AbstractID: 5152 Title: Cumulating static dose distributions to simulate dynamic dose distributions: an experimental study

Purpose: To quantify the change of the beam penumbra when irradiating a moving object. To compare dose distributions from irradiated films of an inhomogeneous moving phantom with cumulated static dose distributions (SDD) obtained from the TPS.
Method and Materials: A cubic inhomogeneous phantom ("tumor in lung"), consisting of a polyethylene insert embedded in a wood phantom, was used for the study. This phantom was set on a "dynamic" plate which simulated respiration. This plate had a vertical excursion of 2cm with a 4s period. X-OmatV films were placed at the center of the insert. They were irradiated perpendicularly to the direction of the movement with a 6MV photon beam of $8x8cm^2$. The movement of the plate was split in 4 intervals of positions. For each position interval, the duration was determined according to the sinusoidal model. SDD were calculated for the different positions of the moving phantom with the superposition convolution algorithm of the Xio TPS. Dynamic dose distributions (DDD) were simulated by summing SDD weighted with the temporal weight. Simulated DDD from films or from the TPS were finally compared with the measured DDD. Penumbrae were measured from dose profiles at the center of the phantom.
Results: For a motion amplitude of 2cm, the penumbra increased with a factor of 2.7 while penumbra from calculated dose distributions increased with a factor of 2.4.
Conclusion: This preliminary study aims at personalizing margins in lung treatments.

Conflict of Interest (only if applicable):