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Simulation and R&D studies for the muon spectrometer at a 10 TeV Muon Collider

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The International Muon Collider Collaboration is making great efforts to design a new collider with muon beams operating at 10 TeV centre-of-mass energy. Such an apparatus will offer enormous potential for the exploration of the particle physics frontier, combining the precision of electron-positron machines with the low level of beamstrahlung and synchrotron radiation, and the high centre-of-mass energy and luminosity of hadron colliders. One of the main challenges arises from the beam-induced background (BIB) originated by the interaction of electrons and positrons from muon decay with the machine. The BIB occupancy drives the development of ad-hoc reconstruction algorithms and high-performance detectors.
Therefore, on the one hand, a full simulation is crucial to understand the feasibility of the experiment implementation and on the other, an extensive R&D program is required to find suitable technologies. In this context, the studies concerning the muon spectrometer are here presented. A new geometry is simulated with seven (five) layers of Gas Electron Multipliers (GEMs) in the barrel (endcap) as track-sensitive chambers. Moreover, both the endcaps are equipped with a layer of Picosec to provide time information to reject BIB hits. Picosec achieves resolutions of the order of tens of picoseconds by amplifying, via a Micromegas, electrons generated by the conversion of Cherenkov light produced from an incident particle on a radiator crystal. A new algorithm to seed global muon track reconstruction with standalone muon objects has been developed. The achievements in the muon reconstruction efficiency, BIB sensitivity and background mitigation, as well as the test beam results with different radiators, various photocathodes, and new-generation gas mixtures for Picosec are presented.

Collaboration

International Muon Collider Collaboration

Role of Submitter

I am the presenter

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