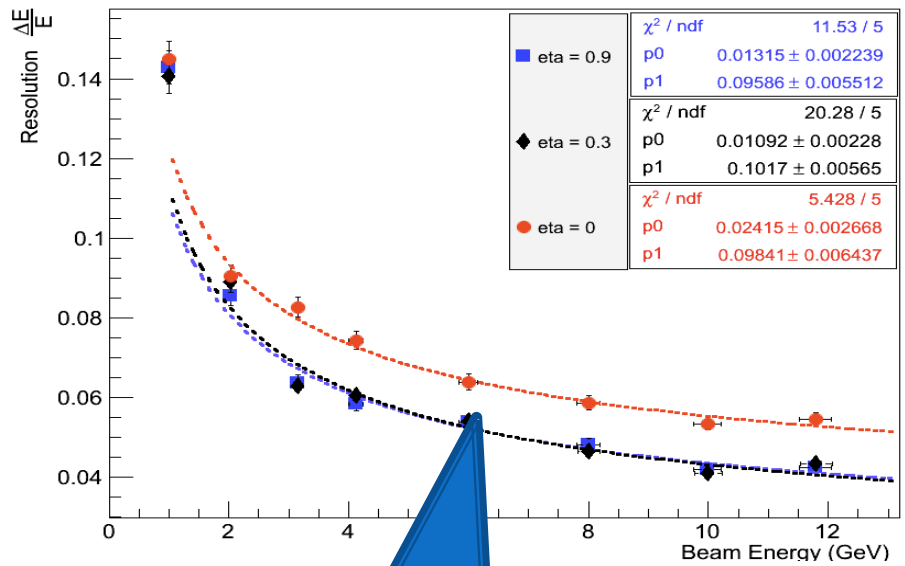
Energy resolution
Simulated with single photons

Full detector Geant4 sim QGSP_BERT_HP + light yield model (Geant4 default Birk)
Pedestal noise (8pe), photon fluctuation (500pe/GeV), Zero sup (16pe), Graph clusterizer

