

AbstractID: 6921 Title: Automated Quality Assurance for Helical Tomotherapy using Exit Detector Data

Purpose: The purpose of this work was to develop techniques for utilizing exit detector data in a helical tomotherapy system to automate the QA process. The clinical significance of this study is that an analysis of the exit detector data acquired during treatment delivery could be used to ensure that the correct delivery sequence is being administered to the patient.

Method and Materials: Software applications were developed to automatically analyze uncompressed detector data. To test this software, a MLC test sequence was designed that allows each MLC leaf to be tested using the exit detector data. The goals of this test are 1.) To identify MLC problems (*stuck leaves, bad valves, etc...*) before failure, and 2.) Perform QA Tests on MLC parameters that affect the delivered dose. Additionally, a clinical test case was created using the treatment delivery sequences for a head & neck patient. The original treatment delivery sequence was modified and 12 known MLC errors were inserted in the MLC controller file. The procedures were delivered and the software was used to analyze the exit detector data.

Results: The MLC QA Test was delivered on four occasions with two MLCs. A software application developed by the investigators was then used to analyze the exit detector data from these deliveries. The software correctly performed Latency Tests, Projection Centering Tests, and MLC Transit Time Tests. For each delivery, the tests showed that the MLCs were properly functioning. For the Head & Neck test case, the shape-detection algorithm was able to identify 11 out of 12 known MLC errors >10 msec.

Conclusion: A technique was developed for performing automated QA of the MLC and individual patient deliveries using exit detector data in a helical tomotherapy system. With the tomotherapy detector array, errors in MLC position > 10 msec have been detected.