

Validation of sid02 simulations

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Validating sid02 simulations

- The compact description
- The hits
- Sampling fractions
- Calibrations

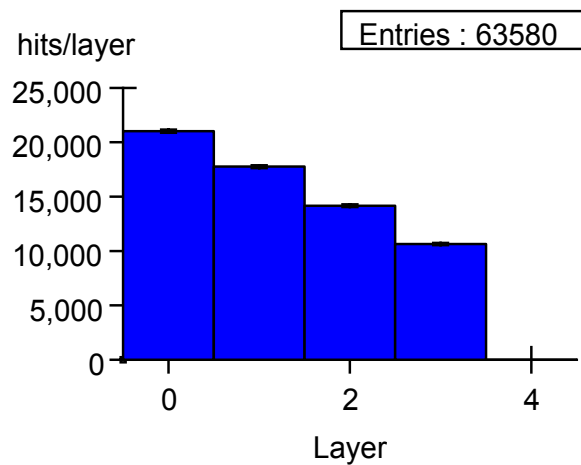
The compact description

- Created by Norman: Used to create the lcdd file for SLIC (Geant4) simulations, and to define the geometry in org.lcsim
- To see the “human readable” description, go to <http://confluence.slac.stanford.edu/display/ilc/sid02>
- Huge coordination effort required between subdetector/MDI groups to try to get it right. (Thanks Norman) Changes to the detector description for the LOI need to be addressed TODAY. (It may already be too late)

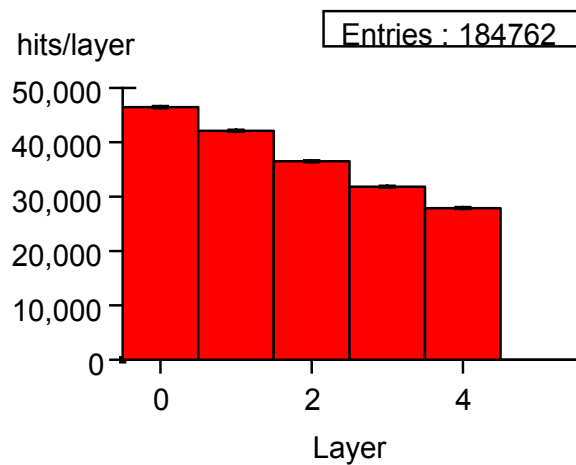
The hits

- Full simulation run on some standard data sets: single particles, qq at various energies, ZZ->qqnunu, etc.
- No property files needed to look at raw hits.
- Do some sanity checks on the raw hits from the SLIC output (.slcio) files.
- Use single pion files, 1-50 Gev, 4-176 degrees in theta. 50k events.