sPHENIX full detector single photon simulation



EIC RD1 study
FermiLab beam tests



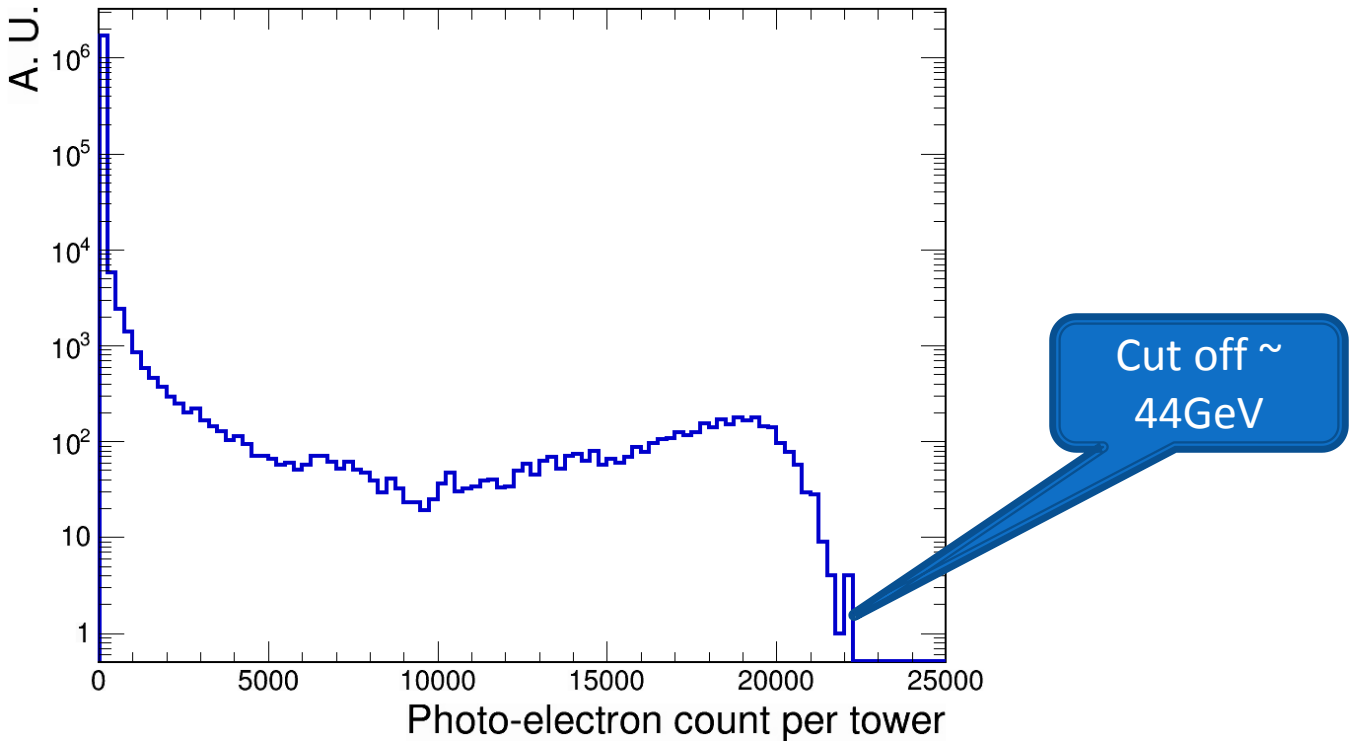
Courtesy: A.Kiselev (BNL)
DIS2014

1D SPACAL in forward rapidity his lowest 1/Sqrt{E} term due to higher sampling fraction from radially shallow showers

