AbstractID: 9320 Title: Treatment planning to reduce the impact of delivery errors in helical Tomotherapy

Purpose: To investigate the source of delivery quality assurance (DQA) errors observed for a subset of patients planned for treatment on Tomotherapy.

Method and Materials: Six patients planned on Tomotherapy were selected for analysis. Three patients had passing DQA plans and three had DQA plans with ion-chamber measurements that deviated from the expected dose by more than 3%. All patients were planned using similar parameters, including a 2.5 cm field width and pitch values ranging from 0.143-0.215. Machine output was determined not to be the problem so normalized leaf timing sinograms were analyzed to determine the mean leaf open time (LOT) for each plan. This analysis suggests the observed discrepancies are associated with plans having predominantly low LOTs. To test this, patients with failing DQA measurements were replanned using an increased pitch of 0.287. After replanning, new DQA plans were generated and ion-chamber measurements performed. Exit fluence data was also collected during the DQA delivery using the onboard MVCT detectors for dose reconstruction purposes.

Results: Sinogram analysis showed increases in mean LOTs of 30-85% for the higher pitch plans. In addition, ion-chamber measurements showed a reduction in point dose errors of 1.9-4.4%, bringing all patient plans within the ±3% acceptance criteria. Dose reconstruction results were in excellent agreement with ion-chamber measurements and clearly illustrate the impact of leaf timing errors on plans having predominantly small LOTs.

Conclusion: The impact of leaf timing errors on plans with low mean LOTs can be significant. This becomes important for plans using low pitches, or potentially for hyper-fractionated treatment schedules. The ability to reduce the impact of these errors by increasing the plan pitch is demonstrated. In addition, the efficacy of dose reconstruction in diagnosing delivery errors is established.

Conflict of Interest: Some authors have a financial interest in TomoTherapy, Inc.