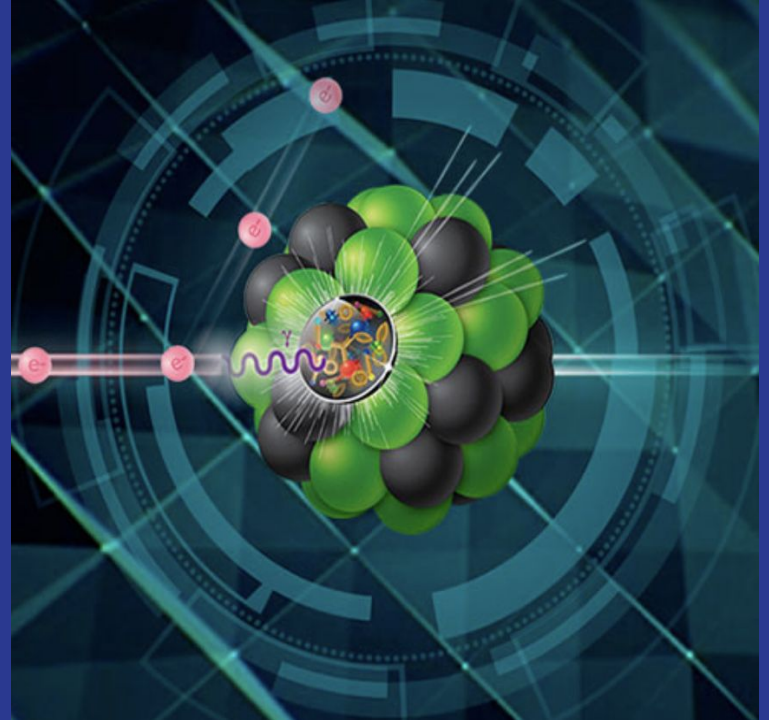


Minimum-Ionizing Particle (MIP) Analysis Results



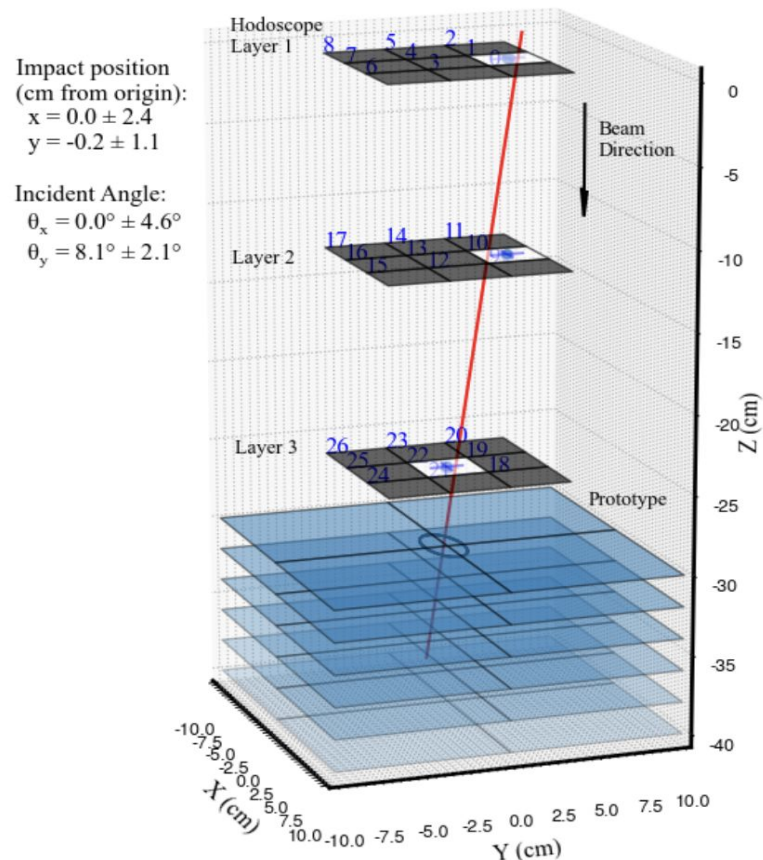
Chase Owen

March 1st, 2024



The Goal:

- This project is intended to improve existing code
- Code parses cosmic ray data to determine the effectiveness of our calorimeter design



Explanation of Terminology

What is a calorimeter?

