AbstractID: 2817 Title: The Clinical Implications of Dynamic Therapies

Purpose: To quantify the effects of respiratory motion on breast treatments and to quantify the improvements in dose homogeneity when implementing gating therapy.

Methods and Materials: A breast phantom was constructed based on the average contours of 6 patients undergoing treatment of breast cancer. Dose to three axial planes was measured: superior, middle, and inferior. A respiratory simulator was designed to mimic breathing motion to a first order approximation. Three treatment types were compared: physical wedge compensators (PWs), enhanced dynamic wedges (EDWs), and step-and-shoot IMRT (ssIMRT). Four wedge angles (15º, 30º, 45º, and 60º) and three velocities of the phantom (v = 1.38 cm/s, v = 1.01 cm/s, and v = 0.50 cm/s) were studied. Dosimetry for each dynamic case was also analyzed when the Real-Time Position Management Gating System was implemented. Film was used as a dosimeter, dose area histograms (DAHs) were calculated for a breast and lung planning target area (PTA), and Normalized Agreement Test (NAT) Indexes were calculated in reference to the static case.

Results: In general, gating therapy improved dose to the breast PTA by up to 14% and reduced dose to the lung PTA by up to 24%. Dose homogeneity was dependent on respiratory rate and phase shift. Deviations from the static case were highest if the collimator speed was of the same magnitude as the speed of the phantom. With ssIMRT, gating the beam may compromise dose coverage of the breast PTA if the timing interval of the gate is too large. Gating the beam decreased NAT Indexes by 9 for PWs, by 16 for EDWs, and by 6 for ssIMRT.

Conclusions: Introducing gating therapy showed a significant improvement in dose homogeneity to the breast and lowered dose to the lung PTAs for all three treatment types.