AbstractID: 10797 Title: Calibration of the dual-transducer focused acoustic radiation field for a multimodal sono-contrast NIR spectroscopy system

Purpose: To calibrate the dual-transducer focused acoustic radiation field, register the focus center in the imaging ultrasound system, and establish a monthly calibration protocol for a noninvasive multi-modal breast cancer scanning system.

Method and Materials:
The scanhead incorporated two 1MHz focused transducers aligned orthogonally to deliver acoustic radiation force (ARF) in a 2.4cm region. A commercial ultrasound probe, located in the same vertical plane as the focused transducers, was used in the system for image co-registration. Dielectric fluid was filled into the scanhead as the ultrasound transmission media.
The scanhead was merged into a water tank filled with degassed distilled water. A function generator connected with an amplifier was used to drive the focused transducers. The imaging ultrasound probe was connected to a commercial ultrasound system. The focused transducers were excited by 1MHz continuous sine wave with amplitude of 200mv from a function generator, amplified by the amplifier. A hydrophone was aligned vertically below the bottom plate and moved by a 3D motion platform (resolution 0.05mm) in the 3D Cartesian space at a step of 0.1mm. An oscilloscope was connected with the hydrophone for data display and acquisition of the voltage signals for calculating the acoustic intensity.

Results: The focal spot that has the maximum peak-positive voltage signal on the oscilloscope was found at 2.34 cm below the bottom plate, which is the designed intersection of the axes of the two focused transducers. The Spatial Peak Temporal Average Intensity was determined to be 0.4 $W \cdot cm^{-2}$, below the FDA therapeutic ultrasound limits (0.72 $W \cdot cm^{-2}$). The focal spot was then registered in the imaging ultrasound images.

Conclusions: This study established the baseline of the dual-transducer focus acoustic radiation field. A monthly calibration protocol has been developed following the same procedure for the focused acoustic radiation field.

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