- Detector used for measuring energy from outgoing particles at the EIC (Electron Ion Collider)
- Inside the detector: plastic tiles ionized by particles -> scintillate, producing light
- Such light is absorbed into a silicon photomultiplier (SiPM)
- Resulting in 5D information of a particle shower (Space, Time, Energy)

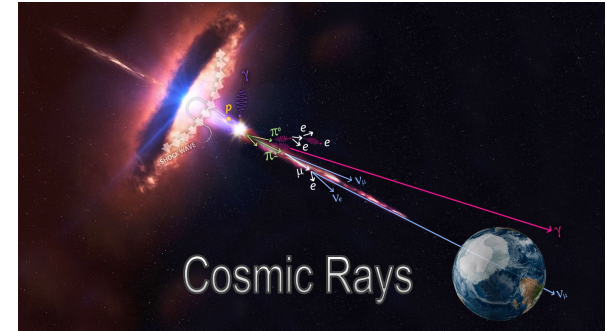
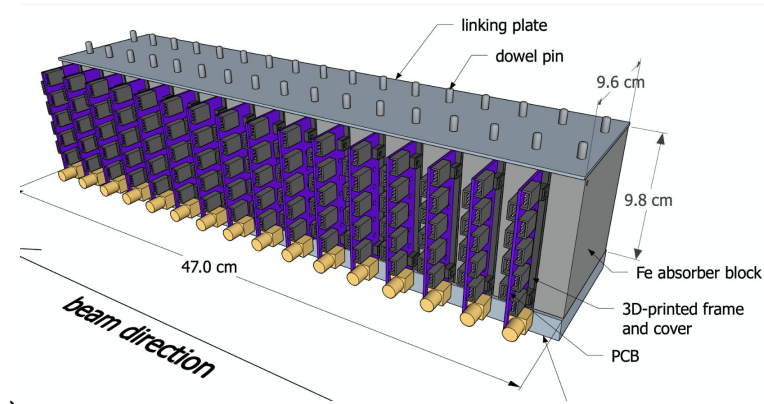
What are cosmic rays?

- High-energy particles moving through space at nearly the speed of light

What is a MIP?

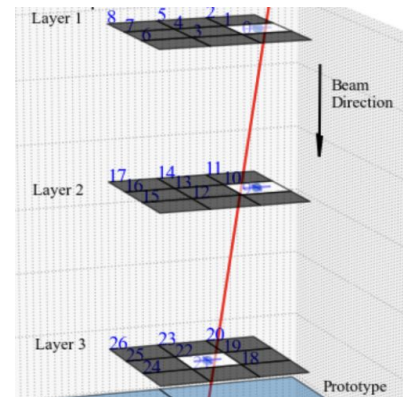
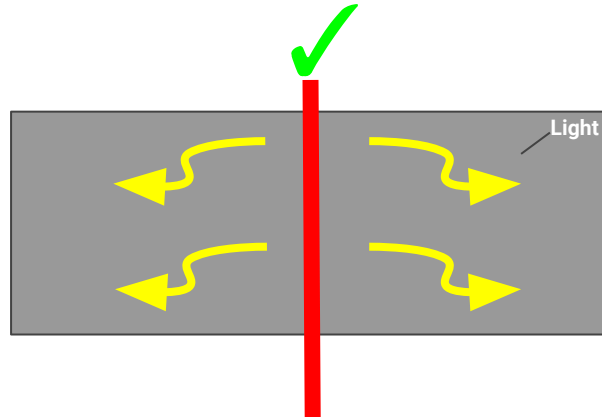
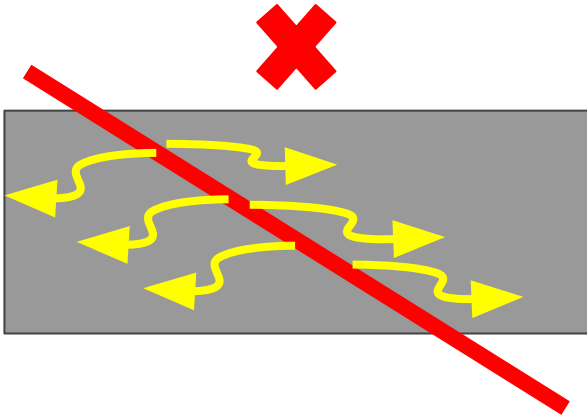
- Detector specific unit of energy, determined by the energy deposited from a minimum-ionizing particle (e.g. cosmic ray muon)
- Unit depends on path length through detector, sensitive to incoming angle

