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Cosmic-ray induced background of shielded HPGe detector

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In experiments searching for rare nuclear events (neutrinoless double beta decay, dark matter, etc.) detailed knowledge of background is necessary in order to achieve reliable analysis and interpretation of experimental data [1]. In the ground-based laboratories, the significant contribution to the background of the detector spectrum originates from the interaction of cosmic rays with materials in the vicinity of the detector and detector itself [2]. In order to achieve reliable interpretation of data, it is necessary to understand and properly analyze background of the HPGe spectrum. One way to investigate background of the HPGe spectrum is to use Monte Carlo simulation [3]. In this paper, GEANT4 software package is used to perform simulation of HPGe detector system, consisting of detector relative efficiency of 100%. Muon and neutron components were simulated separately in order to achieve simpler separation of obtained data. Simulated spectra were merged and compared with experimental one. Furthermore, cosmic-ray induced processes in the Ge crystal itself, as well as in the detector shielding were investigated and spectra corresponding to certain processes induced from cosmic muons and neutrons were obtained. Contributions from each component were quantified.

References:

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