Updated ECal Geometry Simulation Studies

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SiD Optimization Meeting
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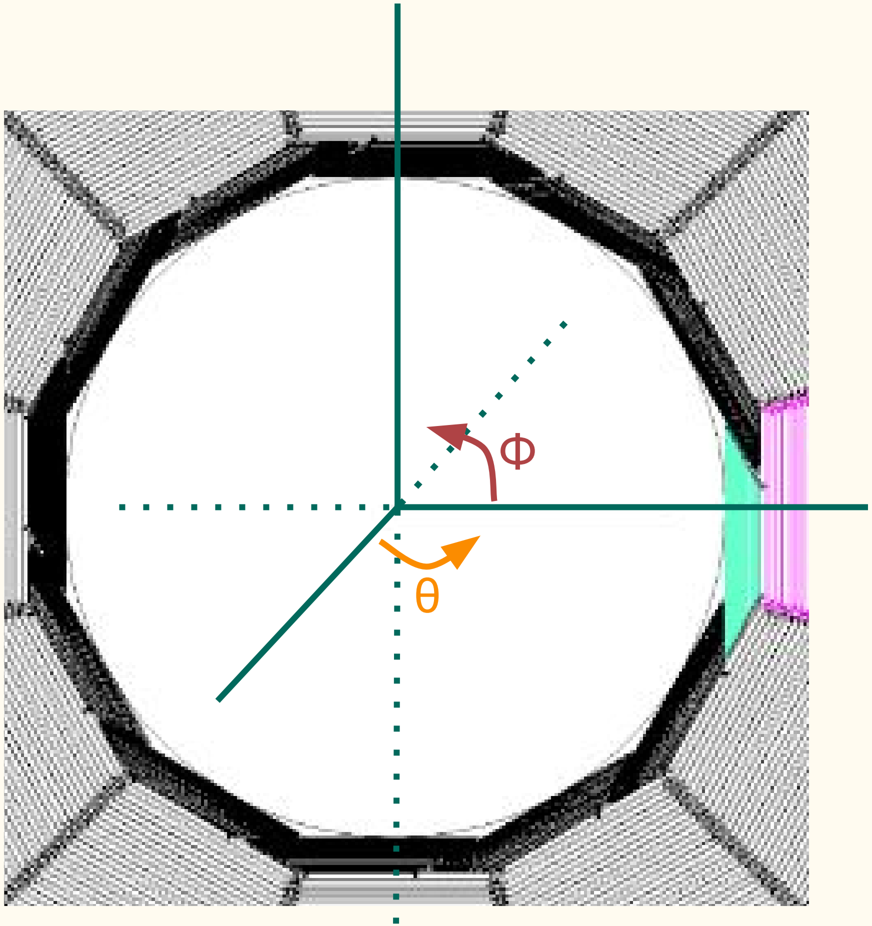
University of Oregon

