Photon v6 Updates

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v6 Sample Specs

- Latest no-BIB (BIB) photon samples located on OSG at

  `/data/DataMuC_MAIA_v0/v6/reco(BIB)/photonGun*`

- Close to full stats on BIB (either some didn't copy over or didn't finish; see file occupancy from each slice below)

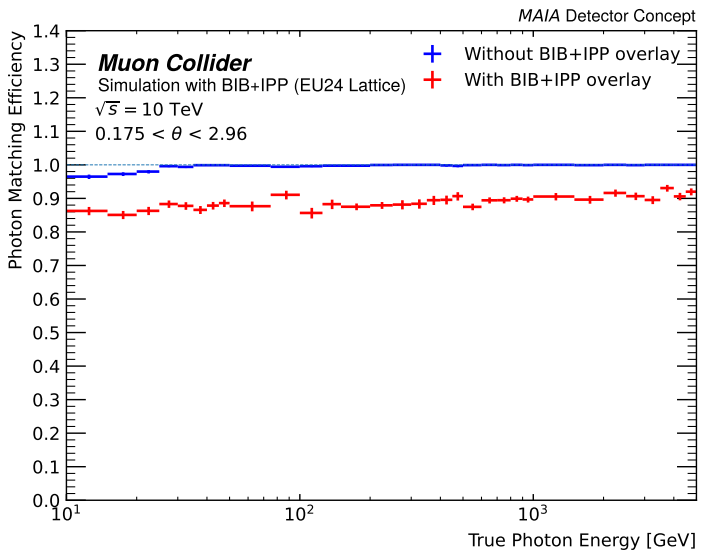
```
[Apptainer> ./check_files.sh /data/DataMuC_MAIA_v0/v6/recoBIB/photonGun_E_0_50/
File progress:
916/1000
[Apptainer> ./check_files.sh /data/DataMuC_MAIA_v0/v6/recoBIB/photonGun_E_50_250/
File progress:
470/1000
[Apptainer> ./check_files.sh /data/DataMuC_MAIA_v0/v6/recoBIB/photonGun_E_250_1000/
File progress:
968/1000
[Apptainer> ./check_files.sh /data/DataMuC_MAIA_v0/v6/recoBIB/photonGun_E_1000_5000/
File progress:
723/1000
```

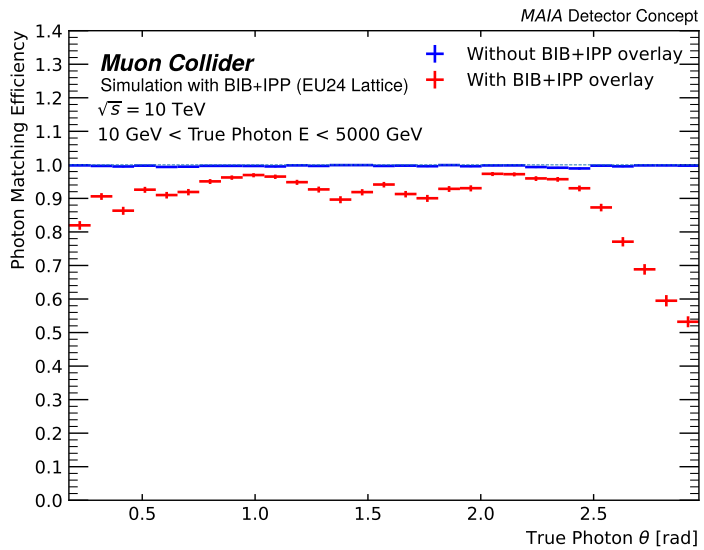
- Made with:
  - Latest software
  - `FTFP_BERT_HP` (thanks JP!)
  - Larry-style Pandora
  - 300ps timing cuts (thanks Alyna + Kiley!)

Efficiency

Matching efficiency plotted against energy (left) and theta (right). BIB matching efficiency is quite poor in the endcaps and exhibits strange asymmetry.