Calorimeter Design



Difference Between Codes

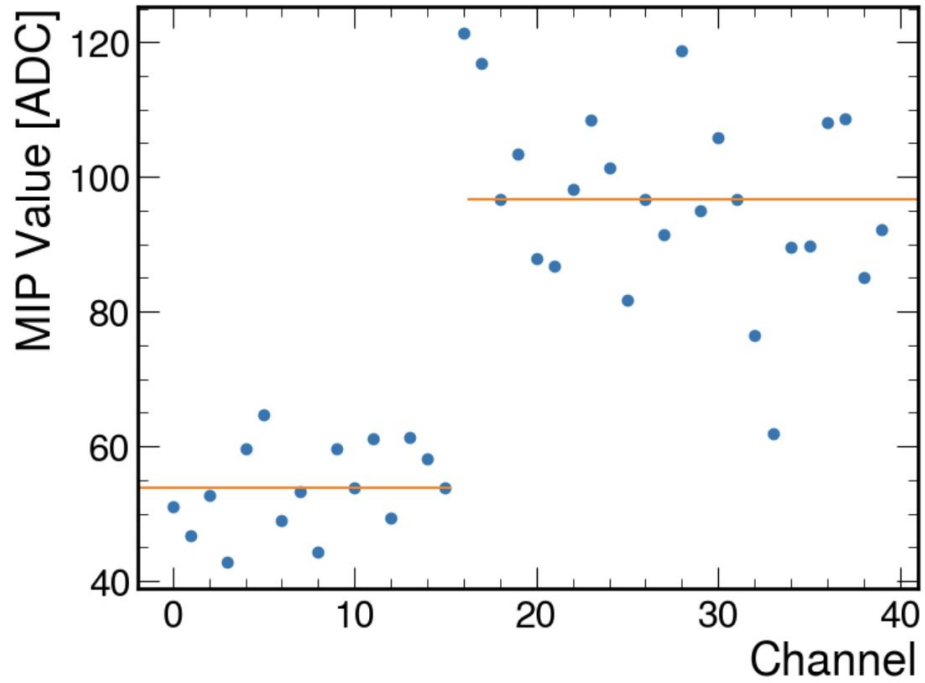
My updated code applies new geometric cuts to restrict the angle of incoming cosmic rays. Essentially, I am limiting events only to those whose path lengths are perpendicular to detector





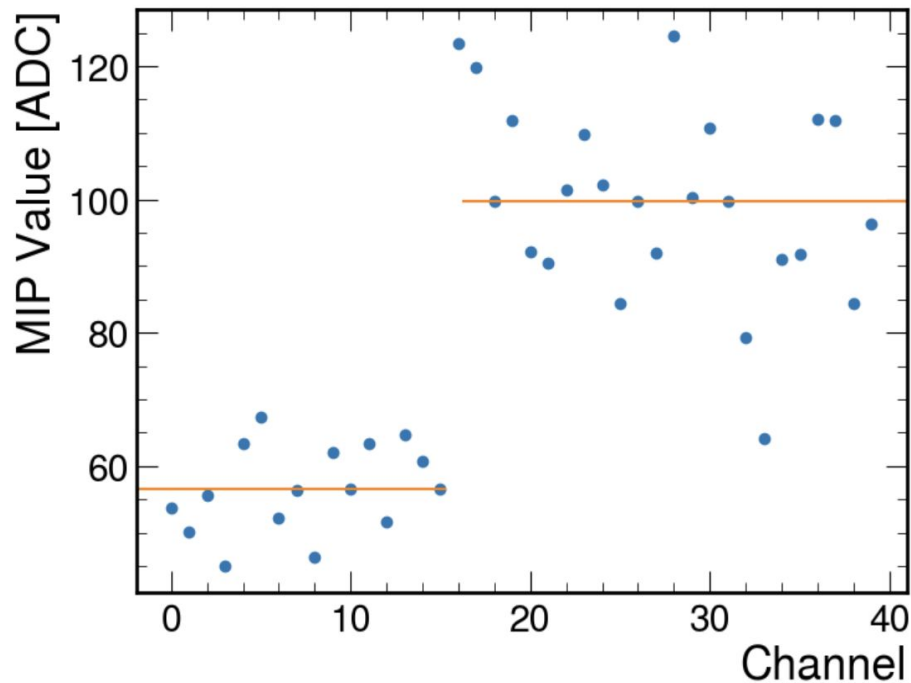
The following comparisons show the difference between the old and new code

