AbstractID: 7195 Title: Optimizing Leaf Width for Multileaf Collimator

Purpose: The multileaf collimator (MLC) has been a standard device for shaping radiation fields. However, the shaped field has stepwise boundary, and can not exactly conform to a treatment target. That means there is always under-blocked and (or) over-blocked areas. The total area discrepancy depends on MLC leaf width. The purpose of this study is to minimize the total area discrepancy through optimizing the width of each individual leaf under the assumption that the total number of leaves and the total width of all leaves remain the same.

Method and Materials: A program was developed to realize the optimization algorithm. Its flow is like this: a). read data of target shapes; b). initialize leaf widths; c). calculate the total area discrepancy; d). randomly change leaf widths and judge whether to accept the change with simulating annealing technique; e). repeat step d till the iteration process is converged.

The algorithm performance was preliminarily evaluated. 113 targets from different treatment sites were randomly selected from the patient data base of our TPS. The target width ranged from 6.8cm to 31.2cm, and had the average of 16.6cm.

Results: We obtained the data for a MLC when the total number of leaf pairs was 5, 7, and 13, respectively. The data show that the optimal leaf width super-linearly increases with the distance away from the central axis. Compared against the MLC with equal leaf width, the MLC with optimal leaf width reduced the total area discrepancy by 25.9%, 28.5%, and 31.4%, respectively. We are collecting data for MLC with more leaf pairs, and investigating the influence of number of targets on optimal leaf width.

Conclusions: Optimizing leaf width significantly improves the conformity of MLC shape to target.