GPS en Neurocirugia

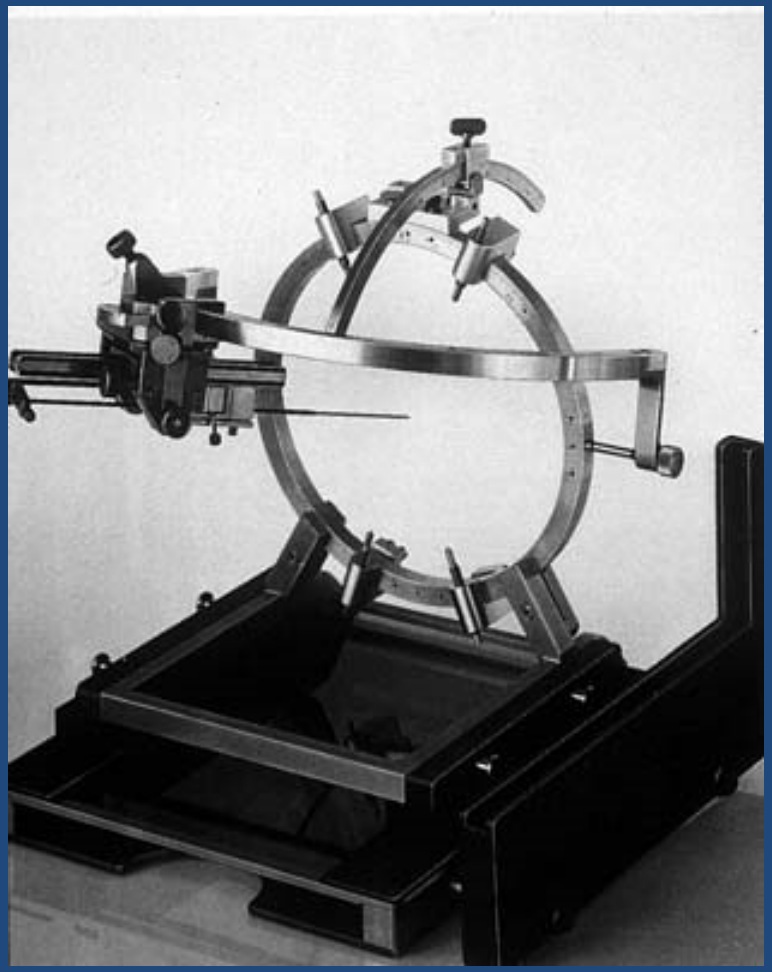
Gustavo Zomosa

Tutores Steffen Hartel

Victor Castañeda

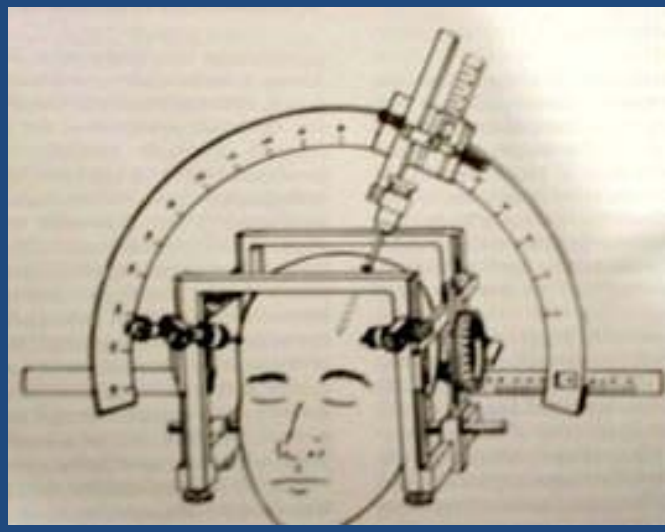
1908 sistema STX Horsley-Clarke

- Coordenadas
- Cartesianas x,y,z
- Experimentacion
- Animal(1)

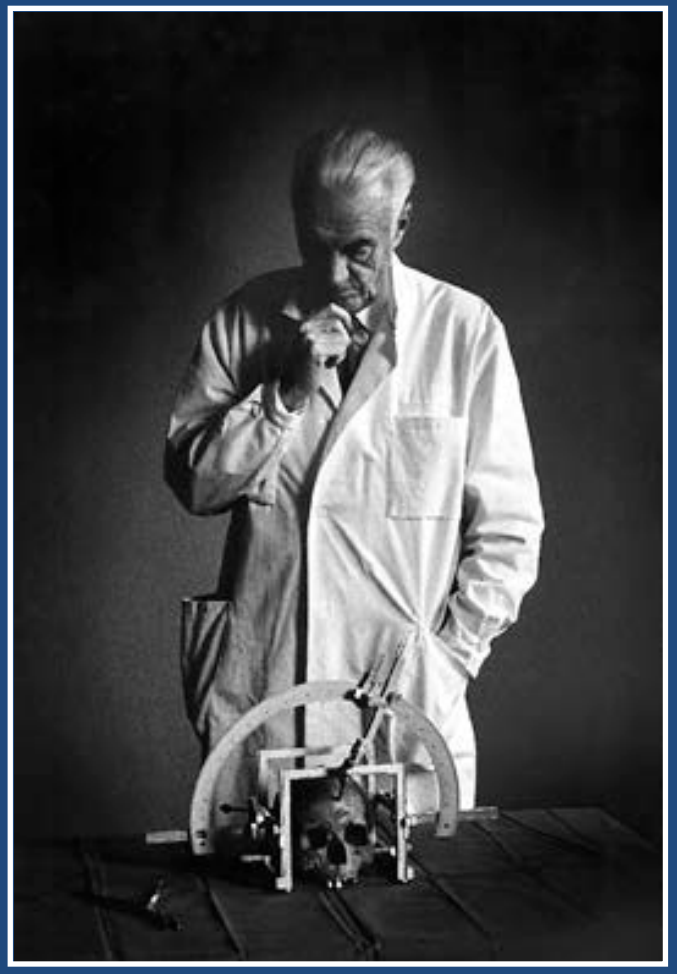


STX Médica

- -1947-48 Spiegel-Wycis
- L.Leksell, Taillerach,Mundinger
- -1960 E.Parkinson, Dolor
- Psicocirugia
- -R. Brown guiada por TC :
- Aparato STX
- Sist. Planif
- Procedimiento Localiz stx (1)



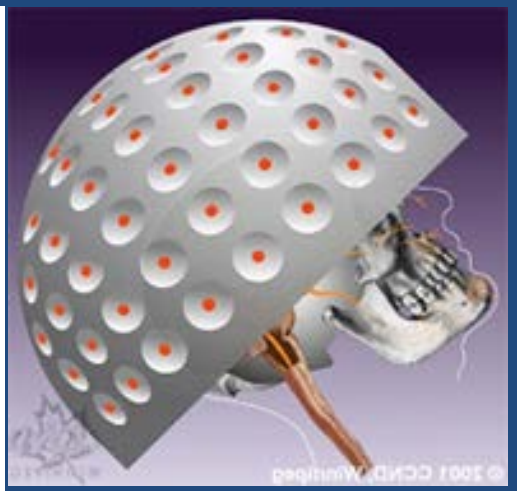
Radiocirugía SRS



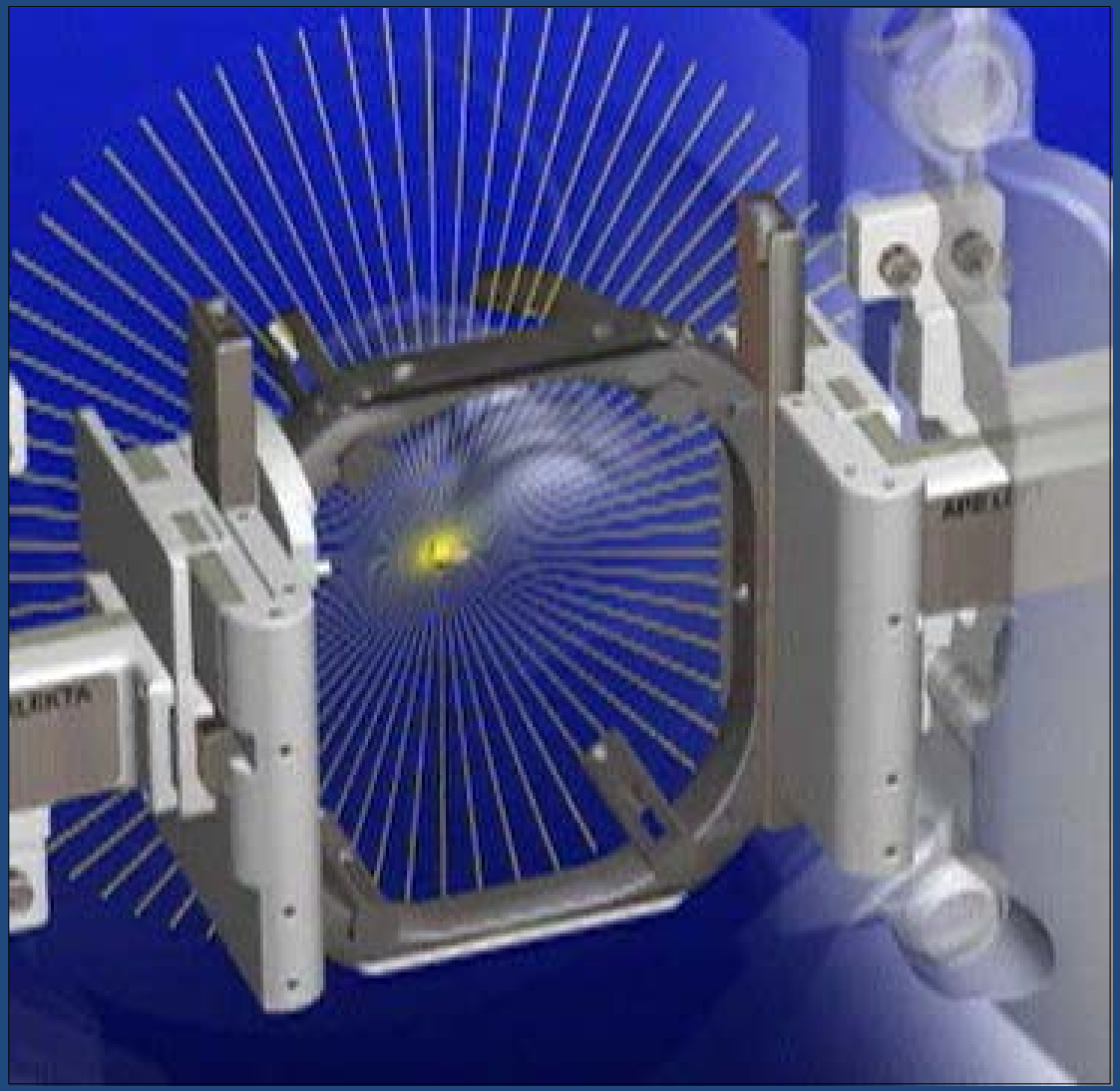
Administración de una dosis alta y única de radiación a un volumen intracraneano pequeño estereotáxicamnte localizado a través del cráneo intacto

