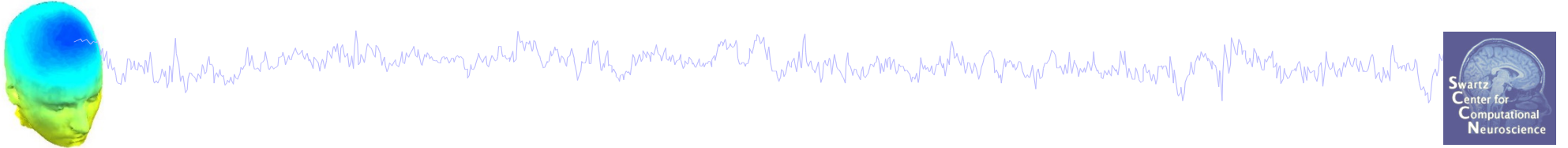
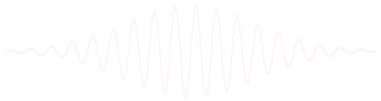


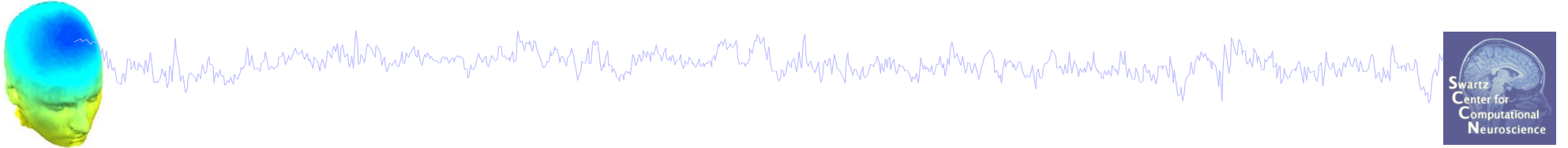
# Which ICs are which?



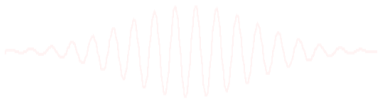
- 1) Manual IC Identification**
- 2) IC Selection**
- 3) Automatic IC Identification**

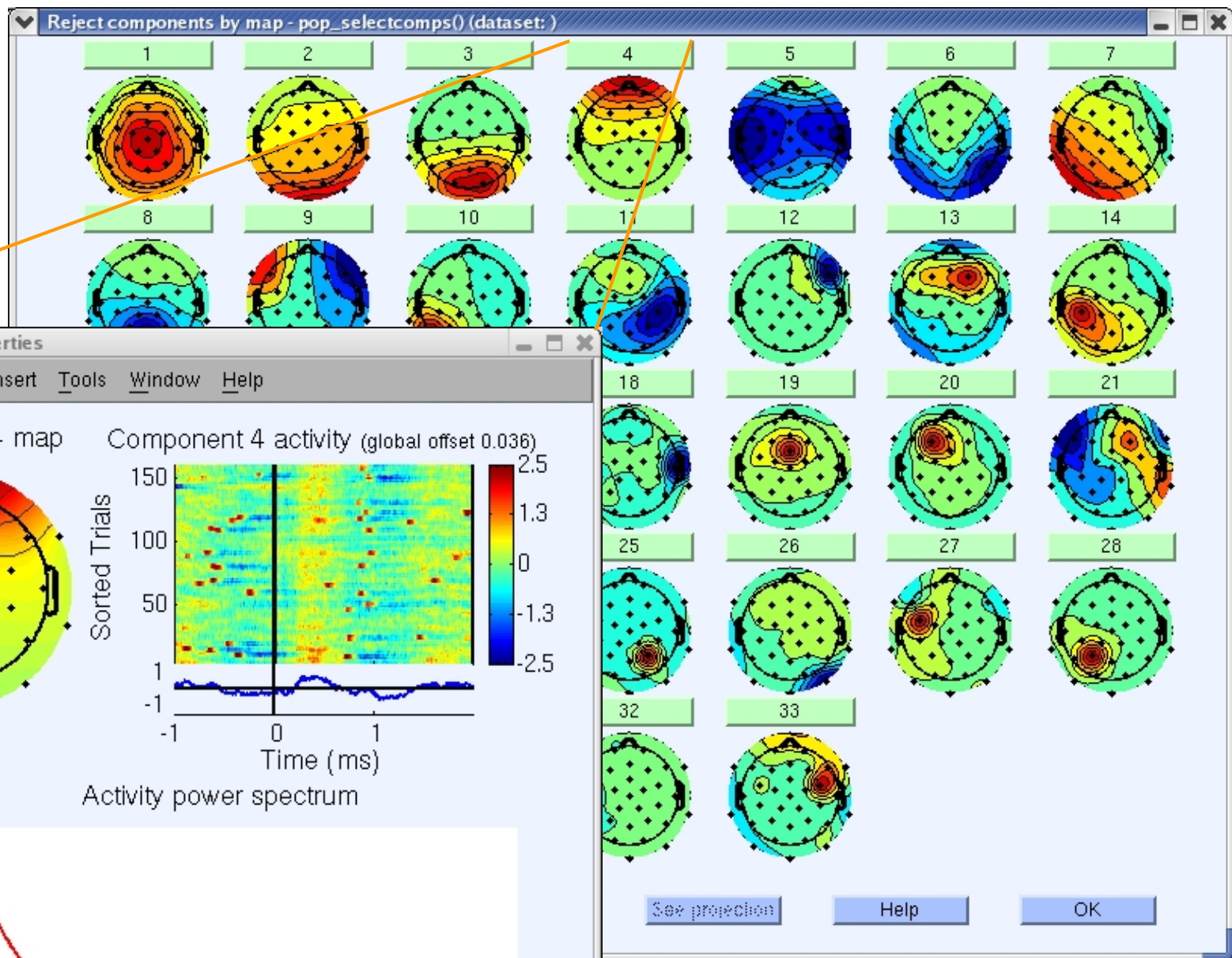


# Which ICs are which?

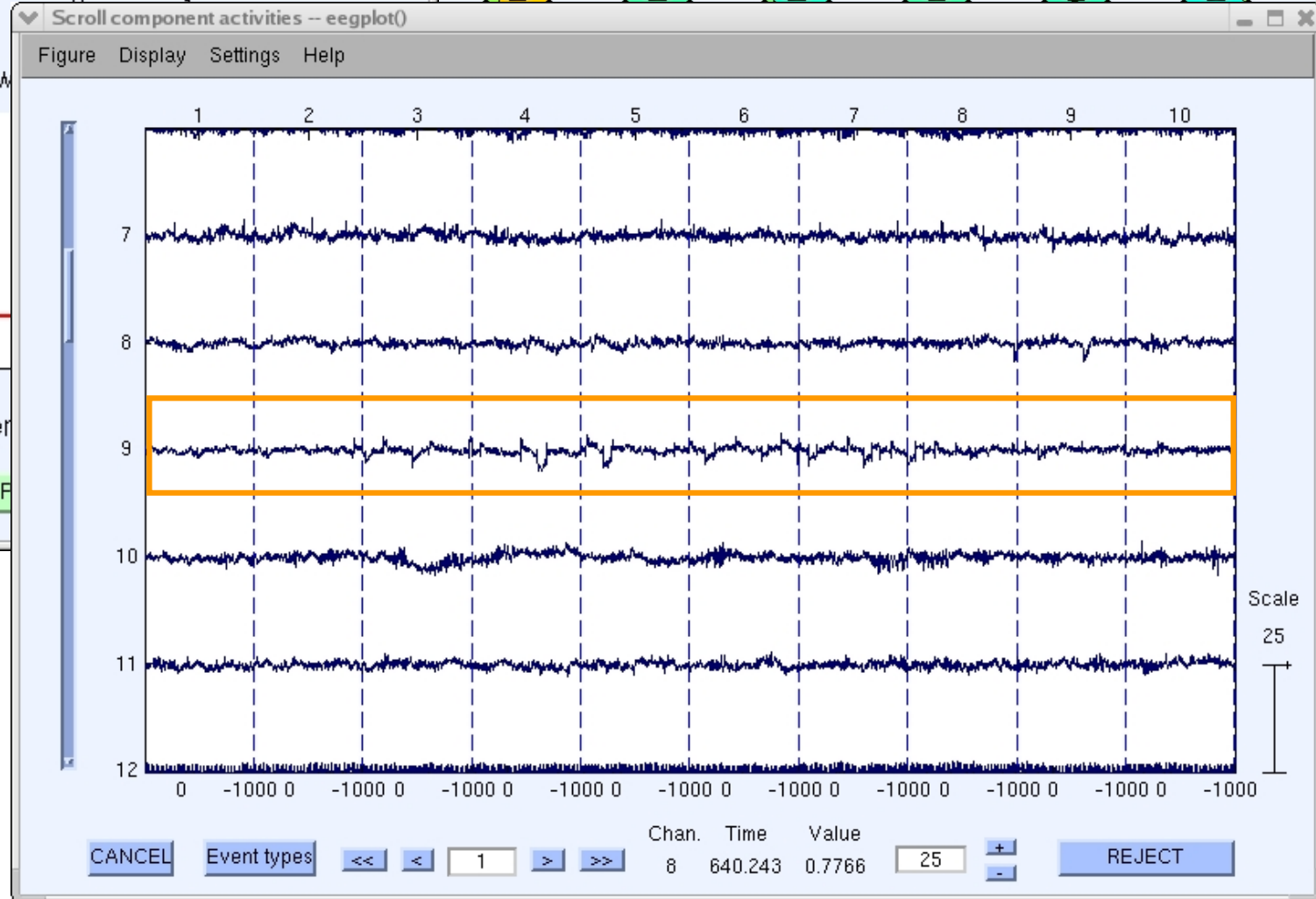
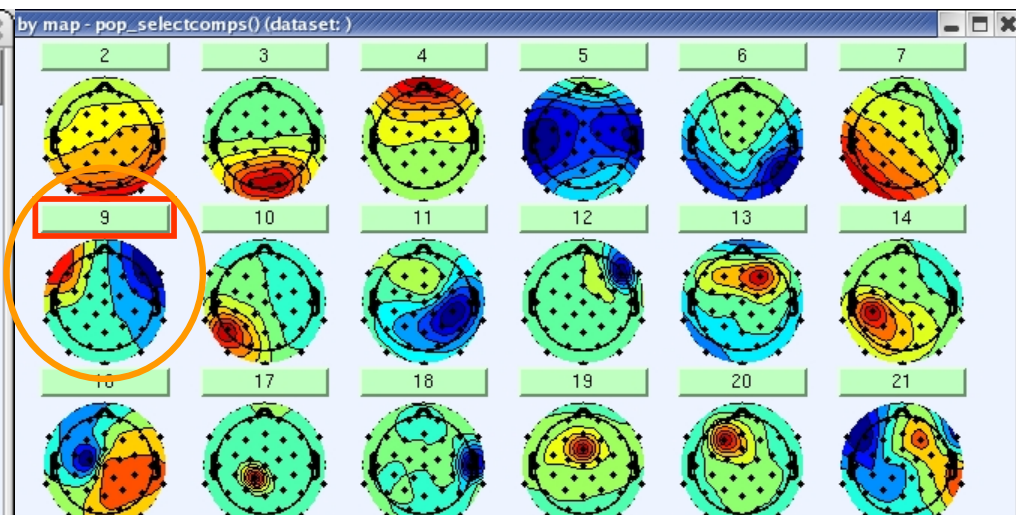
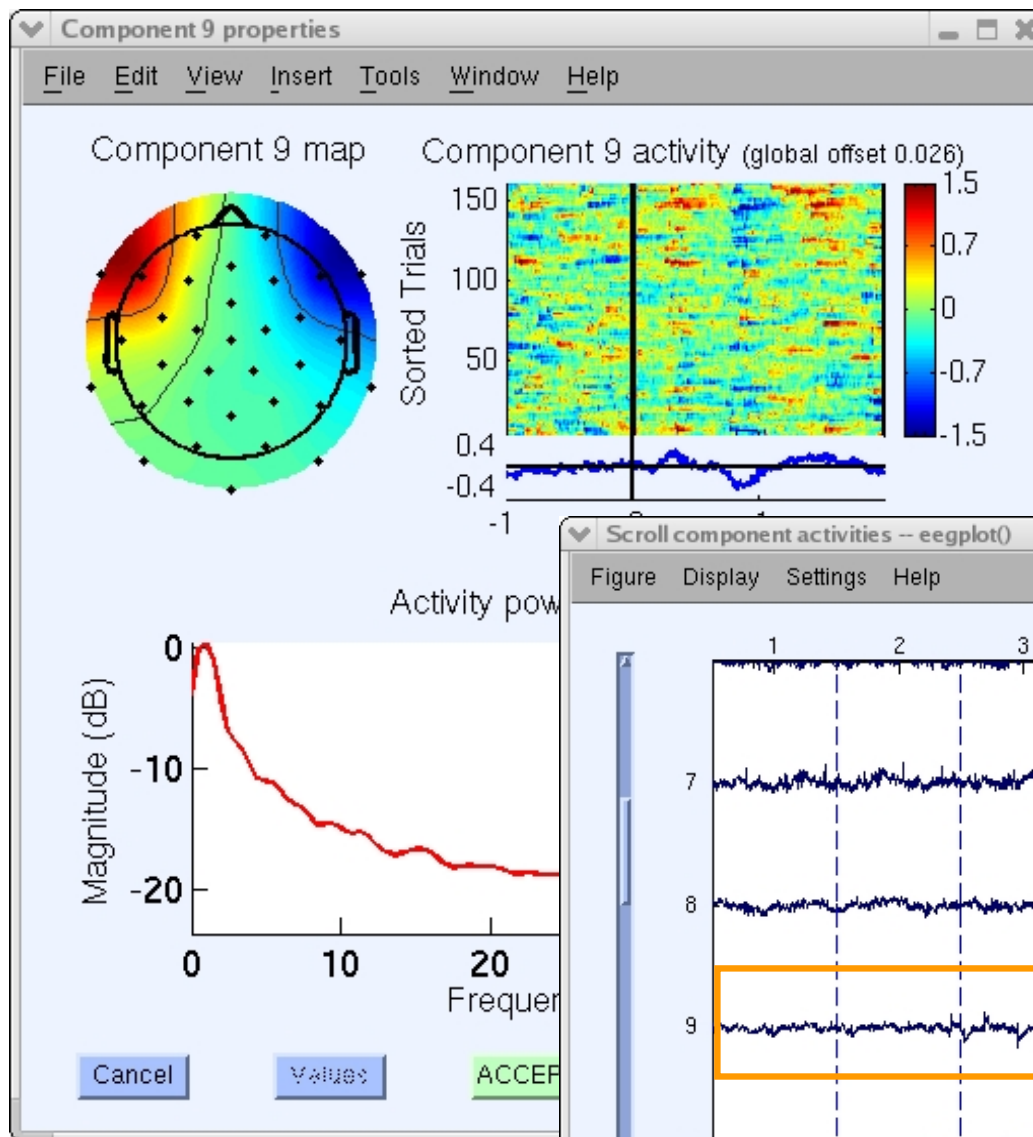


