AbstractID: 11610 Title: Validation of amplitude and phase gating against potential irreproducibility of motion

In gated radiation therapy, reproducibility of patient's internal motion between imaging and delivery is essential. However, changes in period, amplitude, shape of motion, and baseline shift occur. In this study, we investigated the dosimetric impact of the changes on the coverage of clinical and internal target volumes for phase and amplitude gating. We used conventional and intensity-modulated beams that are designed to cover internal target volumes. We assumed a duty cycle of 40-to-60% phases and equivalent amplitudes, a period of 4.5sec, and an amplitude of 4cm as conditions used in imaging. We introduced the above changes from these and used actual patient's breathing motion in the measurement and computational simulation on a diode array (double precision). When a baseline shift of -1cm was assumed, only a part (67%) of clinical target volume (CTV) received a prescribed does for phase gating; a similar profile shift in delivered dose was observed for the amplitude gating (when the amplitude window was stationary). As the amount of the shift increased, the impact increased. An amplitude change by a few centi-meters caused a shift in delivered dose profile and underdose in CTV for phase gating. The underdose was not observed for amplitude gating. The change in breathing periods did not affect the delivered dose profile. The change in breathing pattern from sinusoidal into linear shapes showed underdose in 12% of CTV and profile change for phase gating and no profile change and underdose for amplitude gating. The simulations agreed with the measurements, and used for the amplitude gating study. Results based on actual breathing patterns and intensity-modulated fields will also be presented. This study has demonstrated that unless the amplitude opening is not adapting to the movement and extent of CTV, gated therapy is susceptible to the irreproducibility. Partly supported by Varian Medical Systems, Inc.