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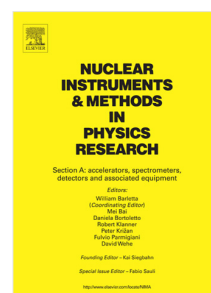
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Identifying neutron shielding in neutron multiplicity counting

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Neutron Multiplicity Counting (NMC) and passive neutron interrogation is becoming a standard procedure in special nuclear material control and accountability, due to the relative optical transparency of other structure materials to neutron flux, making it very effective for measuring composite poorly-characterized samples. Currently, all applicable neutron multiplicity counting methods assume that both the detection efficiency and the neutron die-away time are system parameters, independent of the sample. Clearly, if the detection efficiency of the system is reduced due to neutron absorption or moderation inside the sample, the measurement will be biased. Therefore, detecting a reduction in the detection efficiency, either accidental or deliberate, is a well motivated problem. In the present study we develop, through both theory and implementation, a new method for detecting a reduced effective detection efficiency in NMC by sampling the fourth central moment of the count distribution. One of the attributes that make the proposed method appealing is that it does not require any additional operation and may be easily applied to any standard NMC counter, assuming that the data is recorded in LIST mode. The method is implemented on a set of 18 measurements, 7 of which are standard NMC measurements, and in the remaining 11 the sample is covered by a moderator, noticeably reducing the effective detection efficiency. The new method successfully discriminates between them.

Keywords: multiplicity, shielding, passive interrogation, fourth moment

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