

Magnetic in-vacuum field mapping system for the Muon g-2 experiment

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The Muon g-2 Experiment (E989) at Fermilab will measure the anomalous magnetic moment of the muon, a_μ , with a precision of 140 part-per-billion (ppb), aiming at resolving the >3 standard deviations between the previous measurement at Brookhaven (E821) and the Standard Model calculation of a_μ .

The experimental concept requires a precise measurement of the magnetic field of the 45-m long storage ring to better than 70 part-per-billion. One crucial element in achieving this is an in-vacuum magnetic field mapping system (called the trolley) to map the magnetic field over the full storage region of the muons. The former trolley system from the Brookhaven experiment (E821) with 17 NMR probes was refurbished and upgraded with new electronics, probes, and a modern motion control system including the full suite of software modules for the data acquisition and analysis. The precision of the NMR system has been measured to be better than 1 part-per-billion in our highly uniform, and stable solenoid magnet. The in-vacuum mapping system and its motion control system were successfully commissioned at Fermilab and the system is now operating during the first physics data taking run. This poster highlights the systems key components and its overall performance.

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