Purpose:
To establish the ability of our 3D registered inverse scattering based breast scanner to provide highly reproducible quantitative monitoring of breast health over short and long interval follow up, and to distinguish between malignant and benign lesions using quantitative estimates of speed of sound.

Methods:
Our group has developed a unique method of 3D ultrasound imaging based on the mathematical technique known as inverse scattering, which yields a volumetric map of the speed and attenuation of the breast. Resolution and quantitative accuracy is assessed using known phantoms. We scanned a group of 18 volunteers twice at the UCSD facility, first with a 960 element array and secondly with a 1536 array upgrade. We also scanned 2 volunteers ~25 times over a period of 4 years. We used an earlier published result of Mast to correlate the speed values to bulk modulus in breast tissue. We correlated slices based on 'landmarks' observed in the ductal tissue pattern and noted that this ductal distribution was unique to each patient. We used the speed and attenuation maps for refraction and gain correction in ray based reflection imaging, allowing a 360 degree compounding of the reflection.

Results:
We are able to validate short and long term stability of the image as well as validate our ability to follow the change in tissue and mass characteristics. We observed a significant improvement of the speed image by using the 1536 element 3D array.

Conclusions:
We determined that the quantitative values of the speeds (bulk moduli) remained substantially constant over approximately 6 month periods for the UCSD cases, and several years for the TechniScan, Inc. study. These results are tabulated in the study. We determined that there is a significant difference between the speed of sound (bulk modulus) of malignant and benign lesions.

Funding Support, Disclosures, and Conflict of Interest:

TechniScan, Inc., Salt Lake City