

FUNCTIONAL ULTRASOUND

ICONEUS ONE



The Iconeus One is the only full-featured acquisition system for functional ultrasound (fUS) imaging of brain activity. The Iconeus One allows visualization of cerebral blood flow with sub-millimeter spatial resolution and high sensitivity enabling insights into brain activity through neurovascular coupling.

The Iconeus One provides a user-friendly platform allowing users without a background in fUS technology to image cerebral blood flow and microvasculature. The system also comes with analysis software that integrates the Allen Mouse Brain Atlas to ensure post-processing is streamlined and a wide-variety of data can be exported. The applications include real time fUS, vascular imaging, functional imaging of neuronal activation (including task-based), functional connectivity mapping, and ultrasound localization microscopy.

Applications

Functional Connectivity

Applications for resting-state functional connectivity, seed-based correlation mapping, connectivity maps of behaving animals and drug studies.

Task-Based Functional Imaging

Studies in awake behaving animals, studies in head fixed animals, sleep studies, stimulation studies, compatible with other techniques (EEG, LFP, PET, optogenetics).

Stroke & Vascular imaging

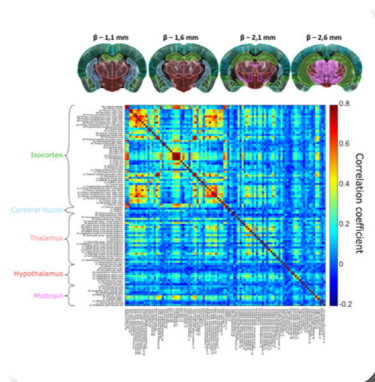
3D visualization of brain vasculature, treatment studies following stroke, ultrasound localization microscopy.

Neuropharmacology

Brain activity changes, functional connectivity changes, epilepsy studies.

Super-Resolution Ultrasound

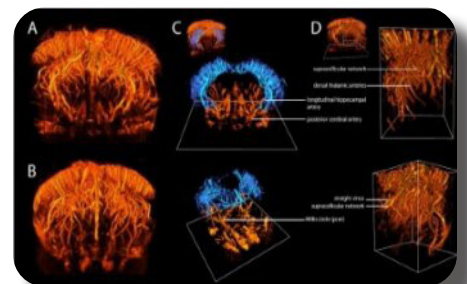
In plane resolution of about 5 μm , quantify blood velocities in the mm/s range, track individual microbubbles as they travel through the blood vessels.



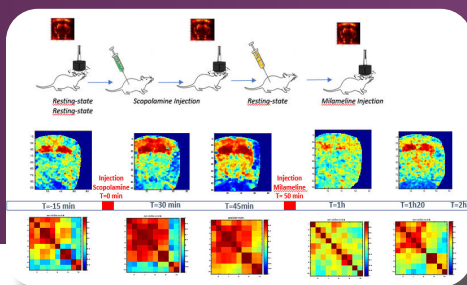
3D connectivity matrix shows strong interhemispheric connectivity patterns using atlas-based regions in the brain.



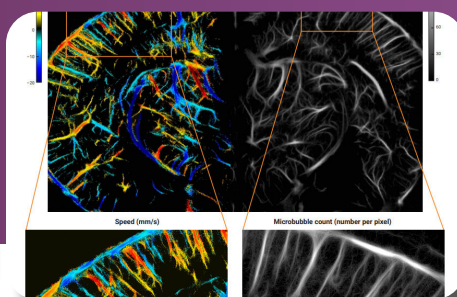
The cerebral blood volume response to whisker stimulation can be seen in the barrel cortex



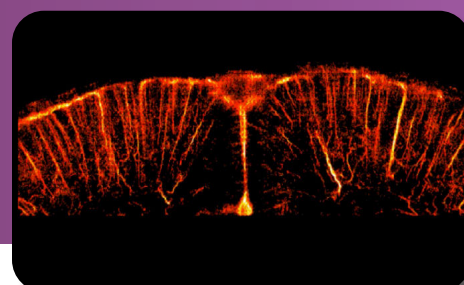
The vasculature from the front (A) and the back (B) of the rat brain are shown. The hippocampus is isolated in blue (C). Details of cortical arteries and supra collicular network are also shown in D.



The effects of scopolamine injection on perfusion and functional connectivity in awake mouse brain.



ULM maps showing blood velocity (left) and microbubble count (right) of the mouse brain vasculature at a resolution of 6.5 μm. Cortex flow directionality allows discrimination between arterioles & venules.



Individual microbubble sources are detected in a 'B-mode' image formed by averaging hundreds of beamformed images. Superposing thousands of responses per second leads to a highly-resolved time-averaged localization map, at depths far below the ultrasound resolution limit.

System Models & Specifications

Available Probes:

Both 3D and 4D probes are available. 3D probes allow scans in two spatial dimensions (+ time), or three spatial dimensions (+ time, with asynchronous multislicing). 4D probes allow scans in three spatial dimensions + time (simultaneous multislicing or volumetric).

System Modes & Specifications

Probe	Summary	Engineered for...	Central	Probe size: L x W x H (mm)	Spatial	Scanning depth (cm)	Field of view (mm)	Number of elements	Type of Probe
IcoPrime	The most versatile sensor: high spatial resolution, good scanning depth, and excellent sensitivity	The majority of fUS applications	15	25 x 17.5 x 6	100	~1.5	14.1	128	3D
IcoPrime-Lite	Lighter version of IcoPrime, with a more flexible cable	Mobile rats	15	25 x 20 x 3.2	100	~1.5	14.1	128	3D
IcoPrime-Mini	Smaller and lighter version of IcoPrime, with a more flexible cable	Mobile mice	15	19 x 13 x 3.2	100	~1.5	7.0	64	3D
IcoPrime-XL	Larger version of IcoPrime, with a wider field of view	Marmosets	15	32 x 25.6 x 6	100	~1.5	21.1	192a	3D
IcoRange	Offering improved scanning depth for larger animals	Non-human primates	8.5	25 x 33 x 9	170	~3	25.6	128	3D
IcoDeep	Offering maximum scanning depth and field of view	Large animals such as pigs	6	16.5 x 35 x 11	250	~4	25.6	128	3D
IcoPrime-4D MultiArray	Offering whole-brain, high-sensitivity volumetric scanning	Head-fixed mice	15	84 x 11 x 9.5b	100	~1.5	0.7 (W) x 0.8 (L)	256a	4D

a) Requires an upgrade to Iconeus One to handle 256 channels. b) W and H measurements refer to the terminal multiarray (indicated).