Dongliang Yan

Medical Device Scientist | Ultrasound R&D | Focused Ultrasound and Imaging
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SUMMARY

Biomedical engineering Ph.D. researcher with 4+ years of experience in medical device R&D, ultrasound imaging, therapeutic ultrasound, and deep learning-based computational imaging. End-to-end expertise spans concept development, ultrasound wave propagation simulation, transducer design and fabrication, prototype development, system integration, data acquisition, image reconstruction and algorithm development, and benchtop verification and validation.

SKILLS

Medical Device R&D: Concept development; system design; prototype fabrication; system integration; benchtop verification and validation; performance characterization; experimental design.
Focused and Therapeutic Ultrasound: HIFU; neuromodulation; beam-path control; focal-field design; cavitation and ablation principles; ultrasound safety.
Ultrasound Imaging and Algorithms: 3-D B-mode; color flow; power Doppler; functional ultrasound imaging (fUS); volumetric flow quantification; ultrasound localization microscopy (ULM); beamforming; Doppler signal processing; 3-D reconstruction.
Deep Learning and Computational Imaging: Transcranial ULM; phase aberration correction; domain-shift mitigation; GAN-based image restoration; microbubble localization and tracking.
Ultrasound Transducer Engineering: Transducer design and fabrication; piezoCAD/KLM; piezoelectric materials; matching and backing layers; assembly; impedance and pulse-echo testing.
Ultrasound Wave Propagation Simulation and Metrology: k-Wave; Field II; hydrophone scanning; ultrasound pressure-field mapping; beam characterization; phantom testing.
MEMS, Robotics, and Embedded Systems: MEMS device development; Arduino-based embedded control; robotic manipulation; CAD (Shapr3D, SolidWorks); 3-D printing; electromechanical actuation; Verasonics; ultrasound data acquisition; system synchronization and control.
Programming and Data Analysis: MATLAB; Python.

EXPERIENCE

Duke University, Biomedical Engineering Durham, NC
Graduate Researcher | Advisor: Prof. Pengfei Song Aug 2024–Present

FASTER-AIR: Portable High-Resolution 3-D Ultrasound Imaging

- Led end-to-end medical device R&D for **FASTER-AIR**, a portable clip-on 3-D ultrasound system built around a MEMS-based tilting acoustic reflector that redirects beams from conventional 1-D linear-array transducers.
- Invented an air-backed convex-concave reflector architecture that redirects and refocuses ultrasound beams, improving **elevational resolution from 2.98 mm to 1.39 mm** and contrast-to-noise ratio from 1.57 to 2.24.
- Developed ultrasound acquisition and image-reconstruction algorithms for **3-D B-mode, color flow, and power Doppler imaging**, together with volumetric blood-flow quantification.
- Designed, fabricated, integrated, and verified the MEMS reflector device and imaging system using ultrasound wave propagation simulation, CAD, 3-D printing, electromechanical actuation, Verasonics programming, hydrophone metrology, and tissue-mimicking phantom testing.
- Developed an **Arduino-based embedded control system** for automated reflector actuation, imaging-plane control, and synchronization with ultrasound acquisition in FASTER-AIR experiments.
- Developed **Beam Scope**, a calibration accessory that replaced a two-scanner, two-transducer, water-tank setup with a portable single-system workflow completed within minutes, improving usability and repeatability.
- Implemented and validated power-weighted Surface Integration of Velocity Vectors (SIVV), achieving near one-to-one agreement with reference flow rates from 60 to 420 mL/min.

Focused Ultrasound Delivery and Concurrent Imaging

- Designed a stainless-steel convex-concave clip-on beam-path remodulator for H-102 focused ultrasound transducers, creating a central aperture for 1-D or 2-D imaging arrays and enabling concurrent image guidance during neuromodulation.
- Applied ultrasound wave propagation simulation, reflector optimization, CAD, and rapid prototyping to characterize focal-field geometry and integrate therapeutic ultrasound delivery with real-time imaging using conventional hardware.
- Performed functional ultrasound imaging (fUS) in mice to map stimulus-evoked cerebral hemodynamic responses in brain regions associated with visual and whisker stimulation.

High-Frequency and Transcranial Ultrasound Localization Microscopy

- Contributed to high-frequency ultrasound localization microscopy (ULM) studies for super-resolution visualization of capillary-scale cerebral microvasculature and evaluated transducer-dependent imaging performance.
- Contributed to a deep learning phase-aberration correction framework for transcranial ULM that used experimentally acquired skull-aberrated and reference microbubble point-spread-function banks to reduce training-to-in-vivo domain shift.
- Supported in silico, ex vivo, and in vivo validation; the method improved in vivo ULM spatial resolution by up to 10.96%, enhanced vessel continuity, and reduced spurious flow-velocity measurements through intact mouse skulls.

