AbstractID: 5593 Title: Accuracy of gated IMRT delivery on the Varian Linac using the Real-time Position Management System

Purpose: To investigate the accuracy of gated IMRT delivery on a Varian linear accelerator equipped with the Realtime Position Management (RPM) camera and software.

Method and Materials: A non-uniform dose distribution within a solid water phantom was contoured and planned with IMRT. A sinusoidally oscillating platform simulated superioinferior respiratory motion, and a reflecting block was placed on the surface of the platform to provide a "respiratory" signal to the RPM camera. First, the phantom was stationary while the platform served only to provide the respiratory signal. The respiratory period was 5 sec, and the treatment was delivered in phase-gated intervals of 6%, 10%, 25% and 50%. Second, the phantom was placed on the platform, with motion amplitude of 6 cm. Here, dose was delivered to the phantom during a small amplitude-defined interval at end-expiration, with periods 1.7 sec, 5.3 sec and 12.6 sec. Dose distributions were captured on film.

Results: Dose profiles generally showed variation between configurations less than 2% the maximal dose, with shorter-interval delivery providing slightly less dose than longer-interval delivery. The only notable difference occurred for the phantom moving with respiratory period of 1.7 sec, where dose fluctuations of nearly 6% occurred at regions of high dose gradient in the direction of motion. It should be noted that the gating interval spanned 15% the respiratory cycle, implying the beam was delivered in only 1.7 x 0.15 = 0.25 sec intervals.

Conclusion: Gated IMRT delivery provided dose distributions equivalent to ungated delivery to within clinically acceptable limits. This result held for significant motion amplitude, under a wide range of respiration frequencies and gating intervals. While discrepancies up to 6% arose at high gradient borders for configurations of extremely rapid motion and short beam-on time, these parameters are very unlikely to be seen in any clinical situation.