

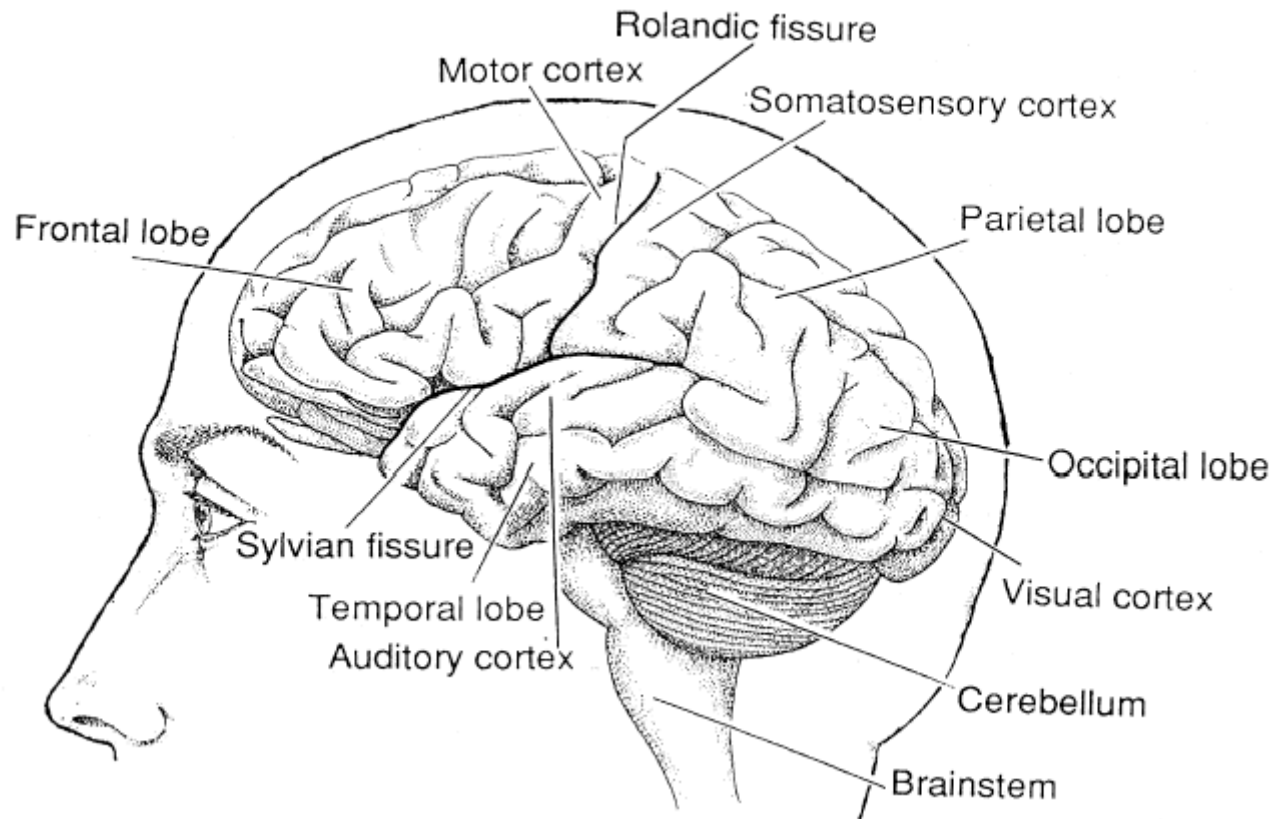
# Introdução ao Biomagnetismo

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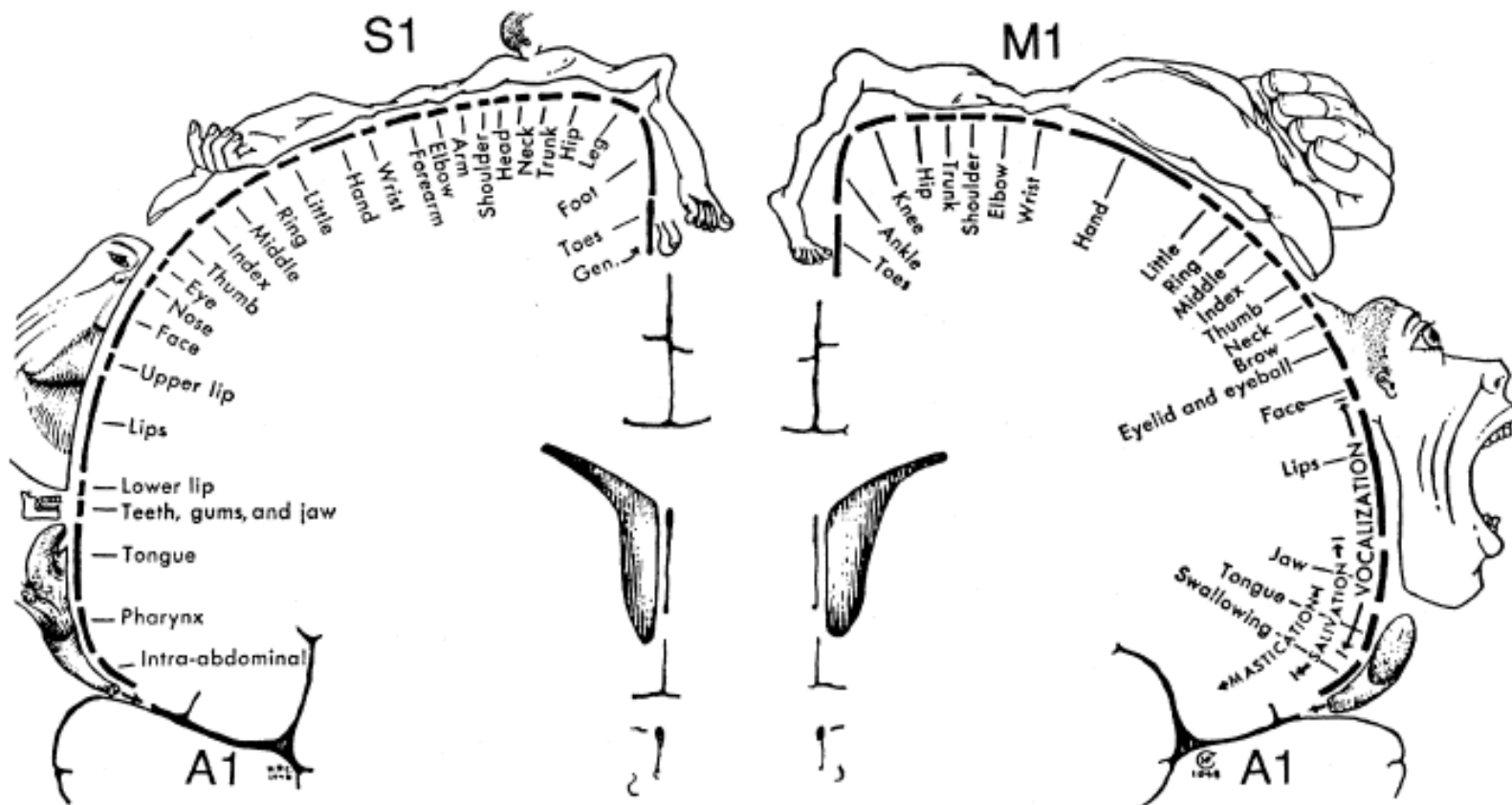
Oswaldo Baffa Filho  
Departamento de Física-FFCLRP  
Universidade São Paulo  
Aula # 7 MEG

*Esse material se destina a uso interno e educacional e não deve ser compartilhado. Fica proibida a sua distribuição sob qualquer forma, assim como a postagem em redes sociais, em sites da internet, e equivalentes.*

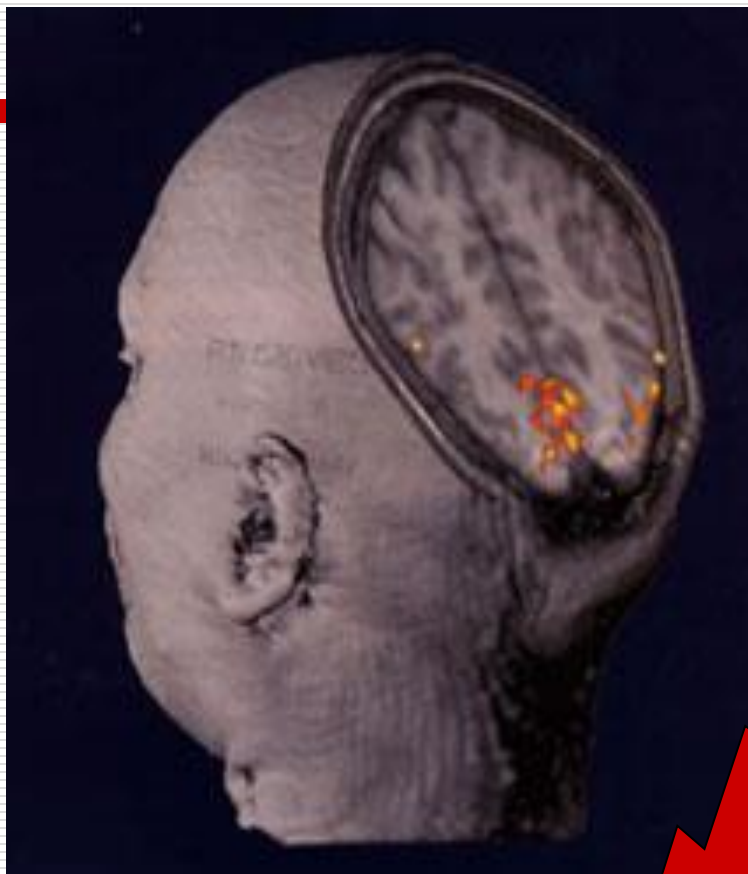
# Vista do cérebro- lado esquerdo



# Córtex somatosensorial (S1) e motor (M1)

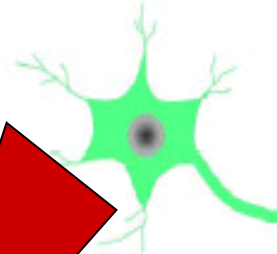
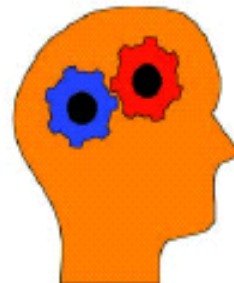


# Métodos não invasivos para localizar a atividade neuronal: fMRI, EEG e MEG



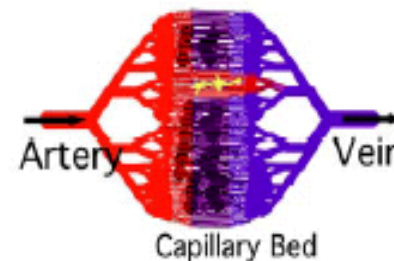
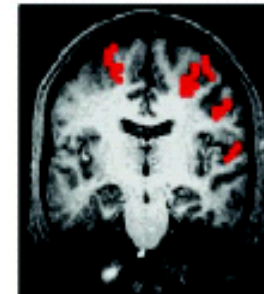
Belliveau et al. Science 1991

