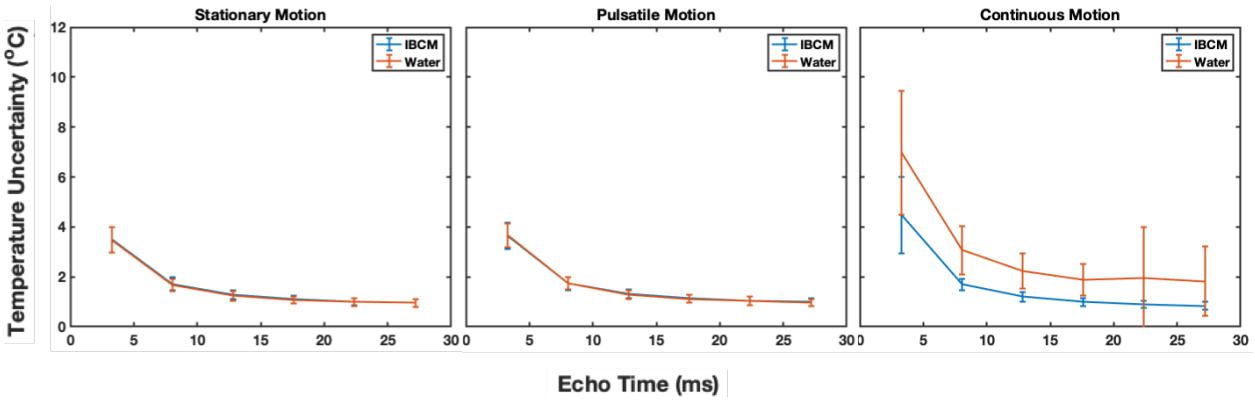
Supplementary Material: Iron Based Coupling Media (IBCM) for MRI-Guided Ultrasound Surgery

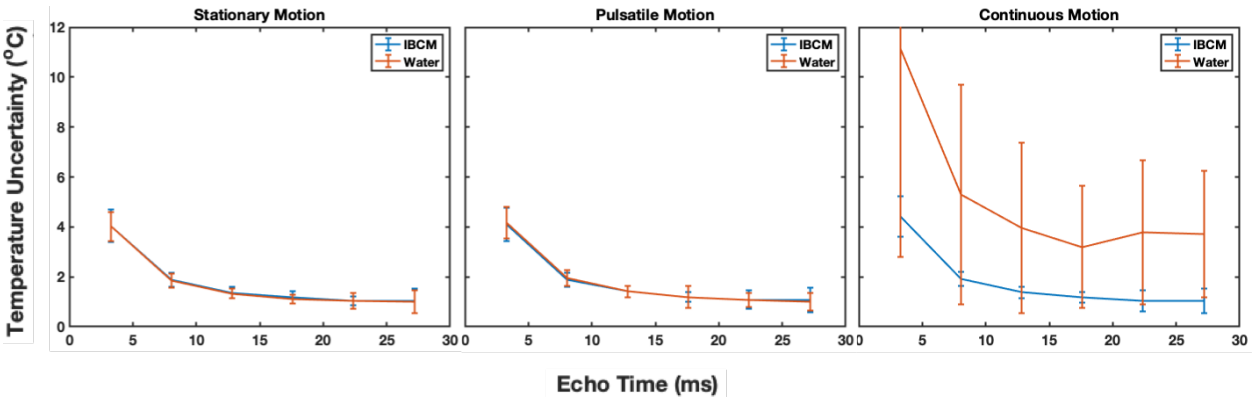
Authors

Steven P Allen[1], Austin Fergusson[2], Connor Edsall[3], Sheng Chen[4], David Moore[5], Eli Vlaisavljevich[2,3], Richey M Davis[6], Craig H Meyer[4,7]

