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Essential Aspects of a Muon Collider Demonstrator

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Muon colliders offer high-luminosity, multi-TeV collisions with minimal synchrotron radiation, but their feasibility depends on advancements in muon production, cooling, and storage. The proposed Muon Collider Demonstrator complex addresses two key aspects: with the neutrinos from Stored Muons (nuSTORM) experiment for muon storage, and the 6D cooling demonstrator for muon cooling.

The 6D cooling demonstrator extends the MICE experiment by incorporating longitudinal emittance reduction alongside transverse ionisation cooling. The design utilises solenoids for tight focusing, dipoles for dispersion, wedge absorbers for differential energy loss, and RF cavities for reacceleration. This paper presents a full implementation of a cooling channel in BDSIM, a Geant4-based simulation tool, along with validation against codes like G4BeamLine, and tracking studies optimising a rectilinear cooling lattice.

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