

# Tratamiento de Imágenes Médicas

## Introducción

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Departamento de Radiología

Harvard Medical School & Brigham and Women's Hospital

# Aplicaciones

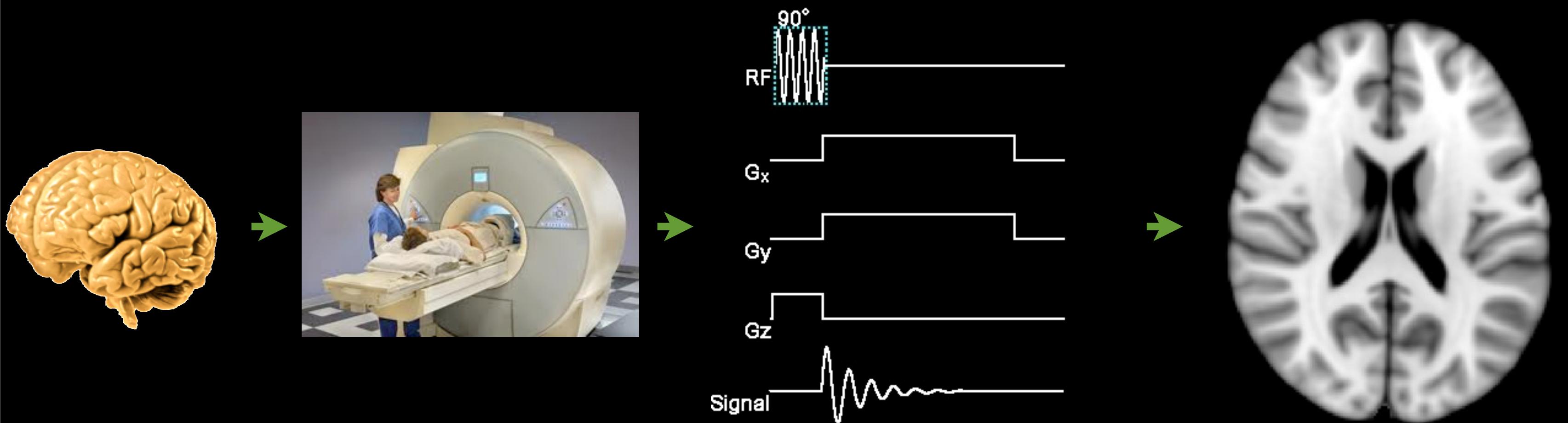
- Asistencia al diagnóstico
- Seguimiento de tratamientos
- Guía y planificación quirúrgica
- Investigación Neurocientífica

**Intra-operative Real-time Querying of White Matter Tracts During Frameless Stereotactic Navigation**

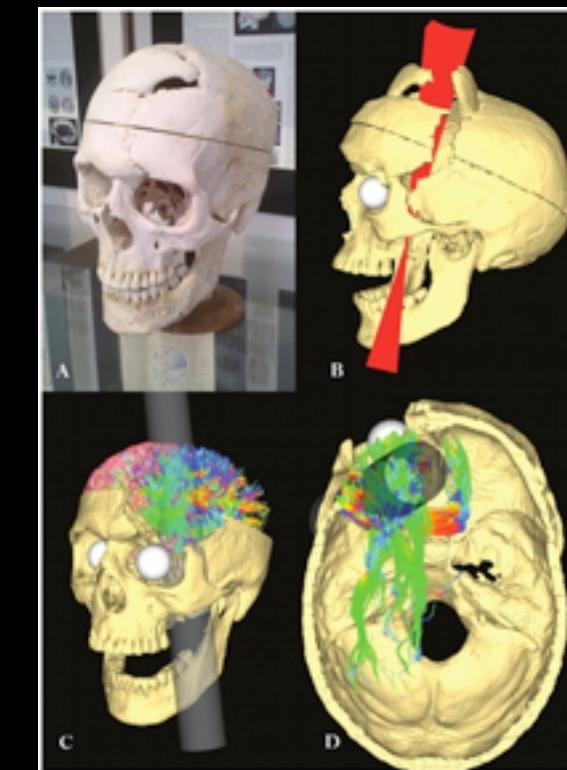
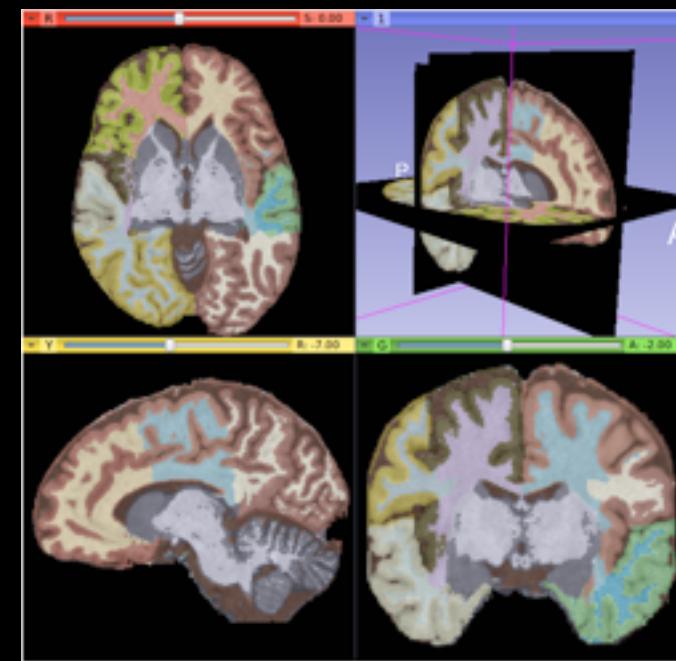
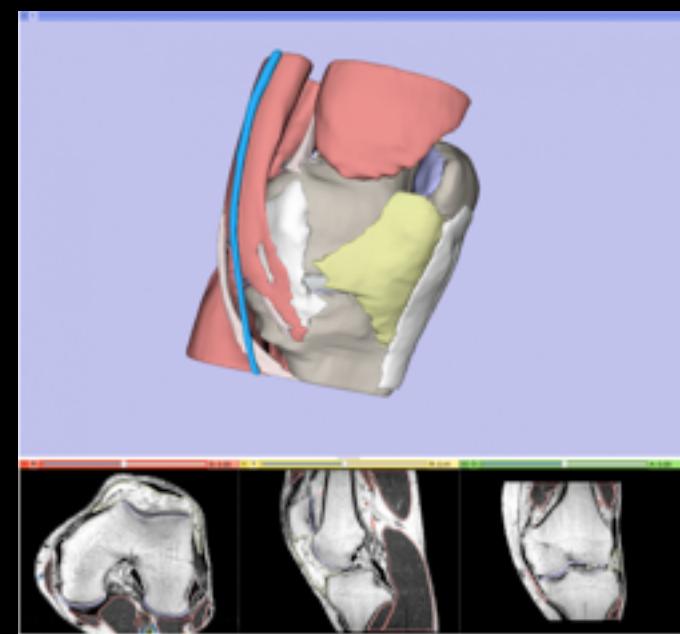
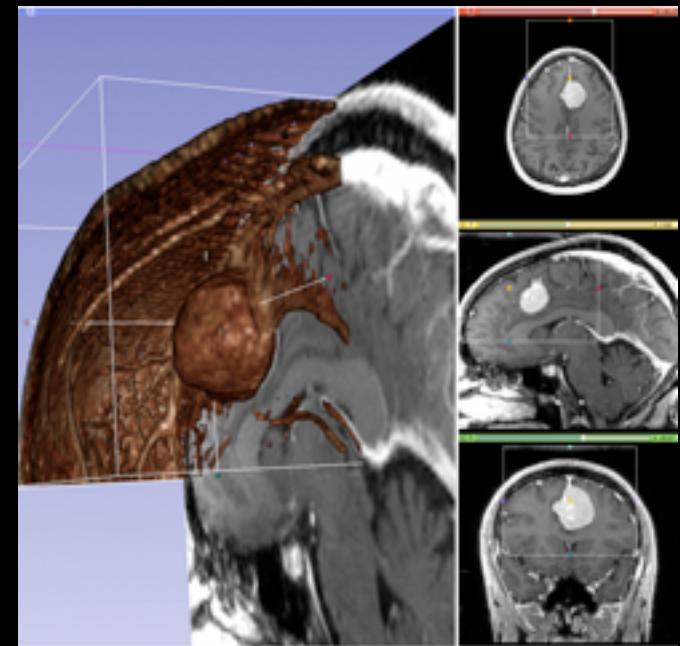
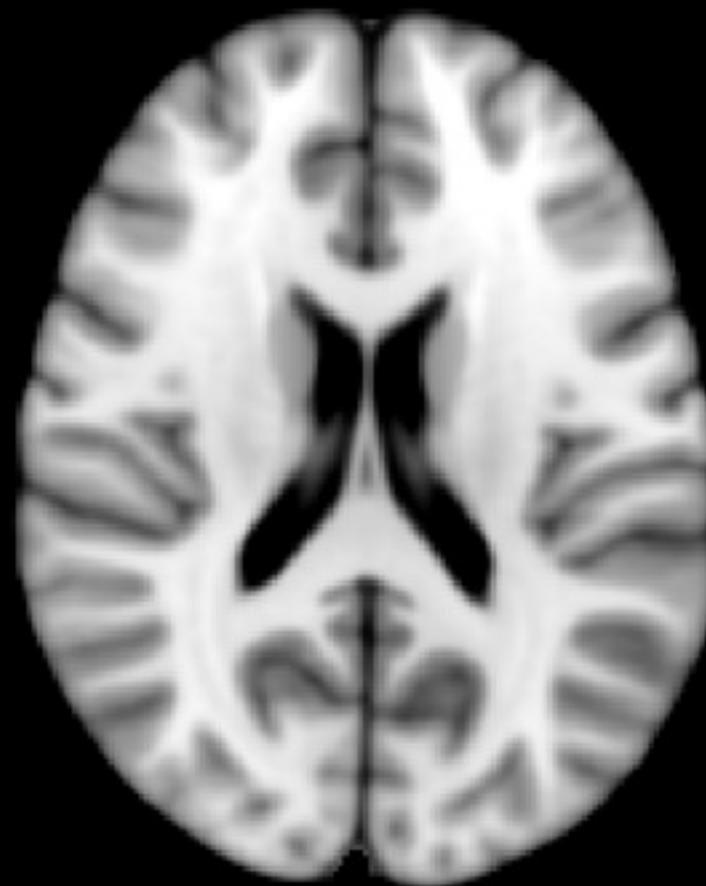
*Elhawary H., Norton I., Liu H., Patel P., Rigolo L., Papademetris X., Hata N., Golby AJ*

