

CRD Ecal reconstruction

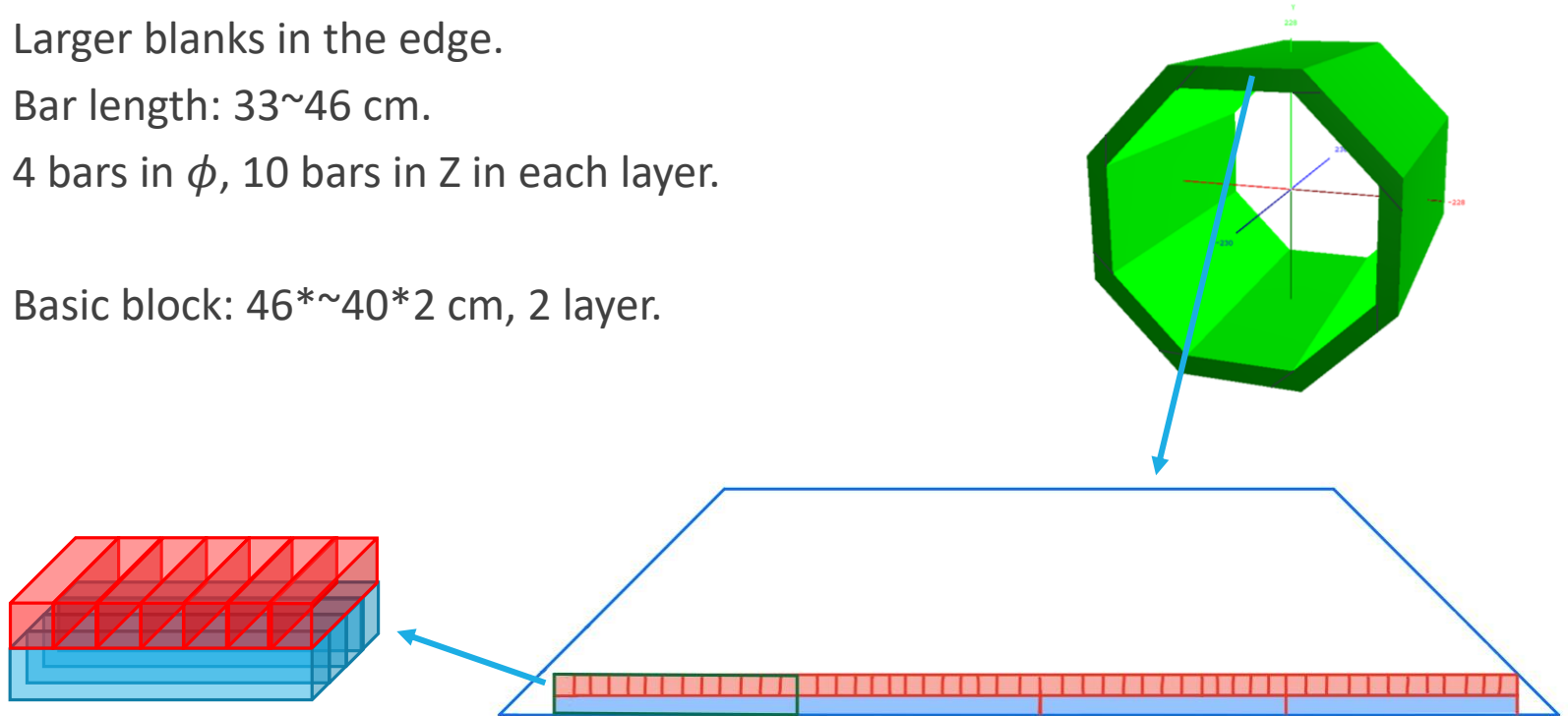
FANGYI GUO



Geometry

Some changes for reconstruction: merge 2 layers into 1 super-layer.

- Larger blanks in the edge.
- Bar length: 33~46 cm.
- 4 bars in ϕ , 10 bars in Z in each layer.
- Basic block: 46*~40*2 cm, 2 layer.



