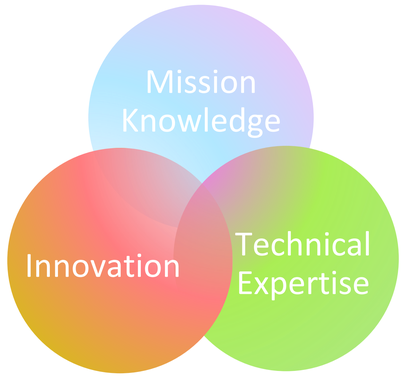
SAND2021-13876D

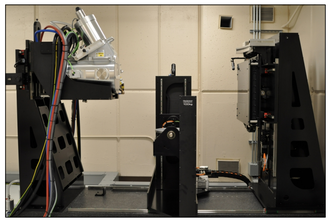
Sandia National Laboratories

Radiography and Radiation Signatures & Detection

The **Radiation Signatures and Detection Science & Technology** group provides scientific expertise and engineered solutions in nuclear proliferation detection, nuclear nonproliferation, nuclear deterrence, and energy. The group boasts expertise in materials science, radiography, radiation physics and detection, and chemistry to devise materials and technologies to detect, characterize, and interpret the unique signatures of radiological and nuclear systems and to provide a sound technical basis for the nation's nuclear deterrent capability.



On-site facilities designed for use of radiation sources include the Radiation Detection Laboratory (80+ radiation sources, flexible space for evolving work), the Sandia California Neutron Interrogation (SCANI) Laboratory (D-D and D-T neutron generators with associated particle imaging), the Radiography Laboratory, and a joint facility for Computed Tomography and Radiation Assessment Operations.



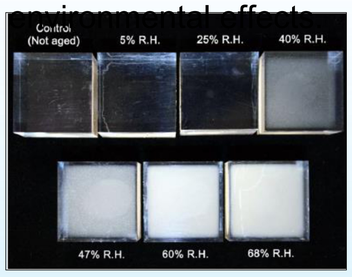
Radiography and Computed Tomography provides imaging and analysis using techniques such as conventional X-ray imaging (fixed & portable systems), x-ray computed tomography (CT), thermography, and x-ray fluorescence (XRF) to support Sandia's nuclear deterrent mission. These capabilities facilitate component design and manufacturing, materials formulation, failure analysis, product and process qualification, and other activities where non-destructive evaluation is needed.

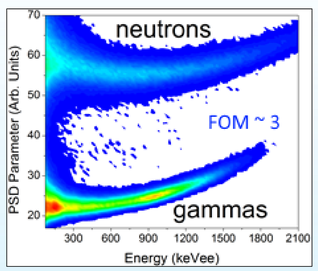
Neutron Coded Aperture

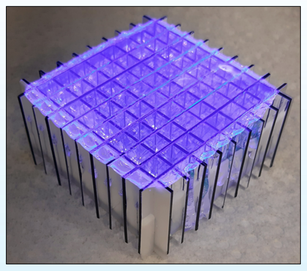
Time Encoded Imager

Systems for warhead verification have been developed using pixelated fast neutron coded aperture imaging and time encoded single pixel compressive imaging techniques. These systems are capable of confirming that the volumetric distribution of the special nuclear material (SNM) in items declared to be warheads is consistent with expectations. Because fast neutrons are quite penetrating, they are largely unattenuated by intervening materials within the items and any shielding that may be present.

Scintillators & Radiation-Sensitive Materials are developed to facilitate gamma-ray spectroscopy and neutron particle detection, maximizing discernable gamma/neutron discrimination and light yield while also possessing high durability and resistance to aging and environmental effects.



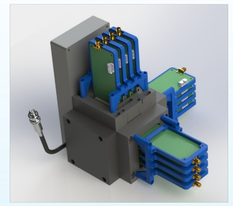




Neutron Scatter Camera
- 2 planes of 16 5" diameter liquid scintillators
- Variable planar gap

Mobile Imager of Neutrons for Emergency Response (MINER)
- 16 3"x3" liquid scintillators
- Compact
- Battery operable
- More uniform Field of View

Single Volume Scatter Camera (SVSC)
- Single scintillating volume
- More compact



R&D on neutron emission detection has been an evolution towards compact and portable technologies that are easy to transport and deploy, have high efficiency, and can be placed near an item to increase sensitivity & spatial resolution.

U.S. DEPARTMENT OF ENERGY
NNSA National Nuclear Security Administration

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