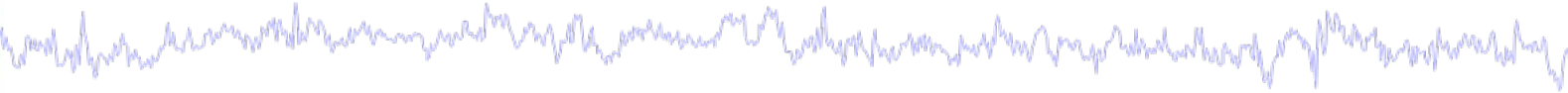


Outline



- ❑ ICA component properties (brain vs artifact)
- ❑ IC vs scalp data, what have we gained?
- ❑ ERP image single-trial analysis



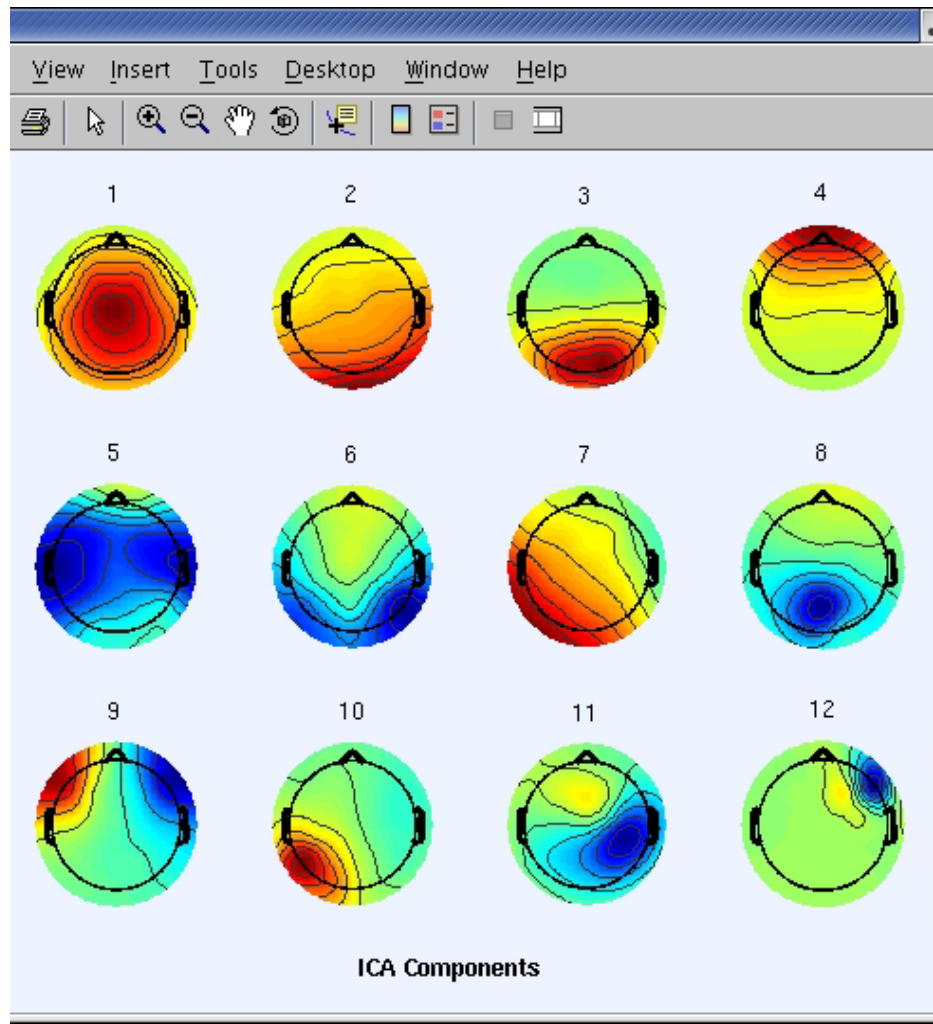
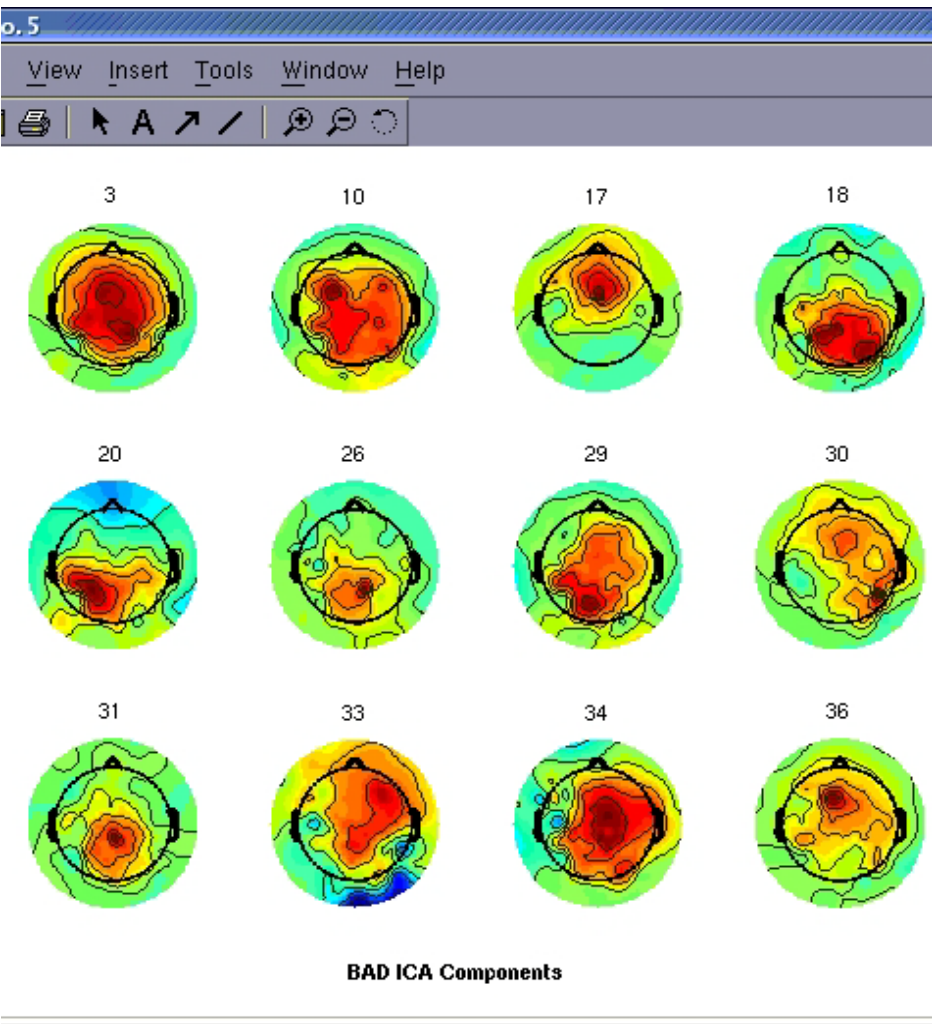
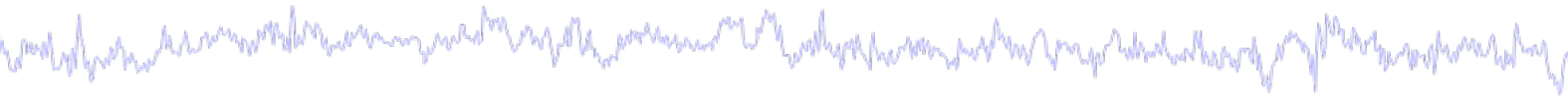
Outline



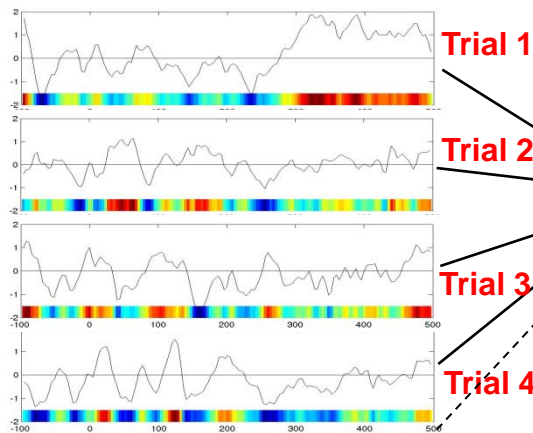
- ❑ ICA component properties (brain vs artifact)
- ❑ IC vs scalp data, what have we gained?
- ❑ ERP image single-trial analysis



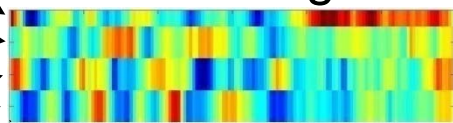
Compare 'good' and 'bad' scalp maps



Plot ICA component properties

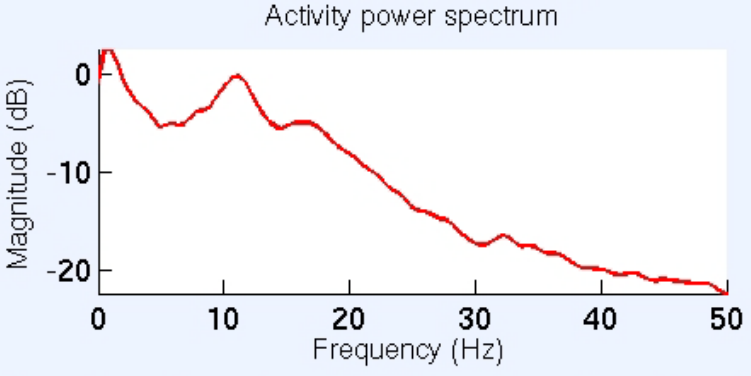
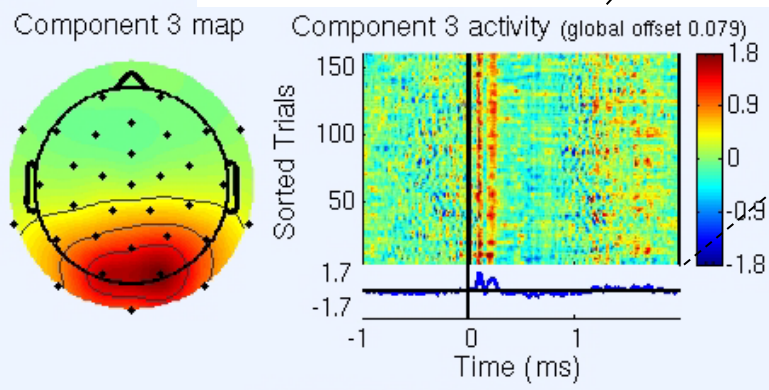


ERP Image

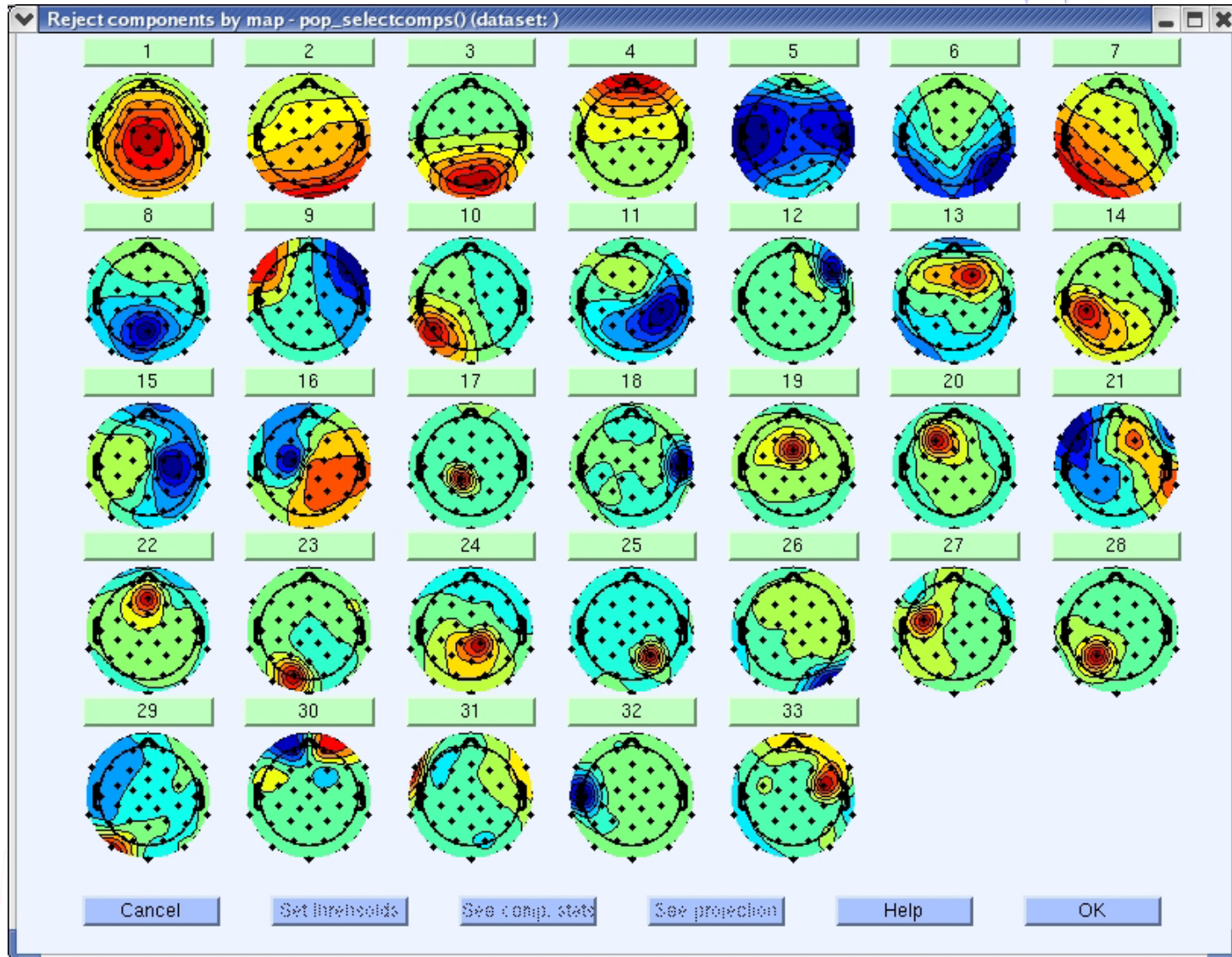
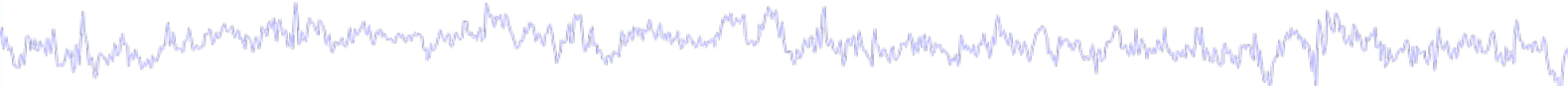