L. LEKSELL

Radiocirugia Frame Leksell Gamma Knife

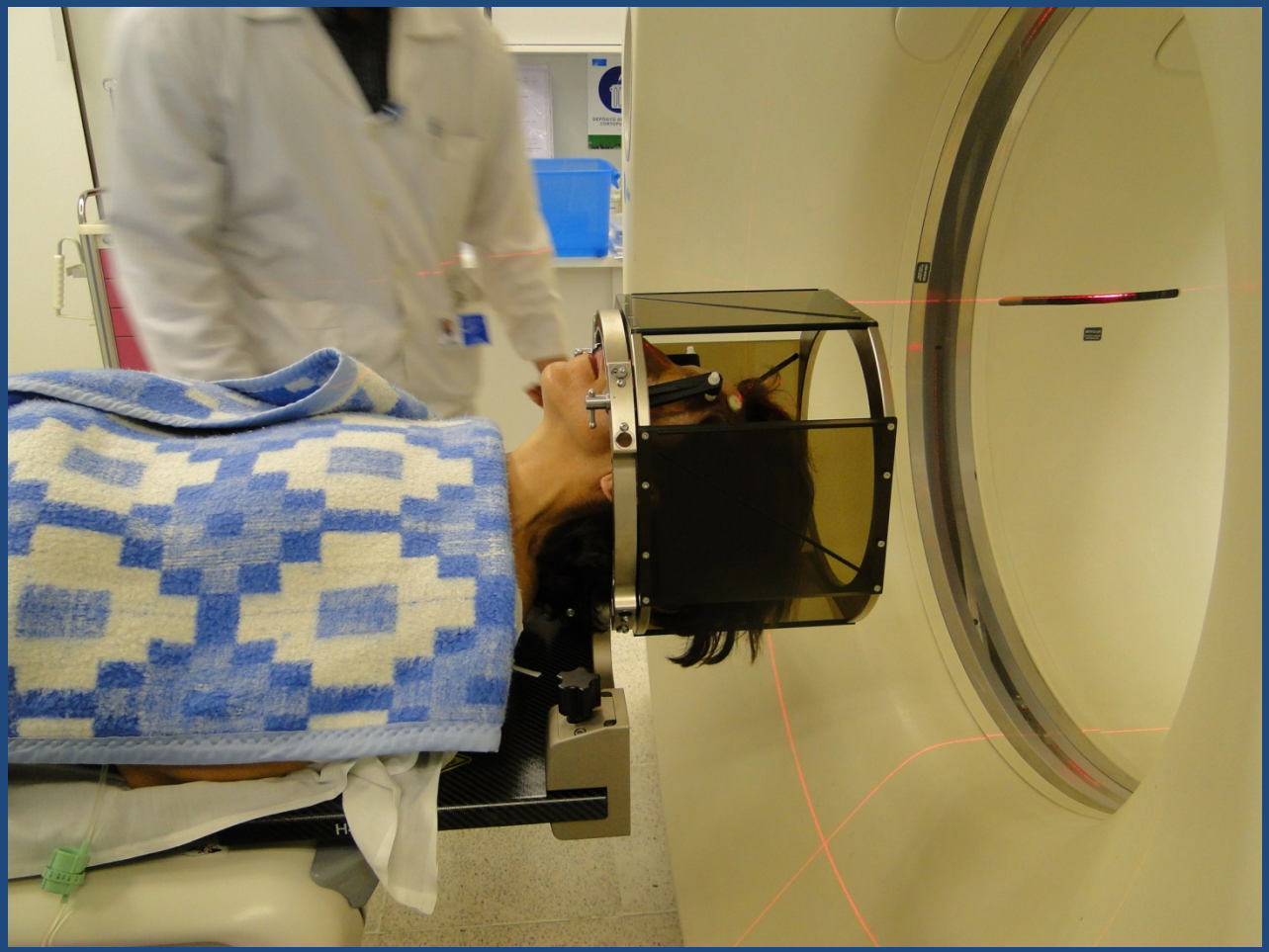


Radiocirugía L G Knife Frame

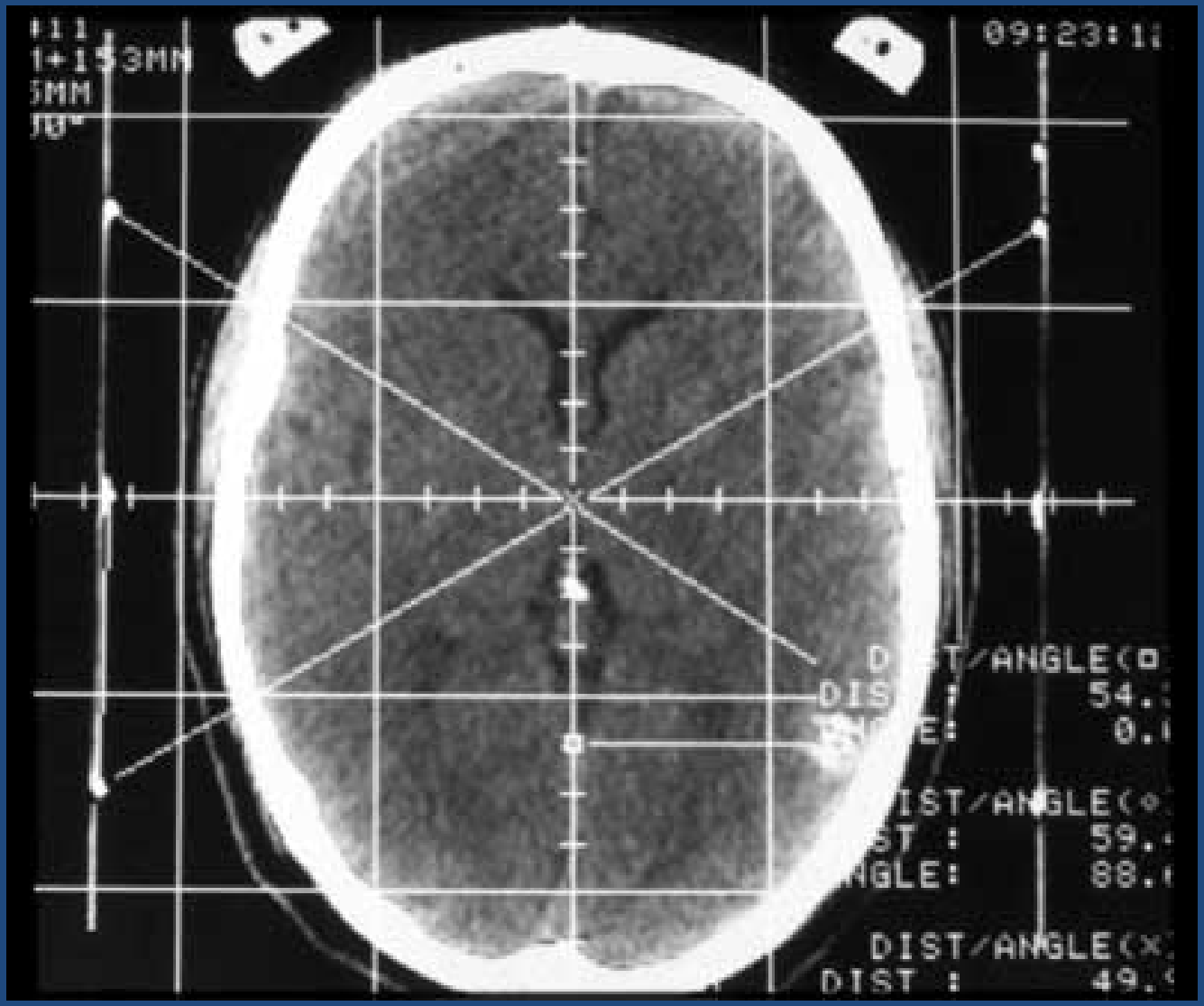


Colocacion Frame

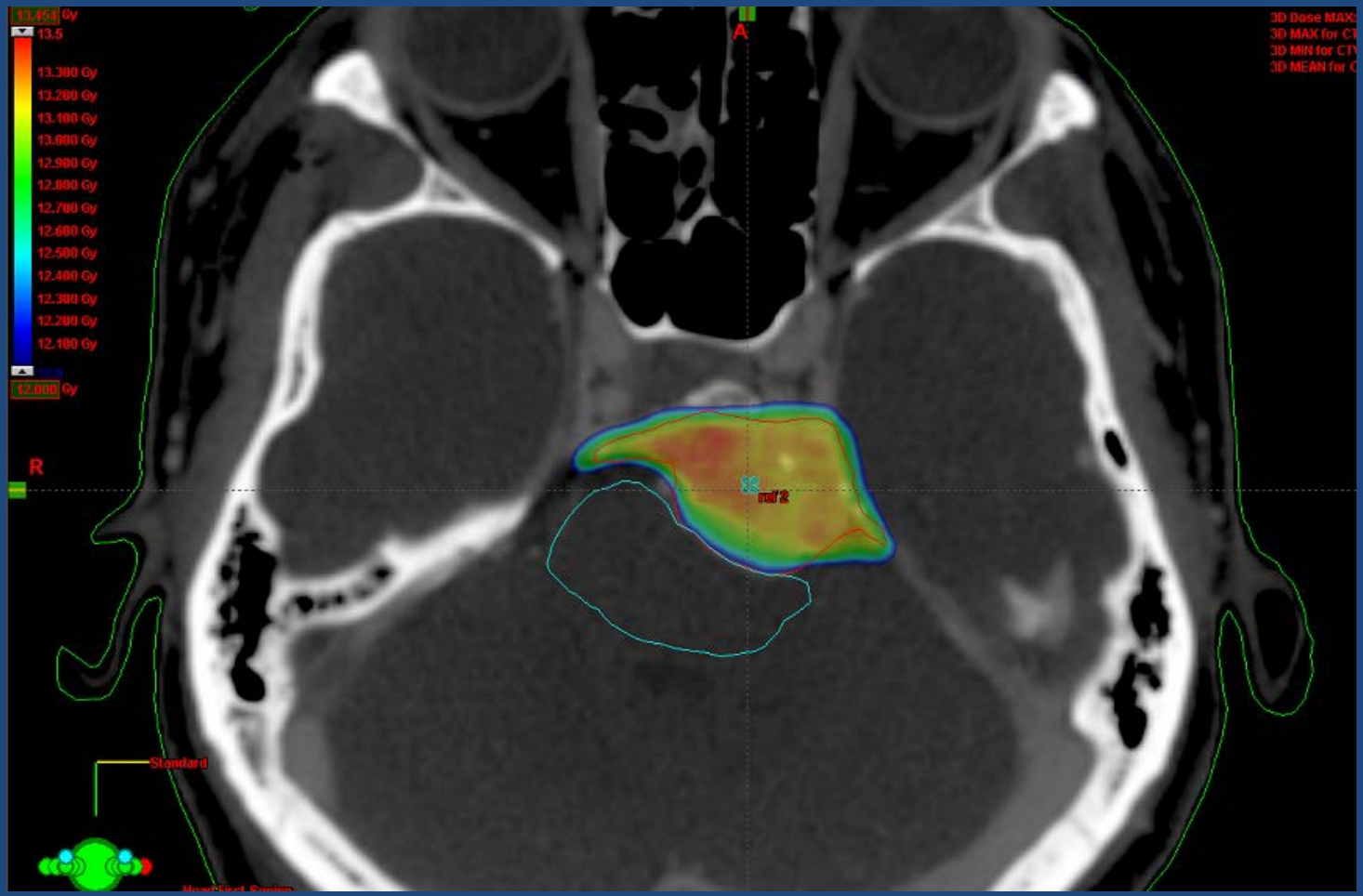
Adquisición TC Fiduciales



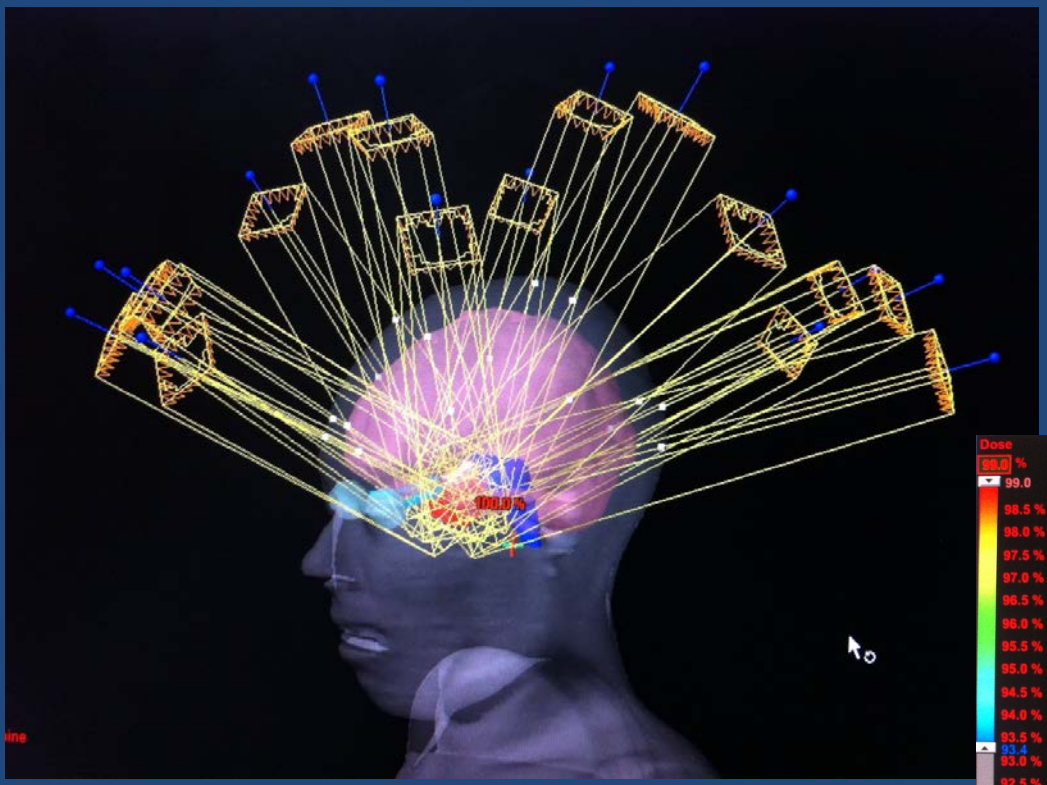
