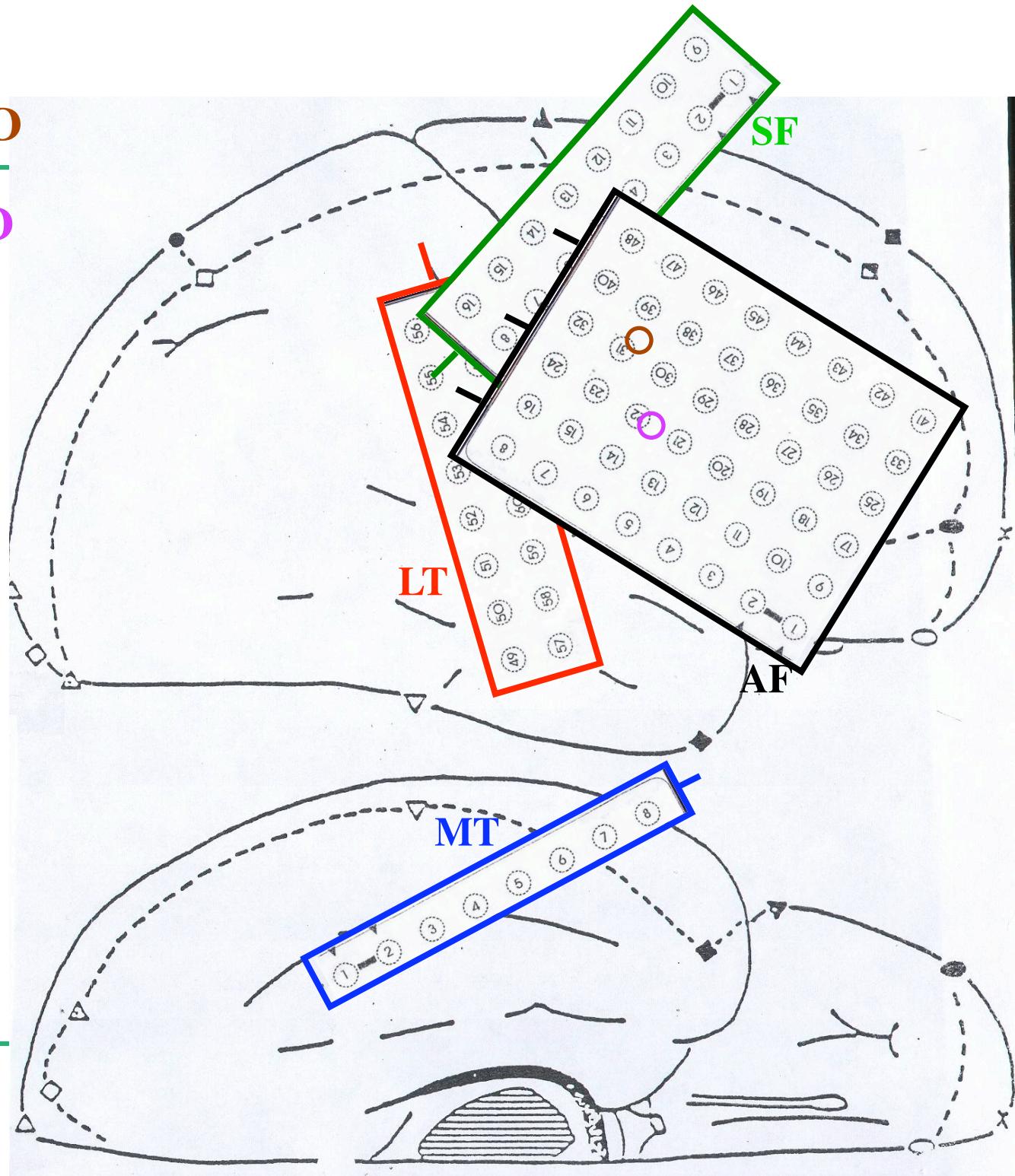
