

Status Update

Daisy Kalra

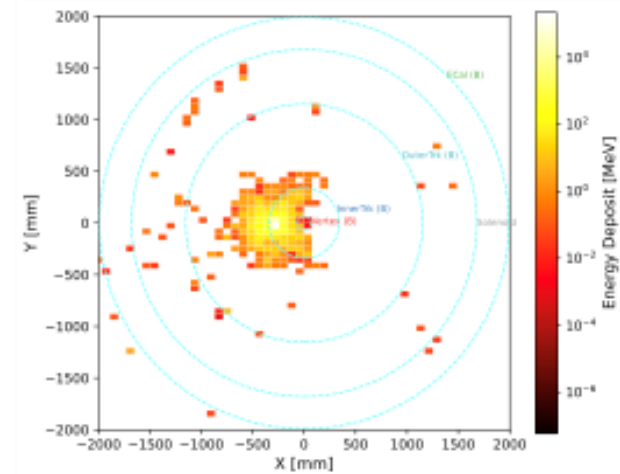
Simons Team Meeting, August 04, 2026

Muon Ionization Cooling – HFOFO

- Muon cooling channel optimization
 - Goal: Add a realistic reference particle (stochastics enabled) in G4beamline which can be used for muon cooling channel optimization studies
 - Compare the energy loss with particle beam that has stochastics enabled and Bethe-Bloch (done)
 - Modify the tune argument so that the simulation runs over an ensemble of events and provide an averaged dE/dx (ongoing)

	Reference particle	Beam, no stochastics	Beam, with stochastics	Realistic Reference, with stochastics	Bethe-bloch
2.5 mm carbon absorber "tube" 200 MeV muon	3.24	3.24	3.26	3.44 ± 0.22	3.29
LiH wedge absorber HFOFO 200 MeV muon	1.72	1.72	1.73	1.81 ± 0.10	1.73

- Goal: To study neutrino slice interactions: a study which estimated $\sim O(10^4)$ neutrino interactions, that crosses a thin slice, in the Muon Collider detector.
- Performed a first study of neutrino interaction signatures in the MAIA detector, by developing a GEANT4 framework, to establish an initial understanding of detector response and develop the foundation for subsequent simulation and analysis efforts.
- Extended the detector specific study into flexible, detector agnostic tool capable of simulation particle interactions in any detector geometry described using GDML (Thanks to Larry)
 - Cleaning up neutrino code to port it over to G4TargetPractice ("a generalized tool") (Larry, Micah, and Daisy)



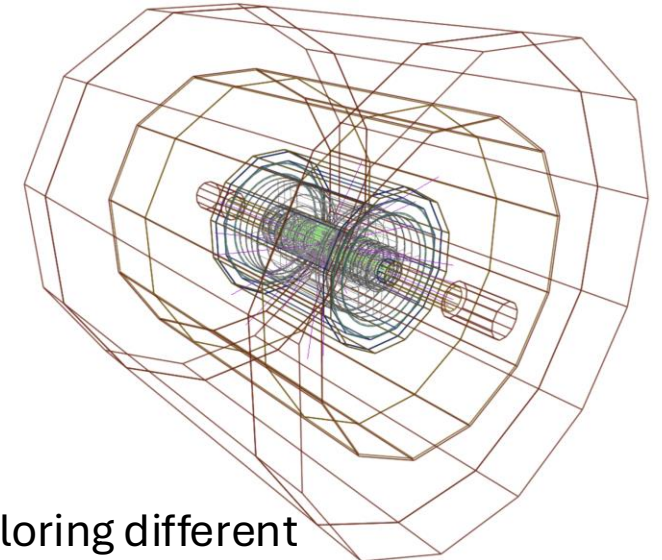
Neutrino Mitigation – An alternate model

- Simultaneously, Jon R. is working on studying neutrino interactions using GENIE event generator and developing detector response workflow



Currently, GENIE provides neutrino cross-section splines for energies below **1 TeV**. Support for spline tables extending up to **5 TeV** is expected soon.

Simulate daughter particles through the MAIA detector



Exploring different
visualizations schemes

The near-term plan (~2 months)

- Compare GENIE-GEANT4 performance.
 - Pick specific energies from neutrino slice paper, optimize biasing, decide useful metrics for comparison studies, perform simulations.