AbstractID: 4533 Title: Geometric Accuracy of a Real Time Target Tracking System with Dynamic MLC

Purpose: Dynamically compensating for target motion during radiotherapy will increase treatment accuracy. A laboratory system for real time target tracking with a dynamic MLC has been developed. In this study, the geometric accuracy limits of this DMLC target tracking system were evaluated.

Method and Materials: A motion simulator was programmed to follow patient-derived tumor motion paths, parallel to the leaf motion direction. A target attached to the simulator was optically tracked, and the leaf positions adjusted to continually align the DMLC beam aperture to the target. Analysis of the tracking accuracy was based on video images of the target and beam alignment. The system response-time was determined and the tracking error measured. Response-time-corrected tracking accuracy was also calculated to investigate the accuracy limits of an improved system.

Results: The response-time of the system is 160±2ms. Because of this response-time, the tracking error is largest when the target velocity is highest. The geometric precision for tracking patient motion is 0.6-1.1mm (1σ) for the three patient datasets tested. The systematic tracking error is very small in all cases (<0.1mm).

Conclusion: A DMLC target tracking system has been developed that can account for detected motion parallel to the leaf direction. The overall geometric accuracy of this system is very promising, with negligible systematic tracking errors and ~1mm random tracking errors. Reducing the response-time will further increase the overall system accuracy.

Conflict of Interest (only if applicable): Two authors are principal investigators on sponsored research agreements between Varian Medical Systems and their respective institutions. One author is an employee of Varian Medical Systems.