AbstractID: 6819 Title: Scatter Rejection and Low-Contrast Performance of a Slot-Scan Digital Chest Radiography System with Electronic Aft-collimation: a Phantom Study

Purpose: To investigate scatter rejection and low-contrast performance of an electronic aft-collimation based slot-scan imaging technique for chest imaging.

Method and Materials: The slot-scan imaging technique was implemented with a 1.6 cm wide fan-beam and a modified flat-panel (FP) detector for electronic aft-collimation. During the scan, the leading edge line of the scanning fan-beam is reset to erase the scatter accumulated while the trailing edge line is read out to acquire the image signals following the fan-beam exposure. Two images acquired with the same techniques were subtracted from each other for measuring the noise levels. A 2-mm thick lead plate with a 2-D array of holes was used to measure the primary signals which were then subtracted from those obtained without the lead plate to determine the scatter components. A 2-D array of aluminum beads (3mm in diameter) is used as the low-contrast objects to measure the contrast ratios (CRs) and contrast-to-noise ratios (CNRs) for evaluation of the low-contrast performance in chest images.

Results: The slot-scan imaging method resulted in lower average scatter-to-primary ratios (SPRs) and improved CRs, primary signal-to-noise ratios (PSNRs) and CNRs than the anti-scatter grid method. Slot-scan imaging used in conjunction with grid resulted in further reduction of the SPRs and improvement of CRs. However, in most cases, the PSNRs were degraded and CNRs were at the same level or even degraded.

Conclusion: Slot-scan imaging with electronic aft-collimation can effectively reject scatter without having to attenuate the primary x-rays. It resulted in almost doubled CNR improvement as compare to the anti-scatter grid method. Further improvement by using slot-scan imaging with an anti-scatter grid was found to be limited.