AbstractID: 14240 Title: Efficacy of a linear lag correction algorithm in an a-Si flat-panel x-ray detector

Purpose: Lag in a-Si flat-panel detectors (FPD) causes significant artifact. To date, most correction models have assumed a linear, time-invariant model (LTIM). We investigated detector response as a function of incident exposure.

Method and Materials: The physics theory for charge trapping in FPD detectors suggests that the process is non-linear and time variant. We measured the rising step response function (RSRF) and falling step response function (FSRF) as a function of incident exposure on a Varian 4030CB detector. An LTIM was implemented for lag reduction with temporal behavior of the panel modeled as a multi-exponential impulse response with four exponentials. The impact of using RSRF, FSRF and different incident exposures (0.5% - 80% of saturation) on calibration coefficients of the LTIM was investigated in projection data and reconstructions of challenging phantoms (large pelvic phantom, uniform head phantom). Effectiveness was measured by calculating the average and maximum error within pairs of ROIs. **Results:** A non-linearity greater than 50% was observed in the FSRF data. A model calibrated with RSRF data resulted in a significant over-correction of FSRF data. Conversely, models calibrated with FSRF data applied to RSRF data resulted in under-corrections, an average error range of 3-21 HU was achieved when different exposure calibration points were used. **Conclusion:** Significant non-linear behavior was observed in the FPD. Furthermore, large residual errors remained following LTIM corrections for many calibration setups, and it is unclear how to choose, *a priori*, the calibration setup that will give the lowest error. A non-LTI correction could potentially describe the panel dynamics and non-linearity more accurately and improve image correction more predictably.

Conflict of Interest:

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