TC fiduciales stx

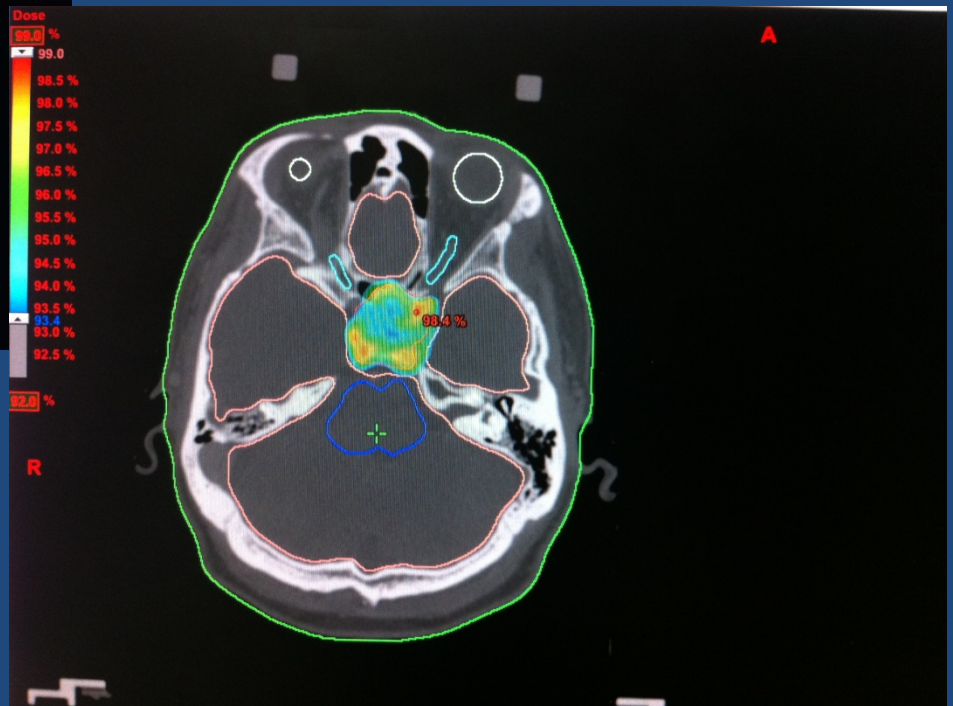


Planificación SRS Fusion CT/RNM



Planificacion SRS 16 campos I.Modulada IMSRS





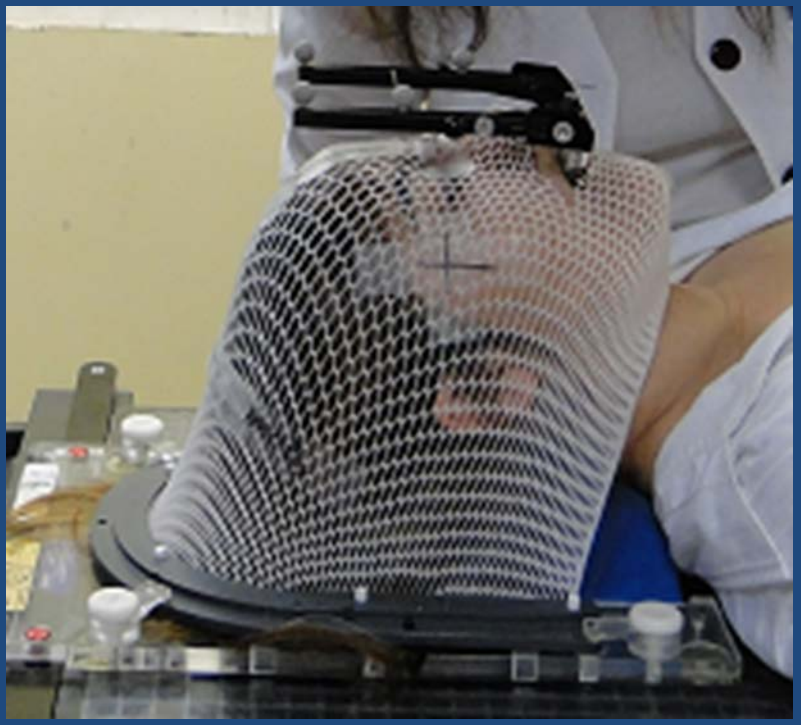
OGP Navegación Optica IR

Frameless with optical guidance (≅ 0.5-1 mm)

