Abstract ID: 17084 Title: A method for fast generation of high resolution software breast phantoms

Purpose: We have developed a new method for generating anthropomorphic software breast phantoms. The method allows for faster generation of phantoms with small voxel size, and provides better control of simulated anatomical structures.

Methods: In this paper we compare the simulation time and quantization artifacts between our previous and the new method. Previously, our breast anatomy simulation was based upon a region growing algorithm. The new method preserves the concept of region growing and is optimized to allow for faster simulation. The new method includes improved thickness control of the simulated skin and Cooper's ligaments. For comparison, we generated phantoms simulating a 450 ml breast using both methods. The phantoms were generated with voxel sizes in the range of 25-1000 microns; we recorded the time needed for simulation. The simulation time as function of the voxel size was fitted using a power-law regression; the regression exponents were compared between the two methods. We also performed a visual comparison of the phantoms generated with different voxel sizes.

Results: For the simulated range of voxel sizes the new method yielded a regression exponent of 2.15, compared to 3.89 for the previous method. The new method is faster than the previous method for phantoms with voxels below 200 microns. Generating phantoms with small voxel size is of importance for reducing quantization artifacts in simulated images; commercial mammography systems have detector element pitch as small as 50 microns. The visual comparison of the phantoms generated at different voxel sizes confirmed the improved quality of simulation with smaller voxels, as reflected by reduced quantization artifacts.

Conclusions: Our new breast anatomy simulation is substantially improved in terms of simulation time and the quality of the simulated images. This is especially important for the simulation of phantom images with various available detector resolutions.