

AbstractID: 10806 Title: Image Quality QA for Three Radiotherapy Cone-Beam CT Systems

Purpose: With the increased presence of volumetric radiotherapy cone beam CT (RT-CBCT) systems, the importance of high grade image quality is crucial to achieve daily image-guided adaptive radiotherapy (IGART) capabilities. We subjected three commercially available RT-CBCT systems to a battery of standard diagnostic image quality tests acquired under clinical conditions. This study reports on the evaluation of image qualities for RT-CBCT's and a diagnostic CT. **Methods and Materials:** RT-CBCT scans were performed on Elekta XVI, Nucletron Simulix, and Varian OBI Advanced Imaging using clinical pelvis scan settings on a CATPHAN Model 600. They were then compared to results from a GE Lightspeed CT scanner. The phantom contained modules allowing measurement of low contrast resolution, slice thickness, Hounsfield Unit (HU) sensitivity, spatial resolution, and image uniformity. **Results:** No CBCT system was able to detect any targets in the low contrast module. Six targets could be seen on diagnostic CT's. All RT-CBCT systems had greater than 33% variations in slice thickness reconstruction. The HU sensitometry test showed absolute differences between accepted HU values and measured values for XVI and Simulix systems to be on average 6 times and 3 times the error seen in a diagnostic CT respectively. HU sensitivity for OBI is within 15% of a diagnostic CT. Both OBI and Simulix had spatial resolution twice that of XVI but were 3 lp/cm worse than a diagnostic CT. Measurements of image uniformity showed that all three RT-CBCT systems have a standard deviation of HU values on the order of 10 times that of a diagnostic CT. **Conclusions:** The image qualities of three evaluated RT-CBCT systems are relatively comparable, yet still inferior to those from helical CT. It is important to note that dosimetric settings can have a clear impact on image quality, and dose measurements were not done for this work.