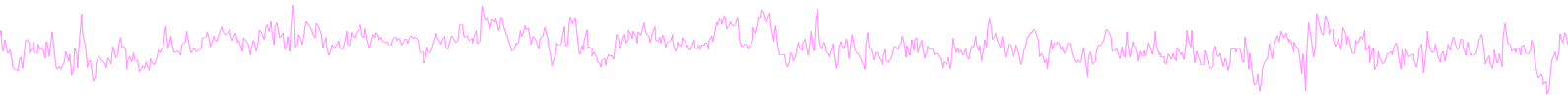
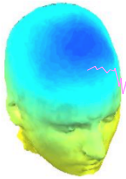
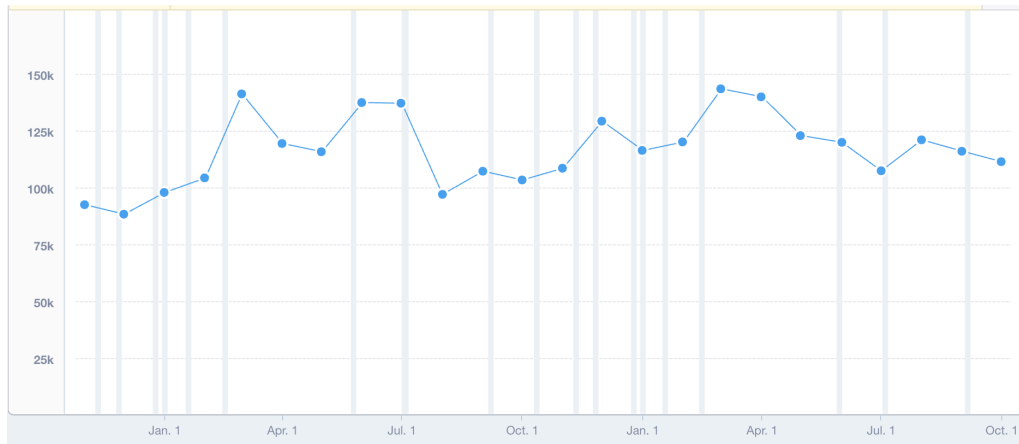


EEGLAB overview

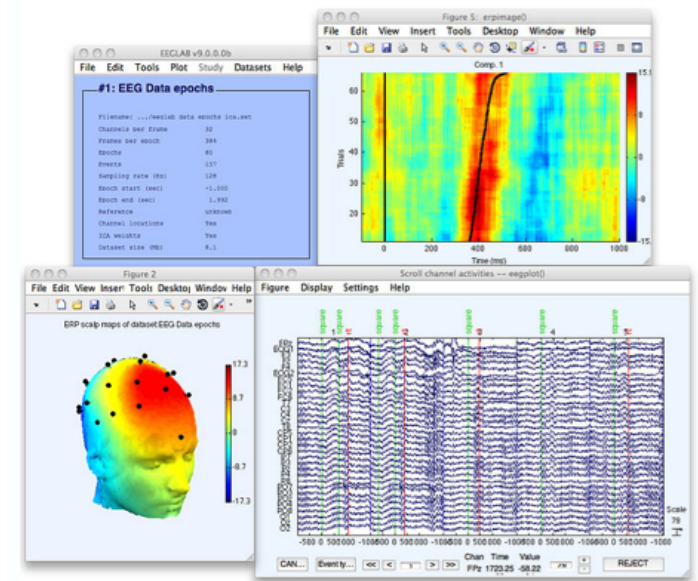


- Collection of about 600 functions (70 000 lines of code)
- About 100 000 download over the past 10 years
- 6 500 users on the discussion list and 10 500 on the diffusion list
- NIH funding since 2003

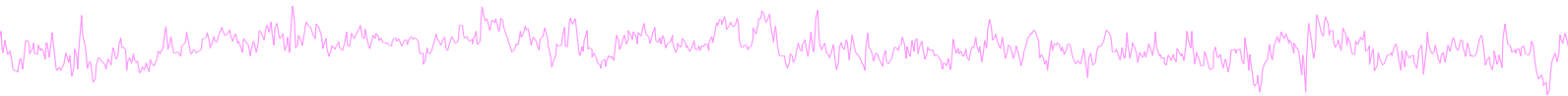
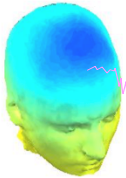