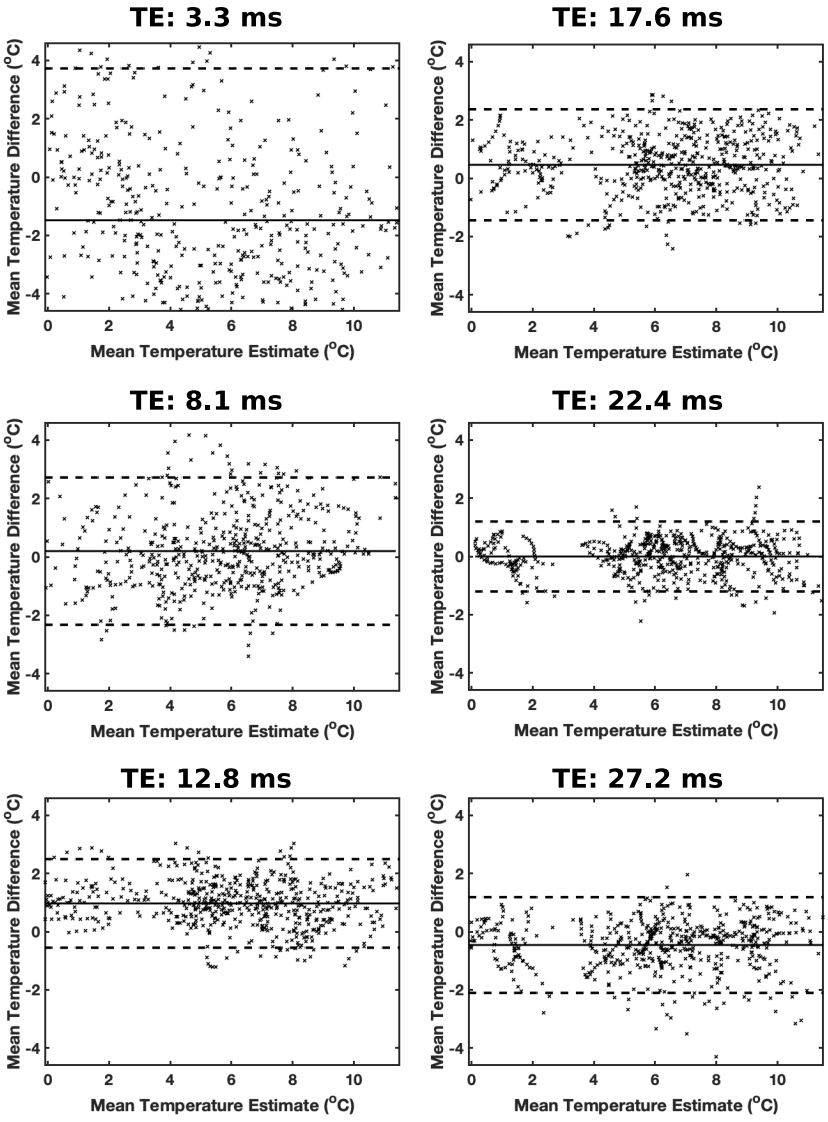
1. *Department of Electrical and Computer Engineering, Brigham Young University, Provo, UT, USA*
2. *Graduate Program in Translational Biology, Medicine, and Health, Virginia Tech, Blacksburg, VA, USA*
3. *Department of Biomedical Engineering and Mechanics, Virginia Tech, Blacksburg, VA, USA*
4. *Department of Biomedical Engineering, University of Virginia, Charlottesville, VA, USA*
5. *The Focused Ultrasound Foundation, Charlottesville, VA, USA*
6. *Department of Chemical Engineering, Virginia Tech, Blacksburg, VA, USA*
7. *Department of Radiology and Medical Imaging, University ofVirginia, Charlottesville, VA, USA4.*



