

AbstractID: 7471 Title: The Feasibility of a Hybrid Active Breath-Hold/Gating Technique for Lung Radiotherapy

Purpose: Deep inspiration active breath-hold enables a reproducible tumor position but a long breath-hold is not practical for many patients with lung disease. Respiratory gating generally requires a surrogate (tracking blocks, strain gauges, etc.) that may not always correspond with actual tumor motion. In this study, we evaluated the feasibility of a hybrid system that used a short shallow inspiration active breath-hold to gate a linear accelerator.

Methods and Materials: Breath-hold volume deviation and tolerance for the hybrid breath-hold/gating technique were evaluated in four subjects. The subjects underwent breathing exams on an active breath-hold device, breathing at normal and fast inhalation flow rates and two different breath-hold volumes (0.6 L and 1.5 L). Latency in the active breath hold system was also measured with a simulated flow signal and a pressure switch. Gated beam stability (Elekta Synergy) was evaluated with an ion chamber and commercial diode arrays.

Results: The short breath-hold paradigm was tolerated well by all subjects. Active breath hold latency was measured to be 157.0 ± 7.8 milliseconds. The deviation between measured and intended breath-hold volume was dependent on the inhalation flow rate of the patient ($r^2 = 0.9363$). The percentage dose difference between non-gated and gated delivery was less than 0.5% for breath-holds longer than 3 seconds. Flatness and symmetry measured on SunNuclear's Profiler was relatively unaffected by gated delivery. Only 4% and 2% of diodes failed strict evaluation parameters in Mapcheck for 6 MV and 18 MV IMRT fields respectively.

Conclusions: The results of this study show that using a short active breath-hold for gating a linear accelerator is feasible.

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