AbstractID: 7622 Title: IMRT Plan Comparison and Selection Using a Fast Equivalent Uniform Dose Based Algorithm for Dose-Volume Constrained Fluence Modulation

Selection of the best IMRT treatment plan from a group of competing trial plans is a difficult but essential component of the planning process. Selecting from many different trial beam arrangements in real-time requires a fast, automated fluence modulation algorithm based on clinically reasonable metrics that can discriminate between arrangements. A fast fluence modulation algorithm for rapid comparison and ranking of competing IMRT beam arrangements is presented. The algorithm modulates fluence to maximize the biologically based metric of target equivalent uniform dose (TEUD) while respecting normal tissue dose-volume and dose heterogeneity constraints. The algorithm arrives at the beamlet fluences in a fixed number of iterations, from a starting point of uniform low beam fluences. At each iteration, beamlet fluences contributing to dose points exceeding dose-volume constraints are reduced (fluence reduction is chosen to incur least loss of TEUD), following which unreduced beamlet fluences are raised to increase TEUD. With each successive iteration, enforcement is increased for fluence lowering of beamlets contributing to dose points in violation, while fluence raising of unaffected beamlets is relaxed, until, at the final iteration beamlet fluence lowering is complete and beamlet fluences are no longer raised. The resultant maximum achievable TEUDs for competing beam arrangements, evaluated in real-time, can then be used to rapidly select a treatment plan. It is demonstrated, in the context of prostate and brain cases, that the algorithm can also be efficiently combined with an automatic orientation selector that uses a local-global search strategy to find optimal arrangements.