AbstractID: 9267 Title: The Impact of Dose Rate Variations for Helical Tomotherapy

Purpose: Intensity modulated radiation therapy treatments using helical tomotherapy involve detector arrays which collect data and stores it in the form of sinograms. This detector data can be used to verify that treatments are being correctly delivered to the patient. The purpose of this work was to examine the dosimetric effect due to dose rate variations.

Method and Materials: During a helical tomotherapy treatment, the intensity of a rotating fan beam is modulated using a 64 leaf binary multi-leaf collimator (*MLC*). The beam passes through the patient and is incident on the detector array, where detector counts are stored as sinogram data. For this study, a total of 53 fractions were evaluated for two different patients (*1 Prostate and 1 Head & Neck*). MLC controller files, which run the delivery sequence for each fraction, were extracted from the data archive system, along with the treatment delivery sinograms from all fractions. Because machine output has a cyclical pattern, errors were first simulated as sine curves with magnitudes varying from 2 to 10%. Then machine output sequences were extracted from the treatment fractions and modified by using the actual variation.

Results: After visual inspection, it was observed that machine output can vary anywhere from 0-3%. When error simulations were inserted, dose differences ranged from 0.6-3%. The results from inserting actual treatment error back into the delivery sequence show that, with even a 1% variation in output, the dose difference is almost 0.5%.

Conclusions: The results show that dose differences for actual error insertions, while not very large, could still cause a discrepancy when routine QA is performed. Changes in machine output vary from patient to patient as well as from day to day, which can cause a difference in the planned and delivered dose.