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Characterising encapsulated nuclear waste using cosmic-ray Muon Tomography

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Muon Tomography (MT) is a burgeoning field of applied nuclear physics research. This technique makes use of the penetrating and Coulomb-scattering properties of cosmic-ray muons to image the internal composition of large and/or sealed containers that cannot be interrogated via conventional means e.g. X-rays. The Nuclear Physics group at the University of Glasgow, in collaboration with the UK National Nuclear Laboratory and Sellafield Ltd., have developed a prototype detector system based on scintillating-fibre and multi-anode photomultiplier technologies to assess the feasibility of using this technique in the non-destructive assay of legacy nuclear waste containers within the UK Nuclear Industry. Images of a small, industrial waste container will be presented from experimental scattering data collected using this MT system. These results showcase the vast potential of this system in characterising the high-Z (atomic number) materials encapsulated within the concrete-filled, steel container. Small uranium and lead samples are reconstructed to sub-centimetre precision and are clearly discriminated from the low-Z concrete background. With a full-scale system under construction in Glasgow to accommodate 500-litre industrial waste barrels, it is foreseen that with continued research and development this system will be deployed within the UK Nuclear Industry in the future and will play an important role in mitigating the risks inherent with the long-term storage of materials of this nature.

Primary author: MAHON, David (University of Glasgow)

Co-authors: Mr CLARKSON, Anthony (University of Glasgow); Dr ZIMMERMAN, Colin (National Nuclear Laboratory); Dr SHEARER, Craig (National Nuclear Laboratory); Prof. IRELAND, David (University of Glasgow); Dr MOUNTFORD, David (National Nuclear Laboratory); Dr YANG, Guangliang (University of Glasgow); Dr RYAN, Matt (National Nuclear Laboratory); Prof. KAISER, Ralf (University of Glasgow); Dr AL JEBALI, Ramsey (University of Glasgow); Mr LUMSDEN, Scott (University of Glasgow)

Presenter: MAHON, David (University of Glasgow)

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