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Design of beam phase space distribution to realize precise three-dimensional beam injection at J-PARC muon g-2/EDM experiment

Wednesday 4 June 2025 16:00 (2 hours)

In the J-PARC muon g-2/EDM experiment, a three-dimensional beam injection scheme will be adopted to inject a 300 MeV/c muon beam into a compact storage orbit. In this scheme, a low-emittance muon beam with X-Y coupling is injected from the edge of a solenoidal magnet and guided to a compact beam storage region where the magnetic field is precisely tunned for a muon g-2 measurement with a good systematic uncertainty.
The method to design the injected beam phase space distribution was previously unclear, as muons pass through an area with a largely position-dependent, non-linear, and time-dependent magnetic field created by the solenoidal fringe field and kicker field during the injection process.
This presentation introduces a new design method. By utilizing a linear approximation of beam transportation, an acceptance is defined for the injected beam distribution. This acceptance is represented as a three-dimensional hyperplane, allowing for a search of an optimal beam distribution by comparing it to beam phase space distribution candidates.
The presentation reports the procedure and results of this method, as well as its limitations due to the assumed linear approximation.

Footnotes

Paper preparation format

LaTeX

Region represented

Asia

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