Application for QIBA Project Funding

Title of Proposal: Analysis of Sources of US SWS Measurement Inter-System Variability		
QIBA Committee/Subgroup: US SWS BC		
NIBIB Task Number(s) which this project addresses:		
PI (Project Coordinator or Lead Investigator Information)		
Last Name: Palmeri	First Name: Mark	Degree(s): MD, PhD
e-mail:		Tel #:
Institution/Company: Duke University		
Total Amount Requested:		

Project Description:

There have been two primary foci for the System Dependencies & Phantom Development US SWS subcommittee during the currently active Round IV funding:

- Phase II viscoelastic (VE) phantom development and correlation with *in vivo* liver data, followed by measurements at different academic, government and industry sites on a variety of US SWS platforms, and
- Development, validation and distribution of digital phantoms that simulate shear wave propagation in elastic and viscoelastic media for a variety of transducer and material properties.

The VE properties of the Phase II phantom recipes from CIRS, Inc. were characterized using two metrics: (1) phase velocity at 200 Hz, and (2) a linear dc/df slope ranging from 100-400 Hz. These empirical metrics avoided having to rely on a (overly simplified) material model that might not be appropriate for liver tissue. External material testing was done at the Mayo Clinic, and comparison with *in vivo* liver data was done at Duke and Philips (using data acquired at the Mayo Clinic). The Phase II phantoms have been measured at over half of the sites to date.

In parallel to the Phase II phantom studies, Duke and Mayo Clinic have been developing and validating Finite Element Method shear wave simulations to generate digital phantoms of shear wave propagation from different curvilinear transducer configurations in elastic and viscoelastic media. The source code for this simulation is publicly available on GitHub, and the datasets are available on QIDW. These simulations have been validated across two commercial FE solvers, LS-DYNA and Abaqus, to demonstrate the absence of numerical bias, and the datasets also have corresponding processing code and example outputs provided in the GitHub repository to allow for in-house validation with other FE solvers. These digital phantoms will allow manufacturers to evaluate sources of bias in their shear wave reconstruction algorithms as a function of focal configuration and material stiffness and viscosity, all of which have been identified as potential first-order sources of inter-system variability.