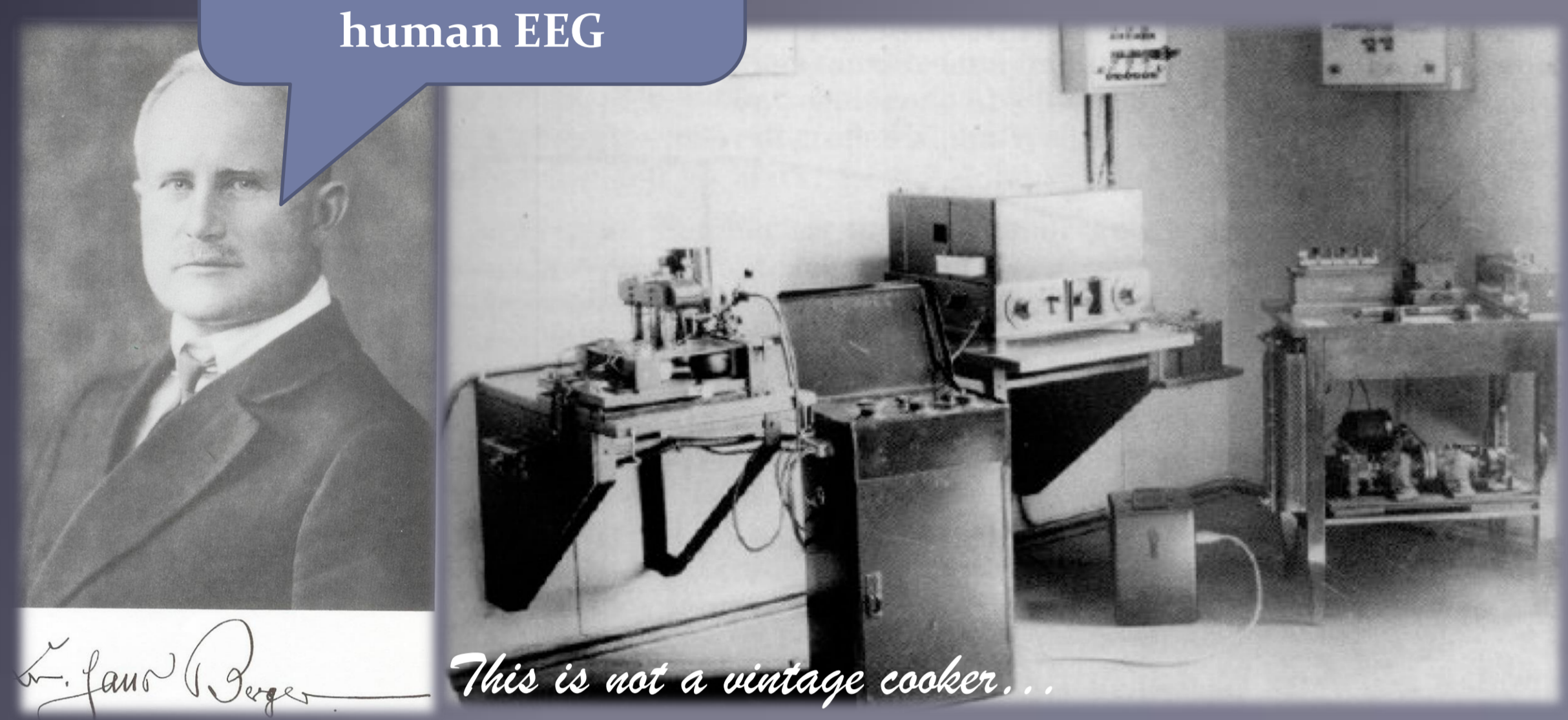


History

The **galvanometer** was the first device used to record human EEG

Nearly a century ago...



