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Cooling demonstrator target and pion capture study

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The muon collider has great potential to facilitate multi-TeV lepton-antilepton collisions. Reaching a suitably high luminosity requires low-emittance high-intensity muon beams. Ionization cooling is the technique proposed to reduce the emittance of muon beams. The Muon Ionization Cooling Experiment (MICE) has demonstrated transverse emittance reduction through ionization cooling by passing the beams with relatively large emittance through a single absorber, without acceleration. The international Muon Collider Collaboration aims to demonstrate 6-D ionization cooling at low emittance using beam acceleration. Two siting options are currently considered for a Cooling Demonstrator facility at CERN, with proton-driven pion production facilitated by the Proton Synchrotron or the Super Proton Synchrotron. In this work, we use FLUKA-based Monte Carlo simulations to optimize the number of pions produced in the proton-target interactions and subsequently captured by a magnetic horn or solenoid-based system. We explore the feasibility of different target and capture system designs for 14, 26 and 100 GeV proton beam energies.

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