



Mono-photon study barrel-endcap

Jets & Clusters

Mohamed Reda Mekouar

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Institute of High Energy Physics, Chinese Academy of Sciences

We chose to do a θ scan with a step of $\Delta\theta = 1^\circ$ to check our resolution over the range $8^\circ \leq \theta \leq 54^\circ$ which is approximately $0.6 \leq \cos(\theta) \leq 0.99$:

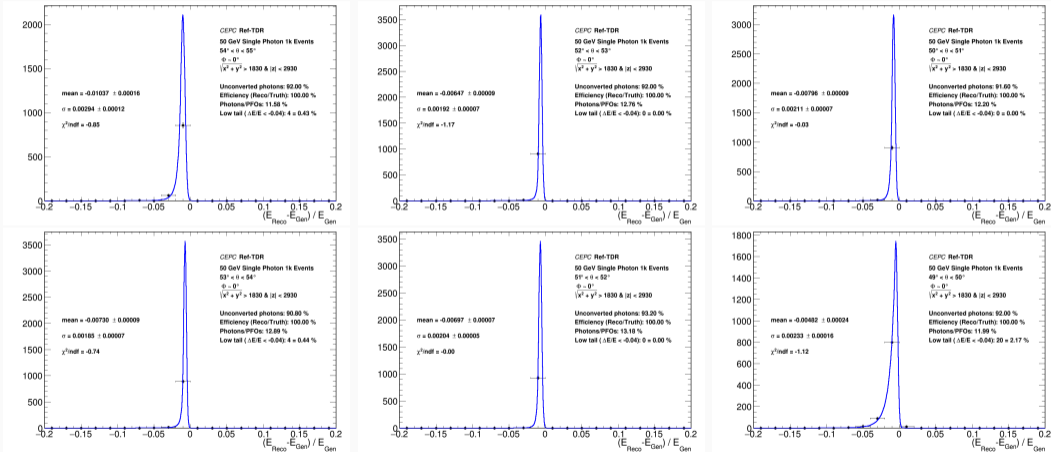
-From $35^\circ \leq \theta \leq 54^\circ \approx (0.6 \leq \cos(\theta) \leq 0.82)$: barrel region

-From $33^\circ \leq \theta \leq 35^\circ \approx (0.82 \leq \cos(\theta) \leq 0.84)$: big crack between barrel and endcap

-From $8^\circ \leq \theta \leq 33^\circ \approx (0.84 \leq \cos(\theta) \leq 0.99)$: endcap region

Barrel region

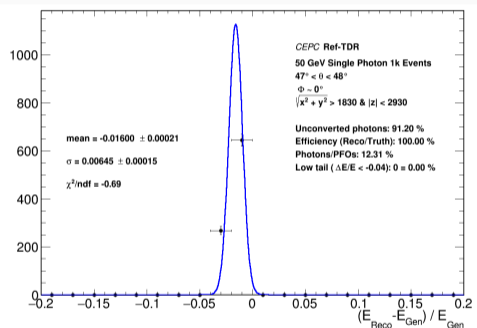
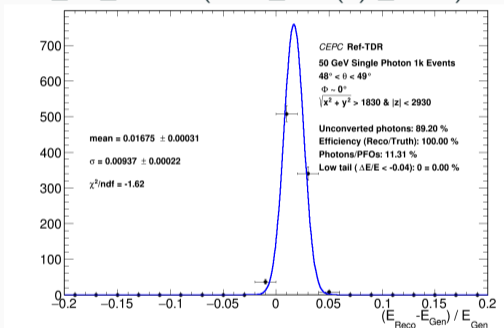
First module in barrel region: From $49^\circ \leq \theta \leq 55^\circ \approx (0.57 \leq \cos(\theta) \leq 0.66)$



The resolution is around 0.2% and the scale less than 1%
 -> Good reconstruction in the first module (bare dead material)

