AbstractID: 7965 Title: Using computer simulation to assess image quality in tomographic breast imaging

Annual screening with mammography is the best known method for early detection of breast carcinoma and is known to reduce breast cancer mortality by approximately 25%. Nonetheless, the diagnostic accuracy of mammography is not perfect. Studies have shown that 30% of cancers are not detected, and 70-90% of biopsies recommended based on mammographic studies turn out to be negative. One of the limiting problems with mammography is that the recorded 2D image represents the superposition of the 3D breast, thus normal anatomical breast structure can combine with useful diagnostic information in such a way to impede visualization of breast tumors. One technique for improving visualization of breast tissue is tomographic imaging of the breast. There has been much interest of late in tomographic breast imaging methods such as tomosynthesis and computed tomography (CT). Tomographic breast imaging systems are complex imaging devices, and there are a number of system and acquisition parameters that should be evaluated for optimal performance. One powerful approach for optimizing and evaluating such systems is to use computer simulation models.

This presentation will discuss a computer simulation methodology developed to model tomographic breast imaging modalities using a cesium iodine (CsI ) based amorphous silicon flat-panel detector. The simulation is divided into three stages: 1) modeling the x-ray spectra typically used for each modality, and scaling the x-ray fluence to provide the appropriate radiation dose, 2) determining the x-ray transmission through the breast model, and 3) modeling the signal and noise propagation through the CsI based detector. Another important aspect that will be discussed is the modeling of 3D breast structure and breast tumors. Examples showing how this computer simulation can be used to evaluate tomographic breast imaging systems will be presented.

Educational Objectives:

1. To understand the issues involved in developing computer models for tomographic flat-panel breast imaging systems.

2. To understand the issues involved in developing 3D breast tissue and tumor models.

3. To learn about how computer simulation models can be used in exploring tomographic breast imaging systems.