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**Detection of Special Nuclear Material in Cargo Using
Continuous Neutron Interrogation and Tension Metastable Fluid Detectors**

This paper presents results using a novel technique for detecting special nuclear materials (SNMs) based on interrogation with a continuous beam of 2.45MeV neutrons coupled with high intrinsic efficiency tensioned metastable fluid detectors (TMFDs) operated in threshold rejection mode. While passive interrogation may be utilized for detecting SNMs such as ^{239}Pu from their strong spontaneous fission neutron signatures, this is not so for highly-enriched uranium (HEU), the timely detection of which has been identified as a grand challenge by the U.S. Domestic Nuclear Detection Office (DNDO). Active (neutron and/or photon based) interrogation represents the only viable means for detecting HEU either shielded or unshielded within cargo containers. Active interrogation by neutrons or photons leads to unequivocal induced fission based signatures in terms of neutron energy and multiplicity. The main challenge under such circumstances pertains to being able to discern the relatively weak emission signatures from the intense interrogation pulses of neutrons and/or photons. Purdue University together with Sagamore Adams Laboratories, LLC (SAL) has been developing the TMFD sensor system that promises to provide high neutron detection efficiency for fast and thermal neutrons while remaining gamma-beta blind.