AbstractID: 5289 Title: Target Failure and Beam-on Load in Helical Tomotherapy

Purpose: To predict target failure for a Helical Tomotherapy unit based on cumulative beam-on time.

Materials and Methods: Helical Tomotherapy is a novel external beam clinical technology and as such it presents new quality assurance challenges. Our unit started treating patients in April 2004. By February 2006, the x-ray target had been changed three times (03/05, 09/05 and 01/06). On visual inspection, a damaged disk-target shows an annulus of severe wear. In one case, the annulus cut through the entire thickness so that the target was split into two parts. Another target had pieces of the outer rim flaked off. Near the failure of a target, machine output changes significantly (>±3%), which requires additional output checks and tuning, and it can also result in treatment interruptions. Although the output seems to decrease most of the time nearing target failure, increases have also occurred. Output variations can be explained by the nature of the target disintegration and its impact on the water-driven target rotation and cooling. We hypothesized that target failure frequency is related to cumulative beam-on time. Since a target replacement almost always entails clinical downtime, such a relation would be useful in predicting when a target change should be scheduled.

Results: We collected beam-on data—including daily and patient specific QA procedures but excluding MVCT beam-on and engineering time—for periods between target changes. The first, second and third periods of 12, 5.75 and 3.75 months had total beam-on times of 369, 212 and 136 hours, respectively. The average daily times for the same periods were 1.4, 1.68 and 1.65 hours.

Conclusion: These data are not yet conclusive but do suggest that lower average daily load impacts on target life stronger than cumulative load. An extended analysis of target wear and beam-on statistics, including MVCT times, will be presented.