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Pileup Systematic Studies in the Fermilab Muon g-2 Experiment

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The Muon g-2 experiment at Fermilab (E989) aims to measure the anomalous magnetic moment of the muon, a_μ, to a precision of 140 ppb, a four-fold increase in precision over the previous experiment at Brookhaven National Laboratory (BNL). The value of a_μ from BNL currently differs from the Standard Model prediction by ~ 3.5 standard deviations or higher, suggesting the potential for new physics and therefore, motivating a new experiment.

The Fermilab experiment follows the measurement principles of the BNL experiment, injecting a beam of positive muons into a storage ring, which focuses the beam with a combination of magnetic and electric fields. The muon anomaly relies on the measurement of the spin precession frequency ω_a about the muon momentum. This presentation will focus on one of the most important sources of systematics to the ω_a analysis: pileup effects. Pileup refers to the overlap of decays in the detector that originate from separate muon decays, too close to each other in time and space to be resolved into individual pulses.

A complete description of how pileup events are identified will be presented along with a discussion of how the correction to a traditional ω_a analysis is formulated and applied

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