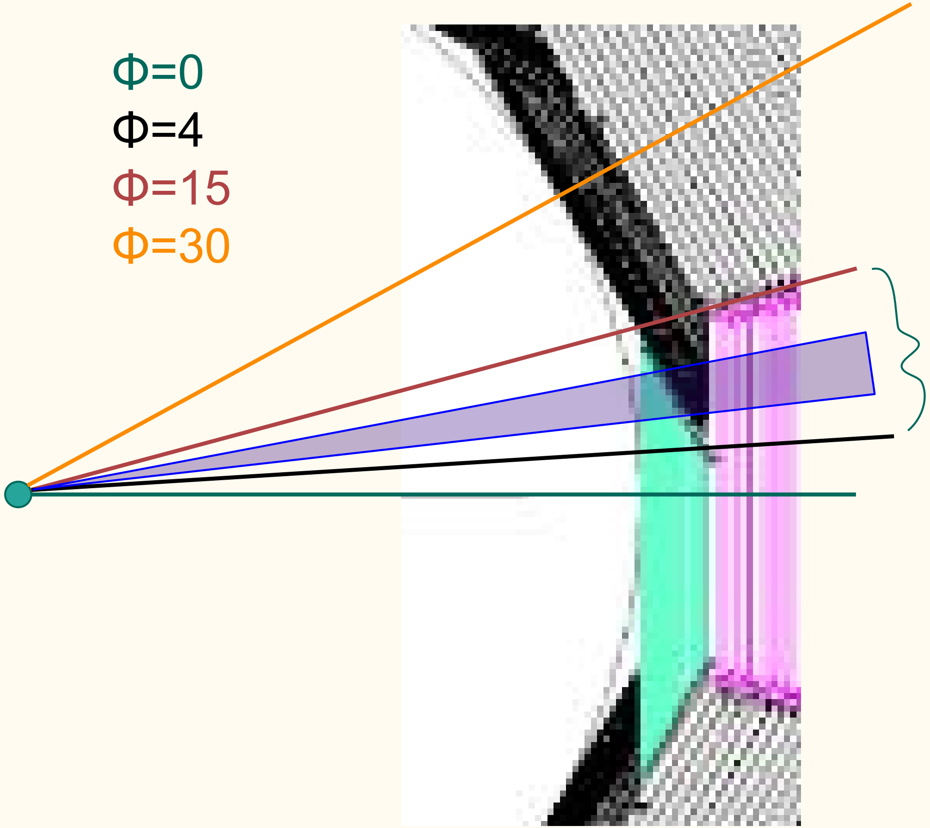
ECal Barrel Geometry

- 12 identical modules
- Overlapping ends
  - No projective cracks like HCal
- 30 layers of Si/DENS24
  - Tungsten
    - 20 x 0.64 X_0 = 2.5 mm
    - 10 x 1.30 X_0 = 5 mm
  - Silicon
    - 30 x 1.25 mm
  - Total module depth = 137.5 mm
- Inner radius = 1.27 m = 1270 mm

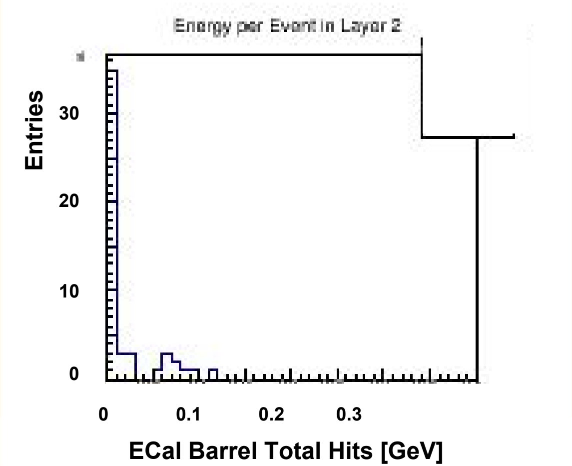


ECal Barrel Geometry

- Runs done at θ=90 (normal to detector surface)
- 100 GeV photons
- Periodic structure
  - Beam goes through entire module through shortest path at increments of 30º
  - Beam goes through overlap region between increments of 4º→15º
  - Beam goes through only thin layers between increments of 8.5º→10.2º



