

Abstract Submitted
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Development of a Novel Helium-3 Probe for the Cross-Check of the Magnetic Field Measurement Calibration for Muon g-2 MIDHAT FAROOQ, Univ of Michigan - Ann Arbor, FERMILAB MUON G-2 COLLABORATION — The muon g-2 experiment at Fermilab (E989) investigates the $\approx 3.3\text{-}\sigma$ discrepancy between the standard model prediction and the current experimental measurement of the muon magnetic moment anomaly, $a_\mu = (g-2)/2$. This effort requires a precise measurement of the 1.45 T magnetic field of the muon storage ring to 70 ppb. The final measurement will employ multiple absolute calibration probes: water probes and a ^3He probe. The ^3He probe offers a cross-check of the water probes with different systematic corrections, adding a level of confidence to the measurement. A low-field ^3He probe was developed at the Univ. of Michigan by employing a method called MEOP for the hyper-polarization of ^3He gas, followed by NMR to determine the frequency proportional to the magnetic field in which the probe is placed. A modified probe design for operation under high fields is currently in production at Argonne National Lab. Future development involves the study of the systematic uncertainties to attain the error budget of ≈ 30 ppb for the calibration. Next, the calibration from the probes will be transferred to g-2 through several steps of a calibration chain ending in the final step of calibrating the NMR probes which measure the field in the muon storage ring at Fermilab.

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