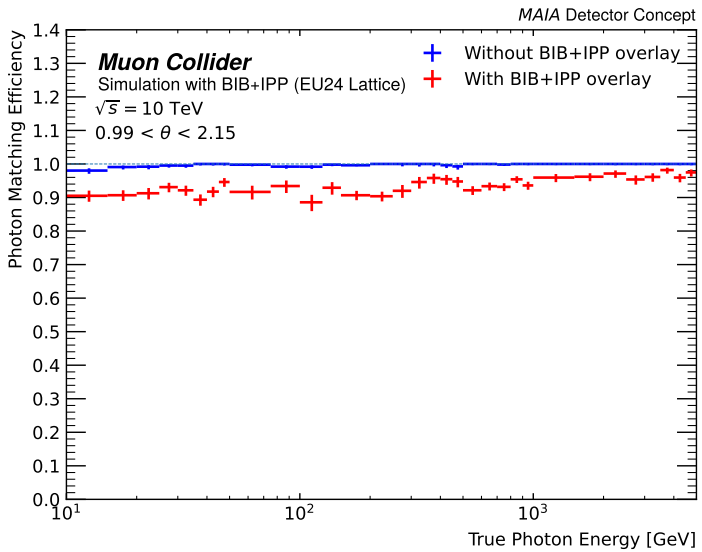
- Cause still under investigation (see following slides)

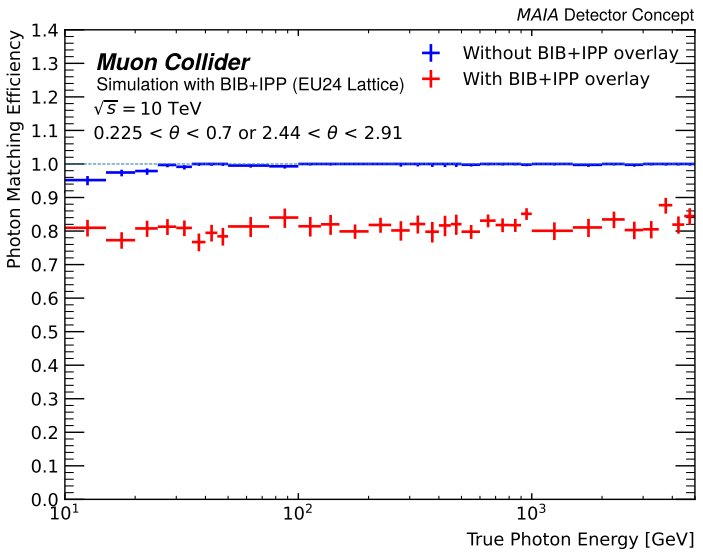




Efficiency, cont'd

Matching efficiency plotted against energy for the barrel (left) and endcap (right) regions. There is very little energy dependency; we see global degradation in the endcaps, whereas efficiency is above 90% in the barrel at all energies.

