

AbstractID: 2524 Title: Effect of Respiratory Motion on the Delivery of Breast Radiotherapy Using Physical Compensators and sMLC Intensity Modulation

Purpose: This study evaluates the effects of respiratory motion on breast radiotherapy delivered using physical compensators and sMLC intensity modulation.

Method and Materials: An anthropomorphic breast phantom was constructed of polyethylene plates between which radiographic films are inserted. The phantom is mounted on a moving platform which simulates one-dimensional sinusoidal oscillation with variable amplitude and frequency. The respiratory motion effect of three breast radiotherapy techniques was evaluated, including sMLC IMRT (Corvus TPS), custom-designed physical compensators, and aperture based IMRT. The treatment plans for the latter two techniques were generated using an in-house TPS. Film comparisons were performed to check experimental reproducibility and evaluate the effects of respiratory motion.

Results: Subtraction residues between two films measured under identical experimental conditions are well within 5%, which is within the uncertainties in experimental setup and dosimetric technique. The largest motion-induced differences occur at the posterior field edge where high dose gradients exist. This is due to dose blurring effects and does not depend on the delivery technique. The subtraction residue in the remainder of the treatment region is within 7%, with the exception of the apex of the breast in the Corvus IMRT plan. A virtual bolus region is created during Corvus planning to allow expansion of the intensity map outside of the skin contour. This region of “flash” is given an electron density of zero. The anterior hot spots observed in the Corvus plan are thought to result from the high intensity delivered to this virtual bolus region.

Conclusions: This work indicates that respiratory motion induced dose variations are generally less than about 2%, which is not considered clinically significant. However, further investigation is warranted to assure that the dose to the apex of the breast is not excessive when using the virtual bolus method to provide flash for Corvus IMRT plans.