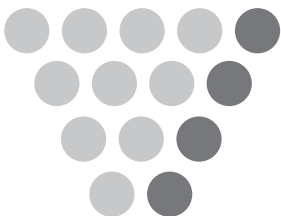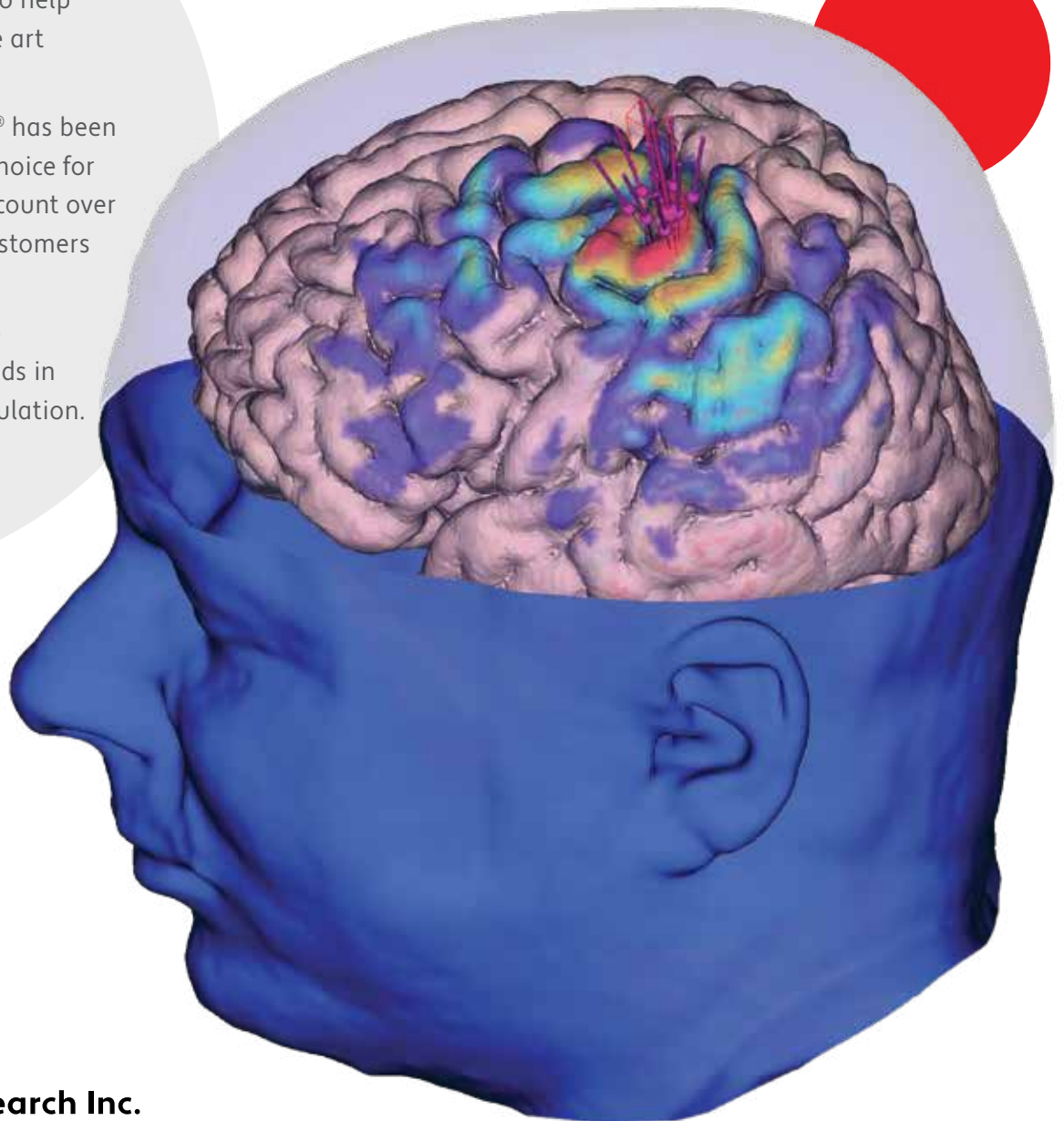# Brainsight®

TMS

For 20 years, Rogue Research Inc. has worked alongside neuroscientists from around the world to help advance the state of the art in neuroscience.

For 20 years, Brainsight® has been the neuronavigator of choice for image-guided TMS. We count over 500 TMS users as our customers around the world.

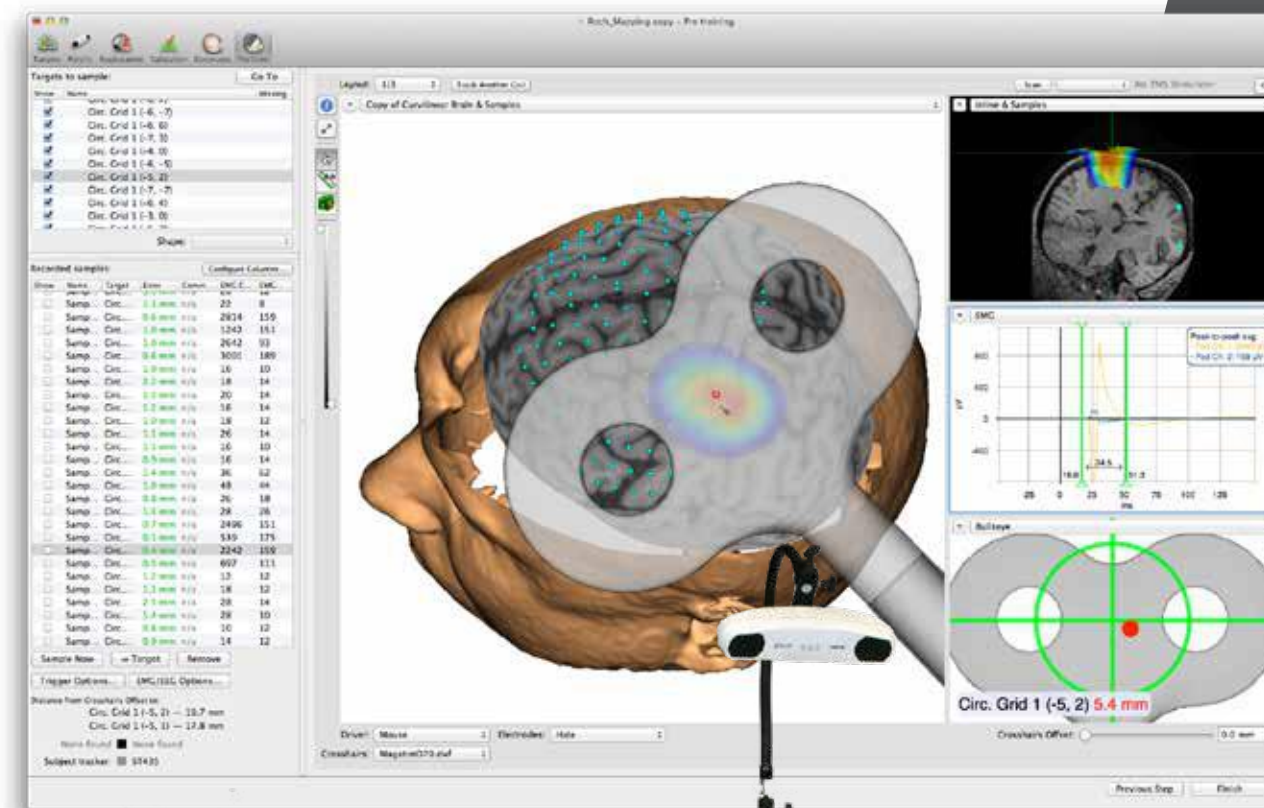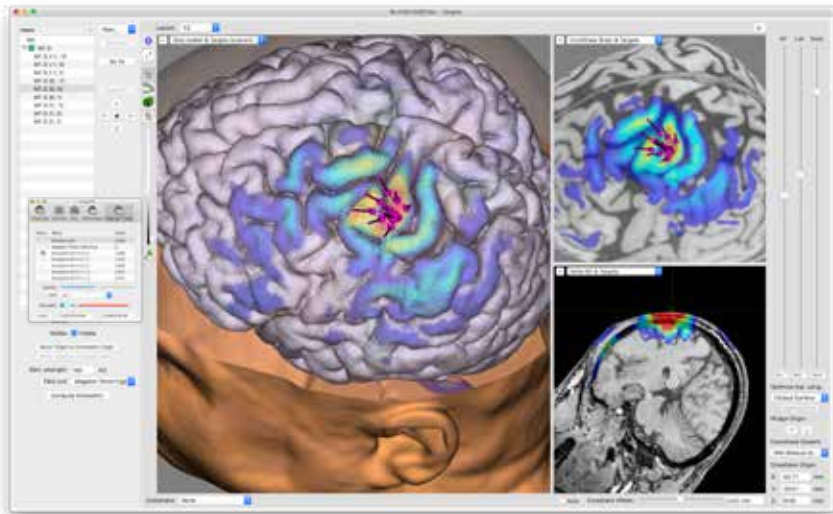Brainsight® continues to evolve to meet your needs in non-invasive brain stimulation.

