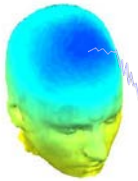
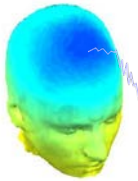
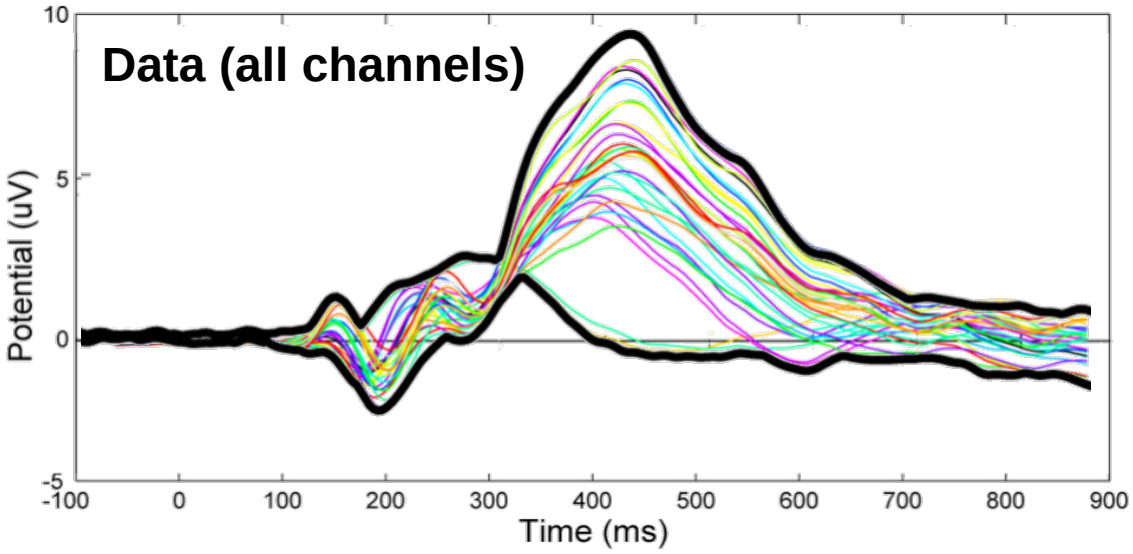
Evaluating ICA components

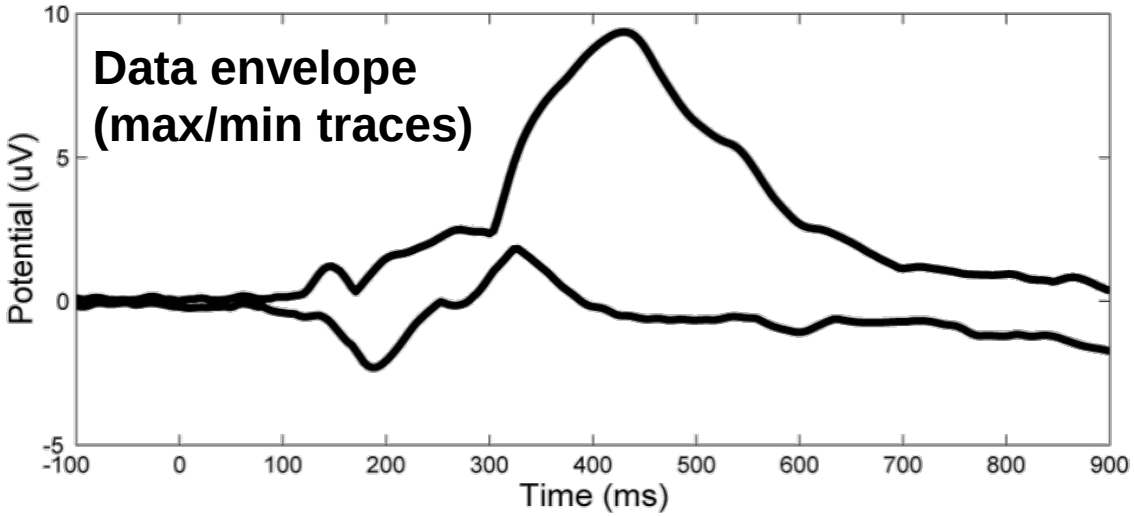


1. IC ERP envelope
2. IC ERP images - advanced
3. Time-frequency analysis
4. IC ERSPs
5. IC cross coherence

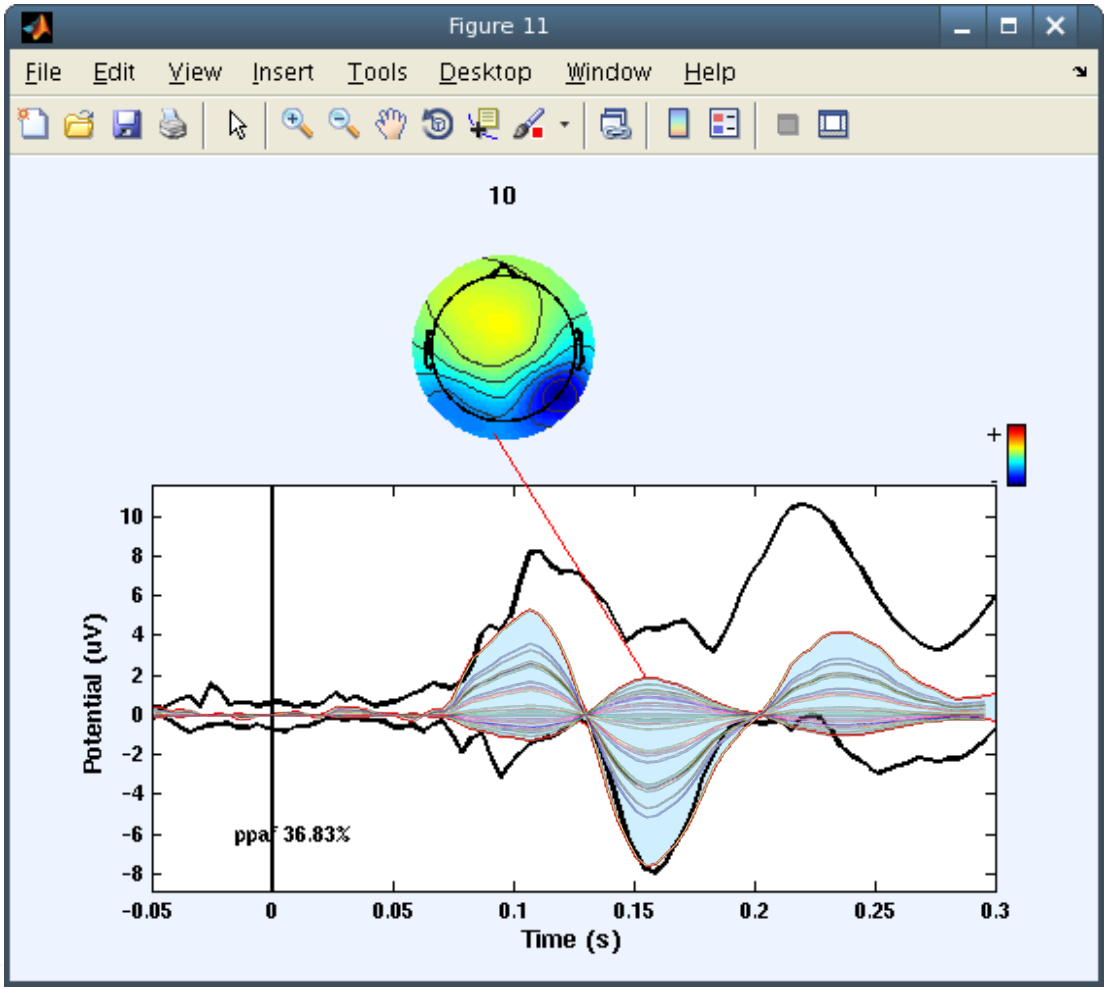
Definition: The data envelope



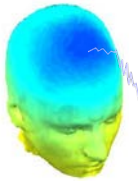


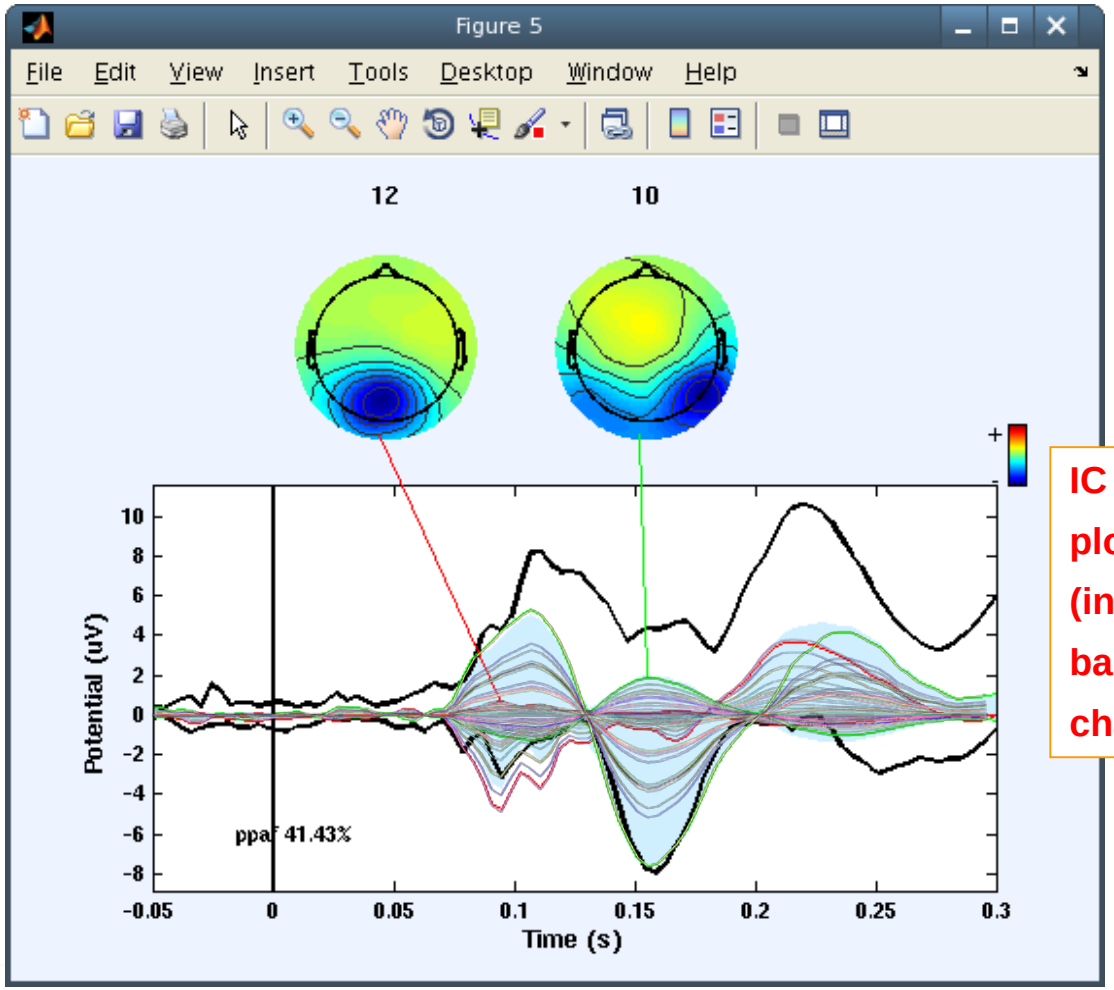


IC back-projection envelope



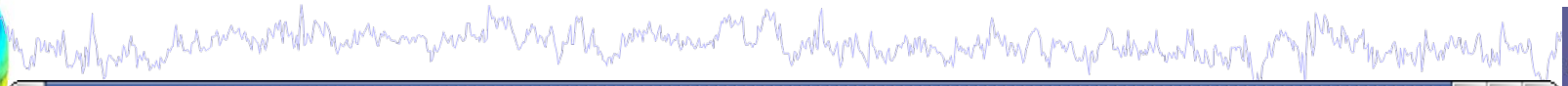
IC back-projection envelope





IC envelopes plotted for simplicity (instead of all back-projected channels)

IC contributions to ERP envelope



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Plot component and ERP envelopes -- pop_envtopo()

Enter time range (in ms) to plot:	-100 1000
Enter time range (in ms) to rank component contributions:	0 600
Number of largest contributing components to plot (1-20):	6
Else plot these component numbers only (<21) (Ex: 2:4,7):	
Component numbers to remove from data before plotting:	
Plot title:	ERP components of faces_4 epochs
Optional topoplot() and spectopo() arguments:	'electrodes','off'

Cancel

EEGLAB v7

File Edit Tools Plot Study Datasets Help

#2: Ste chs

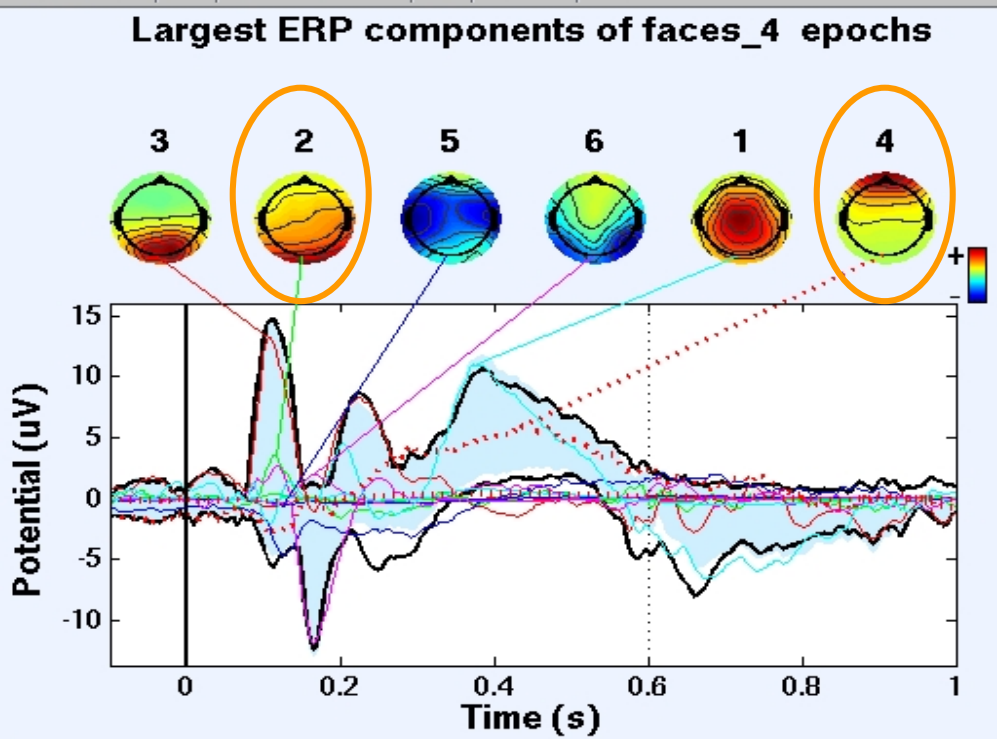
Filename:
Channels
Frames pe
Epochs
Events
Sampling r
Epoch sta
Epoch enc
Reference
Channel lo
ICA weight
Dataset si

