AbstractID: 8993 Title: A New Leaf Sequencing Algorithm/Software for Step and Shoot IMRT delivery

We present a new leaf sequencing algorithm/software for step-and-shoot IMRT delivery. Existing algorithms for step-and-shoot IMRT generate much more segments than necessary for creating the desired beam intensities, resulting in inefficient beam delivery and labor intensiveness. The aim of this work is to minimize the number of segments and shorten the delivery times.

Our new leaf sequencing algorithm, called SLS, is based on graph algorithms in computer science. It takes advantage of the geometry of intensity maps. In SLS, intensity maps are viewed as "mountains" made of unit-size "cubes". Such a "mountain" is first partitioned into special-structured sub-mountains using a new mixed partitioning scheme based on several complementing partitioning methods. Then the optimal leaf sequences for each sub-mountain are computed by a shortest-path or maximum-flow algorithm based on a graph model. The computations of SLS take only a few minutes.

Our comparisons of SLS with other leaf sequencing methods on an Elekta LINAC showed substantial improvements. For example, for a pancreas cancer case, the numbers of segments used by SLS for creating the same intensity maps are only 20% of those by CORVUS. The delivery time of the SLS plan is 25 minutes as compared to the 72 minutes of the CORVUS plan (a 66% improvement).

Verifications have been conducted using films and ion chamber measurements. The results showed that the SLS plans match those of CORVUS in each individual intensity map as well as composite 3-D dose distributions. SLS can also be extended to other types of LINAC systems.