
Optimizing SiD

using slicPandora and a scintillator HCal

Norman Graf & Jeremy McCormick

SiD PFA Meeting

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Overview

- Using a number of SiD variants to test the slicPandora binding and to begin characterizing and optimizing the detector designs.

Scintillator (analog)

- sidloi_opt_scint
- sidloi_opt_scint_5mmskin
- sidloi_opt_scint_10mmskin
- sidloi_opt_scint_octagonal
- sidloi_opt_w_scint

Optimization Tools

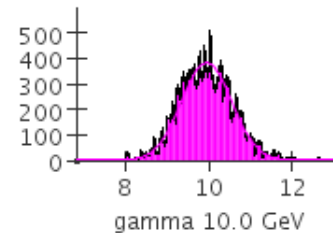
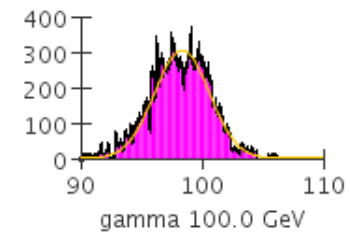
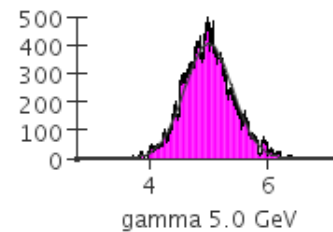
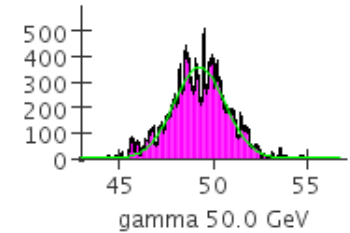
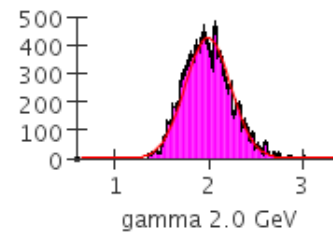
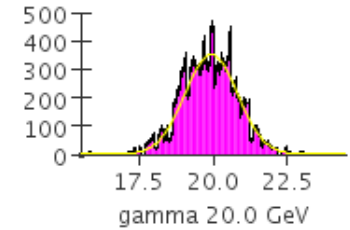
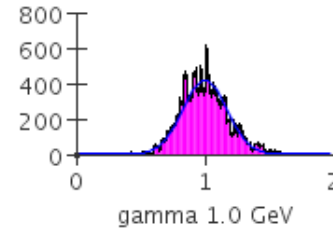
- Code being written to automate standard procedures needed for new detectors:
 - Sampling Fraction determination
 - MIP most-probable-value determination
 - EM shower sampling fractions for Ecal, Hcal, Barrel, Endcap
 - Had shower sampling fractions for Ecal, Hcal, Barrel, Endcap
 - EM shower covariance matrices for particle ID
 - Standard energy and position resolution plot generation using ReconstructedParticle objects.

Optimization Data Sets

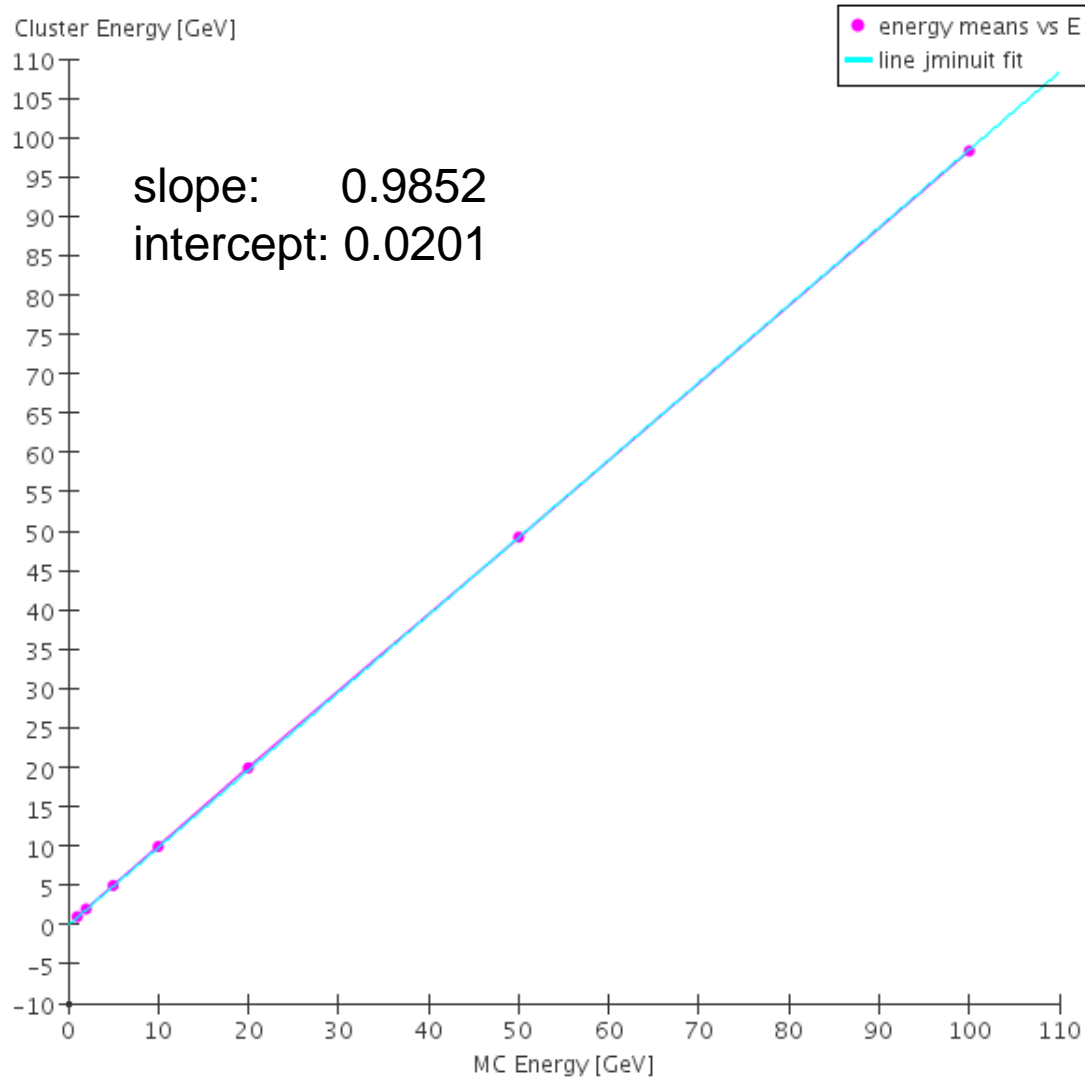
- Single μ^\pm , γ , K^0_L , at fixed angles and energies for sampling fraction determination.
- Single particles (as above, plus e^\pm , π^\pm , K^\pm , p^\pm , ...) at variable angles and energies to study clustering and tracking efficiency and resolution.
- Simple resonances (π^0 , η , ρ^\pm) to study efficiency and resolution of two-particle states.
- Single quarks at fixed energies to study jet energy resolution (u,d,s).
- Single Z^0 at fixed energies to study dijet mass resolution.

