Enabling Explosives and Contraband Detection with Neutron Resonant Attenuation
186363

Year 1 of 3
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Investment Area(s): International, Homeland, and Nuclear Security / Strategic Partnerships

Project Purpose:

Material Identification by Resonant Attenuation is a technique that measures the energy-dependent attenuation of 1-10 MeV neutrons as they pass through a sample. Elemental information is determined from the neutron absorption resonances unique to each element. With sufficient energy resolution, these resonances can be used to categorize a wide range of materials, serving as a powerful discrimination technique between explosives, contraband, and other materials. Our proposed system is unique in that it simultaneously down-scatters and time tags neutrons in scintillator detectors oriented between a d-T generator and sample. This allows not only for energy measurements without pulsed neutron beams, but for sample interrogation over a large range of relevant energies, vastly improving scan times. Our system's core advantage is a potential breakthrough ability to provide detection discrimination of threat materials by their elemental composition (e.g. water vs. hydrogen peroxide) without opening the container. However, several technical and computational challenges associated with this technique have yet to be addressed. There are several open questions: what is the sensitivity to different materials, what scan times are necessary, what are the sources of background, how do each of these scale as the detector system is made larger, and how can the system be integrated into existing scanning technology to close current detection gaps? In order to prove the applicability of this technology, we will develop a validated model to optimize the design and characterize the uncertainties in the measurement, and then test the system in a real-world scenario.

This project seeks to perform R&D and laboratory tests that demonstrate proof of concept (TRL 3) to establishing an integrated system and evaluating its performance (TRL 4) through both laboratory tests and a validated detector model. The validated model will allow us to explore our technology's benefits to explosive detection in various applications.

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