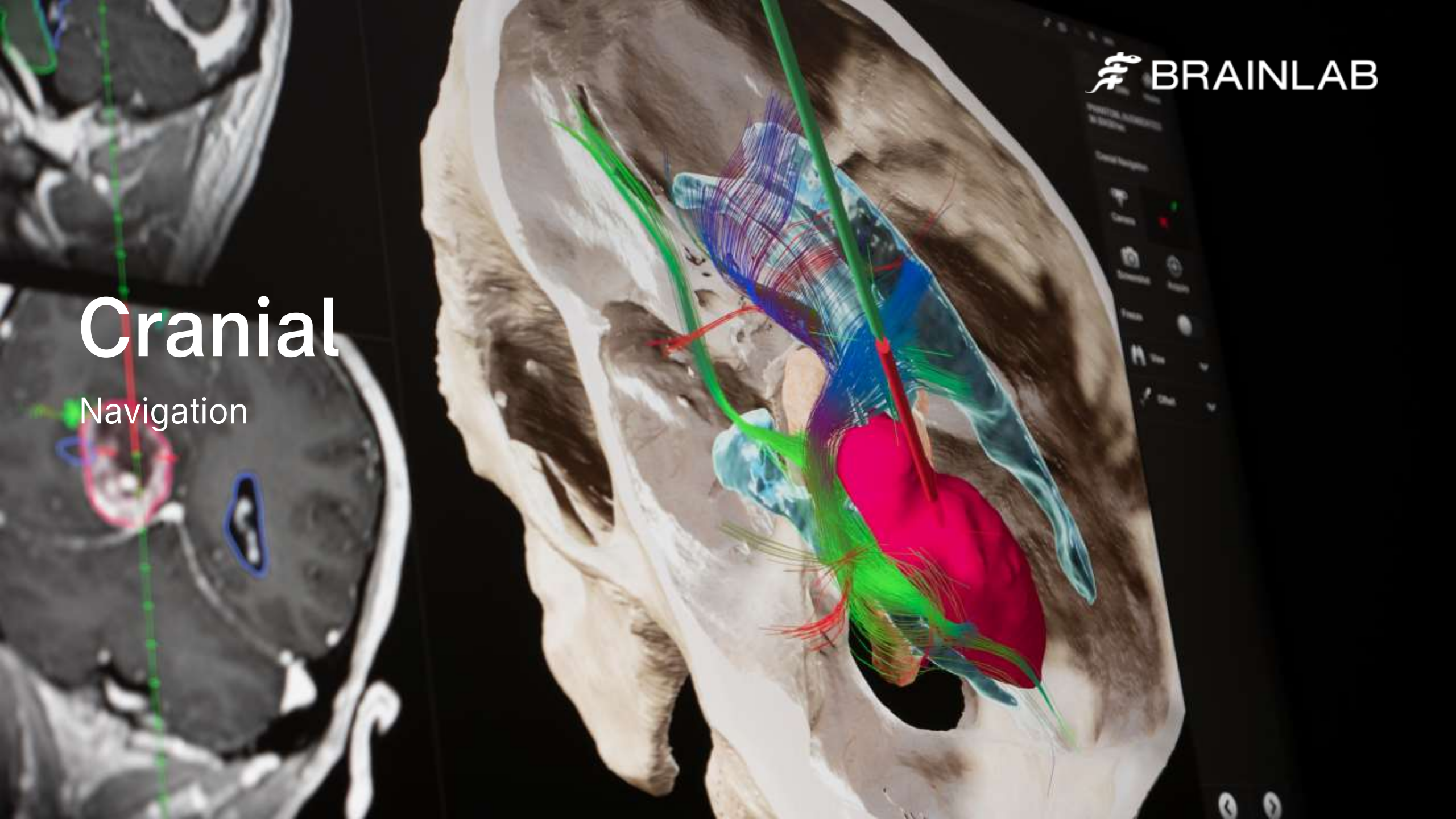


Cranial

Navigation





- 
- A decorative graphic on the left side of the slide, consisting of multiple overlapping, wavy red lines that create a sense of motion and depth, resembling a stylized ribbon or a series of paths.
1. Time-saving Registration
 2. Informed Approach Planning
 3. Easy-to-use Navigation
 4. Vascular Navigation
 5. Navigated Disposable Stylet
 6. Robotic Biopsy Alignment
 7. Precision Manual Alignment
 8. Navigated Disposable Suction
 9. Microscope Integration
 10. Ultrasound Integration
 11. Automatic Image Registration
 12. Electromagnetic Navigation

Time-Saving Registration

Touchless and touch-based options



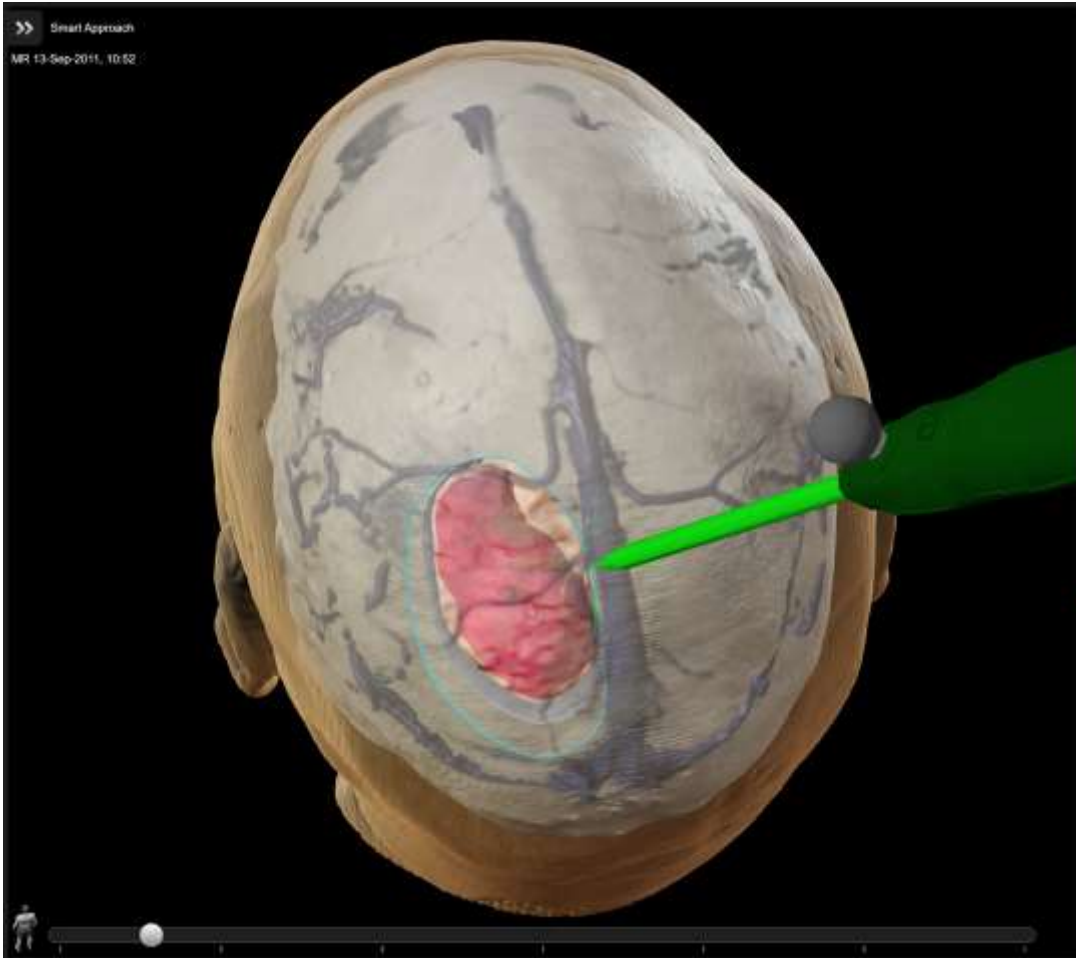
- Pointer registration with or without markers
- Touchless surface matching with Z-touch®
- Touch-sensitive surface matching with Softouch®
- Patient-specific registration guidance
- Planning of intraoperative rescue points for re-registration



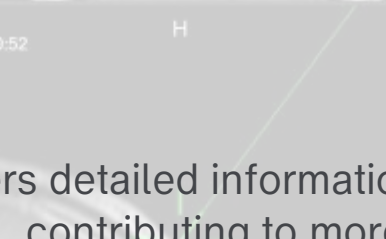
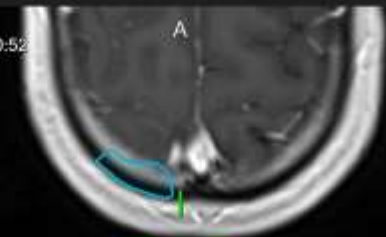
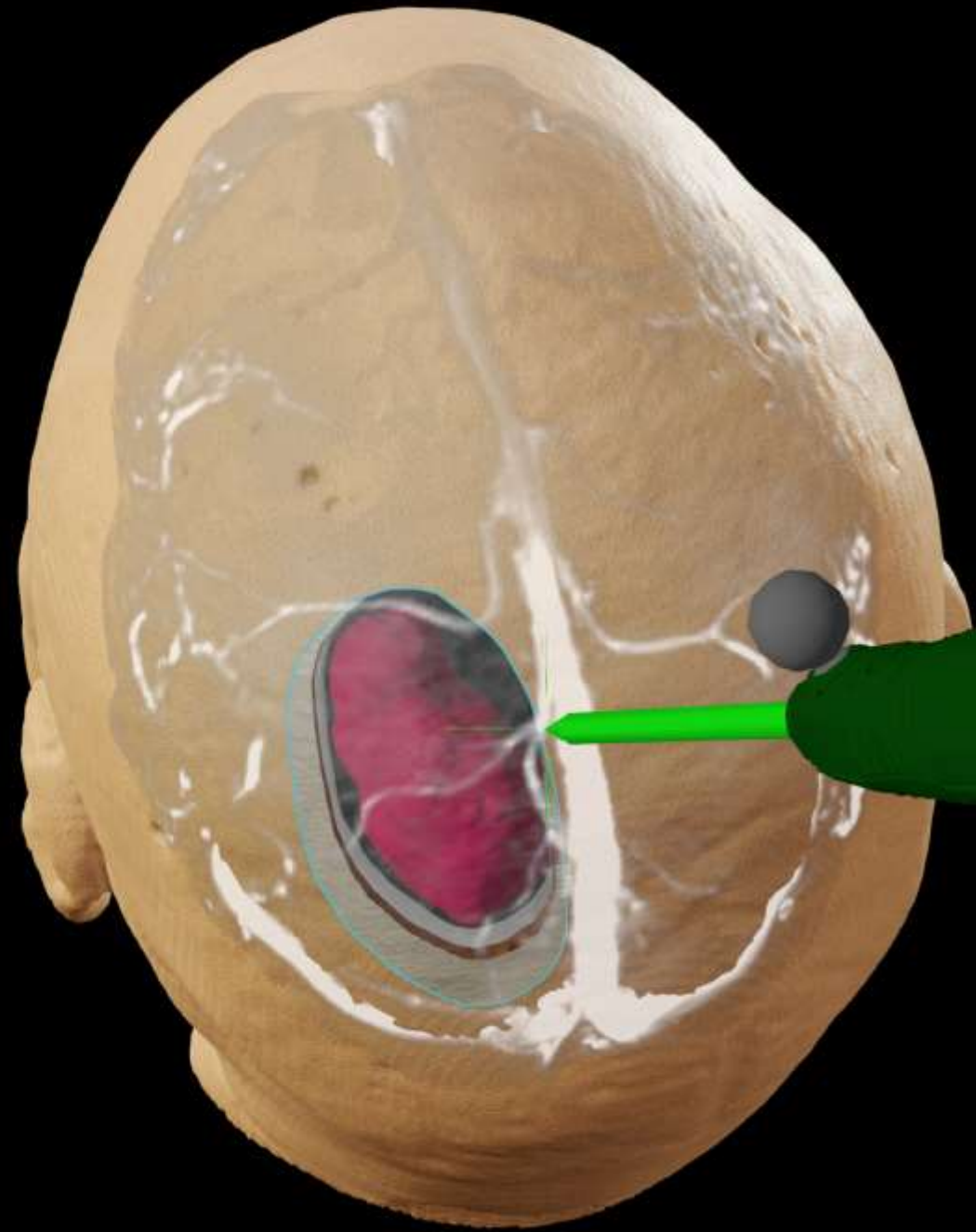
Touch-sensitive surface matching with Softouch

