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Muon Tomography applications to nuclear non-proliferation and waste management

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Muon Scattering Tomography (MST) exploits the naturally occurring flux of high energy cosmic ray muons at the surface of the Earth to non-destructively assay the distributions of dense materials in a region of interest. The Cosmic Ray Inspection and Passive Tomography (CRIPT) detector was designed and built for this application. CRIPT is a unique MST apparatus using extruded plastic scintillating strips coupled with wavelength shifting fiber optics to reconstruct muon tracks. This information is used to extrapolate spatial points where muons have scattered off high density/high-Z materials therefore allowing for the reconstruction of 2D and 3D images. This is of particular relevance in the fields of nuclear non-proliferation, spent fuel verification, and reactor imaging. The former two fields are being explored in detail by research activities underway at Canadian Nuclear Laboratories'Chalk River site. Using the CRIPT detector, fresh PHWR fuel, shielding materials, and storage containers have been successfully imaged. The characterization of these materials and geometries serves as a demonstration of the applicability of MST to current issues in nuclear materials management and nuclear non-proliferation.

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