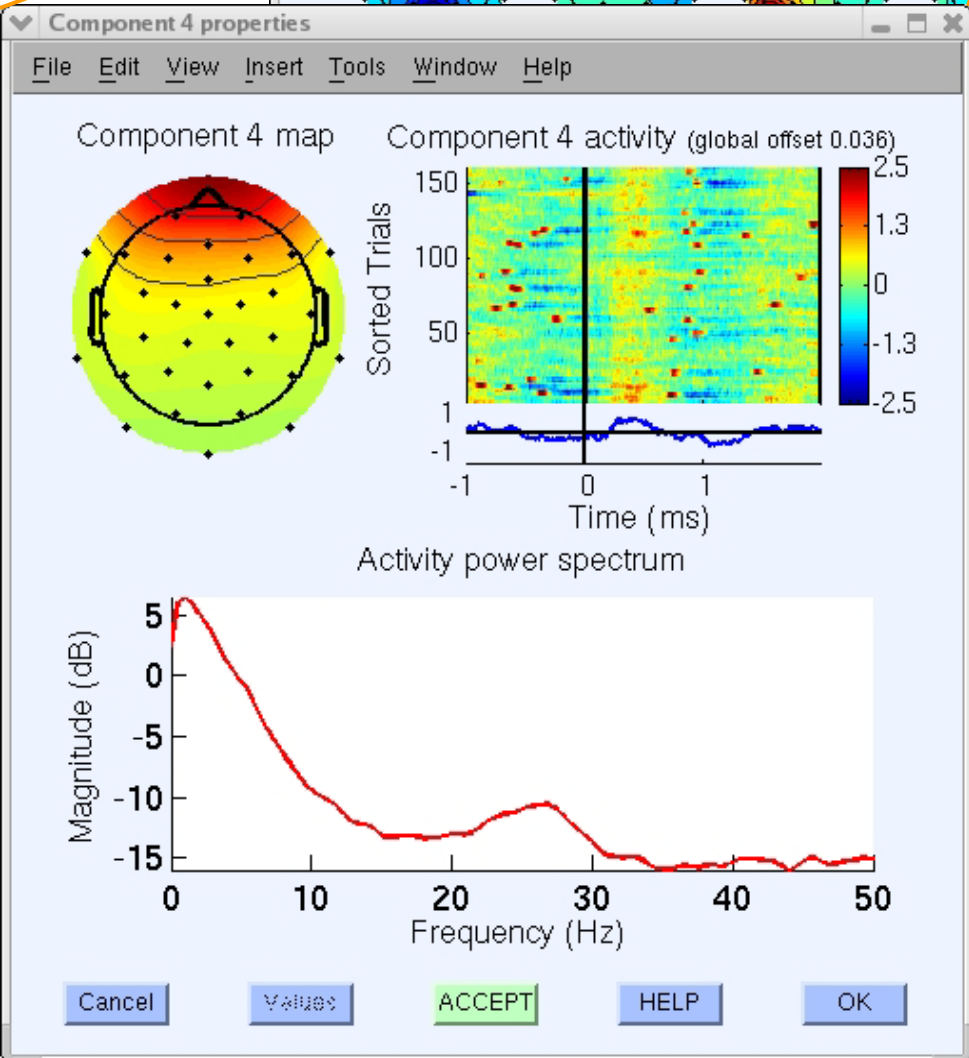
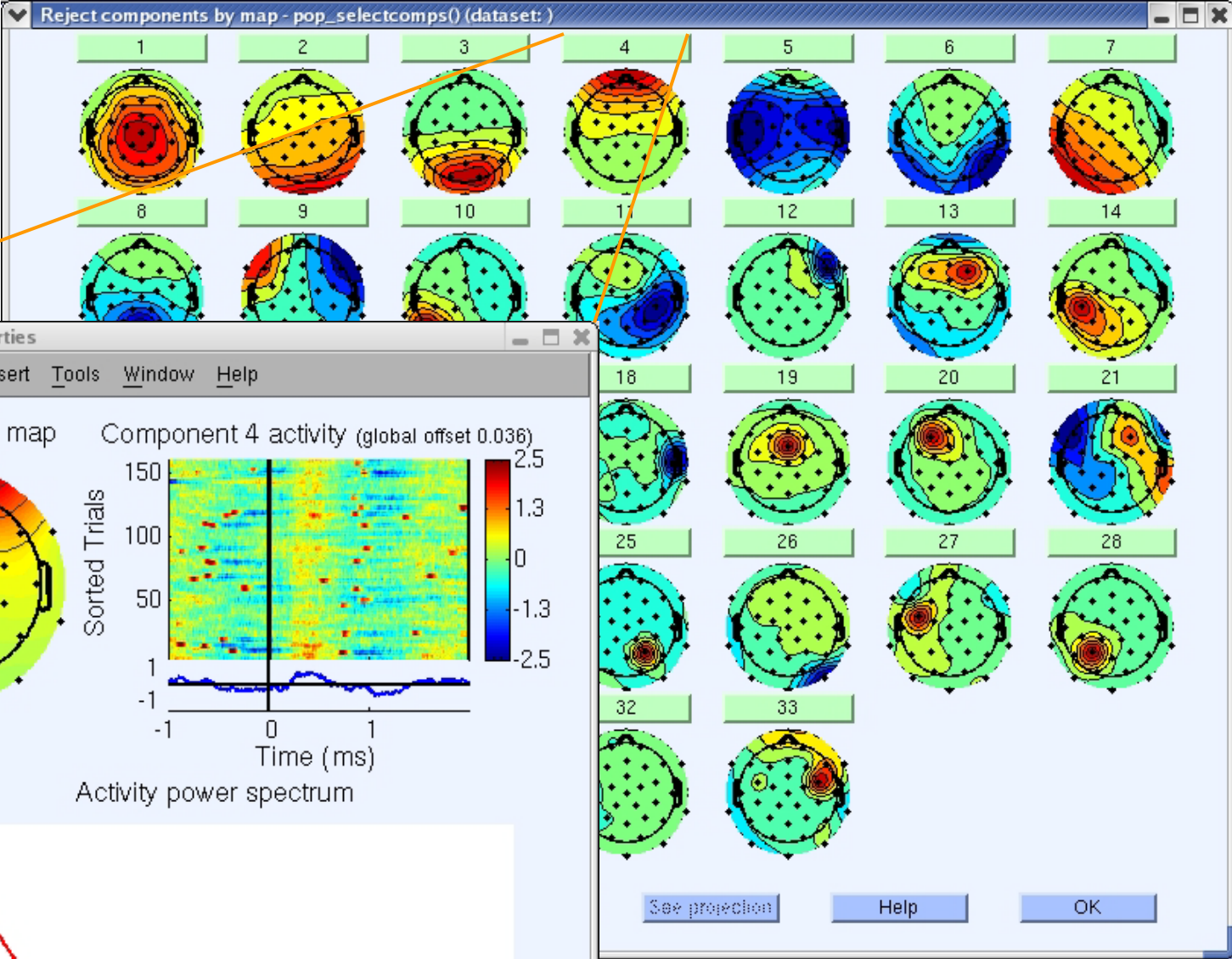
A screenshot of the EEGLAB v6.0b software interface. The 'Plot' menu is open, showing various options for plotting data. The 'Component properties' option is highlighted in blue. Other options include Channel locations, Channel data, Channel spectra, Channel ERPs, and more.

A dialog box titled 'Component 3 properties'. It contains a 'Component number to plot' field with the value '3'. Below the field are 'Cancel', 'Help', and 'Ok' buttons. At the bottom of the dialog are 'Cancel', 'Values', 'ACCEPT', 'HELP', and 'OK' buttons.

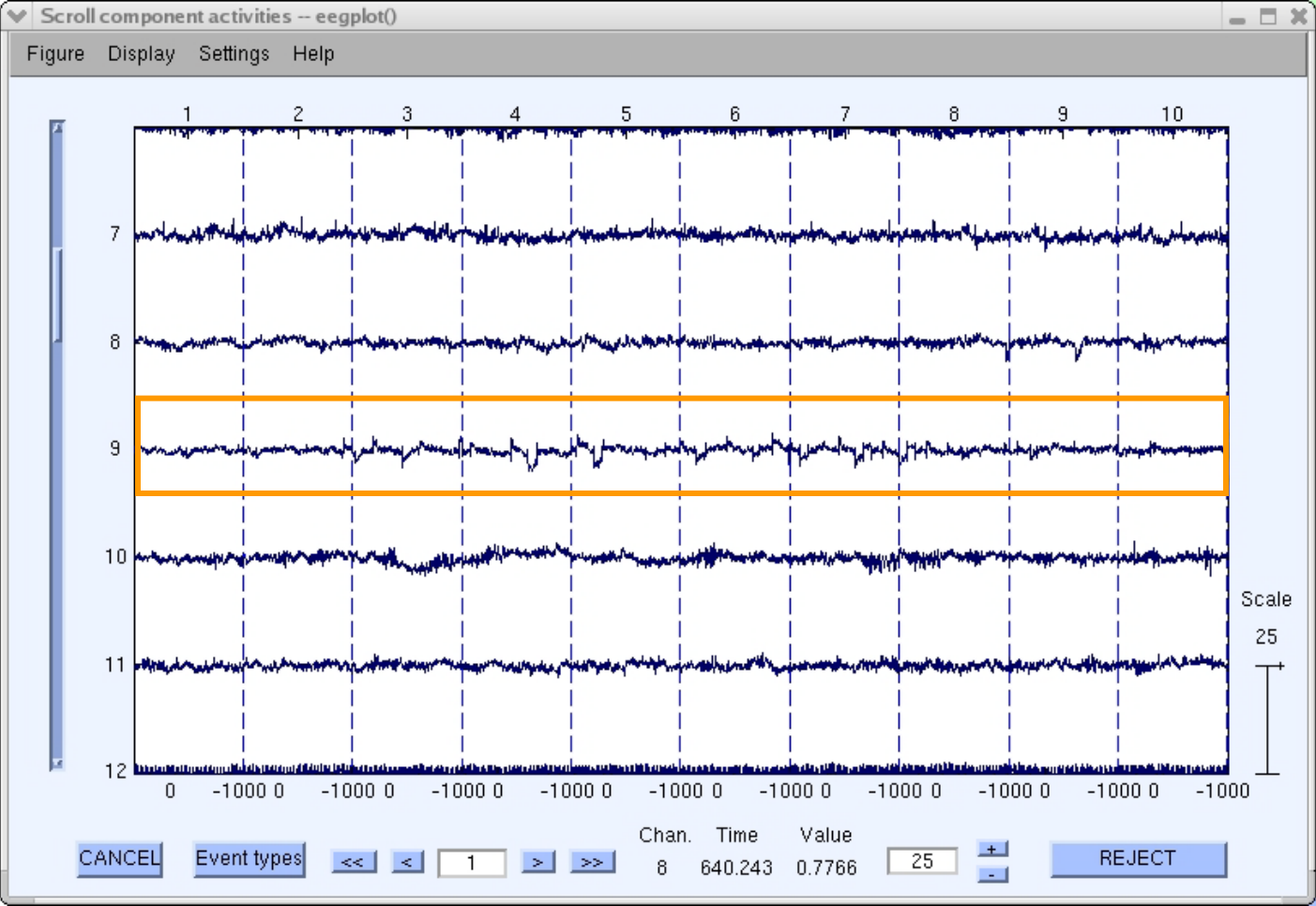
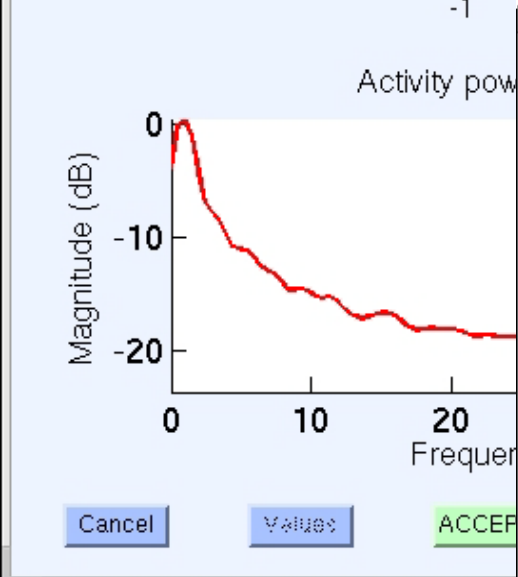
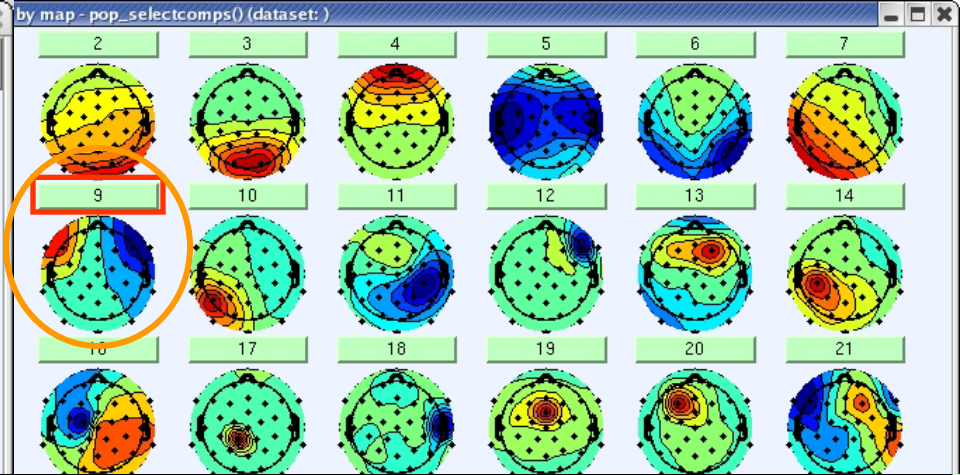
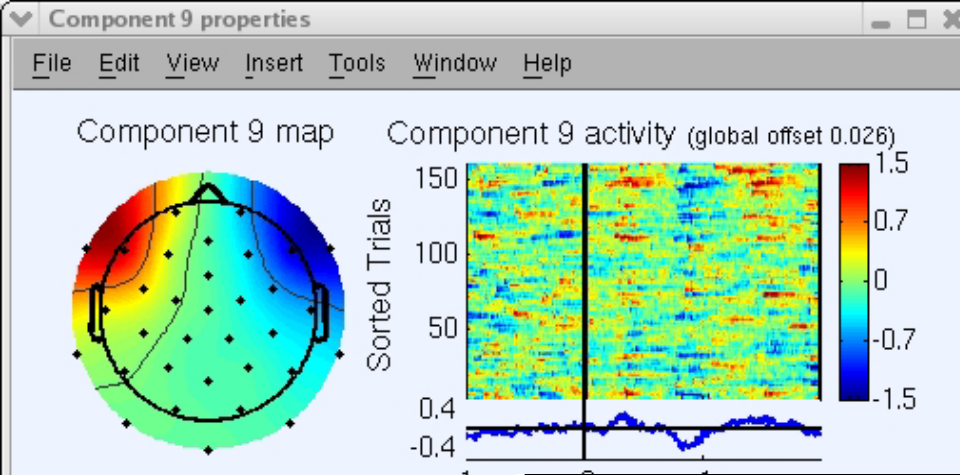


Component scalp maps/properties

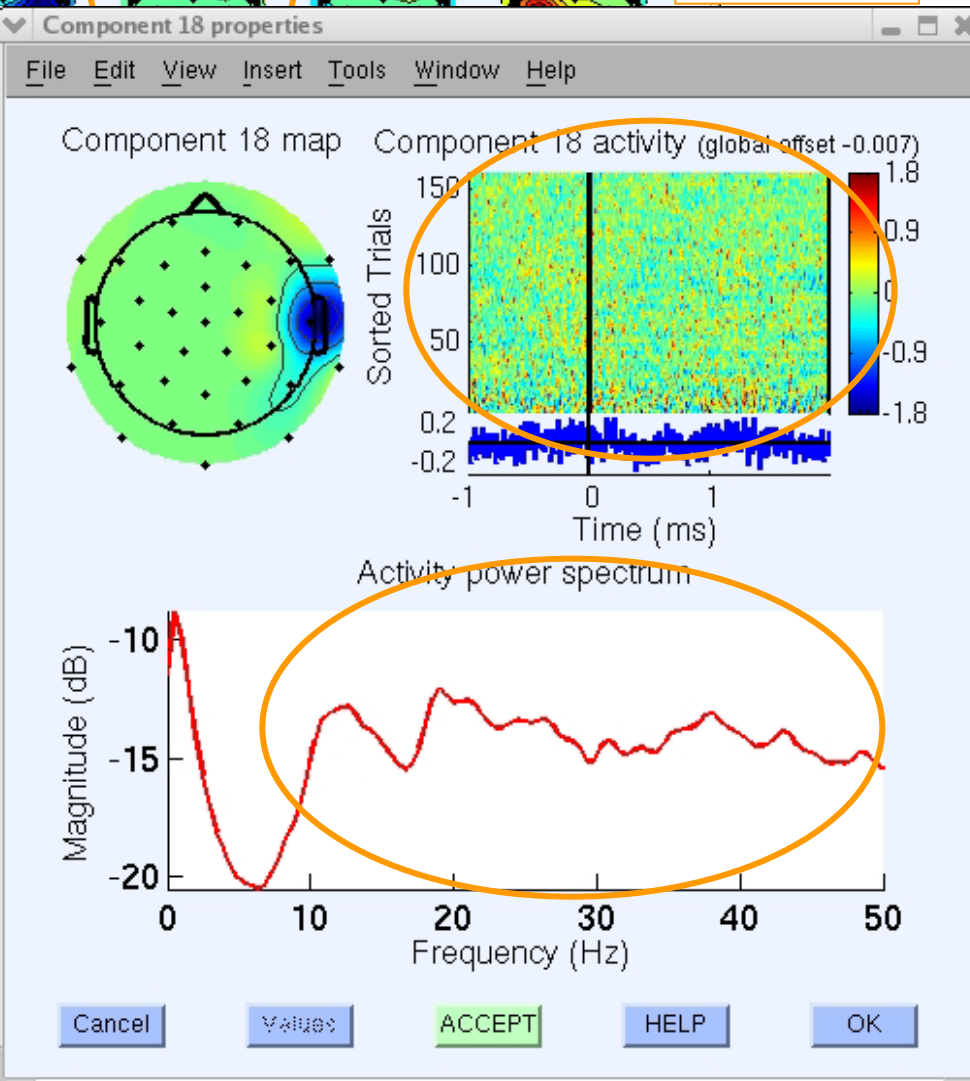
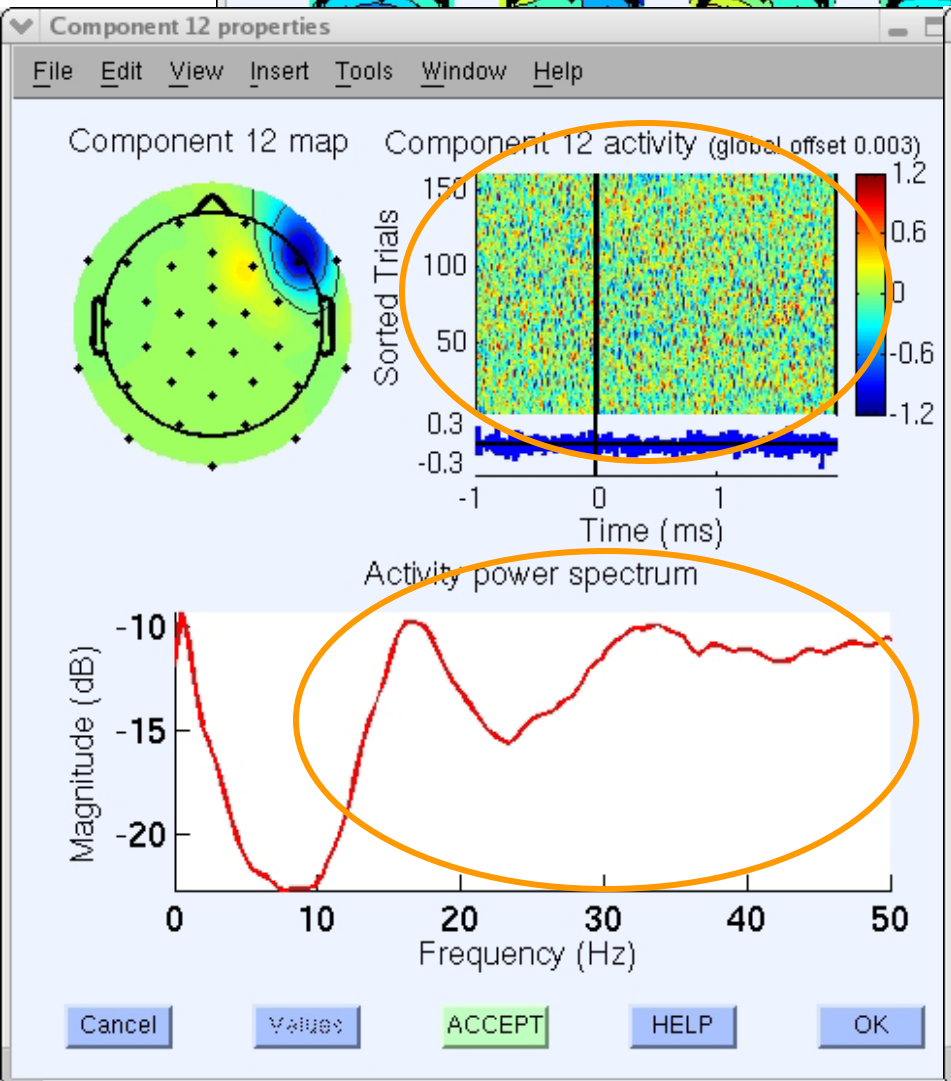
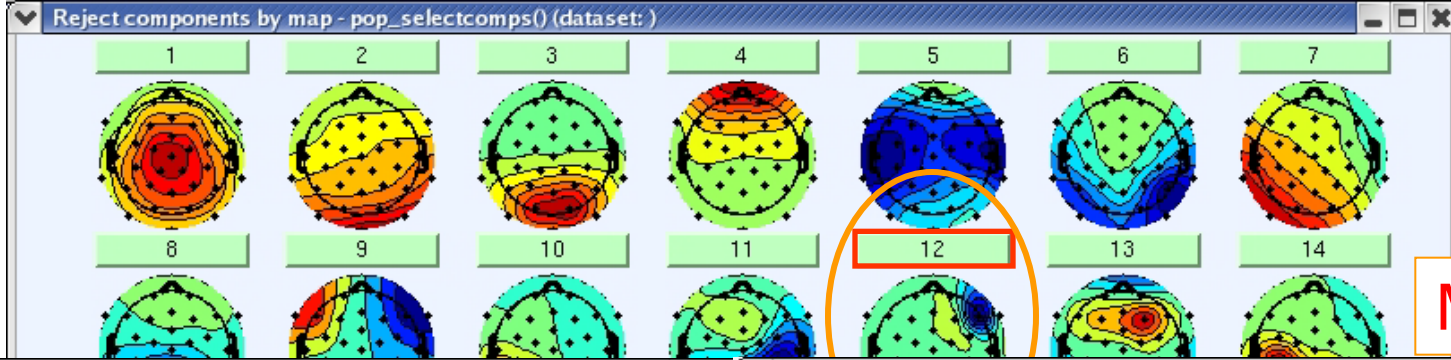


