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A data-driven method for antiproton background measurement in Mu2e

The Mu2e experiment will search for the CLFV process of neutrinoless, coherent conversion of muon to electron in the field of an Al nucleus. The experimental signature is a monochromatic conversion electron (CE) with energy $E_{CE} = 104.97$ MeV. CE-like e^-s could also come from processes like Decay in Orbit of muons stopped in the Stopping Target (ST), cosmic muons interacting or decaying within the detector or antiprotons ($\overline{p}$) produced by the proton beam at the Production Target and annihilating in the ST. The background expected from $\overline{p}$s is very low but highly uncertain. It cannot be efficiently suppressed by the time window cut used to reduce the prompt background because the $\overline{p}$s are significantly slower than the other beam particles. We are developing a data-driven approach to constrain the $\overline{p}$ background. We plan to exploit another final state of $p\overline{p}$ annihilation in the ST, with a much larger Branching Ratio to constrain the background by comparison. $p\overline{p}$ annihilation can give multi-track final state with momentum of $\sim$ 100 MeV/c for each track at a much higher rate than signal like e^-. The idea is to identify and reconstruct these multi-track events and estimate the $\overline{p}$ background by comparison. The Mu2e detector and the default event reconstruction procedure are designed for efficient single track event reconstruction. The topology of a multi track event is very different from a CE event. We are creating new, holistic algorithms to reconstruct single as well as multi-track events. The poster will present the status and discuss the prospects of this novel proto analysis of the antiproton background in Mu2e.

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