AbstractID: 8955 Title: 4D planning from multi phase 3D dose distribution and linear transformation on a single phase plan

Purpose: To reconstruct a 4D dose distribution from the planned dose based on one phase of a 4D-CT image and compare with results from 4D dose reconstructed from multiple phases and phantom measurements.

Method and Materials: A treatment plan was developed for a set of CT images from a single phase of a respiratory motion phantom using ADAC pinnacle TPS. The single phase reconstructed dynamic dose distribution to a coronal pane was obtained for several tumor trajectories by applying a linear transformation on the optimized dose from pinnacle. This was then compared to the dynamic dose distribution obtained by considering a weighted sum of dose distributions from plans based on eight phases of the tumor cycle. Measurements using radiochromic films were made following plan delivery on a LINAC to validate our results.

Results: Using gamma index analysis, the number of pixels exceeding a gamma index of 1 was 7% and 0% for the measured versus single phase, and the single versus multi-phase reconstructed dynamic dose respectively. This was based on a dose difference tolerance of 5% and DTA tolerance of 5mm. The effects of phase dependent weighting versus equal weighting were in general negligible on the dose distribution for the trajectories studied. Using dose difference tolerance of 3% and a DTA tolerance of 4mm, the comparison yielded 0.5%, 0.72% and 1.72% as the percentage of pixels exceeding the gamma index of 1 for sinusoidal tumor motion amplitudes of 1cm, 1.5cm and 2cm respectively.

Conclusion: There was close agreement between the two methods of reconstruction and with measurements. Recreating the dynamic dose distribution from the static dose distribution from a single CT image set can be an efficient way of accurately accounting for relative motion in a static or dynamic dose delivery and can be useful in pre-treatment verification analysis.