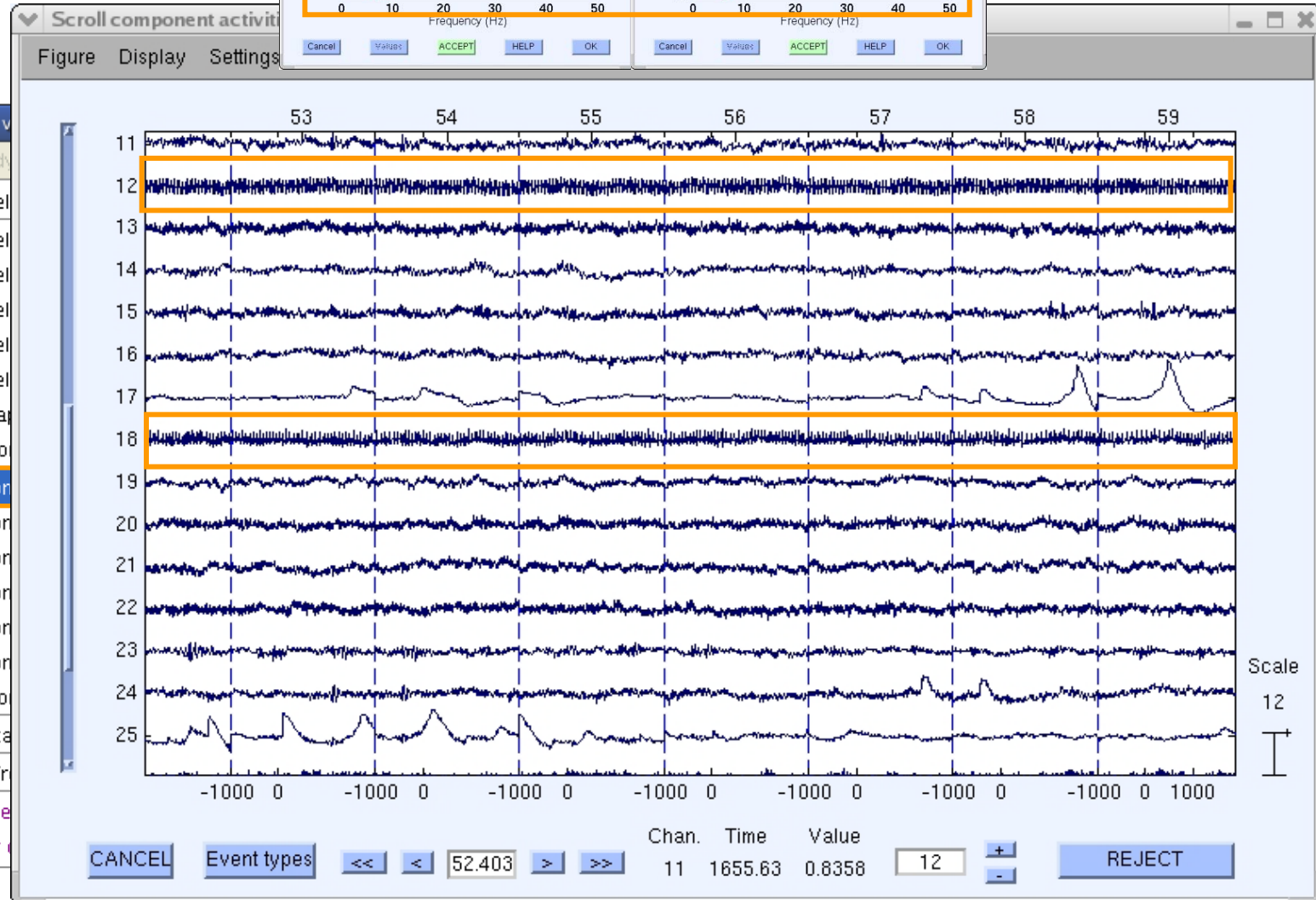
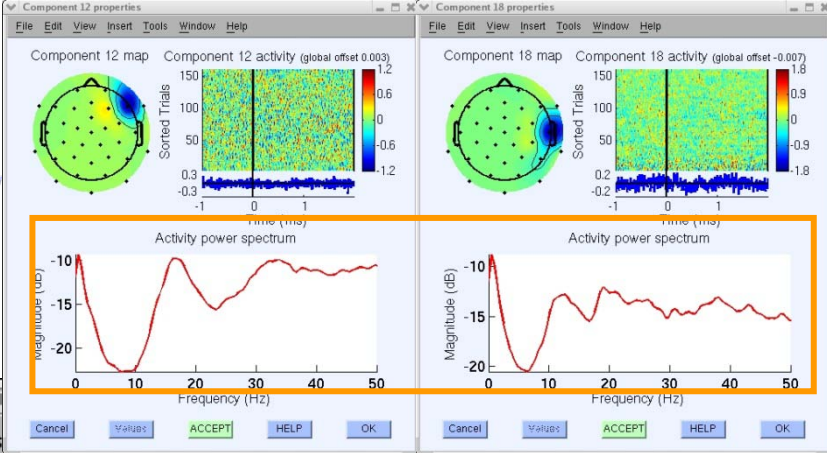
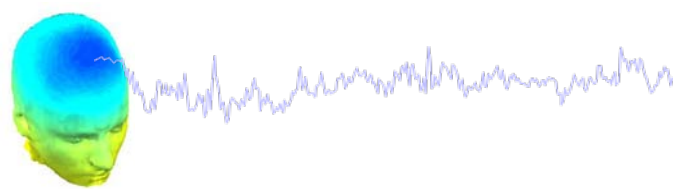


Eye blink component



Lateral eye movement





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

Channel

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Channel

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Channel

ERP ma

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Component

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Component

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Data sta

Time-fr

Average

Cluster

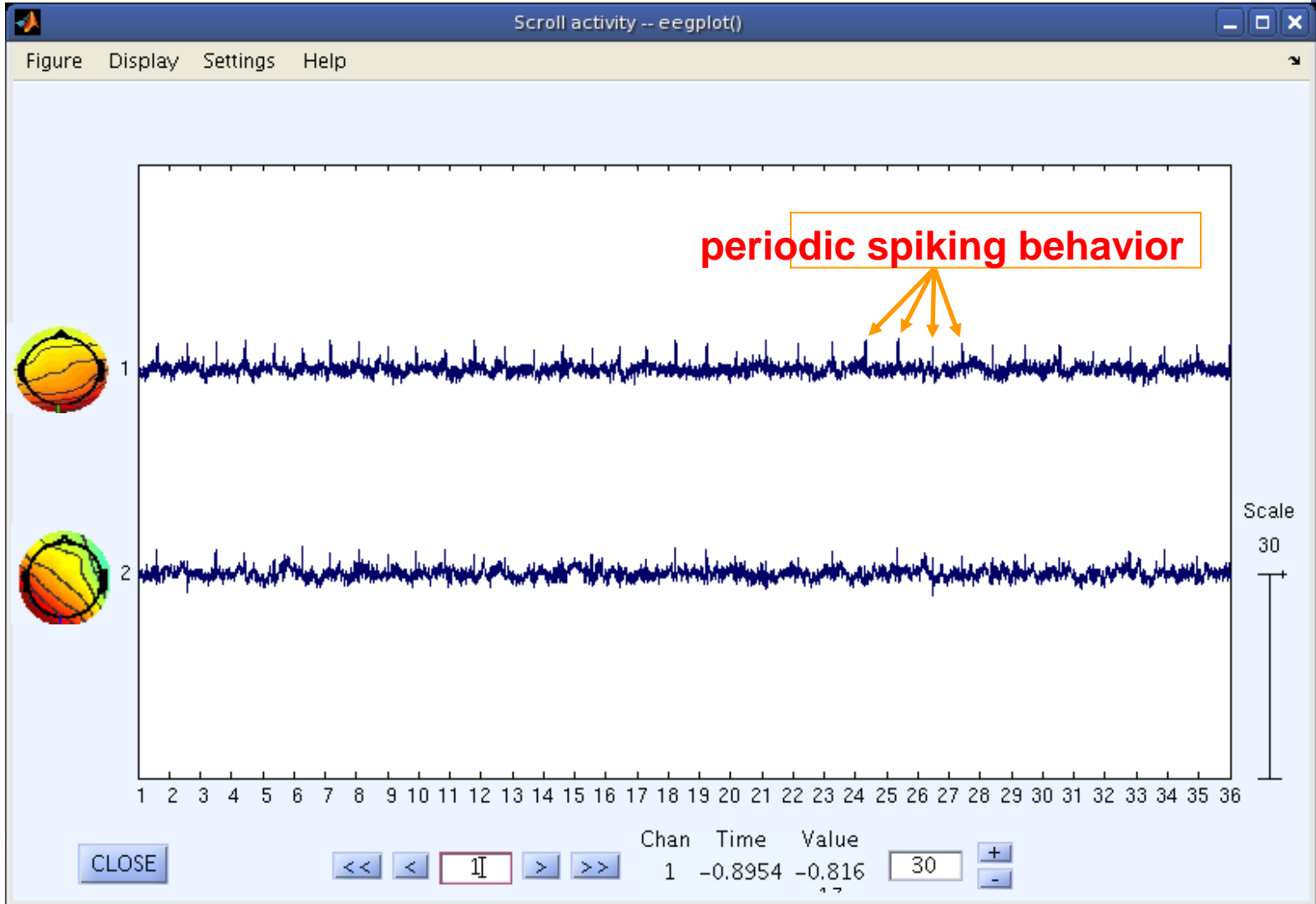
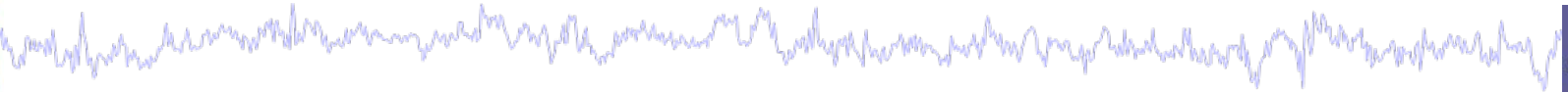
Chan. Time Value

