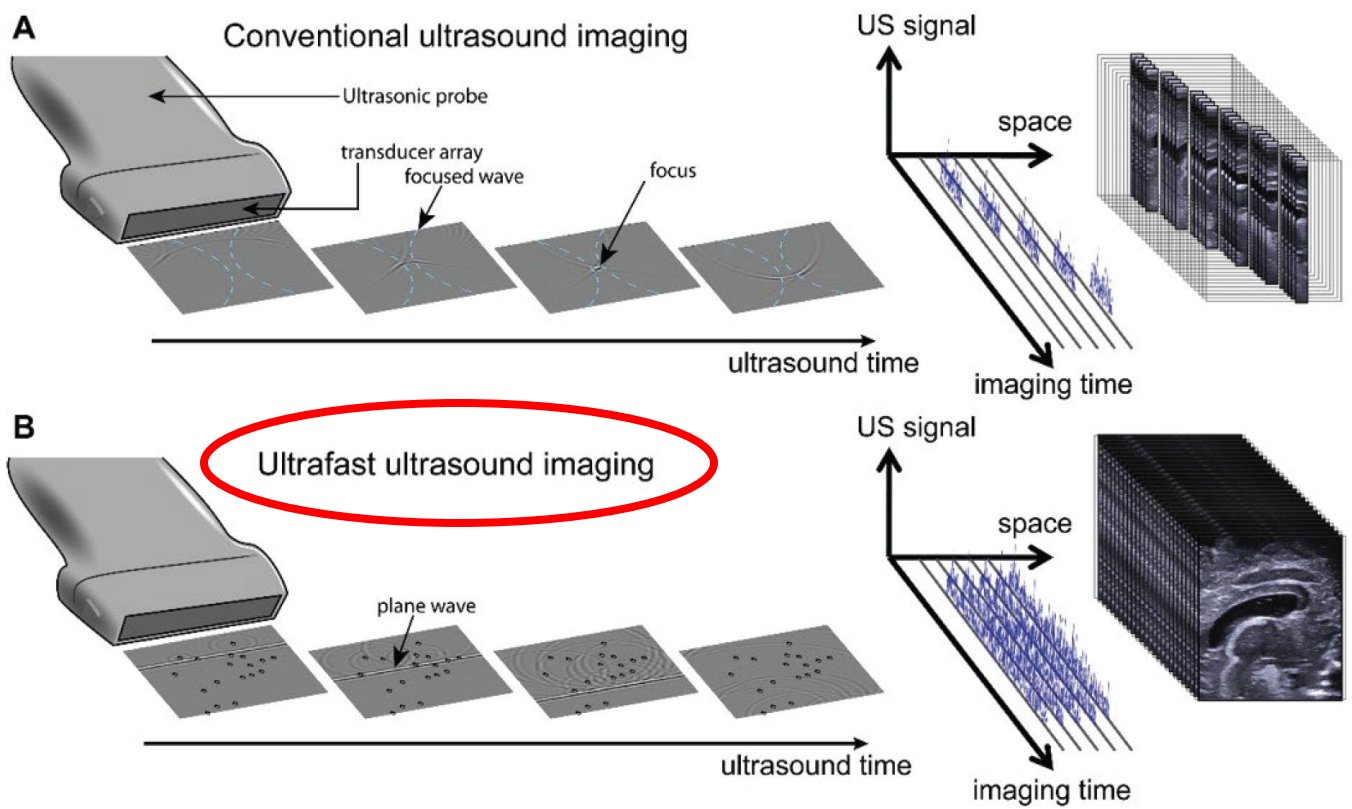
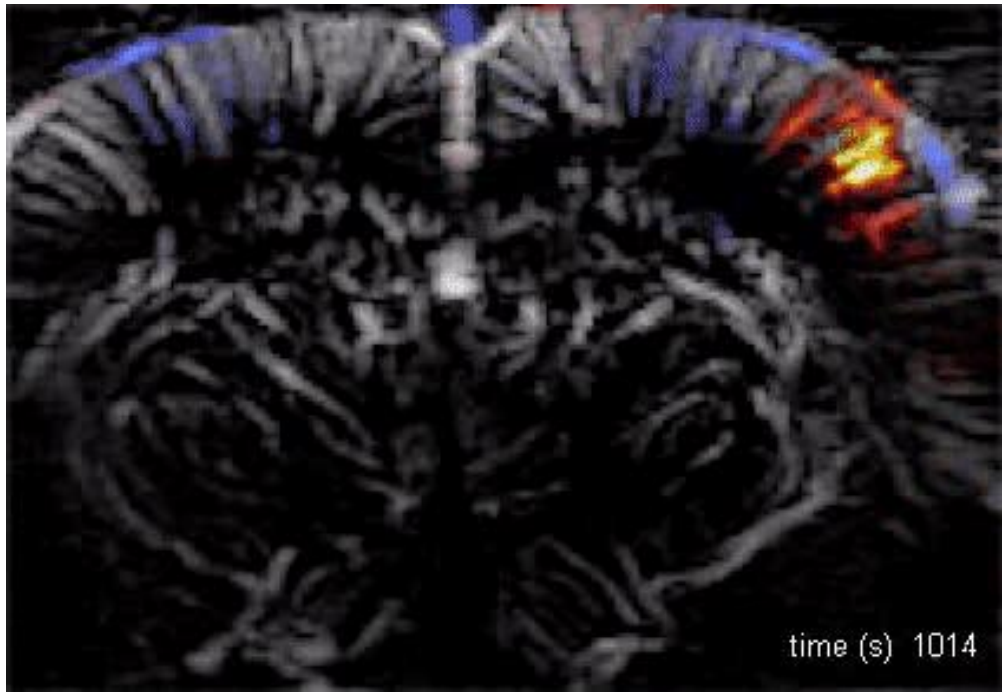
Revealing Brain Operation: Functional Ultrasound Imaging in 3D





