AbstractID: 1337 Title: Investigation of a Deterministic Method Incorporating Coupled Photon-Electron Transport for Photon Beam Dose Calculations in the Presence of Heterogeneities

The accuracy of an adaptive deterministic method, incorporating coupled photon-electron transport and variably sized tetrahedral elements, has been evaluated for use with external photon beam dose calculations. The approach is based on the Attila radiation transport code[1,2], which solves the differential form of the linear Boltzmann transport equation for neutral particles and the linear Boltzmann-Fokker-Planck transport equation for charged particles. Comparisons were made with EGS4/Presta for a 1.5x1.5 cm^2 18 MV polyenergetic beam from a uniform point source incident on a slab phantom (30.5x39.5x30 cm^3) with the following layers: water (0-3 cm), aluminum (3-5 cm), lung (5-12 cm), and water (12-30 cm) [3]. EGS4/Presta parameters included ECUT=0.700 MeV, AE=0.521, ±0.3% statistical uncertainty, and 0.5x0.5x0.2 cm^3 voxels. The Attila calculation included 92,000 tetrahedral elements (0.2 cm spacing along the central beam axis), S_{12} angular quadrature, P_5 scattering order, 24 photon groups and 41 electron groups. Dose was compared along the central axis voxels in EGS4/Presta. Agreement between both codes was excellent. The RMS difference was 1.36%, or 0.71% of the maximum dose.

[1]Wareing TA, *et al*., "**Discontinuous Finite Element Sn Methods on 3-D Unstructured Grids**", *Nucl. Sci. Engr.*, Volume 138, Number 2, July 2001.

[2]Wareing TA, *et al.*, "**Coupled Electron-Photon Transport Methods on 3-D Unstructured Grids**", *Trans Am. Nucl. Soc.*, Washington D.C., Vol 83, 2000.

[3]Rogers, DWO, Mohan R, "**Questions for comparison of clinical Monte Carlo codes**". In *The Use of Computers in Radiotherapy, XIIIth Int'l Conf., Heidelberg* ed. By W. Schlegel and T. Bortfeld, (Springer-Verlag, Heidelberg 2000) pp. 120-122.