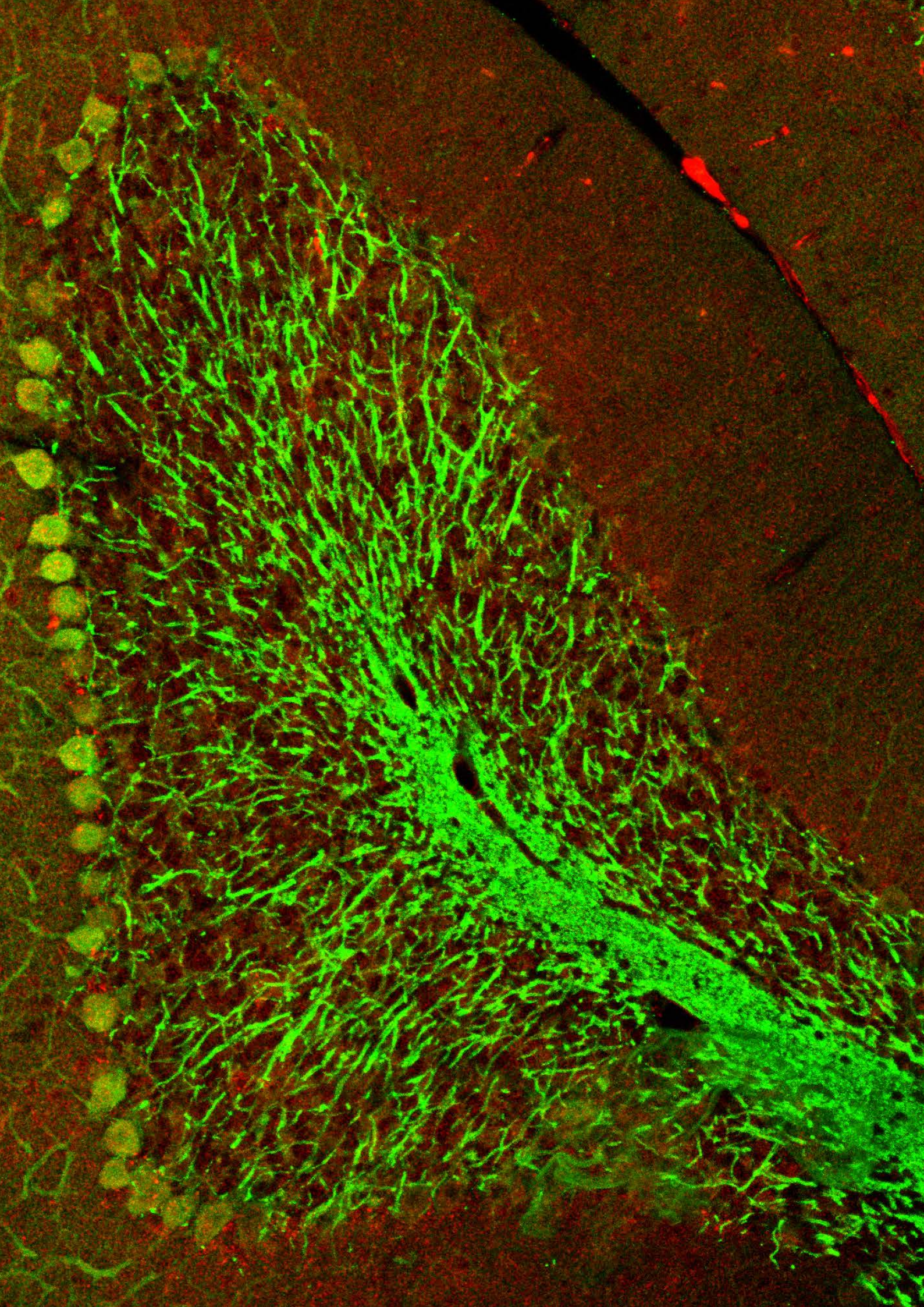


# Life Science & Light Microscopy



 SmarAct



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## Introduction

In both, light microscopy and the even more spread field of life sciences, precise and reliable sample handling is mandatory. To address the varying requirements of such a protean environment, SmarAct has formed a dedicated team of scientists, engineers and modeling experts with specific know-how in life sciences and light microscopy.