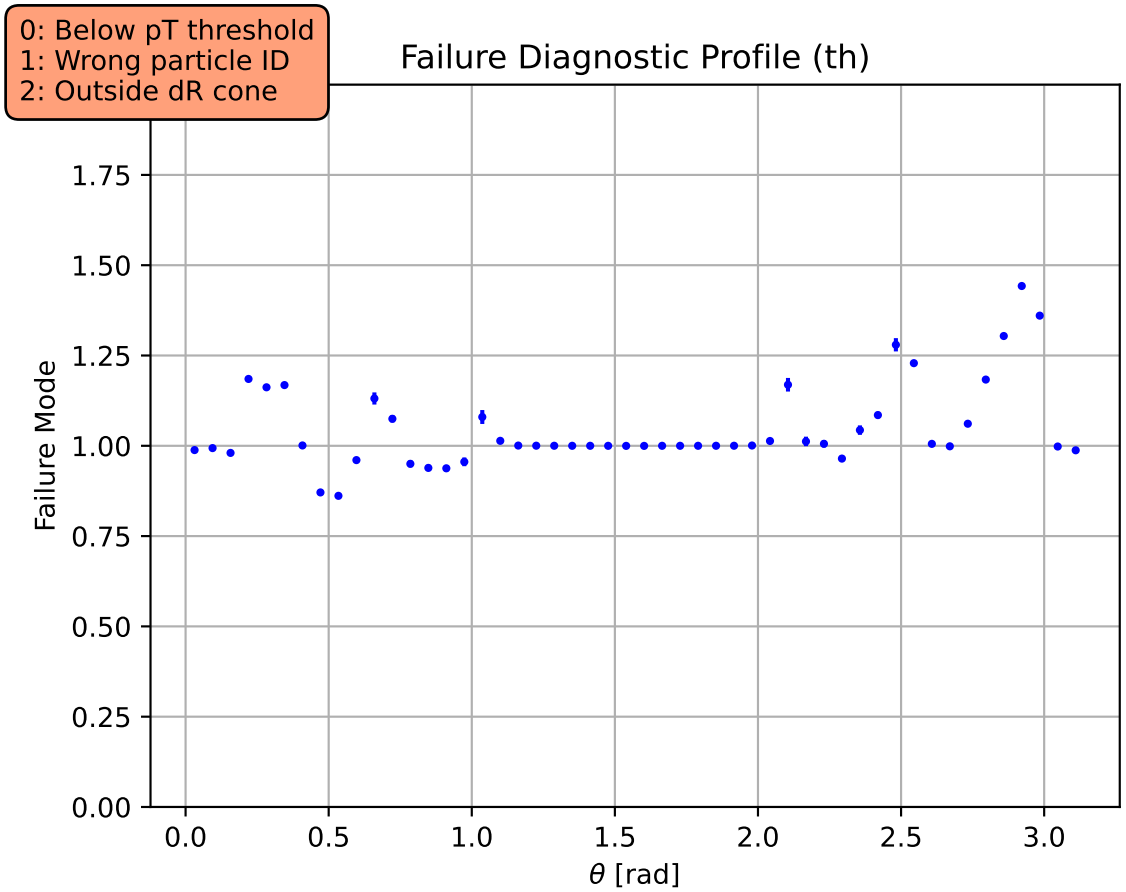




Matching Failure Diagnostics

In an attempt to understand the asymmetry and matching inefficiencies in the endcap region, looked at failure modes for candidate PFOs by polar angle

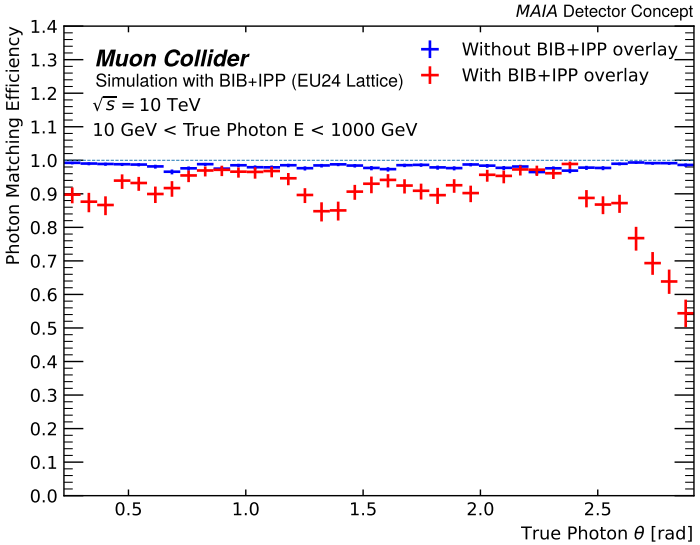
- Also tried turning off particle ID requirement, resulting efficiency with 10% stats is shown at right

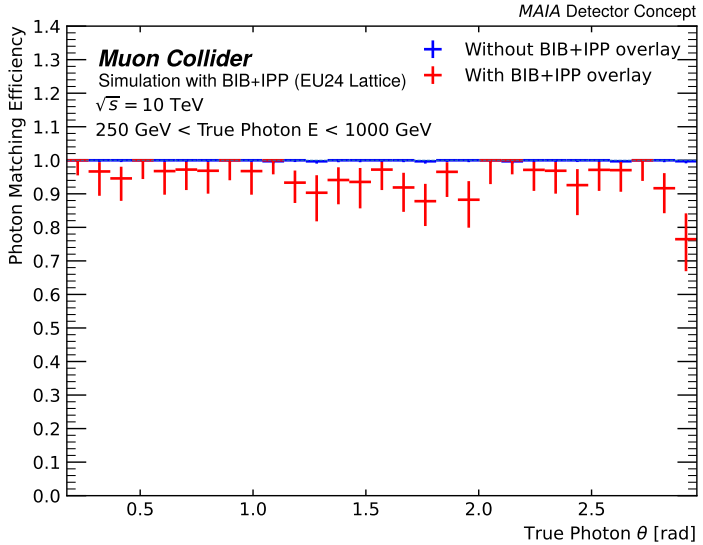


Inspecting Matching Requirements

Turned off the two requirements causing failure:

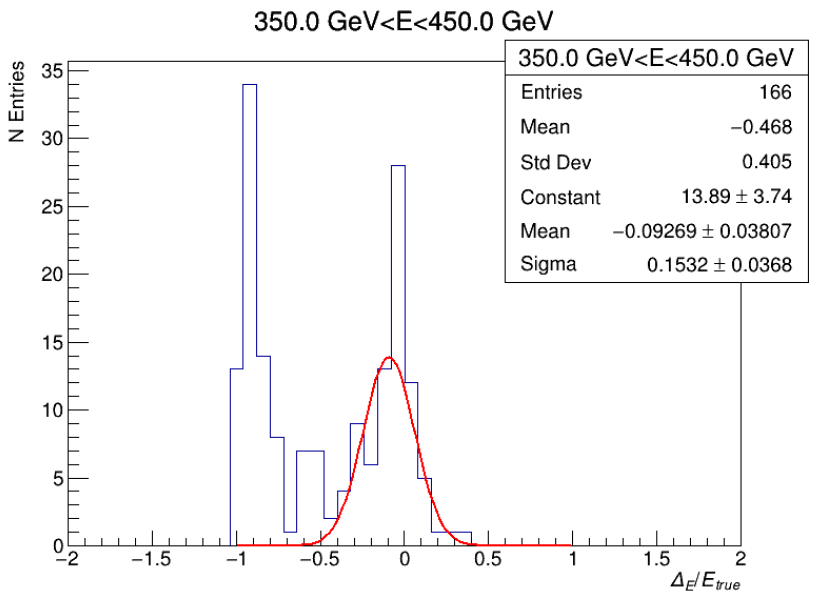
- At left, 10% stats without particle ID requirement
- At right, 10% stats without DR requirement

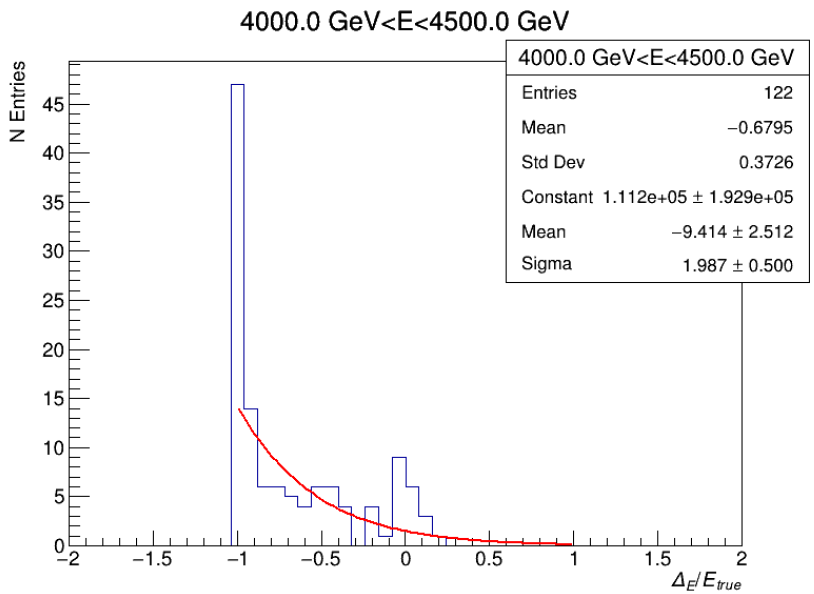




Resolution (Endcaps)