Single Photon Response (Barrel)

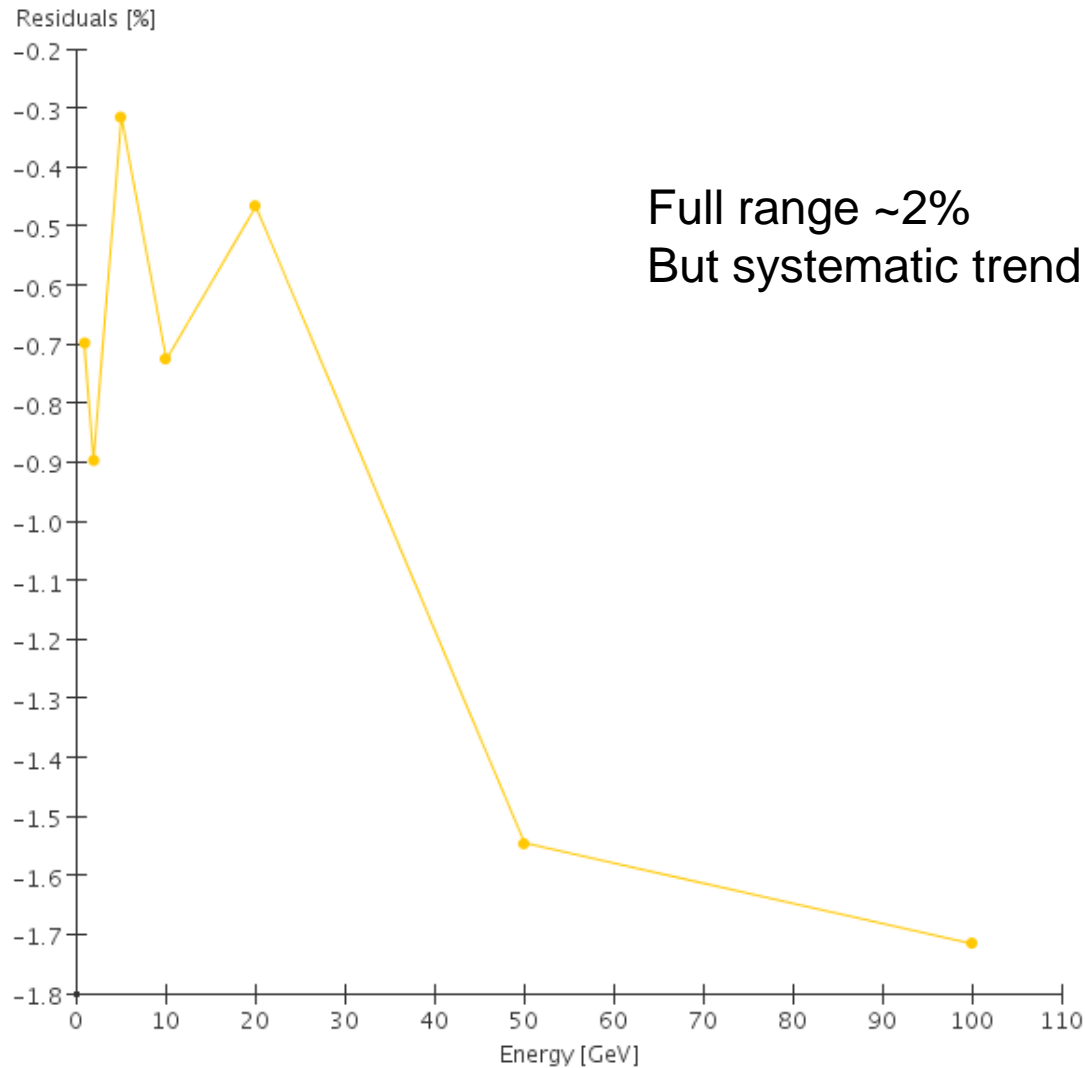
- single photons of discrete energies
 - 1,2,5,10,20,50 &100 GeV
 - $\theta=90$ degrees
 - $\phi=0$ degrees
- misses overlapping portion of barrel staves in EM calorimeter



