AbstractID: 1812 Title: Strategies to Enhance System Gain Toward the Realization of 50-µm Pitch Indirect Detection Active Matrix Flat-panel Mammographic Imagers

Mammography has entered the digital age with a multitude of technologies offering numerous advantages over conventional screen-film systems. For example, imaging systems based on indirect detection active matrix flat-panel technology, offering 100µm pixel pitch, have been commercially introduced. The discrete photodiode design of such imagers precludes arrays with pixel pitches significantly less than 100µm due to reduced optical fill factor. In this paper, we report on the performance of a 75µm pitch, prototype imager based on a continuous photodiode design allowing near-unity fill factor. This imager is based on an a-Si:H thin-film transistor array of 512x512 pixels offering a 3.8x3.8 cm^2 active area. The array was coupled to various commercial x-ray converters including a mammographic phosphor screen (Min-R, Kodak) as well as a pair of CsI(Tl) scintillators (150µm thick coupled to a fiber optic plate, Hamamatsu): one optimized for high resolution (FOS-HR) and one optimized for high light output (FOS-HL). Performance of the imager in terms of measured sensitivity, MTF, NPS and DQE is reported under various mammographic imaging conditions. In addition, calculations of system performance (sensitivity, NPS, DQE) based on a cascaded-systems model were performed and compared to empirical results. The model was also used to predict the performance of hypothetical 50µm pitch imagers. Results indicate that the use of the continuous photodiode design leads to significant performance enhancement over conventional designs and may be key to allowing high DQE performance at pixel pitches as low as 50µm. This work was supported by NIH grant R01-CA76405.