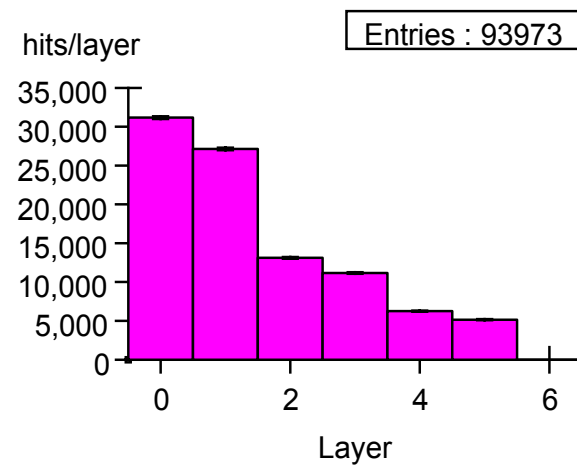
VtxEndcapHits: layer



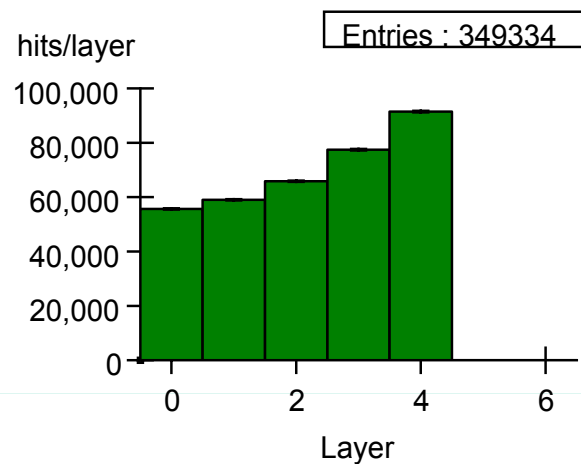
VtxBarrHits: layer



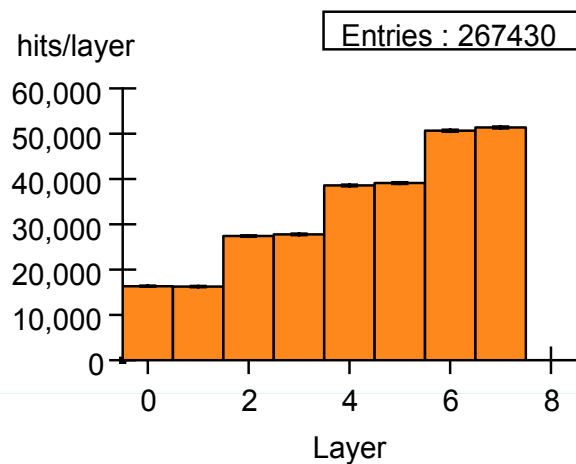
TkrForwardHits: layer



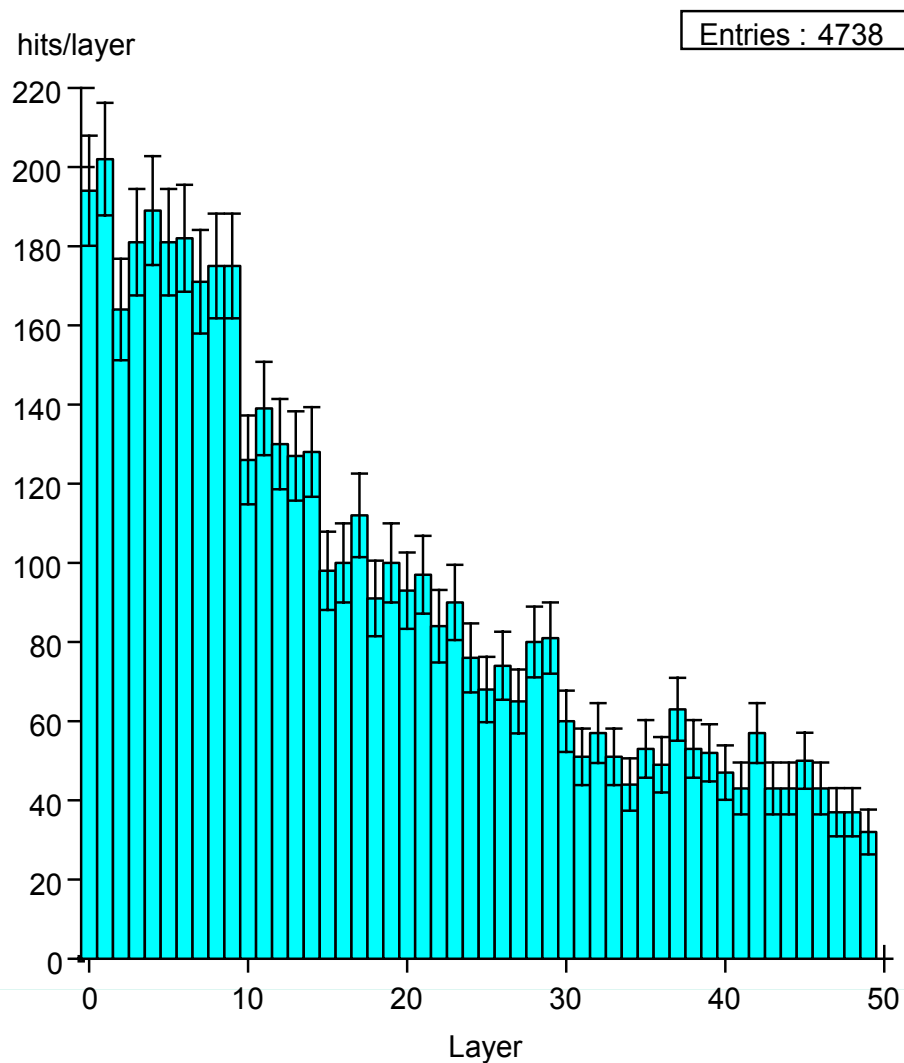
TkrBarrHits: layer



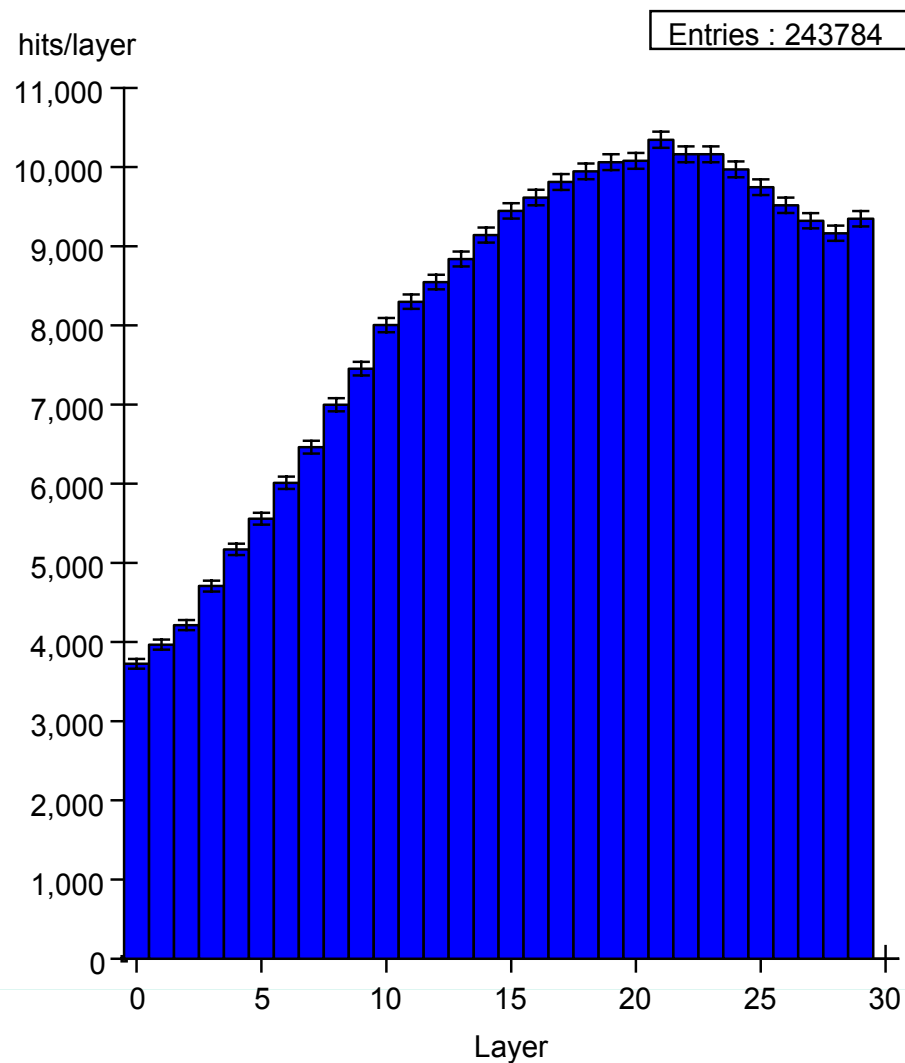
TkrEndcapHits: layer



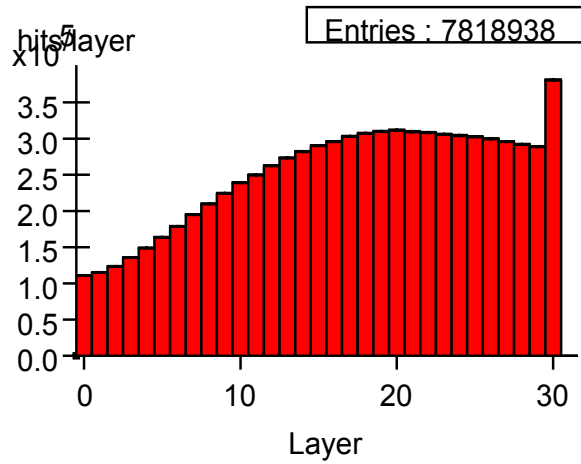
BeamCalHits: layer



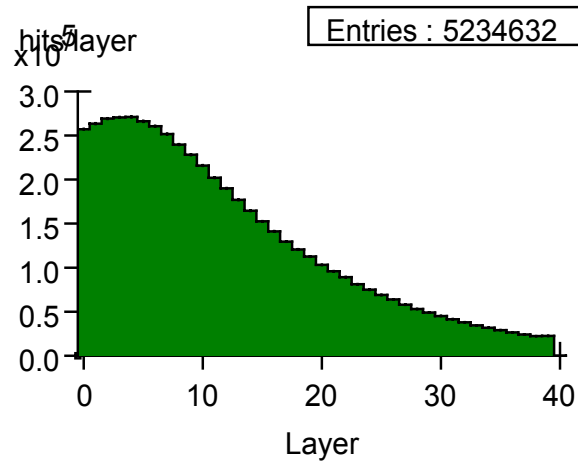
LumiCalHits: layer



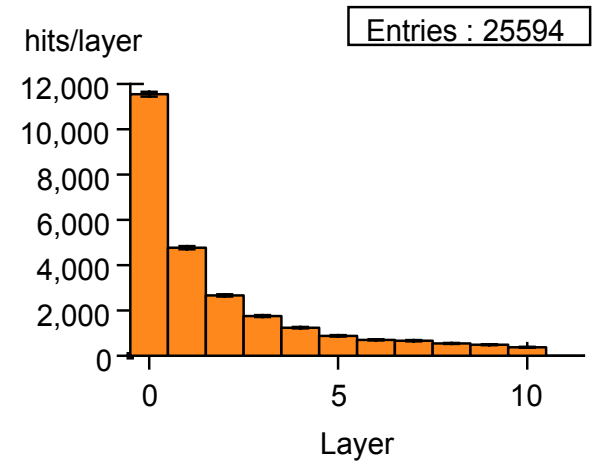
EcalBarrHits: layer



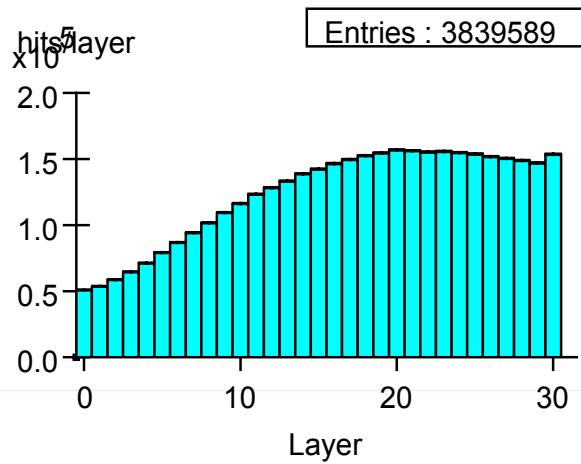
HcalBarrHits: layer



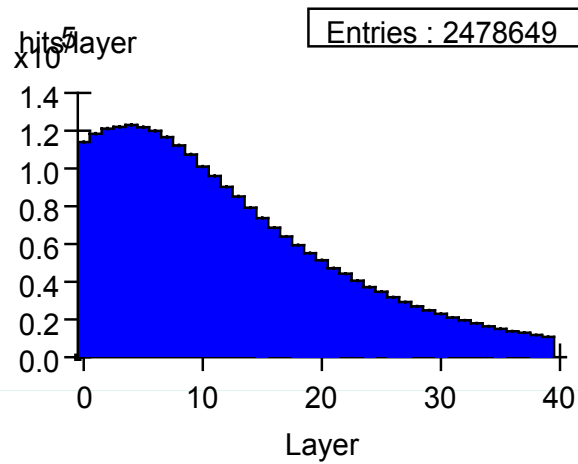
MuonBarrHits: layer



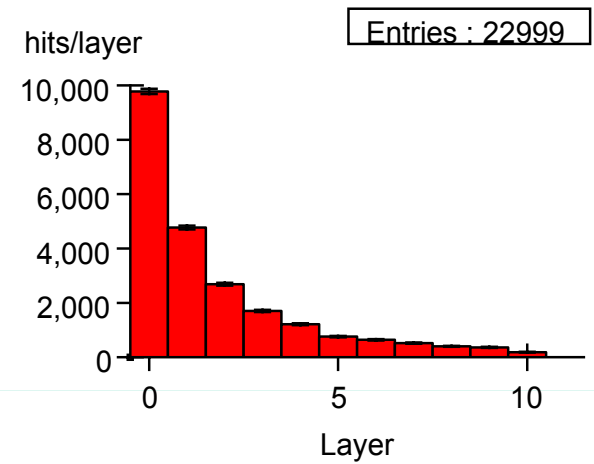
