

AbstractID: 7611 Title: Dual window gated beam delivery for stereotactic body radiotherapy

Purpose: It is crucial to have a small margin for stereotactic body radiotherapy (SBRT). Gated delivery is one of the methods to reduce intra-treatment organ motion. Total treatment time increases 3 or 5 times due to low duty cycle (20 – 30 %) when gated therapy. We have designed and tested the dual window gated therapy (DWGT) to increase duty cycle while to keep the residual motion unchanged.

Method and Materials: The DWGT turns beam on when breathing phase reaches the end of exhale (EE) or the end of inhale (EI), which will increase duty cycle up to 2 time than conventional gating. In order to make DWGT possible, a dynamic MLC file that has two static apertures to irradiate each gating position is generated. Dose rate is modulated to compensate the difference between gating MLC sequence and the breathing phase caused from breathing frequency variation during treatment. DWGT was tested with three breathing functions, the sinusoidal, the 4th order cosine and a patient's breathing signal (RPM, Varian). All the breathing signals used in this study have $\pm 20\%$ breathing frequency variations during treatment.

Results: Duty cycles which are to keep the residual motion less than 20% of the amplitude for the sinusoidal, the 4th order cosine and a patient's breathing signal were 20.7%, 46.8% and 38.3%, respectively for conventional gating. Duty cycles increased to 67.2%, 18.6% and 52.0%, respectively, which is 85%, 44% and 36% increasing effect from conventional gating when with DWGT. Little residual motion increase (less than 0.8 mm) for a patient's breathing signal, have been found between conventional gating and DWGT.

Conclusions: DWGT increased the duty cycle to 1.36-1.85 times while to keep minimal residual motion increasing effect. Since the duty cycle increase effect is breathing pattern dependent, the DWGT is useful for the selected SBRT cases.