AbstractID: 10274 Title: a-Se Flat-panel (FP) Detector Based Scan Equalization Digital Radiography (SEDR) System: A Chest Phantom Study

Purpose: To implement an a-Se FP detector based SEDR system for chest imaging and to investigate scatter rejection properties and low-contrast performance of the system.

Method and Materials: A prototype SEDR system was implemented with an a-Se FP detector to improve image quality in heavily attenuating regions. Slot-scan imaging geometry was used to reduce x-ray scatter without attenuating primary x-rays by modifying FP's readout for electronic aft-collimation. A 24-segment fan-beam width modulator assembly was developed to equalize x-ray exposures at detector input for more uniform image SNRs. A 2-mm thick lead plate with a 2-D array of aperture holes was used to measure primary signals which were then subtracted from those obtained without the lead plate to determine scatter components. A 2-D array of aluminum beads (3mm) was used as low-contrast objects to measure the contrast ratios (CRs) and contrast-to-noise ratios (CNRs) for evaluating low-contrast performance in chest images. Two images acquired with same techniques were subtracted from each other for measuring the noise levels. SPRs, SNRs, CRs and CNRs of the SEDR images were measured and compared with those of slot-scan and full-field images acquired with and without anti-scatter grid.

Results: Both SEDR and slot-scan techniques resulted in lower SPRs, improved SNRs, CRs, and CNRs than anti-scatter grid technique in all regions. The improvement is more pronounced in heavily attenuating regions: SEDR technique produced the best CNRs and the lowest SPRs, followed in order by slot-scan and anti-scatter grid techniques.

Conclusion: SEDR technique can reject scatter effectively without attenuating primary x-rays. Furthermore, it improves image SNRs and CNRs in heavily attenuating regions by modulating x-ray intensities regionally and compensating for x-ray attenuation by patient's anatomy.

Acknowledgement: This work was supported in part by grants CA104759 and CA124585 from NIH-NCI, a grant EB00117 from NIH-NIBIB, and a subcontract from NIST-ATP.