

EEGLAB Processing

Data import

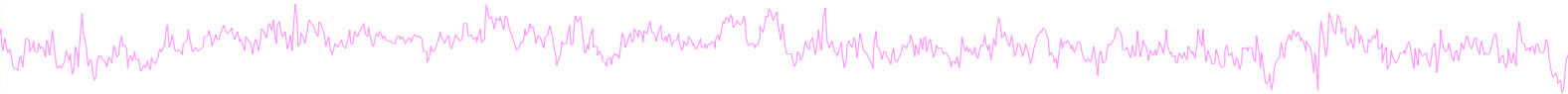
Basic ERP visualization

Arnaud Delorme

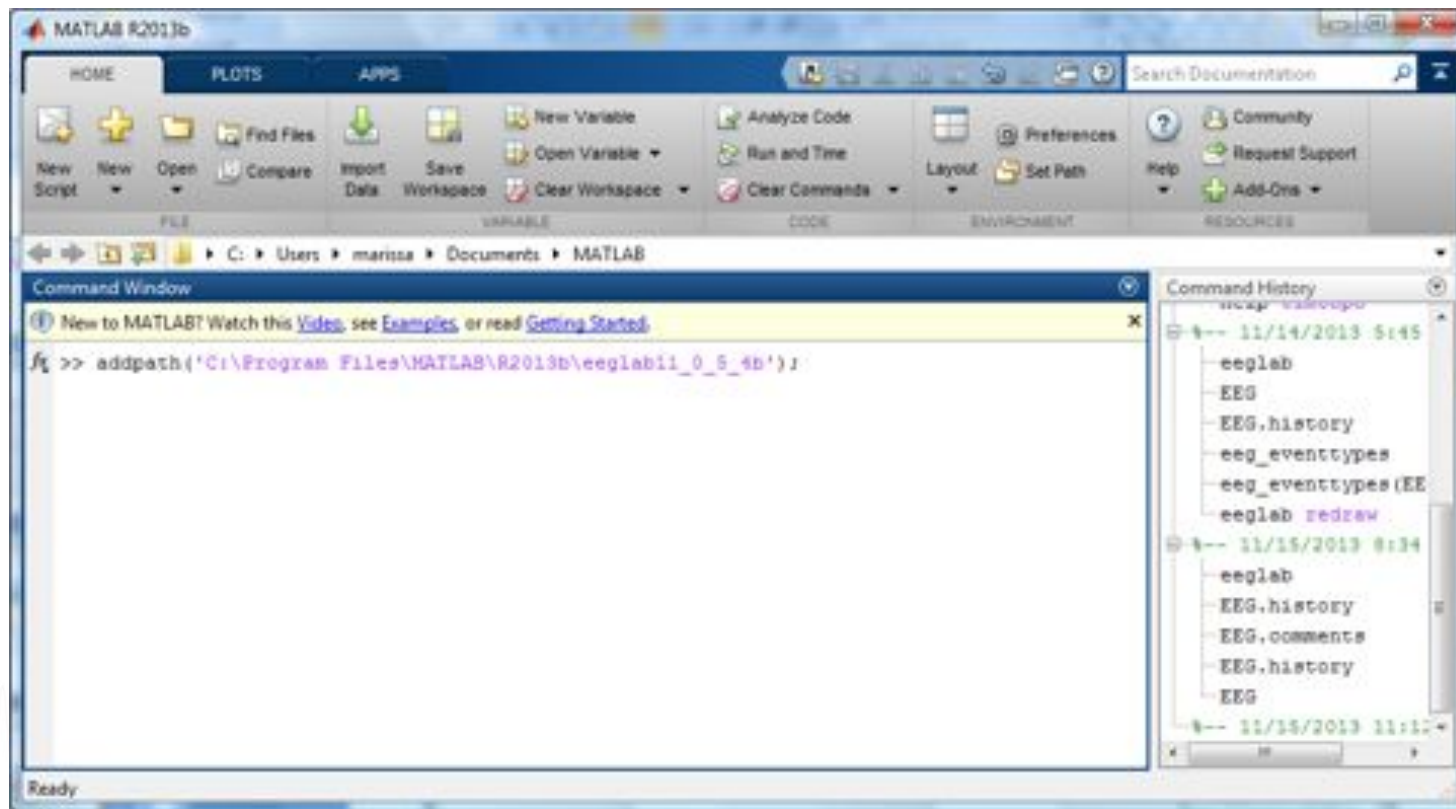
(thanks to Marissa Westerfield)



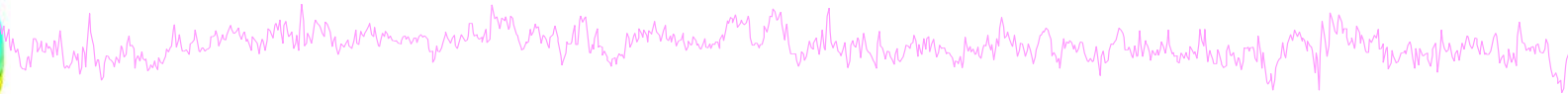
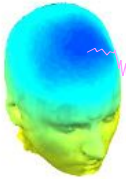
Installing EEGLAB and data folder



- Start Matlab
- Add the EEGLAB folder to your Matlab path:



The EEGLAB Matlab software

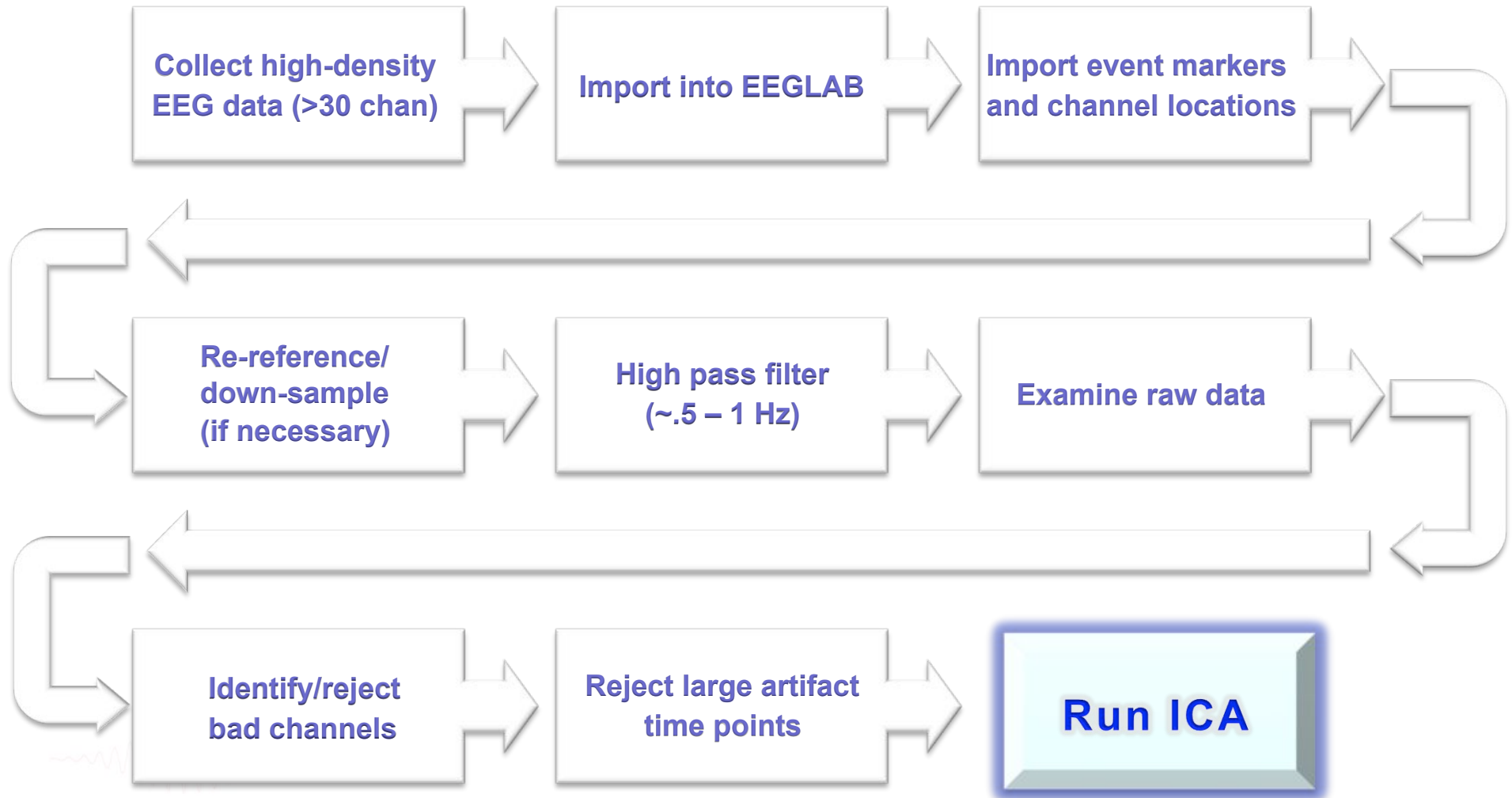
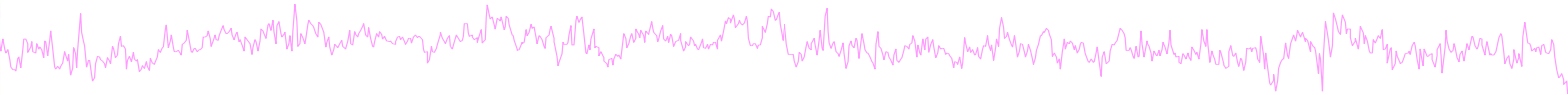
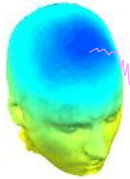


main graphic interface

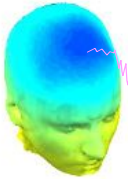
The screenshot shows the MATLAB R2013b environment. The EEGLAB v11.0.5.4b window is open, displaying a message box titled "No current dataset". The message box contains the following instructions:

- Create a new or load an existing
Use "File > Import data" (new)
Or "File > Load existing dataset" (old)
- If new:
 - "File > Import epoch info" (data)
 - "File > Import event info" (continuous)
 - "Edit > Dataset info" (add/edit dataset)
 - "File > Save dataset" (save dataset)
- Prune data: "Edit > Select data"
- Reject data: "Tools > Reject"
- Epoch data: "Tools > Extract epochs"
- Remove baseline: "Tools > Remove"
- Run ICA: "Tools > Run ICA"

Pre-processing pipeline



Importing a dataset



EEGLAB v11.0.5.4b

File Edit Tools Plot Study Datasets Help

Import data Using EEGLAB functions and plugins

Import epoch info Using the FILE-IO interface

Import event info Using the BIOSIG interface

Export Troubleshooting data formats...

Load existing dataset

Save current dataset(s)

Save current dataset as

Clear dataset(s)

Create study

Load existing study

Save current study

Save current study as

Clear study

Memory and other options

History scripts

Quit

From ASCII/float file or Matlab array

From Netstation .mff (FILE-IO toolbox)

From Netstation binary simple file

From Multiple seg. Netstation files

From Netstation Matlab files

From BCI2000 ASCE file

From Snapmaster .SMA file

From Neuroscan .CNT file

From Neuroscan .EEG file

From Biosemi BDF file (BIOSIG toolbox)

From Biosemi BDF and EDF files (BDF plugin)

From EDF/EDF+/GDF files (BIOSIG toolbox)

From ANT EEPiobe .CNT file

From ANT EEPiobe .AVR file

From BCI2000 .DAT file

From BIOPAC MATLAB files

From Brain Vis. Rec. .vhdr file

From Brain Vis. Anal. Matlab file

From CTF folder (MEG)

From ERPSS .RAW or .RDF file

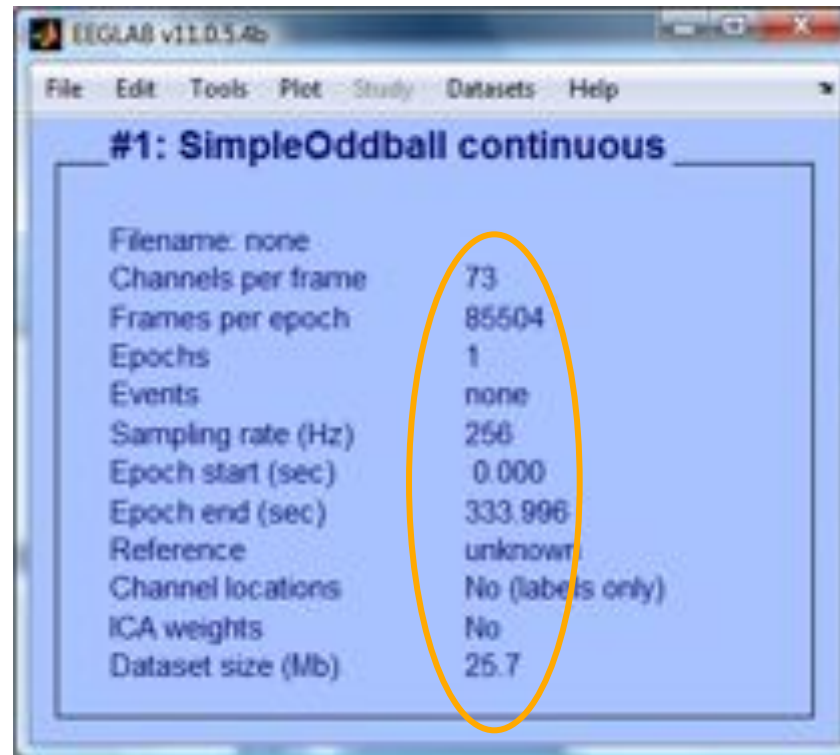
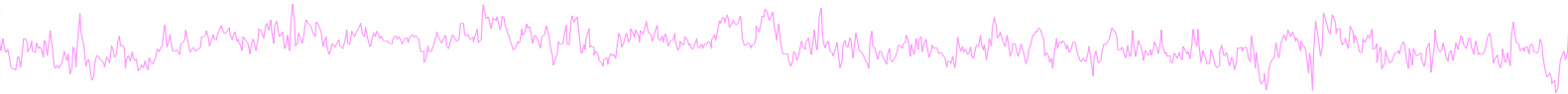
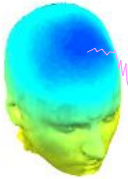
From INStep .ASC file

From 4D .m4d pdf file

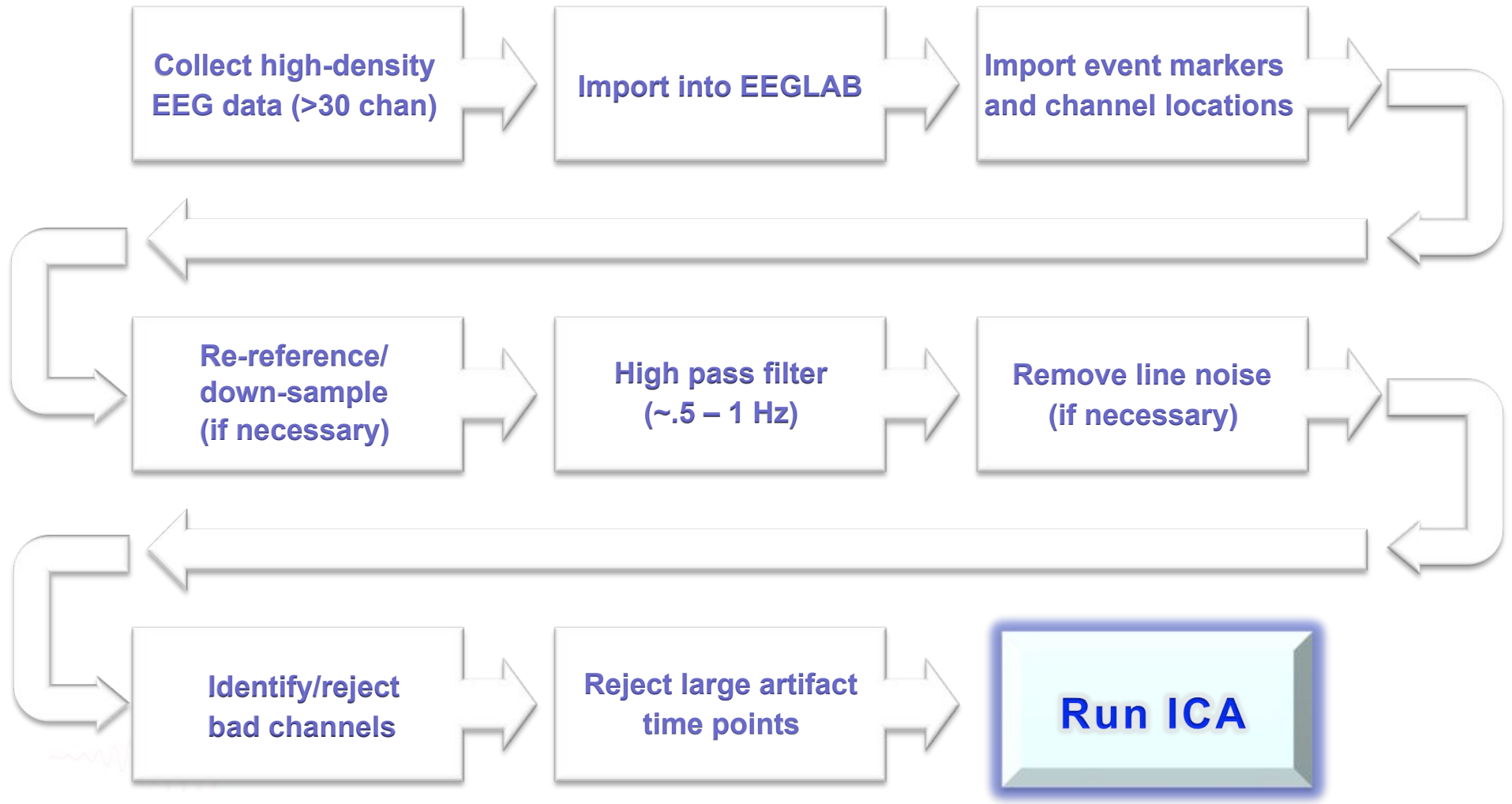
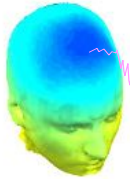
From Procom Infinity Text File

**Tip for Biosemi users:
Use the 'BDF plugin' version
of the Biosemi BDF/EDF importer**

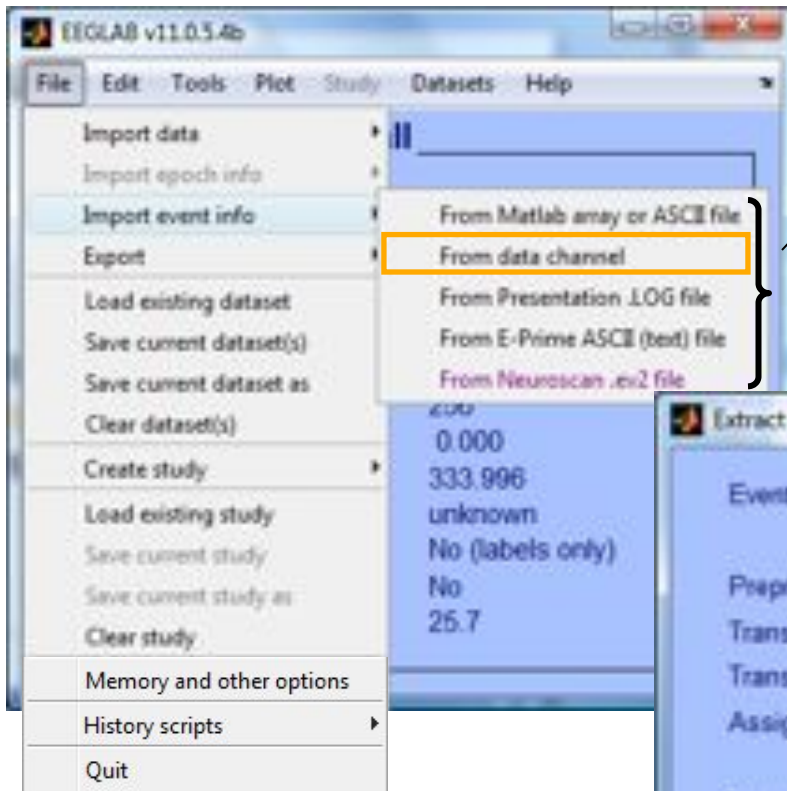
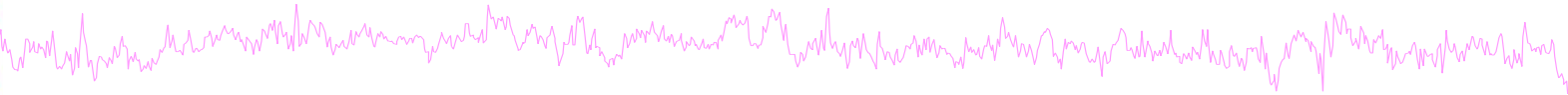
Imported EEG data



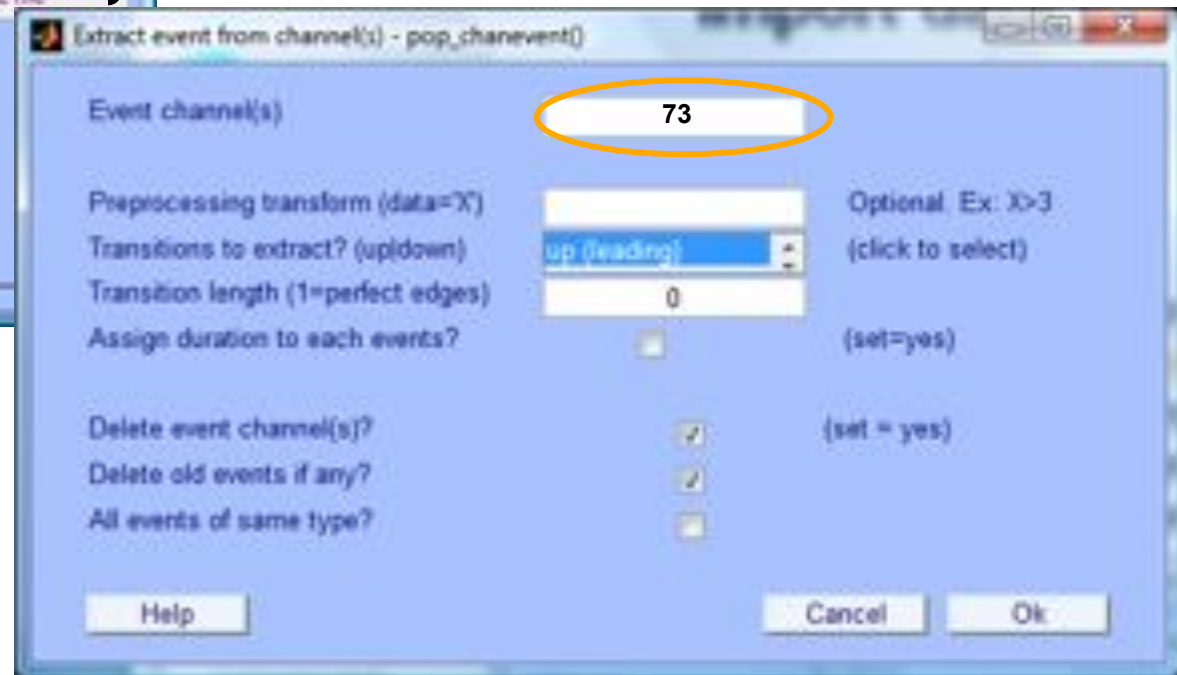
Pre-processing pipeline



Import data events

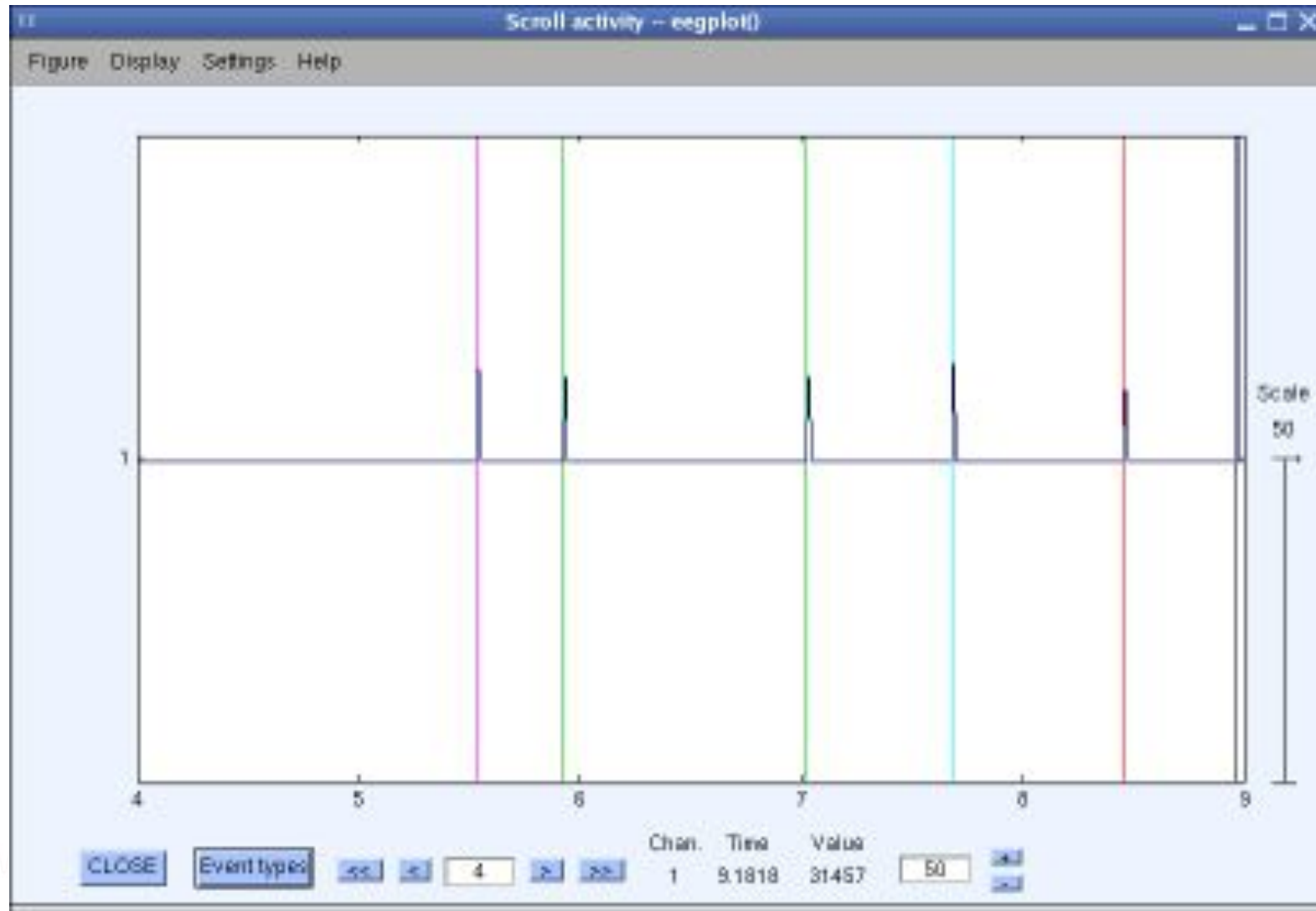
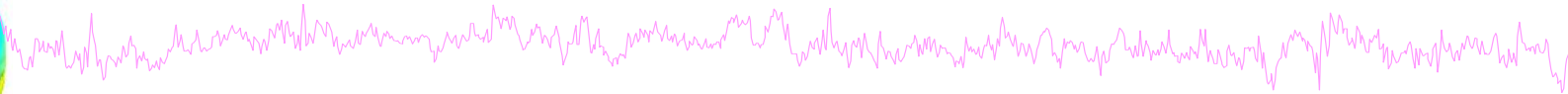


- Import events from Matlab array or ASCII file
- **Import events from data channel**
- Import from Presentation event file
- Import events from E-Prime event file
- Import events from Neuroscan event file

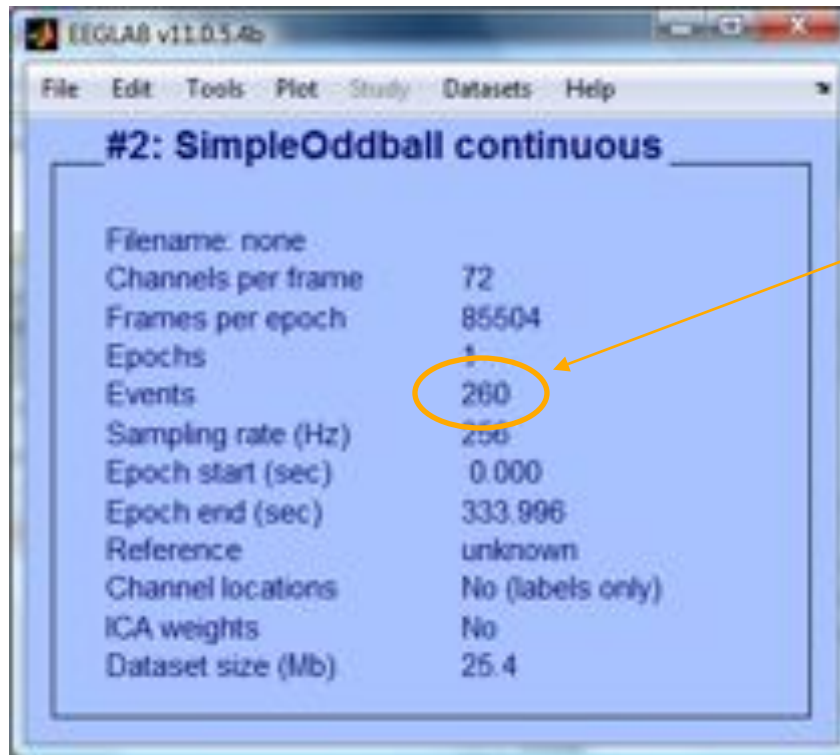
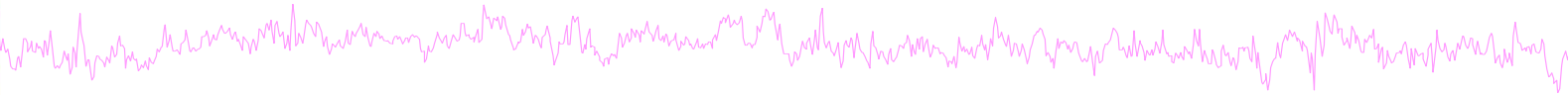
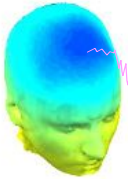


(Often imported automatically
during data import)

Appearance of an event channel in raw data



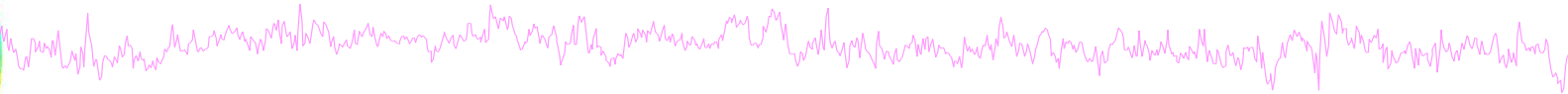
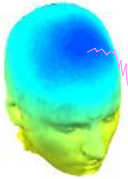
Imported data events



If event import was successful, you will see an appropriate number here



Sample data: basic P300 paradigm



File

SimpleOddball.set

Data

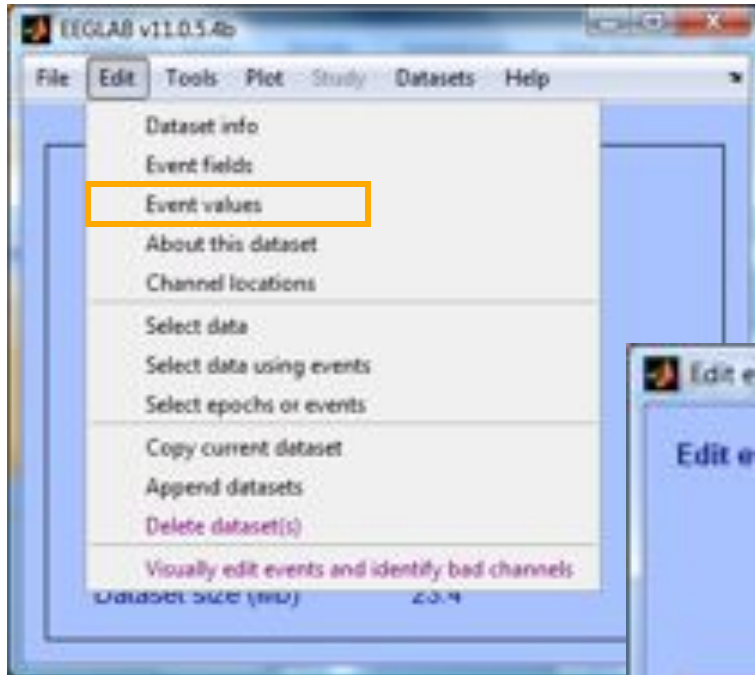
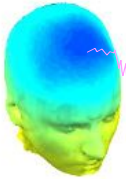
68 channel EEG, 256 Hz sampling rate, Biosemi system, re-referenced during import to averaged left and right mastoid electrodes

Task

speeded button press response to star shape (no response to circle shape), 100 ms presentation duration, 200 trials



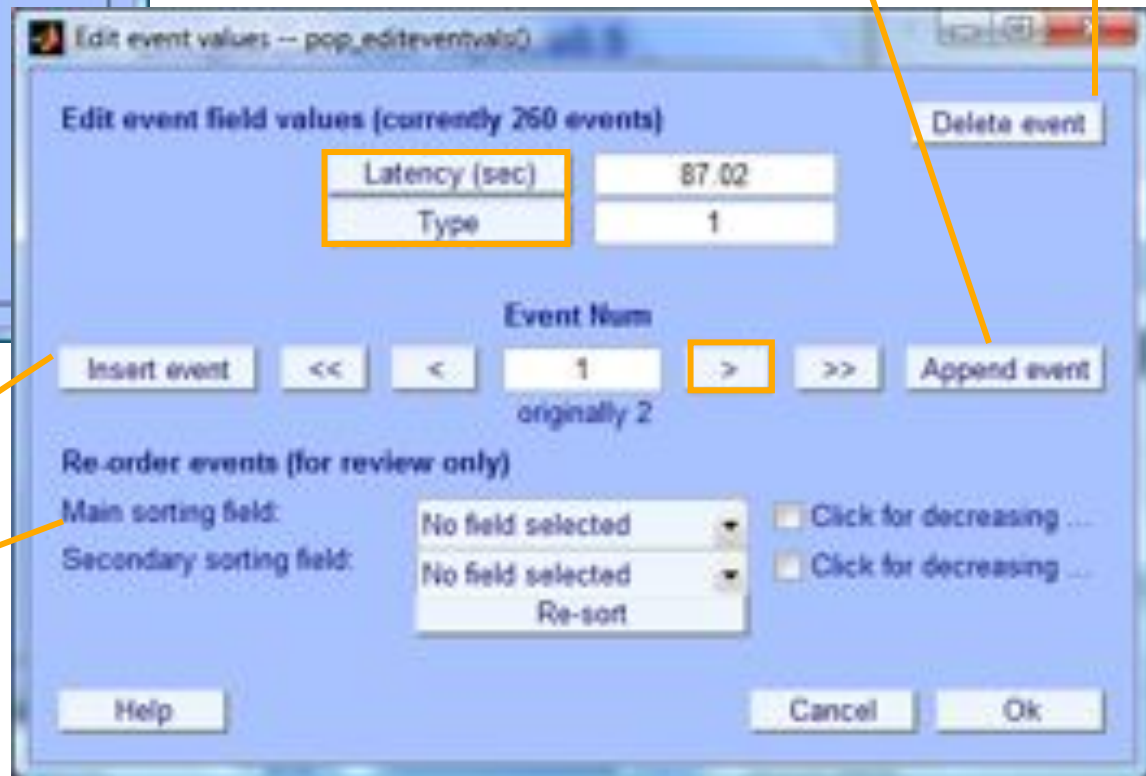
Review event values



Event 'type' and 'latency' are recognized fields

Append event AFTER current event

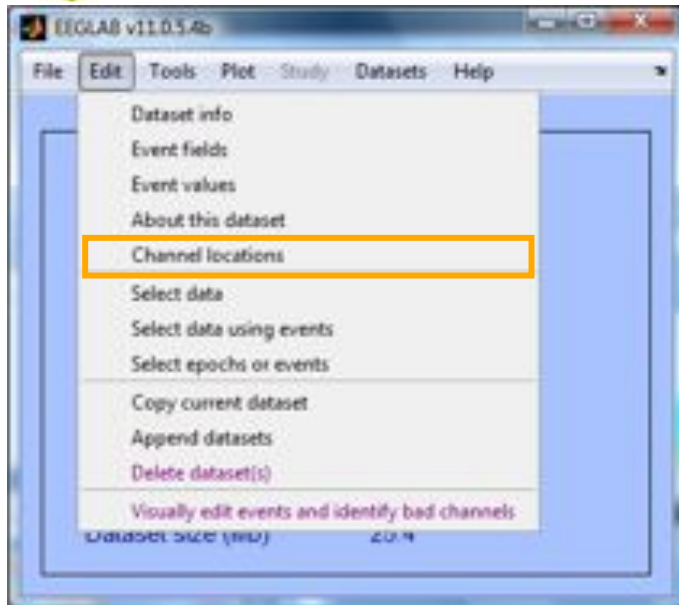
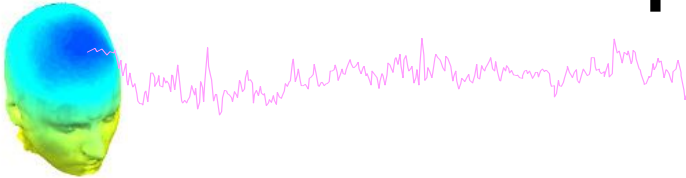
Delete CURRENT event



