Comparison of relative rates for the PhotoElectric, Compton, and Pair Production physics processes in GEANT4 Using Silicon

1 Abstract

The objective of this report is to compare photoelectric effect, compton scattering, and pair production rates to each other for incident photons in the energy interval from 100 eV to 10 GeV.

2 Discussion

30 cm thick Si target is constructed in GEANT4. 8 different energies (100 eV, 10 keV, 100 keV, 1 MeV, 10 MeV, 100 MeV, 1 GeV, 10 GeV) are chosen for the incident gamma and 10000 simulations are performed to improve statistics. The physics processes are assigned ProcessID variable which is 1 for photoelectric effect, 2 - for compton scattering, and 3 - for pair production. ROOT is used to plot a 3-D representation of the process type on Y-axis, the incident photon energy on the X-axis and the number of counts along the Z-axis. The results presented in figure 1 show the dominance of the photoelectric effect as the interaction mechanism at low energies. Compton scattering probability increases and becomes dominant mechanism in the energy interval between several hundred keV and several MeV, where pair production overtakes.
Figure 1: Comparison of photoelectric effect, compton scattering, and pair production rates to each other for incident photons in the energy interval from 100 eV to 10 GeV

References

[1] Class notes