Barrel region

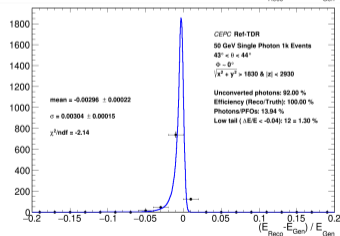
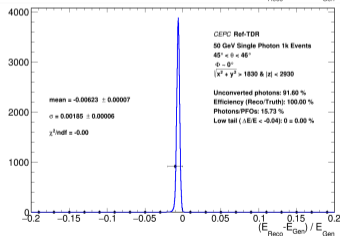
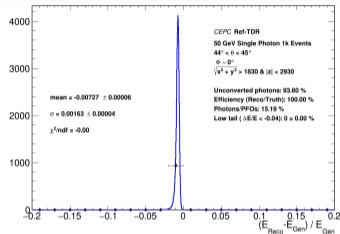
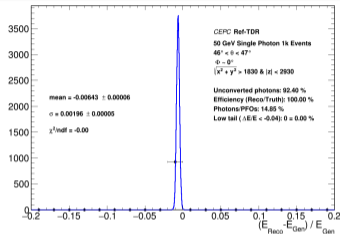
Dead material/crack between first and second module in barrel region: From $47^\circ \leq \theta \leq 49^\circ \approx (0.66 \leq \cos(\theta) \leq 0.68)$



Resolution decreasing in the 2° range covering the dead material/crack between two modules

Barrel region

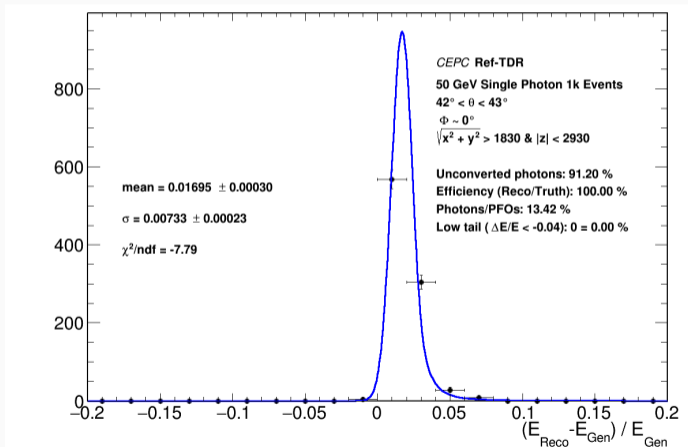
Second module of the barrel: From $43^\circ \leq \theta \leq 47^\circ \approx (0.68 \leq \cos(\theta) \leq 0.73)$



Good reconstruction within the module (small increase in resolution when approaching 43° -> shifting to dead material) - γ conversion rate still around 8% (as expected in barrel)

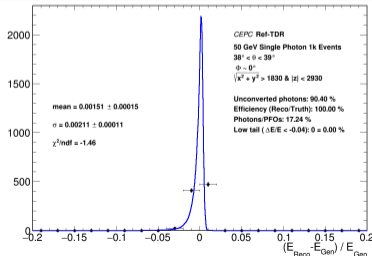
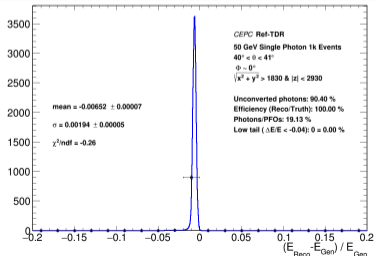
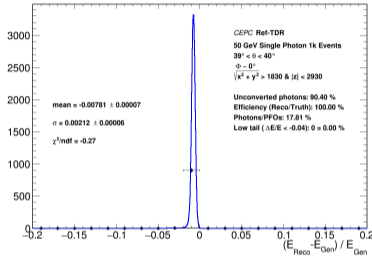
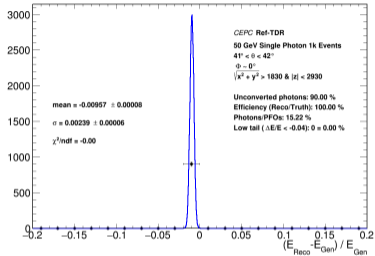
Barrel region

Dead material/crack between second and third module in barrel region: From $42^\circ \leq \theta \leq 43^\circ \approx (0.73 \leq \cos(\theta) \leq 0.74)$