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

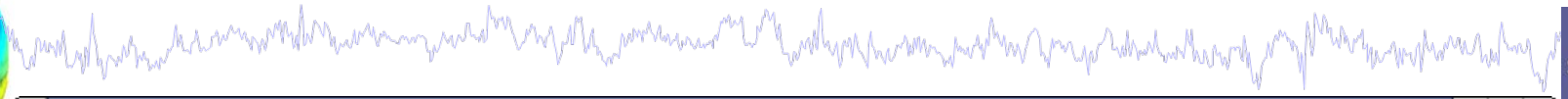
With component maps
With comp. maps (comp
In rectangular array

Figure 3

File Edit View Insert Tools Desktop Window Help



IC contributions to ERP envelope



Swartz Center for Computational Neuroscience

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Enter time range (in ms) to rank component contributions:	0 600
Number of largest contributing components to plot (1-20):	6
Else plot these component numbers only (<21) (Ex: 2:4,7):	
Component numbers to remove from data before plotting:	2, 4, 7, 9, 12, 17,18,25
Plot title:	ERP components of faces_4 epochs
Optional topoplot() and spectopo() arguments:	'electrodes','off'

Cancel

Artifact Components

EEGLAB v6.0b

File Edit Tools Plot Study Datasets Help

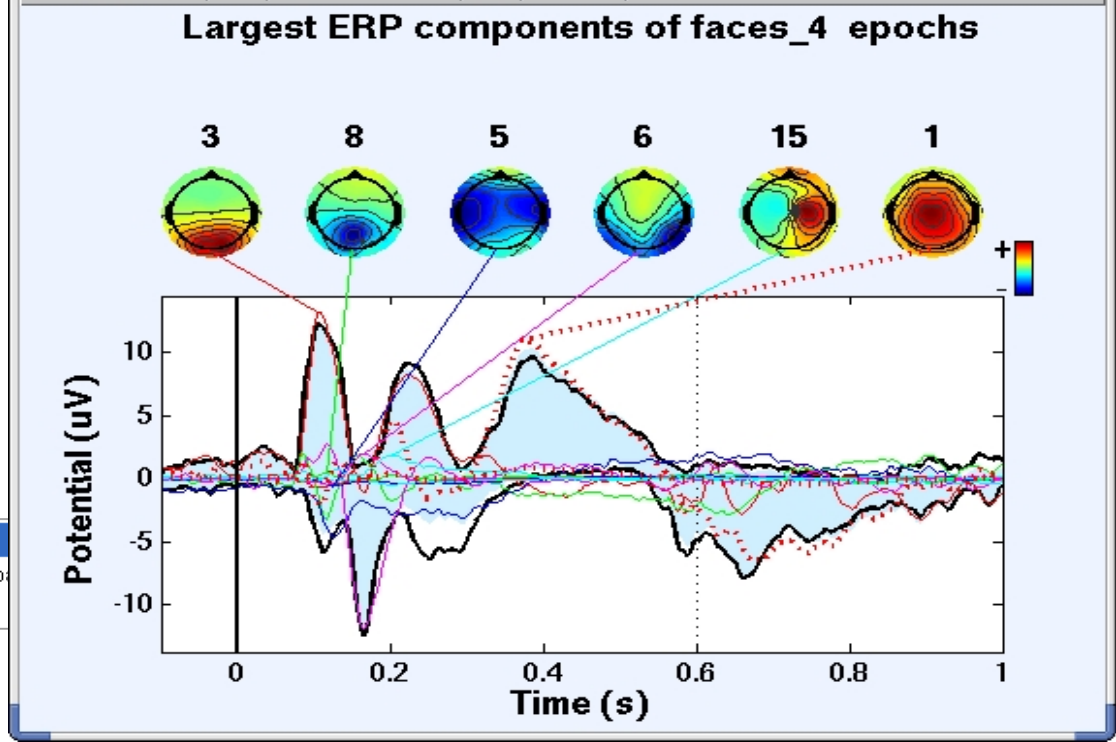
#1: faces

Filename: ...
Channels pe
Frames per e
Epochs
Events
Sampling rat
Epoch start (
Epoch end (s
Average refe
Channel loca
ICA weights
Dataset size

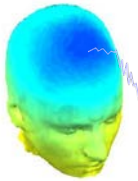
- Channel locations
- Channel data (scroll)
- Channel spectra and maps
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)
- Component spectra and maps
- Component maps
- Component properties
- Component ERP image
- Component ERPs → With component maps / With comp. maps (comp / In rectangular array
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms
- Average time-frequency
- Cluster dataset ICs

Figure 5

File Edit View Insert Tools Desktop Window Help



Evaluating ICA components



1. IC ERP envelope
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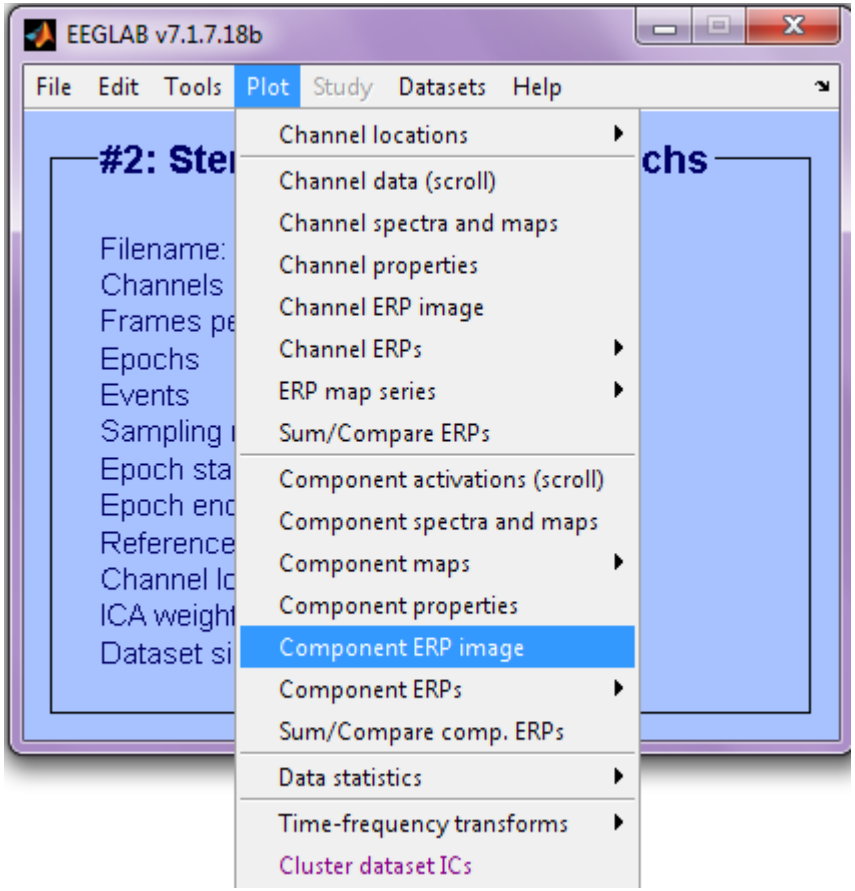
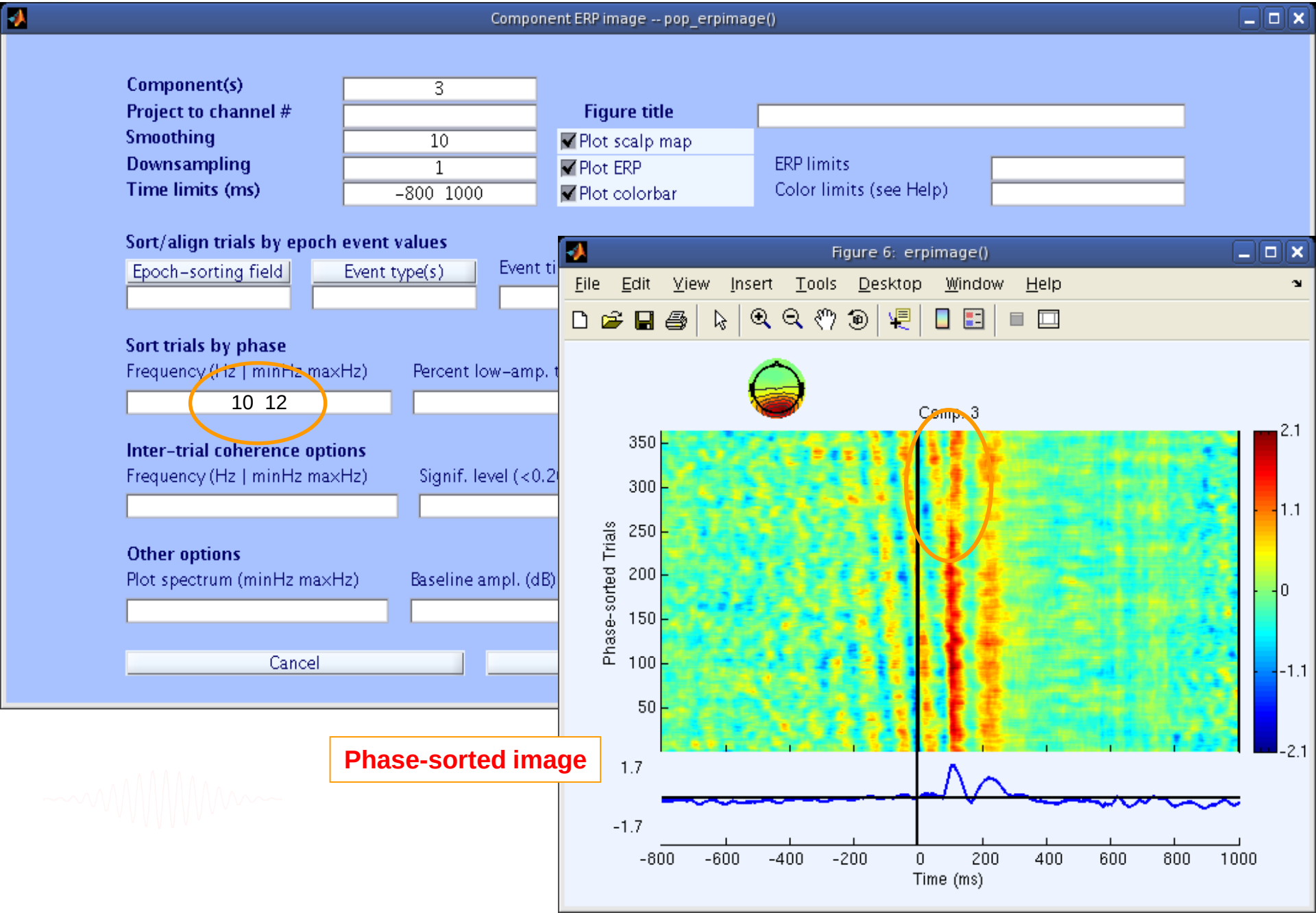
Component ERP image