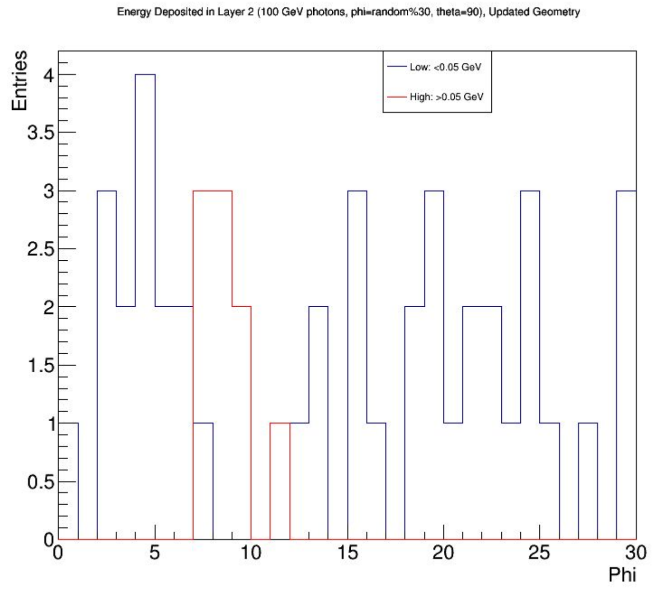
Confirmation of Geometry Orientation



Hits in layer 2 from random phi distribution

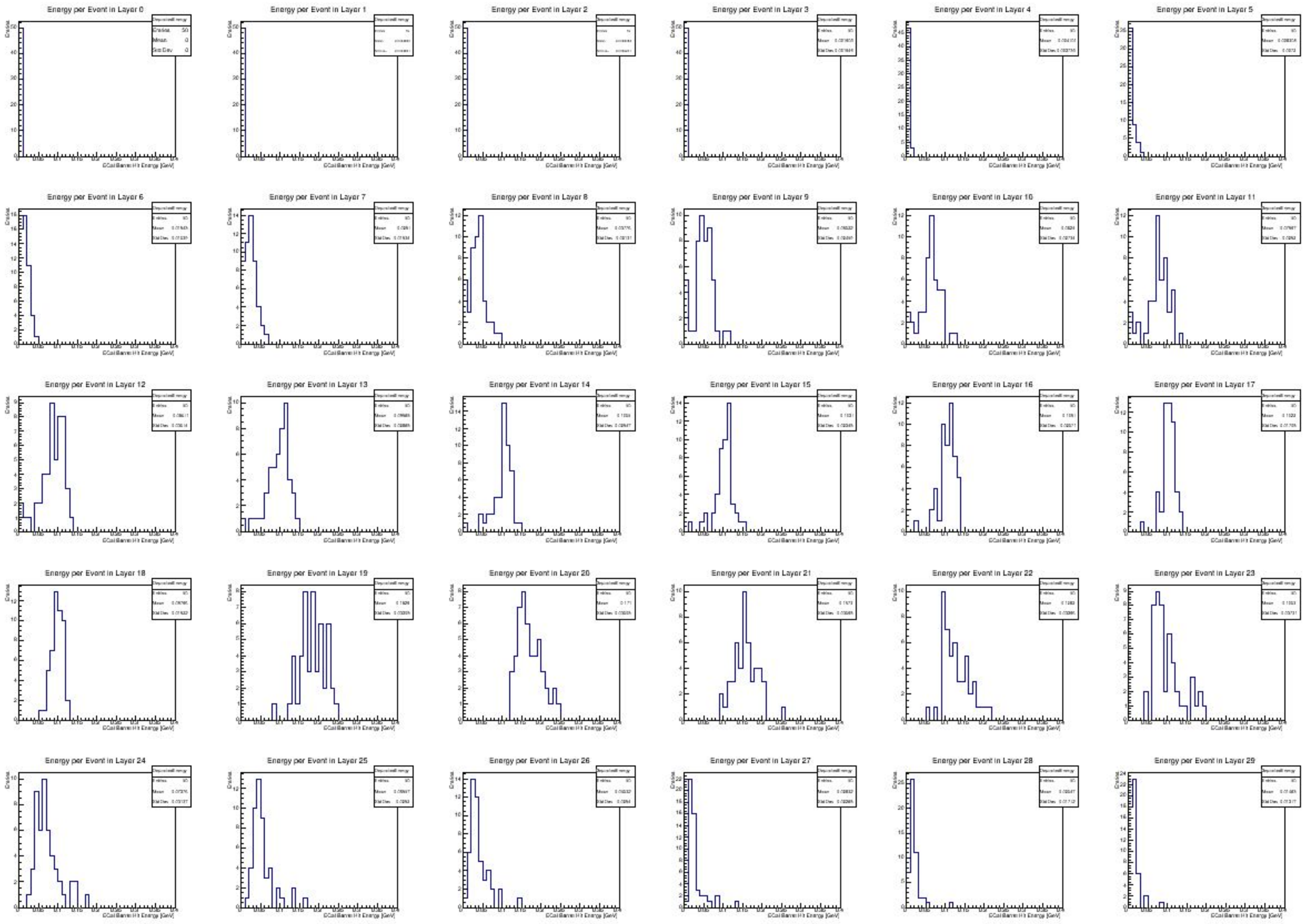
Random phi angles modulo 30

Red = if the sum of all hits in layer 2 from one event is high (>0.05 GeV) - peak at 7.5^{o}
Blue = if the sum of all hits in layer 2 from one event is low (<0.05 GeV)