University of Illinois Urbana-Champaign, Bioengineering Urbana-Champaign, IL
Graduate Researcher Jun 2023–Aug 2024

- Conducted early-stage medical device R&D by translating reflector-based beam-control concepts into CAD designs and 3-D-printed benchtop prototypes.
- Designed and fabricated custom single-element ultrasound transducers for benchtop experiments and prototype evaluation.
- Developed Verasonics acquisition sequences and experimental workflows for ultrasound data collection, system synchronization, and prototype performance evaluation.
- Performed hydrophone metrology, ultrasound pressure-field mapping, and beam characterization to compare measured performance with theoretical and simulated predictions.
- Verified reflector geometries through ultrasound wave propagation simulation, quantitative beam analysis, and controlled phantom testing.

Ultrasound Transducer Resource Center, University of Southern California Los Angeles, CA
Student Research Assistant | Advisor: Prof. Qifa Zhou Jan 2022–Apr 2023

- Designed and fabricated custom ultrasound transducers from piezoCAD/KLM modeling through material preparation, assembly, and device integration.
- Performed electrical impedance measurements and A-mode pulse-echo testing for transducer performance characterization and verification.
- Built and operated an ultrasound tweezer platform for cell manipulation and supported experimental safety validation.

EDUCATION

Ph.D. in Biomedical Engineering Expected Summer 2027
Duke University Durham, NC
Relevant Coursework: Robotic Manipulation (Spring 2026)

Ph.D. Studies in Bioengineering Jun 2023–Aug 2024
University of Illinois Urbana-Champaign Urbana-Champaign, IL

M.S. in Biomedical Engineering Aug 2021–May 2023
University of Southern California Los Angeles, CA

PUBLICATIONS

- **D. Yan***, M. R. Lowerison, D. P. Bradway, M. Yi, S. Abbasikamazani, J. Zou, and P. Song, "Air-backing acoustic reflectors for enhanced FASTER 3-D ultrasound imaging," submitted to *IEEE Transactions on Ultrasonics, Ferroelectrics, and Frequency Control*, 2026.
- M. Yi, Z. Huang, Y. Wang, B.-Z. Lin, **D. Yan**, Y. Shin, M. Lowerison, and P. Song, "Addressing domain shift in deep learning-based phase aberration correction for transcranial ultrasound localization microscopy," submitted to *IEEE Transactions on Medical Imaging*, 2026.
- M. R. Lowerison et al., including **D. Yan**, "Comparison of high-frequency ultrasound transducers for microvascular localization microscopy in the mouse brain," *Imaging Neuroscience*, vol. 3, 2025.
- M. R. Lowerison et al., including **D. Yan**, "Capillary-scale microvessel imaging with high-frequency ultrasound localization microscopy in mouse brain," *bioRxiv*, 2024.
- Z. Dong et al., including **D. Yan**, "Real-time 3-D ultrasound imaging with a clip-on device attached to common 1-D array transducers," *Journal of the Acoustical Society of America*, vol. 155, p. A102, 2024.
- Y. Zeng et al., including **D. Yan**, "Manipulation and mechanical deformation of leukemia cells by high-frequency ultrasound single beam," *IEEE TUFFC*, vol. 69, no. 6, pp. 1889–1897, 2022.

CONFERENCES AND PRESENTATIONS

IEEE International Ultrasonics Symposium (IUS 2026) Raleigh, NC
Selected Oral Presentation Oct 4–8, 2026

- Selected to present "Air-Backed Curved Acoustic Reflectors for Elevational Beam Refocusing in FASTER 3-D Ultrasound Imaging" at the 63rd IEEE International Ultrasonics Symposium.

International Symposium on Ultrasonic Imaging and Tissue Characterization Silver Spring, MD
Oral Presentation Apr 2026

- Presented FASTER-AIR's air-backed reflector architecture, high-resolution 3-D imaging performance, streamlined calibration workflow, and volumetric flow validation.

AIUM Annual Convention Orlando, FL
Poster Presentation Mar–Apr 2025

- Demonstrated clip-on 3-D ultrasound and volumetric flow imaging on a GE LOGIQ E10 scanner using a standard clinical L2-9D probe.