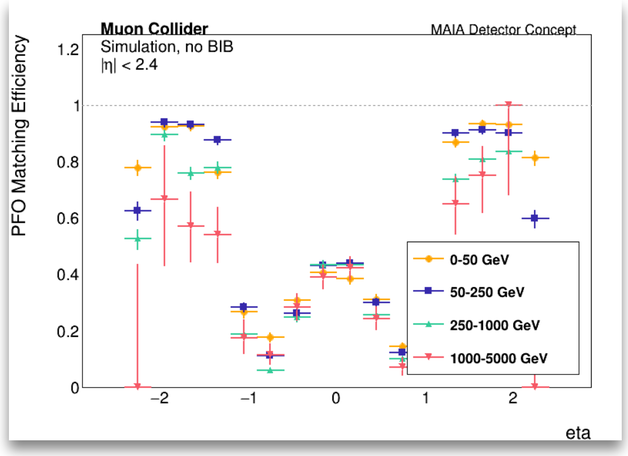
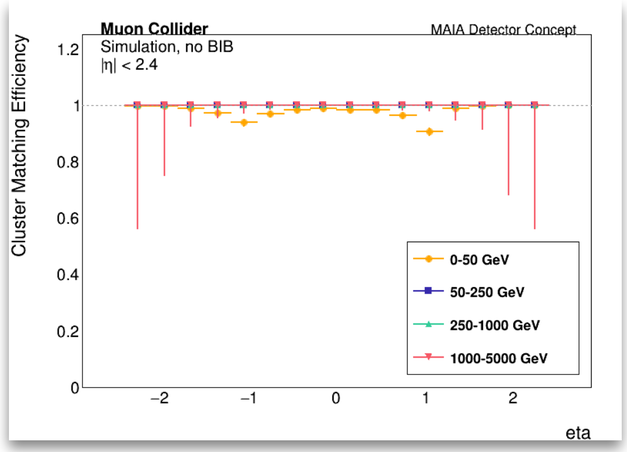
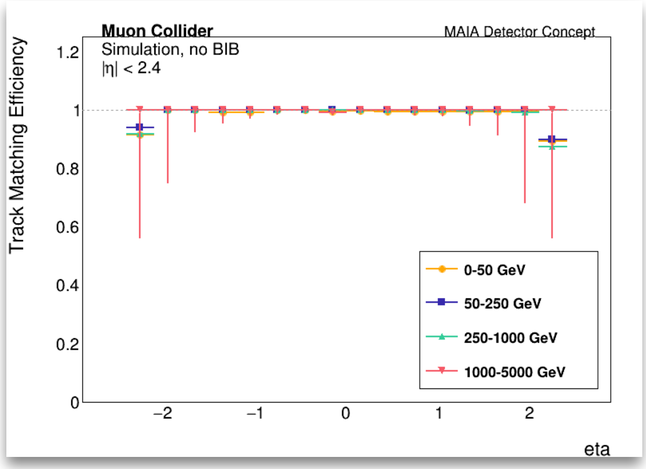
Electron reconstruction update

- Using V5 samples
- Have been looking into Pandoras PFA code, and looking at the variables and values for LCElectronID (the particle plugin used to create electron pfos)
- Since Pandora can reconstruct electron tracks and clusters efficiently
  - we can analyze the individual cluster hits to find updated values that we can implement in our own LCParticleID, that will work for the MAIA geometry
  - The goal in this is to see a higher reconstruction efficiency in electrons

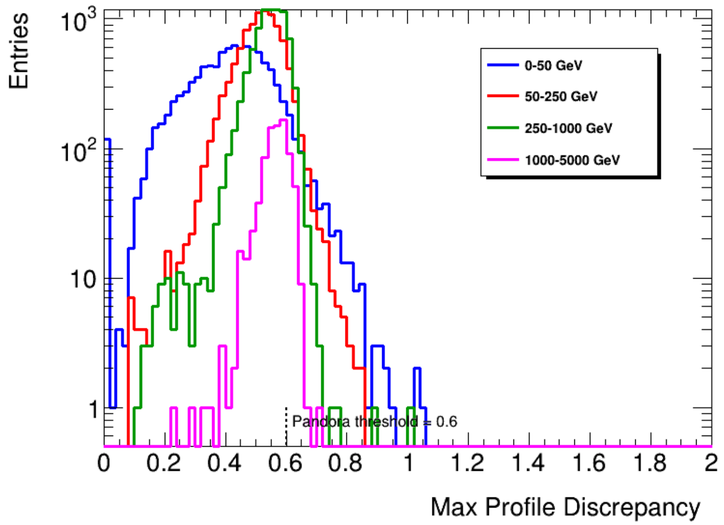
```
LCParticleIdPlugins::LCElectronId::LCElectronId() :
    m_maxInnerLayer(4),
    m_maxEnergy(5.f),
    m_maxProfileStart(4.5f),
    m_maxProfileDiscrepancy(0.6f),
    m_profileDiscrepancyForAutoId(0.5f),
    m_maxResidualEOverP(0.2f)
{
}
```