Single Photon Linearity (Barrel)

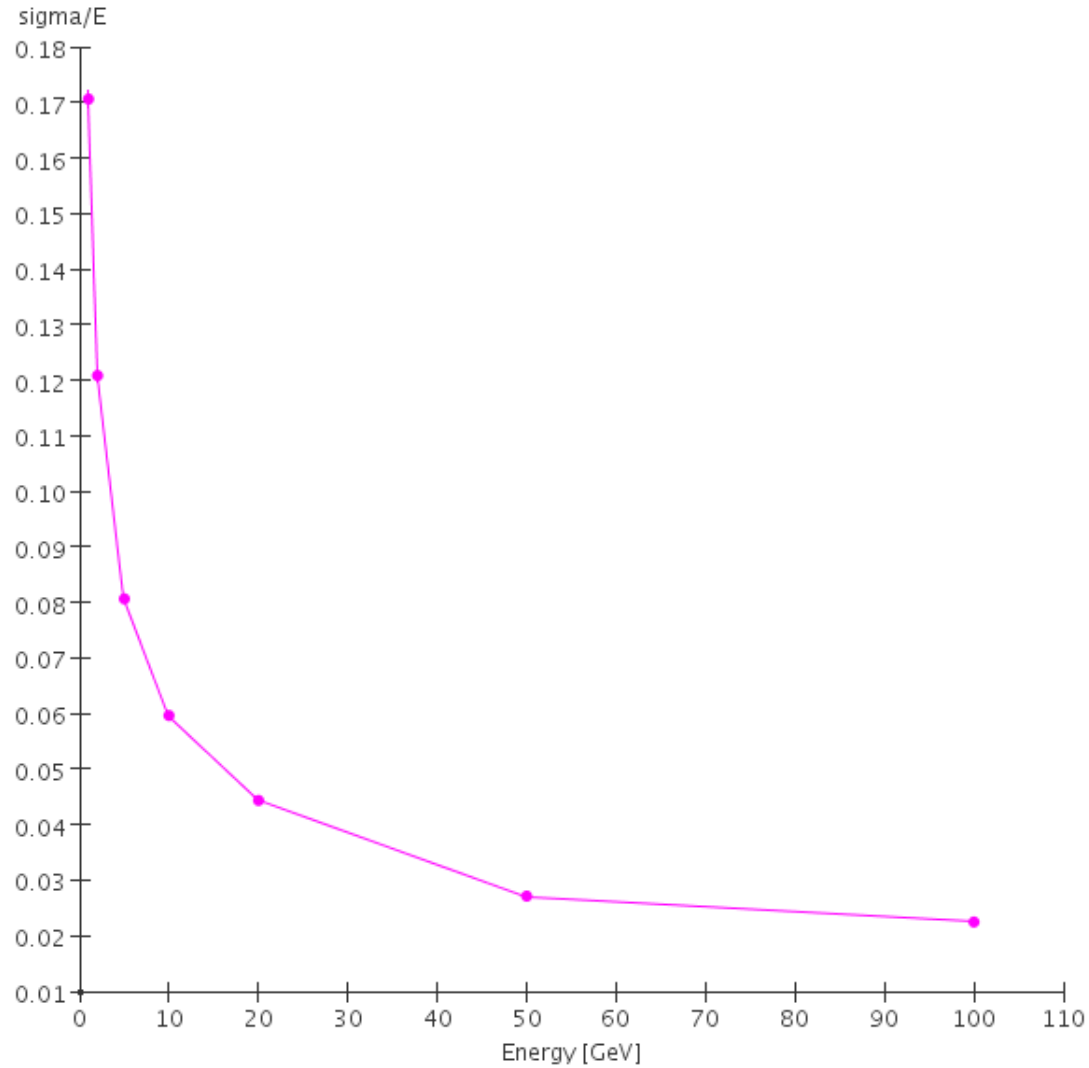


Single Photon Residuals (Barrel)