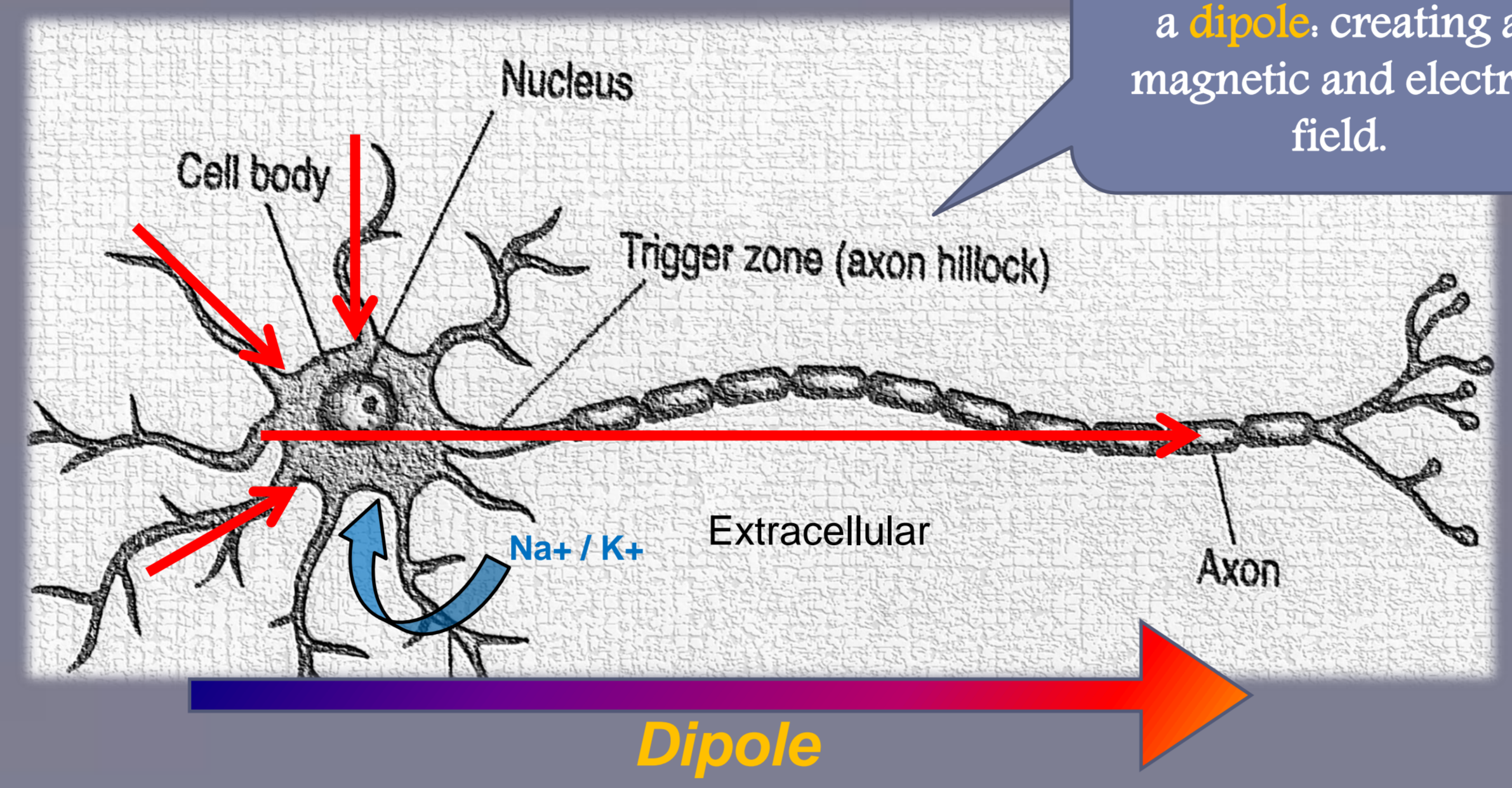
In 1924, Hans Berger, of the University of Jena in Austria, carried out the first human EEG recordings using metal strips pasted to the scalps of his subjects as electrodes and a sensitive galvanometer as the recording instrument. Berger was able to measure the irregular, relatively small electrical potentials (50 to 100 μ V) coming from the brain. By studying the successive positions of the moving element of the galvanometer recorded on a continuous roll of paper, he was able to observe the resultant patterns in these brain waves as they varied with time.

