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Estimating the Cosmic-ray Exposure of SuperCDMS detectors[1]

ASHLEY BROOKS, JOHN ORRELL, Pacific Northwest National Laboratory — The Super Cryogenic Dark Matter Search (SuperCDMS) experiment at SNOLAB will use detectors instrumented with phonon and ionization sensors to attempt to measure the recoil energy imparted to Ge and Si nuclei due to collisions of dark matter particles. During fabrication and shipment, the detectors are exposed to cosmic-ray secondaries that collide with the Ge and Si nuclei and through spallation create radioisotopes within the detector crystals. A particular isotope of concern is tritium which has a 12-year half-life and creates a background that diminishes the detectors' sensitivity to dark matter interactions. To estimate the cosmic-ray exposure of the crystals along shipment routes and to select future routes with minimum cosmic-ray exposure, a MATLAB program was created taking into account geographical location, duration of route, driver rest period (sleeping, refueling, etc.) , and elevation. To further understand the cosmic-ray exposure of the detectors, a calculation was reviewed to determine the overburden shielding provided by the Stanford Underground Facility, a shallow underground location used to protect the crystals from cosmic rays during detector fabrication.

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