Video Supplement

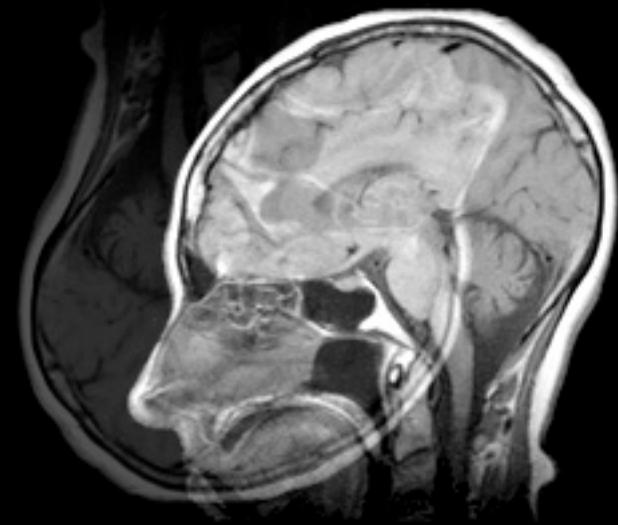
# Esquema del Circuito



# Esquema del Circuito



# Artefactos

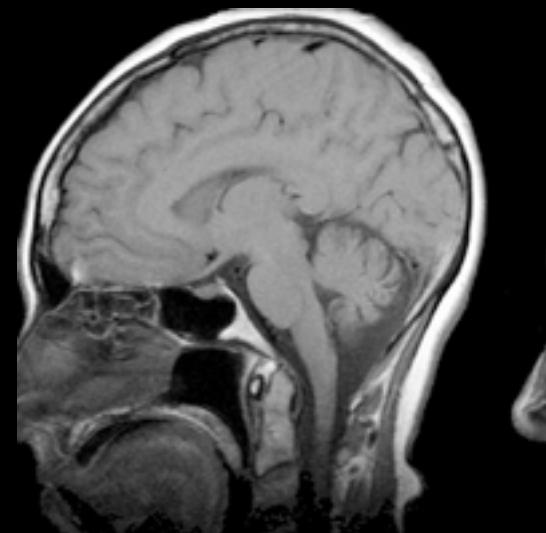


(c) BMRI, ILS

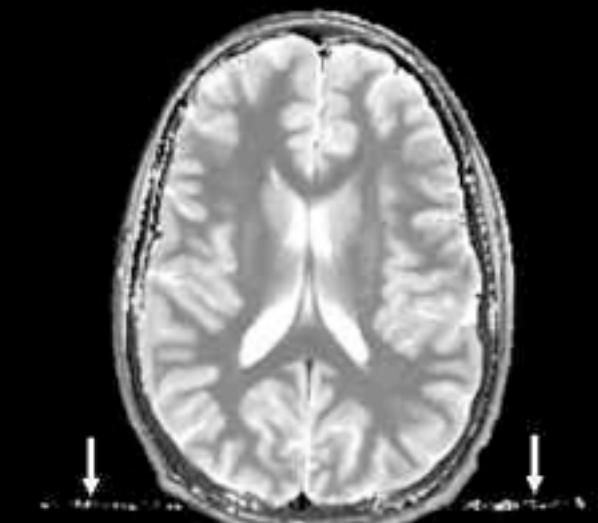
Problemas de  
Corriente Continua



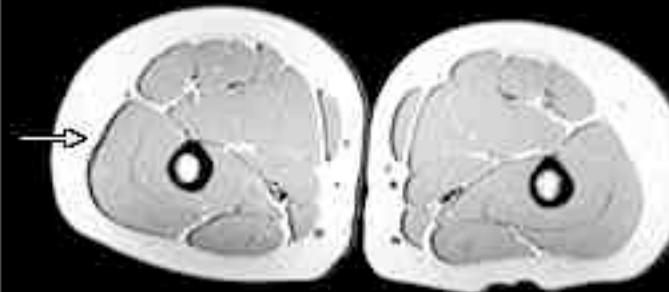
Homogeneidad del Campo  
Magnético de Base



