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Pileup Study for the Precession Frequency Analysis in the Fermilab Muon $g-2$ Experiment

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The Muon $g-2$ experiment at Fermilab aims to achieve an unprecedented precision of 140 ppb in measuring the muon's anomalous magnetic moment. This high-precision experiment necessitates a thorough examination of factors that could potentially bias the fitted anomalous precession frequency, ω_a , including the multi-positron pileup effect. During Run-1, we observed biases up to 100s of ppb caused by unresolved pileup. Three established methods for correcting pileup contamination exist: the shadow window method, the empirical method, and the probability density function method. Our group implemented the shadow window method to correct the time and energy spectra of reconstructed positrons. However, as the statistics increase, triple coincidence pileup becomes more significant, and the accuracy of higher-order corrections becomes more crucial. In this research, we employ a simplified toyMC model to simulate the pileup effect, aiming to identify a more accurate formula for high-order corrections within the shadow window method. A preliminary result will be presented in this poster.

Primary authors: ZENG, Yonghao; CHEN, Cheng (Shanghai Jiao Tong University); KHAW, Kim Siang (TDLI/SJTU)

Presenter: ZENG, Yonghao

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