

Purpose: Image guided radiation therapy using cone-beam computed tomography (CBCT) is becoming routine practice in modern radiation therapy. The purpose of this work was to develop an imaging QA program for CT and CBCT units in our department based on the ACR CT accreditation phantom (model 464, Gammex-RMI). It has four testing modules permitting one to test CT number accuracy, slice width, low contrast resolution, image uniformity, in plane distance accuracy, and high contrast resolution reproducibly with suggested window/levels for image analysis.

Methods: Baseline values were obtained from images acquired on a Phillips Brilliance Big Bore CT simulator and CBCT images acquired on three Varian OBIs. DICOM images were exported and analyzed with software (Automated CT Software, Gammex-RMI) or manually (OsiriX). Baseline values will be used to ensure that image quality stays consistent quarterly.

Results:Initial CT simulator images showed that image quality was within ACR guidelines for all tested scanning protocols. Due to image noise and reconstruction artifacts, manual analysis should be used for future analysis of CBCT images. Image analysis from two OBIs showed that the HU calibration had drifted or was not properly calibrated, while the third OBI showed reasonable agreement with accepted values. All three OBIs were unable to distinguish the low contrast resolution plugs, had the same high contrast resolution, were within 0.7 mm of the accepted in plane resolution, and were within 0.5 mm of the nominal slice width.

Conclusions: Preliminary analysis shows that the ACR phantom could be modified to be more useful in evaluating the low contrast resolution of CBCT systems. Suggestions will be made as to how ACR guidelines for image analysis could be modified to better suit CBCT systems, such as for image uniformity. It is expected to eventually incorporate all departmental CT imaging systems in into this imaging QA program.