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Bayesian tuning of the Compact Muon Beam Line for the Mu3e experiment

Currently PSI delivers the most intense continuous muon beam in the world with up to few 10ˆ8 μ+/s and aims at keeping its leadership upgrading its beamlines within the HIMB project to reach intensities up to 10ˆ10 μ+/s, with a huge impact for low-energy, high-precision muon based searches.

The use of hyper parameter search algorithms has shown that not only the stringent rate requirements can be met, but that higher phase space quality can be achieved. To reach such high quality tunes during commissioning, a novel tuning strategy is required, due to the large aberrations introduced by the employment of solenoidal elements along the HIMB beamlines. We present here the preliminary tests carried out in December 2023 at the Compact Muon Beam Line (CMBL) at PSI, serving the Mu3e experiment, where for the first time a tuning of low energy muon transfer lines with Bayesian algorithms was performed. The method was explored with both point-like detectors to maximize the rate on-axis and arrays of plastic scintillators to tune the delivered rate and the beam spot size at once.

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