Campo de Vista  
(Wraparound)



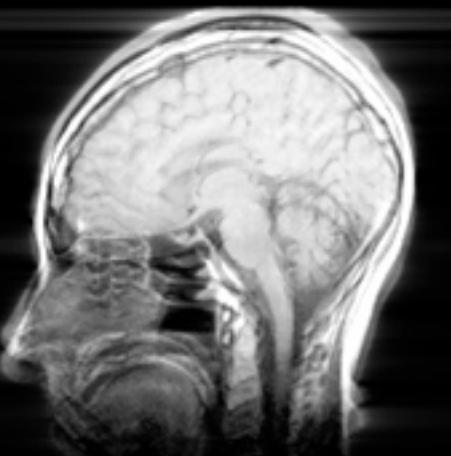
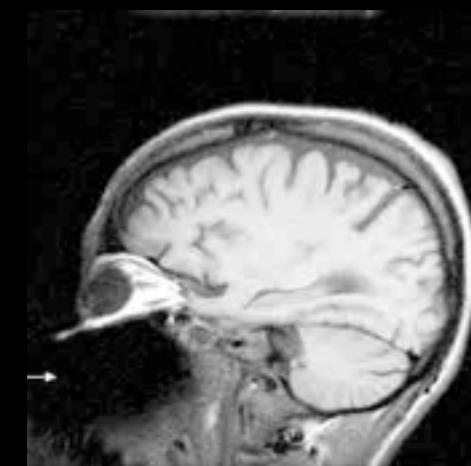
Movimiento  
(flujo sanguíneo)



Desplazamiento Químico



Homogeneidad de  
Radiofrecuencias



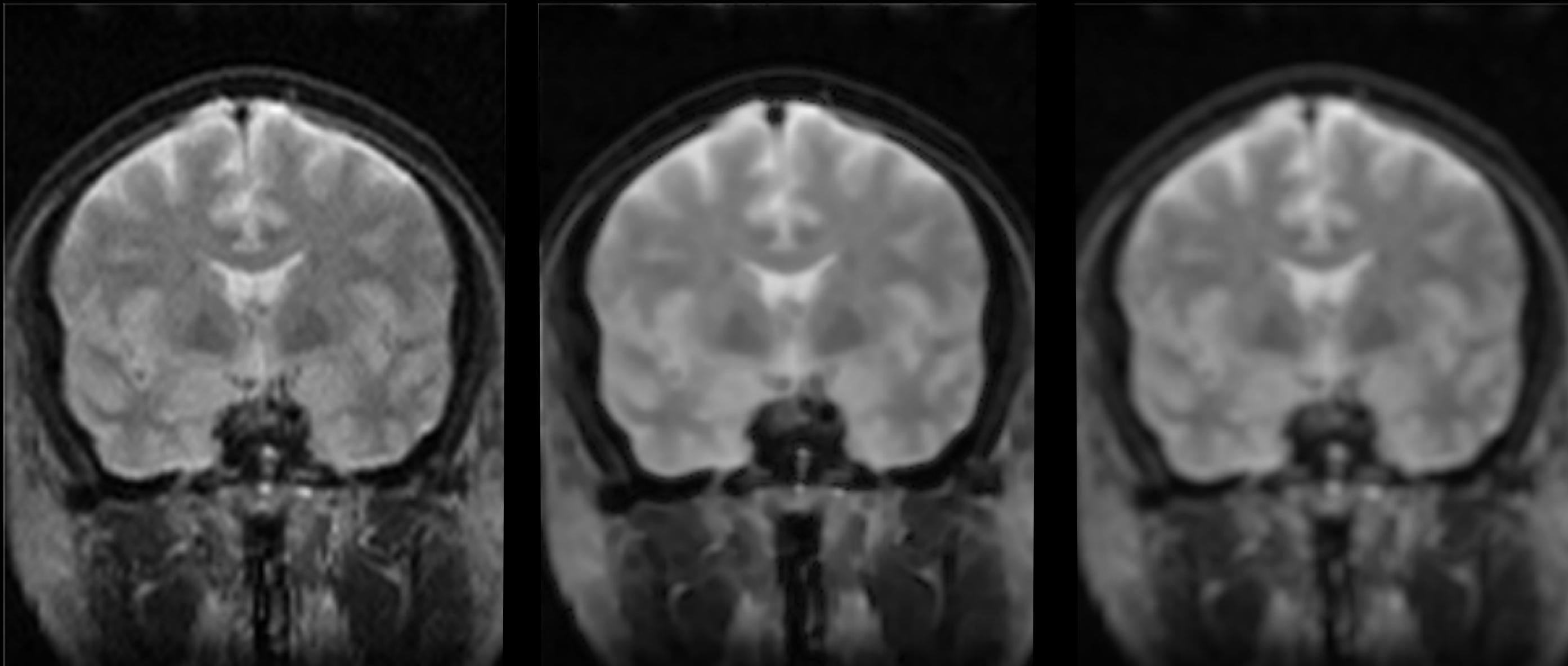
Movimiento

# Distintas Disciplinas

- Estimación del Ruido y Eliminación
- Detección Automática de Estructuras
- Registración
- Reconstrucción
- Realidad Aumentada