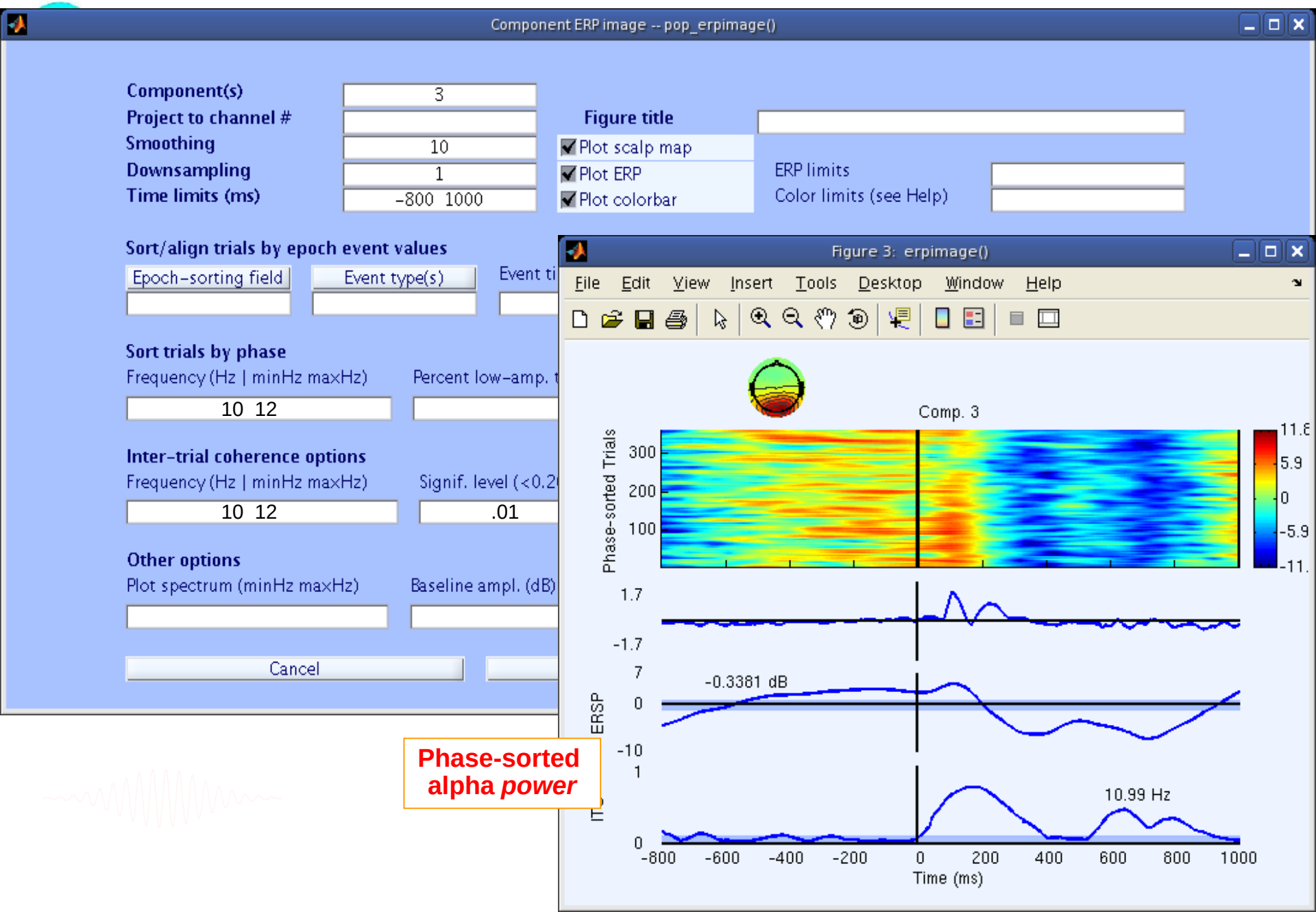


Component ERP Images



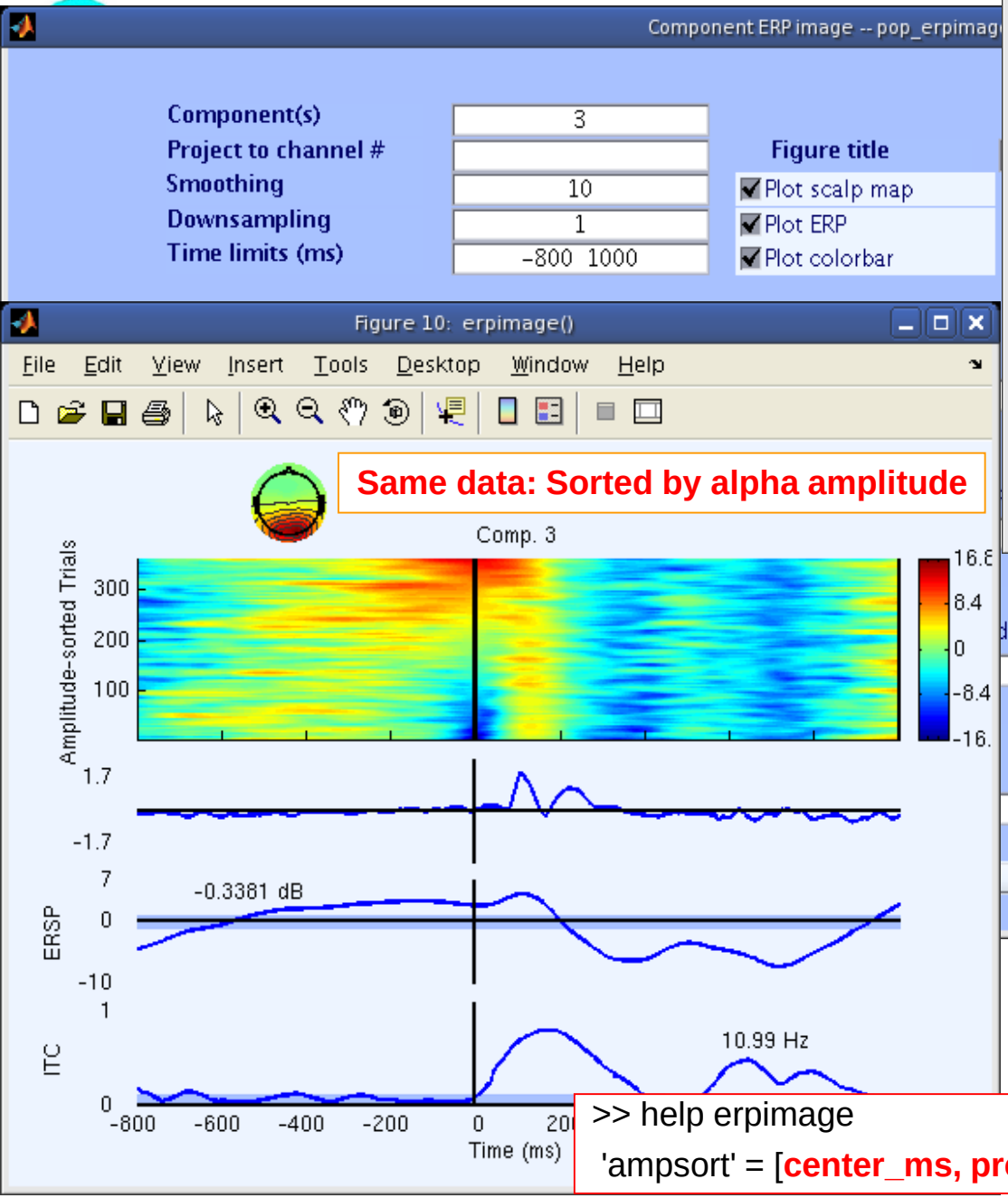
Phase-sorted image

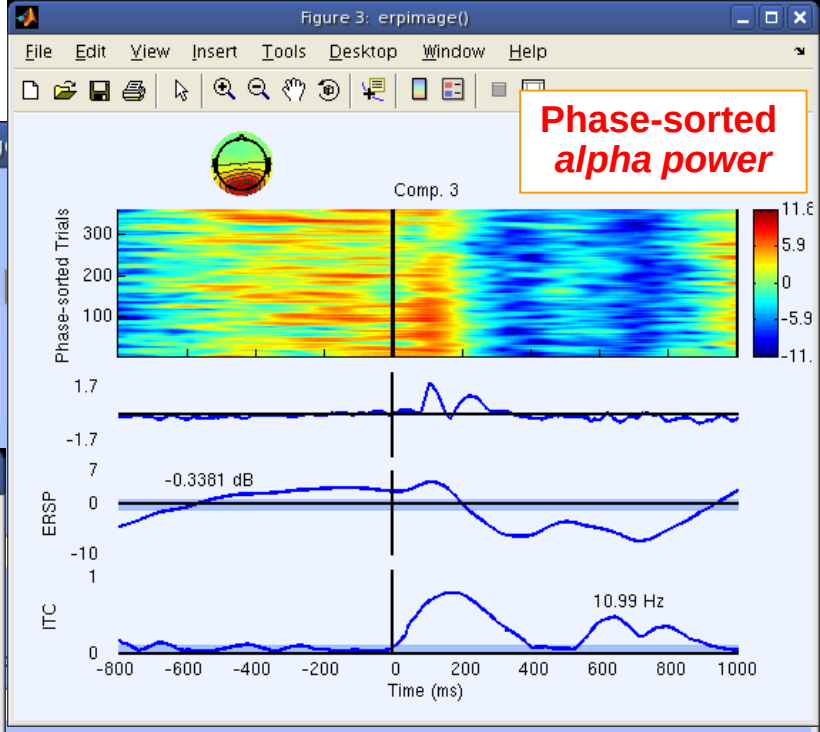
Component ERP Images

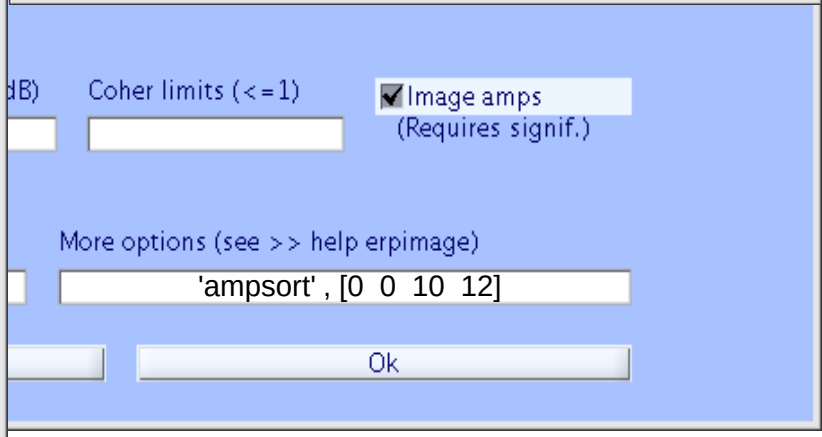


Phase-sorted alpha *power*

Component ERP



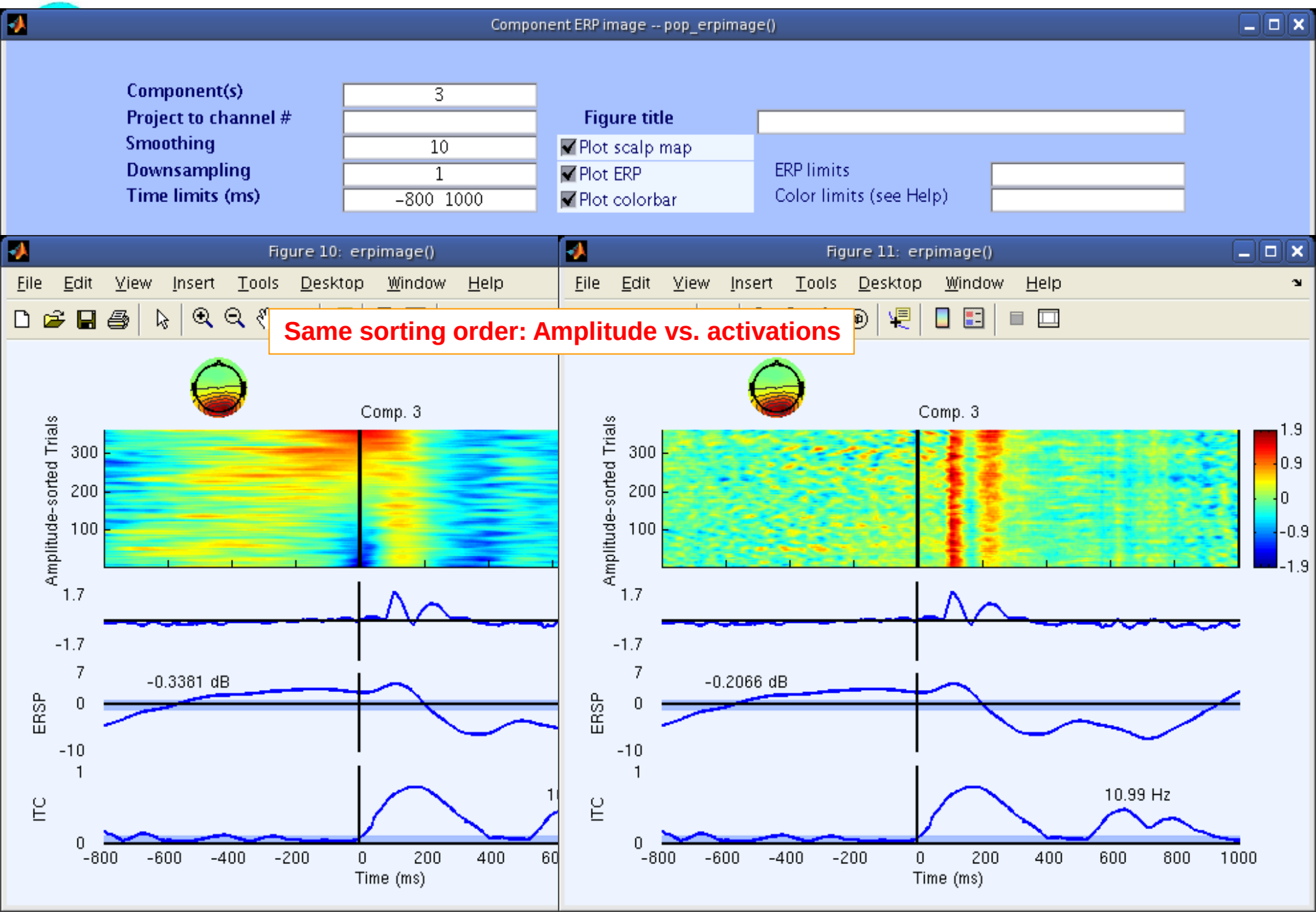




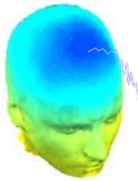
>> help erpimage

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

Component ERP Images



Evaluating ICA components



1. IC ERP envelope
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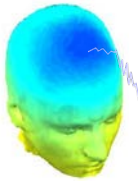
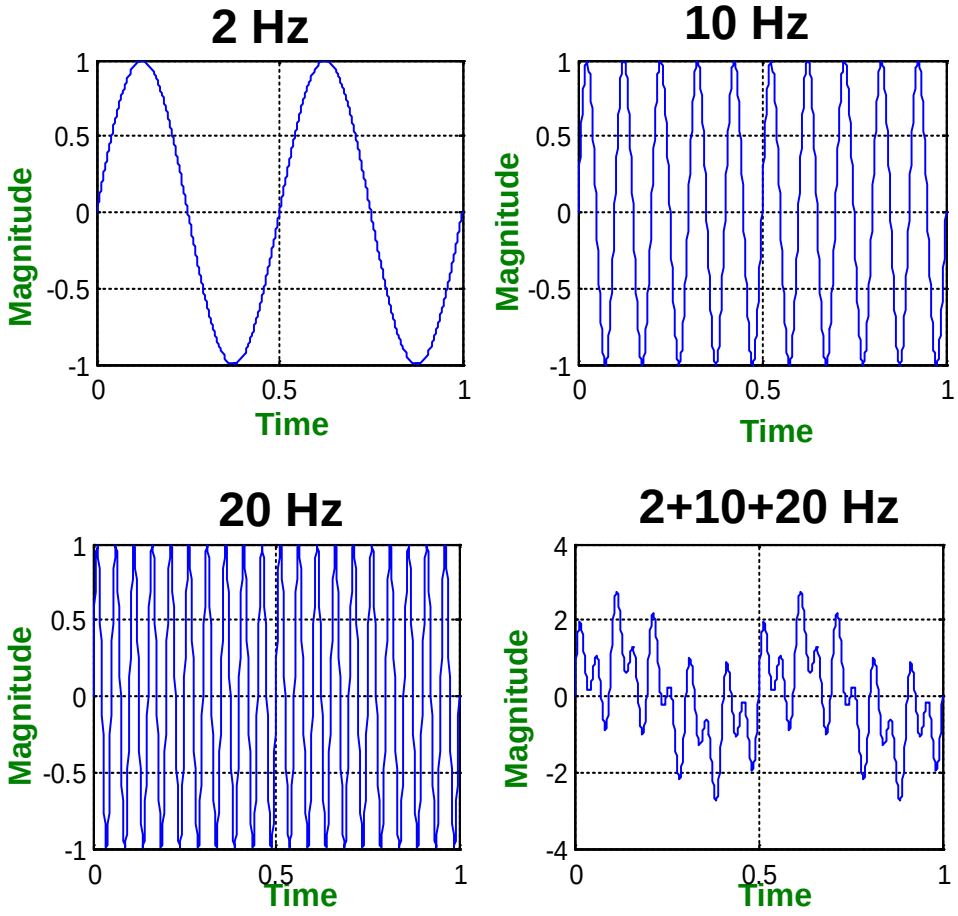
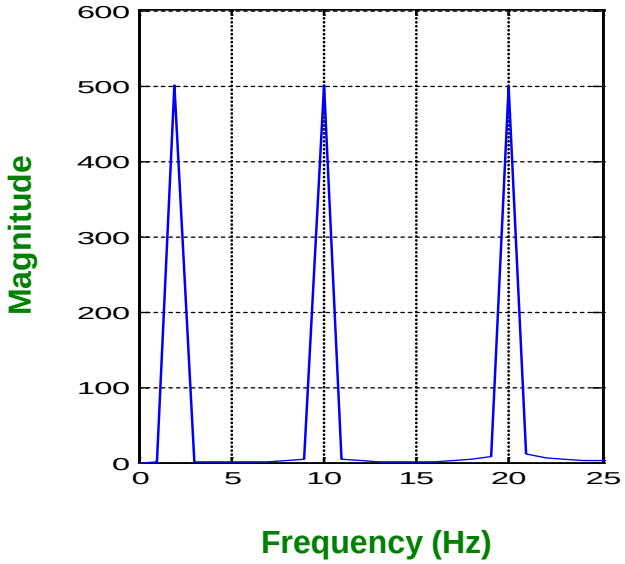
Stationary signals

