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Tracking the magnetic field in the Fermilab Muon g-2 experiment

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Recently the Muon g-2 collaboration published the most precise measurement of the anomalous magnetic moment of the muon, a_μ , with a 460 ppb uncertainty based on the Run 1 data. The measurement principle is based on a clock comparison between the anomalous spin precession frequency of spin-polarized muons and a high-precision measurement of the magnetic field environment using nuclear magnetic resonance (NMR) techniques, expressed by the (free) proton spin precession frequency. To achieve the ultimate goal of a 140 ppb uncertainty on a_μ , the magnetic field in the storage region of the muons needs to be known with a total uncertainty of less than 70 ppb. Three devices are used to measure and calibrate the magnetic field in the Muon g-2 storage ring: (a) an absolute calibrated NMR probe, (b) a movable array of NMR probes that can be pulled through the storage region of the muons and (c) a set of NMR probes in the vicinity of the storage region. In this talk, we present the measurement and tracking principle of the magnetic field and point out improvements implemented for the analysis of the data recorded in Run 2 and Run 3.

In-person participation

No

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