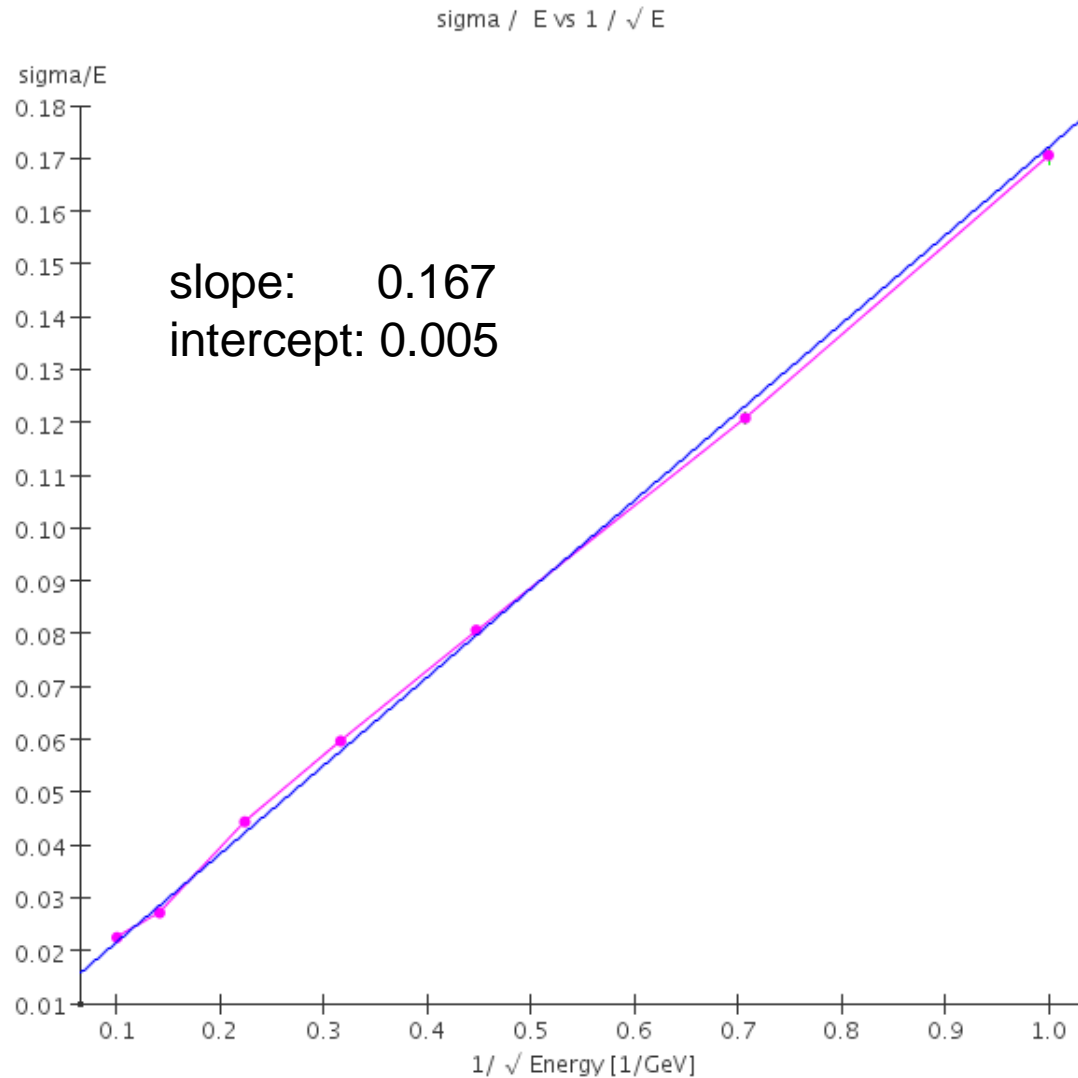


Full range ~2%
But systematic trend obvious.

Single Photon Resolution (Barrel)

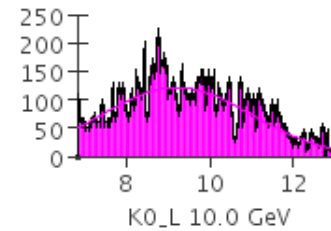
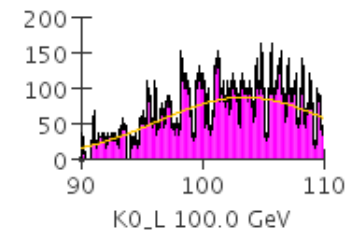
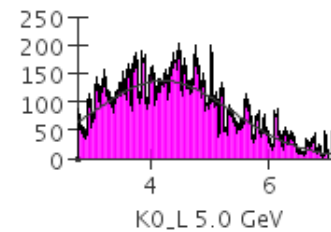
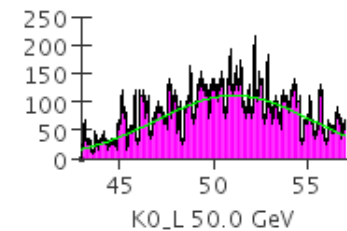
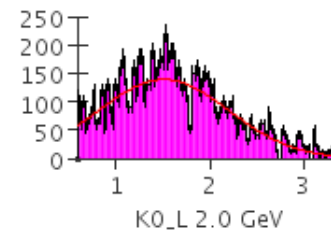
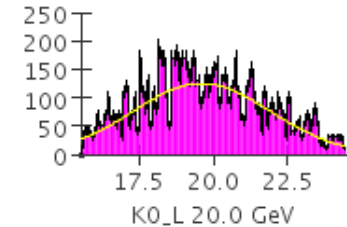
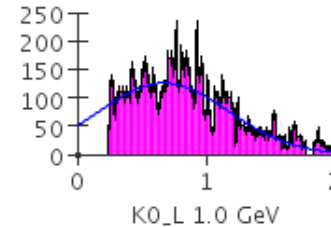