DigiHit reconstruction

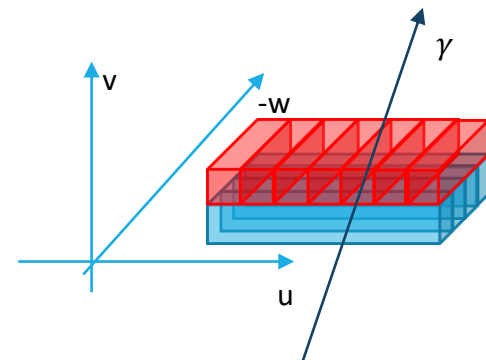
Recorded SimHit: G4step.

1st step: Merge the steps in the same bar into one new SimHit(SimBar).

2nd step: segment SimBar to get 1*1*1 cm cube, as truth SimHit.

3rd step: Cross locating in each block to get DigiHit(1*1*2 cm).

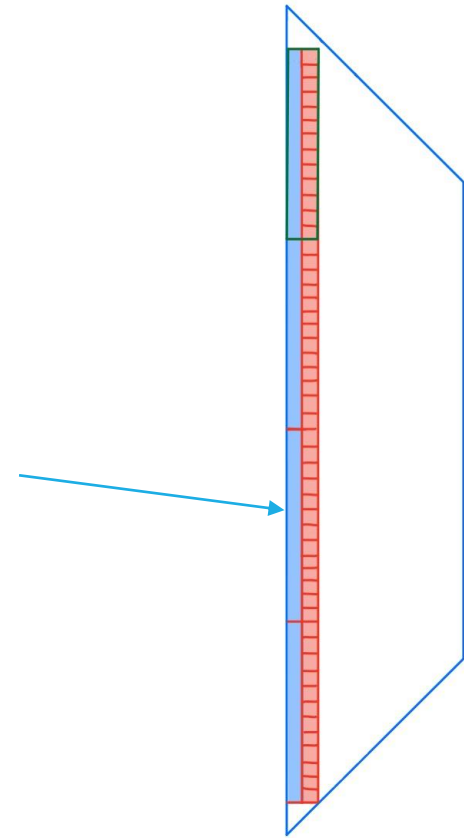
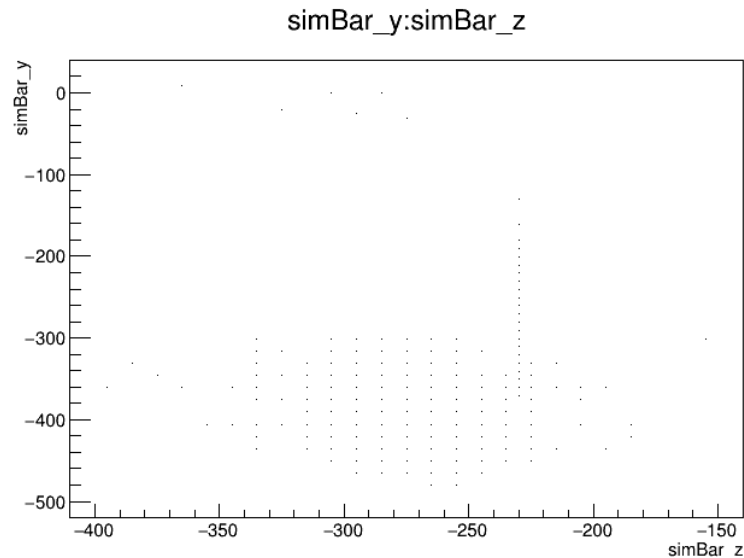
- Get energy deposition in each u-bar/v-bar $E_{bar1}[Nbars], E_{bar2}[Nbars]$.
- Hit(bar2_u, (bar1_v+bar2_v)/2, bar1_w)
- Hit.E = $E_{bar1} \frac{E_{bar2}}{\Sigma E_{bar2}} + E_{bar2} \frac{E_{bar1}}{\Sigma E_{bar1}}$.
- Position from time:
 - layer1: $x_T = x_{bar} + \frac{T1-T2}{2} v, \sigma_x = \frac{\sigma_T}{\sqrt{2}} v$.
 - If ($|x_T - x_{bar2}| > N\sigma_x$) remove this hit.



Single photon performance

30GeV single photon, $\theta = 98^\circ$, $\phi = -8^\circ$.