Rogue Research Inc.
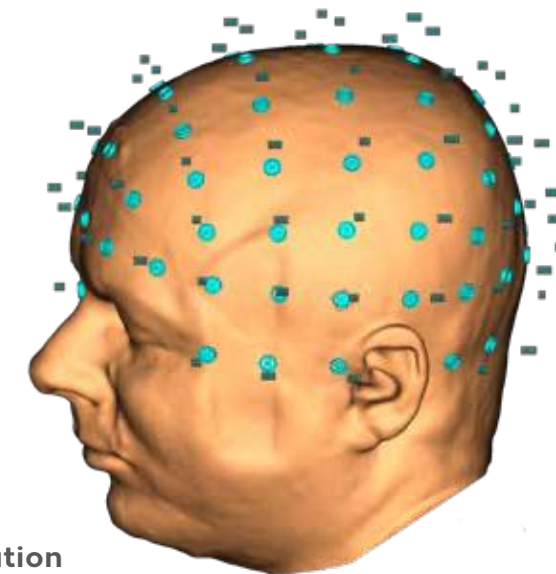
Brainsight®

THE
NEUROSCIENCE HUB

Brainsight® for TMS

- Works with any coil from any manufacturer
- Flexible, easy coil calibration
- Define target based on anatomy, MNI or Talairach coordinates, MRI overlay, previous TMS session
- Use SimNIBS current modelling to optimize coil placement to your target
- Links to TMS device via TTL trigger and serial port
- Integrated 2-channel EMG for mapping studies
- For each TMS pulse, Brainsight™ can record:
  - coil position and orientation
  - coil status (on supported TMS models)
  - intended target
  - positioning error
  - distance to target
  - EMG response
  - EEG response (when using NEUROPRAX EEG)
  - NIRS optode locations

Flexible Subject Chair

- Reclined and Upright
- Unique Coil Arm
- Less Intrusive
- Preserves field of view

EEG Integration

- Store Montages for EEG, NIRS or Combination
- Use Brainsight® to ensure correct placement and to record EEG electrode locations
- Export EEG data and electrode locations for Analysis

Brainsight® Features

- Integration with Brainsight NIRS and EEG electrode recording
- Integrated 2-channel EMG device
- Live EMG display
- NIRS and EEG cap manager
- Improved grid mapping tool

- Integration with SimNIBS for realistic induced current modelling
- Support for Axilum TMS Robots
- Easy to use coil-specific calibration adapters
- Optional subject chair
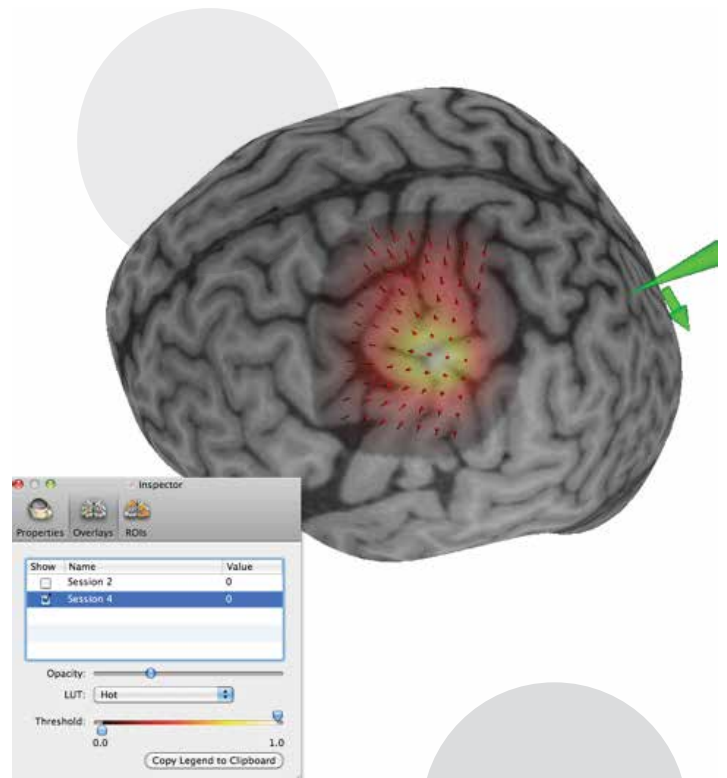
ROBOTICS

We are collaborating with Axilum Robotics to combine Brainsight® and their robotic TMS holder. The result offers exciting possibilities for automated TMS applications including motor mapping, automatic coil placement and motion head correction for longer TMS sessions.