Stimulation/Task



Neural Activity

Functional Map



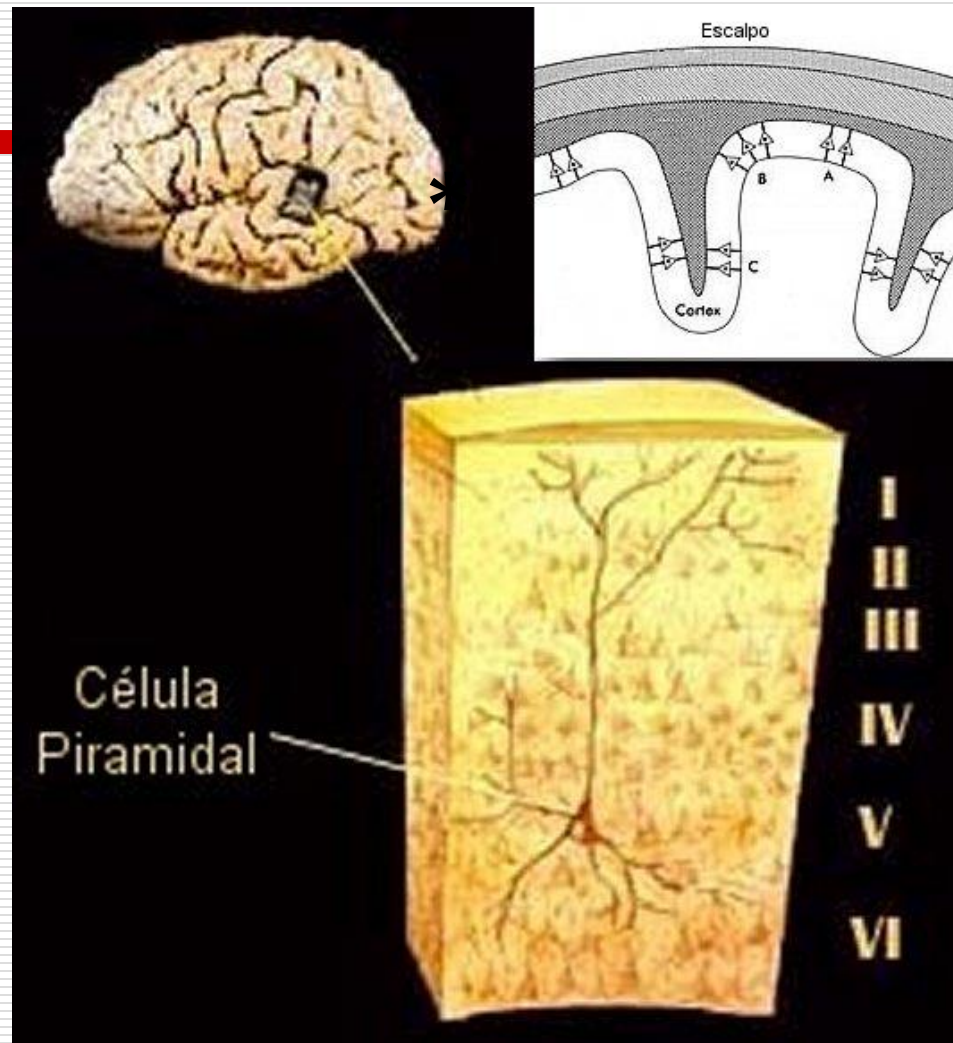
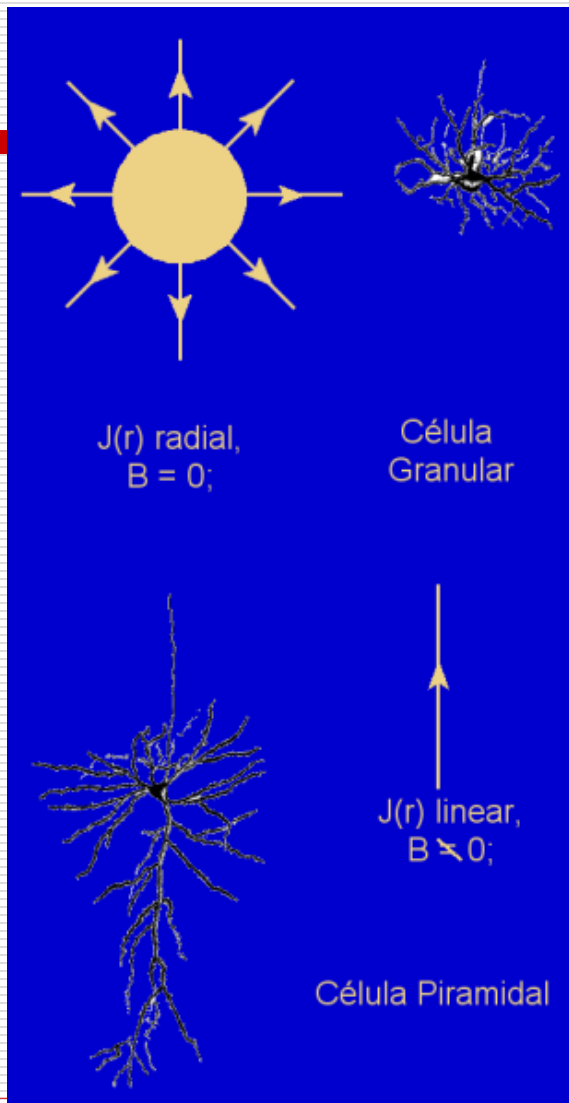
Vascular Response

Fig. 1. Schematic chain of processes from behavior to functional mapping.

Kim, PNAS, 2003

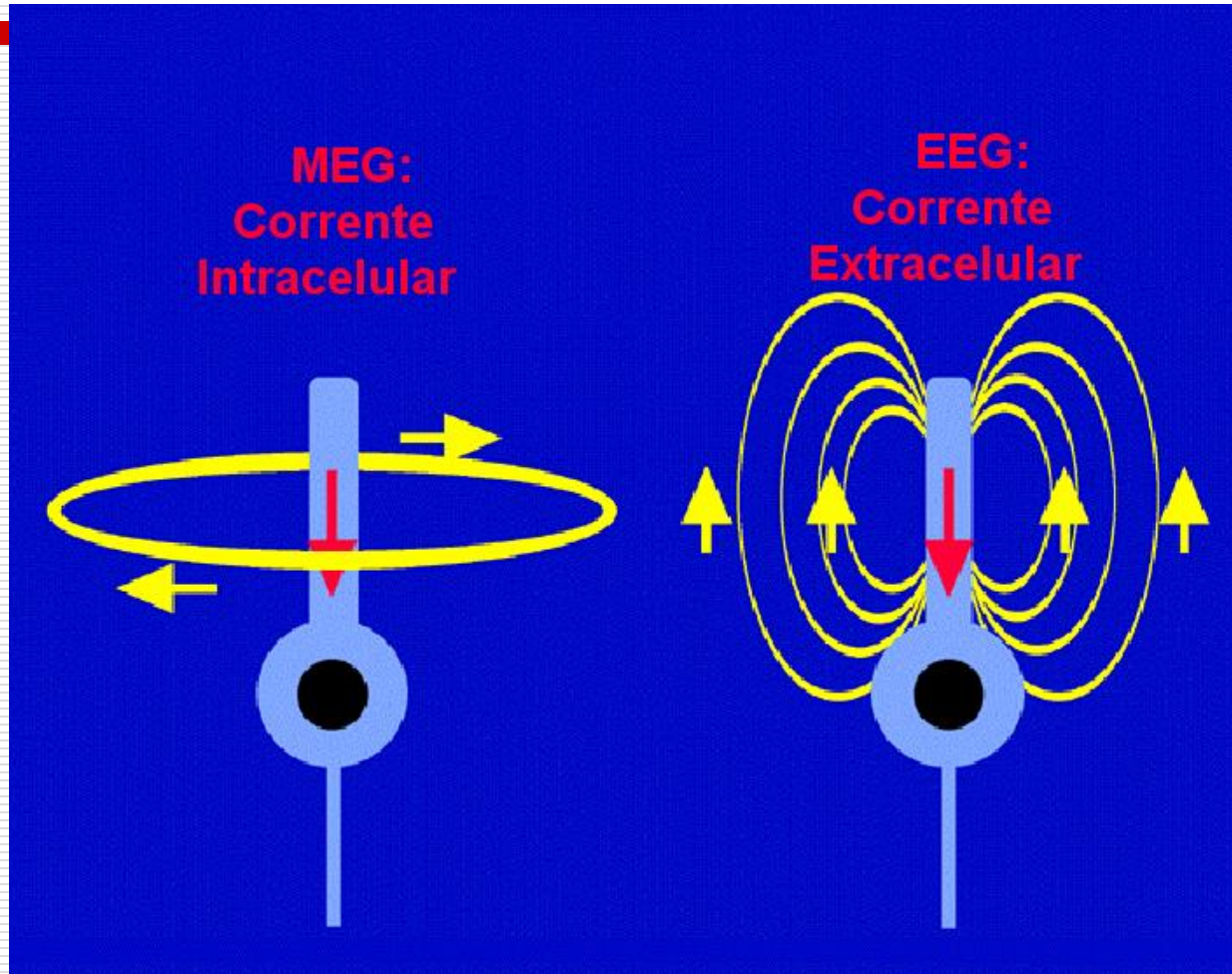
**MEG e EEG**

# Arquitetura Celular → Fontes

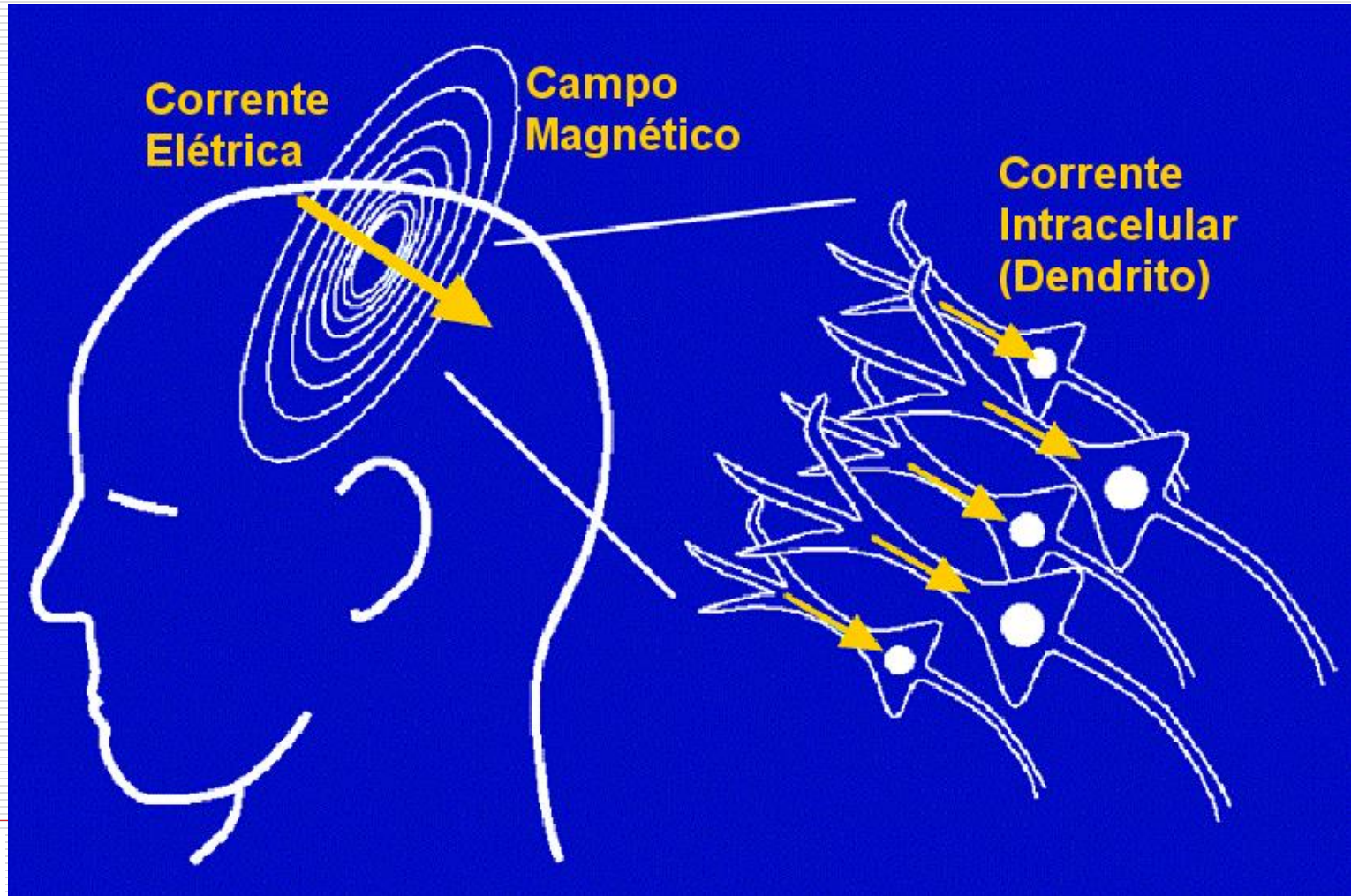


\*Modificado de Bear, F.M.; Connors, B.W e Paradiso, M.A. - Structure of the Nervous System, *Neuroscience. Exploring the Brain*

