

AbstractID: 3663 Title: Cumulated fraction effects on the interplay between MLC and respiration-induced intra-fraction motion during step-and-shoot IMRT and dynamic arc delivery

**Purpose:** To investigate the cumulative MLC and respiration-induced tumor motion interplay effects over a multi-fraction treatment regimen for step-and-shoot IMRT and dynamic arc delivery.

**Method and Materials:** Seven-field IMRT and nine-arc dynamic plans were used to test the interplay effects between the MLC and respiration-induced motion. Respiration-induced motion was simulated with a motion model consisting of a slide-table with a platform placed on top of the slide table. Phantoms were placed on top of the platform and ten film measurements were performed for sinusoidal motion in the superior-inferior direction and the medial-lateral directions with a motion amplitude of 1 and 2 cm and period of 4 s. Each of the films was obtained by initiating the treatment at a random starting motion phase, and marked with fiducials that were later used to register and add the films from successive fractions. The cumulated average following each fraction was subtracted from the 10-film average, which represented a previously validated approximation to the ensemble average accounting for all possibilities of starting motion phase, field loading time, and inter-beam setup time.

**Results:** Marked differences in the shape of the isodose lines are observed between different fractions. A histogram distribution of the difference between the average 2D film dose distribution from 10 films and the cumulated average from successive fractions (1-9) showed progressive narrowing. The greatest change in the distribution occurred between fractions 1-3. The standard deviation of the distribution decreased to  $< 1$  cGy after 6 fractions for motion in the M-L and S-I directions for step-and-shoot IMRT delivery and 7 fractions for dynamic arc delivery.

**Conclusion:** Our results indicate that the interplay effects between the MLC and periodic tumor motion markedly diminish after 6-7 fractions for both step-and-shoot IMRT and dynamic arc delivery.

**Conflict of Interest (only if applicable):** N/A