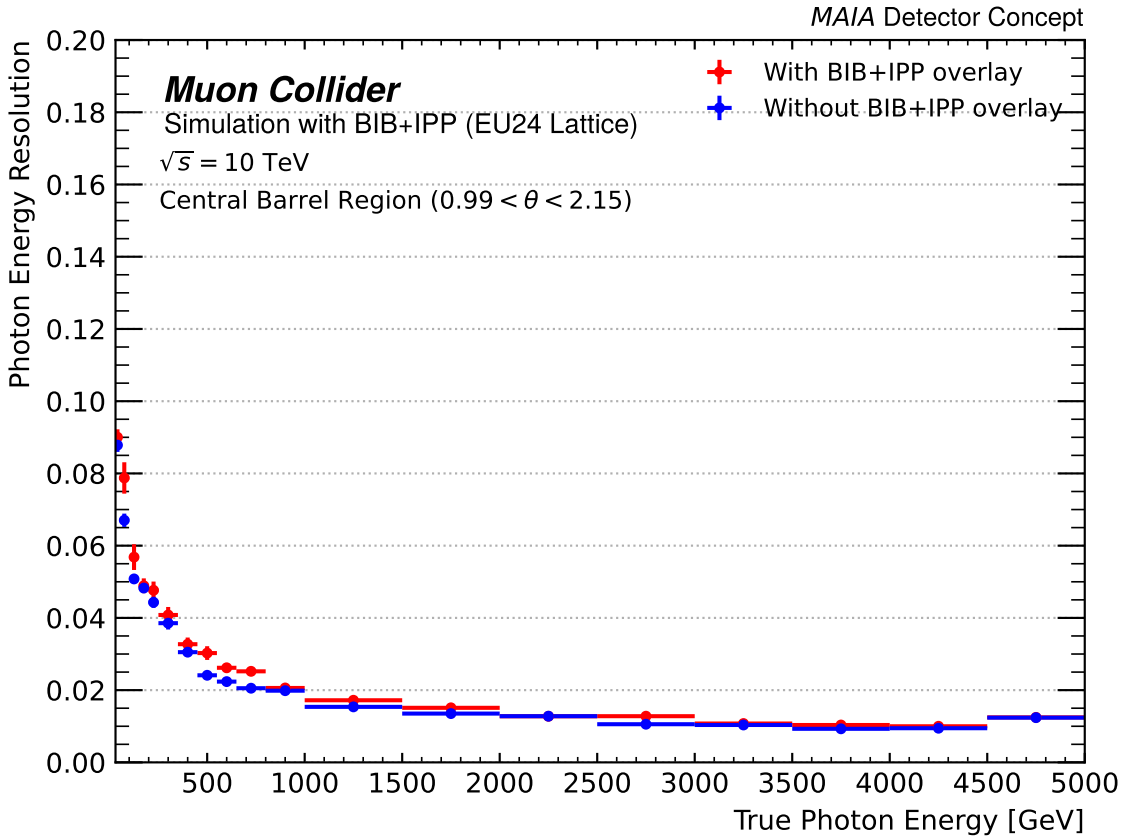
We have no resolution curve in the endcaps, as the individual Gaussian slices display extreme bimodality/lack of Gaussian structure. A clearly mismatched peak emerges at ~ -1. See representative slices below.





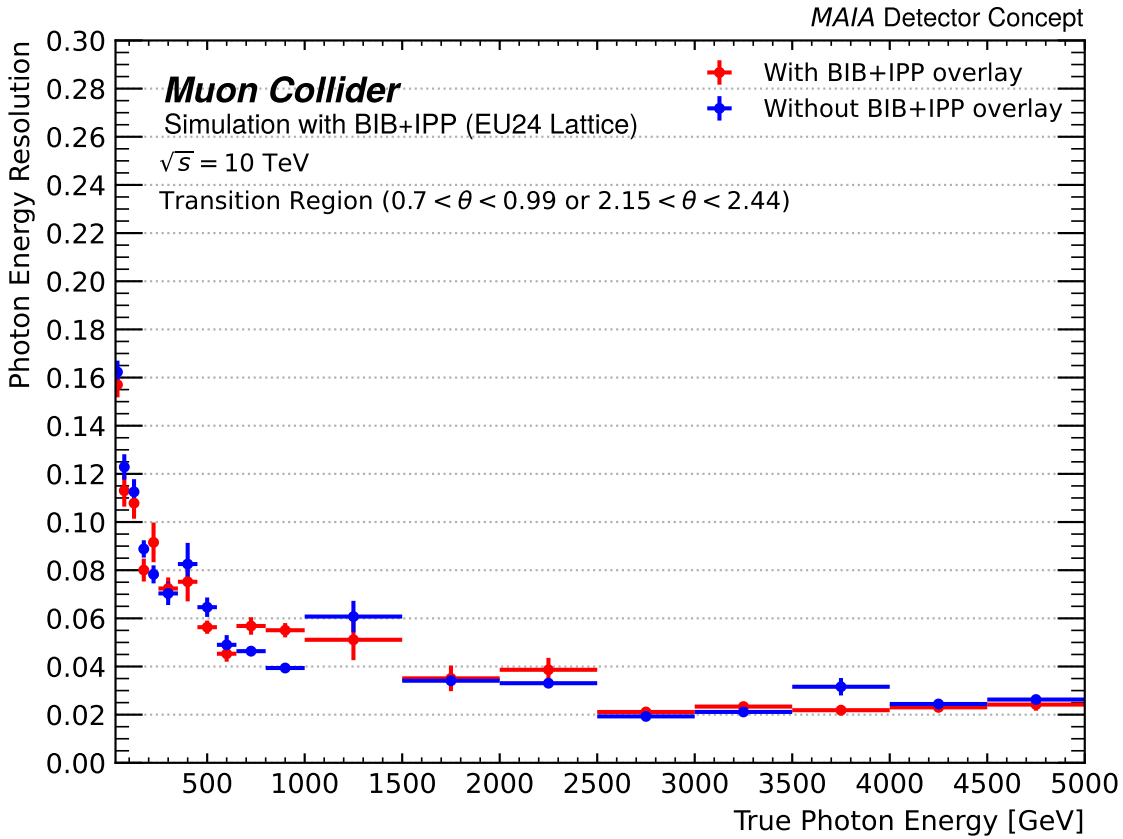
Resolution (Barrel)