<http://sccn.ucsd.edu/eeglab>

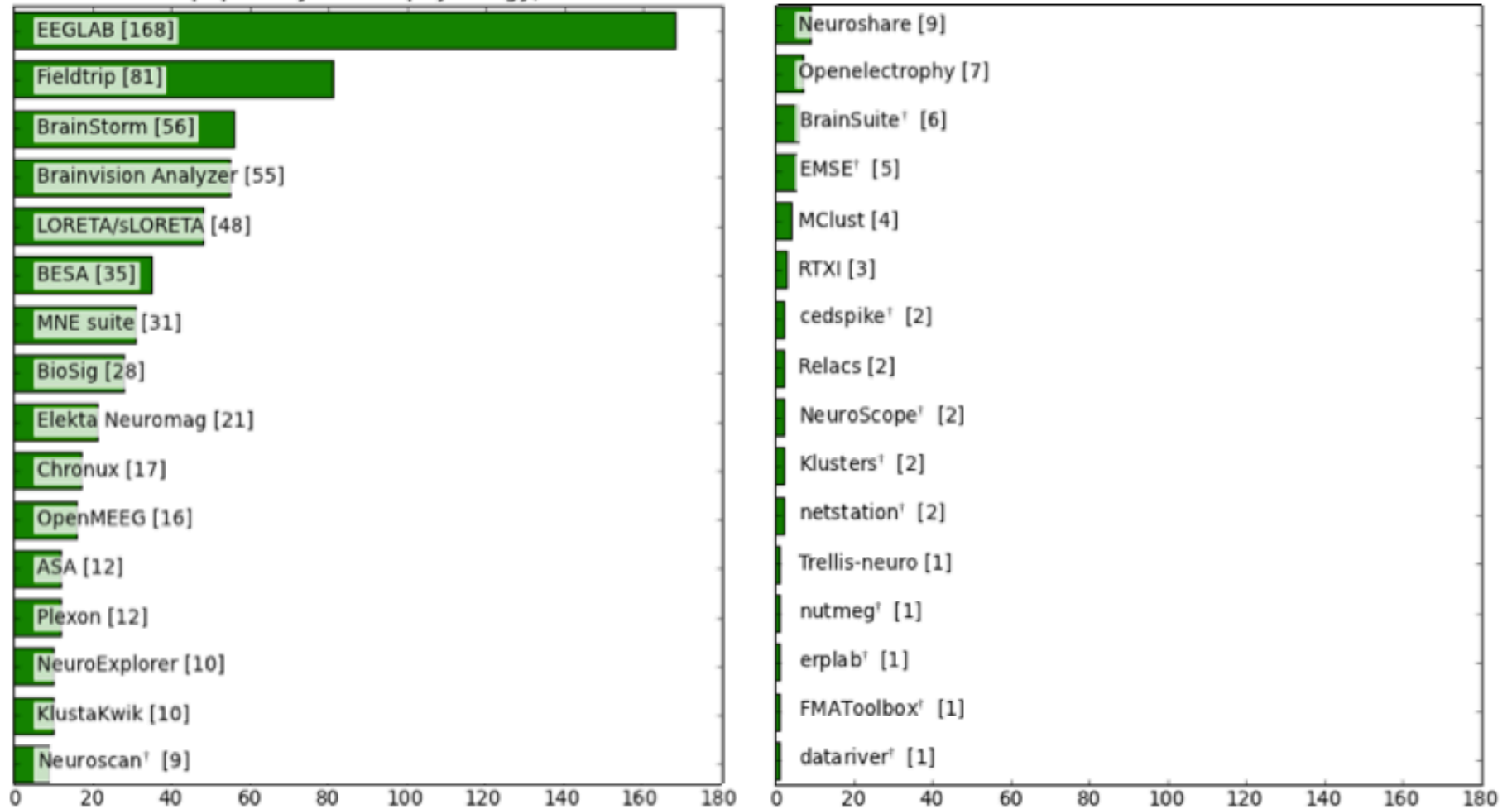
<http://sccn.ucsd.edu/wiki/eeglab>



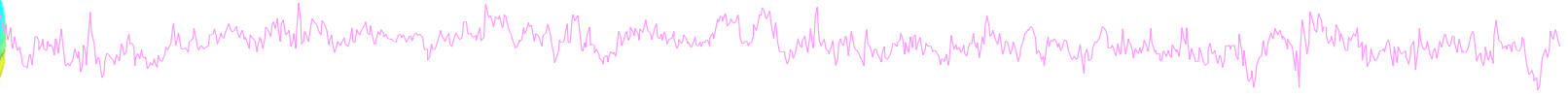
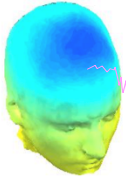
Hanke & Helcencko, 2011, Frontier in Neuroinformatics



