AbstractID: 7251 Title: Dosimetric effects of a 4D Magnetic Localization System for LINAC beam gating on prostate and lung radiation therapy

Purpose:
The Calypso® Medical 4D Localization System is capable of tracking continuous dynamic motion, and has been FDA cleared for use in the prostate. To date, automatic intervention for the measured motion is not a function of the system. We investigated use of the system to gate radiation therapy delivery on a motion phantom for both a lung and prostate fraction

Materials and Methods
A Calypso gating prototype system with an optically isolated relay was connected to the BEAM_HOLD interface of a Varian Trilogy linac. A sample 3D lung plan and SMLC prostate plan were randomly selected from the active patient list. The Washington University 4D phantom was programmed to move a film box through 2 patient-measured prostate and lung trajectories. Radiation therapy was delivered to the static phantom, to the phantom undergoing each motion trajectory without gating, and to the phantom undergoing motion trajectories while the Calypso System was gating the linac. A 4x4x4 mm gating window centered on isocenter was used for the prostate, while a linear gating window corresponding to exhalation (ie 2 mm<y<5 mm) was used for the lung.

Results
Without gating beam delivery, prostate motion during treatment delivery caused approximately 10% underdosing and overdosing due to the superior/inferior and anterior/posterior prostate motion. The Calypso System triggering gated therapy delivery reduced these areas significantly, as seen in difference images using film dosimetry. Likewise, lung tumor motion caused a geometric mismatch between static and motion delivery. The Calypso System with prototype gating showed a decrease in this mismatch.

Conclusions
A wireless electromagnetic implanted transponder system for linac gating was effective in reducing dosimetric errors caused by prostate and lung motion. More work is needed to define optimal gating windows to provide maximal clinical efficiency with minimal delivery error.

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