

AbstractID: 5919 Title: Enhanced efficacy in helical tomotherapy quality assurance

Purpose: The Helical Tomotherapy Image Guided Radiation Therapy (IGRT) system delivers highly conformal dose distributions in a dynamic fashion. This system is also capable of acquiring MV-CT images and registering them with the planning CT for accurate target localization. Efficient QA tools are necessary for the effective implementation of this technology. This work describes the design of a custom phantom for daily QA of a Helical Tomotherapy linear accelerator.

Materials and Methods: A custom designed 20x20x20cm³ water-equivalent phantom was fabricated for this purpose. Eight ionization chambers are positioned inside the phantom. Low and high electron density plugs along with a specific image-resolution-plug are incorporated into the phantom for testing the image quality indicators. This phantom also includes two slide-out film cassettes for planar dose verification. The commercial eight-channel electrometer is used. Daily QA is performed in the following three steps;

- 1) *Static Beam Quality Tests:* Machine output, percent depth dose and off-axis factors are checked simultaneously for a 5x40cm² open field.
- 2) *Image Quality and Registration:* The QA phantom is off-set to a known position and an MV-CT is obtained. After verifying the image quality, MV-CT images are registered with planning CT to determine the suggested shift accuracy.
- 3) *Accuracy of the helical delivery:* Treatment plans with two targets (separated by 12cm inferior-superiorly) are used to test the helical delivery. Film dosimetry will detect errors such as couch position inaccuracies that could be missed by the point-dose measurements.

Results and Discussion: This QA procedure is designed to verify vital components of the Tomotherapy system such as beam quality, image quality, accuracy of the target localization, and helical delivery. Typical time required for this QA testing is only 30 minutes.

Conclusions: This QA process is simple, efficient and verifies several important dosimetric and geometric parameters.

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