AbstractID: 10634 Title: Fast kerma-based patient dose calculations in diagnostic radiology using EGSnrc

Purpose: Current studies aim at individual, Monte Carlo (MC) based estimation of dose to patients undergoing computed tomography (CT) examinations. The EGSnrc MC code is known to simulate radiation transport accurately and was extended for efficient calculations in x-ray diagnostic procedures. **Method and Materials:** Based on the EGSnrc/egspp class-library the user-code CTDOSPP was developed, allowing for the rotation of sources in a step&shoot or spiral mode with arbitrary pitch along a CT-based, voxelized patient geometry. Formfilter geometries are accounted for by weighting primary photons depending on their attenuation in the filter. Photon-splitting and track-length estimators (TLE) were implemented for calculation of kerma, usually adequate in energy range of diagnostic x-rays. The TLE uses precalculated energy-absorption coefficients and track-lengths of photons within a voxel. CTDOSPP results were compared to kerma-distributions in homogeneous phantoms of the standard DOSXYZnrc code for static kV-fields. Efficiency of the implemented TLE for a complete CT-simulation was calculated in realistic thorax geometries at various dose-grid resolutions. **Results:** Calculated distributions agreed within statistical uncertainty of <1% for kerma-calculations. DOSXYZnrc was about a factor 2 slower than CTDOSPP, both using photon-splitting, presumably due to the improved implementation of geometry related functions in egspp. For patient geometries the kerma-calculations employing the TLE were up to 170 times more efficient than full dose calculations without any variance reduction and including secondary electron transport. Compared to the splitting-technique, the TLE was up to 14 times more efficient in calculating kerma, depending on the chosen resolution of the dose-grid. For a complete thorax scan, dose to the lungs could be calculated within a sub-percent statistical uncertainty in less than a minute on a standard desktop PC. **Conclusion:** CTDOSPP simulates typical CT- and other kV x-ray procedures and resulting kerma-distributions efficiently, thus allowing for individual dose estimation in diagnostic radiology in the future.