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Development of a Track-Trigger for Measuring the Antiproton Annihilation Cross-Section in the Mu2e Experiment at Fermilab

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The Mu2e experiment at Fermilab will enable the search for the neutrinoless muon to electron conversion in the field of an Al nucleus, a charged lepton flavor violating process. If observed, there would be a clear indication of physics beyond the Standard Model. Mu2e aims to reach a single event sensitivity of 3×10^{17} , improving from the previous limit by 4 orders of magnitude. This improvement relies on the development of trigger selection systems, designed to discard data from background-induced events by placing kinematic, topological cuts on a particle's reconstructed track. One of the largest sources of background Mu2e faces is proton-antiproton annihilation, with an expected number of 0.010 ± 0.010 . These annihilations produce a 2 GeV shower of particles, among which there could be an electron that can mimic the conversion electron signal. The uncertainty on this background is dominated by the systematic uncertainty associated with the theoretical model.

The goal of my research is to reduce this systematic uncertainty by enabling the measurement of the antiproton production cross-section in a control region. To do this, I will develop an antiproton trigger selection system by taking advantage of the track multiplicity and topology for these events. After development, I will make the first performance study of this trigger. The development of this trigger is essential to enable a data-driven analysis targeting the reduction of the systematic uncertainty of the antiproton-induced background.

Mini Symposia (Invited Talks Only)

Author: MARTINEZ, Ethan**Presenter:** MARTINEZ, Ethan**Session Classification:** Quark and Lepton Flavor Physics**Track Classification:** Quark and Lepton Flavor Physics