Bitetray with optical fiducials for patient setup and treatment delivery using cones

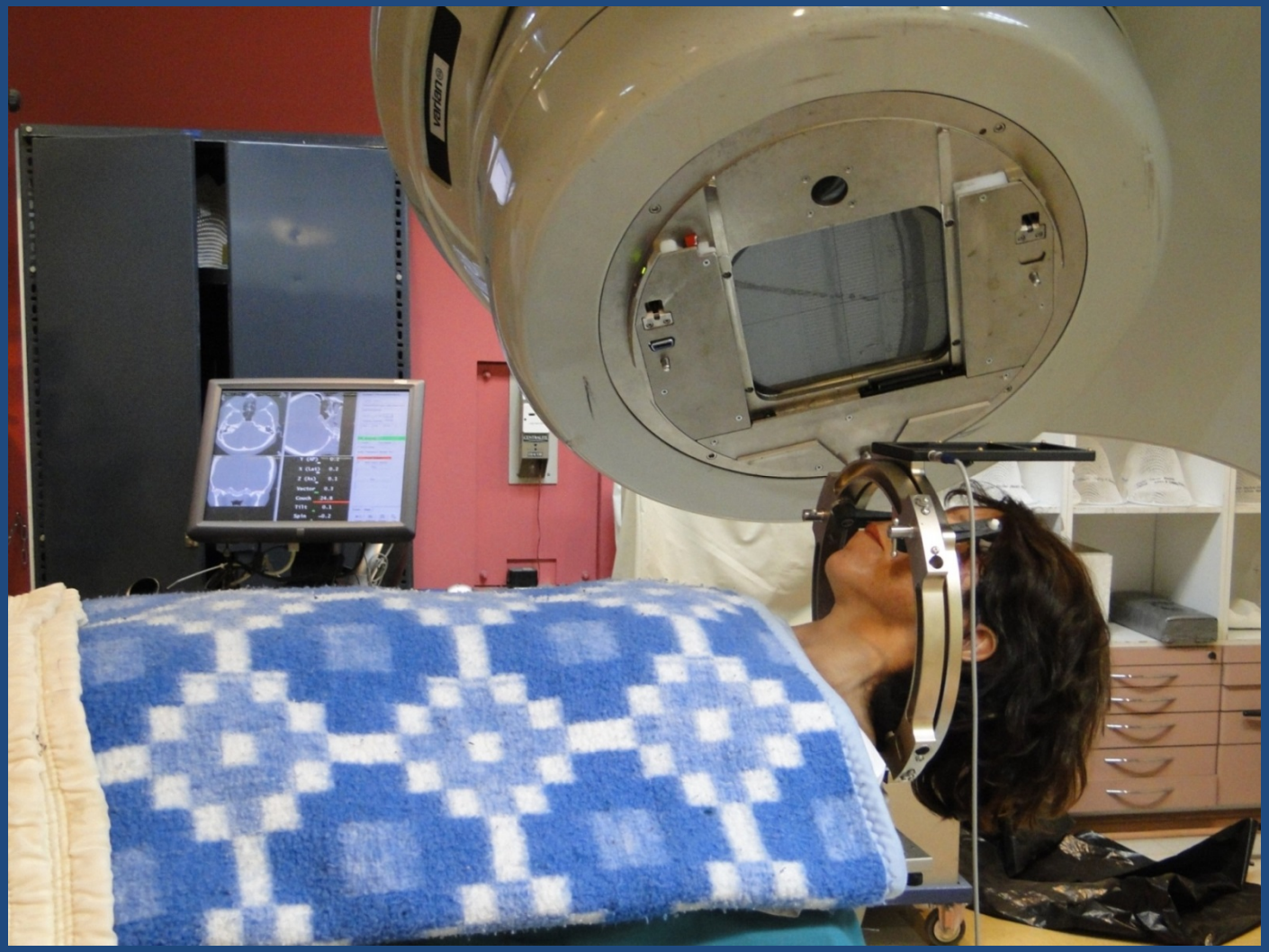
Ceiling mounted
3D infrared camera

Radiocirugía LINAC Frameless



OGP Navegación IR

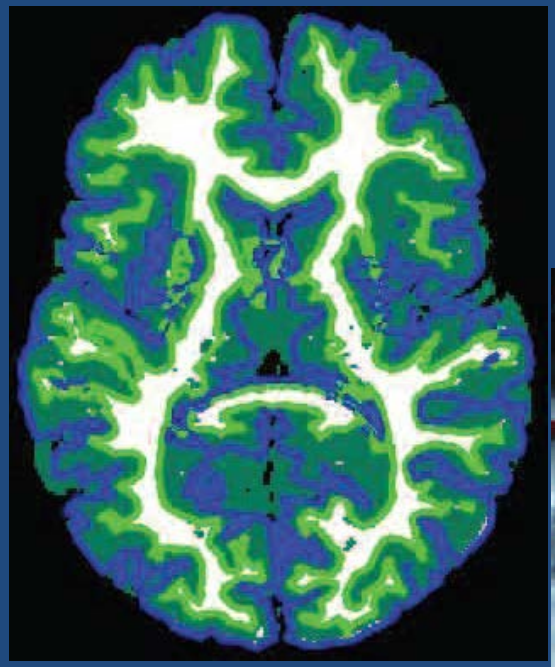
Radiocirugía LINAC Frame Navegacion

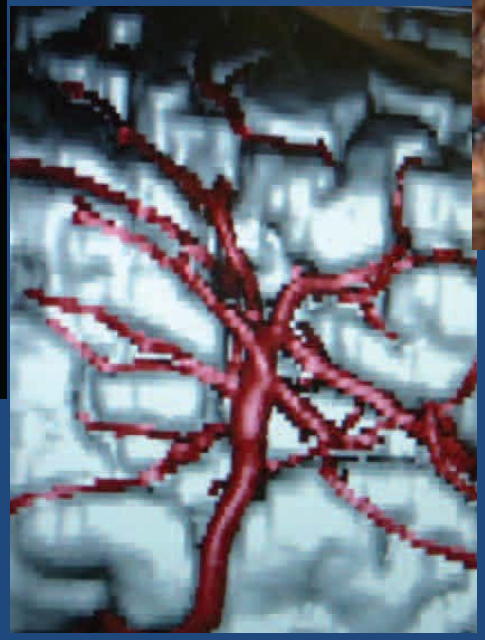


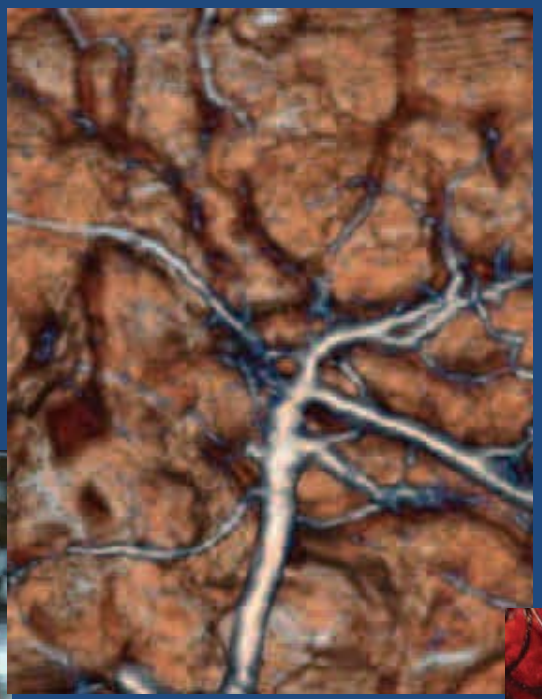
SISTEMA GPS ROBOTICO EN NC

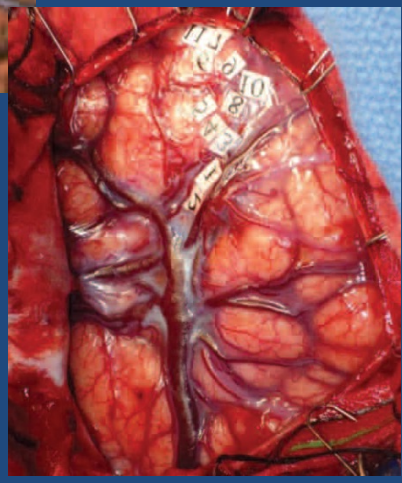
IMAGENES

MRI T1WSPGR 3D axial-planar + CT s/c 4D-CT angio + 4D-CT venografia (2)

