$H \to \gamma\gamma$ improvements

Physics benchmarks

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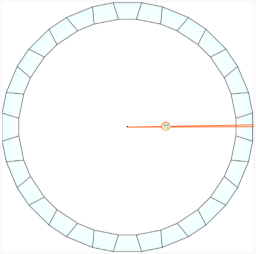
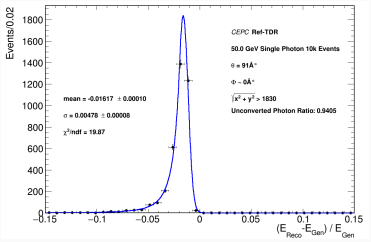
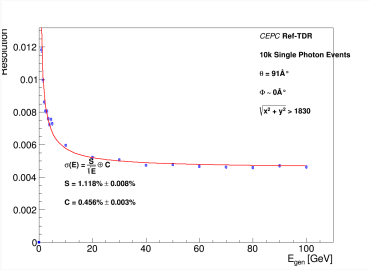
Crystal Bar study

In the crystal bar at the center of our ECAL barrel module, our resolution is at its lowest, expecially for higher energies



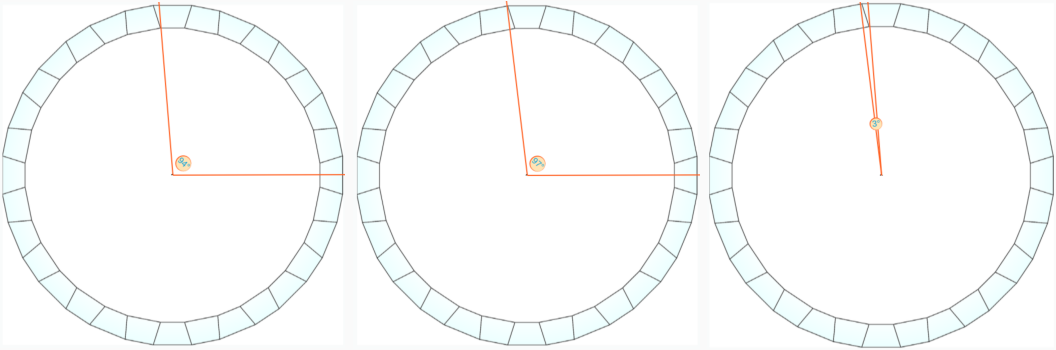




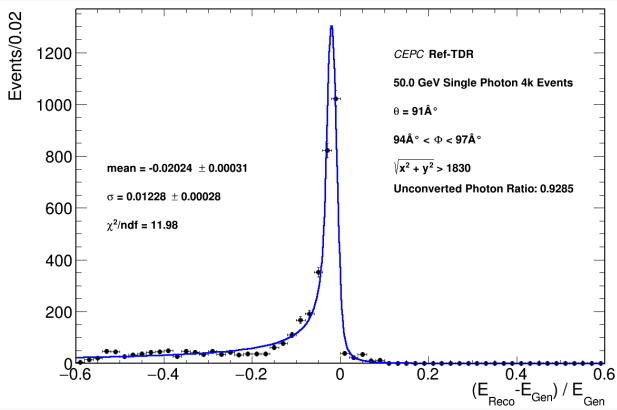
Crack Region study

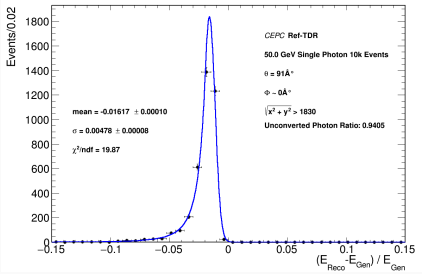
32-sided polygon: Interleaved arrangement of regular and inverted trapezoids.

Crack region generally at $5.625° = \frac{360°}{32} \times \frac{1}{2}$ from the center of a module, covers around 3°



Crack Region study

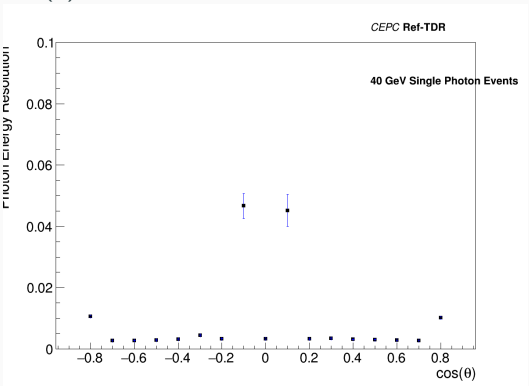


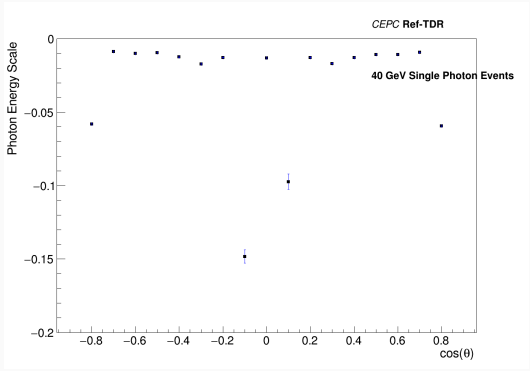


-> It is clear that compared to the center of cell (crystal bar), the resolution is worse in the crack region (1.2% v. 0.46% @ 50 GeV)