ELEVATETMS

Recently, we have developed our own TMS device, called ElevateTMS™. ElevateTMS™ has the ability to generate new pulse waveforms with variable pulse width, individual phase control and directionality. Based on technology referred to as cTMS, ElevateTMS™ can output monophasic, biphasic, triphasic, quadripulse as well as rTMS with many unidirectional pulse shapes that open up new areas of research in magnetic stimulation.

Rogue Research Inc.

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info@rogue-research.com

ELEVATE TMS

Take **TMS** to the next level

For 20 years, Rogue Research has worked to develop tools that help you advance the boundaries of neuroscience. Brainsight® is the neuronavigator of choice in over 500 labs around the world.

We continue this tradition of offering the best tool possible with the release of our latest product, **ELEVATE TMS**. Based on a completely different architecture than traditional TMS, called cTMS. **ELEVATE TMS** offers more **control** than any TMS device available today.

Rogue Research Inc.

Rogue Research Inc.
20 Years of Innovation for Research

Features of ELEVATETMS

- First new TMS design in years
- Variable pulse shapes to reliably excite or inhibit neuronal circuits
- Monophasic, biphasic, unidirectional pulses
- Integrated output recording
- Integrated EMG
- External control via sequence file and Ethernet interface
- Optional current reversal module (~2 msec switching time)

Repetitive

Wide Pulse
Narrow Pulse

Unidirectional (biphasic)

Single Pulse

Biphasic
Unidirectional (monophasic)
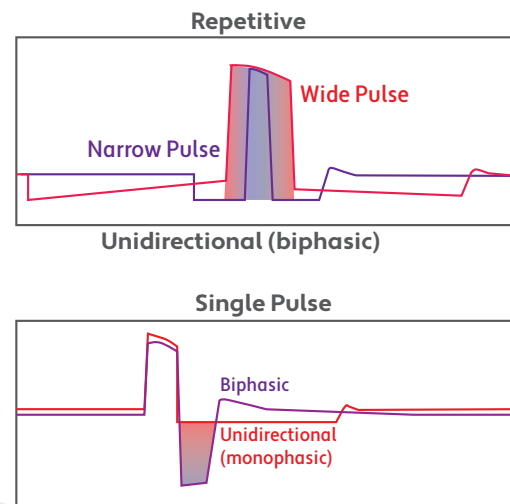
Pulse Waveform Capabilities

- Directionality Control: Controls amplitude of the -ve phase relative to the +ve phase
- Variable pulse widths up to 385 µSec (with optional high inductance coil)
- Monophasic, biphasic, polyphasic, staircase, asymmetric
- Repetition rates up to 1 kHz
- Unidirectional theta burst
- Charging power: 2x1500 Joules per second

The Three Steps of Effective TMS
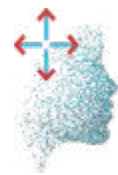
Targeting
Use the planing step in **Brainsight®** to combine anatomical MRI, fMRI and current modelling to determine the optimal target and coil orientation to reach it.

Dosing
Elevate TMS gives you more control over how the TMS pulse modulates cortical excitability. Select the best pulse shape to reliably achieve the desired effect.

Execution
Use **Brainsight®**'s Neuronavigation features to accurately place the coil over the planned target and carry out your TMS session

Modern, intuitive user interface

- Large, capacitive touch screen
- Simple and advanced controls
- Predicted waveform displayed initially and actual measured output overlaid for confirmation of delivered pulse

Brainsight® TMS

ELEVATETMS

Thoughtful Coil Designs

- Removable handles to suit every preference
- Different inductances to extend cTMS pulse range
- B-Field 3D mapped for use in E-field modelling research
- Integrated coil tracker mount
- More models to come (cooled coil, 50mm fig-8 etc.)

Selected Publications

ELEVATETMS

The Journal of Physiology 596(20) June 2018 DOI: 10.1113/JP275798
Effect of Coil Orientation on Motor Evoked Potentials in Humans with Tetraplegia
Hang Jin JoHang Jin JoVincenzo Di LazzaroMonica A. Perez

Brain Stimul. 2016 Jan-Feb;9(1):39-47. doi: 10.1016/j.brs.2015.08.013. Epub 2015 Sep 1.
Enhancement of Neuromodulation with Novel Pulse Shapes Generated by Controllable Pulse Parameter Transcranial Magnetic Stimulation.
Goetz SM1, Luber B2, Lisanby SH2, Murphy DL1, Kozyrkov IC1, Grill WM3, Peterchev AV4.

Clin Neurophysiol, 127(1), 675-83 (2015)
Effect of coil orientation on strength-duration time constant and I-wave activation with controllable pulse parameter transcranial magnetic stimulation.
D'Ostilio K, Goetz SM, Hannah R, Ciocca M, Chieffo R, Chen JC, Peterchev AV, Rothwell JC

Clin Neurophysiol. 2016 Jan;127(1):675-83. doi: 10.1016/j.clinph.2015.05.017. Epub 2015 May 30.
Effect of coil orientation on strength-duration time constant and I-wave activation with controllable pulse parameter transcranial magnetic stimulation.
D'Ostilio K1, Goetz SM2, Hannah R3, Ciocca M4, Chieffo R5, Chen JC6, Peterchev AV7, Rothwell JC3.

Clin Neurophysiol 125, S1–S339Peterchev, A.V., D'Ostilio, K., Rothwell, J.C., Murphy, D.L. (2014).
Intermittent theta burst stimulation inhibits human motor cortex when applied with mostly monophasic (anterior-posterior) pulses.
Sommer M, Ciocca M, Hannah R, Hammond P, Neef N, Paulus W, Rothwell JC (2014)

Repetitive cTMS Specifications

Note :The multi- parameter nature of cTMS makes it difficult to describe in a table. Feel free to contact us.

	Pulse Type (+ve pulse width, -ve Pulse width)	M-Ratio	10 Hz	25 Hz	50 Hz	100 Hz	200 Hz	400 Hz	800 Hz	1000 Hz	Max Freq. (Hz) at 100% output	Maximum Output (%)
Unidirectional train — **Balanced Pulses**	(45µs, 145µs)	0.2	100	100	49	24	11	NA	NA	NA	24	100
	(60µs, 185µs)	0.22	100	82	40	19	9	NA	NA	NA	20	100
	(75µs, 225µs)	0.25	93	55	27	13	6	NA	NA	NA	15	93
	(11µs, 54µs)	0.76	100	100	100	100	100	100	65	49	550	100
	(20µs, 78µs)	0.139	100	100	100	100	91	43	19	14	184	100
	(30µs, 105µs)	0.1627	100	100	100	91	44	20	NA	NA	91	100
	(40µs, 131µs)	0.182	100	100	100	54	26	12	NA	NA	55	100
	(50µs, 158µs)	0.1987	100	100	70	34	16	NA	NA	NA	35	100
	(60µs, 185µs)	0.2165	100	97	47	23	10	NA	NA	NA	24	100
	(70µs, 212µs)	0.2365	97	66	32	16	7	NA	NA	NA	17	97
	(80µs, 238µs)	0.2599	78	57	28	13	6	NA	NA	NA	18	85
Bi-Directional	(86µs, 255µs)	0.2756	78	47	23	11	NA	NA	NA	NA	15	78
	+ve (60µs, 100µs)	1	43	43	43	26	13	5	NA	NA	63	43
	-ve (60µs, 100µs)	1	43	43	43	21	10	4	NA	NA	50	43

Higher output possible with possible decay (displayed during planning step)

Rogue Research Inc.

