AbstractID: 6634 Title: 3-D Elasticity Imaging with a 2-D Array

Purpose: Assess the performance of various motion tracking strategies applied to a 3-D RF echo data set from an oil-in-gelatin phantom with spherical targets for a multi-step deformation totaling about 15% axial strain. Discuss the prospects and preliminary experience of in vivo motion tracking.

Method and Materials: A prototype 9-MHz 2-D CMUT array connected to a Siemens SONOLINE Antares was used to acquire RF echo data from a 100-mm x 100-mm x 70-mm oil-in-gelatin phantom containing a 10-mm diameter spherical inclusion that has a 5:1 elastic contrast with the background. This CMUT array images like a 1-D linear array in generating a 2-D image in the azimuthal plane, and it acquires a 3-D volume by electronically stepping the 2-D imaging plane in the elevational direction. A series of controlled compressions of 1.5—2% axial strain were applied. Phantom motion was tracked with off-line data processing using different approaches including 2-D, 2.5-D and 3-D axial guidance tracking. The method that performed the best was applied to a 3-D in vivo data set obtained with the same transducer.

Results: The contrast to noise ratios (CNR) and the cross correlation between the motion-compensated RF and the reference RF for the four motion tracking approaches were used as metrics of performance. The CNR increased with increasingly sophisticated motion tracking with 3-D axial guidance performing the best. The same trend was observed with the normalized cross correlation. Tracking in vivo data has proved more difficult.

Conclusions: These results demonstrate the improvement in motion tracking available through 3-D tracking. This work also demonstrates that volume data acquisition allows accurate motion tracking and axial strain image formation for an entire target (within the field of view). Volume data acquisition with 2-D arrays will provide a major advancement in the capabilities of elasticity imaging systems.