

AbstractID: 13105 Title: A feasibility study of a 4D intensity-modulated arc tracking technique for treatment of moving targets

Purpose: A major challenge of Intensity-modulated arc therapy(IMAT) is in dealing with moving targets since the conventional gating technique may not be easily applied. The purpose of this work is to develop a 4D IMAT tracking technique for moving targets and investigate its feasibility for clinical use.

Method and Materials: 4DCT images at 10 different breathing phases were acquired. The target was contoured for each phase and a 3D RapidArc plan was generated based on the 50%phase CT images. Each control point in the RapidArc plan was then correlated to the patient's respiration phases with consideration given to changes in gantry speed and dose rate. A novel program was developed to read the RapidArc plan and target contours from all 10 phases. In order to generate a 4D RapidArc plan with the capability of DMLC tracking, the MLC modification algorithm originally developed for on-line plan modification was used to modify the MLC leaf positions at each control point to correspond to the respiration phases. 4D RapidArc plans for phantom and lung cases were used to evaluate the proposed technique. Experimental measurements for both 4D and 3D plans in a moving phantom were performed and the results were compared with the calculated and measured results for the 3D RapidArc plans in a "static" phantom.

Results: Analysis of isodose and gamma distributions indicated that the dose distribution in the moving target delivered using the proposed technique is comparable to that in a static target delivered using a 3D RapidArc plan. The results were much improved using the 4D IMAT delivery compared with the 3D plans for a moving target.

Conclusion: A 4D RapidArc tracking technique can be implemented and our results indicated that it is feasible to incorporate the intra-fraction organ motion into a 4D IMAT planning to track the moving targets.