AbstractID: 14138 Title: Clinical issues associated with the use of Monte Carlo–based prospective planning for lung SBRT and spine SRS patients

Purpose: To investigate the clinical issues associated with the use of Monte Carlo–based prospective planning for lung SBRT and spine SRS patients. **Methods:** Experimental verification of the iPlan v.4.1 MC photon beam algorithm (BrainLab) was performed using film and ion-chamber in water phantoms and solid-water slabs containing bone and lung-equivalent materials for a 6 MV photon beam from a Novalis linac. MC dose verification was performed for 5 spine and 7 lung patients using an anthropomorphic phantom. Treatment plans of prospectively treated patients were examined to investigate the influence of statistical uncertainties, MC-based dose-to-water (D_w) and medium (D_m) and calculation speed. **Results:** Agreement between calculations and measurements in the water phantom verification tests was, on average, within 2%/1 mm (high dose/high gradient), and was within ±4%/2 mm in the heterogeneous slab geometries. For spine SRS, the agreement between PB and D_m calculations were within 4 % of IC measurements, however, the difference between MC_D_w and D_m was on average 9 %. For the lung SBRT tests the average difference between calculated PB doses and IC reading was 13%, and both MC calculations agreed within 1.5 % of measurements. The use of reduced uncertainty below 2% increases dose calculation time significantly but has an insignificant effect on the dose volume histograms (DVH). **Conclusion**: Prospective treatment planning with a well-commissioned MC algorithm provides improved dose coverage and can be introduced for efficient calculations in the routine clinical setting. However, further investigation is warranted on issues such as dose-to-medium and water, the impact of statistical uncertainties on serial and parallel organs, and proper approaches for reliable dose measurements at small field sizes, under non-equilibrium conditions.
Acknowledgement: Supported in part by a grant from the NIH/NCI (R01CA106770)