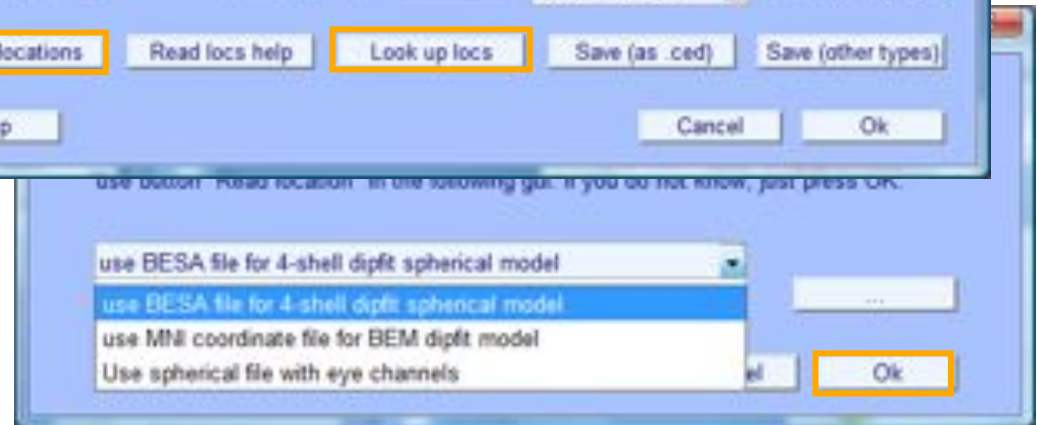
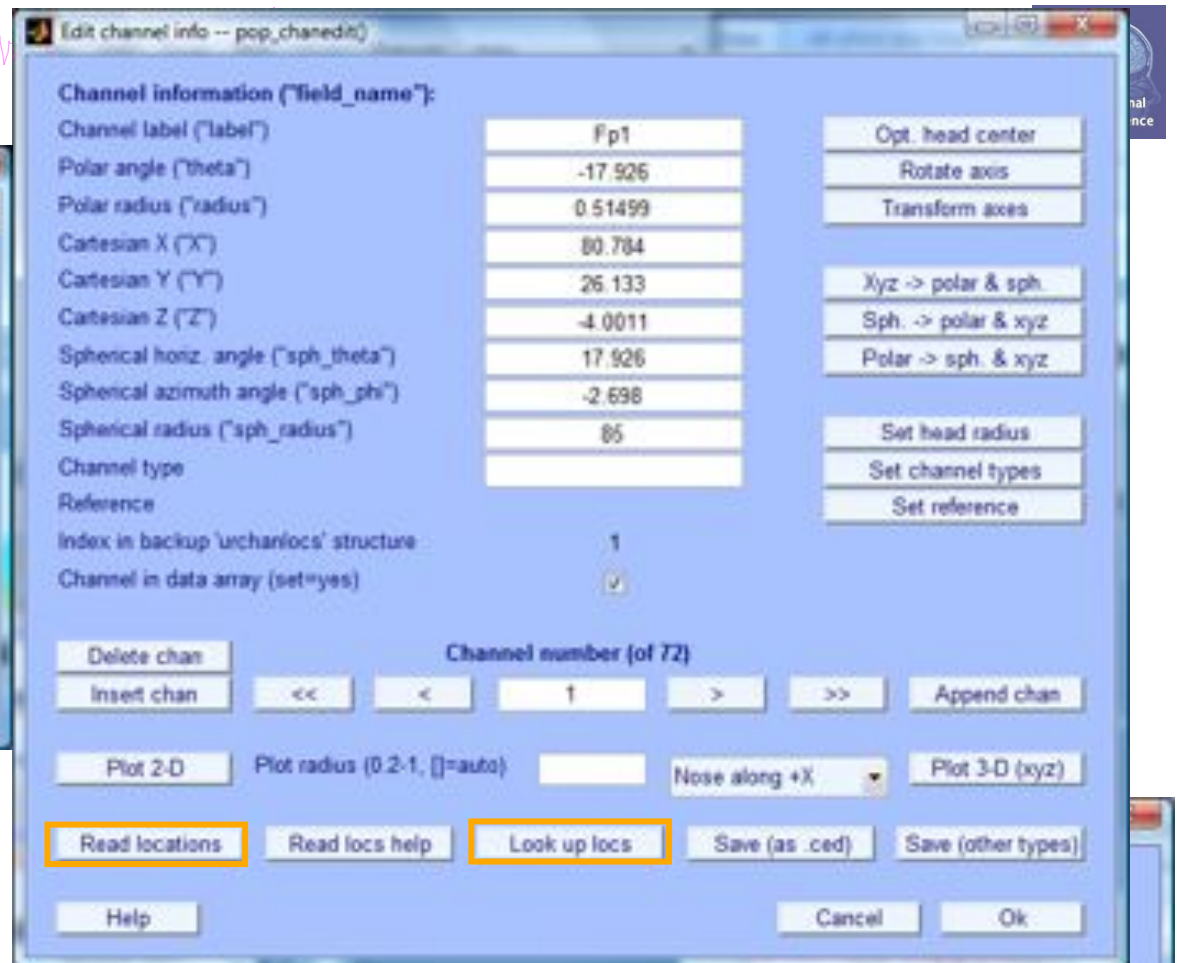
Insert event BEFORE current event

To resort: first select Main sorting field

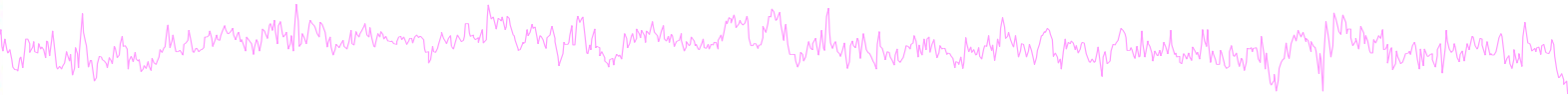
Import channel locations



7 file formats supported
(Polhemus, BESA, ...)



Import channel locations



Set channel info -- pop_chaninfo()

Channel information (field_name):

Channel label ('label')	LEYE
Polar angle ('theta')	-45.1543
Polar radius ('radius')	0.54074
Cartesian Z ('Z')	0.79487
Cartesian Y ('Y')	0.79917
Cartesian X ('X')	-0.49595
Spherical locat. angle ('sph_theta')	45.1543
Spherical smooth angle ('sph_sph')	-7.8726
Spherical radius ('sph_radius')	1.1379
Channel type	EEG
Reference	
Index in backup ('channel_idx')	
Channel in data array ('data_idx')	

Buttons: Delete chan, Insert chan, Plot 2-D, Plot radius (D-T, D-prob), Head along XZ, Plot 3-D (xyz), Head locations, Head loc help, Load loc help, Save loc help, Save other types, Help, Cancel, Ok

Convert channel locations -- pop_chancenter()

Optimize center location or specify center: 0.00

Channel indices to ignore for best-sphere matching

Buttons: Help, Cancel, Ok

Force electrode location -- forceloc()

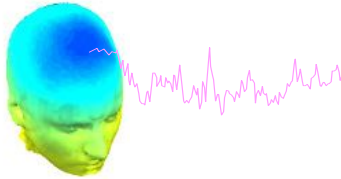
XY value	Coordinate	Electrode list
0	X (rotate X-Z plane)	Cz

Buttons: Pick, Help, Cancel, Ok

Set channel -- pop_chaninfo()

Channel indices	1:75
Type in g. EEGs	EEG

Buttons: Help, Cancel, Ok



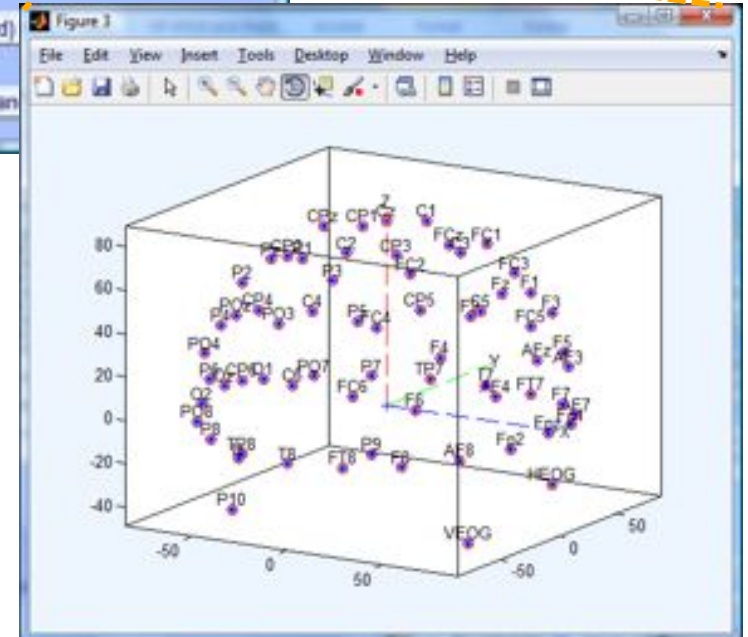
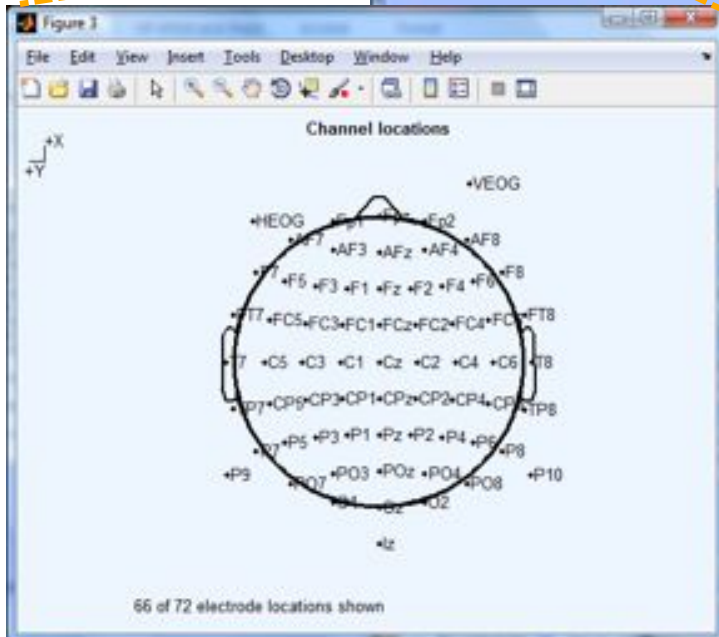
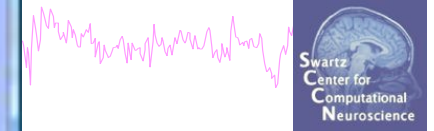
Edit channel info -- pop_chanedit

Channel information ("field_name"):

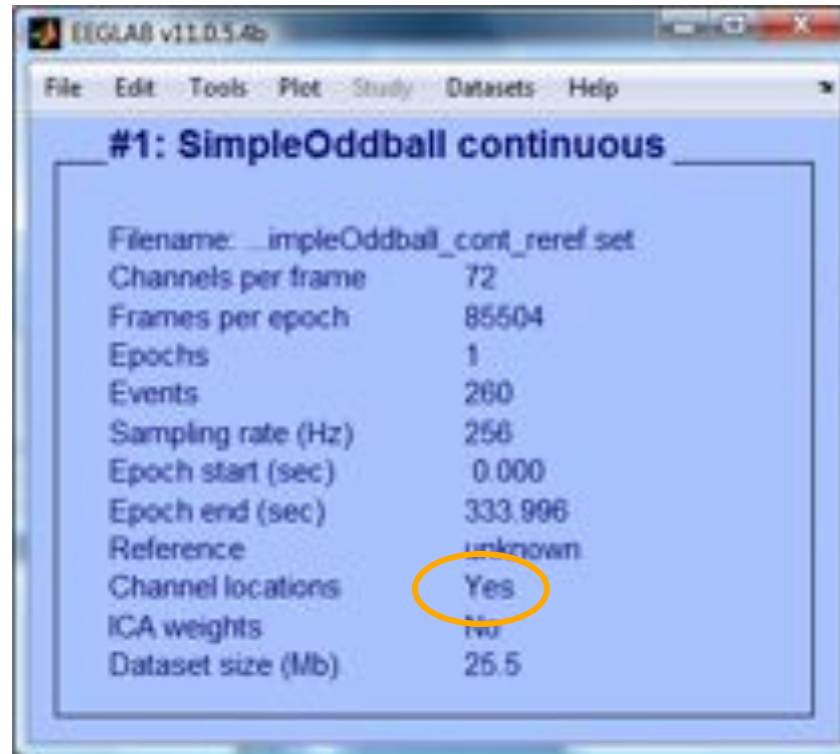
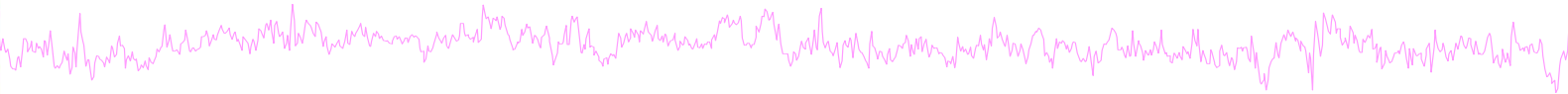
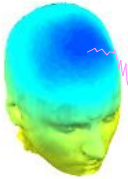
Channel label ("label")	HEOG	Opt. head center
Polar angle ("theta")	-42	Rotate axis
Polar radius ("radius")	0.65556	Transform axes
Cartesian X ("X")	55.7734	
Cartesian Y ("Y")	50.2186	xyz -> polar & sph
Cartesian Z ("Z")	-39.9051	Sph. -> polar & xyz
Spherical horiz. angle ("sph_theta")	42	Polar -> sph. & xyz
Spherical azimuth angle ("sph_phi")	-28	
Spherical radius ("sph_radius")	85	Set head radius
Channel type		Set channel types
Reference		Set reference
Index in backup 'urchanlocs' structure	68	
Channel in data array (set=yes)	<input checked="" type="checkbox"/>	

Channel number (of 72): 68

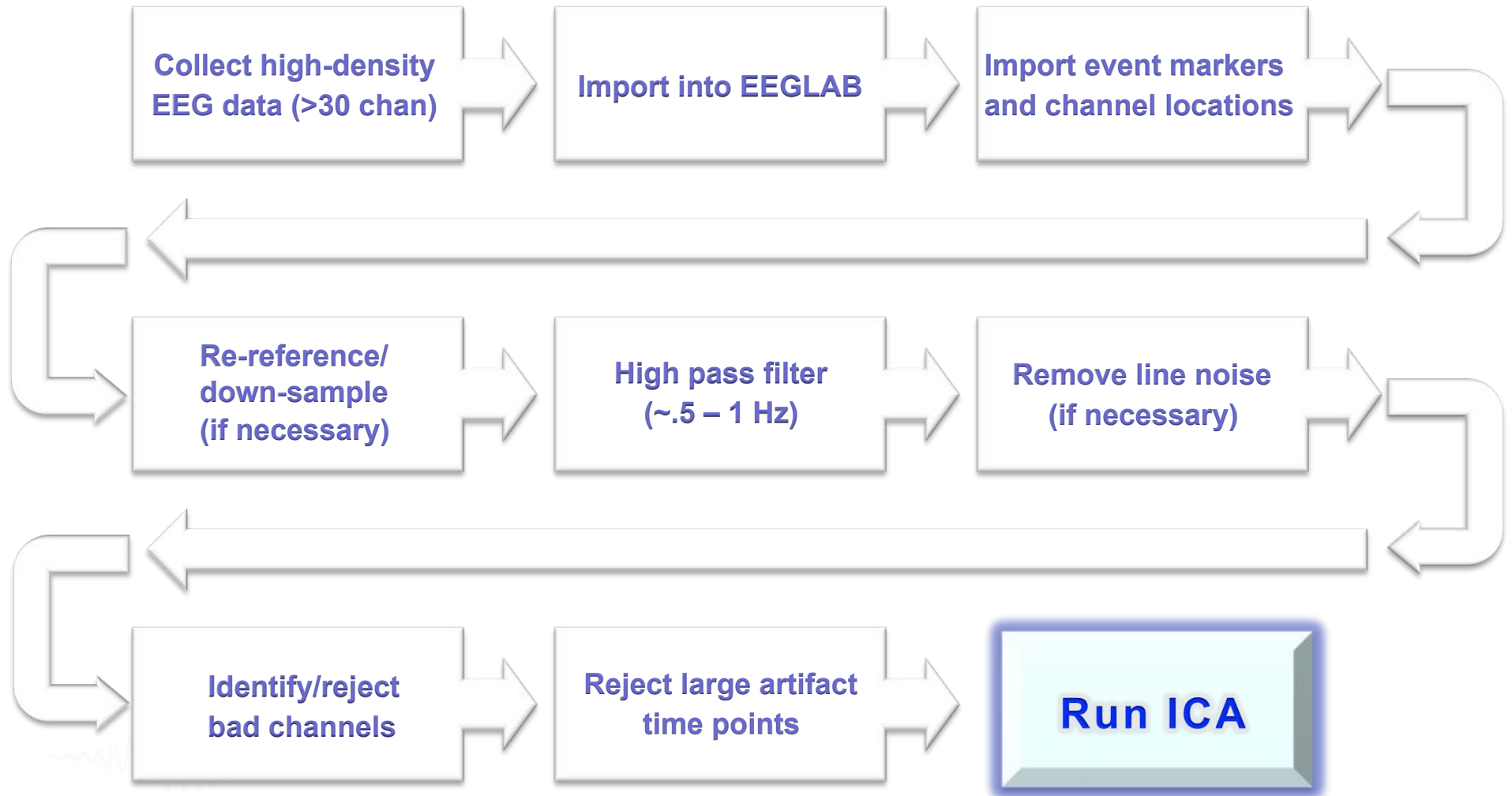
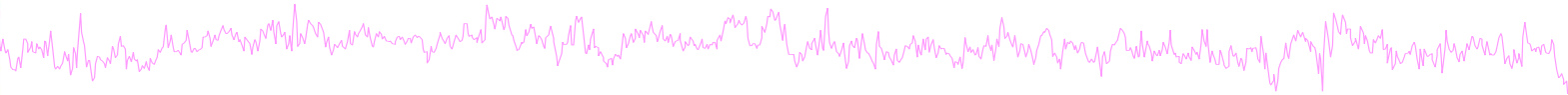
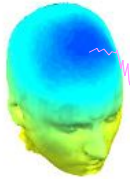
Buttons: Delete chan, Insert chan, Plot 2-D, Plot radius (0.2-1, []=auto), Nose along +X, Plot 3-D (xyz), Append chan



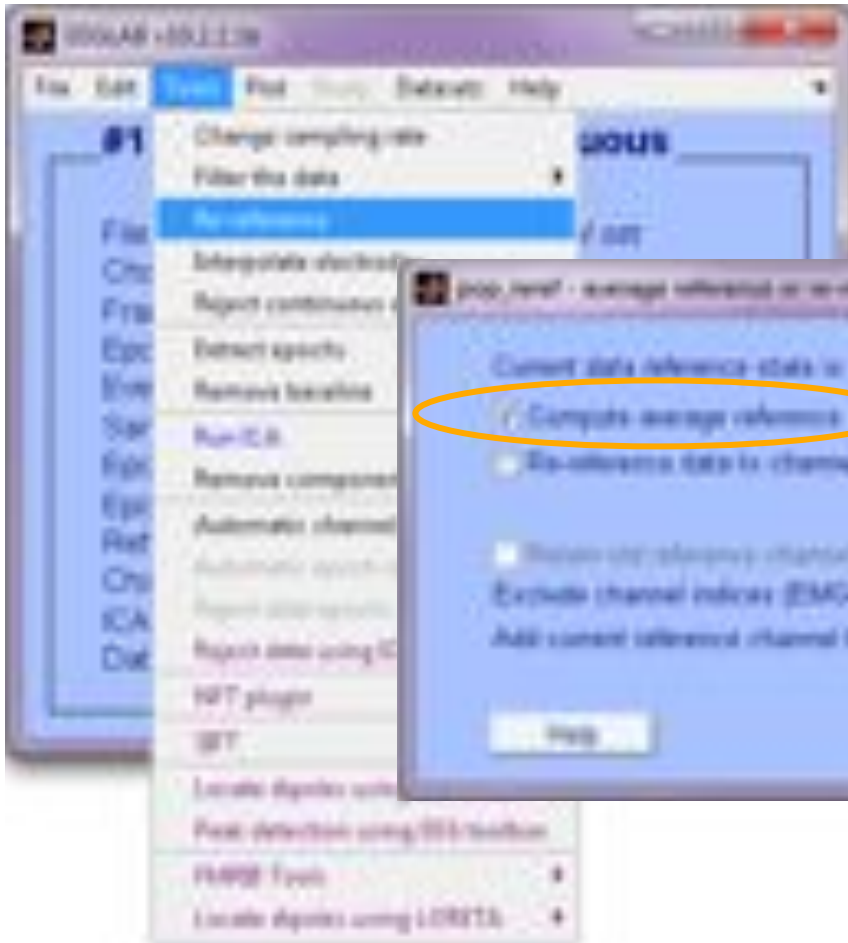
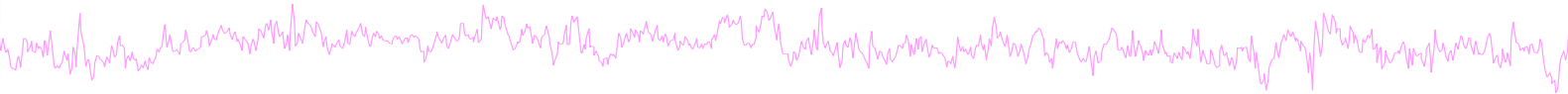
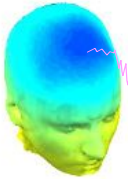
Imported channel locations



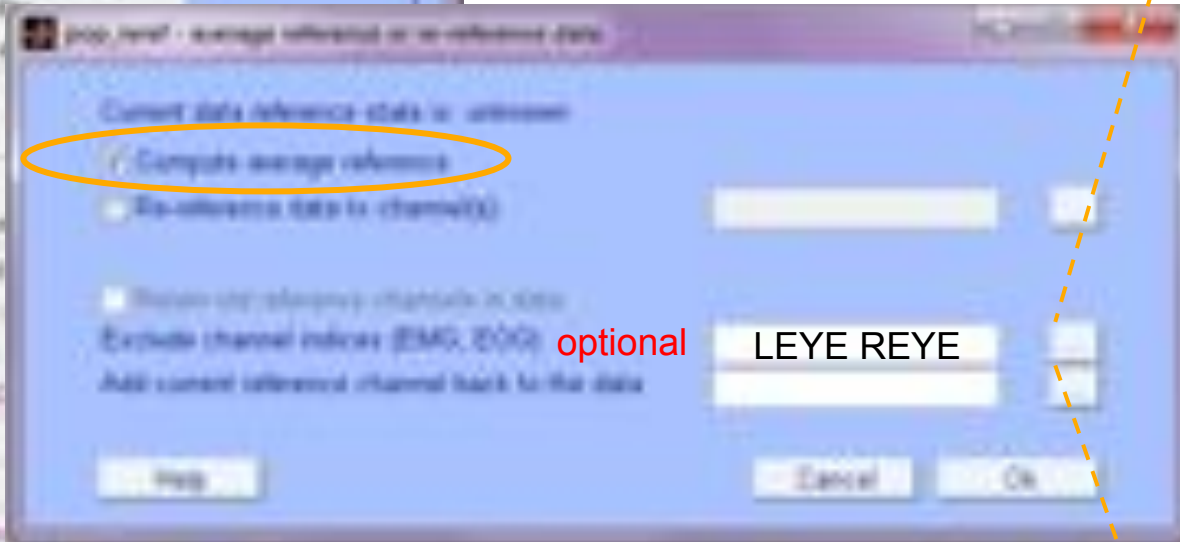
Pre-processing pipeline



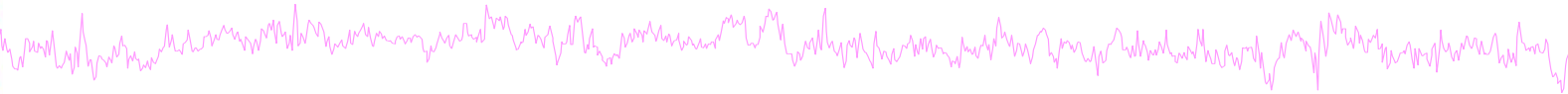
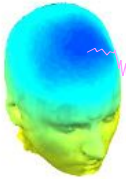
Re-reference data (if necessary/desired)



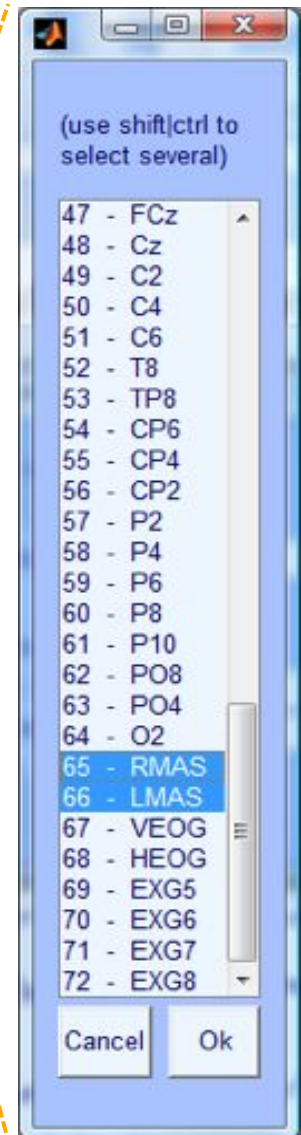
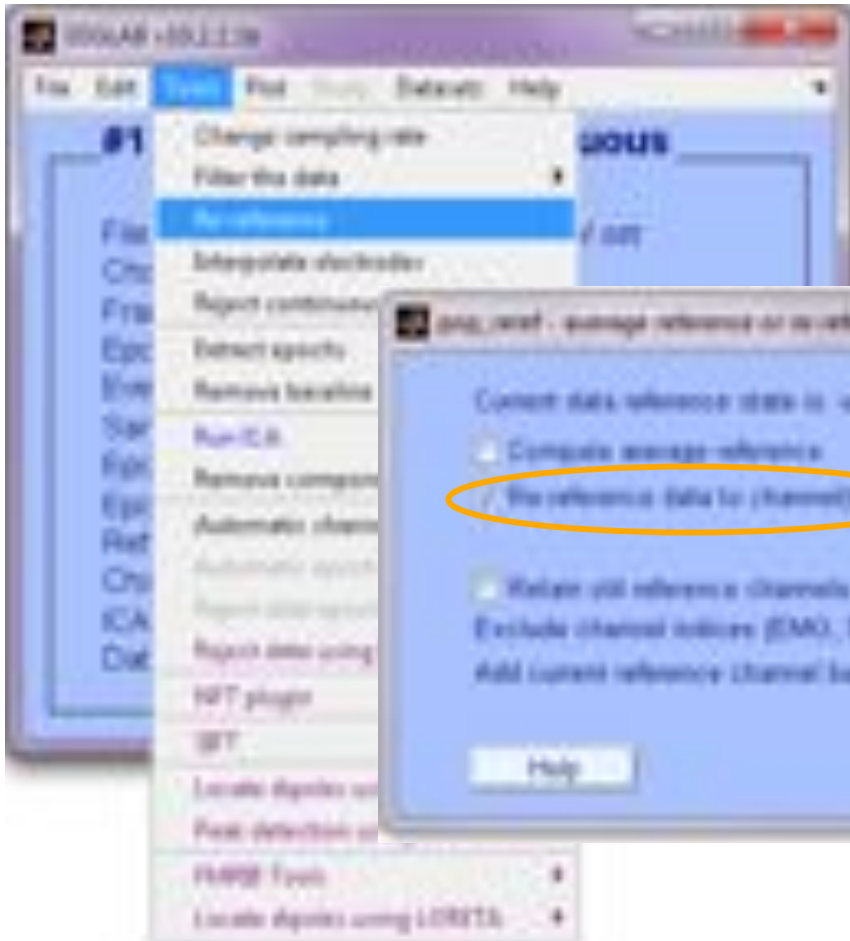
For example,
average reference

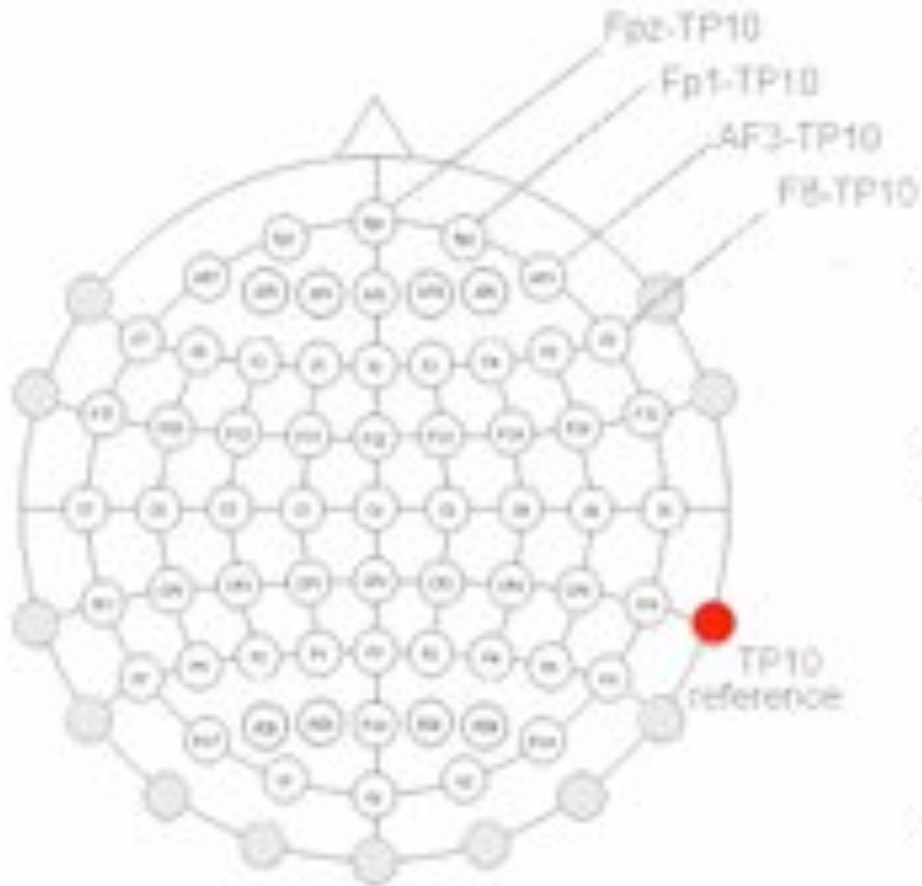
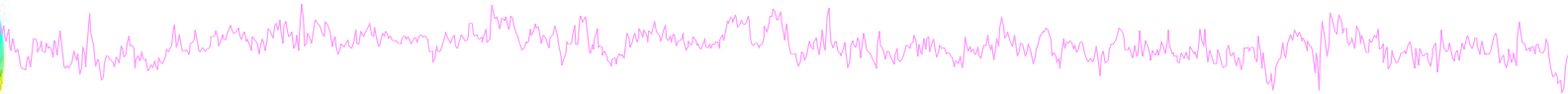


Re-reference data (if necessary/desired)



OR, re-reference to
(i.e.) 'linked mastoids'





