

Sharif University of Technology
Electrical Engineering Department
Neuroscience Lab
Brainstorm MATLAB Toolbox
Dr. Ghazizadeh
Zahra Kavian - 98102121



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1 Register Electrodes With MRI

Project electrodes on the scalp using MRI head points.

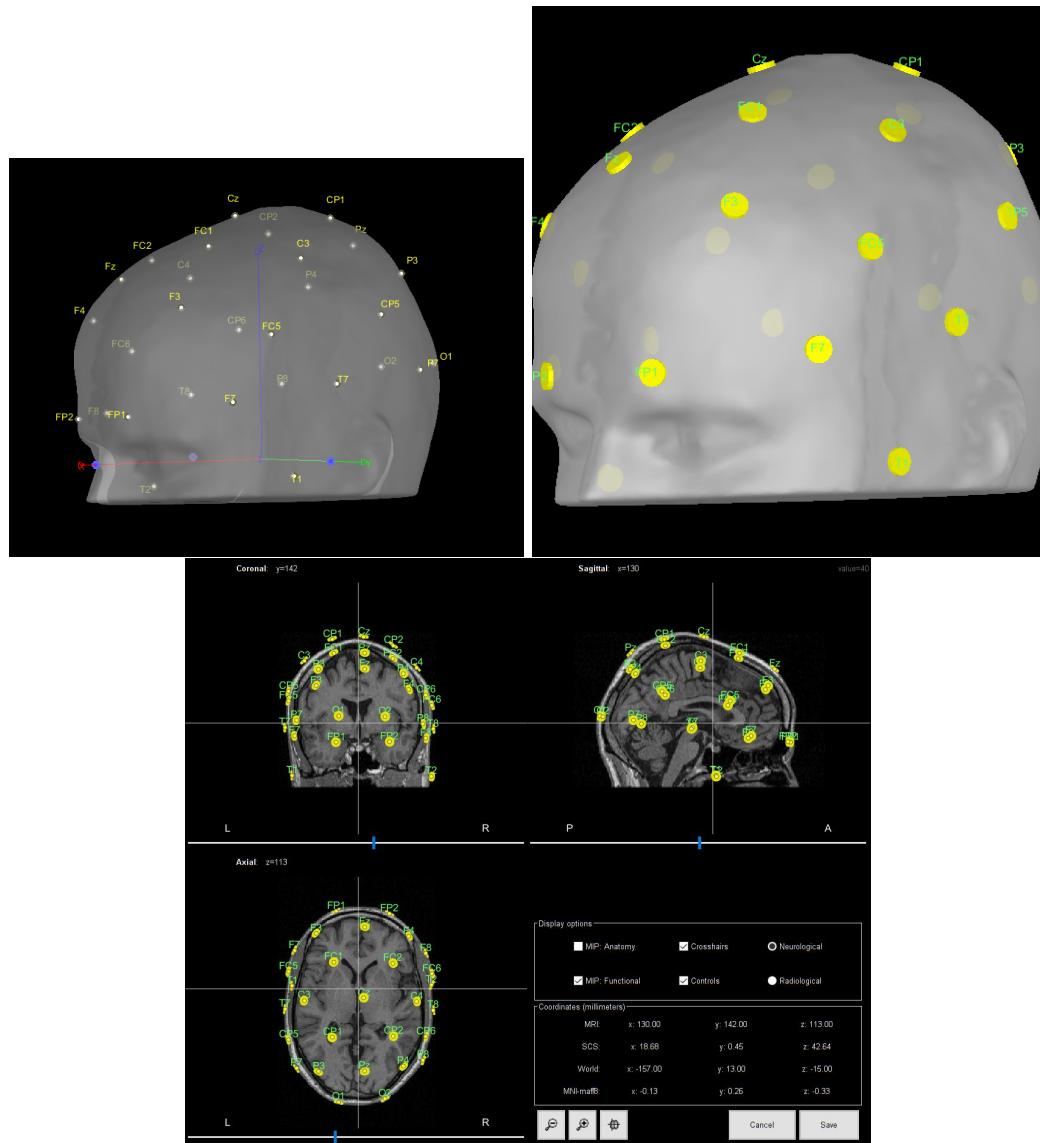


Figure 1: EEG electrodes position on the scalp.

2 Power Spectrum Density

First, I filter the signals and only keep the frequencies between 10 and 80Hz. Figure 2 is the filter frequency response.

