AbstractID: 5400 Title: Validation of Synchronized Dynamic Dose Reconstruction using Film Dosimetry

Purpose: To validate a method of retrospective dose reconstruction that uses real-time intra-treatment patient motion data that is synchronized with MLC leaf positions during IMRT treatments.

Method and Materials: IMRT fields from an IRB-approved prostate protocol were delivered to a water-equivalent phantom on a programmable translation stage. Kodak XV film was placed at 5 cm depth with an SSD of 95cm and marked to register it with the Monte Carlo (MC) calculation grid. Motion was synchronized with beam delivery by using the target signal to trigger motion. Film measurements were repeated for each beam while the phantom was stationary, and while moving with both idealized and clinically measured motion profiles. MLC leaf positions and fluence state for each beam were obtained from the Varian DynaLog files. MC dose accumulation was performed which incorporated the real-time phantom motion, DynaLog files and beam state. Films were digitized and compared to the results of the MC calculations.

Results: Film measurements in stationary phantoms were measured three times on two machines. The measured dose distributions were compared and showed an average difference of 0.38 +/- 1.53 cGy. The average difference between MC and film measurements of the moving phantom was 0.44 +/- 3.4 cGy and was independent of the motion profile. Measured dose patterns, for both stationary and moving phantoms, were generally well reproduced by MC dose accumulation, including tongue-and-groove and motion related features. Doses in moving and static phantoms were compared, for both films and simulations. The measured dose deviations due to motion were well-characterized by the MC dose accumulation method and not significantly different when a static phantom was compared to MC calculation.

Conclusion: Real-time motion and machine data may be used to reconstruct the dose delivered to the target volume, and may serve as a basis for dynamic refinement of treatments.