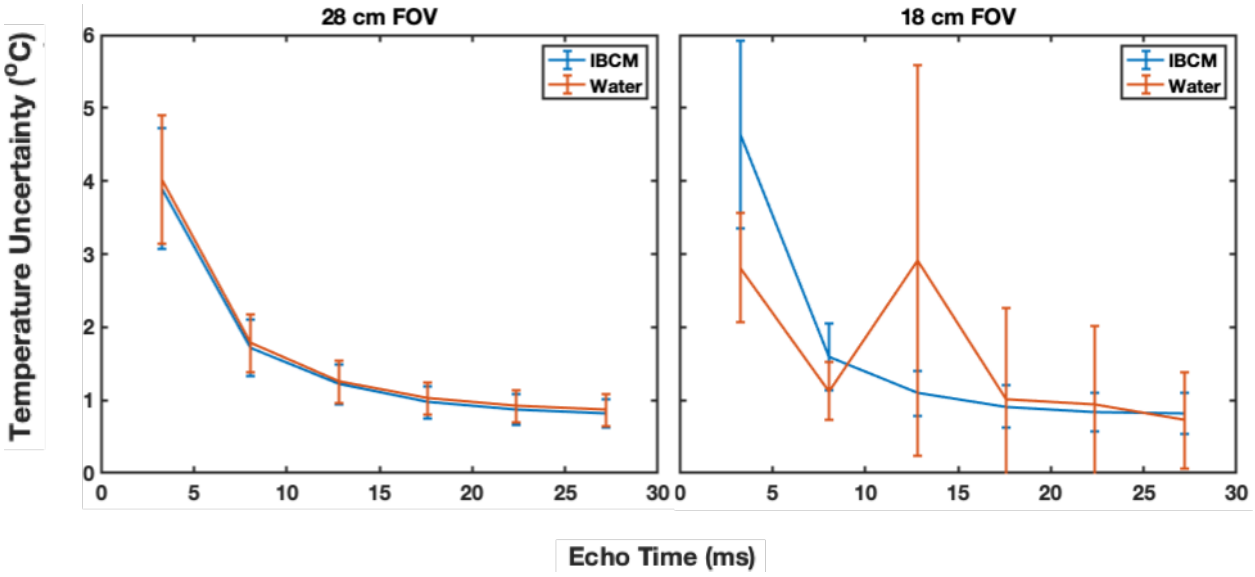
Supplemental Figure S-1. Mean and standard deviation of the temperature uncertainty values within the bounding box shown in Figure 3 computed for each echo time. Temperature uncertainty increases when the water coupling medium is in the continuous motion state.



Supplemental Figure S-2. Mean and standard deviation of the temperature uncertainty values within the bounding box shown in Figure 3 computed for each echo time. Temperature uncertainty increases when the water coupling medium is in the continuous motion state.



Supplemental Figure S-3. Bland-Altman plots comparing temperature estimates using water and the IBCM at 12 co-registered pixels at the treatment focus. Temperatures are computed for each echo time.



Supplemental Figure S-4. Mean and standard deviation of the temperature uncertainty values within the bounding box shown in Figure 3 computed for each echo time. Temperature uncertainty increases when water is used as the coupling medium and the field of view is reduced to 18 cm.

	Odeen et al. [21]	Grissom and Allen [20]	Ma et al. [19]	Allen et al. [15]	Current Study
Thermometry Method	3D, Single Echo, GRE	2D, Single Echo, GRE, Undersampled	Not Reported	2D, Multi-Echo, GRE	2D, Multi-Echo, GRE
Medium Motion State	Continuous	Pulsatile	Not Reported	Continuous	Pulsatile
Medium Suppression Method	Saturation Pulses	2D RF Excitation	Heavy Water	Commercial IBCM	Custom IBCM
Medium Suppression Efficacy (%)	Not Reported	Not Reported	Not Quantified	75% TSE Scans	>400 for TSE scans
Thermometry Uncertainty Improvement (°C)	1.11	6	Not Reported	Not Reported	0.51
Thermometry Accuracy (°C)	Not Reported	±1	Not Reported	±3	0.5

Supplemental Table S-2. Comparison in methods and results between this study and previously published methods to reduce coupling-media-induced guidance imaging errors. Differences in methodologies make direct comparison difficult.