Brainsight®

NIRS

For 20 years, Brainsight® has been the neuronavigator of choice for image-guided TMS and veterinary neurosurgery. We count about 500 users as our customers around the world.

Over the last few years, we at Rogue Research have been focusing on the integration of neuronavigation and data acquisition within Brainsight. Our latest step forward is the development of Brainsight® NIRS.

Rogue Research Inc.
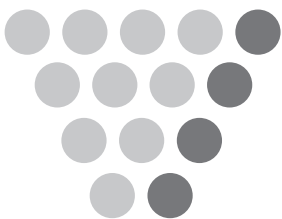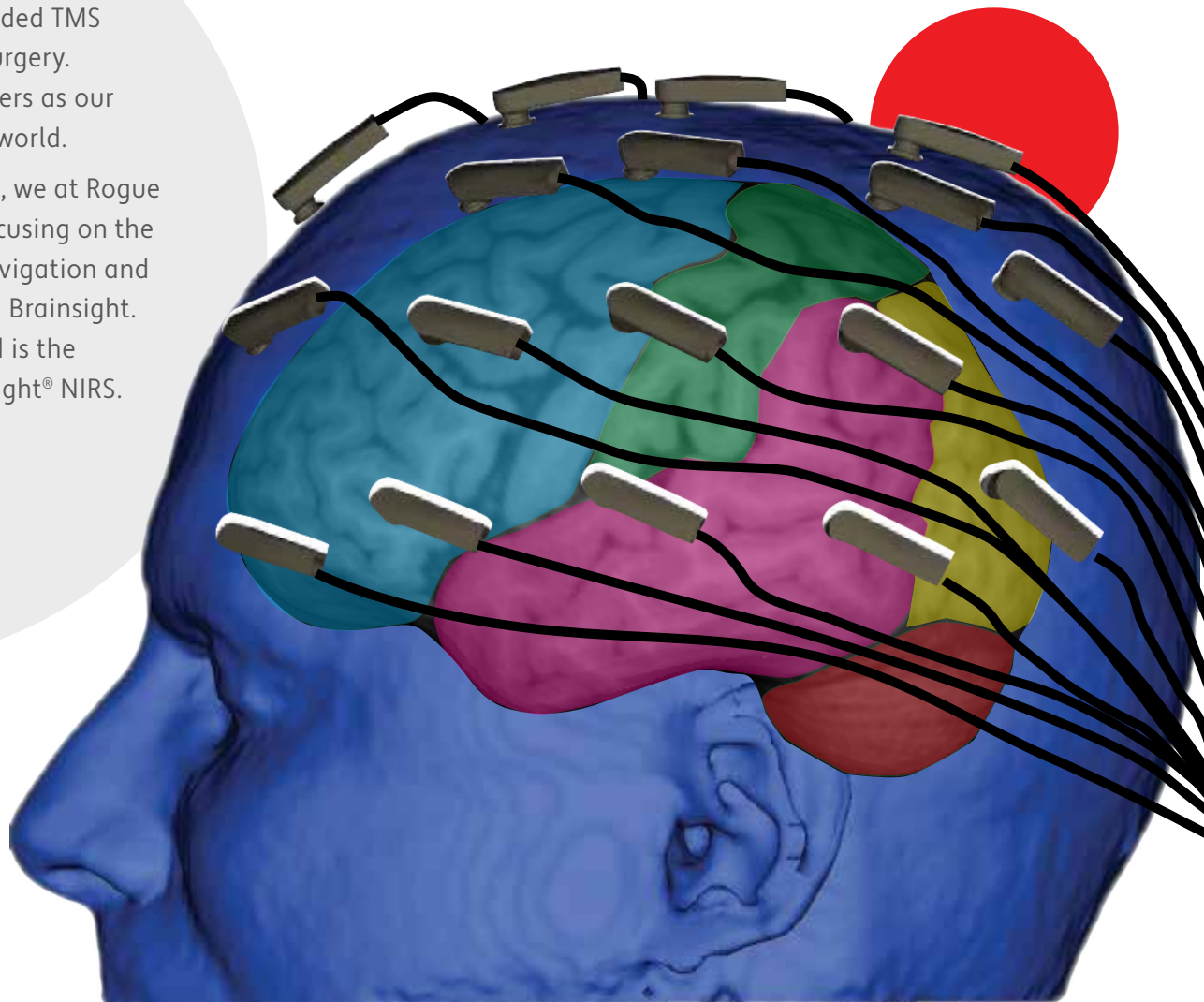
Brainsight®

NIRS THE **NEWEST ADDITION TO**

THE **NEUROSCIENCE HUB**

Brainsight® Neuronavigator

Brainsight NIRS starts off with the Brainsight neuronavigation system. For 15 years, Brainsight has been setting the standard for functionality and ease of use for TMS localization and veterinary neurosurgery.

In addition to the standard features of Brainsight, Brainsight NIRS includes all the device controls and a montage manager to define your common NIRS and EEG configurations for quick recall at the start of a NIRS session. Co-register the optodes to the MR images and you are ready to go.

Easily perform NIRS with TMS and your favorite EEG. Brainsight takes care of recording the NIRS data and optode/electrode locations in one place, synchronized to the stimulus event.
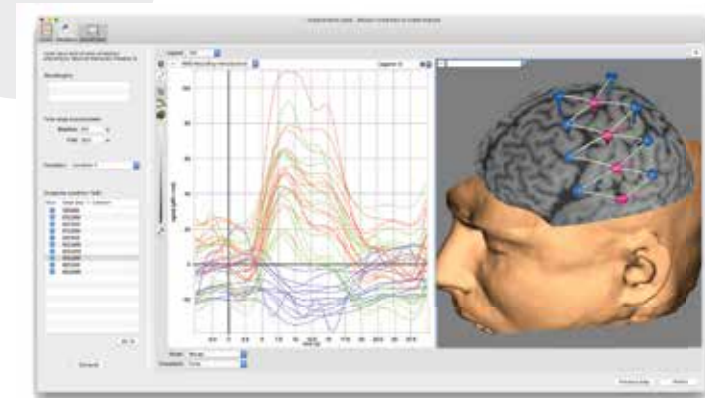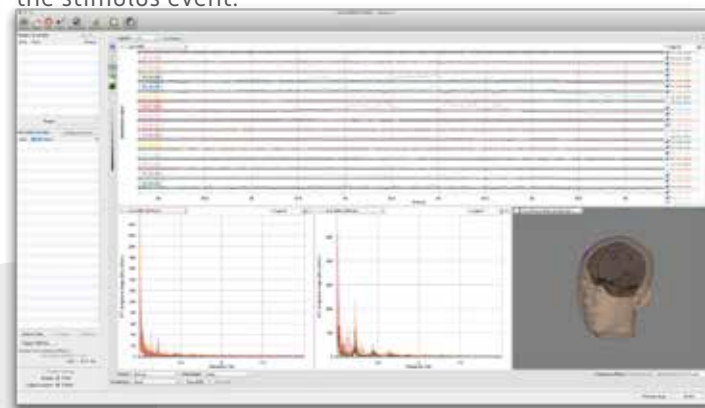
Brainsight® NIRS Hardware