Software popularity: Electrophysiology, MEG/EEG



EEGLAB standard processing pipeline



Single subject

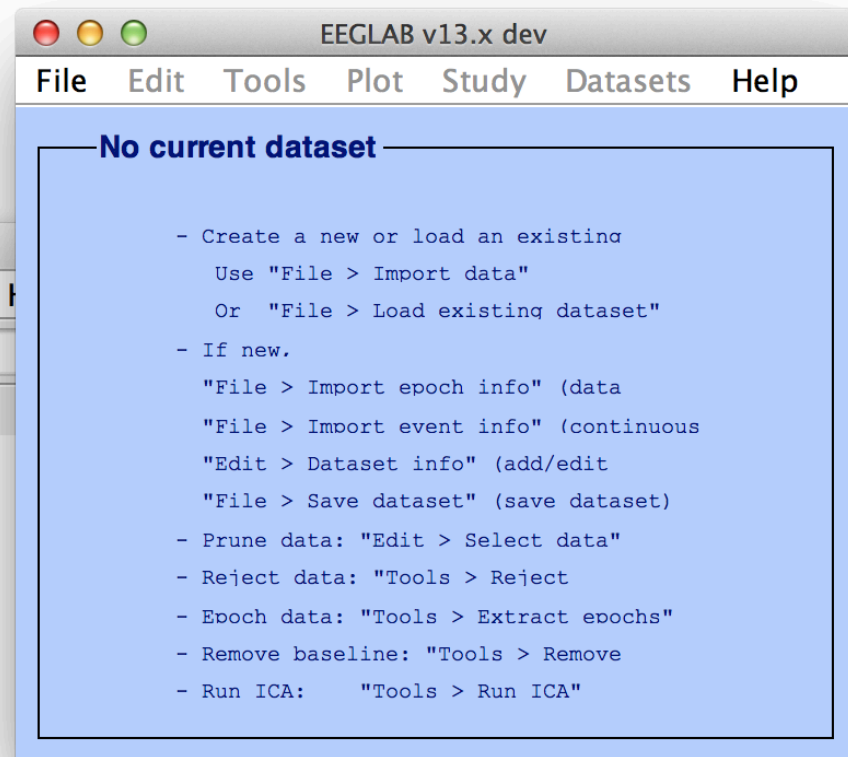
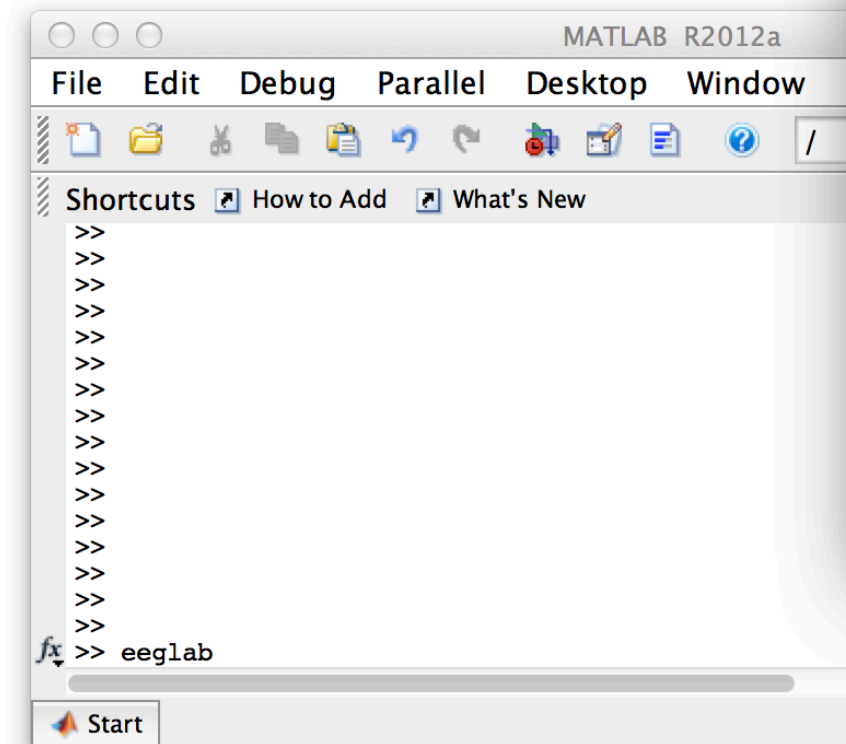
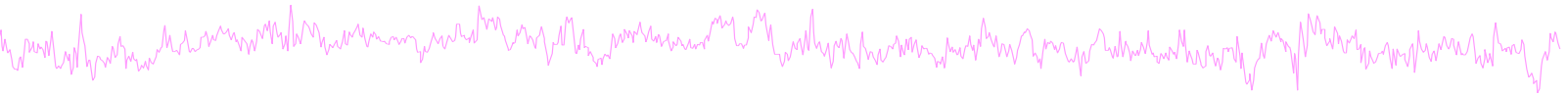
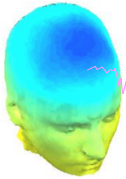
1. Import binary data, events and channel location
2. Edit, Re-reference, Resample, High pass filter data
3. Reject artifacts in continuous data by visual inspection
4. Extract epochs from data & reject artifactual epochs
5. Visualize data measures
6. Perform ICA decomposition
 - Perform source localization of components
 - Analyze components contribution to ERP
 - Analyze components contribution to spectrum