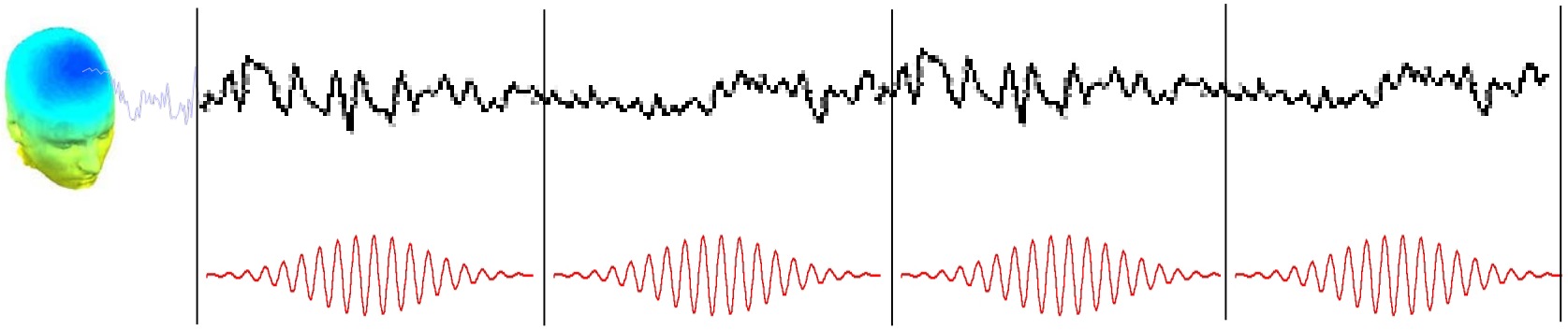




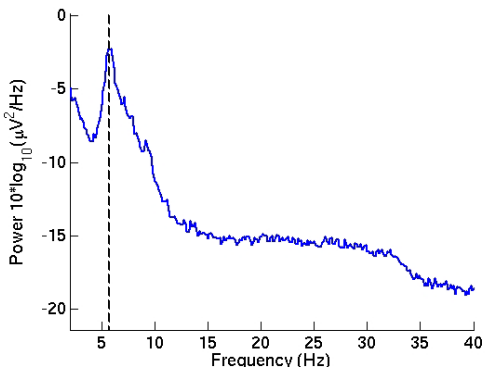
Power spectrum

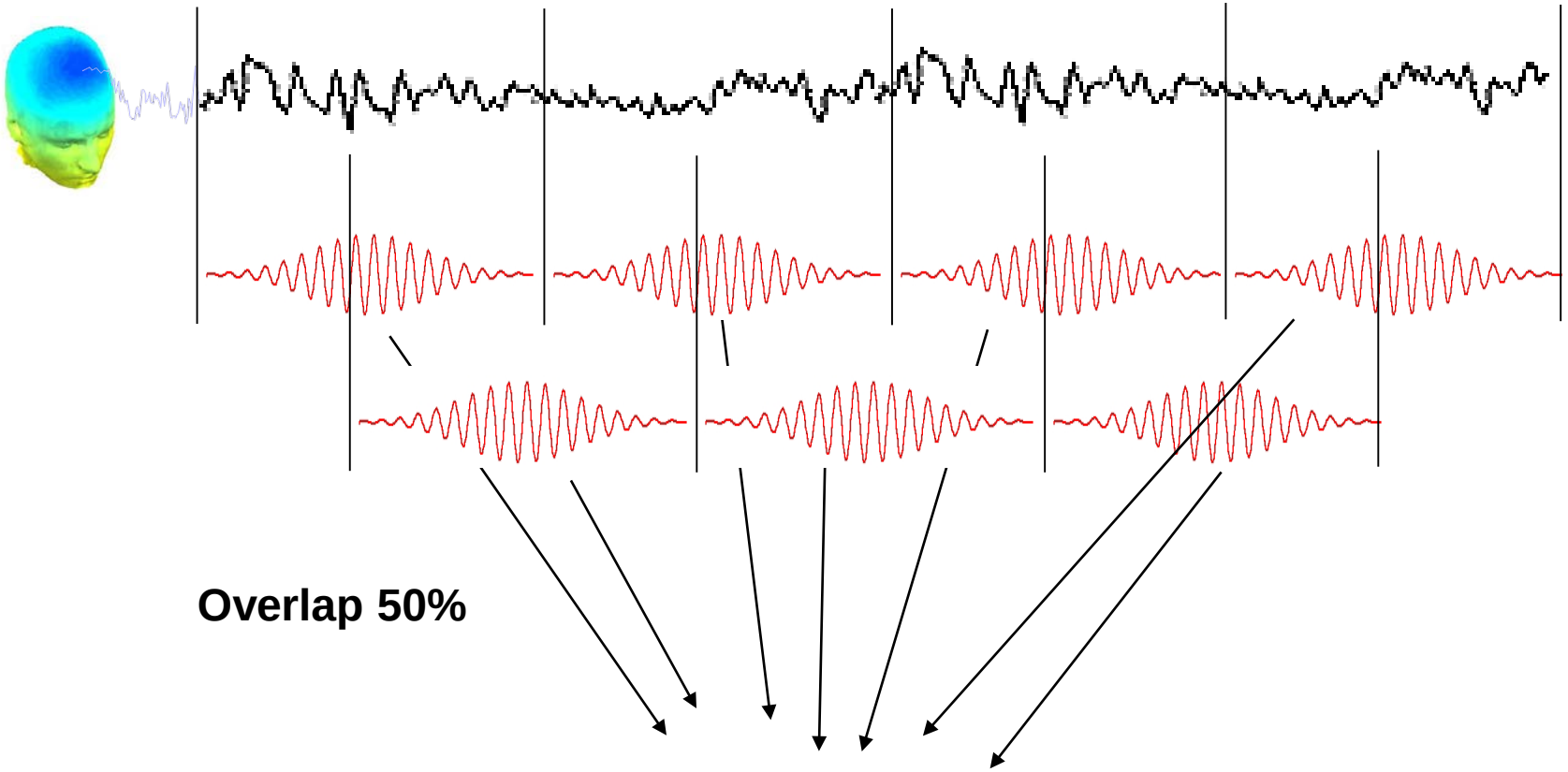


Slide courtesy of Petros Xanthopoulos, Univ. of Florida



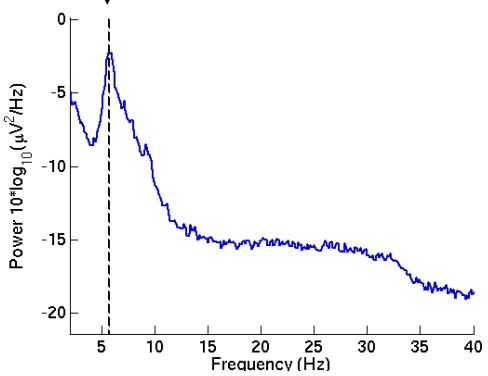
Average of squared absolute values



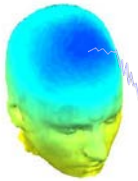


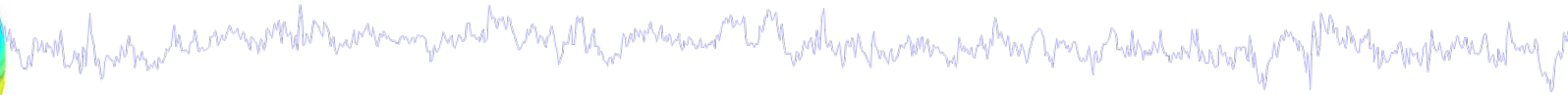
Overlap 50%

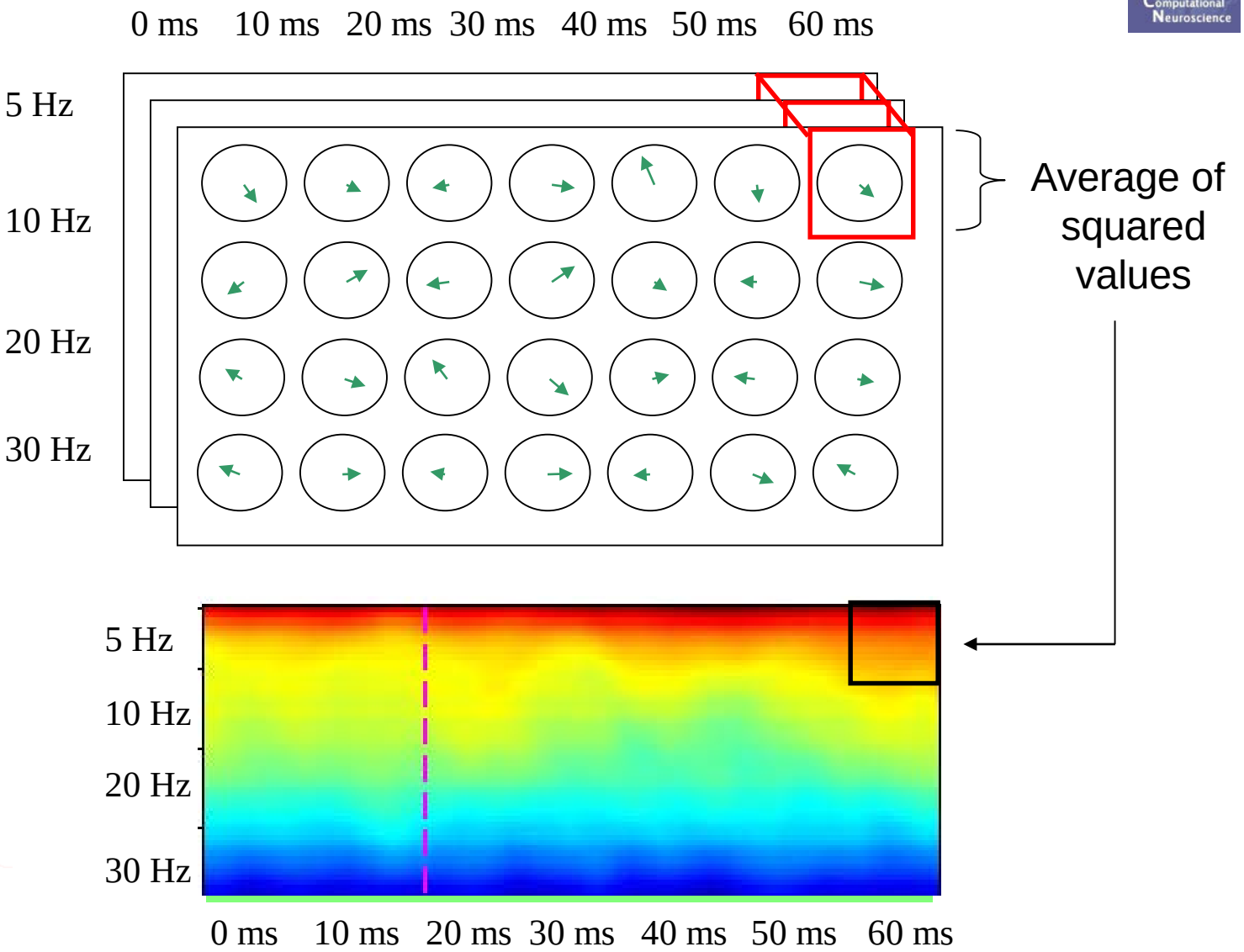
Average of squared amplitudes



Spectrogram or ERSP

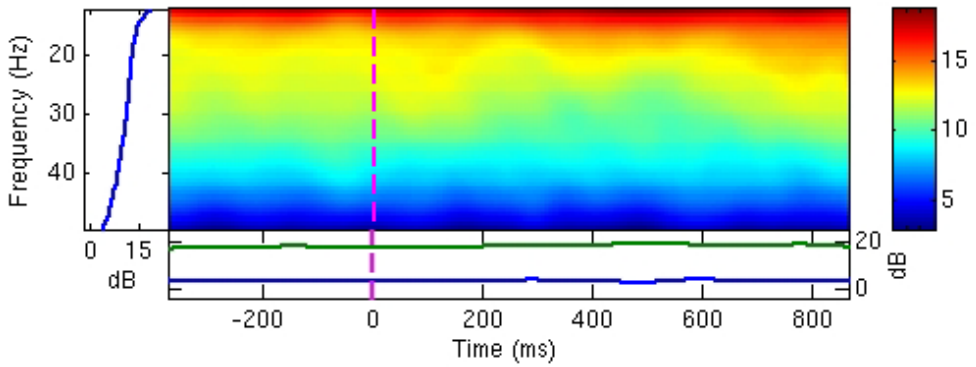






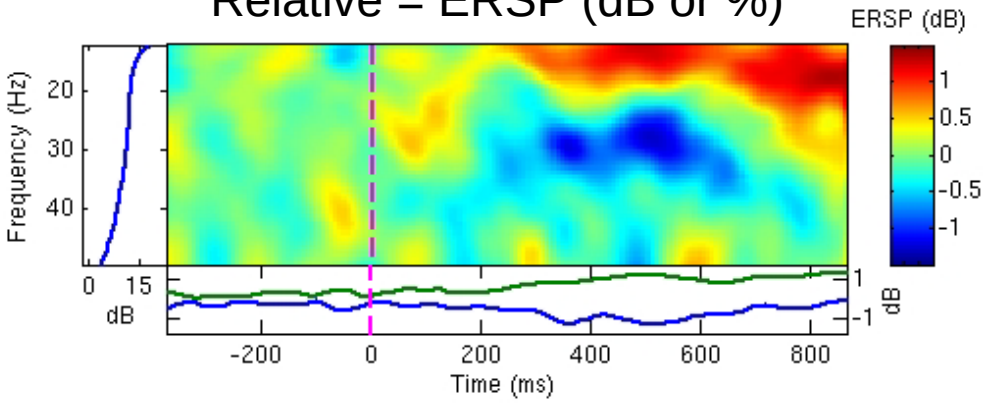
Absolute versus relative power

Absolute = ERS

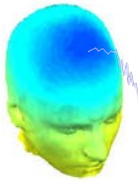


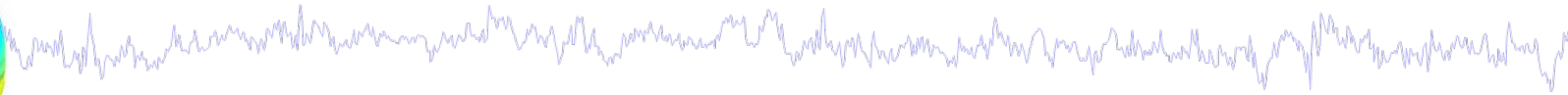
Subtract the average “baseline” spectrum