- 1) **Manual IC Identification**
- 2) **IC Selection**
- 3) **Automatic IC Identification**



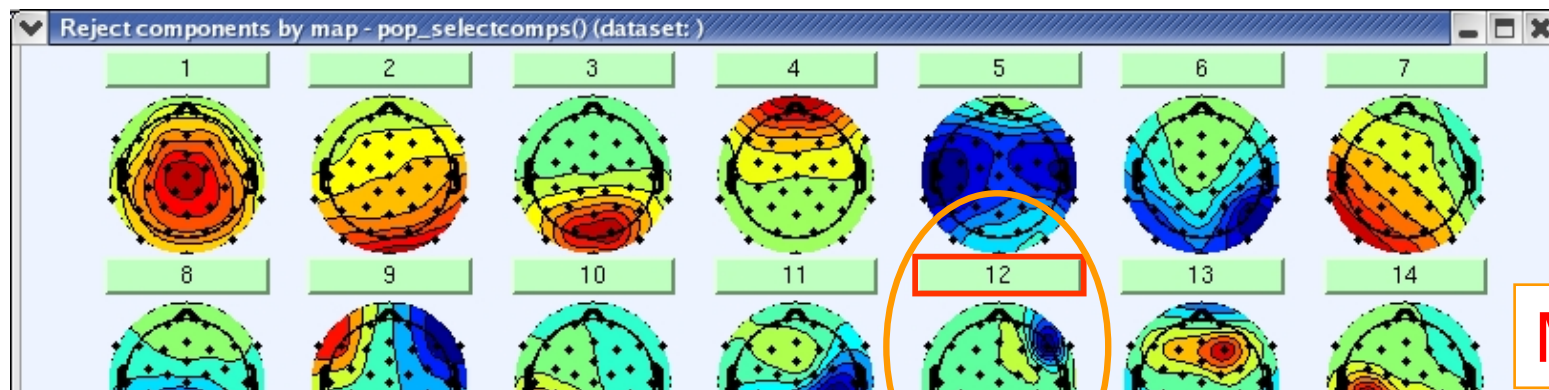


Eye blink component

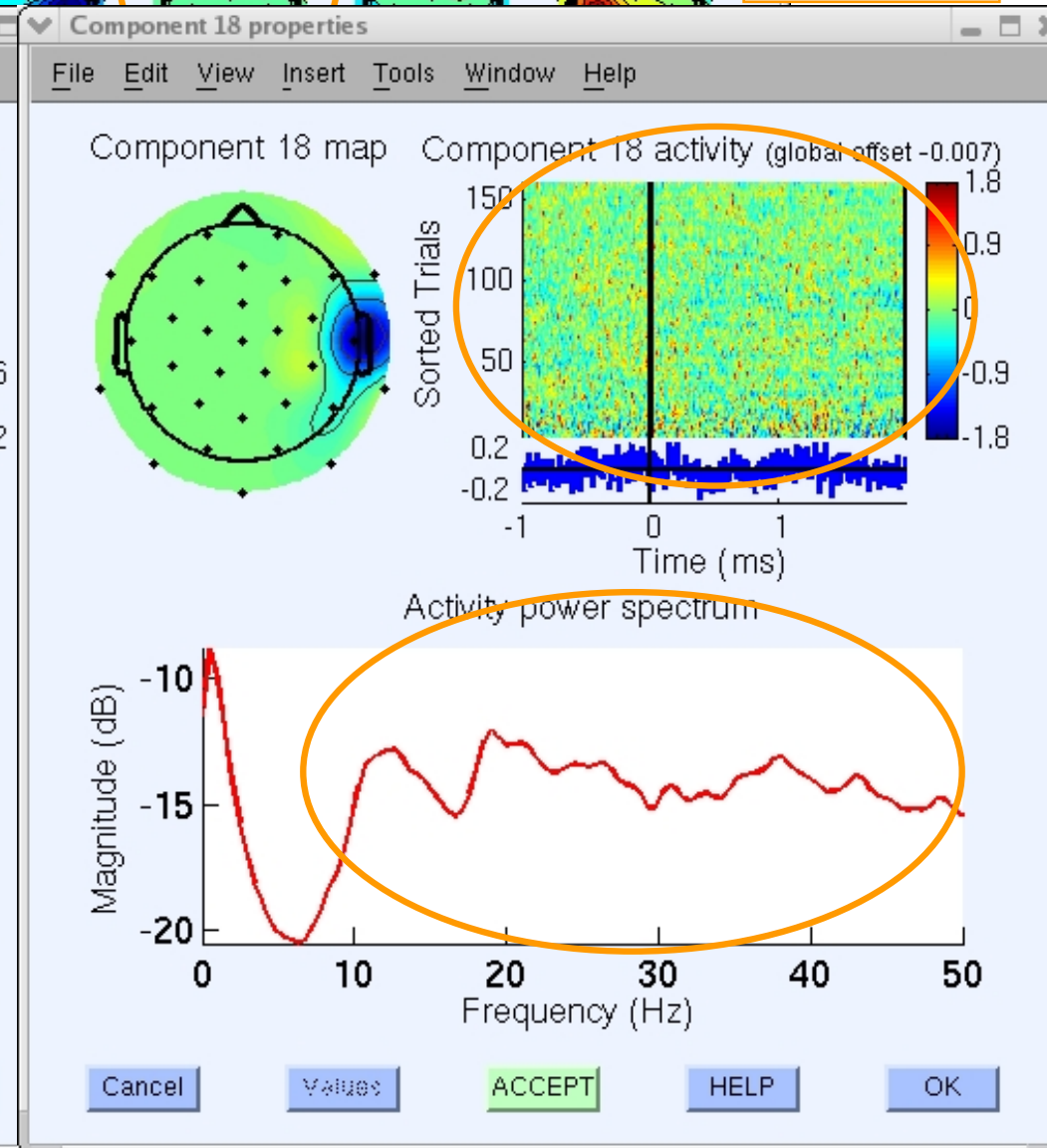
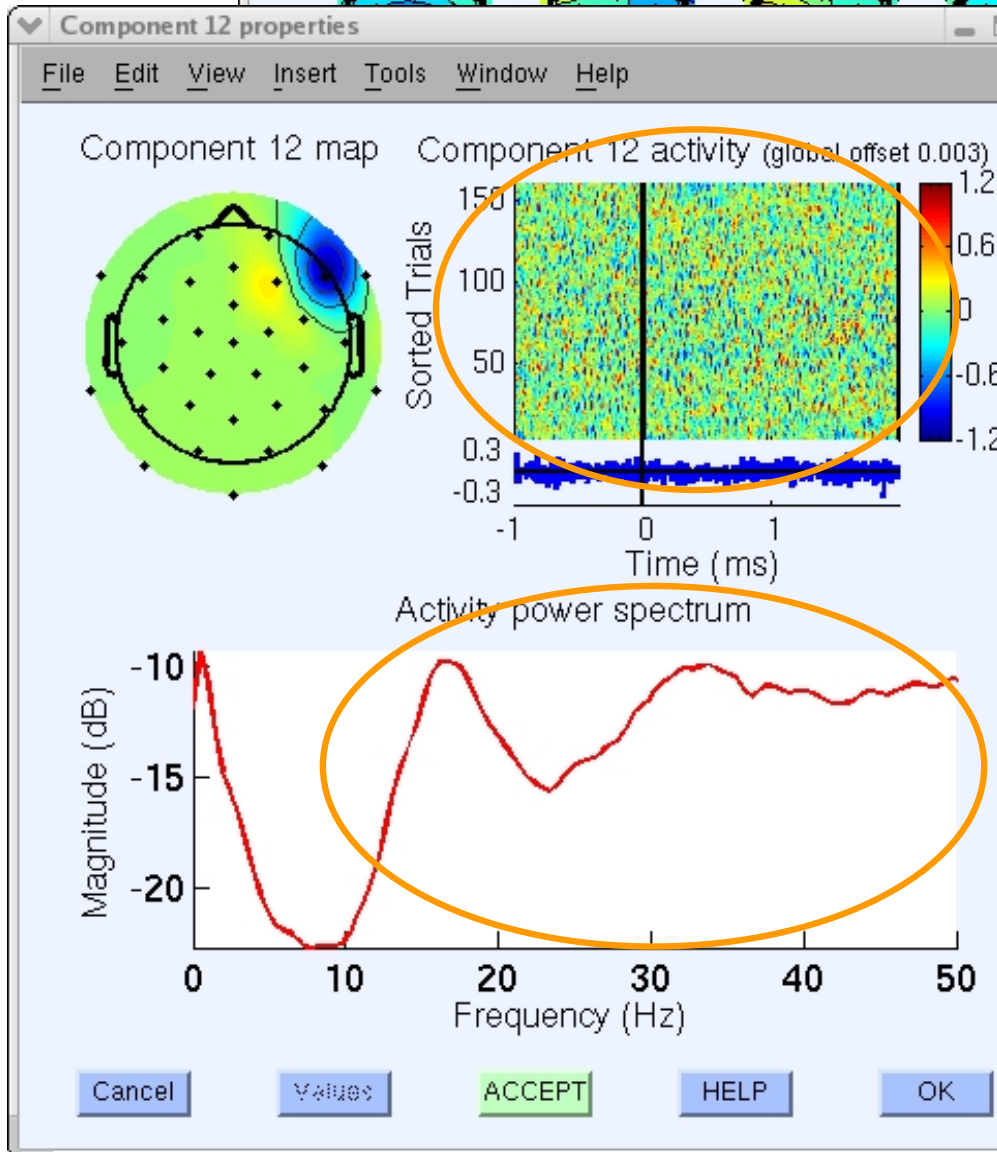