Definition

ElectroEncephaloGraphy (EEG) is a technic to record the brain electrical activity

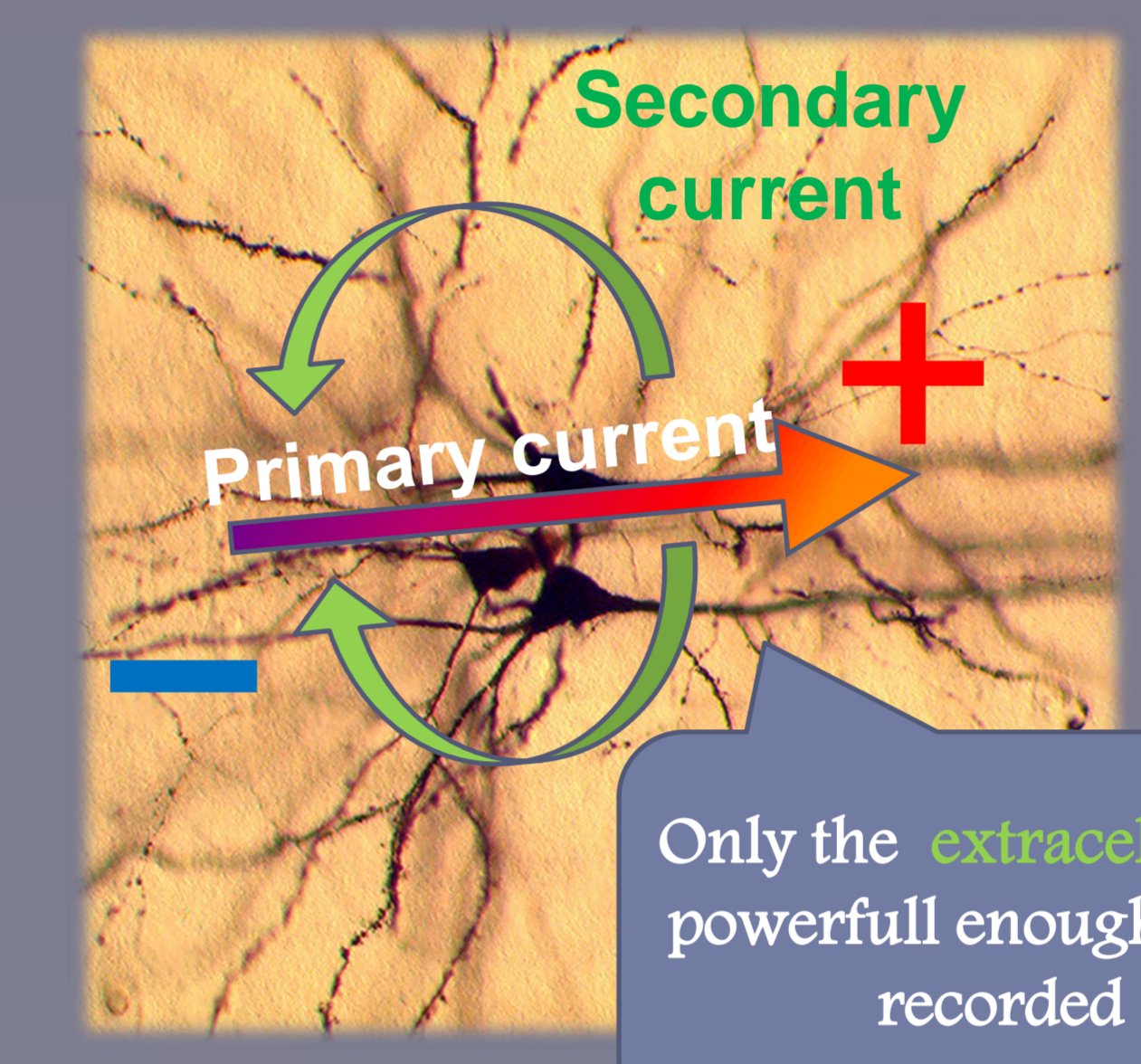
Electrophysiology

The neuron dipole model



The neuron behaves like a **dipole**, creating a magnetic and electric field.

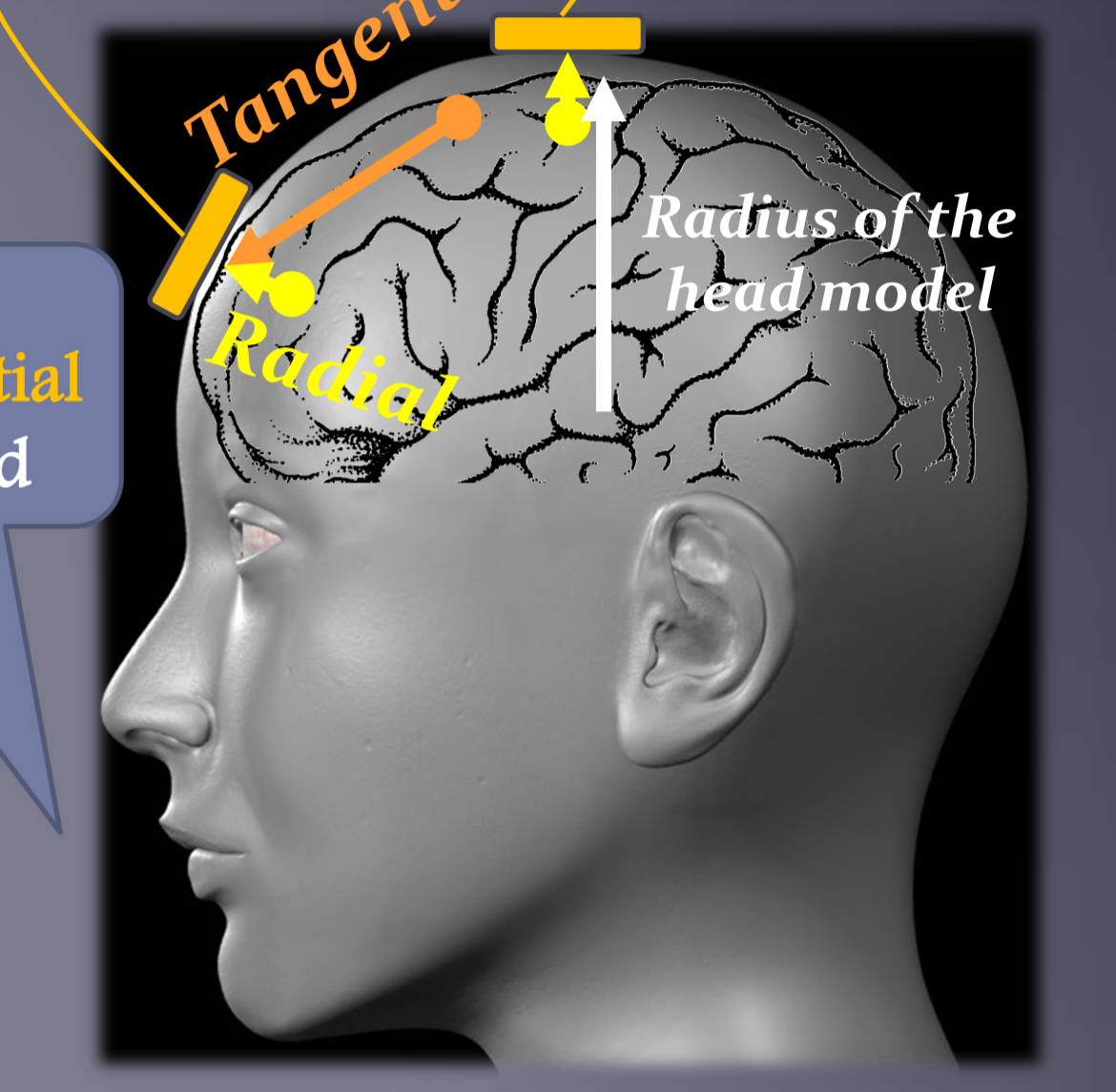
- The brain cells (neurons) are made of dendrites (incoming nervous message) and axons (outgoing nervous message).
- The neuron in action emits **Action Potentials** (APs).
- APs are generated via ionic flow (NA+/K+) through membrane "gates".
- APs are successions of electric depolarizations and repolarizations.