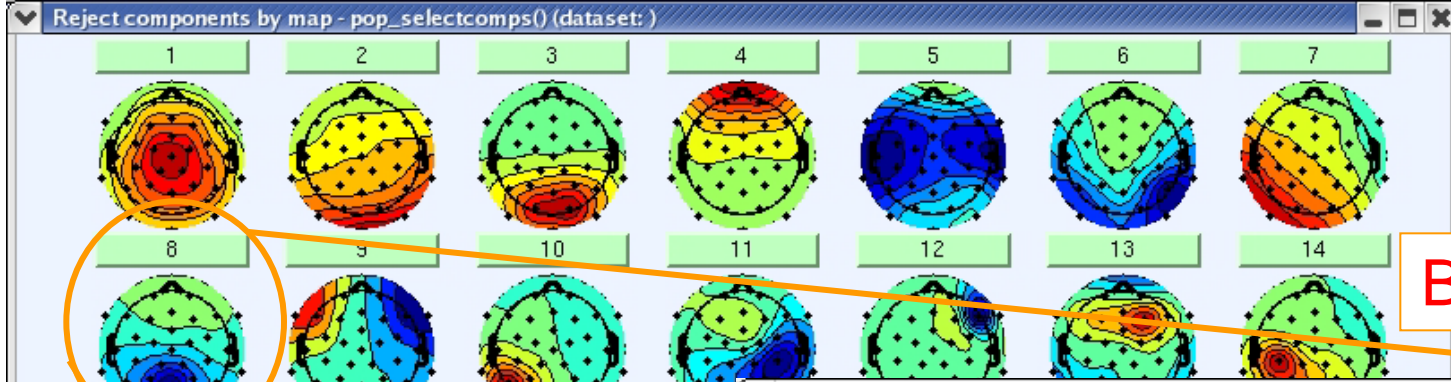
11 1655.63 0.8358

12

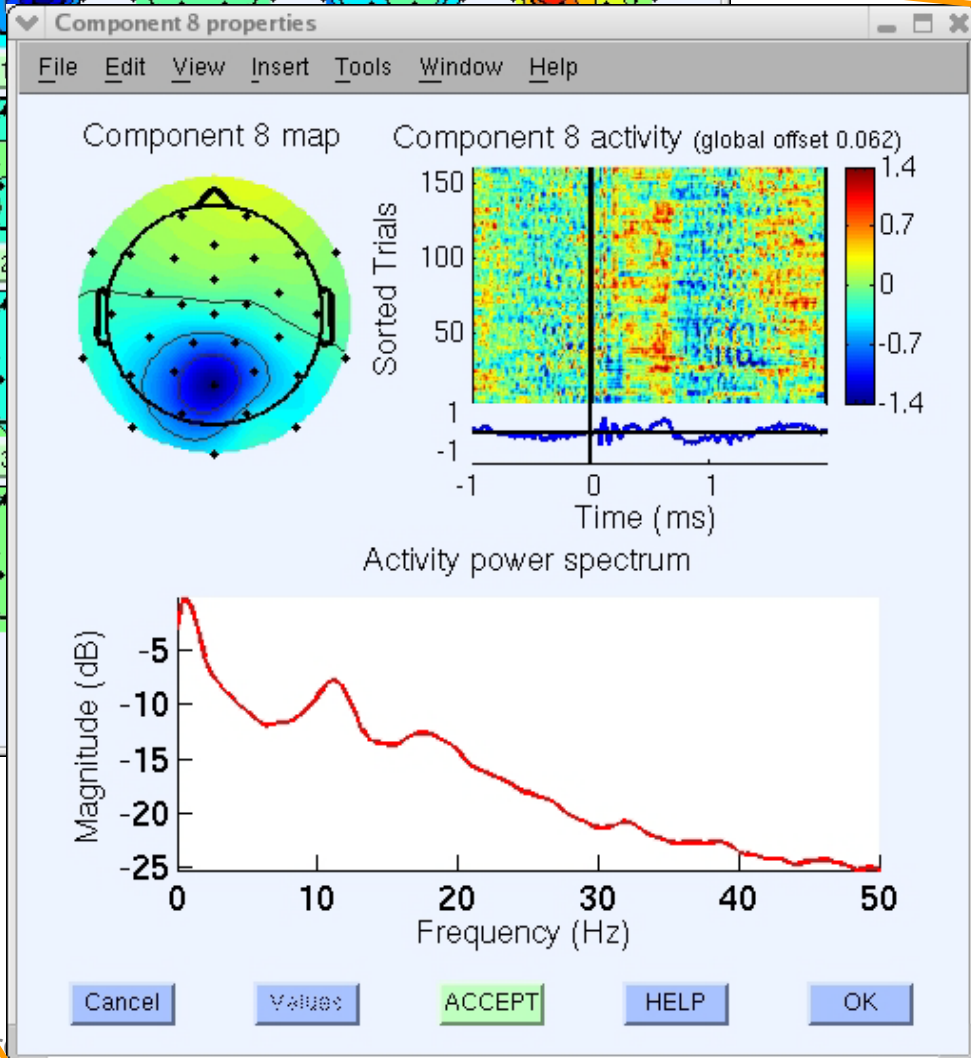
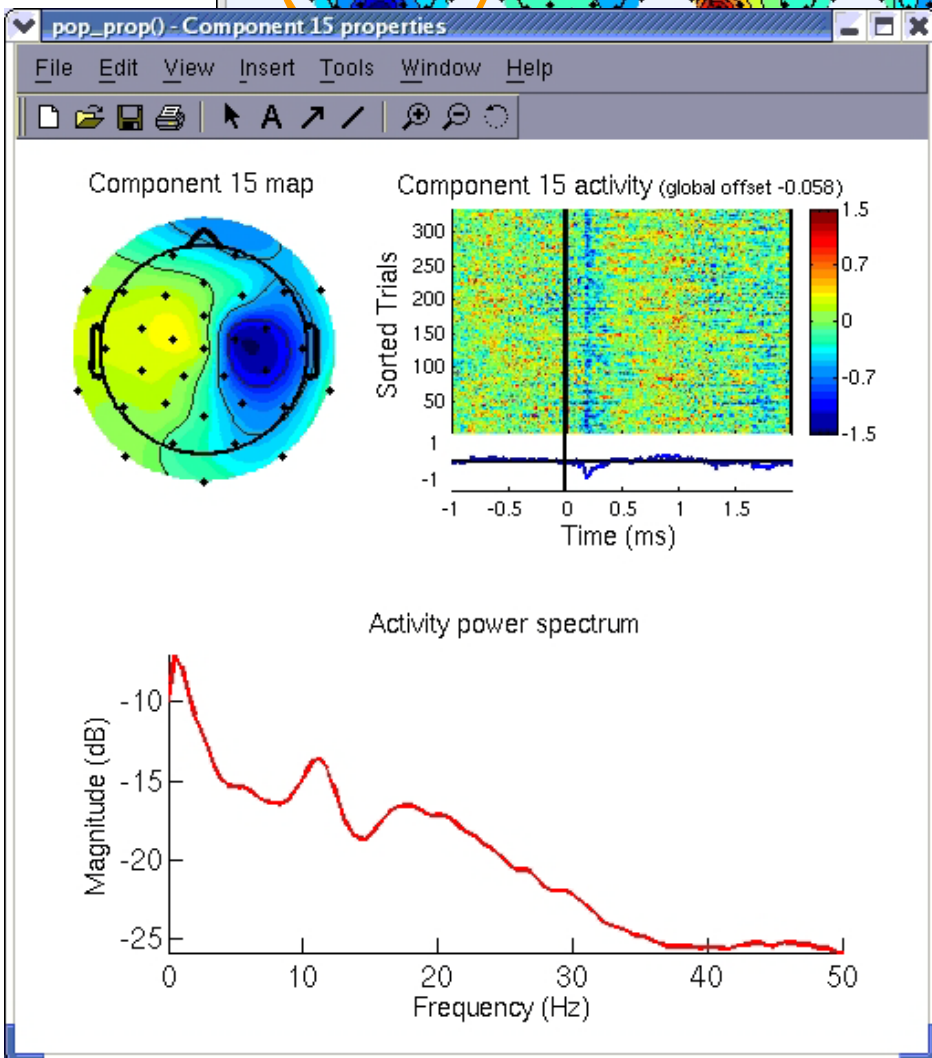
REJECT

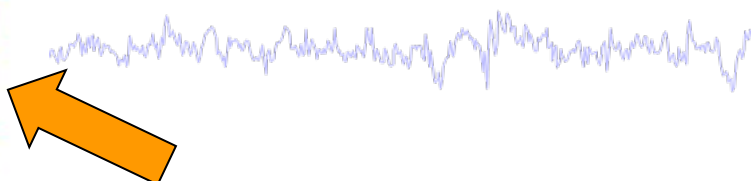
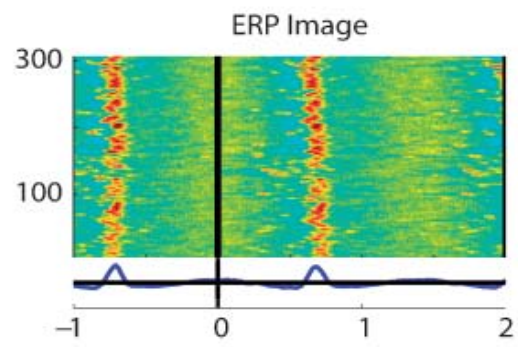
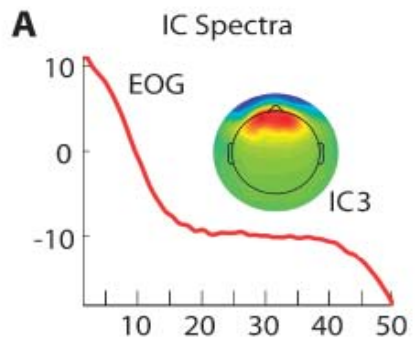
Pulse artifacts



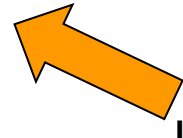
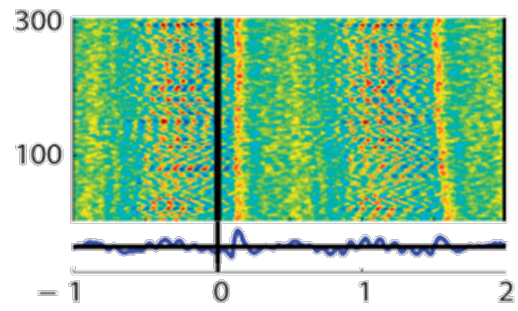
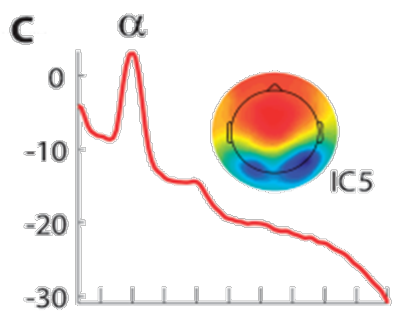
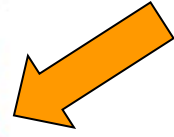
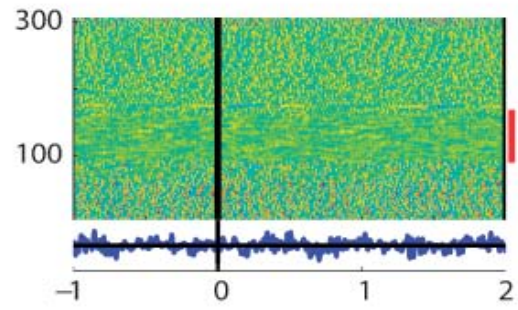
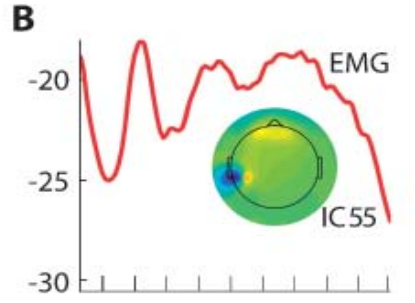


Brain ICs

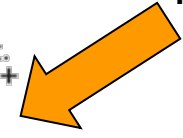
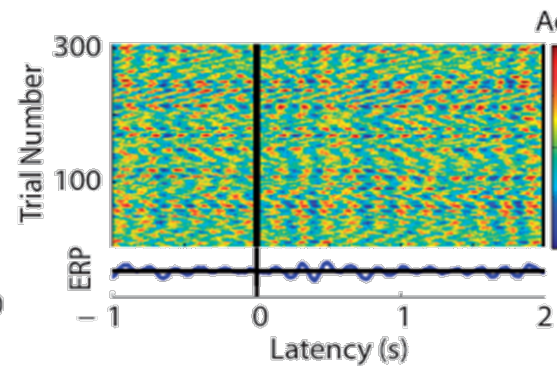
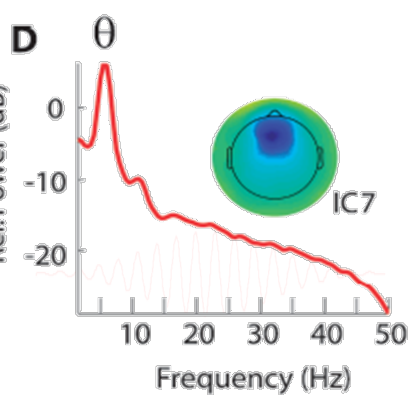




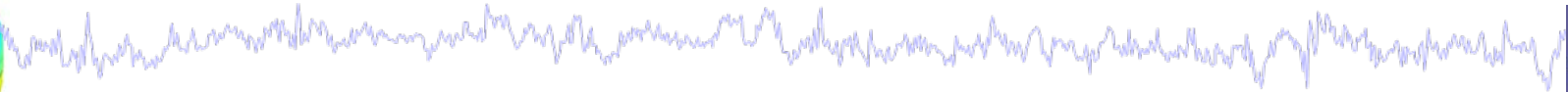
ICA can help filter out artifacts



ICA can also isolate brain sources



Outline



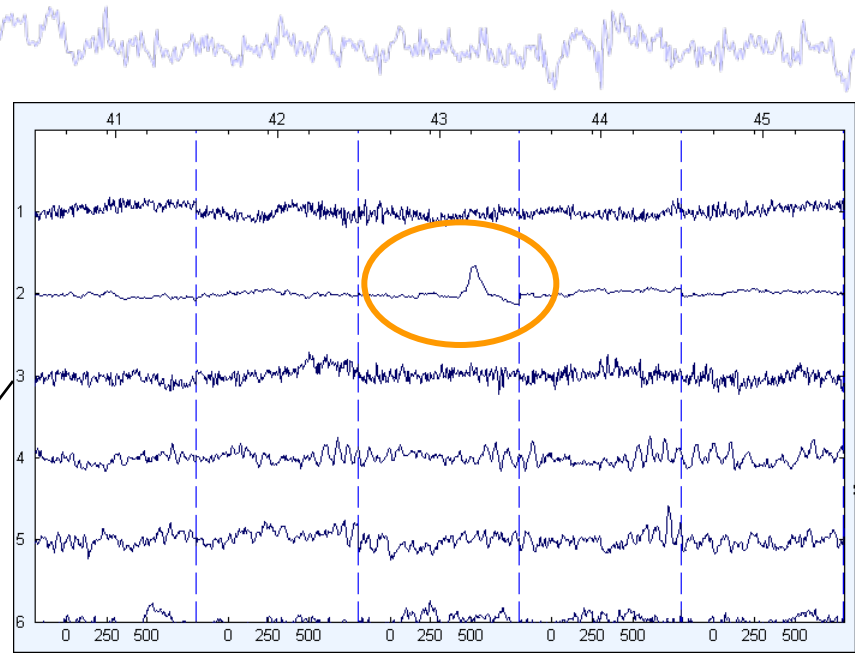
- ICA component properties (brain vs artifact)
- IC vs scalp data, what have we gained?
- ERP image single-trial analysis



Eye blink correction



Identify eye-blink components:



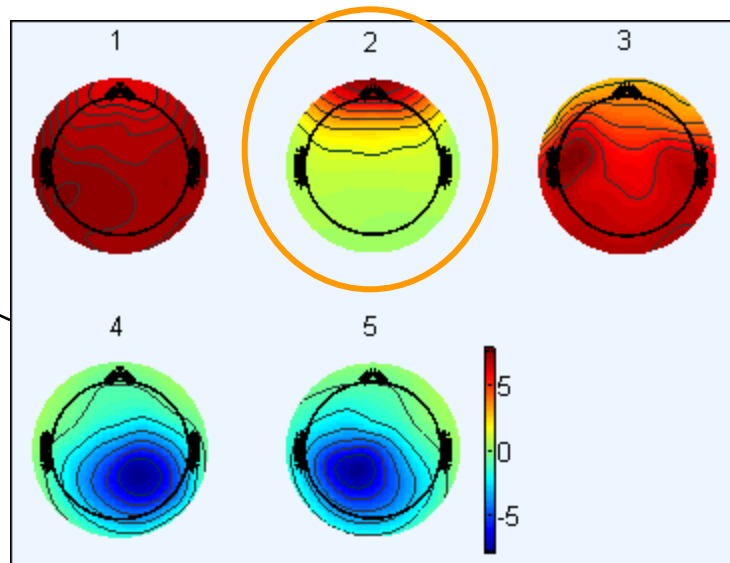
EEGLAB v4.512

File Edit Tools Plot Datasets Help

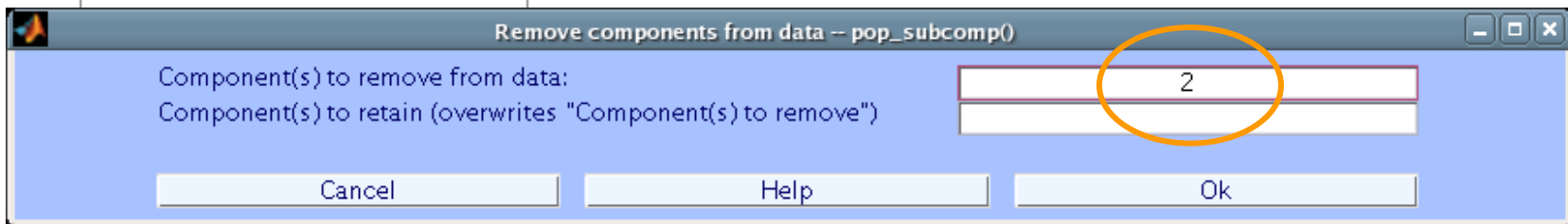
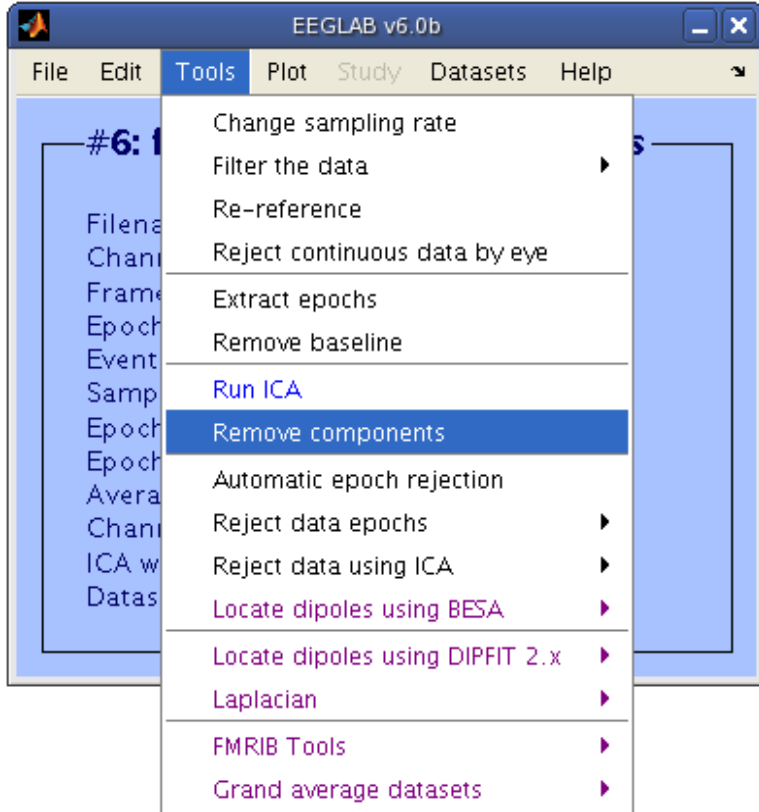
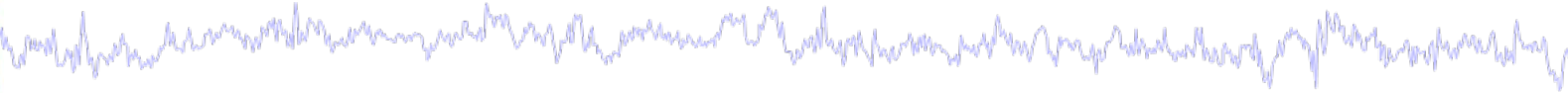
#1: (no)