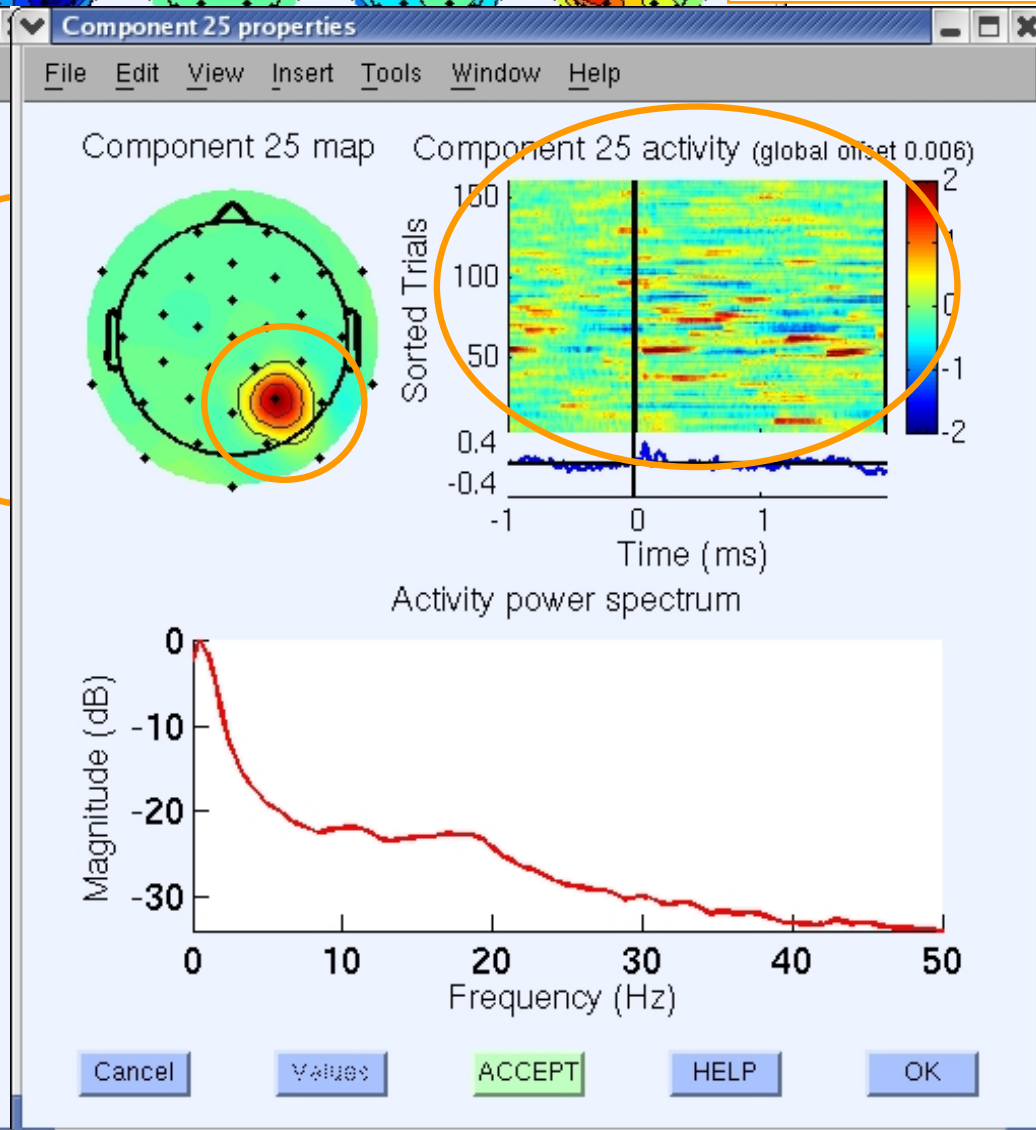
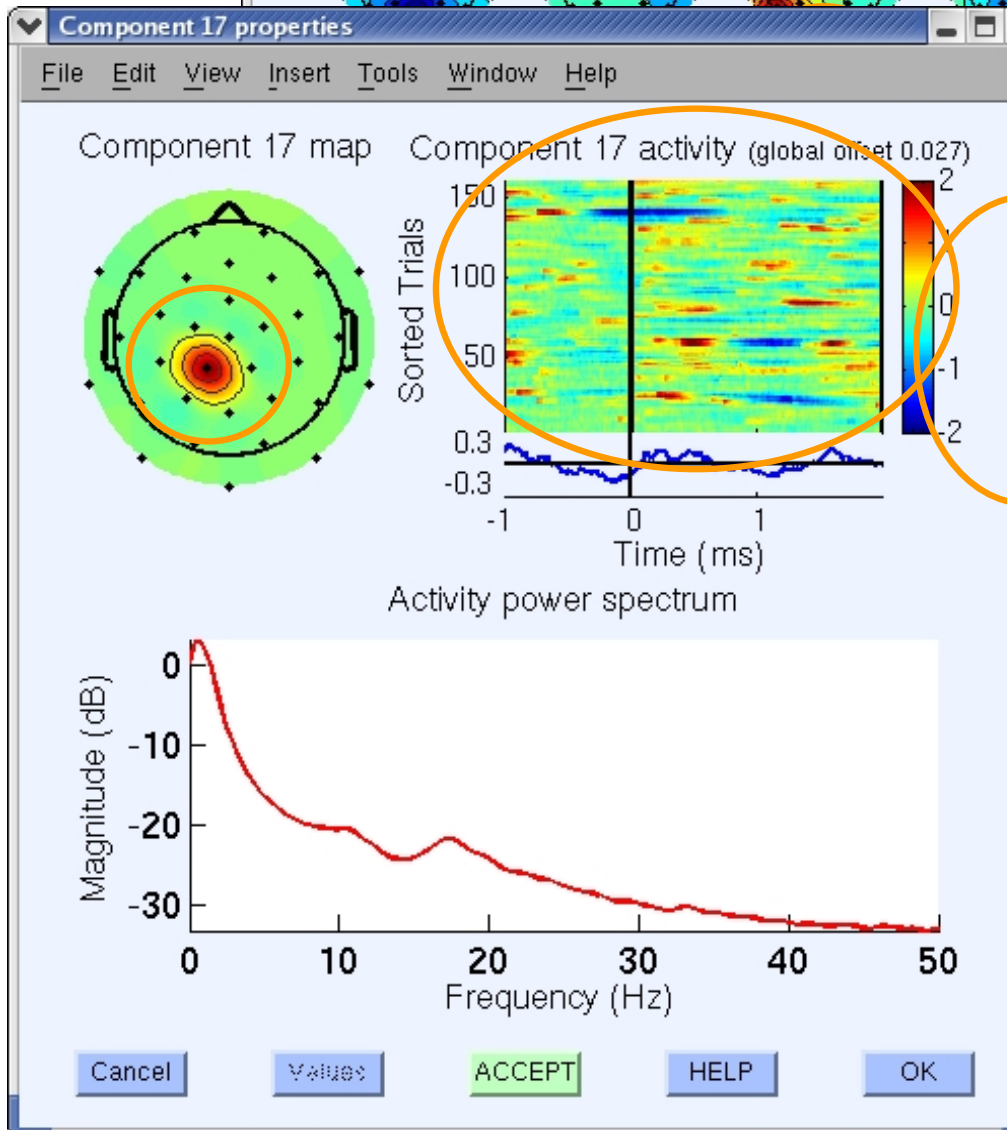
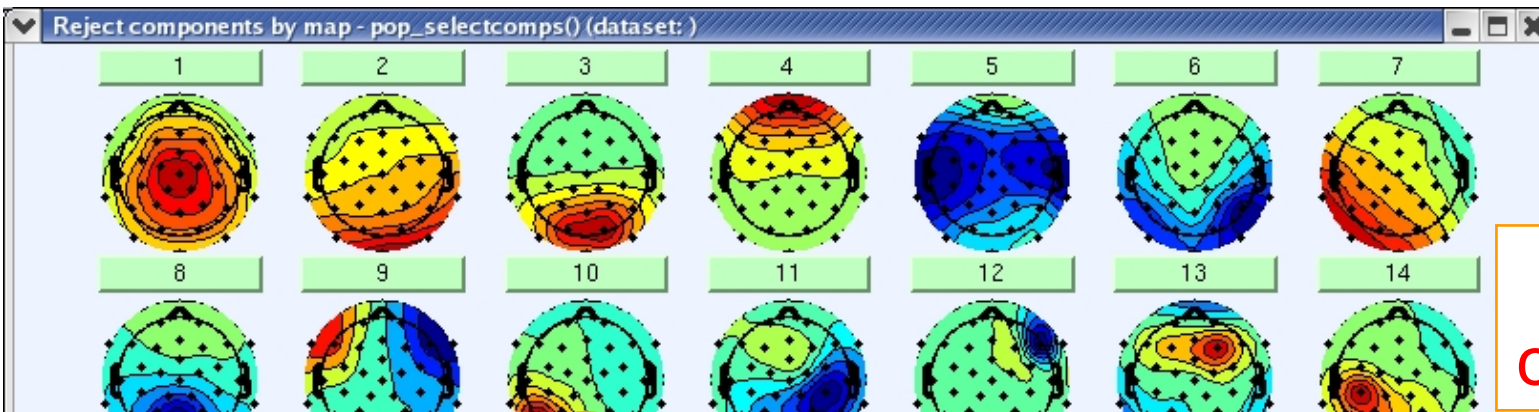
Lateral eye  
movement



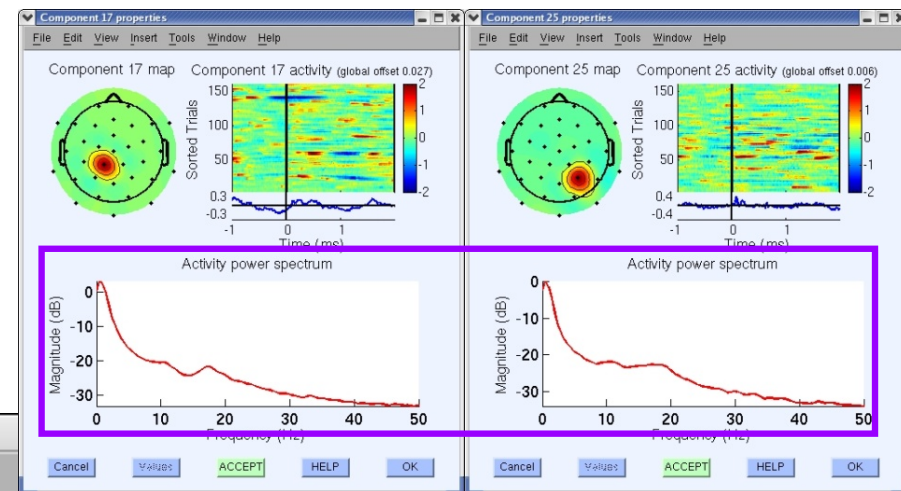
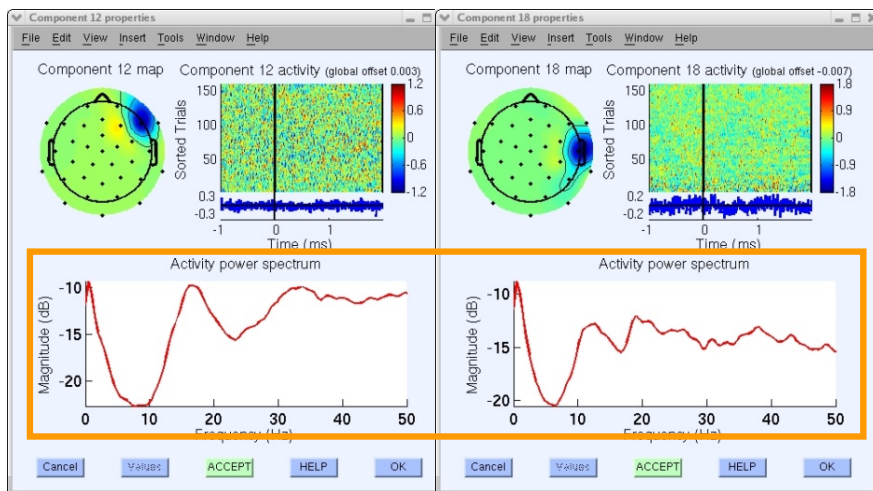


Muscle









EEGLAB v

File Edit Tools Plot Study

#1: faces

Filename: ...