Only the **extracellular** is powerful enough to be recorded

- The **secondary current** comes from dendrites activity.
- Only neurons in an **open field** configuration (pyramidal cells).
- Only the cortical areas where neurons are aligned enough to create an **equivalent dipole**.

What and Where ?



Radial and tangential dipoles are mixed

- Equivalent dipoles within the cortex can be in the **radial** plan or in the **tangential** plan.
- Both are measured on a given electrode.

METHOD

EEG recording Caps

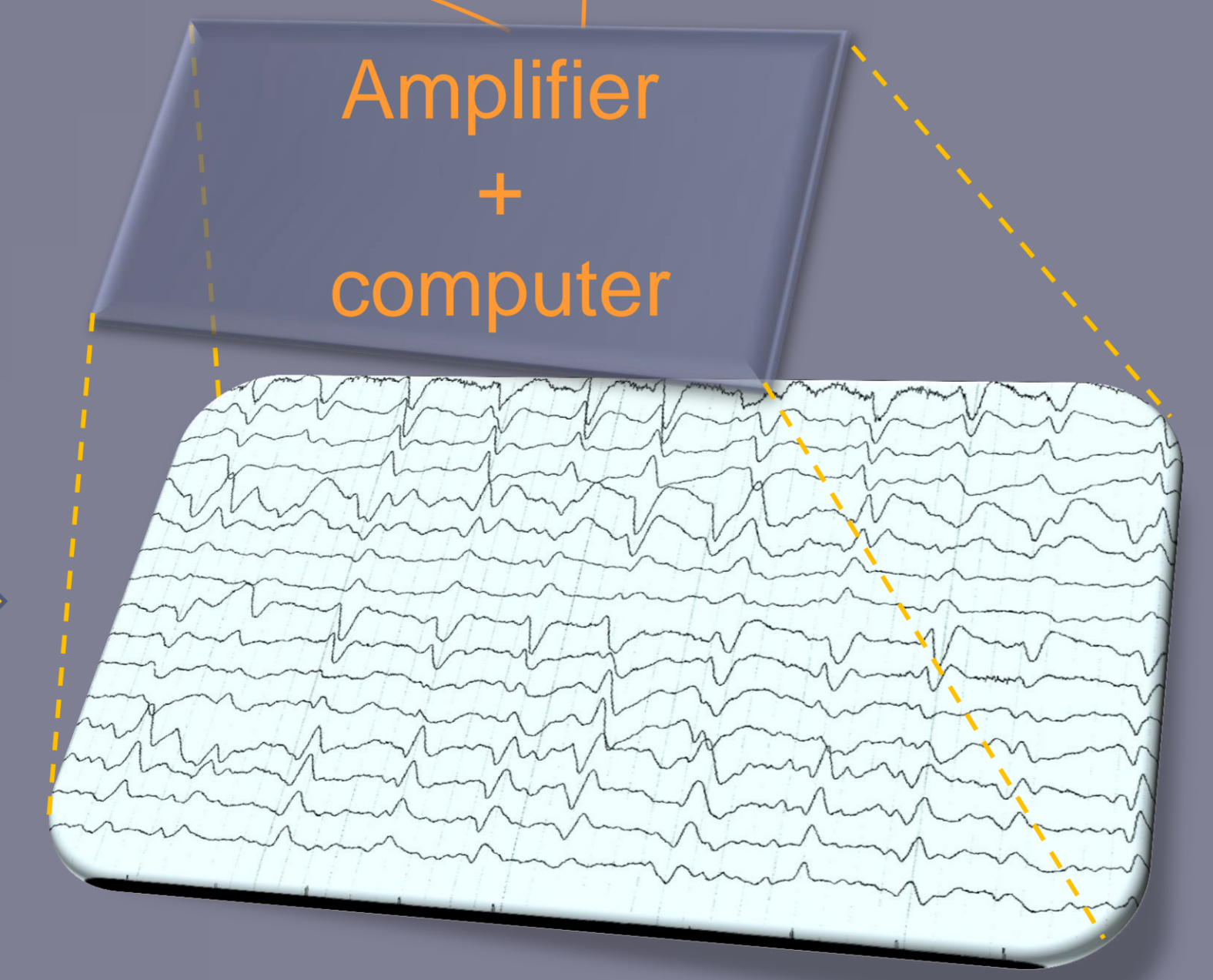


My head is too small for a standard cap

The cap is usually made of 16 to 256 passive or active electrodes



Ongoing EEG signal

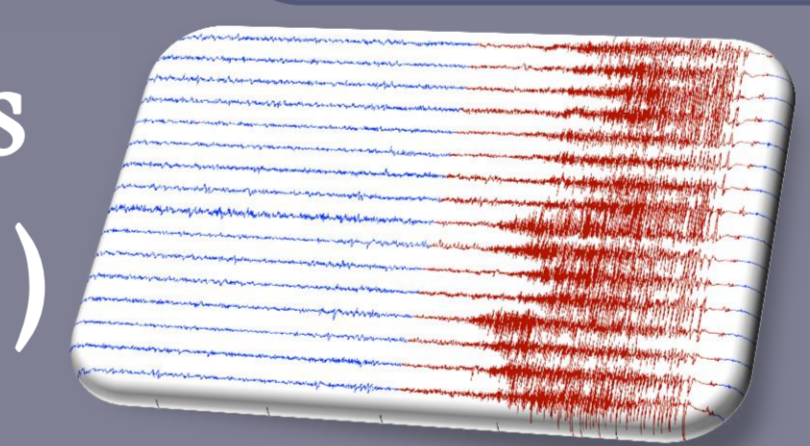


For each electrode, raw ongoing EEG signal is recorded. The signal corresponds to the spontaneous activity of neuronal populations

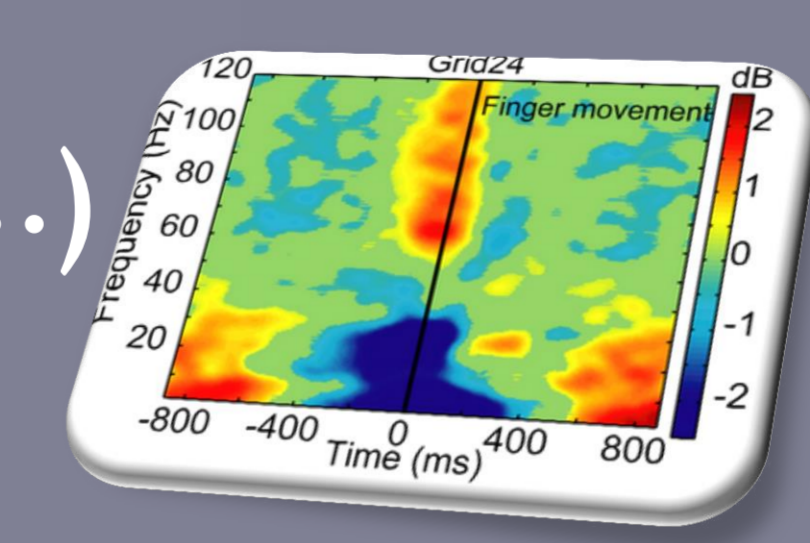
Analyses

Analyses can be done on ongoing EEG or time-locked, in the time or the frequency domain...