Relative = ERSP (dB or %)



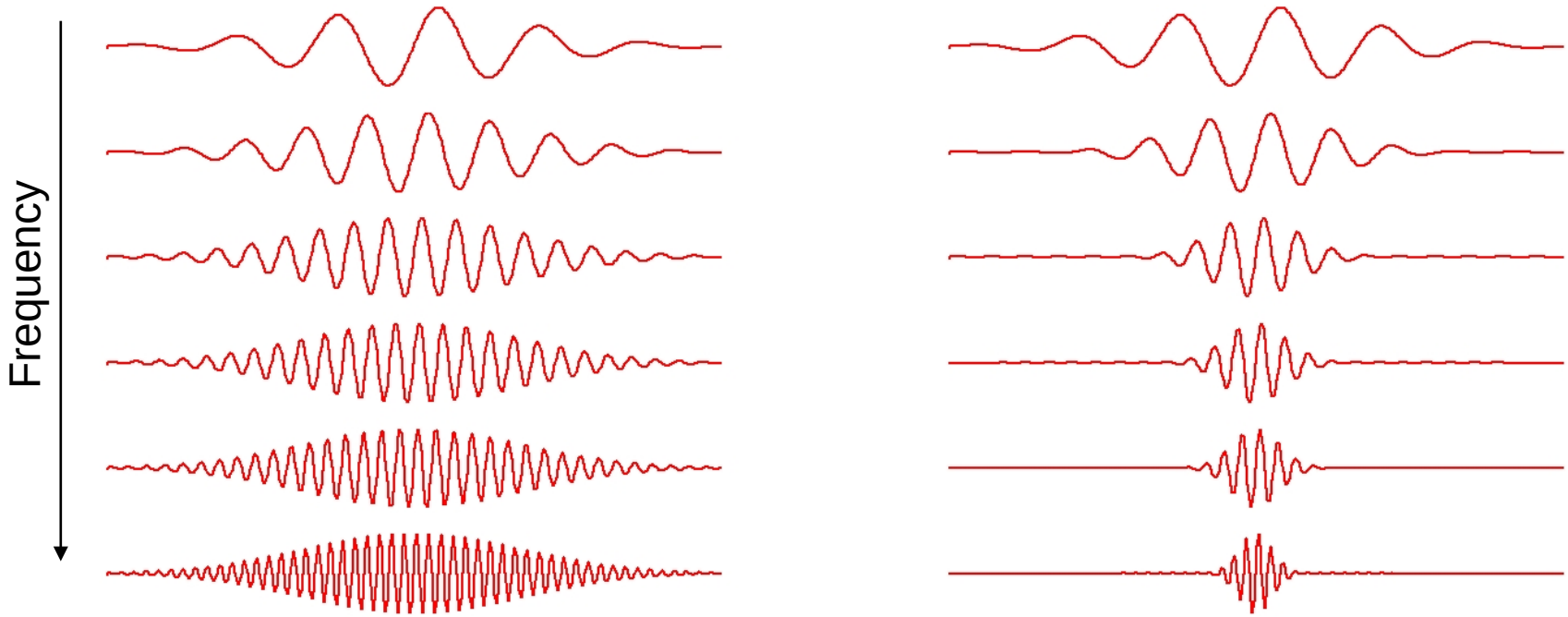
Difference between FFT and wavelets



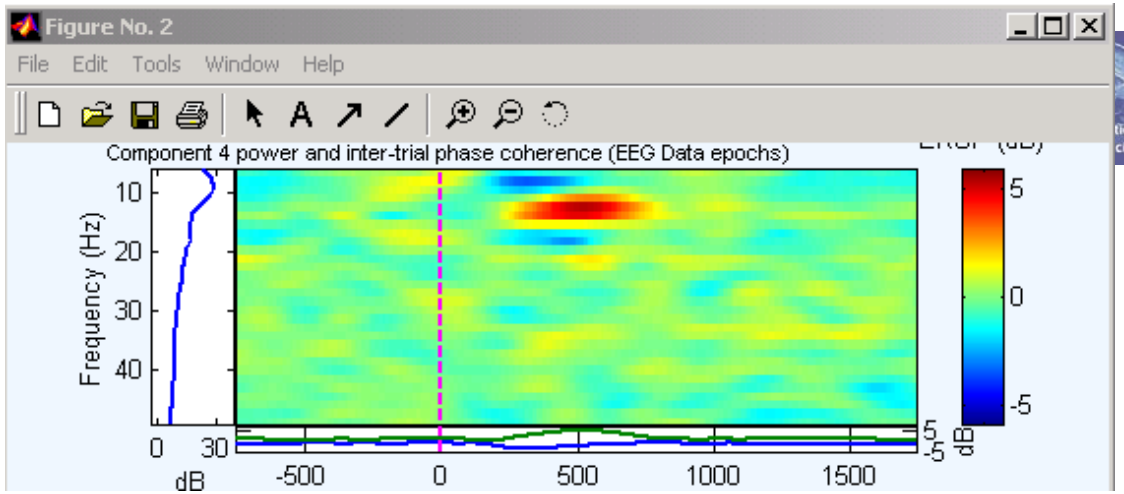


FFT

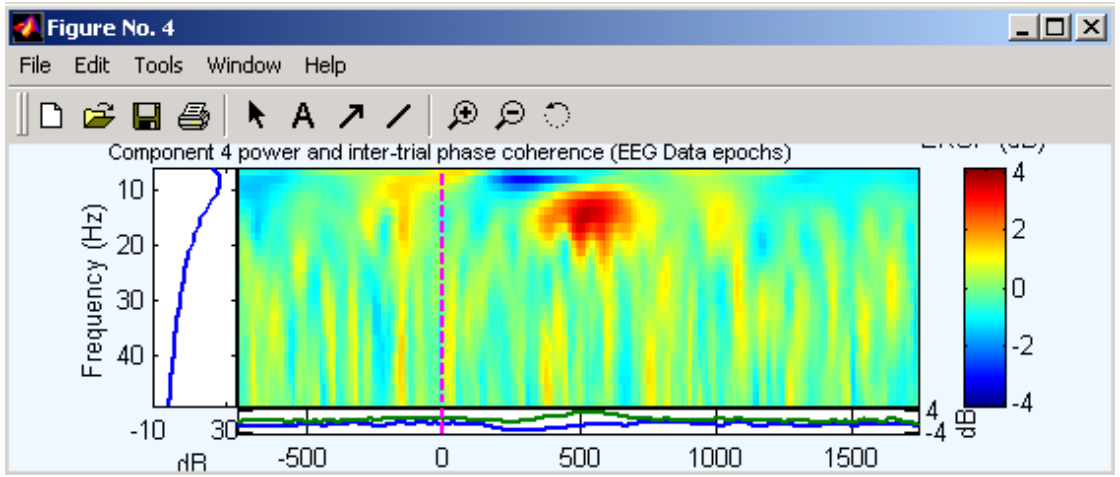
Wavelet



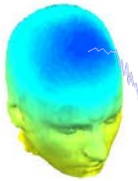
FFT

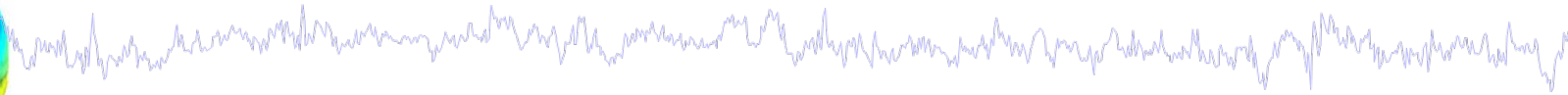


Pure wavelet



Wavelets factor





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Wavelet (0)= FFT

Wavelet (1)

1Hz

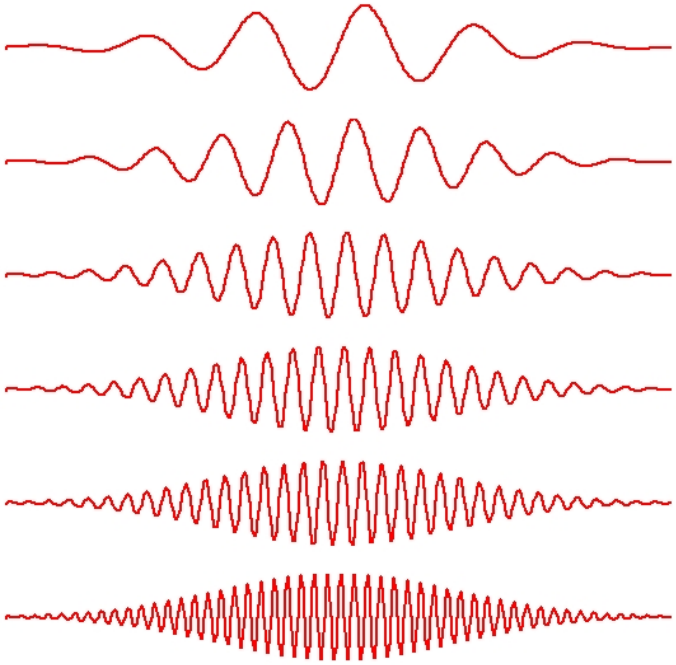
2Hz

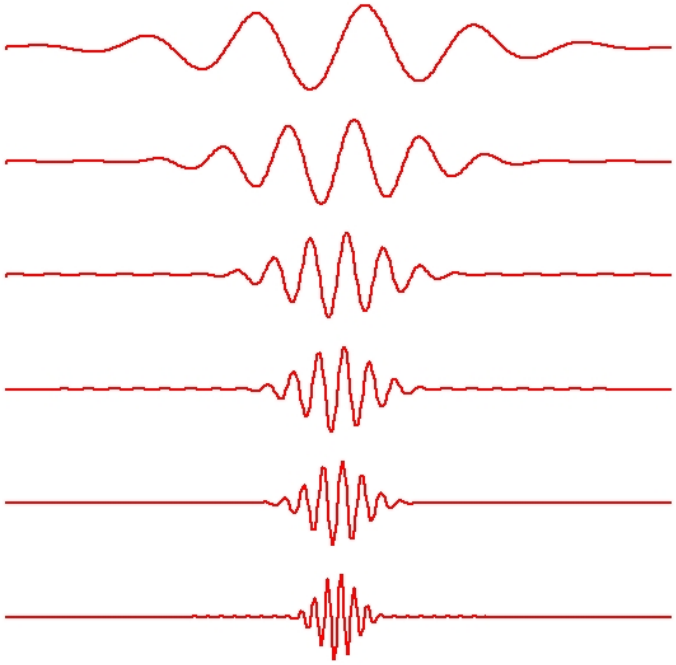
4Hz

6Hz

8Hz

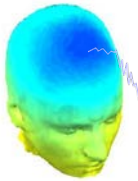
10Hz

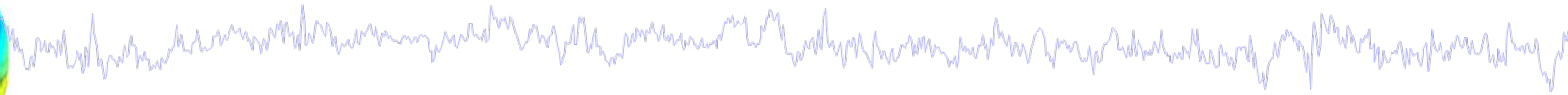




exact same number of wavelets at all freqs

Modified wavelets





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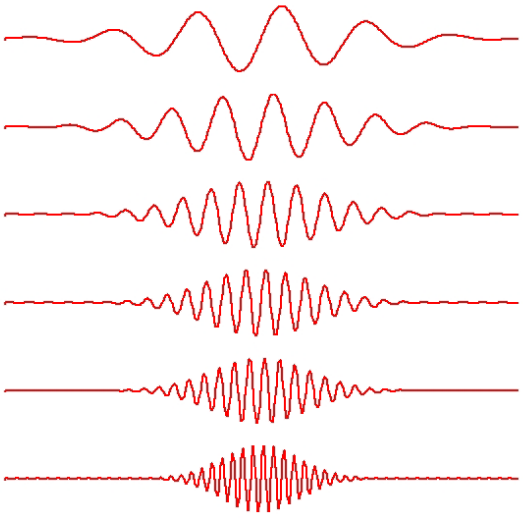
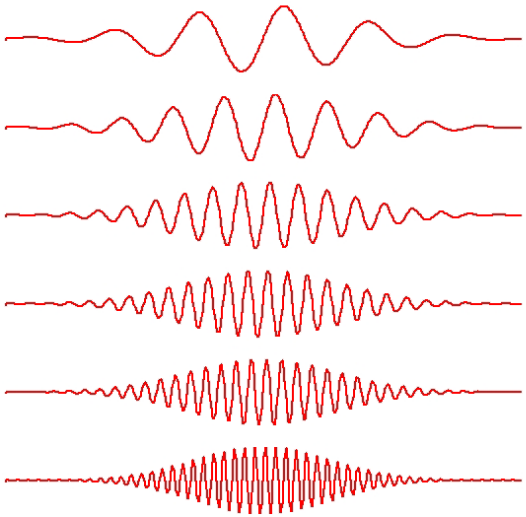
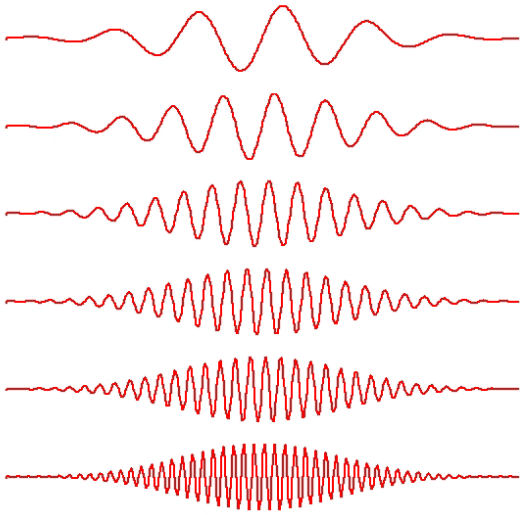
Wavelet (0.8)