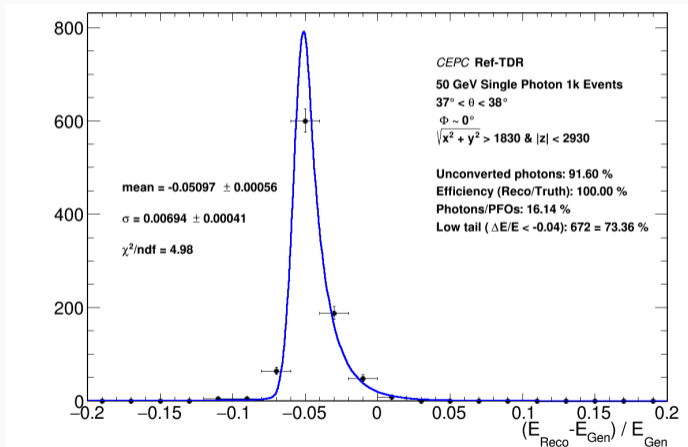
Barrel region

Third module: From $38^\circ \leq \theta \leq 42^\circ \approx (0.74 \leq \cos(\theta) \leq 0.79)$



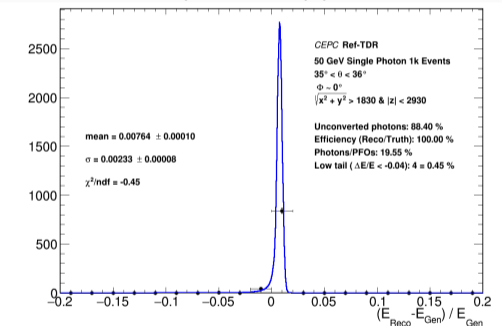
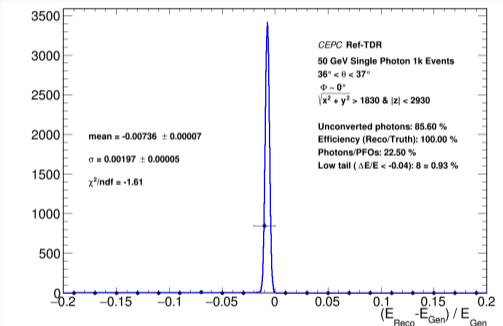
Barrel region

Dead material/crack between 3rd and 4th module in barrel region: From $37^\circ \leq \theta \leq 38^\circ$
 $\approx (0.79 \leq \cos(\theta) \leq 0.8)$



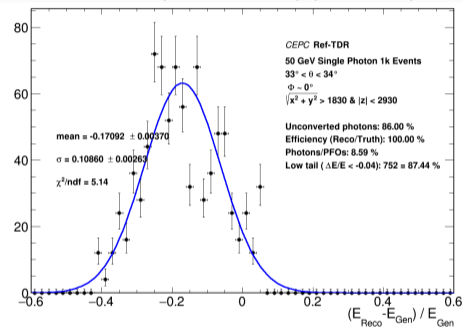
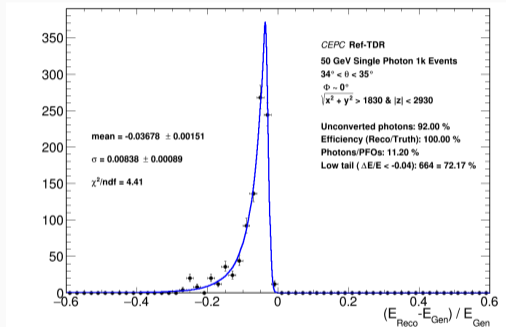
Barrel region

Fourth and last module in the barrel: From $35^\circ \leq \theta \leq 37^\circ \approx (0.8 \leq \cos(\theta) \leq 0.82)$



Crack region

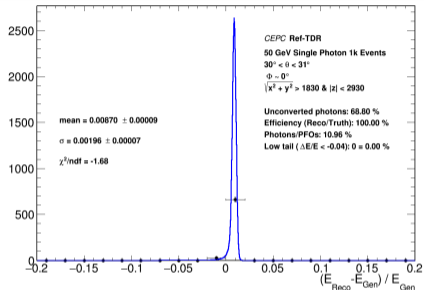
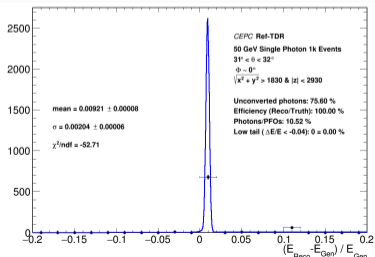
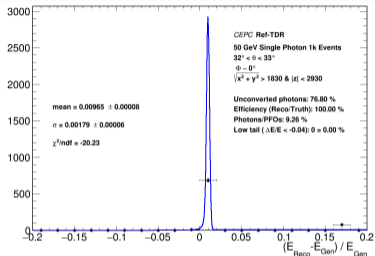
Big crack between barrel and endcap: From $33^\circ \leq \theta \leq 35^\circ \approx (0.82 \leq \cos(\theta) \leq 0.84)$