Max Profile Discrepancy



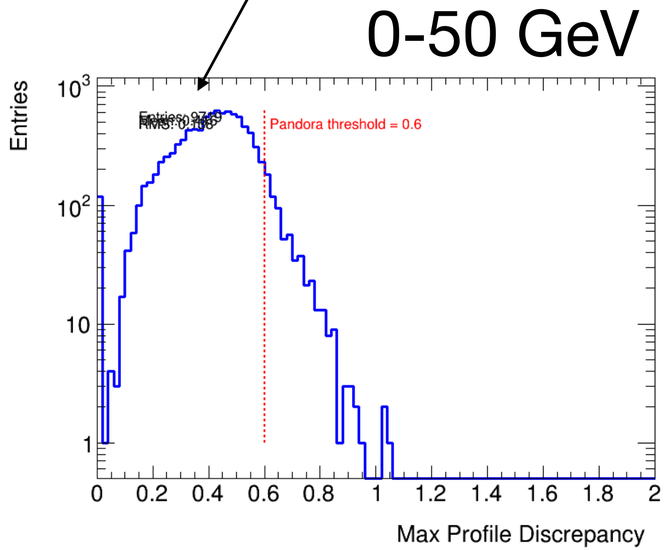
Profile discrepancy is a measure of how much the EM shower deviates from expected

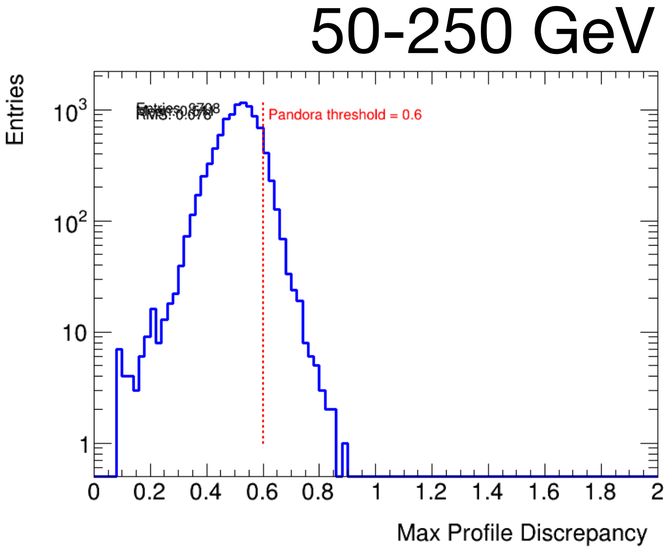
- the expected profile is made using a gamma distribution

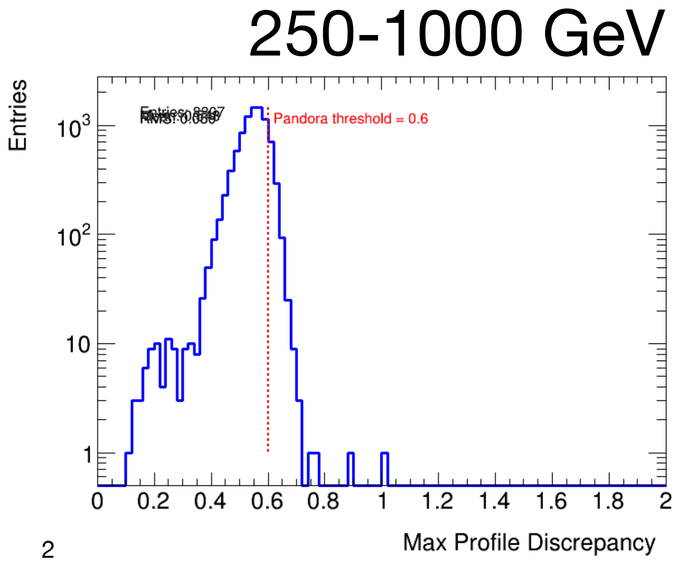
Thoughts are: an energy dependent max profile discrepancy should be looked into due to higher energies having larger profile discrepancies, and lower energies having a larger spread in profile discrepancy than higher energies