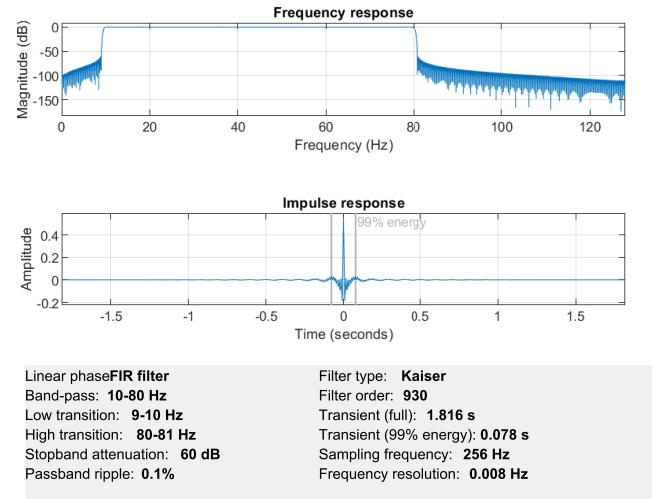


Figure 2: Filter Frequency Response.

Then, I measure the power spectrum density before and after filtering. You can compare them PSD in figure 3

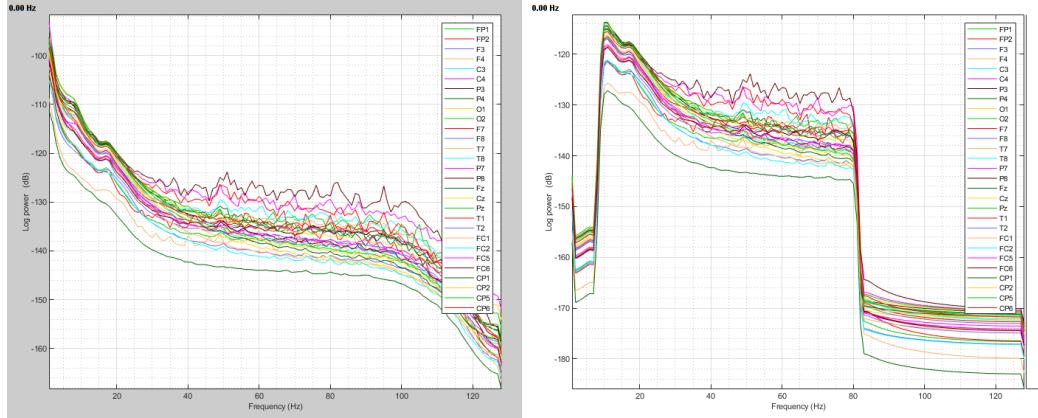


Figure 3: Power Spectrum Density. left: before filtering, right: after filtering.

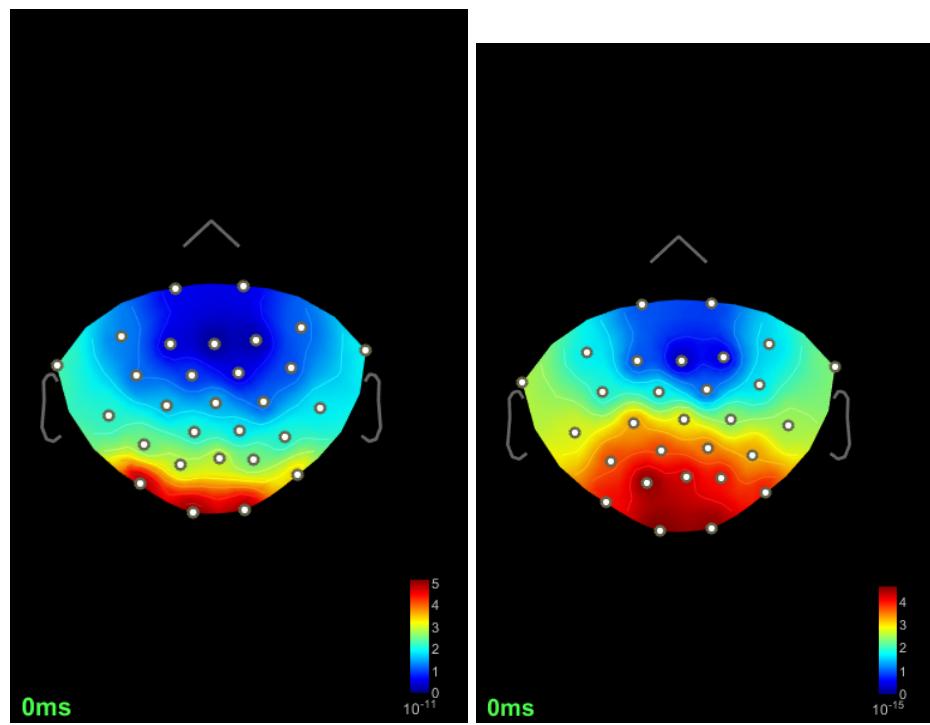


Figure 4: Power Spectrum Density. left: before filtering, right: after filtering.