Channels per

Frames per e

Epochs

Events

Sampling rat

Epoch start (

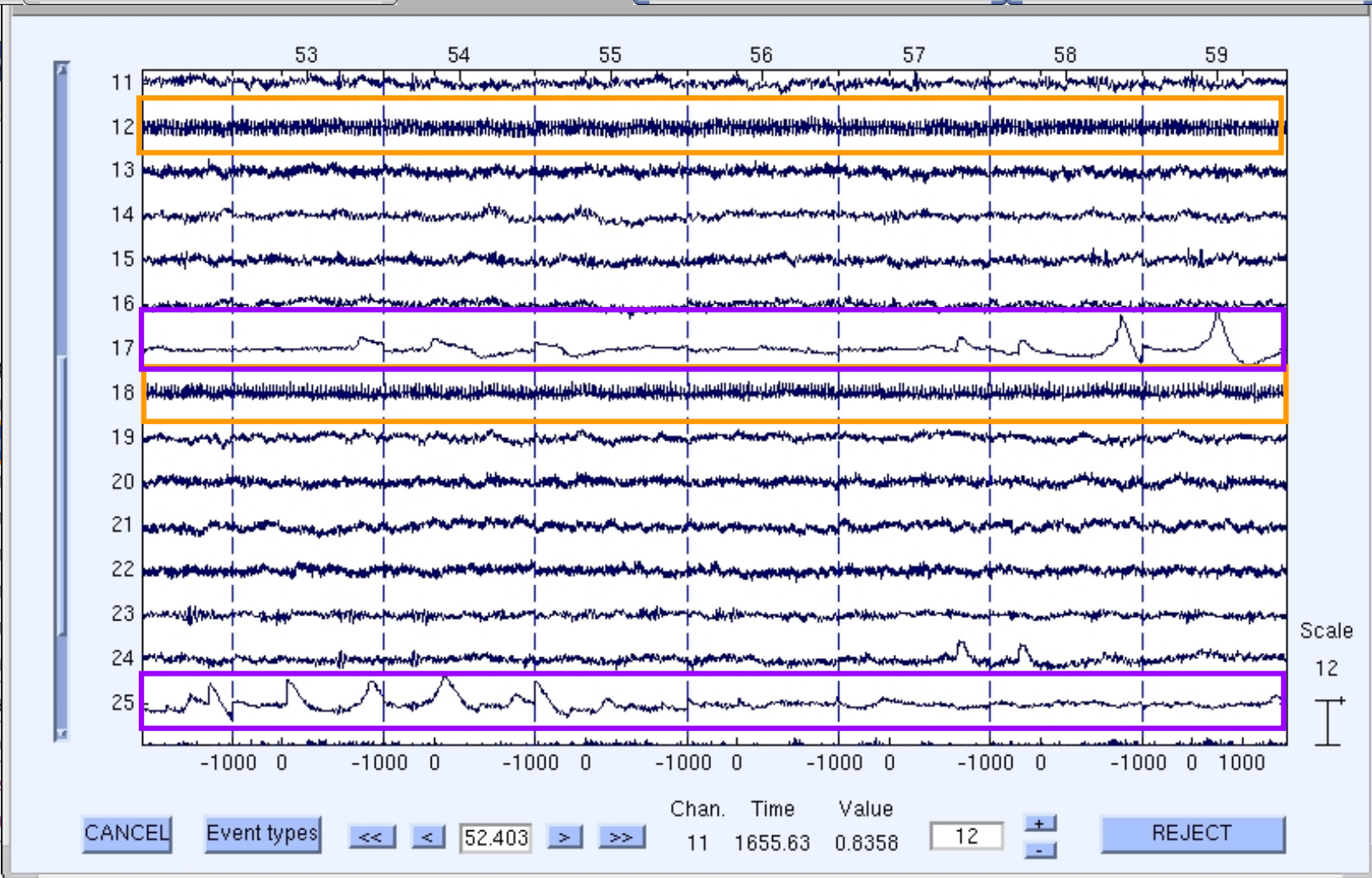
Epoch end (s

Average refe

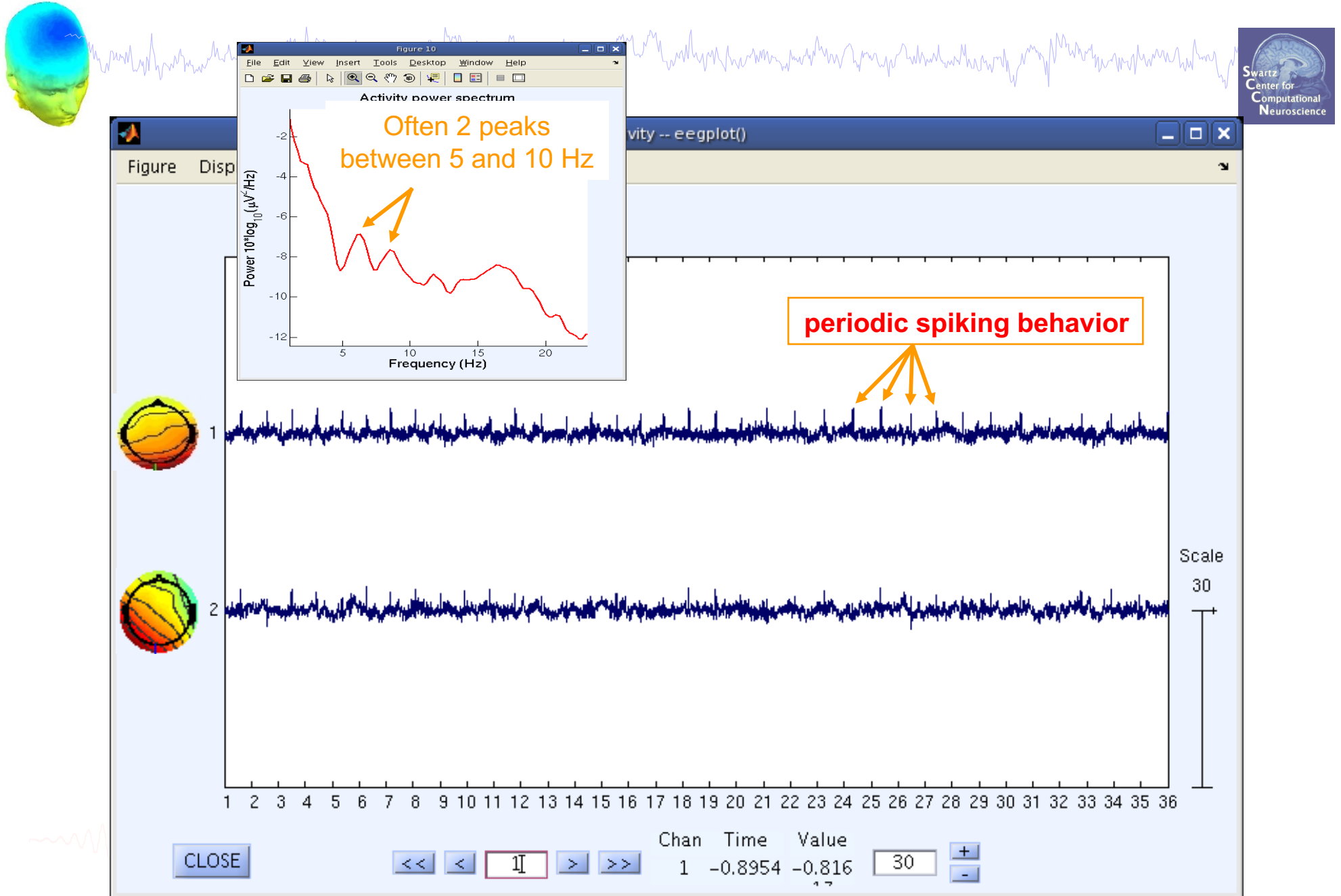
Channel loca

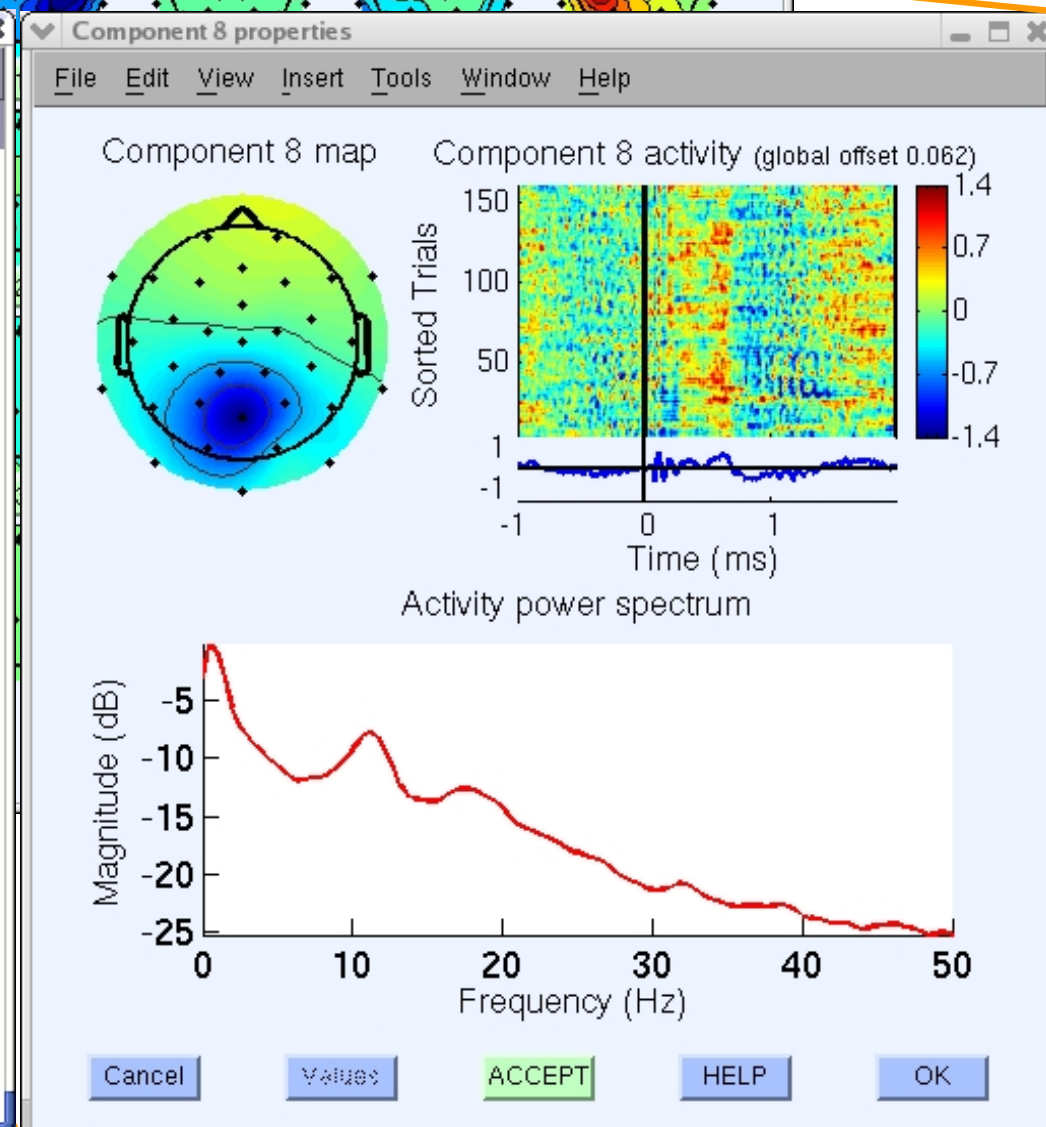
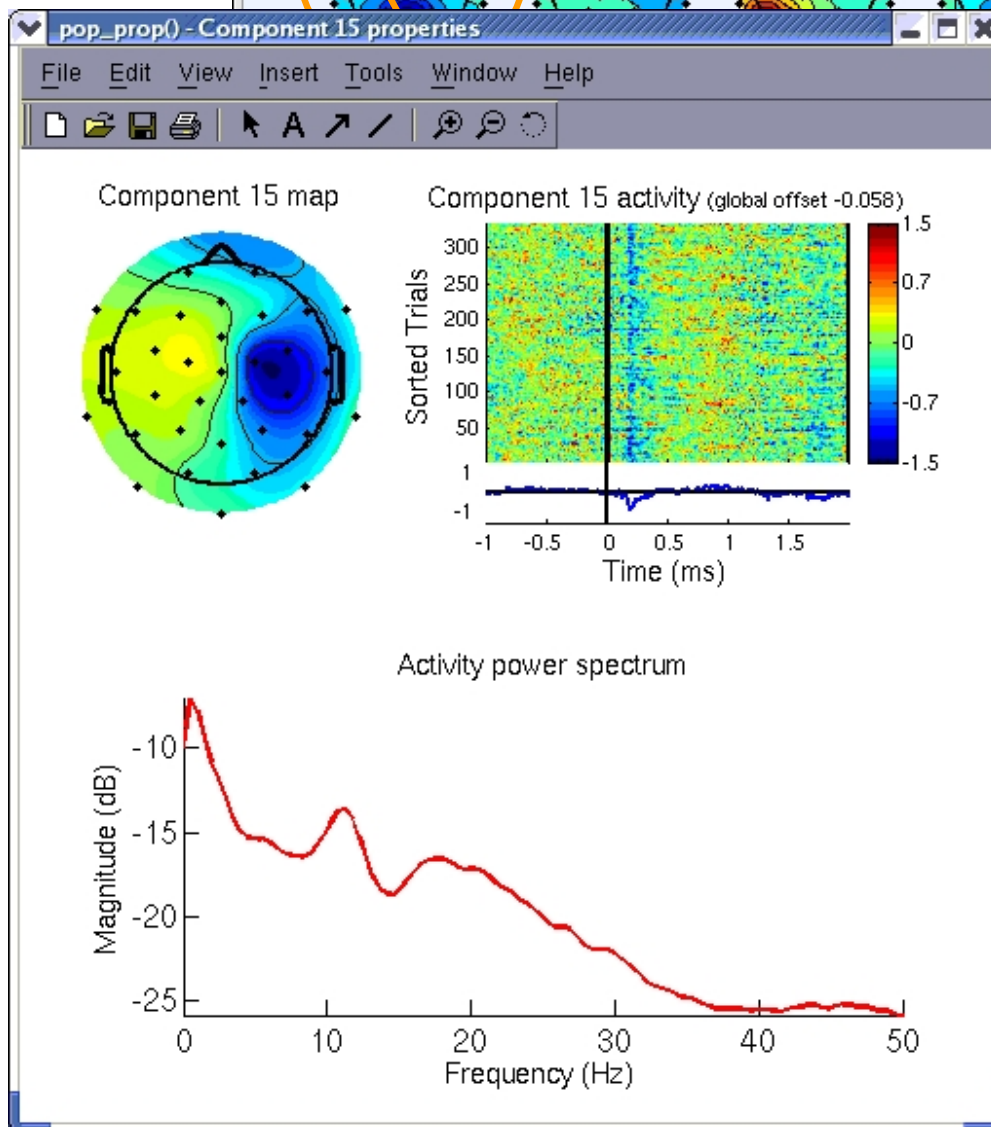
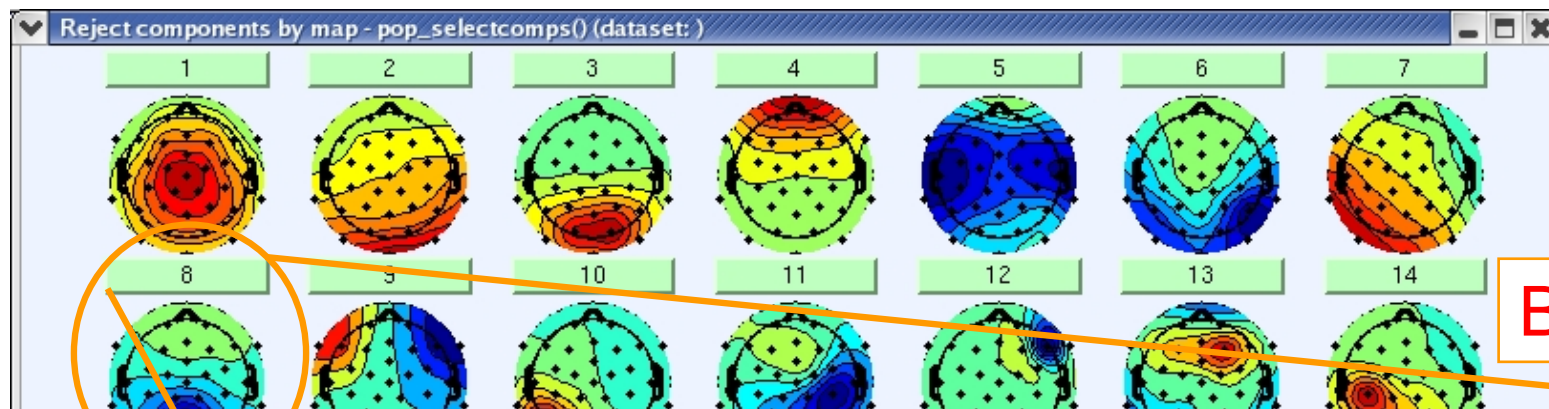
ICA weights

