AbstractID: 4806 Title: Brightness-based methods for correcting beam-former sound speeds

Purpose: The speed of sound (SOS) varies among patients and spatially within a patient. Differences between the SOS assumed in the beam former and that of tissue defocuses B-mode images. A global effective SOS value can be chosen to maximize image quality. This study investigates brightness based methods for SOS corrections.

Method and Materials: The beam former assumed SOS in a Siemens Antares machine was varied while imaging two phantoms having different SOS's (ATS539-1440m/s and RMI403-1540m/s). Three methods were used to quantify resultant image quality changes: visual inspection, zeroth order statistics over a region of interest (ROI) and axial/lateral variation of echo signals arising from discrete reflectors. Peak brightness (PB), mean brightness (MB) and mean of brightness squared (MBS) were measured.

Results: Visual inspection showed image sharpness improvement at an appropriate SOS. The optimal SOS values correlate with phantom specifications, but are lower (30-70m/s). Operating conditions affect the optimal SOS. The brightness varies partially due to the fractional overlap of the transmission/reception focal zones, drifting apart with depth.

MBS over a ROI proved superior to MB in distinguishing an optimal SOS. Both measures suffered drift problems with SOS for ROI's far from the transmit focus. Including structures in the ROI affects the ability to generate an SOS peak.

The lateral extent of a bright spot/glint selected either visually or by a simple search, varies with the assumed SOS. PB and MBS of line signals showed a peak around the optimal SOS. Axial signals are more robust. The maxima at glints result in minima for neighboring axial lines demonstrating good focusing.

Conclusions: Visual inspection and glint analysis yield consistent SOS's that improve image quality. SOS accuracy for diagnostic use is limited due to effects of operating conditions of the machine and needs further investigation.