EcalEndcapHits: layer



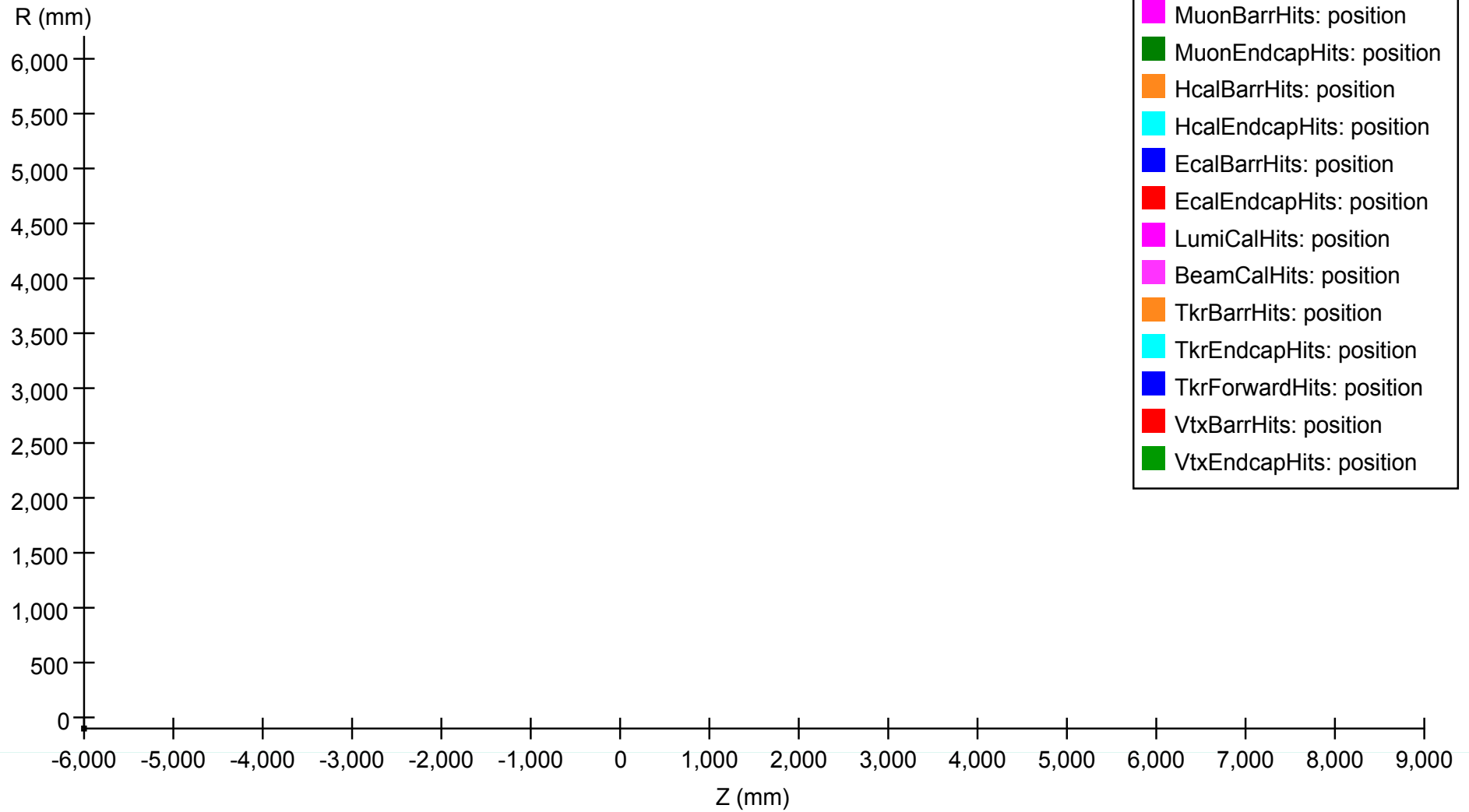
HcalEndcapHits: layer



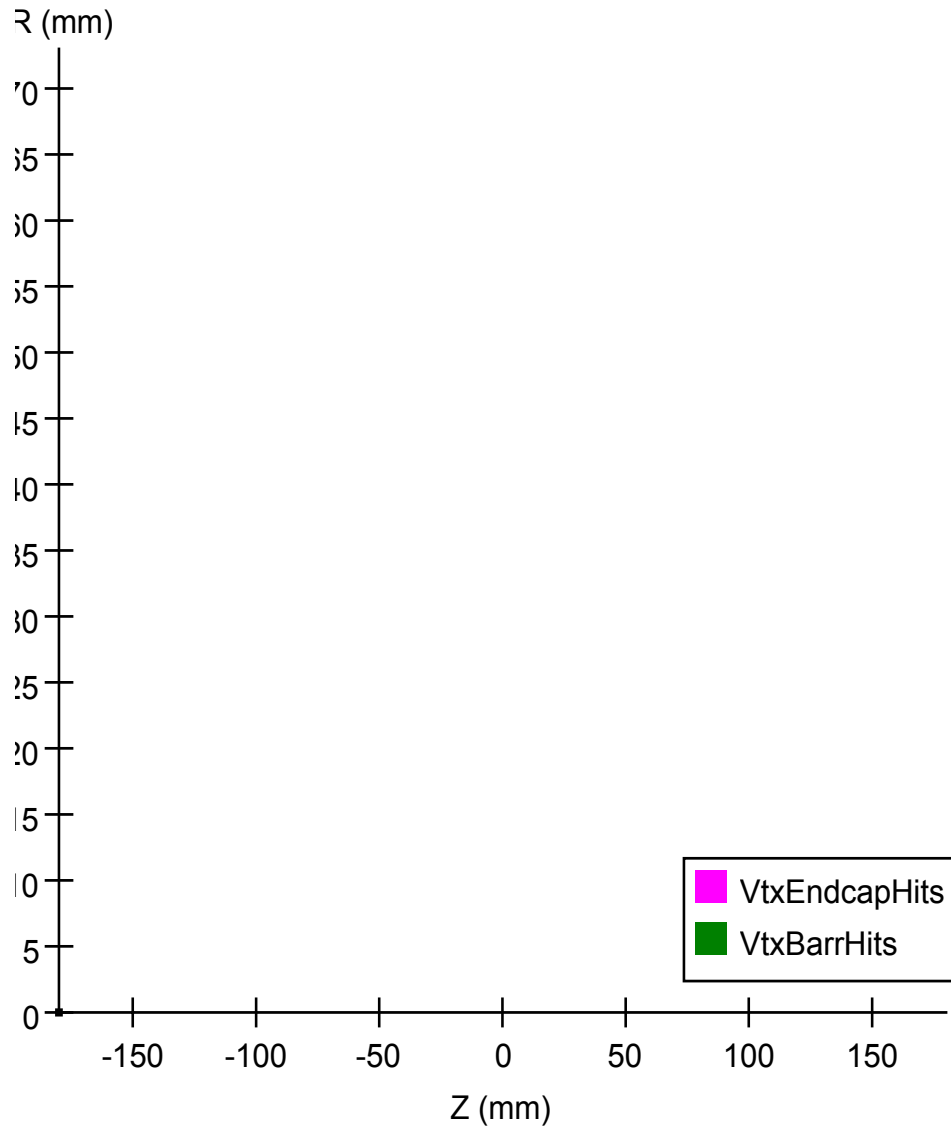
MuonEndcapHits: layer



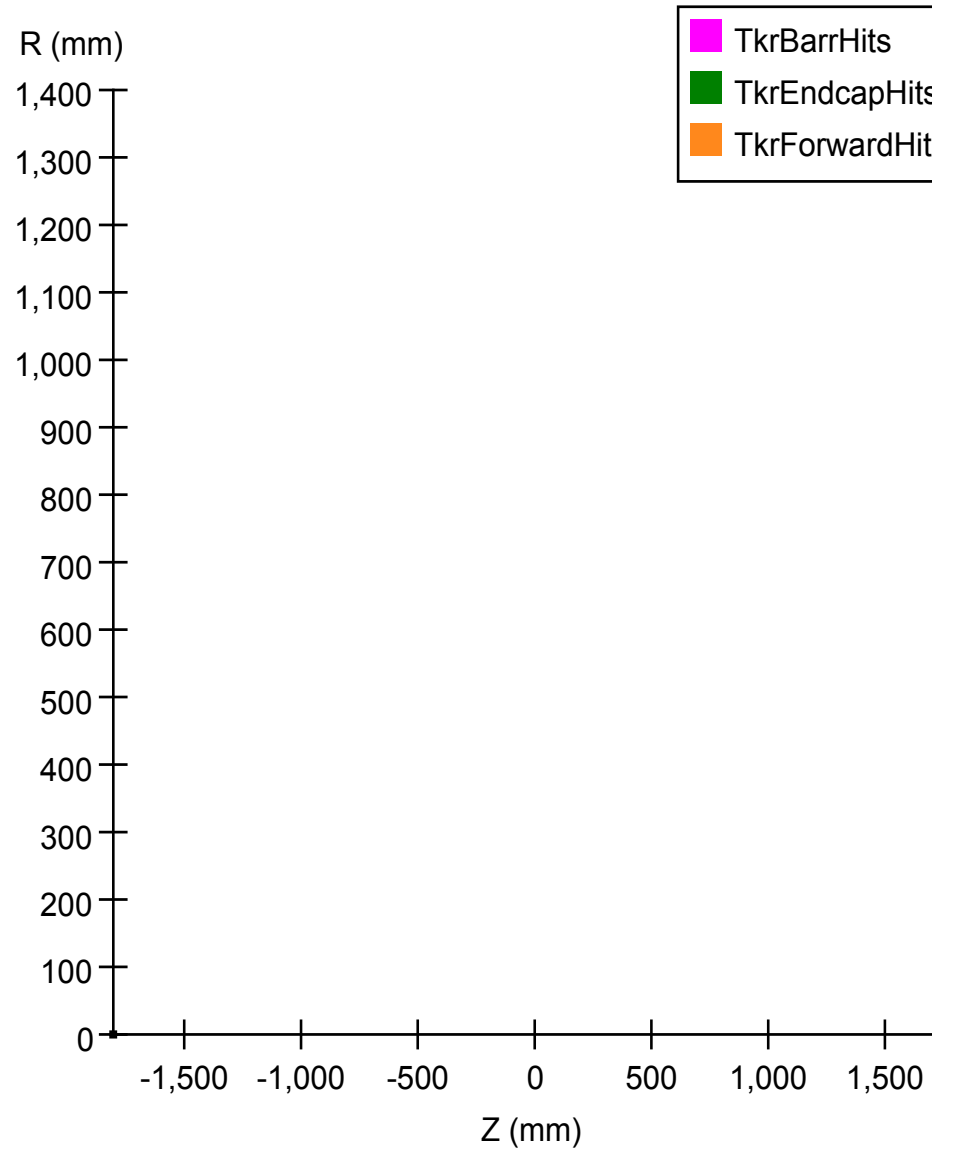
R vs Z position of hits



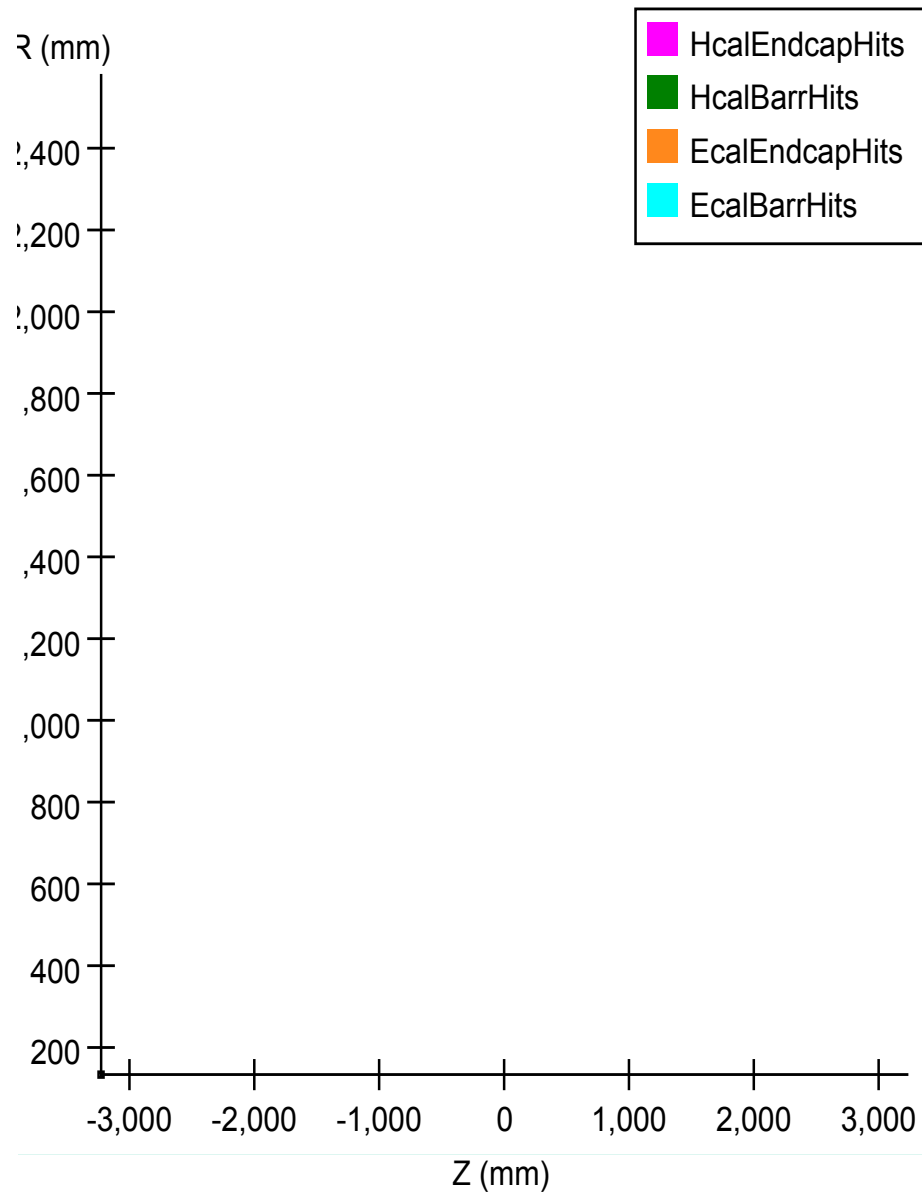
R vs Z hit position



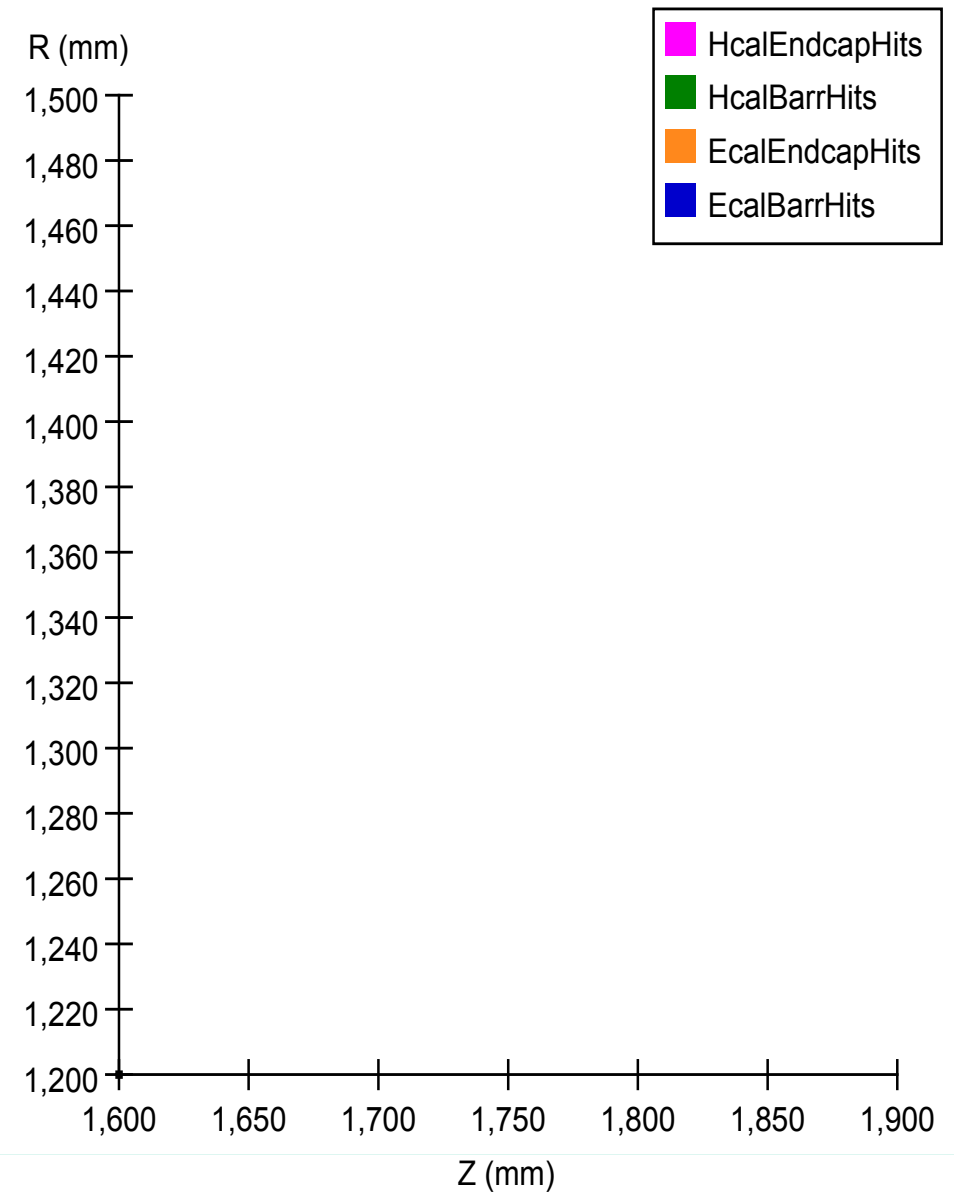
R vs Z hit position



R vs Z hit position



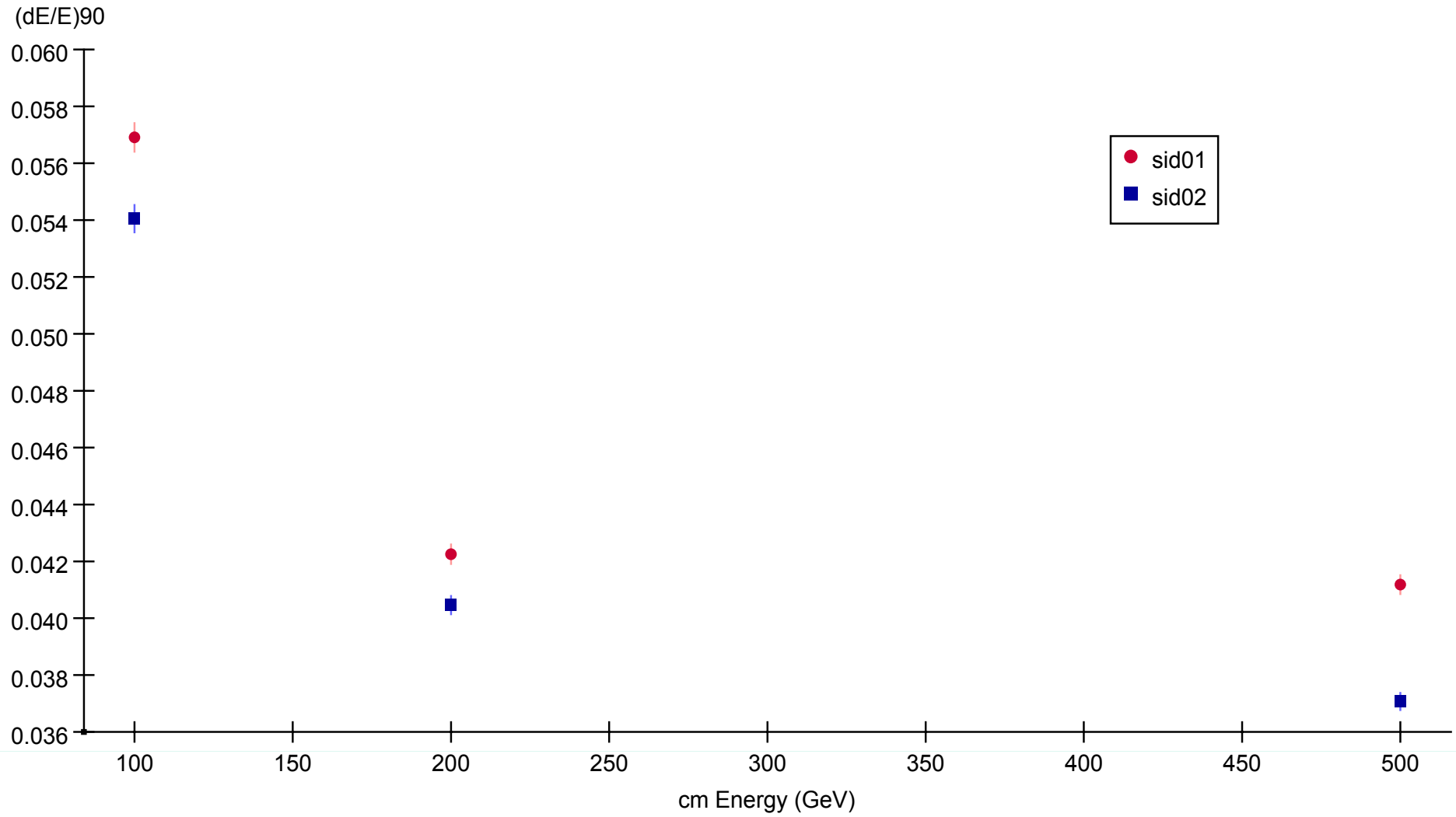
R vs Z hit position



Sampling fractions

- Calculate simple sampling fractions for each calorimeter. Add energy for each (sub)calorimeter per event, and minimize dE/\sqrt{E} using combined sample of $qq \rightarrow uds$ at (100,200,500)GeV. No angle or particle type corrections.