When we set out to design our NIRS system, we did not want to just do what others have done. We set out to make a unique device that is simpler to use and reflects current trends in NIRS imaging. The interface on the device itself is just enough to connect to the Brainsight neuronavigator where all the interaction occurs, removing the need for a redundant screen and keyboard. The result is a device that can be placed exactly where it needs to be to access the subject. You operate the device using the already familiar and easy to use Brainsight workflow-based user interface. The control computer can be next to it or in the next room if needed. All data is acquired and stored within the Brainsight project file where everything is mapped to the subject's anatomical MR images. Since we are using Brainsight, we can also store TMS coil information and simultaneous EEG data for truly integrated multi-modality acquisition. The system supports 8-32 channels that can be upgraded in 8-channel increments. In addition to 4 sources and 8 "cortical" signal detectors (per 8-channel module), our system includes 4-16 additional dedicated source proximity detectors allowing you to sample scalp-dominated signals without sacrificing the cortical detectors. We can sample up to 100 Hz for the NIRS channels and up to 8 kHz for our 8 auxiliary channels which are ideal for experiment state information and/or physiology information (e.g. cardiac or respiratory)

Brainsight® 8-32 Channel Unit

Brainsight® NIRS-8

Designed for Multi-Modal Use

One of the most challenging aspects of NIRS is the cap. Since Brainsight is designed with multi-modality in mind, the design of the cap and optodes are even more important. We have focused our efforts on a flexible optode design that can be simply used with other modalities including EEG, MRI, TMS and MEG.

The optode itself has a low profile (7mm) and the fibre is parallel to the head (90˚ to the optode surface). This allows a TMS coil to be placed relatively close to the head for simultaneous TMS and NIRS. The angled fibres also make it possible to apply the optodes to a subject lying down (e.g. MEG, fMRI).

The last piece of the puzzle is the cap. Our optode design allows us the flexibilty to seek the best cap solution for your particular needs. Our elastomer cap allows easy access to the hair and holds the optodes on the scalp. We can design and build various configurations to meet your needs, or use rapid prototyping to construct adapters to fit the optodes to your own caps. We also support the use of EEG caps with unique montages and adapters that simplify combining NIRS with EEG.

Brainsight NIRS

Specifications

Feature	Brainsight NIRS (8-32 ch. Model)	Brainsight NIRS-8
Number of detectors	8-32	8
Number of detectors dedicated to proximity measurements	4-16	4
Detector type	Si APD (cortical detectors) Si photodiode (proximity detectors)	Si APD (cortical detectors) Si photodiode (proximity detectors)
Emitter type	Laser diode (Class 3B)	Laser diode (Class 3B)
Number of source optodes	4-16 (could do 24)	4 (could do 6)
Typical number of channels (source-detector pairs)	72	18
Number of wavelengths per optode	2-3	2-3
Supported wavelengths	685nm, 705nm 830nm * Other configurations available on demand	685nm, 705nm 830nm * Other configurations available on demand
Sensitivity	< 0.5pW (cortical detectors) < 1pW (proximity detectors)	< 0.5pW (cortical detectors) < 1pW (proximity detectors)
Dynamic range	> 100dB @20Hz (cortical detectors) > 90dB @20Hz (proximity detectors) * Extra 37dB with gain adjustment.	> 100dB @20Hz (cortical detectors) > 90dB @20Hz (proximity detectors) * Extra 37dB with gain adjustment.
Modulation	FDMA	FDMA
Real time data display	Yes	Yes
Maximum power	10mW / wavelength (mean)	10mW / wavelength (mean)
Sampling rate	1-100Hz (up to 64 pairs, 128 pairs @50Hz)	1-100Hz (up to 64 pairs, 128 pairs @50Hz)
Host connection	Ethernet (possibility of multiple clients)	Ethernet (possibility of multiple clients)
Interlock	Yes	Yes
Exported file format	.nirs (HomER)	.nirs (HomER)
Number of auxiliary channels	8 (TTL or analog inputs).	8 (TTL or analog inputs).
Trigger out.	1	1
Auxiliary sampling rate	1-8000Hz	1-8000Hz
Optode height	~7mm	~7mm
Optical fibre length	3m standard * Custom length on demand.	3m standard * Custom length on demand.

Rogue Research Inc.

Brainsight®

Vet

For 20 years, Brainsight® has been the neuronavigator of choice for veterinary neurosurgery. We count over 450 users as our customers around the world for our combined neuronavigation products.

We are building on our neuronavigation foundation to provide a host of products and services for the neuroscience research field, including the design and manufacture of custom implants, implantable MRI coils as well as our new fMRI/ePhys combination chair
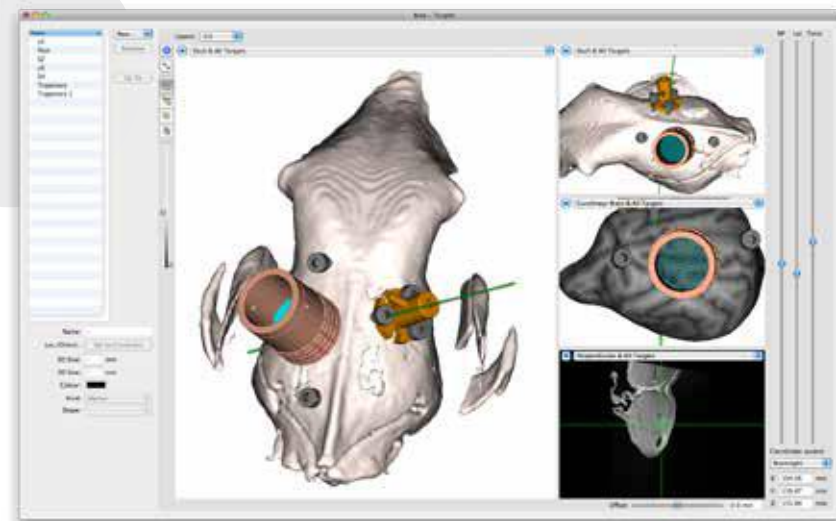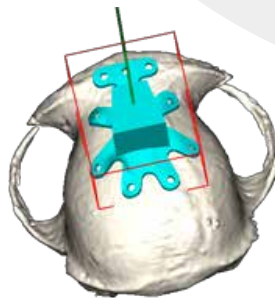
Rogue Research Inc.