Informed Approach Planning

Consolidated clinical data for decision-making



- Vivid 3D preview of lesions and critical structures before opening the skull
- Virtual scalpel simulates craniotomy and creates a “bone flap” object that can be saved for documentation
- Switch between 3D and dedicated Maximum Intensity Projection (MIP)-based view for enhanced visualization of cortical vessels
- Approach planning in 3D and correlated inline or axial, coronal, sagittal navigation views provides spatial orientation



PHANTOM, AUGMENTED
M-304301ec

Cranial Navigation

Camera

Screenshot Acquire

Freeze

View

Offset

Craniotomy

Back Resection

BRAINLAB

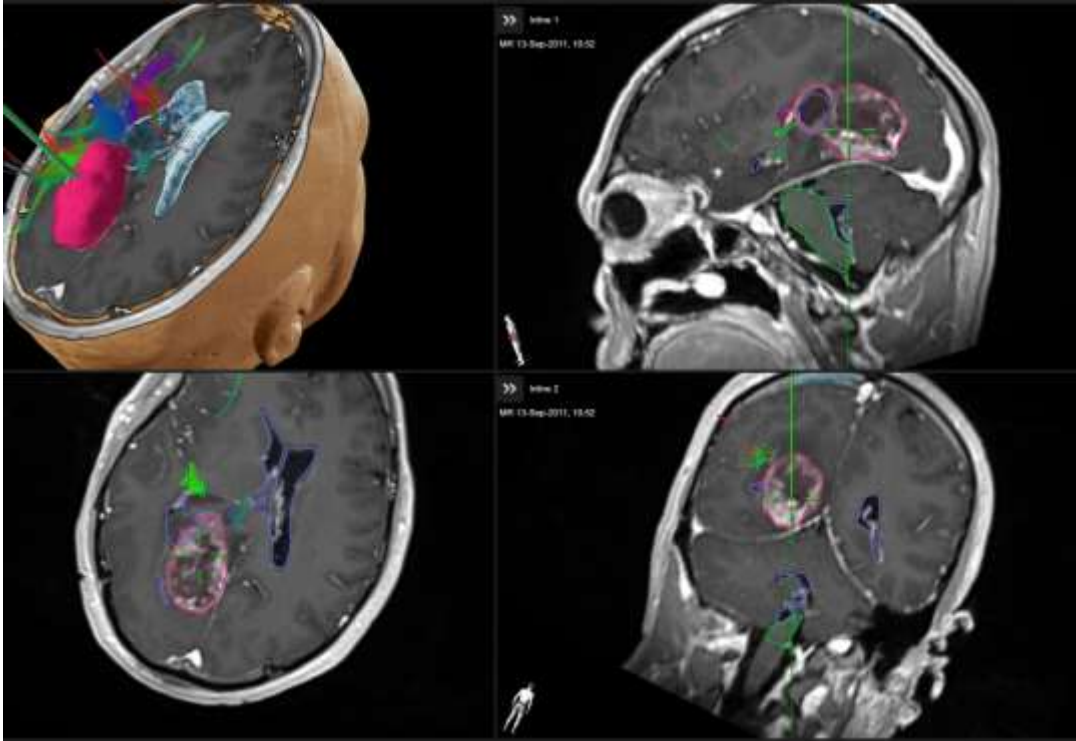
MIP view delivers detailed information about cortical vessels, contributing to more informed patient access planning



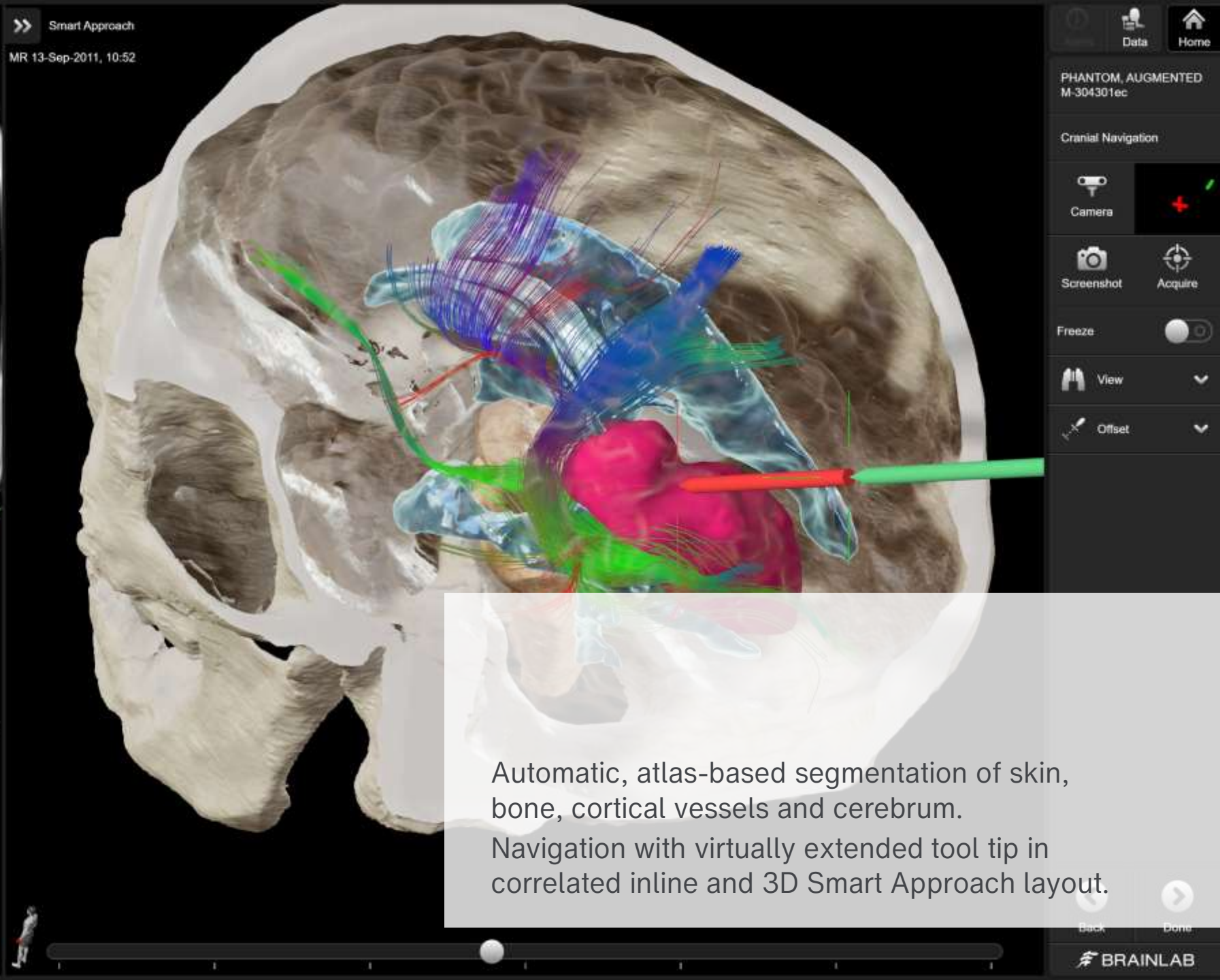
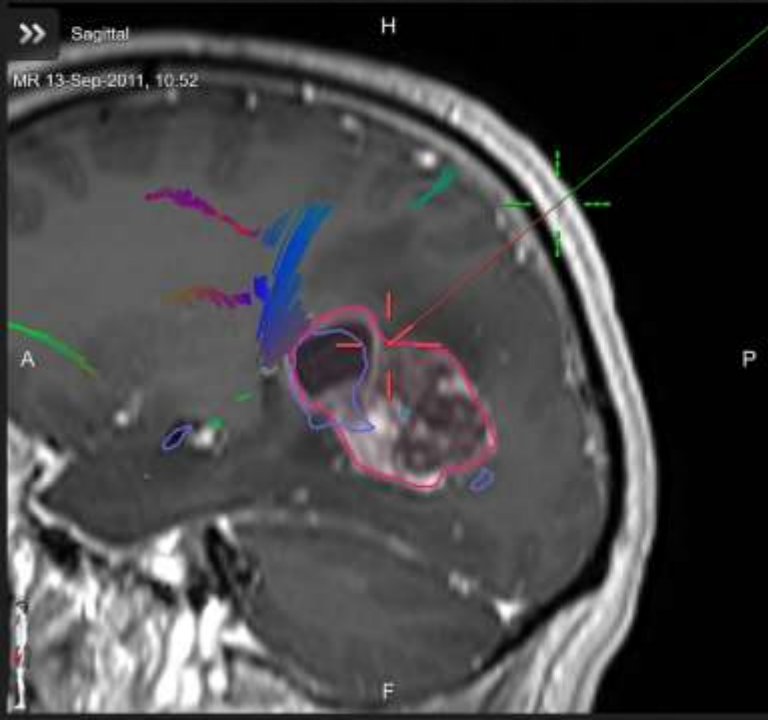
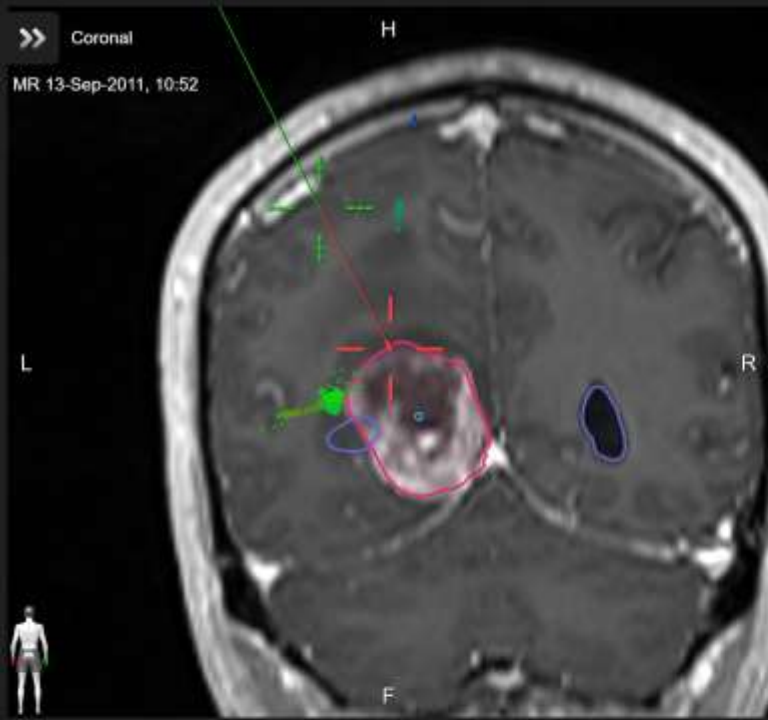
Easy-to-use Navigation

