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Precision Magnetic Field Calibration for the Muon $g-2$ Experiment at Fermilab DAVID FLAY, Univ of Mass - Amherst, MUON G-2 COLLABORATION — The Muon g-2 Experiment at Fermilab (E989) has been designed to determine the muon anomalous magnetic moment to a precision of 140 parts per billion (ppb), a four-fold improvement over the Brookhaven E821 measurement. Key to this precision goal is the determination of the magnetic field of the experiment's muon storage ring to 70 ppb. The magnetic field will be measured by nuclear magnetic resonance (NMR) probes, mounted on a trolley and pulled through the muon storage region when muons are not stored. These trolley probes will be calibrated in terms of the free-proton Larmor precession frequency by a specially-constructed NMR calibration probe. In E821, the uncertainty in the field measurement was 170 ppb, of which 90 ppb was due to the calibration procedure of the trolley and 50 ppb was due to the calibration probe. In E989, these uncertainties will be reduced to 30 ppb and 35 ppb, respectively. These reduced uncertainties directly improve the experiment's sensitivity to new physics. To meet these stringent requirements, a new probe has been built. Details of the probe, NMR electronics, and calibration procedure will be presented; additionally, the main field systematic uncertainties will be discussed.

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