1. Average Reference assumption

$$Fpz + Fp1 + AF3 + F8 + FT8 + \dots + TP10 = 0$$

2. First recalculate the activity at reference TP10

Sum of all electrode activity =

$$Fpz + Fp1 + AF3 + F8 + \dots - 64TP10$$

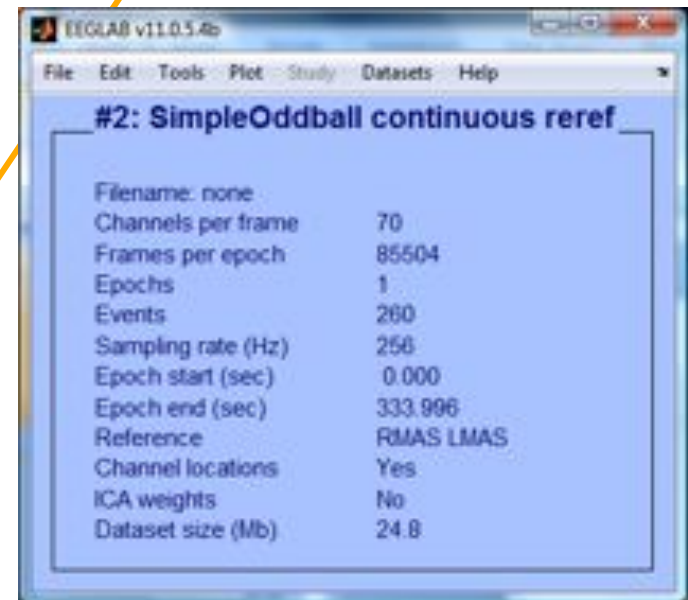
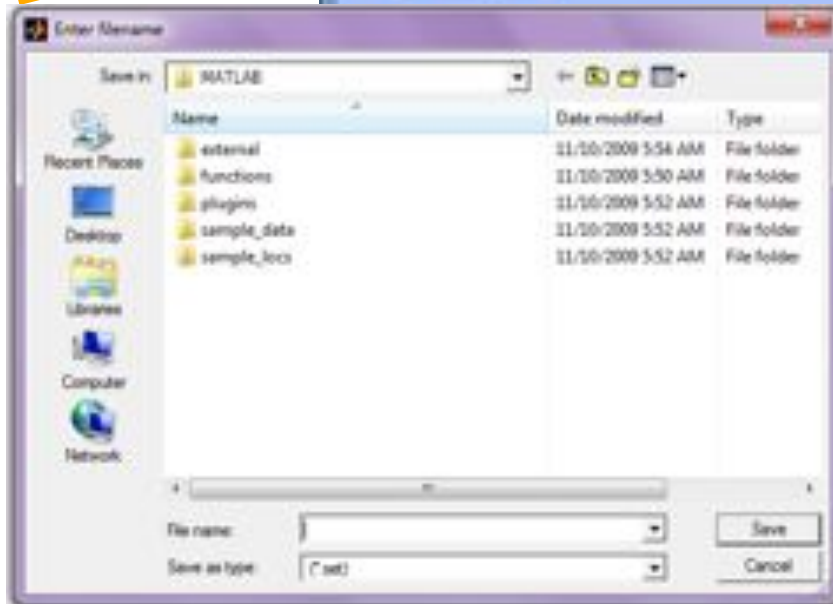
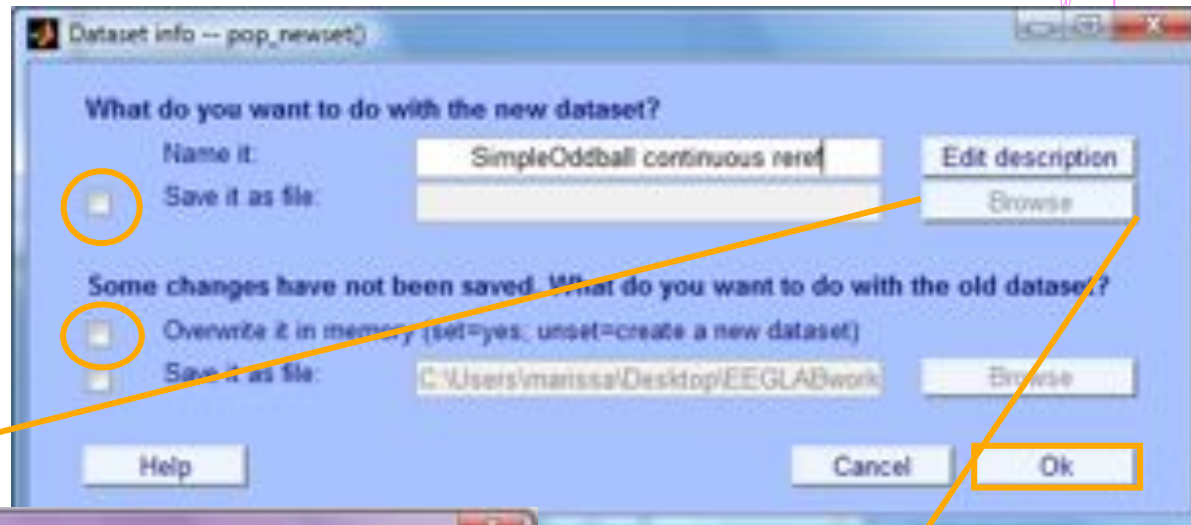
minus $Fpz + Fp1 + AF3 + F8 + \dots + TP10 = 0$

$$TP10 = - (\text{Sum of all electrode activity})/65$$

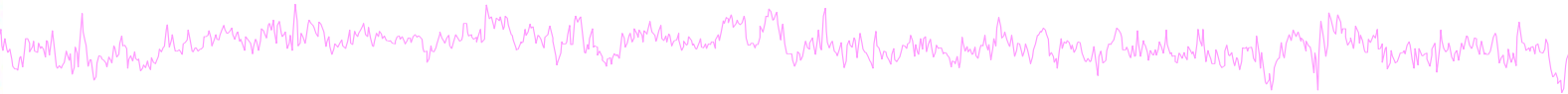
3. Add up the activity of TP10 to all channels



Save new dataset, keep old one



Multiple active datasets (ALLEEG)



EEGLAB v11.0.5.4b

File Edit Tools Plot Study Datasets Help

#1: SimpleOddball continuous

Filename: _impleOddball_cont_reref.set

Channels per frame	72
Frames per epoch	85504
Epochs	1
Events	260
Sampling rate (Hz)	256
Epoch start (sec)	0.000
Epoch end (sec)	333.996
Reference	unknown
Channel locations	Yes
ICA weights	No
Dataset size (Mb)	25.5

EEGLAB v11.0.5.4b

File Edit Tools Plot Study Datasets Help

#2: SimpleOddball continuous

Filename: none

Channels per frame	72
Frames per epoch	85504
Epochs	1
Events	260
Sampling rate (Hz)	256
Epoch start (sec)	0.000
Epoch end (sec)	333.996
Reference	RMAS LMAS
Channel locations	Yes
ICA weights	No
Dataset size (Mb)	24.8

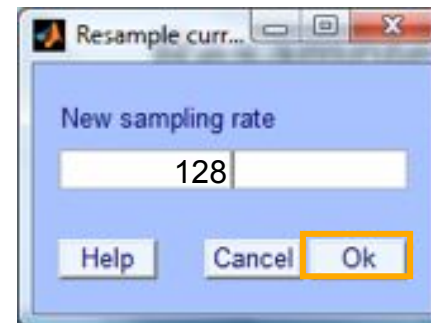
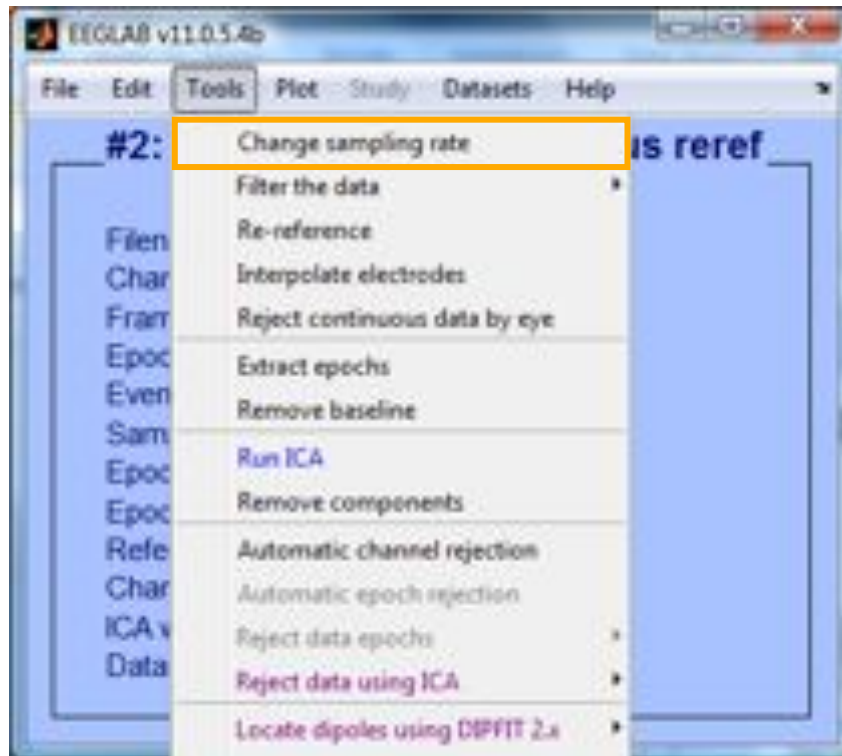
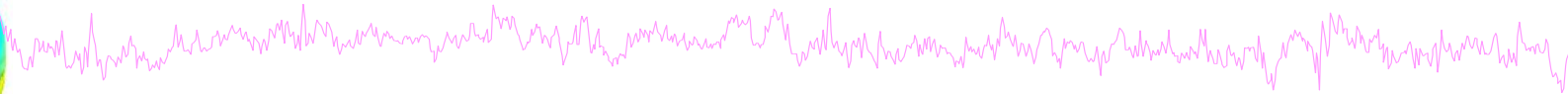
Dataset 1: SimpleOddball continuous

Dataset 2: SimpleOddball continuous

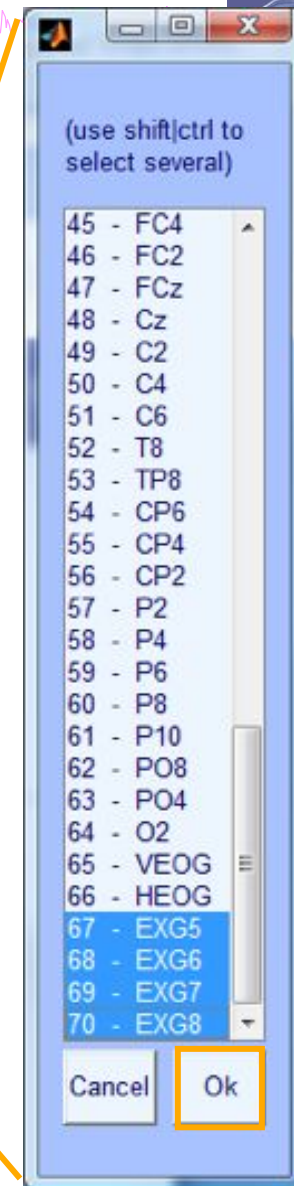
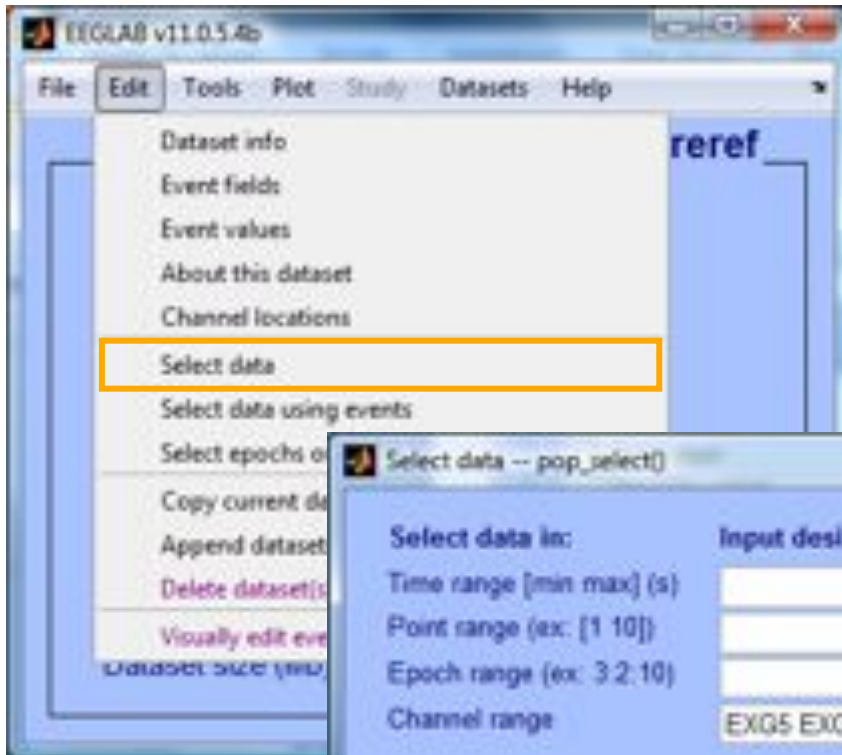
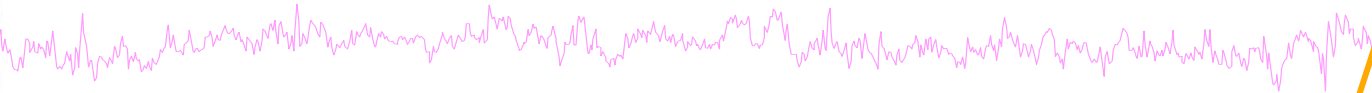
Select multiple datasets



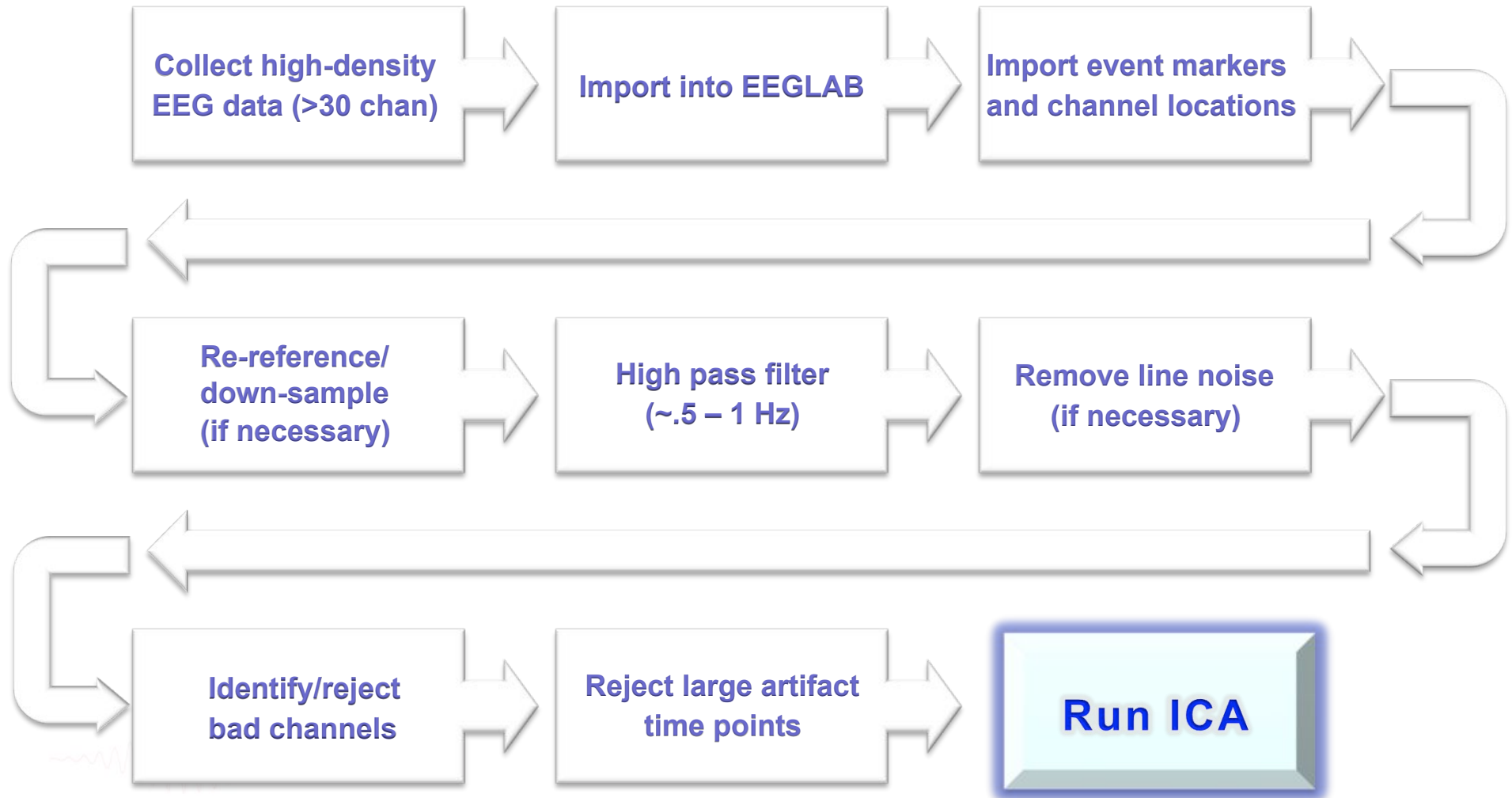
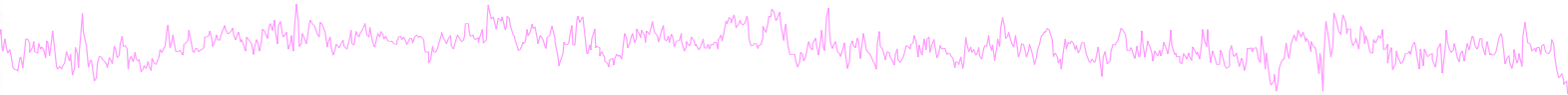
Resample data (if necessary)



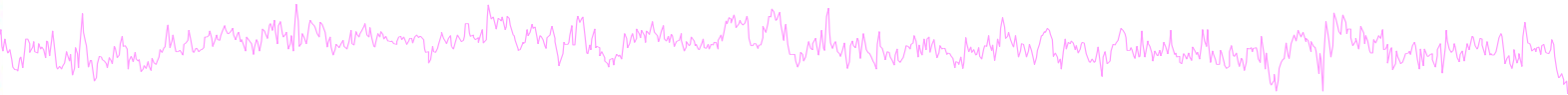
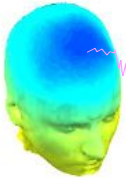
Remove unwanted channels



Pre-processing pipeline



Load an existing dataset



EEGLAB v11.0.5.4b

File Edit Tools Plot Study Datasets Help

- Import data
- Import epoch info
- Import event info
- Export
- Load existing dataset**
- Save current dataset(s)
- Save current dataset as
- Clear dataset(s)
- Create study
- Load existing study
- Save current study
- Save current study as
- Clear study
- Memory and other options
- History scripts
- Quit

Load dataset(s) -- pop_loadset()

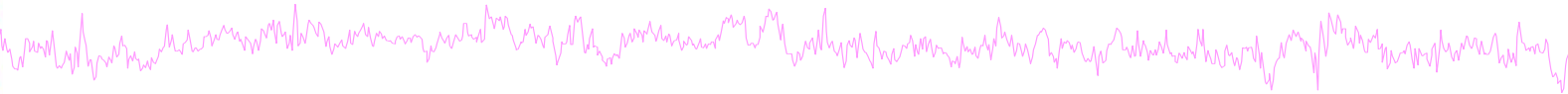
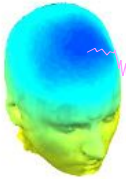
EEGLABworkshop Data

Name	Date modified	Type
faces_3.set	11/11/2013 4:21 PM	SET File
faces_4.set	11/11/2013 4:21 PM	SET File
SimpleOddball.set	11/13/2013 7:15 AM	SET File
SimpleOddball_cont_j...	11/14/2013 9:57 PM	SET File
stem_125Hz.set	11/11/2013 4:17 PM	SET File

File name: [] (*.SET; *.set) [Open] [Cancel]



Filter the data (if necessary/desired)

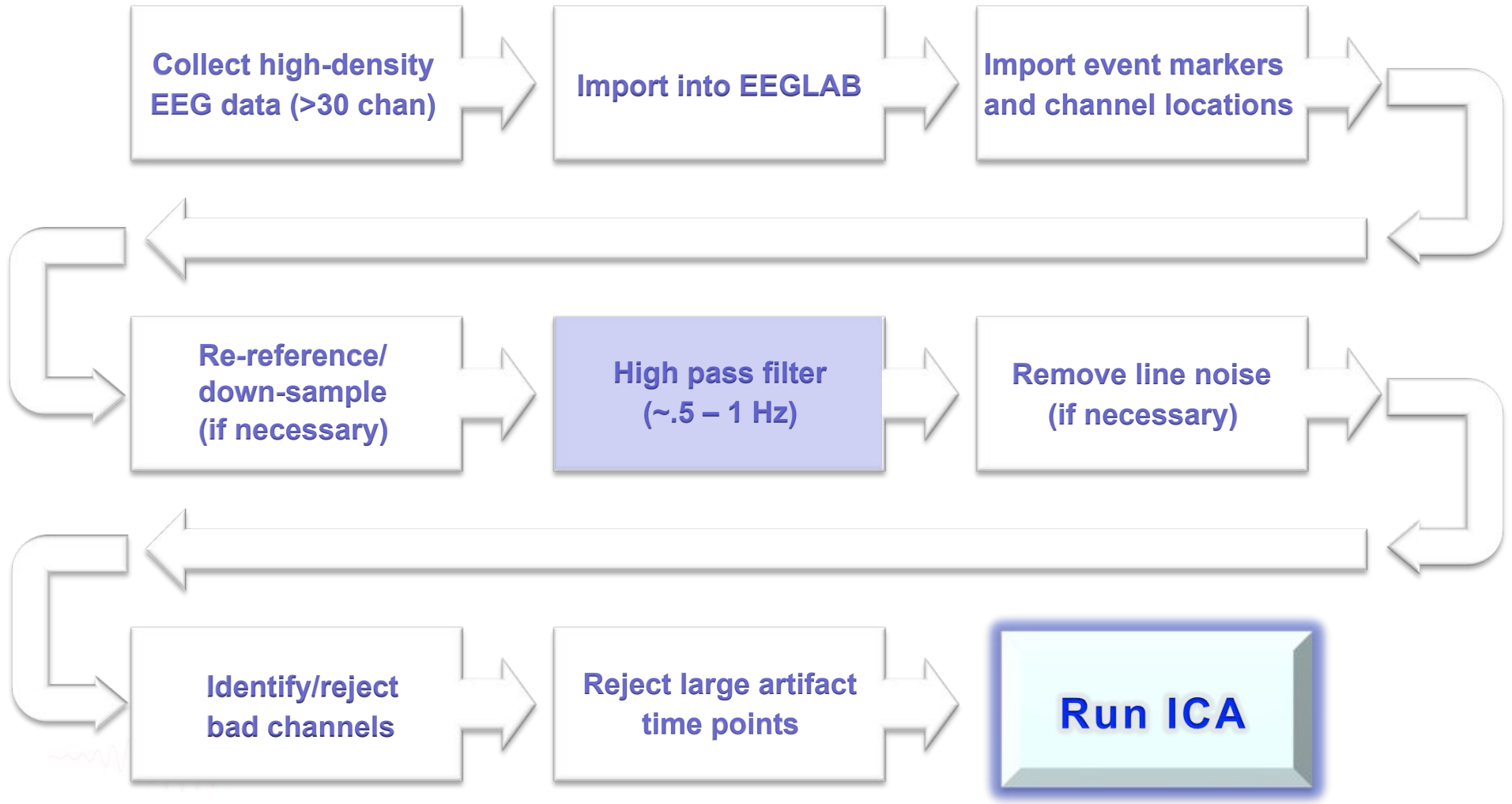
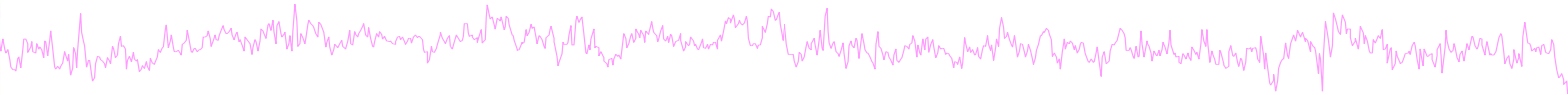
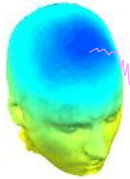


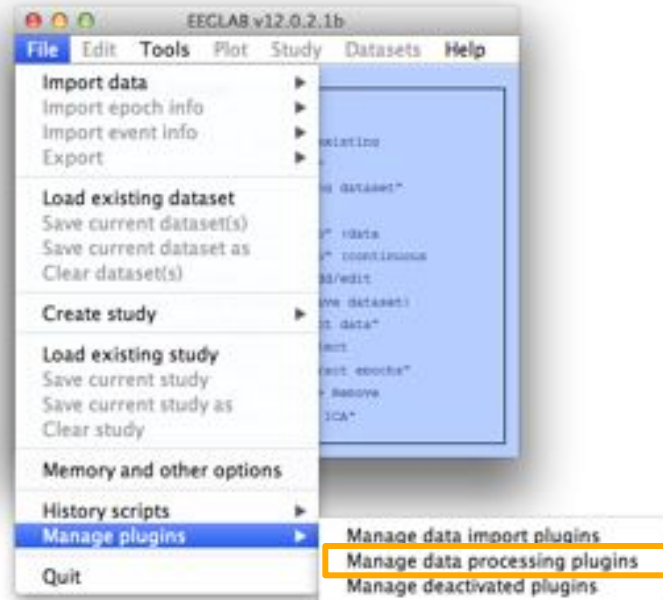
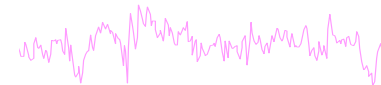
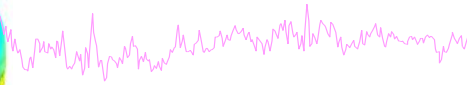
Lower cut off frequencies require longer stretches of continuous data

The screenshot shows the EEGLAB v11.0.5.4b software interface. The 'Tools' menu is open, showing options like 'Change sampling rate', 'Filter the data', 'Re-reference', etc. The 'Filter the data' dialog box is open, showing the 'Lower edge of the frequency pass band (Hz)' set to 0.5. The 'Dataset info' dialog box is also open, showing the new dataset name 'SimpleOddball hipass0.5' and the option 'Overwrite it in memory' checked.

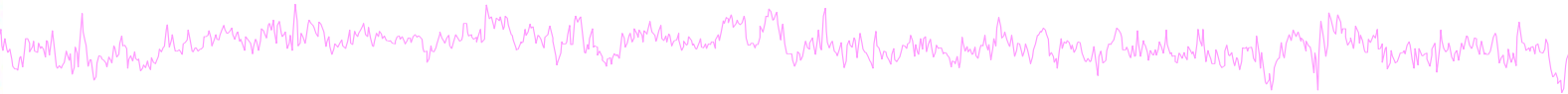
High-pass needed for ICA

Pre-processing pipeline





Remove line noise (Cleanline)

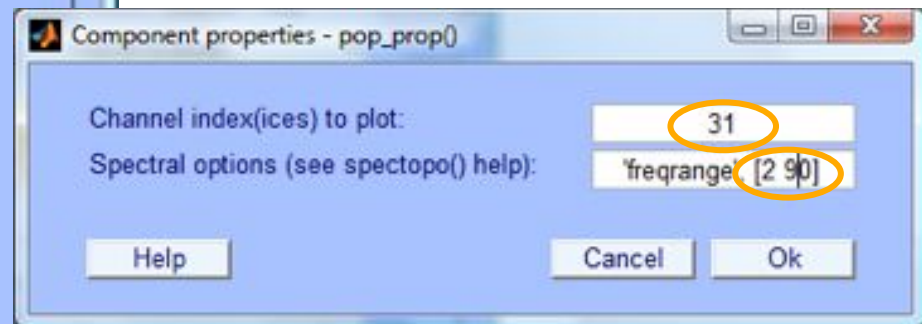
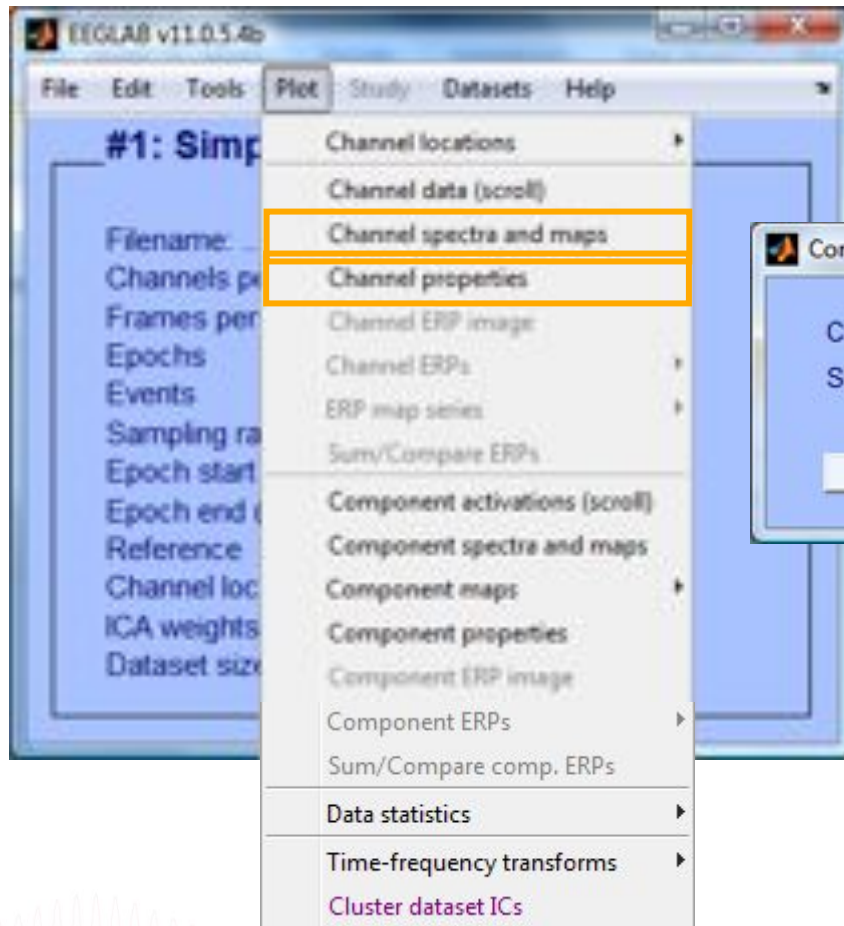
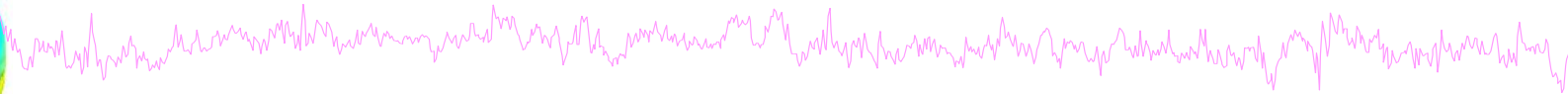


The screenshot shows the EEGLAB v11.0.5.4b interface. The 'Tools' menu is open, and 'CleanLine' is highlighted. The 'CleanLine Options' dialog box is also open, showing various settings for line noise removal. The settings are as follows:

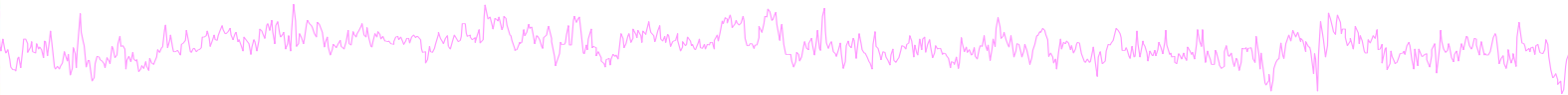
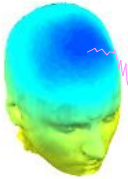
Option	Value
Line noise frequencies to remove	[60 120]
Scan for line noise	<input checked="" type="checkbox"/> (set)
p-value for detection of significant sinusoid	0.01
Bandwidth (Hz)	2
Type of signal to clean	Channels
Indices of Channels/Components to clean	'1:55'
Sliding window length (sec)	4
Sliding window step size (sec)	2
Window overlap smoothing factor	100
FFT padding factor	2
Visualize Original and Cleaned Spectra	<input type="checkbox"/> (set)
Normalize log spectrum by detrending	<input type="checkbox"/> (set)
Produce verbose output	<input checked="" type="checkbox"/> (set)
Plot Individual Figures	<input type="checkbox"/> (set)

A red arrow points to the 'Visualize Original and Cleaned Spectra' checkbox, which is currently unchecked. A yellow box labeled 'uncheck' is placed next to the arrow.

Plot channel spectra



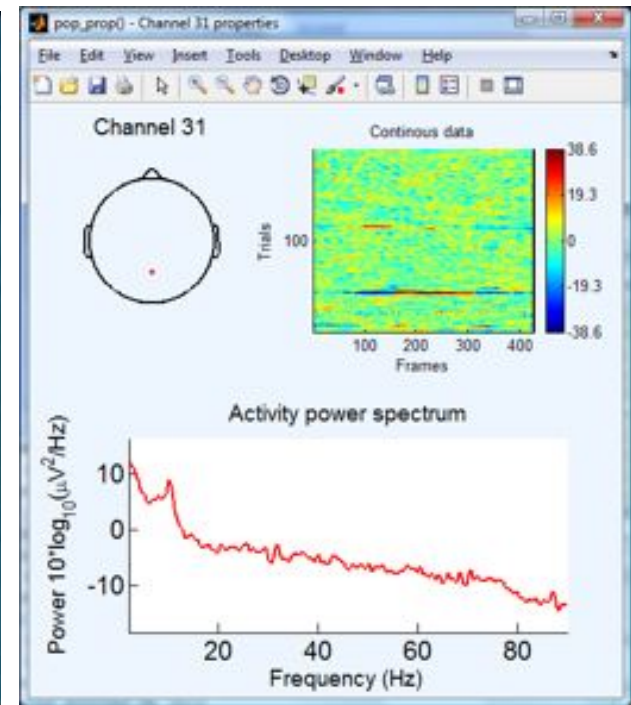
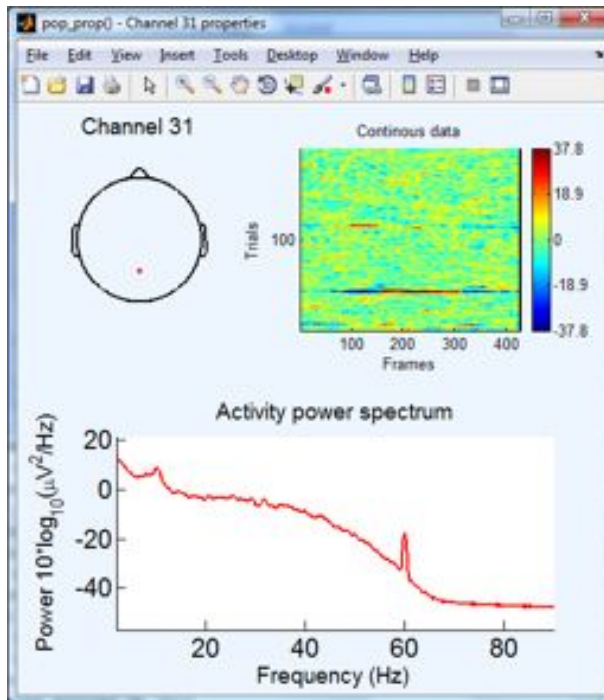
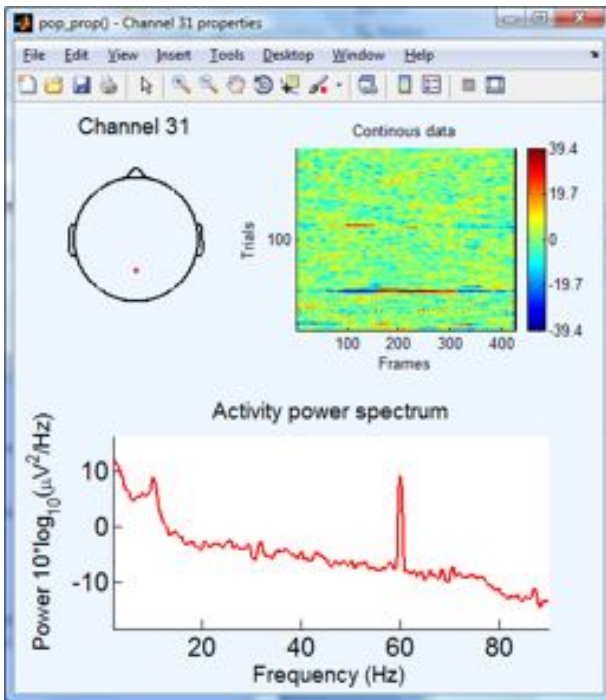
Filter comparisons



