

AbstractID: 5000 Title: Investigation of Dose Reduction Strategies for Image Guidance with kV-CBCT in Radiation Therapy

Purpose: To explore methods of minimizing the dose to eye (lens) and contra-lateral breast during image guidance with kilo voltage cone beam CT (kVCBCT) in radiotherapy.

Method and Materials: A set of high sensitivity MOSFET, with high bias, was utilized for dose measurements. The MOSFET calibration factors, in terms of cGy/mV, were determined by measuring the response at a depth of 2.0 cm in water against ion chamber. Dose to eye was measured using a head phantom for 360-degree full rotation, 270-degree and 195-degree scans (half rotation plus fan angle). The eye dose was also measured for 195-degree scan simulating x-ray tube rotation anterior as well as posterior to the head. Dose to contra-lateral breast was also evaluated with a Rando phantom. The dose measurements were performed for 120kV beams with mAs values of 0.5, 1, 2 and 3.2 per projection. The images obtained during these measurements were analyzed for image quality.

Results: The dose measured on the surface of the eye was less by 50% for 270-degree scan and by 75% for 195-degree posterior scan compared to 360-degree scan. The dose to contra-lateral breast was less by 30% and 40% for 270 and 195-degree scans. Excellent image quality was obtained with 0.5 mAs/projection and 320 projections over a complete rotation scan, however, acceptable image quality also resulted with 195-degree scan with 75% reduction in eye dose. Reducing the number of projections, over a given arc angle decreased the dose to critical organ, but resulted in artifacts.

Conclusion: Reducing the scanning arc resulted in significant reduction in dose without much loss of image quality. A posterior scan reduced the dose to eye considerably without any significant change in the image quality. This work demonstrates that there are opportunities to minimize dose to critical organs without compromising the quality.