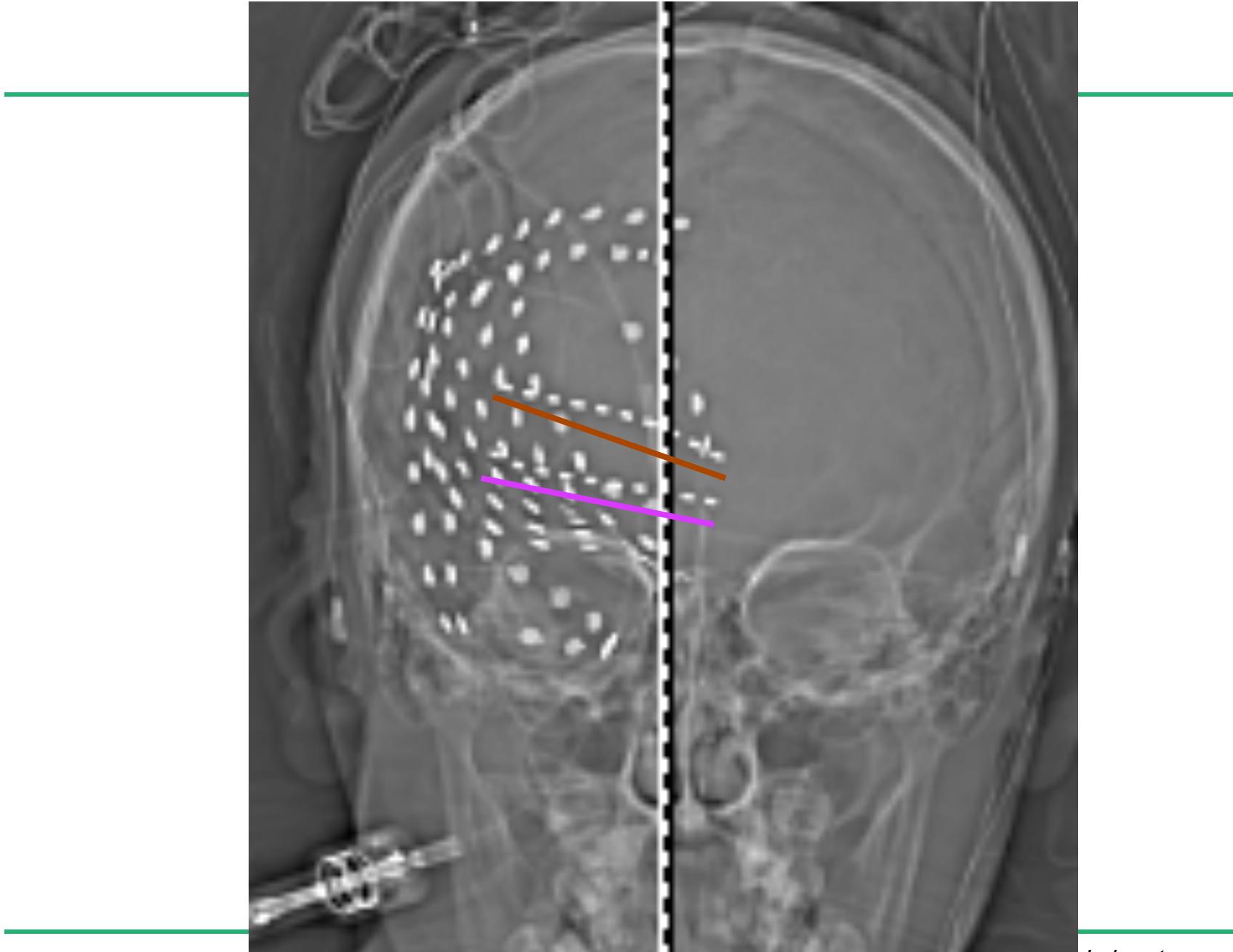