Dataset size



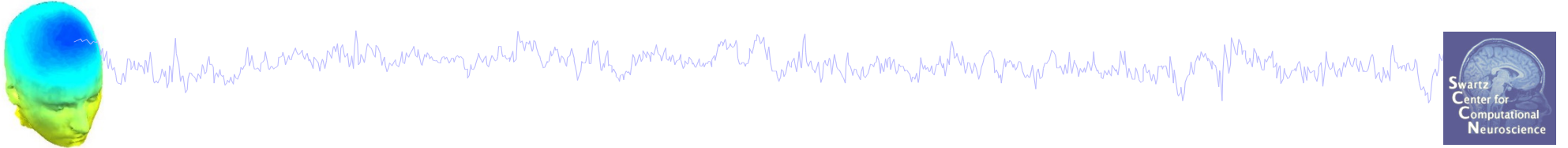
# Pulse artifacts



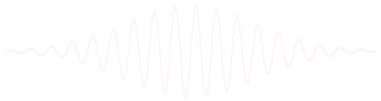




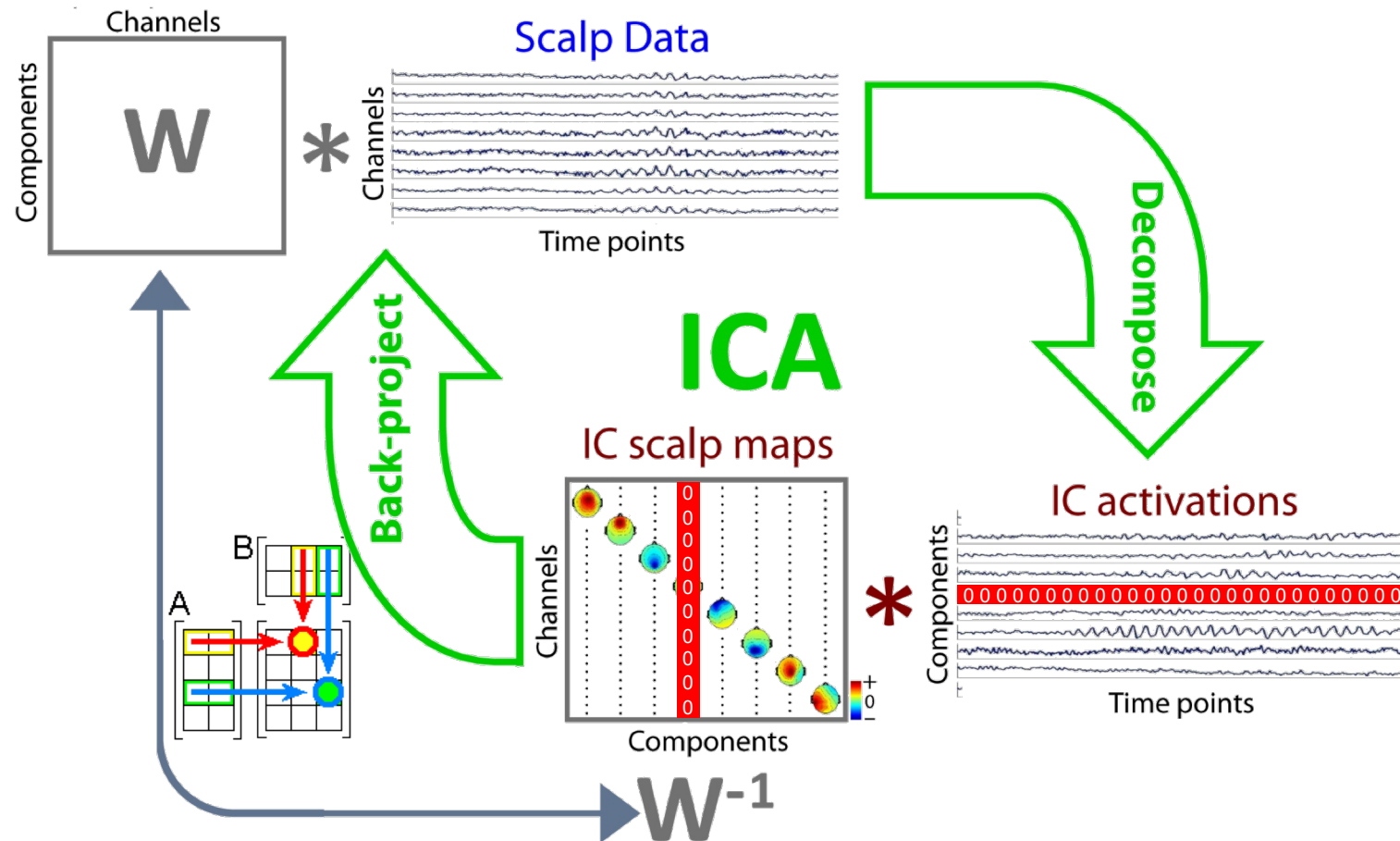
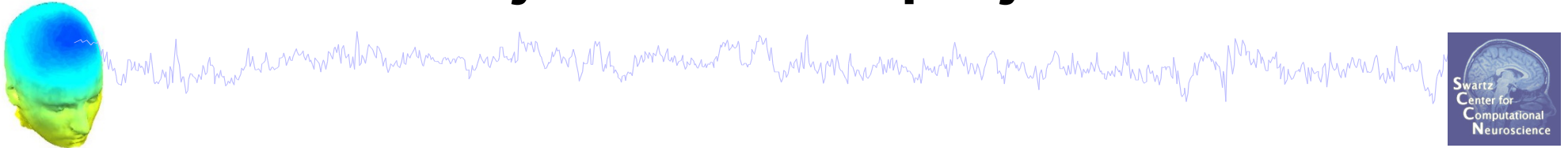
# Which ICs are which?



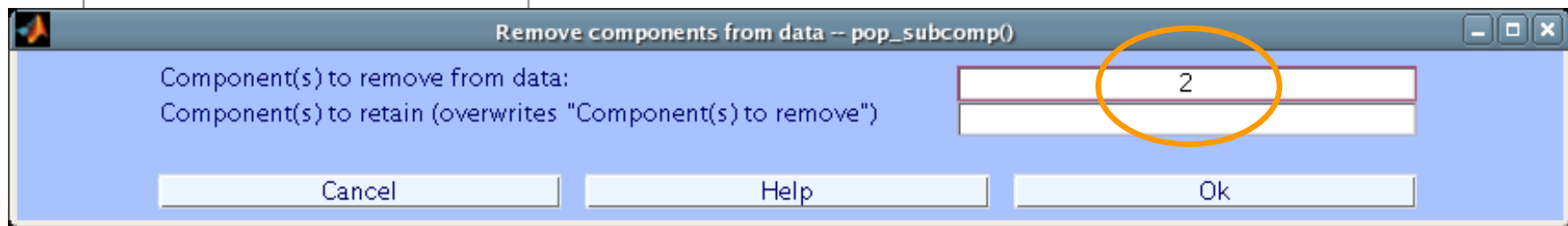
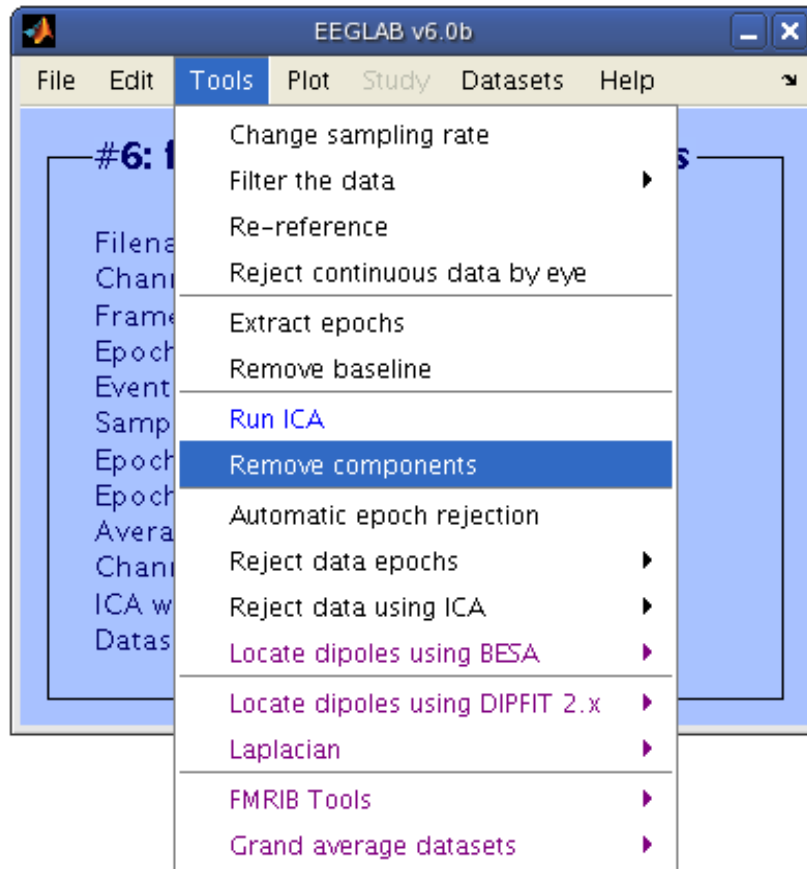
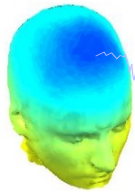
- 1) Manual IC Identification
- 2) IC Selection
- 3) Automatic IC Identification