Ultrafast acquisition → **high sensitivity to changes in blood flow** (neurovascular response)

→ ***Functional Ultrasound Brain Imaging***

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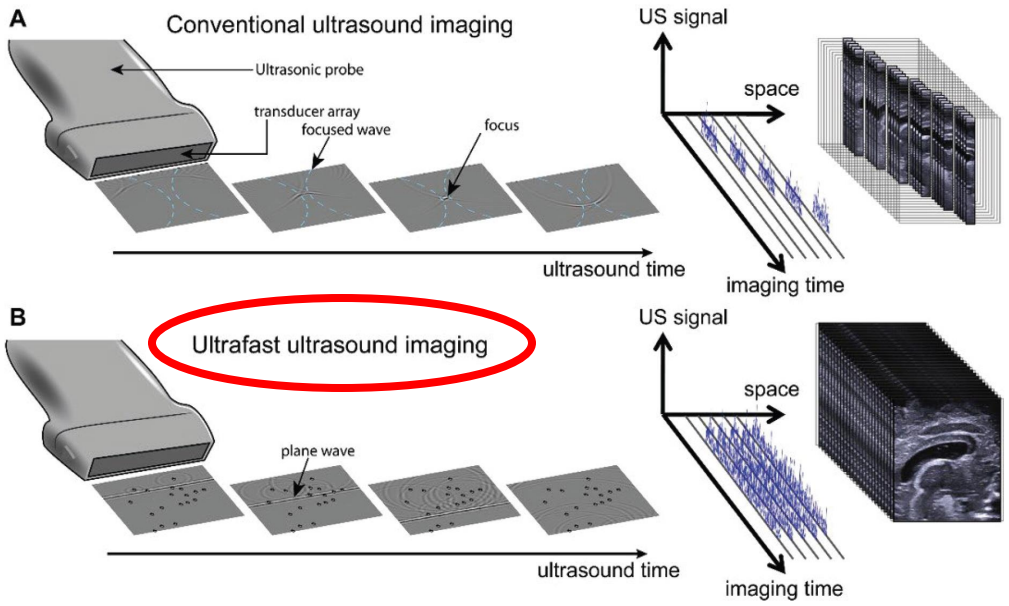
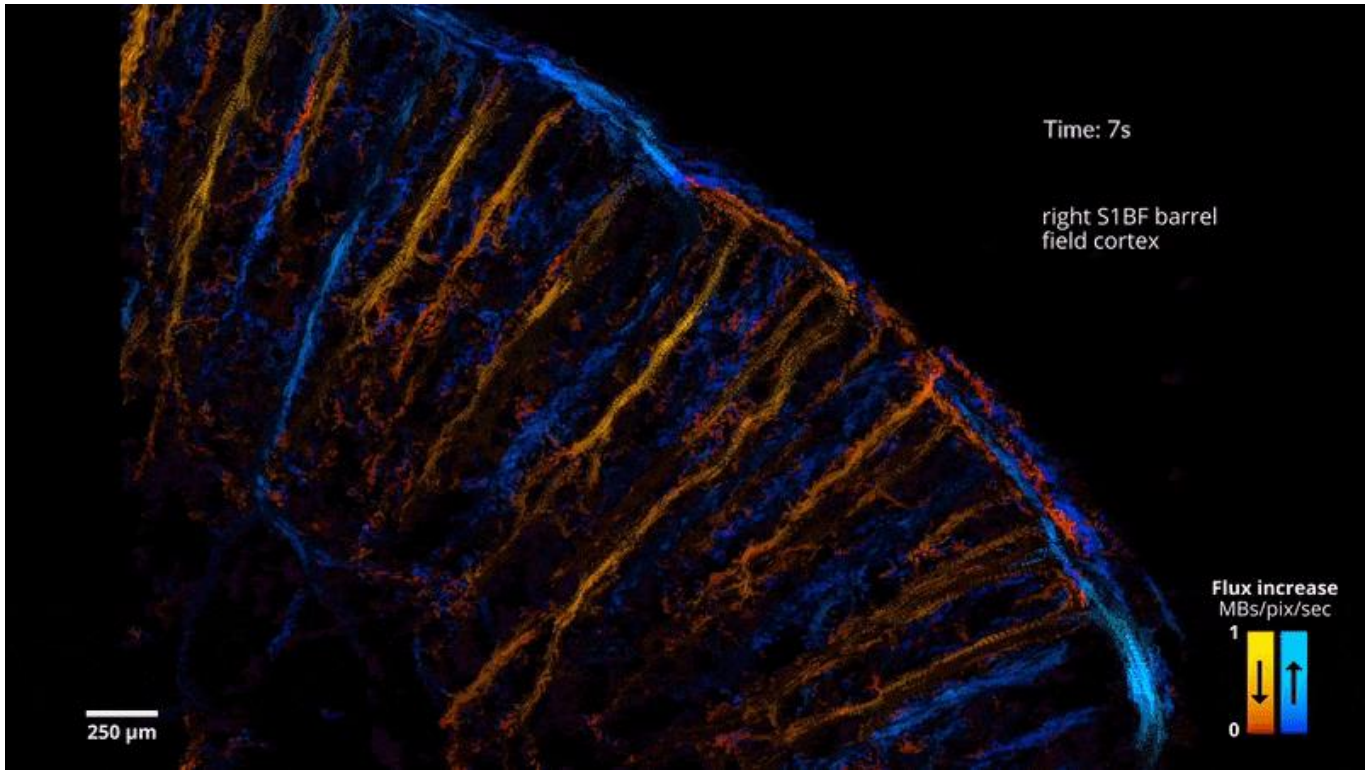
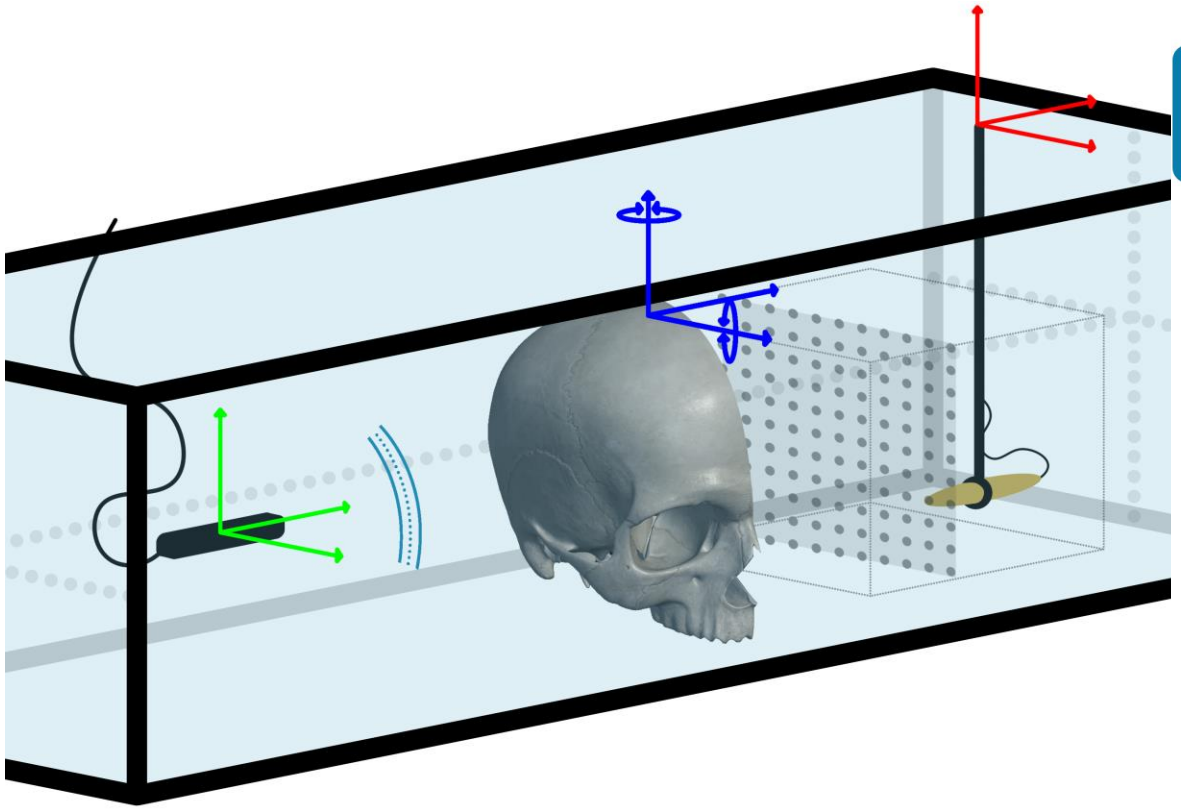


