AbstractID: 3330 Title: A Generalized Field Splitting Algorithm for Optimal IMRT Delivery Efficiency

Purpose: The purpose of this work is to develop an algorithm for optimally splitting a large intensity-modulated field for delivery with a MLC into two or more adjacent subfields that maximizes MU efficiency, and to provide mathematical proofs that the algorithm is optimal in the most general cases.

Method and materials: The field split can be stated as the following mathematical problem: given a fluence matrix which exceeds the largest field size limitation of the delivery system, find two or three subfields, each of which satisfies the field size limitation constraint, that combine to give the original fluence map, and with the additional constraint that the sum of the delivered MUs of the subfields be minimized. In this general formalism, the subfields can overlap and the field split does not have to be in a straight line. We first construct an optimal MU leaf sequence for the large field ignoring the width constraint. The optimal field split is then generated by appropriate partitioning of the optimal leaf sequence into leaf sequences for the subfields. The overlapping region of the subfields creates a natural feathering area which is clinically desirable.

Results: Compared to a simple field splitting that cuts through the center of a fluence map, our algorithm showed an average decrease in total MU of about 19% on 32 clinical fluence maps with the largest decrease in total MU of 45%. In many cases, the total MU of the split fields does not increase from the MU of the original sequence when the width constraint is ignored.

Conclusions: We have developed an algorithm that solves the most general version of the field splitting problem for large intensity modulated fields. We provide rigorous mathematical proofs that the proposed algorithm for field splitting is optimal in MU efficiency.