Wavelet (0.5)

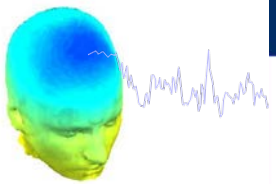


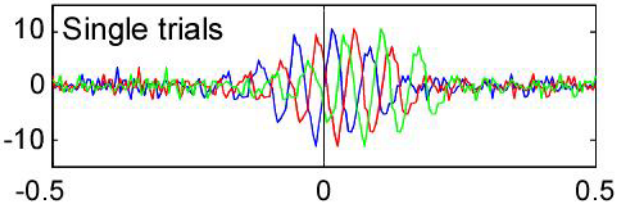
Wavelet (0.2)

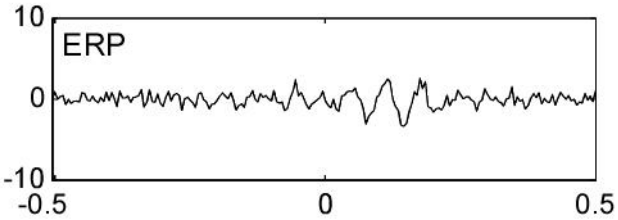


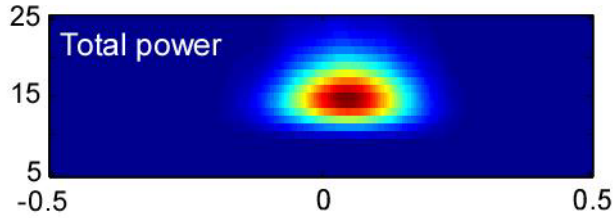
Scaled to require more wavelets at higher freqs (less than FFT though)

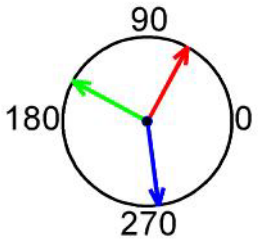
Intertrial Coherence (ITC)



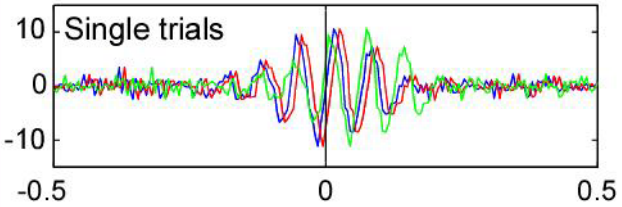


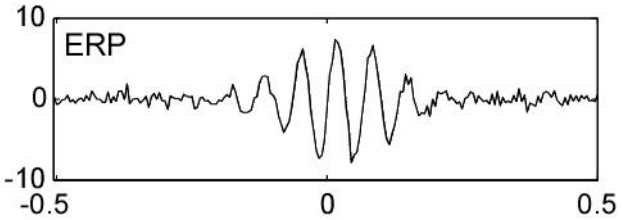


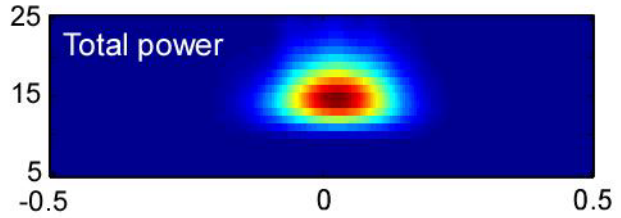


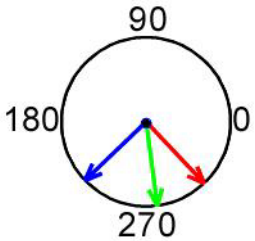


ITC: .05





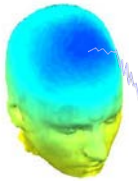




ITC: .80

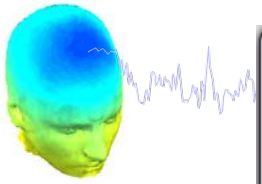
Slide courtesy of Stefan Debener

Evaluating ICA components



1. IC ERP envelope
2. IC ERP images - advanced
3. Time-frequency analysis
4. IC ERSPs
5. IC cross coherence

Plot IC ERSP



Plot component time frequency -- pop_newtimef()

Component number 3
Sub epoch time limits [min max] (msec) -1000 1996
Use 200 time points
Frequency limits [min max] (Hz) or sequence
Use limits, padding 1
Log spaced
Baseline limits [min max] (msec) (0->pre-stim.) 0
Use divisive baseline
No baseline
Wavelet cycles [min max/fact] or sequence 3 0.5
Use limits
Use FFT
ERSP color limits [max] (min=
ITC color limits [max]
Bootstrap significance level (
Optional newtimef() argumen
Plot Event Related Spectral Po
Cancel

EEGLAB v7.1.7.18b

File Edit Tools Plot

#2: Ste

Filename:
Channels
Frames pe
Epochs
Events
Sampling
Epoch sta
Epoch enc
Reference
Channel lc
ICA weight
Dataset si

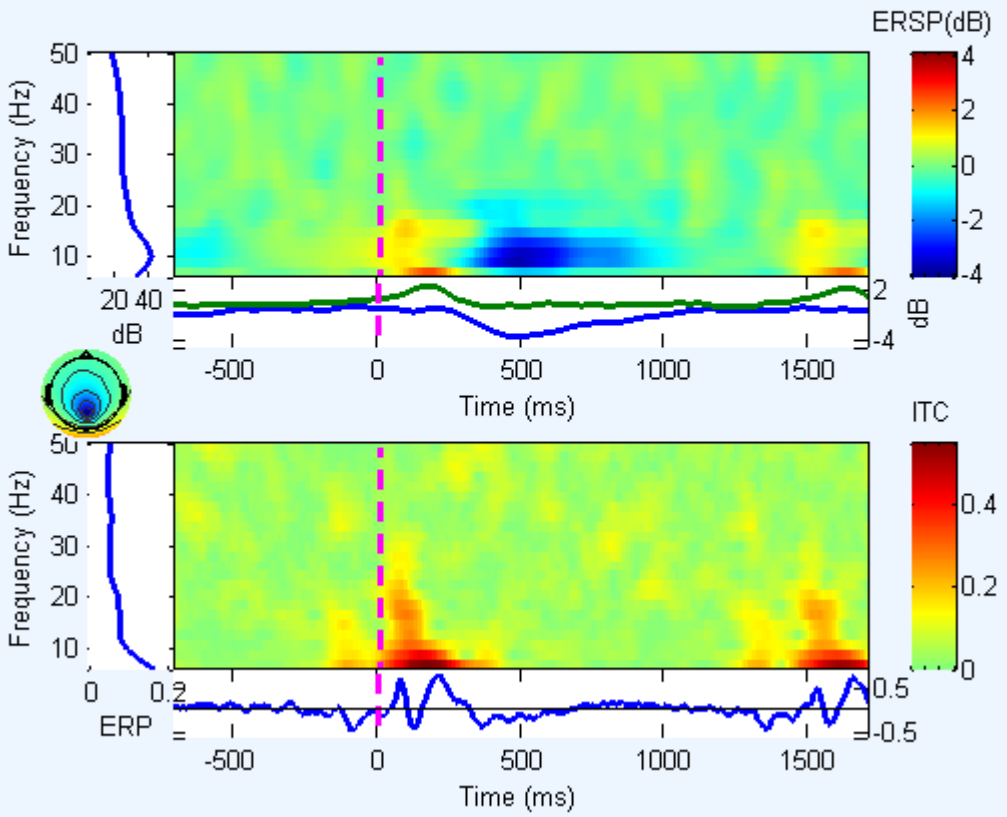
Sum/Compare ERPs
Component activations (scroll)
Component spectra and maps
Component maps
Component properties
Component ERP image
Component ERPs
Sum/Compare comp. ERPs
Data statistics
Time-frequency transforms
Cluster dataset ICs

Channel t
Channel c
Compone
Compone

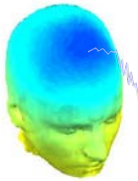
Figure 3

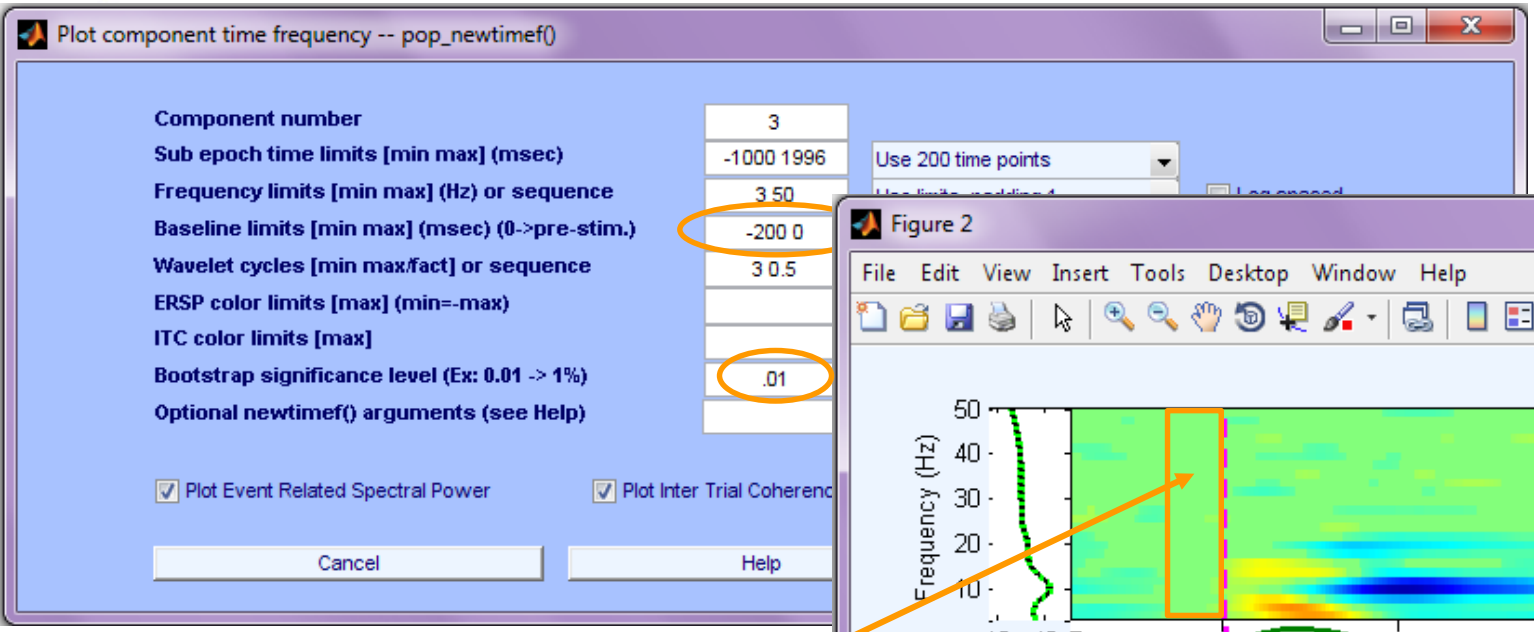
File

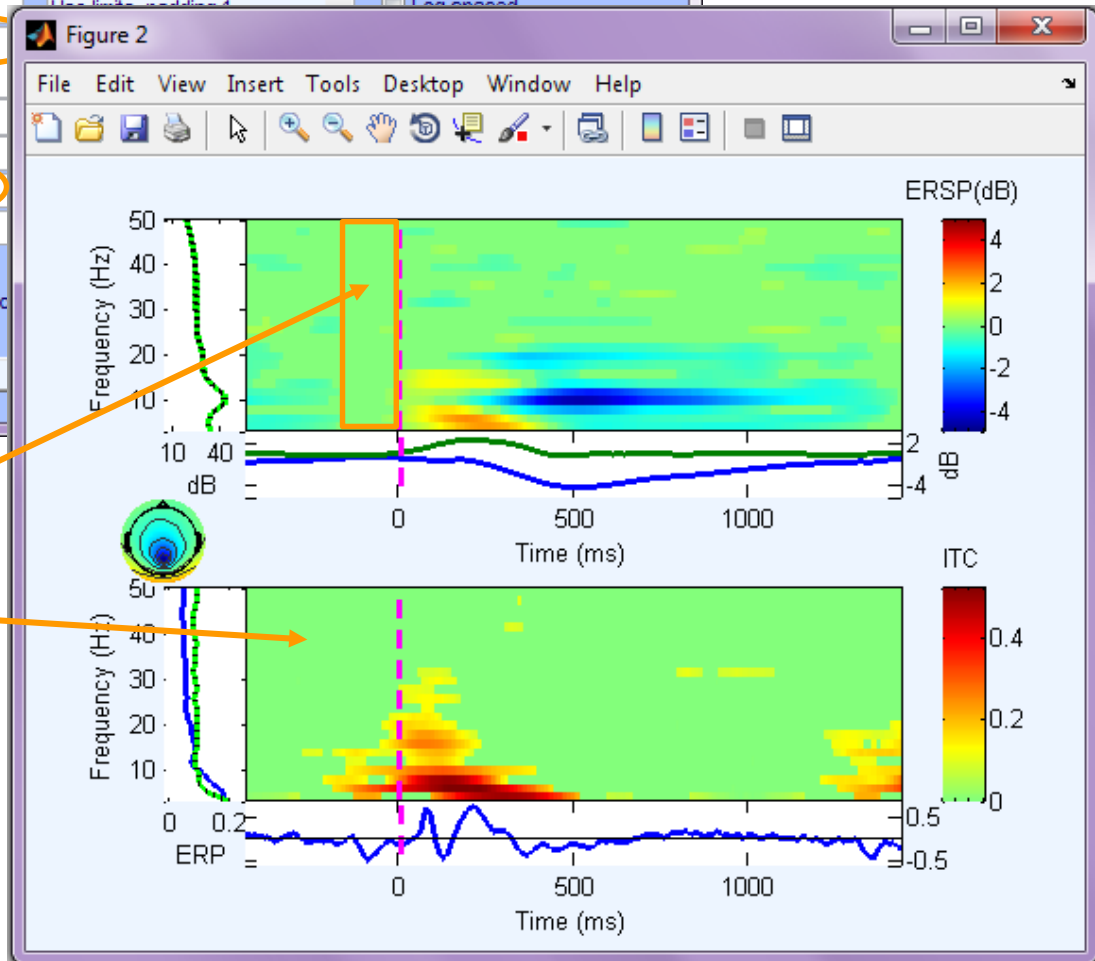
Time points lost at beginning and end of epoch!