Brainsight® Vet

Brainsight® brings the power and flexibility of neuronavigation, to non-human veterinary surgery.

Intuitive User Interface

- Steps are displayed sequentially
- Screen layout optimizes automatically to current task
- Support for Atlas coordinates

3D Reconstruction and Visualization

- Segment and reconstruct the skull and other anatomy
- Export reconstructions into common CAD formats (e.g. for 3D printer)
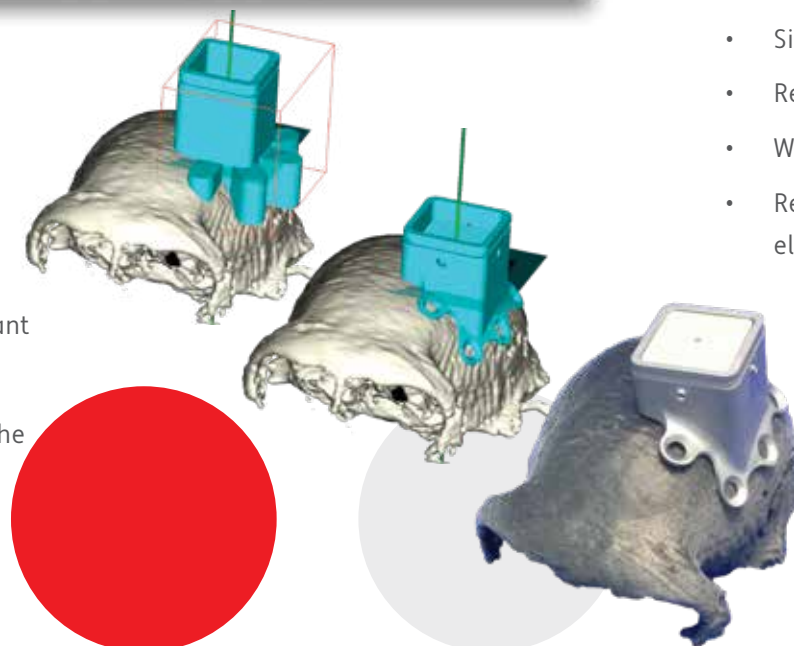- Import CAD files of implants and place them virtually on the skull

Custom Implant Design

- Load CAD file of "blank" implant and place it virtually on the skull
- Brainsight subtracts the skull shape from the implant and creates a customized CAD file
- Our state of the art machining facilities can build the implant rapidly

Custom tools and implants

- Unique, flexible surgical chair
- Fiducial marker system for accurate subject-image registration
- Custom surgical tools for many procedures

Extensive electrophysiology support

- Use our planning tools to simulate every detail of your chamber placement
- Simulate a wide variety of chambers and grid styles
- Record actual chamber location in surgery
- Work with multiple chambers simultaneously
- Reduce search time during recordings by simulating electrode placement
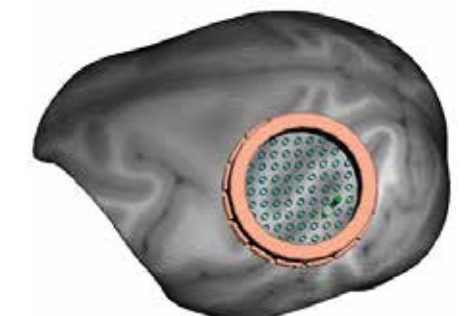
Brainsight®
Vet

fMRI/ePhys Chair

- Our new combined fMRI/ePhys chair combines the features of two chairs into one well designed unit

- Supports day to day training in the upright position

- Switches to the horizontal mode for fMRI scanning using most mainstream MRI scanners

- Supports different fixation methods and animal sizes
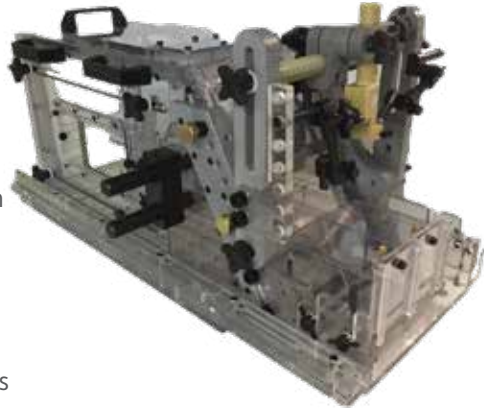
Brainsight® Includes

- Brainsight® software
- Apple iMac computer and mobile trolley
- NDI Vicra Position Sensor
- Surgical tools to simplify common procedures- cannula insertion for injections and electrode placement

- Surgical head clamp with fixation arm
- Tracker accessories to track the subject's head and tool guide
- Custom surgical tools for needle injections or recording chamber placement

Rogue Research Inc.