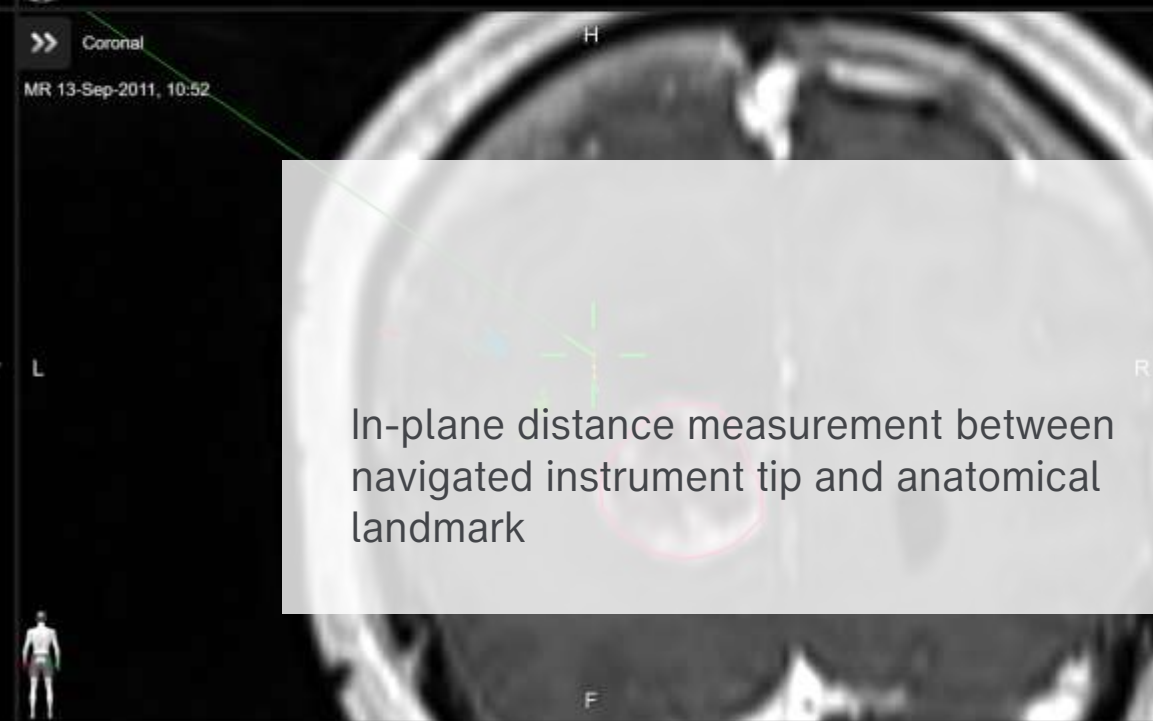
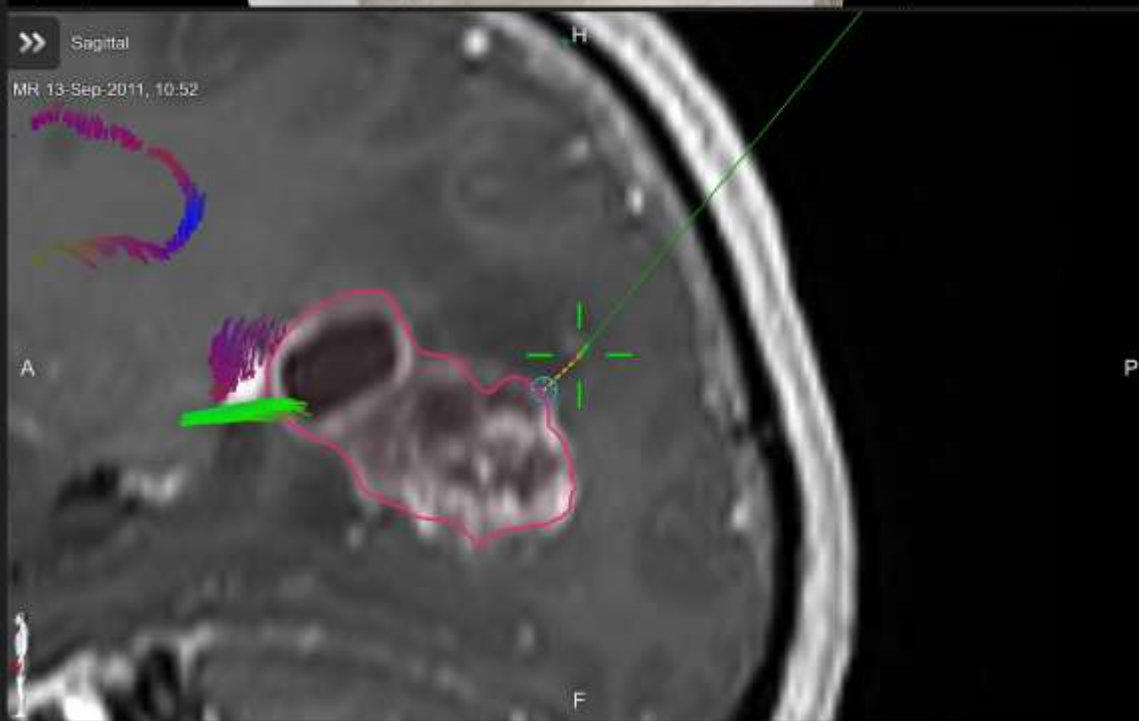
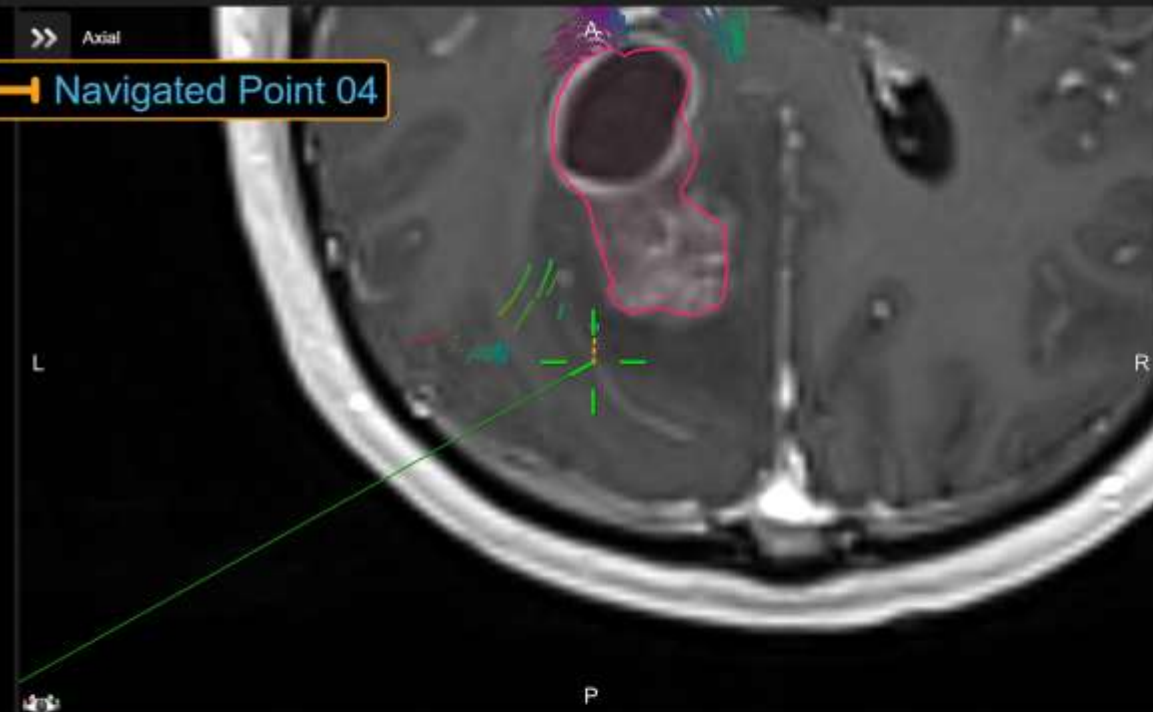


Automated functions for reduced screen interaction



- Simultaneous navigation in different datasets
- 3D view dynamically adapts and zooms according to resection progress
- CT and ultrasound overlay mode consolidates relevant anatomical details
- Dynamic 3D view provides 3D context around the tool tip to help with orientation
- Automatically displays optimal patient data in the most suitable layout
- Drag-and-drop layout customization





In-plane distance measurement between navigated instrument tip and anatomical landmark

PHANTOM, AUGMENTED M-304301ec

Cranial Navigation

Camera

Screenshot

Acquire

Freeze

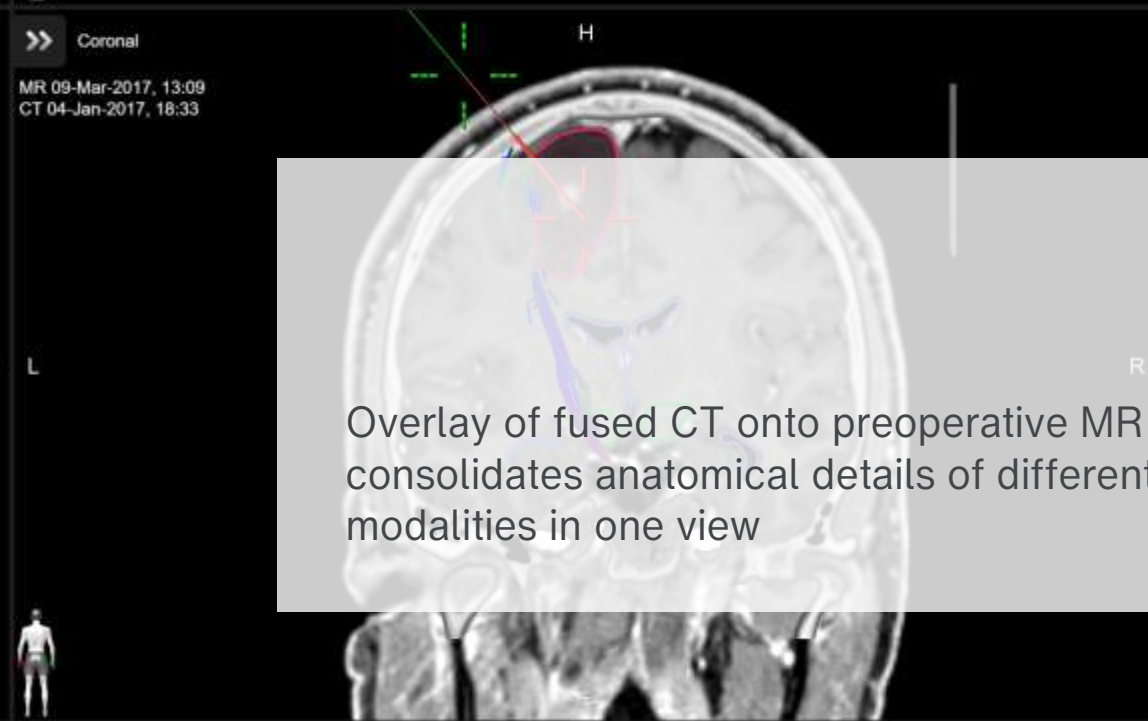
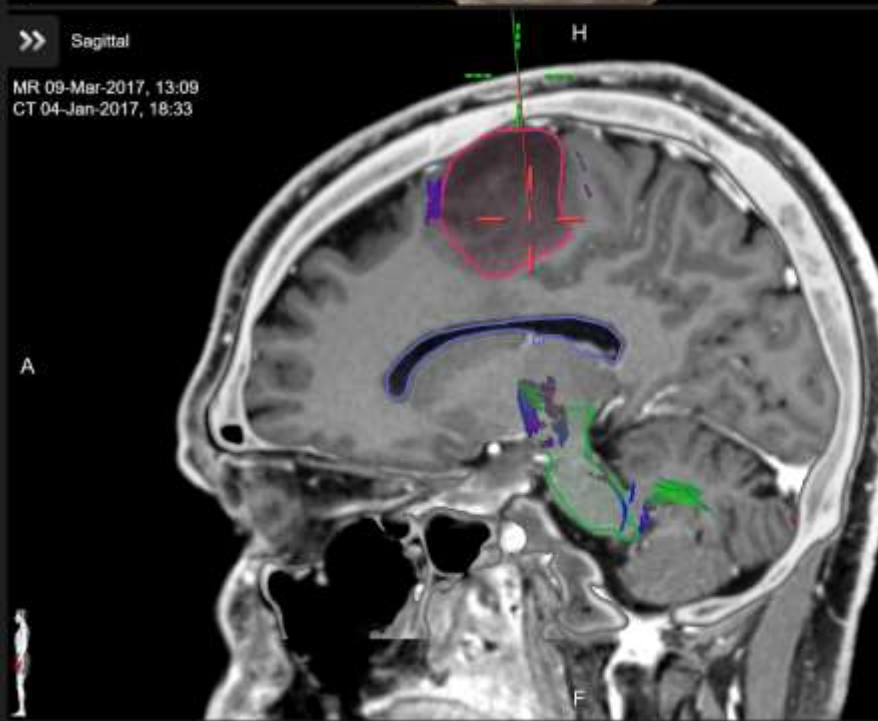
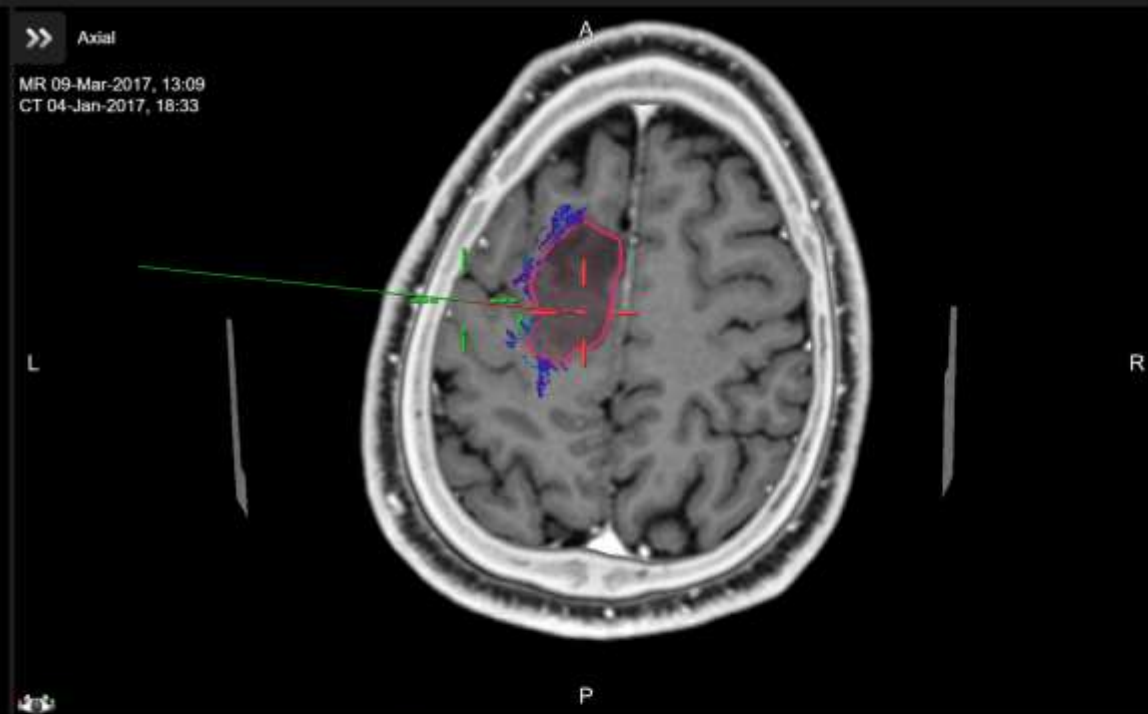
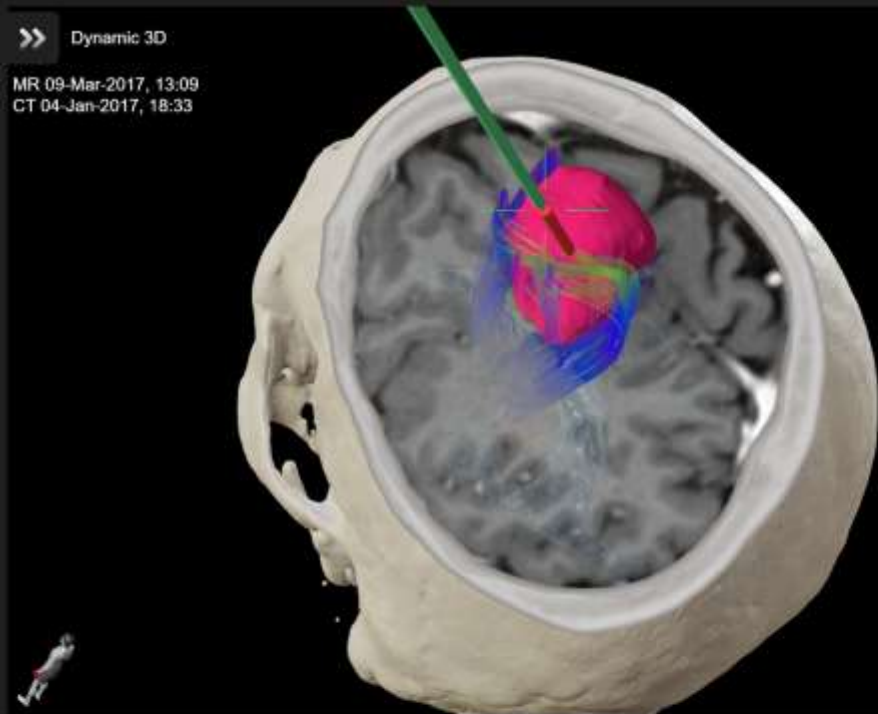
View

