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#07-14 Boron Coated Straws imaging panel capability for neutron emission tomography for source localization inside radioactive drums

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The evaluation of fissile mass inside radioactive waste drums is essential for radioactive waste management, nuclear safety and criticality issues. However, passive and active neutron measurements can be strongly impacted by the uncertainty on the neutron source position within the drum and by matrix effects.
Therefore, an imaging panel proposed by Proportional Technologies Inc and composed of seven Boron Coated Straw (BCS) detectors has been tested to localize neutron interactions, in view to reduce uncertainties associated to plutonium or uranium position inside radioactive waste drums. In a previous work, a numerical model of the imaging panel has been developed and validated from a comparison with experimental profiles obtained with a 252Cf source.
In the first section, the feasibility of neutron emission tomography by a setup composed of five extended imaging BCS panels is demonstrated by numerical Monte Carlo simulation.
The second section details the experimental validation of the neutron emission tomography. Measurements are carried out with AmBe and 252Cf located inside an empty 118 L drum by rotating the BCS imaging panel around it. Afterwards, deconvolution algorithms are applied to provide 2D neutron source images for each angle. Finally, the 3D images are reconstructed using the RTK circular projection.
The results demonstrate the capability of the BCS imaging to provide the 3D location, i.e. axial and radial positions of one and two neutron sources. Furthermore, the first tests with this passive neutron measurement system show a satisfactory 3D reconstruction for 252Cf and AmBe sources separated by 20 cm.
Consequently, BCS imaging panels open interesting prospects to reduce the uncertainty associated to plutonium or uranium localization in neutron measurements.
Work is undergoing to assess the capability of this system for 118 L drums filled with organic and metallic matrices. Additionally, further prospects concern the performance of other deconvolution and reconstruction algorithms.

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