phi = 0

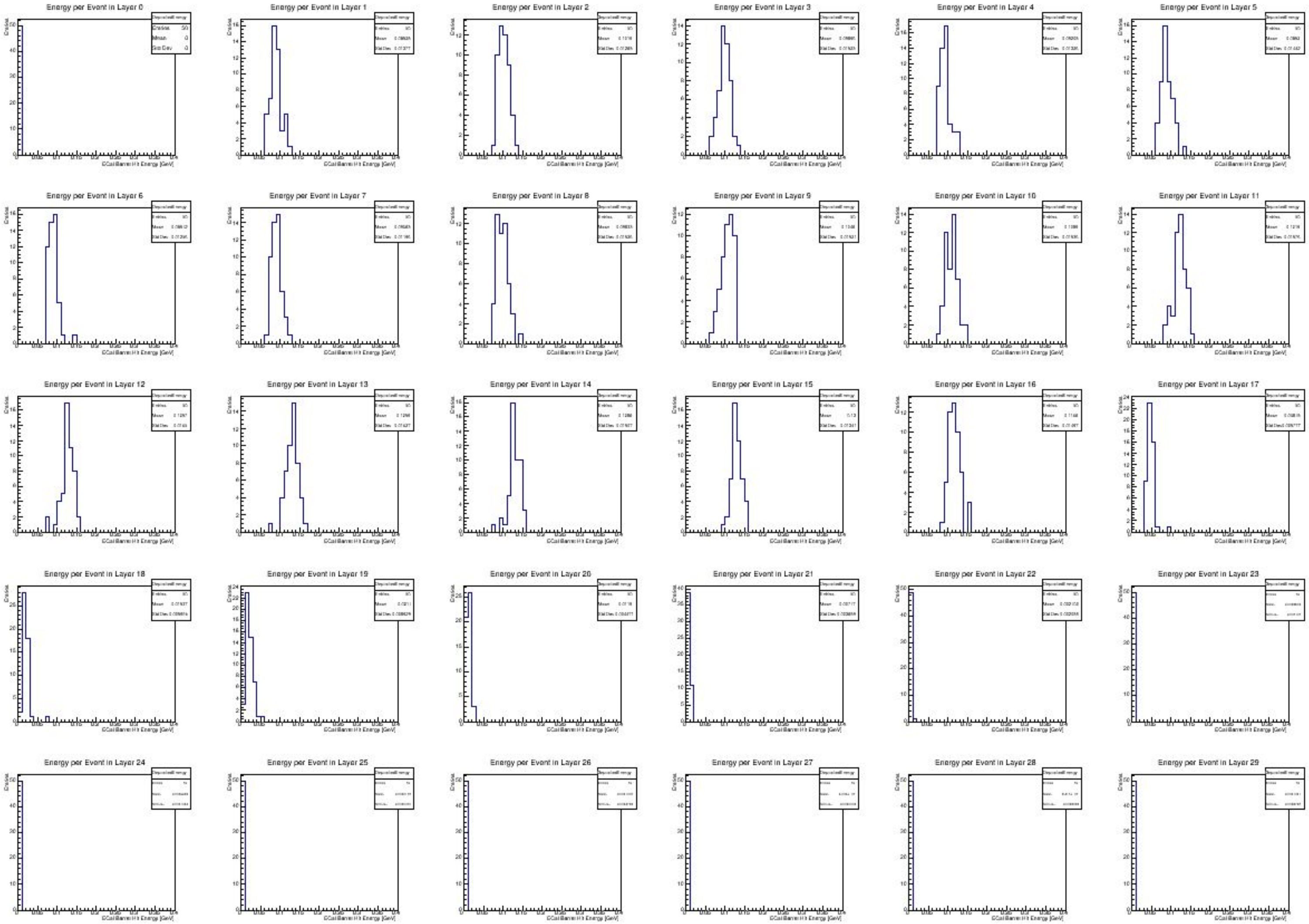
Normal development with depth of EM shower is observed



