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Studies of Radiation Damage in Silicon Photomultipliers for the Fermilab Mu2e Cosmic Ray Veto System

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The Mu2e experiment at Fermilab will search for the coherent neutrinoless conversion of a muon to an electron in the field of an atomic nucleus with a sensitivity of four orders of magnitude better than previous experiments. The Mu2e detector is surrounded by a cosmic ray veto system (CRV) that is required to reduce the cosmic-ray background to 0.10 events over the course of the run with an efficiency of 99.99%. The CRV consists of four layers of scintillator strips with embedded wavelength-shifting fibers and silicon photomultiplier (SiPM) readout. The SiPMs will be exposed to a neutron background which over time may damage the sensors. Several different model SiPMs were irradiated at a proton beam facility. The dark current, dark rate, single photo-electron resolution, cross-talk and response before and after exposure will be presented. A comparison of an equivalent neutron irradiation will also be given.

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