AbstractID: 9696 Title: A Complete QA System to Locate Accurate Positions of X-ray Source and Detector at Any Rotation Angle for MV or kV Machine

Purpose: Recent development of volumetric arc therapy necessitates an efficient QA tool to ensure safe and accurate dose delivery of arc therapy. The purpose of this work is to develop a QA phantom and associated data analysis software tool to efficiently assess the accuracies of various geometrical parameters related to arc delivery.

Method and Materials: A rectangular phantom has been constructed with 13 ball bearings (BBs) embedded on the surface. The BB locations were optimized by using a geometric simulation software developed in house. An arc treatment plan with 26x20 cm field size at every gantry angle was generated for the QA purpose. During a QA test, portal images were acquired in a cine mode. A computer program was developed for automatic extraction of the BB locations on every image and computation of the geometric parameters that are important to the arc delivery. The X-ray source location, variation of source to axis distance, the gantry angle index, and the iso-center coordinates are computed and compared with the vendor's specifications. This QA system was examined using a Varian Trilogy.

Results:

The performance of the QA package was assessed by intentionally introducing a number of errors in the arc delivery. As a result, our QA system showed great sensitivity and accuracy in error detection. Our data analysis indicated that the variation of nominal gantry angle from the calibrated one could be up to 2.6 degrees with a standard deviation of 0.8 degrees. It has been observed frequently that two or three consequent images were recorded with the same nominal gantry angle while the gantry was continuously rotating at a pretty constant speed, which was proved by the calibrated results.

Conclusions:

Iso-center location, source positions, and gantry angle variation during an arc therapy delivery can be examined accurately with this QA system.