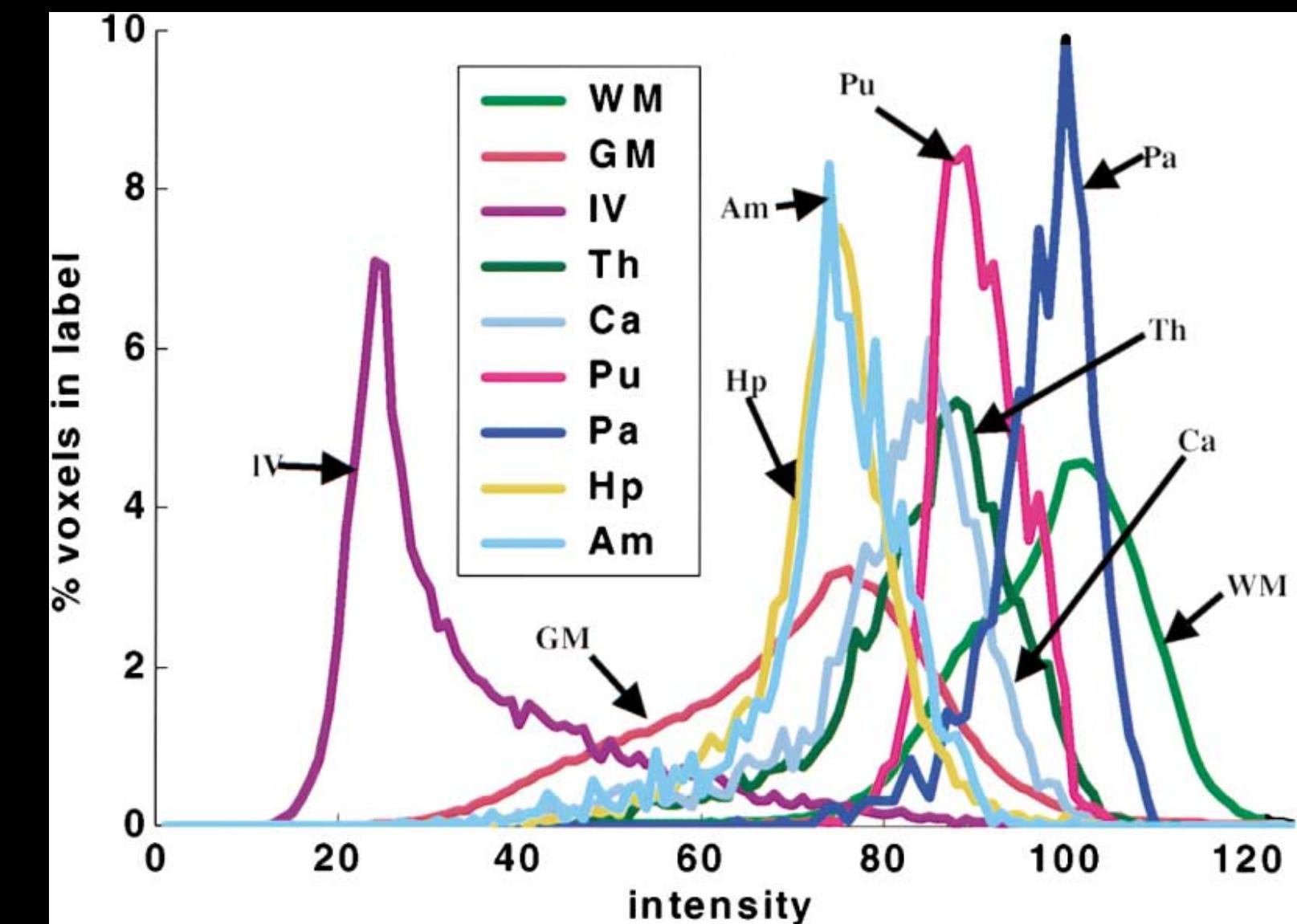
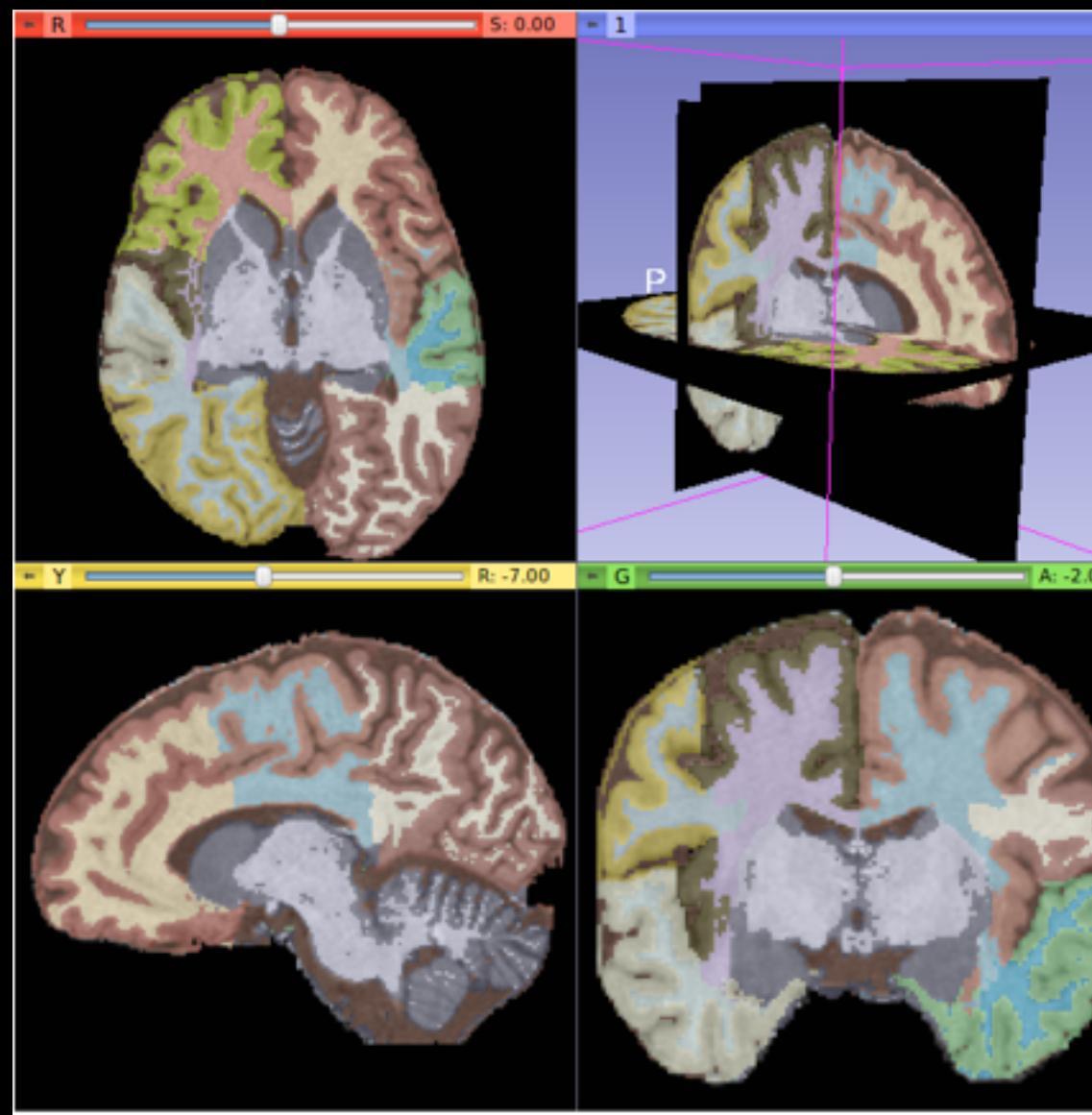
# Distintas Disciplinas

