

AbstractID: 9353 Title: Recent Improvements in the Geant4 Monte Carlo Simulation Toolkit for Medical Physics Applications

Purpose: Rapid growth of the medical user base for the Geant4 Monte Carlo Simulation Toolkit over the past few years has led to major improvements in the code addressing specific needs of the medical physics community. Problems in applying the toolkit to the energy domain of medical physics have been indicated by users (e.g. by the paper by Poon et al. [1]) and subsequently addressed by the code developers. Consequently, many recent papers show greatly improved results for simulations [2,3]. The purpose of this presentation is to update the medical physics community about key improvements in the Geant4 toolkit for radiotherapy physics applications. **Method:** A recent Technical Note published by the SLAC (Stanford Linear Accelerator) Geant4 team has provided the first and most useful summary of code improvements in the energy regions of interest to radiation therapy. We have analyzed this information and assessed the impact on simulations in electron and photon therapy. Further, we have expanded the information to issues affecting proton and ion therapy as well as imaging applications. **Results:** The original multiple scattering model in Geant4 was based on the Lewis formalism. Results from Poon et al. and others showed that the approach was insufficiently precise. In response to these findings, modifications were made to the model based on ideas from Penelope and EGSnrc including: limit the particle step size near geometry boundaries, use correlations between lateral displacement and scattering angle and add options to use single or plural scattering near boundaries (instead of multiple scattering). Single Scattering processes were added which can be used to entirely replace multiple scattering if desired. Models for energy loss fluctuations were substantially revised. **Conclusion:** This presentation summarizes significant recent improvements in Geant4, which may lead to an even more widespread acceptance of this toolkit in radiation therapy.