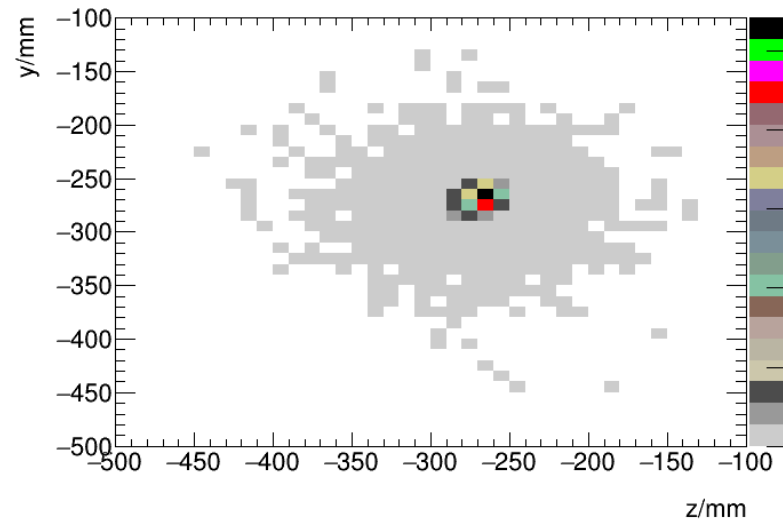
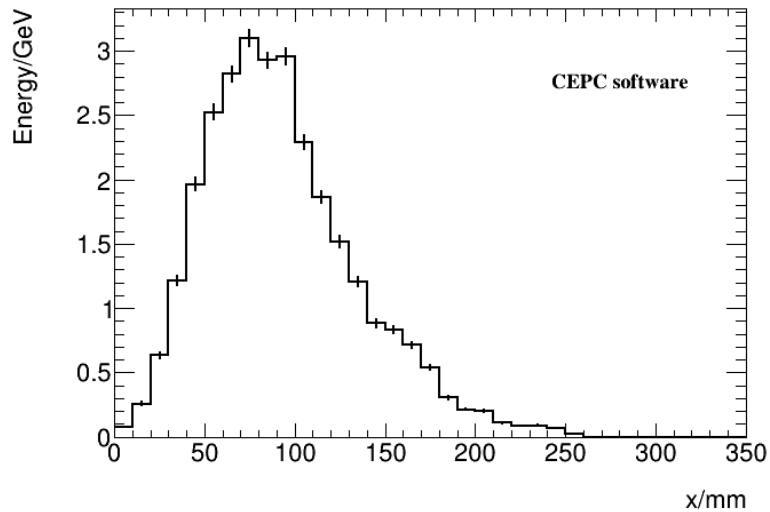
- Energy threshold for step: 3MeV.
- Crystal attenuation length: $\sim 10^{10}$.
- Crystal time resolution: 0.1 ns
- Cross locating threshold: 3σ .



Single photon performance

Truth Simhit:

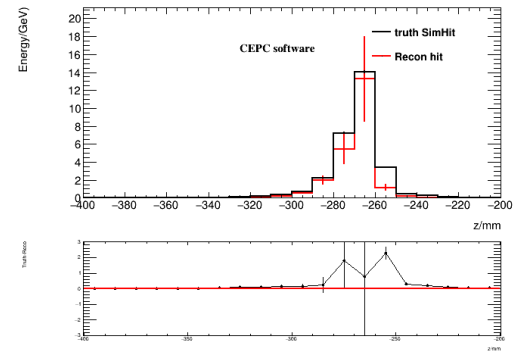
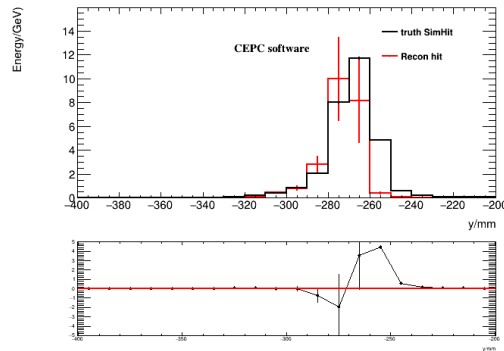
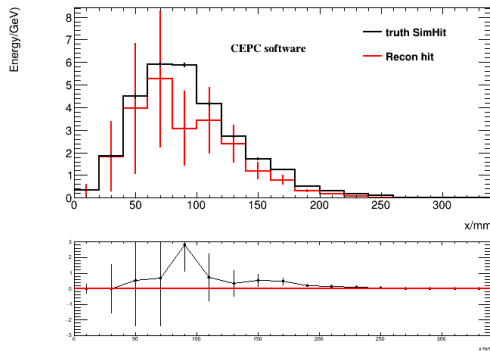
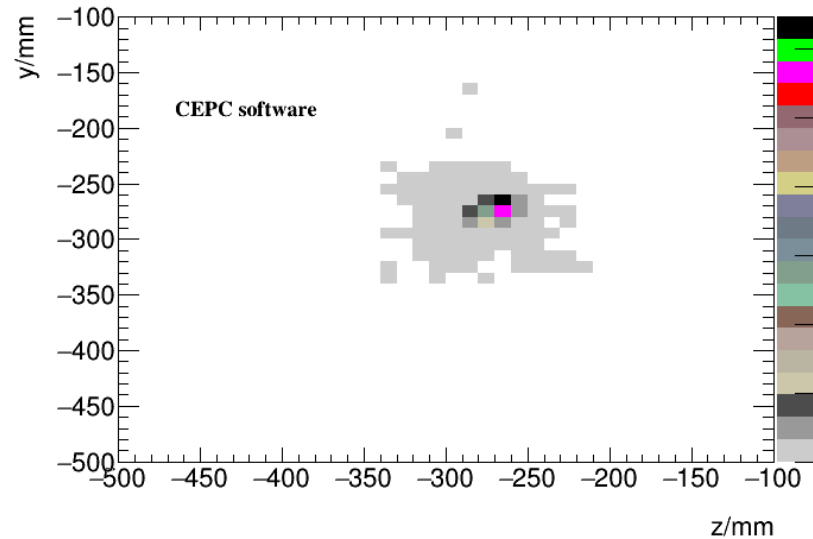
- Total energy: 29.42GeV.
- Hit number: 45687.



Single photon performance

Reconstructed DigiHit:

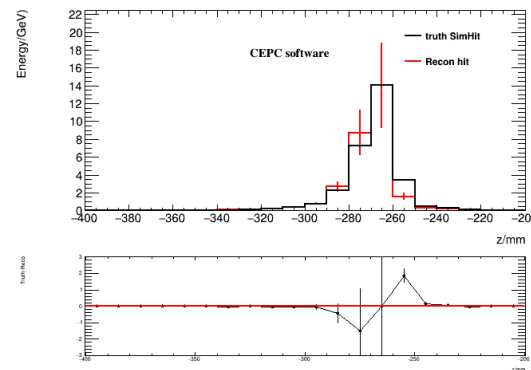
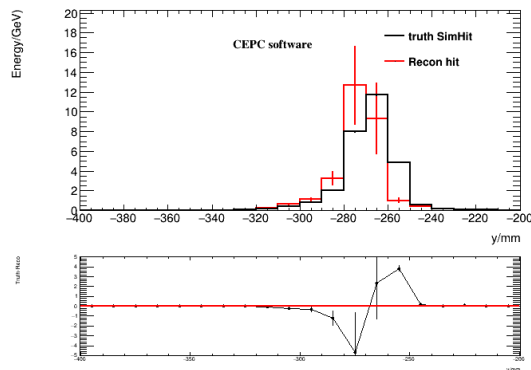
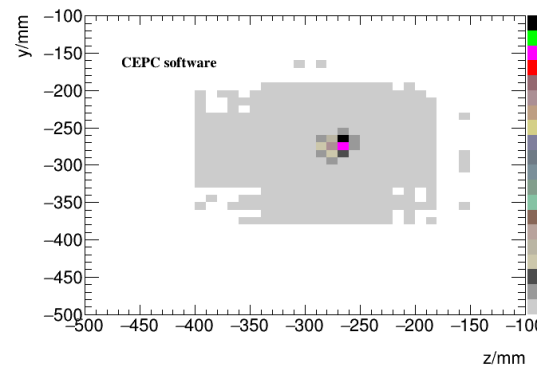
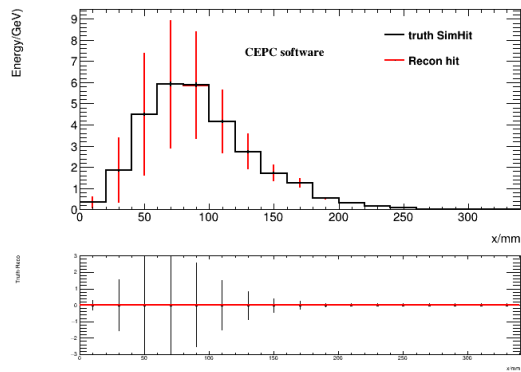
- Total energy: 22.78GeV
- Hit number: 371.