6666 St-Urbain., Suite 300, Montreal (QC) Canada H2S 3H1
Telephone + 1 (514) 284-3888
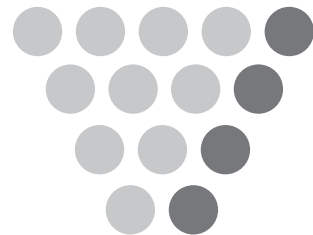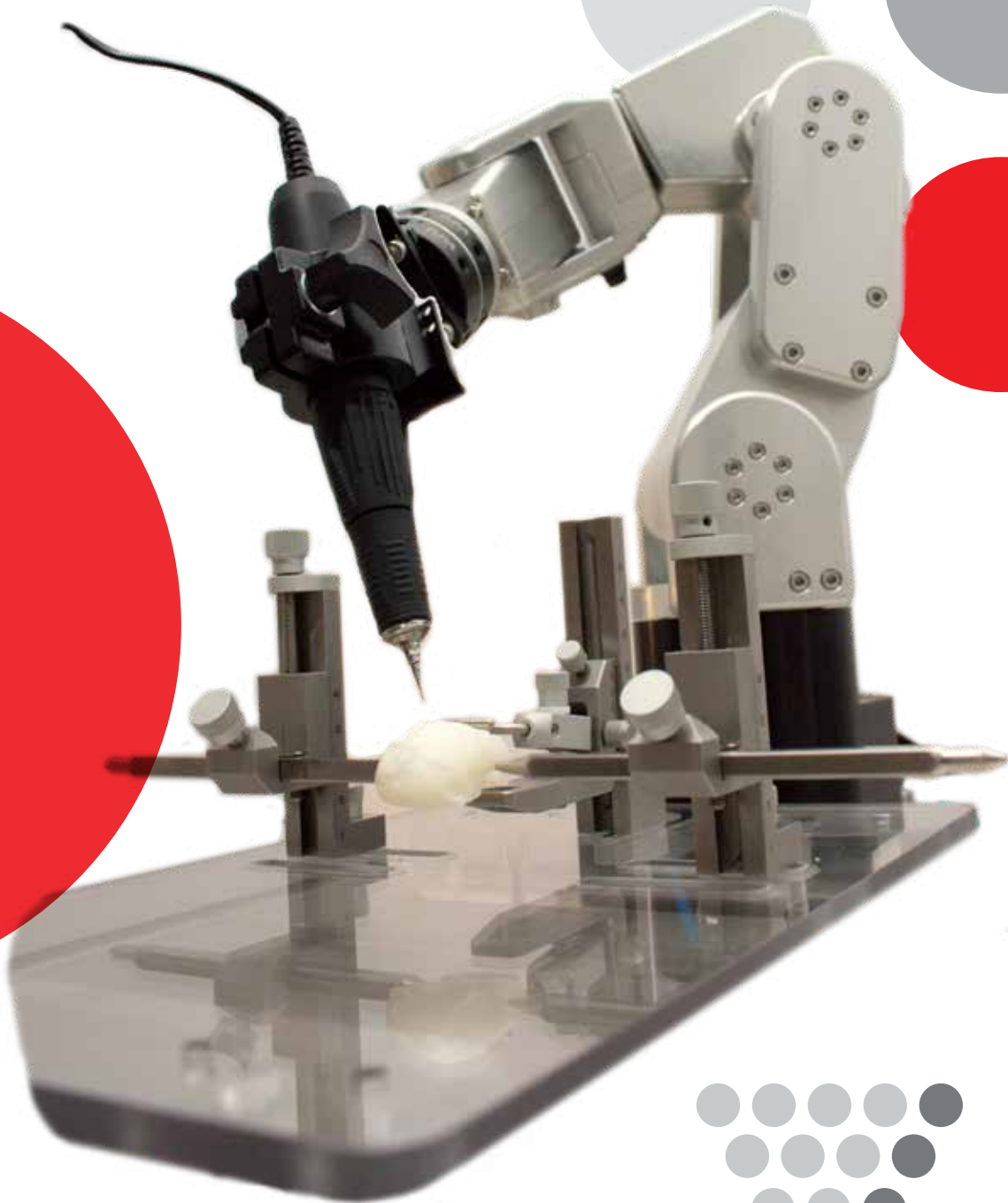 **Toll free (North America)** 866-984-3888 . **Fax** + 1 (514) 284-6750

www.rogue-research.com
info@rogue-research.com

Brainsight®

Vet

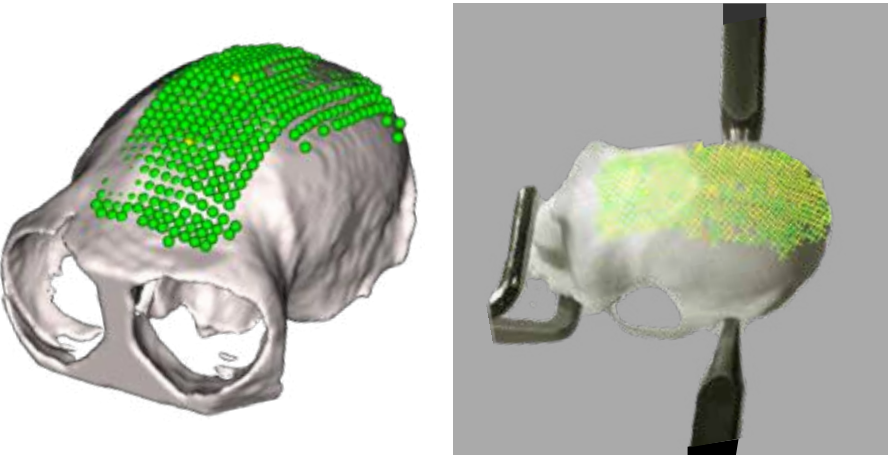Surgical Robot for
Veterinary Applications

Rogue Research Inc.