3 Independent Component Analysis (ICA)

The signal is filtered again with band-pass filter with lower frequency band equal $0.5Hz$. Then ICA algorithm is used to detect and removed eye movement contaminated IC. I run it only in time window $500 - 700s$, which has more eye movement artifacts. Also sort component based on the correlation with the reference channel (ECG & EOG). At the end, I select the two first component which are significantly related to eye artifact.

ICA algorithm is run with different method and compare its result. I think 'picard' detect components better than others.

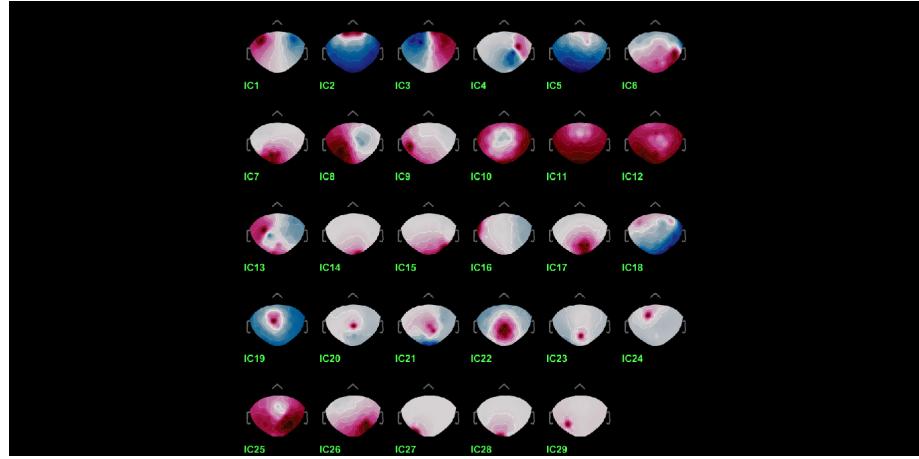


Figure 5: All ICA components.

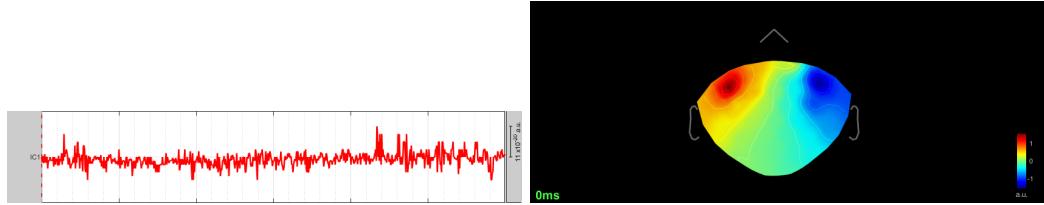


Figure 6: The first IC, 'fastica' method.

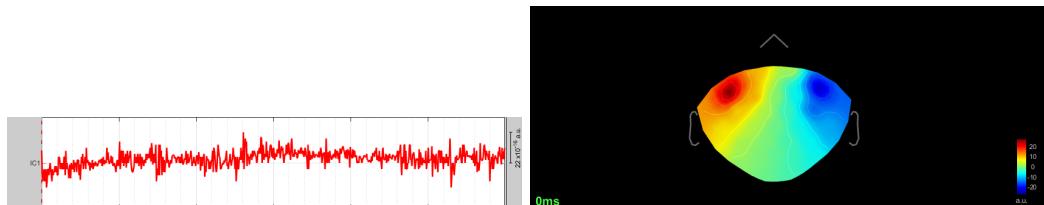


Figure 7: The first IC, 'infomax' method.

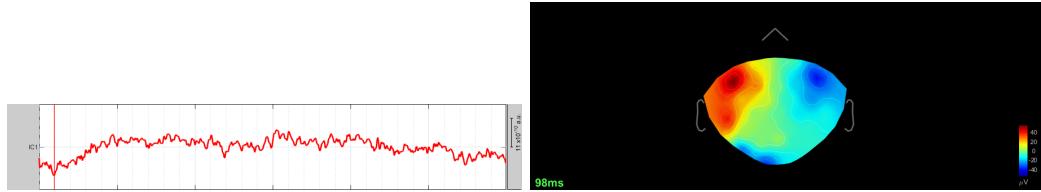


Figure 8: The first IC, 'jade' method.

