AbstractID: 9470 Title: Geant4 Benchmarking for IMRT Dose Calculations

Purpose:
The purpose of this work is to test the accuracy of the Geant4 release 9.0 for use in IMRT patient dose calculations. This is of importance since major changes were made in the multiple scattering engine starting with Geant4 release 8.0, but the package has not since been extensively tested for low energy photons relevant for simulating patient treatments. We compare calculated dose distributions in homogeneous and heterogeneous multilayer phantoms with experiments and with results from a well-benchmarked Monte Carlo toolkit, DPM (Dose Planning Method).

Method and Materials:
We investigated the ability of Geant4 to reproduce experimentally measured lateral and depth dose profiles in a homogeneous water phantom irradiated with 10x10 cm^2, 30x30 cm^2 and 40x40 cm^2 open fields. The results were compared with both DPM and experimental data. Next, Geant4 was used to calculate dose distributions in heterogeneous phantoms consisting of slabs of water, bone and lung, paying particular attention to the handling of material interfaces. The results were compared with DPM.

Results:
We find that Geant4 and DPM give nearly identical results for each of the heterogeneous phantoms, agreeing to better than 2% in the depth dose through each material and the lateral dose profiles across all material boundaries. The agreement between Geant4, DPM and experimental data in the homogeneous water phantom is also quite good, with all three agreeing to within 2% in depth dose (neglecting the buildup region), and in lateral dose profiles taken at 5 and 10 cm depths (neglecting the beam penumbra).

Conclusion:
Homogeneous and heterogeneous phantom studies show that Geant4 yields accurate dose distributions for clinically relevant photon fields.