AbstractID: 6638 Title: Quality Assurance of Megavoltage Cone-Beam CT

Purpose: Megavoltage Cone-Beam CT (MVCBCT) is now widely used in radiation therapy. The objective of this work was to evaluate the stability of MVCBCT and define a quality assurance protocol.

Methods and Materials: Two MVCBCT systems were followed for a period of 4 months. The systems were fully calibrated (geometry, CT# scaling factor and flat panel corrections) and analyzed daily on the first week, weekly for a month and monthly thereafter. Images of a gold seed placed at the machine isocenter were used to track the positional accuracy and stability of the system. An image quality phantom was used to monitor the stability with respect to CT#, contrast-to-noise ratio (CNR), spatial resolution, noise and uniformity. A graphical user interface was developed with Matlab to automatically analyze the image quality. For each day of analysis, images were reconstructed using the calibrations obtained that day and the oldest calibrations available to investigate how frequently calibration is needed.

Results: The stability of all measurements over the 4-month period was excellent. The reconstructed gold seed position relative to isocenter was better than 1 mm for a period of 4 months. Small variations in image quality were observed between the two systems. The inserts mean CNR were 12.4±0.7 and 12.2±0.7 for the two systems. Using the initial calibrations resulted in slightly more variability in the measurements. Based on the measurements and our experience of the last 5 years, we generated a practical list of possible artifacts occurring with MVCBCT.

Conclusion: Monthly calibration of the MVCBCT system is largely sufficient. Imaging a small fiducial on a daily or weekly basis may also be warranted to detect geometric misalignments caused by sudden mechanical failures. Based on the measurements, a system performance baseline for MVCBCT has been defined.

Conflict of Interest:
Research sponsored by Siemens OCS.