Average mean value:
79.49806591628462
Average width value:
267.8783049655859

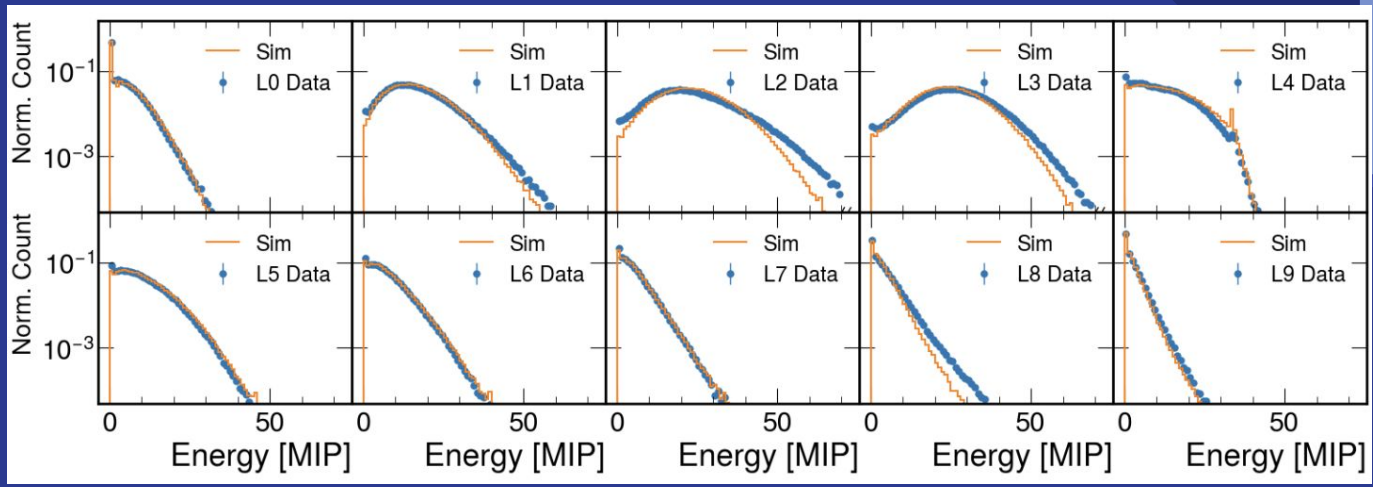


Old

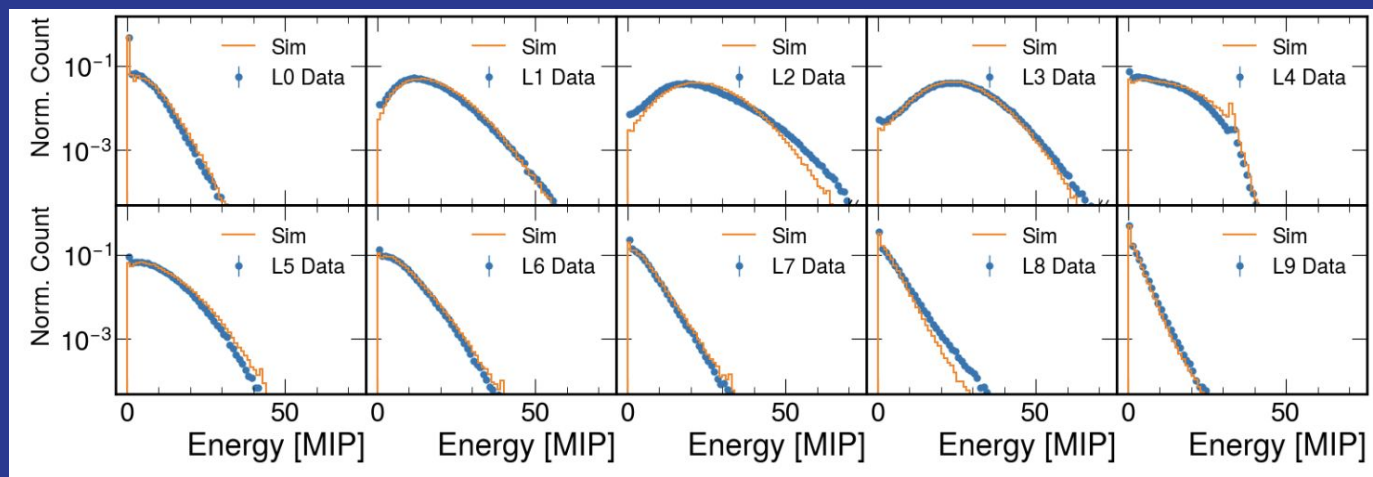
Average mean value:
82.47681704159723
Average width value:
124.04371149242272