Single photon performance

Some hit lost in Cross locating. If we set the threshold to 1000:

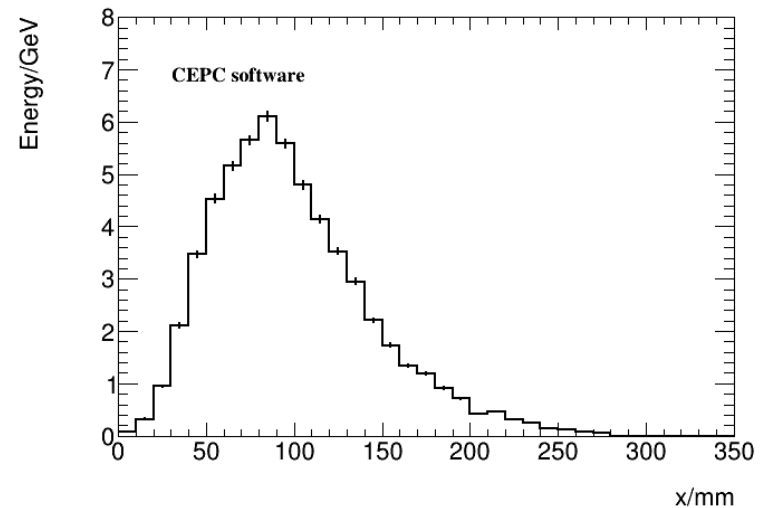
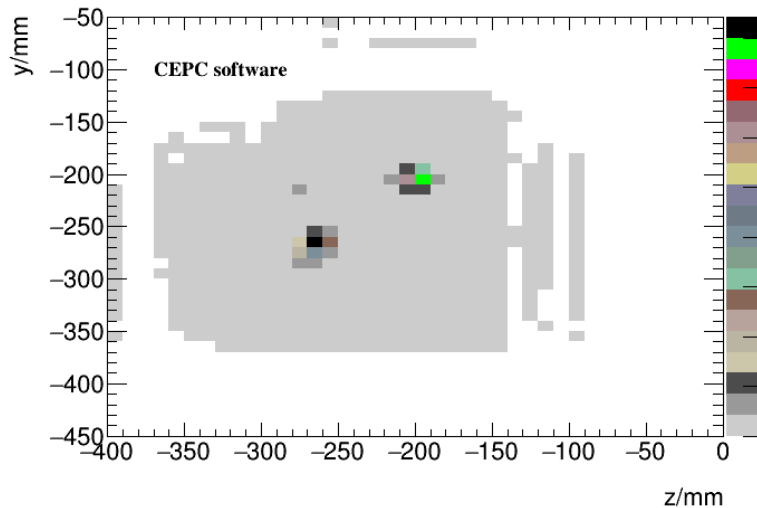
- Total energy: 29.36GeV
- Hit number: 1562



