AbstractID: 6774 Title: Management of dynamic MLCs when treating moving targets

Purpose: Interplay between organ motion and leaf motion has been shown to generally have a small dosimetric impact for most clinical IMRT treatments. However, it has also been shown that for some MLC sequences there can be large daily variations in the delivered dose, depending on details of the patient motion or number of fractions. This study investigates guidelines for dynamic MLC sequences that will keep daily dose variations within 10%.

Materials and Methods: Dose distributions for a range of MLC separations (0.2 - 5.0cm) and displacements between adjacent MLCs (0 - 1.5cm) were exported from Eclipse to purpose-written software which simulated the dose distribution moving across a moving target. Target motion parallel and perpendicular to the MLC motion was investigated for a range of amplitudes (0.5 - 4.0cm), periods (1.5 - 10s), and MLC speeds (0.1 - 3.0 cm/s). Target motion was modeled as $\sin^6$. MLC sequences were identified which kept dose variations within 10% compared to the dose delivered with no motion. Results were confirmed experimentally by measuring the dose delivered to MOSFETs in a moving phantom for a range of MLC sequences.

Results: The maximum allowable MLC speed when target motion is parallel to the MLC motion can be conservatively summarized as a simple function of target amplitude and MLC separation. When the target motion is perpendicular to MLC motion the maximum allowable MLC speed can be described as a function of MLC slit width and the displacement of adjacent MLCs. The guidelines were successfully applied to two-dimensional motion. Rules were less restrictive for periods<4s, indicating that it may be useful to monitor or control patient breathing.

Conclusion: Some MLC sequences should be avoided. The use of simple guidelines when treating moving targets using dynamic IMRT can reduce the possibility of large variations in delivered dose.