OSD
—
ID

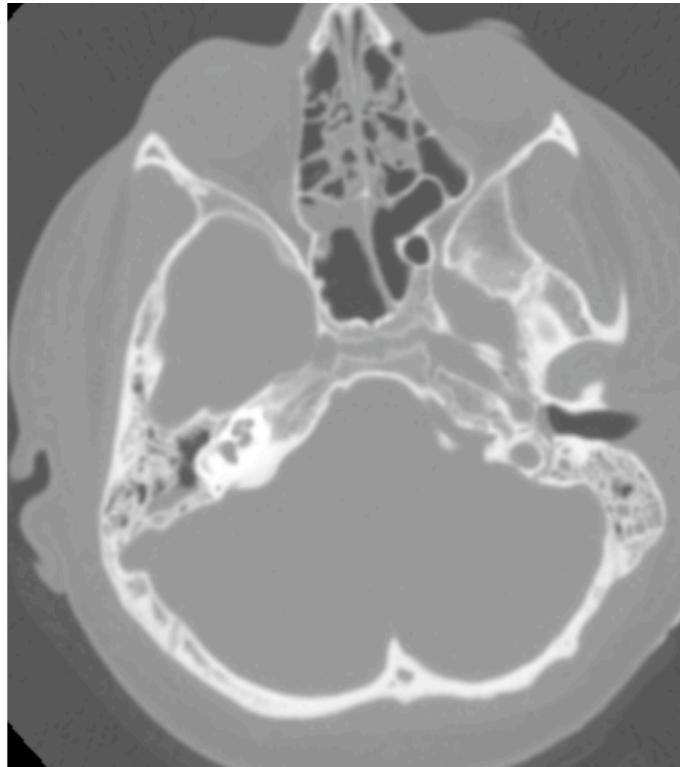




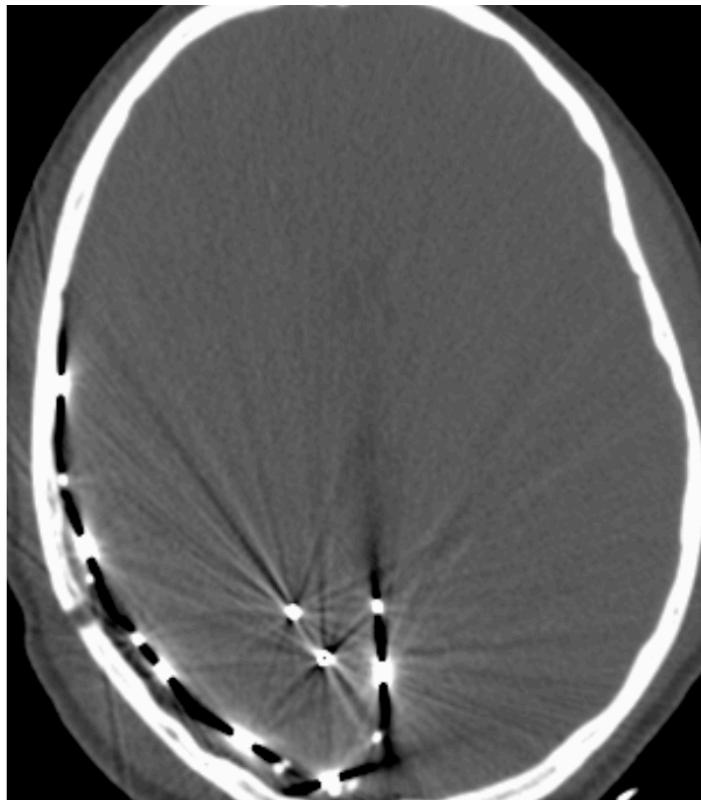


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