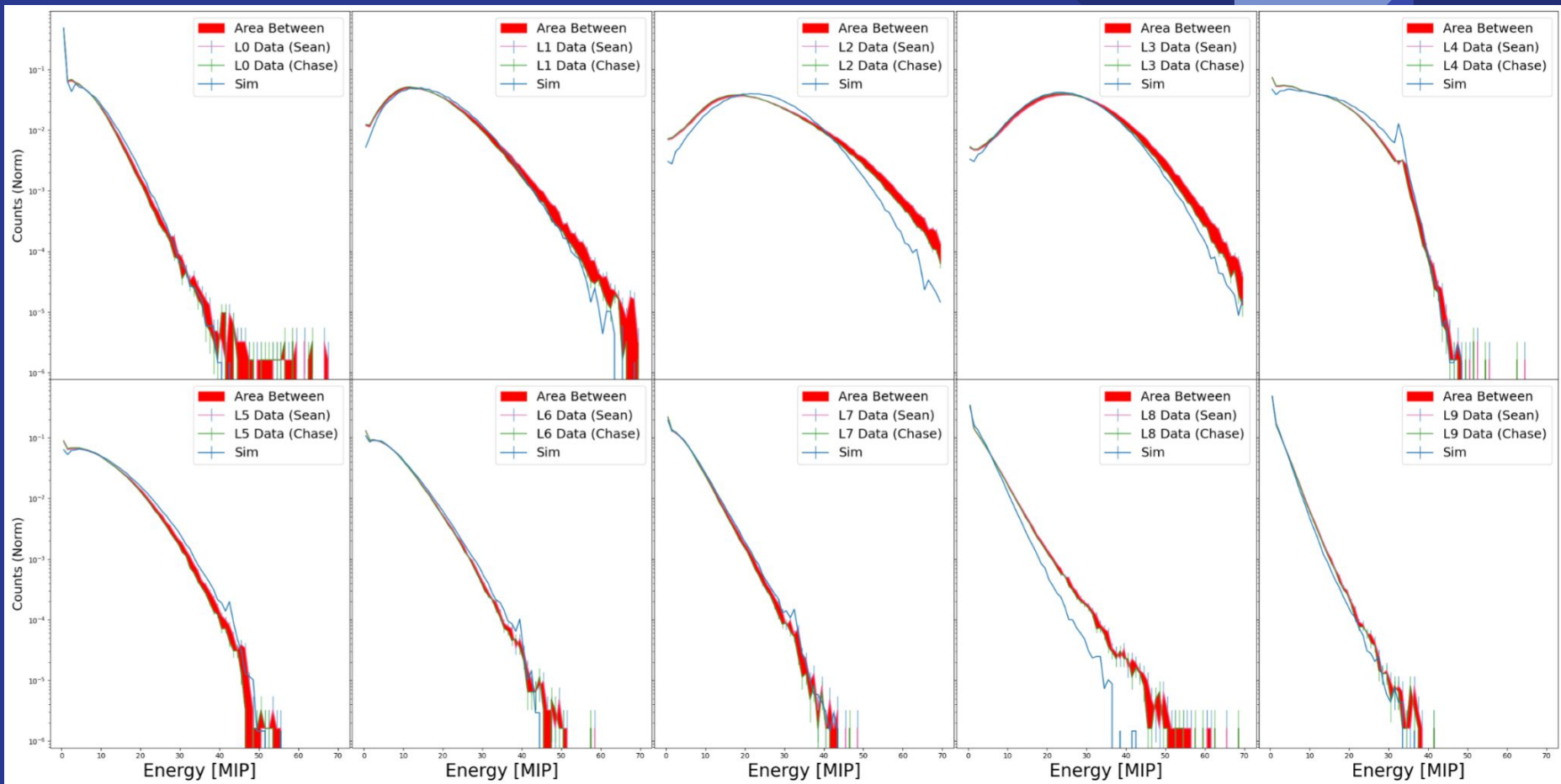
New



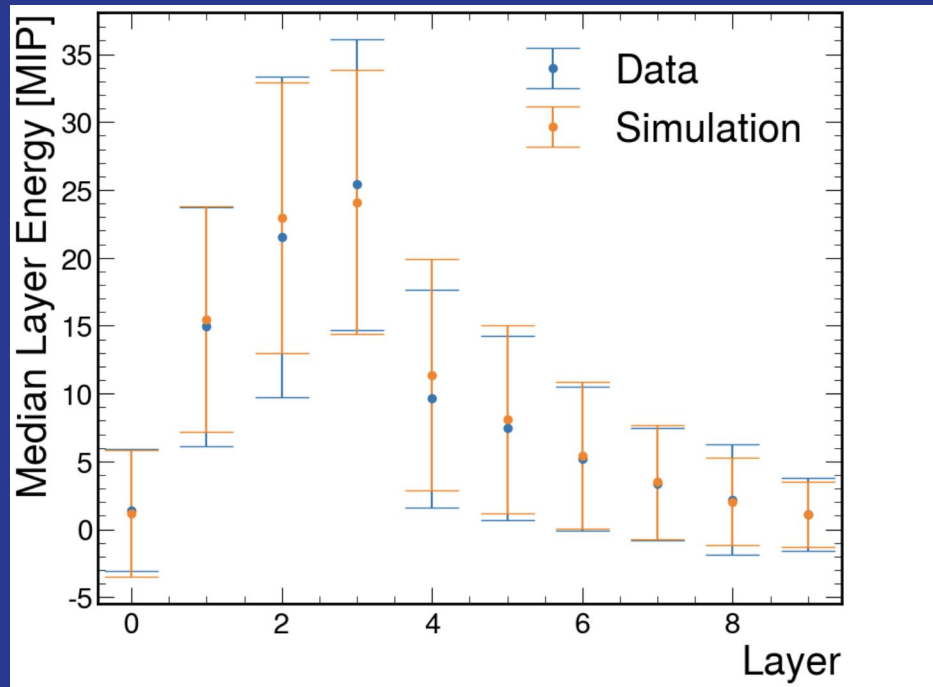
Old



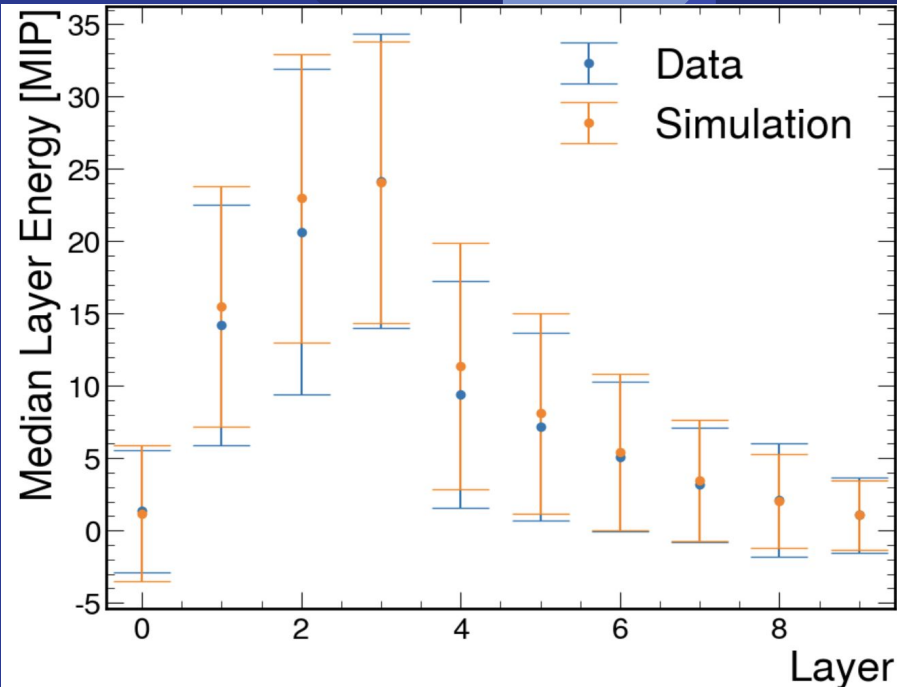
New