The resolution reasonably gets much worse because we have an empty gap between the barrel and endcap

Endcap region

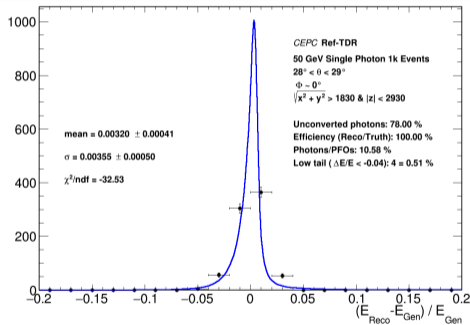
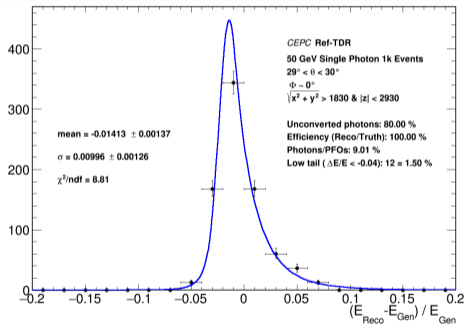
First module of the endcap: From $30^\circ \leq \theta \leq 33^\circ \approx (0.84 \leq \cos(\theta) \leq 0.87)$



Resolution in endcap is as good as barrel (0.2%) but with much higher γ conversion rate (25-30%) - Mean/Scale shifted to positive side (to be calibrated)
Small bump in the higher tail (around $0.1 < \Delta E/E < 0.2$) (bug in Digi/Reco?)

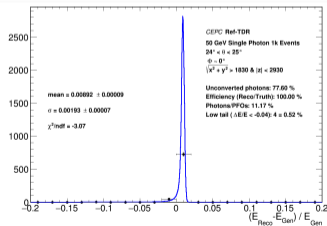
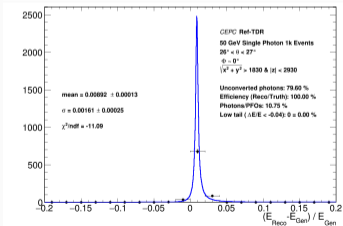
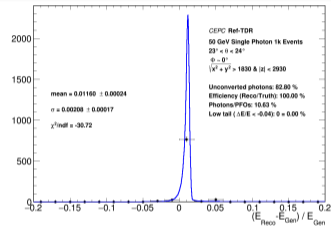
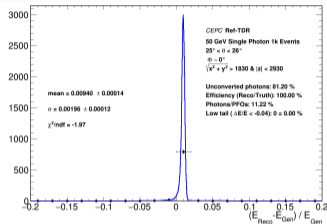
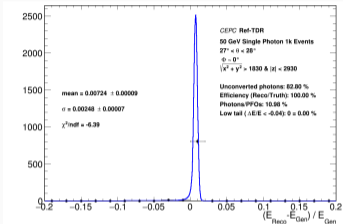
Endcap region

Dead material/crack between first and second module in endcap region: From $28^\circ \leq \theta \leq 30^\circ \approx (0.87 \leq \cos(\theta) \leq 0.88)$



Resolution goes as high as 1.3% in the first crack between endcap modules

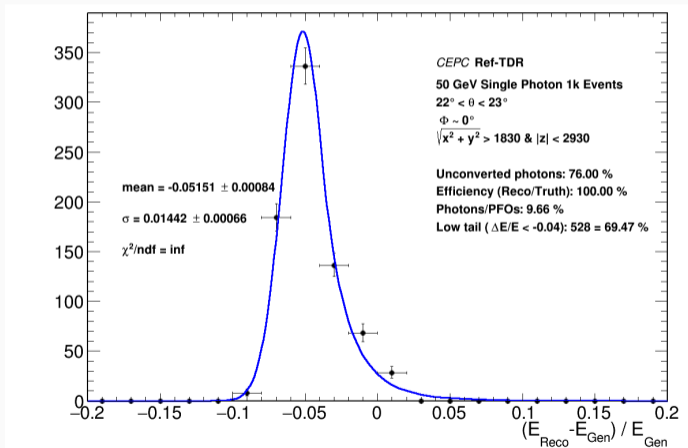
Second module in endcap region: From $23^\circ \leq \theta \leq 28^\circ \approx (0.88 \leq \cos(\theta) \leq 0.92)$