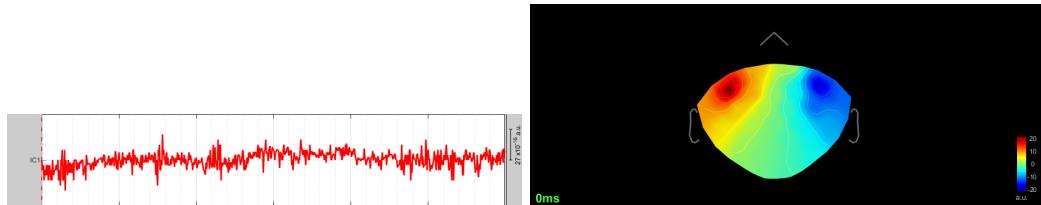


Figure 9: The first IC, 'picard' method.

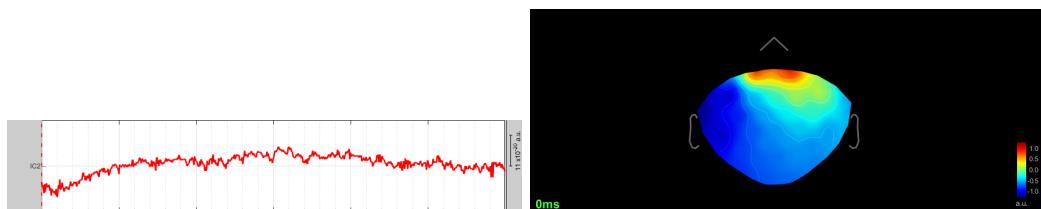


Figure 10: The first IC, 'fastica' method.

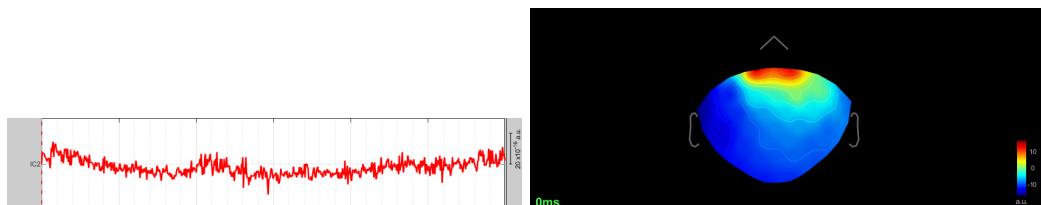


Figure 11: The first IC, 'infomax' method.

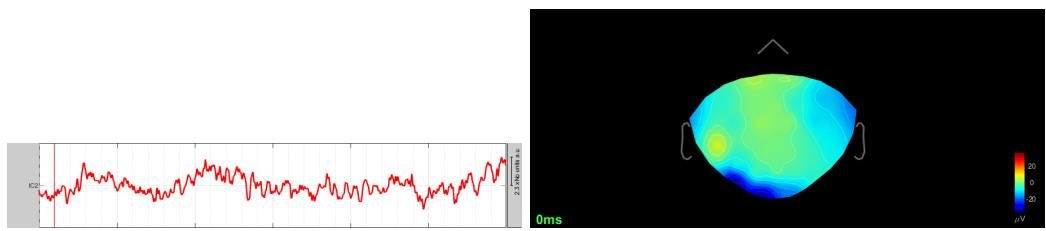


Figure 12: The first IC, 'jade' method.

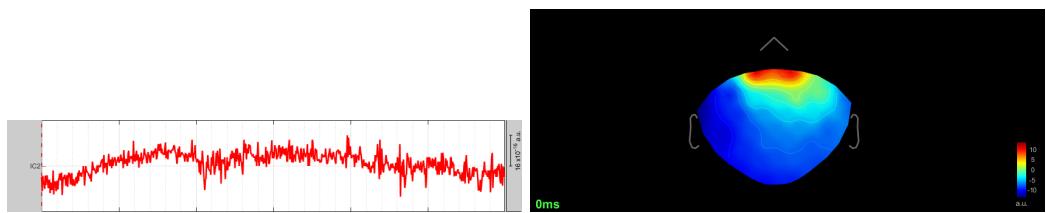


Figure 13: The first IC, 'picard' method.

Compare signals before and after removing the first two components.