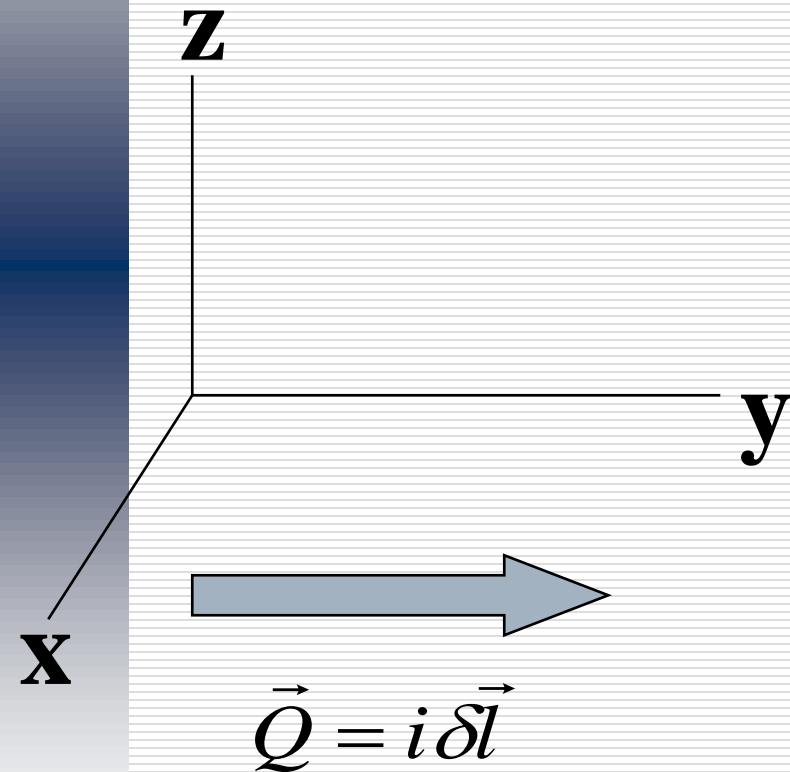
# Fontes do MEG e EEG (<http://www.ctf.com/>)



# Magnetoencefalografia (MEG)



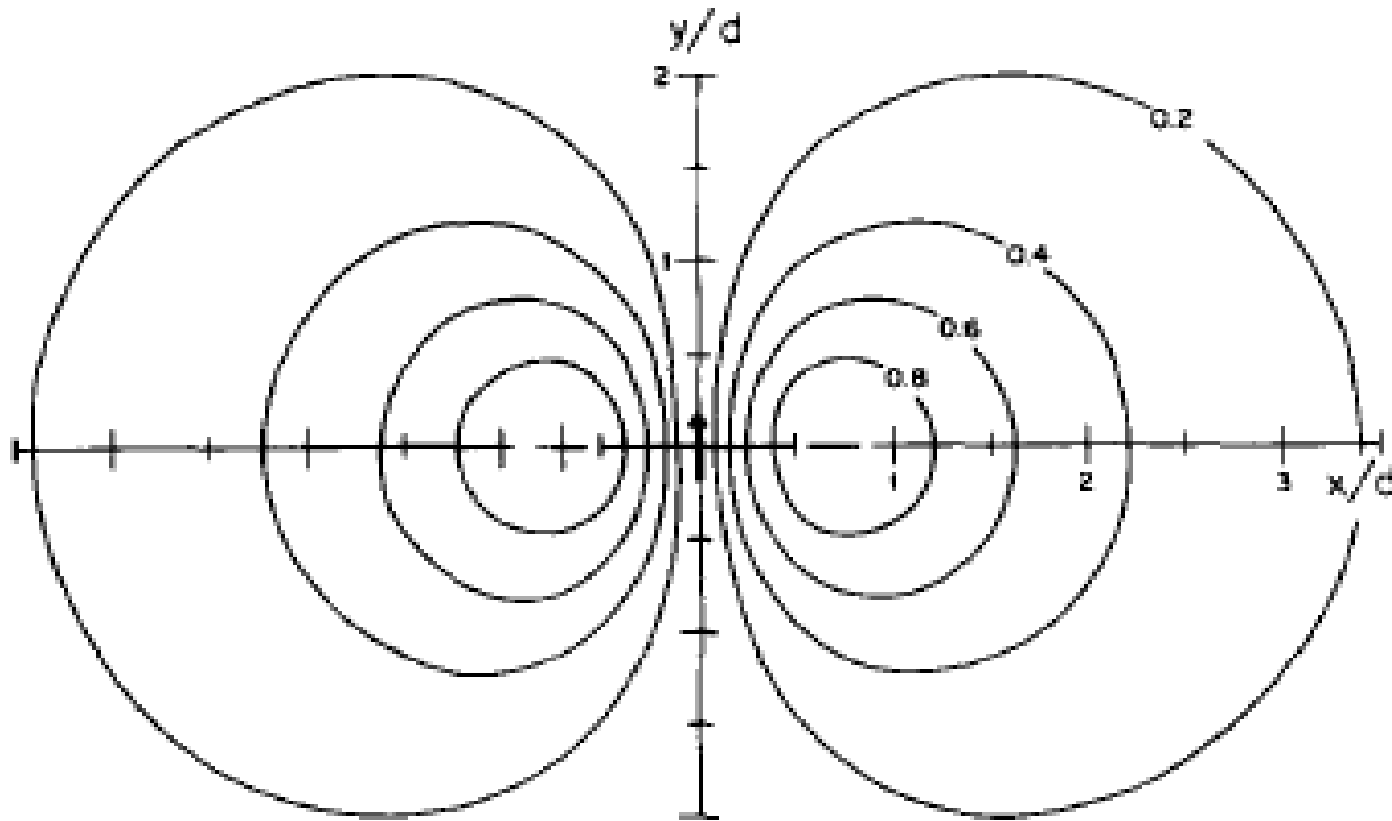
# Campo Magnético de um Dipolo de Corrente



$$B_z = \frac{\mu_0 Q}{4\pi d^2} \frac{x}{(1 + x^2 + y^2)^{3/2}}$$

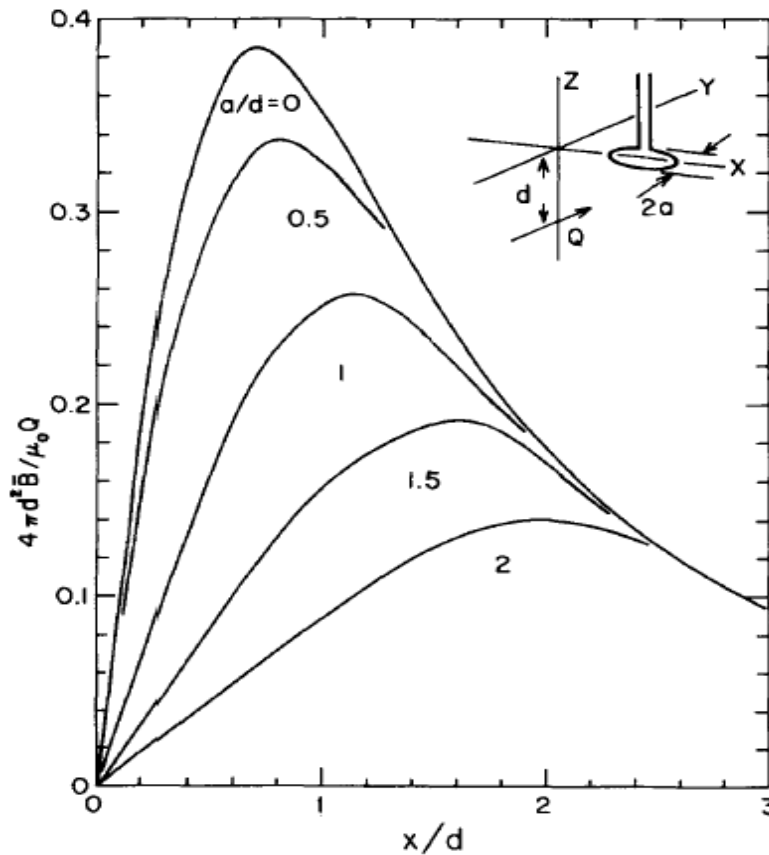


# Campo Magnético de um Dipolo de Corrente



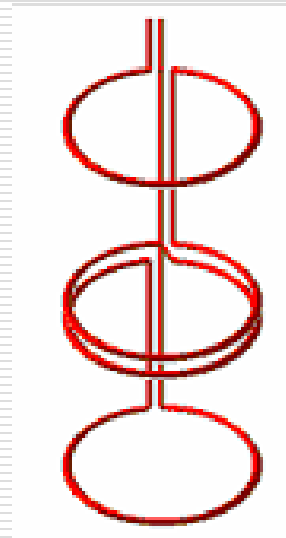
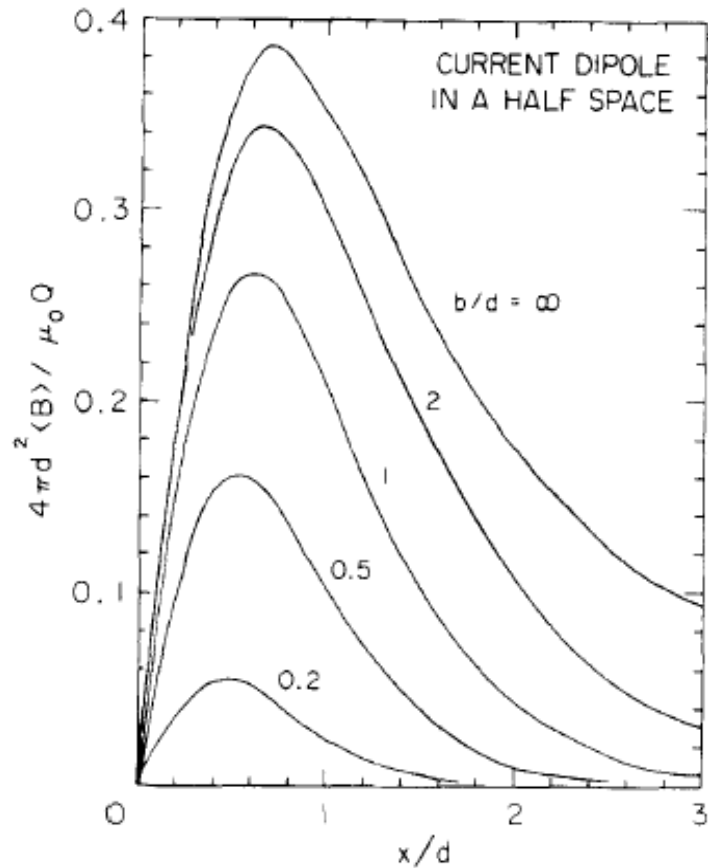
X

# Campo $\langle B_z \rangle$ no eixo $x$ para um magnetometro



Campo médio **B** registrado ao longo Da direção **X** para uma bobina de raio  $a$  e uma fonte localizada a uma profundidade  $d$