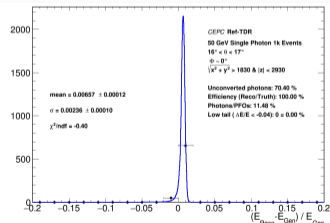
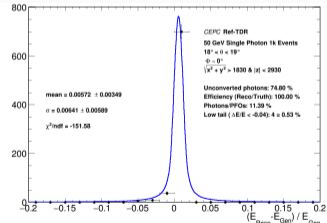
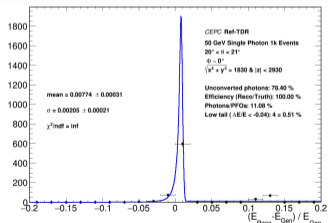
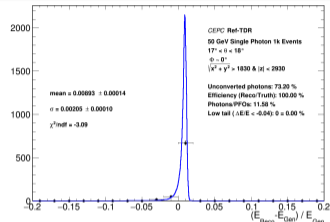
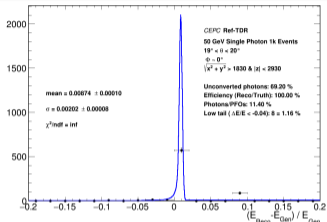
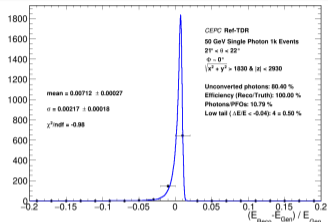
Resolution still at 0.2% and
Scale almost at 1% -
Conversion rate at around
20%

Endcap region

Dead material/crack between second and third module in endcap region: From $21^\circ \leq \theta \leq 22^\circ \approx (0.92 \leq \cos(\theta) \leq 0.93)$

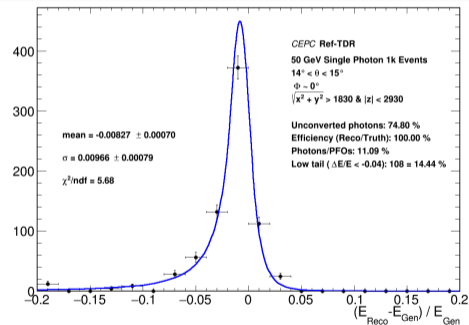
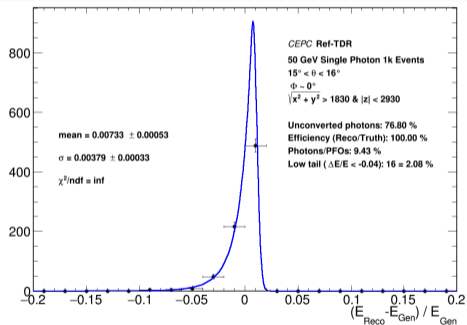


Third module: From $16^\circ \leq \theta \leq 21^\circ \approx (0.93 \leq \cos(\theta) \leq 0.96)$



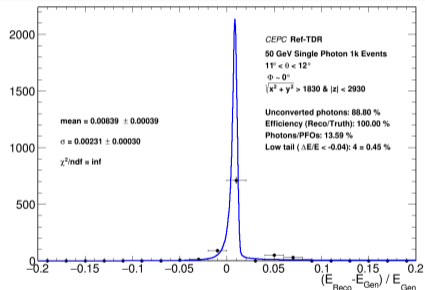
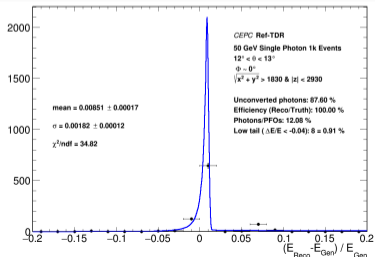
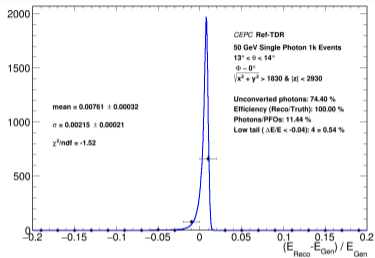
Small bump appearing again in higher tail

