Muon reconstruction and updates

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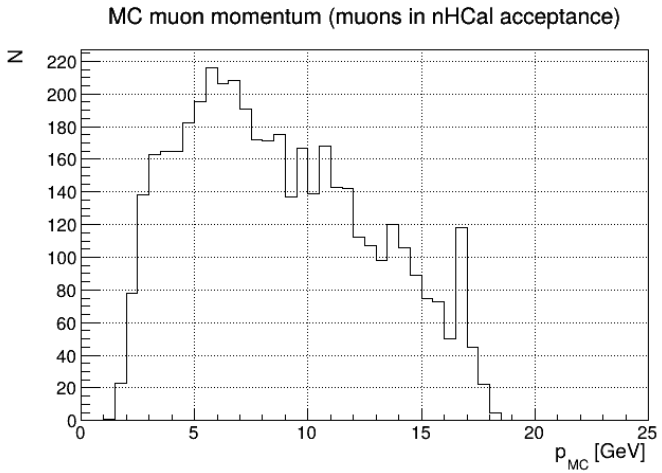
Outline

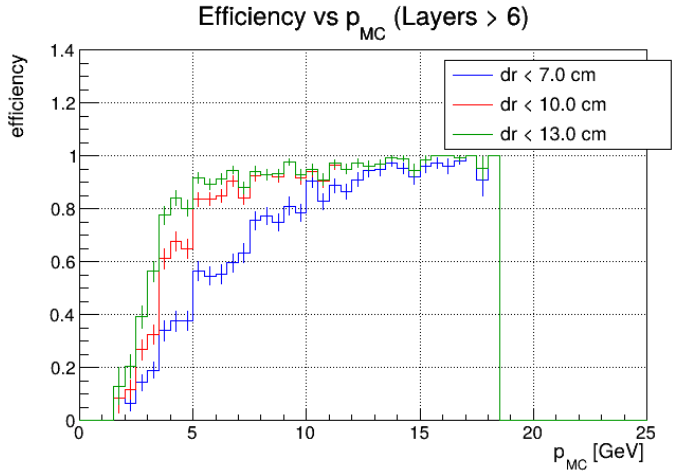
1. Geometry update
2. Muon/pion identification

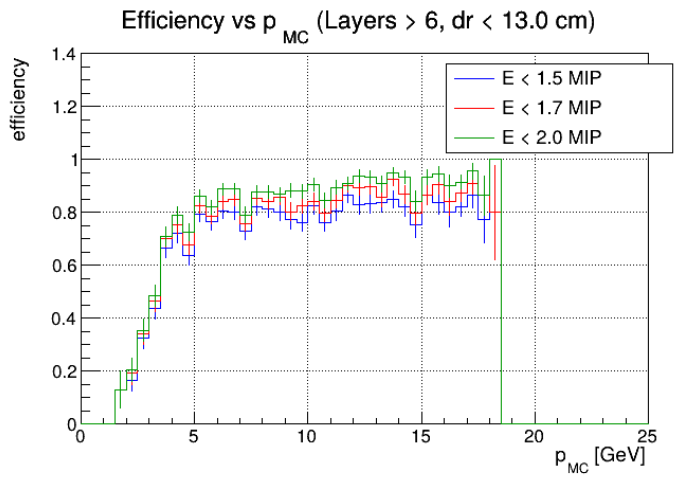
Geometry update

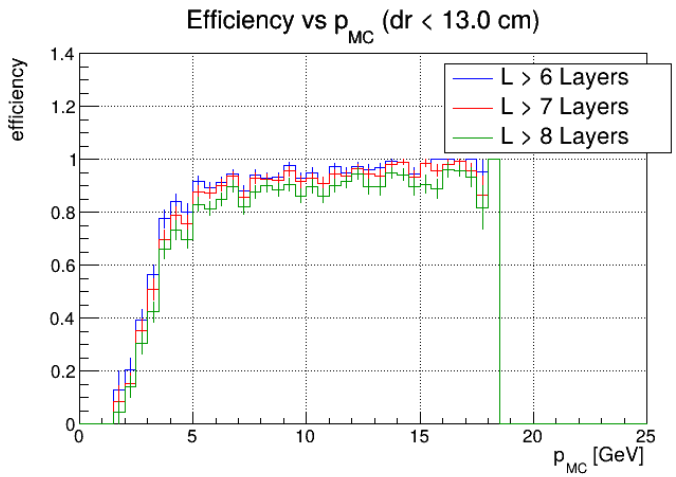
- Updated geometry to 10 layers of 4 cm steel and 2.4 cm scintillator
- Already merged with epic main branch
  - `https://github.com/eic/epic/pull/979`
- Separate, potential issue with overlap between flux return and extended nHCal during sampling fraction calculation
- Need to check the impact
- Missed by the overlap check