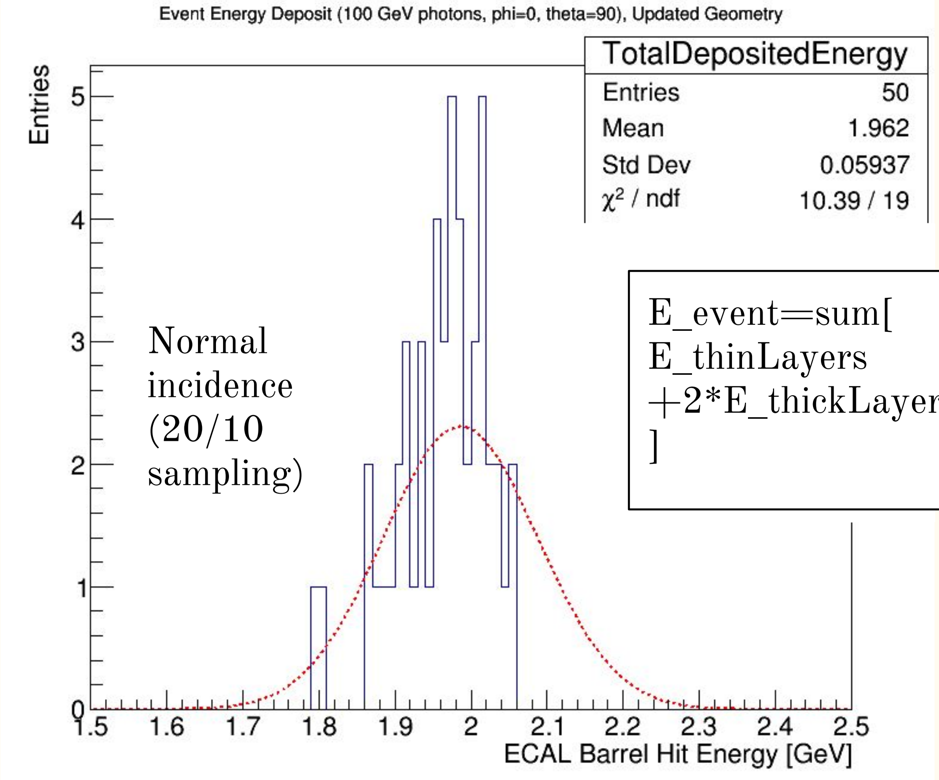
phi = 10

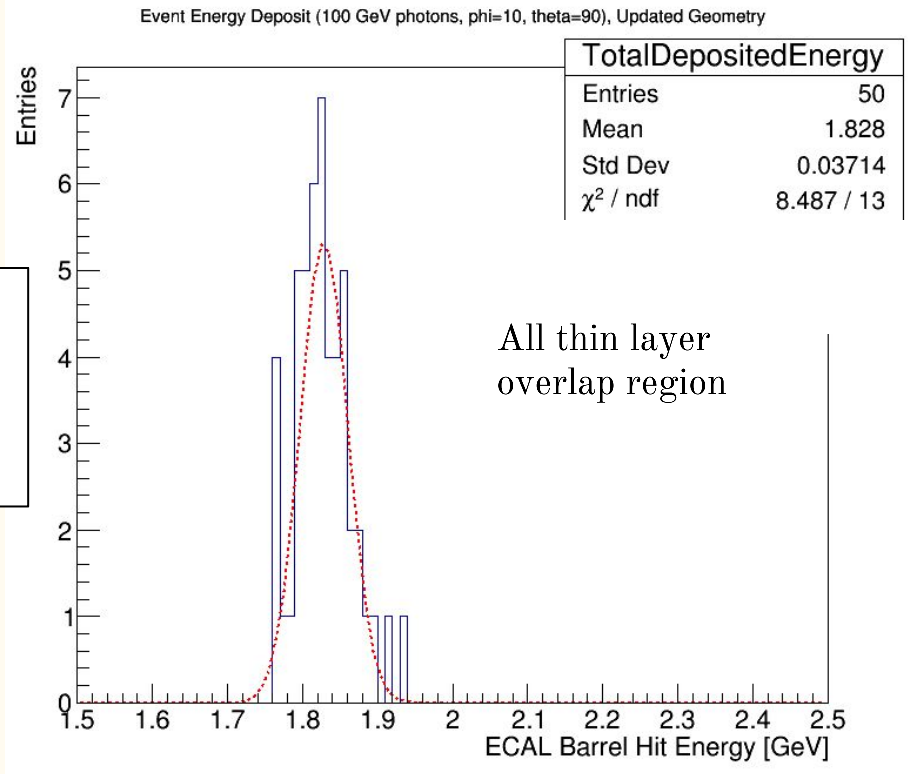
No hits in layers >21

Significantly more energy in layers 2-10 than for phi=0 due to overlapping module



Beams through Thin Layers





Normal incidence (20/10 sampling)

E_event=sum[E_thinLayers +2*E_thickLayers]

All thin layer overlap region

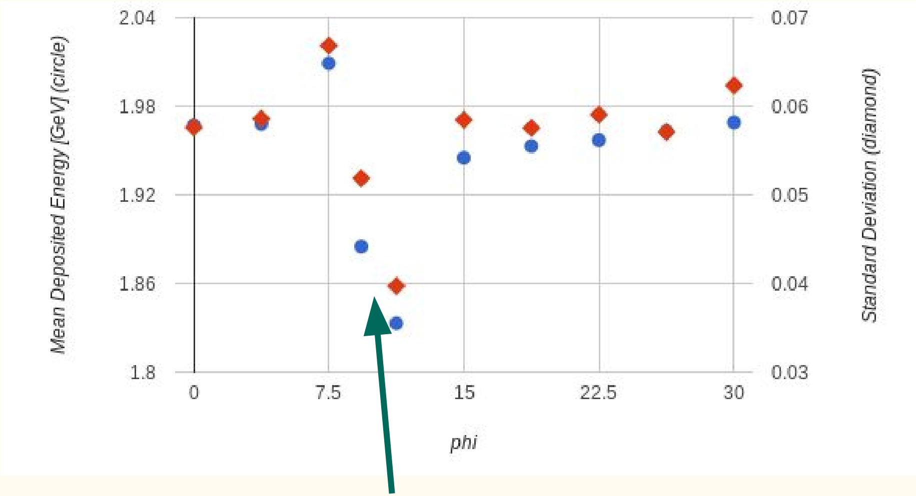
Beams through Thin Layers

Regions of only thin tungsten layers provide finer sampling than the rest of the calorimeter, therefore in these regions the deposited energy is more accurately measured

These regions are also thinner (in total tungsten) than the region of normal incidence by 8%, so more radiation is leaked out of the calorimeter resulting in a lower mean energy.

