

Magnetometry for the Muon $g-2$ Experiment

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The Muon $g - 2$ Experiment at Fermilab aims to measure the muon anomalous magnetic moment with a precision of 140 parts per billion (ppb). The experiment collaboration has published the latest measurement based on the first three Runs (collected from 2018 to 2020) in August 2023 with a precision of 200 ppb. The experiment accumulated three more years of data, from 2020 to 2023, which are currently being analyzed. The additional statistics is sufficient to achieve and possibly exceed the goal of 100 ppb of final statistical uncertainty. As the statistical error gets reduced, increasing attention is dedicated to the study of the systematic uncertainties. Among them, one source is a magnetic transient generated by the fast kickers. In order to center the muon orbit into its final position in the storage ring, a 120 ns magnetic pulse of 240 G is issued by three kickers right after injection. This induces eddy currents in the kicker aluminum structure that last for several microseconds. To measure the 10 mG magnetic perturbations generated by the eddy currents, the INFN team developed a laser magnetometer based on the Faraday effect. This talk will describe the technical principles, the operations, and the data analysis of this very sensitive device.

Collaboration

Muon $g-2$

Role of Submitter

I am the presenter

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