## Estimación de Ruido y Limpiado



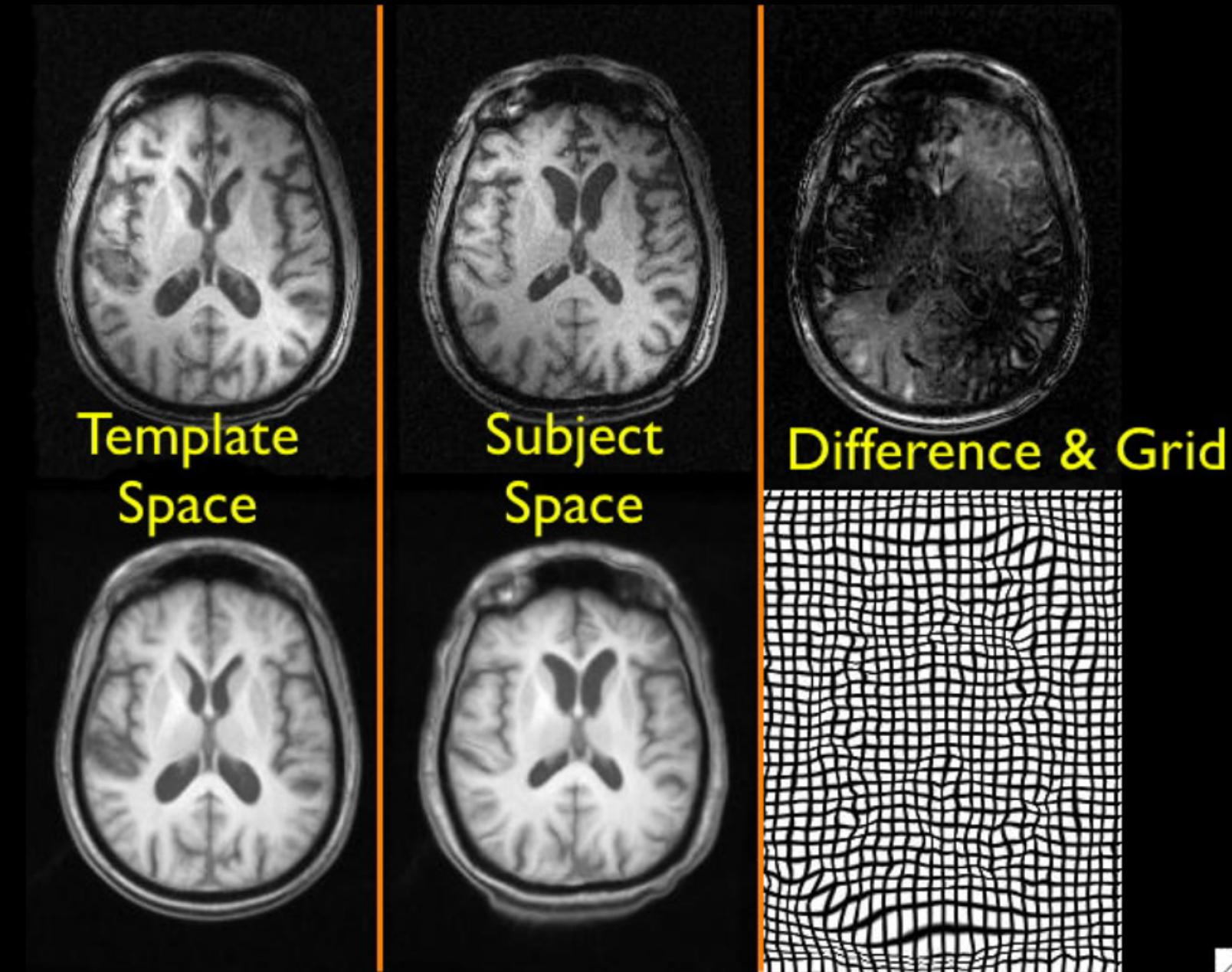
# Distintas Disciplinas

## Detección Automática de Estructuras

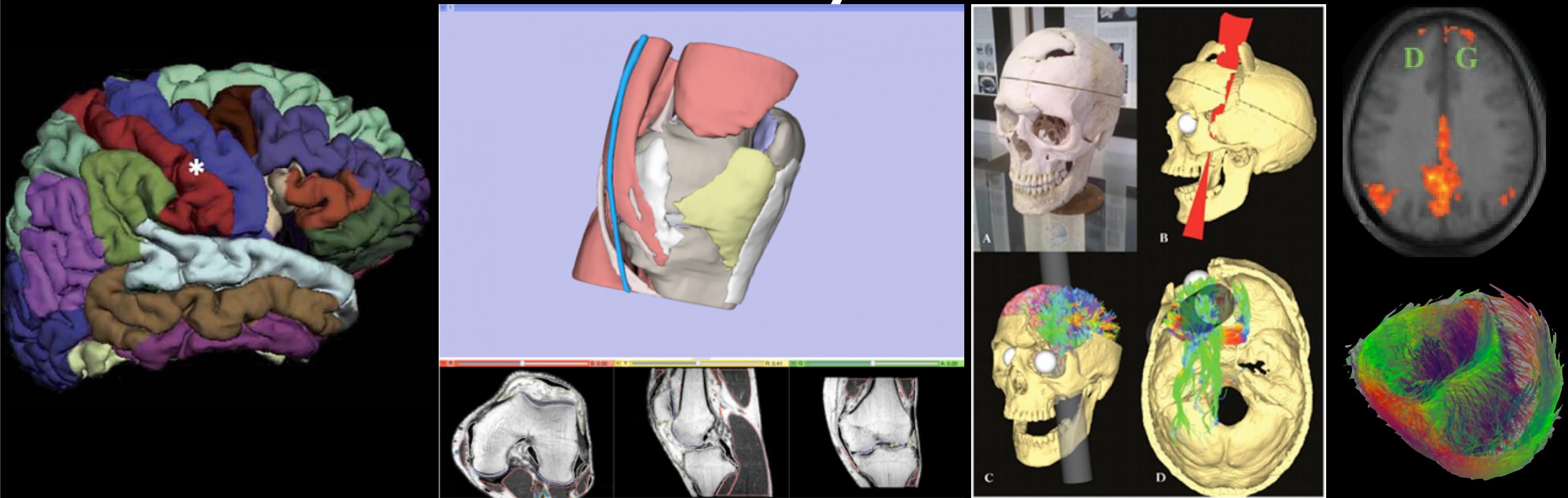


# Distintas Disciplinas

## Registración

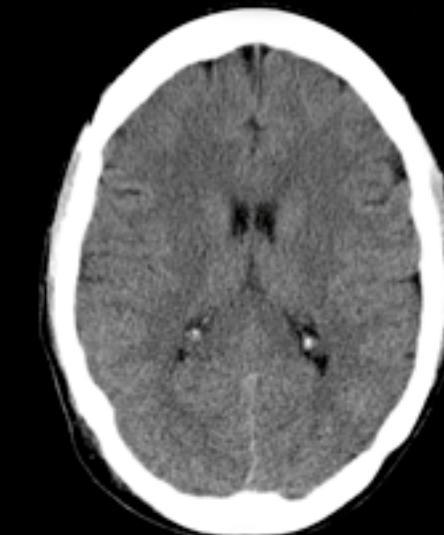