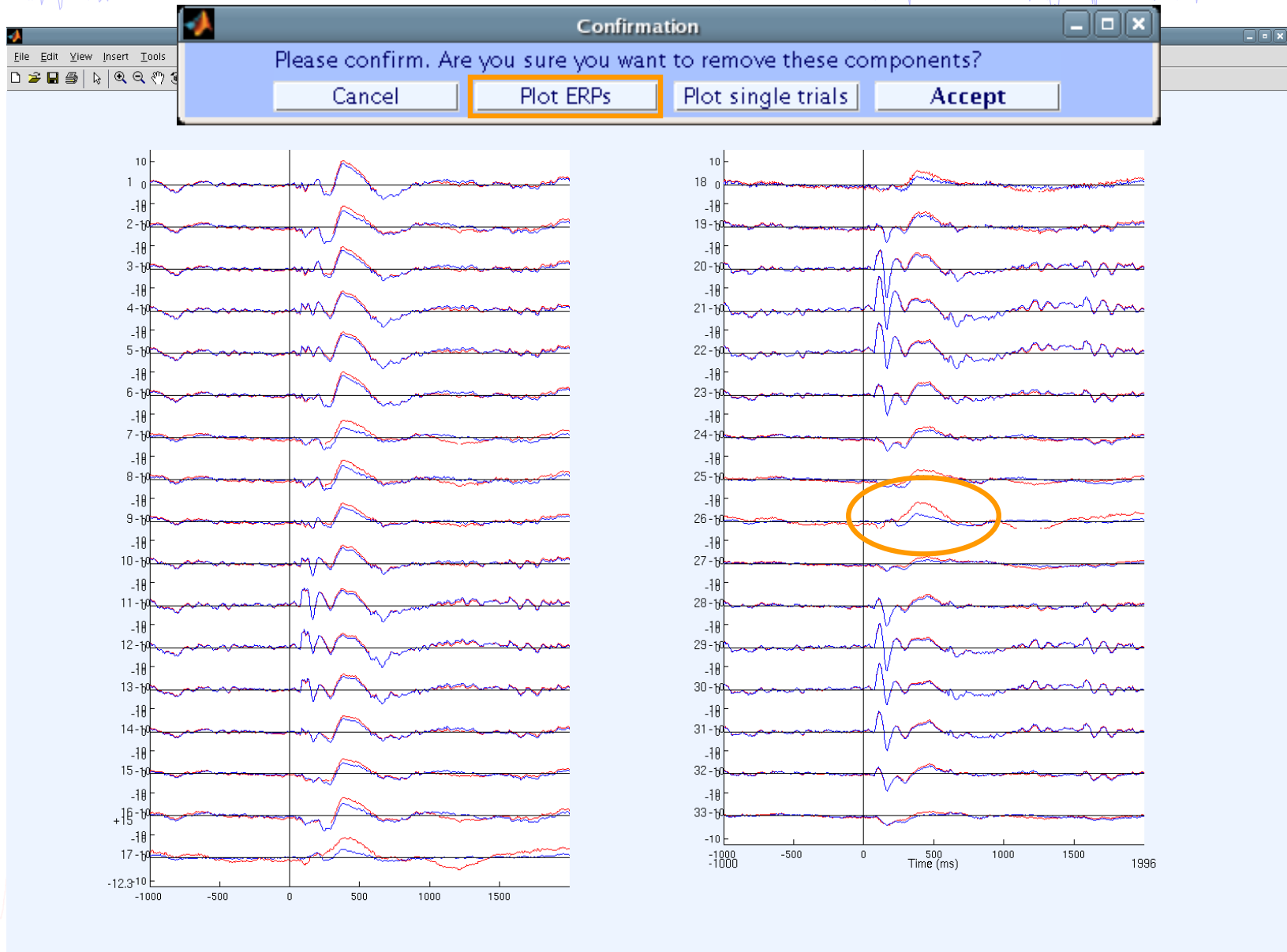
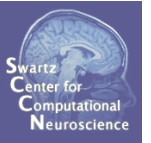
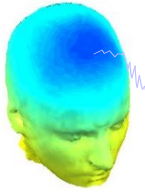
# IC rejection/back-projection



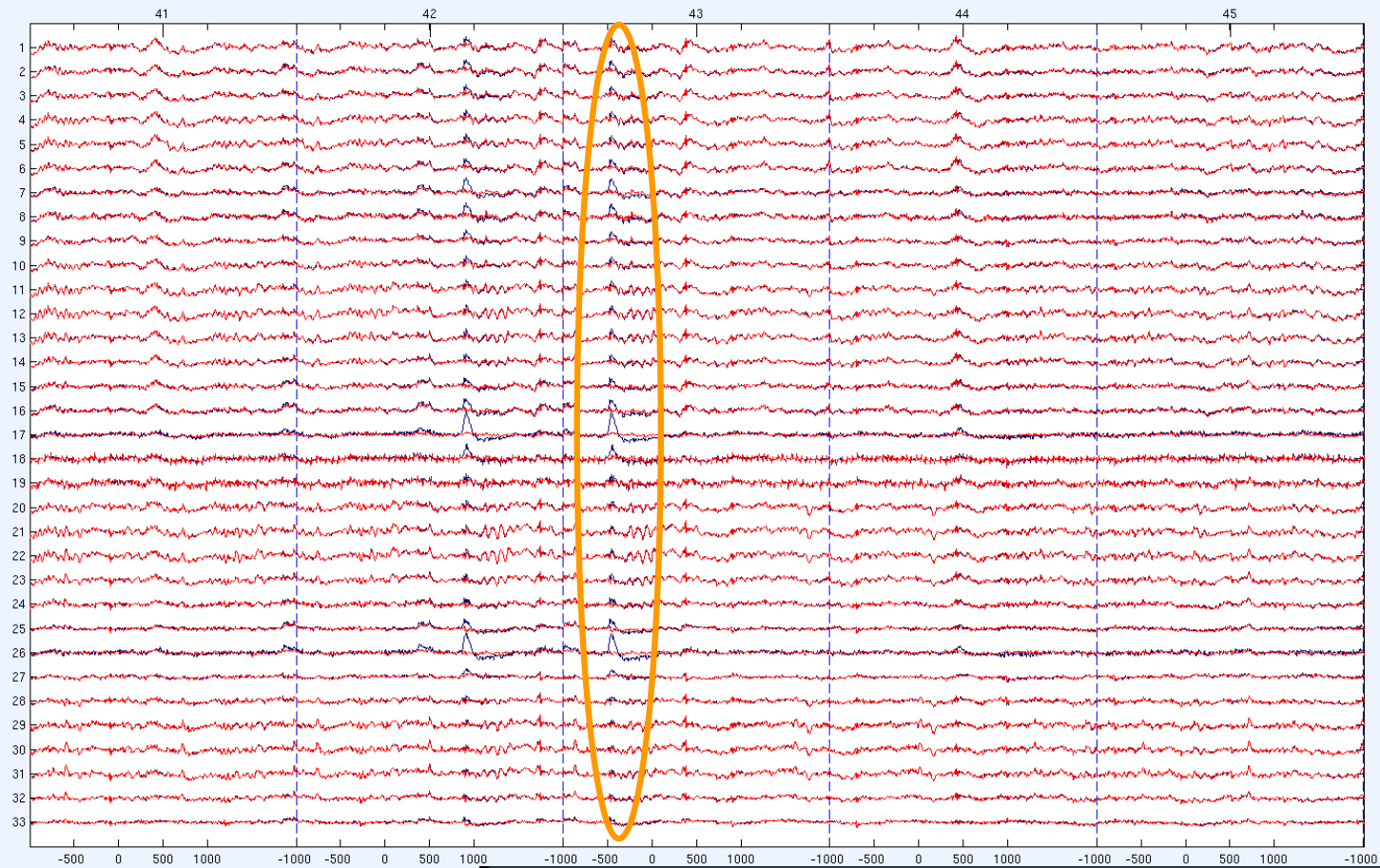
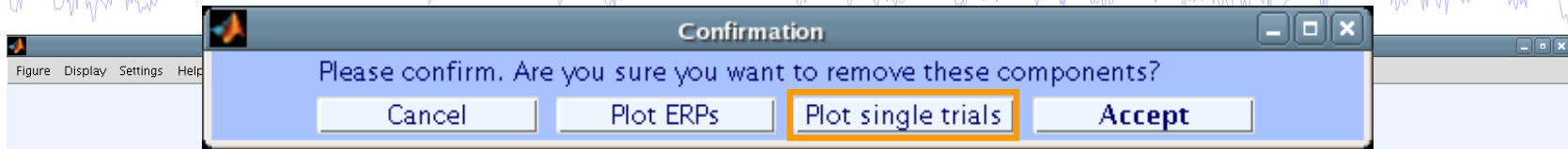
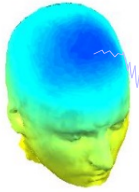
# Independent Component Rejection



# Eye blink correction



# Eye blink correction

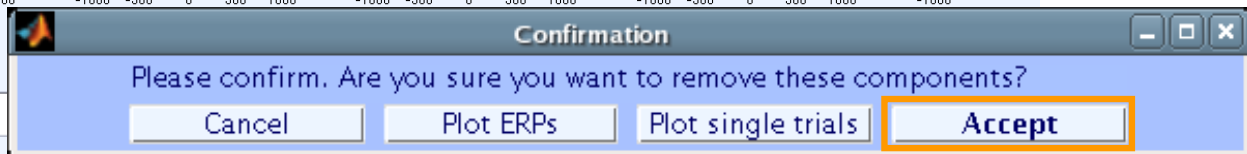


CLOSE

<<

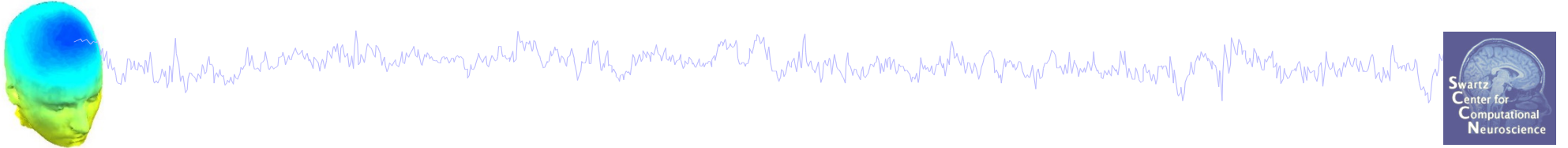
<

41

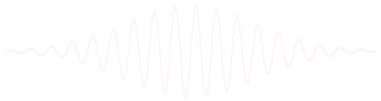




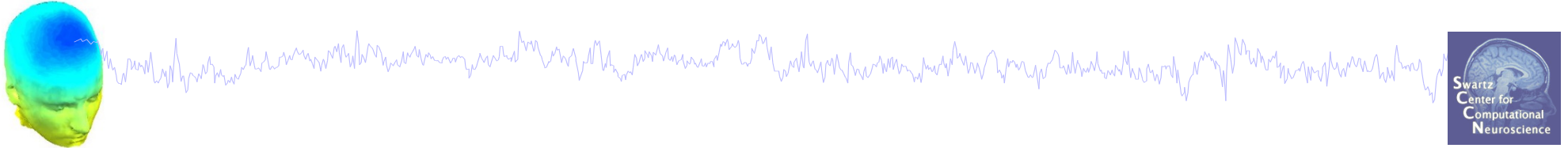
# Which ICs are which?



