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Measurement of the Photo-peak Efficiency and Covariance Analysis of ☒-Ray Detectors of TANGRA Project using 22Na, 60Co, 133Ba, 137Cs, 152Eu, 228Th and Comparison with the Geant4 and MCNP Simulation.

Tuesday 2 July 2024 13:00 (15 minutes)

Conducting thorough research on the inelastic scattering of 14.1 MeV neutrons on atomic nuclei using the tagged neutron technique is the main objective of the TANGRA project at the Frank Laboratory of Neutron Physics (FLNP) of the Joint Institute for Nuclear Research (JINR) in Dubna, Russia [1,2,3]. We tested the respective photo-peak efficiency of the HPGe and LaBr3(Ce) gamma-ray detectors in a recently built experimental facility as part of this ongoing programme of study. We have conducted our experiment with some common gamma-ray radioactive point sources such as 22Na, 60Co,133Ba, 137Cs, 152Eu, and 228Th. Furthermore, we used the GEANT4 code to do Monte Carlo (MC) simulations in order to determine these efficiencies. The simulations showed that the outcomes of the Monte Carlo computations and the experimental data agreed rather well. Our study results might be helpful for scientists using HPGe and LaBr3(Ce) detectors for gamma-ray spectroscopy, as well as for processing and analysing data collected during TANGRA project tests [4,5]. The agreement between our experimental data and the Geant4 (MC) simulation result is excellent. We have also compared our results with others'data and MCNP result and found our results are more consistent. The propagation of error or micro-correlations takes into account various sources, including source activity, gamma ray abundance, gamma ray counts, and the half-life of radioactive nuclides. These correlations are thought to be the source of covariance information for the efficiency of the HPGe and LaBr3(Ce) detectors at various ɣ-ray energies. This study aims to provide a thorough analysis of photo-peak efficiencies together with covariance matrix data. In many different domains, such as nuclear physics, environmental science, medicine, geology, archaeology, and more, gamma-ray spectroscopy is an essential analytical method.

Section

Applications of nuclear methods in science, technology, medicine and radioecology

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