

AbstractID: 10528 Title: Developing a Treatment Planning Framework for Using Non-Coplanar Non-Isocentric Beams to Improve Plan Quality

Purpose: Historically, coplanar isocentric techniques gained popularity due to the ease of patient setup and treatment delivery. A new class of remote-controlled robotic couches (e.g., Treago, Siemens) that are being introduced for linac-based radiotherapy will make possible rapid and accurate couch translations and rotations between treatment fields and will open door for efficient delivery of non-coplanar beams. In addition, treatments at extended distance can be easily introduced to achieve some non-coplanar beam angles not possible with the isocentric setup because of a collision. We propose a framework for treatment planning employing non-coplanar non-isocentric beams to be delivered in conjunction with a robotic couch.

Method and Materials: In the proposed algorithm, the design of a treatment plan will start with the selection of optimal beam orientations by varying gantry angle and couch angle and position based on a geometrical relationship between target(s) and organs at risk. A rank order list of candidate beam angles will be created. The candidate beams will be checked for possible gantry-couch and gantry-patient collisions. In most cases, a wide range of robotic couch translations will allow treatments at extended distance, which will greatly reduce the number of infeasible beam orientations. Finally, inverse treatment planning will be performed based on a physical or biological cost function using the highest ranked deliverable beams.

Results: Once the proposed framework is implemented, we will quantify dosimetric gains and identify tumor sites most likely to benefit. The proposed approach is expected to take advantage of Cyberknife-like angular flexibility with the added benefit of intensity modulation at each beam angle.

Conclusion: It is hypothesized that for certain tumor sites a considerable improvement in plan quality can be achieved through the use of non-coplanar non-isocentric treatments. General strategy for implementing such a treatment approach using a robotic couch has been proposed.