

AbstractID: 4887 Title: Dose Calculation in Presence of a Metallic Object Using Megavoltage Cone-Beam CT

Purpose: CT image artefacts caused by the presence of metallic objects hinder organ delineation and preclude precise dose calculation. In contrast, the presence of high atomic number material has relatively little impact on the image quality of Megavoltage Cone-beam CT (MVCBCT). The objective of this work was to determine if MVCBCT could be used for accurate dose calculation in the presence of metallic objects.

Material: Experiments were performed with a 16cm diameter cylindrical water-equivalent phantom. MVCBCT and kVCT images of the phantom were acquired with and without a 1.5 cm diameter steel rod (3 mm wall thickness) sitting on the phantom. Using a treatment planning system, dose distributions were calculated for a 6 MV 10 cm square field AP beam for these configurations. Dose measurements were performed using an ion chamber placed at isocenter and mosfet detectors placed at 35 locations in the phantom. Measured and calculated dose values were compared.

Results: Without metal, dose calculated in the phantom using either the kVCT or the MVCBCT image corrected for cupping artefact were all within 2% of each other and of the measured values, showing the ability to use the MVCBCT for dose calculation. In the presence of the metallic object, erroneous density values, around the rod, made dose calculation on the kVCT unreliable. MVCBCT provided correct density values (within 5%) and differences between measured and calculated dose values were on average 3.2% (SD 3.4%). The two largest differences (10.6% and 8.9%) were found in a high dose gradient region below the rod.

Conclusion: MVCBCT can be used in a treatment planning system for dose calculation in the presence of metallic objects. Results for non-cylindrical geometries will also be presented.

This research is supported by Siemens