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Title : Geant4 code for gamma spectrometry measurement: a toolkit for Nuclear, Medical, Astronomical and High Energy Physics.

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Abstract : In the Monte Carlo method, quantities of interest for the application are calculated through statistical sampling of interaction processes. Gamma spectroscopy is a widely used technique, well-illustrated by the following list of examples: Environmental Radioactivity Monitoring, nuclear industry, geochemical investigation, and astrophysics. Most radioactive sources produce gamma rays, which are of various energies and intensities. Geant4 (for GEometry ANd Tracking) is a platform for the simulation of the passage of particles through matter, using Monte Carlo methods. The GEANT4 toolkit allows the simulation of the following physical processes: the photo-electrical effect, the Compton Effect, the electron-positron pairs generation and the Rayleigh diffusion. Our study shows the combination between gamma spectrometry, development of related Monte Carlo equation and the presentation of the Geant4 toolkit for gamma spectrometry simulation (simulation of the interaction of gamma photon through matter). It is clearly found, at the end of this study, that Monte-Carlo simulation is a useful, inexpensive alternative that also provides greater flexibility and gained time when determining the detector response and efficiency during an environmental monitoring.

Key-words: Monte Carlo method; Geant4 toolkit; Gamma spectrometry; simulation; geometry; interaction

Graphical summary: Preliminary geometry of BEGe 6530 model simulation (Geometries & detector construction).