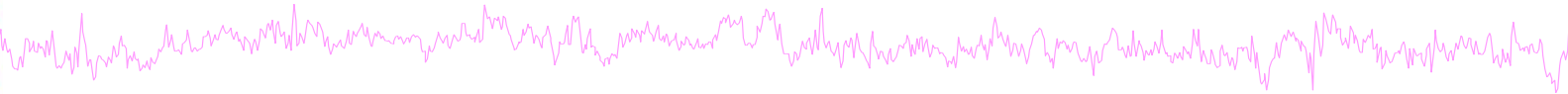
0.5 Hz high-pass filter

0.5 Hz high-pass filter
50 Hz low-pass filter

0.5 Hz high-pass filter
Cleanline



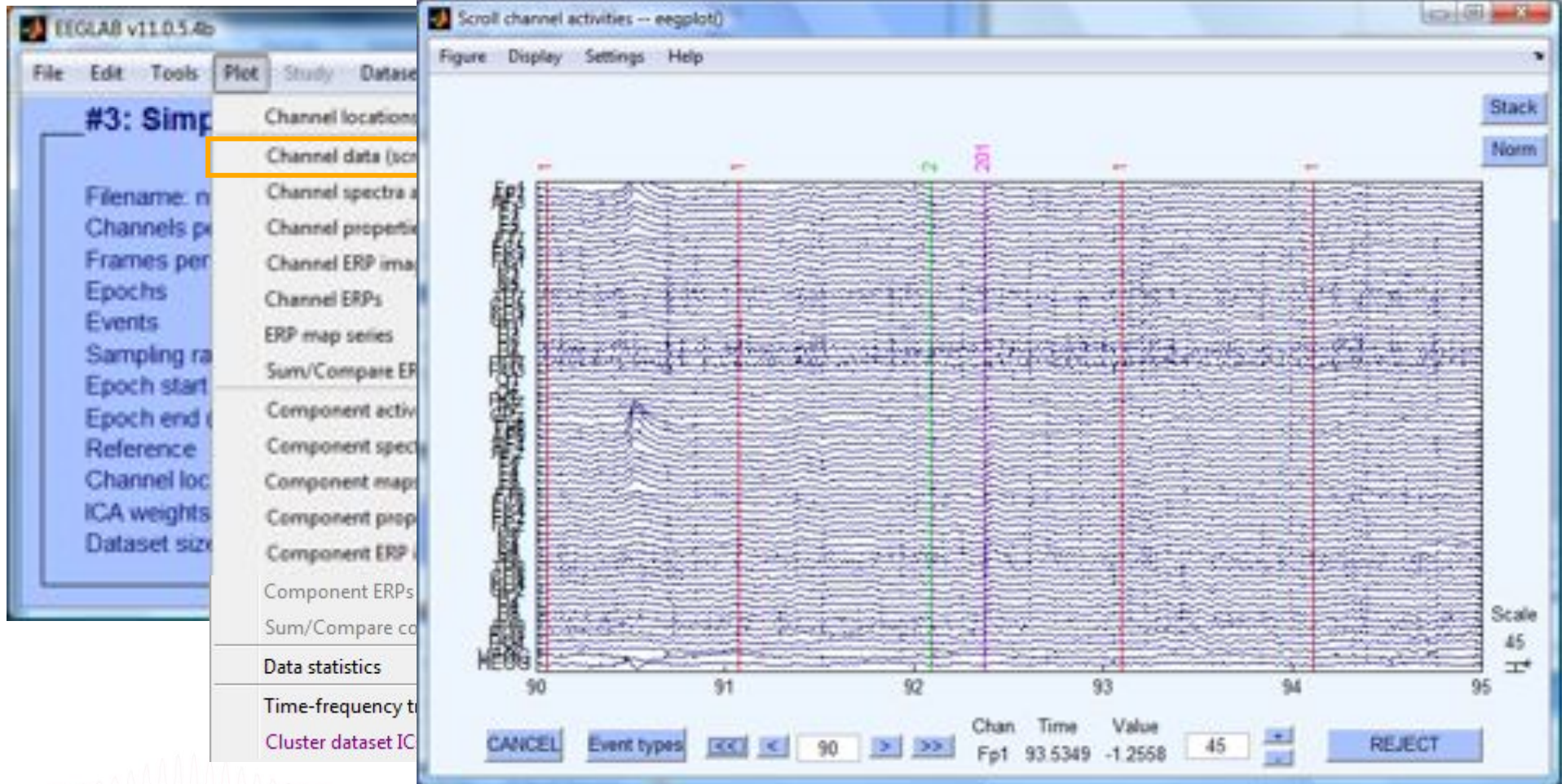
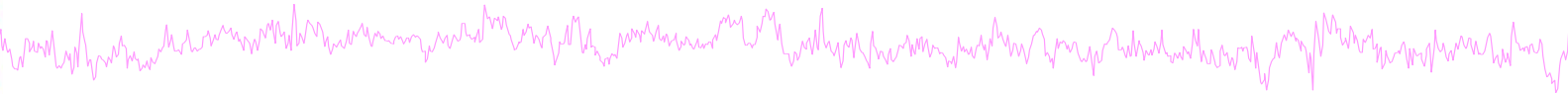
Other useful plugins



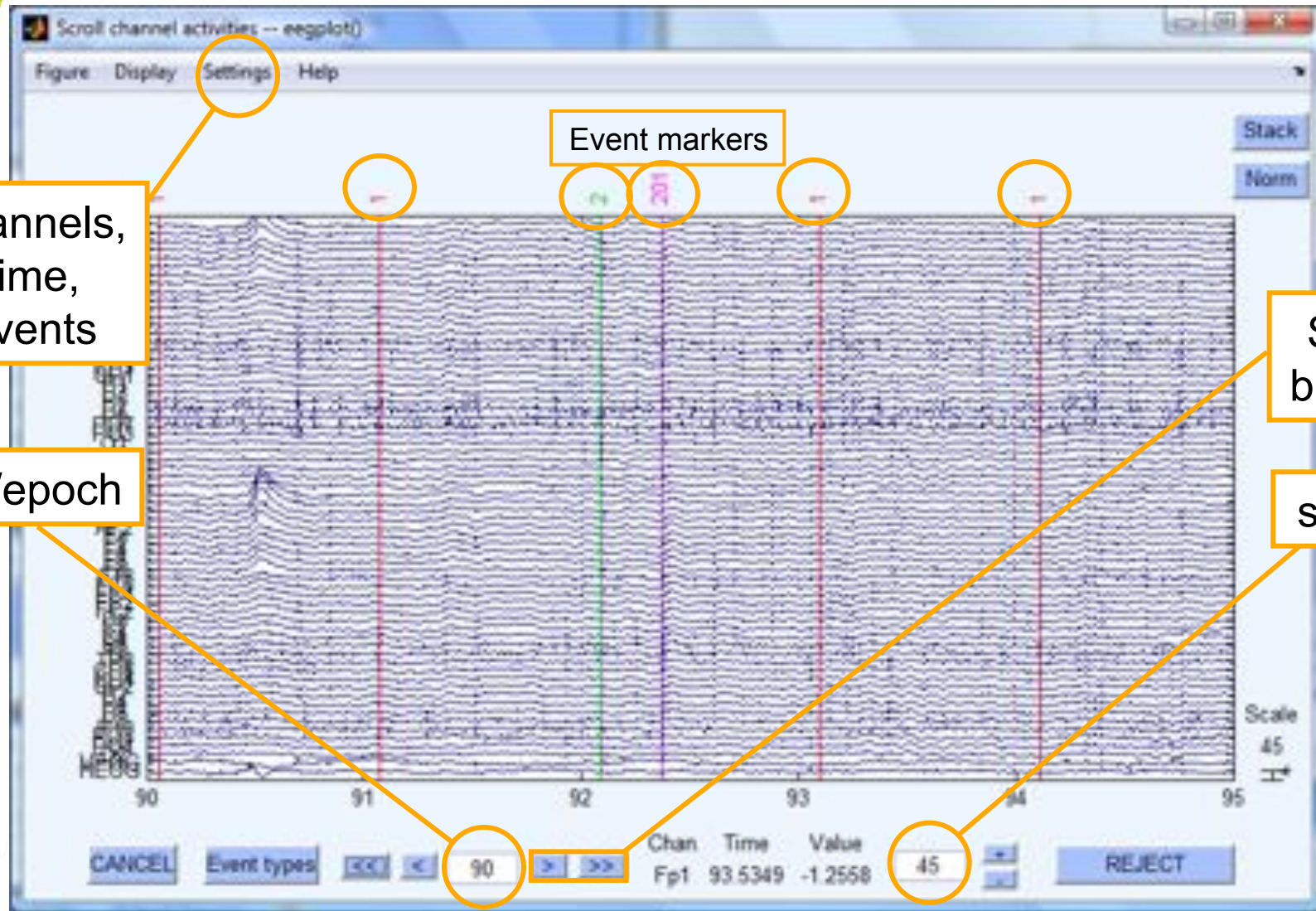
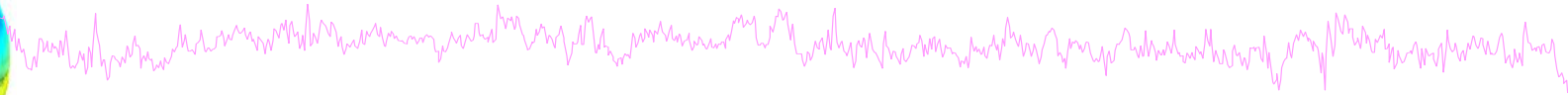
- Cleanline (developed by Tim Mullen)
<http://www.nitrc.org/projects/cleanline/>
- ERPLAB Toolbox (developed by Steve Luck and Javier Lopez-Calderon at UC Davis)
<http://www.erpinfo.org/erplab/erplab-home/>



Scroll channel data



Scroll channel data



channels,
time,
events

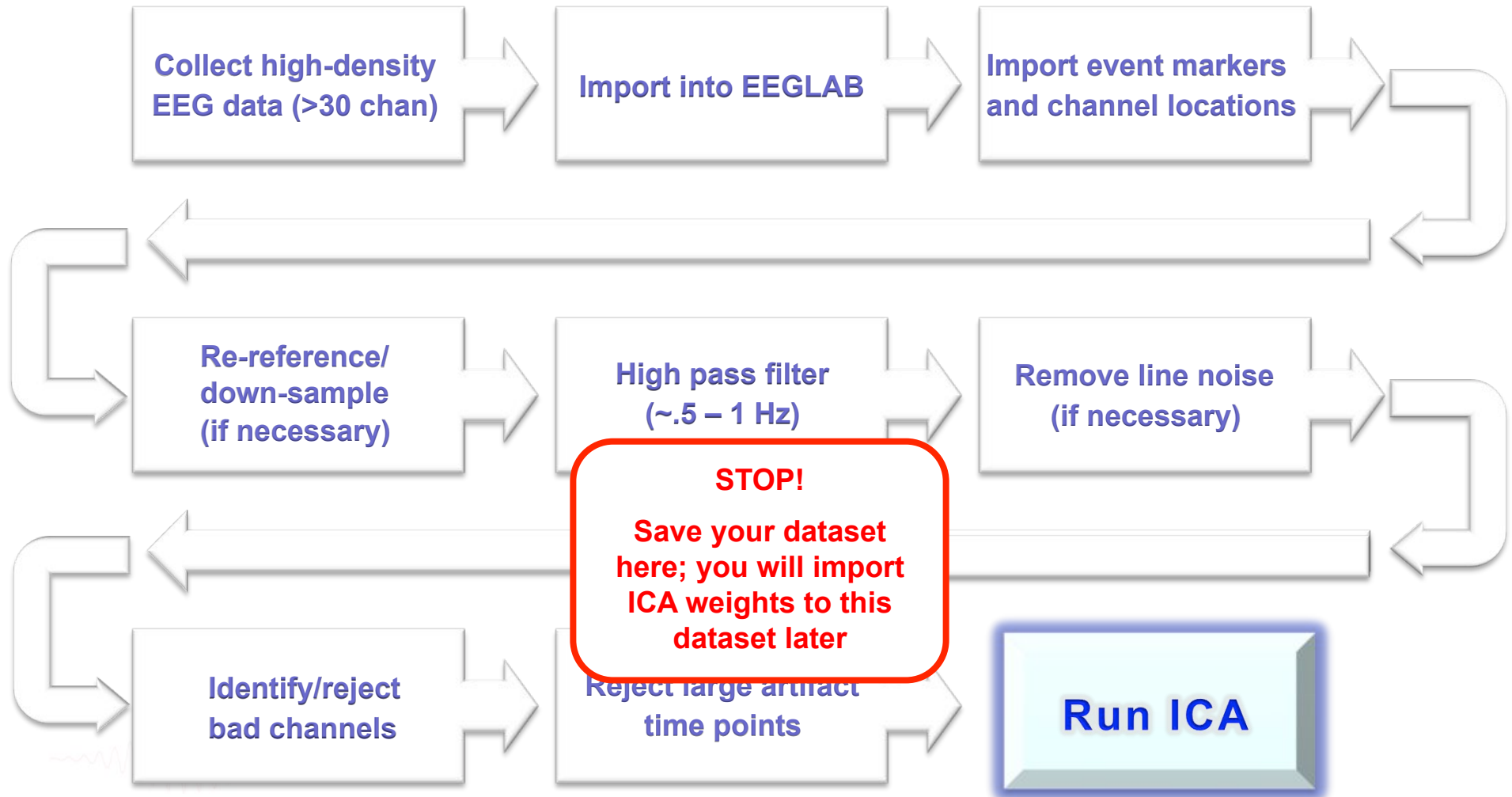
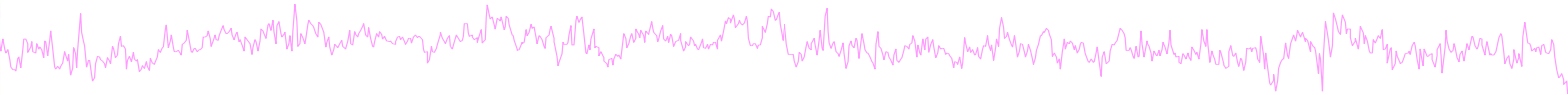
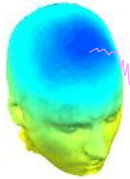
Event markers

Scroll
buttons

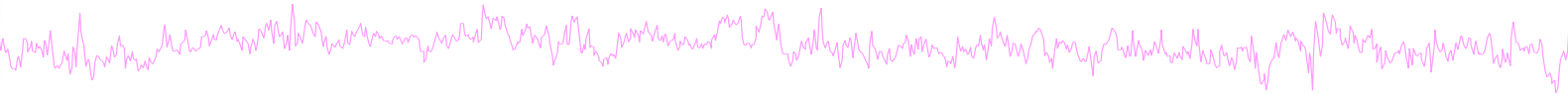
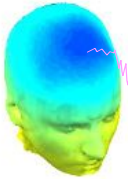
sec/epoch

scaling

Pre-processing pipeline



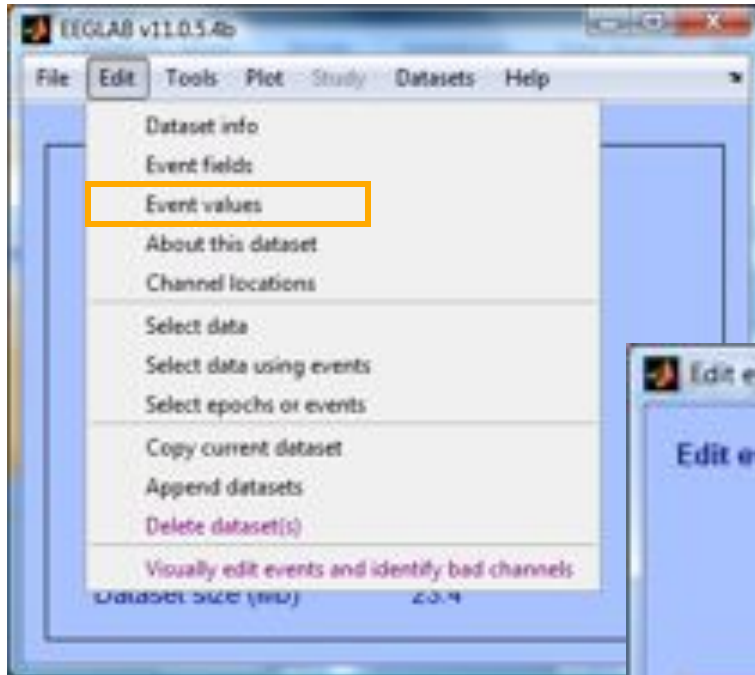
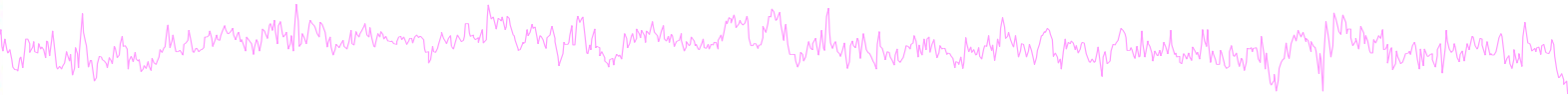
Visualizing ERPs



- Epoch data according to different event types
- Reject epochs containing artifact
- Various plot types (channel and scalp topography)



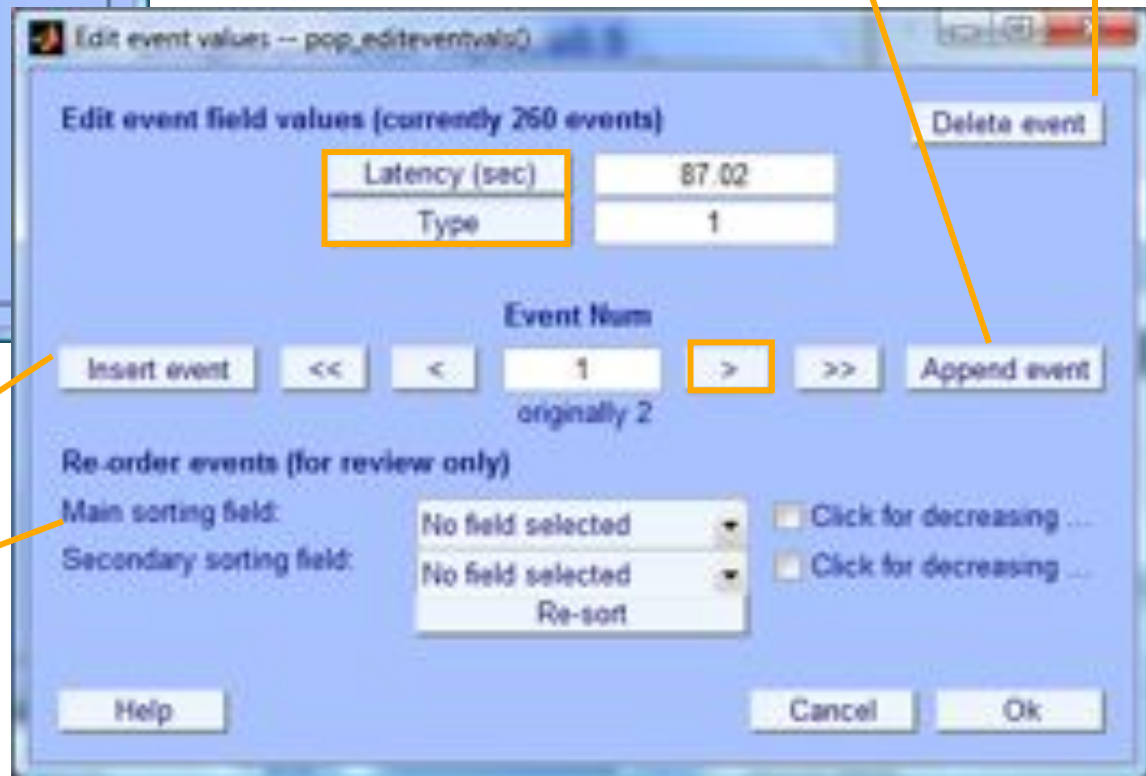
Review event values



Event 'type' and 'latency' are recognized fields

Append event AFTER current event

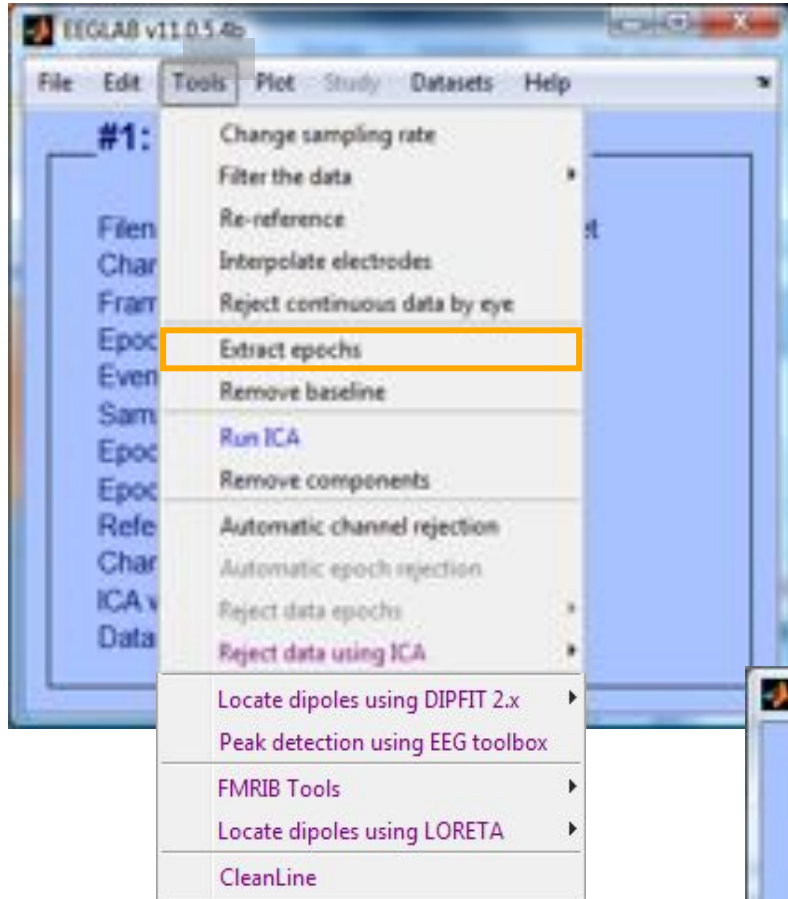
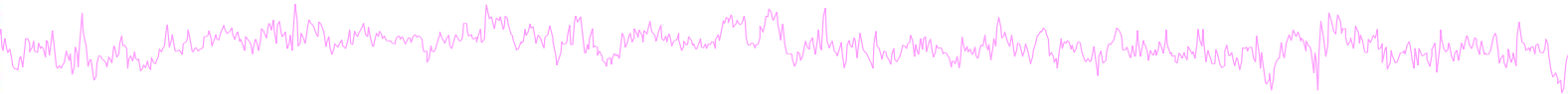
Delete CURRENT event



Insert event BEFORE current event

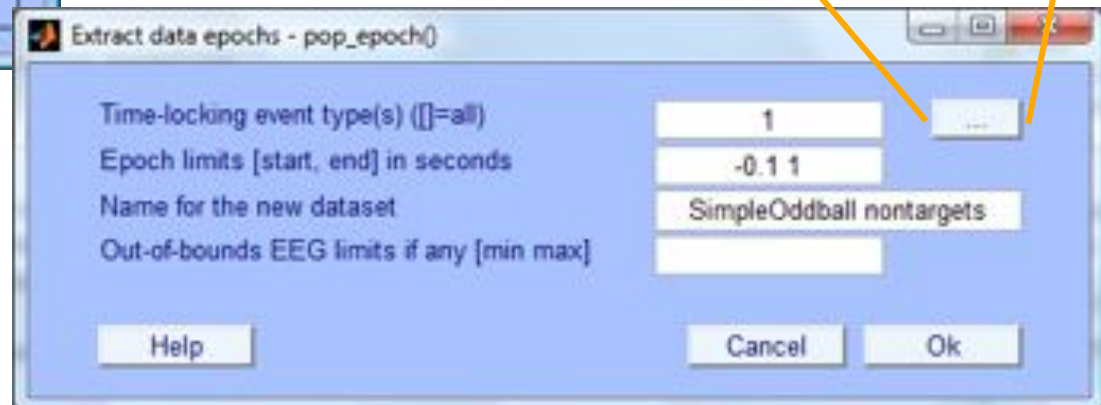
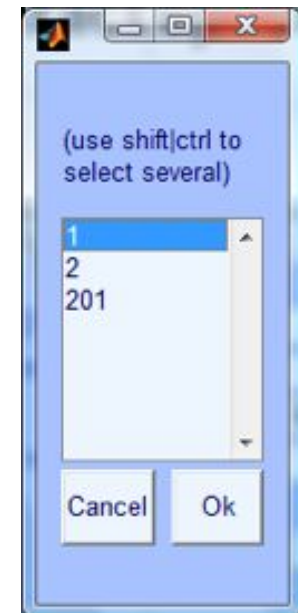
To resort: first select Main sorting field

Extract epochs

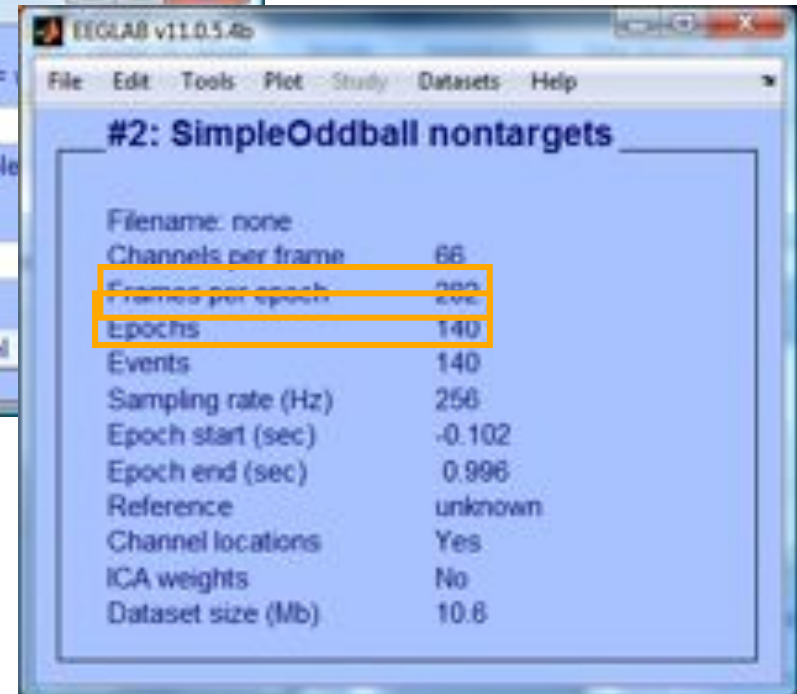
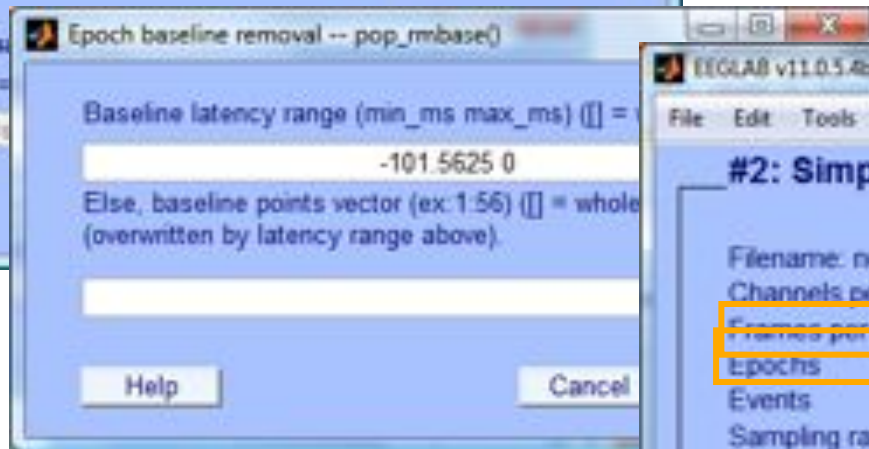
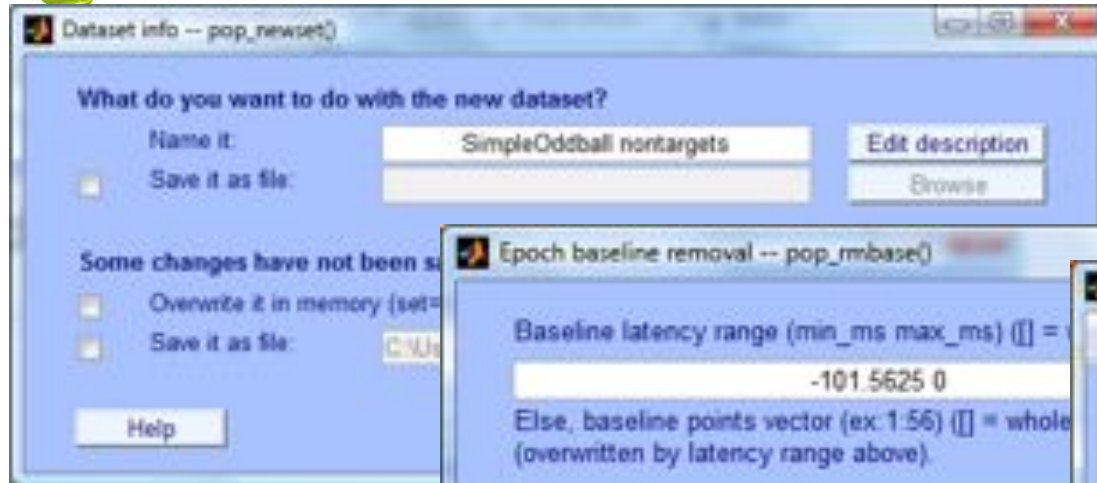
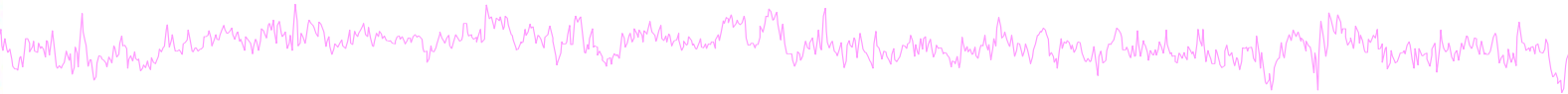


```
>> eeg_eventtypes (EEG)
```

```
1      140
2       60
201    60
```



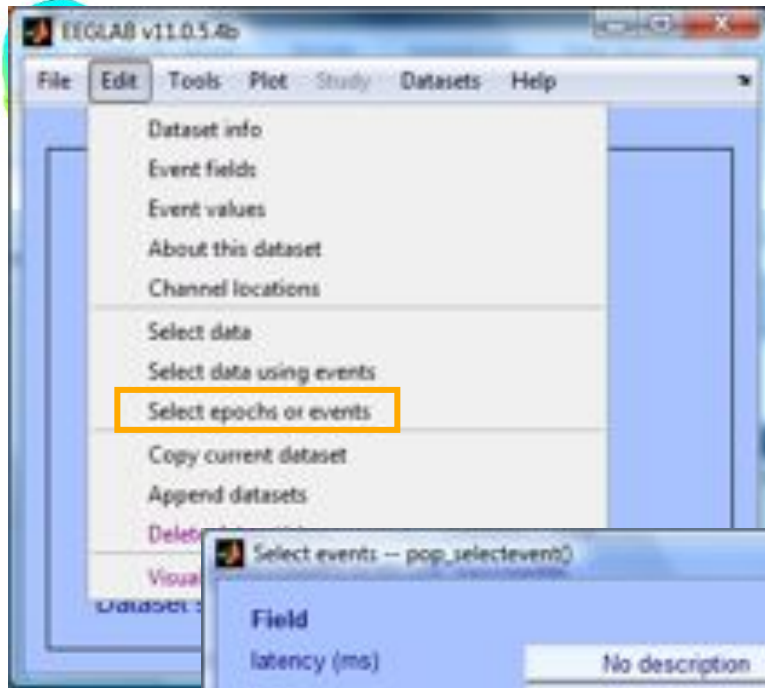
Extract epochs



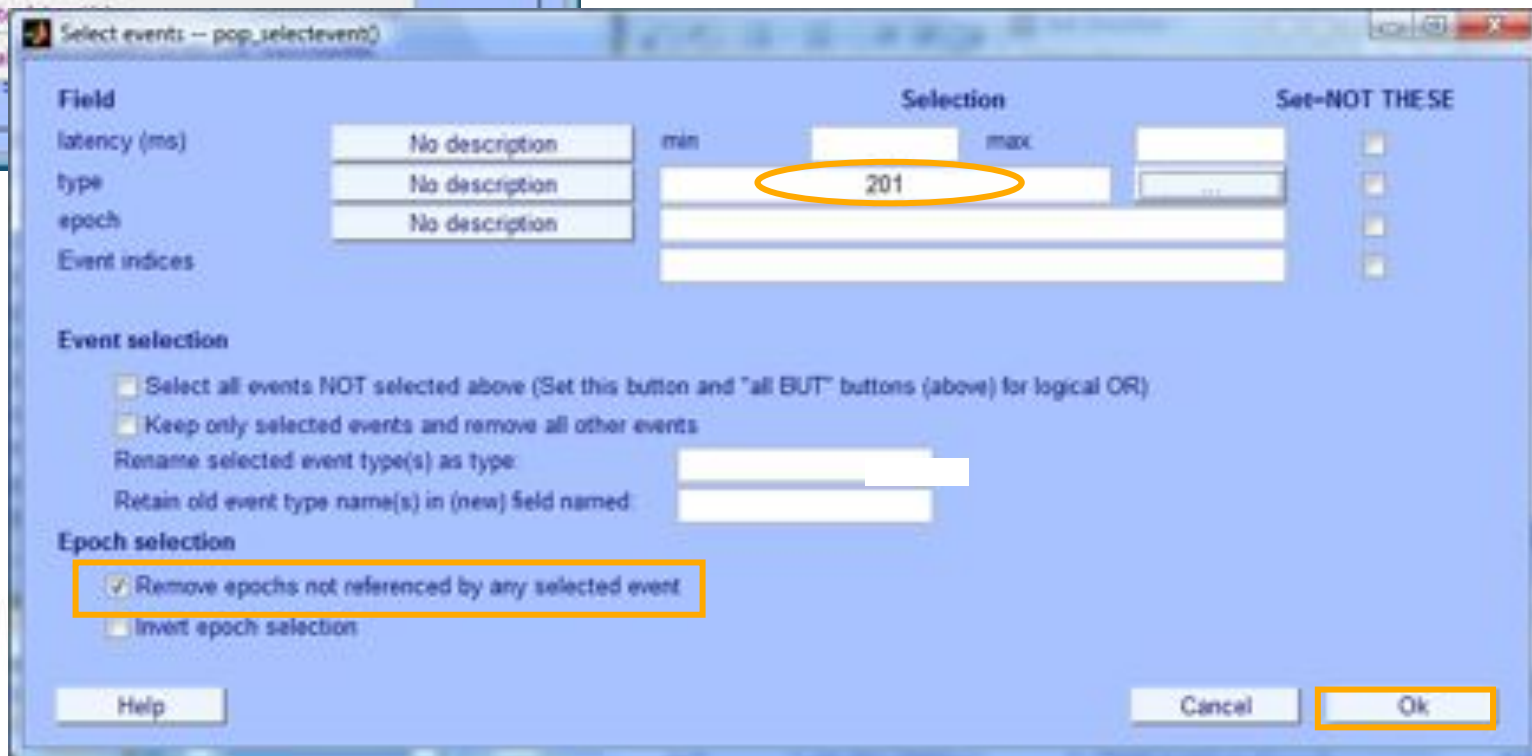
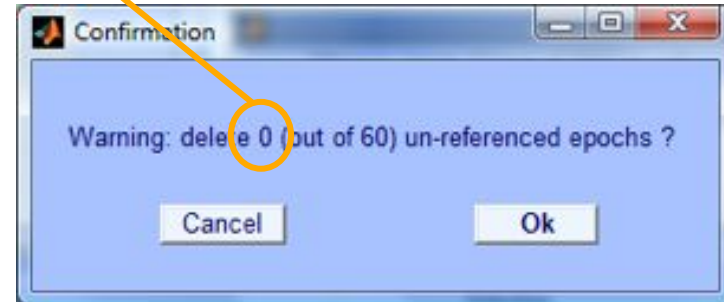
Go back to Dataset #1 and repeat this process for all events of interest (in this example, event type 2 (targets))