15 years ago we pioneered the introduction of frameless stereotaxy for modern veterinary surgery with the introduction of Brainsight®
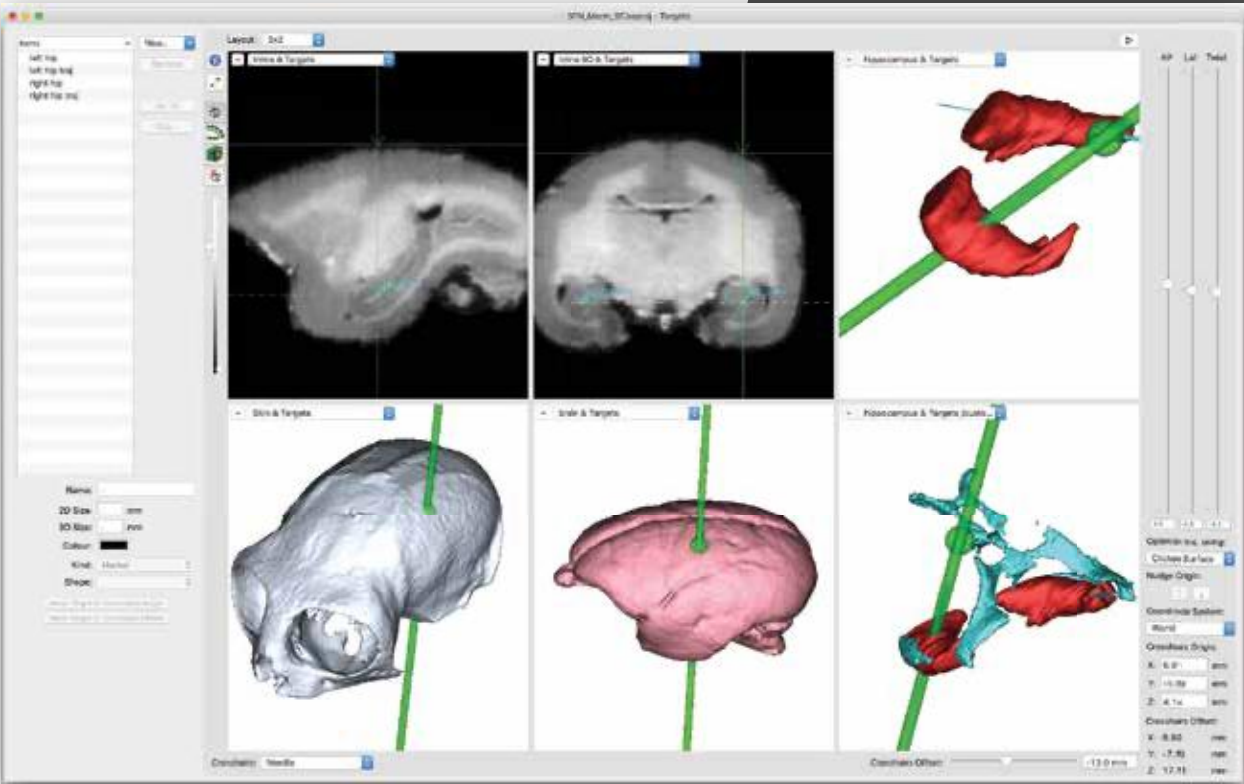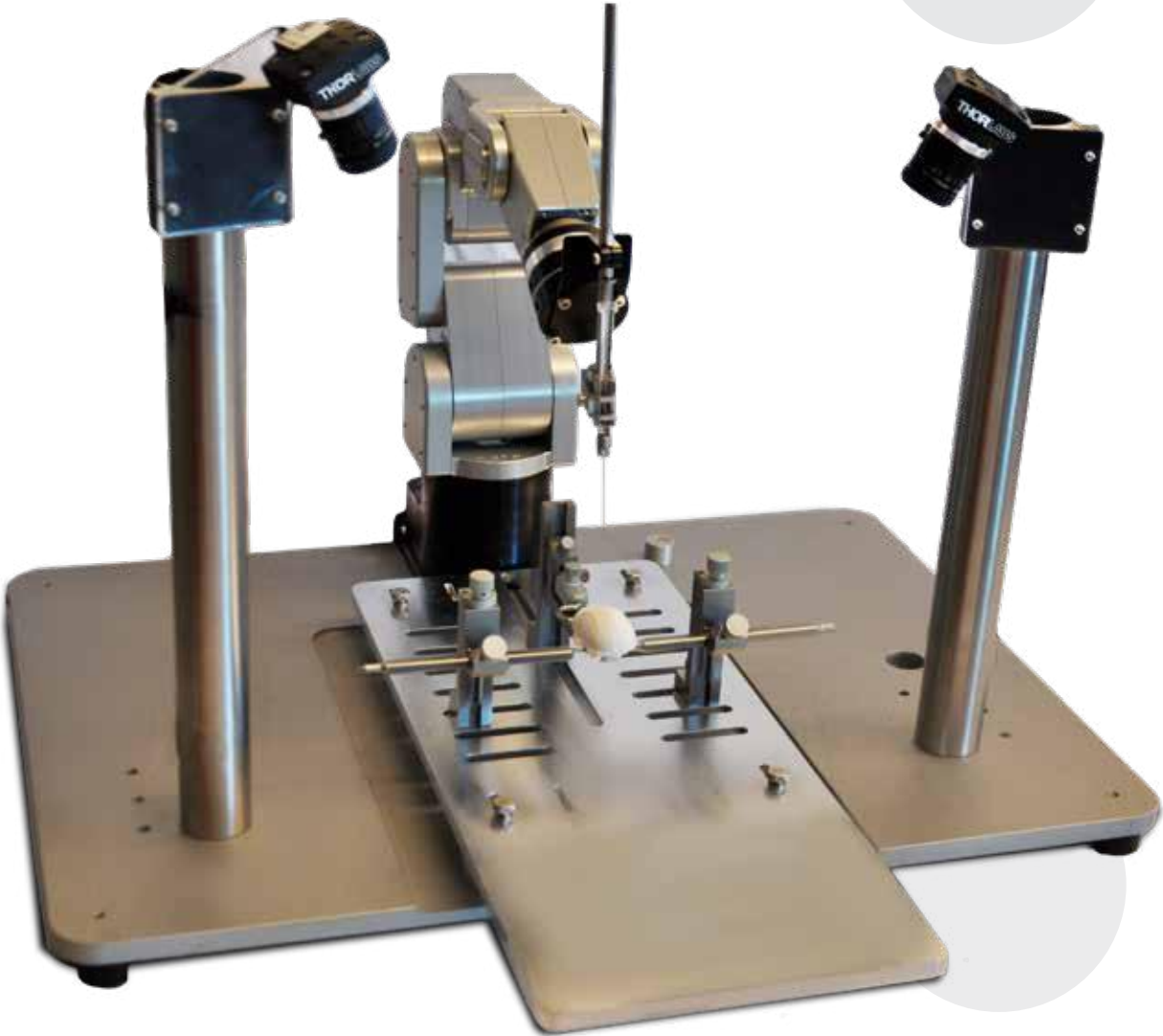

Brainsight®

Vet

Brainsight® can be used for almost any animal requiring a neurosurgical procedure as long as magnetic resonance or CT images are available. Brainsight's powerful yet easy to use interface generates 3D views of your animal's images. The images can be used to pick your target and the best path to the target prior to surgery and guides your tool to the target along that path in surgery.

Pioneers IN
IMAGE-GUIDED TECHNOLOGIES

Our hardware development staff has designed and constructed custom neurosurgical tools for human neurosurgery for 16 years and the basic technology behind Brainsight® follows the same principles as those for human "frameless" stereotaxy systems.

Our system can adapt to a variety of stereotaxic holders. For larger animals, we can adapt the robot to be placed near the surgical head fixation device for high-accuracy surgery.
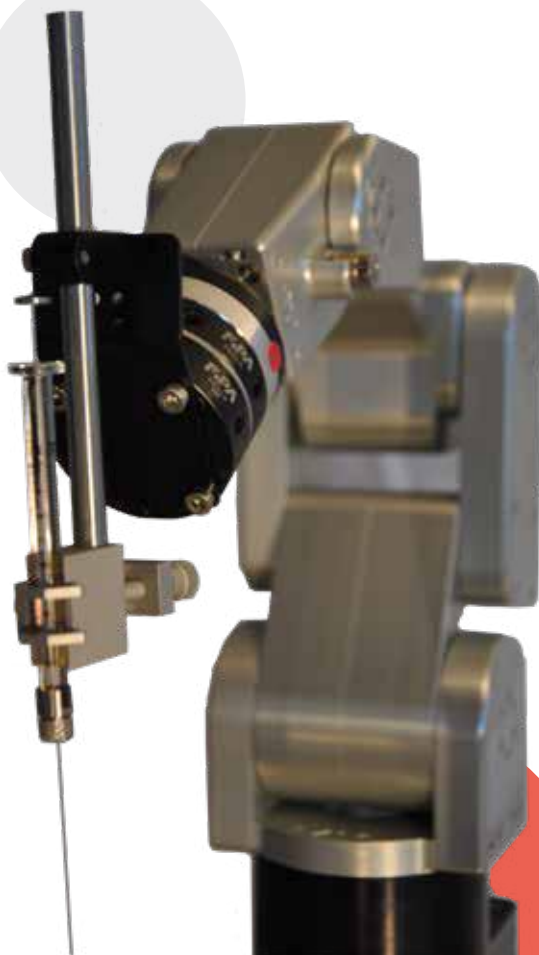
Our stereo-vision system allows us to accurately co-register the animal to the images using a laser and 3D cameras.

Brainsight

Vet

Brainsight® Vet Robot Includes

- Brainsight® software
- Apple iMac computer and interface hardware
- High precision 6-axis robot with universal tool mount
- Stereo camera system for touch-free registration

- Surgical tools to simplify common procedures such as drilling
- Support for subject-specific MRI and Atlases

Rogue Research Inc.