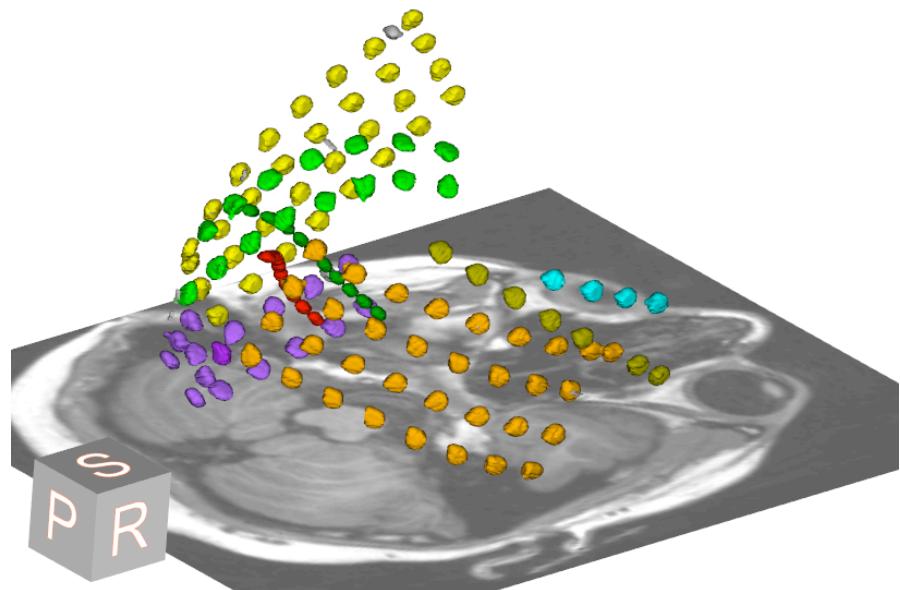
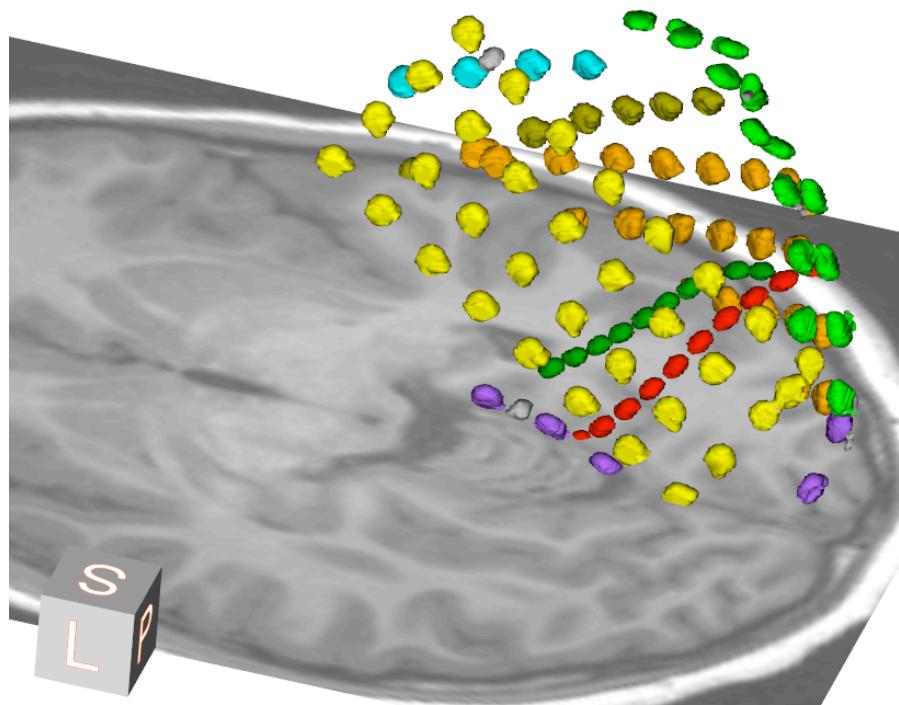
CT with strip/grid/depth electrodes



