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Trigger Studies for the Mu2e Experiment

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The Mu2e experiment at Fermilab aims to detect charged lepton flavor violation by observing neutrinoless muon-to-electron conversion in the field of an aluminum nucleus. Within the Mu2e apparatus, low-energy muons are captured in the atomic orbits in an aluminum stopping target. Isolating the desired excess of monoenergetic 105 MeV electrons will require precise suppression of primary background sources such as muon decay-in-orbit, radiative pion capture, and cosmic rays. An initial of selection will be required in the form of a trigger.

The minimal Standard Model extension allowing for neutrino oscillations necessarily includes such lepton flavor-violating transitions as μ⟶e in the charged lepton sector, but the predicted amplitude of these decays is dramatically suppressed by the W± mass to a branching fraction of less than 10ˆ-50 . Many favored BSM theories, however, including SUSY with R-parity violation, new gauge bosons, large extra dimensions or a non-minimal Higgs sector, predict rates for charged lepton flavor violating (CLFV) processes as large as 10ˆ-14. Mu2e expects to achieve a single event sensitivity of 3 x 10ˆ-17 in the muon-to-electron conversion rate, an improvement by four orders of magnitude over previous experiments. Any detectable sign of CLFV at this regime will be incontrovertible evidence of new physics.

In this poster we describe initial performance tests in the development of a Mu2e trigger. These tests use recently-created event samples that include improved geometry and background information. A rejection factor of approximately 10ˆ2 with a per-event timing of under 14 ms will be required for the experiment to operate within the allowed data budget.

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