Energy resolution in the barrel region, uncalibrated, with and without BIB. Best we've seen in a LONG time.



Resolution (Transition Region)

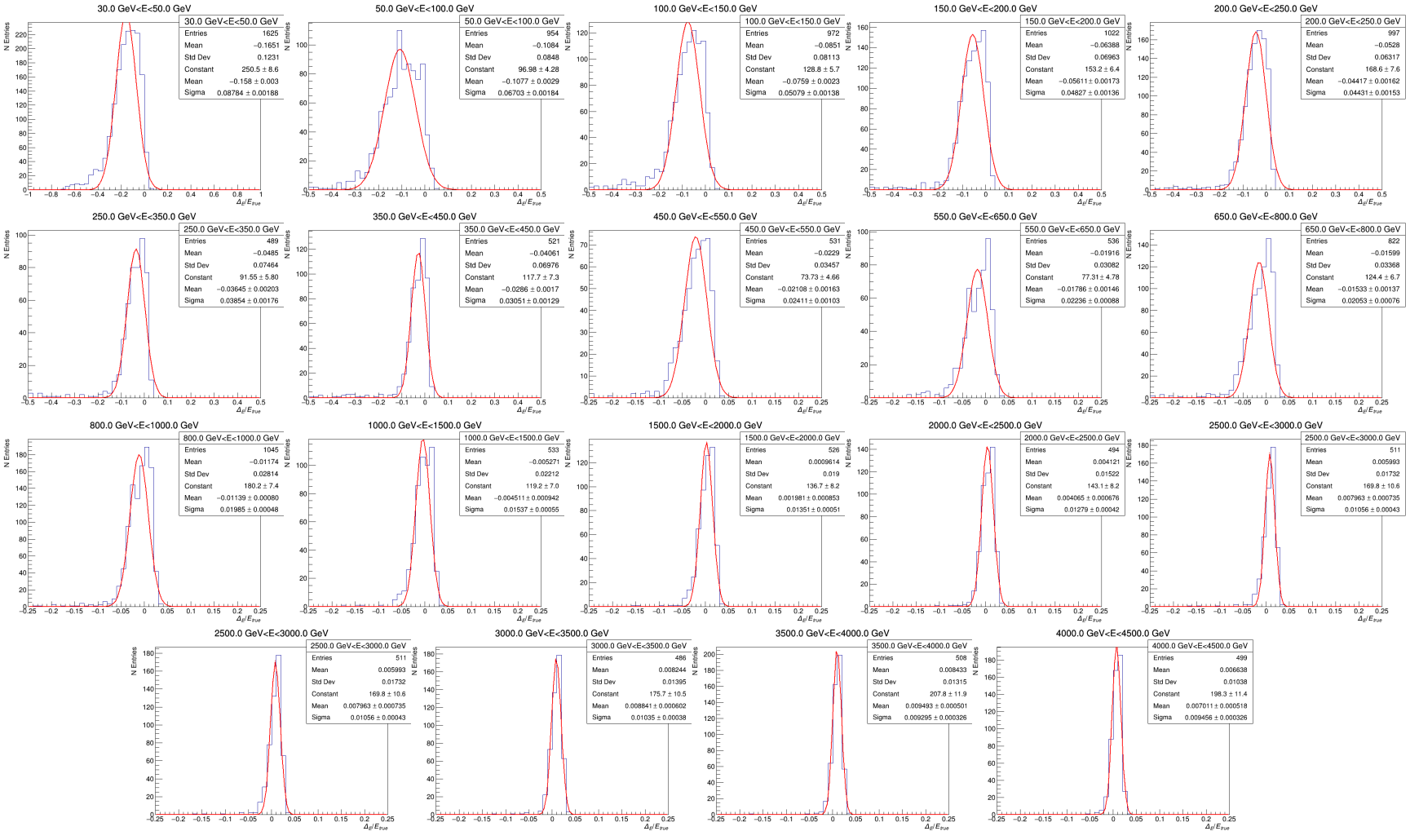
Energy resolution in the transition region, uncalibrated, with and without BIB. Again, BIB resolution looks really nice. Obviously some binning optimization needs to be done on both samples.



