Study on detector geometry for active non-destructive inspection system of SNMs by nuclear resonance fluorescence

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Abstract:

An active non-destructive detection system for special nuclear materials (SNMs) such as 235U has been developed for container inspection at sea ports. The SNMs can be detected by using nuclear resonance fluorescence (NRF) with a quasimonochromatic gamma-ray beam provided from a laser Compton Scattering (LCS) source. We have studied the optimum geometry for the detector array by Monte Carlo simulation code, GEANT4, which has been modified to take into account all physical processes in NRF. The simulation code has been checked by the experimental data taken in New-SUBARU and HiGS facility. NRF yield at different scattering angles were examined with different thickness of 235U target. The result shows that the backward angle is the optimum geometry for NRF detection in terms of NRF yield and S/N ratio caused by atomic scattering. Realistic simulation for a container cargo has been performed. Detector array of 100 LaBr3(Ce) detectors has been examined with 3 different size of crystals. Consequently, we can demonstrate the ability of the proposed inspection system.

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