AbstractID: 10744 Title: Accurate determination of a linac radiation isocenter using iterative analysis of digitized star shot images

Purpose: To develop an accurate method to measure radiation isocenter for linac with sub-millimeter isocenter radius. **Method and Materials:** Conventional star shot film is produced for gantry and collimator radiation isocenters. The pattern of gantry rotation and collimator rotation is produced on the same Kodak XV ready pack film by placing the film at vertical, and then horizontal positions at isocenter using a carefully placed "Iso-Align" device. The beams can be differentiated easily because of the well define length of testing beams for collimator rotation, and penetrating beams of the gantry rotations. The film was digitized and the image was enhanced to show clearly the beam edges and center line of each narrow beam using a public domain image analysis software. Each beam can be described by a linear equation that was obtained through sampling and linear regression of the beam's central line. Using iterative search algorithms and analytical calculations, the location of the isocenter and its radius were obtained. Because gantry isocenter and collimator isocenter were determined on the same image, we were able to measure the lateral deviation between these two isocenters. The impacts of beam arrangements on isocenter determination were also investigated. **Results:** We applied this method on a Varian Trilogy machine. A 0.2 mm radius was measured for collimator radiation isocenter. The gantry radiation isocenter was measured to be of 0.3 mm radius. The lateral distance between two isocenters was 0.3 mm. The results are highly reproducible. **Conclusion:** We established a method to determine accurately the radii of the radiation isocenters of a LINAC. The precision of this method had not been achievable by the traditional analysis of a star-shot film, but it is necessary for evaluating a linac for high precision radiotherapy.