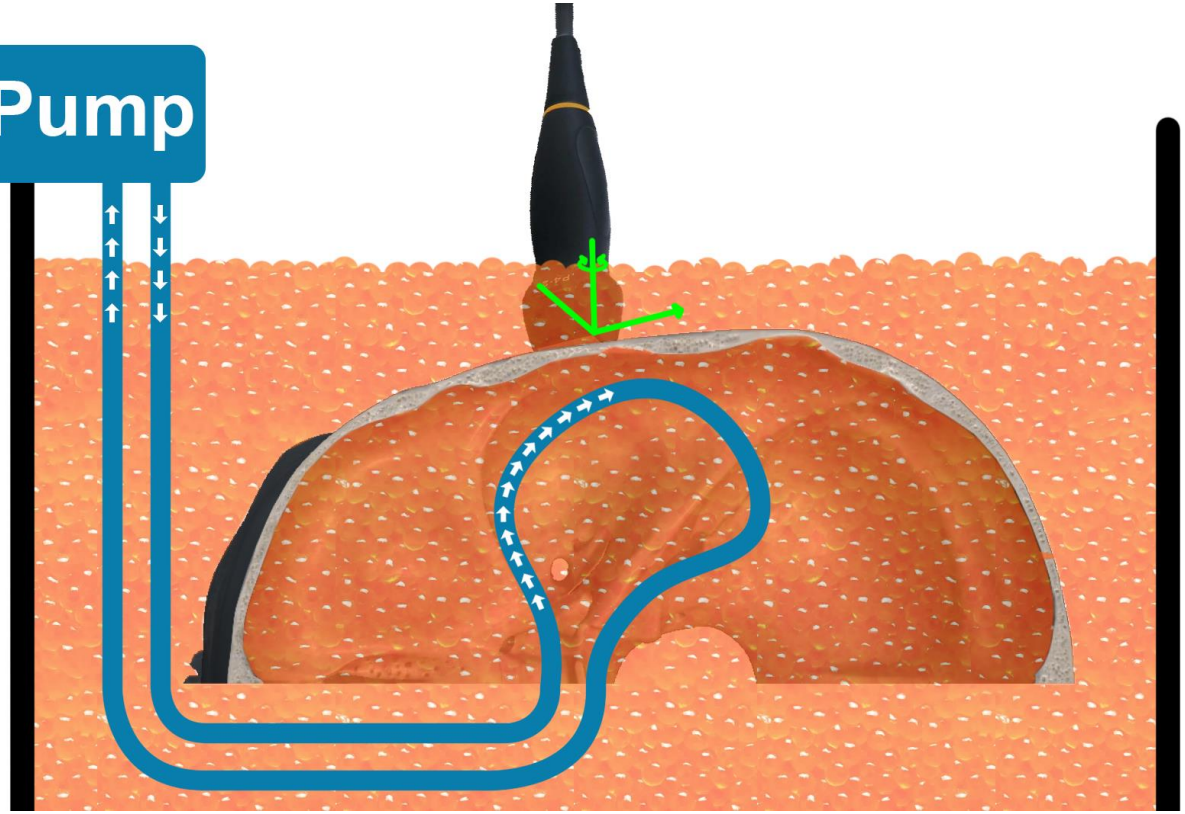


Ultrafast acquisition → **track trajectories of individual microbubbles** (microvasculature)