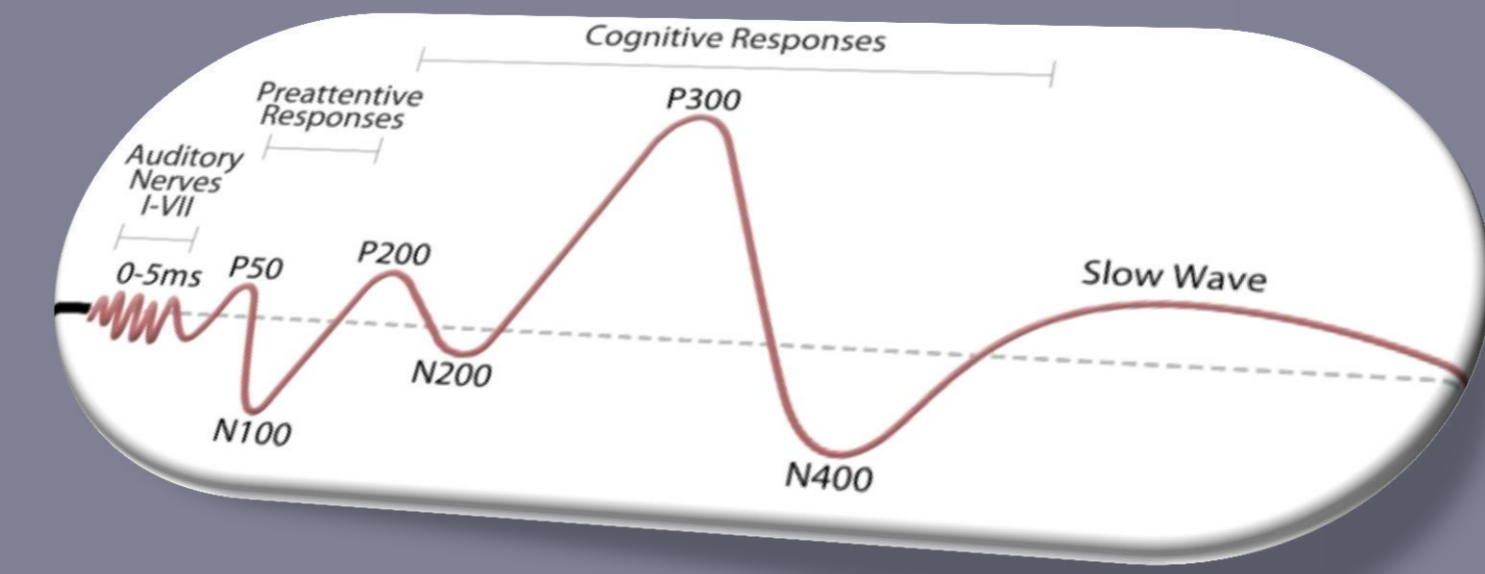
Clinical diagnosis (epilepsy, coma...)



Rhythms (α , β , γ , θ ...)



