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SIMSPEC-G: a new code for simulating the working of HPGe detectors

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HPGe detectors are one of the most important components of experimental nuclear physics. Therefore, a deeper understanding of them is required for better utilization of the available resources. Simulations allow us to do that in a faster way while also pointing to unaccounted processes in case of a mismatch between simulated and measured spectra. While there exist many simulation routines to reproduce a spectrum, these are complicated as they are designed to have as few restrictions on the general setup, so as to cater to many detector materials and geometry. The new code SIMSPEC-G, being developed, is simple, fast and specific to HPGe detectors. In the beginning, we consider gamma photons $\leq$ 1 MeV, which interact with detector material through photoelectric and Compton interactions only. The interaction length is estimated using the energy dependent cross section data of the detector material obtained from the photon database at NIST [1]. SIMSPEC-G allows for tracking of gamma photons passing through the detector, storing the information about the type (Compton or photoelectric) and the point of interaction, energy lost, etc. This allows us to compute the energy spectra, the most probable energy deposited after the first interaction, distribution of different types of multiple scattering processes at different energies, efficiency, etc. Initially, we worked with a single crystal geometry, but later we extended the simulation to accommodate for clover geometry. We also worked out the effect of multi-segment events, due to clover geometry, on various parameters. The distribution of energy deposited in the first interaction segment in case of multi-segment events was also studied. Addback factor's variation with incident photon energy is also estimated. Further details will be shared in the presentation.

REFERENCE

1. M. J. Berger, J. Hubbell, S. Seltzer, J. Chang, J. Coursey, R. Sukumar, D. Zucker and K. Olsen, "XCOM: Photon Cross Sections Database," 1 November 2020. [Online]. Available: www.nist.gov/pml/xcom-photon-cross-sections-database

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