Offset

Back

Done

BRAINLAB



Overlay of fused CT onto preoperative MR consolidates anatomical details of different modalities in one view

Alerts Data Home

DEMO, Cranial Fibertracki...
Brain Tumor, MR, DTI, CT...

Cranial Navigation

Camera

Screenshot Acquire

Freeze

View

Offset

Back Done

BRAINLAB



SELECTED DATA

Images

Overlay Mode

	Ultrasound	Scan 3
58	0.5 mm	08.05.2020, 15:40:23
	Ultrasound	Scan 1
52	0.5 mm	08.05.2020, 15:09:11
	MRI	t1_mpr_ns_tra_prae_KM_FIL_S13_D...
192	1.0 mm	13.09.2011, 10:52:27
	OT ADC	ADC (ep2d_diff_MDDW_20_p2)
20	6.5 mm	16.10.2007, 15:19:04
	OT FA	Colored FA (ep2d_diff_MDDW_20_p2)
20	6.5 mm	16.10.2007, 15:19:04
	MRI	ep2d_diff_MDDW_20_p2
20	6.5 mm	16.10.2007, 15:19:04
	OT FA	FA (ep2d_diff_MDDW_20_p2)
20	6.5 mm	16.10.2007, 15:19:04

Objects

Auto-segmented Objects

Fiber Bundles

LAYOUTS

AUGMENTED, Phantom
2016-04-19

Navigation

Camera

Screenshot Acquire

Freeze

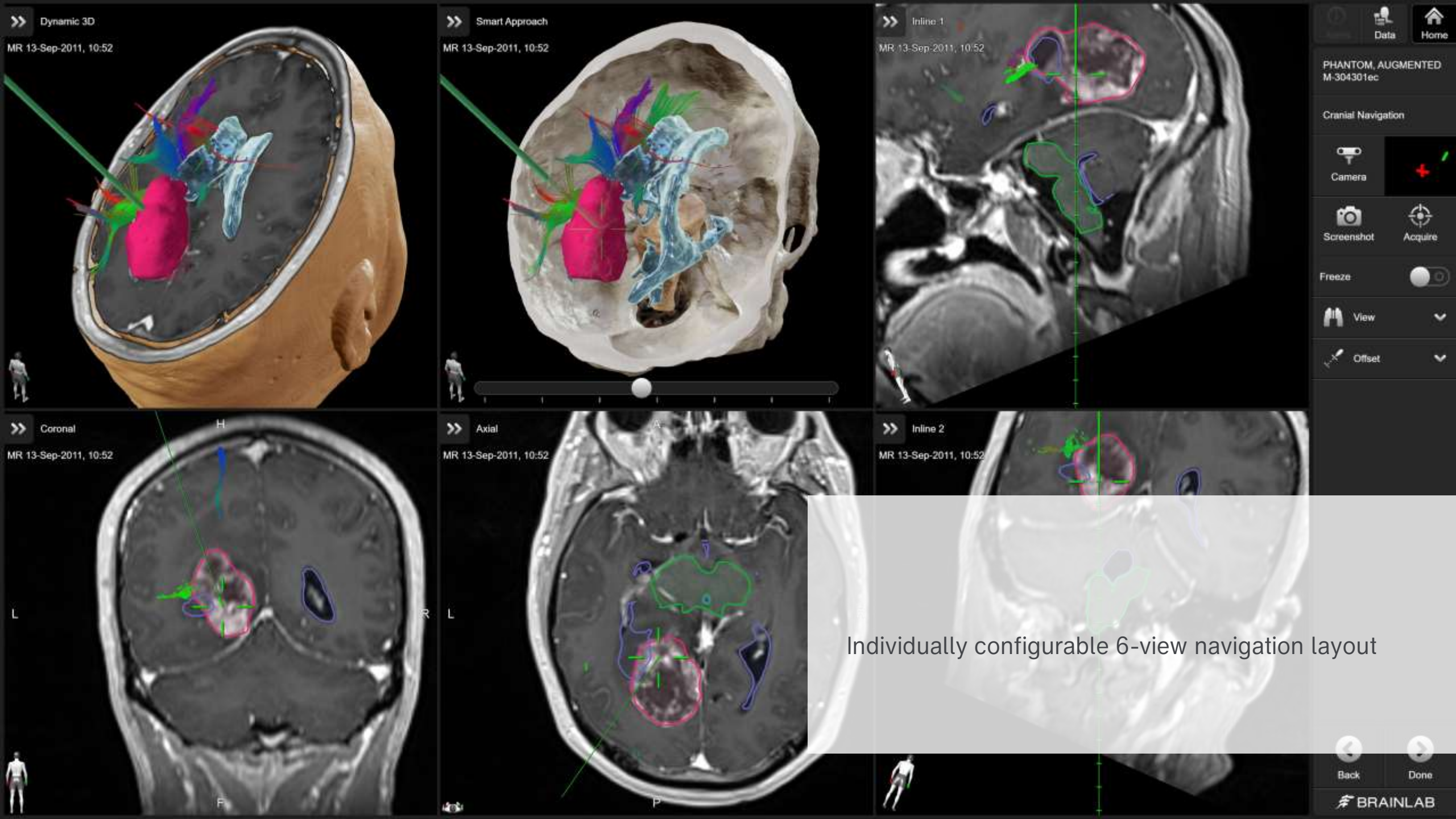
View

Offset

Back Done

BRAINLAB

Intuitive customization and population of view layouts via drag-and-drop



>> Dynamic 3D
MR 13-Sep-2011, 10:52

>> Smart Approach
MR 13-Sep-2011, 10:52

>> Inline 1
MR 13-Sep-2011, 10:52

>> Coronal
MR 13-Sep-2011, 10:52

>> Axial
MR 13-Sep-2011, 10:52

>> Inline 2
MR 13-Sep-2011, 10:52

Individually configurable 6-view navigation layout

Data Home

PHANTOM, AUGMENTED
M-304301ec

Cranial Navigation

Camera +

Screenshot Acquire

Freeze

View

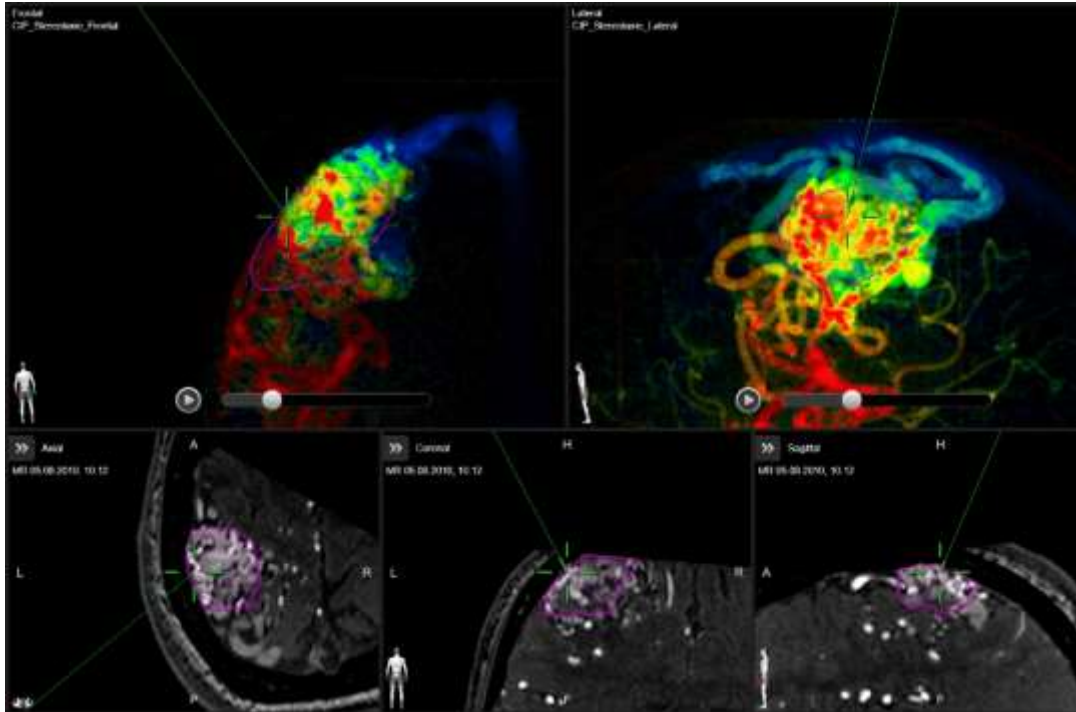
Offset

Back Done

BRAINLAB

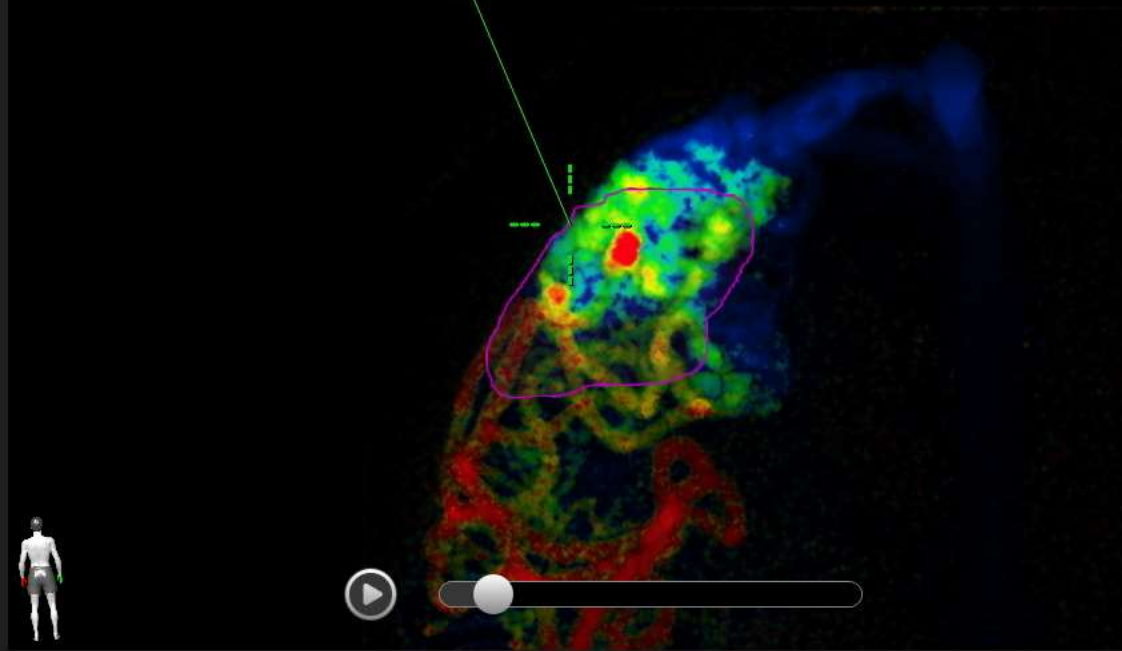
Vascular Navigation

Feeding and draining vessel identification

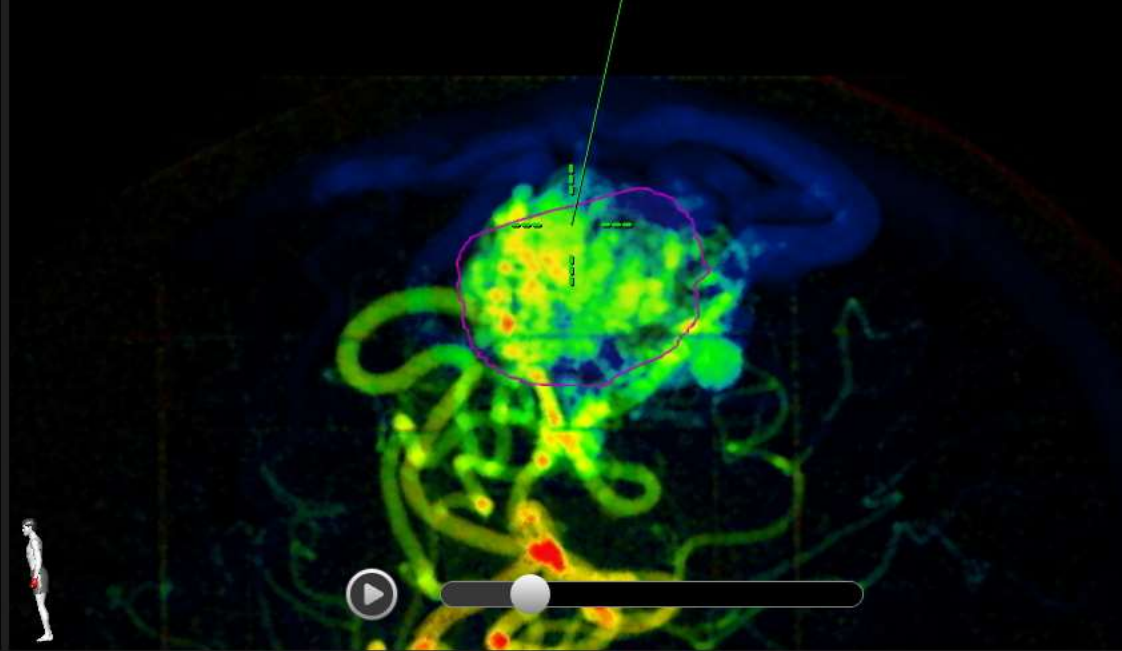


- Combines co-registered 2D angiography pairs and navigated 3D MR reconstructions
- Displays nidus object on navigation data
- Supports approach planning