Filename: Channels p Frames pe Epochs Events Sampling r Epoch star Epoch end Average re Channel lo ICA weight Dataset siz

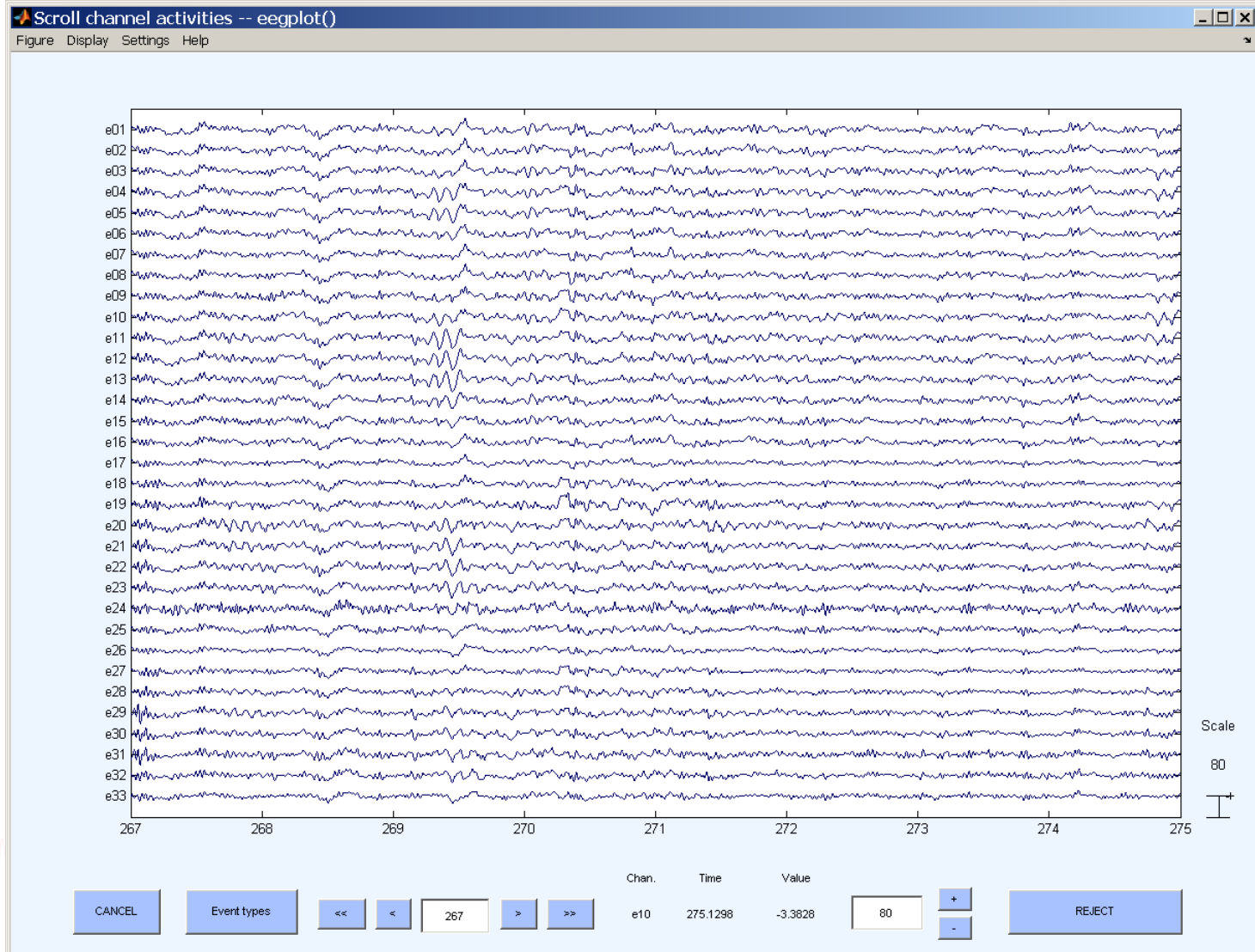
- Channel locations
- Channel data (scroll)
- Channel spectra and maps
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)**
- Component spectra and maps
- Component maps**
- Component properties
- Component ERP image
- Component ERPs
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms



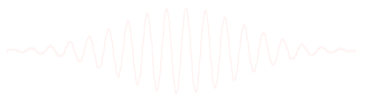
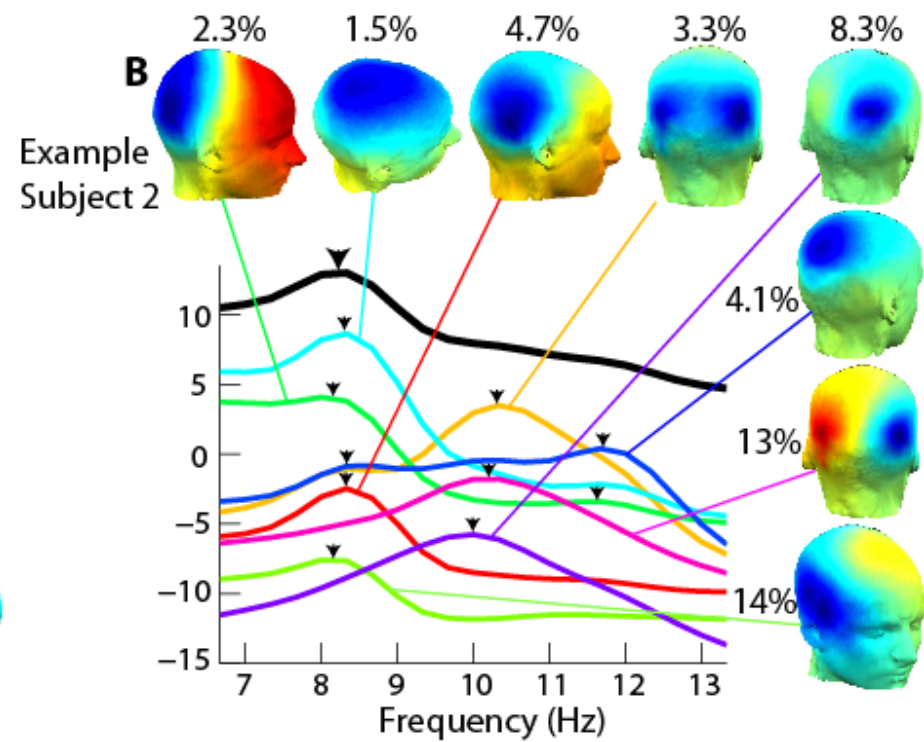
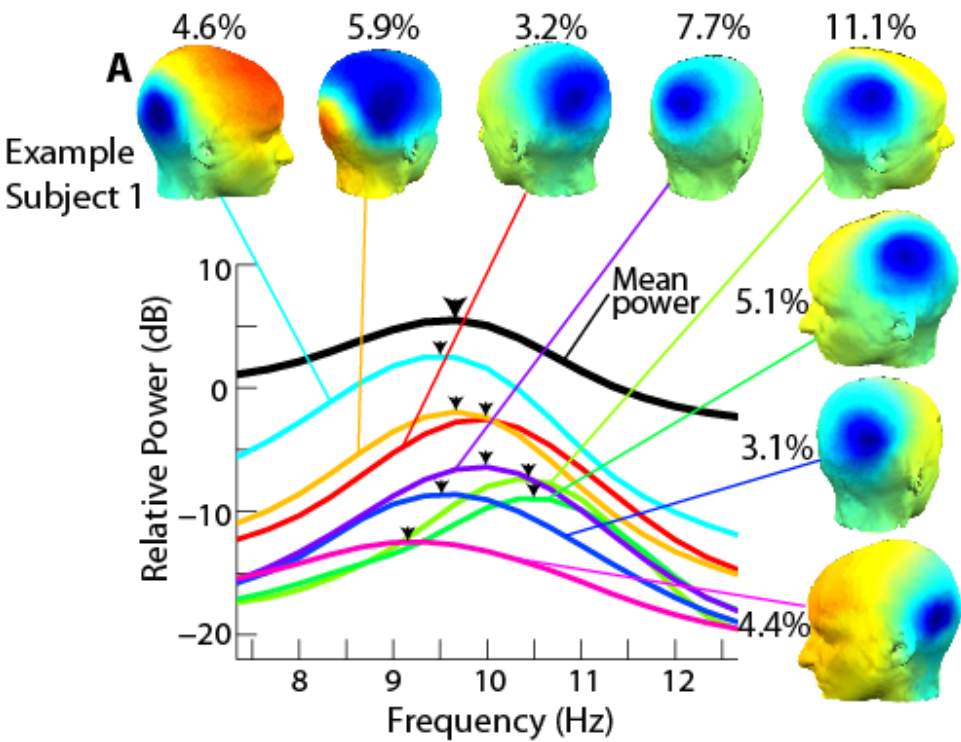
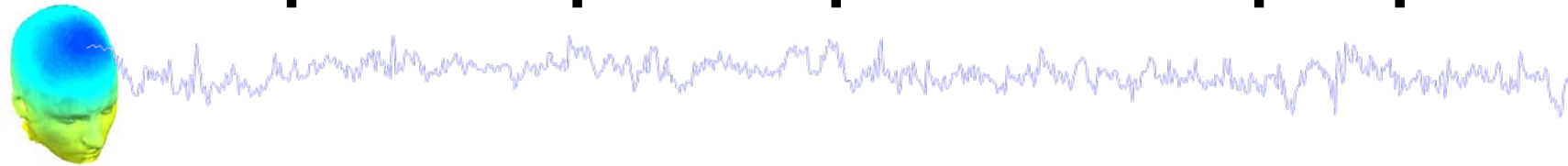
Eye blink correction



Eye blink correction



Independent power spectra and alpha peaks

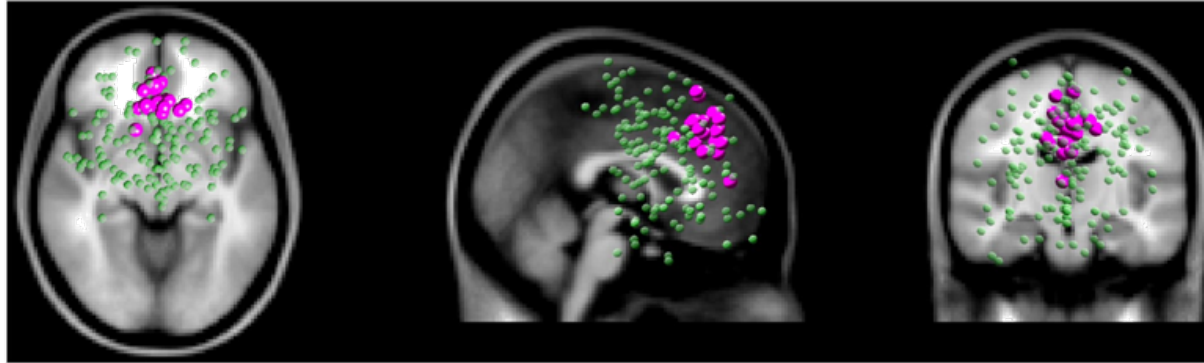


Frontal midline theta cluster



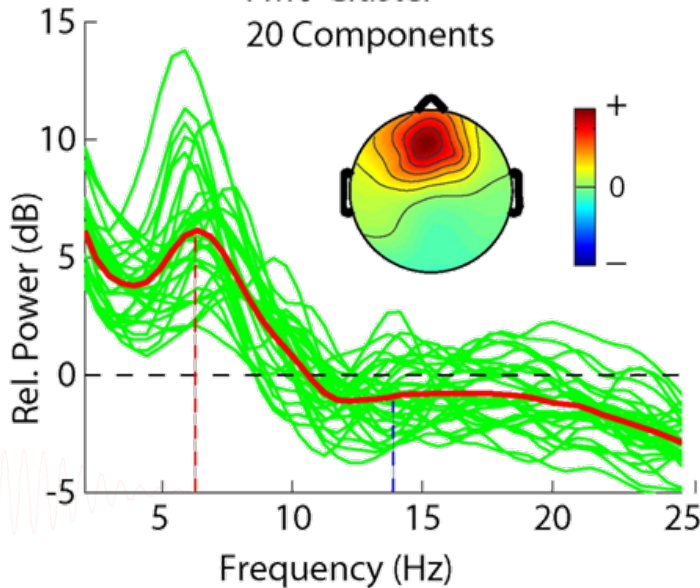
B

FM θ Cluster



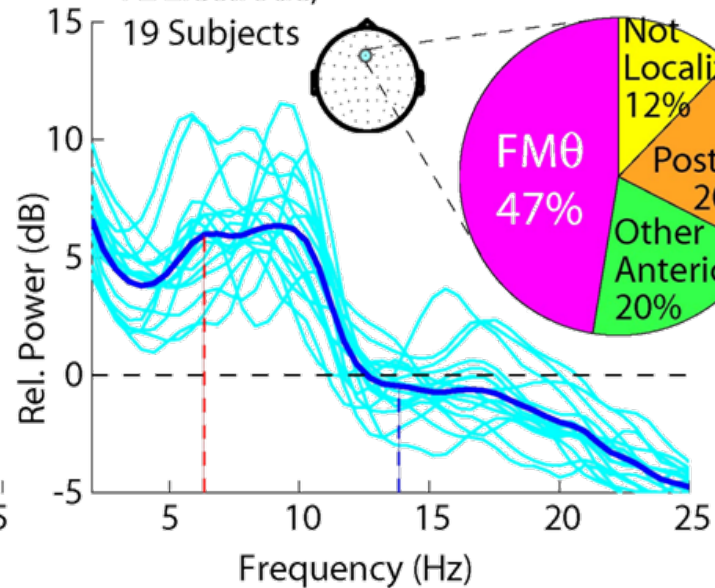
C

FM θ Cluster
20 Components



D

Fz Electrode,
19 Subjects

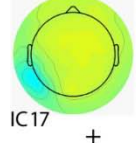
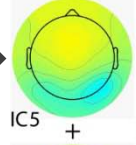
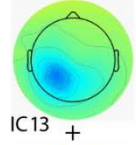
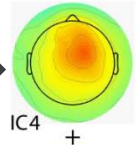
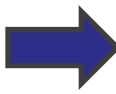


E

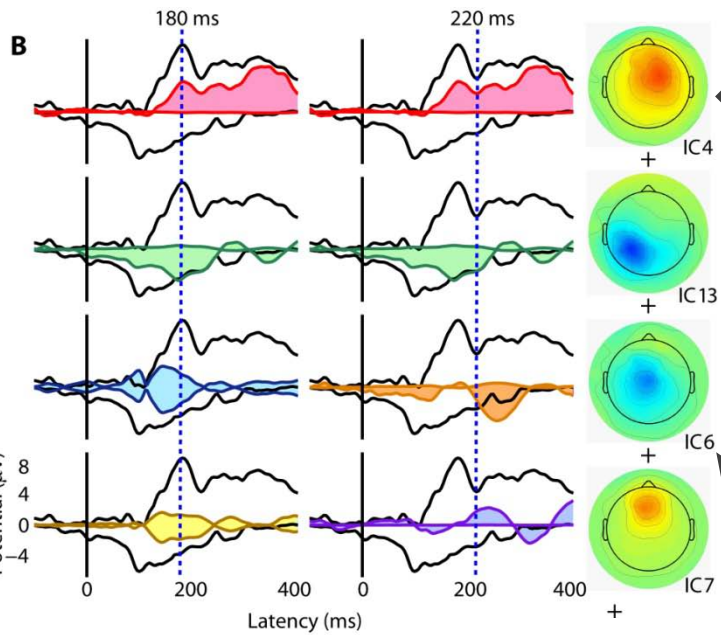
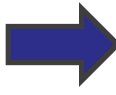
Component vs scalp ERP



Strong frontal contribution



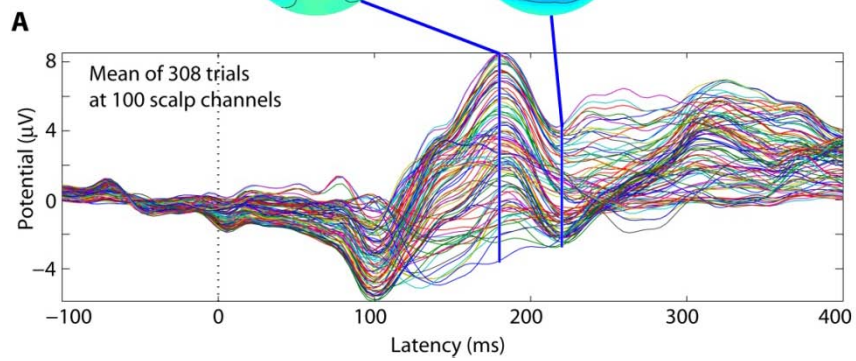
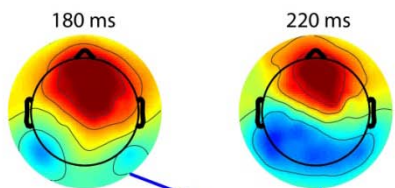
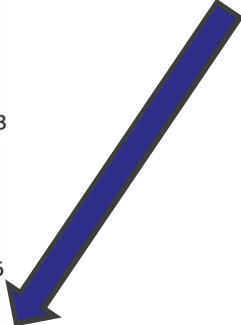
Relatively weak bilateral occipital



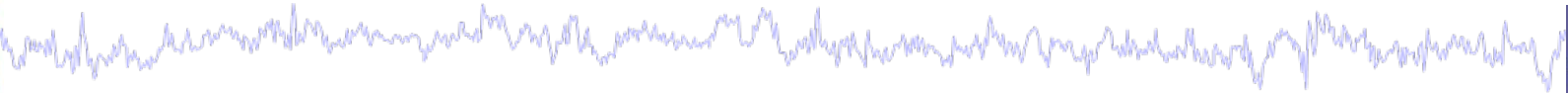
Strong frontal contribution



Each component ERP should be considered separately!!



