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Machine-detector interface studies for a multi-TeV muon collider

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Circular muon colliders offer the prospect of colliding lepton beams at unprecedented center-of-mass energies. The continuous decay of stored muons poses, however, a significant technological challenge for the collider and detector design. The secondary radiation fields induced by decay electrons and positrons can strongly impede the detector performance and can limit the lifetime of detector components. Muon colliders therefore require an elaborate interaction region design, which integrates a custom detector shielding together with the detector envelope and the final focus system. In this paper, we present design studies for the machine-detector interface and we quantify the resulting beam-induced background for different center-of-mass energies. Starting from the optics and shielding design developed by the MAP collaboration for 3 TeV, we devise an initial interaction region layout for the 10 TeV collider. In particular, we explore the impact of lattice and shielding design choices on the distribution of secondary particles entering the detector. The obtained results serve as crucial input for detector performance and radiation damage studies.

In-person participation

Yes

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