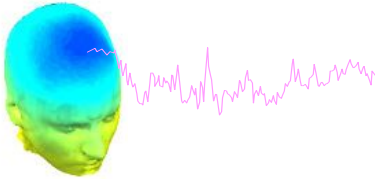


Select a subset of epochs

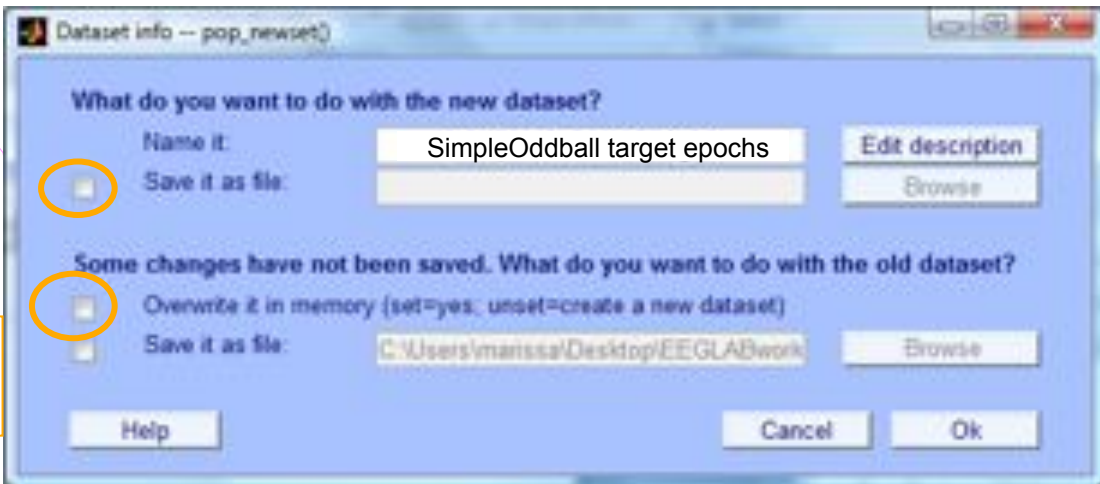


'0' because the subject did not miss any targets

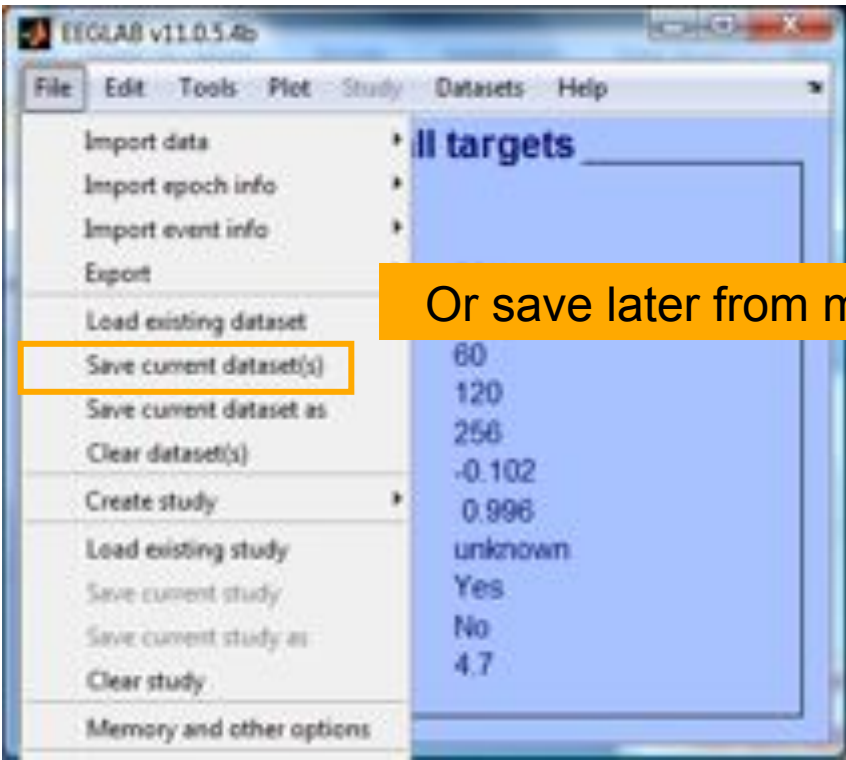




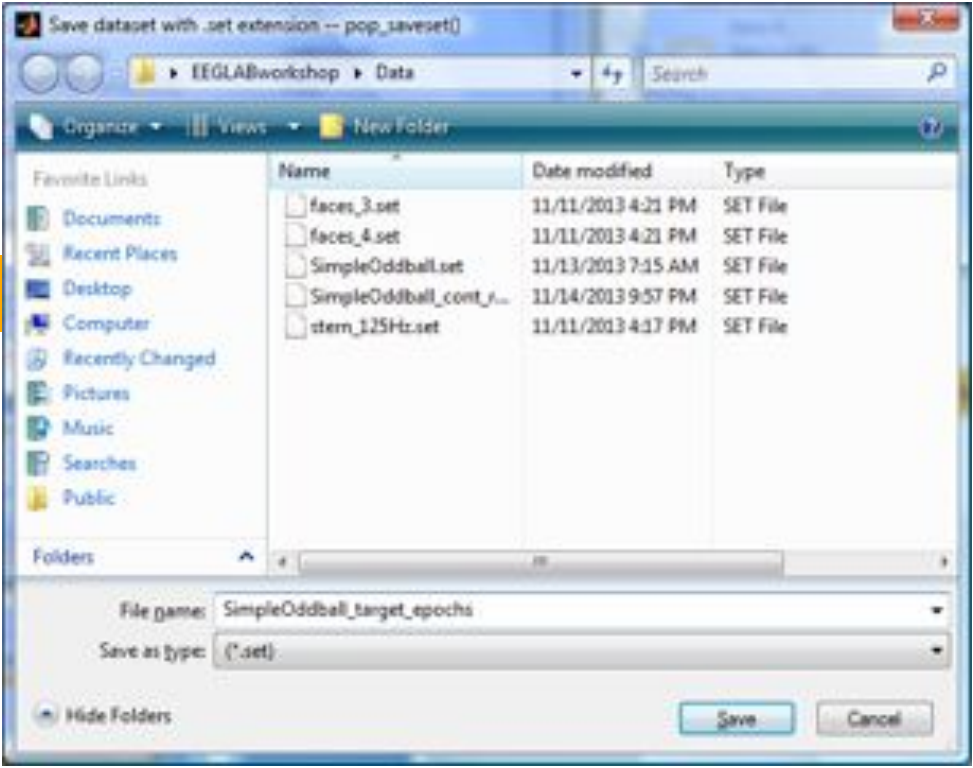
'Do not overwrite current dataset'



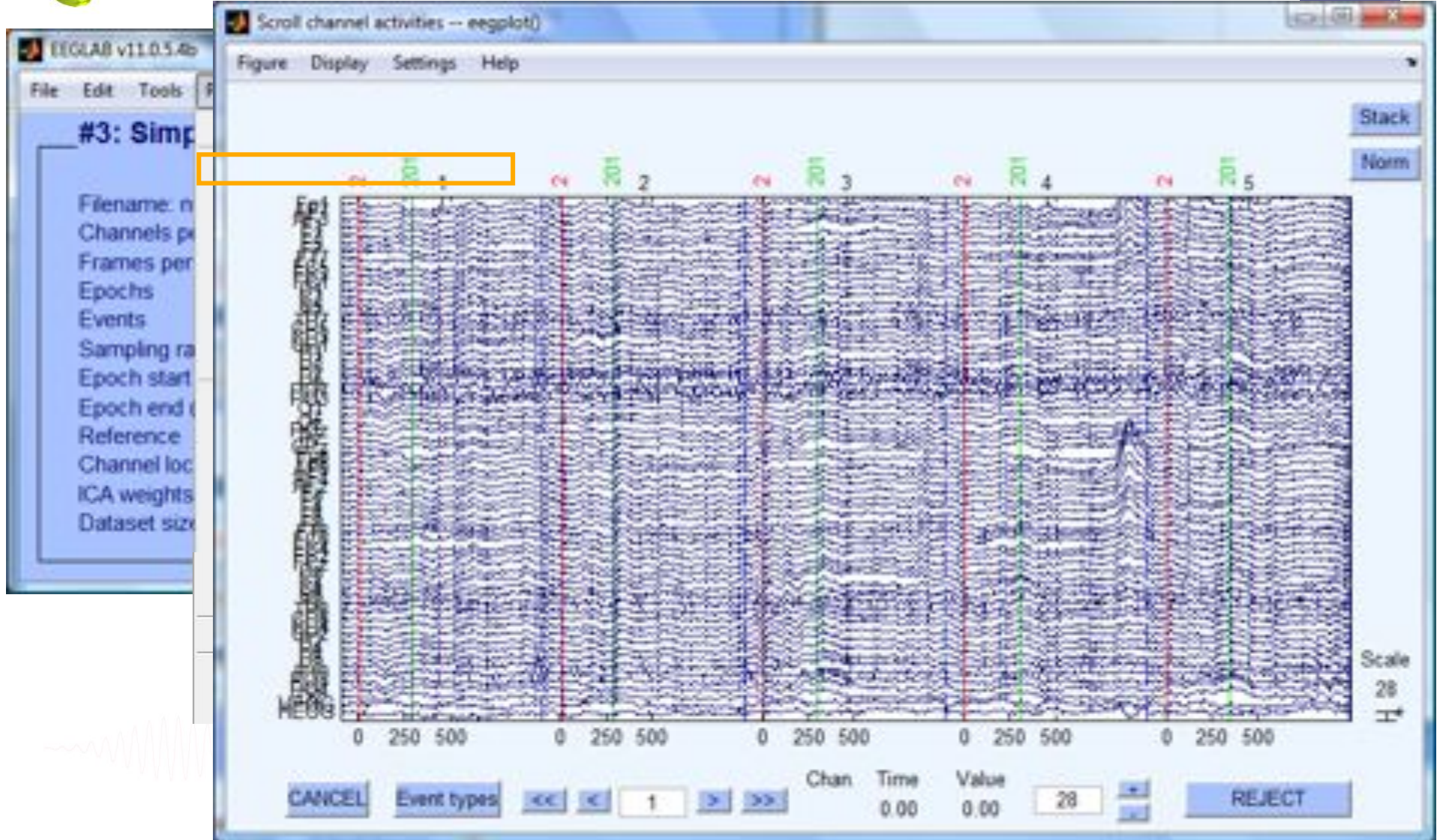
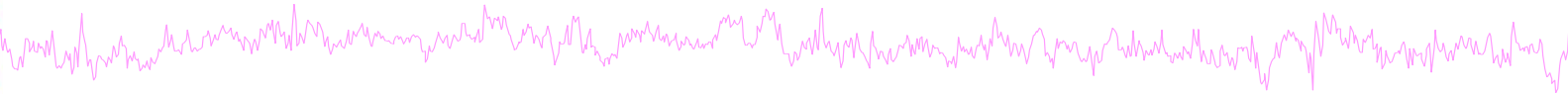
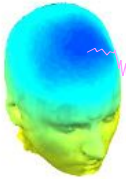
Save dataset (optional)



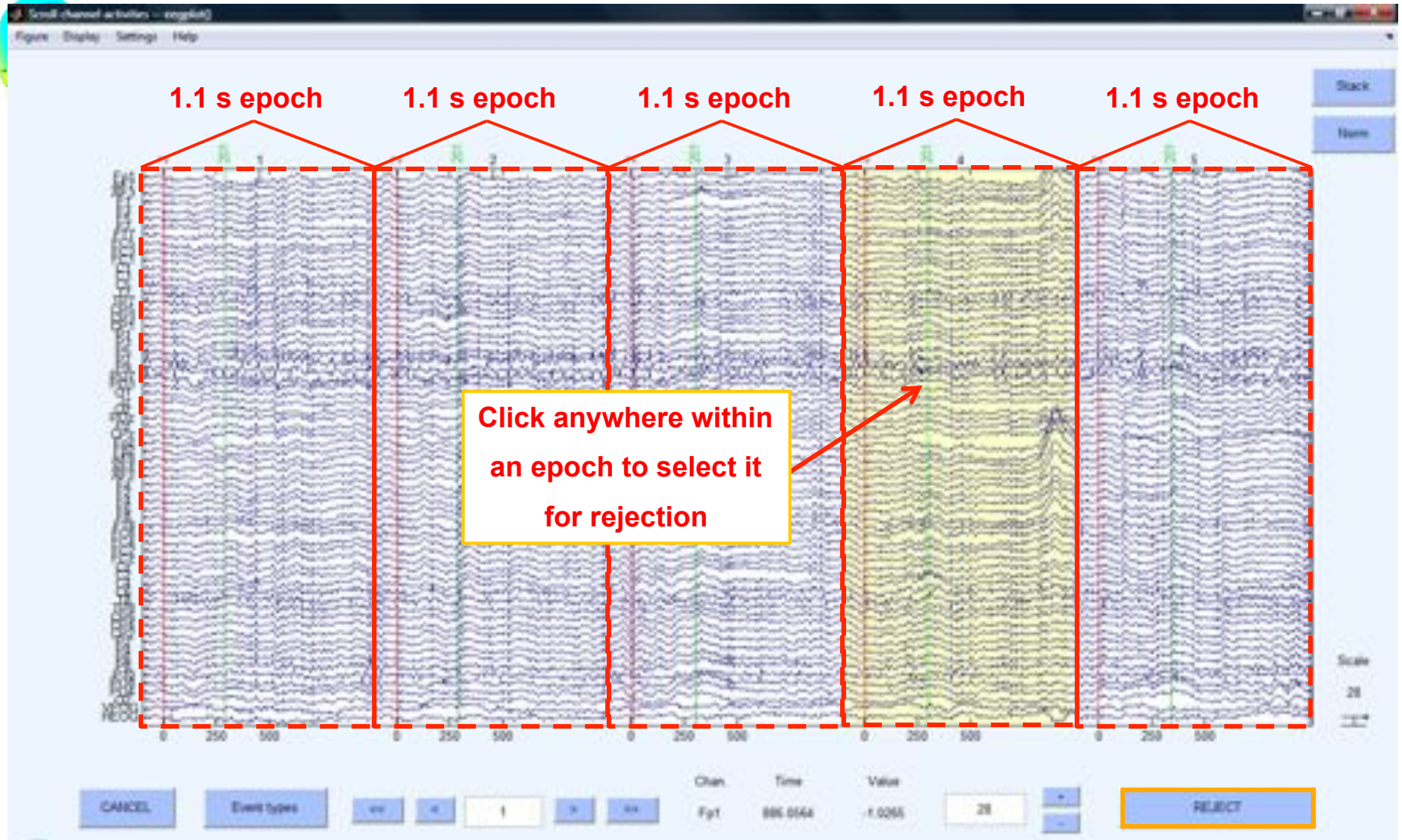
Or save later from menu



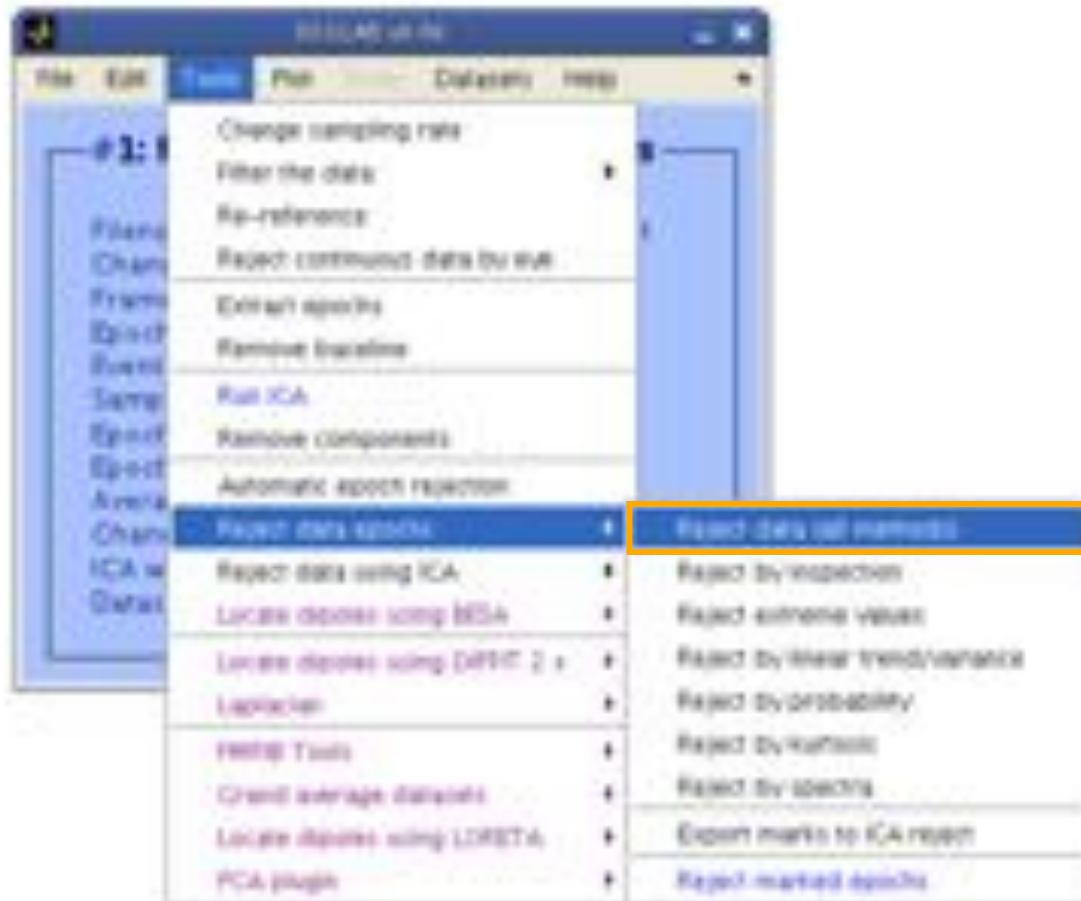
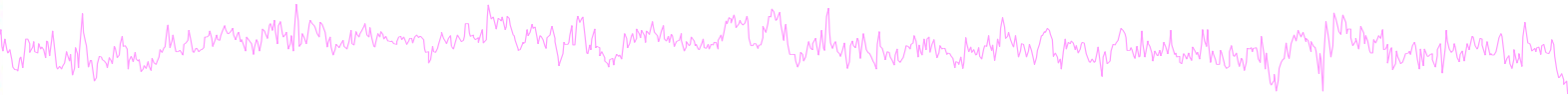
Scroll (epoched) channel data



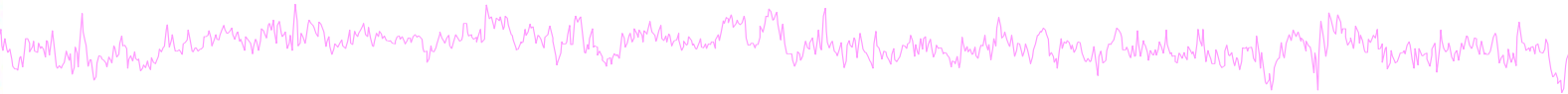
Reject epochs with artifact



Reject data epochs



Reject data epochs



visual inspection

Reject trials using data statistics - pop_rejmen0

Mark trials by appearance Scroll Data Marked trials: 0

Find abnormal values

Upper limit(s) (uV)	25	Lower limit(s) (uV)	-25
Start time(s) (ms)	-1000	Ending time(s) (ms)	1996
Electrode(s)	1-31	Currently marked trials	0

Calc / Plot Help

Find abnormal trends

Max slope (uV/epoch)	50	R-squared limit (0 to 1)	0.3
Electrode(s)	1-31	Currently marked trials	0

Calc / Plot Help

Find improbable data

Single-channel limit (std. dev.)	5	All channels limit (std. dev.)	5
Electrode(s)	1-31	Currently marked trials	0

Calculate Scroll Data Plot Help

Find abnormal distributions

Single-channel limit (std. dev.)	5	All channels limit (std. dev.)	5
Electrode(s)	1-31	Currently marked trials	0

Calculate Scroll Data Plot Help

Find abnormal spectra (slow)

Upper limit(s) (dB)	25	Lower limit(s) (dB)	-25
Low frequency(s) (Hz)	0	High frequency(s) (Hz)	50
Electrode(s)	1-31	Currently marked trials	0

Calc / Plot Help

Plotting options

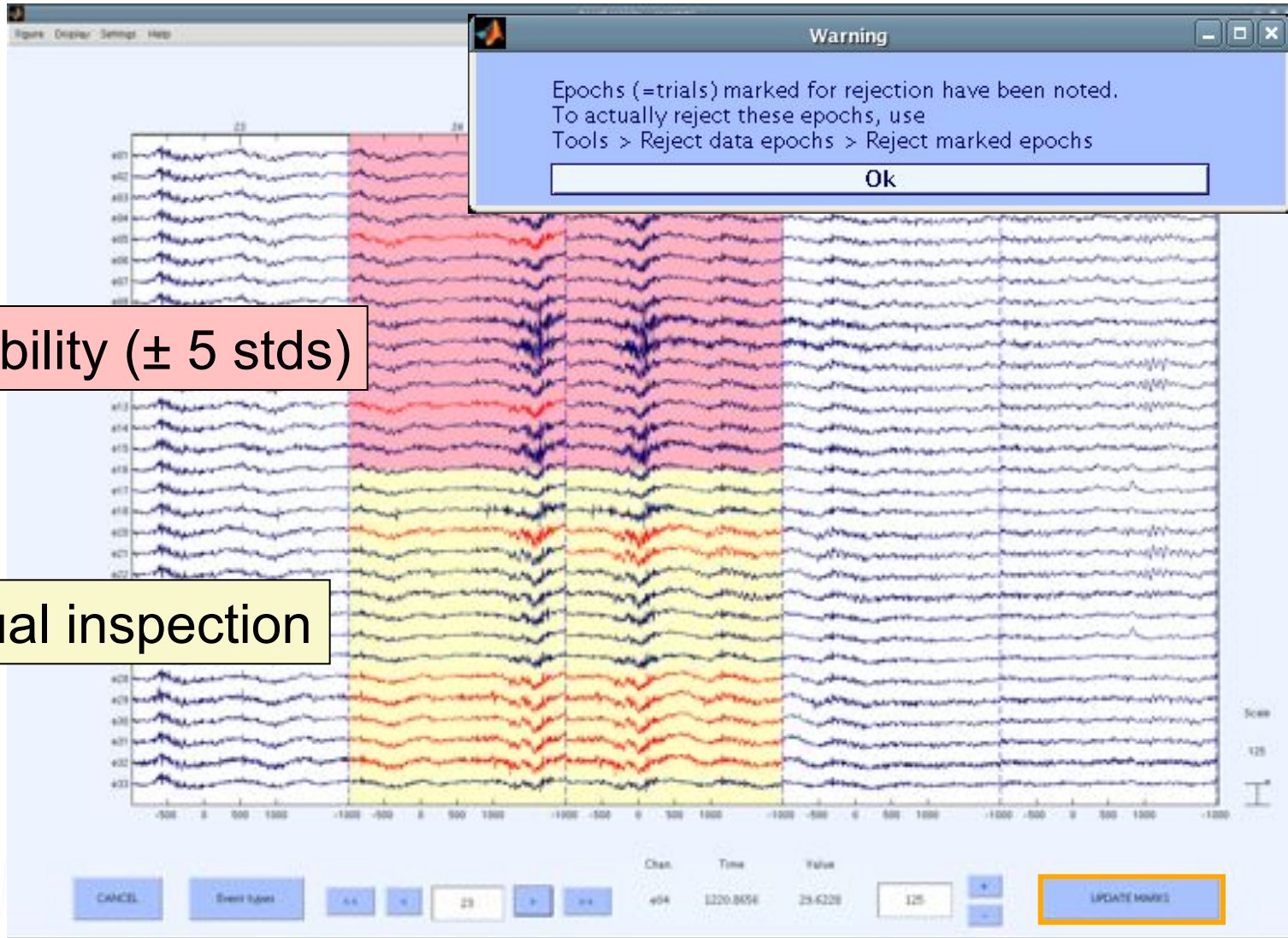
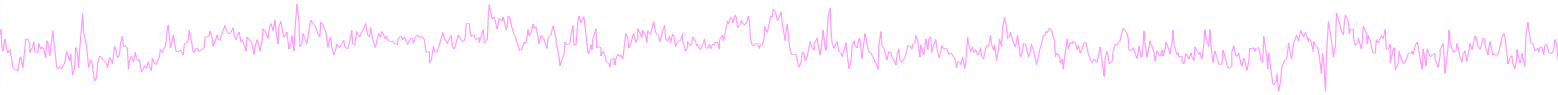
Show all trials marked for rejection by the measure selected above or checked below | /

<input checked="" type="checkbox"/> Abnormal appearance	<input checked="" type="checkbox"/> Abnormal values	<input checked="" type="checkbox"/> Abnormal trends
<input checked="" type="checkbox"/> Improbable epochs	<input checked="" type="checkbox"/> Abnormal distributions	<input checked="" type="checkbox"/> Abnormal spectra

Close (keep marks) Clear all marks Reject marked trials

probability

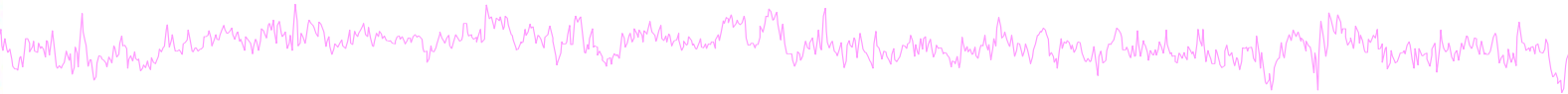
Reject data epochs



Probability (± 5 stds)

Visual inspection

Plot channel measures over time



Reject trials using data statistics - pop_rejmen0

Mark trials by appearance Scroll Data Marked trials: 0

Find abnormal values

Upper limit(s) (uV)	<input type="text" value="25"/>	Lower limit(s) (uV)	<input type="text" value="-25"/>
Start time(s) (ms)	<input type="text" value="-1000"/>	Ending time(s) (ms)	<input type="text" value="1996"/>
Electrode(s)	<input type="text" value="1-31"/>	Currently marked trials	<input type="text" value="0"/>

Calc / Plot

Find abnormal trends

Max slope (uV/epoch)	<input type="text" value="50"/>	R-squared limit (0 to 1)	<input type="text" value="0.3"/>
Electrode(s)	<input type="text" value="1-31"/>	Currently marked trials	<input type="text" value="0"/>

Calc / Plot

Find improbable data

Single-channel limit (std. dev.)	<input type="text" value="5"/>	All channels limit (std. dev.)	<input type="text" value="5"/>
Electrode(s)	<input type="text" value="1-31"/>	Currently marked trials	<input type="text" value="0"/>

Calculate

Find abnormal distributions

Single-channel limit (std. dev.)	<input type="text" value="5"/>	All channels limit (std. dev.)	<input type="text" value="5"/>
Electrode(s)	<input type="text" value="1-31"/>	Currently marked trials	<input type="text" value="0"/>

Calculate

Find abnormal spectra (slow)

Upper limit(s) (dB)	<input type="text" value="25"/>	Lower limit(s) (dB)	<input type="text" value="-25"/>
Low frequency(s) (Hz)	<input type="text" value="0"/>	High frequency(s) (Hz)	<input type="text" value="50"/>
Electrode(s)	<input type="text" value="1-31"/>	Currently marked trials	<input type="text" value="0"/>

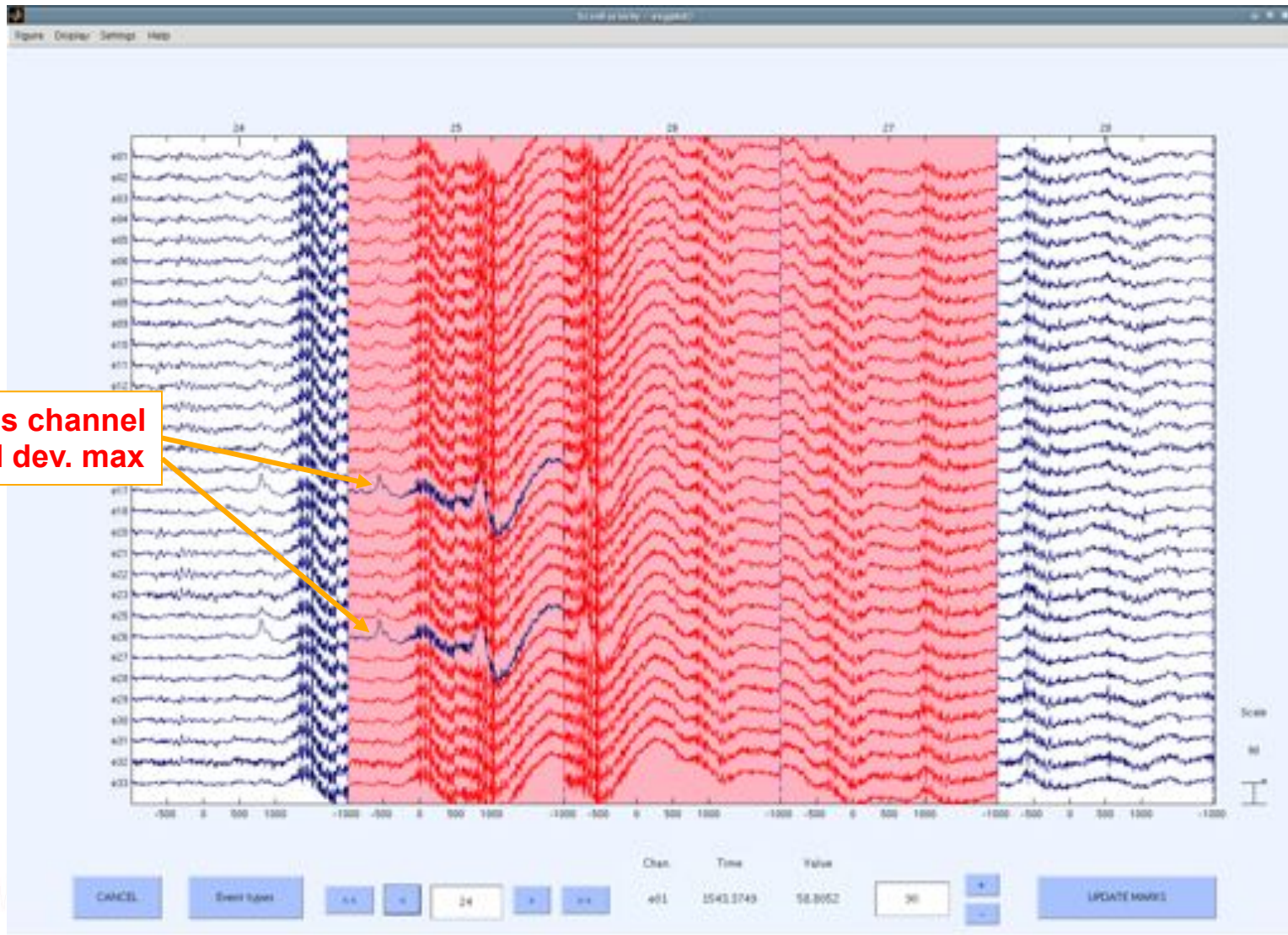
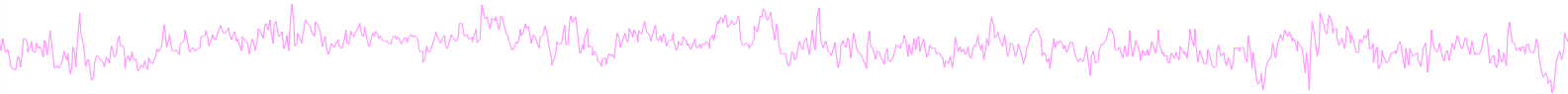
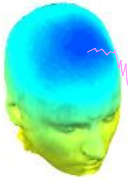
Calc / Plot

Plotting options

Show all trials marked for rejection by the measure selected above or checked below

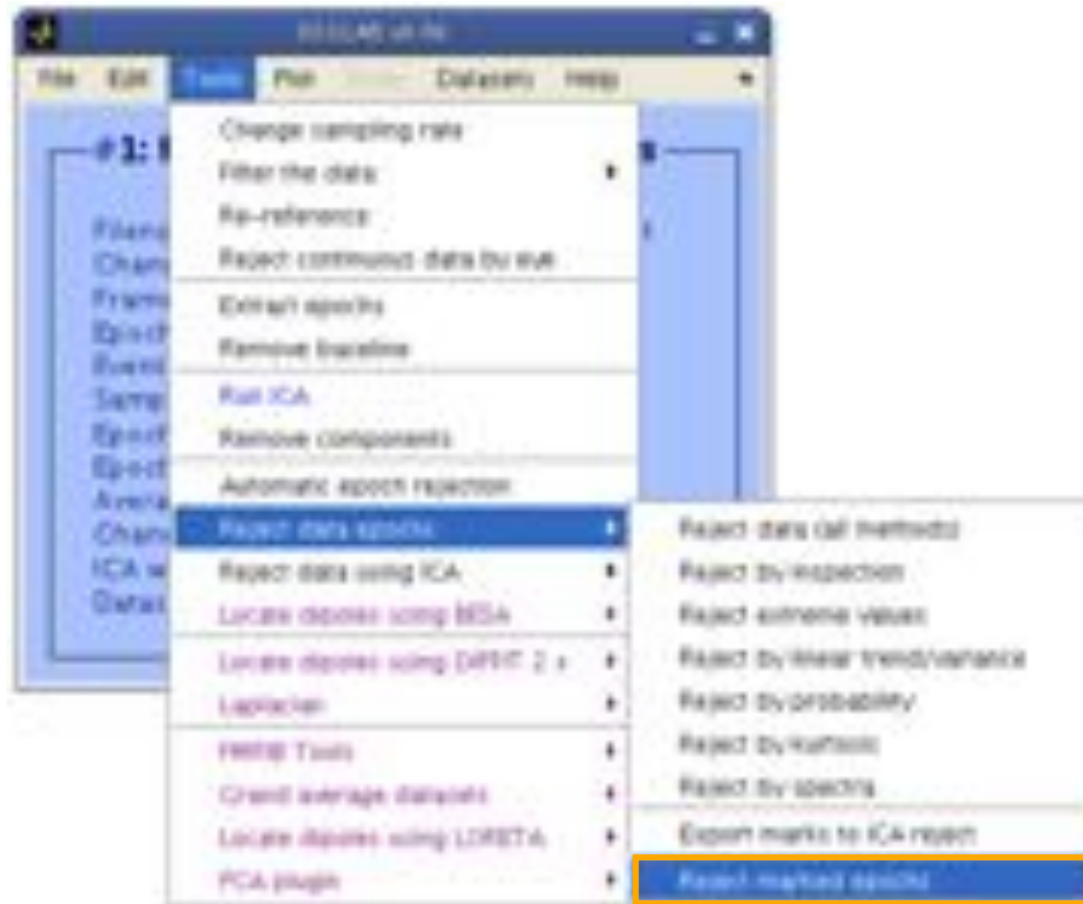
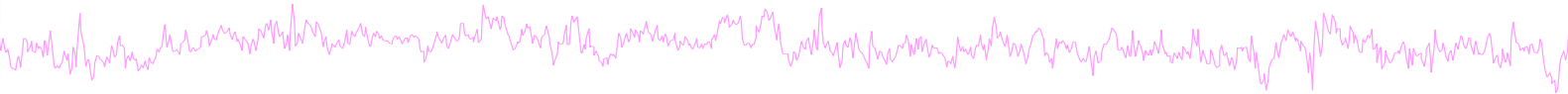
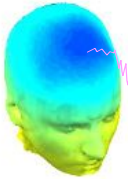
<input checked="" type="checkbox"/> Abnormal appearance	<input checked="" type="checkbox"/> Abnormal values	<input checked="" type="checkbox"/> Abnormal trends
<input checked="" type="checkbox"/> Improbable epochs	<input checked="" type="checkbox"/> Abnormal distributions	<input checked="" type="checkbox"/> Abnormal spectra