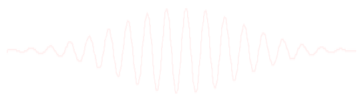
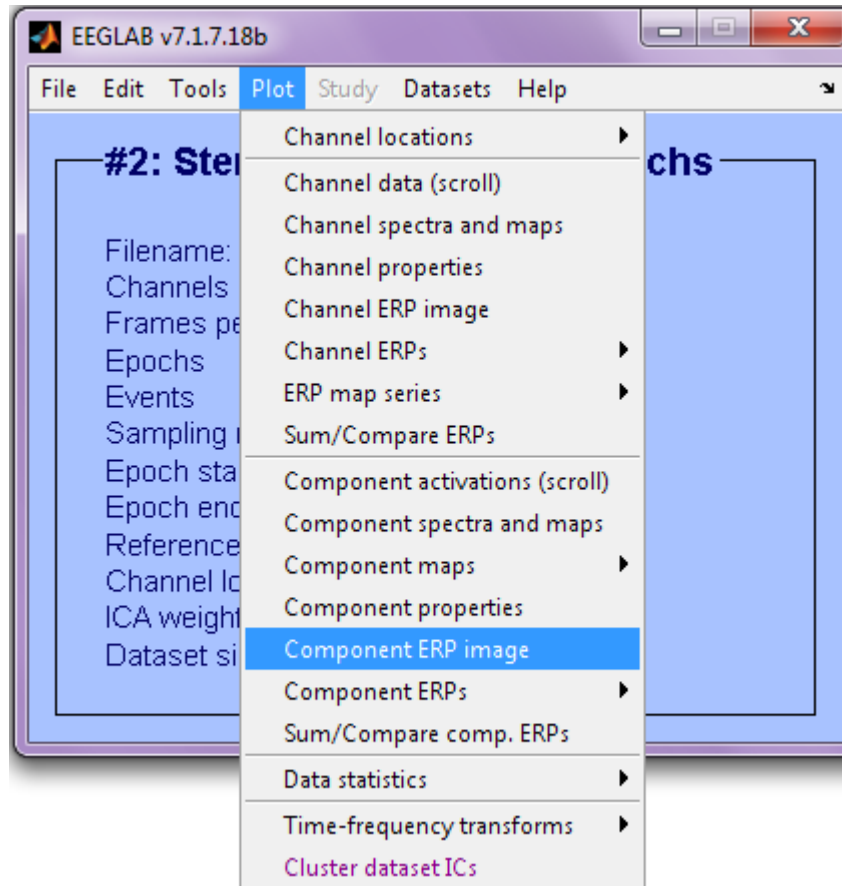
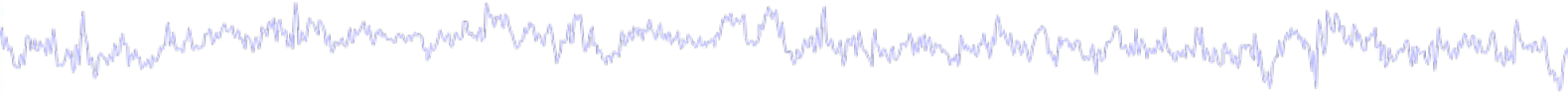
Outline



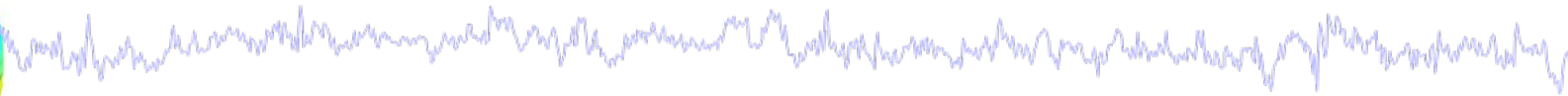
- ICA component properties (brain vs artifact)
- IC vs scalp data, what have we gained?
- ERP image single-trial analysis



Component ERP image



Component ERP Images



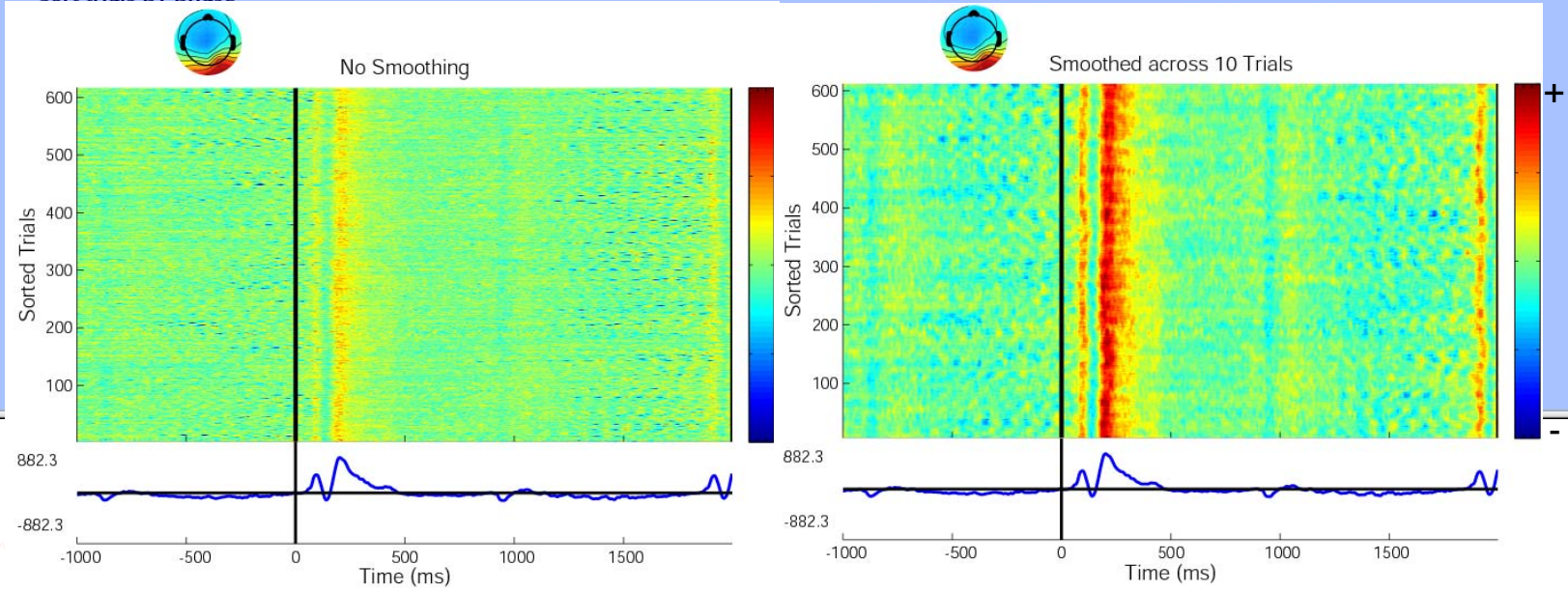
Component ERP image -- pop_erpimage()

Component(s)	11	Figure title	
Project to channel #		<input checked="" type="checkbox"/> Plot scalp map	
Smoothing	10	<input checked="" type="checkbox"/> Plot ERP	ERP limits
Downsampling	1	<input checked="" type="checkbox"/> Plot colorbar	Color limits (see Help)
Time limits (ms)	-1000 1996		

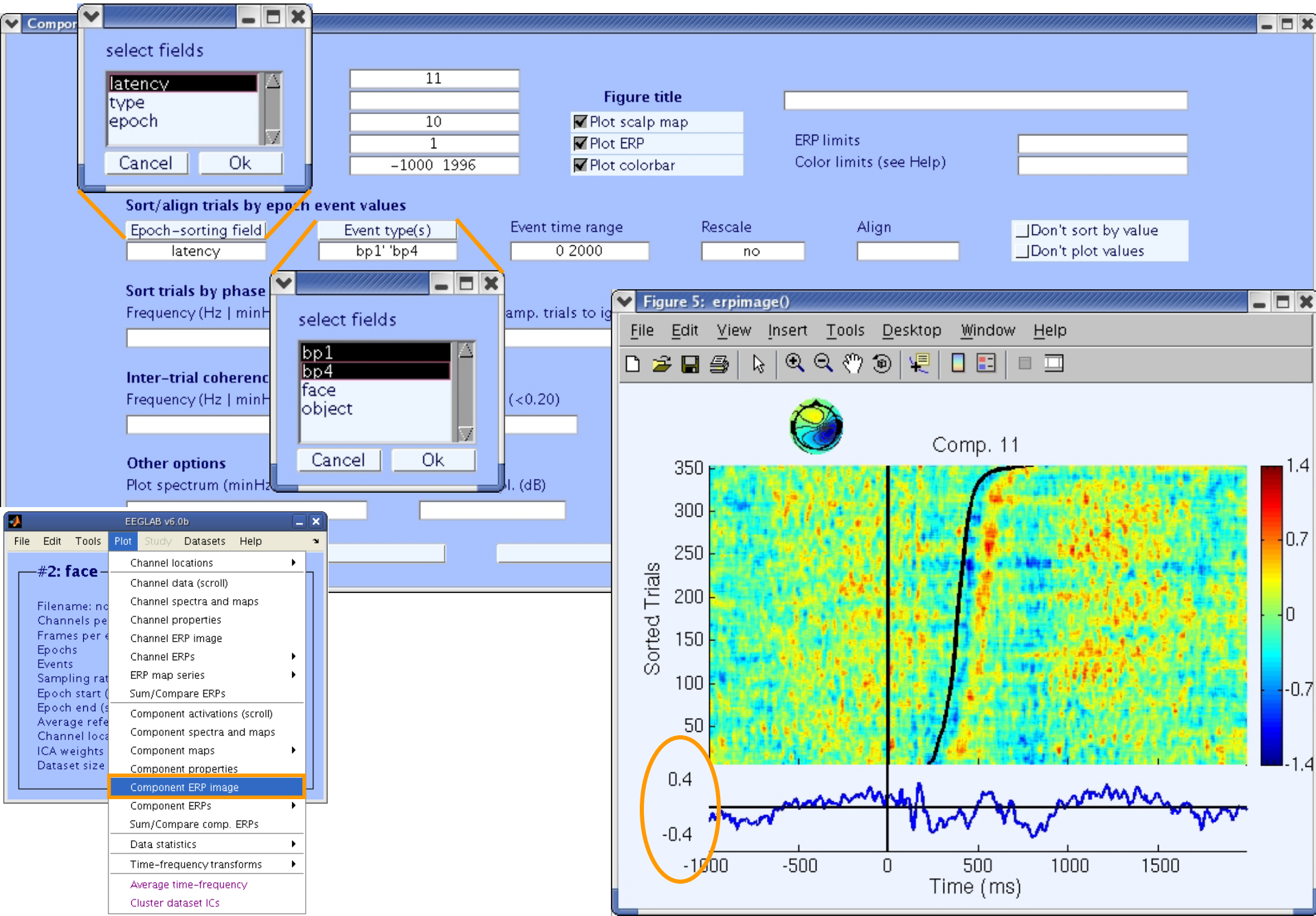
Sort/align trials by epoch event values

Epoch-sorting field	Event type(s)	Event time range	Rescale	Align	<input type="checkbox"/> Don't sort by value
latency	bp1' 'bp4	0 2000	no		<input type="checkbox"/> Don't plot values

Sort trials by phase



Component ERP Images



Component ERP Images

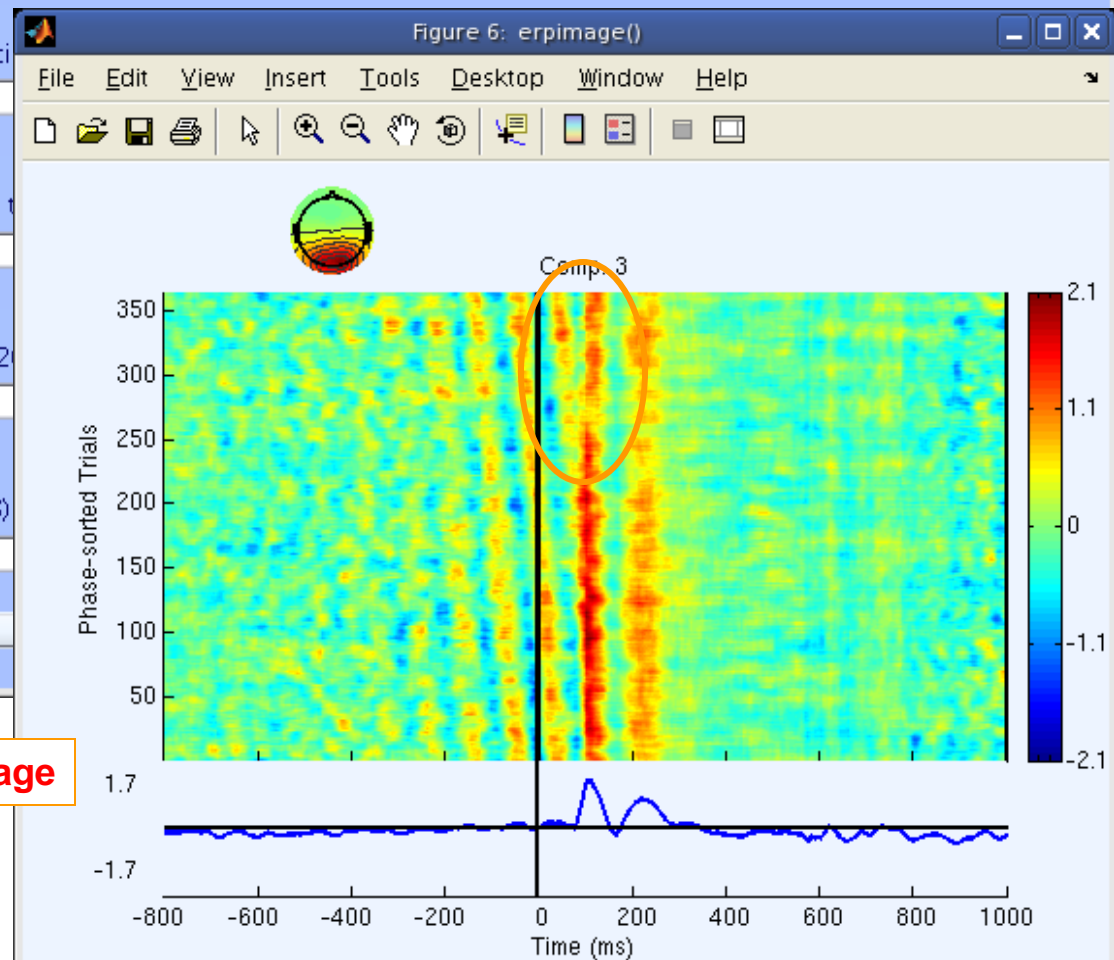
Component ERP image -- pop_erpimage()

Component(s)
Project to channel #
Smoothing
Downsampling
Time limits (ms)

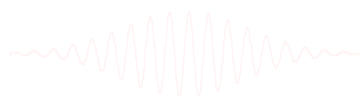
Figure title
 Plot scalp map
 Plot ERP
 Plot colorbar
ERP limits
Color limits (see Help)

Sort/align trials by epoch event values
Epoch-sorting field Event type(s) Event time

Sort trials by phase
Frequency (Hz | minHz maxHz) Percent low-amp.
Inter-trial coherence options
Frequency (Hz | minHz maxHz) Signif. level (<0.2)
Other options
Plot spectrum (minHz maxHz) Baseline ampl. (dB)



