

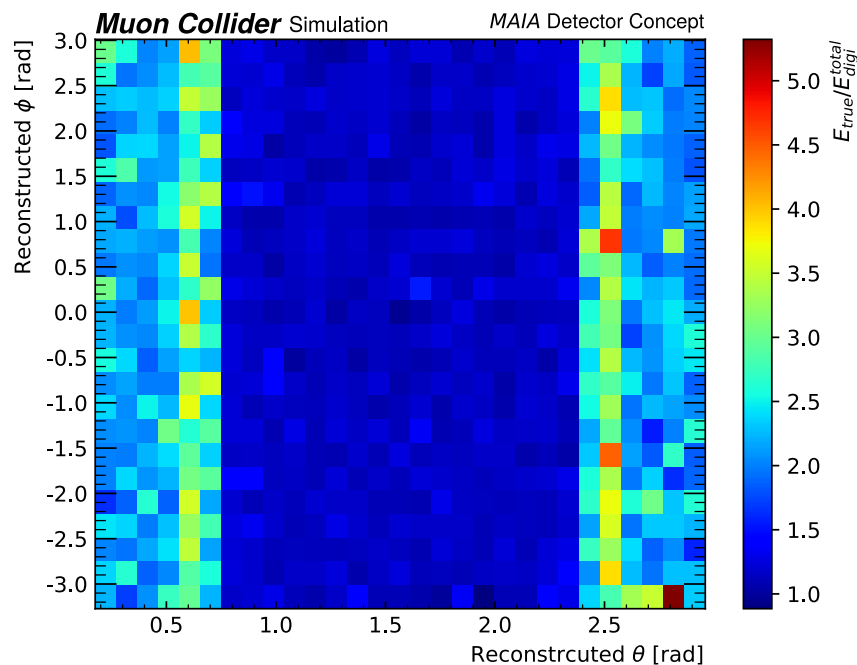


Calo Digi Updates

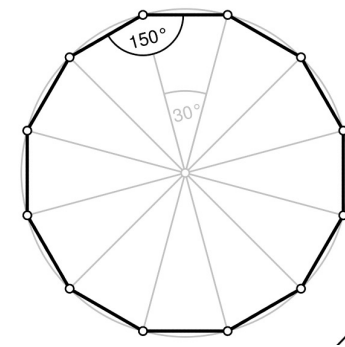
17 Jun 2025



Phi vs Theta, $E_{MC}/\Sigma E_{digi}$ for Neutrons

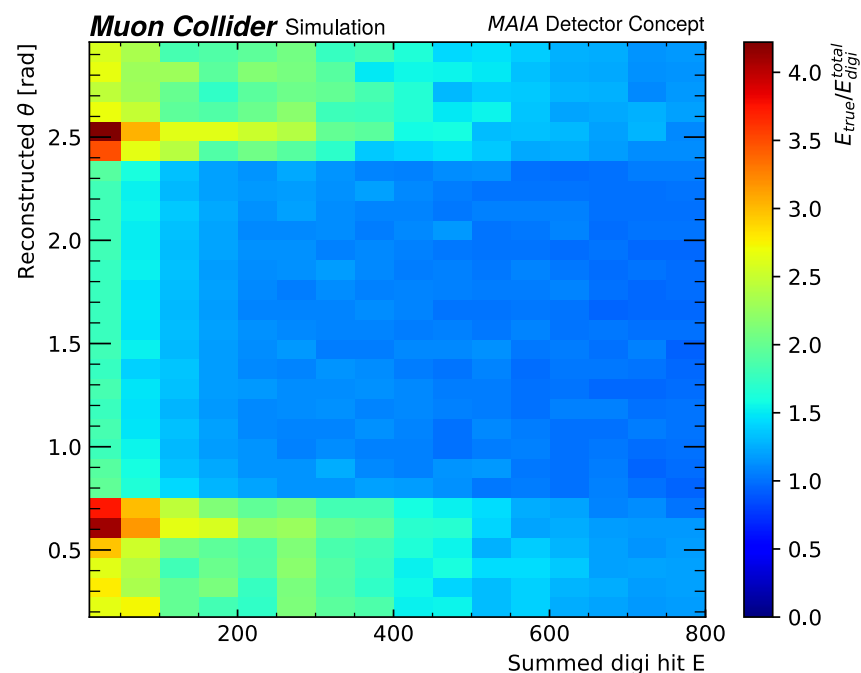


- Sum all digi hits in **ECAL and HCAL***
- Phi bins selected so that they alternate whether they contain a point or a flat section
- **Much** more energy loss in endcaps
 - Recall, this is where we see no ECAL contribution
 - Also a much larger stdev in response here



