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Study of the effect of solenoid field uncertainties on the physics goals of the Mu2e experiment

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The Mu2e experiment at Fermilab proposes to measure the ratio of the rate of neutrinoless coherent conversion of muons into electrons in the field of a nucleus, relative to the rate of muon capture on the nucleus. The conversion process is an example of charged lepton flavor violation. Observation of this process would provide unambiguous evidence for physics beyond the Standard Model. The design of the experiment is based on three superconducting solenoid magnets: The Production Solenoid, forming the muon beam; the Transport Solenoid, transporting muons to the detector region; and the Detector Solenoid, housing the detector complex. Uncertainties in the fields of the solenoids may arise from (i) fluctuations of the currents from the nominal values; (ii) misalignments of the coils due to mechanical and magnetic forces; or (iii) approximations in the field calculation. A study of the impact of field uncertainties on the physics goals of the experiment is presented. This study examines the effect of field uncertainties on muon and pion stopping rates in the aluminum stopping target. The possibility of testing the Transport Solenoid field with low momentum electrons is also examined, as an alternative to measuring it with field probes, which is technically difficult due to mechanical interference.

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