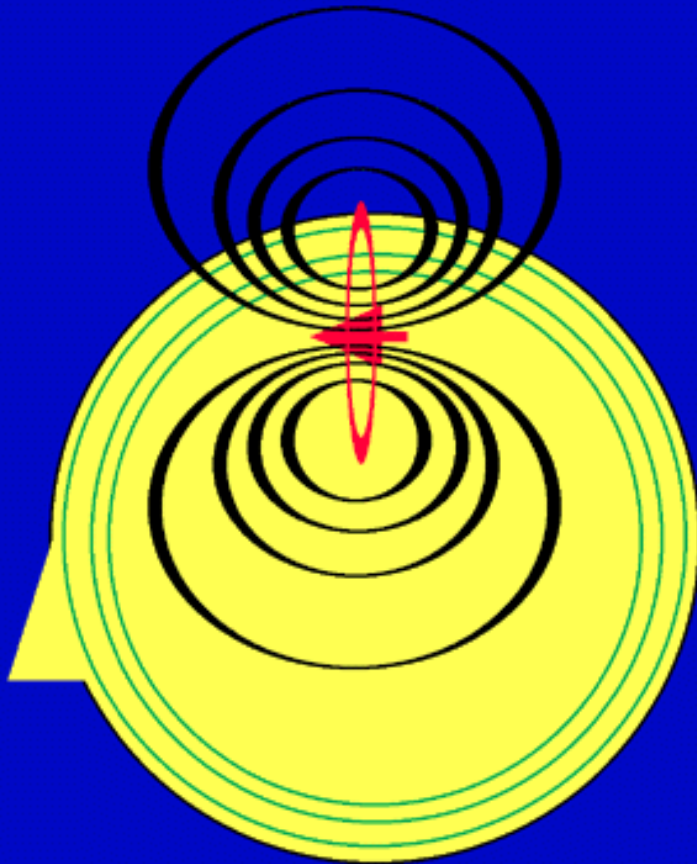
# Campo $\langle B_z \rangle$ no eixo x para um gradiometro de 2ª ordem