Single Photon Resolution (Barrel)

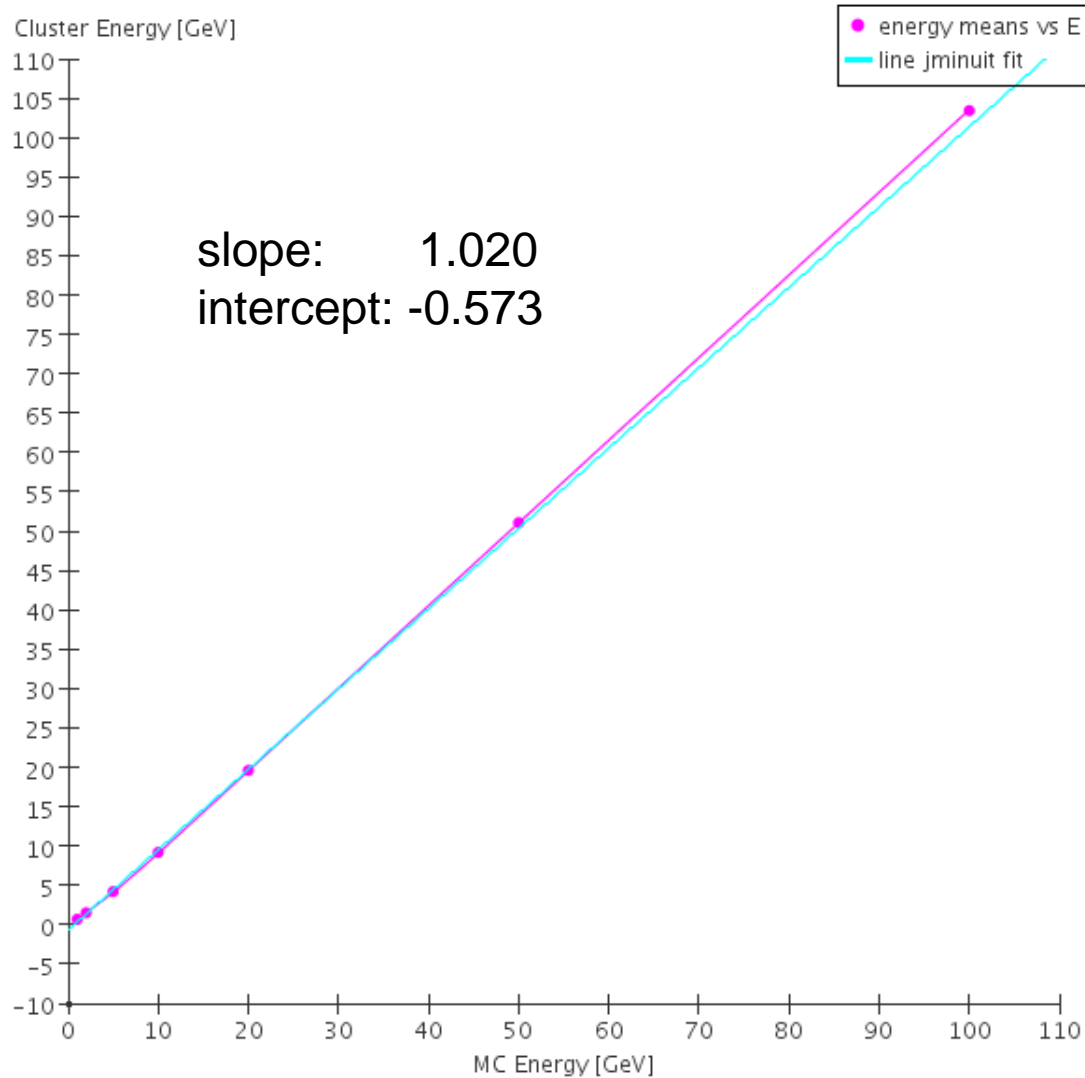


Single K_L^0 Response (Barrel)