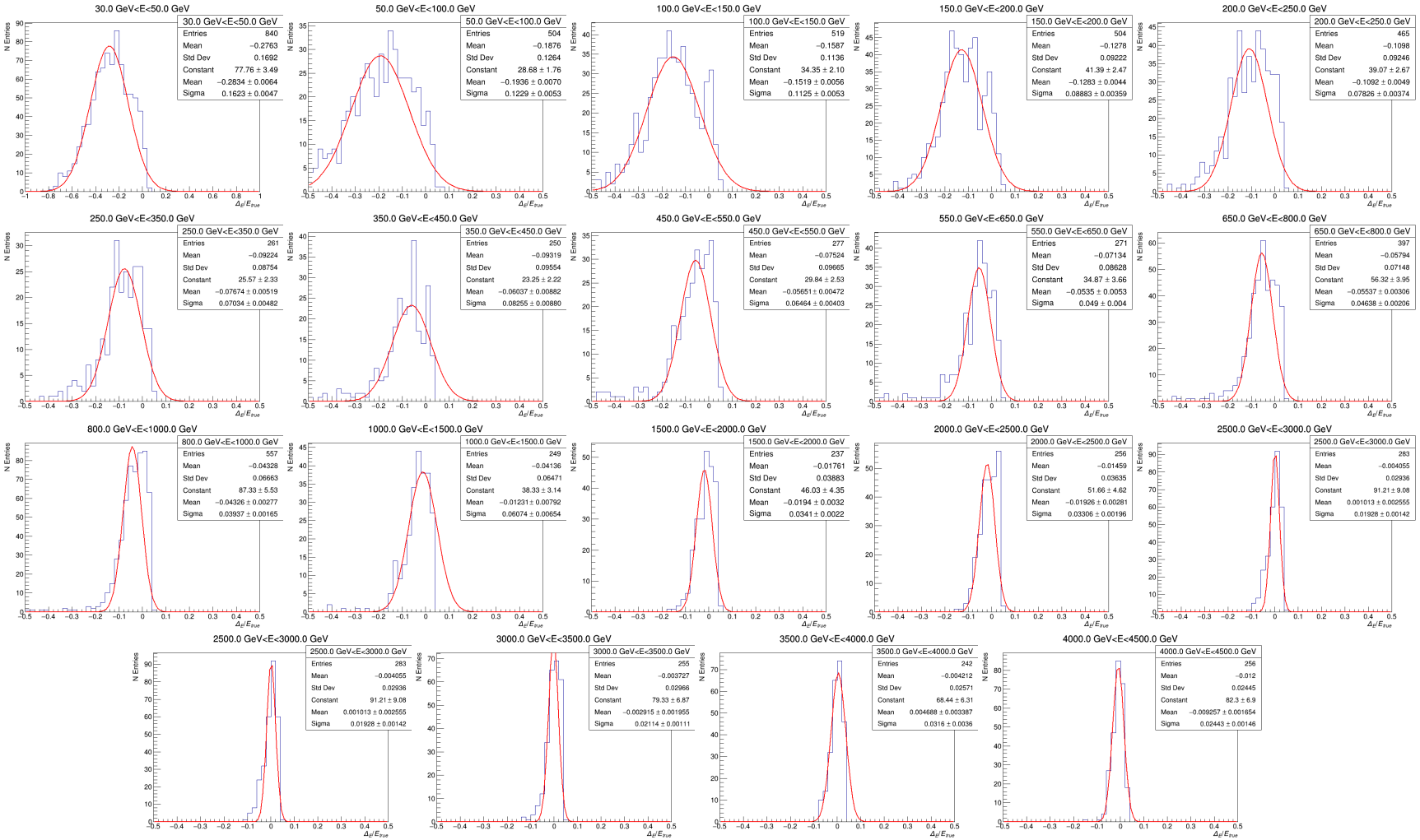
Next Steps

- Preliminary investigation has shown hints of angular dependence within the bimodality in the endcap region – mismatches are heavily represented near nozzles
- Will explore topology of events in that region
- Still need to refine the binning in the transition region
- I will look at v6 neutrons next!

