AbstractID: 4843 Title: Algorithm for optimizing beam angles in IMRT treatment planning

Purpose: The goal of beam angle optimization in external radiation therapy treatment planning is to find field directions which shall result in an optimal treatment plan. In this work, a beam angle optimization algorithm to be used in Intensity Modulated Radiation Therapy (IMRT) treatment planning has been developed.

Method and Materials: The plan optimality is defined by constraints set on the Dose-Volume Histogram (DVH) of the target(s) and of the critical organs. The same constraints may be applied both in beam angle and in beam profile (beamlet) optimization. In beam angle optimization, either a co-planar or a non-coplanar initial search space may be used. The search space is covered with a preset number of uniformly distributed fields. Thereafter, a few beamlet optimization iterations are calculated in order to produce optimal beam profiles. Each field is then removed from the plan, and the corresponding value of the objective function is calculated. The fields with a low importance value are thereafter removed. The process is continued until the desired number of fields in the plan has been reached.

Results: The optimized plans have been compared with equispaced beams, class solution –based plans and manually made plans. Beam angle optimization has been found to decrease the OF value typically to 20-80 % of the original value calculated with reference plans. The improvement has been clearly visible also in the shape of the DVH curves. The algorithm has been designed to execute fast (less than 30 minutes) in order to be applicable in routine use for patient-specific planning.

Conclusion: The new beam angle optimization algorithm has been able to produce IMRT plans with superior quality to class solution or manually made plans.

Conflict of Interest: This work has been funded by Varian Medical Systems Inc.