→ ***Super-Resolution*** *Functional Ultrasound Brain Imaging*

Revealing Brain Operation: Functional Ultrasound Imaging in 3D

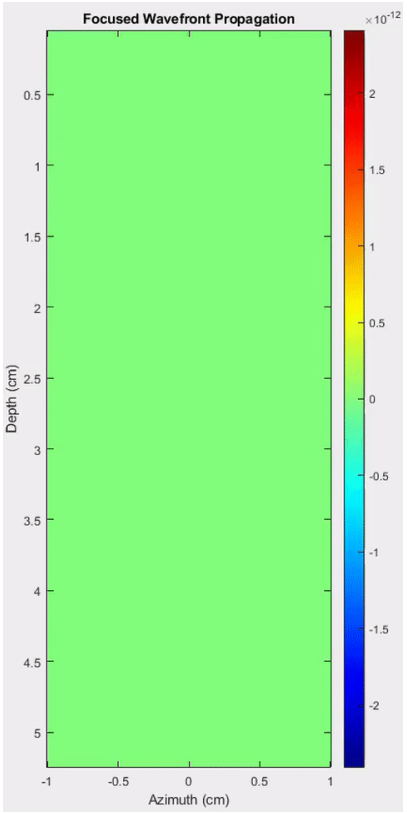


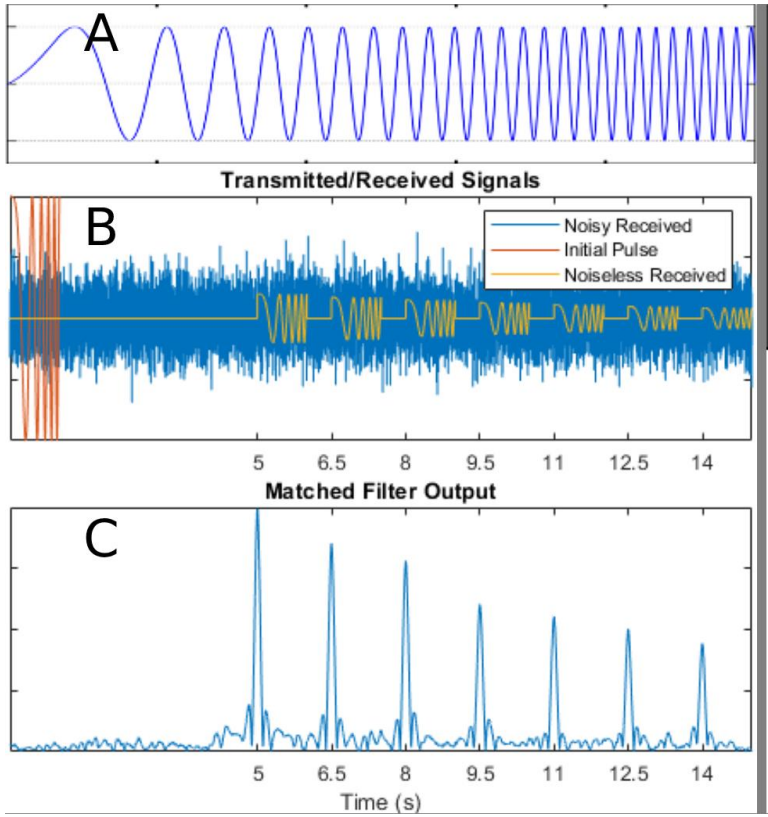


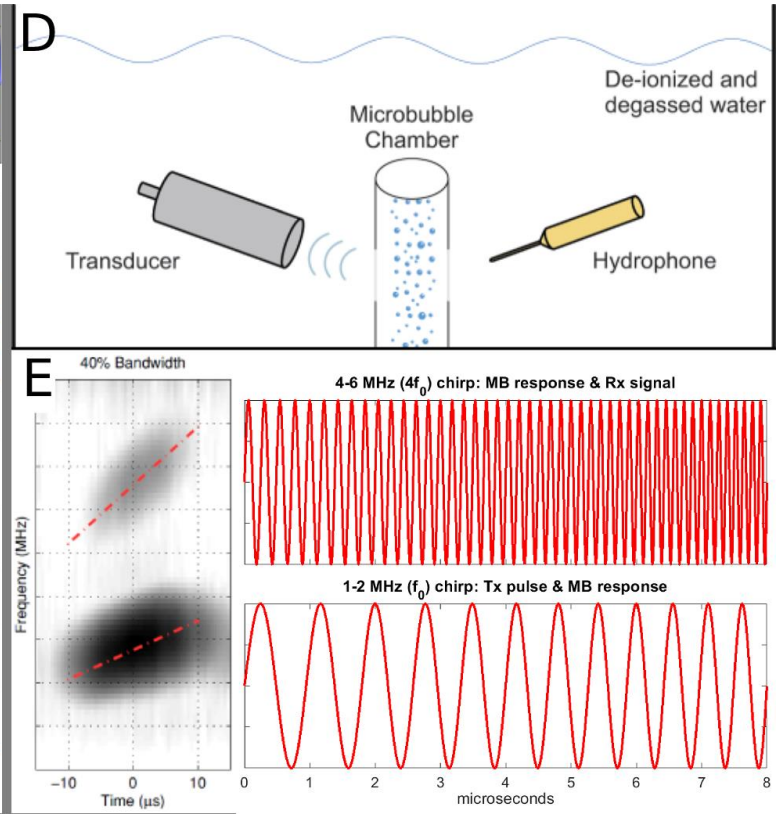
Challenge: **Non-invasive (Transcranial) 3D** Super-Res. Func'l US Imaging