- Visualizes 2D DSA data as Color Intensity Projection (CIP)
- Interactively displays dynamic color-coded contrast flow projections
- Assists with surgical target identification and analysis

Frontal
CIP_Stereotaxie_Frontal



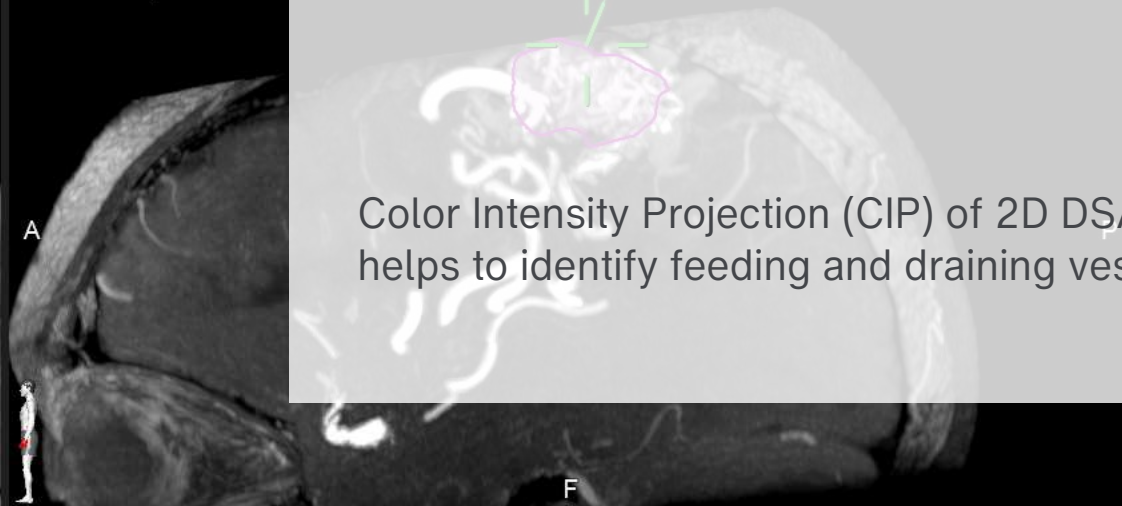
Lateral
CIP_Stereotaxie_Lateral



Coronal MIP
MR 05.08.2010, 10:12



Sagittal MIP
MR 05.08.2010, 10:12



Color Intensity Projection (CIP) of 2D DSA data helps to identify feeding and draining vessels

Navigated Disposable Stylet

Image-guided freehand procedures



- Supports cerebral shunt placement
- Navigation-ready pre-calibrated tool
- Shunt/catheter vendor independent
- 1.1mm diameter, 160mm length
- 10 sterile disposable stylets per package

Robotic Biopsy Alignment



Seamless workflow with navigation-ready instruments



- Automatic alignment of Cirq to planned biopsy trajectory after manual arm positioning
- Cirq Alignment Software provides visual guidance towards region of interest
- Dedicated 3.4mm drill guide helps keep incisions small
- Special biopsy anchor for the skull adds stability to the setup
- Pre-calibrated biopsy needle with guide tube facilitates seamless performance

Biopsy 01 ↓ 55.5

DOE, Jane
BLAB5787464910870671600

Cirq Robotic Alignment

Camera

Screenshot Instruments

Biopsy 01

Deviation Monitoring

Threshold: 1.0 mm

Zoom: 130%

Intuitive arm positioning guidance towards planned biopsy trajectory

Ready, lock brakes ✓

Biopsy 01 ↓ 55.5

DOE, Jane
BLAB5787464910870671600

Cirq Robotic Alignment

Camera

Screenshot Instruments

Biopsy 01

Deviation Monitoring

Threshold: 1.0 mm

Zoom: 120%

Navigation arrows

Back Done

BRAINLAB

25.0 mm

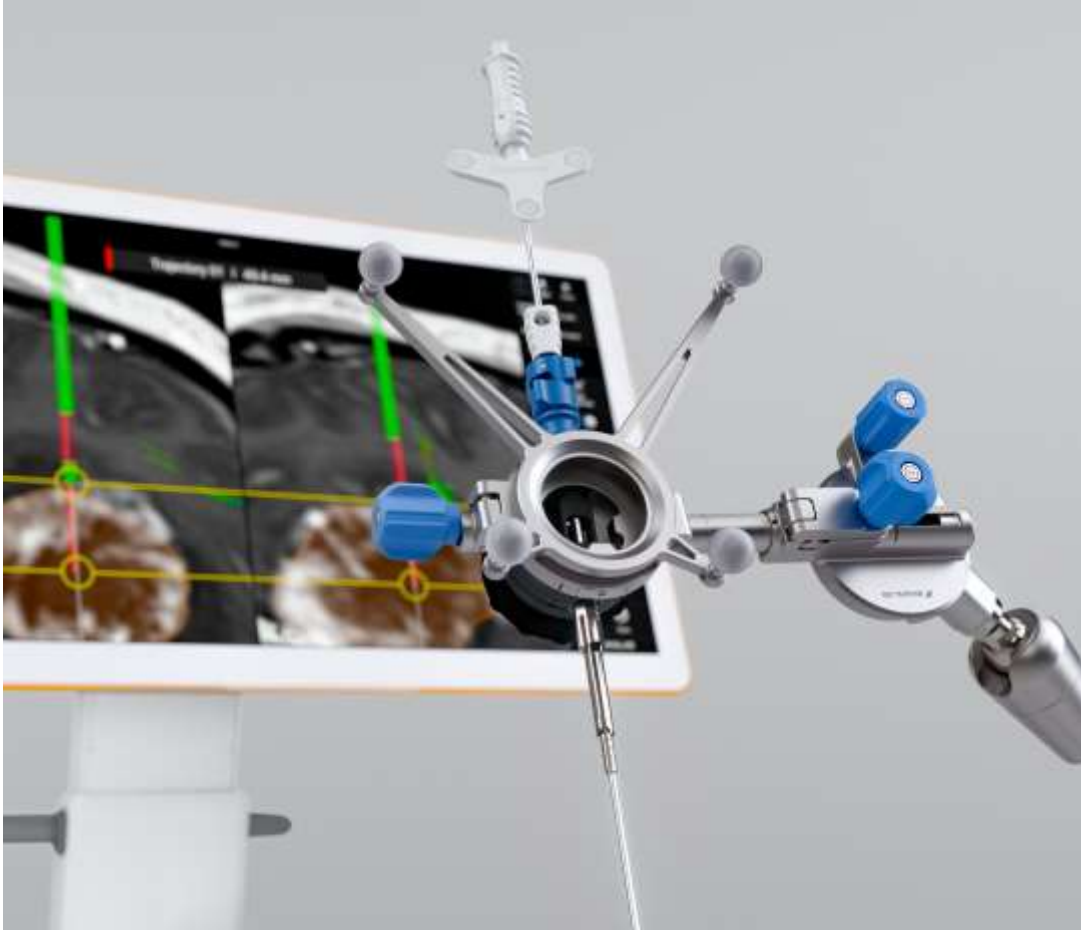
25.0 mm

After automatic alignment, tracking of biopsy needle insertion along the trajectory includes distance measurement