Plot IC ERSP

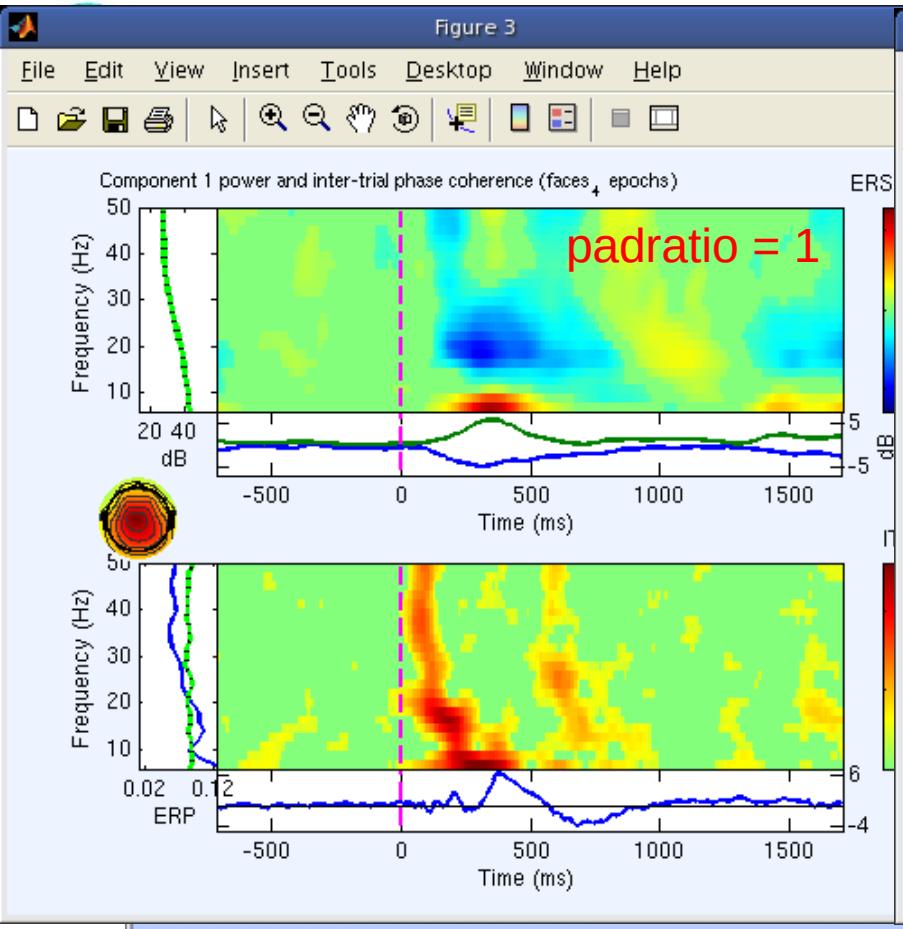


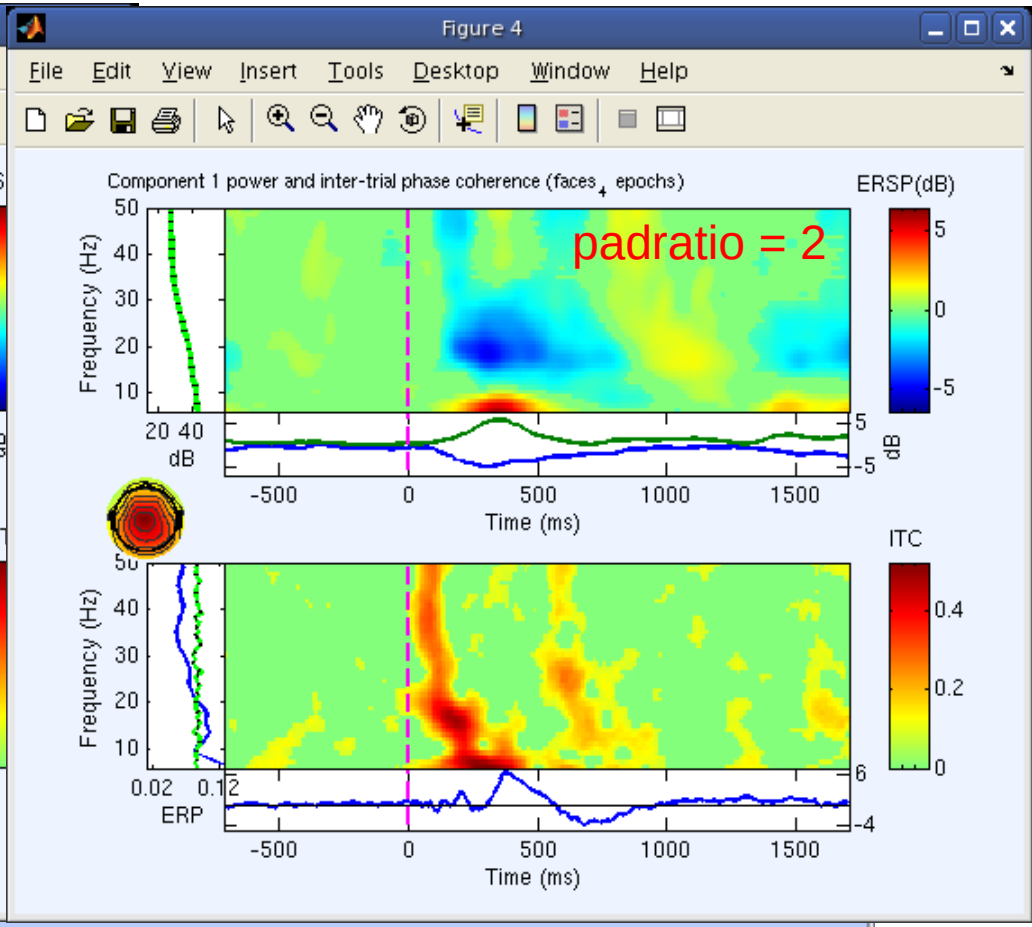




Pure green denotes non-significant points

Plot IC ERSP

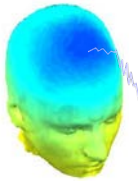




Increase # freq bins

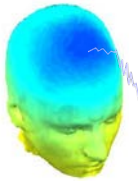
Component number	1	
Sub epoch time limits [min max] (msec)	-1000 1996	Use 200 time points
Frequency limits [min max] (Hz) or sequence		Use limits, padding 1 — Log spaced
Baseline limits [min max] (msec) (0->pre-stim.)	0	Use divisive baseline — No baseline
Wavelet cycles [min max/fact] or sequence	3 0.5	Use limits — Use FFT
ERSP color limits [max] (min=-max)		see log power (set)
ITC color limits [max]		plot ITC phase (set)
Bootstrap significance level (Ex: 0.01 -> 1%)		FDR correct (set)
Optional newtimef() arguments (see Help)		