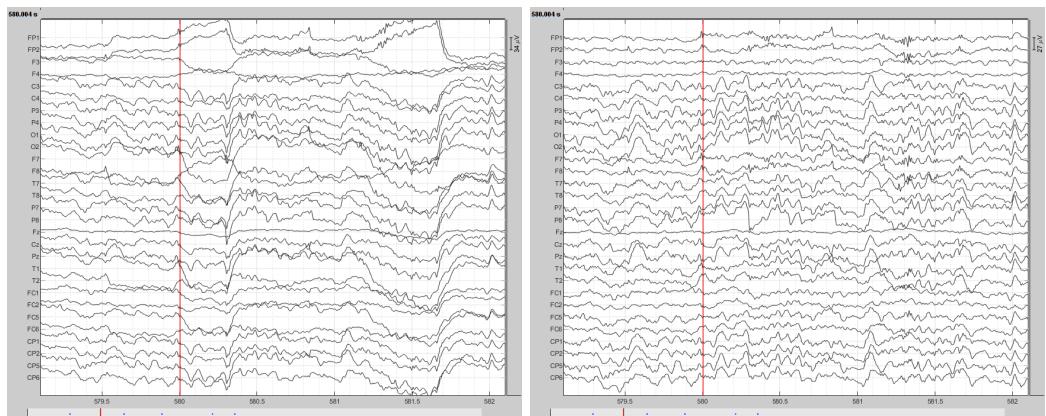


Figure 14: Compare signals before and after removing eye movement component.

4 cluster of the spikes

I import the spikes, make a cluster of the spikes on the FC1 electrode and show it in butterfly mode.

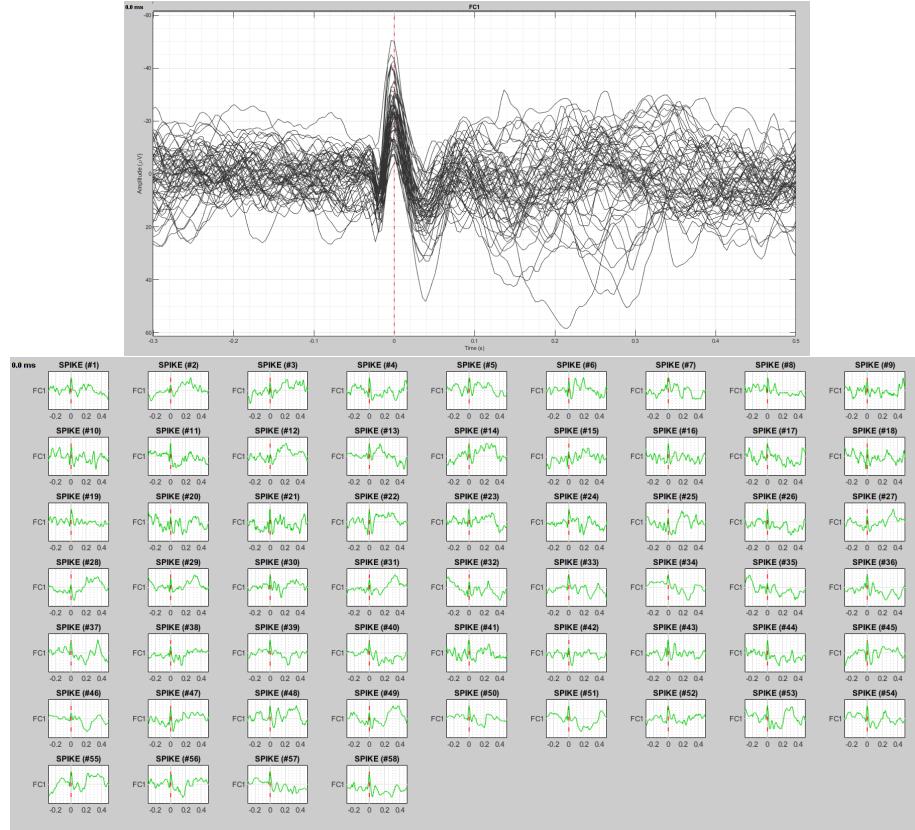


Figure 15: Cluster of spikes, FC1.

5 Average of Spikes

Now, I average all spikes and show in figure 16 and 17.