Phase-sorted image



Component ERP Images

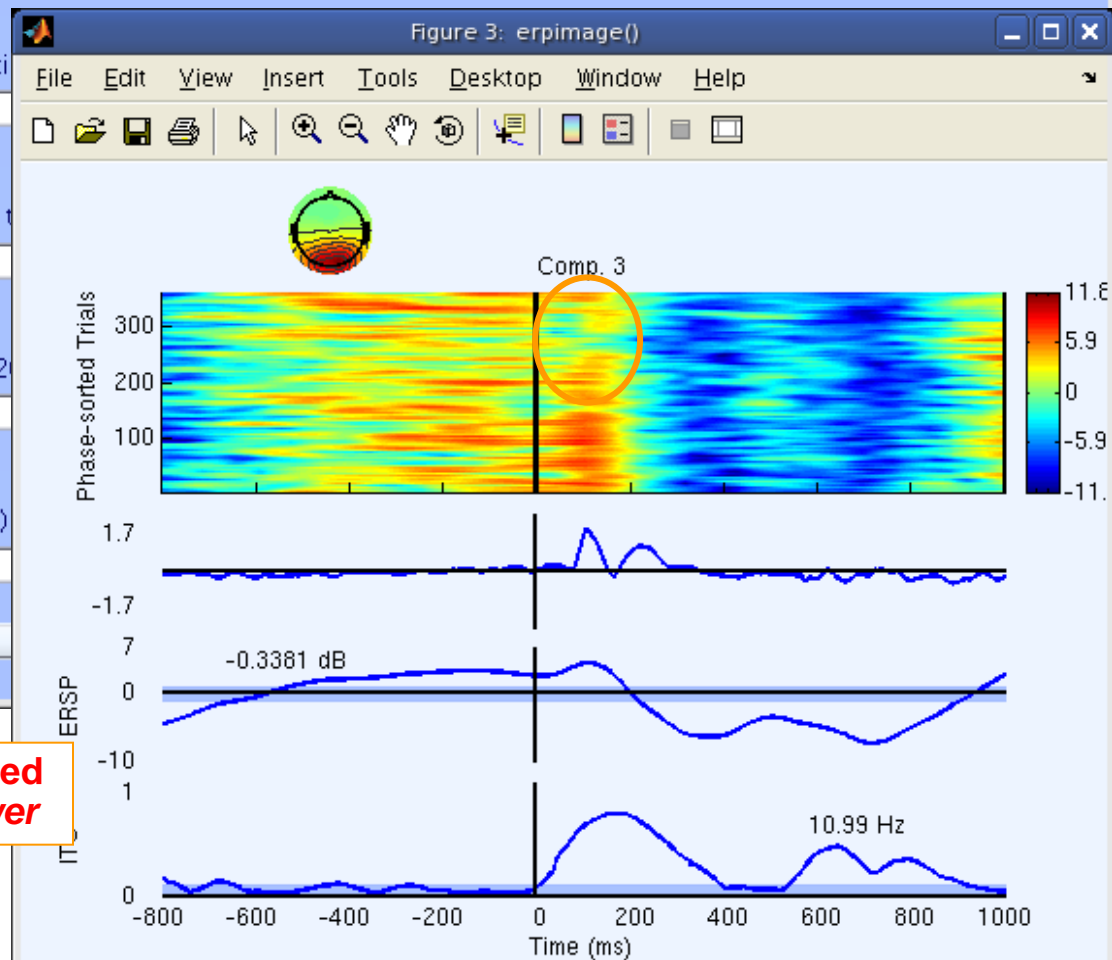
Component ERP image -- pop_erpimage()

Component(s)
Project to channel #
Smoothing
Downsampling
Time limits (ms)

Figure title
 Plot scalp map
 Plot ERP
 Plot colorbar
ERP limits
Color limits (see Help)

Sort/align trials by epoch event values
Epoch-sorting field Event type(s) Event time

Sort trials by phase
Frequency (Hz | minHz maxHz) Percent low-amp.
Inter-trial coherence options
Frequency (Hz | minHz maxHz) Signif. level (<0.2)
Other options
Plot spectrum (minHz maxHz) Baseline ampl. (dB)



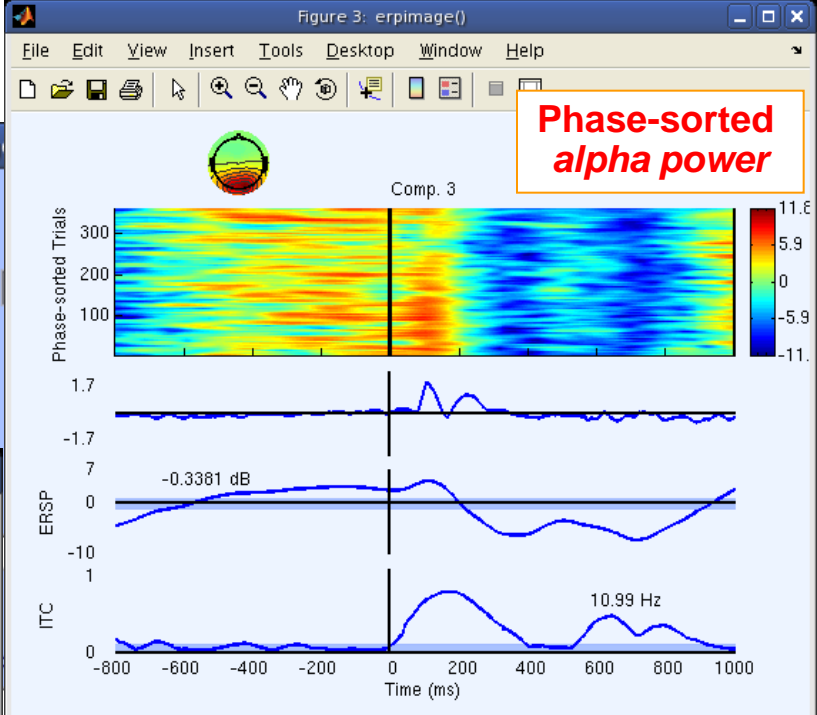
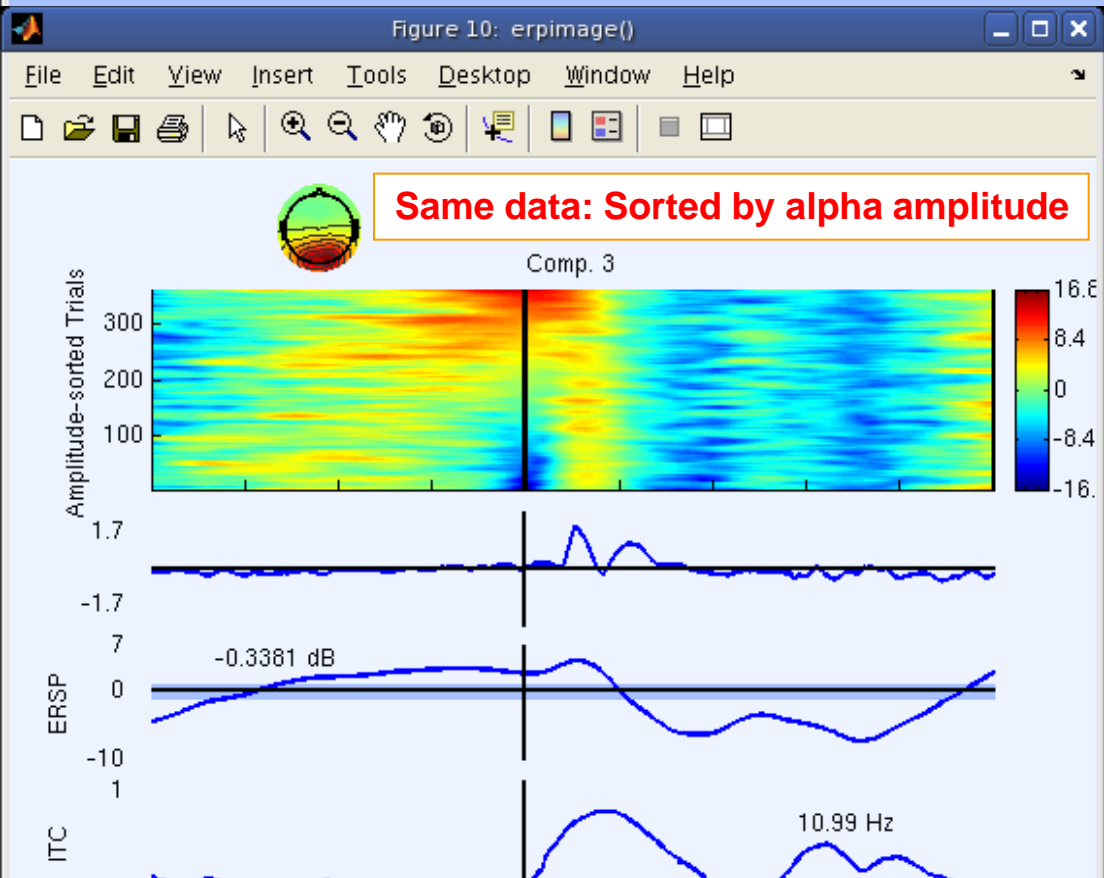
**Phase-sorted
alpha power**

Component ERP

Component ERP image -- pop_erpimag

Component(s)	3	Figure title
Project to channel #		
Smoothing	10	
Downsampling	1	
Time limits (ms)	-800 1000	

Plot scalp map
 Plot ERP
 Plot colorbar



Coher limits (≤ 1) Image amps (Requires signif.)

More options (see >> help erpimage)

'ampsort', [0 0 10 12]

Ok

>> help erpimage

'ampsort' = [center_ms, prcnt, freq, maxfreq] Sort epochs by amplitude.

Component ERP Images

Component ERP image -- pop_erpimage()

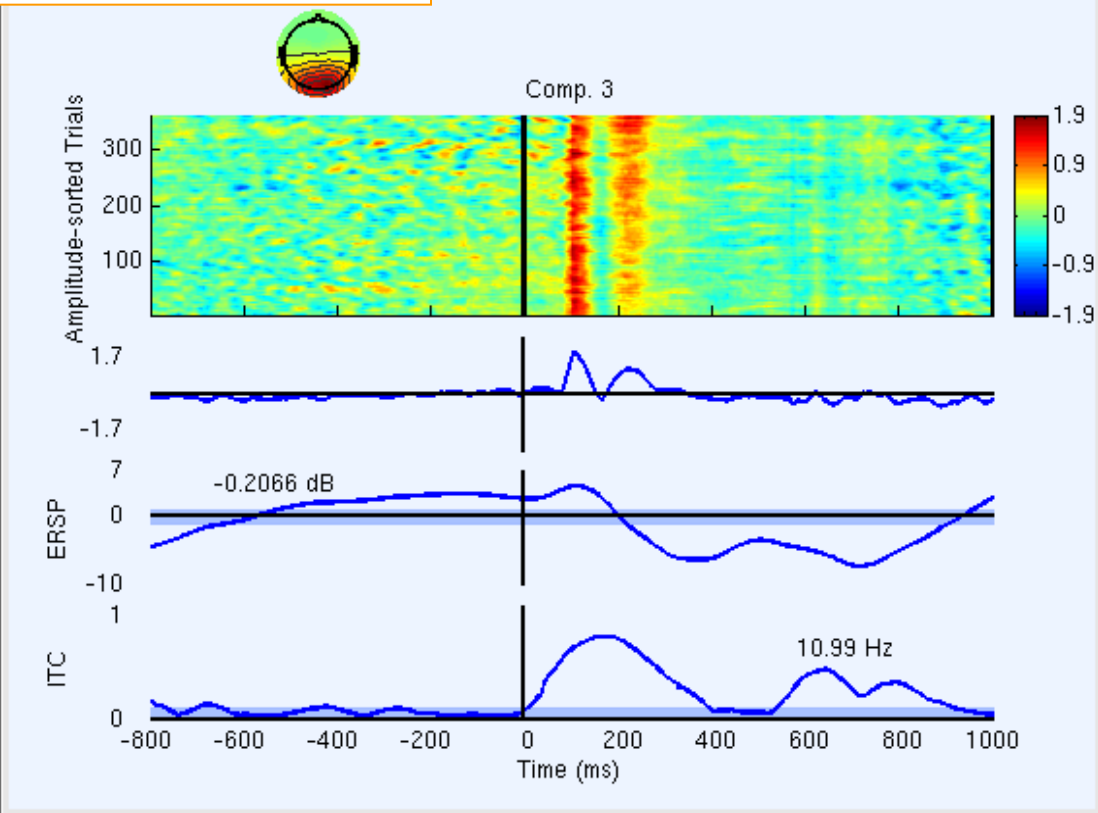
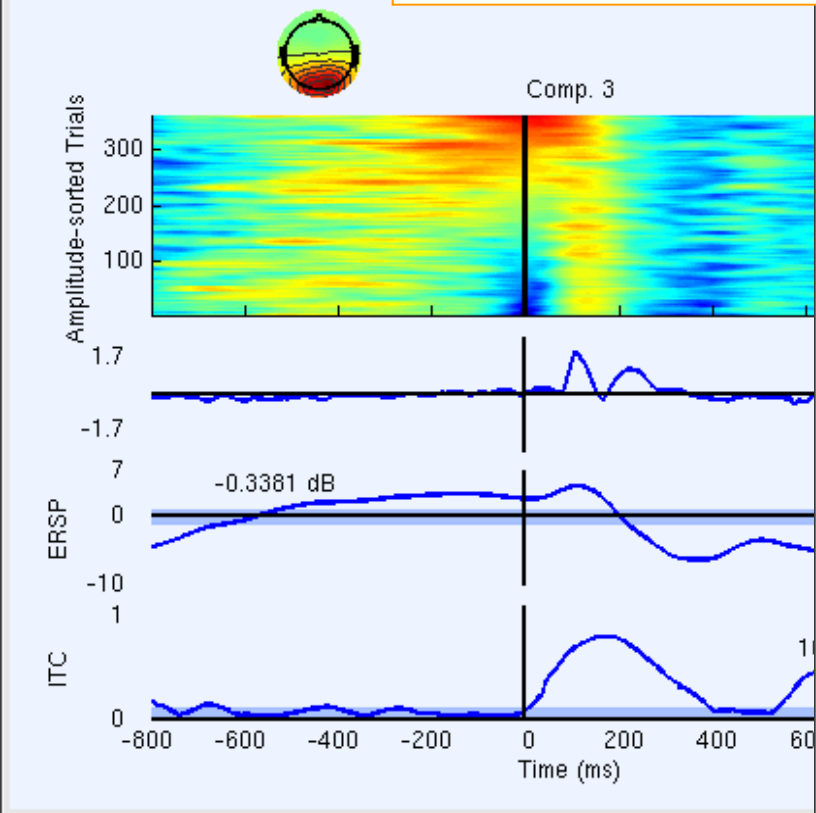
Component(s)	3	Figure title	
Project to channel #		<input checked="" type="checkbox"/> Plot scalp map	ERP limits
Smoothing	10	<input checked="" type="checkbox"/> Plot ERP	Color limits (see Help)
Downsampling	1	<input checked="" type="checkbox"/> Plot colorbar	
Time limits (ms)	-800 1000		

Figure 10: erpimage() | Figure 11: erpimage()

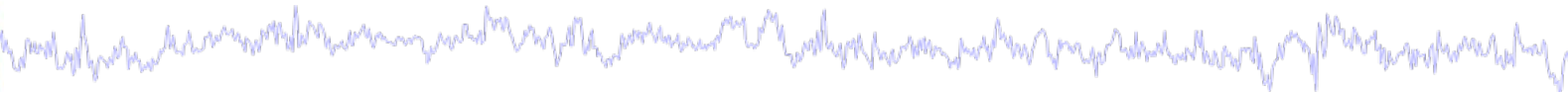
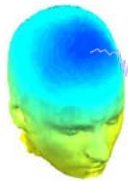
File Edit View Insert Tools Desktop Window Help

File Edit View Insert Tools Desktop Window Help

Same sorting order: Amplitude vs. activations



Sorting options in ERP image: RT



EEGLAB v7.2.7.18b

File Edit Tools **Plot** Study Datasets Help

#1: Step 1

- Channel locations
- Channel data (scroll)
- Channel spectra and maps
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)
- Component spectra and maps
- Component maps
- Component properties
- Component ERP image**
- Component ERPs
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms
- Cluster dataset ICs

Filename:
Channels
Frames per epoch
Epochs
Events
Sampling rate
Epoch start time
Epoch end time
Reference channel
Channel locations
ICA weights
Dataset size

Component ERP image -- pop_erpimage()

Component(s) 17

Project to channel #

Smoothing 5

Downsampling 1

Time limits (ms) -3000 3000

Figure title

Plot scalp map

Plot ERP

Plot colorbar

ERP limits

Color limits (see Help)

Sort/align trials by epoch event values

Epoch-sorting field Event type(s) Event time range Rescale Align Don't sort by value Don't plot values

latency in' out no

Sort trials by phase

Frequency (Hz | minHz maxHz) Percent low-amp. trials to ignore Window center (ms) Wavelet cycles

3

Inter-trial coherence options

Frequency (Hz | minHz maxHz) Signif. level (<=0.20) Amplitude limits (dB) Coher limits (<=1) Image amps (Requires signif.)