CT and preop MRI fusion



3D visualization of electrodes



EEG/MEG Source Imaging

- Noninvasive measurements



128 channel EEG

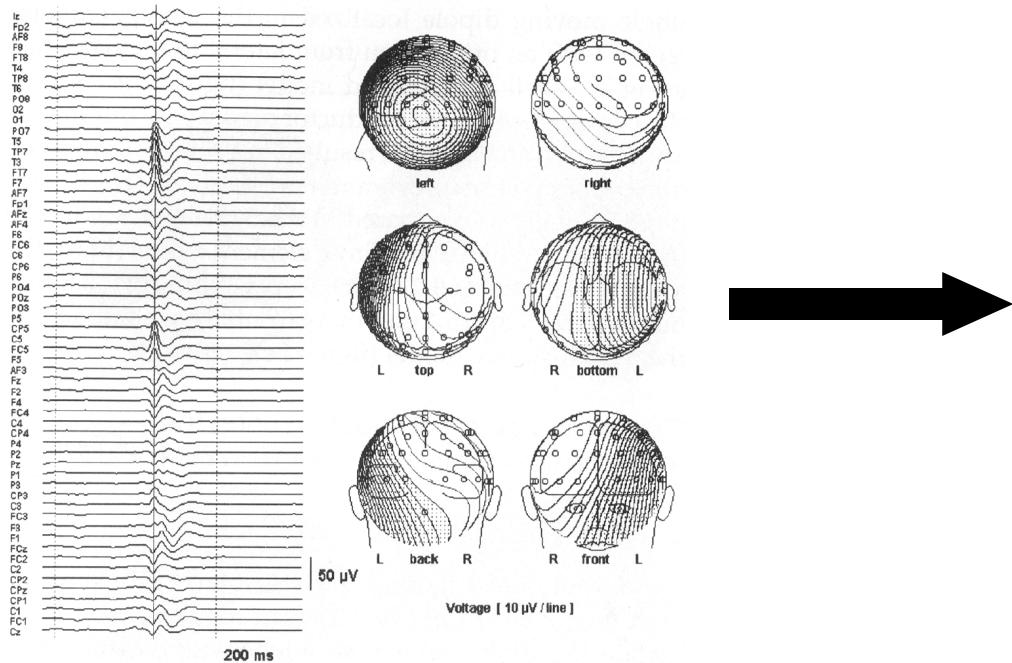


MEG

EEG/MEG Source Reconstruction

Measure EEG and/or MEG.

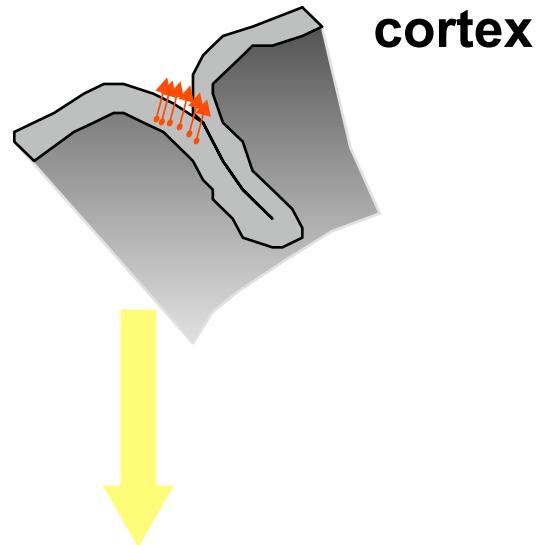
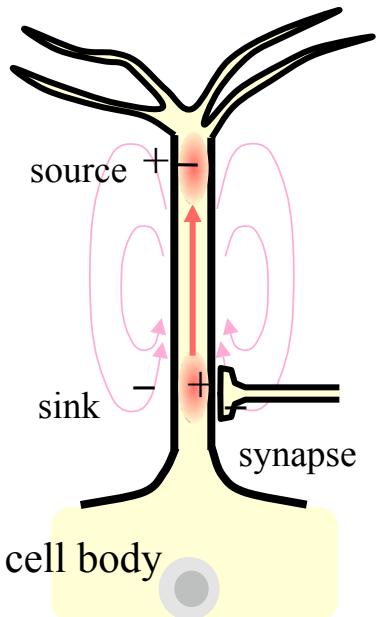
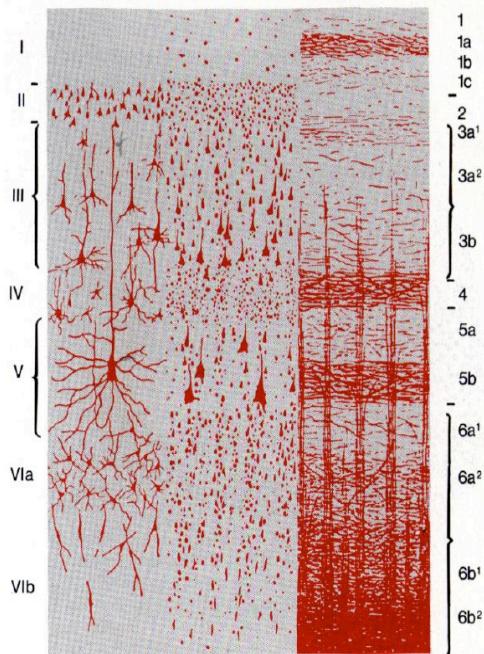
Reconstruct the current distribution.