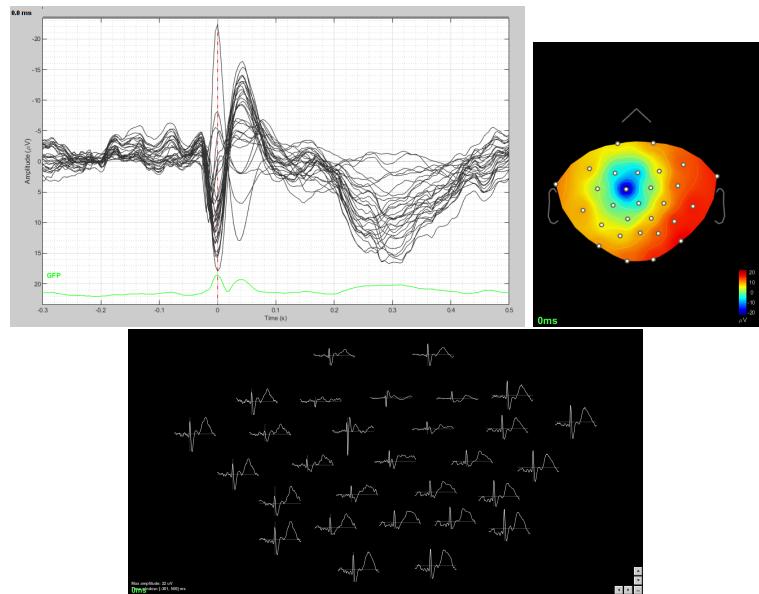


Figure 16: Average of spikes.

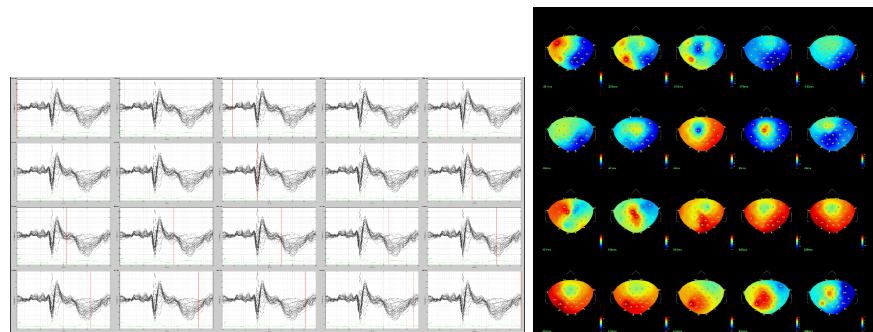


Figure 17: Average of spikes.

6 Head Model

BEM Spheres head models:

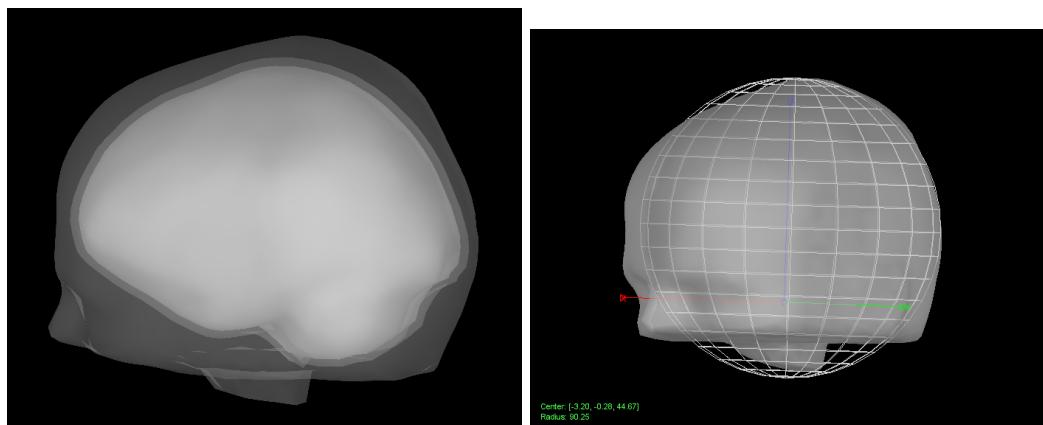


Figure 18: Head Models, left: BEM sphere, right: 3-shell sphere.

7 Inverse Problem

Solving the inverse problem with different method and compare the results.