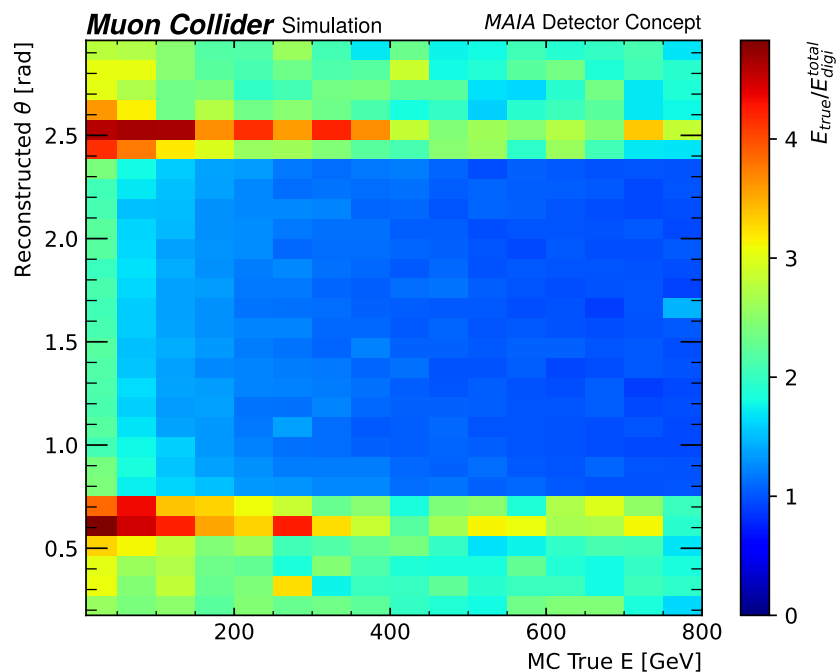
*For events meeting our matching criteria
(Nonzero amt of hits within dR cone 0.1, dt=2ns)

Theta vs ΣE_{digi} , $E_{\text{MC}}/\Sigma E_{\text{digi}}$ for Neutrons



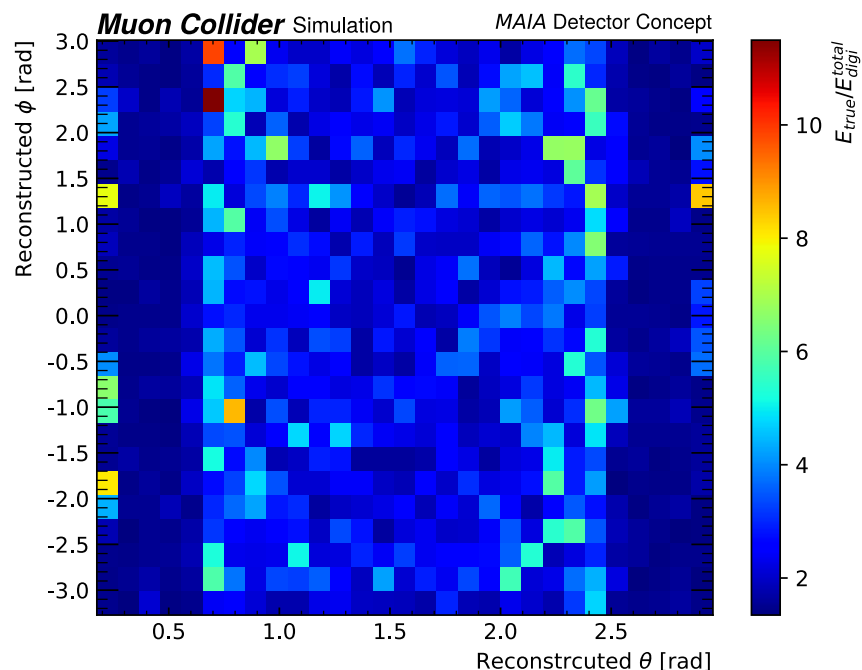
- **More** loss in endcap regions
 - HCAL and ECAL digi summed – contribution from both in barrel and transition regions
- Significant energy dependence!
- At $\Sigma E_{\text{digi}} > 500$ GeV, angular dependence is repressed
 - ECAL fraction less significant for these events?
- Below 100 GeV, significant loss in transition regions