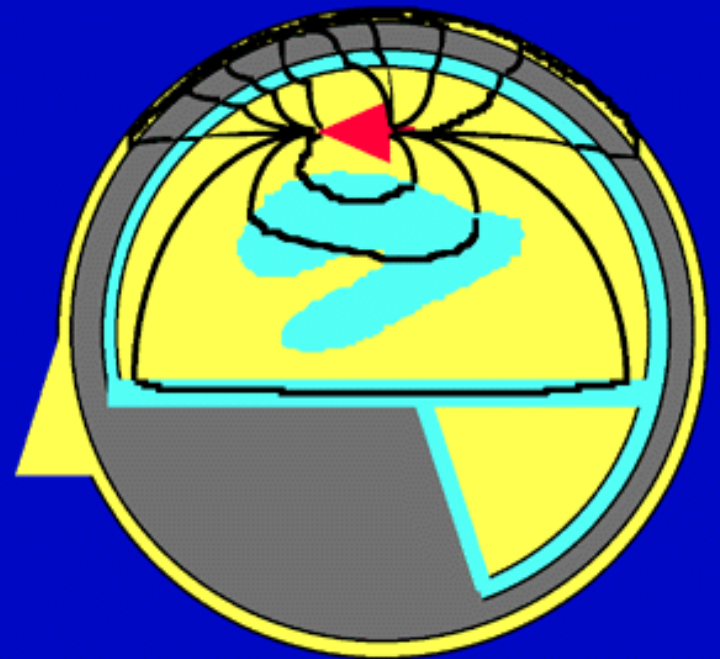
$b$  = linha de base

# Distorção do EEG por Diferenças de Condutividade Elétrica

**MEG**

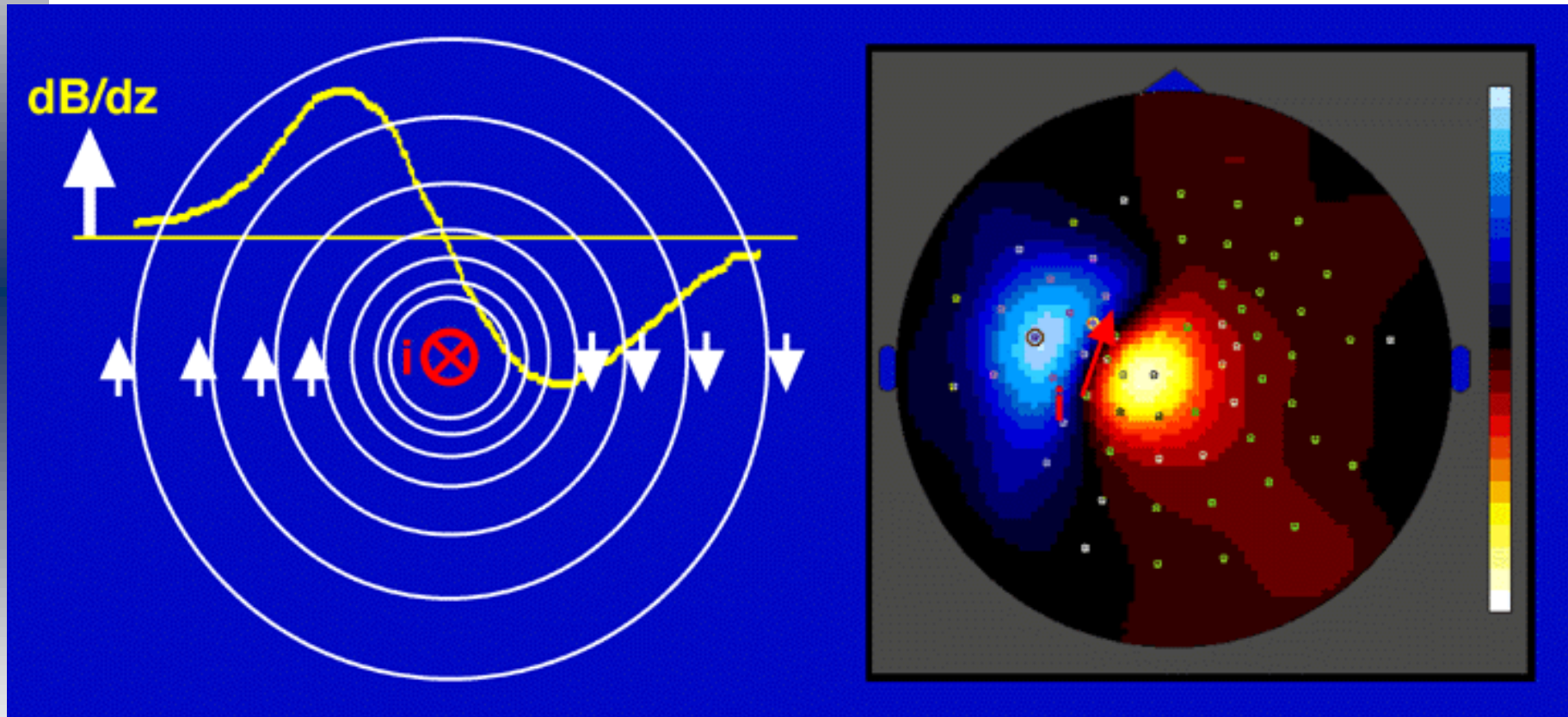


**EEG**

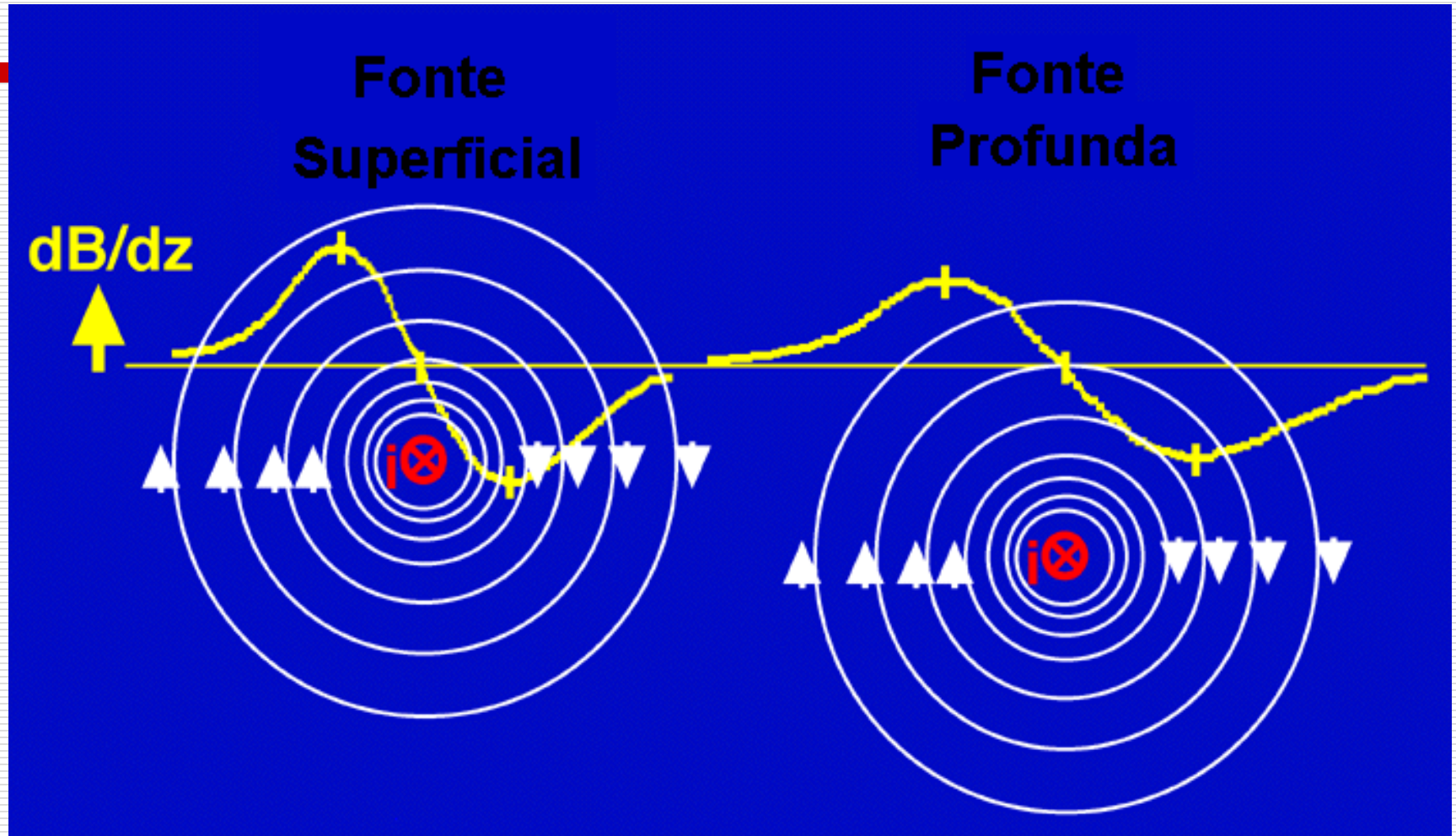


# Detecção das Fontes de MEG

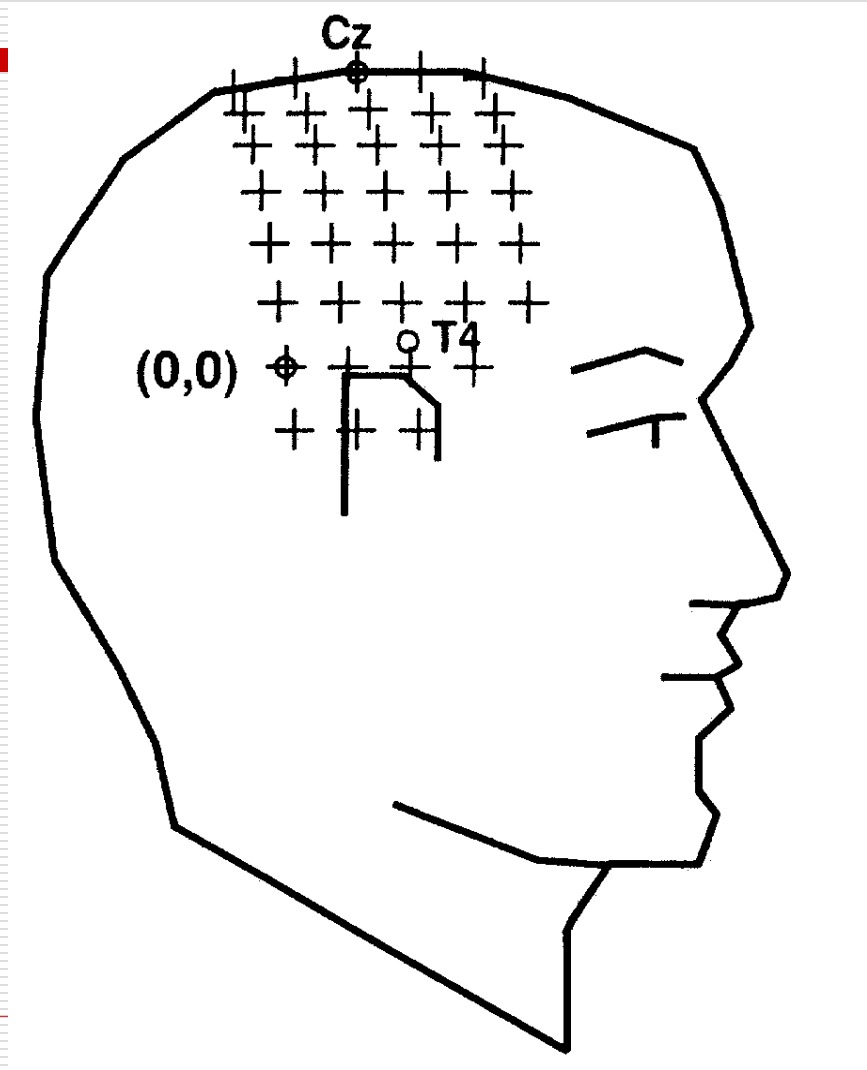
(<http://www.ctf.com/>)



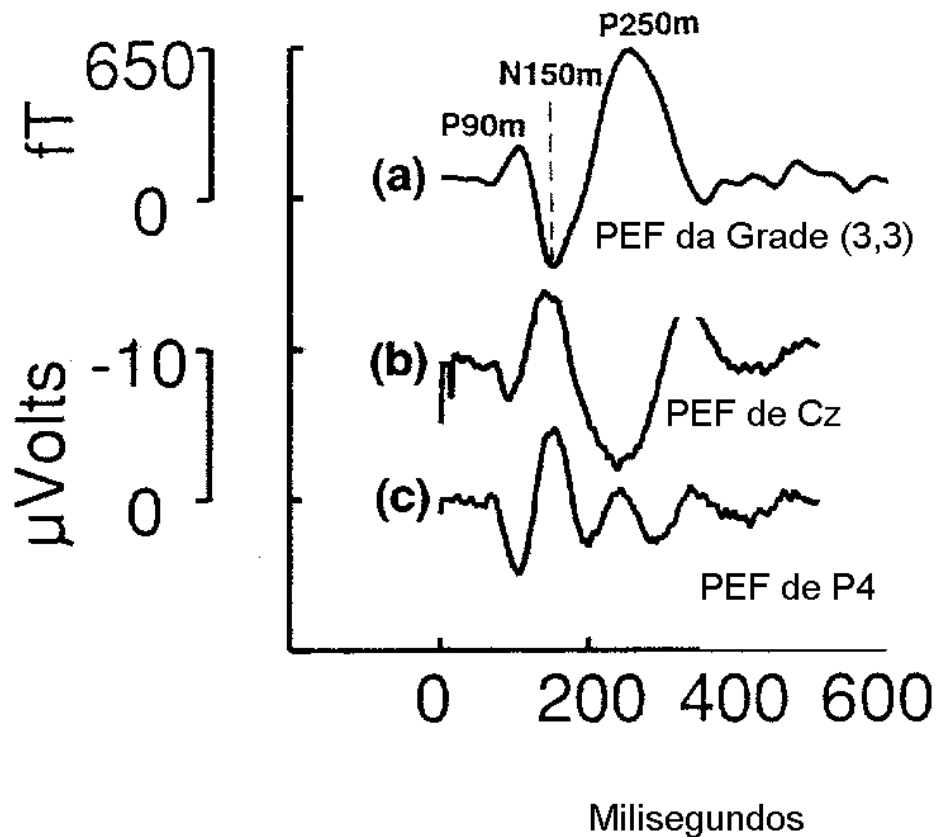
# Cálculo das Fontes de MEG



# Medidas de MEG - Dor



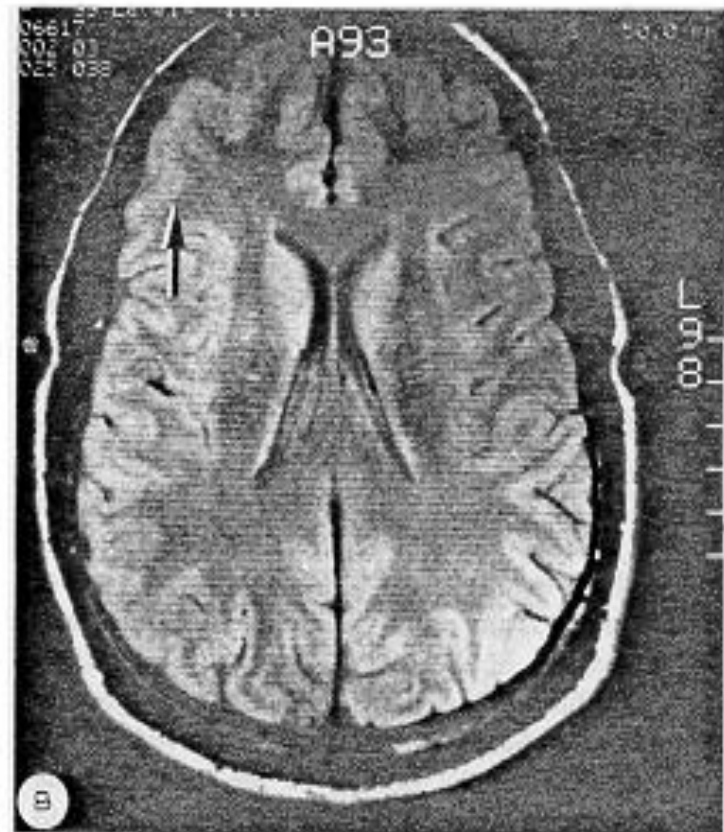
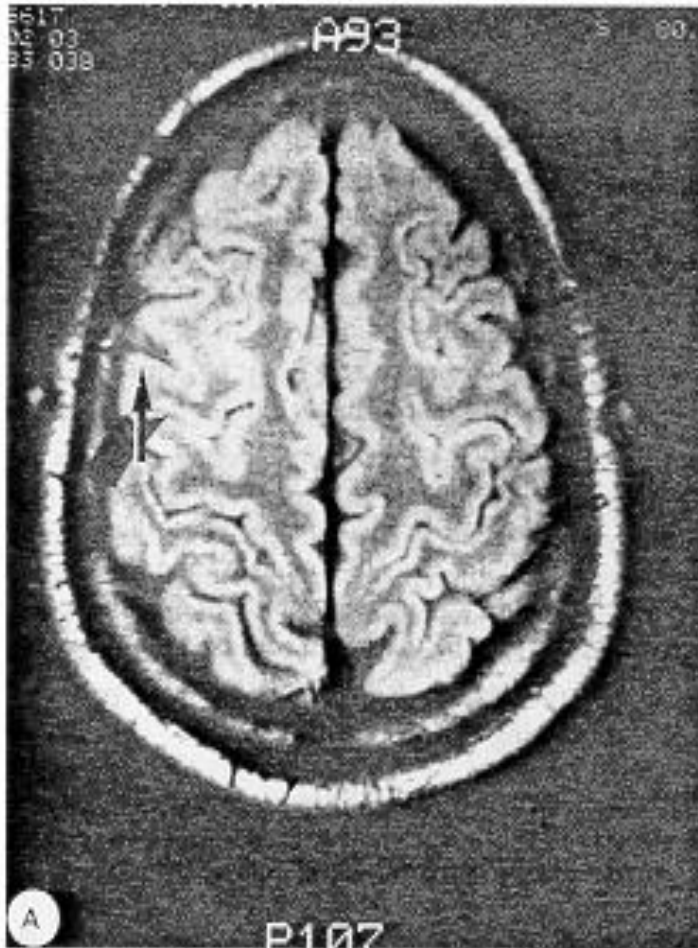
# Sinais evocados - estímulo elétrico





# Imagem Multimodal

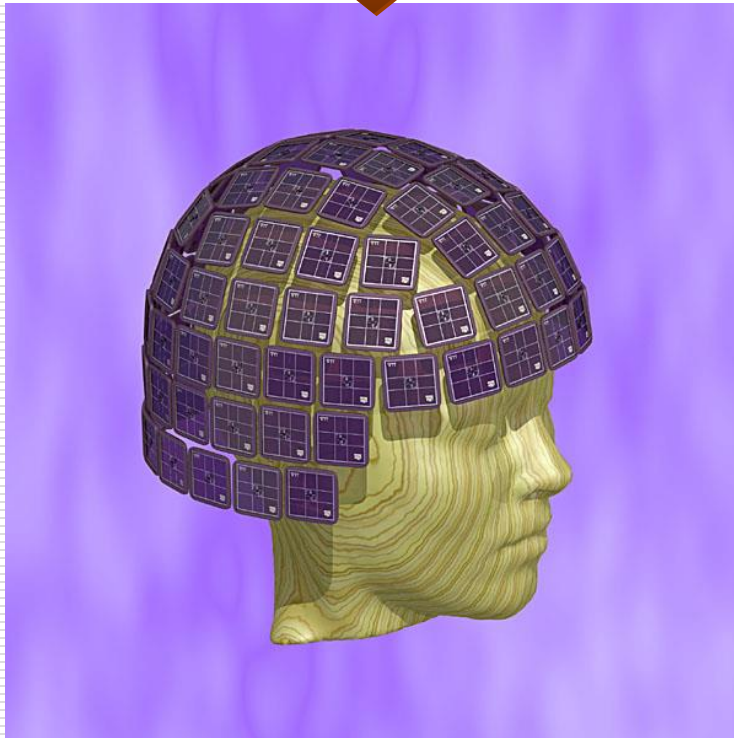
A fonte de corrente é superposta à imagem de RM