# Distintas Disciplinas Reconstrucción y Visualización



# Diferentes Modalidades

Imágenes Anatómicas



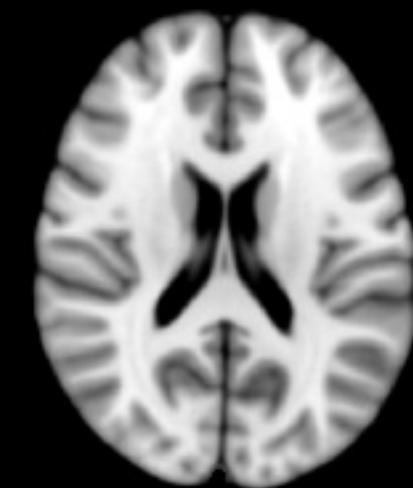
TC

Imágenes Funcionales

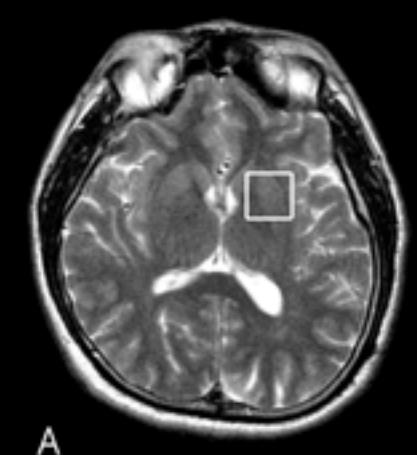


Ultrasonido

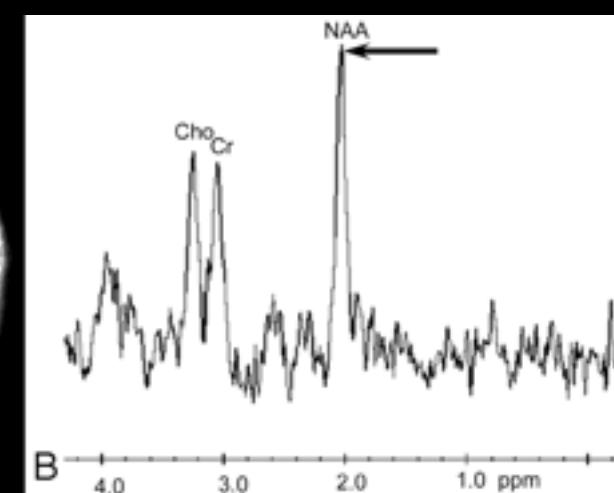
Espectroscopías



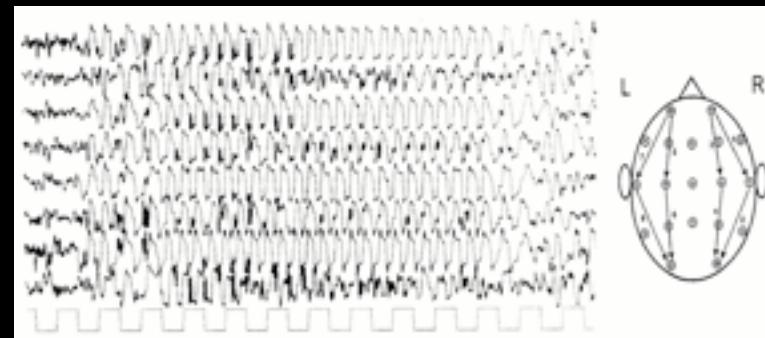
MRI



A

