

AbstractID: 10939 Title: Measurements of Fiducial marker positions for real-time MLC beam tracking delivery using MV fluence video

Purpose: The objective of this work was to perform fiducial marker position measurement for real-time MLC beam tracking delivery using MV fluence video.

Method and Material: Fiducial markers implanted in the tumor have been proposed for obtaining accurate target localization. Correlation of the on-line acquired marker trajectory with the actual motion is crucial in real time tracking. This study was based on real-time video, in which an EPID was used to acquire MV fluence of a dynamic phantom with an implanted fiducial marker. A QUASAR dynamic phantom was used to mimic patient respiratory motion. The motion of the dynamic phantom insert was achieved using an actuator generating sinusoidal motion to the moving rod. The measured fiducial marker position was compared with the actual marker position on the sinusoid curve for beams perpendicular to the direction of marker motion.

Results: The integrated marker trajectory accumulated within a 1 mm vibration range in a straight line along the motion direction for a 15 respiratory cycle measurement. The acquired trajectory extent of motion (peak-to-peak amplitude) was exactly 20 grids which matched well with the actual marker peak-to-peak amplitude of 20 mm. A plot of the acquired and programmed curves showed latency (~100 ms) between the acquired and actual marker trajectories for the first 2 ~ 3 cycles. Thereafter, the measured fiducial marker positions matched its motion curve well within 50 ms latency with the amplitude vibrations within 2 mm error along the motion direction.

Conclusion: Fiducial marker position measurement from MV fluence is a crucial step in real-time tracking radiotherapy. This study demonstrated a close correlation between the acquired and actual marker positions for a simple sinusoidal motion. More complex trajectories involving actual patient breathing patterns will be analyzed in the future.