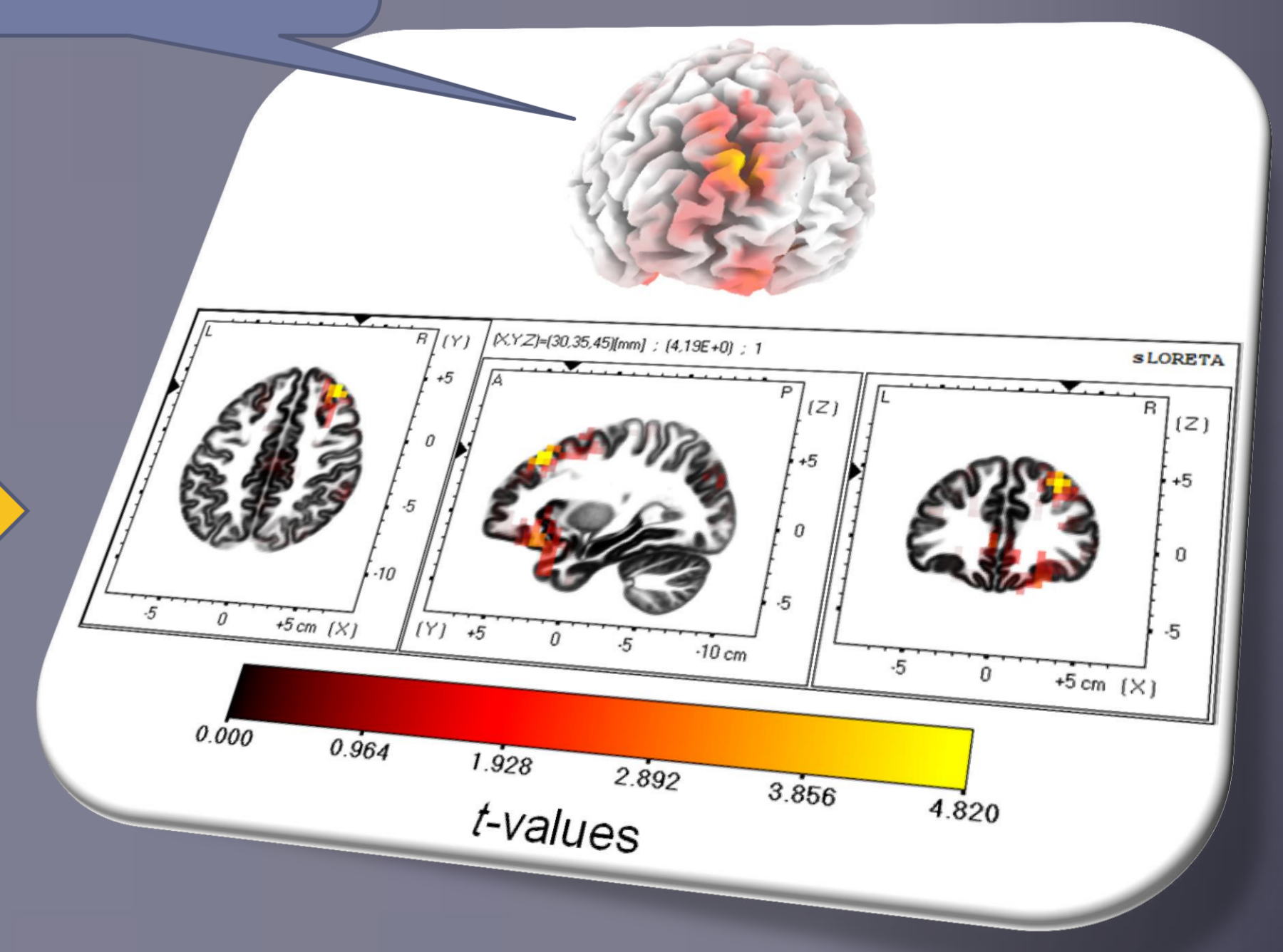
Event Related Potentials (ERPs: see the dedicated poster)



Analyses can be made from the ongoing EEG signal or time-locked to a given stimulation/response (e.g., auditory tones, finger movements)

Who said that EEG has a bad spatial resolution ??

Going deeper...



Despite the mathematical challenges to find EEG brain sources, some powerful software provide accurate source localization