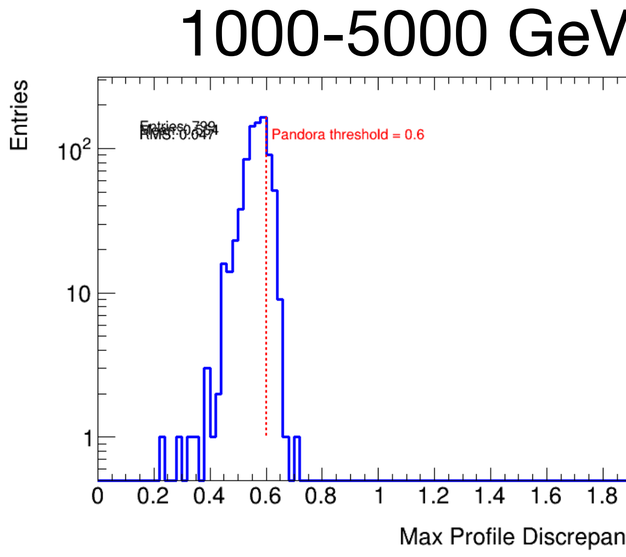
PROFILE DISCREPANCY SUMMARY STATISTICS				
pT Range (GeV)	Entries	Mean	RMS	% > 0.6
0-50	9719	0.416	0.138	6.9
50-250	9708	0.511	0.078	9.7
250-1000	8807	0.543	0.059	12.8
1000-5000	799	0.564	0.047	19.1

I apologize for this mess



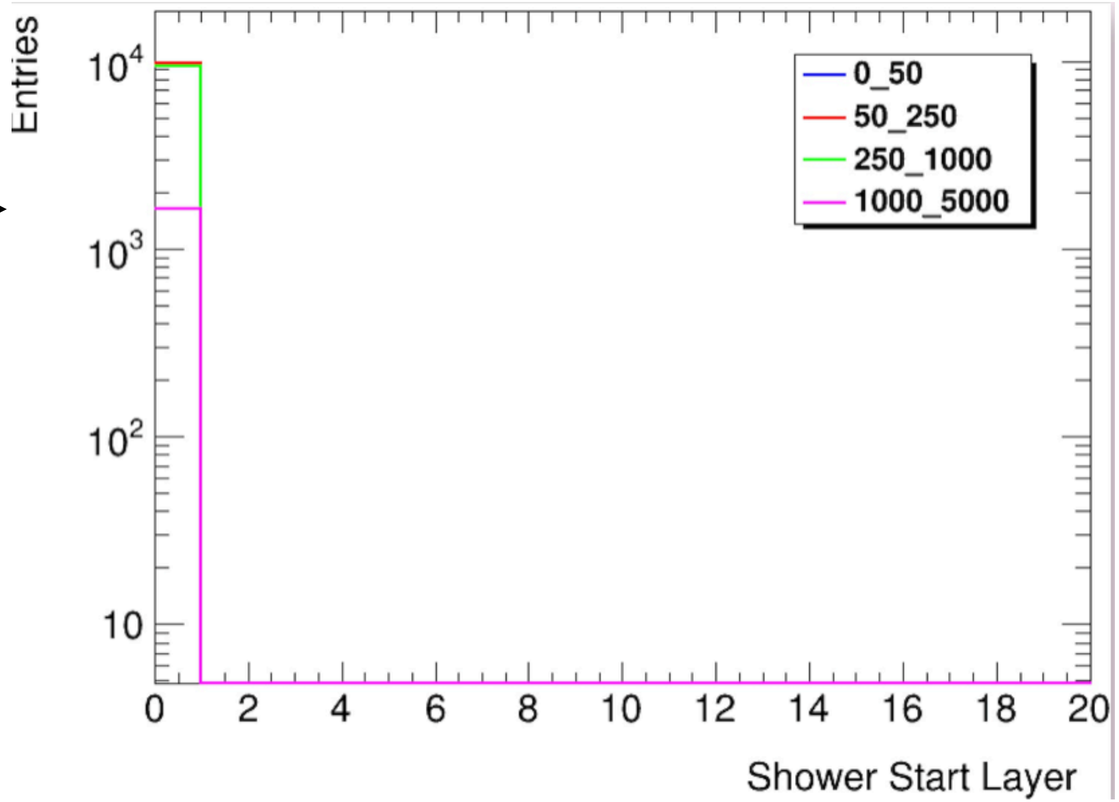






EM shower start layer

- In which layer of the ECAL does the EM shower first deposit more than 1% of its energy?
  - This plot corresponds with the variable max inner layer, which currently is 4
  - Pandora was built for a detector with less background and less material than the MAIA detector
  - Due to the extra tracking material and solenoid in front of the ECAL, showers are starting sooner than expected (they're expected to start showering when they hit the ECAL, but some higher pT electrons could travel farther in the ECAL before starting to shower which we don't see happening)
- Considering lowering this value from 4 to 2? Or might keep the same value and adjust more detrimental values first



Next Steps

- Working on plots to show the difference between E and p of electron cluster and track pair
- Currently this value is $0.8 < E/p < 1.2$
  - I feel like error could be happening here due to the solenoid in between tracker and ECAL, causing a bigger difference in E/p than expected
- Also currently working on code that will implement these variables and updated values to more efficiently create electron PFOs in the MAIA environment!