

# Simulations for the Muon $g-2$ Experiment at Fermilab

*Wednesday, 15 February 2023 17:40 (30 minutes)*

The main goal of the Fermilab Muon  $g-2$  experiment is to determine the muon anomalous magnetic moment ( $a_\mu$ ) to a 140 parts per billion (ppb) uncertainty, to compare it with the Standard Model prediction. The value of  $a_\mu$  is determined by measuring two quantities: the anomalous spin precession frequency of positive muons circulating in a storage ring and the magnetic field experienced by the stored muons. In 2021, the collaboration published the first result with ~6% of the final statistics and a total uncertainty of 462 ppb dominated by the statistical contribution. This result is in agreement with the previously published measurement obtained at Brookhaven National Laboratory (BNL); the combination of the two results disagrees by 4.2 standard deviations with the most accurate theoretical prediction published in 2020 and by 1.5 standard deviations with the calculation that uses Lattice QCD results. To achieve the final uncertainty goal, the muon beam dynamics, from injection to storage until all muons decay, has to be fully under control. This talk, after describing the experimental technique, presents work on beam dynamics systematic studies using experimental data and simulation.

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**Session Classification:** Senior Session