AbstractID: 3612 Title: Topographic Treatment Planning and Delivery

Purpose:
The purpose of this work was to develop a leaf-sequencing algorithm for fixed-gantry (*non-rotational*) treatment delivery on a helical tomotherapy system. Topographic delivery creates intensity-modulated fields by moving the couch at a constant velocity relative to 10-mm wide fan-beam that is modulated with a 64-leaf binary MLC.

Method and Materials:
Inverse treatment planning was performed using Pinnacle 7.4. The calculated intensity maps were exported to a custom leaf-sequencing program that modeled the leaf sequences as a tap moving over a collection of bottles. The leaf-sequencing algorithm was developed using a tap analogy in a step-wise process. The initial back edge and final front edge of each step were determined from Newton's Equations of Motion. Once the edges of the steps were established, the number of covered bottles was calculated. The final step was the determination of the time required to fill the each bottle with the prescribed dose from Fourier's Convolution Theorem.

Results:
The leaf-sequencing algorithm was initially tested using artificially constructed dose distributions that were compared with the calculated deliverable dose distributions based on the algorithm output. The difference between the theoretical doses and the deliverable doses was much less than 1 percent. The agreement between the Pinnacle intensity maps and the deliverable doses were generally less than 1 percent, with the exception of near the field edge where the intensity map values decreased by 80% in one pixel width.

Conclusion:
A leaf-sequencing algorithm was developed for fixed-gantry treatment delivery on a helical tomotherapy system. The developed algorithm produced calculated deliverable distributions that agreed remarkably with the artificially constructed distributions. Accuracy of the leaf sequencing algorithm will be verified by the film dosimetry method and will be presented at the meeting.