WG6 IPNDV Experimental Technology Data Sheet

November 29, 2019, Boardman, Australia, Tagziria, EU

Name of Experimental Campaign:
Belgium exercise to investigate performance of measurement methods

Technology Name: Gamma-ray imaging

Physical Principle/Methodology of Technology:
Gamma-ray imaging via compressed sensing

What Does the Method Determine/Measure (e.g., presence of nuclear material, isotopics, mass):
Gamma-ray spectrum, presence of neutrons, location of gamma rays, isotope identification

The technology has a wide gamma energy range (40 keV–3 MeV) that images over a wide field of view (360° x 90°).

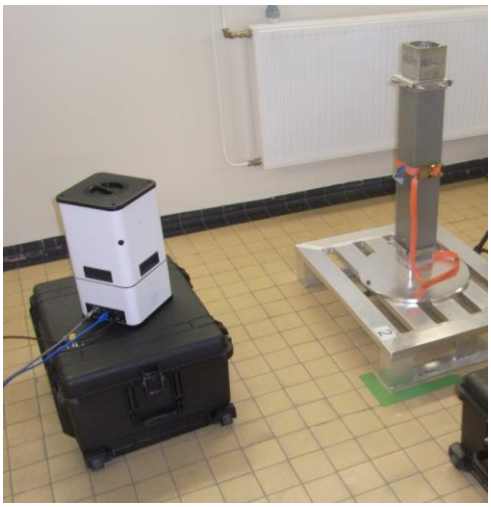
What Is the Applicability to IPNDV:
The technology can detect, identify, and localize the presence/absence of nuclear material.

The methodology of the technology means the hardware could be used as an information barrier. The spectral and location information could be hidden in an "encrypted" count modulation obtained by the equipment.

Type of Data Collected by the Technology:
Gamma-ray spectrum, 360° x 90° optical image, 360° x 90° gamma image

Constraints (e.g., time to install the equipment, measurement times including distance from object, dose rate required, required Cd shielding to limit the count rate):
Time to install: 10 minutes; measurement times: ≥1 minute at 1 m. Longer for low activities (dose rates).

Physical Description/Diagram/Photos of the Experimental Setup/Layout:



Specific Objects Measured (which of the experimental objects were measured; if not described elsewhere, describe experimental objects here):

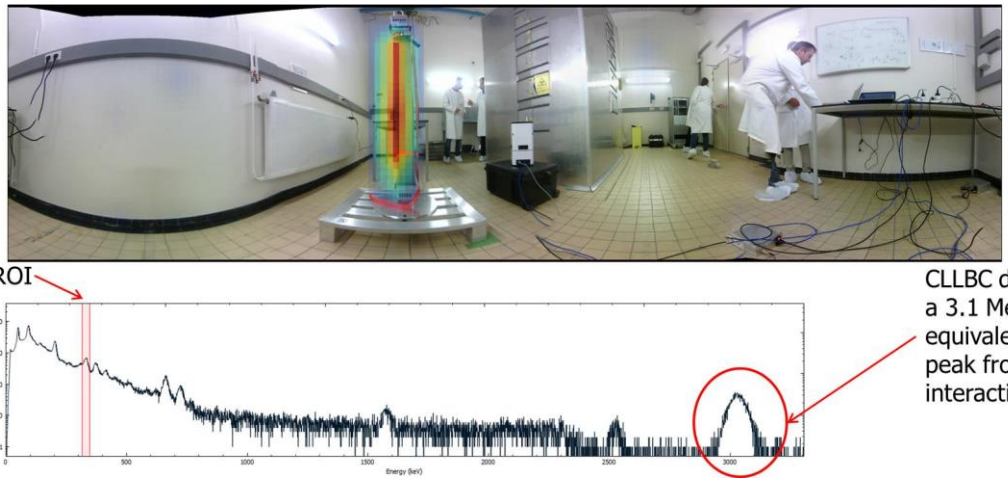
There were 27 configurations in total; various pin numbers (1, 19, and 61); shielding (Pb, Cd, Poly) , percentage in ^{239}Pu (62, 79, 96), lengths (50 and 100cm) etc. as per SCK schedule.

Process Required to Analyze the Data (include any software used):

The graphical user interface (GUI) displays the spectral, image, and identification information.

Preliminary Results (qualitative, not quantitative; e.g., did the method perform as expected, if not how was it different):

Method performed as expected. The system captured the gamma-ray spectra, gamma images, and detected the presence of neutrons, for the various configurations measured.



Final Results (if available; if not, estimate of when final results will be available):
Final results in early 2020

Lesson Learned (e.g., what went well, what went wrong or not as expected, do the results confirm what we said in the technology tables?):
The imager provided the spectrum, location, and the isotopic identity of gamma emitters. The imager also determined the presence of neutrons.

As expected, the low-energy emissions can be shielded and the localization (and spectral) information can be hidden. Imaging of the high-energy emissions reveals the source localization.

The imager provides information on the presence and absence of SNM. The SNM is present in one area and absent in all other areas.

Deployment of two imaging systems (at 90°) can further confine the position of SNM.