Dead material/crack for the third module in endcap region: From $14^\circ \leq \theta \leq 16^\circ \approx (0.96 \leq \cos(\theta) \leq 0.97)$



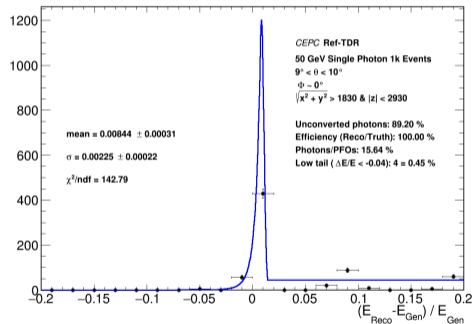
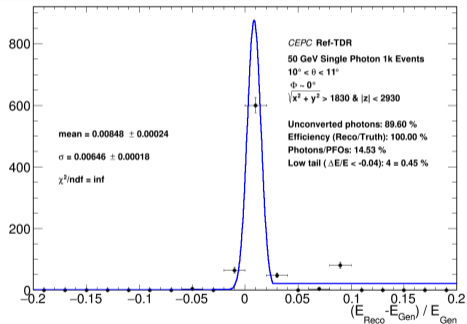
Endcap region

Last module: From $11^\circ \leq \theta \leq 14^\circ \approx (0.97 \leq \cos(\theta) \leq 0.98)$



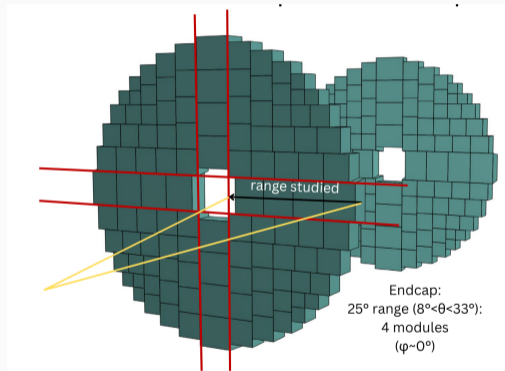
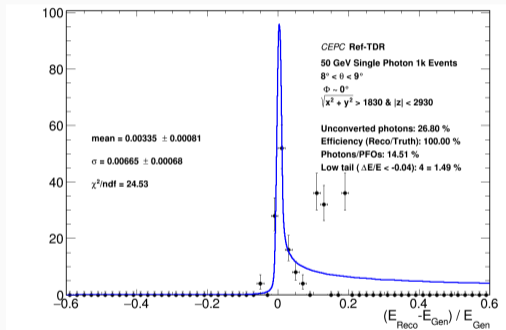
Endcap region

Dead material for last module in endcap region: From $9^\circ \leq \theta \leq 11^\circ \approx (0.98 \leq \cos(\theta) \leq 0.988)$



Endcap region

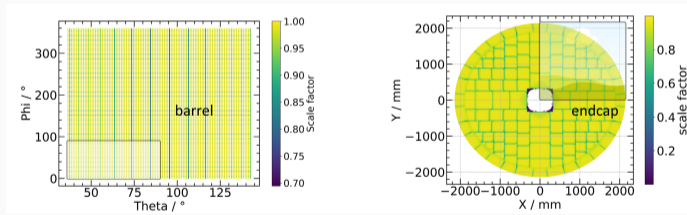
Limit of endcap region (big hole in the center of the endcap): From $8^\circ \leq \theta \leq 9^\circ \approx (0.988 \leq \cos(\theta) \leq 0.99)$



Lots of converted photons (75% not reconstructed in endcap because, almost no material in this range for endcap)

Perspectives

- Using these results to scale/calibrate and shift the mean values of our reconstructed photons
- Fixing the bump in the higher tail
- 2D scans for resolution (φ, θ) to mitigate effects/impact of different crack regions (within barrel, between barrel & endcap, within endcap, according to φ and those according to θ)



Define zones for 2D scan to scale over rest of subdetectors according to symmetries
($0^\circ < \varphi < 90^\circ$, $8^\circ < \theta < 89^\circ$)?

- Upcoming important geometry update in CEPCSW according to decision on granularity (10mm v. 15mm)?

Thank you!