# Magnetoencefalografia

Sensores de Campo

Magnético



Sistema de Dois Arranjos de  
Sensores Magnes II, Bti,  
2 x 37 Canais

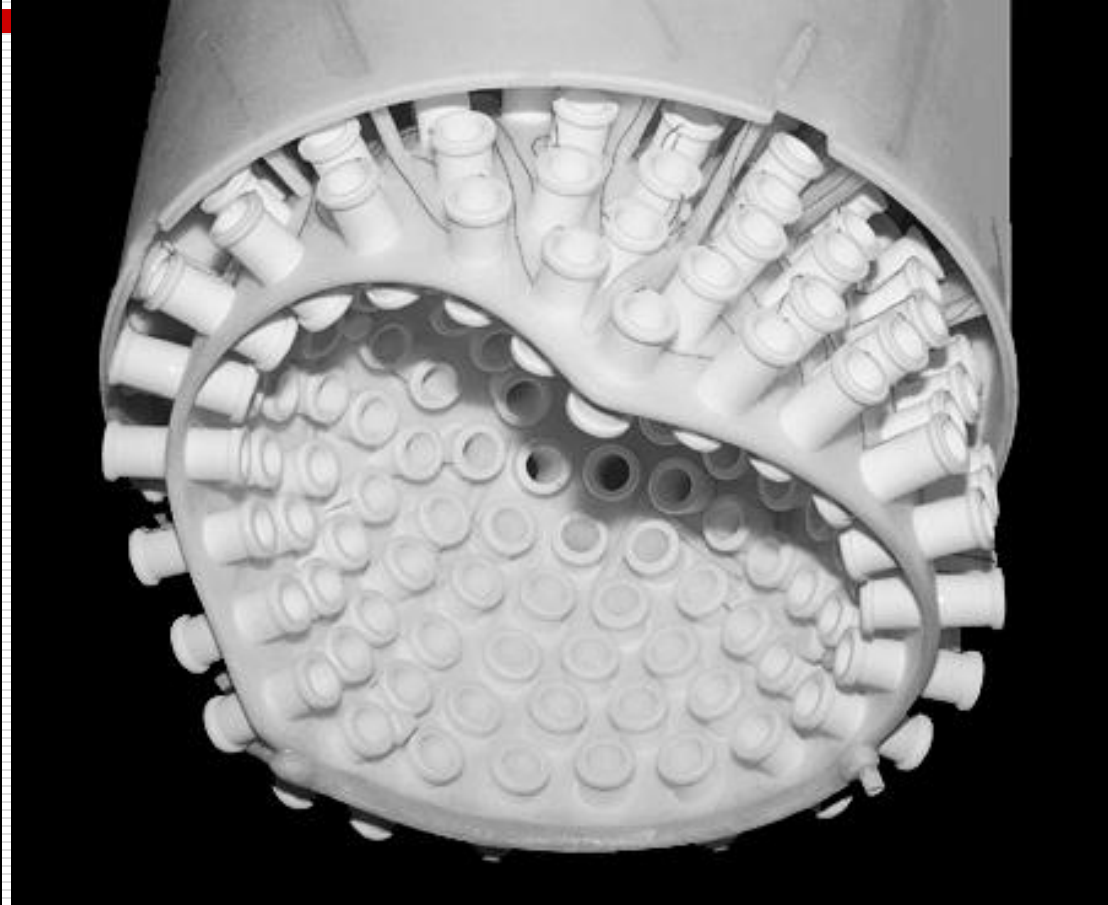
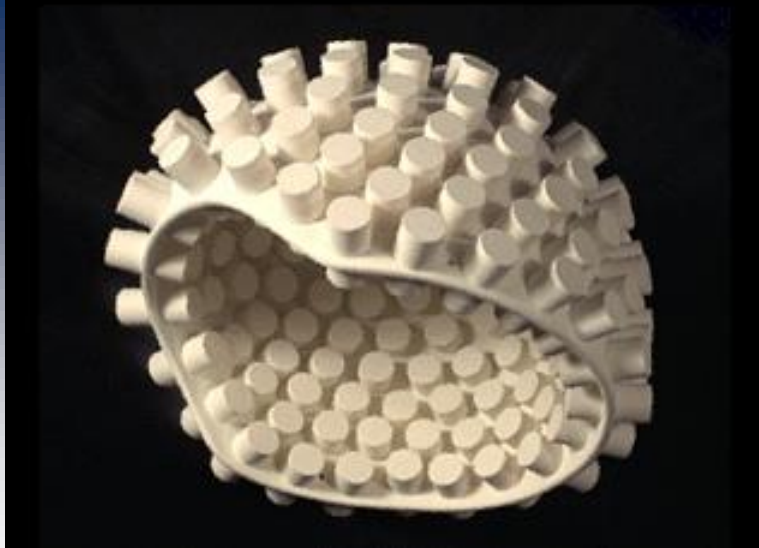
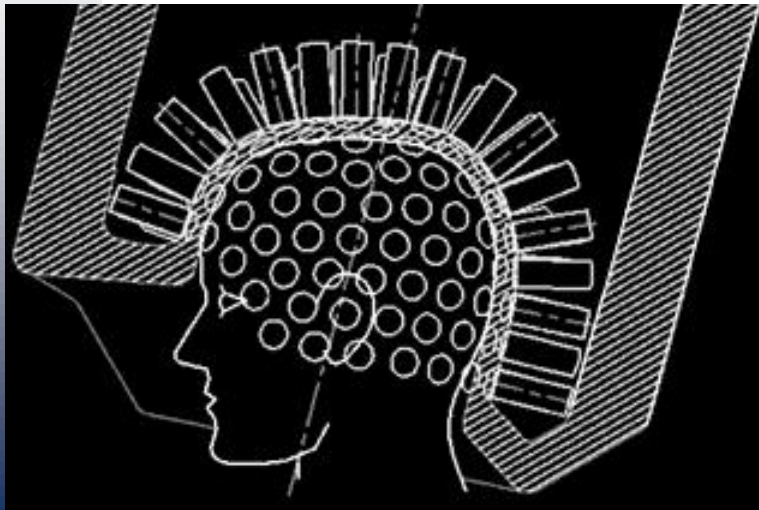


# Omega 151 and Omega 275

<http://www.ctf.com/>



# Arranjo dos Sensores



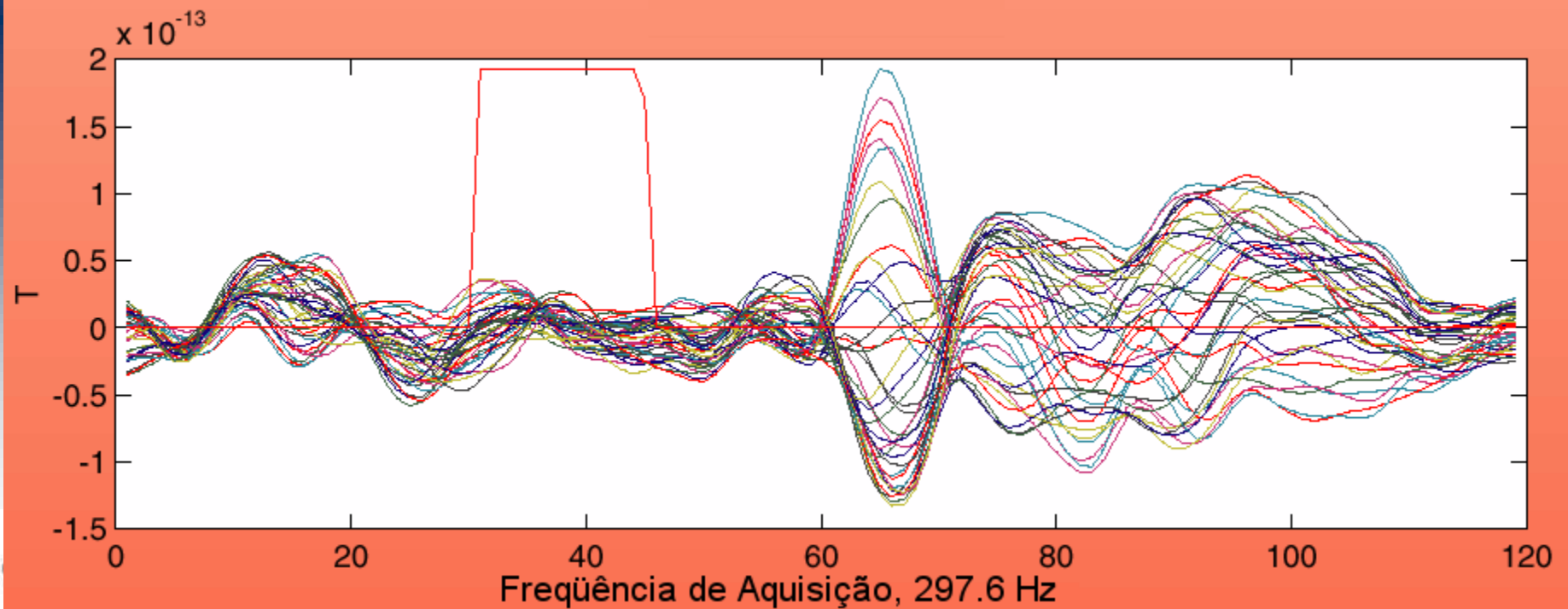
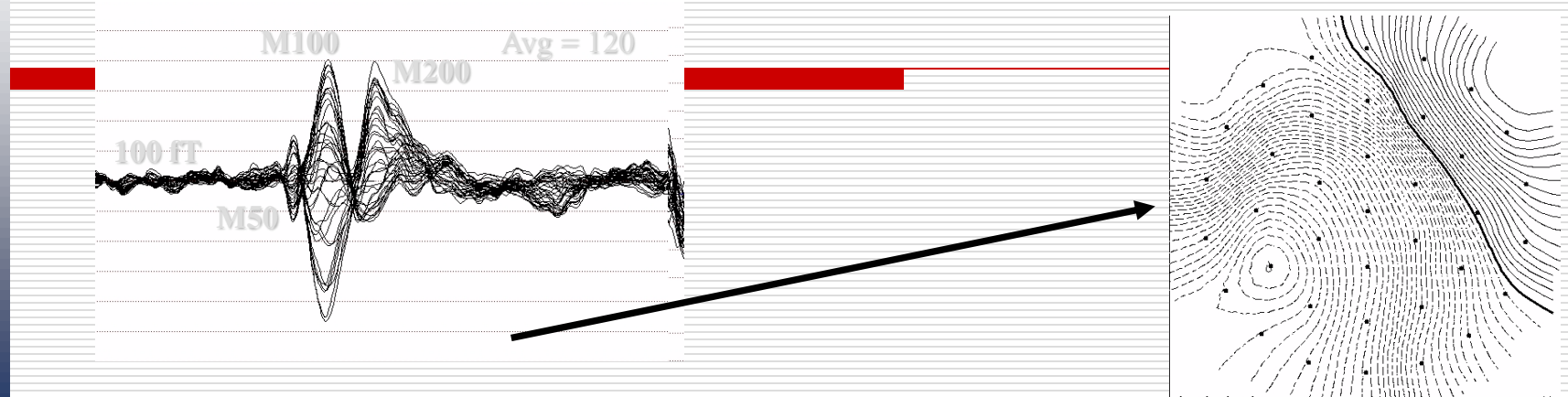
# Neuromagnetometro 300 canais



