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Tracking-detector design for a multi-TeV Muon Collider

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A multi-TeV **Muon Collider** is a promising candidate for the next energy-frontier facility, combining in a single machine usually competing features, such as high energy reach, clean final states, and small environmental footprint. In particular, a collider with the centre-of-mass energy of 10 TeV is the long-term target of the ongoing design study, while lower intermediate energies are also considered. Featuring much smaller size and lower energy consumption its discovery potential would be comparable to that of the FCC-hh with its 100 TeV centre-of-mass energy.

One of the biggest technical challenges at a Muon Collider experiment is designing a detector capable of delivering high physics performance under the extremely intense beam-induced background (BIB) that originates from the muon decays along the collider ring. It is particularly challenging in the tracking detector, where hit density can reach 1000 hits/cm^2 close to the interaction region at the total ionising dose of ~1 Mrad/year. It is therefore necessary to design the tracking detector such that effective mitigation of background can be achieved to make full event reconstruction feasible.

This contribution presents the latest results from a full-simulation study on the optimal design of a Muon Collider tracking detector. It includes the nominal performance figures obtained from simulations together with the most promising BIB-mitigation strategies, and an overview of promising technologies compatible with this detector design.

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