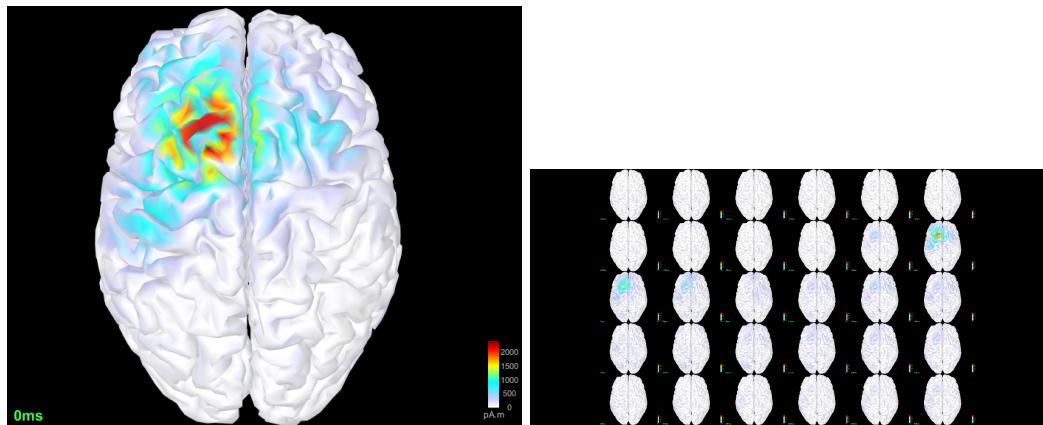


Figure 19: Minimum Norm- Current density map- Constrained.

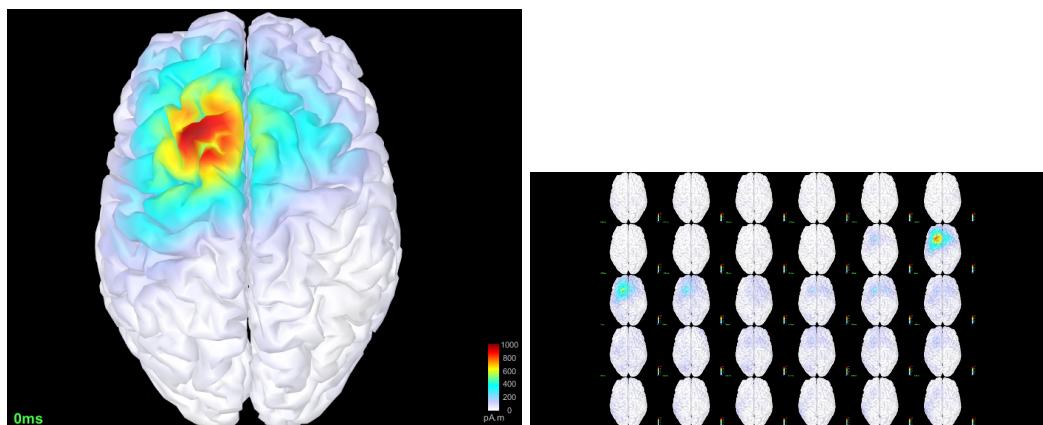


Figure 20: Minimum Norm- Current density map- Unconstrained.

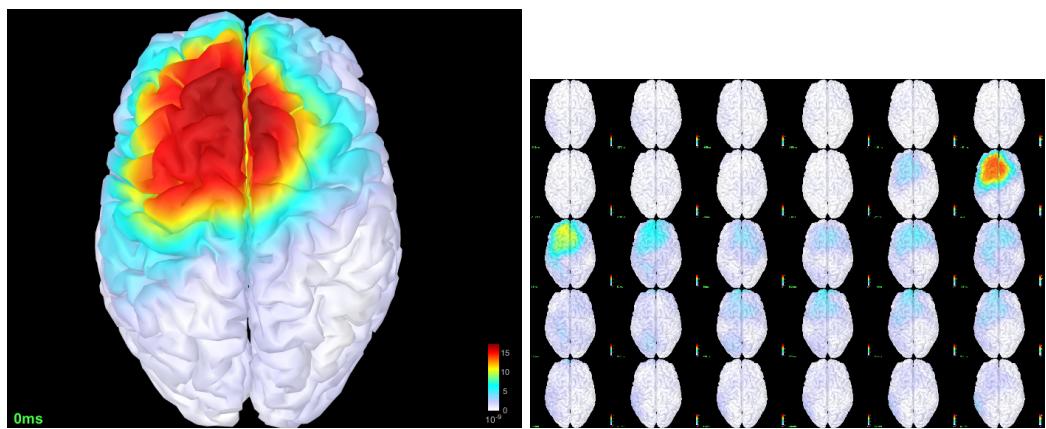


Figure 21: Minimum Norm- sLORETA- Unconstrained.

