

WG6 IPNDV Experimental Technology Data Sheet

November 2019, AWE, UK

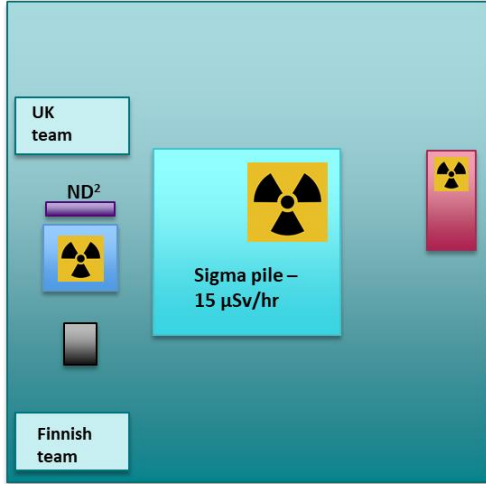
Name of Experimental Campaign: Belgium exercise to investigate performance of measurement methods
Technology Name: ND²
Physical Principle/Methodology of Technology: Thermalization of neutrons in polyethylene followed by neutron capture in He-3 tubes.
What Does the Method Determine/Measure (e.g., presence of nuclear material, isotopics, mass): Presence of a neutron radiation source, effective Pu240 mass and alpha ratio.
What Is the Applicability to IPNDV: The collection of high-quality neutron data on fissile material with varying amounts of shielding.
Type of Data Collected by the Technology: Neutron list mode
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): The more time available to count, the more information can be ascertained about the material emanating the neutrons. Count time was around 30 minutes for this exercise. Distance from object should be as close as possible; our distance can be seen in the photo in the next section. With the caveat that an extra measurement is beneficial at a distance from the object at which efficiency of the detector is known, for us this is 1 m from the center of the source.
Physical Description/Diagram/Photos of the Experimental Setup/Layout:  <p>The diagram illustrates the experimental setup layout. It features a central yellow box labeled 'Sigma pile – 15 µSv/hr' with a radiation symbol. To its left is a blue box labeled 'ND²' with a radiation symbol. To the right is a red box with a radiation symbol. In the top left corner is a light blue box labeled 'UK team'. In the bottom left corner is a light blue box labeled 'Finnish team'. A small black rectangle is positioned below the ND² box.</p>

Diagram of the day one layout. The ND² was placed as closely as possible to the fuel.

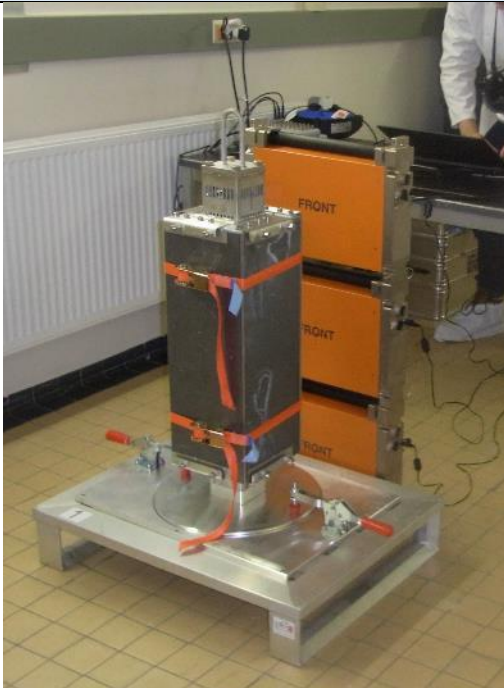
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ND² equipment in place

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

MOX fuel of two different isotopics were measured, with two different types of shielding in addition to bare. This makes six measurements made in total, using all our equipment. Nineteen pins were used for both isotopic compositions.

76%	96%
Bare	Bare
Cadmium	Cadmium
Lead and Poly	Lead and Poly

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

The gross counts are in an Excel sheet and can be visually assessed to determine the mass assay. The list mode data are stored in .bin files and require software PTR32 software to analyze.

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

The method performed as expected, giving results that compared well to our prior modeling.

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Raw data are available, but final results are not yet available.

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?):

Our ND² performed as expected. It would have been useful to have more information on the Sigma pile and space allowances before arrival.