- Only additional properties file needed is the digisim steering file.
- Look at event energy residuals and compare to sid01. (Using rms90)

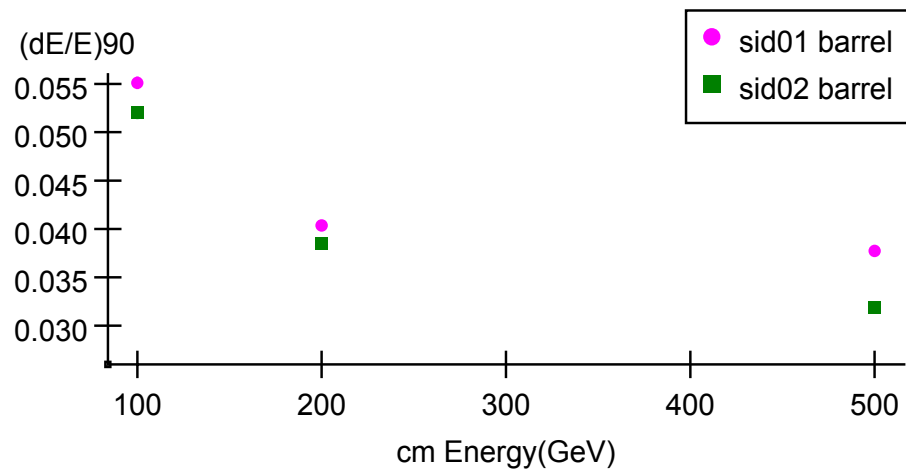
Fixed E qq events: Ecal+Hcal only, no corrections: cos theta < 0.9



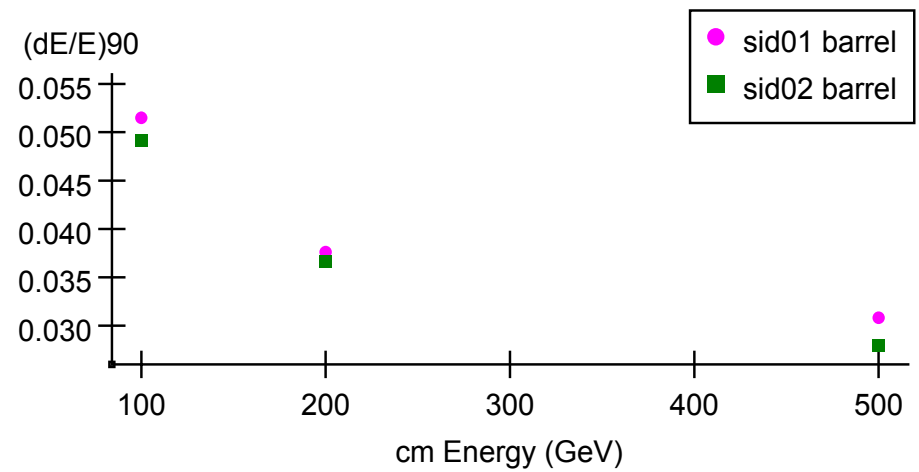
Sampling fractions (cont)

- Can do the same thing with an angle correction for the digital calorimeters, and can also use the muon calorimeters.

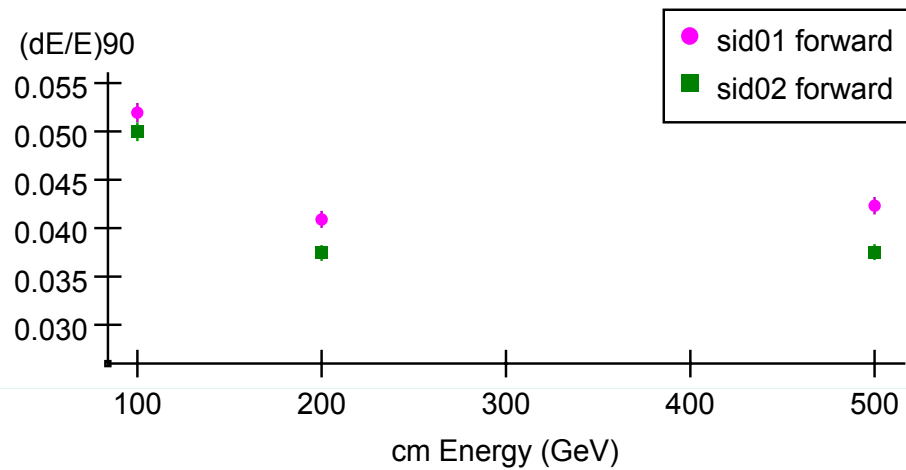
Fixed E qq evts: Ecal + angle corrected Hcal



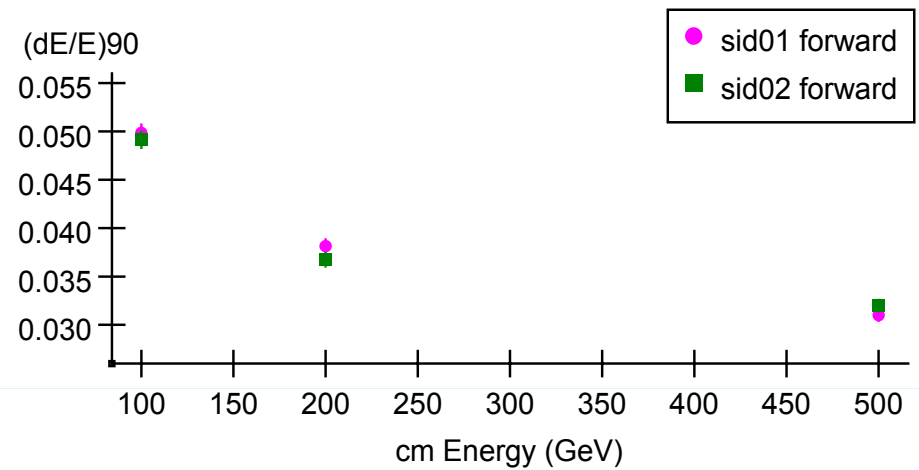
Fixed E qq evts: Ecal + angle corrected Hcal + Mcal