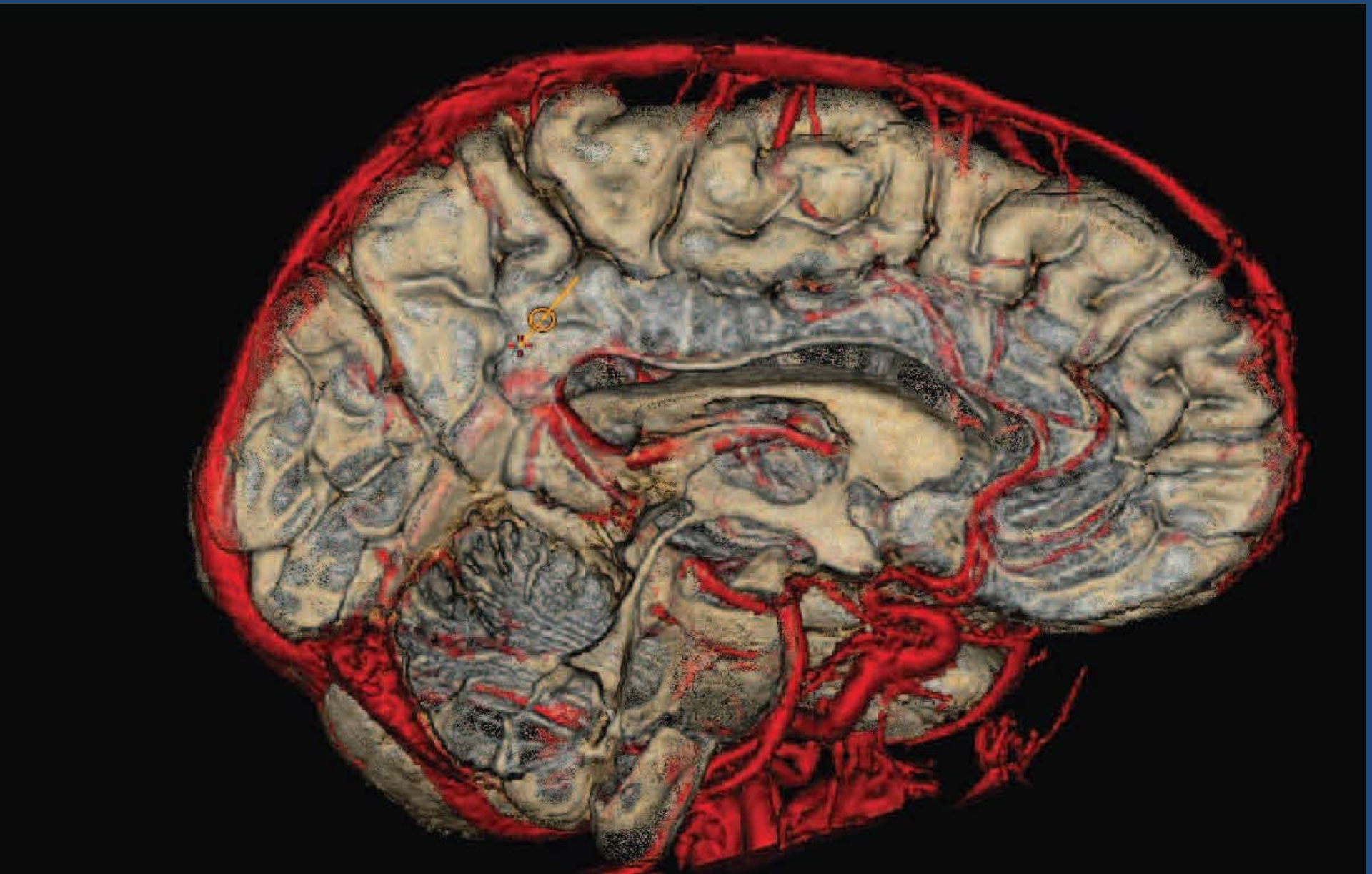




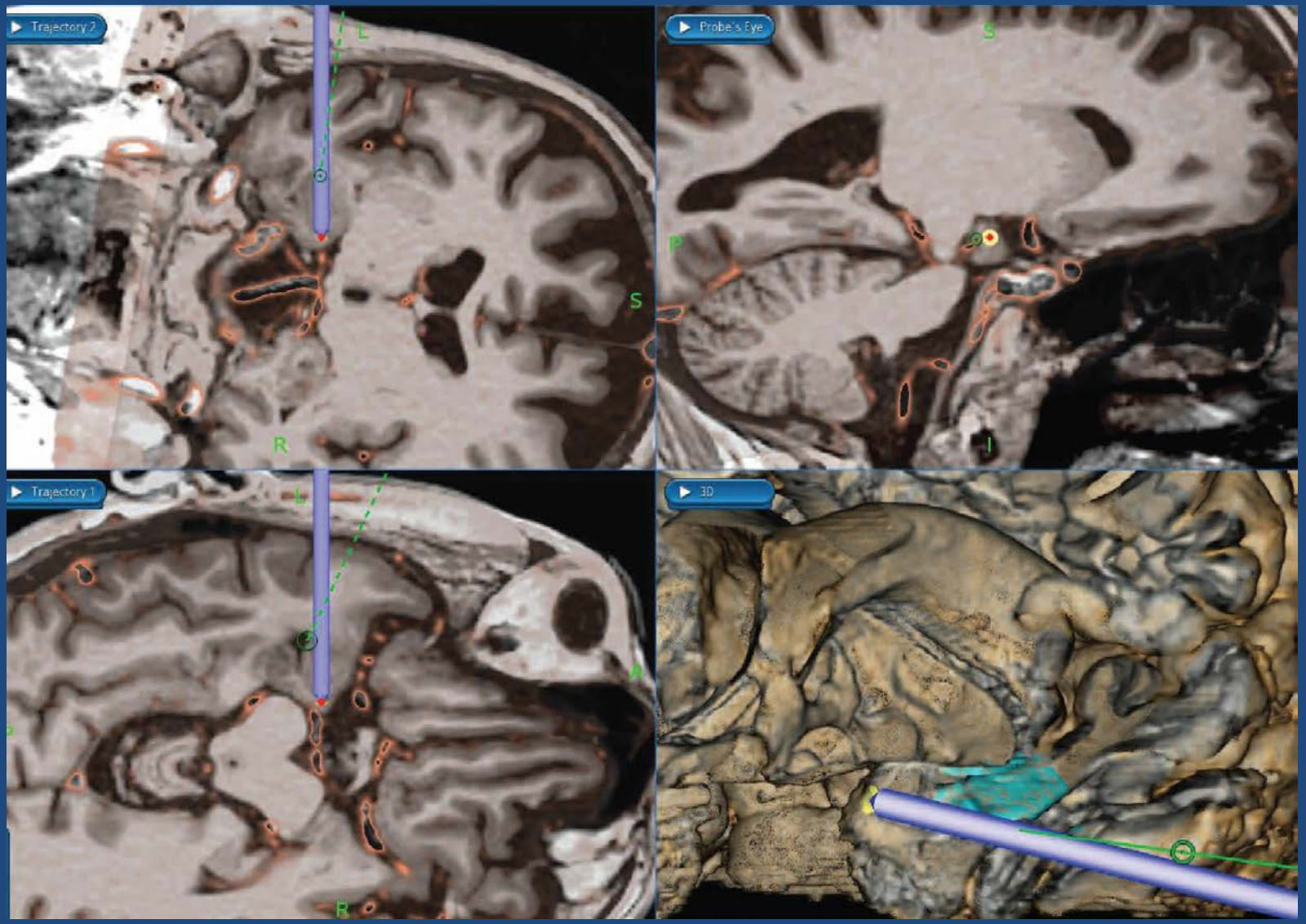




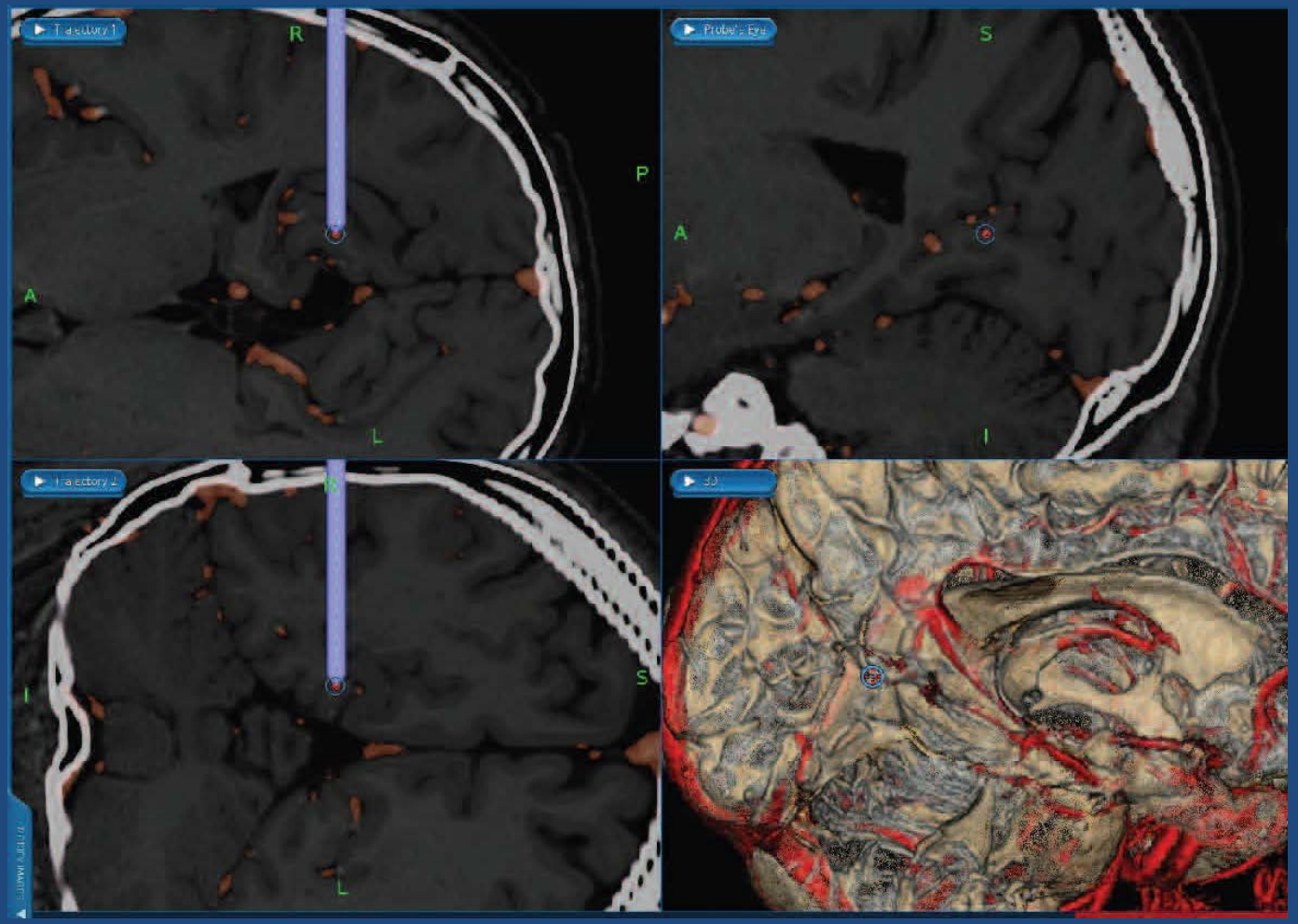
Localizacion gyrus del cíngulo DEEP



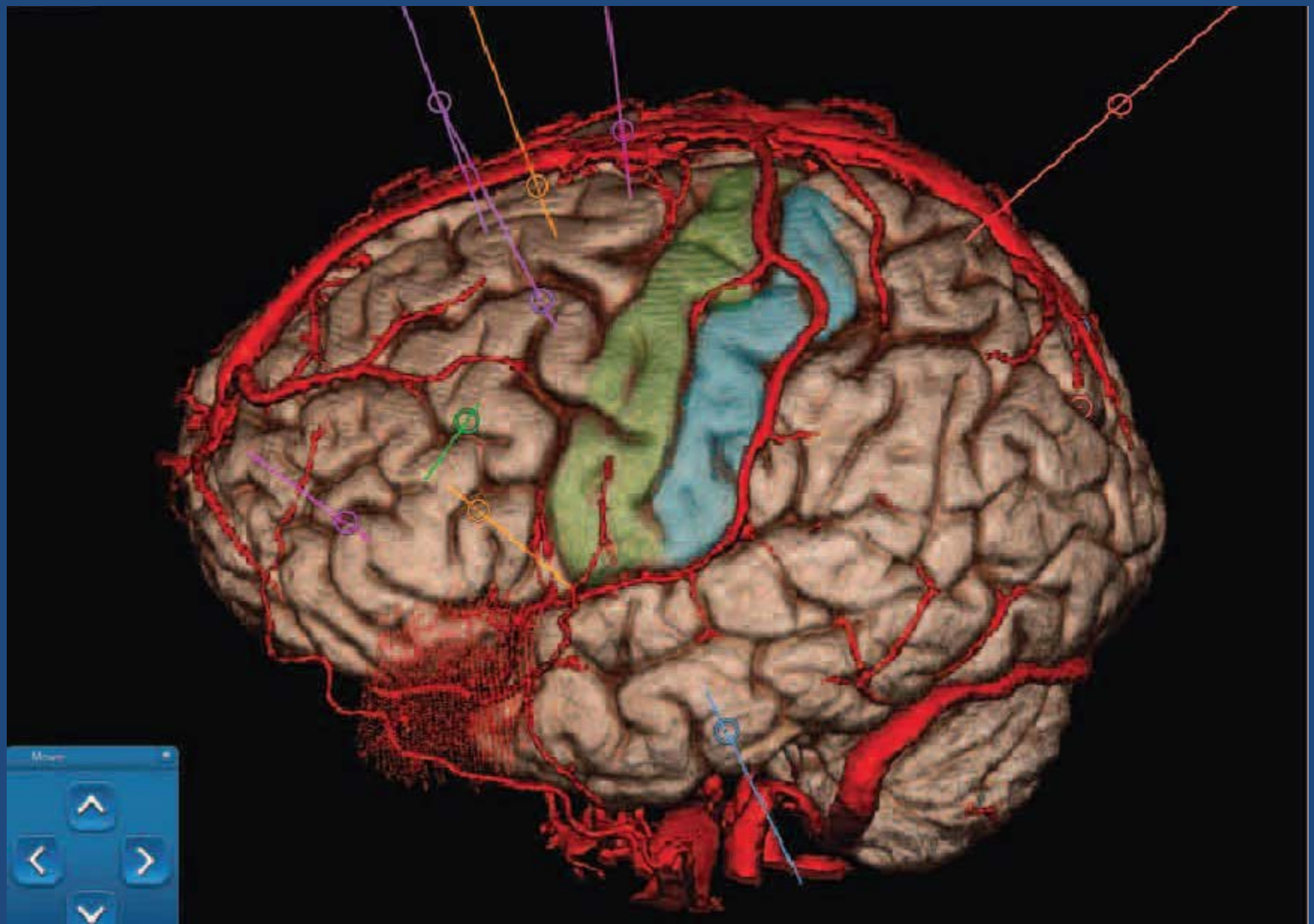
Amidgalehipocampectomia cirugia Epilepsia



DEEG cingulo posterior



DEEG area Mo=Ve, Se=Az.



Conclusiones del trabajo Mc Gill

- Precisión de la reconstrucción < 0.5 mm (surcos, arterias, venas, sust gris-blanca, craneo, zonas elocuentes)
- Reduccion t preop 160 a 25 min $p<0.05$ con robot/navegación convencional Medtronic R y de t introp de localización automatica de 58 a 15 min (manual) $p<0.05$ para DEEG.

Principios de un Sistema GPS robotico en NC (3)(4)

- Software de planificación preop