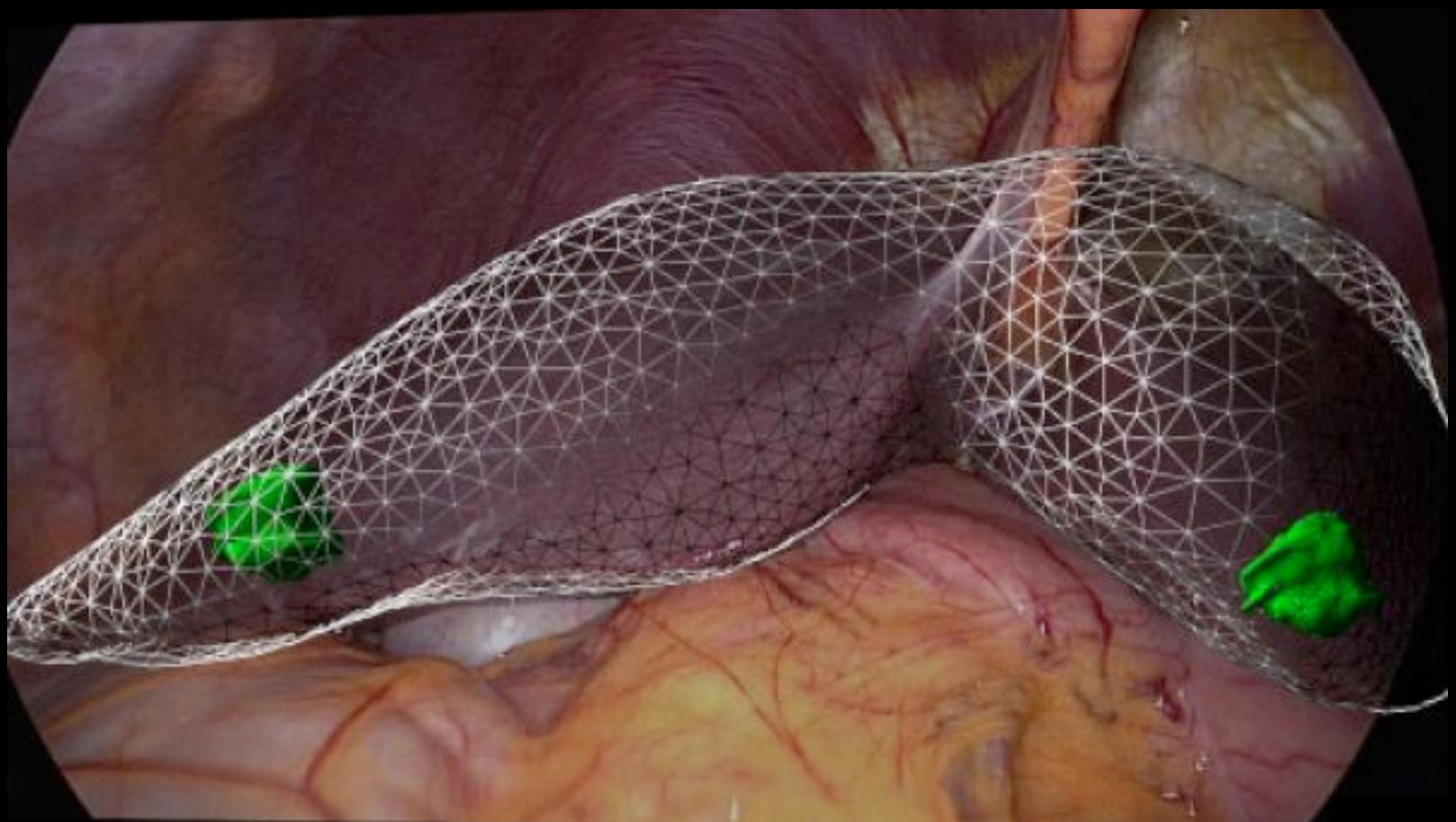


Espectroscopías MRI



EEG

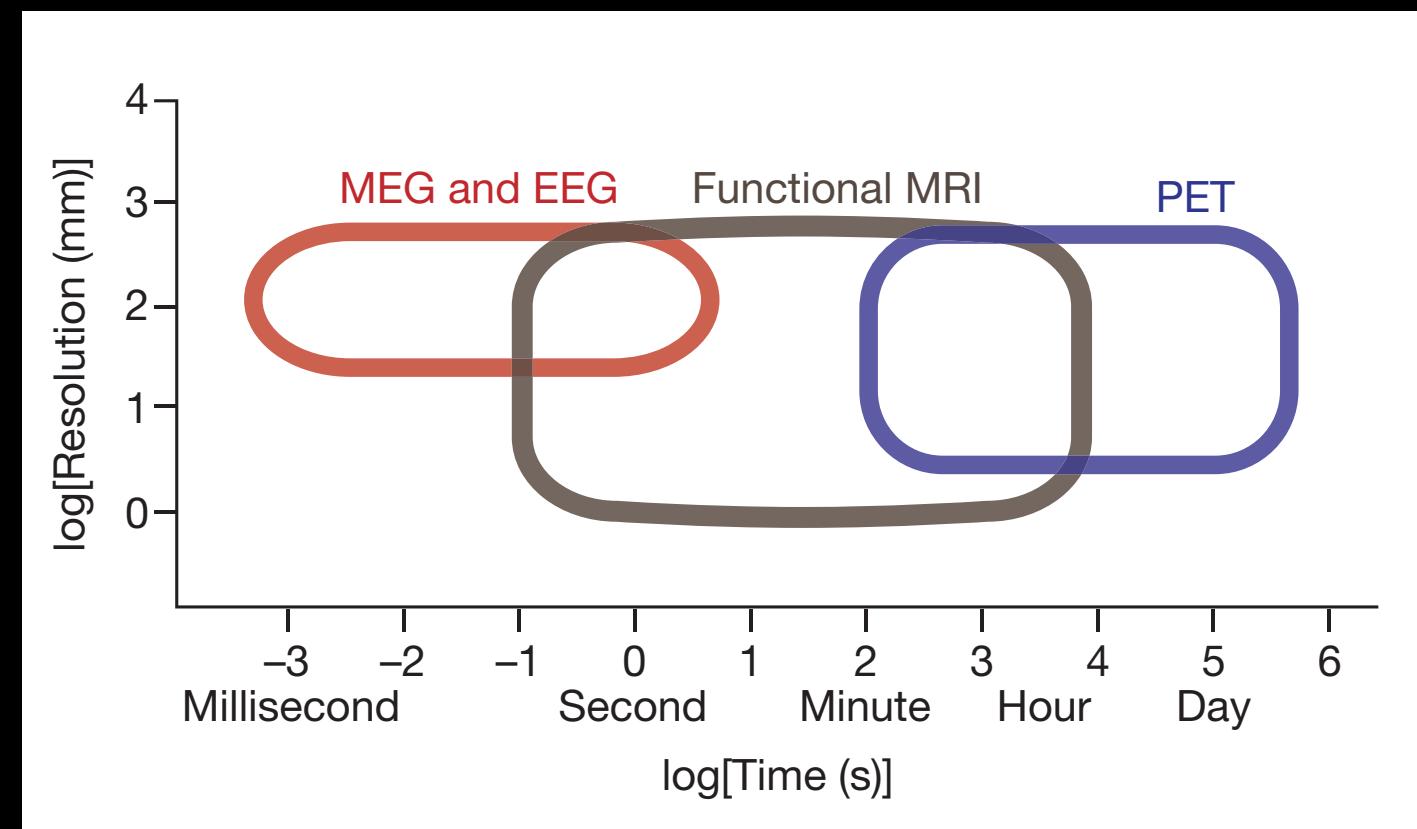
# Realidad Aumentada y Planificación



Asistencia en cirugía Hepática  
(Equipo Shacra - INRIA, Francia)

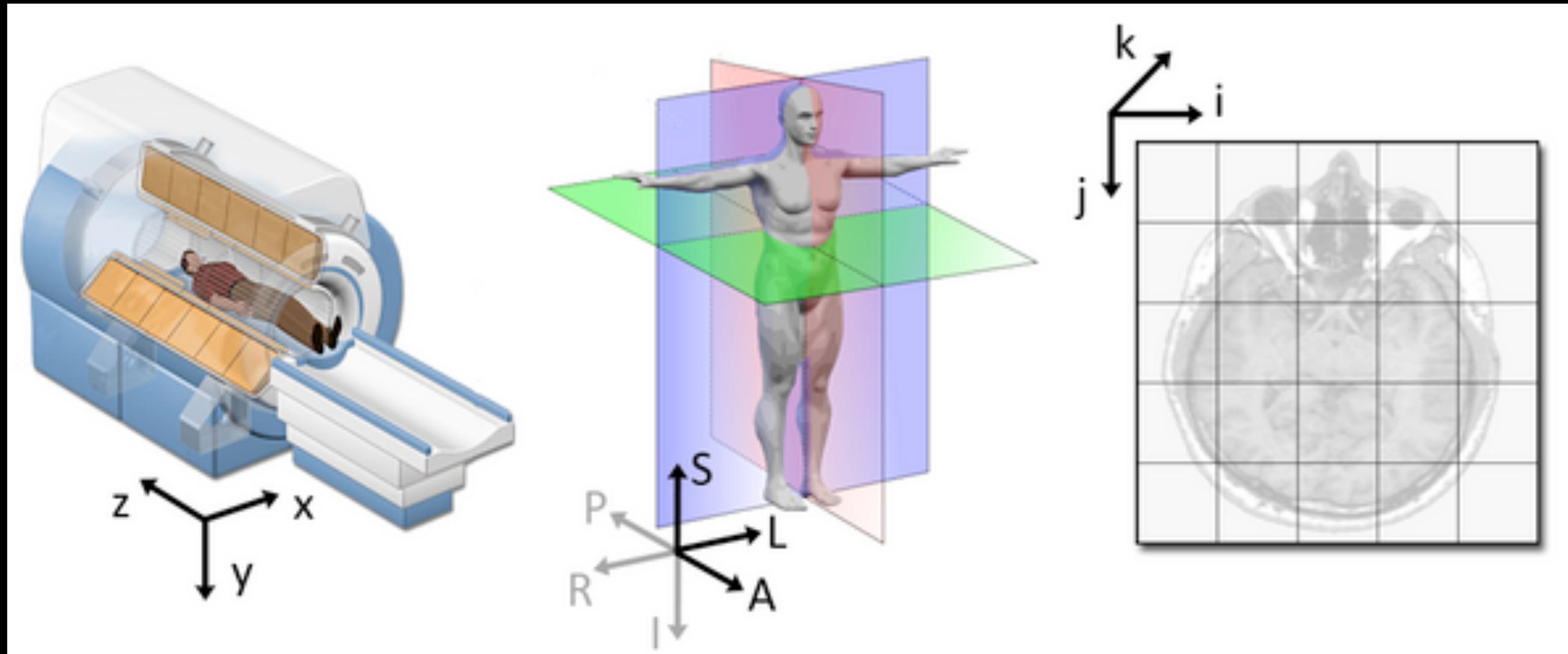
Simulación Biomecánica Cerebral  
(Equipo Shacra - INRIA, Francia)