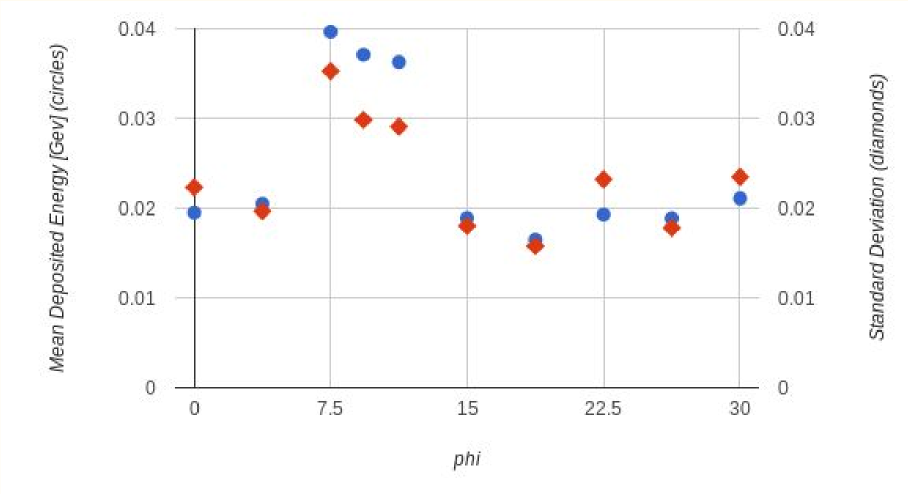
100 GeV Photons - 1000 events

ECAL

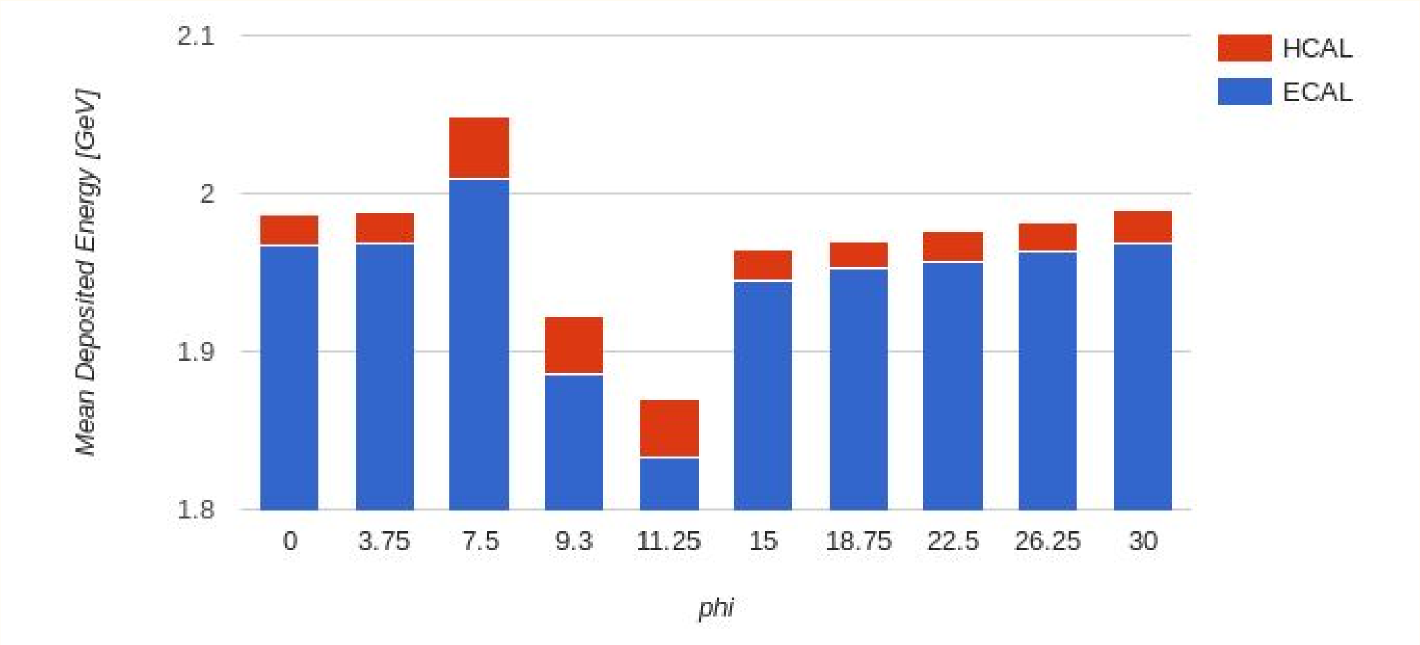


Finer sampling

HCAL

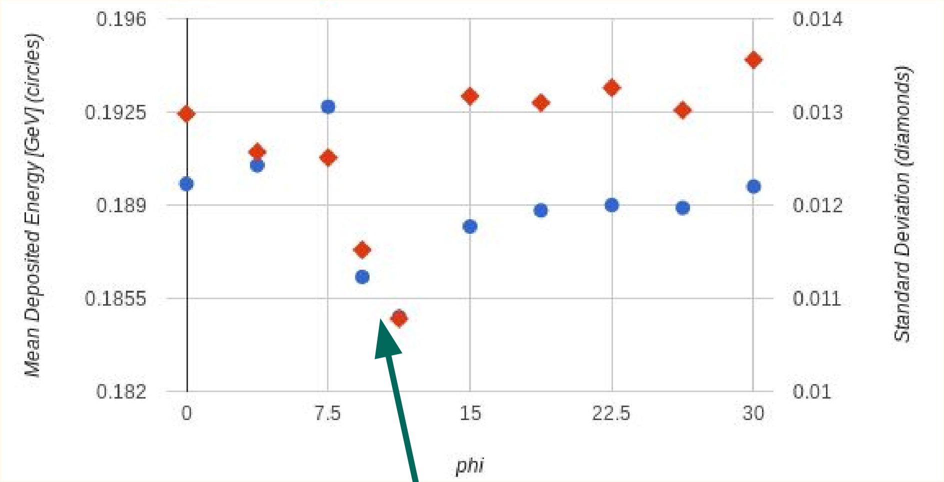


100 GeV Photons - 1000 events Con't