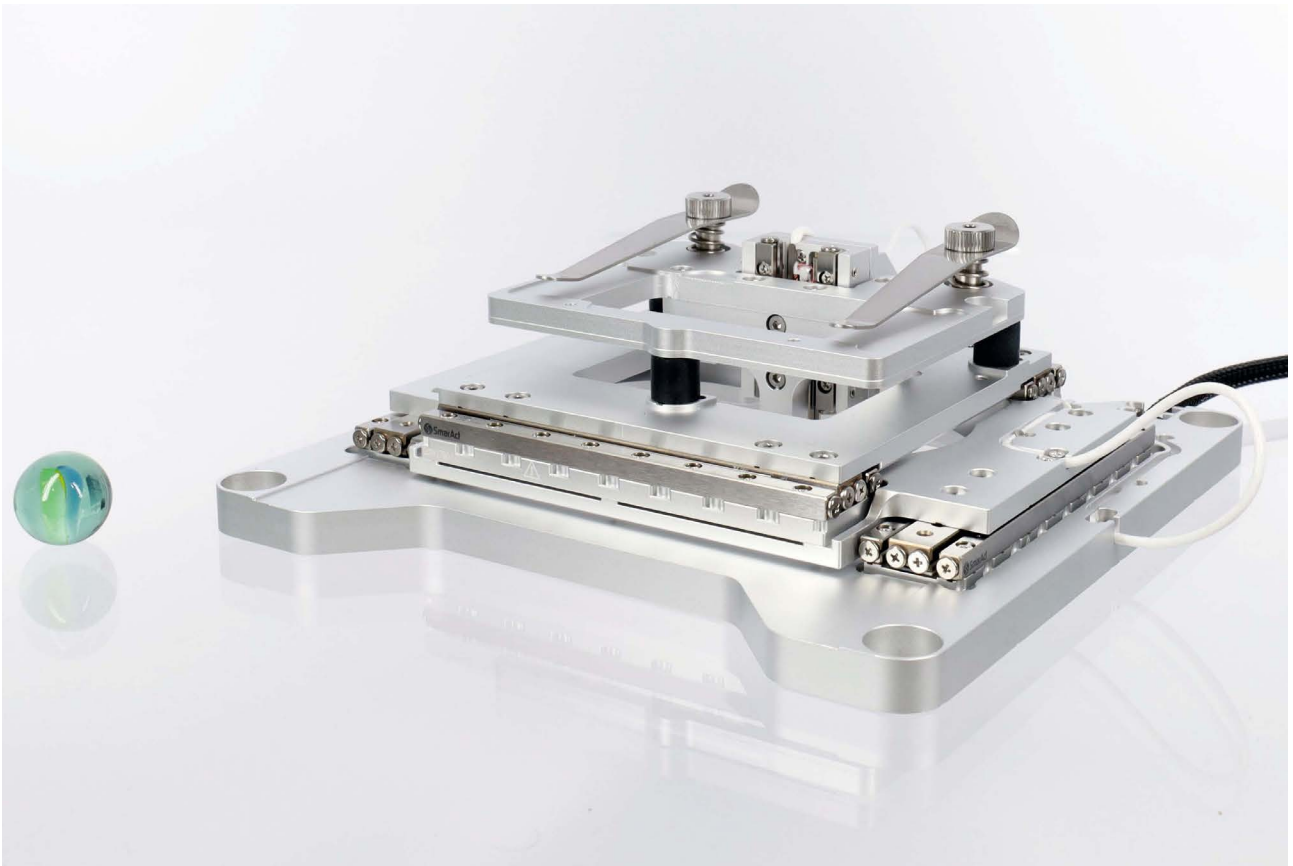
## (Light-)Microscopy

SmarAct has developed microscope stages that allow the specimens to be positioned in multiple dimensions and can be combined with micro-manipulation systems for in situ sample manipulation. Our microscope stages are based on compact linear positioners and allow long travel ranges with nanometer precision in highest closed-loop repeatability. In addition to the standard universal object slide holder, unified well plate holders, standard bread

board adapters and petri dish holders are available. The optional micro-manipulation systems are very versatile devices when it comes to the handling of pipettes, micro-knives, micro-grippers, micro-injectors or other mechanical or electrical probes. Our portfolio includes several different manipulators with three and four degrees of freedom for the most common tasks.

