AbstractID: 9347 Title: Multileaf Performance and Quality Assurance For Volume Modulated Arc Therapy

Purpose: The purpose of this study was to determine the effects of Multi Leaf Collimator (MLC) leaf velocity on leaf positional accuracy during modulated arc delivery.

Materials and Methods: MLC performance was measured for intensity modulated arcs delivered on a Varian21EX equipped with a 120-leaf dynamic MLC. The performance of the MLC was tested using arc-based delivery sequences developed by the investigators for routine MLC leaf velocity testing. MLC performance was also tested using actual VMAT delivery sequences created with a commercially available inverse planning system. Errors in the MLC leaf positions were measured using the MLC controller, which recorded positions of each leaf every 50 milliseconds. To characterize the performance of MLC leaves we introduce the notion of MLC leaf performance curve, which is defined to be a dependency between the MLC leaf velocity and the expected leaf position error.

Results: At leaf velocities below 2 cm/sec, the MLC leaves were within 2-mm of the planned position during 98% of the test sequences. The performance of the MLC leaves did not significantly vary with the MLC moving into or out of the carriage. However, there was a significant difference in the performance between the 5-mm and 1-cm MLC leaves. Large leaf velocities translate into large magnitudes of MLC leaf positional errors. The typical shape of the leaf performance curve is linear.

Summary: The maximum allowable leaf speed for VMAT treatment delivery will depend on the leaf sequencing. If the intensity is modulated with small MLC leaf separations, then the leaf velocity will need to be limited to 1 cm/sec. Leaf position errors of greater than 1-mm can have a detrimental impact on the delivered dose distributions for small leaf pair separations. Analyzing the leaf performance curves estimated for each leaf one can easily reveal poorly performing MLC leaves.