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Precision Measurement of the Muon Spin Precession Frequency ωa in the Fermilab Muon g-2 Experiment

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The Fermilab Muon $g-2$ Experiment is designed to measure the muon's anomalous magnetic moment, $a_\mu = (g-2)/2$ with a final accuracy of 140 parts per billion. This quantity is determined from two key measurements; the magnetic field and the difference between the muon's spin precession frequency and its cyclotron frequency, given by $\omega_a = \omega_s - \omega_c$, in a highly uniform 1.45 T magnetic field within a 14-meter-diameter storage ring.

In this talk, we present the methodology for determining ω_a. Muons with a momentum of 3.1 GeV are injected into the storage ring, and ω_a is extracted from the time distribution of decay positrons recorded by 24 electromagnetic calorimeters placed symmetrically inwards around the ring. We will provide an overview of recent results and analysis techniques based on data collected from 2020 to 2023, including positron reconstruction and fitting procedures as well as corrections for systematic effects such as gain fluctuations, pileup, and beam dynamics.

Secondary track

T09 - Beyond the Standard Model

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