

Purpose: To evaluate the cone beam computed tomography (CBCT) dose and imaging quality of the TrueBeam STx linear accelerator equipped with the X-Ray Imaging System.

Methods: In accordance to the recommendations of TG-111, a 0.6 cm³ Farmer thimble ionization chamber was used for in-phantom measurements at the center and periphery (4 cm from edge, 12 o'clock) of 30 cm diameter × 30 cm length cylindrical phantom. A total of six new CBCTscan protocols were evaluated: 1) head (full trajectory, 100 kVp, 264 mAs), 2) head (half trajectory, 100 kVp, 146.40 mAs), 3) low dose thorax (full trajectory, 125 kVp, 264.00 mAs), 4) pelvis (full trajectory, 125 kVp, 686.40 mAs), 5) pelvis spotlight (half trajectory, 125 kVp, 731.27 mAs), and 6) pelvis spot light (full trajectory 125 kVp, 1318.68 mAs). Doses from MV, portal imaging and kV fluoroscopy were evaluated as well. Image quality was evaluated using the Catphan 504 placed at isocenter and scanned under the exact same parameters as the dosimetric study.

Results:The measured dose for CBCT settings 1-6 (center, periphery) are: 1) 0.37cGy, 0.37cGy; 2) 0.2cGy, 0.34cGy; 3) 0.64cGy, 0.64.cGy; 4) 1.64cGy, 1.66cGy; 5) 3.5cGy, 7.27cGy and 6) 6.05cGy, 8.14cGy. With regards to image quality, we observed two general trends: First, comparing the half trajectory reconstructions to the full trajectory reconstructions, shading artifacts are visible in the half trajectory reconstructions. Second, by nature of the half reconstructions under the Thorax and Pelvis protocols, the resolution is degraded by 56%; which is due the fact that the pixel size is larger for the half fan methodology.

Conclusion: In this study we evaluated the imaging dose and quality of the TrueBeam STx linear accelerator. The measured doses and image quality are consistent with previous measurements reported in the literature for older generation Varian On-board Imaging systems (OBIs).