

AbstractID: 5669 Title: Investigation into the cause of a new artifact in cone beam CT reconstructions on a flat panel imager

Purpose:

To investigate the source of and possible corrections for a new artifact seen in cone-beam CT (CBCT) images acquired using an a-Si flat panel imager (FPI) (Varian 4030CB). The new artifact is a bright circular region, tangent to the phantom edge, in images of elliptical and off-center phantoms.

Methods and Materials:

Temporal response of the FPI was measured using a step-wedge phantom, as a function of dose and irradiation history (10 cycles of 80 s exposure, with 9 off-cycles varying in time between 2 and 30 minutes, total time 1hour 20 min). A linear time invariant (LTI) model was developed by fitting multi-exponentials to the lag response from the step-wedge phantom. Anthropomorphic phantoms – pelvis placed centrally, and head placed off-center – were scanned and reconstructed with and without the developed correction.

Results:

Detector lag and continuous and significant monotonic gain increase (up to 10% for long irradiation periods) were observed during constant irradiation. Even after long periods of no exposure, with the detector being continuously read out, the gain did not return to the original, start-of-day value. Unlike Overdick et al., we did not see a saturation effect in the gain change. In CBCT reconstructions, differences up to 35 HU existed close to the edges of the artifact. After applying our correction model, differences were reduced to less than 10 HU. Our anthropomorphic phantoms did not generate streaks or comet tails, which other investigators have shown to be due to lag.

Conclusion:

We have determined that the source of the circular artifact observed is a non-ideal temporal response. This artifact can be mostly eliminated by applying a correction based on a LTI model. Future work will focus on more accurate modeling to completely eliminate the artifact.

Conflict of Interest:

Funding was provided by Varian Medical Systems.