AbstractID: 12960 Title: A Method for Measuring X-ray Beam Profiles using a Flat Panel Detector

Purpose: Many digital x-ray imaging applications require knowledge of the spatial distribution of the incident x-ray flux intensity (beam profile), which is often obtained through Monte Carlo simulations or dedicated measuring equipment such as point detector that is raster scanned. Direct measurement of flux intensities using an area detector is difficult due to detector gain variations. We present a method to separate detector gain variations from flux intensity variations thus providing a practical means for efficient measurement of beam profiles using area detectors.

Method and Materials: A flat panel imager is used to acquire at least two unattenuated intensity images at slightly shifted positions. Signal intensity differences read from the same pixel are assumed to be due to flux intensity variations while differences measured at a same spatial location are assumed to be due to gain variations. Detector gain maps and flux intensity maps are then created by mathematically decoupling the flux and gain intensity components from the readings. The process is repeated in the other in-plane direction to generate 2-D maps. To test the method, a Varian Paxscan 4030CB was used to measure the beam profile produced by a Varian G242 tube. Results were compared to Monte Carlo simulations and raster-scanned photodiode measurements.

Results: The detector gain of the imager and the beam profile of the source were separated. The beam profiles measured using the propose method were independent of how prior gain calibrations were performed and matched well with Monte Carlo predictions and photodiode measurements.

Conclusions: A robust method to measure the beam profile of an x-ray field using an area detector is presented. The method also generates a detector gain map that is independent of flux intensity variations.

Employees of Varian Medical Systems.