Precise Manual Alignment



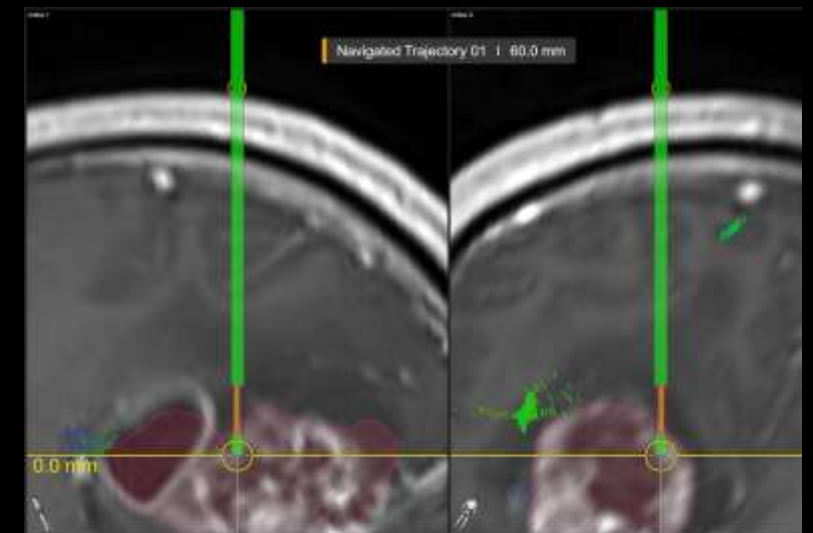
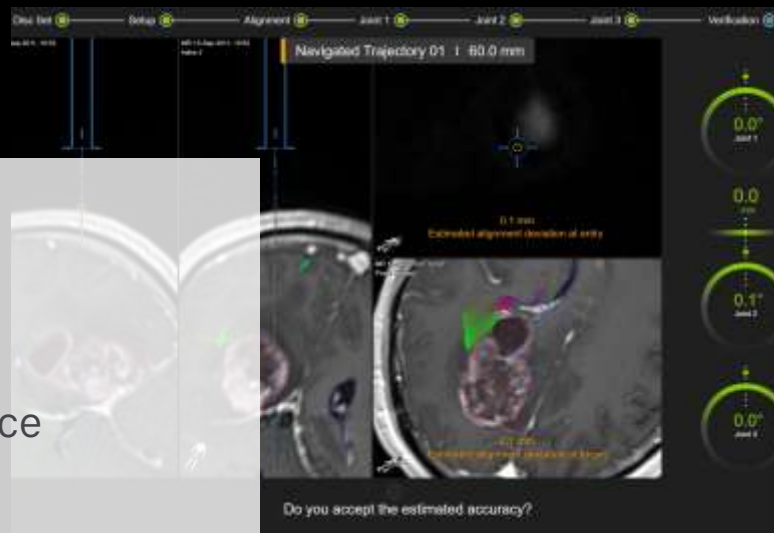
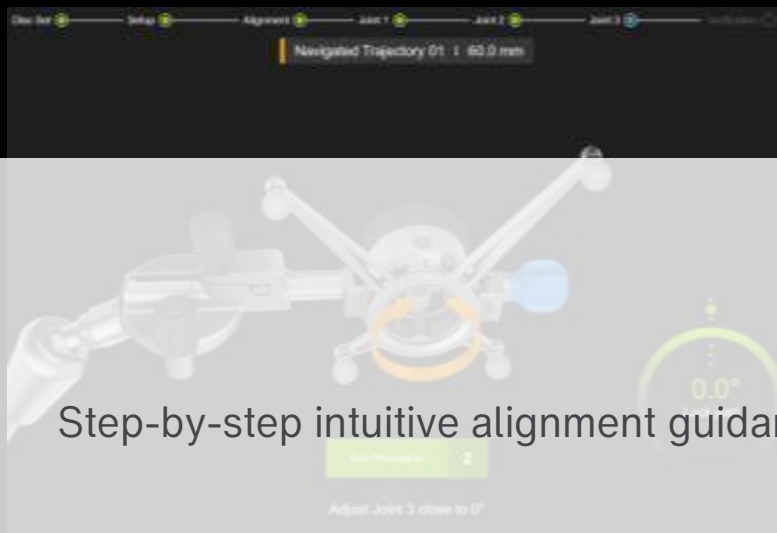
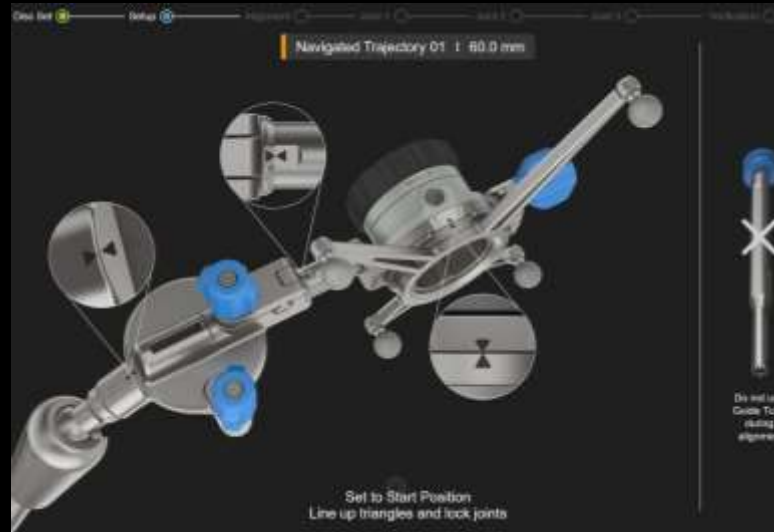
Multi-purpose instrument holder VarioGuide® Alignment System¹



- Frame-based precision without a head frame²
- Flexibly adapts to instruments from Ø 1.8 – 8 mm
- Dedicated (optional) Cranial Biopsy Drill Kit¹ minimizes the potential for deviation from the planned trajectory and allows for minimally invasive drilling
- Software-supported measurement of bone thickness¹ for setting the Drill Depth Stop prevents drilling too deep
- Potential reduction of total procedure time²
- Disposable Pre-calibrated Biopsy Needle (Ø 2.1 mm)¹ seamlessly integrates into navigation workflow

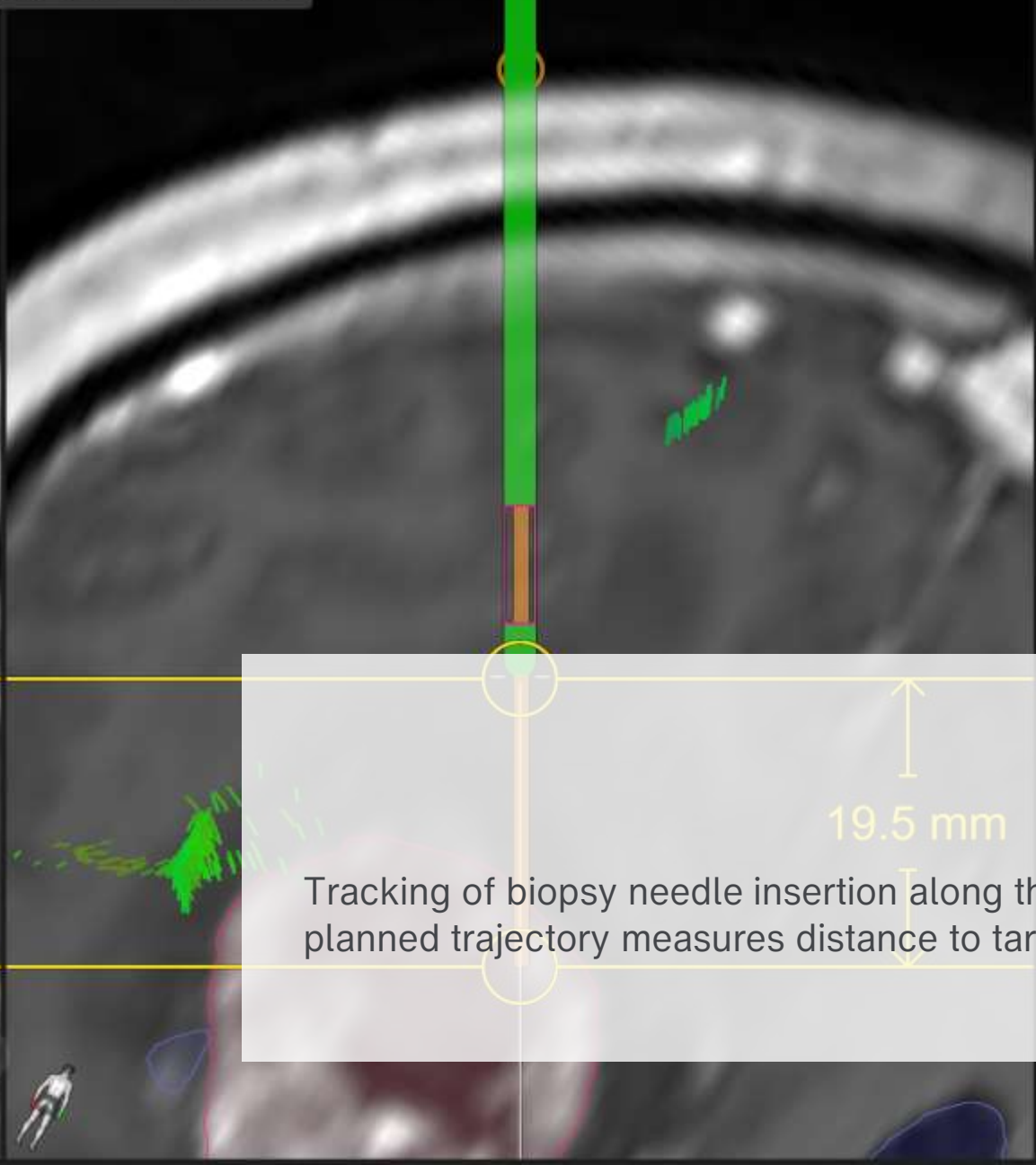
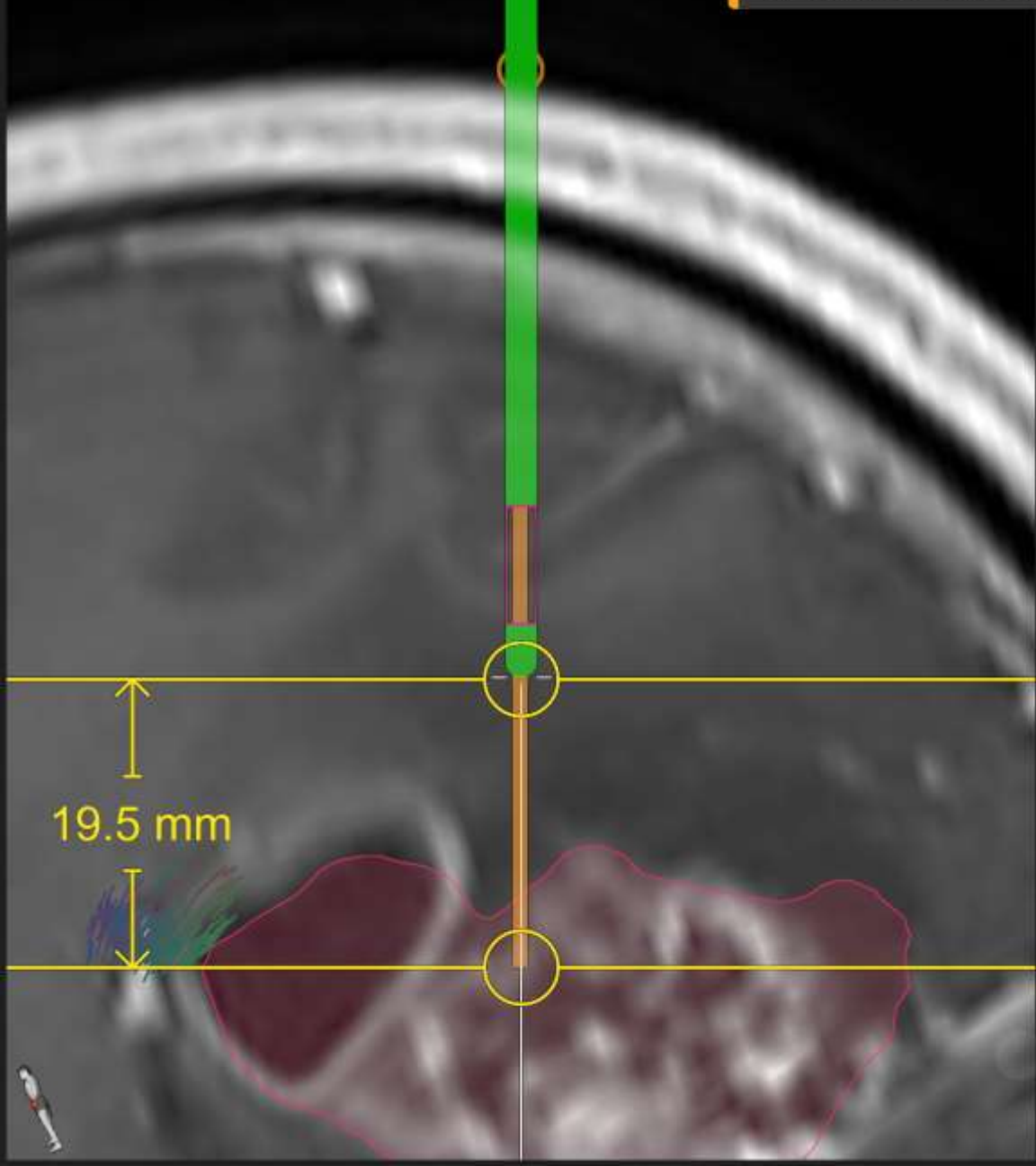
¹Not yet commercially available in the USA

