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Design of the front-end complex for a muon cooling demonstrator at CERN

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The muon collider has great potential for enabling high-luminosity multi-TeV lepton-antilepton collisions provided low-emittance, high-intensity muon beams can be produced. Ionization cooling is the proposed technique to achieve the required muon beam emittance. The International Muon Collider Collaboration aims to demonstrate the integration and reliable operation of a 6D ionization cooling system, including RF acceleration in strong magnetic fields. This study focuses on the design of the muon production and transport systems for a Muon Cooling Demonstrator facility in the CERN TT7 tunnel. FLUKA simulations are used to optimize the target and magnetic horn geometries to maximize pion production and capture, assuming a 14 GeV proton beam from the Proton Synchrotron (PS). The transport line, designed to deliver 190-210 MeV/c muons into the cooling channel, consists of a short pion decay section, followed by a momentum-selecting chicane and a matching section. The chicane integrates collimation and phase-rotation systems for transverse and longitudinal tuning of the muon beam. Beam optics for the transport lattice are designed in MAD-X, with tracking studies performed using BDSIM.

Footnotes

Paper preparation format

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Author: JURJ, Paul (Imperial College London)

Co-authors: ROGERS, Chris (Science and Technology Facilities Council); PASTERNAK, Jaroslaw (Science and Technology Facilities Council); LOSITO, Roberto (European Organization for Nuclear Research); KAMATH, Rohan (Imperial College London)

Presenter: KAMATH, Rohan (Imperial College London)

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