Other differential distributions

-> We also studied the Photon Energy Resolution and Photon Energy Scale relative to $cos(\theta)$



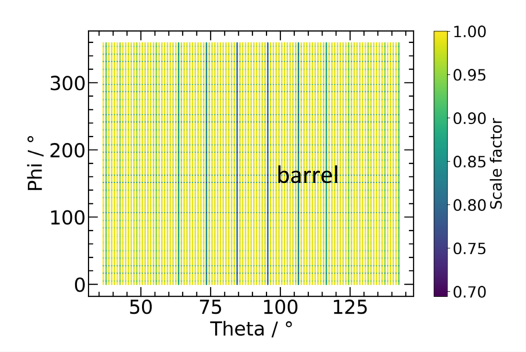


-> Our figures are symmetric as expected

3 values to be checked more in depth: $|cos(\theta)|$ = 0, 0.1, 0.8

Specific cos values to check

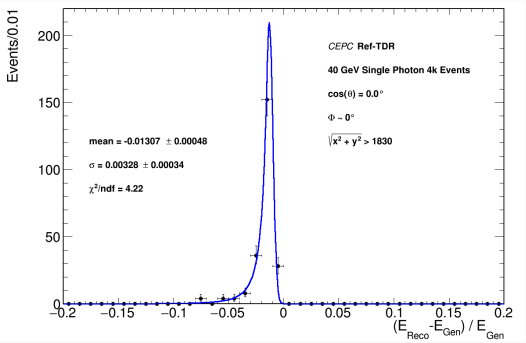
For $|cos(\theta)|$ = 0.1, 0.8 ($\theta = 84.26°\&95.74°, 36.87°\&143.13°$)
We saw a clear an increase in resolution and decrease in scale which is explainable by the fact that these values are in crack regions (different types of crack regions)

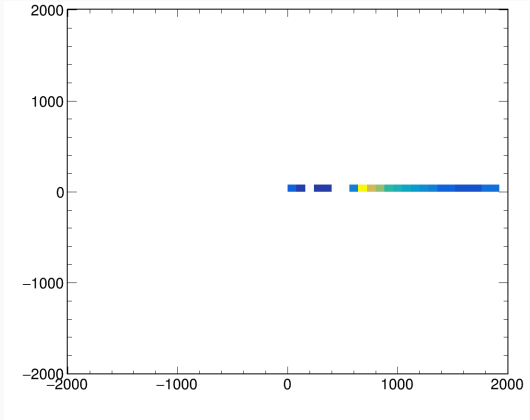


-> $\theta = 84.26°\&95.74°$: Crack region between two cells of ECAL
-> $\theta = 36.87°\&143.13°$: Crack region between Barrel and Endcap

Specific cos values to check

As for $cos(\theta)$ = 0 ($\theta = 90°$) Ratio of unconverted photons = 5.6%

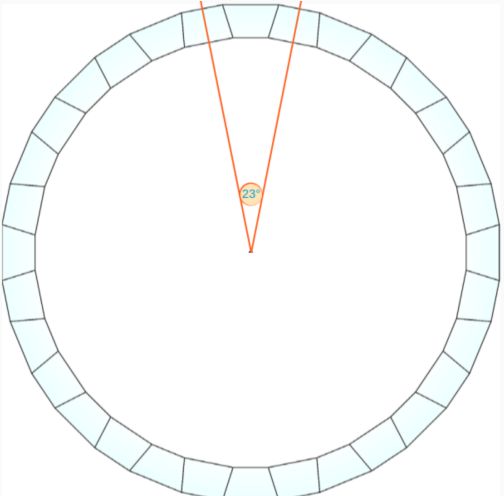




-> This is due to interference with TPC Gas Chamber

Differential distributions relative to ϕ

225k events generated to scan the resolution evolution over a 22.5° variation of phi (0.1° step with $\approx$ 1k events)



Perspectives

Checking the differential distributions for $cos(\theta)$ in crack region ($94° < \theta < 97°$)

Scanning resolution for ϕ varying between two cracks

Using results from Energy Scale in diphoton channel for calibration in order to fix the shift in invariant mass

Calculating E_{ECAL}/E_{Total} to check for leakage