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Progress on Conventional and Machine-Learning-Assisted Optimizations of a Rectilinear Cooling Channel

The design of a rectilinear cooling channel for a future muon collider poses an interesting multiobjective optimization problem: what are the lowest achievable longitudinal and transverse emittances while minimizing beam loss? In this work, we present our progress on computing these tradeoffs using a genetic algorithm. This algorithm can propose candidate solutions, evaluate their performance using a full-physics-included simulation tool, and then select the best performing individuals based on the objective functions we have selected. A second, more efficient algorithm that supplements the simulations with a machine-learning model is also considered. Our initial results demonstrate improved performance over literature values for the first stage of a proposed design [1] and continued effort in this direction may lead to shorter, higher performance cooling channels for the construction of a muon collider.

[1] Stratakis, D., Palmer, R. B. (2015). Physical Review Special Topics - Accelerators and Beams, 18(3), 031003

Primary authors: PIERCE, Christopher (University of Chicago); Mr DINN, Sophia (University of Chicago); Mr ZHANG, Aubrey (University of Chicago); Dr STRATAKIS, Diktys (Fermilab); KIM, Young-Kee (University of Chicago)

Presenter: PIERCE, Christopher (University of Chicago)

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