

Designing for Tunability and Feedback in the Muon EDM Experiment

Tuesday, 31 March 2026 12:00 (2 hours)

The muon electric dipole moment (muEDM) experiment at PSI relies on highly sensitive off-axis muon injection into a compact frozen-spin trap. Injection performance depends strongly on magnetic field and material properties that are difficult to characterize with sufficient accuracy prior to commissioning. For a system of this complexity, purely feed-forward optimization of experimental geometry based on simulation alone is limited by unavoidable model uncertainty. We are therefore exploring a design for the next phase of our experiment that explicitly prioritizes *tunability*: the ability to compensate expected deviations using controllable correction elements and measurement-based feedback. This naturally leads to a control formulation, in which detector outputs can be interpreted as system states, controllable elements (e.g. steering coils) as control actions, and injection efficiency as a performance objective.

This poster presents an early-stage study aimed at developing such a tunable experimental design. We discuss ongoing and planned studies of the experiment, and outline how feedback-based methods could be applied to bridge the sim-to-real gap in practice. The goal is to form a concrete, experimentally motivated control problem and invite discussion on how modern learning-based methods could be integrated into the development of the experiment.

Student

Yes

Primary author: JAEGER, Johannes Alexander (ETH Zurich / Paul Scherrer Institut)

Co-author: SCHMIDT-WELLENBURG, Philipp (PSI - Paul Scherrer Institute)

Presenter: JAEGER, Johannes Alexander (ETH Zurich / Paul Scherrer Institut)

Session Classification: Poster session