## Super resolution Microscopy

With the advancements in super resolution microscopy, the demand for highly precise, multi-dimensional sample manipulation has increased together with the need for affordable solutions. SmarAct offers several plug-and-play kits for different open-source microscopes (e.g., NanoPro 1.0, MiCube, K2 TIRF a.o.) and our team of experts will support you all the way to realize your specific setup.



## High Precision Positioning Solutions

Most applications in science and industry require more than one degree of freedom when it comes to precise positioning of samples and tools. SmarAct's mission is to solve your specific positioning tasks successfully and to your complete satis-

faction. From positioning of components and samples on a flat surface to highly complex 3-D positioning tasks: SmarAct's positioning systems are designed to meet your challenges precisely.

General Specifications	
Travel	Up to 2 m
Normal Force	Up to 30 N
Resolution	1 nm
Repeatability	+/- 40 nm
Velocity	> 20 mm/s
Enviroments	Atmospheric, HV, UHV, Cryo
Materials	Aluminum, black anodized, non magnetic upon request



## High Precision Microscope Stage for Two Photon Polymerization by UpNano

Two-photon polymerization (2PP) is not limited to layer-by-layer fabrication, but is an inherent 3D process technology suitable for the fabrication of almost any conceivable 3D structure, including those in the nm range.

In a transparent, photosensitive liquid material, only the areas that are to polymerize are selectively aligned in a tiny laser focus.

This process is based on the second order absorption of the laser light intensity in

the material and therefore requires very high laser focal intensities at a very small focus as well as the highly precise alignment of the laser focus within the material. The Austrian high-tech company UpNano uses a customized version of SmarAct's SOM-180150 high-precision microscope stage – a long range piezo stage with a travel range of 120 x 100mm – for this purpose.

The stage's motion accuracy combined with the

breakthrough 2PP technology offers enormous potential and enables innovative applications in academic and industrial research, e.g. in biomechanics such as tissue engineering.

To demonstrate the capabilities of UpNanos NanoOne, a tiny castle was 3D printed onto the sharpened tip of a pencil using 2PP and then imaged by scanning electron microscopy.

# Ophthalmologie

High precision in the treatment of age-related macular degeneration. For a research project of the TU Munich (Augenlinik und Poliklinik, Klinikum Rechts der Isar, Dr.-Ing. M. Ali Nasser) we provide a set of piezo driven SLC-1750 stages with integrated position encoders. With a travel range of 31 mm and an outer dimension of only 17 x 50 mm<sup>2</sup> the stages are a perfect compromise between travel range and

compactness. These piezo driven linear stages are the main part of a hybrid parallel-serial kinematic used as a pre-generation medical device that enables ophthalmologists to improve administration of substances such as drugs and stem-cells to desired targets located below the retina. The design of the kinematic system allows an end-effector precision of 14  $\mu\text{m}$  (x), 10  $\mu\text{m}$  (y) and 4  $\mu\text{m}$  (z). A detailed explanation about

the applications of such a drug delivery platform can be found in recent publications of the group <sup>[1]</sup>.

<sup>[1]</sup> A targeted drug delivery platform for assisting retinal surgeons for treating Age-related Macular De-generation (AMD), M. A. Nasser et al., 2017 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), doi: 10.1109/EMBC.2017.8037815



