

AbstractID: 12778 Title: The next generation solid state x-ray image intensifier (SSXII)

**Purpose:** We report on new advancements with a solid state x-ray image intensifier (SSXII) to expand the field-of-view (FOV) and improve detector performance. **Method and Materials:** The SSXII is a new high-resolution, high-sensitivity radiographic and fluoroscopic imager based on electron-multiplying CCDs (EMCCDs), which views a CsI:Tl phosphor through a fiber optic taper (FOT). The SSXII has demonstrated the capabilities to significantly improve upon the inherent limitations of current state-of-the-art x-ray image intensifiers and dynamic flat panel detectors (FPD), with superior performance in terms of MTF, instrumentation noise, and DQE. To expand the FOV, a modular array has been constructed. The EMCCD camera electronics have been designed to enable a 2 x 2 abutable array configuration. The 27 mm center-to-center distance enables use of 3.4:1 magnification ratio FOTs, thereby providing a FOV of 5.44 x 5.44 cm (an increase in area of 290% over the initial single module prototype). Larger arrays can be constructed. Performance of this next generation SSXII was extrapolated based on measured MTFs and transmission efficiencies of the individual components that comprise the detector. **Results:** Calculations indicate an averaged improvement in the MTF of a factor of 1.2 across the higher spatial-frequency range (5 to 10 cycles/mm). X-ray sensitivities are expected to increase by 40% due to a reduction in the FOT magnification ratio (from 4:1 to 3.4:1). The instrumentation noise equivalent exposure (INEE) was calculated to decrease from 0.2 to 0.03  $\mu$ R, which is two orders of magnitude lower than present FPDs. The DQE was determined to improve by an averaged factor of 2.2 from 5 to 10 cycles/mm. **Conclusions:** With an expanded FOV, the SSXII is a promising candidate to replace existing state-of-the-art detectors, providing improved resolution, lower instrumentation noise, and better signal-to-noise ratio performance.

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