## Low Frequency Broadband Actuator for MRE



K.N. Magdoom<sup>1,2</sup>, Thomas T. Jones<sup>3</sup>, Marcial Garmendia – Cedilos<sup>3</sup>, Randall Pursley<sup>3</sup>, Thomas Pohida<sup>3</sup>, and Peter J. Basser<sup>1</sup>

<sup>1</sup>Section on Quantitative Imaging and Tissue Sciences, *Eunice Kennedy Shriver* National Institute of Child Health and Human Development, Bethesda, MD, USA <sup>2</sup>The Henry M. Jackson Foundation for the Advancement of Military Medicine (HJF) Inc., Bethesda, MD, USA <sup>3</sup>National Institute of Biomedical Imaging and Bioengineering, Bethesda, MD, USA

#### INTRODUCTION

- Low frequency elastography is important for deducing material properties of tissue whose characteristic time scales are much longer than the frequencies typically probed in MRE, including viscoelastic and poroelastic properties.
- Low frequency MRE is however challenging due to the large and stable displacements required to match the NMR sensitivity obtained at high frequencies.
- In this study, we report the development of a new low-frequency broadband (0 several kHz) actuator to perform MRE within a micro-imaging MRI scanner.

### **MATERIALS AND METHODS**



- Sample : Bilayer agarose (0.1% bottom and 0.12% top)
- 100 µm free stroke length piezo from Thorlabs

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- Piezo interfaced with gel using 3D printed plunger and ran at 10 Hz
- MRE experiment performed at Bruker 7T using 3D pulsed gradient spin echo to measure displacement profile at 10 ms intervals.
- Isotropic shear modulus calculated from the measured data using algebraic Helmholtz inversion.



**Experiment instrumentation setup** 

**Close up view of piezo actuator** 

**RESULTS AND DISCUSSION** 



# Vector displacement data of the gel (µm) with blue arrows showing vector direction

#### CONCLUSIONS

- Excitation mode complex and uniform across the field of view
- Two different gel concentrations distinguished based on their differences in shear modulus
- Future work involves extracting viscoelastic and poroelastic gel properties.