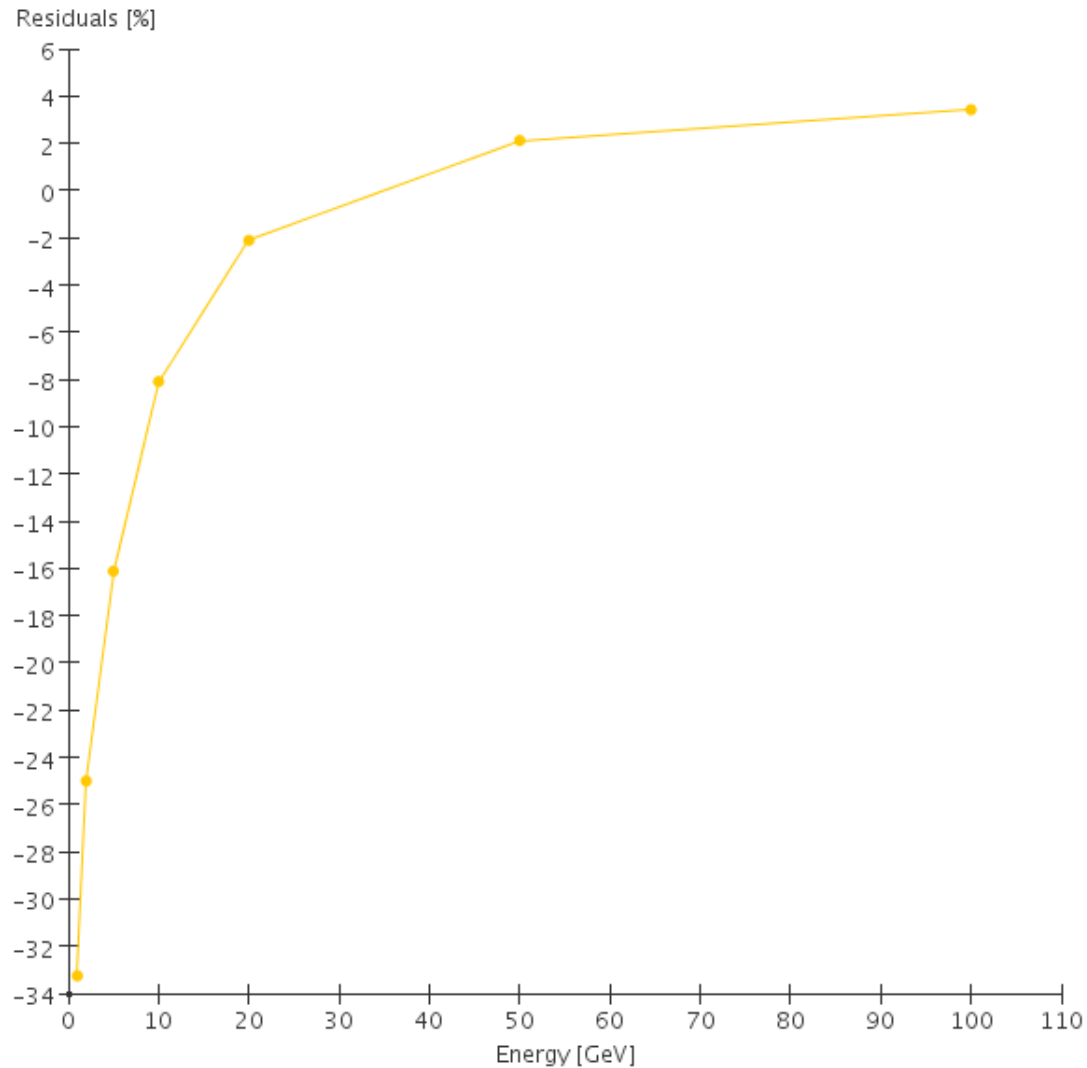
- single K_L^0 of discrete energies
 - 1,2,5,10,20,50 & 100 GeV
 - $\theta=90$ degrees
 - $\phi=0$ degrees
- misses projective cracks of barrel modules in Had calorimeter



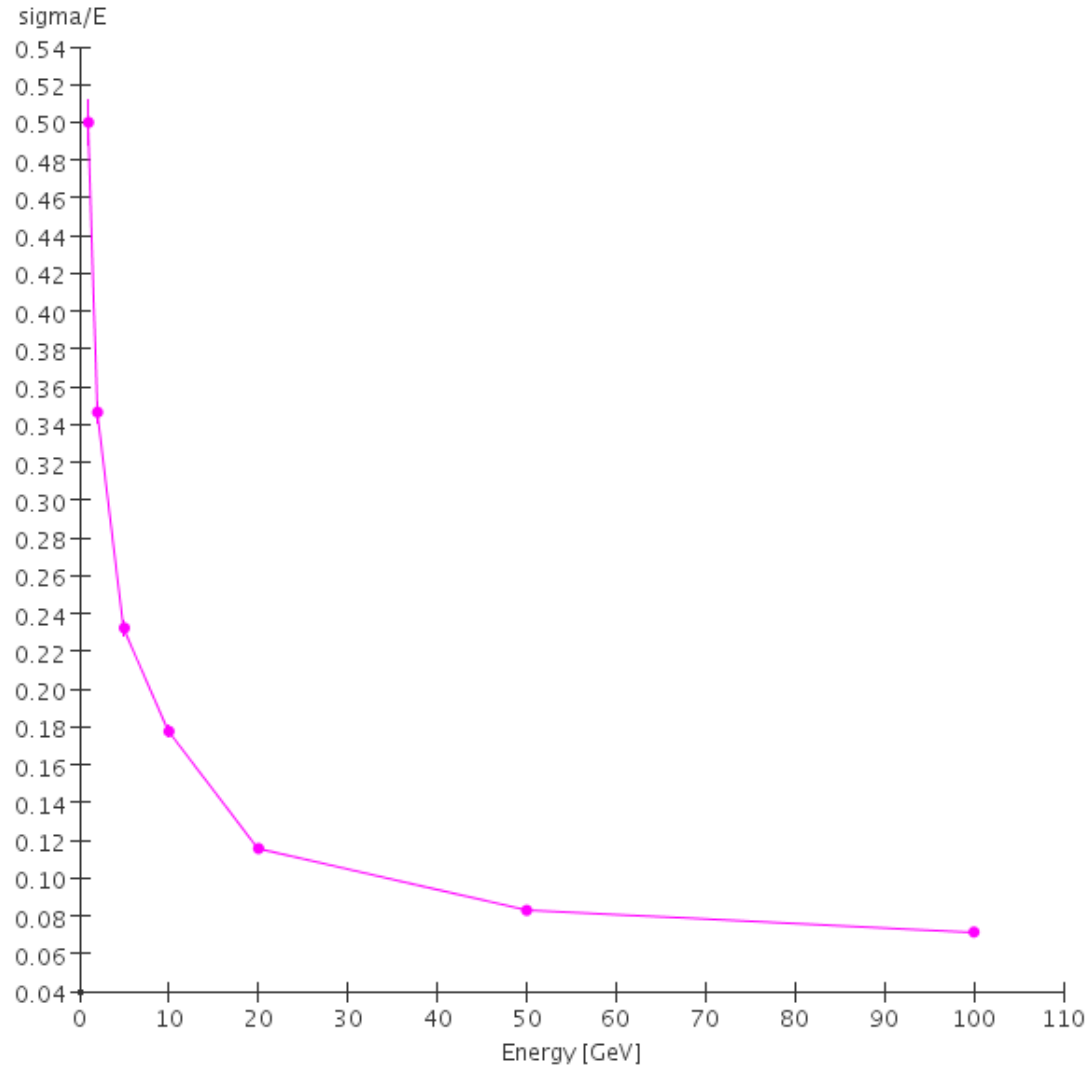
Single K_L^0 Linearity (Barrel)



