MEETING OF THE AMERICAN PHYSICAL SOCIETY DIVISION OF PARTICLES AND FIELDS

Contribution ID: **388** Type: **Presentation**

Studies of Beam Induced Radiation Backgrounds at the Mu2e Experiment and Implications for the Cosmic Ray Veto Detector Operations

Wednesday, 2 August 2017 14:38 (17 minutes)

The Mu2e experiment will search for a neutrinoless muon-to-electron conversion process using a novel apparatus design that promised almost four orders of magnitude of sensitivity improvement to the current limit. An important background is caused by cosmic-ray muons faking the conversion electron signature. In order to reach the designed sensitivity, Mu2e needs to obtain a cosmic-ray veto (CRV) efficiency of 99.99%. The CRV consists of four layers of plastic scintillator which surrounds the detector with an area of approximately 300 m2. One of the challenges the CRV faces is the large neutron and gamma fluxes produced from beam interactions present in the apparatus. This radiation can damage the detector components and generate large background rates in the CRV. Extensive studies have been made to optimize the shielding needed to mitigate these rates. We present results from sophisticated simulations of the rates and estimate the total deadtime produced by the radiation backgrounds in the CRV.

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Session Classification: Computing, Analysis Tools, and Data Handling

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