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Progress on the design of solenoids for the 6D cooling channel of a muon collider

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In the current and most evolved design concept of a muon collider, there exists two long (˜1 km) channels for cooling newly created muons and anti-muons. Termed the '6D cooling channels', the beam is cooled in momentum and position space using a series of alternating polarity solenoids, which create an oscillating field in the beam direction, absorbers and radio-frequency cavities. In total there are around 3000 solenoids per channel, contributing to a significant portion of the cost and engineering demands of the entire machine. The integration of the requirements of the field profile with feasible solenoid configurations is a difficult and unique problem, without analytic descriptions to readily relate these. Our approach addresses this problem in two steps: in the first we constrain the beam optics optimization studies by setting engineering limits on solenoid parameters; in the second we have developed a numerical optimization routine to find the best configuration given a desired field profile, in terms of cost and engineering complexity. The following paper reviews this approach and key features,and presents optimization results on the latest optics solution.

Footnotes

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Author: FABBRI, Siara (CERN)

Co-authors: BOTTURA, Luca (European Organization for Nuclear Research); STATERA, Marco (Istituto Nazionale di Fisica Nucleare)

Presenter: FABBRI, Siara (CERN)

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