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Challenges and concepts for a multi-TeV Muon Collider experiment

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Muon colliders provide a unique route to deliver high energy collisions that enable discovery searches and precision measurements to extend our understanding of the fundamental laws of physics. All this at a single circular collider and on a feasible timescale, as reviewed in the frame of the European Roadmap for Accelerator R&D and during the U.S. Snowmass process. The recently formed International Muon Collider Collaboration, hosted at CERN, targets the design of a muon collider facility with a center of mass energy of 10 TeV or higher, which seem feasible and
sustainable with technologies that can be made available in the near future. Currently a 3 TeV stage is considered viable as a post HL-LHC facility.
The main challenges are to produce bright muon beams, while facing the drawback arising from the short muon lifetime at rest. The detector design,
the choice of the technologies, and reconstruction algorithms are heavily influenced by the beam-induced background (BIB). A dedicated design
of the machine detector interface is required to mitigate an unprecedented amount of secondary and tertiary decay products of muons beams at the interaction point. From an initial detector concept and full simulation studies of data reconstruction performance and physics projections
at 1.5 and 3 TeV, we outline next steps in the development of a multi-purpose detector for a muon collider with center-of-mass energies up to 10 TeV.
The status of the experiment design, future plans for R&D and synergies will be discussed.

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