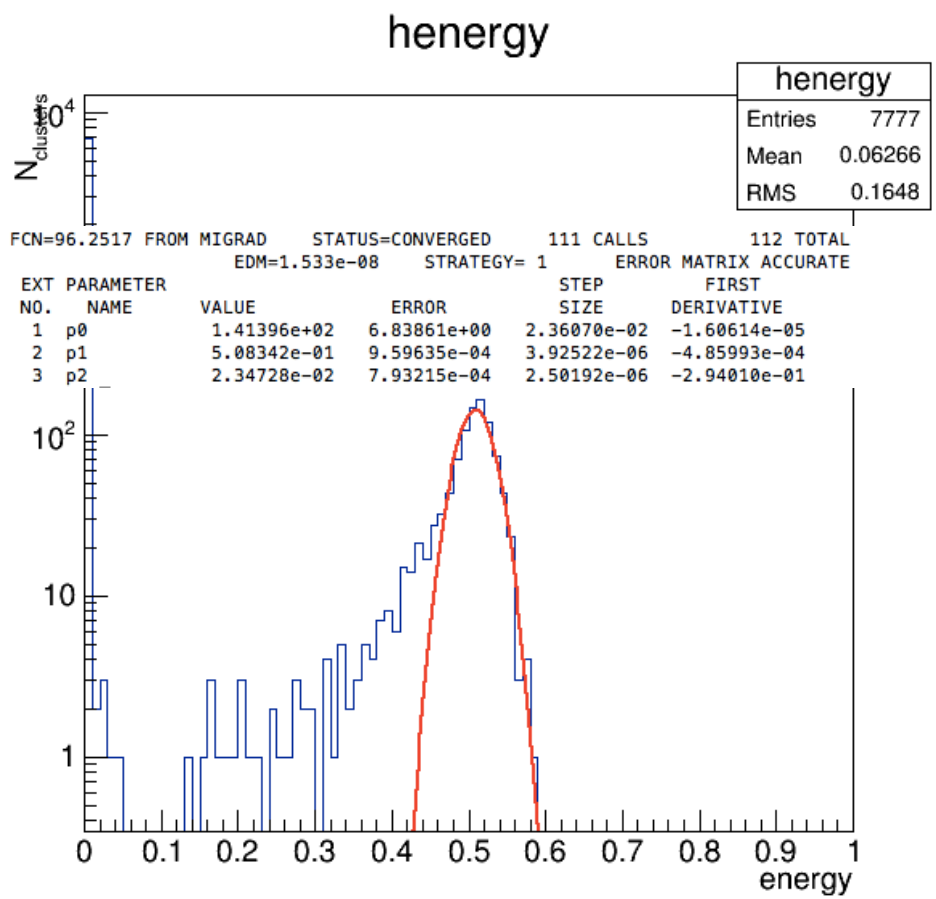
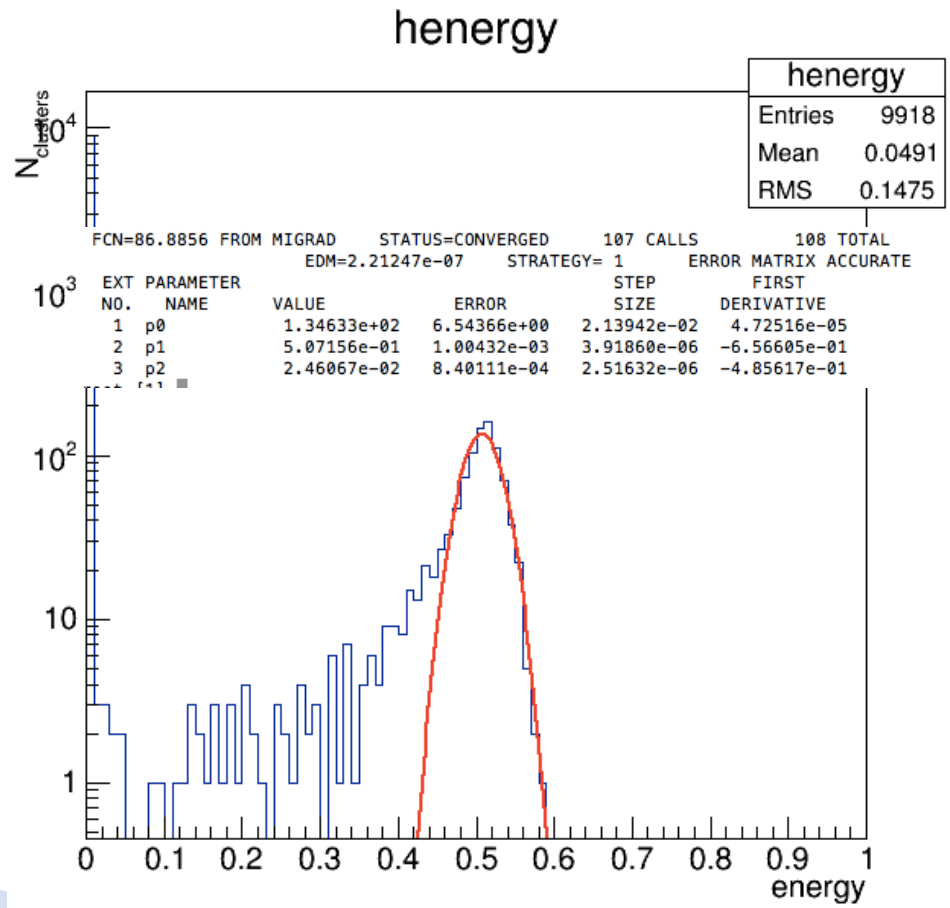
Used [1] + [2]/sqrt(E) in fit instead of sqrt sum??

Dynamic range plot

50 GeV photon shower in 2D-projective SPACAL, all eta ranges
Plot photon observed per tower per event,
max ~ 22k photon/tower, pedestal σ~8 photon, range ~ 12bit (max/pedestal 1 σ)



Photon resolution [Megan and Stefan]

- PHENIX Clusterizer from Sasha B. survived PHENIX->sPHENIX migration.
  - Promising use of the PHENIX Clusterizer in HI embedded events
- Fit with Gaus
- [0]*exp(-0.5*((x-[1])/[2])**2)

Plots from Megan Connors (GSU)