

Neutrino Beams at a Muon Collider Complex

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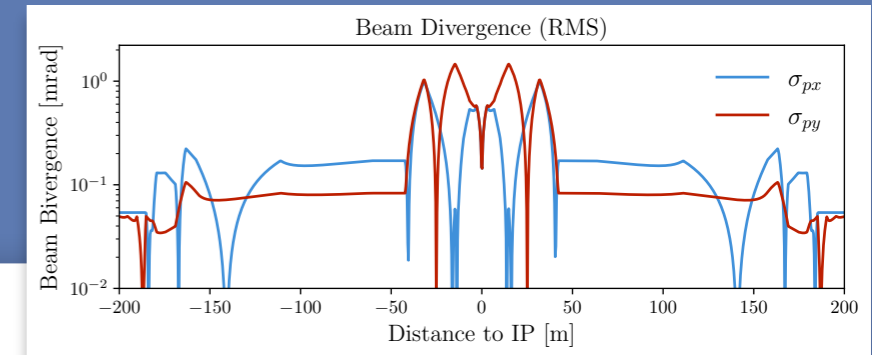
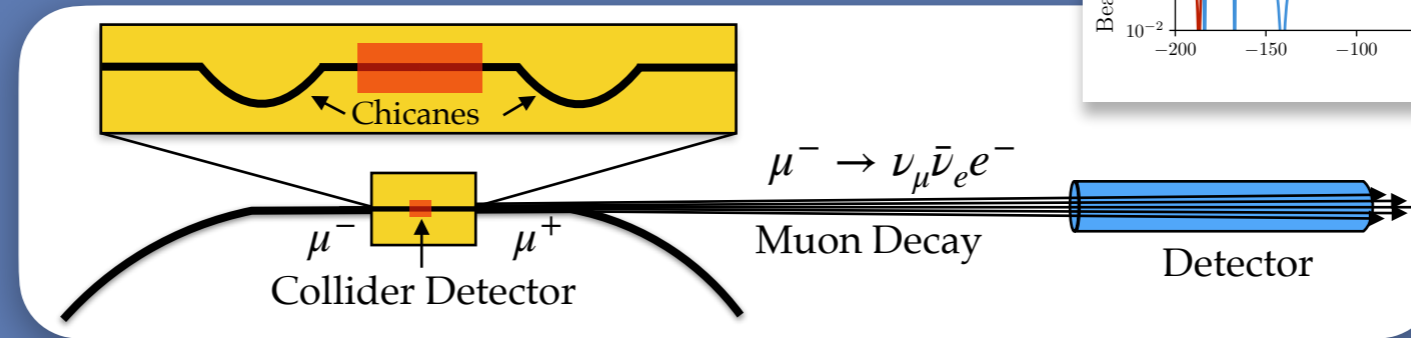
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Introduction

The muon collider would be an energy and intensity frontier facility colliding muons at ~ 10 TeV center-of-mass energy. The decay of these high energy muons makes the muon collider a fitting choice to study neutrinos. We study the forward region 1km downstream from the interaction point, accurately simulating the beam profile and neutrino event rates seen by a detector at that location.

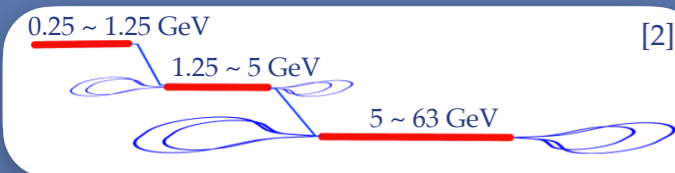
Collider Ring

- The chicanes near the interaction point reduces background electrons in the muon beam. The difference in mass deflects the electrons at a different angle than the muons along the curve and they are absorbed into the pipe walls.