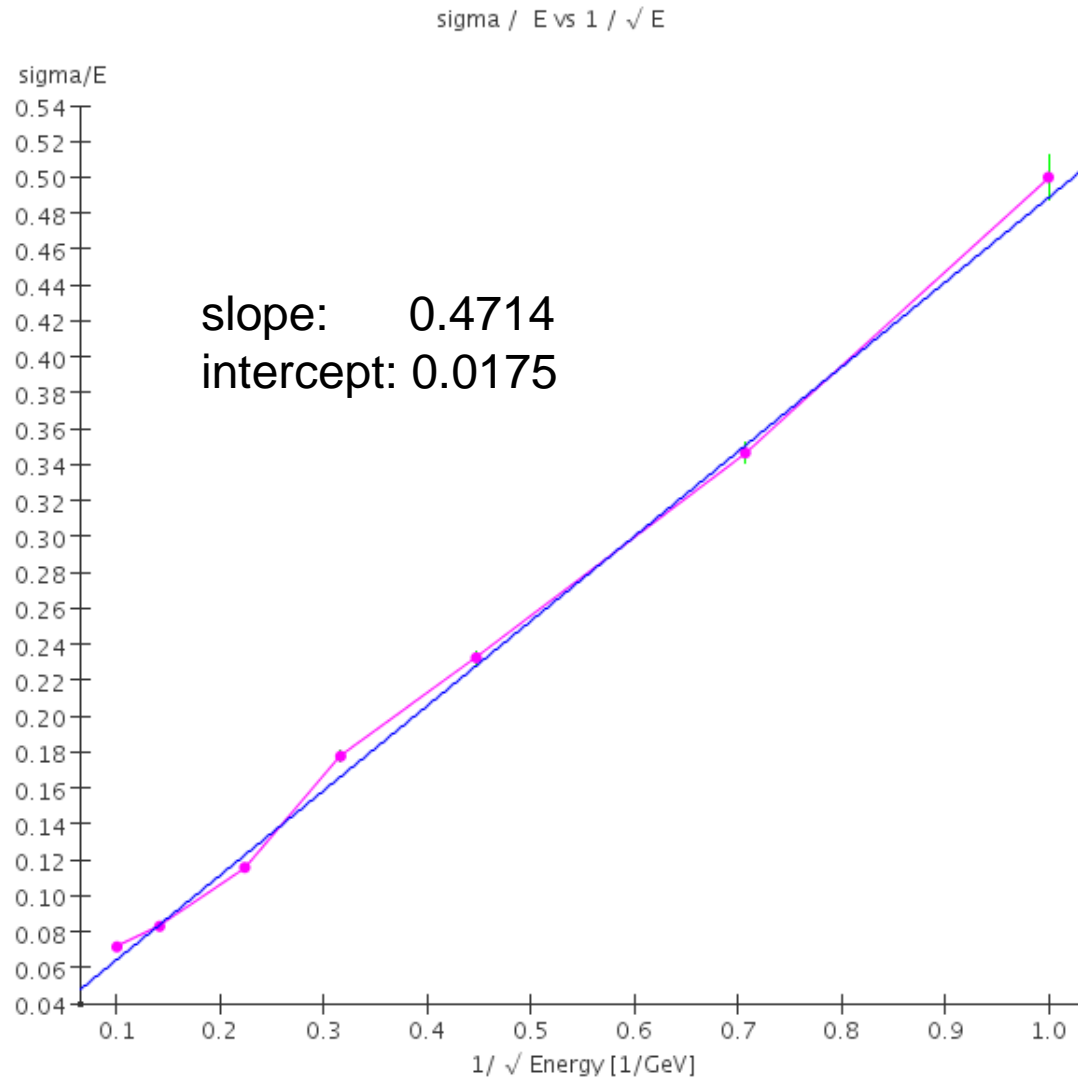
Single K^0_L Residuals (Barrel)



