

## AbstractID: 10942 Title: Verification of the GEANT4 Monte Carlo Code in Low Energy Photon Transport

**Purpose:** GEANT4 is a powerful and versatile general-purpose Monte Carlo code. The reliability of GEANT4 in high energy photon transport has been largely confirmed. On the other hand, the discrepancy to other Monte Carlo codes in low energy range has also been reported in the past years. The purpose of this investigation is to explore the performance of GEANT4 at low photon energies (< 50 KeV), and to verify the recent improvements of GEANT4 in photon physics.

**Method and Materials:** The MCNP Monte Carlo code will be used as the reference in this study. The physics of dominant photon interactions in low energy range (Photoelectric effect, Compton scattering, and Rayleigh scattering) implemented in the two codes and the corresponding cross section/attenuation coefficient data will be compared. The production of fluorescent photons, which play an important role in dose deposition of KV photons, will be especially addressed. Simplified cases involving  $^{125}\text{I}/^{103}\text{Pd}$  or KV X-ray beam will be modeled and simulated with both MCNP and the latest version of GEANT4 to exemplify the extent of influence under various situations.

**Results:** Detailed physics descriptions are required for modeling low energy photon transport in Monte Carlo codes. Differences in physics implementation between MCNP and GEANT4 are known. These differences could induce noticeable differences in radiation dose and particle flux.

**Conclusion:** GEANT4 has been gradually accepted to be a very useful Monte Carlo simulation tool to tackle many problems in radiation therapy. A comprehensive study of KV photon transport provides verification of the reliability of the code in the low energy range, and will potentially boost the applications of GEANT4 in radiotherapy modalities such as eye plaque therapy, prostate seed implant brachytherapy, and intraoperative radiotherapy (IORT).