AbstractID: 11281 Title: Comparison of dosimetric inaccuracies introduced by intra-fraction respiratory motion in IMRT and VMAT

Purpose: To compare the dosimetric inaccuracies introduced by intra-fraction respiratory motion in equivalent IMRT and VMAT plans.

Method and Materials: First, a commercial respiratory motion platform was adapted to support the 3D dosimetric phantom. A slit-field IMRT and equivalent VMAT plan were delivered to the phantom with one-dimensional (S-I direction) respiratory motion ($\cos^4$ pattern, peak-to-peak amplitude = 1.5cm, 15 BPM). A clinical patient IMRT plan and equivalent VMAT plan were also delivered to the moving phantom. The plans were delivered to the phantom with the motion platform both static and dynamic with a range of different starting phases in the respiratory cycle. Measurements were compared using the percent differences (PD) of the dynamic measurements relative to the static measurements.

Results: The mean dynamic versus static target PD for non-clinical IMRT and VMAT fractions were –6.4 ±11.9% and –4.2 ±6.7%, respectively. The mean dynamic versus static target PD for clinical lung IMRT and VMAT fractions were -1.1 ±4.2% and –0.9 ±3.3%, respectively. The PD of the clinical IMRT plan showed sensitivity toward the relative starting phase of the target, while the clinical VMAT plan did not. This suggested that the IMRT plan experienced a greater degree of the MLC interplay effect than the VMAT plan. After several fractions, IMRT and VMAT dosimetric inaccuracies due to respiratory motion became less distinguished, most notably for the IMRT plan.

Conclusion: In the context of stereotactic radiosurgery, in which fewer fractions are delivered, VMAT may be particularly advantageous to reduce discrepancies introduced by intra-fraction motion.