A Fourier Method for Recovering the Muon Beam Momentum Distribution for the Fermilab Muon g-2 Experiment[1] JOSHUA FAGIN, ANTOINE CHAPELAIN, DAVID RUBIN, TYLER BARRETT, Cornell University, FERMILAB E-989 MUON G-2 EXPERIMENT COLLABORATION — The Fermilab E-989 Muon g-2 Experiment aims to measure the anomalous magnetic moment of the muon (a_μ) as a precision test of the Standard Model of particle physics. We perform this measurement by observing the spin precession frequency of a stored muon beam along with the magnetic field in the muon storage ring. The ring features a set of electrostatic quadrupoles which are necessary to maintain vertical storage of the beam. These quadrupoles also introduce a significant correction to a_μ known as the E-field correction, which depends on the momentum distribution of the muon beam. Here we present a method for recovering the momentum distribution via Fourier analysis of the muon beams cyclotron motion (or fast rotation). We motivate the procedure analytically, demonstrate its application empirically, and discuss sources of systematic uncertainty as it applies to Run-1.

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