Single K_L^0 Resolution (Barrel)



Single K_L^0 Resolution (Barrel)

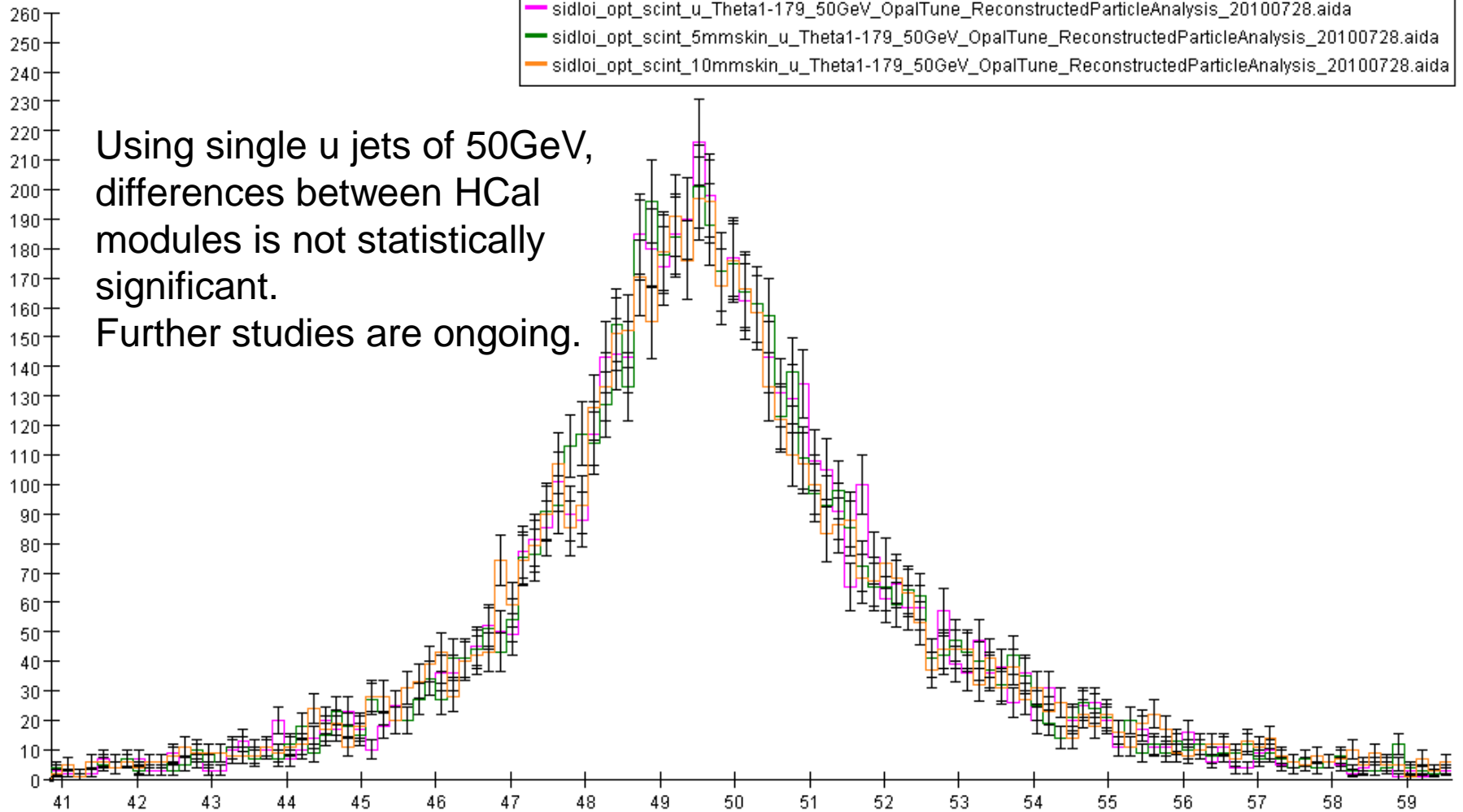


Single K_L^0 Response (Barrel, all Phi)

- will repeat with single K_L^0 of discrete energies
 - 1,2,5,10,20,50 GeV
 - theta=90 degrees
 - $0 < \phi < 2\pi$ degrees
- uniformly covers all phi, including projective cracks of barrel modules in Had calorimeter
- Will do with both 5mm and 10mm skins.

0, 5 and 10mm skins in HCal Barrel

u - 50_GeV - Central Event Energy ($\cos(\theta) < 0.8$)



Summary

- Workflow being streamlined & automated.
 - slicPandora close to being generally useful for analog calorimeter readout
 - purely digital binding being studied
 - Detector optimization studies being conducted.
 - First indications are that projective HCal barrel modules, even with dead “skins”, are not show-stoppers.
 - First set of detectors (to study HCal properties) defined, and large set of diagnostic events available for analysis.
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