- Capacidad de navegar intraop
- Tecnología robótica
- Sistema de registro automatico basado en reconocimiento de características faciales sin contacto. Otros sistemas no robot requieren contacto con marcadores fiduciales para construir un modelo virtual 3D del craneo
- Error de registro se hace matching entre vol 3D y preop MRI , en estudio (1): 0.4-0.6mm std 0.1, navegacion 1.2mm 0.3 y target 1.2mm std 0.4.

Indicaciones de NC Robótica GPS

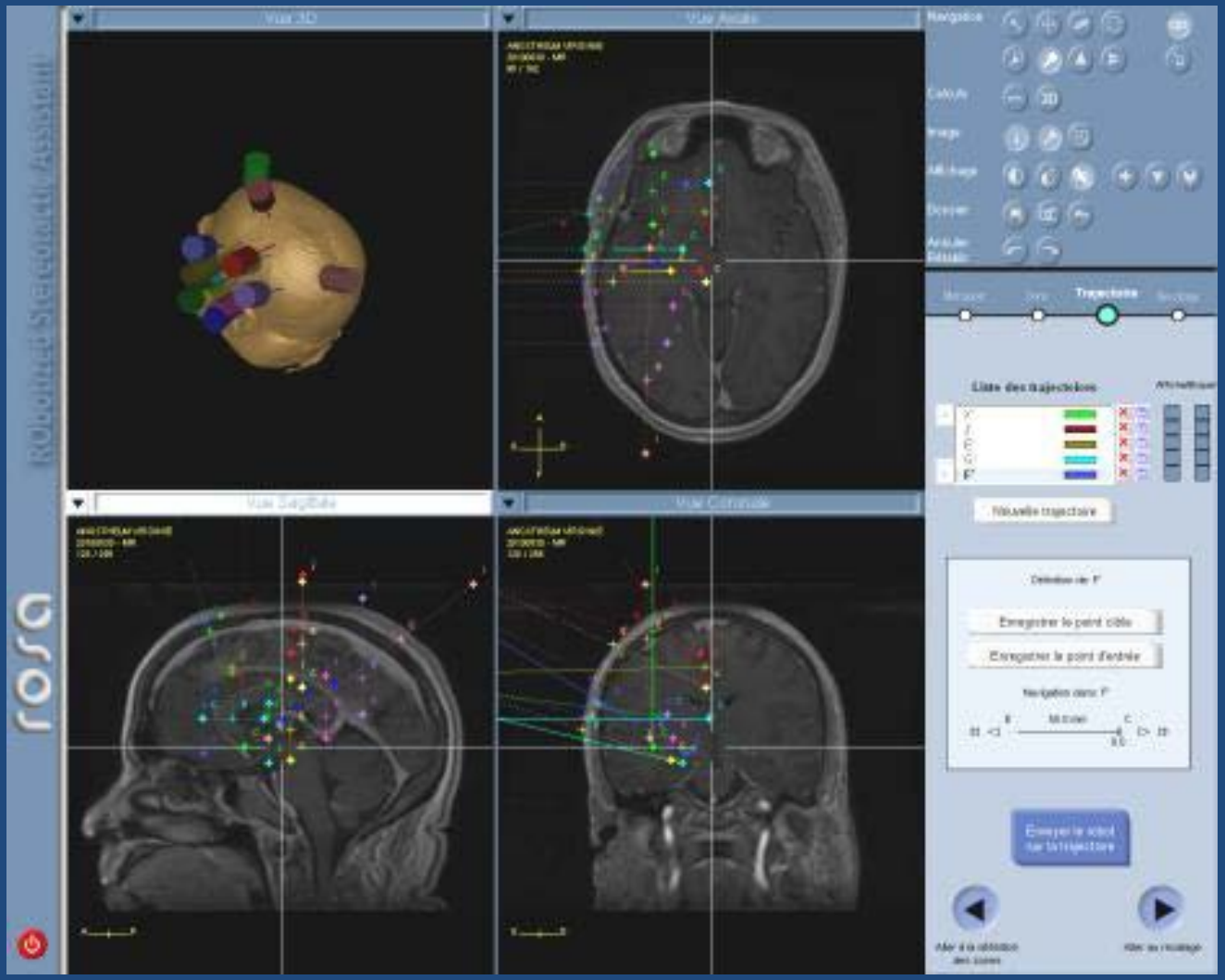
- Posicionamiento de Electrodos cerebrales profundos : DEEG.(5)(10)(12)
- Optimizacion de Cirugia Epilepsia.(6)(11)
- Optimizacion de implante de electrodos para neuromodulacion en E. de Parkinson, Dolor.(8)
- Optimizacion de Bp cerebrales (7)