²Bradac et al. (2017): *World Neurosurgery*, DOI:10.1016/j.wneu.2017.04.104



Step-by-step intuitive alignment guidance

Navigated Trajectory 01 | 60.0 mm



Tracking of biopsy needle insertion along the planned trajectory measures distance to target

Alerts Data Home
 DEMO, Biopsy
 2016-04-19
 Alignment Software Cranial
 Camera
 Screenshot Align VarioGuide
 Deviation Monitoring
 Threshold 0.5 mm
 View
 VarioGuide Help
 Trajectory
 Navigation Tools
 Back Done
 BRAINLAB

Navigated Disposable Suction¹

Instant and continuous performance



- Suction and pointer combined into one pre-calibrated, ready-to-navigate tool
- Ergonomic design supports seamless navigation especially under the microscope
- Integrated passive markers on both sides of the suction for right and left-handed use
- Available with outer tube diameter of 2.7 mm (Charr 8) and 4.0 mm (Charr 12)
- Lightweight design (14 g or 18 g) for comfortable instrument handling

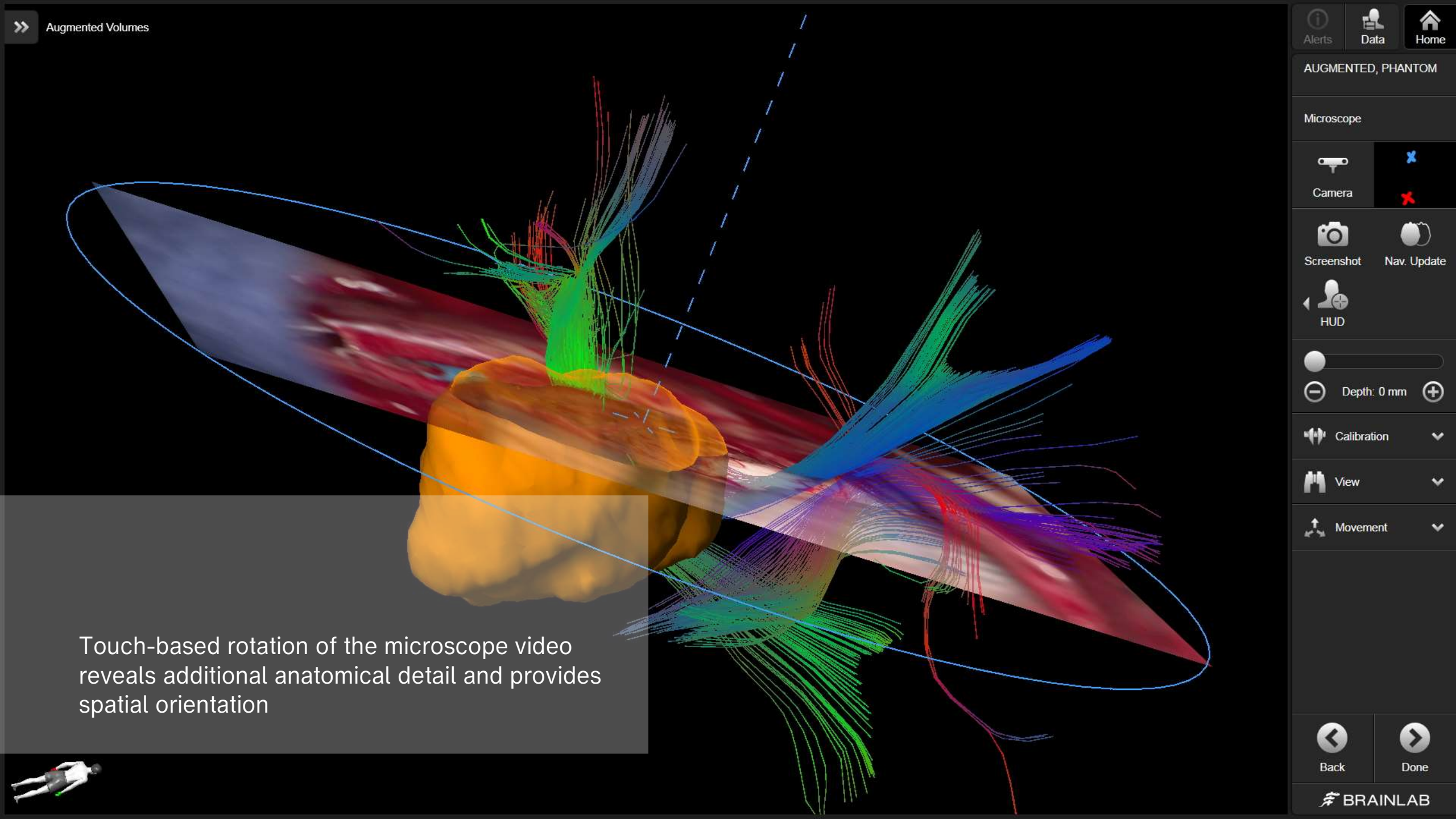
¹ Not yet commercially available in CE markets

Microscope Navigation

Meaningful distraction-free context



- Integrates microscopes used with or without oculars
- Positional tracking of microscope with visualization of optical axis and focal point
- Augmented visualization of planned structures including eloquent fiber tract information
- Displays relevant information on navigation screen and in ocular
- Corrects initial patient registration based on Maximum Intensity Projection (MIP) or pre-planned anatomical landmarks
- Navigation-controlled robotic alignment of microscope



Microscope

Camera

Screenshot Nav. Update

HUD

Depth: 0 mm

Calibration

View

Movement

Back Done

Touch-based rotation of the microscope video reveals additional anatomical detail and provides spatial orientation





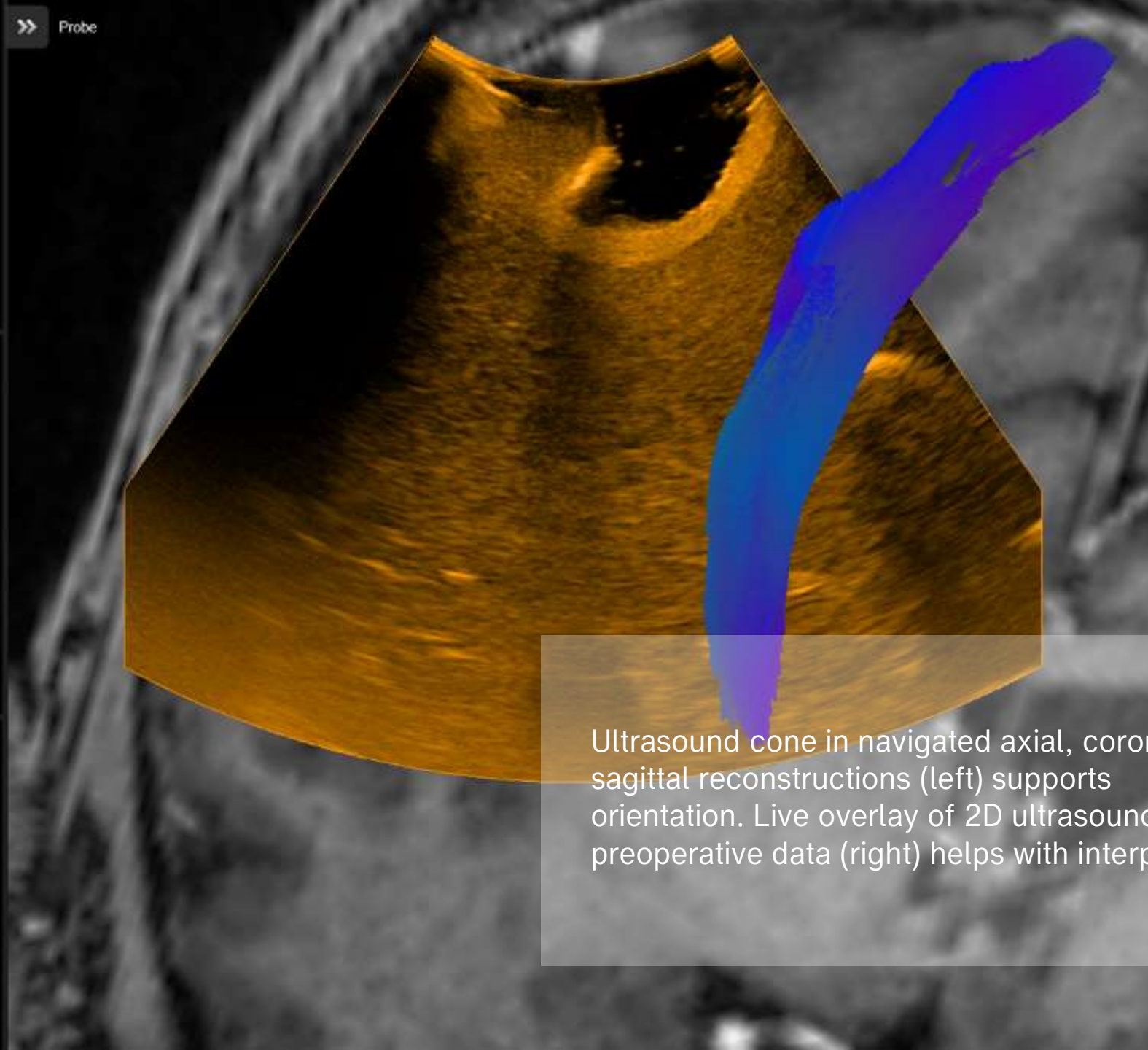
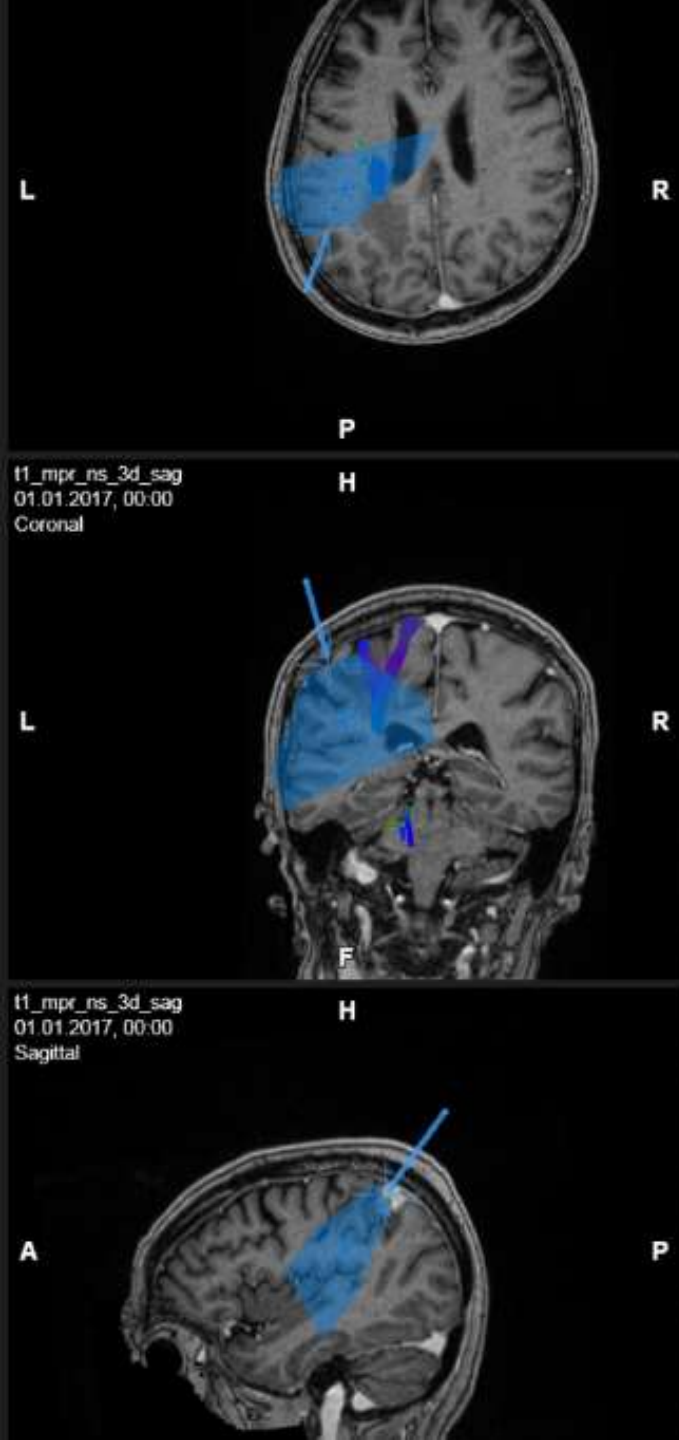
Injection of Augmented Volumes with tractography as seen in ocular