# Sistema no interior de uma sala magneticamente blindada

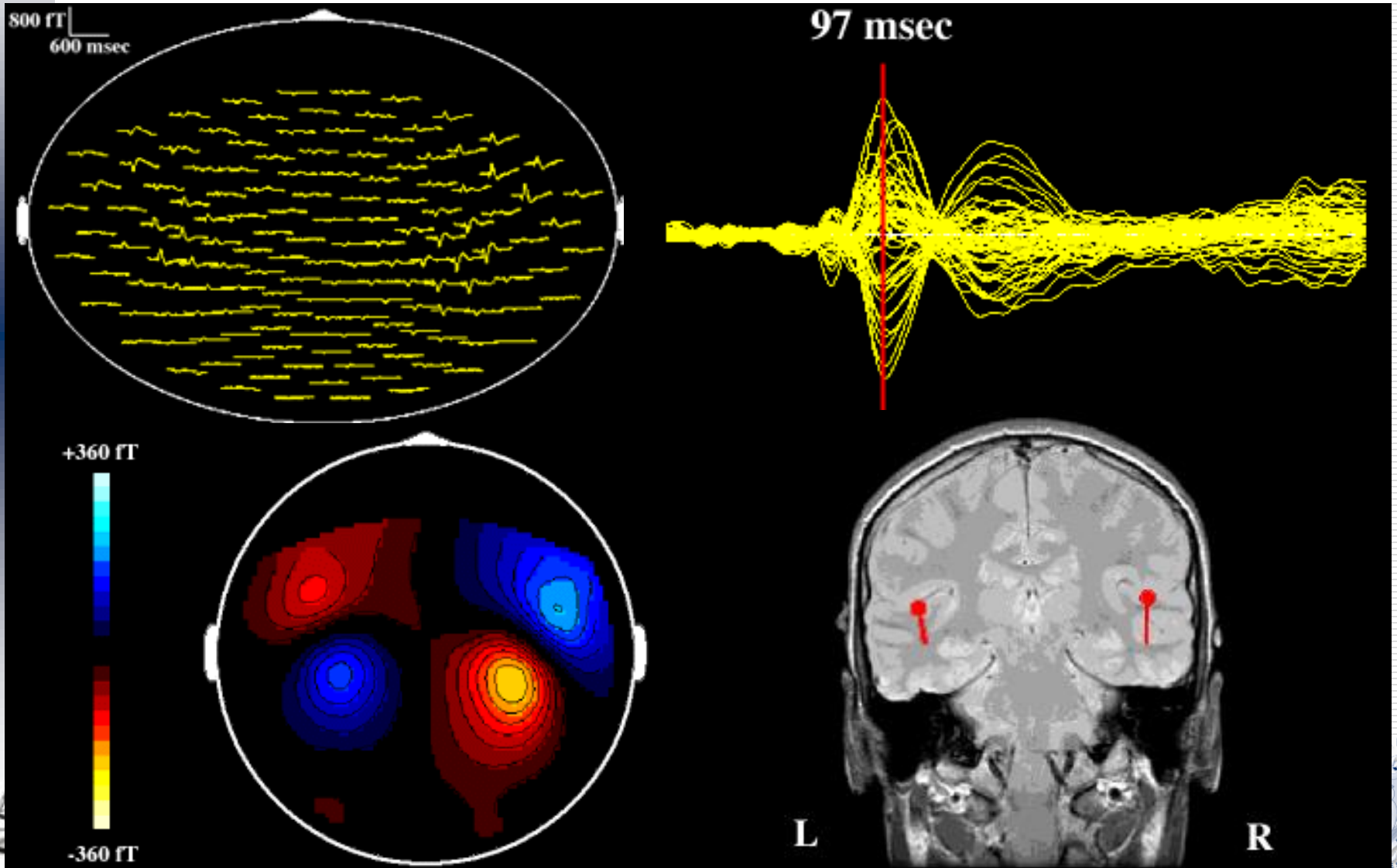


# Campos Evocados



# Interpretação dos Dados

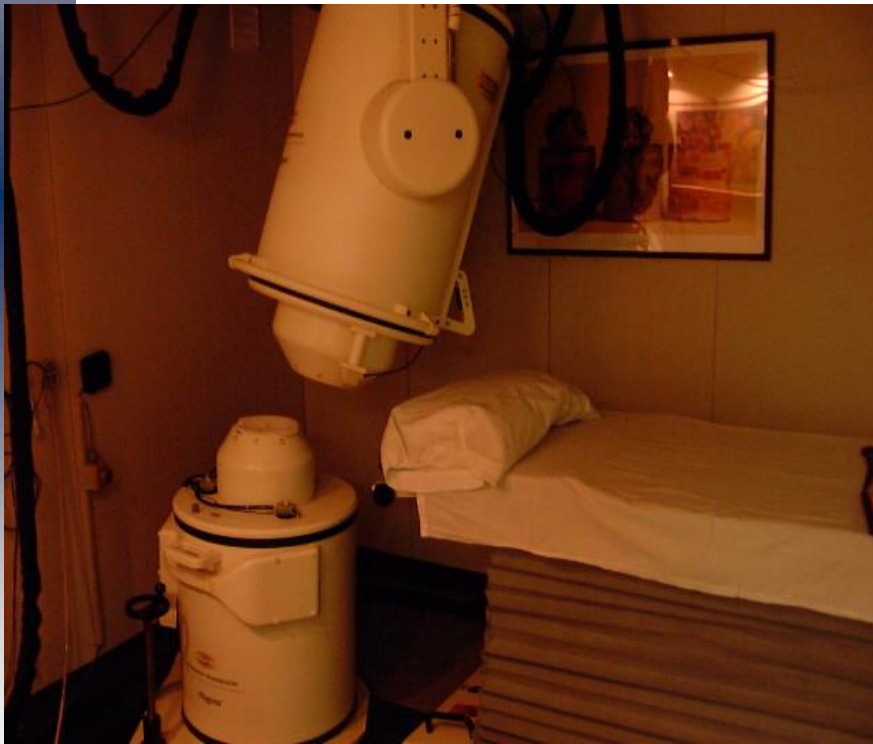
resposta normal a um estímulo auditivo nos dois ouvidos





# Magnes II – Sistema Bti

- ❑ Sensor Dual Magnes II, Bti - 2 x 37 Canais
- ❑ Montado no Interior de uma Câmara Magneticamente Blindada

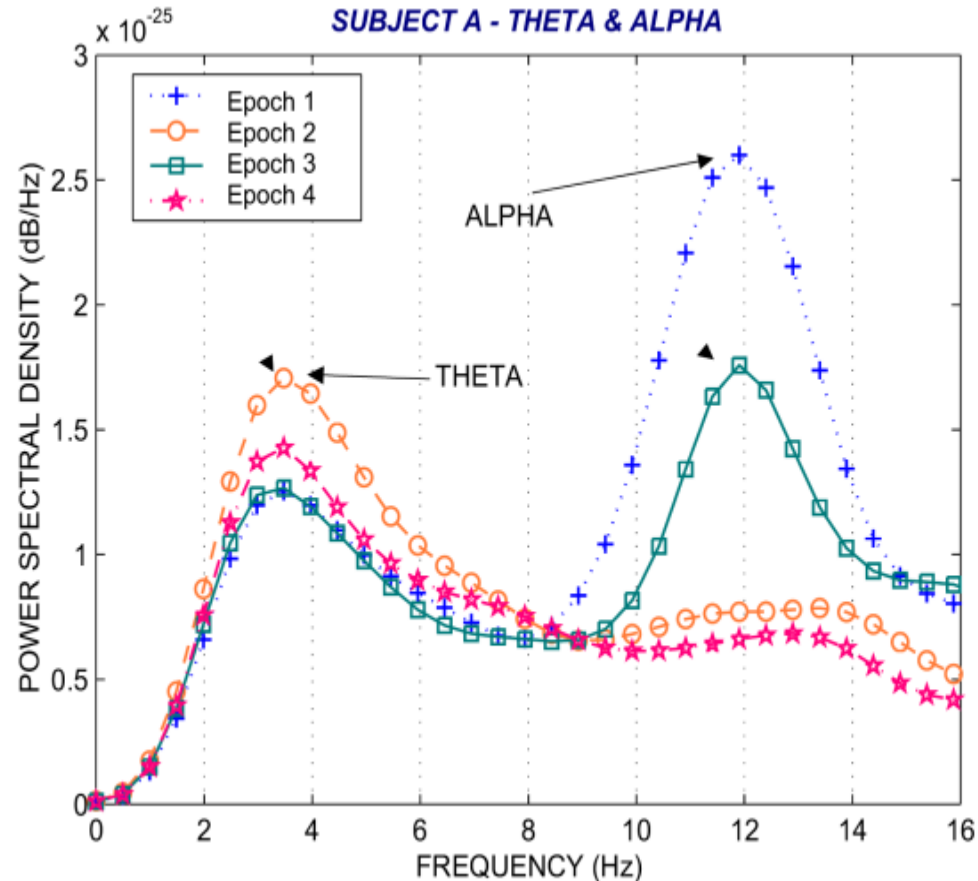


# Vista da Cidade Virtual



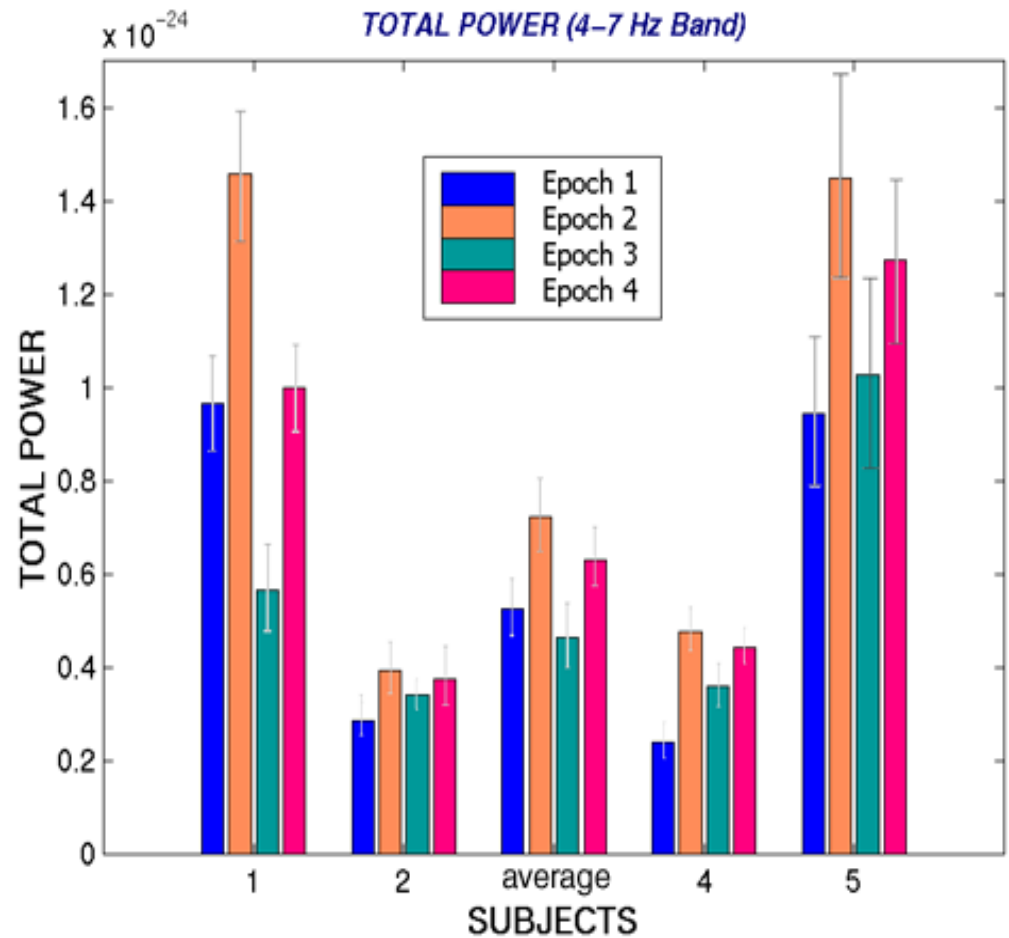
# Densidade do Espectro de Potência

- Densidade do Espectro de Potência
  - Rejeição de Artefatos
    - Piscar os Olhos
    - Coração
  - FFT Janelada:
    - Tipo : Hanning
    - Resolução
      - Aprox. 1 Sec.
    - Sobreposição
      - Nenhuma