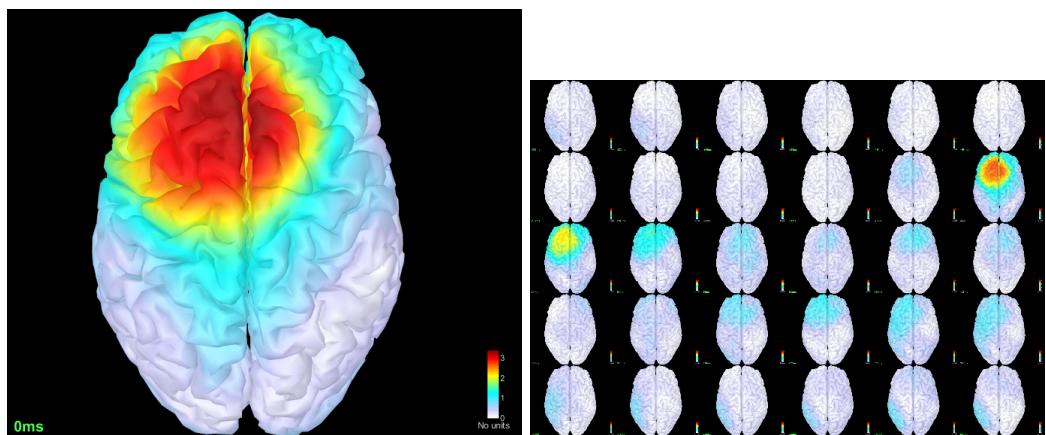


Figure 22: LCMV beamformer- Unconstrained.

3 Shell Spheres head models:

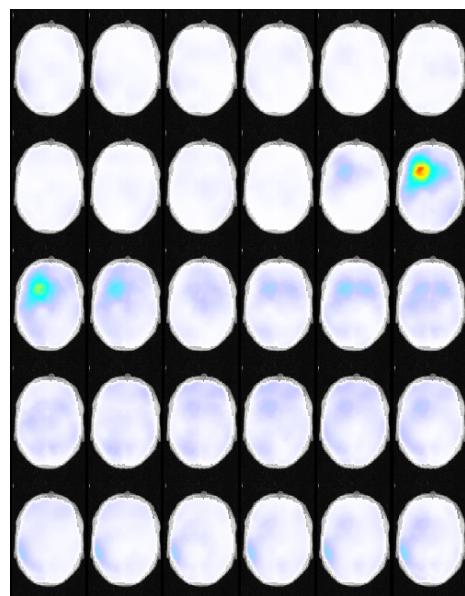


Figure 23: Minimum Norm.

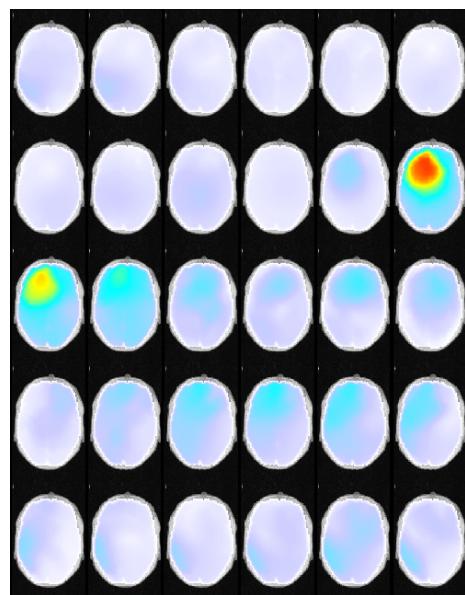


Figure 24: LCMV beamformer.

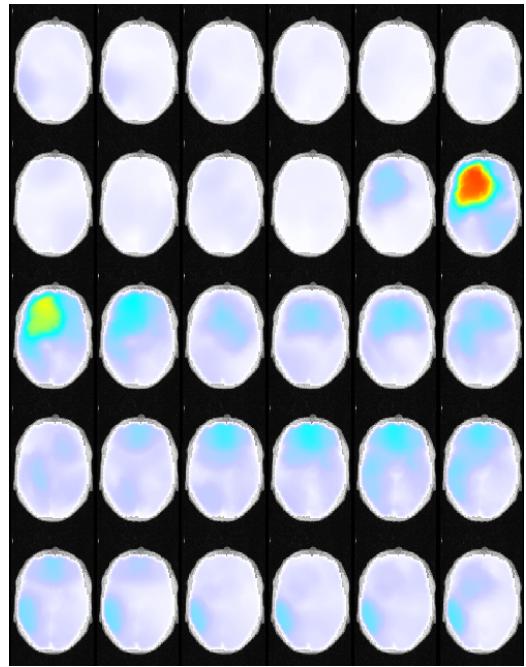


Figure 25: sLORETA.