AbstractID: 4914 Title: Monte Carlo Dose Verification of Prostate Patients Treated with Simultaneous Integrated Boost IMRT

Purpose: To evaluate the dosimetric accuracy of Superposition/Convolution (SC) and Monte Carlo (MC) calculated dose distributions for simultaneous integrated boost (SIB) prostate cancer intensity modulated radiotherapy (IMRT) compared to experimental (film) measurements and the implications for clinical treatments.

Method and Materials: Twenty prostate patients treated with in-house SIB-IMRT protocol were selected. SC-based plans used for treatment were re-evaluated with EGS4-based MC calculations for treatment verification. Accuracy was evaluated with-respect-to film-based dosimetry. Comparisons used γ-index, DTA, and superimposed dose distributions. The treatment plans were also compared based on dose-volume indices for targets and critical structures.

Results: Flat-phantom comparisons demonstrated that the MC algorithm predicted measurements better than the SC algorithm (%γ>1 8.4% for MC vs. 18.3% for SC). The average $PTV_{prostate}$ D_{98} and PTV_{nodes} D_{95} indices agreement between SC and MC was 1.2%±1.1 (range: -38%, +0.1%) and 1.6%±1.5 (range: 3.6%, 0.6%) respectively. For rectum, the average differences in SC and MC calculated D_{50} ranged from -3.6% to 3.4%. There were up to 34.3%±42.5 (range: 0.2%, 115%) differences between SC and MC calculated average D_{50} index for small bowel. This large deviation is due to large differences in small bowel volume within the treatment field and small bowel dose for each patient. For femurs, the differences in average D_{50} reached up to 9.6%±4.5 (range: 1.2%, 14.5%).

Conclusion: MC agrees better with film measurements than SC. Although on average SC-calculated doses agreed with MC calculations within the targets within 2%, there were deviations >10% for some patient's treatment plans. The major source of these deviations may be due to the inaccuracies in fluence prediction model for SC calculation. The use of SC may compromise the clinical outcome of patients and MC-based IMRT would be beneficial for IMRT plan optimization. (Supported by NIH-R0198524).