A dual-beam system was constructed to improve conformal therapy and radiosurgery procedures. This system is mounted on a drum-based Philips SL-20 medical linear accelerator and is comprised of orthogonal MV and kV imaging systems. Images acquired with these systems must be registered to the treatment beam reference frame. We have developed a novel technique to characterize the motion of the x-ray sources and detectors (components) of the dual-beam system as a function of gantry angle.

The technique is based on digital high-resolution optical images and mechanical measurements of the components, as the gantry rotates through 360^{o}. Motion characterization is performed in 3 steps. 1) The measurement of the drum motion in the laboratory reference frame, based on mechanical measurements and optical images of a dot pattern fixed in the laboratory reference frame. 2) The measurement of the components' motion in the drum reference frame, based on optical images of landmarks on the components. 3) The measurement of the relative position of the imaging systems, based on MV and kV radiographic images of a phantom. Combination of these motions yields the complete motion of the components in the laboratory reference frame.

Results obtained show that our technique is capable of measuring the longitudinal motion of the drum, the location of the rotation axis of the drum, and the position of the components, as functions of gantry angle, each with a precision of 250 μm in the laboratory reference frame.

This work is supported in part by the NCI (CA-66074).