# Diferentes Modalidades

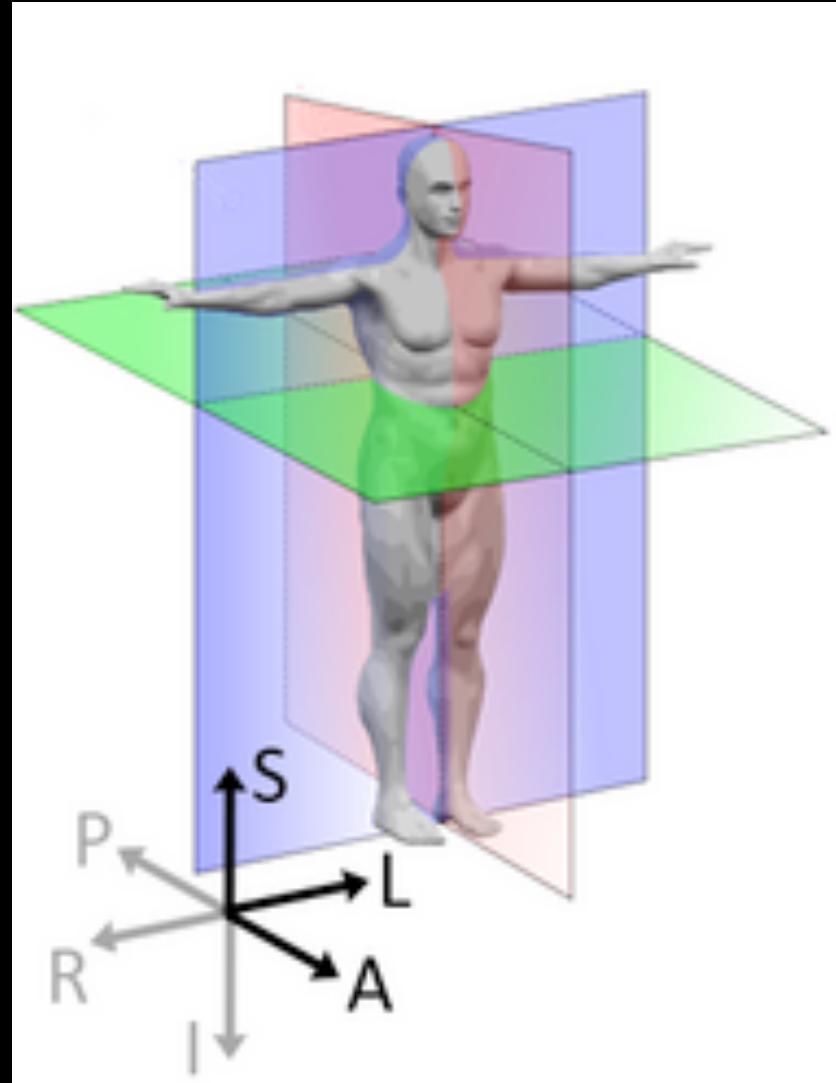


Imágenes Funcionales

# Sistemas de Coordenadas

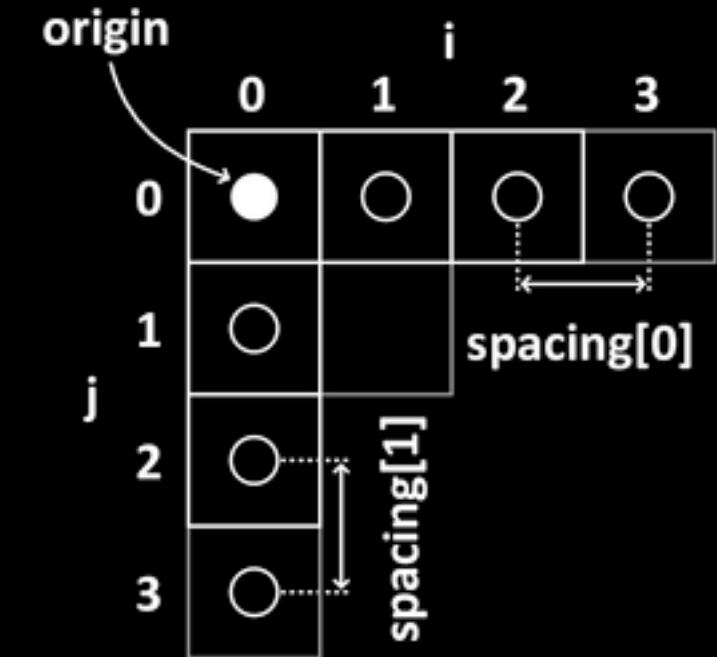


# Sistemas de Coordenadas Del Sujeto al Voxel



$RAS = \begin{cases} \text{from left towards right} \\ \text{from posterior towards anterior} \\ \text{from inferior towards superior} \end{cases}$

$LPS = \begin{cases} \text{from right towards left} \\ \text{from anterior towards posterior} \\ \text{from inferior towards superior} \end{cases}$



$$\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} A_{11} & A_{12} & A_{13} \\ A_{21} & A_{22} & A_{23} \\ A_{31} & A_{32} & A_{33} \end{pmatrix} \begin{pmatrix} i \\ j \\ k \end{pmatrix} + \begin{pmatrix} t_1 \\ t_2 \\ t_3 \end{pmatrix}$$

# Ecuación Rectora

$$P(R|I) = P(R) \cdot P(I|R) / P(I)$$

Conocimiento *a posteriori*; Conocimiento *a priori*;  
Verosimilitud; Evidencia

Solución Buscada:

R tal que  $P(R|I)$  sea máximo  
o el *máximo a posteriori*

Conexión con Optimización

$$E(R;I) = -\log P(R) - \log P(I|R) + \log P(I)$$

# Ecuación Rectora

$$E(.) = \text{Similaridad}(.) + \text{Regularidad}(.)$$

Limpiado

$$E(L) = \text{Similaridad}(I,L) + \text{Regularidad}(L)$$

Registración

$$E(t) = \text{Similaridad}(t(M), T) + \text{Regularidad}(t)$$