AbstractID: 13900 Title: A Coarse Mesh Transport Method for the Calculation of Photon Energy Deposition in Tissue

Purpose: To develop and test a novel, transport-based method for calculating the energy deposition of a photon beam in tissue. **Method and Materials:** The new method is based on a hybrid Monte Carlo-Deterministic Coarse Mesh Transport Method COMET. COMET is a method for solving the linear Boltzmann Transport Equation based on an incident angular current expansion. It has been shown to perform well for 2D coupled photon-electron transport calculations aimed at determining the energy deposition of a photon beam. The COMET method uses pre-computed Monte Carlo-based response expansion coefficients to achieve accuracy comparable to Monte Carlo methods in a fraction of the time. The current work extends the photon transport capability of the COMET method to handle 3D geometry and to simulate realistic photon sources. The method is tested with a simple benchmark problem consisting of a 20x20x20cm water phantom irradiated by a collimated, polyenergetic photon source at a source-to-surface distance (SSD) of 80cm. Although the COMET mesh size is arbitrary, the phantom is divided into 1x1x1cm voxels for convenience. The accuracy of the method is evaluated by comparison to a reference calculation performed with EGSnrc. **Results:** The distribution of energy deposition was examined voxel by voxel. The largest error for any voxel is found to be less than 3.3% of the maximum energy deposition value from the reference solution. The relative standard error for each voxel in the reference solution is less than 0.5%. The COMET solution took 0.27 core-hours to compute compared with 84 core-hours for the reference solution. **Conclusion:** The work indicates that the COMET method holds promise for fast and accurate 3D photon and electron dose calculations. Furthermore, sources of error are identified and suggestions are made to improve the accuracy of the new method during future development.