

AbstractID: 7429 Title: Trajectory Based Radiation Therapy

Purpose: To develop a time efficient IMRT delivery platform that simultaneously exploits all mechanical degrees of freedom of the linac.

Method and Materials: Trajectory Based Radiation Therapy (TBRT) is a new technique for planning and delivering optimized dose distributions where the radiation source moves along a continuous 3-dimensional trajectory defined by gantry angle, couch angle, and couch position. The trajectory is constructed using a series of control points distributed along the trajectory. For planning, continuous source motion is modeled as a series of static beams with one beam defined at each control point. Highly restrictive constraints are placed on MLC and source motion to preserve a continuous, efficient and accurate delivery. Normally these restrictions would also severely limit the ability of the optimization algorithm to derive a high quality plan. This problem is solved using a novel technique for aperture based optimization where a coarse sampling of unrestricted control points is used in the initial stages of optimization. As the optimization progresses additional control points are added with increasing restrictions on MLC and source motion. This approach maintains time efficiency and delivery accuracy while allowing the optimization to derive a high quality plan.

Results: Time studies have shown that TBRT delivery times are reduced to ~ 1.5 to 3 minutes for a 200 cGy fraction. Thus far, results have shown that treatment plans generated with TBRT have dose distributions that are equivalent to or superior to static gantry IMRT.

Conclusion: On-line imaging techniques have provided clinicians with tools for verifying patient position and adapting treatment plans but at the expense of increased treatment time. TBRT is well suited for on-line verification and adaptation with delivery times that are substantially shorter than static gantry IMRT, IMAT and Tomotherapy.

Conflict of Interest: Supported in part by Varian Medical Systems