Fixed E qq evts: Ecal + angle corrected Hcal



Fixed E qq evts: Ecal + angle corrected Hcal + Mcal



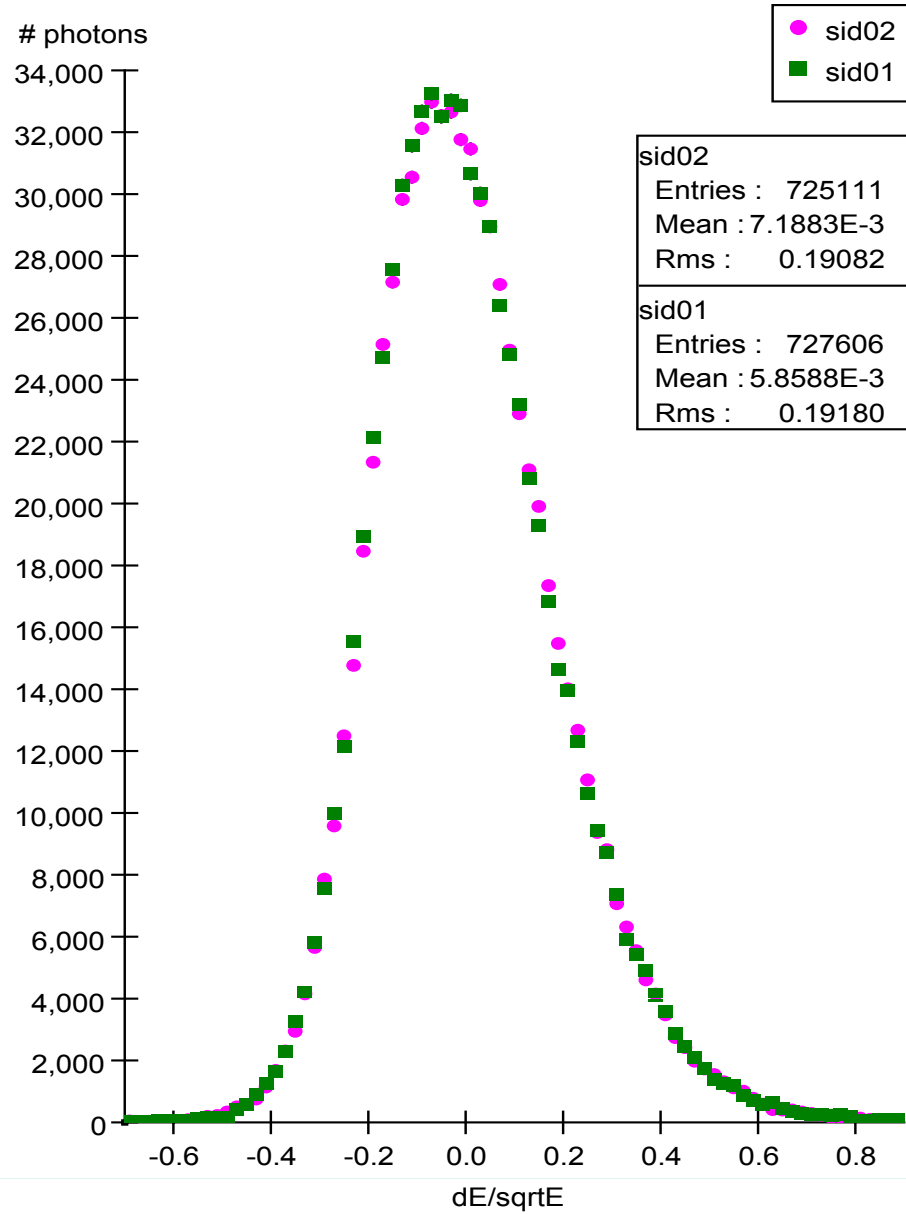
Calibrations

- The calibration program uses the cheat reconstruction, therefore most of the properties files must be included with the detector. (See <https://confluence.slac.stanford.edu/display/ilc/Defining+a+Detector>)
- The calibration uses ZZ events at 500 GeV cm. This defines the energy and angular distributions of the particles.
- Photons and neutral hadrons are selected (with cuts) and their calorimeter energy deposits (cheat reconstruction).
- Only Ecal deposits are used for photons
- For neutral hadrons, Ecal and Hcal deposits are used, and a nonlinearity correction is made.

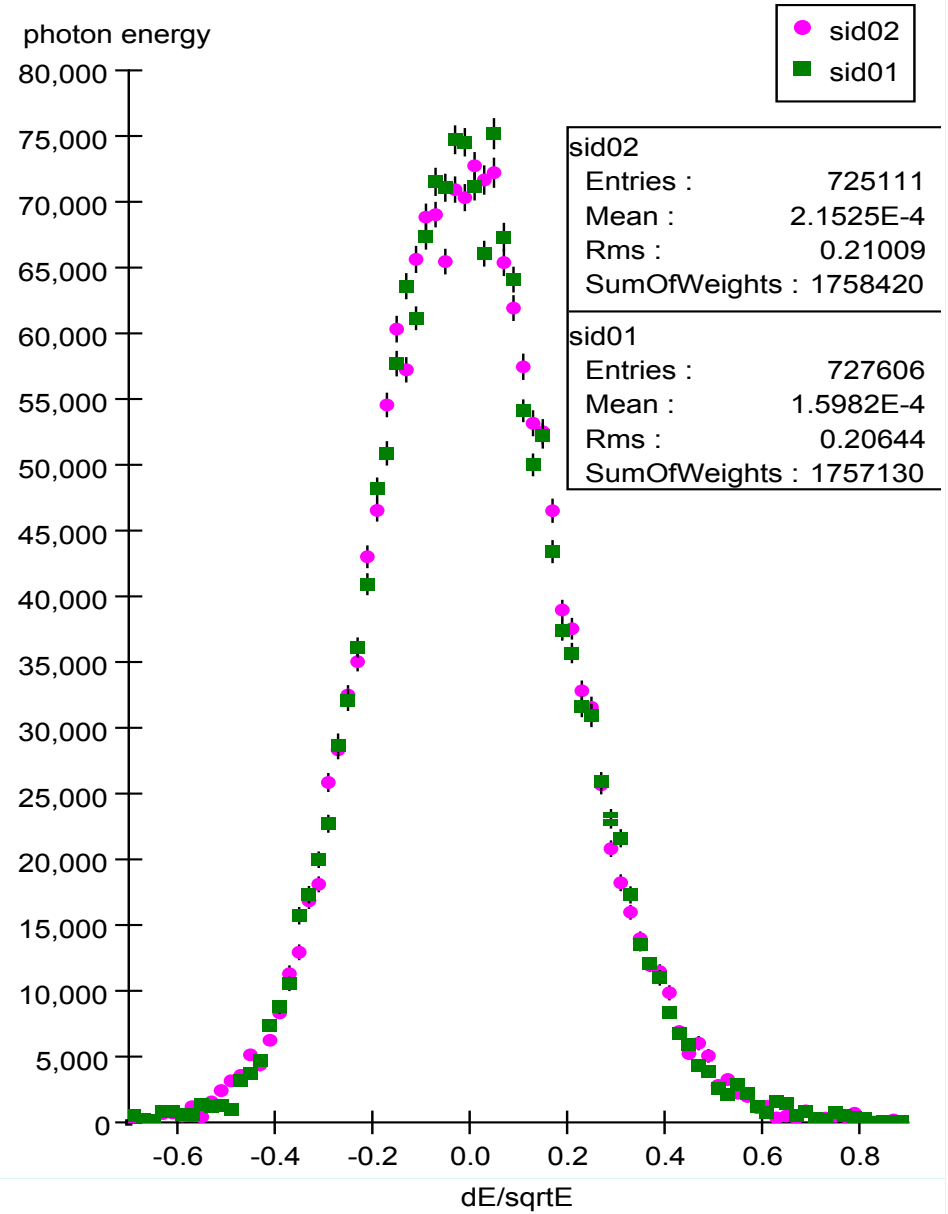
Calibrations (cont)

- Look at results as an effective resolution by looking at dE/\sqrt{E} single particle distribution summed over all particles, both unweighted and energy weighted.

