

## Setup Verification in Linac-Based Radiosurgery

A semi-automatic technique has been developed for direct setup alignment to treatment room laser cross-hairs of radiosurgical circular fields from an isocentric linac. Alignment without an intermediate step is achieved by acquiring an image of the treatment room positioning laser cross-hairs superimposed on the radiosurgical circular field image. Two types of detectors, each sensitive to both the laser light and ionizing radiation, may be used to acquire the *laser/radiation* images. The first detector consists of a 0.3 mm thick layer of photoconducting *amorphous selenium* deposited on a copper plate and the second is film. An algorithm uses the *laser/radiation* image to calculate the center of the radiosurgical field image as well as the intersection of the laser cross-hairs. This determines any alignment deviations, and the information is then used to translate the radiosurgical collimator to its correct aligned position. The algorithm and detector system can detect deviations with a precision of ~0.04 mm.

Once the radiosurgical field is aligned to the ceiling laser, the alignment technique can be extended to determine deviations of the gantry and couch axis-of-rotation from the nominal linac isocenter. A device, resembling a gyroscope, was built in our machine shop for this purpose. It is attached to the treatment couch and holds a piece of radiographic film perpendicularly to the beam axis at the linac nominal isocenter for all possible gantry and couch angles. The device allows us to determine with relative ease the effective diameter of a linac nominal isocenter.