

## AbstractID: 7508 Title: Detection of Breast Cancer with Ultrasound Tomography

**Purpose:** To investigate the use of operator independent ultrasound tomography for breast imaging with the goal of differentiating breast masses.

**Method and Materials:** A series of *in-vitro* and *in-vivo* experiments were carried out using a recently developed prototype based on the principles of ultrasound tomography. To characterize the performance of the prototype, an anthropomorphic breast tissue phantom with embedded inclusions was imaged to yield reflection and transmission (i.e. sound speed and attenuation) tomograms. The *in-vivo* performance of the prototype was assessed by imaging 125 patients with suspicious mammograms. Each data set yielded ~45 to ~75 tomograms covering the whole breast volume. Masses were identified by biopsy and their locations inferred from conventional mammography and ultrasound exams. These data were compared with the ultrasound tomograms to evaluate the *in vivo* detection capabilities of the prototype.

**Results:** Our techniques successfully demonstrated tomographic imaging of breast architecture in both reflection and transmission imaging. Furthermore, phantom studies indicated that masses as small as 6 mm in size were detected in all imaging tomograms. In addition, statistically significant differences were observed between the sound speed and attenuation measurements of the benign inclusions and cancerous masses. The *in vivo* data suggested that ~90% of masses >15mm in size were routinely detected including cancers as small as 8 mm in size. Overall, reflection, sound speed, and attenuation imaging of breast masses were demonstrated both *in vitro* and *in vivo*.

**Conclusion:** Operator-independent whole-breast imaging and the detection of breast masses are feasible using ultrasound tomography techniques. Our approach has the potential to provide a cost-effective, non-invasive, and non-ionizing means of evaluating breast masses, leading to more routine analysis and evaluation of treatment response.