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Spin Tracking for the Fermilab E989 Muon $g-2$ Experiment[1]
ABEL LORENTE CAMPOS, University of Kentucky, FERMILAB E989 COLLABORATION — The E989 Muon $g-2$ Experiment at Fermilab studies the anomalous magnetic moment a_μ of the muon with a precision goal of 140 ppb. Previous measurements at Brookhaven National Laboratory estimated a discrepancy greater than 3 sigma with respect to the Standard Model prediction. With 20 times more statistics, the E989 experiment aims to evaluate this discrepancy. The measurement of a_μ depends on highly precise measurements of the magnetic field and the difference between spin precession and cyclotron frequencies, ω_a. By design, muons of "magic momentum" (3.094 GeV/c) are stored in the 1.45 T magnetic storage ring. This momentum is chosen to minimize distortions of ω_a caused by the electrostatic quadrupoles used to vertically focus the beam. Deviations from the magic momentum and vertical oscillations induced by the quadrupoles result in sub-ppm corrections that must be calculated by precise reconstruction of the beam's motion, both in data and simulation. This talk will present an approach to evaluate these corrections via development of a spin tracking simulation. This simulation will be used to study the beam-related systematic errors to ω_a and other studies such as beam tracking or convolution of the beam with the magnetic field.

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