AbstractID: 11519 Title: A Comparison Study of a New Optimal Field Splitting Algorithm in IMRT

Introduction In IMRT treatment planning, multi-leaf collimator (MLC) with a *maximum leaf spread constraint* is used to deliver the prescribed intensity maps (IMs). However, the maximum leaf spread of an MLC may require splitting a large IM into several overlapping sub-IMs that are each delivered separately. Existing approaches usually require fixed sizes of sub-IMs. We developed a method producing sub-IMs of flexible sizes subject to the maximum leaf spread, which may improve the delivery efficiency. In this work, we propose to optimally split an IM into sub-IMs while minimizing the total complexity of the sub-IMs.

Method and Material The complexity measure of an intensity map we use is the total sum of positive gradients of all rows. We solve the optimal field splitting problem using dynamic programming. Our algorithm also balances minimum beam-on times of the resulting sub-IMs.

We evaluated the performance of our algorithm by implementing it on clinical IMs obtained from the Department of Radiation Oncology, University of Iowa and comparing it to ommercial software derived solutions. 14 IMs from pelvic treatment plans on 2 patients were used for splitting resulting in 3 sub-IMs (3-splitting) algorithm experiments and 20 IMs from head & neck treatment plans from 3 patients were used for 2-splitting algorithm experiments. We replaced the field splitting method in Pinnacle with our method and the results were compared.

Results For 3-splitting cases, the number of segments was reduced by 12.5%, and the number of MU's was improved by 30.0%, along with 144-sec reduction of beam delivery time per fraction. For 2-splitting, the number of segments was reduced by 5.3%, and the number of MU's was improved by 27.6%. The performance for 3-splitting cases was better than for 2-splitting.

Conclusion We have developed an optimal field splitting method which appears to outperform the commercial software Pinnacle.