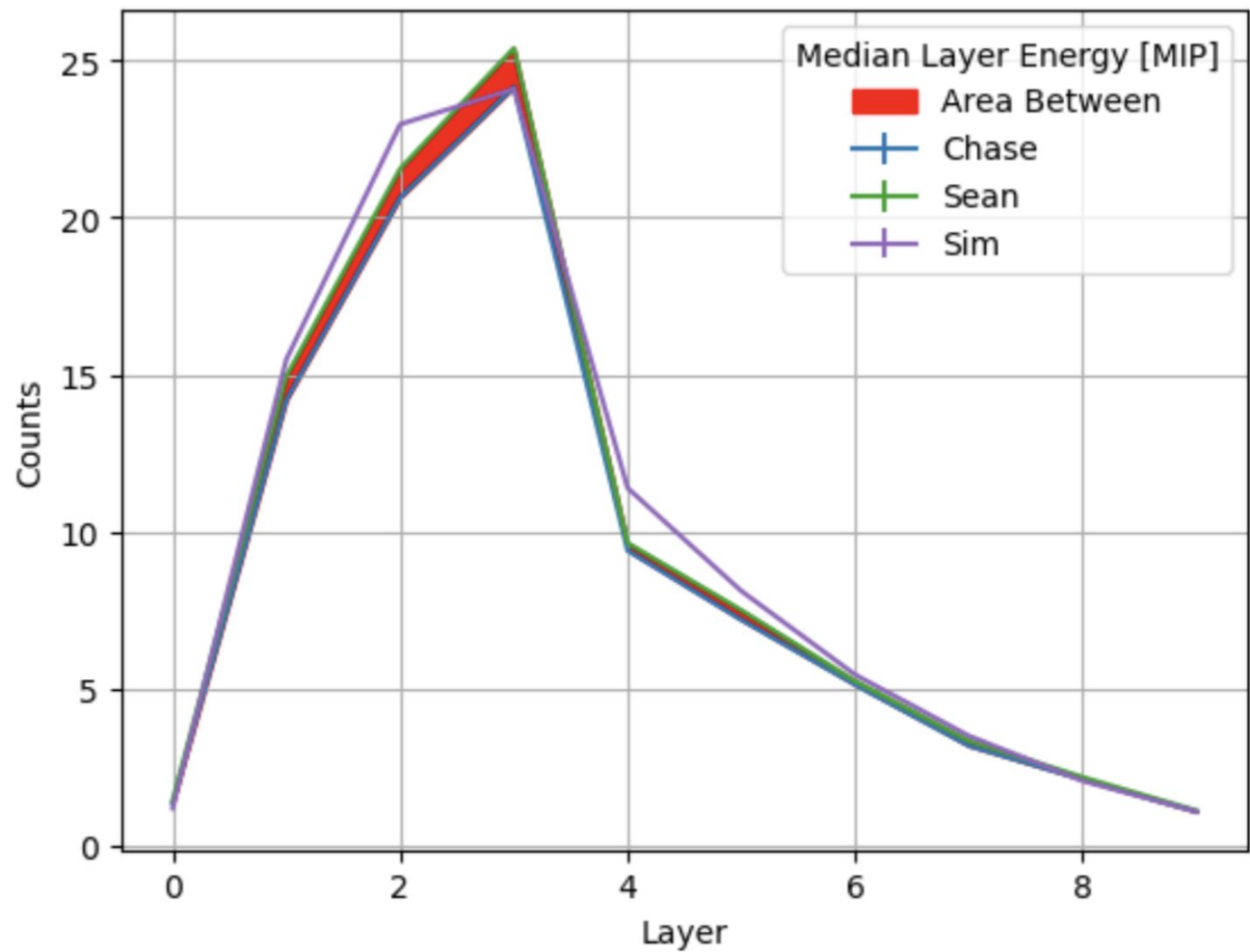
Area Between old and new code

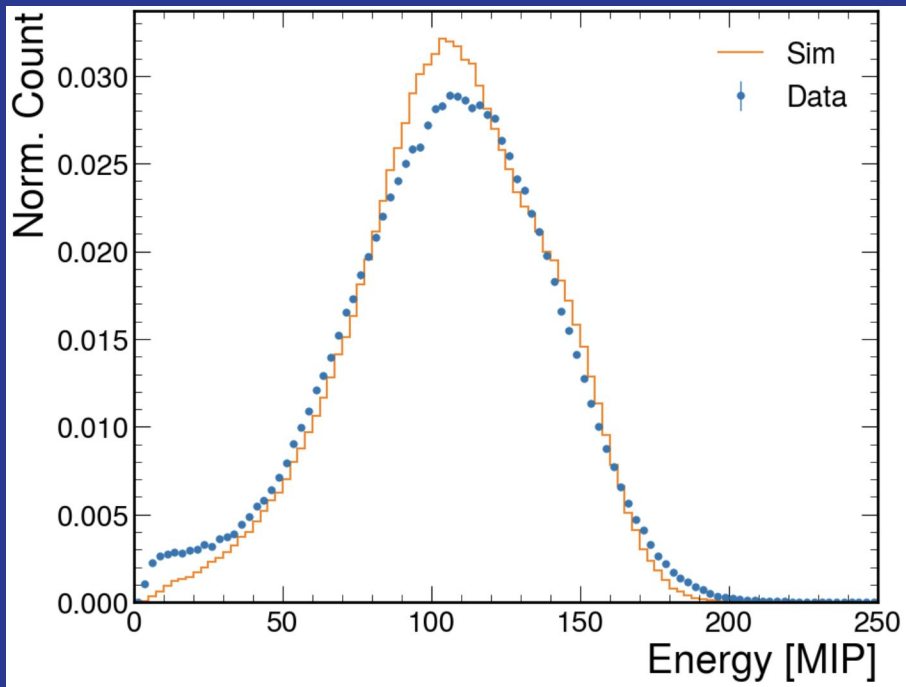


Old

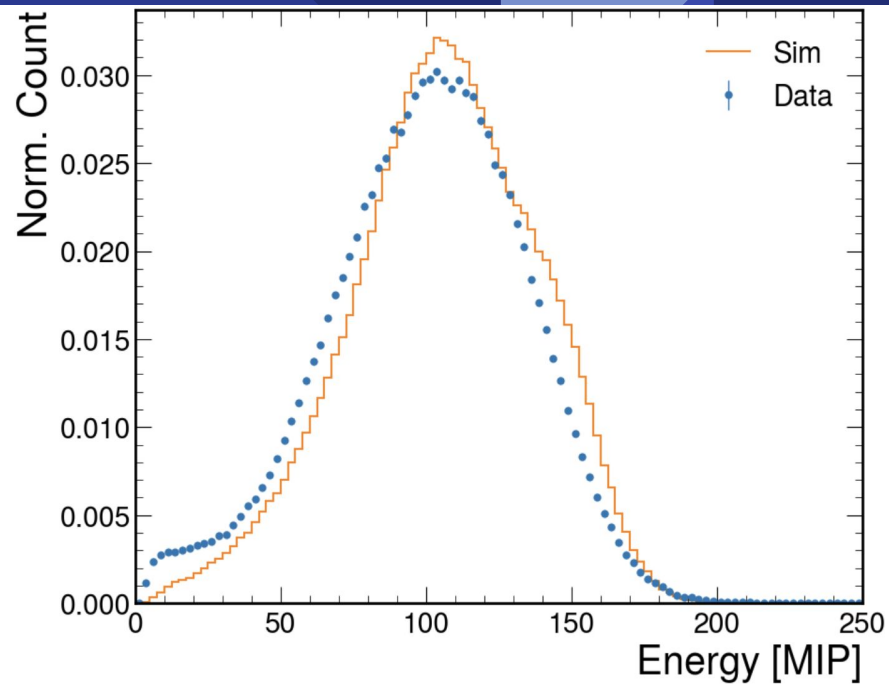