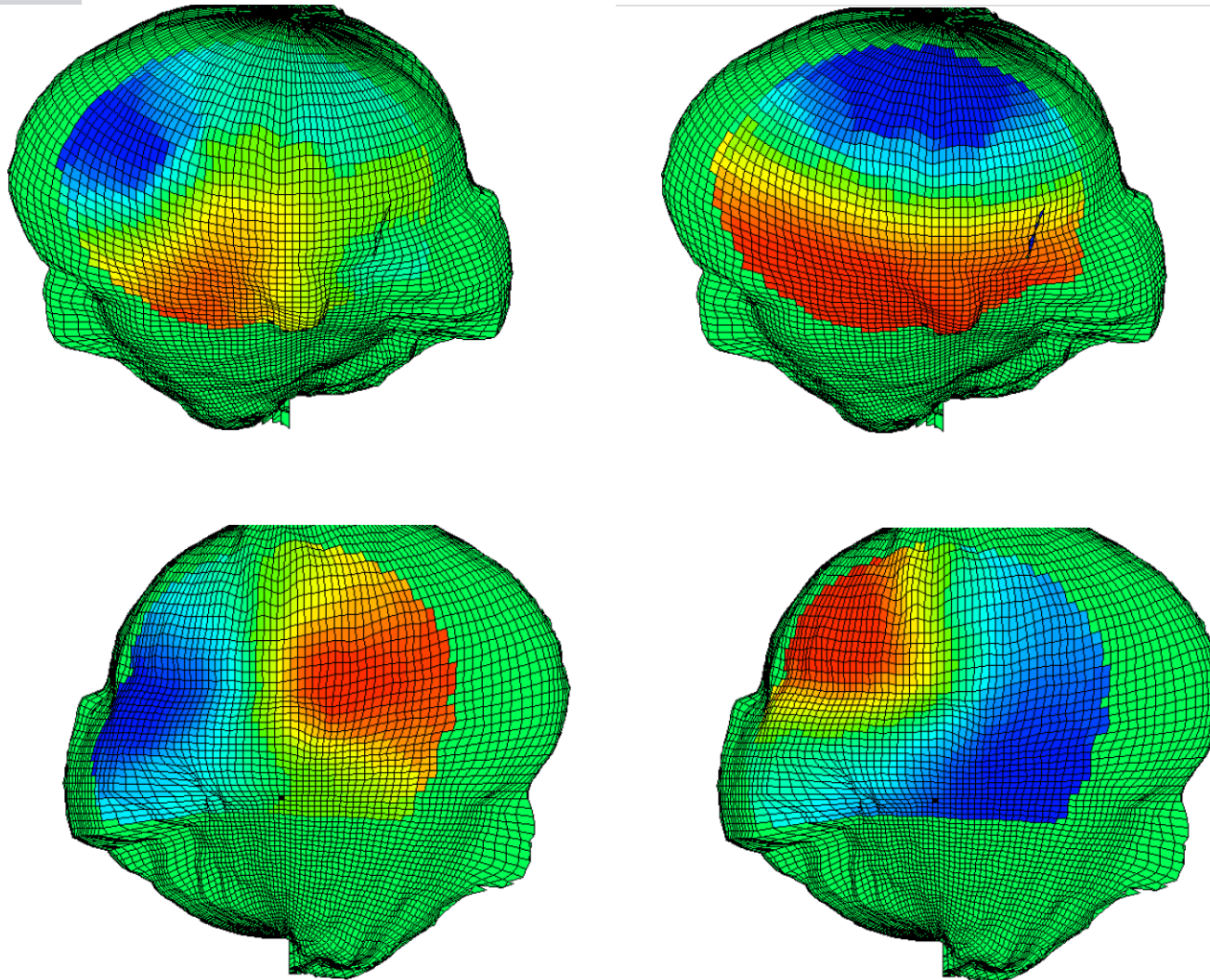


# Banda Teta (4 - 7 Hz)

- Clássica 4 Hz - 7 Hz
- Média de 4 medidas
- Potência Menor
  - Períodos 1 & 3
- Potência Maior
  - Períodos 2 & 4



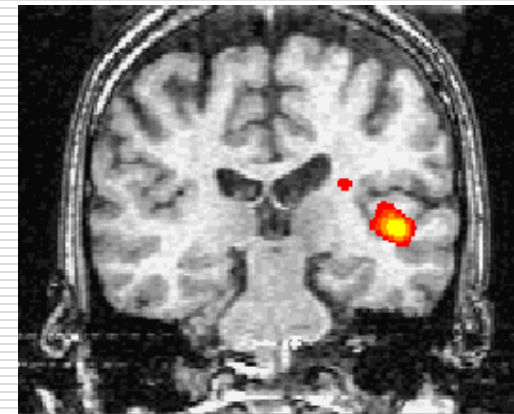
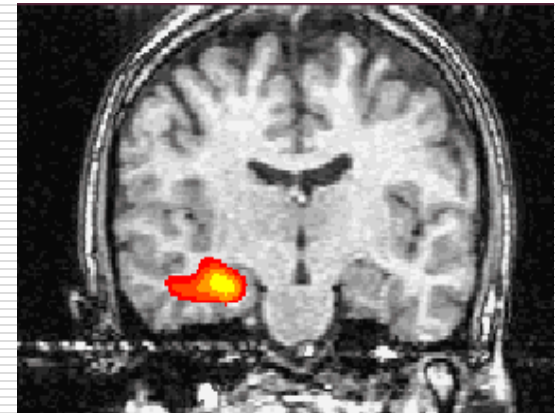
# Ajuste de Dipolos



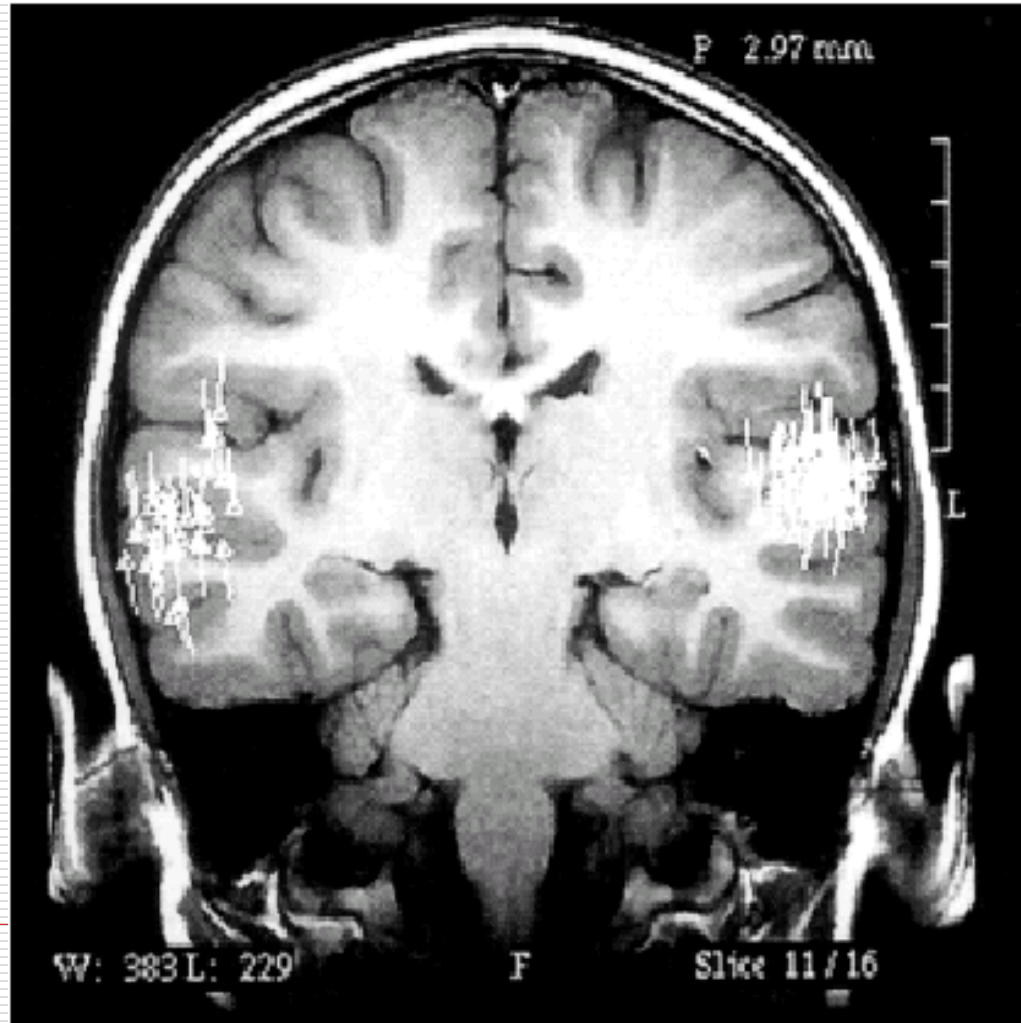
dipolos foram localizados próximo do giro temporal superior em estruturas profundas em ambos hemisférios

# Localização - MSI

- Modelo de um único Dipolo
- Densidade de Dipolos
  - Filtro Gaussiano
  - Kernel – Resolução de 2 mm
- Principais Regiões
  - Giro Temporal Superior
  - Estruturas Temporais Mediais



# Imagem de RM com a Localização de Atividade Elétrica



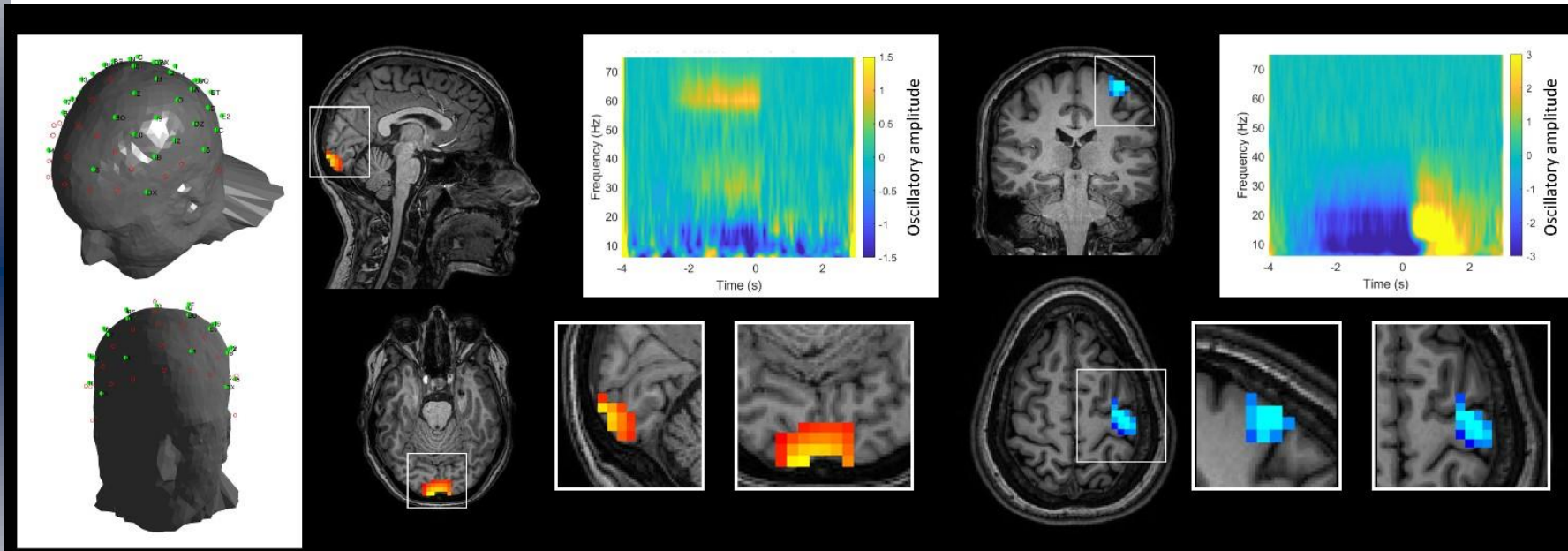
Imagens mostrando a matriz de magnetômetro de campo zero QuSpin montada no couro cabeludo de um participante.



*Fonte: The University of Nottingham OPM-MEG group are funded by the Wellcome Trust and the Engineering and Physical Sciences Research Council UK.*



# Resultados da primeira experiência de 50 canais



*Fonte: The University of Nottingham OPM-MEG group are funded by the Wellcome Trust and the Engineering and Physical Sciences Research Council UK.*

# MEG versus Outras Técnicas