Reject data epochs

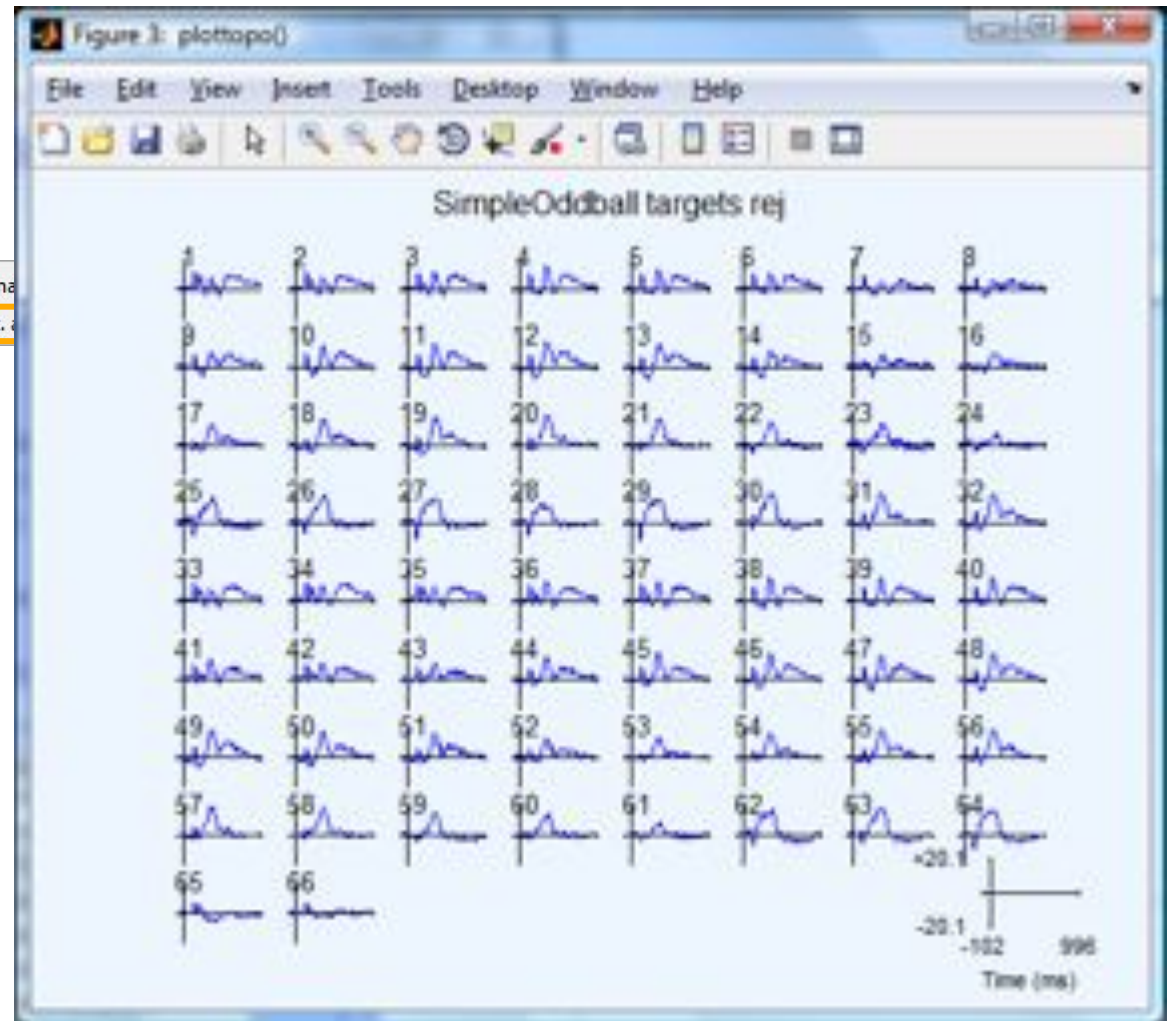
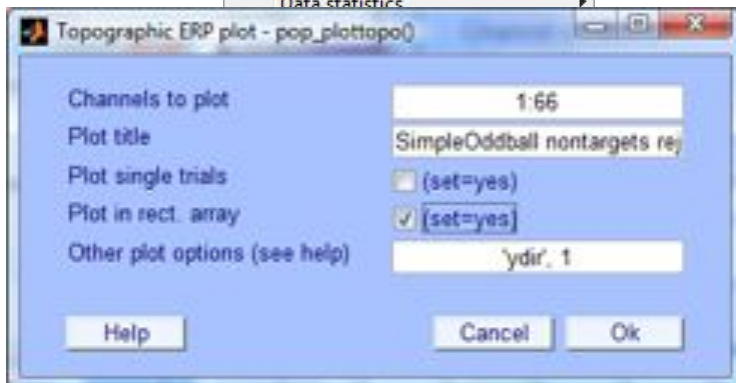
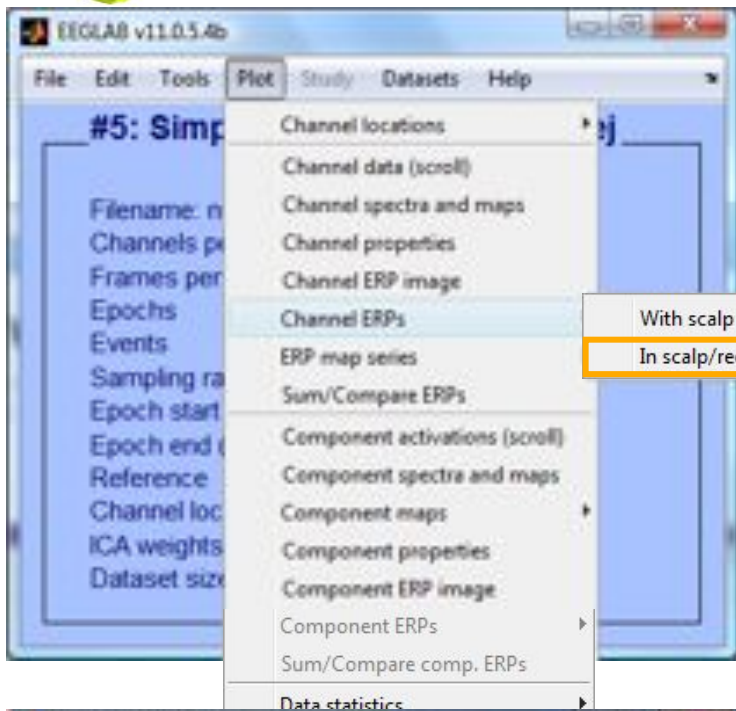
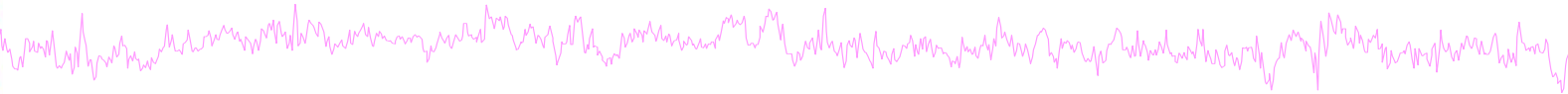
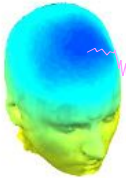


Exceeds channel standard dev. max

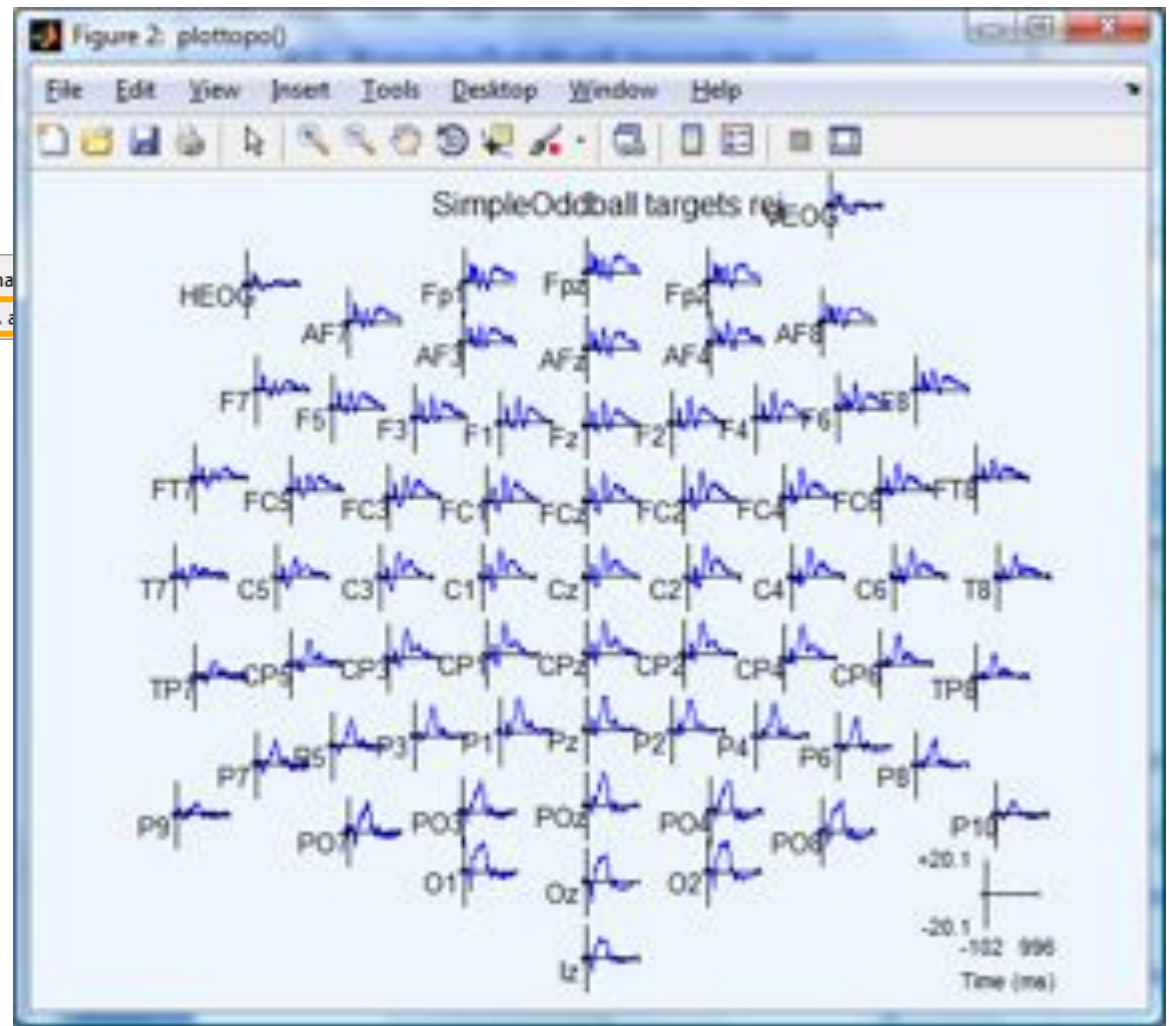
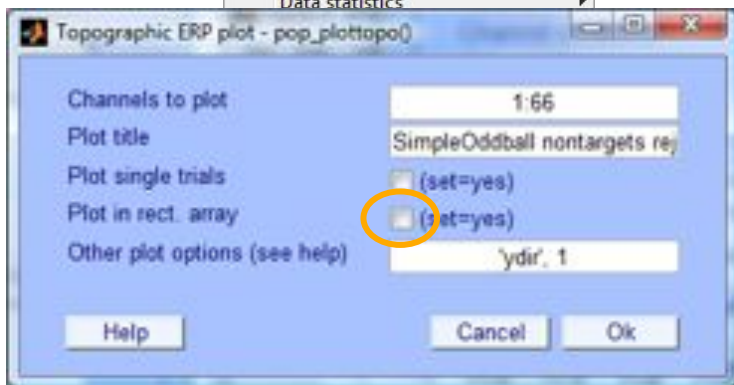
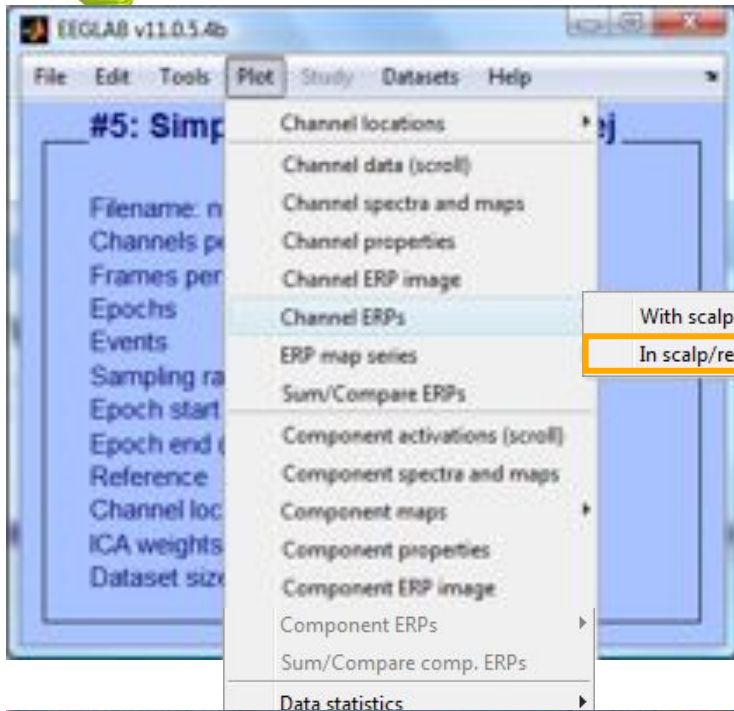
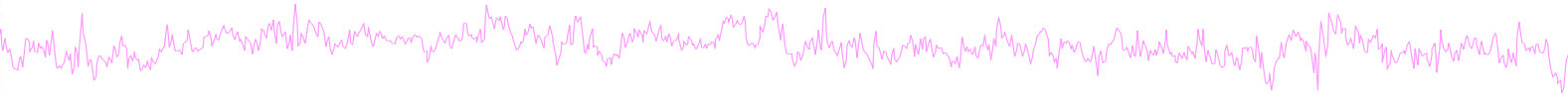
Reject data epochs



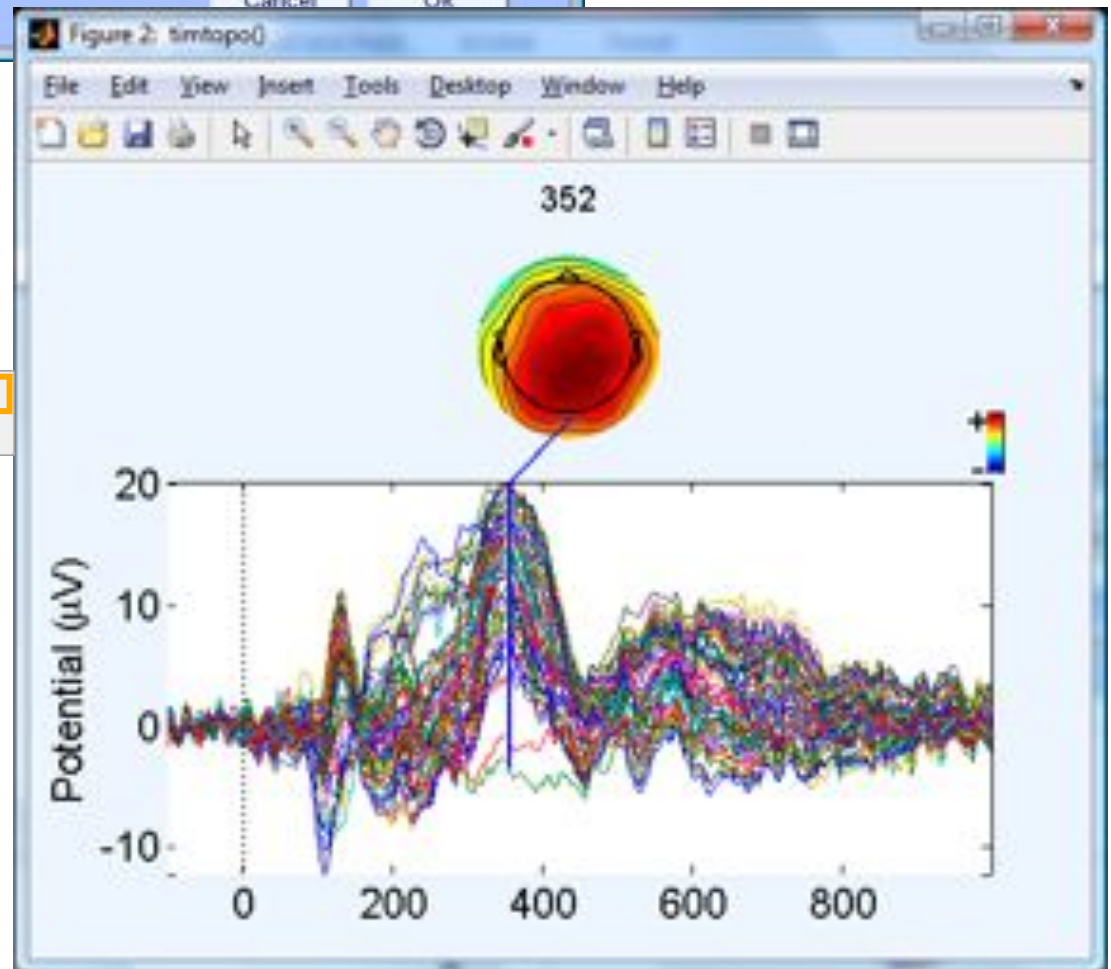
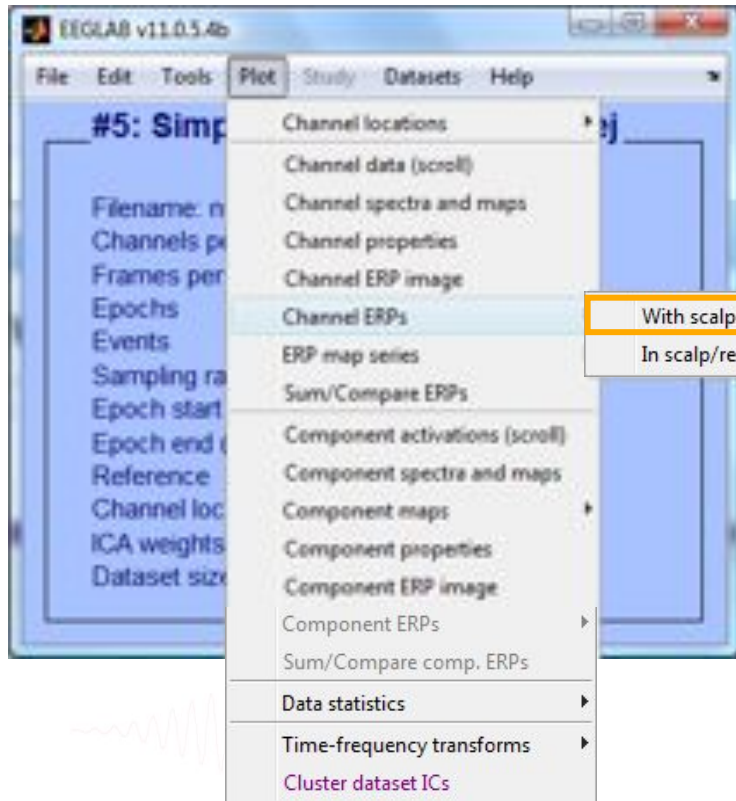
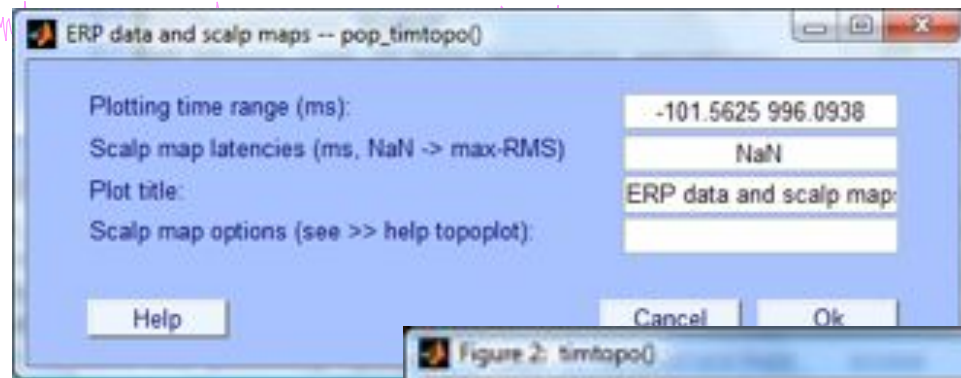
Visualize ERP in rectangular array



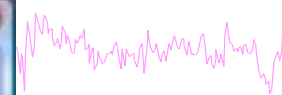
Visualize ERP in topographic array



Visualize ERP scalp distribution



Visualize channel ERPs in 2D



EEGLAB v11.0.5.4b

File Edit Tools **Plot** Study Data

#4: SimpleOddball

Filename: n...
Channels per...
Frames per...
Epochs
Events
Sampling ra...
Epoch start...
Epoch end (...
Reference
Channel loca...
ICA weights
Dataset size

- Channel location
- Channel data (...
- Channel spectr...
- Channel prop...
- Channel ERP im...
- 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

Plot ERP scalp maps in 2-D — pop_topoplot()

Plotting ERP scalp maps at these latencies
(range: -102 to 996 ms. NaN -> empty):

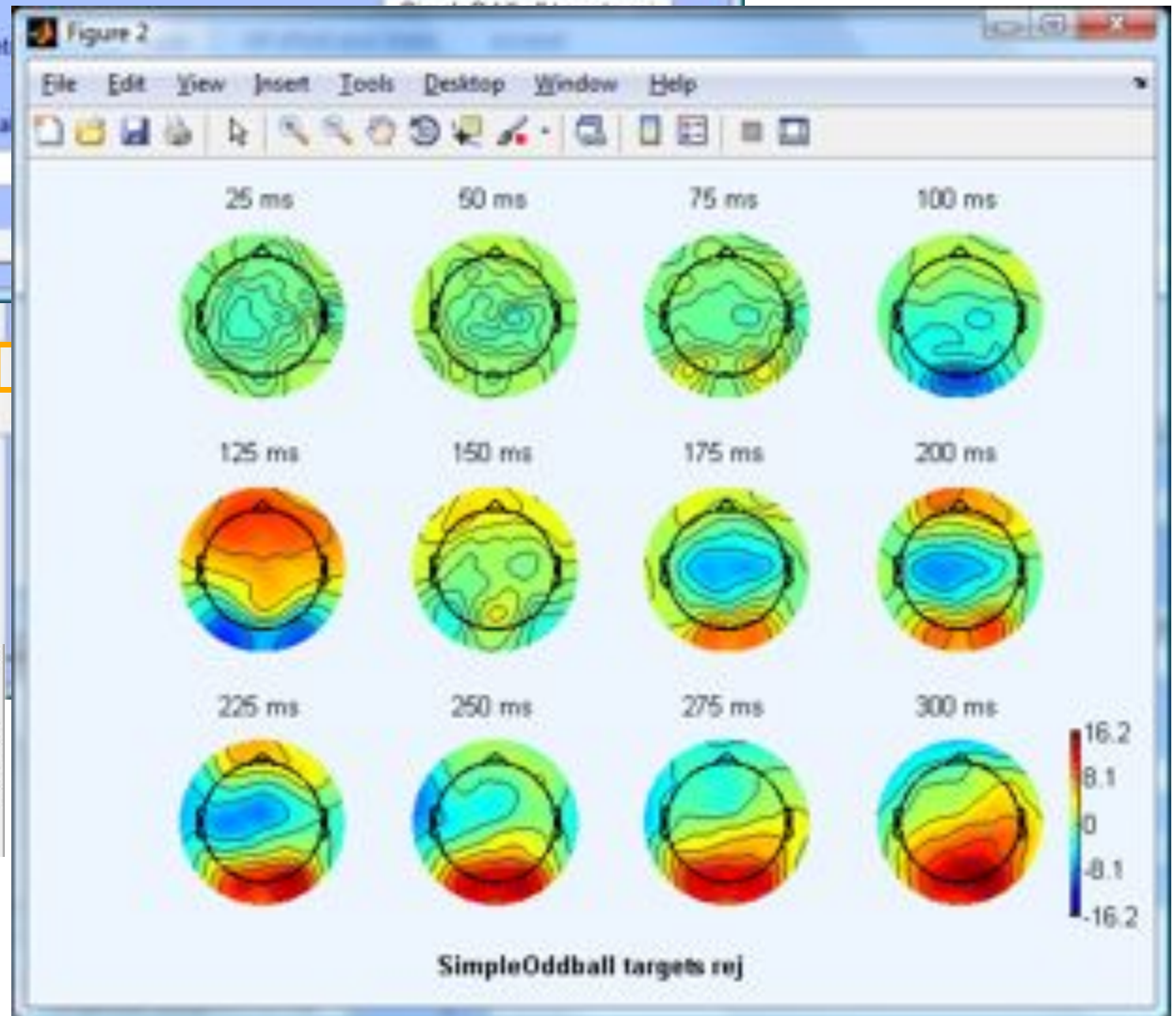
25:25:300

Plot title

Plot geomet...

-> Additional

Help



Visualize channel ERPs in 3D



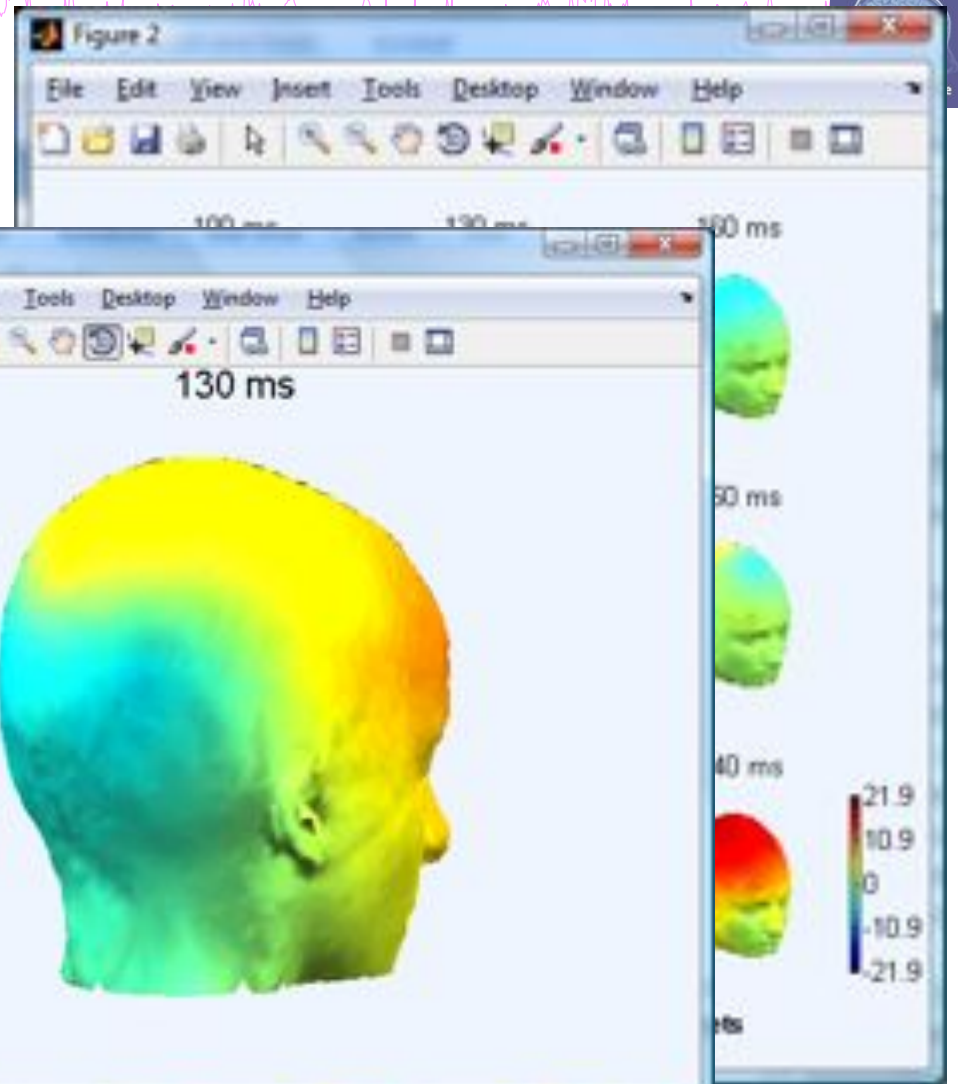
EEGLAB v11.0.5.4b

File Edit Tools **Plot** Study Datasets Help

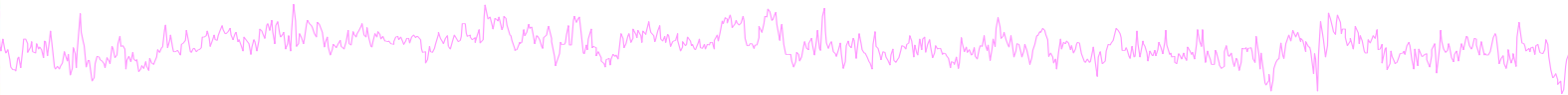
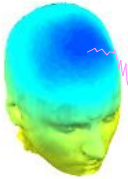
#4: Simp

Filename: n
Channels pe
Frames per
Epochs
Events
Sampling ra
Epoch start
Epoch end
Reference
Channel loc
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
- Cluster dataset ICs

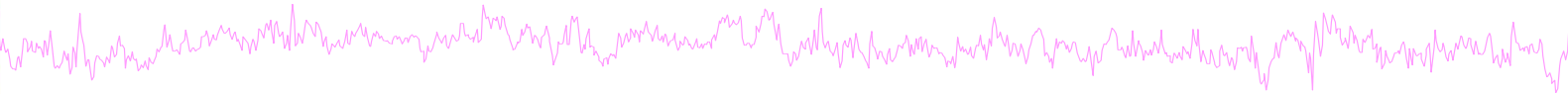
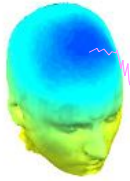


Exercises



- Load SimpleOddball.set
- Rereference data to average reference
- Hi-pass filter the continuous data, then save
- Epoch the data on circles (event type 1) and stars (event type 2)
- Scroll the epoched data and perform visual rejection of epochs
- Explore the automated artifact rejection tools
- Save 'clean' epoched datasets for circles and stars



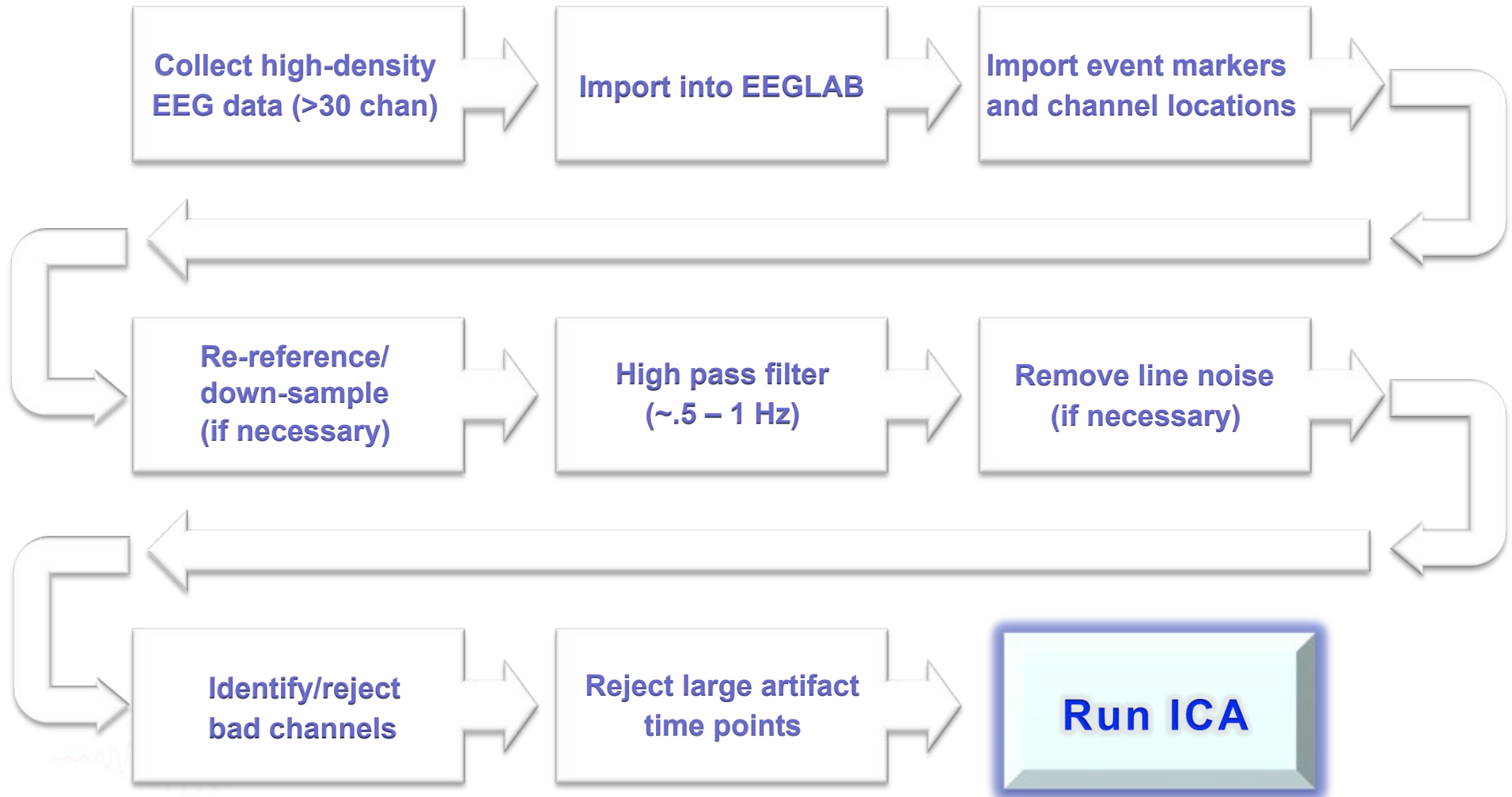
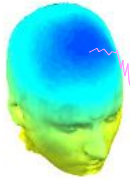


EEGLAB Processing

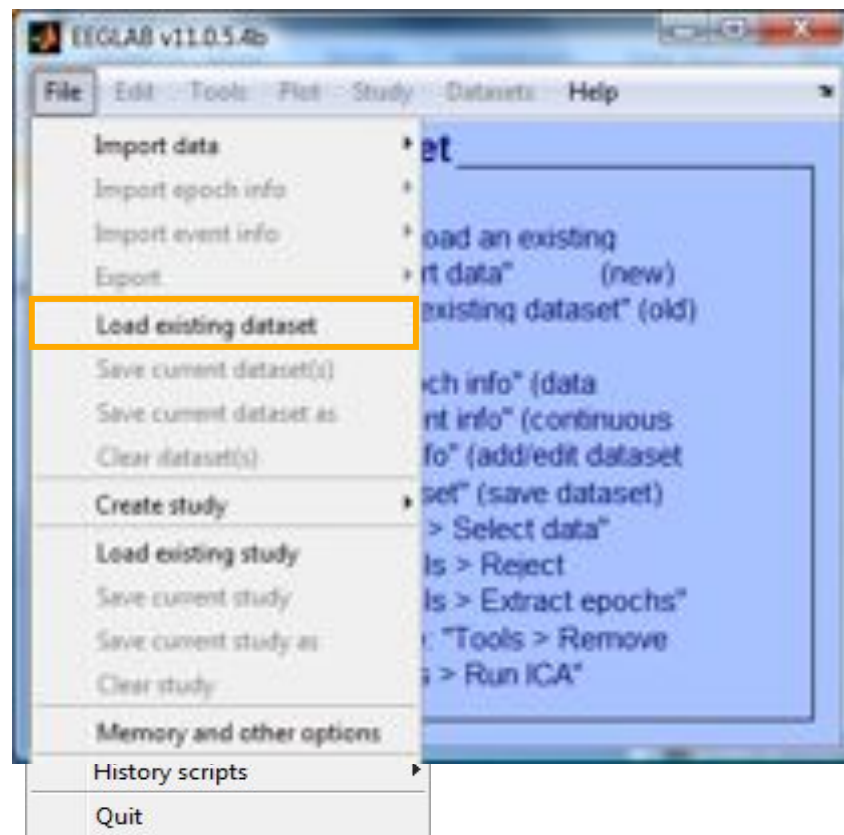
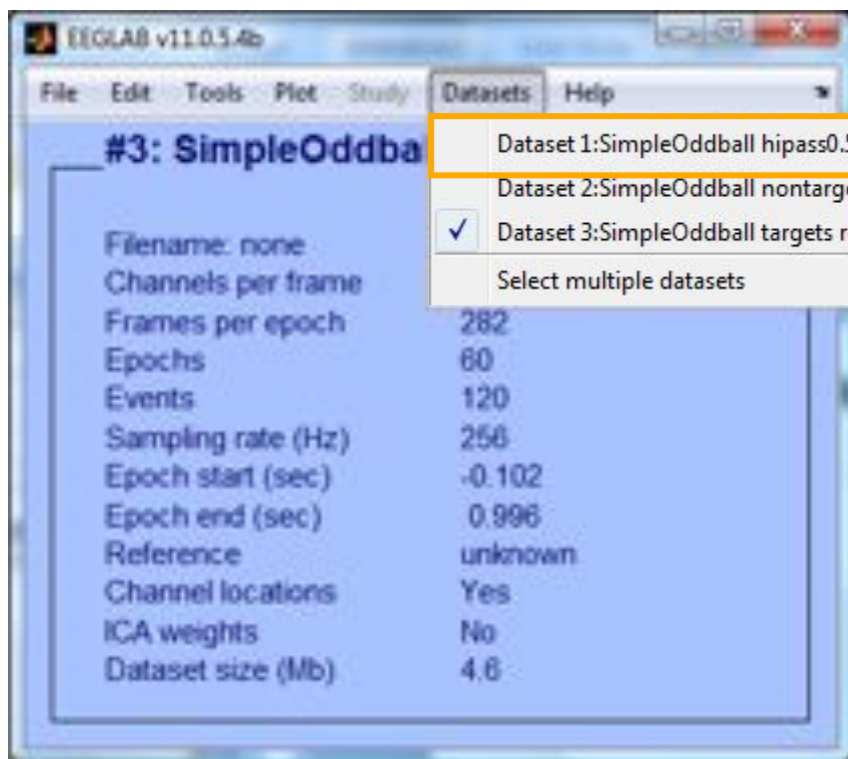
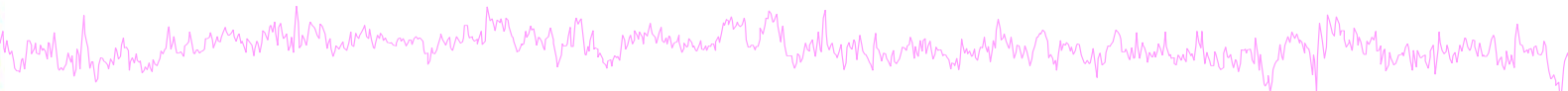
Data cleaning for ICA