Ultrasound Integration

Intraoperative live imaging



- Digitally integrates BK Medical ultrasound devices
- Overlays live 2D ultrasound on preoperative images to help interpret ultrasound
- Displays pre-planned data on ultrasound
- Upgrades 2D ultrasound with 3D functionality
- Navigation on intraoperatively acquired 3D ultrasound volumes
- Helps compensate for brain shift
- Allows for real-time resection control



ULTRASOUND PHANTOM...
2018_4_30_3

Ultrasound Navigation

Camera

Probe: N13C5
Depth: 65 mm

Screenshot Scan US

Freeze

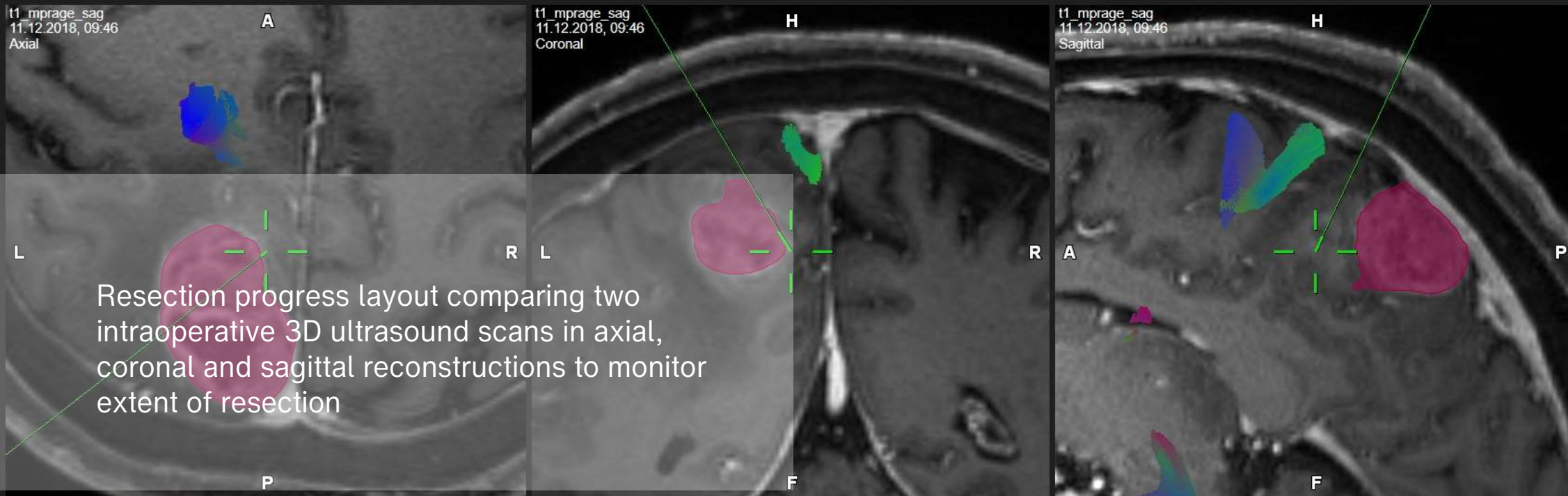
Viewing

Overlay

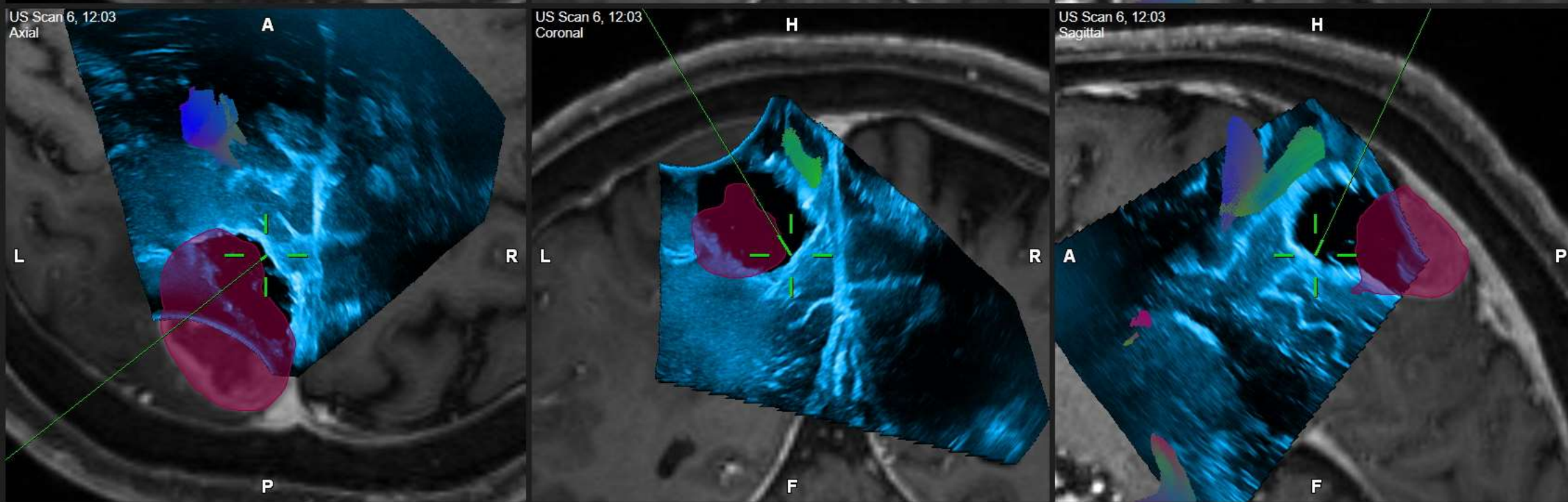
Probe

Back Done

Ultrasound cone in navigated axial, coronal and sagittal reconstructions (left) supports orientation. Live overlay of 2D ultrasound onto preoperative data (right) helps with interpretation.



Resection progress layout comparing two intraoperative 3D ultrasound scans in axial, coronal and sagittal reconstructions to monitor extent of resection



Alerts Data Home

CZ_HK_ULTRASOUND_NA...

Ultrasound Navigation

Camera

Screenshot Scan US

Freeze

Stacking

Viewing

Overlay

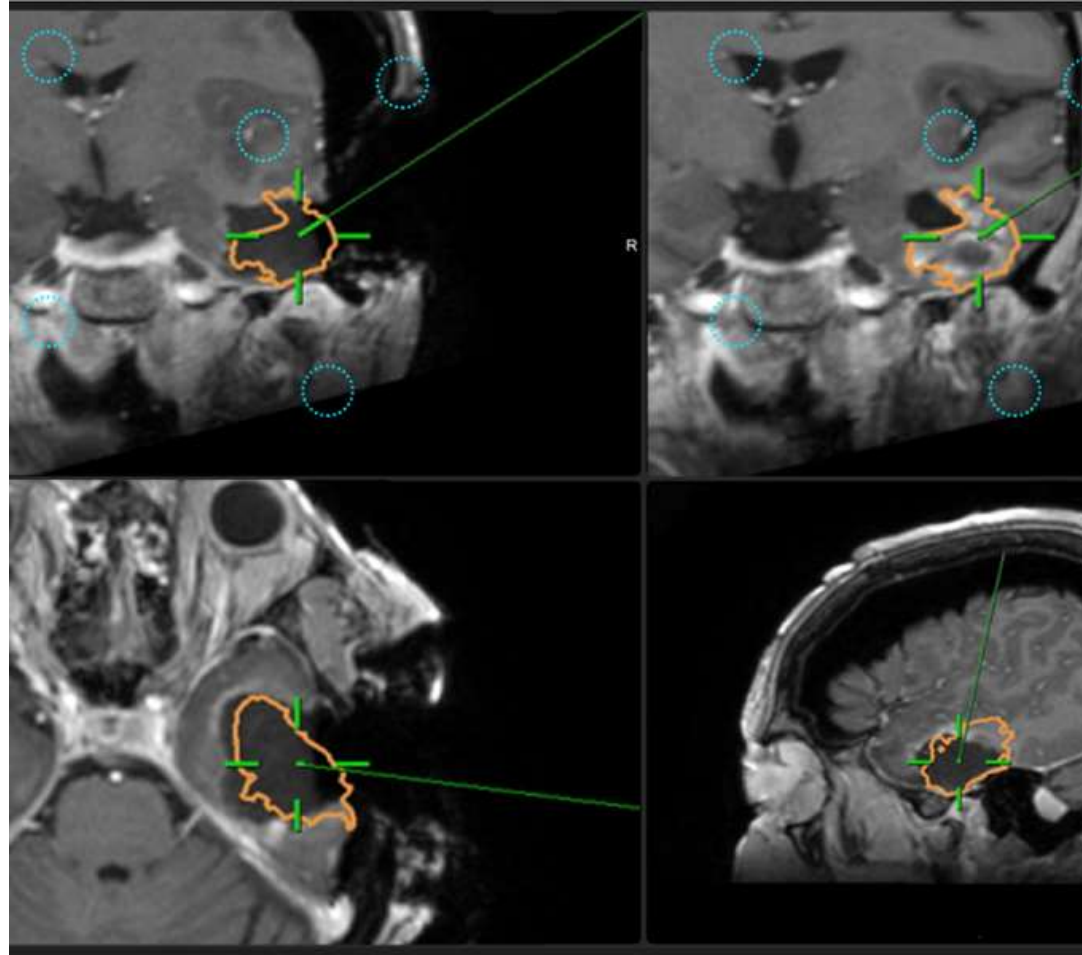
Probe

Back Done

BRAINLAB

Automatic Image Registration

Seamless integration of intraoperative MRI or CT



- Adds intraoperatively acquired data to surgical navigation
- Eliminates need to access anatomical landmarks
- Accurate image registration
- Available for various MR scanners
- Universal integration of CT, rotational angiograph and cone-beam CT¹

¹ Technical feasibility determined on case-by-case basis

Electromagnetic Navigation

Straightforward pinless cranial procedures



- Animated setup and registration guidance
- Remote controlled trajectory planning
- Pre-calibrated EM stylet for navigated catheter placement
- On-the-fly universal instrument calibration



brainlab.com