New



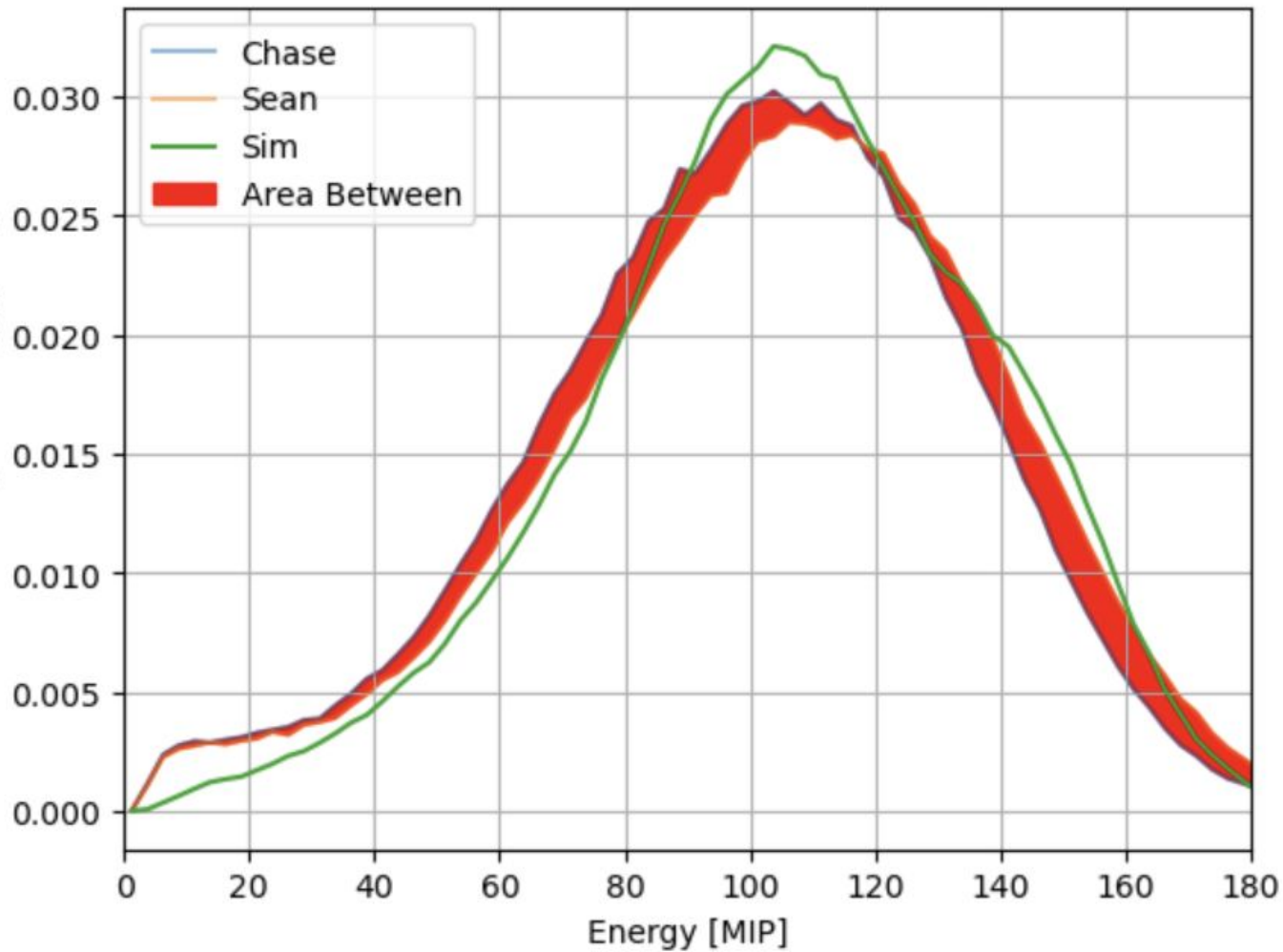


Old



New

Median Layer Energy [MIP]



Results:

The team reached a consensus affirming that the code I developed exhibits a higher level of accuracy and aligns more closely with simulations



Thank You!

Any Questions?