AbstractID: 10168 Title: Comparison of RTPS and Monte Carlo dose distributions in heterogeneous phantoms for clinical photon beams

Purpose: To compare dose distributions from three different radiotherapy treatment planning systems (RTPS) with those from Monte Carlo (MC) calculations and measurements, in heterogeneous phantoms for photon beams. **Methods and Materials:** This study used four algorithms for RTPS: AAA (analytical anisotropic algorithm) implemented in the Eclipse (Varian Medical Systems) treatment planning system, CC (collapsed cone) superposition from the Pinnacle (Philips), and MGS (multigrid superposition) and FFT (fast Fourier transform) convolution from XiO (CMS). The dose distributions from these algorithms were compared with those from MC and measurements in a set of heterogeneous phantoms. The phantom inhomogeneities mimic relevant clinical treatment sites, which include lung slab, lung-bone slab, bone-lung slab, mediastinum, and tumor geometries. The benchmark comparisons were performed in lung densities of 0.30 g/cm^3 and a bone density 1.819 g/cm^3 for 3×3, 5×5, and 10×10 cm^2 field sizes, 4, 6, 10, and 15 MV photon beams. **Results:** MC dose distributions agreed much better with measured data than the superposition algorithm in a set of heterogeneous phantoms. The difference in dose distributions between Eclipse-AAA and MC were up to 15%. Eclipse-AAA underestimated the dose inside the lung region for low energies of 4 and 6 MV, and in constant, overestimated in the tissue region. The dose distributions from Pinnacle-CC and XiO-MGS almost agree with those of MC and measurements but increase errors at15 MV, especially for a small field of 3×3 cm^2. The FFT convolution extremely overestimated the dose inside the lung slab compared to MC. **Conclusions:** The dose distributions from the superposition algorithms almost agree with those from MC as well as measured values at 4 and 6 MV. The dose errors for Eclipse-AAA are lager in lung model phantoms for 4 and 6 MV. The FFT convolution should not use for dose calculations in heterogeneous regions.