

Purpose:

To overcome the limitations of mammography, X-ray breast computed tomography (breast CT) was developed. The prototype machines for this technique have been installed in some research institutes and are currently under clinical evaluation. Breast CT is expected to be an effective diagnosis tool because it can generate 3-dimensional images of a breast. However, the spatial resolution of the existing system is not sufficient to identify microcalcifications within the breast. The purpose of this study was to develop a prototype of high-resolution breast CT system.

Methods:

Our prototype system consists of a microfocus X-ray tube (focus size: 5 μm) and a flat panel detector (FPD, indirect conversion type, pixel pitch: 50 μm , matrix size: 2366×2368) with C-arm frame, bed, and computer for control. The spatial resolution of the images can be modified by altering the geometric magnification (minimum spatial resolution: 20 μm). Images are reconstructed using cone-beam X-ray projections and the FDK algorithm.

Results:

The proposed system was evaluated by using the breast phantom with a mass lesion and microcalcifications. The breast was scanned using a continuous X-ray source at a tube voltage of 100 kV, tube current of 0.1 mA, and spatial resolution of 80 μm . The 3-dimensional structure of the mass region and microcalcifications were clearly identified on the obtained images.

Conclusions:

We developed a prototype of high-resolution breast CT system that employs a micro-focus X-ray tube and an FPD. Experimental results showed that our CT system offers exceptional spatial resolution. Thus, our breast CT system may be useful in the diagnosis of mass lesion and microcalcification.