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Monte Carlo Modeling and Experimental Evaluation of a 6LiF:ZnS(Ag) Test Module for Use in Nuclear Safeguards Neutron Coincidence Counting Applications

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This paper summarizes the Monte Carlo modeling, prototype construction, calibration and characterization of a 3He-free neutron detection test module consisting of several compact 6LiF:ZnS(Ag) thermal neutron absorbers in a moderating slab configuration. In order to determine the suitability of the test module for implementation in a nuclear safeguards coincidence counter, safeguards-relevant detection parameters, such as intrinsic efficiency, die-away time, gamma sensitivity, and dead time effects, are evaluated experimentally using a 252Cf spontaneous fission neutron source and 137Cs gamma sources. The 6LiF:ZnS(Ag) test module performance will be assessed systematically in comparison to other alternative 3He technologies which have already been investigated. The design of coincidence and multiplicity counters based on this technology will then be discussed.

Country or International Organization

UK

Primary author: SCHEAR, Melissa (Symetrica)

Co-authors: PEDERSEN, Bent (JRC); RAMDEN, David (Symetrica); DERMODY, Geraint (Symetrica); TAGZIRIA, Hamid (JRC); PEERANI, Paolo (JRC)

Presenter: DERMODY, Geraint (Symetrica)

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