Theta vs E_{MC} , $E_{MC}/\Sigma E_{digi}$ for Neutrons



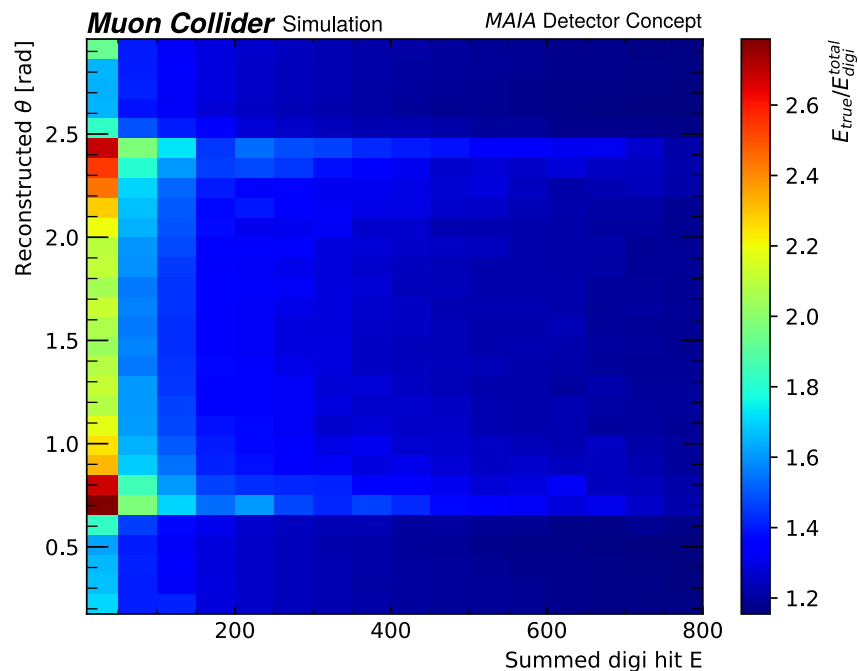
- Distinction between transitions and endcaps fade, distinction between barrel and endcap remains sharp
- Very poor performance in transition regions up to ~ 300 GeV MC energy

Phi vs Theta, $E_{MC}/\Sigma E_{digi}$ for Photons



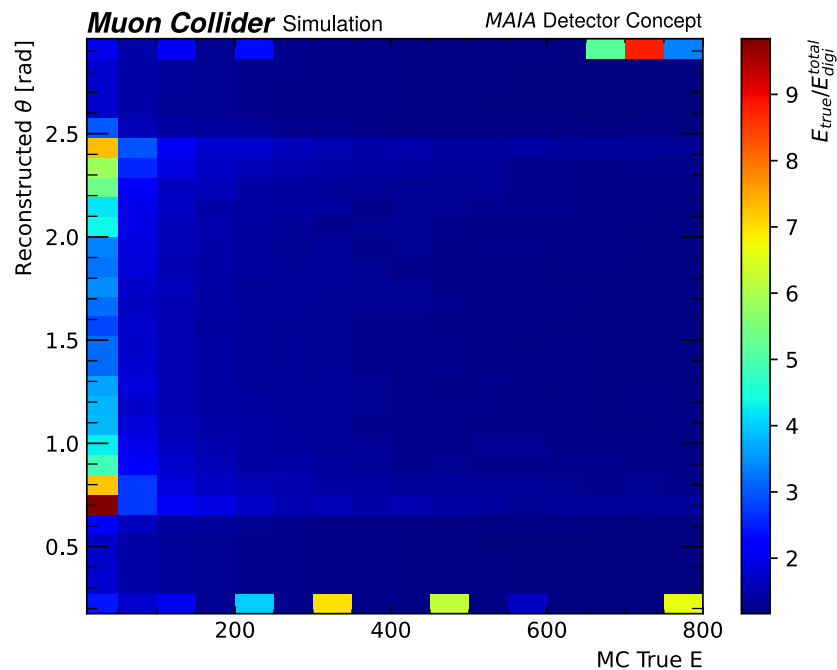
- Overall pretty good agreement in endcaps
- In barrel/transition, a lot more stochastic
- A few severe outliers in transition and edges of theta acceptance; response reaches $>10x$
- “Flipped” behavior from analogous neutron plot
 - Endcaps are consistent, in. $\sim 1-2x$ range
 - Barrel/transition has wider stdev, more energy loss

Theta vs ΣE_{digi} , $E_{\text{MC}}/\Sigma E_{\text{digi}}$ for Photons



- Similar structure to the analogous neutron plot (with endcap/barrel flipped)
- Angular dependence starts to fade around 700 GeV
 - Most severe under 50 GeV
- Globally very reasonable (mostly less than 2x) and smooth from cell to cell

Theta vs E_{MC} , $E_{MC}/\Sigma E_{digi}$ for Photons



- What I suspect are stats issues dominate at the edges of theta acceptance
- Qualitatively, behavior is much the same

Reflections

- A lot of this may be meaningless post-overlap-fixes
- On a digi level, neutron events without an ECal contribution lose much more of their energy; actually not much energy loss in the barrel once HCal and ECal hits are combined
- For the photon samples, ECal response (as a function of deposited digi energy) is significantly better than the reco response we've used to calibrate the samples
 - For photons, the issue is at the clustering stage, not digi
- For neutrons, the opposite is true
 - As Tova found, issue is further upstream than clustering
 - Will repeat this study once new samples are available, see how much can be attributed to energy non-conservation from overlaps