AbstractID: 12704 Title: Beam-centric algorithm for pretreatment patient position correction in external beam radiation therapy

Purpose: In image-guided pretreatment patient position adjustment methods, image registration is used to determine alignment parameters. Since most positioning hardware lacks the full six degrees of freedom (DsOF), accuracy is compromised. We present an algorithm for determining optimal realizable adjustments and demonstrate that such compromises are often unnecessary when planned treatment beams are modelled as part of the adjustment calculation. **Method:** Our beam shape model is based on the polygonal intersection of each beam segment with the plane in pretreatment image volume that passes through machine isocenter, perpendicular to the central axis of the beam. Under a virtual 6-DOF correction, ideal positions of these polygon vertices are computed. The proposed method determines the couch, gantry and collimator adjustments that minimize the total mismatch of all vertices over all segments with respect to their ideal positions. Using this geometric error metric as a function of the number of available DsOF, the user may select the most desirable correction regime. **Results:** For a simulated plan consisting of three equally weighted coplanar fixed beams, we achieve a 7% residual geometric error (with respect to the ideal correction, considered 0% error) by applying gantry rotation as well as translation and isocentric rotation of the couch. For a clinical head-and-neck IMRT plan with 7 beams and 5 segments per beam, the corresponding error is 6%. Correction involving only couch translation (typical clinical practice) leads to a much larger 18% mismatch. After adjustment, dose volume histograms demonstrate clinically significance of geometric error reduction. **Conclusion:** Suggested algorithm improves delivery accuracy using standard delivery hardware without significantly increasing total treatment session duration. It encourages parsimonious utilization of all available DsOF. Finally, in certain cases, it obviates the need of a 6-DOF robotic couch for pre-treatment position adjusment. **Conflict of Interest:** Research sponsored by Siemens Medical Solutions.