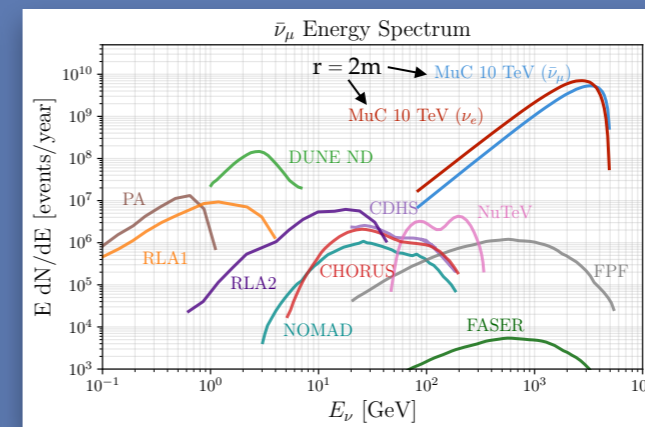
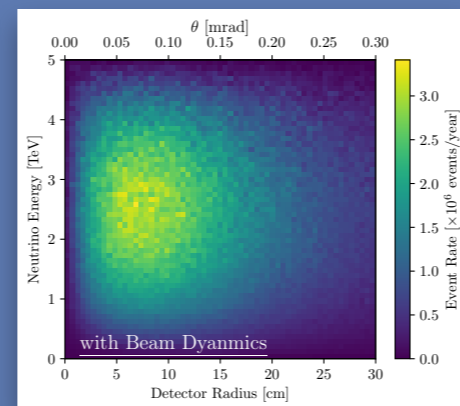
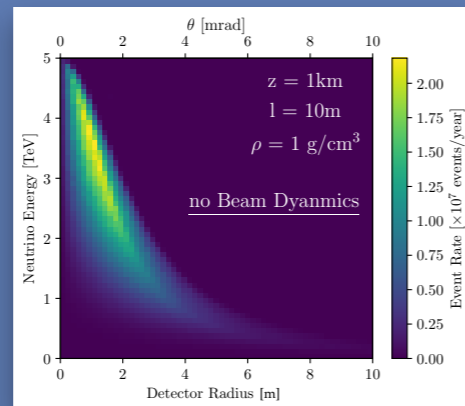
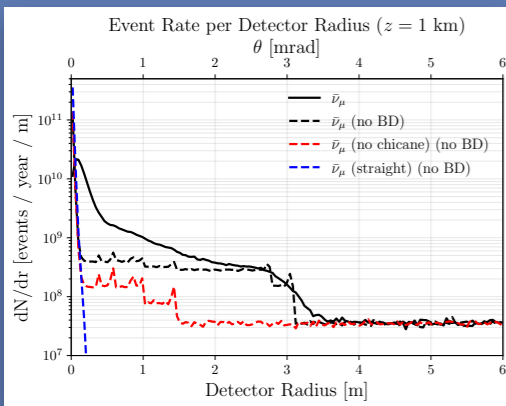


- We obtain transverse beam dynamics data from accelerator physicists and simulate them onto our lattice. [1]

Characterizing the Neutrino Beam



- The preliminary design of the low-energy accelerator complex consisting of a linear pre-accelerator (PA) and two recirculating linear accelerators (RLA). These are sources of low-energy neutrinos that can be used to search for new physics and measure standard oscillation parameters. [3]



MINT (Muon Induced Neutrino Tool):
Python Monte-Carlo simulation around the muon collider complex
(Work in progress)

References

- [1] Beam dynamics parameters courtesy of Marion Vanwelde (International Muon Collider Collaboration)
- [2] IMCC. Interim report for the International Muon Collider Collaboration.
<https://arxiv.org/pdf/2407.12450>
- [3] In collaboration with Paddy Fox and Pedro Machado (Fermilab)

- Comparing various collider configurations shows how the geometry of our lattice and the beam dynamics (BD) strongly influences the beam profile and the detector acceptance. Applying beam dynamics to our simulation washes out energy-angle correlations in the neutrino beam.