Localizacion

- Automat
- Laser

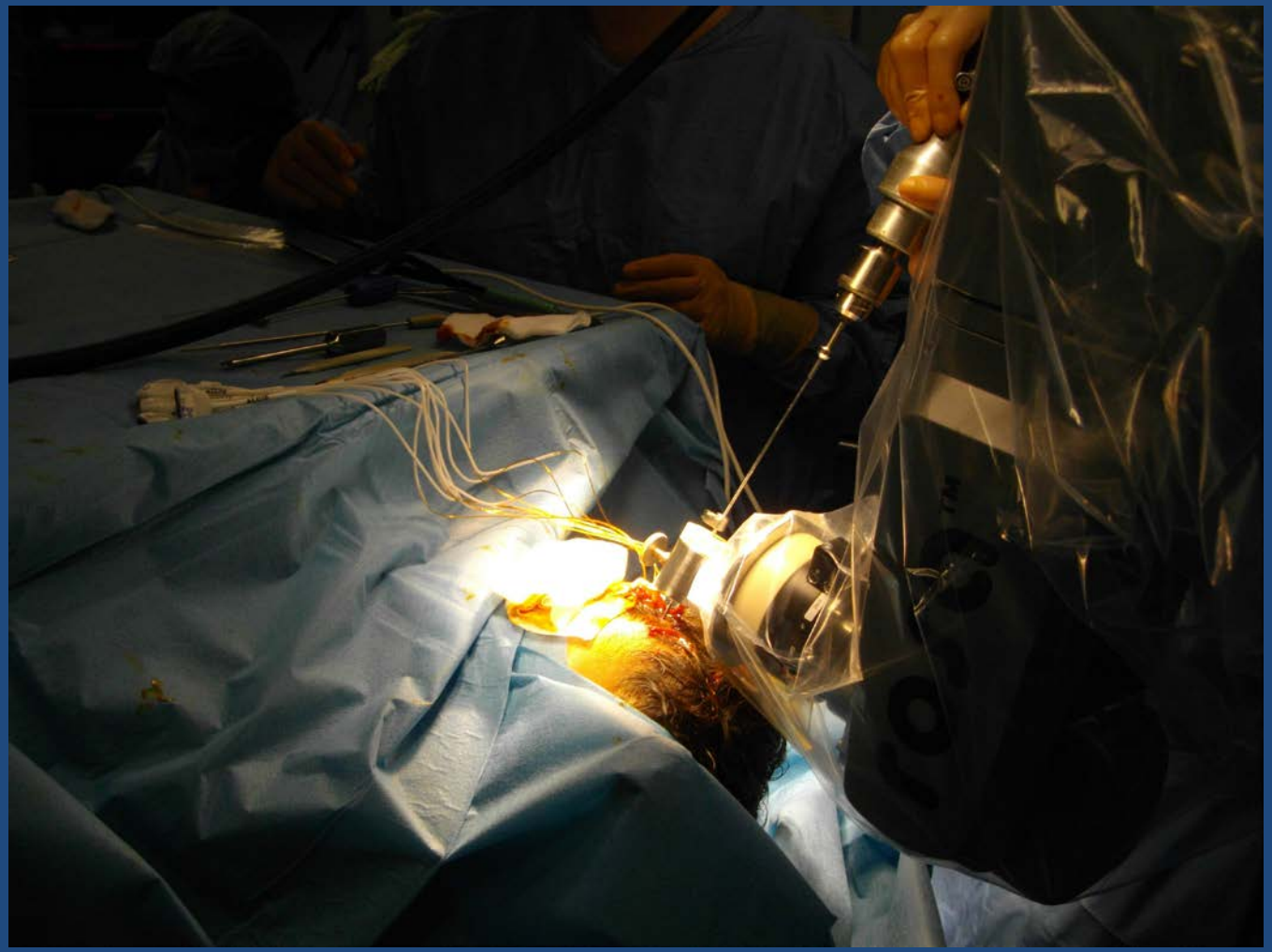
Planificacion colocacion Electrodos DEEG

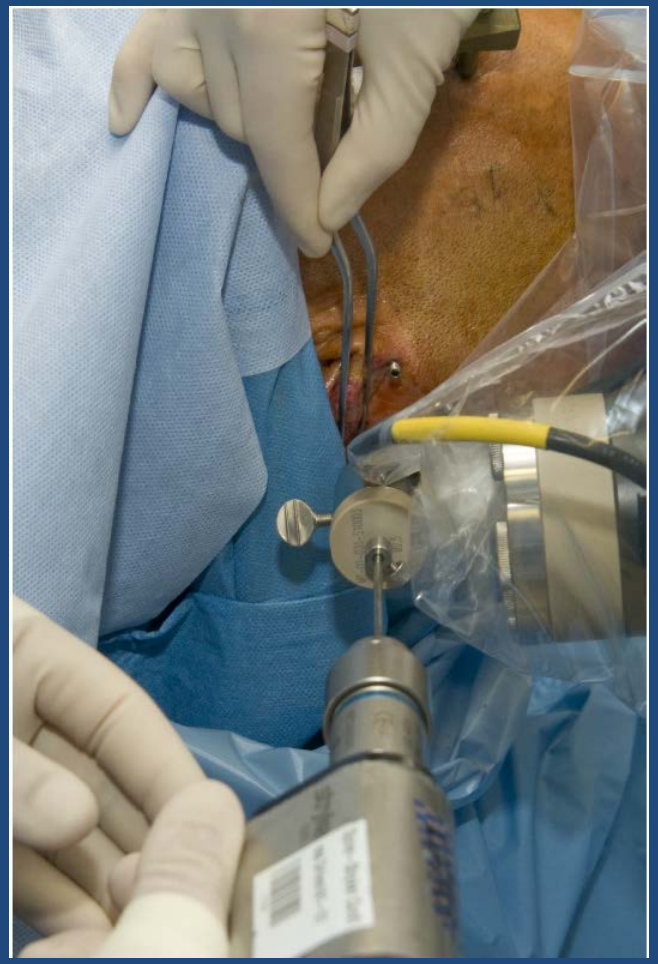
Amine LAHLOU1;
Pierre KEHRLI1;
Suela DYLDJERI;
Edouard HIRSCH2
1 Department of Neurosurgery, 2 Department of Neurology, University hospital of Strasbourg, France , (2)



Posicionamiento automático trepanos

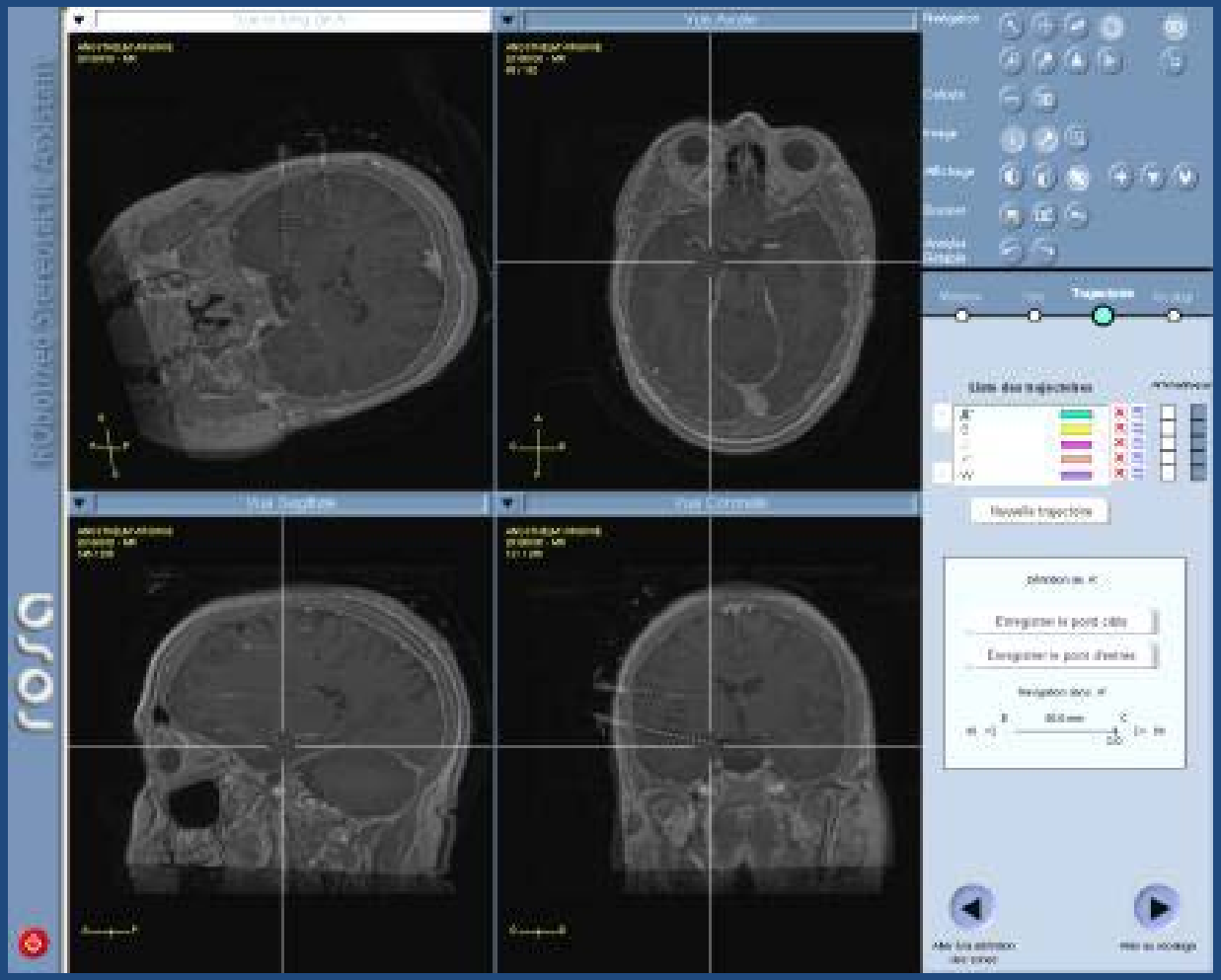
Guia robotizada intraop DEEG





Guia robótica para trepanos para DEEG

Control posicionamiento
Fusion Rnm preop/Ct Scan intraop



Colocacion electrodos DEEG (5)

