

AbstractID: 12936 Title: A Technique to Correct Crescent Artifacts in On-Board CBCT

Purpose: Large dark and bright crescents are commonly seen in cone-beam (CB) CT images acquired onboard radiation therapy machines. The purpose of this project is to develop a technique for removing this artifact.

Method and Materials: We propose that crescent artifacts are caused by small angle-dependent shifts of the bowtie filter and that they can be avoided by using angle-dependent blank projections when reconstructing CBCT images. Blank projections are those acquired without an attenuating object in the field of view. Bowtie motion as a function of angle was quantified by tracking the center of mass of pixel intensity in blank projections. Computer simulations were used to demonstrate that crescent artifacts arise under that quantified level of bowtie motion. Clinical onboard scanner studies with a Catphan® 504 phantom were used to demonstrate that crescent artifacts are removed by incorporating angle-dependent, rather than fixed, blank projections into image reconstruction.

Results: The center of mass study indicated that crescent artifacts result from shifts in the bowtie filter of much less than 1 mm. The computer-simulation studies demonstrated crescent artifacts when the same blank image was used for all projection angles. These crescent artifacts matched the positions, widths, and amplitudes of those seen clinically. In the computer-simulation studies and with data acquired on clinical CBCT systems, the artifacts were removed when angle-dependent blank images were utilized.

Conclusion: Crescent artifacts are shown to arise from unaccounted motion of the bowtie filter during the acquisition of CBCT projections. Correction of this artifact, through use of angle-dependent blank images, is proposed and demonstrated. This technique could be effectively implemented into clinical practice.

Conflict of Interest: This research is partly supported by Varian Medical Systems.