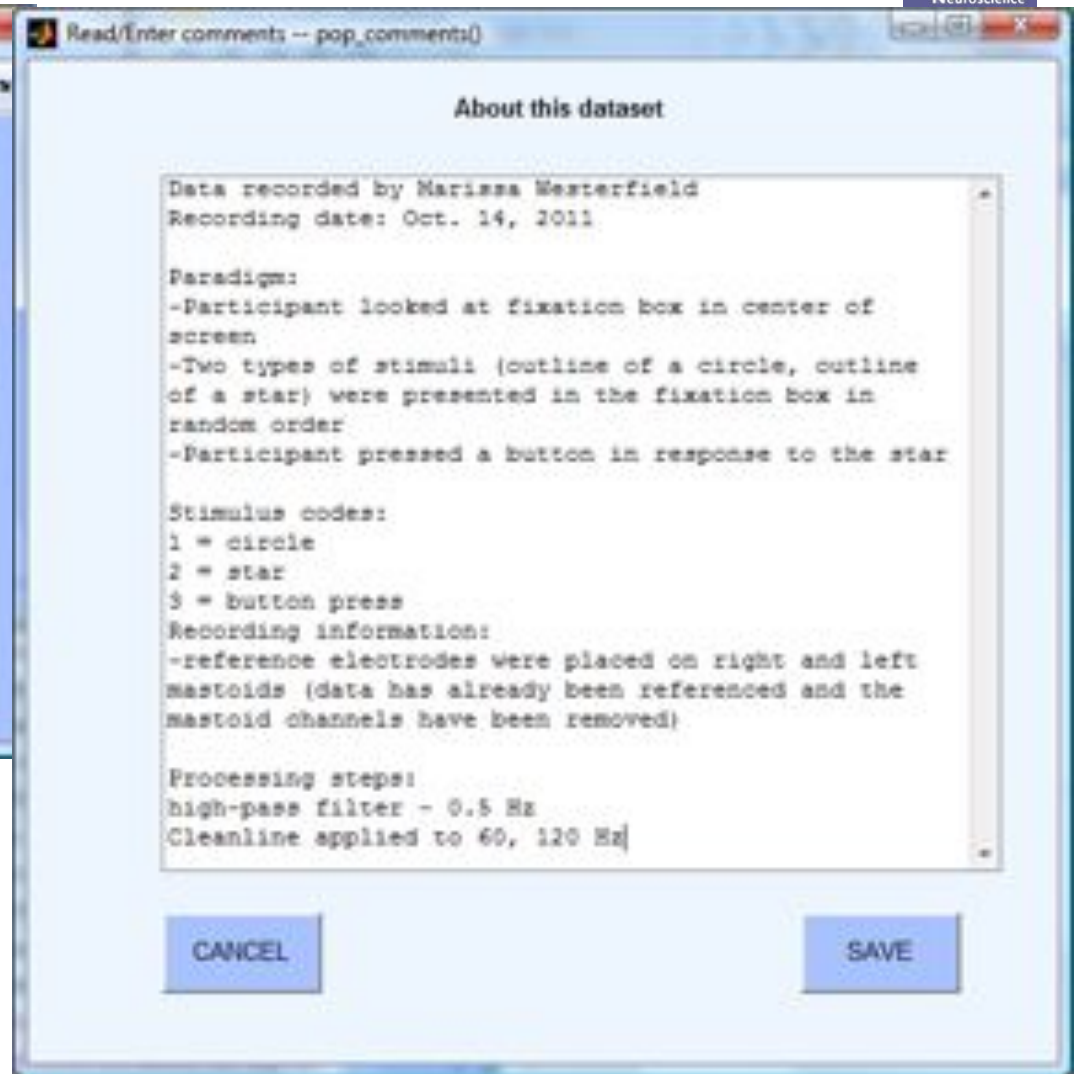
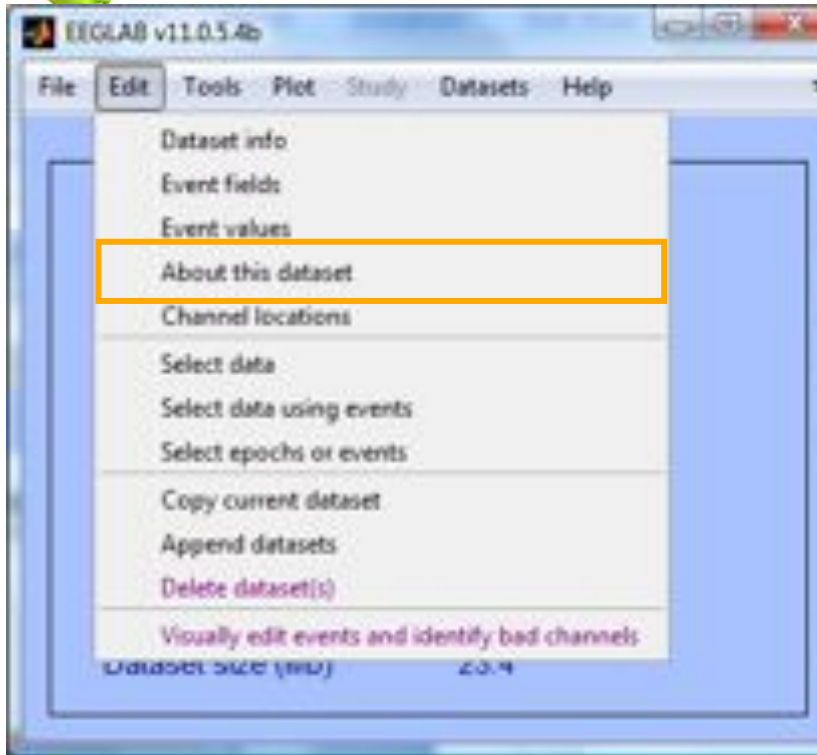
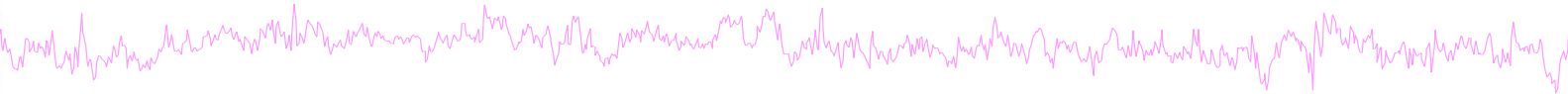
Pre-processing pipeline



Retrieve or reload continuous EEG dataset



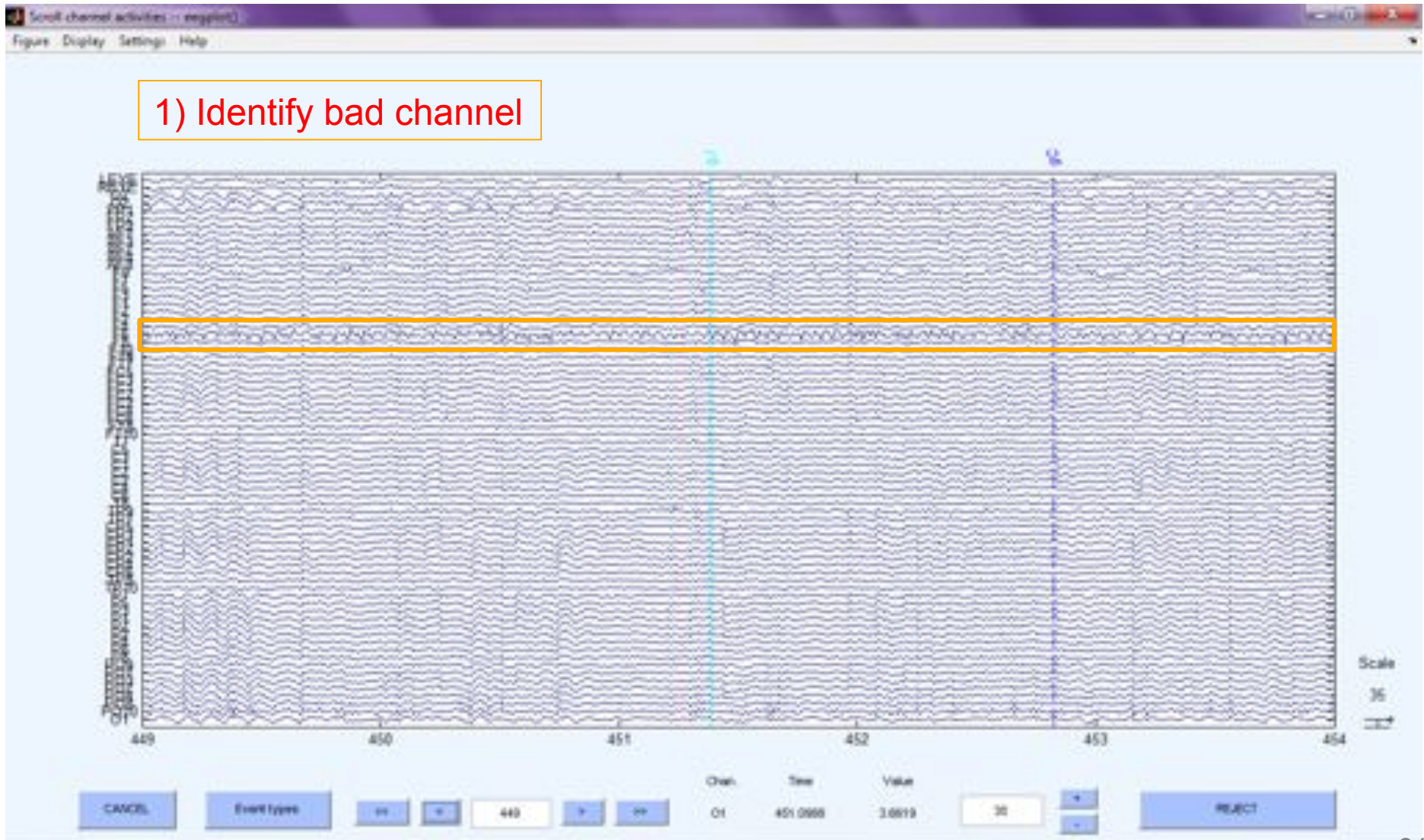
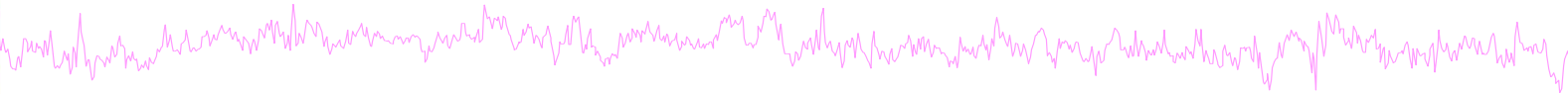
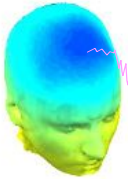
Comments and dataset history



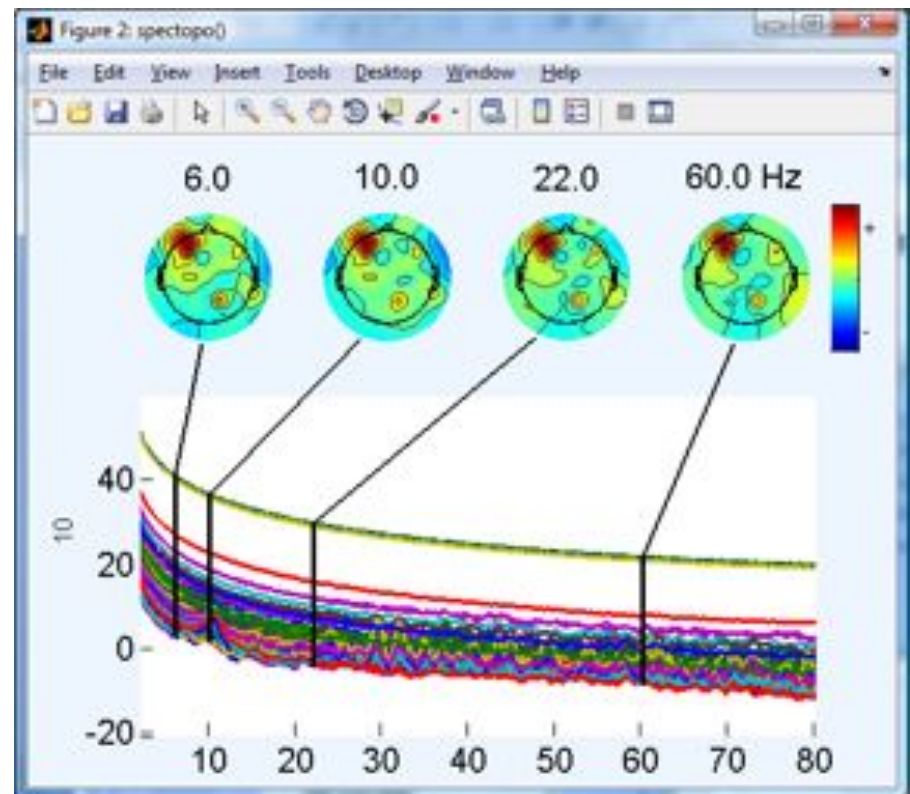
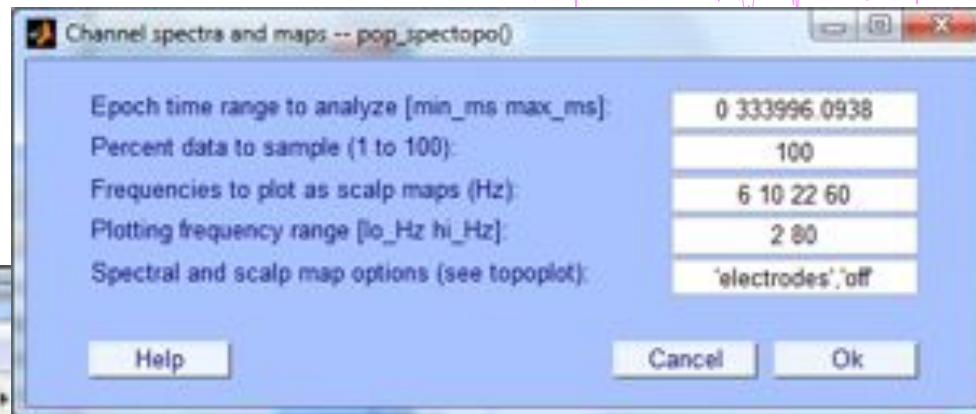
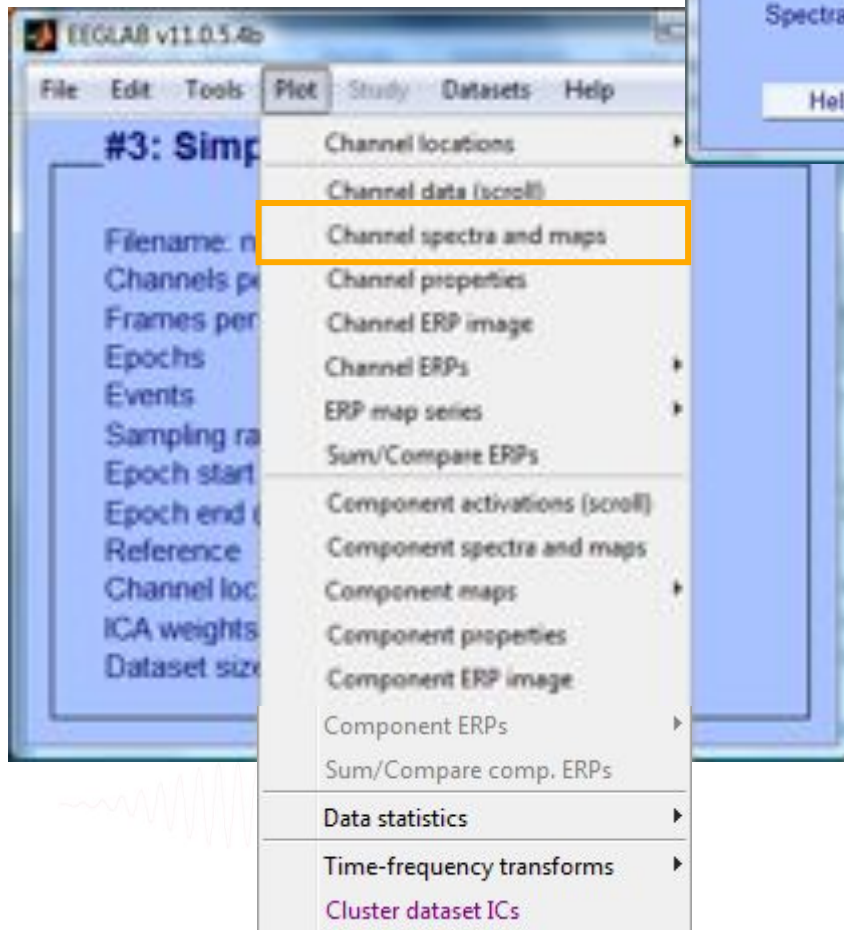
Also:
>> EEG.comments

or
>> EEG.history

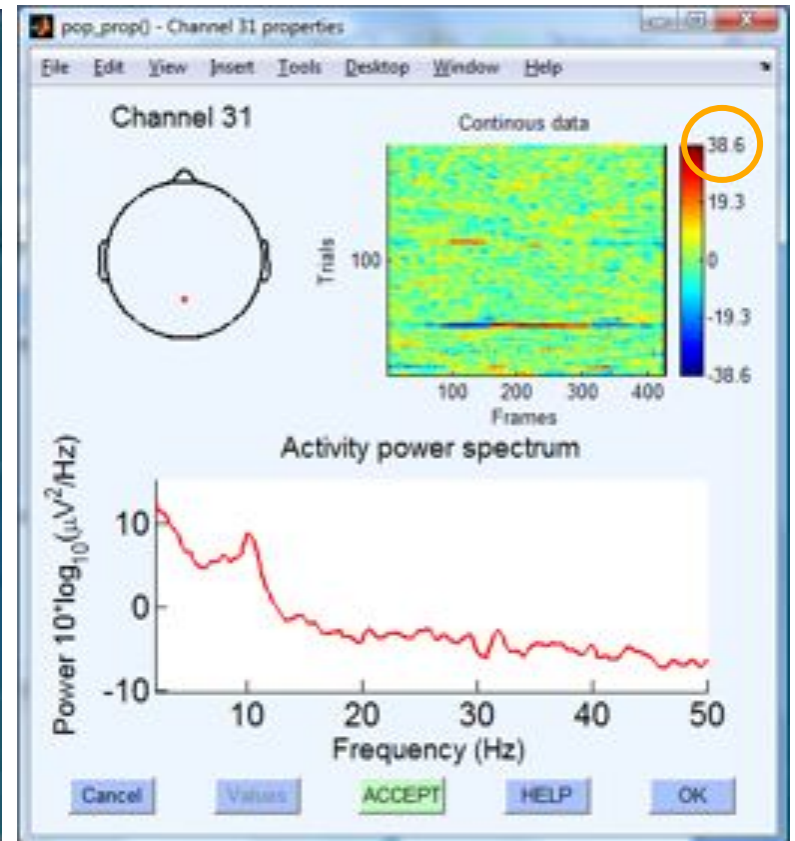
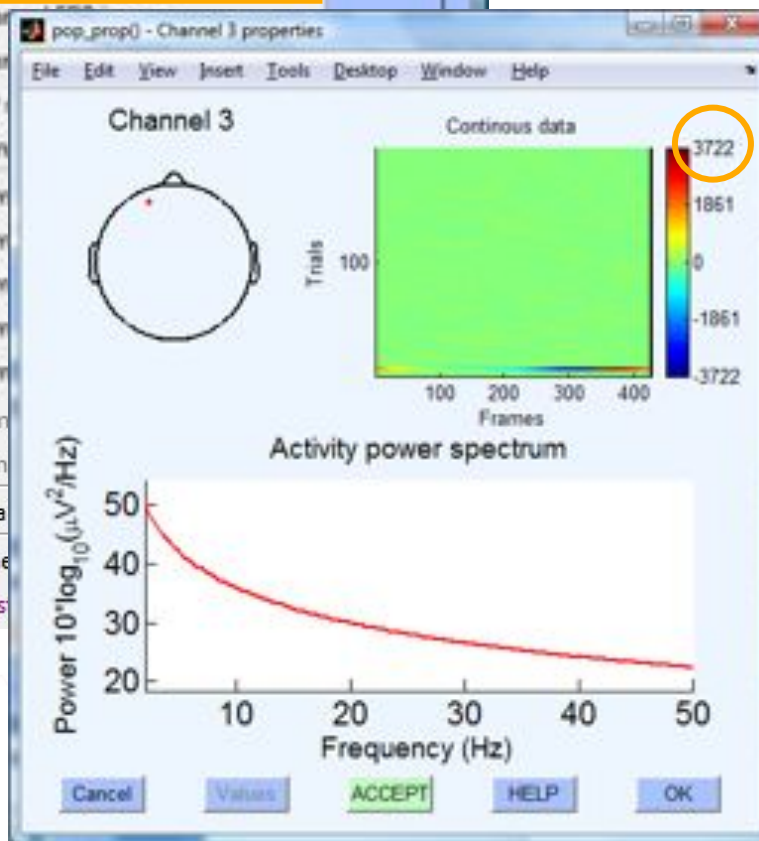
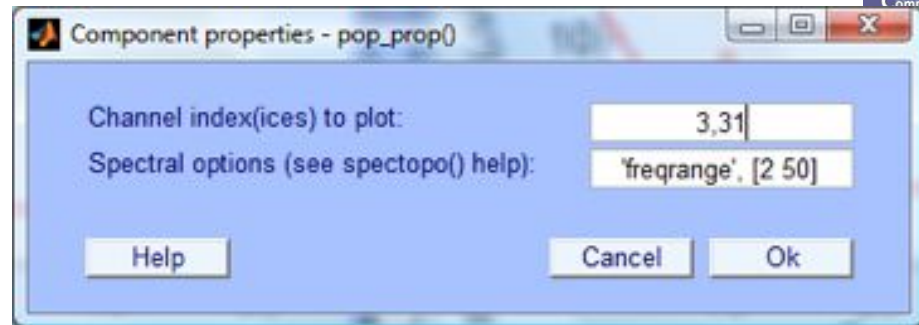
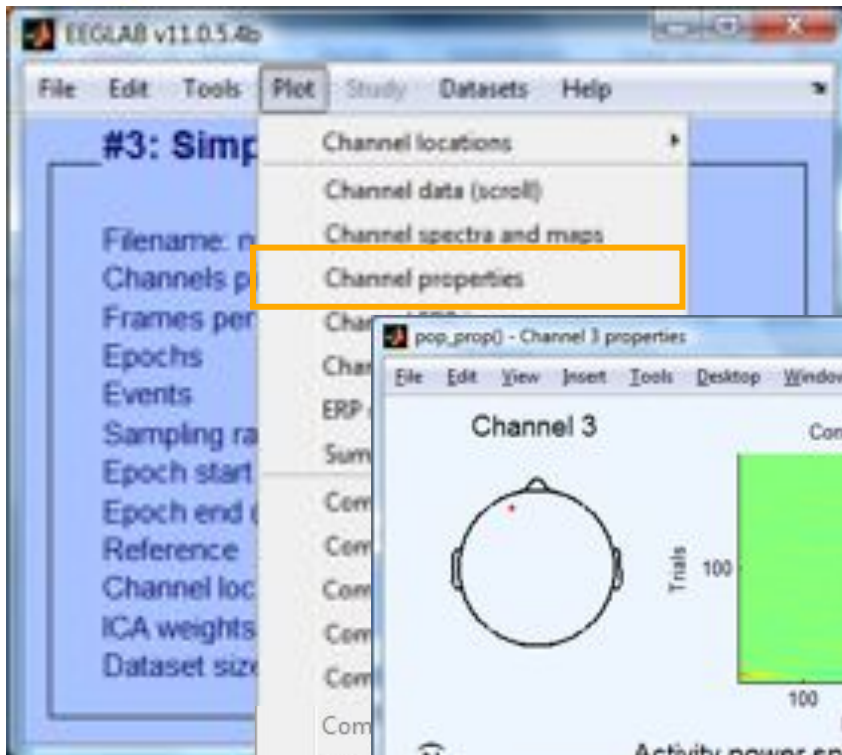
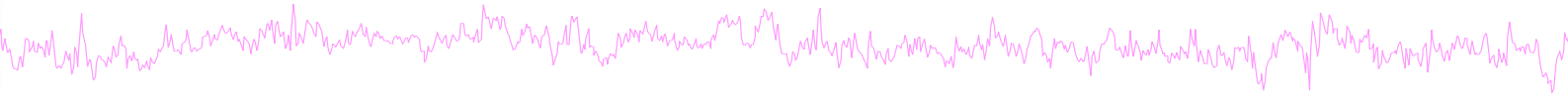
Manually identifying bad channels



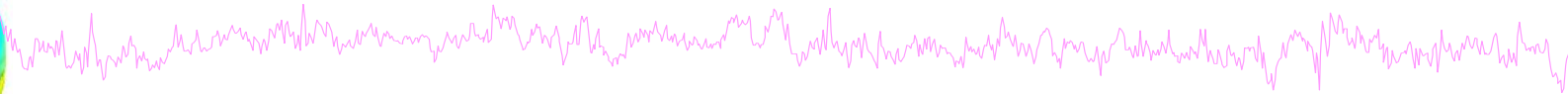
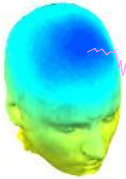
Manually identifying bad channels



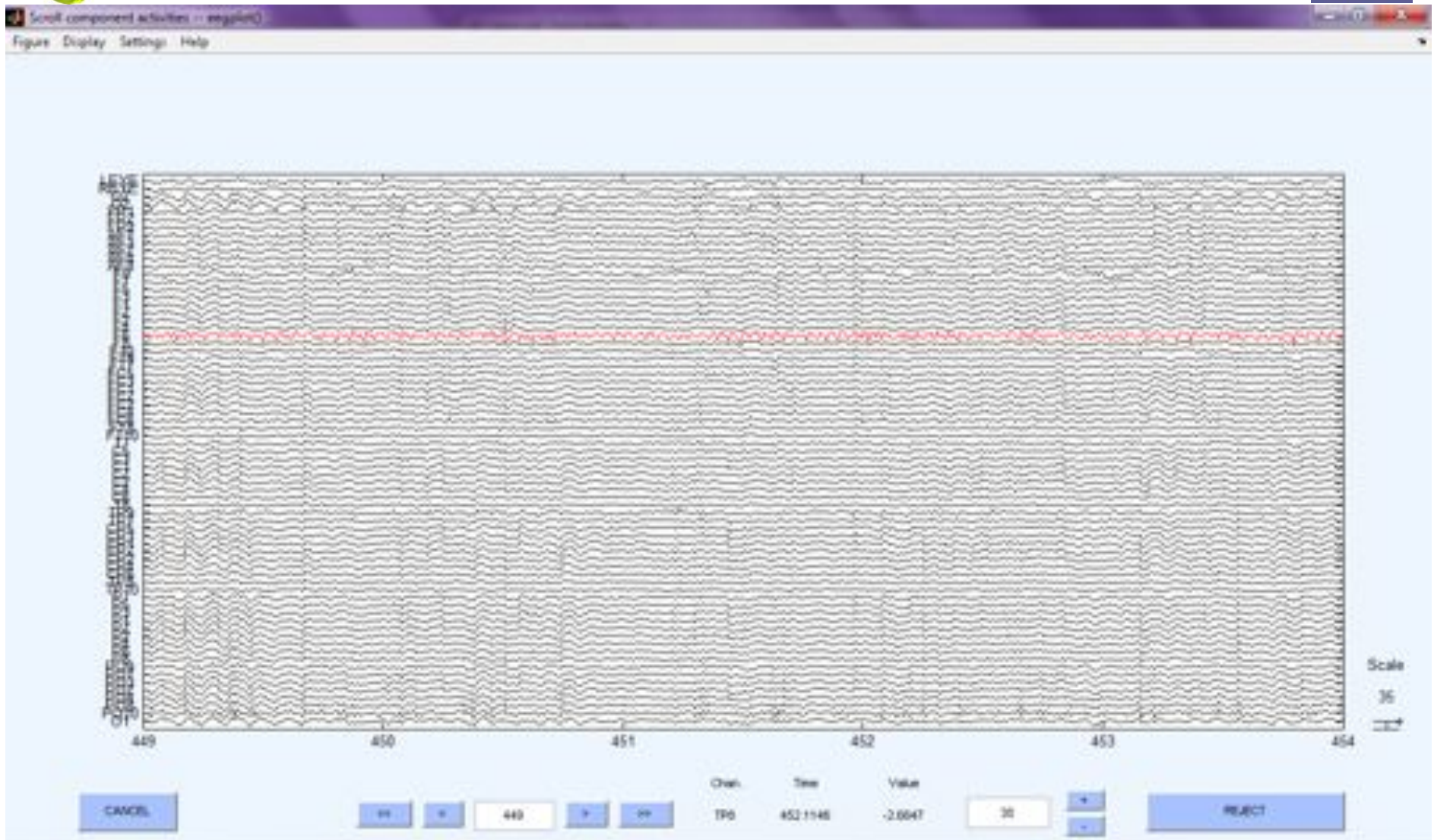
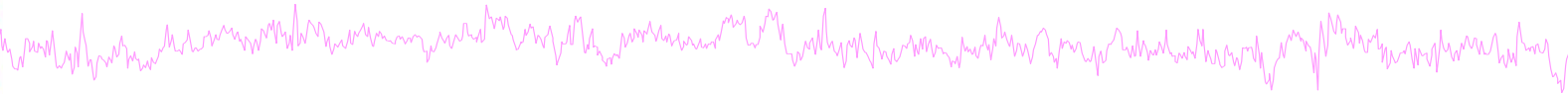
Manually identifying bad channels



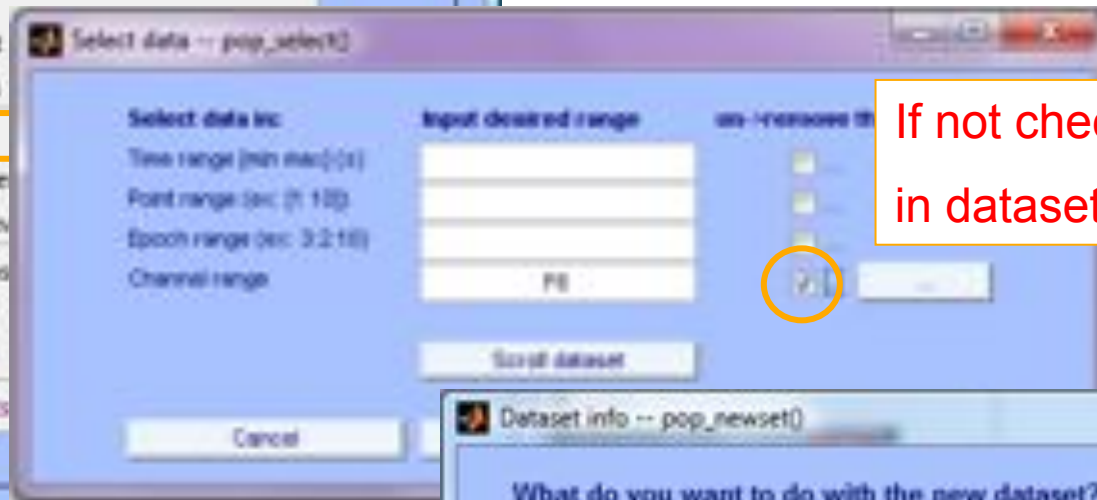
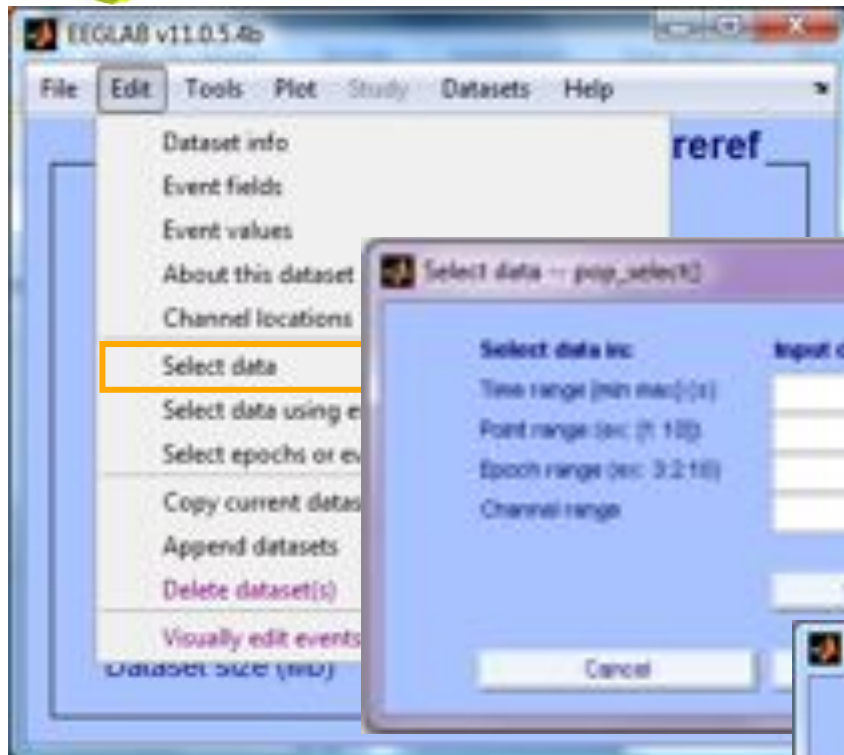
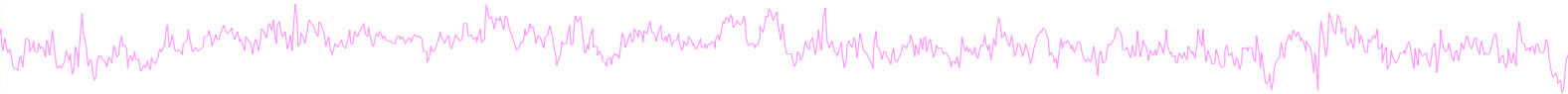
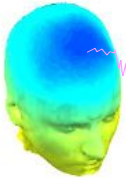
Auto-detection of noisy channels



Auto-detected noisy channel



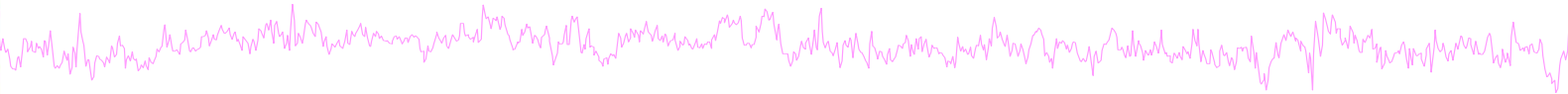
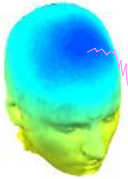
Removing channel(s)