EEG/MEG inverse problem

The source model

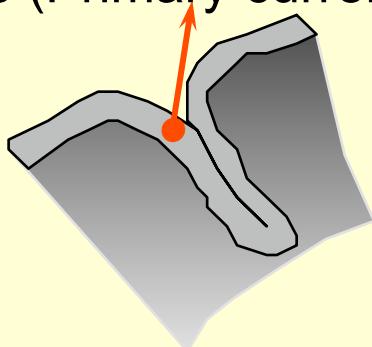
Microscopic current flow ($\sim 5 \times 10^{-5}$ nAm)



Equivalent Current Dipole (Primary current) (~ 50 nAm)

parameters:

position : x, y, z
direction : θ, ϕ
magnitude : μ



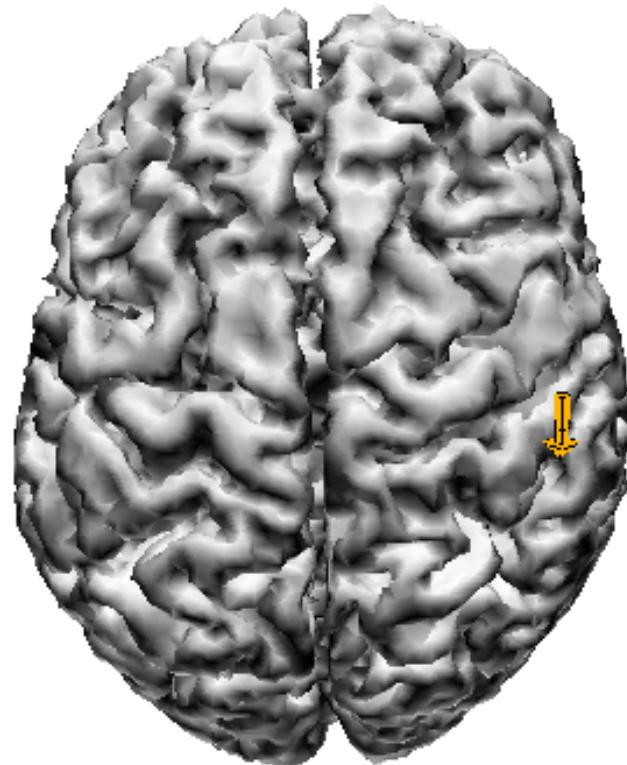
Size of Macroscopic Neural Activity

$\sim 30 \text{ mm}^2 = 5.5 \times 5.5 \text{ mm}^2$

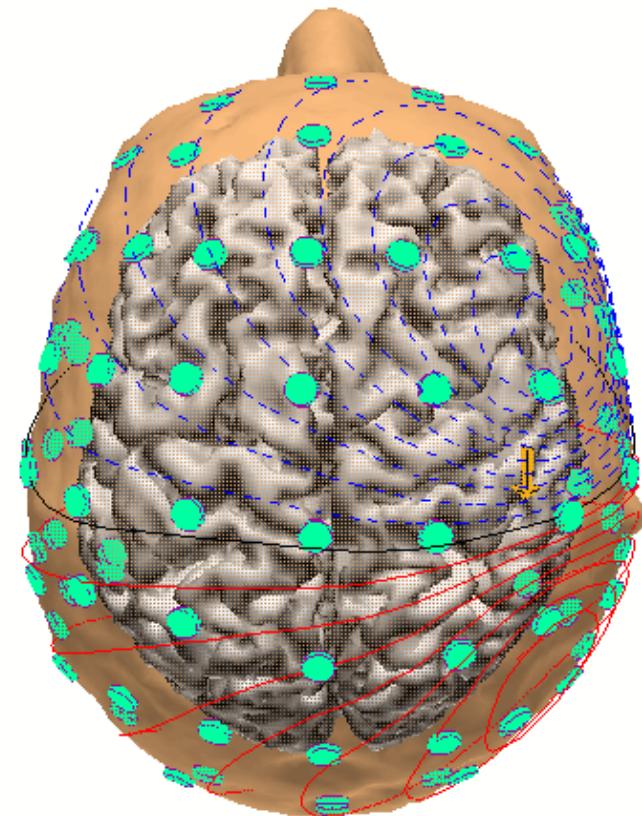
Bioelectromagnetic field simulation

Place a dipole

Compute the EEG



Simulate
quasistatic
Maxwell
equations.