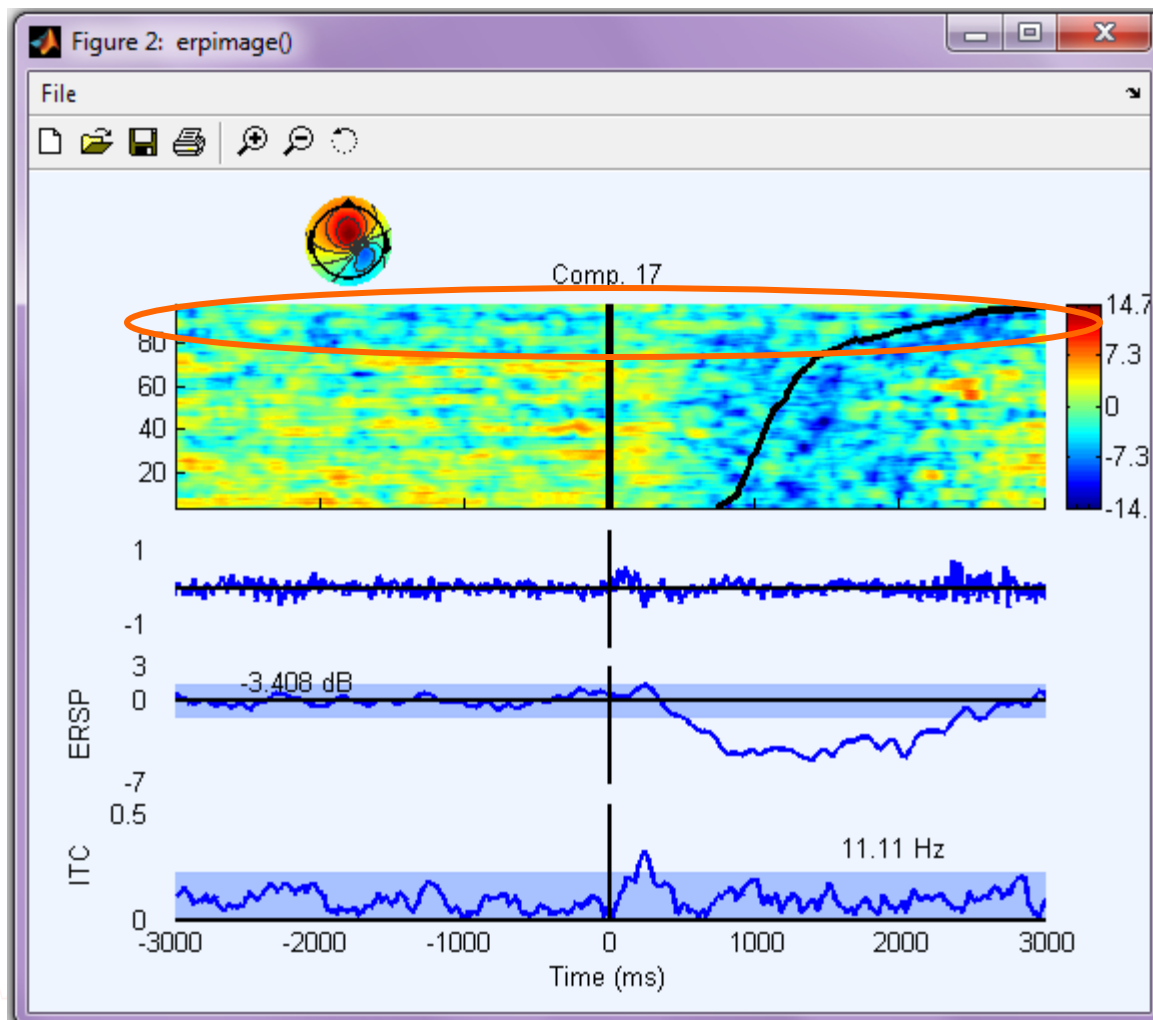
8 12 0.01

Other options

Plot spectrum (minHz maxHz) Baseline ampl. (dB) Mark times (ms) More options (see >> help erpimage)

Help Cancel Ok

Sorting options in ERP image: RT



Sorting options in ERP image: type

(ie, "was the probe letter in memorized set or not?")



Component ERP image -- pop_erpimage()

Component(s) 3
Project to channel #
Smoothing 5
Downsampling 1
Time limits (ms) -300 1000

Figure title
 Plot scalp map
 Plot ERP
 Plot colorbar

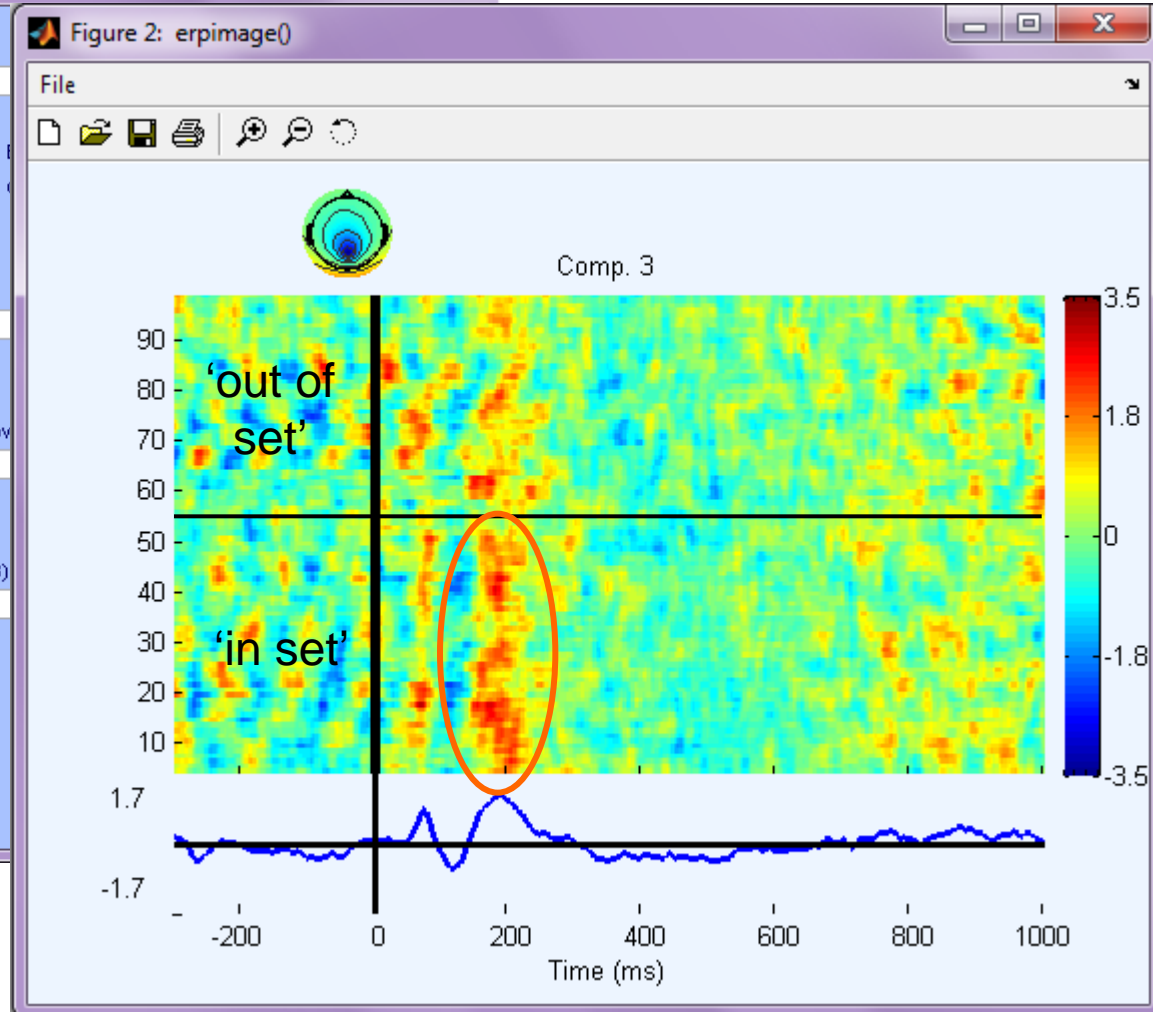
Sort/align trials by epoch event values
Epoch-sorting field type
Event type(s) in' out
Event time range
Rescale no

Sort trials by phase
Frequency (Hz) | minHz maxHz
Percent low-amp. trials to ignore
Window

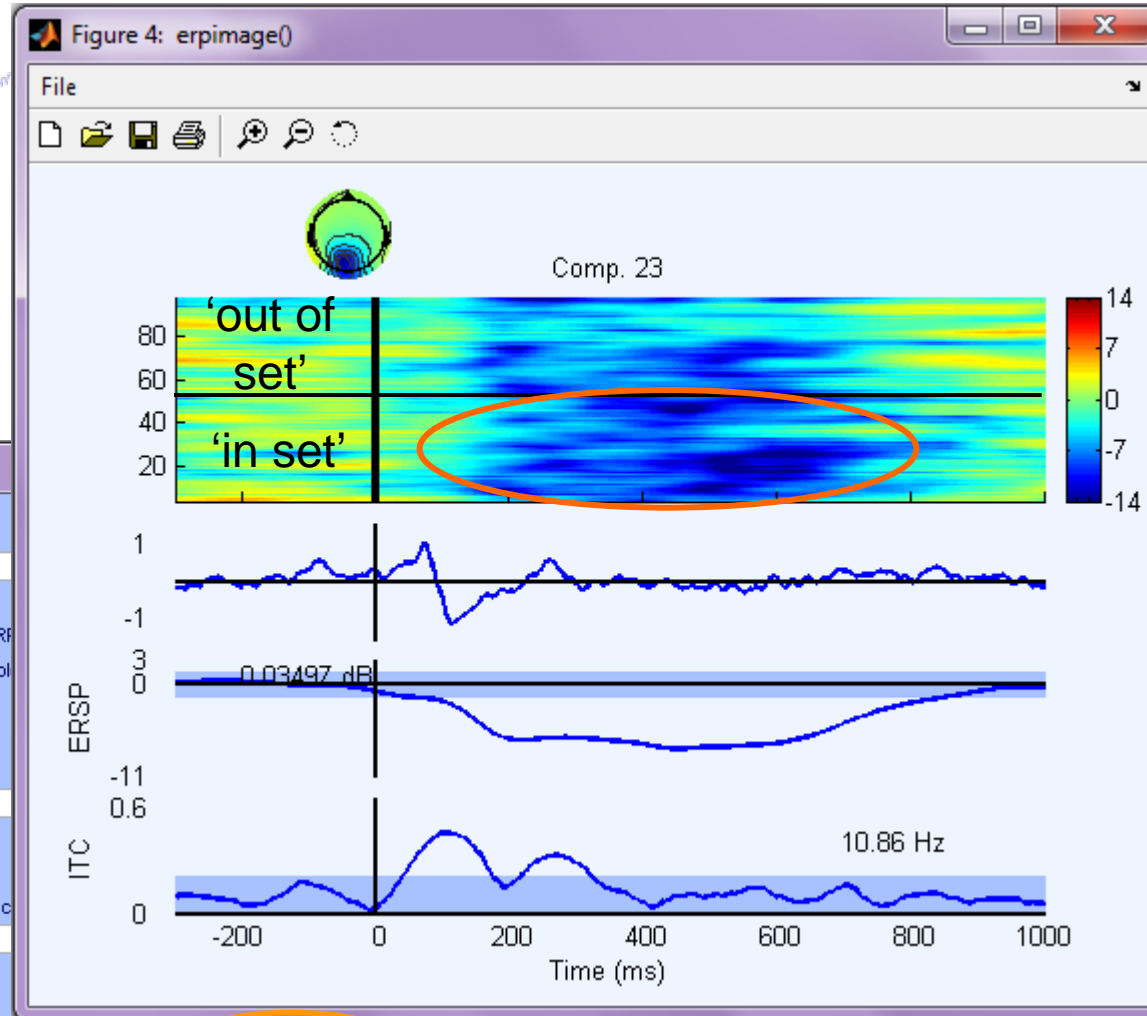
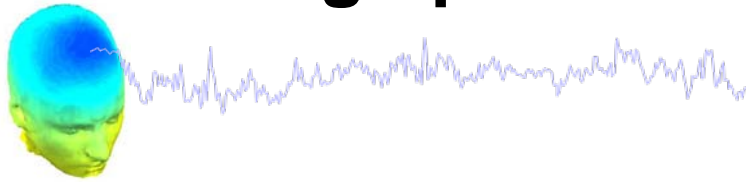
Inter-trial coherence options
Frequency (Hz) | minHz maxHz
Signif. level (<=0.20)
Amplitude limits (dB)

Other options
Plot spectrum (minHz maxHz)
Baseline ampl. (dB)
Mark times (ms)

Help



Sorting options in ERP image: type (img amps)



Component ERP image -- pop_erpimage()

Component(s)

Project to channel #

Smoothing

Downsampling

Time limits (ms)

Figure title

Plot scalp map

Plot ERP

Plot colorbar

Sort/align trials by epoch event values

Epoch-sorting field Event type(s) Event time range Rescale

Sort trials by phase

Frequency (Hz | minHz maxHz) Percent low-amp. trials to ignore Window c

Inter-trial coherence options

Frequency (Hz | minHz maxHz) Signif. level (<=0.20) Amplitude limits (dB) Coher limits (<=1) Image amps (Requires signif.)

Other options

Plot spectrum (minHz maxHz) Baseline ampl. (dB) Mark times (ms) More options (see >> help erpimage)

Sorting options in ERP image: memory load



Component ERP image -- pop_erpimage()

Component(s) 4

Project to channel # []

Smoothing 5

Downsampling 1

Time limits (ms) -3000 500

Figure title []

Plot scalp map

Plot ERP

Plot colorbar

ERP limits []

Color limits (see Help) -11 11

Sort/align trials by epoch event values

Epoch-sorting field: load

Event type(s): rB' rC' rD' rF' rG' r

Event time range []

Rescale: no

Align []

Don't sort by val

Don't plot values

Sort trials by phase

Frequency (Hz | minHz maxHz) []

Percent low-amp. trials to ignore []

Window center (ms) []

Wavelet cycles 3

Inter-trial coherence options

Frequency (Hz | minHz maxHz) 5 7

Signif. level (<0.20) 0.01

Amplitude limits (dB) []

Coher limits (<=1) []

Image amps (Requires signi)

Other options

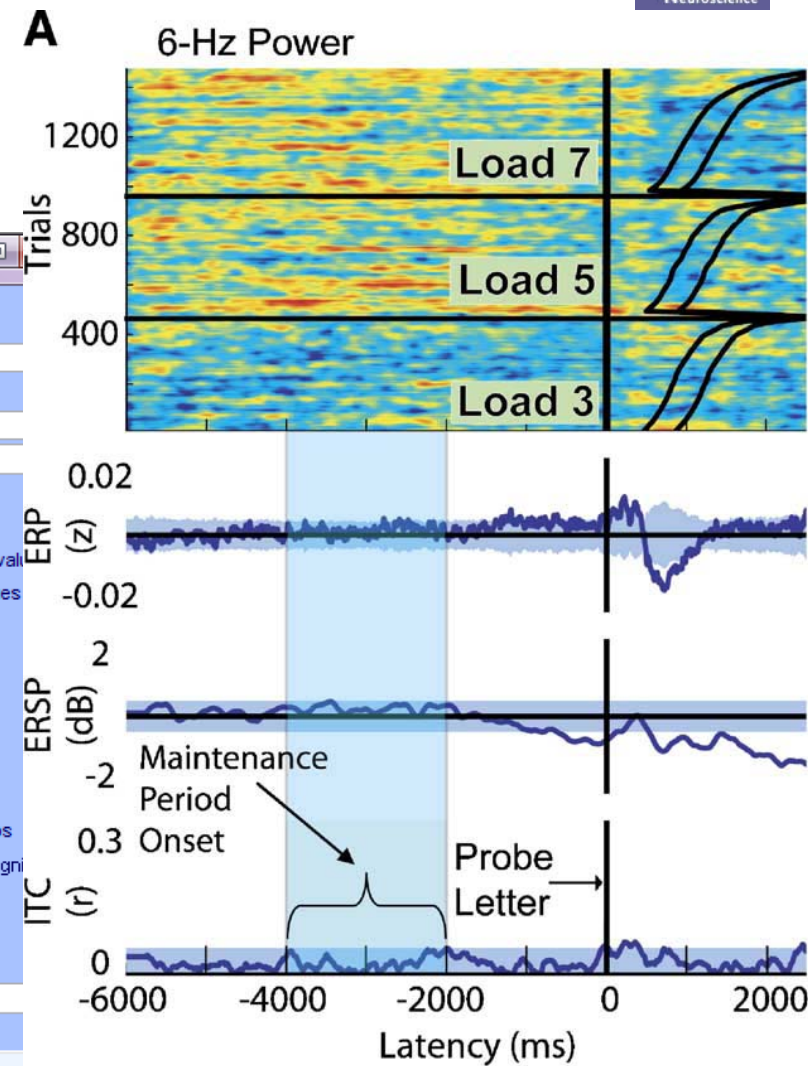
Plot spectrum (minHz maxHz) []

Baseline ampl. (dB) []

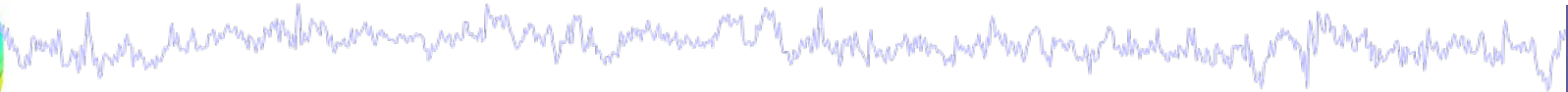
Mark times (ms) []

More options (see >> help erpimage)

Help Cancel Ok



Summary



- ICA extracts brain and artifact activities
- IC vs scalp data improves SNR and localization
- ERP image single-trial analysis: many options...