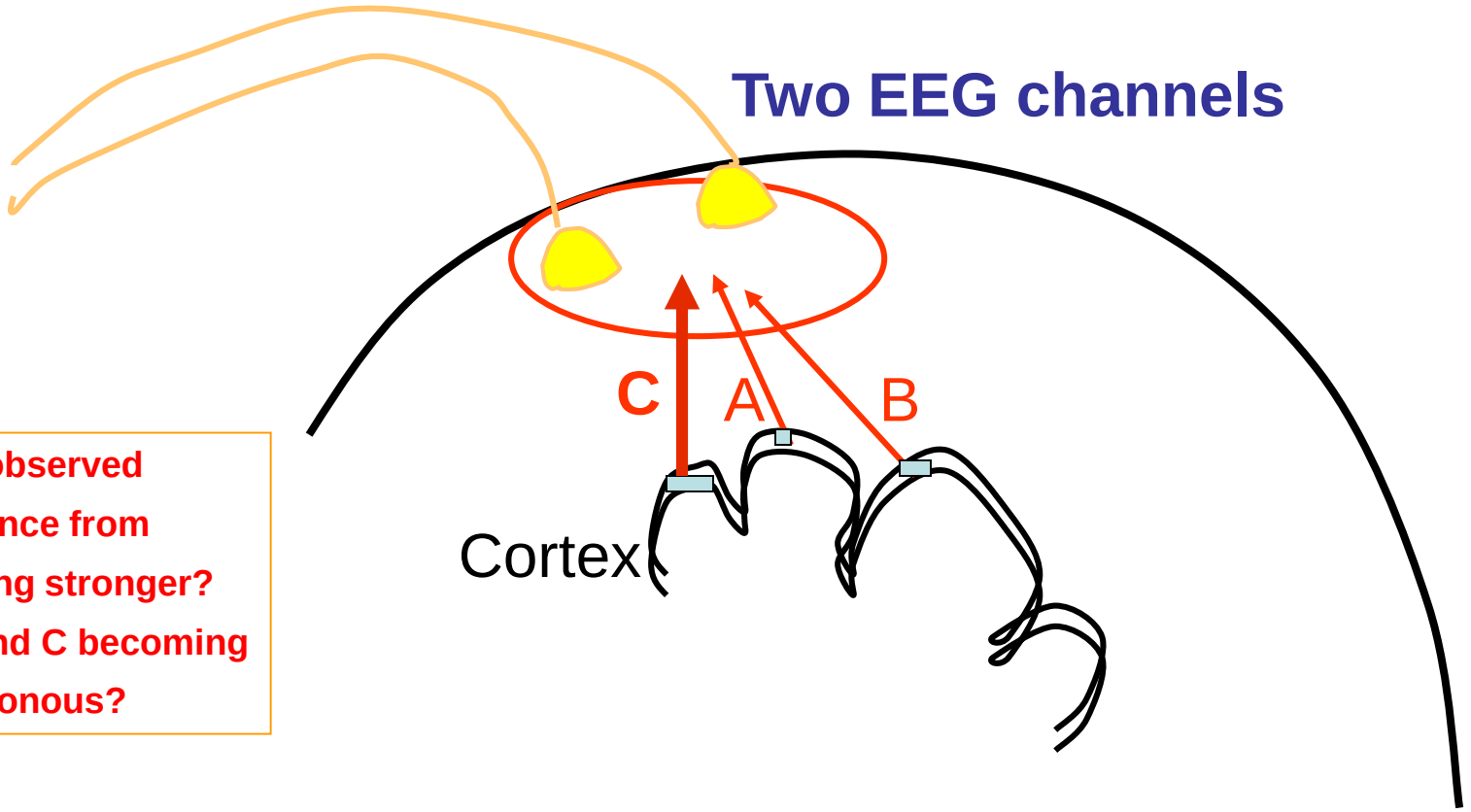
Evaluating ICA components



1. IC ERP envelope
2. IC ERP images - advanced
3. Time-frequency analysis
4. IC ERSPs
5. IC cross coherence

Scalp channel coherence confounds

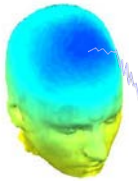


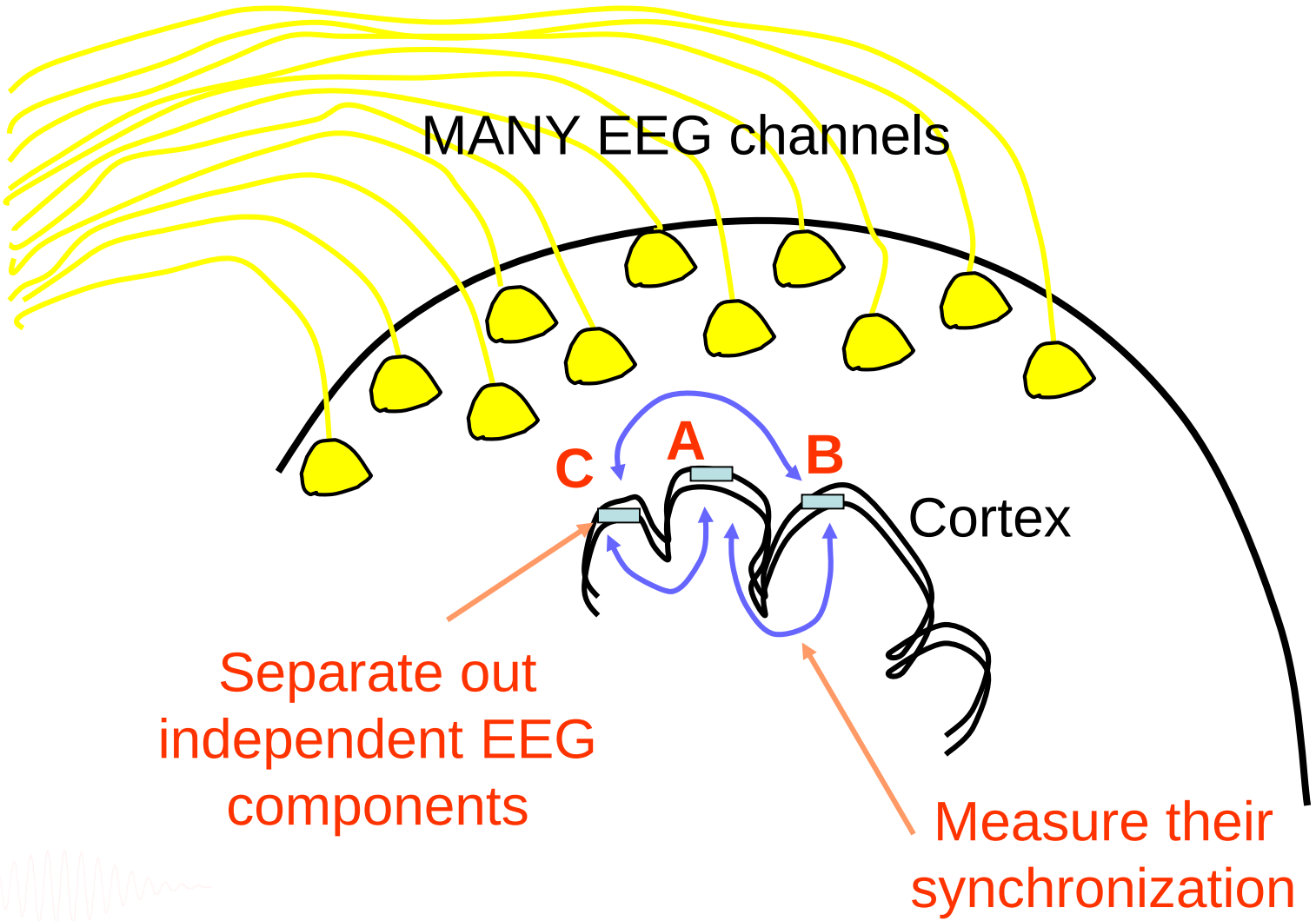


Is the observed coherence from C getting stronger? Or B and C becoming synchronous?

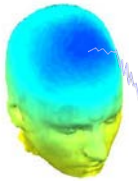
Scalp channel coherence includes source confounds!

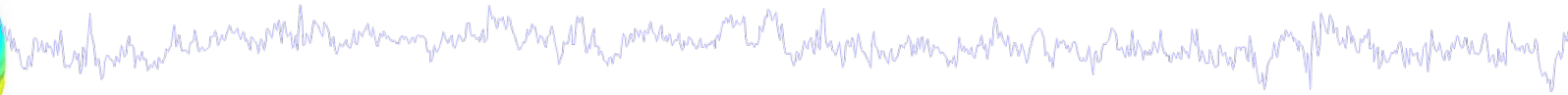
Scalp channel coherence confounds





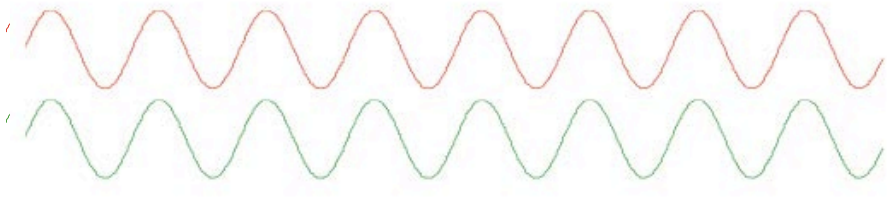
Cross-coherence amplitude and phase

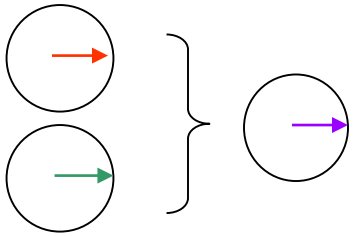




2 components, comparison on the same trials

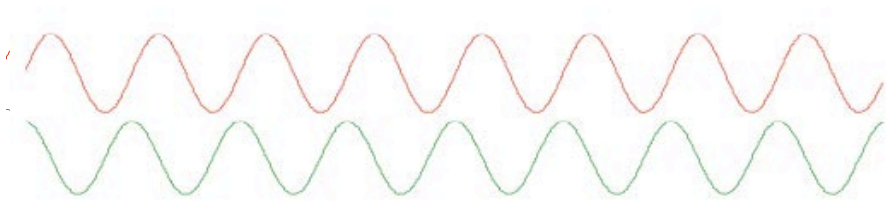
Trial 1

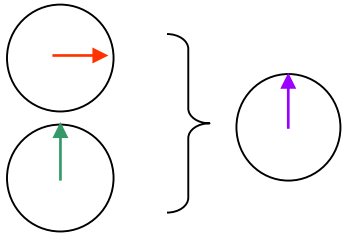




Coherence amplitude 1
Phase coherence 0

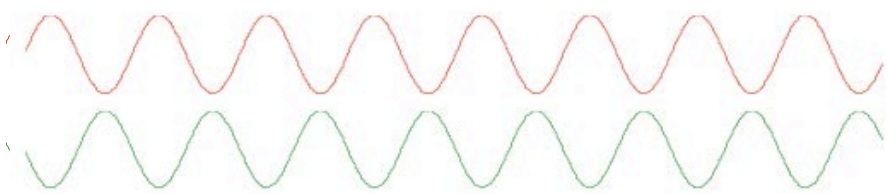
Trial 2

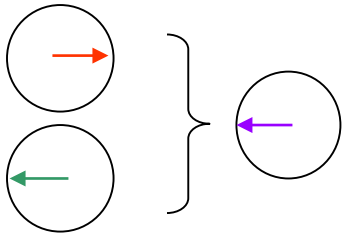




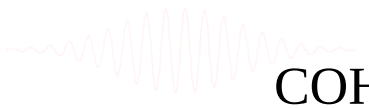
Coherence amplitude 1
Phase coherence 90

Trial 3

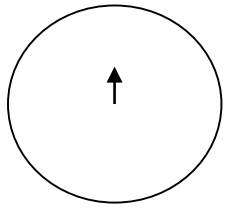




Coherence amplitude 1
Phase coherence 180

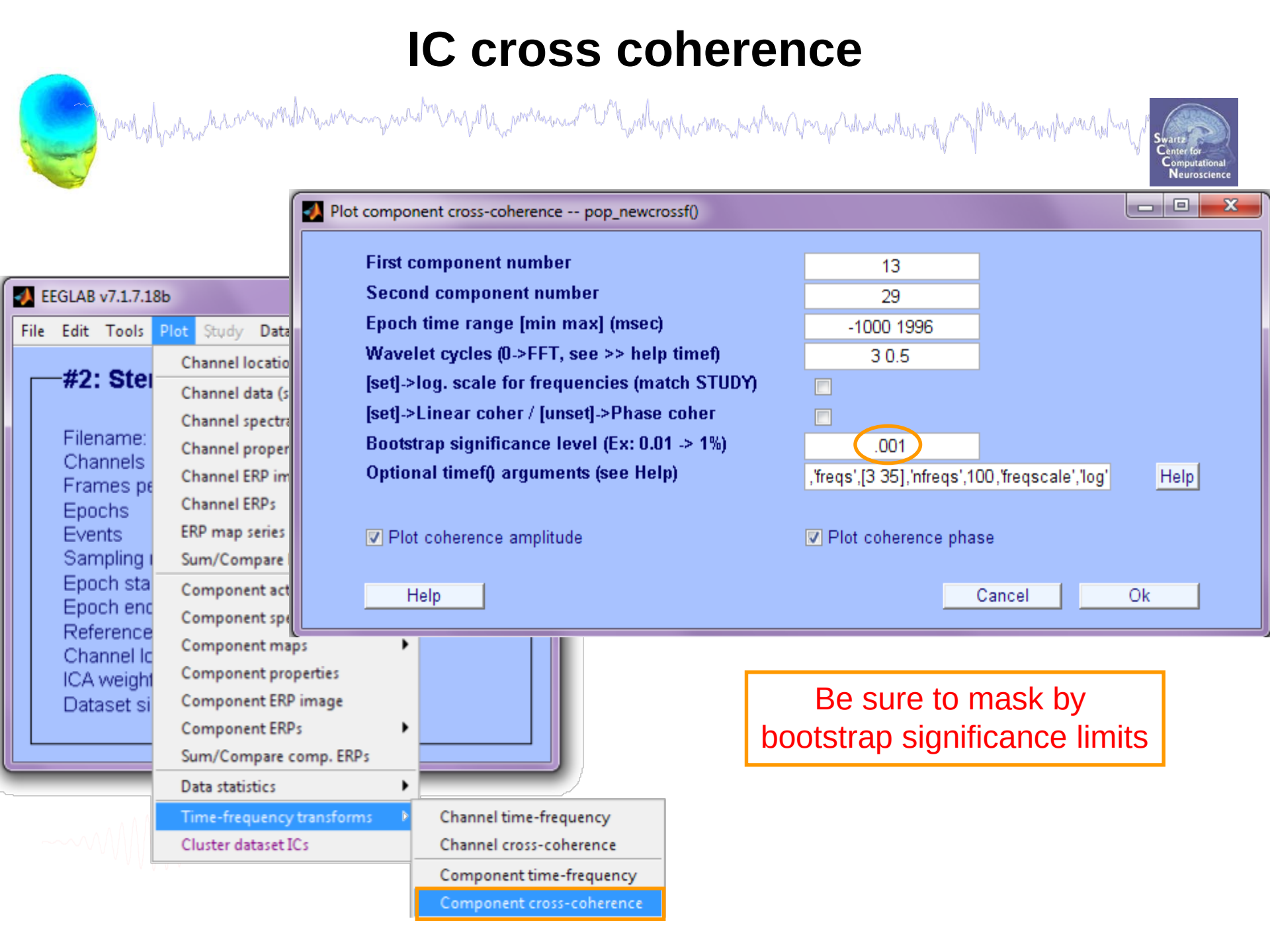


COHERENCE = mean(phase vector)



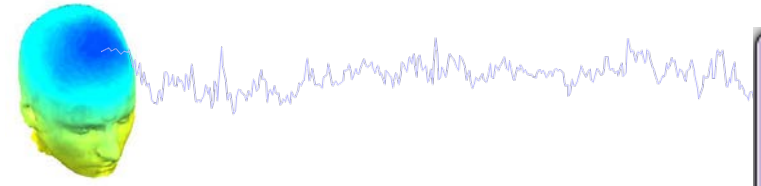
Norm 0.33
Phase 90 degree

IC cross coherence



Be sure to mask by bootstrap significance limits

IC cross coherence



EEGLAB v6.0b

File Edit Tools Plot Study Datasets Help

#6: faces

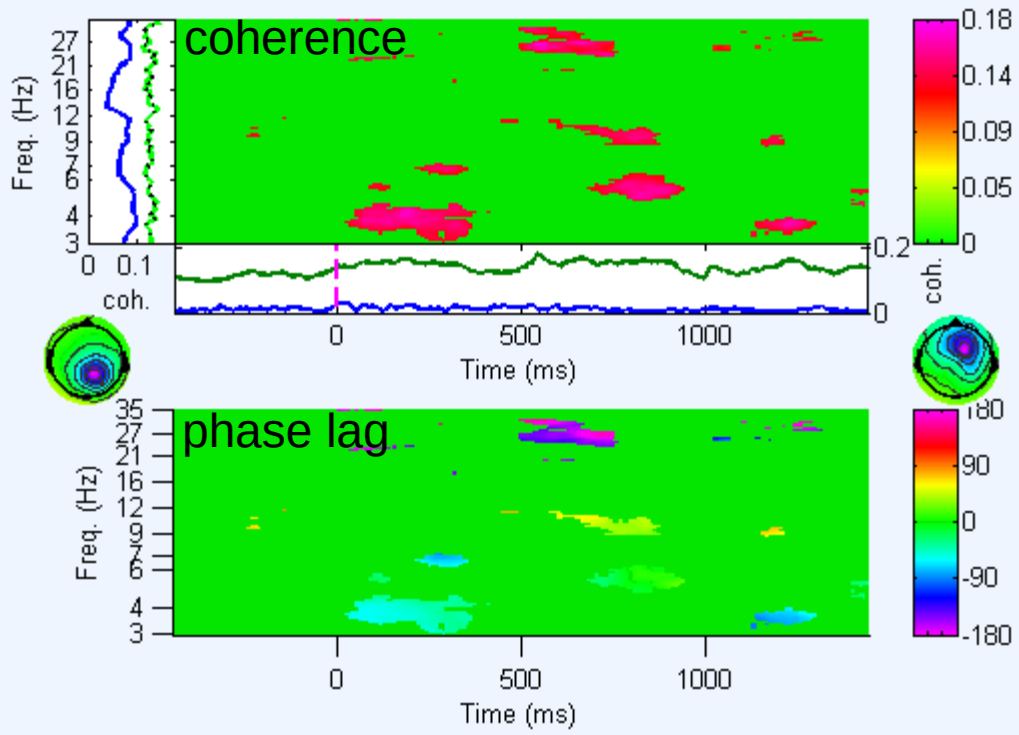
Filename: nc
Channels pe
Frames per e
Epochs
Events
Sampling rat
Epoch start (
Epoch end (s
Average refe
Channel loca
ICA weights
Dataset size

- 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
- Average time-frequency
- Cluster dataset ICs

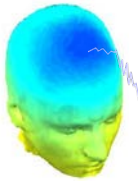
- Channel time-frequency
- Channel cross-coherence
- Component time-frequency
- Component cross-coherence

Figure 5

File Edit View Insert Tools Desktop Window Help



Exercise



- **ALL**

  - Load stern_125Hz.set, epoch on **Memorize** letters [-2s 2s], reject noisy epochs

- **Novice**

  - From the GUI, plot component ERPs with maps

  - Plot an IC ERP image; try sorting by RT or phase, is there any effect of the time-locking event on the activation pattern?

- **Intermediate**

  - Plot ERSPs for an IC

  - Compare FFT and wavelet methods; Do the results agree?

  - Plot ERSPs with no baseline and with different baseline periods; how might this affect your results/conclusions?

- **Advanced**

  - Plot cross coherence between two selected ICs

    > Compare this result with cross coherence between two channels that are highly weighted in the scalp maps of the ICs you used