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Neutron-gamma emission tomography for security and non-proliferation applications

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Nuclear security issues have received increased attention in recent years, in particular in the current geopolitical climate. At the same time, fast developments in the nuclear energy sector also require new developments for enhanced nuclear non-proliferation and safeguards techniques. There is a strong connection between these areas in terms of technical solutions in the field. We have demonstrated that the novel neutron-gamma emission tomography (NGET) technique [1], which is based on correlated detection of fast neutrons and γ rays from spontaneous/induced fission in actinide materials, will contribute to an important technological step for the characterisation of radioactive waste [2,3], as well as for advanced radiation portal monitoring (RPM) systems for different security applications [2,4,5]. In this talk I will review new developments and future perspectives for applying NGET in these and other applications of benefit to society.

[1] Jana Petrović, Alf Göök, and Bo Cederwall, Rapid imaging of special nuclear materials for nuclear nonproliferation and terrorism prevention, *Sci. Adv.* 7, 1 (2021). <https://doi.org/10.1126/sciadv.abg3032>

[2] B. Cederwall, A novel 3D-imaging and characterisation technique for special nuclear materials in radioactive waste, *EPJ Nuclear Sci. Technol.* 9, 8 (2023) <https://doi.org/10.1051/epjn/2022037>

[3] J. Vasiljević, V. Peters, A. Puranen, and B. Cederwall, 'Sensitive imaging of actinide materials in shielded radioactive waste' *Nature Sci. Rep.* 14, 26798 (2024)

[4] Jana Vasiljević and Bo Cederwall, Performance Evaluation of an Imaging Radiation Portal Monitor System, *Appl. Sci.* 12(18), 9001 (2022). <https://doi.org/10.3390/app12189001>

[5] R. Stone, New type of imager could help spot smuggled nuclear materials, *Science*, 19 May 2021. <https://doi.org/10.1126/science.abj5464>

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