AbstractID: 6470 Title: A novel Infrared camera system for mechanical QA of radiation treatment accelerators

Purpose: To develop a fast and accurate procedure for mechanical QA of linear accelerators that can be used during installation and routine mechanical QA.

Method and Materials: A system was developed which consists of an IR-camera and an IR-marker attached to the gantry, treatment table or collimator. Software was written to process signals from the IR-camera for the duration of gantry rotation and reconstruct the trace of the marker in three orthogonal planes. A circular fit of the trace in the plane of gantry rotation provides 3D coordinates of mechanical isocenter for gantry rotation. A linear fit of this trace in orthogonal planes provides information on gantry sag and rotational hysteresis. A similar procedure was developed for table mechanical QA. Orthogonality of the planes of table and gantry rotation is determined by the angle between linear fits for the gantry and table traces.

Results: Mechanical QA tests were performed in two different treatment rooms equipped with IR-camera systems. The accuracy of mechanical alignment of the axis of rotation of the gantry and couch was demonstrated to be within 1mm of the nominal isocenter defined by the room lasers. In each treatment room, the tests were repeated three times and reproducibility of the tests was better than 1mm. The tests revealed both the known effect of gantry sag and also rotational hysteresis. Orthogonality of the planes of gantry and table rotation was also determined.

Conclusions: An IR-based procedure for mechanical QA of radiation treatment accelerators was developed and tested. This procedure accurately detects the location of mechanical isocenter and provides additional information such as the extent of gantry sag and rotational hysteresis. The system provides quantitative 3D displacement of mechanical isocenter that can be effectively used in the initial installation of accelerators as well as in an ongoing quality assurance program.