Muon identification



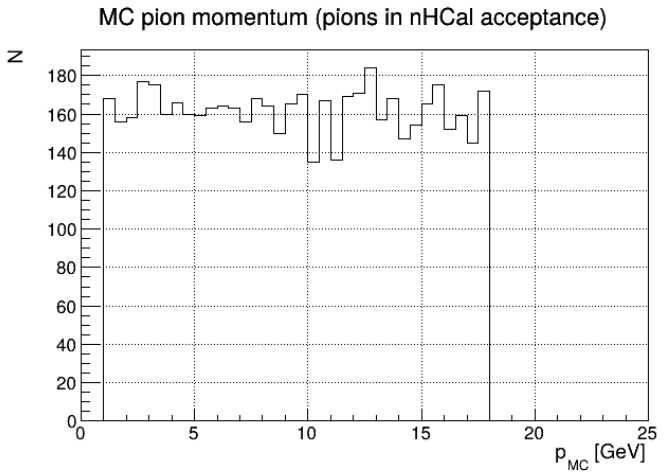


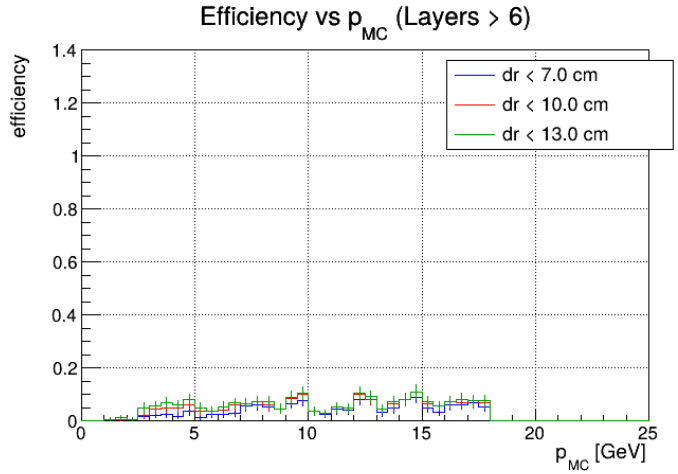


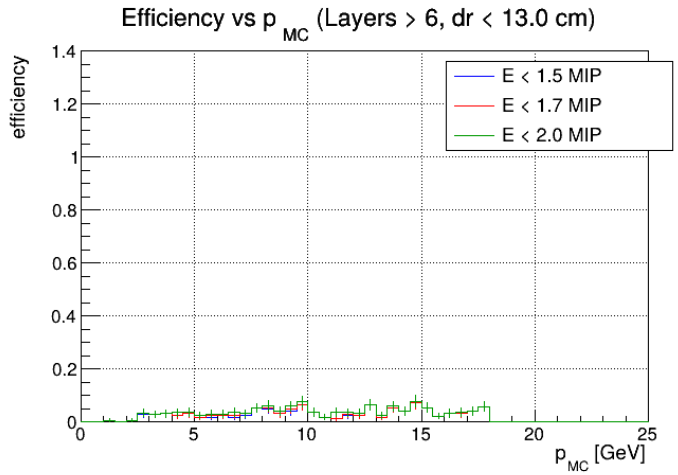


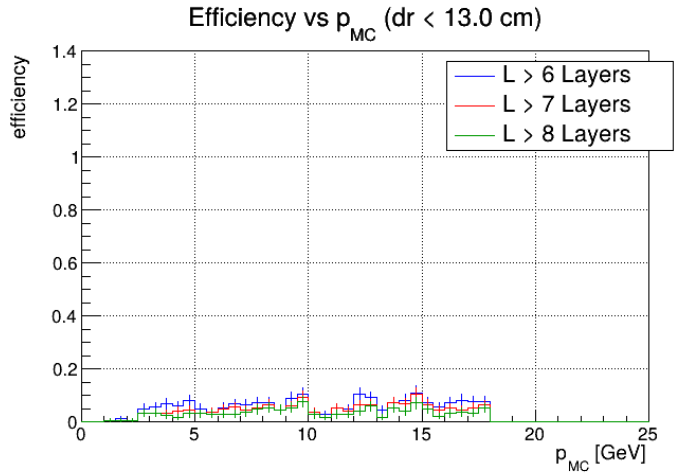
- Now requiring $\frac{E_{proj}}{E_{layer}} > 0.8$ for each point
- Works good for muons
- See nHCal benchmarks:
  `https://github.com/eic/detector_benchmarks/tree/pr/nhcal/benchmarks`

Pion rejection









- Now requiring $\frac{E_{proj}}{E_{layer}} > 0.8$ for each point
- Some pions still pass, may be indistinguishable from muons for a given thickness
- Expected fraction of pions not interacting hadronically:
  - $e^{-2.5} = 0.082085$ nHCal
  - $e^{-3.5} = 0.0301974$ nHCal+EEEMCal
- This means we may need a thicker detector to improve muon/pion ID

Summary

- Implemented updated geometry
- Looks like there may be an upper limit in muon/pion ID performance for a given thickness

BACKUP