2 photon performance

2 photon with 30GeV, (θ, ϕ) : $\gamma_1 (98, -8)$, $\gamma_2(96, -6)$

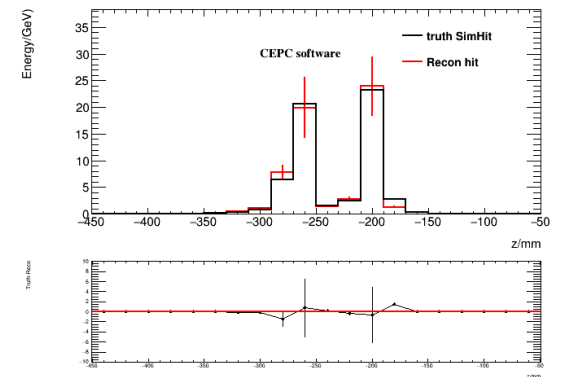
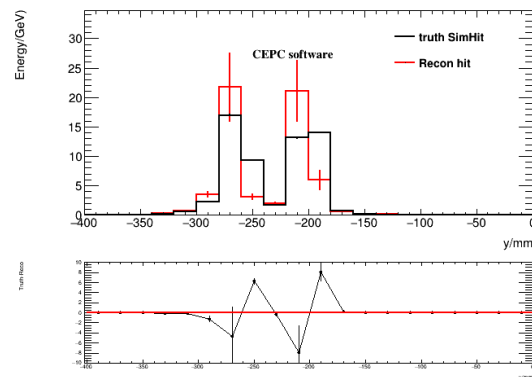
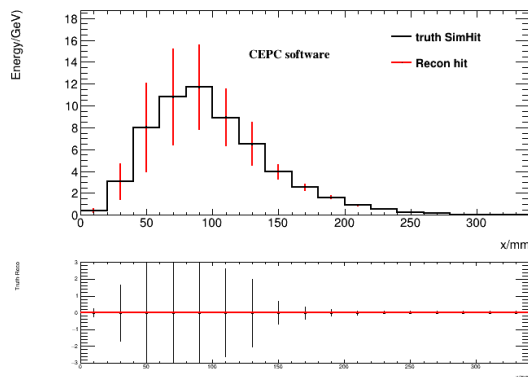
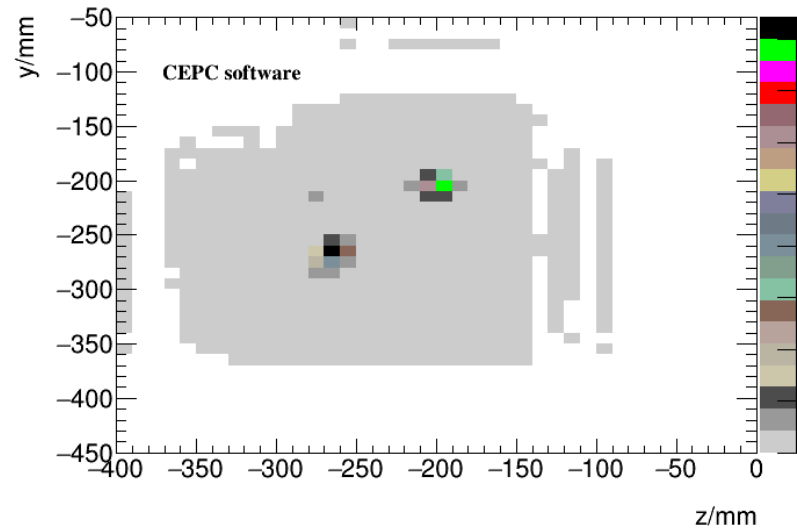
- Distance: 6.4 cm in y and z.
- SimHit total energy: 59.27GeV, hit number: 93024



2 photon performance

Reconstructed DigiHit:

- Total energy: 59.25GeV
- Hit number: 3324
- No cross locating threshold

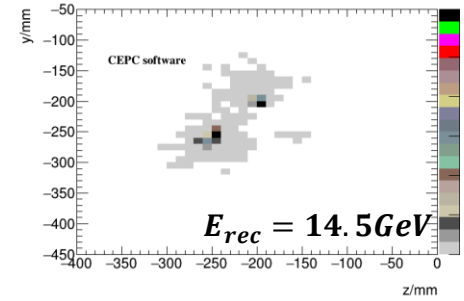
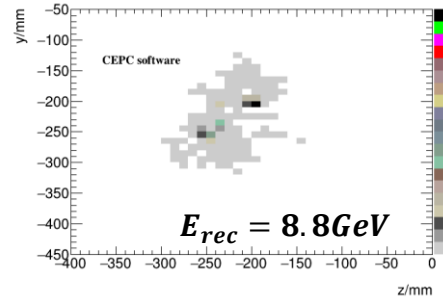
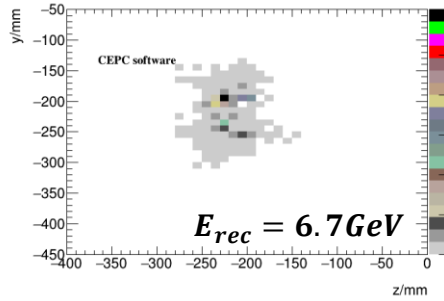