- 1) Manual IC Identification
- 2) IC Selection
- 3) Automatic IC Identification



# Further Resources



## Some attempts to automate IC classification:

### MARA ("Multiple Artifact Rejection Algorithm")

**"Automatic Classification of Artifactual ICA-Components for Artifact Removal in EEG Signals."** Irene Winkler, Stefan Haufe and Michael Tangermann (2011).

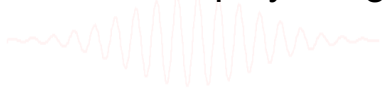
### IC\_MARC

**"Classification of independent components of EEG into multiple artifact classes."** Laura Frølich, Tobias S. Andersen, and Morten Mørup (2014).

### ICLabel

Paper in progress. Crowd-sourcing heuristic knowledge about IC components to build automatic classifier.

We'll play the game later: [labeling.ucsd.edu](http://labeling.ucsd.edu)



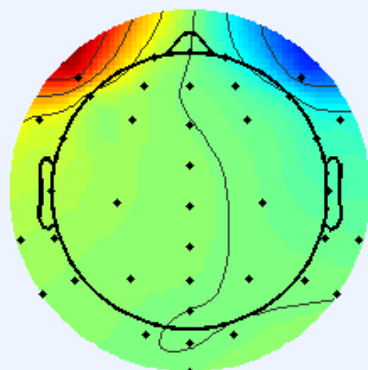
All of these have EEGLAB plugins available. Other IC classifiers exist as well.

# View components properties - pop\_viewprops() (dataset: 001.SDRT.allruns.ICA.set)



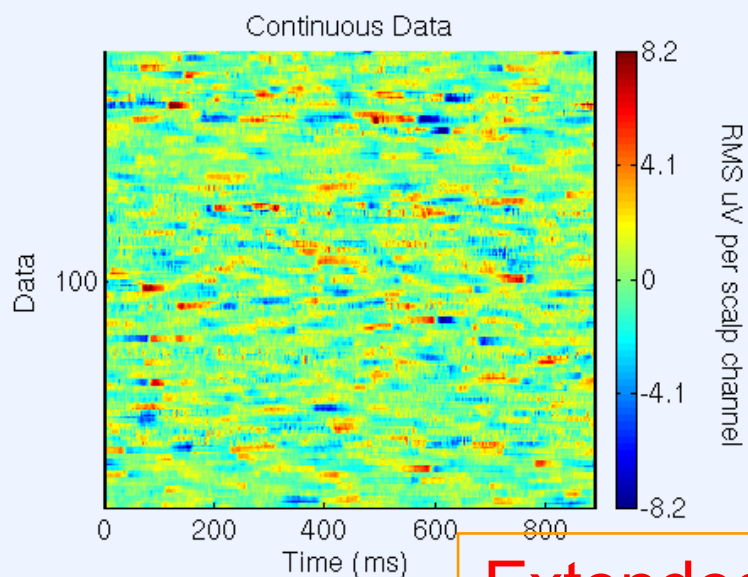
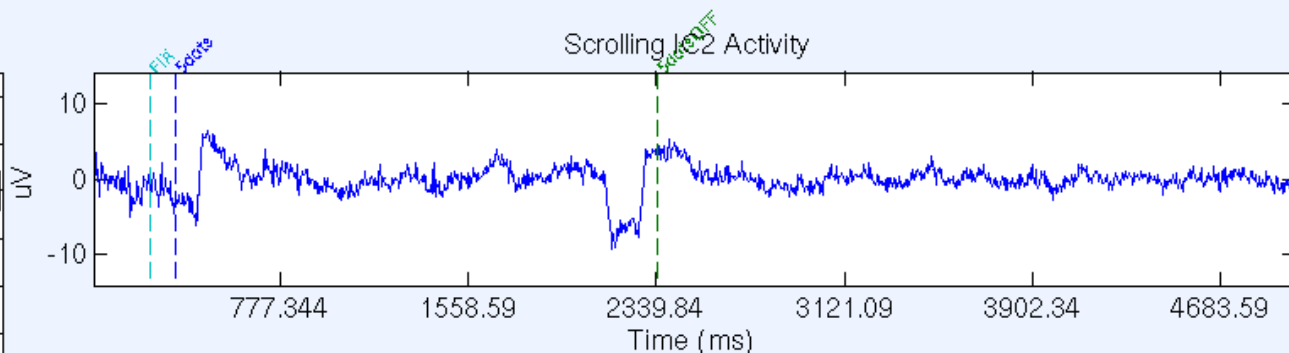
## IC2 - pop\_prop\_extended()

IC2



ICLabel	Probability
Brain	0.0%
Muscle	0.6%
Eye	95.5%
Heart	0.3%
Line Noise	0.0%
Channel Noise	0.1%
Other	3.4%

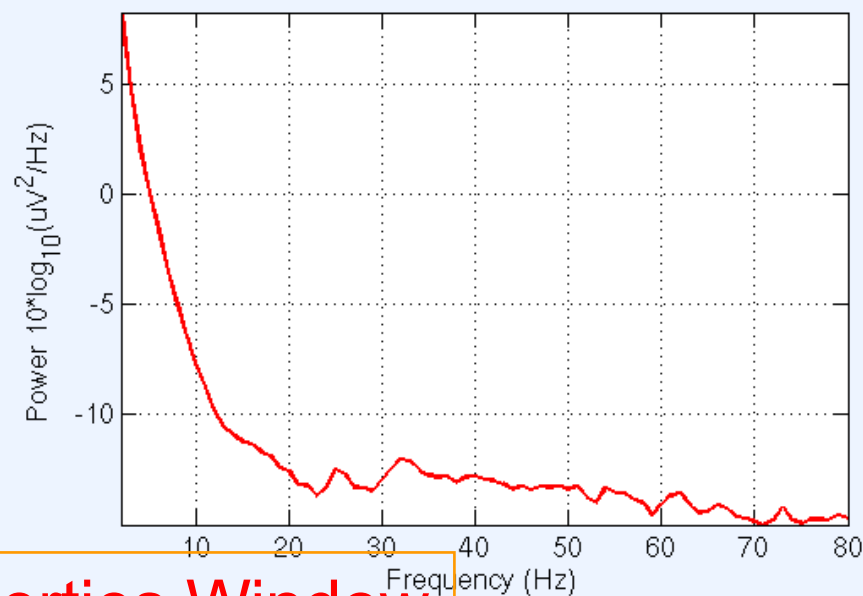
% scalp data var. accounted for: 7.5%



Dipole Position

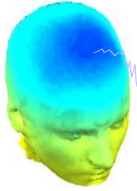


IC2 Activity Power Spectrum



**Extended IC Properties Window**

# ICLabel website



Purpose of the website:

Gather IC labels to accompany our vast collection of datasets.

**labeling.ucsd.edu/tutorial**

ICLabel Login

Login

[Need To Register?](#)

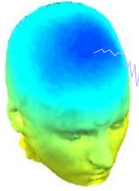
[Forgot Your Password?](#)

[What Is This Site?](#)

[Just want to practice?](#)

[Check Out The Leaderboard!](#)

# ICLabel website - Profile



## Features:

1. Tutorial on IC classification
2. Labeling practice
3. Label collection

## Profile for [SCCN] Luca Pion-Tonachini

[Label EEG Components](#)

[Tutorial](#)

[Practice Labeling](#)

[Leave A Comment](#)

[Log Out](#)

Welcome to your profile. Below you can see some statistics of your activity. To the left, you can navigate to other parts of the website. If you are new to labeling EEG components, I highly recommend reading the tutorial and practicing on some components with feedback. If there is something you think is missing, let me know by leaving a comment (link to the left).

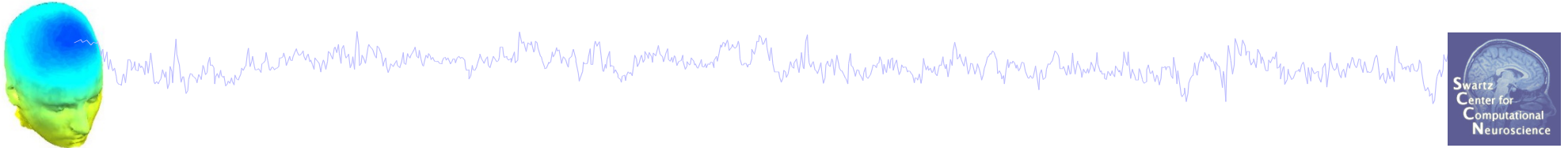
**Number of labels submitted: 2782**

**Time of last submitted label: 2016-11-13 22:48:48**

**Member since: 2016-01-28 01:11:14**



# ICLabel website - Tutorial



## Tutorial: EEG Independent Component Labeling

[Overview](#)

[Why Help Us?](#)

[How To Label](#)

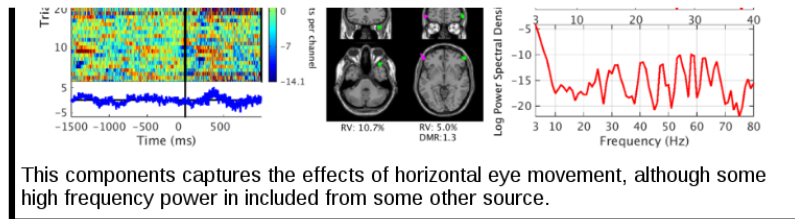
[Telling Components Apart](#)

[Practice Labeling](#)

[Leave A Comment](#)

[Return To Labeling](#)

[Profile](#)

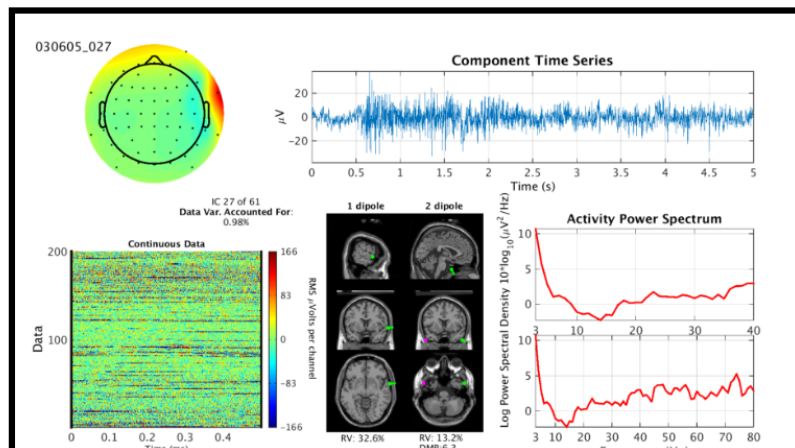


### Muscle Component

Muscle components describe the electrical fields generated by muscle activity, known as [electromyography](#) (EMG). Their activations are powerful relative to EEG but motor unit action potentials (the underlying source of EMG) do not synchronize causing most of the power of EMG to be spread out among higher frequencies. Nonetheless, these components can still look dipolar, although they will seem very shallow as they are not localized within the brain. You can tell a shallow dipole by how concentrated its scalp topography is. The more concentrated, the shallower. That isn't to say that all muscle components will be dipolar.

### Summary

- Power concentrated in higher frequencies (20 Hz and above)
- Can still be dipolar, but will be located outside the skull



# ICLabel website – Label feedback

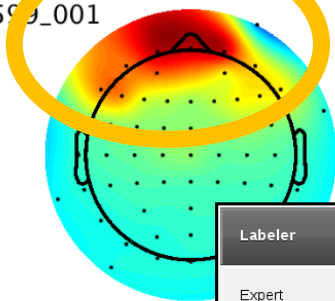
What type of IC is this?

