AbstractID: 8755 Title: Characterization of a delivery system for volumetric modulated arc therapy

Purpose: To evaluate the capabilities and characteristics of a delivery system for volumetric modulated arc therapy (VMAT).

Method and Materials: A linear accelerator control system capable of dynamic MLC motion, variable gantry speed, and dose rate modulation during arc delivery was evaluated. The speed and stability of MLC and gantry motion, and the stability of the dose rate was analyzed through a series of test arcs. The transition efficiency between variable dose rates and gantry speeds, reproducibility, and delivery performance of a clinical prostate VMAT treatment were also analyzed. Delivery characteristics and mechanical reproducibility were evaluated by analyzing dynamic delivery log file output and dosimetric agreement was evaluated using a cylindrical phantom with two orthogonal diode arrays.

Results: The VMAT control system was capable of maintaining a constant dose rate within 3–5% after a 40^{o} stabilization distance during constant MU/degree arcs from 0.21 to 3.33 MU/deg. Dose rate fluctuations were accounted for by gantry speed regulation during delivery. Leaf motion was stable with maximum positional errors of < 1 mm as the leaves traveled to their maximum extent and changed direction. Leaf errors were independent of gantry angle. Transitions between different MU/deg during delivery were smooth, with stabilization at the new dose rate in < 5 degrees. Dosimetric analysis of a prostate VMAT delivery had a gamma index (3%/3mm) of < 1 for 98.4% of diodes receiving > 4% of the maximum dose.

Conclusion: The linear accelerator control system was capable of delivering VMAT plans with constant and variable MU/deg. Small dose rate fluctuations are inherent in the system and are compensated for by dynamic changes of the gantry speed. Dynamic MLC motion is stable and not dependent on the gantry angle. Evaluation of the system on additional clinical plans is warranted.