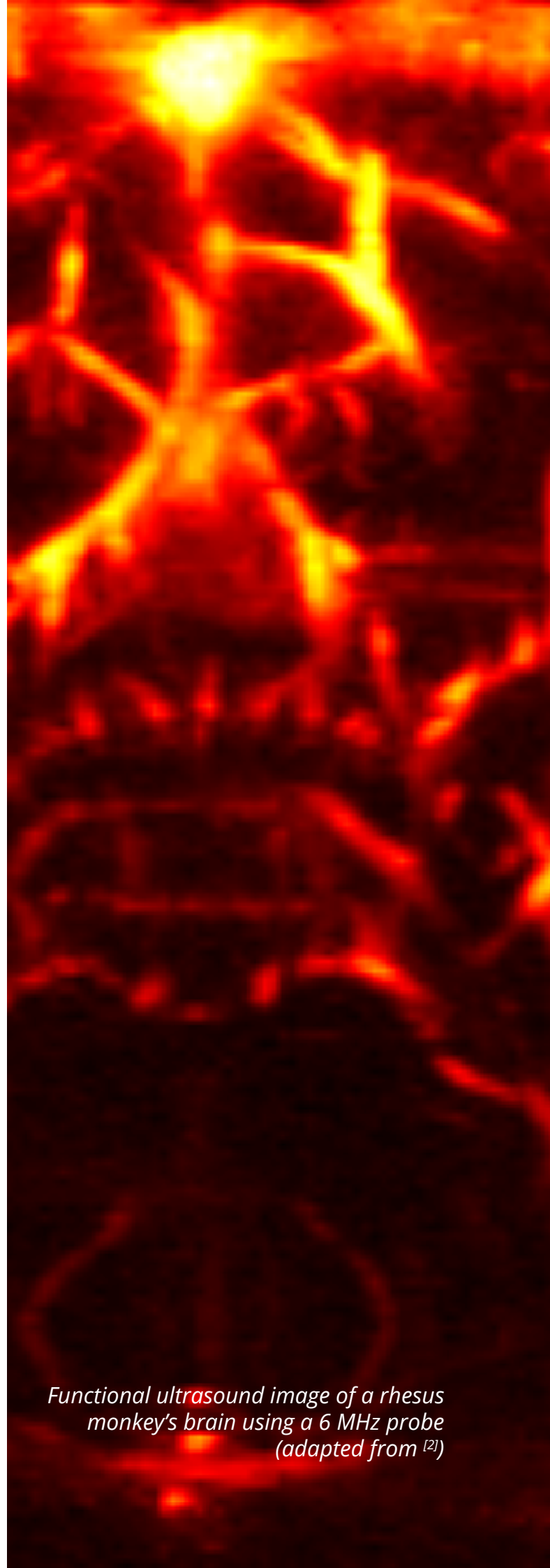
# Lightweight probe positioning system for primate brain research by Iconeus

Ultrasound-based brain scanning

Iconeus is a Paris-based manufacturer of hardware and software for acquiring brain scans using the technique of functional ultrasound. This method uses multi-plane-wave pulses of ultrasound from specialized probes to provide information on blood flows and hence on brain activity. These probes need to be accurately positioned during the scanning process, in order to optimize the field of view (and resolution) of the final 2D or 3D brain image.

Much of the work carried out using Iconeus' equipment involves head-fixed studies on rodents, but as part of a mission to accelerate the development of clinical applications in humans, there is now increasing interest in using the equipment with primates. However, this requires a lighter probe positioning system than the four-axis motorized scanning platform that the company currently offers. With a weight of just 26 g, the SLC-1740 is far less cumbersome than the existing head-fixed platform, providing greater comfort for the subjects, while retaining the single axis of movement that is needed to accurately position the probe. As a result, Iconeus plan to employ it as the standard probe positioning system for all of their instruments sold for use with primates.

<sup>[2]</sup> Functional ultrasound imaging of the brain reveals propagation of task-related brain activity in behaving primates. Dizeux A, Gesnik M, Ahnine H, Blaize K, Arcizet F, Picaud S, Sahel JA, Deffieux T, Pouget P, Tanter M. Nat Commun, 2019. doi: 10.1038/s41467-019-09349-w



*Functional ultrasound image of a rhesus monkey's brain using a 6 MHz probe (adapted from <sup>[2]</sup>)*

With the development and production of market-leading solutions in the field of high-precision positioning, automation and metrology, the SmarAct Group reliably accompanies their customers in achieving their goals. The broad product portfolio – from single positioning stages to complex parallel kinematics, miniaturized robots, control systems and measurement technology – is complemented by automated microassembly solutions. Even the most challenging customer requirements can be met by maximum adaptability and complete in-house production.

Since its founding in 2005, SmarAct has steadily grown from a small team of engineers to a group of companies with three independent business units and over 220 highly skilled members. Today, SmarAct relies on years of experience and, above all, on a very passionate team with unconditional customer focus.

[www.smaract.com](http://www.smaract.com)

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