Leaderboard

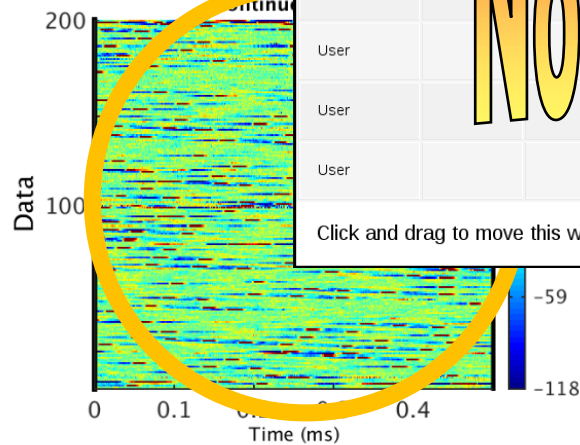
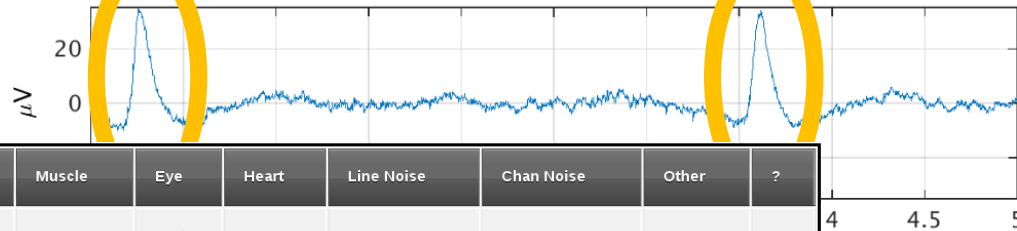
Tutorial

Profile

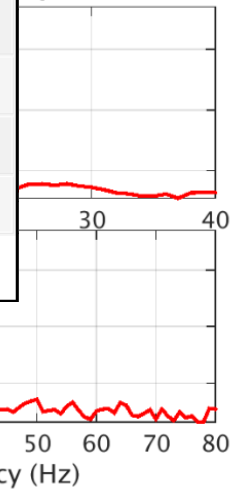
01259\_001



Component Time Series



Spectrum

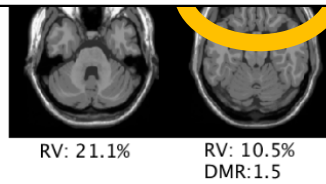


Labeler	Brain	Muscle	Eye	Heart	Line Noise	Chan Noise	Other	?
Expert			✓					
Expert			✓					
Expert			✓					
User								
User								
User								

Click and drag to move this window.

Next Comment

No Login Required



Log Power Spectral

Brain

Muscle

Eye

Heart

Submit

Line Noise

Chan Noise

Other

?

# ICLabel website - Label

What type of IC is this?



Newest IC

Back 1

Log Out

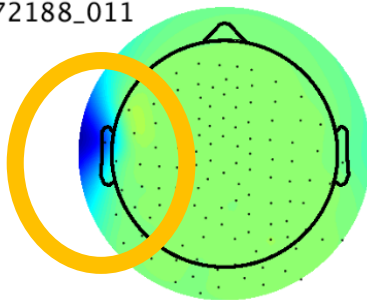
User: [SCCN] Luca Pion-Tonachini  
Labels: 2782

Leaderboard

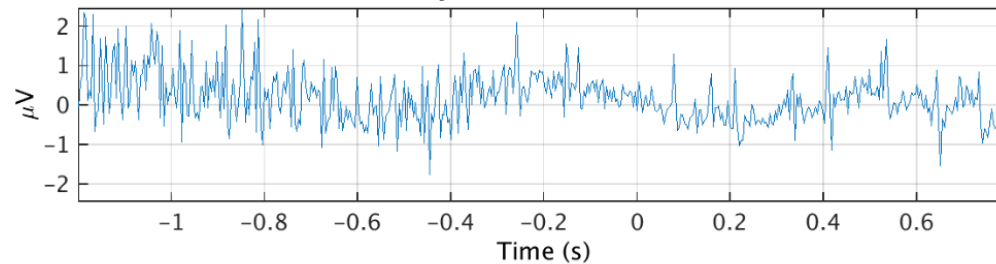
Tutorial

Profile

072188\_011

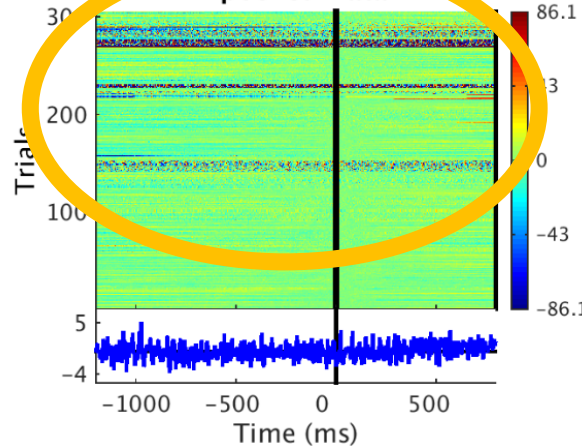


Component Time Series



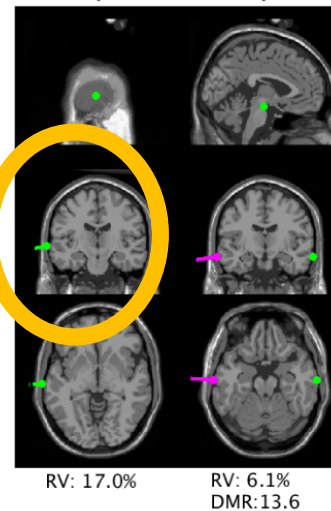
IC 11 of 30  
Data Var. Accounted For:  
15.96%

Epoched Data



1 dipole

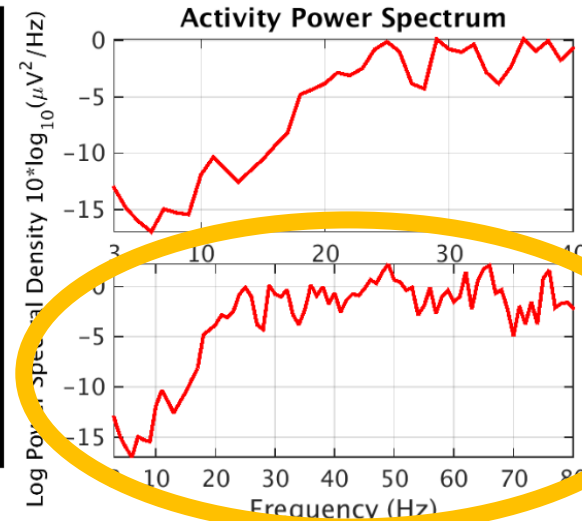
2 dipole



RV: 17.0%

RV: 6.1%  
DMR: 13.6

Activity Power Spectrum



Brain

Muscle

Eye

Hear

Next

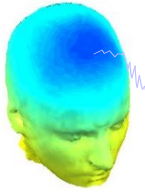
Line Noise

Chan Noise

Other

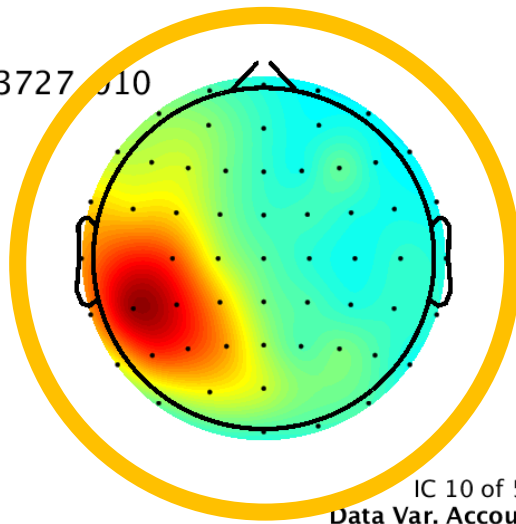
?

# One More Example IC

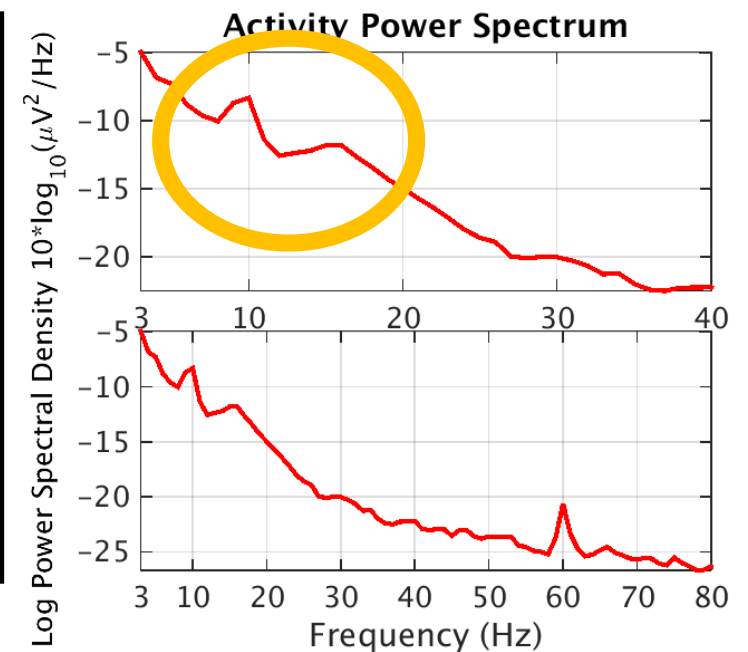
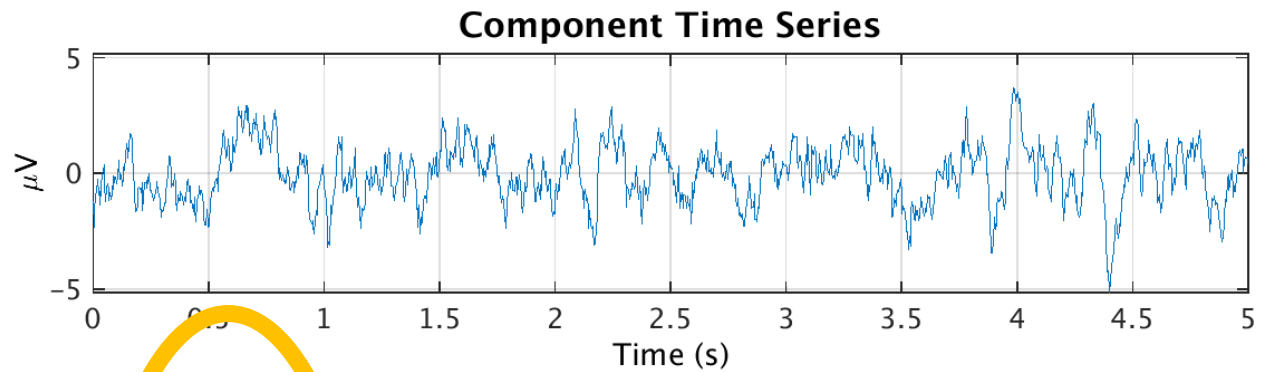
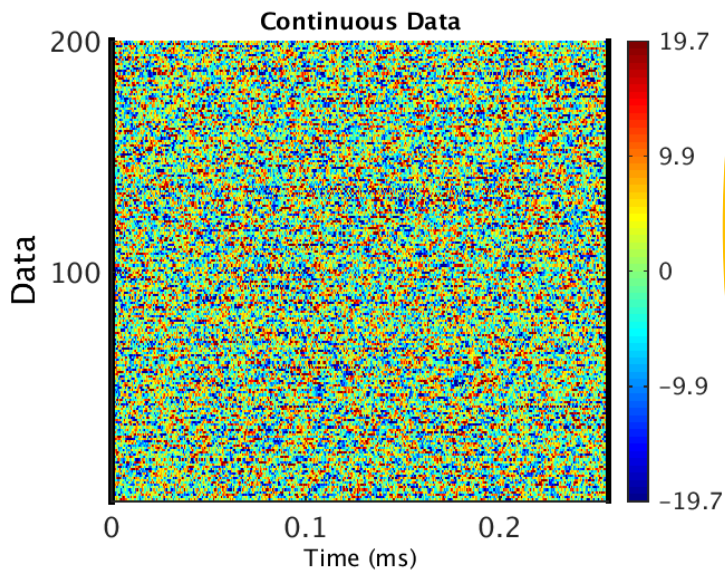


Brain

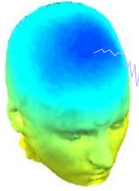
063727-010



IC 10 of 58  
Data Var. Accounted For:  
1.97%



# Exercises



Now and later:

- Practice on the ICLabel website:

[labeling.ucsd.edu/labelfeedback](http://labeling.ucsd.edu/labelfeedback)

Alternatively

- Load stern.set (continuous data, contains ICA weights)
- Classify the components present in the dataset.

