

AbstractID: 13919 Title: Assessing dose inaccuracies in the Superposition/Convolution Algorithm with Monte Carlo for SBRT lung tumors

Purpose: To assess dose inaccuracies in the superposition/convolution dose algorithm with Monte Carlo and how it affects SBRT lung treatments.

Materials & Methods: The treatment strategy for the SBRT tumors at MGH is to use 3DCRT for tumors with motion amplitude of less 5mm. The SBRT treatment planning uses either 2 or 3 non-coplanar arcs, with a total of 8-10 beams. Following the dose planning guidelines provide by RTOG 0813 and 0618, the PTV is conformed with an isodose between 60% and 80% value. This will guarantee that the penumbra tail does not extend to deeply into the lung, while manipulating the hotspots of 120-140%, such as to situate them within the PTV region. SBRT dose calculation is performed with the commercial CMS superposition/convolution algorithm (SCA) and verified with in-house developed Monte Carlo (MC) dose engine. SCA was also compared with MC in heterogeneous GAMMEX phantom to assess in a wide range of heterogeneous materials the accuracy of SCA.

Results: A cohort of 10 SBRT patients was studied with both SCA and MC dose algorithms comparing PTV coverage after dose normalization. The SCA was shown to incorrectly estimate the dose in the PTV by 1-3% relative to the MC prediction, before normalization. The SCA differences occurred when the tumor was situated very close to a bone structure, such as rib cage. Similar results were observed in the irradiation of the heterogeneous phantom. The SCA dose algorithm inaccurately predicts doses if the region is shadowed by a high density material such as bone.

Conclusions: Lung Cancer is the number one cause of cancer mortality in both men and women. Inaccuracies in the SCA dose computation can affect the treatment outcome of SBRT. This study suggests that accurate dosimetry in SBRT treatment of lung patients requires the use of Monte Carlo techniques.