Robot-Assisted Stereotactic Laser Ablation in Medically Intractable Epilepsy: Operative Technique

- Jorge Gonzalez-Martinez, MD,
- PhD*
- Sumeet Vadera, MD*
- Jeffrey Mullin, MD, MBA*
- Rei Enatsu, MD*
- Andreas V. Alexopoulos, MD,
- MPH*
- Ravish Patwardhan, MD‡
- William Bingaman, MD*
- Imad Najm, MD

Operative Neurosurgery 10:167–173, 2014

FIGURE 1. Preoperative volumetric T1-weighted with contrast MR images loaded to ROSA software, showing target were defined

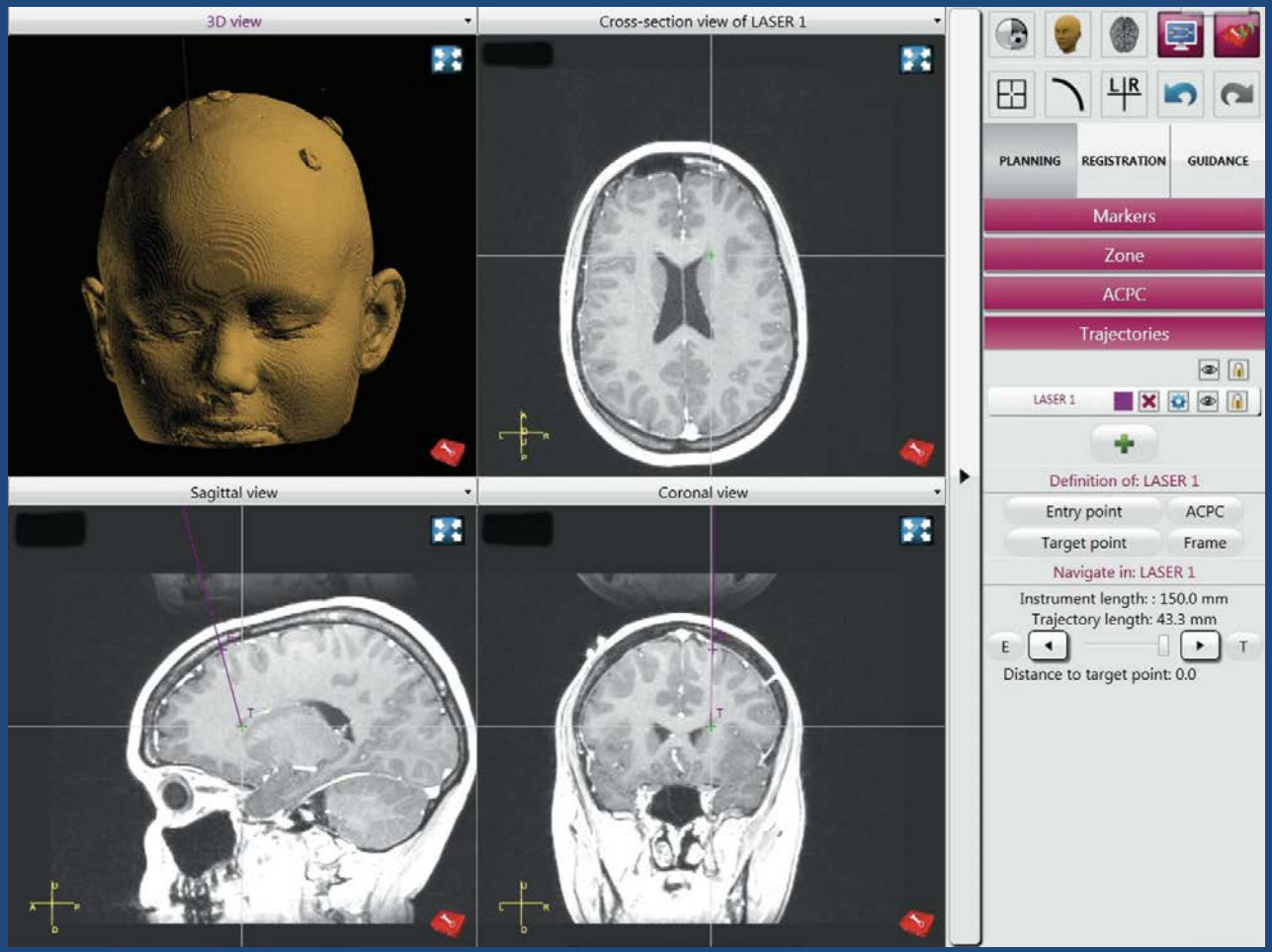
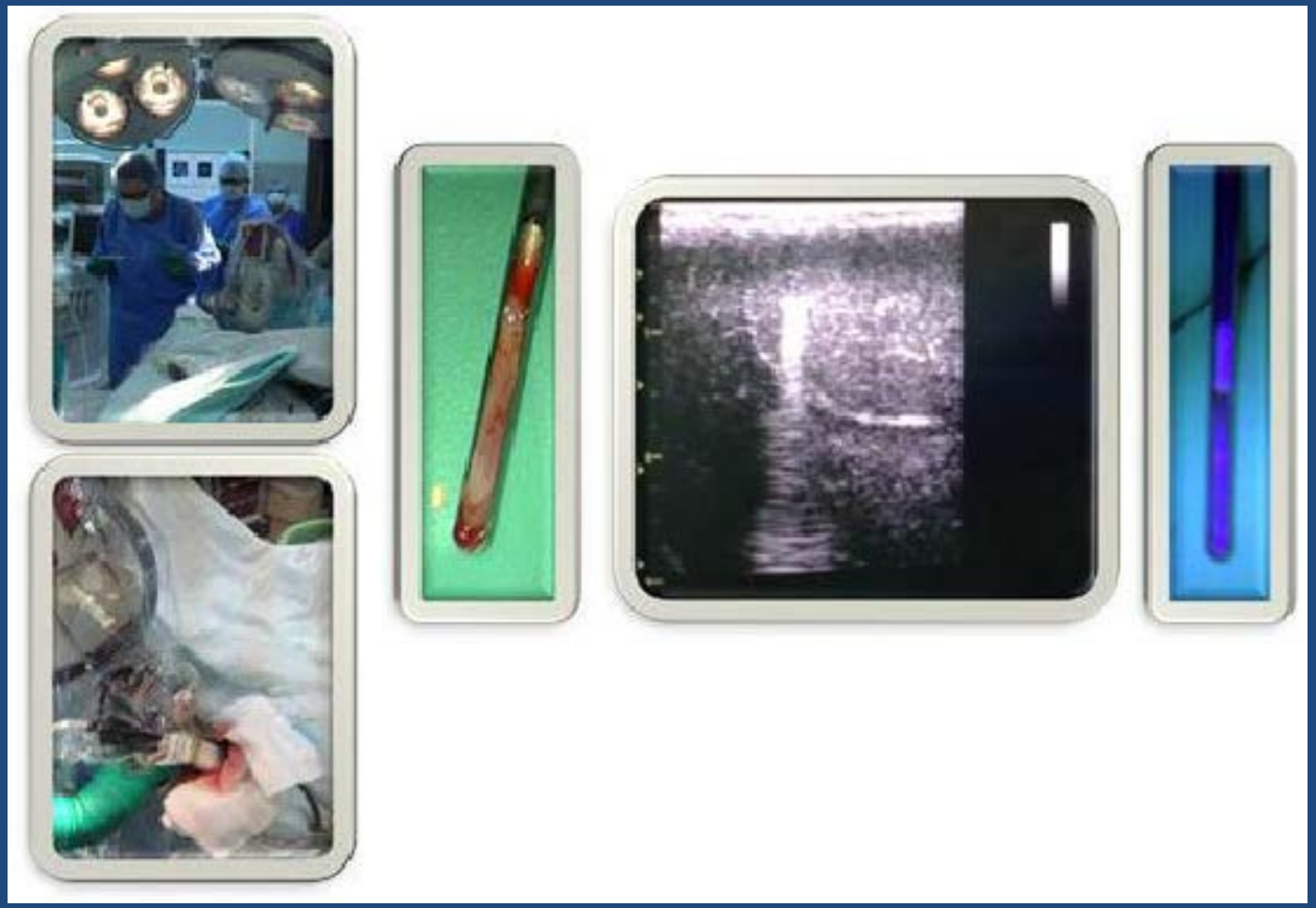


FIGURE 3. Intra-operative photographs showing robot guiding trajectory (A, B), laser applicator passage into brain through skull bolt (C), robot disconnection and removal after laser probe placement, allowing intraoperative MR imaging procedure (D), and final aspect with dressing applied (E). Operative Neurosurgery 10:167–173, 2014

Asistencia robótica Bp cerebral+US+5 ALA fluorescente (9)



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THE REGISTER OF THE NEUROSURGICAL MEME

Conclusiones

- La localización GPS ha sido una inquietud y necesidad permanente de la NC, que han conducido al desarrollo multiples sistemas, ligados a fiduciales de imagenes cada vez mas complejas y precisas para lograr la seguridad necesaria para efectuar procedinientos cada vez más complejos para tratar una amplia gama de trastornos anatómicos y funcionales del sistema nervioso.

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- Operative Neurosurgery 10:167–173, 2014
- **(4) Serletis D , Bulacio J, Bingaman W, Najm I and González-Martínez J.**
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