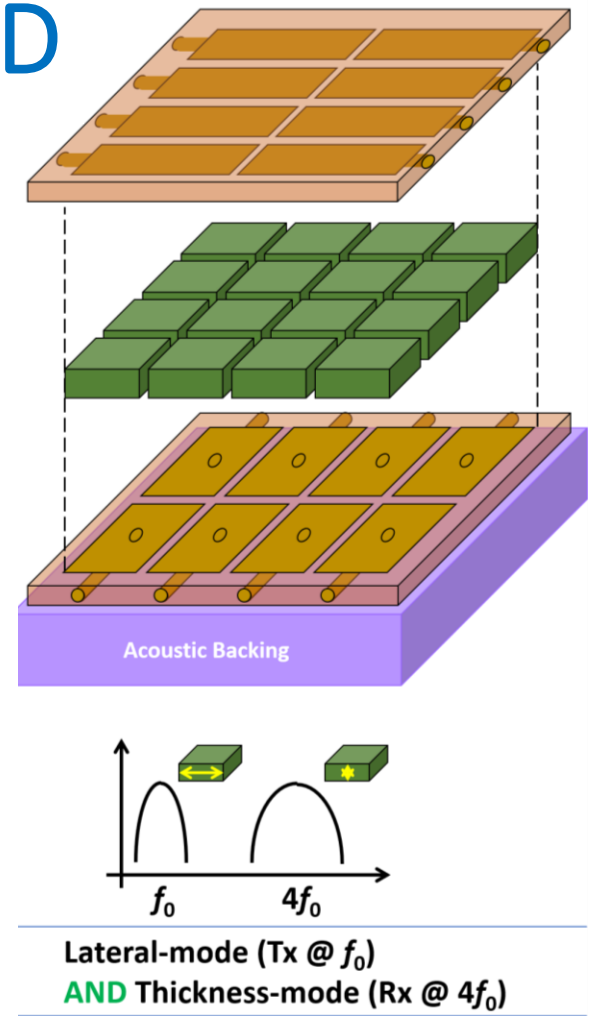
→ Step 1: ***Acoustically Characterize Skull***