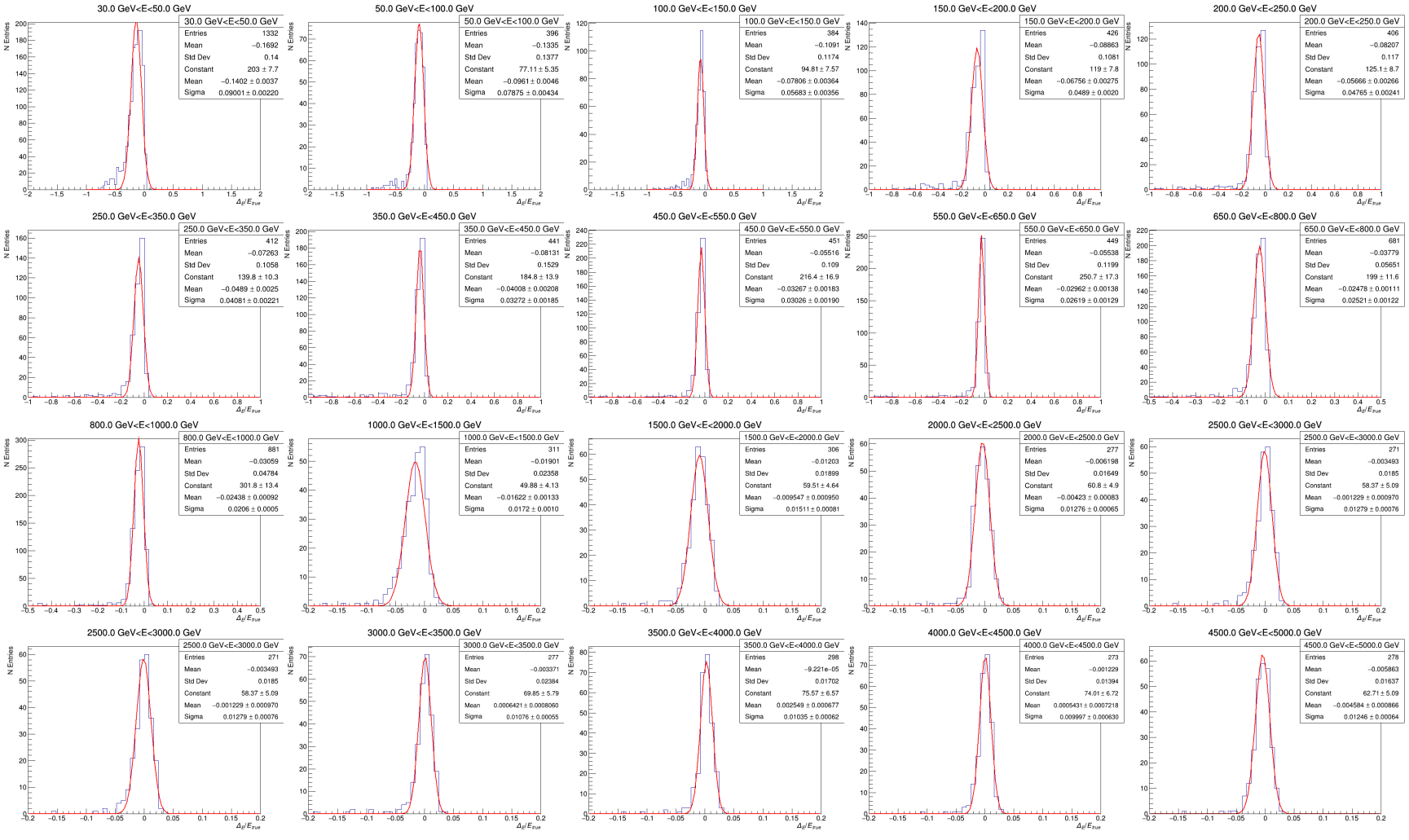
Gaussian Slices (Barrel – uncalibrated)



Gaussian Slices (Transition – uncalibrated)



Gaussian Slices (BIB Barrel – uncalibrated)



Gaussian Slices (BIB Transition – uncalibrated)