AbstractID: 7298 Title: Automated CBCT QA for image-guided radiation therapy

Purpose: The use of image-guided patient positioning requires fast and reliable Quality Assurance (QA) methods to ensure the megavoltage (MV) treatment beam coincides with the integrated kilovoltage (kV) imaging and guidance system. This study describes an automated and comprehensive QA procedure to monitor the coincidence of the mechanical, radiation and imaging isocenters using cone-beam CT (CBCT) and planar X-ray imaging.

Method and Materials: The On-Board Imaging (OBI) system consists of a kV x-ray tube and an amorphous-silicon flat panel imaging detector which are attached to a medical linear accelerator. A Penta-Guide phantom (Modus Medical Devices Inc. London, Ontario, Canada) with five internal markers and external markers for isocenter position and field sizes was imaged using the CBCT, kV and MV capabilities. The markers' location and size can be automatically determined using our graphical software system. The accuracy of CBCT imaging is assessed by comparison of the extracted marker positions and sizes against the phantom specifications. The coincidence of the imaging and dosimetric isocenters are tested by a similar analysis of the markers extracted from the kV and MV images. Additional tests are also performed such as isocenter stability with gantry angle, image size, collimator angle and size, and gantry angle.

Results: The test was performed on all four IGRT-enabled machines available in our institution. The coincidence between the mechanical, radiation and imaging isocenter are within 1 mm for all four accelerators. Isocenter stability with gantry angle was also within 1 mm. The acquisition of the images took ~ 5 min, and the automated software analysis took less than 1 min.

Conclusion: Our automated image analysis may be used as a daily QA procedure because it is completely automated and uses a single phantom setup.