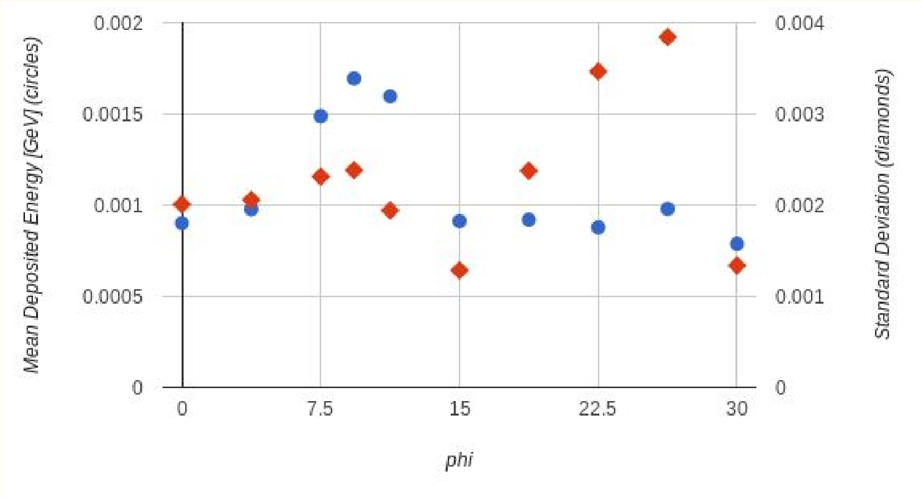
10 GeV Photons - 500 events

ECAL

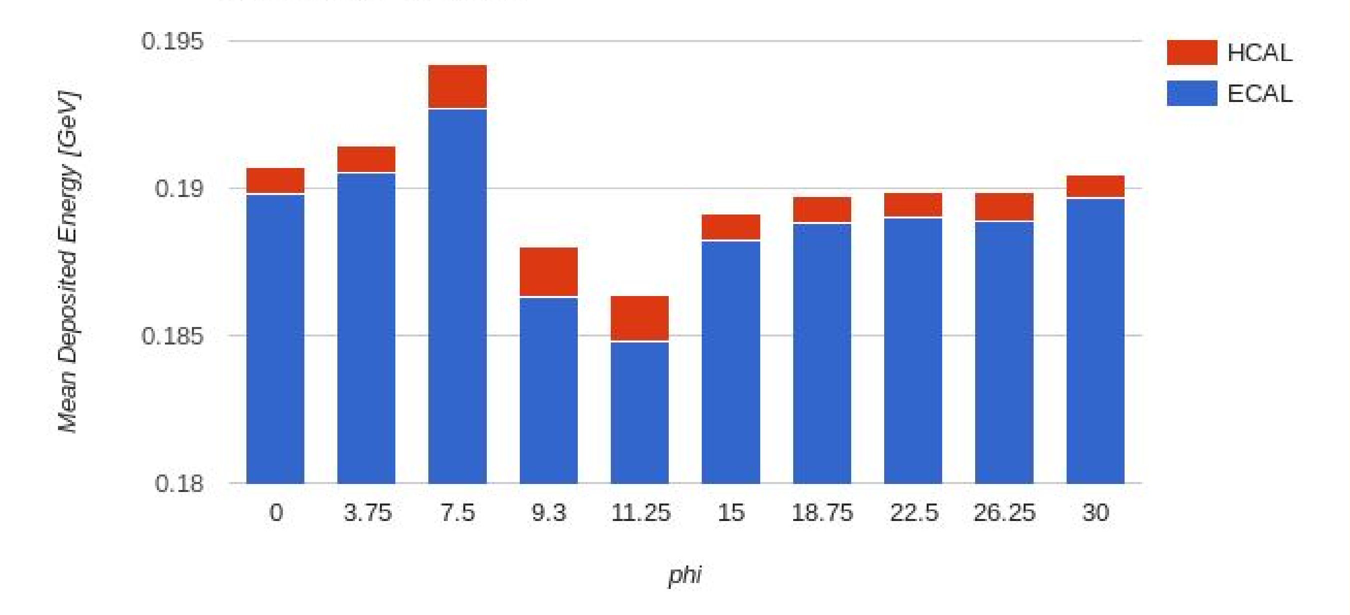


Finer sampling

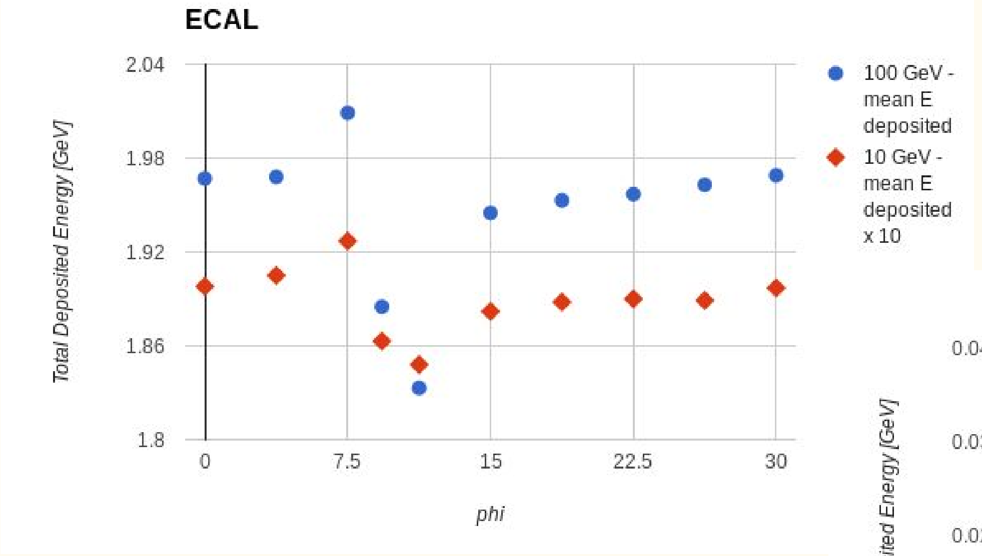
HCAL

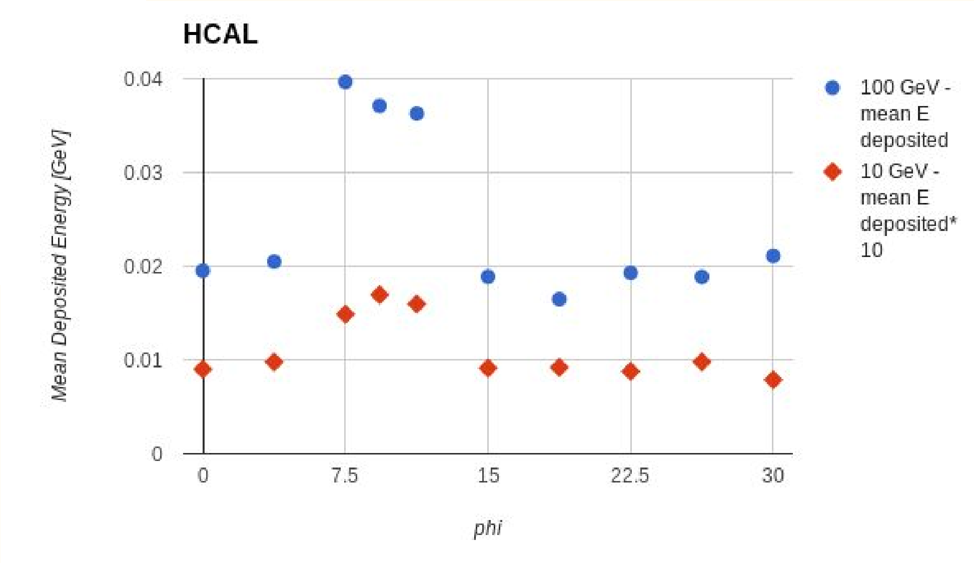


10 GeV Photons - 500 events Con't



100 GeV / 10 GeV Comparison





Future Work

- Investigate further phi=7.5
- Extract ECal calibration constant
- More exactly weight thick and thin deposits (now only doubling deposits in silicon layers following thick tungsten layers