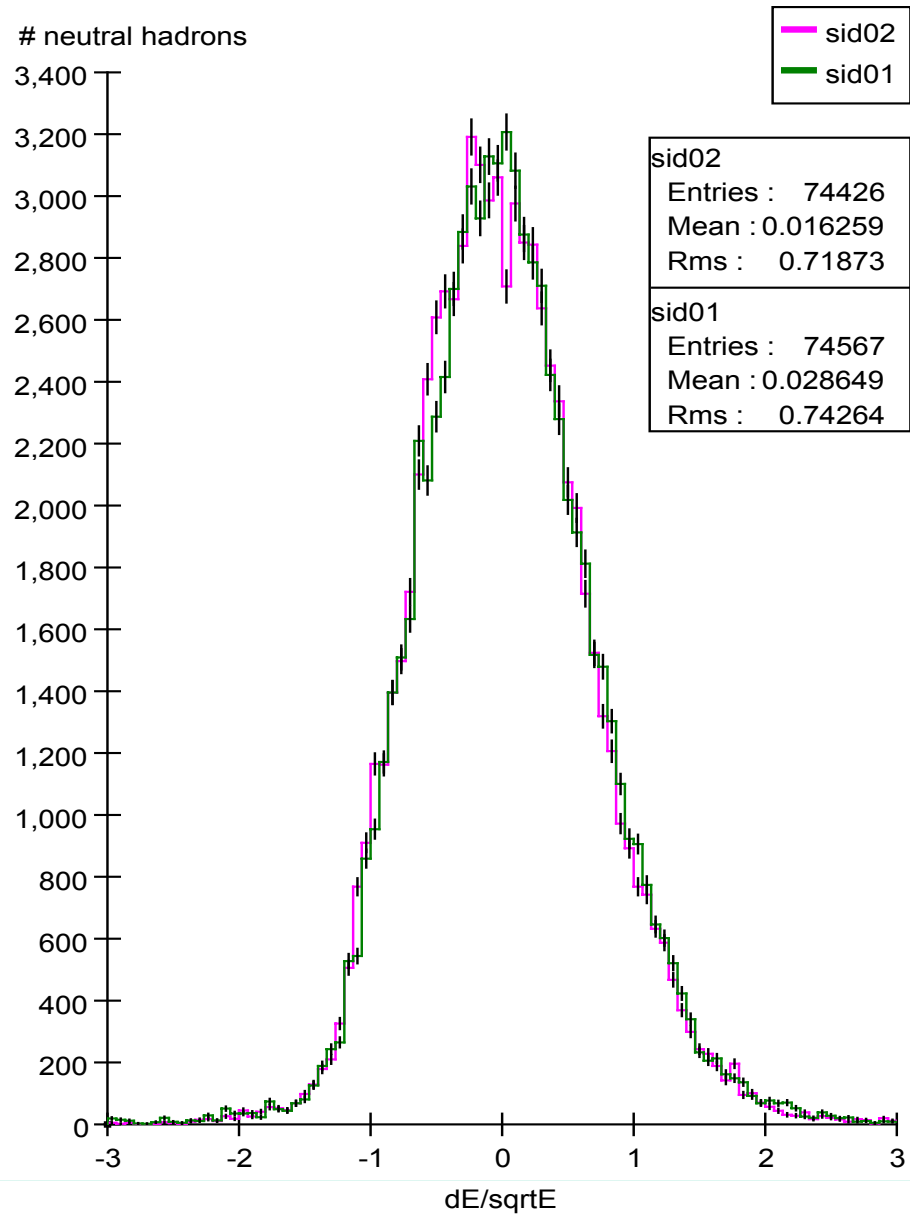
Photon - dE/\sqrt{E}



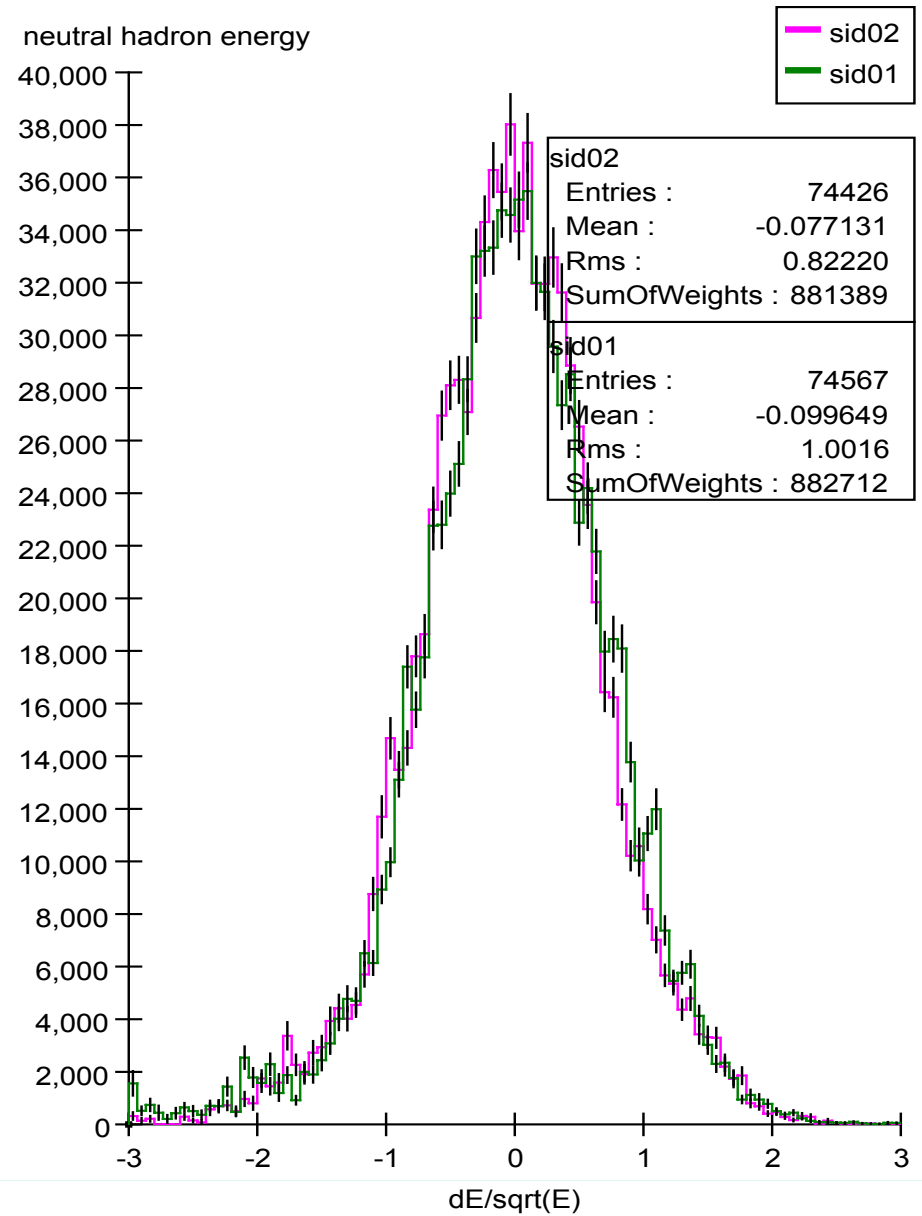
Photon - Ewted dE/\sqrt{E}



neutral hadrons - dE/sqrt(E)



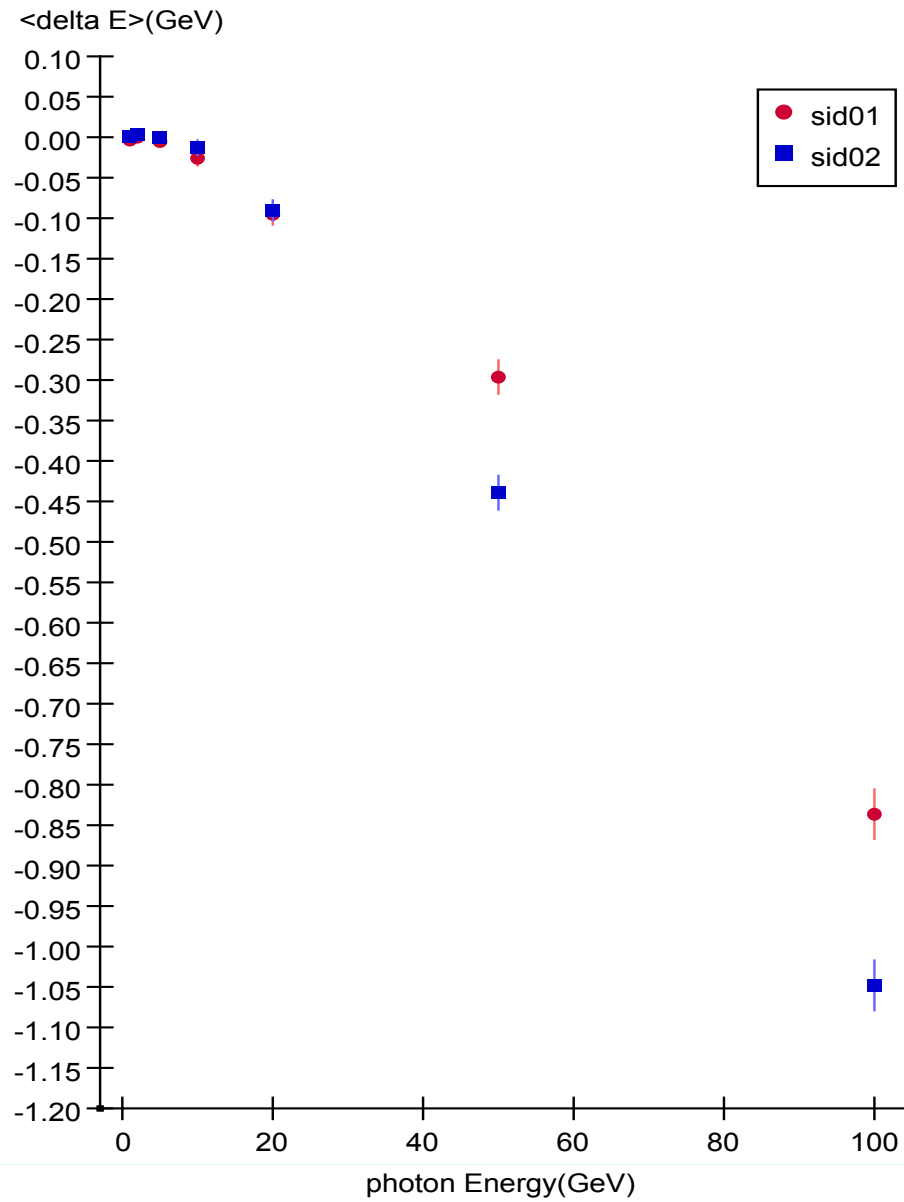
neutral hadrons - Ewted dE/sqrt(E)



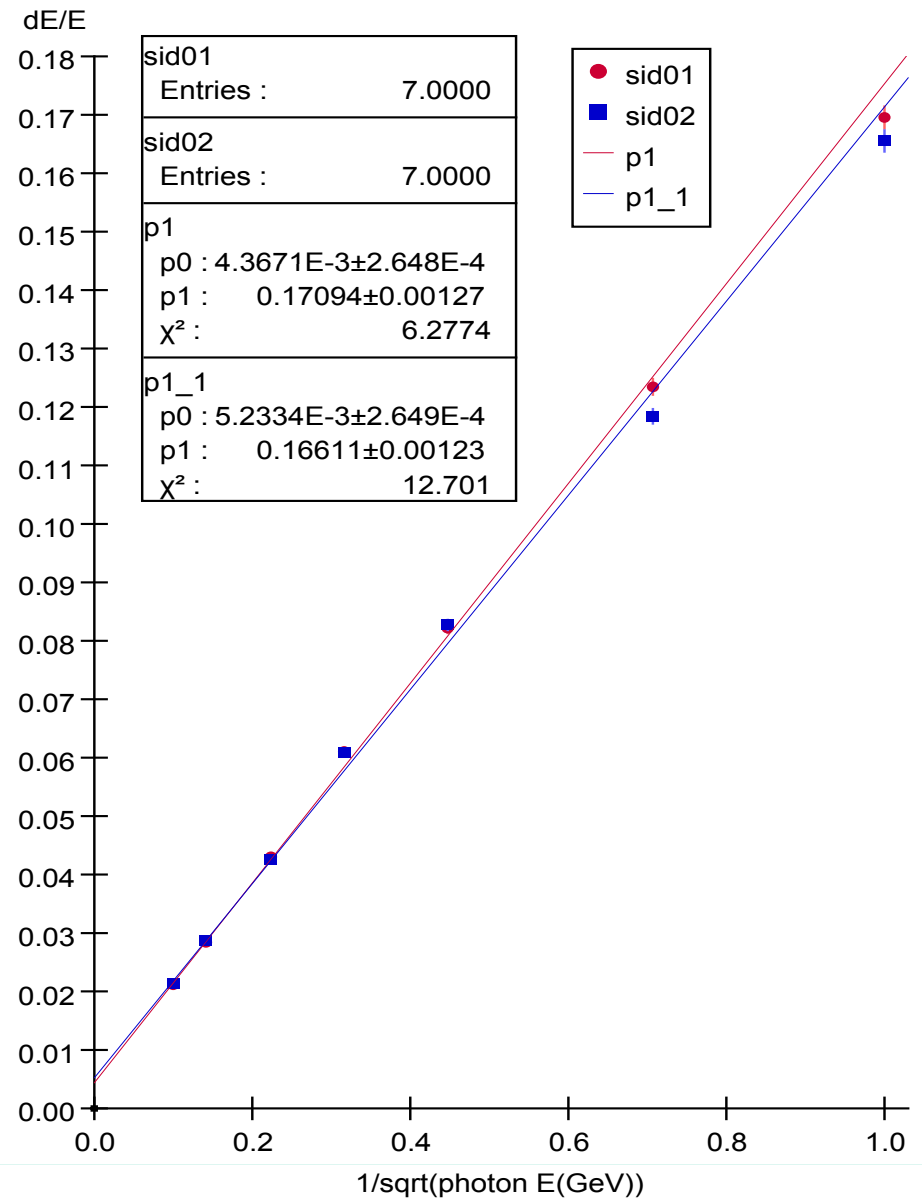
Calibration (cont)