Revealing Brain Operation: Functional Ultrasound Imaging in 3D





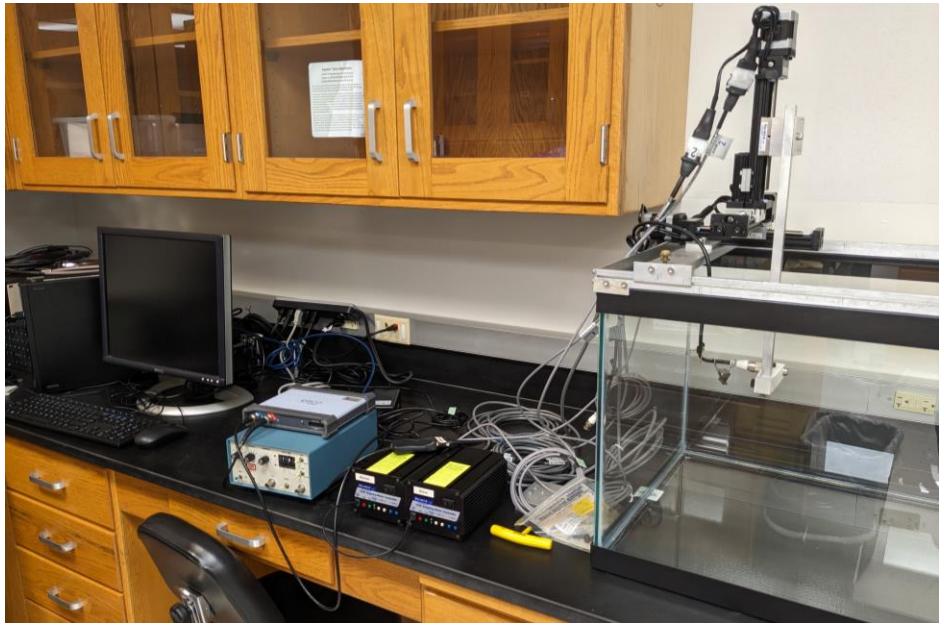


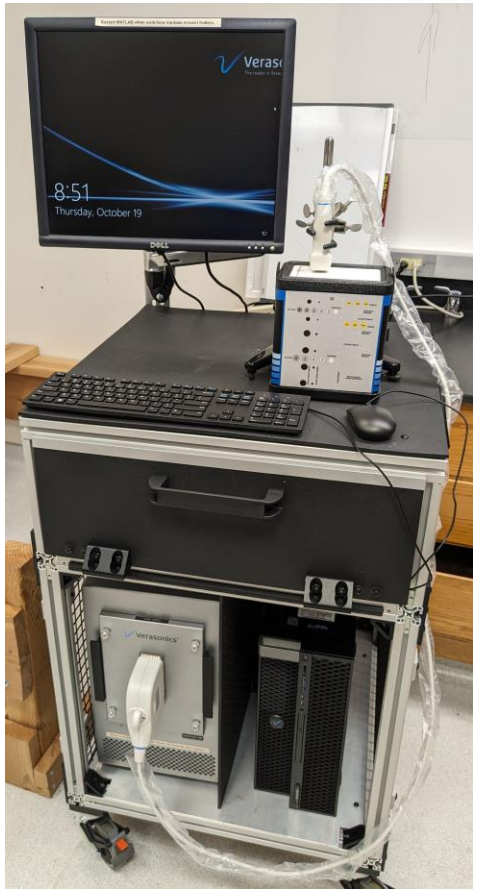


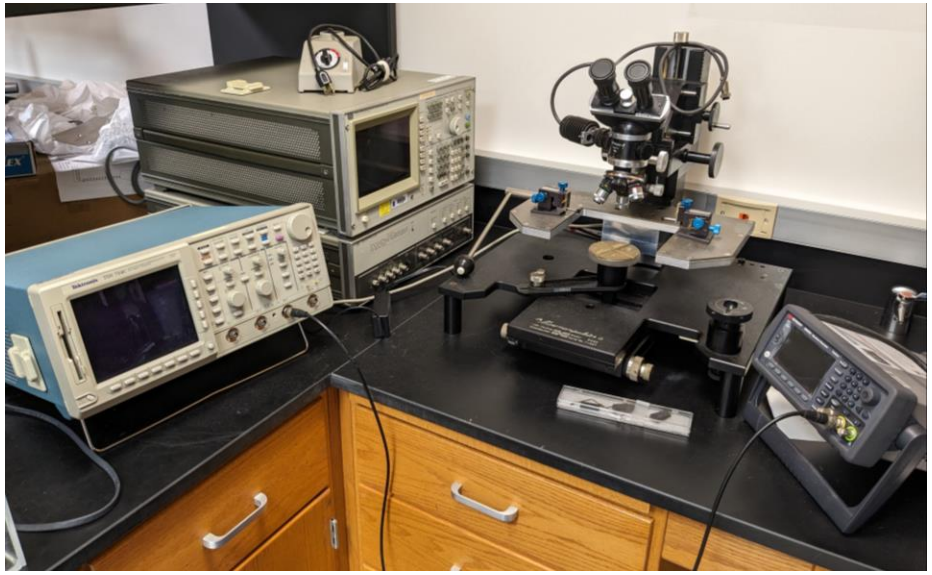
Challenge: **Non-invasive (Transcranial) 3D** Super-Res. Func'l US Imaging

→ Step 2: ***Refine New Algorithms & Device Design***

Revealing Brain Operation: Functional Ultrasound Imaging in 3D







Lab & Equipment: Research US Scanner + Probes, Test Phantoms, Characterization Tank, …Dicing Saw, Probe Station & Z-meter…

Revealing Brain Operation: Functional Ultrasound Imaging in 3D

Ultrasonic Imaging Tissue Characterization

ultracon 2024
Advancing Medical Ultrasound
April 6–10, 2024
Austin, Texas

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ACOUSTICS 23
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IEEE UFFC-JS 2024
IEEE Ultrasonics, Ferroelectrics, and Frequency Control Joint Symposium
Taipei Nangang Exhibition Center, Taipei, Taiwan || September 22 – 26, 2024

