Study of Background Particles for the Implementation of a Neutron Veto into the SuperCDMS
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ABSTRACT

Astronomical observations have revealed that most of the matter in the universe is non-luminous, non-baryonic dark matter. The Cryogenic Dark Matter Search (CDMS) was designed to look for Weakly Interacting Massive Particles (WIMPs), a strong candidate for dark matter. The CDMS experiment used Ge and Si crystal detectors to search for WIMPs by using ionization yields; the ratio of ionization and recoil energy. To extend upon this research, the Super Cryogenic Dark Matter Search is proposed to include more sensitive Ge crystal detectors with a greater target mass of 100 kg and a reduction in the number of background events. To greatly decrease the background counts, the implementation of a neutron veto has been introduced. Neutrons and WIMPs produce similar interaction signatures within the Ge crystal detectors to the point where neutrons can cause a “false positive” reading. These neutrons come from cosmogenic sources and radioactive decay in materials surrounding the detector. In this research, an increased understanding of shielding from the intrinsic environmental background is achieved. To do this, Geant4 is used to simulate particle interactions with the shielding material of a neutron veto. By studying various geometrical configurations, the reduction in background can be optimized for a liquid scintillator veto.