

## AbstractID: 6518 Title: Monte Carlo coupled modeling of a computed radiography system

**Purpose:** To develop a model that allows for understanding the physical properties and the effect of readout parameters on objective image quality metrics of a 'flying spot' computed radiography (CR) system.

**Method and Materials:** A Monte Carlo simulation method [Fasbender et al., Nucl Instrum Methods Phys Res A 512 (2003): 610-8] that describes the optical transport in a 'flying spot' readout was implemented by adapting the code of Jacques [Photochem Photobiol 67 (1998), 23-32]. This program was coupled with a 'parallel-cascades' approach [Yao and Cunningham, Med Phys 28 (2000): 2020-38] to predict system MTF and DQE. Grain size was assumed to follow a normal distribution in the imaging plate (IP) and granular noise was determined using the works of Nutting and Siedentopf. Additional assumptions include, orthogonal x-ray incidence, no scatter, no glare, no defects in the IP, a constant discharge fraction, and a linear readout amplifier were assumed for a linear and wide-sense stationary process. X-ray spectra representative of radiography and mammography were used in the simulations. Published or estimated parameters that correspond to two common IPs were compiled from multiple sources.

**Results:** For radiography with 0.2-mm sampling, model results showed good agreement with published literature values for system MTF ( $r > 0.99$ ) and moderate agreement for DQE ( $r = 0.75$  to  $0.99$ ) over four orders of incident exposure (0.03 to 30-mR). For mammography with 0.1-mm sampling, model results showed good agreement with published literature values for system MTF ( $r > 0.99$ ) and for DQE ( $r = 0.95$  to  $0.99$ ) over two orders of incident exposure (~1 to 100-mR).

**Conclusion:** The proposed model facilitates identifying factors that could improve CR performance. Accurate estimates of IP parameters and model improvements such as incorporation of Lubberts' effect could further improve model accuracy. Supported in part by NIH R01EB004015 and Georgia Cancer Coalition award.