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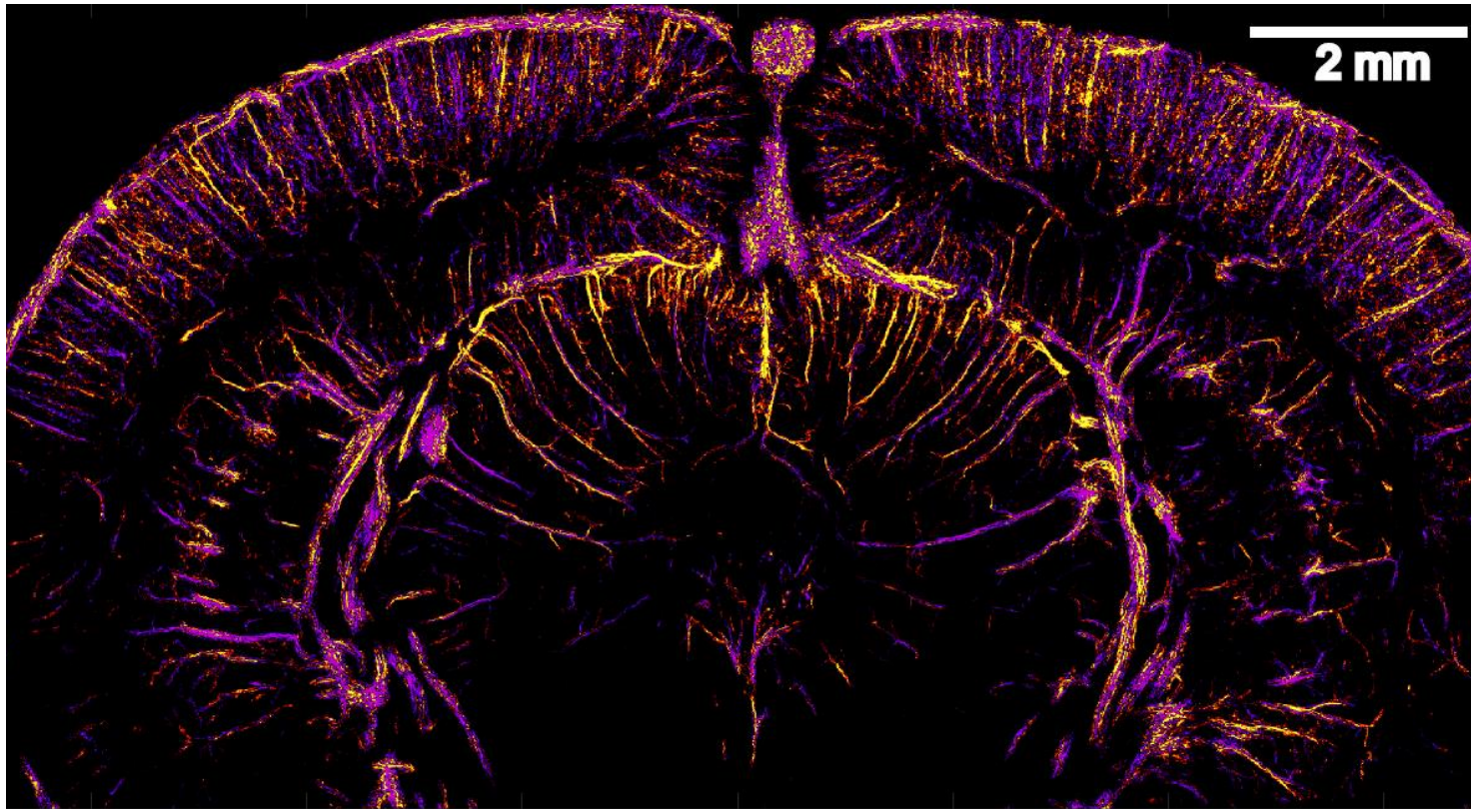
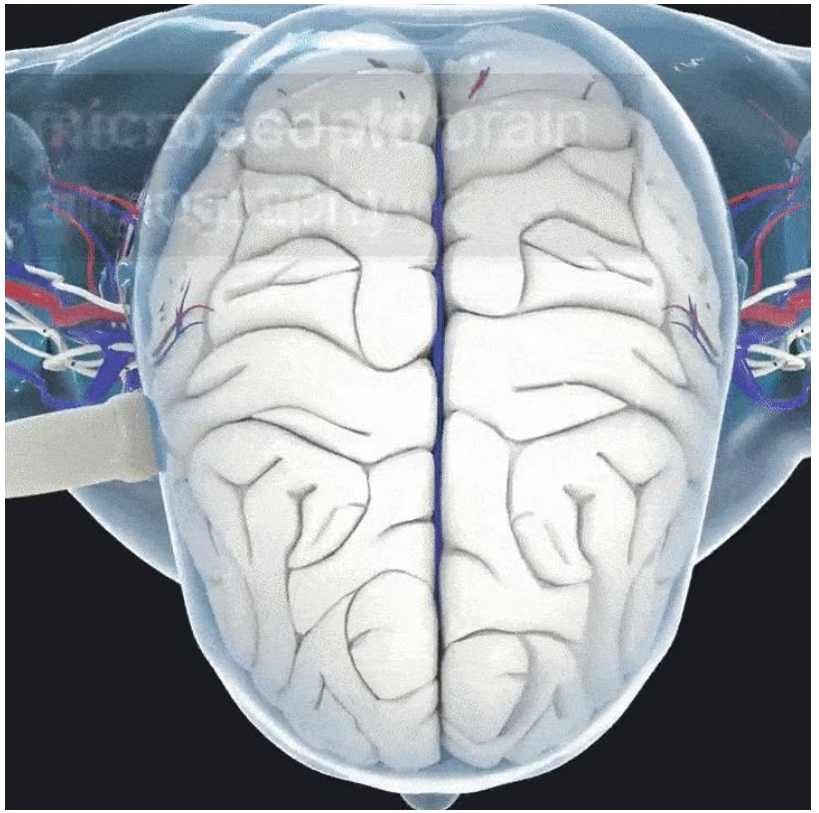
Forums/Conferences to Present Research Progress

→ ***Domestic & International Locations***

Revealing Brain Operation: Functional Ultrasound Imaging in 3D





Goal: **Non-invasive (Transcranial)** Super-Res. Func'l US **in 3D**

→ ***Transform Neuroscience Understanding***

Revealing Brain Operation: Functional Ultrasound Imaging in 3D

Experience Gained

This experience will provide you with new skills and knowledge:

- Understanding how medical images are acquired and reconstructed
- Improving coding skills for ultrasound pulse and beam simulations
- 3D scanning, CAD designing, and 3D-printing custom probe fixtures
- Taking experimental ultrasound measurements and images
- Analyzing data (from hydrophone, impedance analyzer, & scanner) to compare methods
- Applying machine learning methods to accelerate outputs
- Problem-solving and creating new hardware and algorithm solutions
- Improving communication skills (writing and speaking/presenting)