- Check the calibration by applying to mono-energetic single particles at 90 degrees.
- For each energy, fit gaussian to the measured energy distribution.
- Use mean and sigma of gaussian fit to examine nonlinearity and resolution.
- Compare to sid01

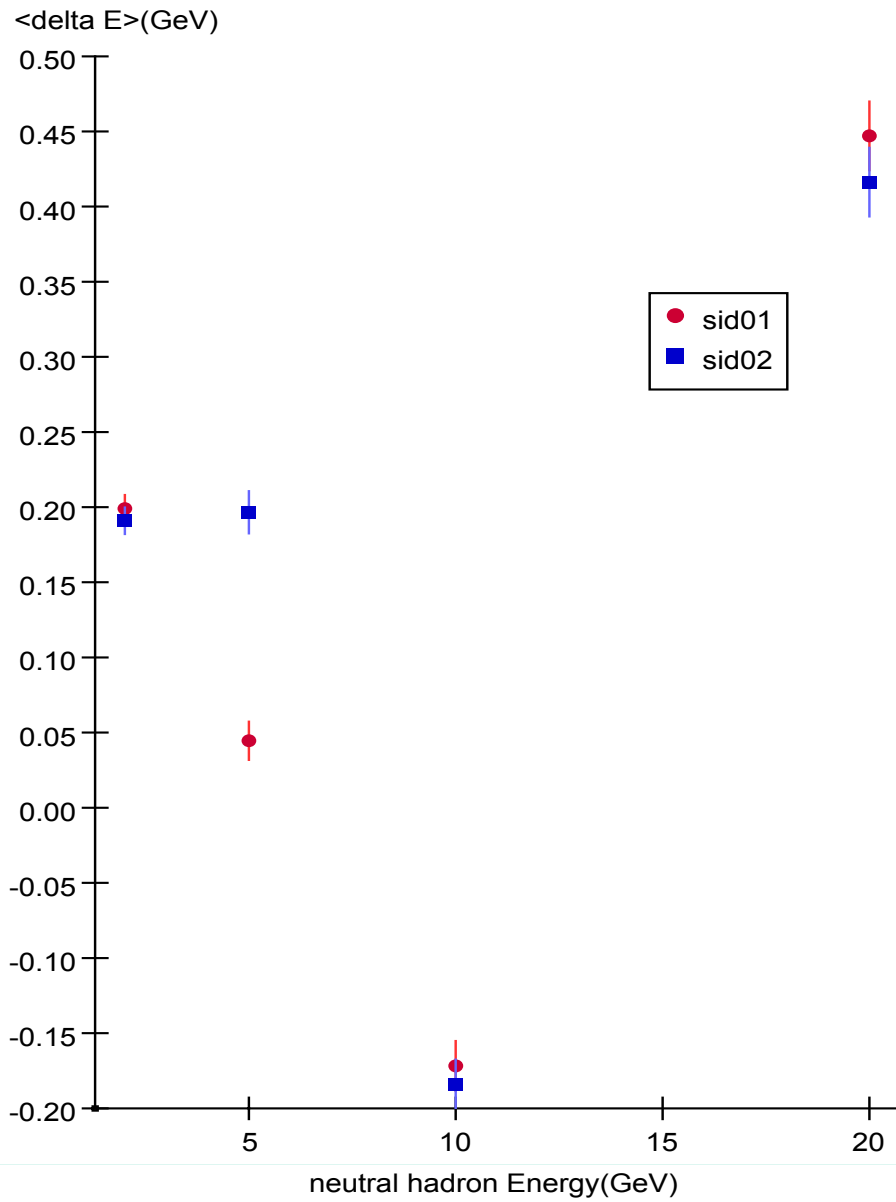
Photons:cos theta=0:nonlinearity



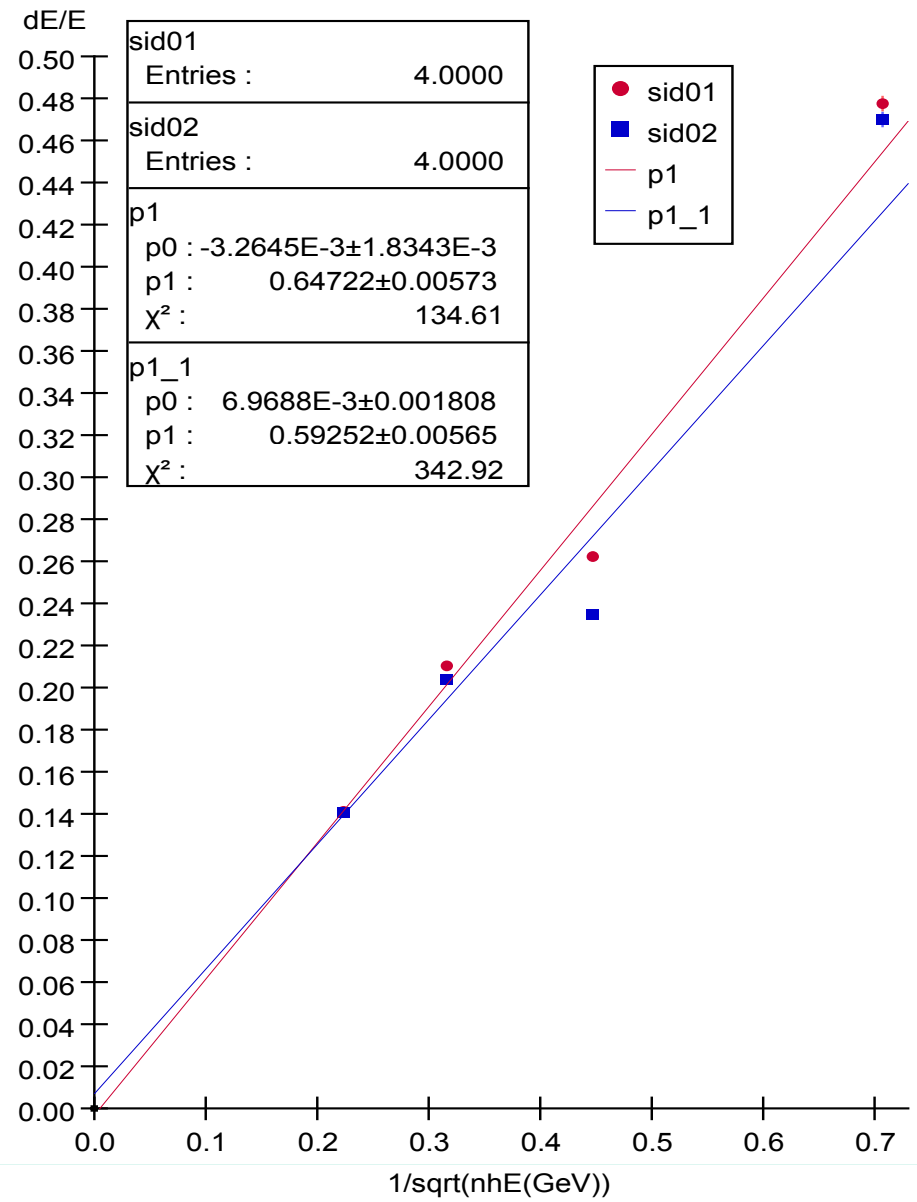
Photons:cos theta=0:resolution



Neutral hadrons:cos theta = 0:nonlinearity



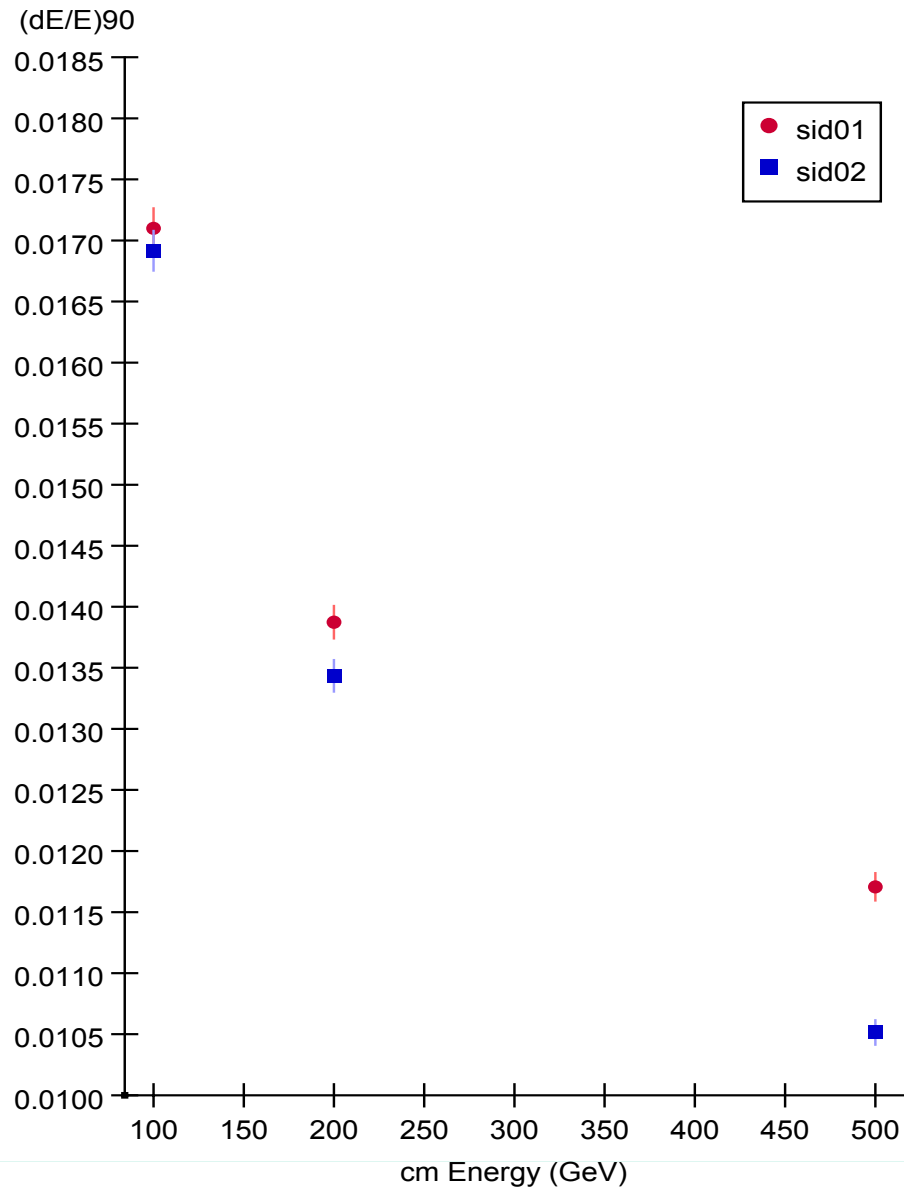
Neutral hadrons:cos theta=0:resolution



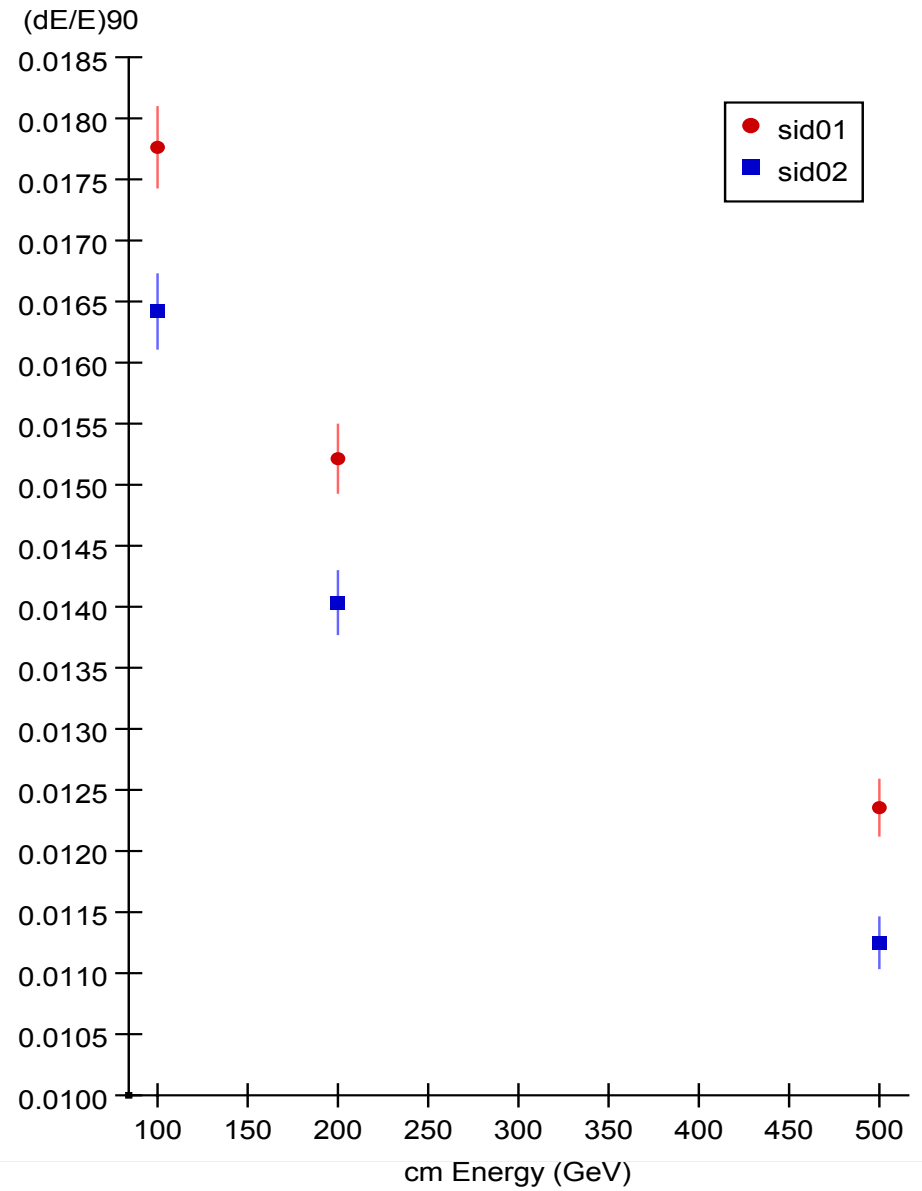
Calibration (cont)

- Can also check PFA results, using PPR and UI results comparing with sid01.