If not checked, will result in dataset with one channel



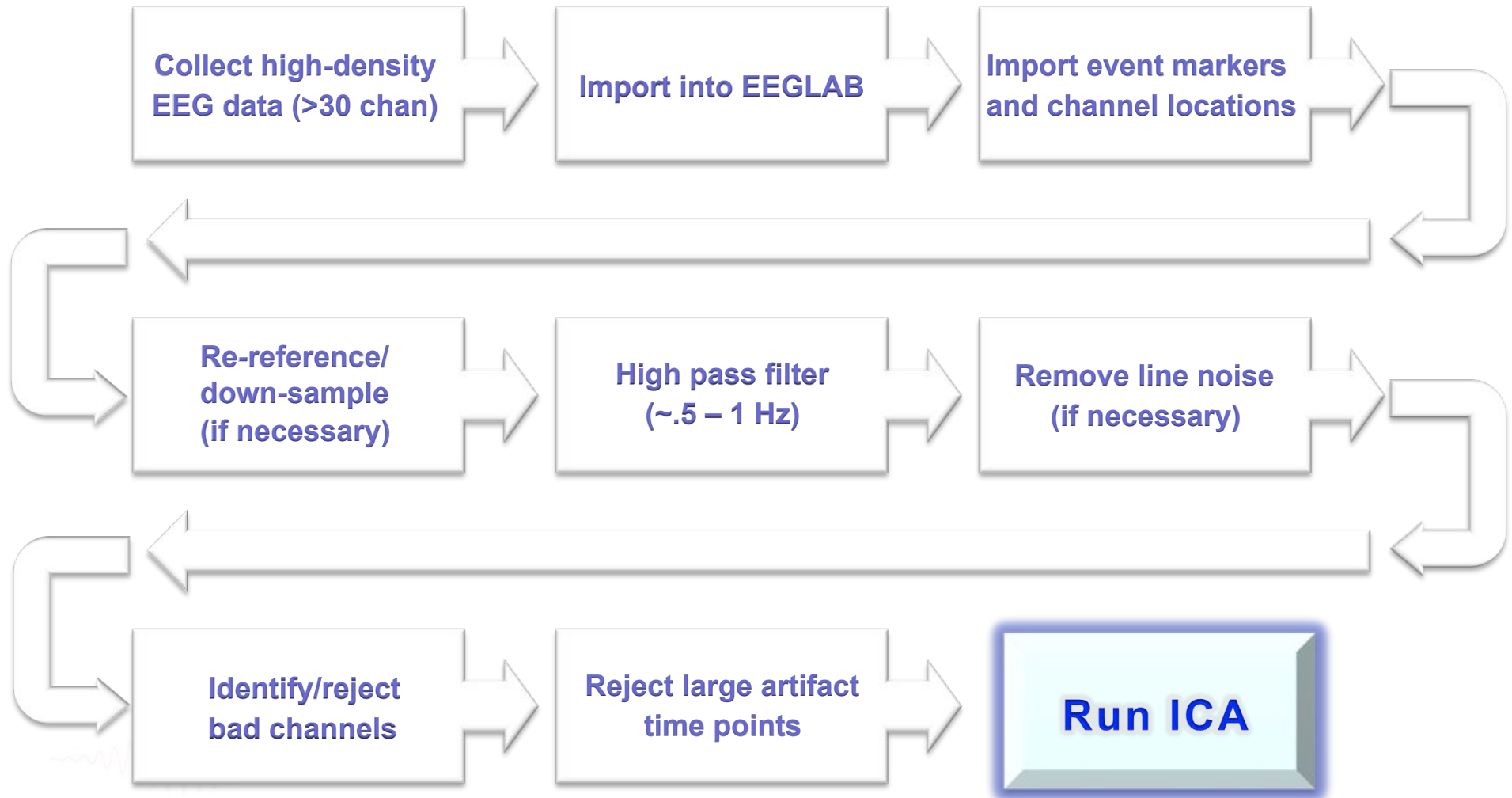
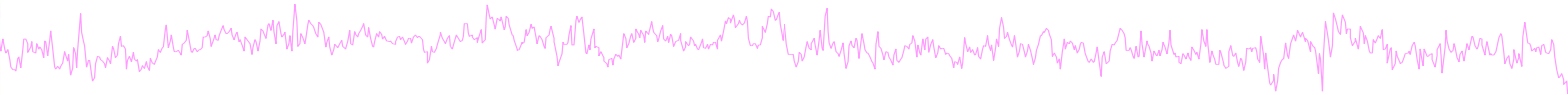
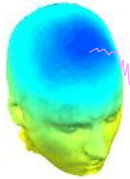
Removing channel(s)



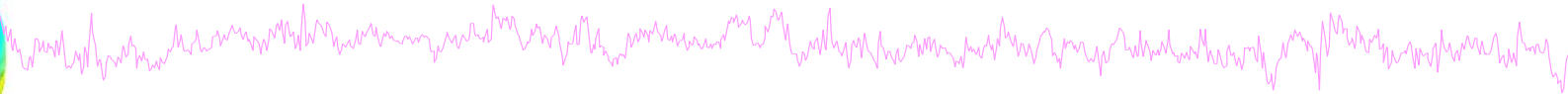
- You may prefer to interpolate bad channels rather than remove them altogether
- The loss in dimensionality will affect the ICA decomposition
- Usual solution:
 - Delete the bad channels before running ICA
 - STUDY tools will do much of this automatically (interpolate missing channels, etc)



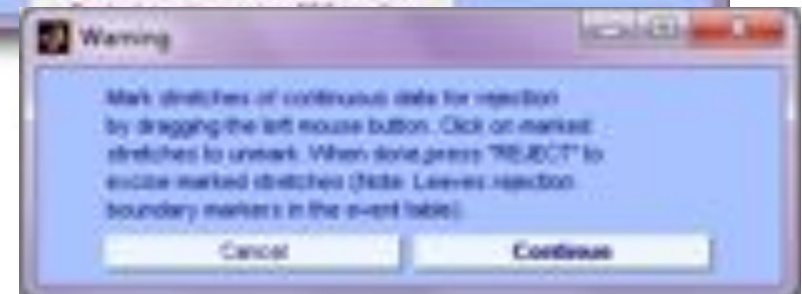
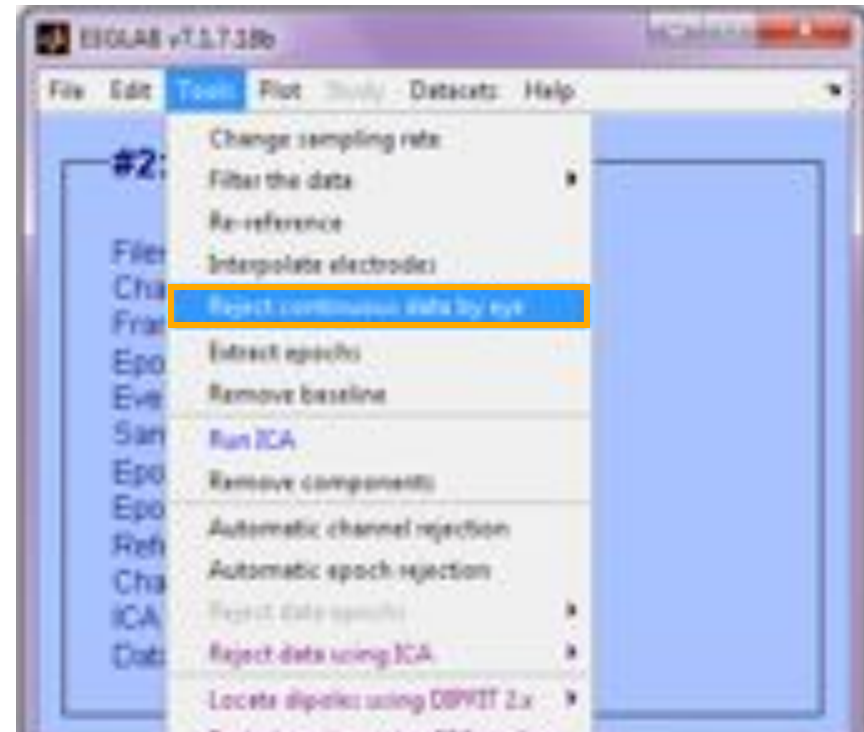
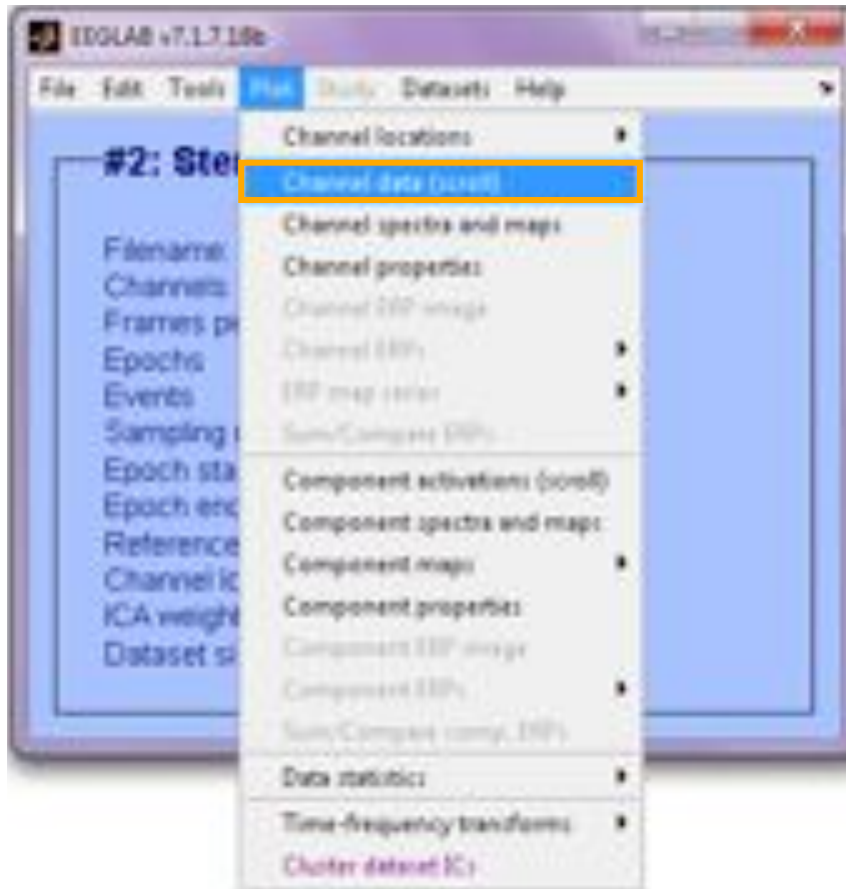
Pre-processing pipeline



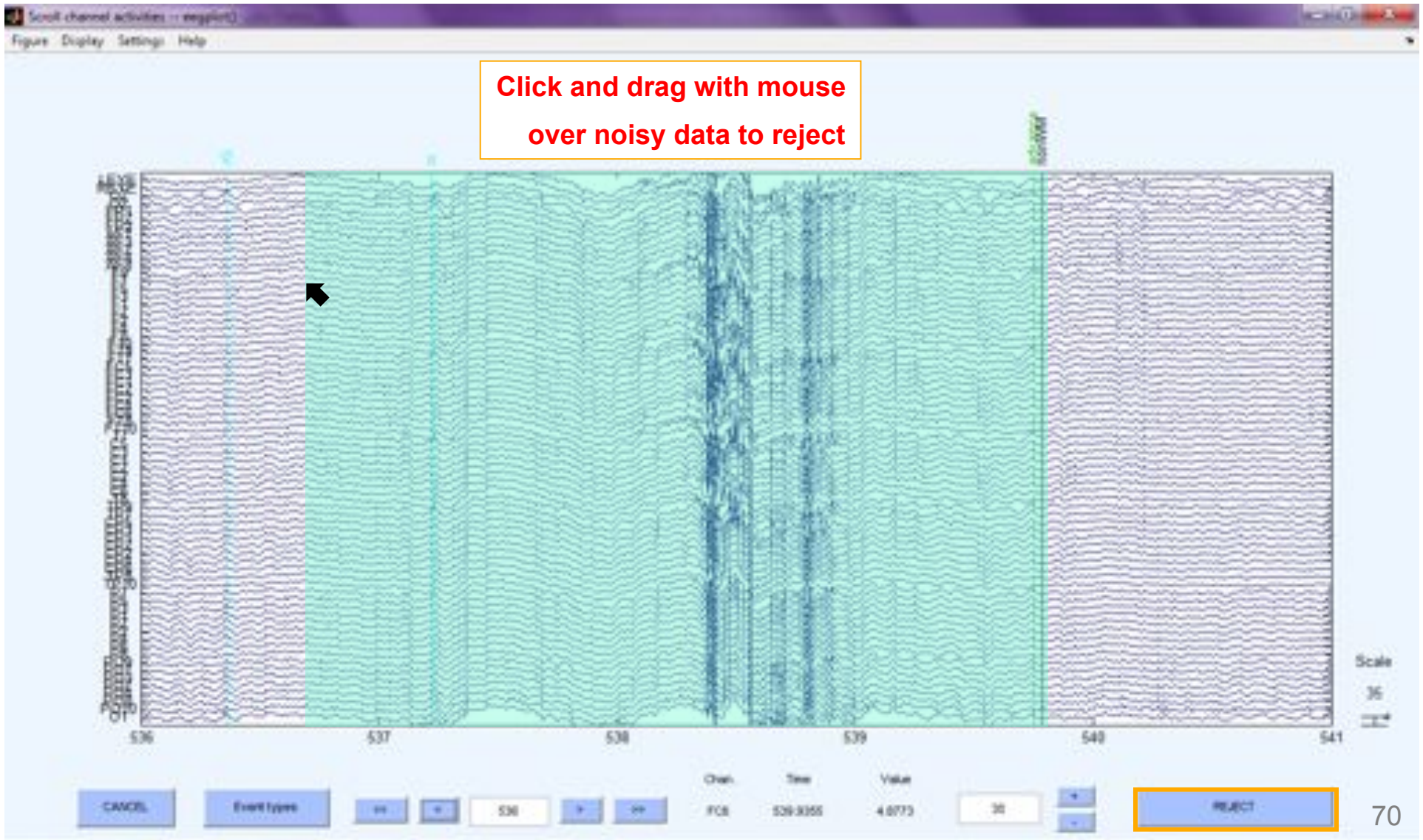
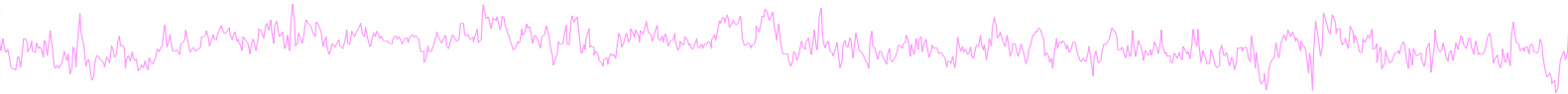
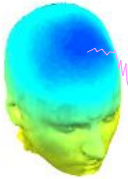
Reject continuous data



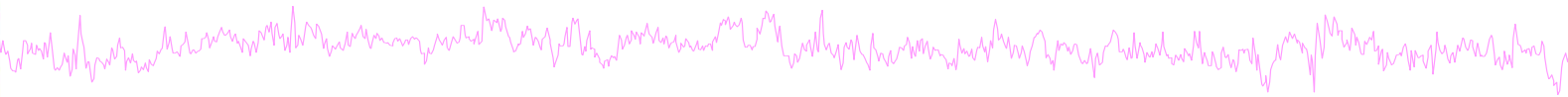
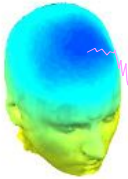
Equivalent



Reject continuous data



Rejecting data for ICA

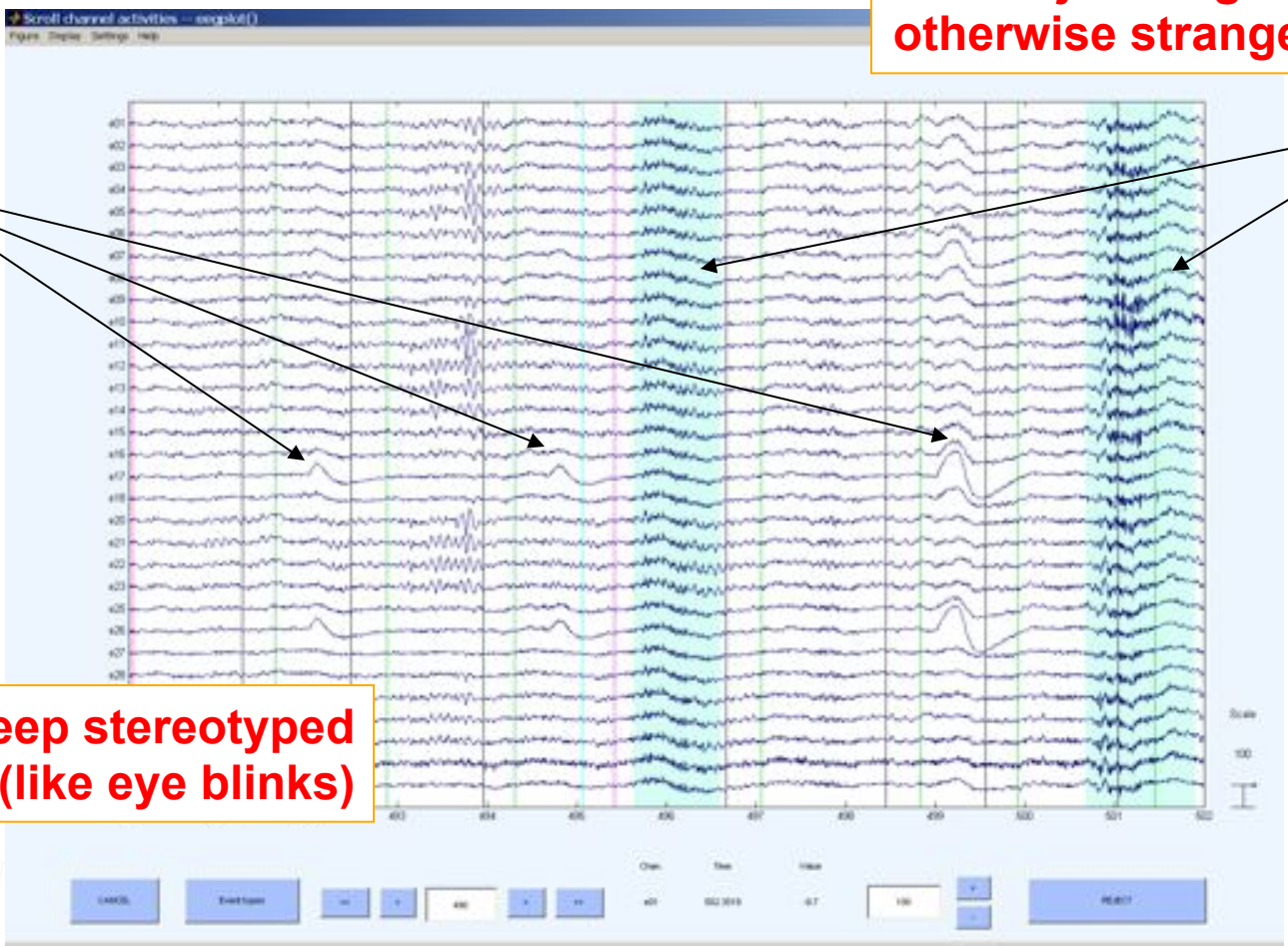


To prepare data for ICA:

Reject large muscle or otherwise strange events...

Keep

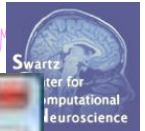
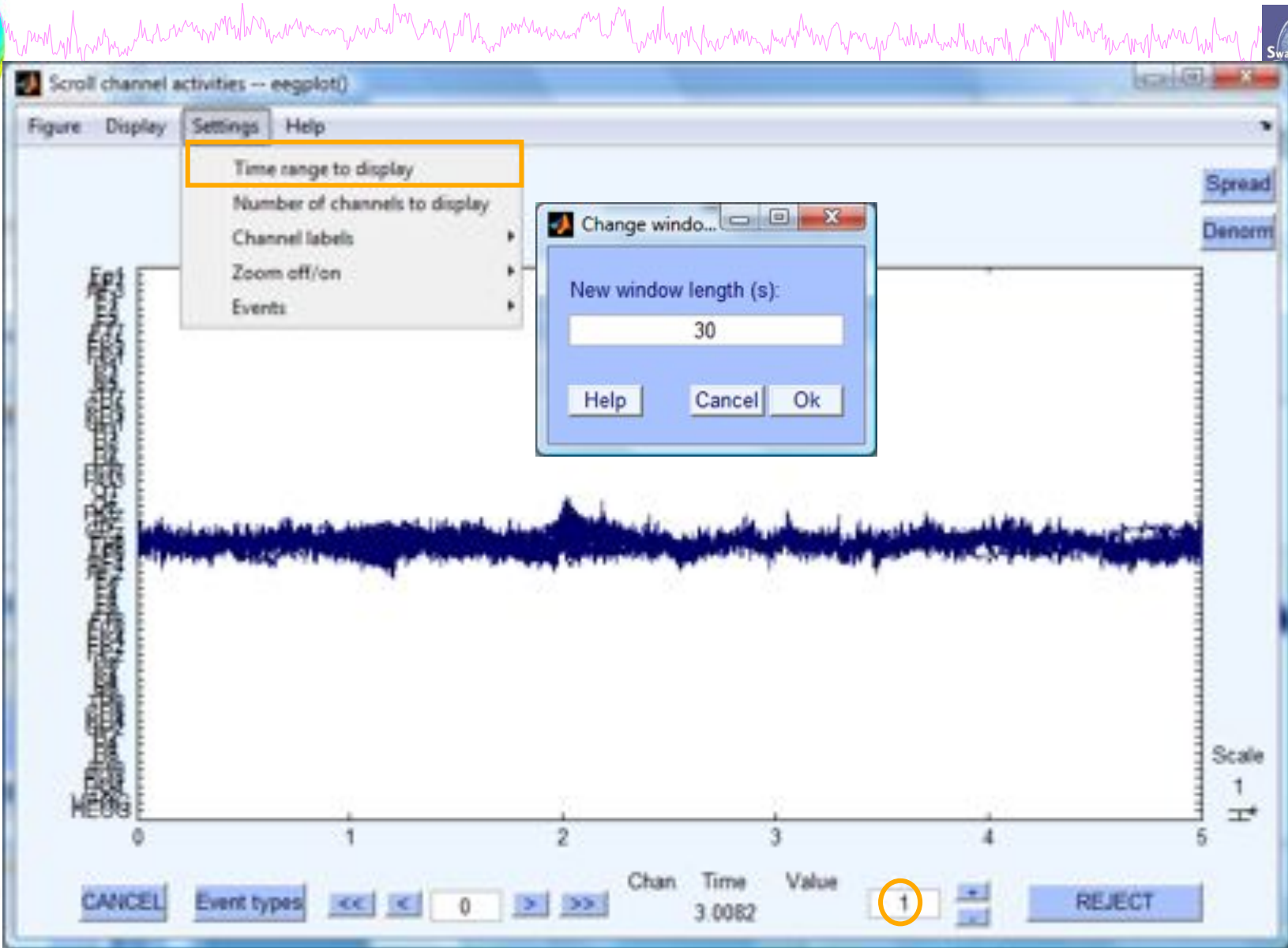
Reject



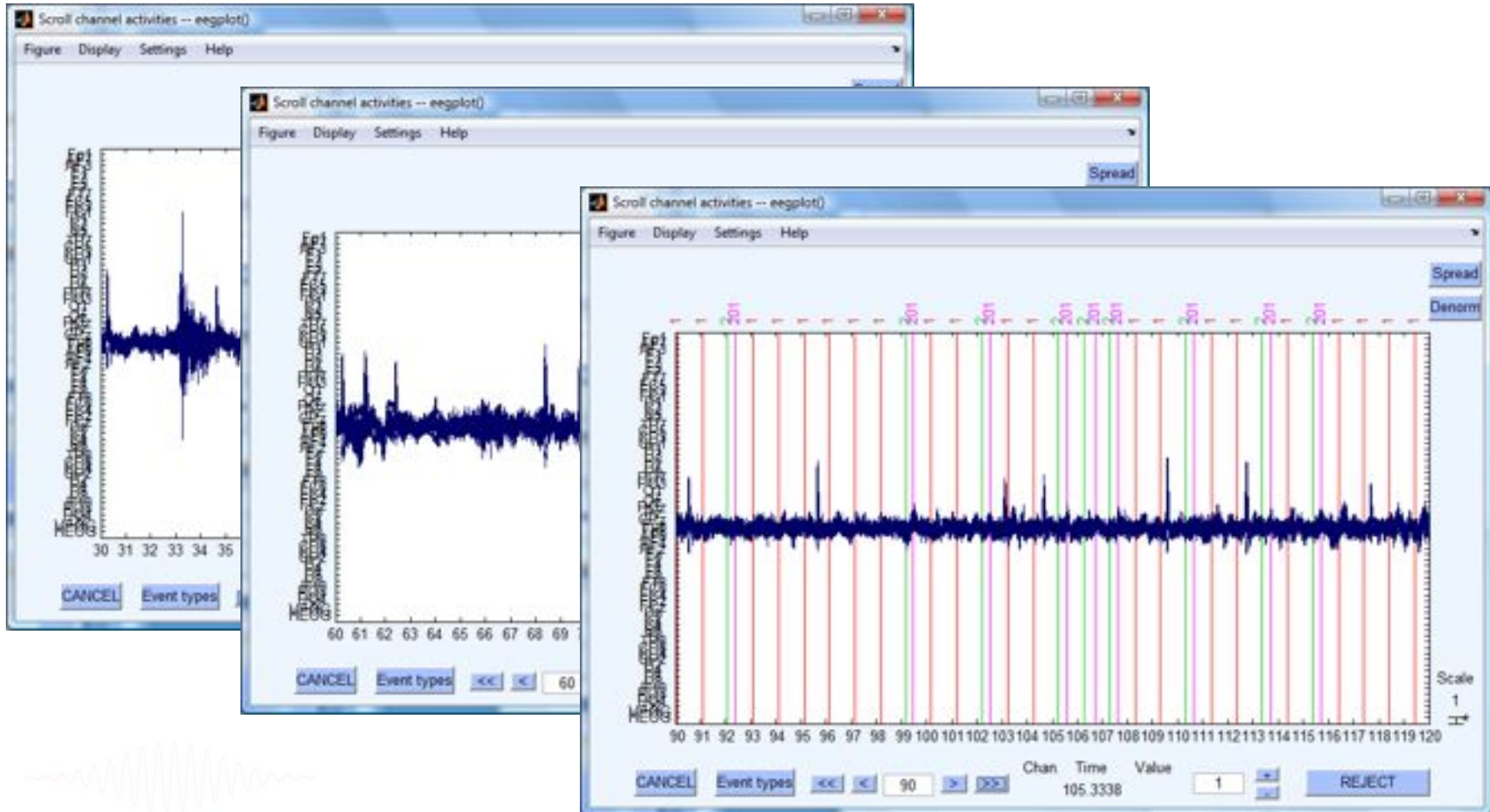
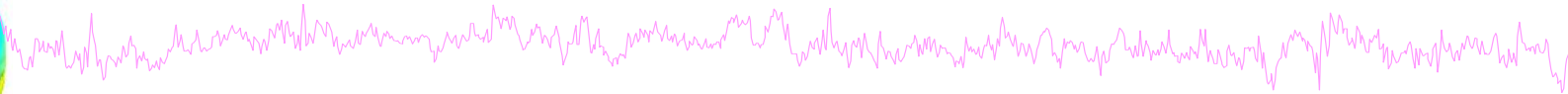
... but keep stereotyped artifacts (like eye blinks)



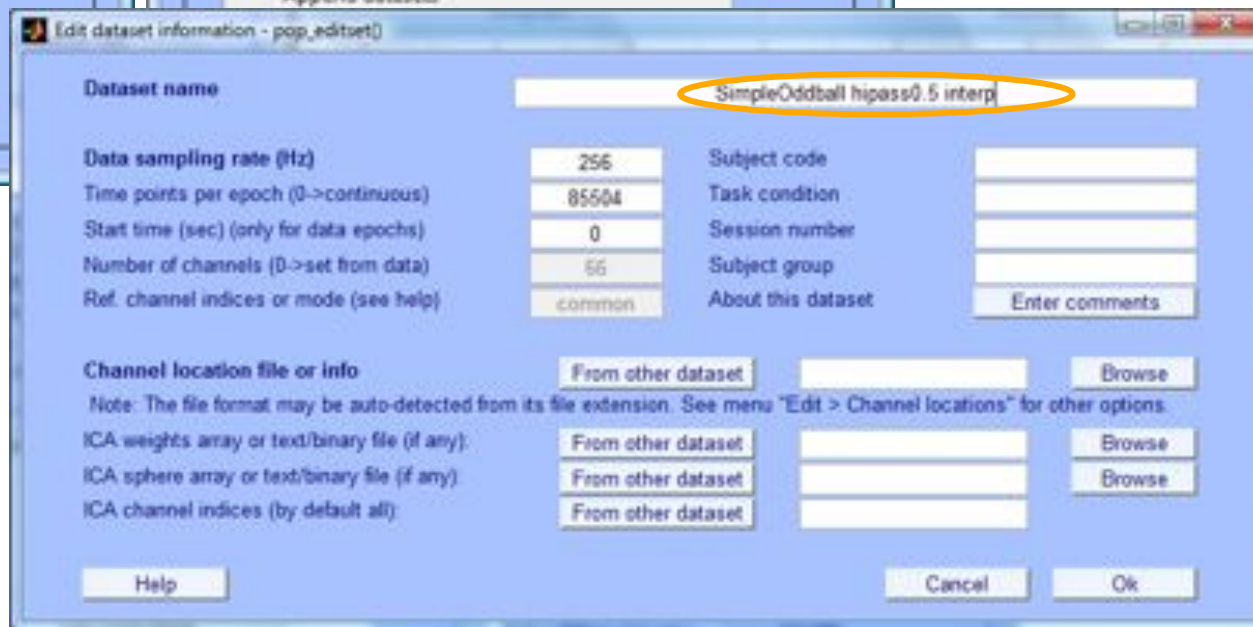
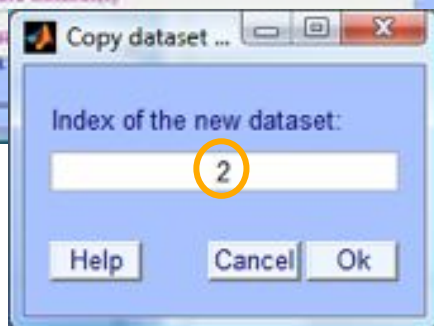
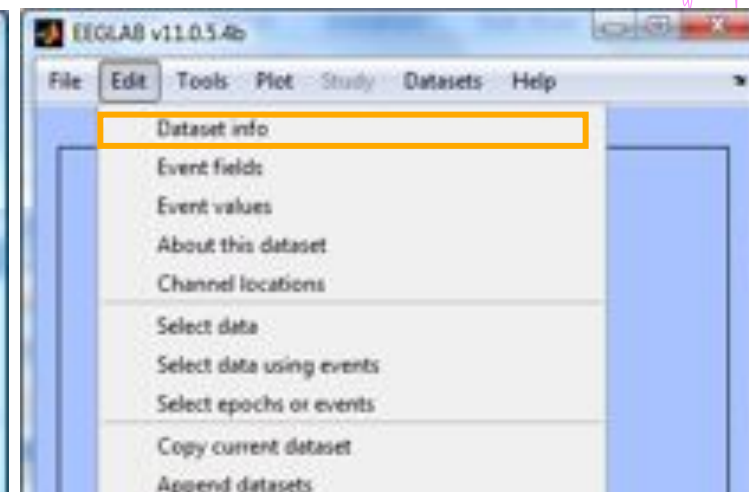
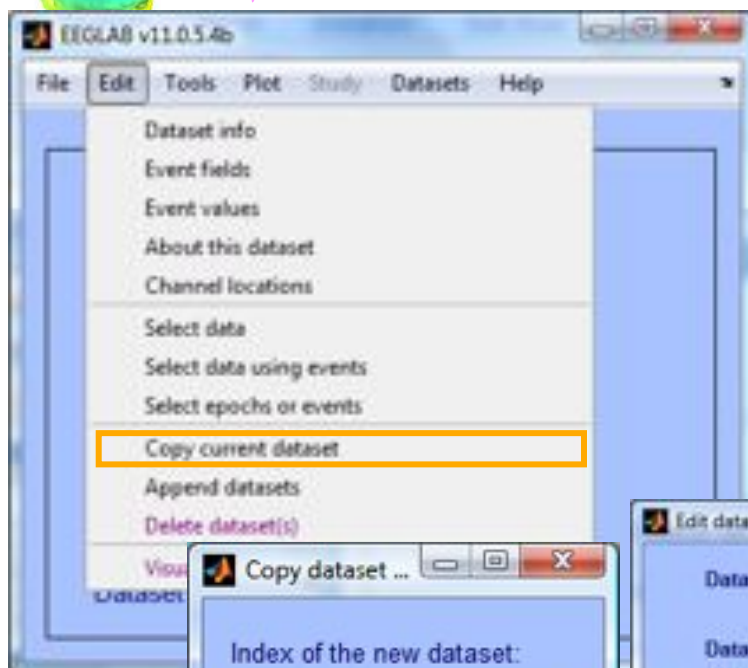
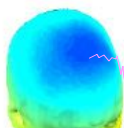
Fast (but sloppy) artifact rejection



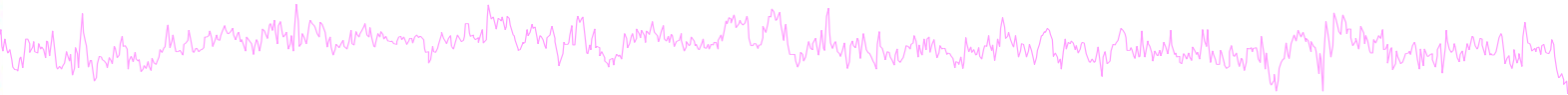
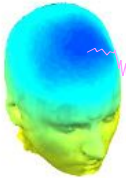
Fast (but sometimes sloppy) artifact rejection



Interpolate bad channel(s)



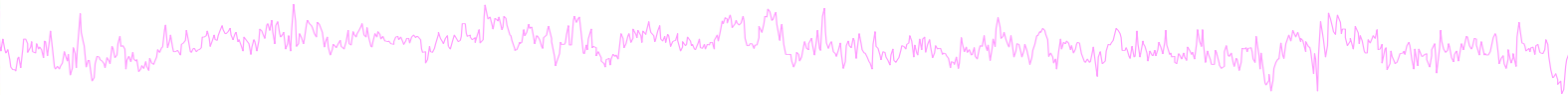
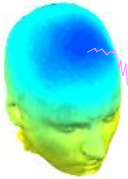
Interpolate bad channel(s)



The image shows a sequence of steps in EEGLAB for interpolating bad channels:

- The main EEGLAB window has the **Tools** menu open, with **Interpolate electrodes** highlighted.
- The **Interpolate channel...** dialog box is open, showing options for selecting channels to interpolate and the interpolation method (set to Spherical Spline). The **Ok** button is highlighted.
- The **Select data -- pop_select()** dialog box is open, showing options for selecting data ranges. The **Channel range** is set to 3, and the **Scroll dataset** button is visible.
- The **Choose dataset** dialog box is open, showing the **Dataset index** set to 1. The **Ok** button is highlighted.

Exercises



- Load a previously filtered version of SimpleOddball.set
- Identify bad channel(s) using auto-detection tool; plot channel properties of flagged channels
- Identify and remove non-task portions of continuous data; see if the previously flagged channels are still identified as bad
- Scroll the epoched data and perform visual rejection of epochs
- Explore the automated artifact rejection tools



Pre-processing pipeline

