Contribution ID: **16** Type: **not specified**

Developments of neutron-gamma emission tomography for radioactive waste characterization

Thursday, 31 October 2024 11:30 (20 minutes)

The capability to detect and accurately localize special nuclear materials (SNM) or other actinide materials is crucial for various nuclear security and safeguards applications including the management of radioactive waste. The Neutron-Gamma Emission Tomography (NGET) technique enables rapid detection and precise location of fissile materials by correlating the energy and the time of the emitted gamma rays and neutrons emitted from the same fission event using statistical or machine learning approaches. The technique has been developed in a system employing fast organic liquid scintillators (EJ309) detectors featuring fast-timing and neutron-gamma discrimination capabilities and applied to a novel imaging radiation portal monitor system for nuclear security applications and for radioactive waste characterization. NGET detectors of different sizes have been integrated into an automated scanning system for enhanced non-destructive assay of radioactive legacy waste at the Studsvik nuclear decommissioning site. In this system, the NGET imaging modality is combined with additional gamma-ray transmission and high-resolution gamma-ray emission tomography enabling a comprehensive non-destructive characterization station for the Swedish legacy radioactive waste drum inventory. The NGET setup integrated into this advanced radwaste characterization (ARC) station is composed of sixteen cylindrical detectors, eight detectors with 12.7 cm diameter by 12.7 cm height, and eight detectors with 7.62 cm diameter by 7.62 cm height. A characteristic feature of the NGET technique is that it allows imaging with a spatial resolution up to an order of magnitude better than the dimensions of the detector cells. In this work, 252Cf source measurements were performed and compared with Monte Carlo simulations using the GEANT4 code, illustrating the influence of the detector dimensions on the imaging performance.

Presenter: ESCUDEIRO, Rafael (KTH Royal Institute of Technology)