Nuclear Science and Technology Division

Passive Detection of Low Spontaneous Fission Rate Source With Fast Time Correlation Methods

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ABSTRACT

Passive Detection of Low Spontaneous Fission Rate Source With Fast Time Correlation Methods

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The recent addition to the Nuclear Materials Identification System (NMIS) of large area (up to 100 x 100 cm square) detectors sensitive to fast neutrons and gamma rays permits fast (1GHz) time coincidence measurements of fissile materials with low spontaneous or induced fission rates. To test the potential of fast (1GHz) time coincidence methods, measurements were performed using NMIS with depleted uranium metal masses of ~9 and ~18 kilograms. The spontaneous fission rate for uranium is mainly due to spontaneous fission in ^{238}U at a rate of 6.8 spontaneous fissions per second per kilogram. The uranium was centered between the detectors and pairs of 50 × 50- and 100 × 100-cm-square plastic scintillation detectors were used. The time coincidence distribution between pairs of detectors and the multilpet (the number of times n pulses were detected in a time interval) distributions were measured. Deviation of the multiplet distribution from Poisson indicates the occurrence of fission. This paper describes the results of these measurements.