3cm*3cm

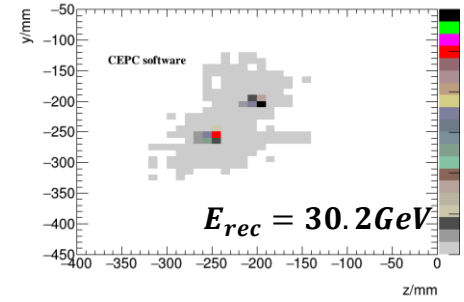
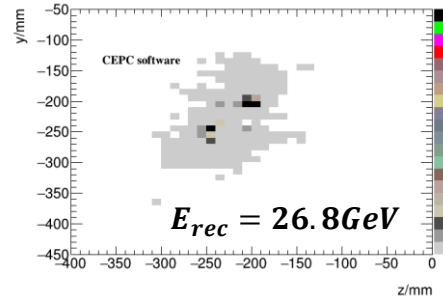
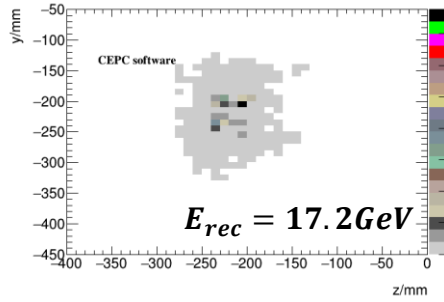
4cm*4cm

5cm*5cm

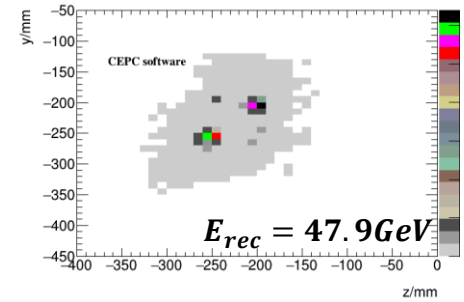
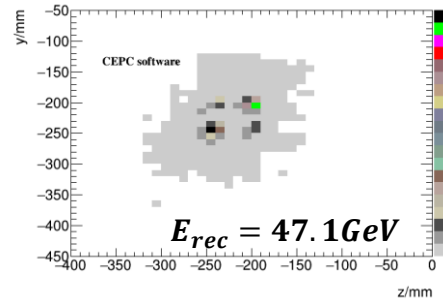
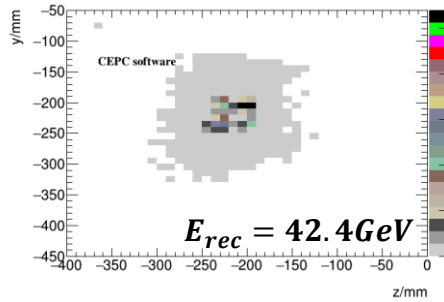
2σ



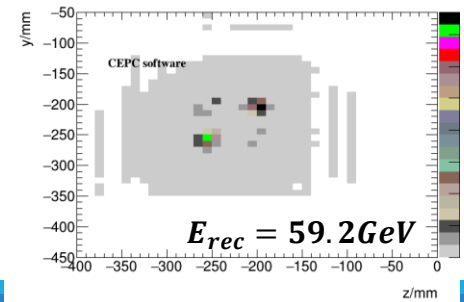
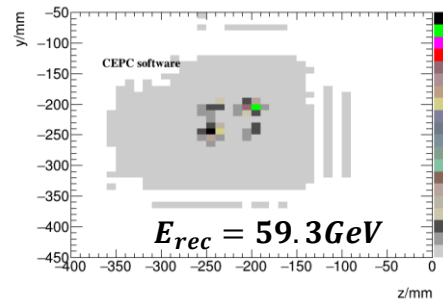
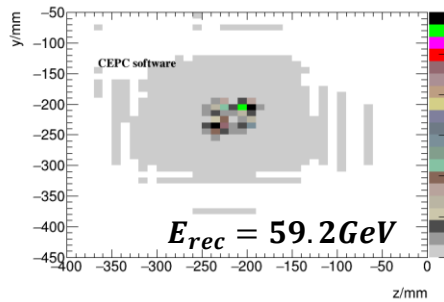
3σ



5σ



No cut



Conclusion

Remaining problem:

- Position mismatch in y-z plane.
- Energy uncertainty
- Energy loss and fake clusters