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Developing multi-track event reconstruction to constrain the antiproton background in Mu2e

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The Mu2e experiment at Fermilab will search for the CLFV neutrinoless coherent muon to electron conversion in the field of an Al nucleus. The experimental signature of the process is a monochromatic electron (CE) with E_{CE} =104.97 MeV/c. CE-like electrons could also come from background processes like the cosmic muons, Decays in Orbit of muons stopped in the Stopping Target (ST), Radiative Pion Capture at the ST followed by $\gamma \rightarrow e^+e^-$ conversion or antiprotons produced by the proton beam at the Production Target and annihilating in the ST. The background induced by $\overline{p}$s is expected to be very low but has a large systematic uncertainty. This background cannot be suppressed by the time window cut used to reduce the prompt background because $\overline{p}$s are significantly slower than the other beam particles. However, $p\overline{p}$ annihilation in the ST is the only source of events with multiple tracks coming from the ST, simultaneous in time, each with a momentum in the signal window region. We plan to exploit this unique feature. The idea is to identify and reconstruct events with multiple tracks and use them to estimate the $\bar{p}$ background. The Mu2e detectors: the Tracker and the Calorimeter along with the default event reconstruction are optimised for efficient single e^- track reconstruction. The topology of a multi-track $p\bar{p}$ annihilation event is very different from a CE event. We have developed new physics-neutral algorithms to reconstruct multi-track final state events. These new algorithms not only significantly improve the efficiency of reconstructing $p\bar{p}$ annihilation events, but they also improve the efficiency of single e^- track reconstruction.

Collaboration

Mu2e

Role of Submitter

I am the presenter

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