AbstractID: 7882 Title: Optimizing Mammography Image Quality and Dose: X-ray Spectrum and Exposure Parameter Selection

Optimization of exposure parameters (target, filter, and kVp) in digital mammography necessitates maximization of the image signal-to-noise ratio (SNR), while simultaneously minimizing patient dose. The goal of this talk is to compare, for each of the major commercially available full field mammography (FFDM) systems, the impact of the selection of technique factors on image SNR and radiation dose for a range of breast thickness and tissue types. The comparison will be based on the results of a multi-center phantom study. The five commercial FFDM systems tested, the Senographe 2000D from GE Healthcare, the Mammomat Novation from Siemens, and the Selenia from Hologic, the Fischer Senoscan, and Fuji's 5000MA used with a Lorad M-IV mammography unit, are located at five different university test sites. Performance was assessed using all available x-ray target and filter combinations and nine different phantom types (three compressed thicknesses, and three tissue composition types). Each phantom type was also imaged using the automatic exposure control (AEC) of each system to identify the exposure parameters used under automated image acquisition. The figure of merit (FOM) used to compare technique factors is the ratio of the square of the image SNR to the mean glandular dose (MGD). The results show that, for a given target/filter combination, in general FOM is a slowly changing function of kVp, with stronger dependence on the choice of target/filter combination. In all cases the FOM was a decreasing function of kVp at the top of the available range of kVp settings, indicating that higher tube voltages would produce no further performance improvement. For a given phantom type, the exposure parameter set resulting in the highest FOM value was system-specific, depending on both the set of available target/filter combinations, and on the receptor type. Noise performance differed noticeably among the FFDM systems and played an important role in determining relative FOM values. In most cases, the AECs of the FFDM systems successfully identified exposure parameters resulting in FOM values near the maximum ones, however there were several examples where AEC performance could be improved.

Educational objectives:

1. become familiar with the effect of changing kVp, target material, and filtration on the mean glandular dose for a variety of breast
2. become familiar with the effect of changing kVp, target material, and filtration on image signal and noise for specific commercial FFDM systems
3. learn how the exposure technique factors selected for a variety of breast types by the AECs of current FFDM systems compare with the technique factors resulting in optimal FOM values