- Define barrel = $0 < \cos(\theta) < 0.8$
- Define forward = $0.8 < \cos(\theta) < 0.95$

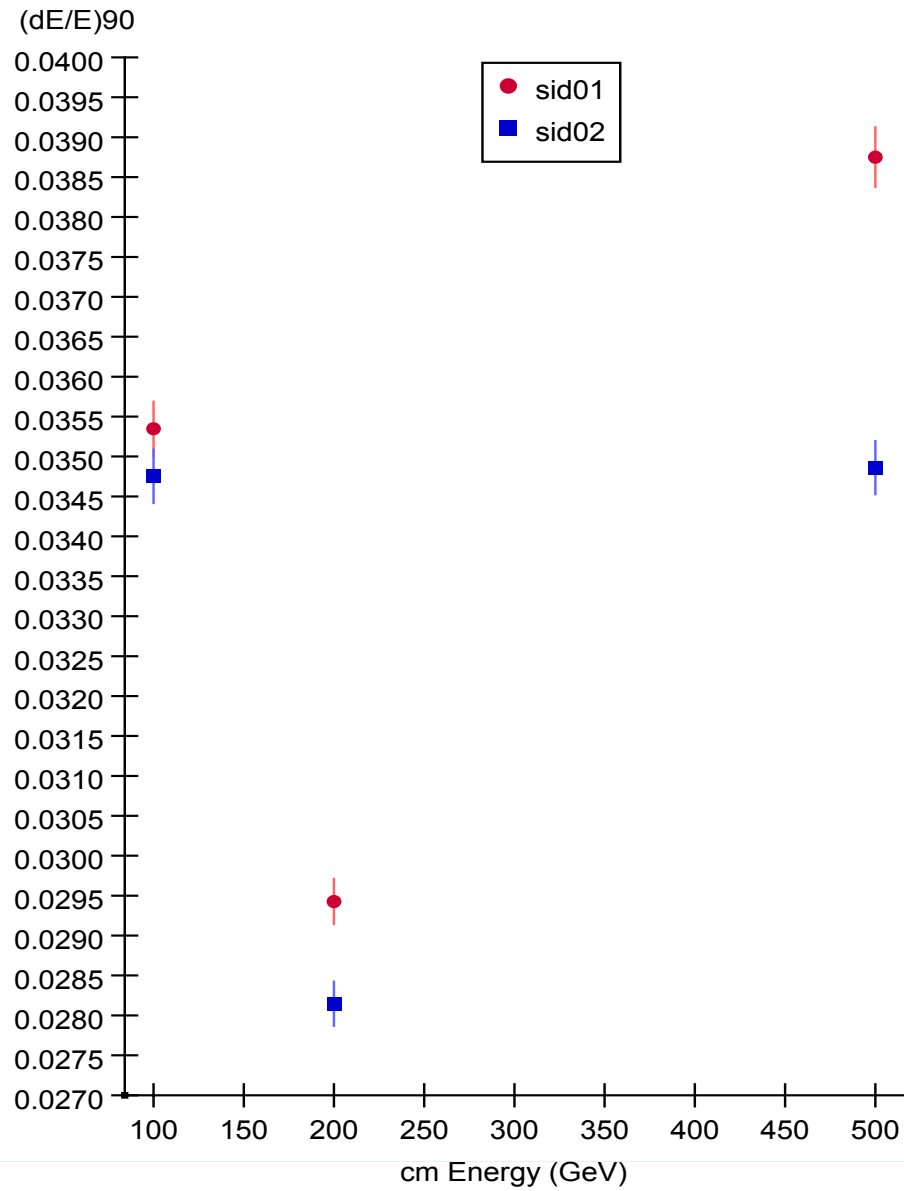
Fixed E qq events: PPR event E resolution: Barrel



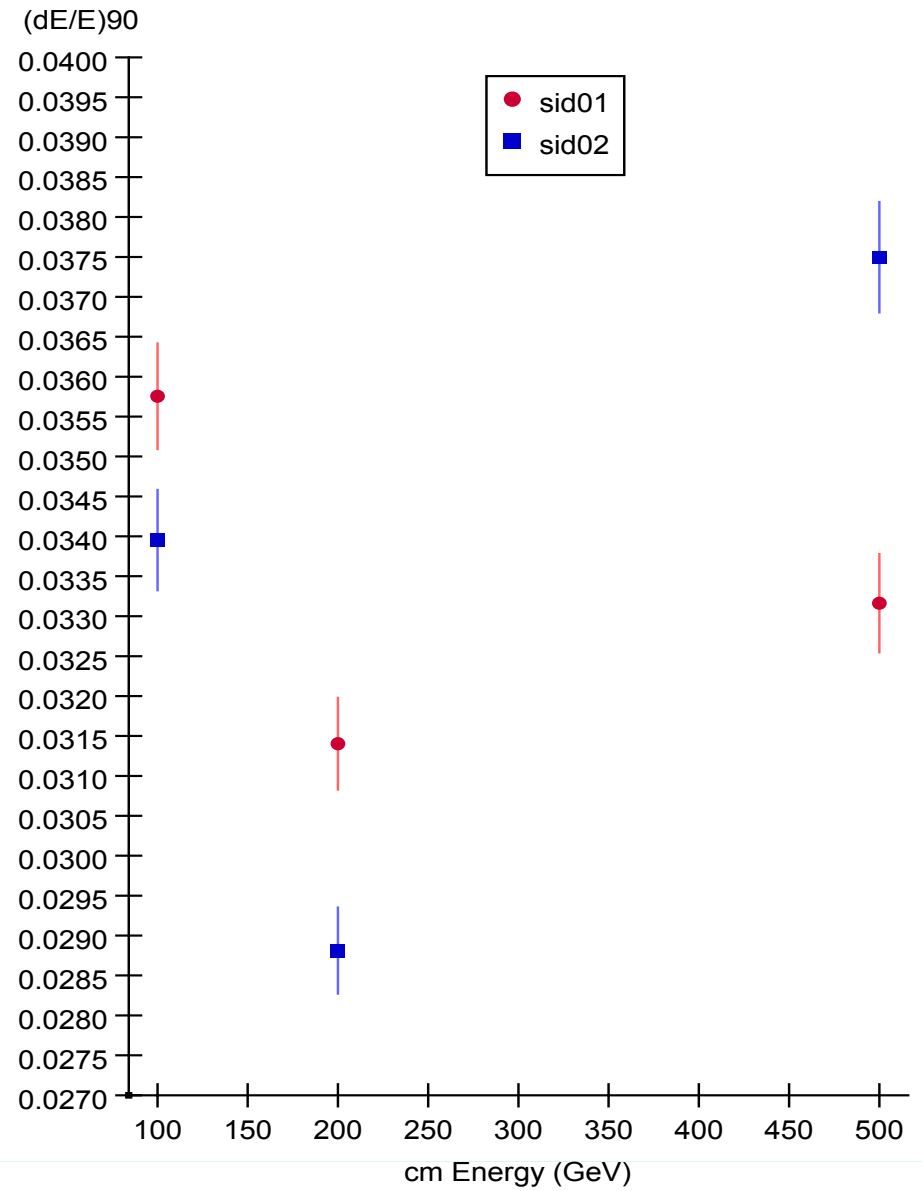
Fixed E qq evts:PPR event E resolution:Forward



Fixed E qq events:UI PFA evtE resolution:Barrel



Fixed E qq evts:UI PFA evtE res: Forward



Summary

- Simulations of the sid02 detector have been studied, and so far no glaring problems have been found. Comparisons with sid01 show no unexpected results, with the possible exception of the forward region in 250 GeV jets.