Purpose:
The aim of this study was to investigate the distribution of single coherent scatter of a flat panel based first generation breast CT system using computer simulations.

Methods:
The phantom, beam and detector were Monte Carlo simulated using the Easy Particle Propagation user code. The breast was simulated using a 50/50 cylindrical breast phantom with a diameter of 14 cm and a height of 10.5 cm. The number of incident photons was set to result in a dose of 4 mGy for a 3D breast scan of 288 projections. The beam and detector were translated across the phantom in steps of 0.1 cm for one projection. In order to improve the signal to noise ratio (SNR) from coherent scatter, a ring integration was performed such that signal from pixels whose centers were at distances r (with r being the distance from the center of the detector) were summed. Ring widths of 50 microns, 250 microns, 500 microns and 1 mm were probed. Detector phantom separations (DPS) of 1 cm and 11 cm were also investigated.

Results:
A DPS of 11 cm provides more CS than any type of contaminating scatter in the desired momentum transfer (MT) range. A ring width of 1 mm provides a ring width with the best SNR while keeping the necessary MT resolution to theoretically resolve glandular tissue and carcinoma. The total number of CS photons per ring can vary by as much as 30% for beams that go through different thicknesses of the phantom.

Conclusions:
We have implemented and validated a simulation of flat panel based first generation CT of the breast. The detector phantom separation and the different ways of reading the signal on the detector affect the magnitude of coherent scatter and, consequently, its application for imaging.