

AbstractID: 7739 Title: Application of volumetric molecular breast imaging with a dedicated SPECT-CT mammothomograph

Purpose: Clinical 2D-scintimammography therapeutic response monitoring results imply that fully-3D molecular imaging could benefit early response prediction. Capabilities of prototype functional SPECT and anatomical x-ray CT integrated imaging subsystems, dedicated to whole breast and chest wall diagnostic imaging of normalcy, disease and therapeutic response are demonstrated. The system provides patient comfort while imaging the pendant, uncompressed breast and anterior chest wall in common fields-of-view, yielding inherently registered, volumetric images.

Method and Materials: The high-performance SPECT system has 2.5mm CZT multi-element pixelation and 6.7% FWHM energy resolution at 140keV; the subsystem gantry can sweep the camera about a hemisphere with simple/complex trajectories. The CT subsystem has 15% FWHM quasi-monochromatic x-ray cone beam at 36keV and 127micron CsI micro-columnar pixelation. Both subsystems rotate on a common azimuthal stage. The CT system is equatorially restricted, though fully 3D positioning mobilization is possible for both subsystems on the same hybrid gantry. Emission SPECT data are iteratively reconstructed using OSEM, and transmission CT data using iterative OSTR. Rigid body transformations employing mixed emission/transmission fiducial markers around the breast help register and fuse the reconstructed data.

Results: Initial cross contamination studies indicated transmission scatter contamination of SPECT images was negligible (<1%). Emission contamination of CT images was greater, degrading reconstructed image SNR by 20-30%. Use of a radio-opaque patient bed reduces emission contamination. Registered and fused data yield high-resolution images of geometrical and anthropomorphic phantoms. New designs of the fully flexible hybrid system will allow for nearly complete sampling by both subsystems.

Conclusion: A hybrid SPECT-CT mammothomography system was successfully implemented for use in breast diagnostics.

Conflict of Interest: MPT and JEB are inventors of this technology, and are named as inventors on the patent for this technology applied for by Duke. If this technology becomes commercially successful, they and Duke could benefit financially.