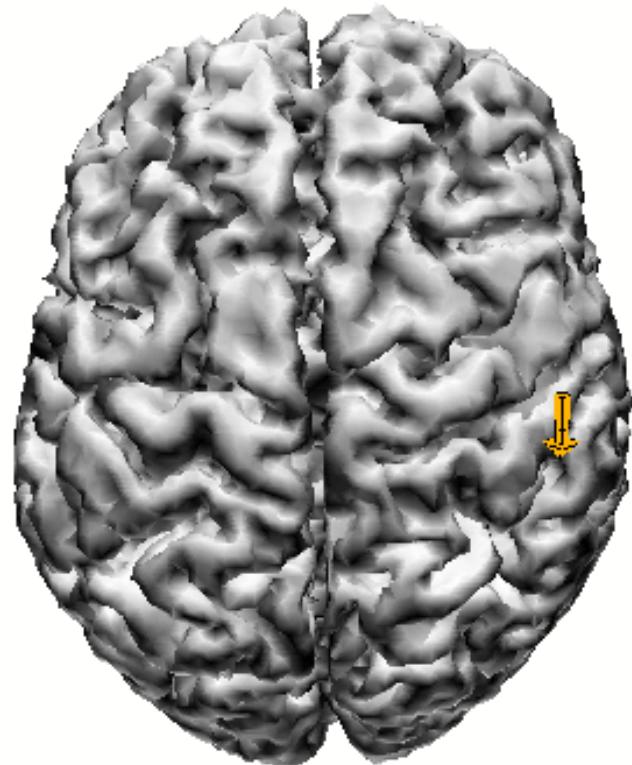


EEG forward problem

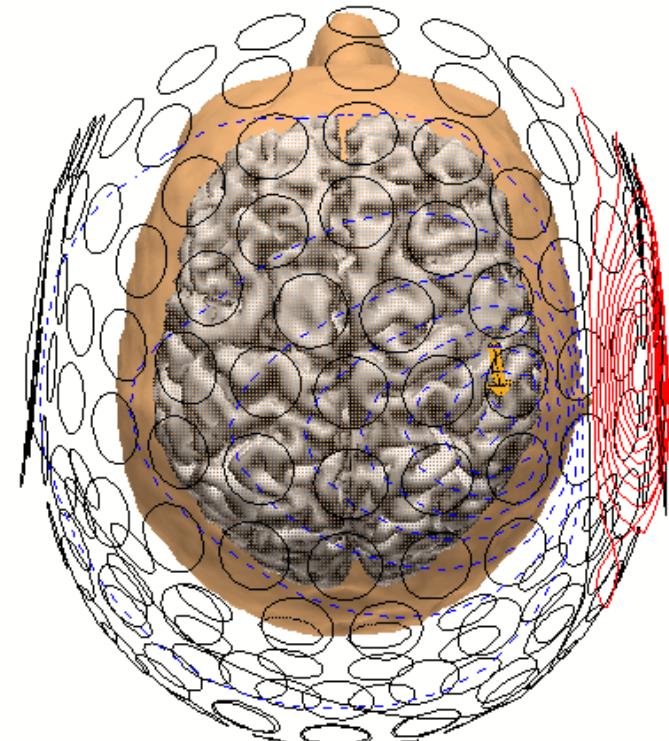
Bioelectromagnetic field simulation

Place a dipole

Compute the MEG

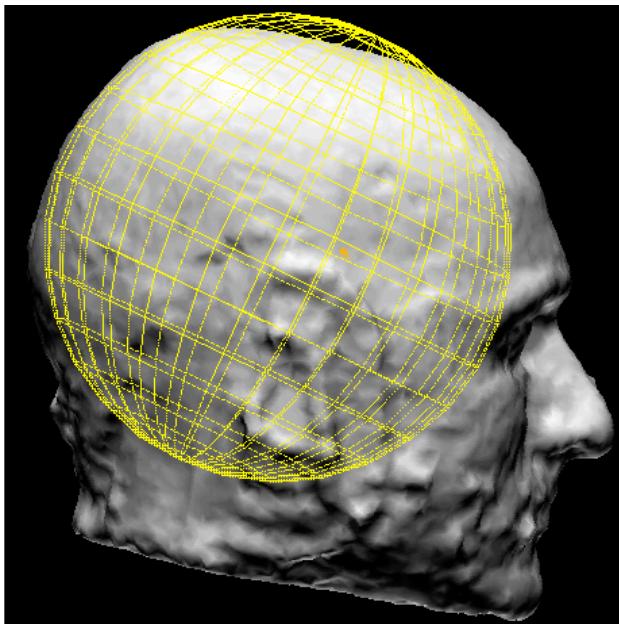


Simulate
quasistatic
Maxwell
equations.

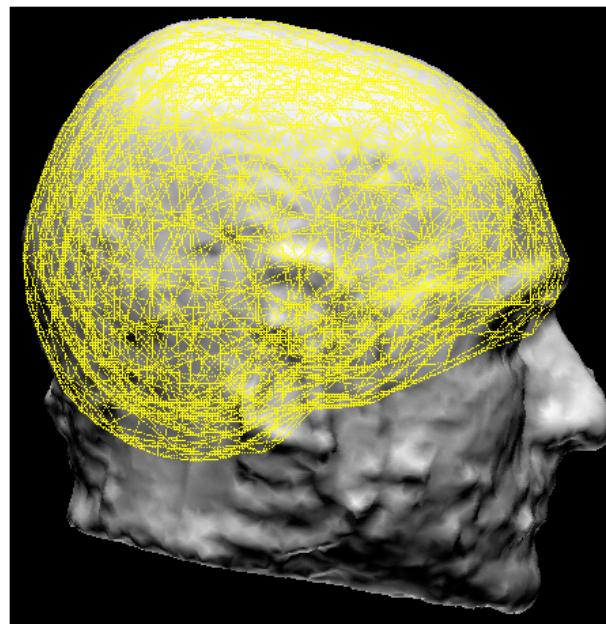


MEG forward problem

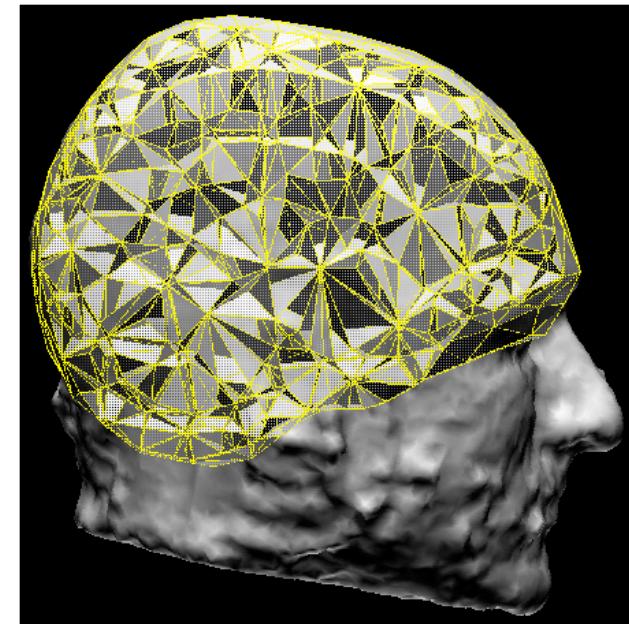
The forward problem: Volume conductor modeling



3 Shell



Boundary Element (BE)



Finite Element (FE)

	Geometry	Conductivity
Skin	unrealistic	unreal.
Skull	unreal.	unreal.
CSF	unreal.	unreal.
GM	unreal.	unreal.
WM	unreal.	unreal.

	Geometry	Conductivity
Skin	realistic	realistic
Skull	realistic	unrealistic
CSF	unrealistic (1 isotropic value)	
GM		
WM		

	Geometry	Conductivity
Skin	realistic	realistic
Skull	realistic	realistic
CSF	realistic	realistic
GM	realistic	realistic
WM	realistic	realistic