AbstractID: 10354 Title: A method for measuring the MTF of digital radiography systems using noise response

Purpose: To provide a new method for measurement of the modulation transfer function (MTF) using the noise response of digital radiography systems. **Method and Materials:** Cascaded linear system methods have been used for several decades to accurately predict the signal and noise performance of a wide variety of digital x-ray imaging technologies including x-ray image intensifiers, direct and indirect flat-panel detectors (FPDs), and CCD/EMCCD-based detectors. The noise response of such imagers inherently incorporates the detector resolution response, i.e. the detector MTF. In this work, a generalized linear systems analysis was used to derive an exact relationship. The two-dimensional noise power spectrum (NPS) was plotted versus the mean signal level, for all spatial-frequencies. A linear regression was fitted to this data to isolate the quantum-noise component, the shape of which depends in part on the system resolution. The spatial-frequency response of the resulting slopes was then used to obtain the MTF. The accuracy of this method was investigated using simulated images from a simple detector model, based on high-resolution EMCCD detectors, in which the MTF was known exactly. Measurements were also done on a FPD and the results were compared using the standard edge response method. **Results:** The MTF measured from the noise response of the simulated detector system showed exceptional agreement with the "true MTF" at *both* low and high spatial-frequencies. Differences of 0.3%, 1.8% and 6.1% were observed at 5, 10 and 15cycles/mm, respectively. The FPD MTF obtained using the noise and edge response methods were also shown to agree within experimental uncertainty. **Conclusions:** Initial results indicate that the noise response method is a simple technique which can be used to accurately measure the MTF (in all directions simultaneously) of digital x-ray imagers, alleviating the burdens of development and implementation of precision edge or slit devices.

(Support: NIH-R01-EB008425; NIH-R01-EB002873)