Multi-subjects

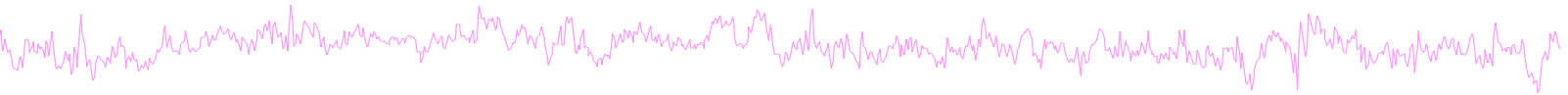
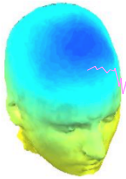
1. Build study and STUDY design
2. Pre-compute measures
3. Cluster components
4. Analyze clusters

Advanced analysis using scripting and EEGLAB command line functions

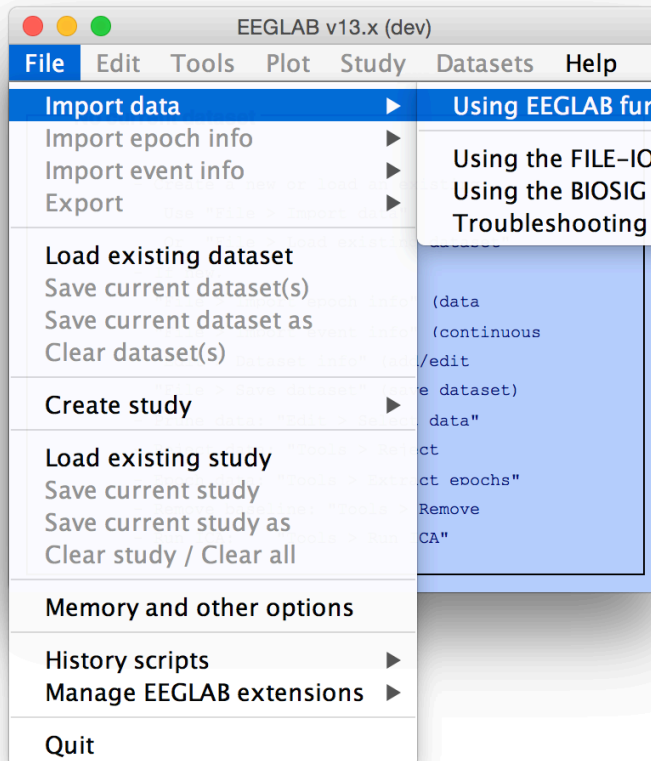
The EEGLAB Matlab software



1. Importing data



Import/load data



From ASCII/float file or Matlab array

From Netstation binary simple file
From EGI Net Station .MFF file
From Multiple seg. Netstation files
From Netstation Matlab files

From BCI2000 ASCII file

From Snapmaster .SMA file

From Neuroscan .CNT file
From Neuroscan .EEG file

From Biosemi BDF file (BIOSIG toolbox)
From EDF/EDF+/GDF files (BIOSIG toolbox)
From Biosemi BDF and EDF files (BDF plugin)

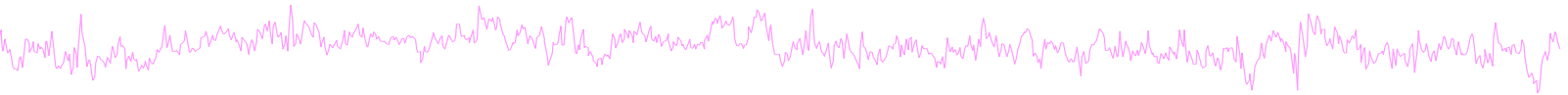
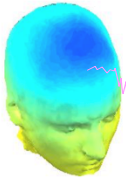
From a NeurOne file (.ses)

From BIOPAC MATLAB files

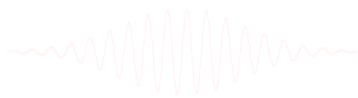
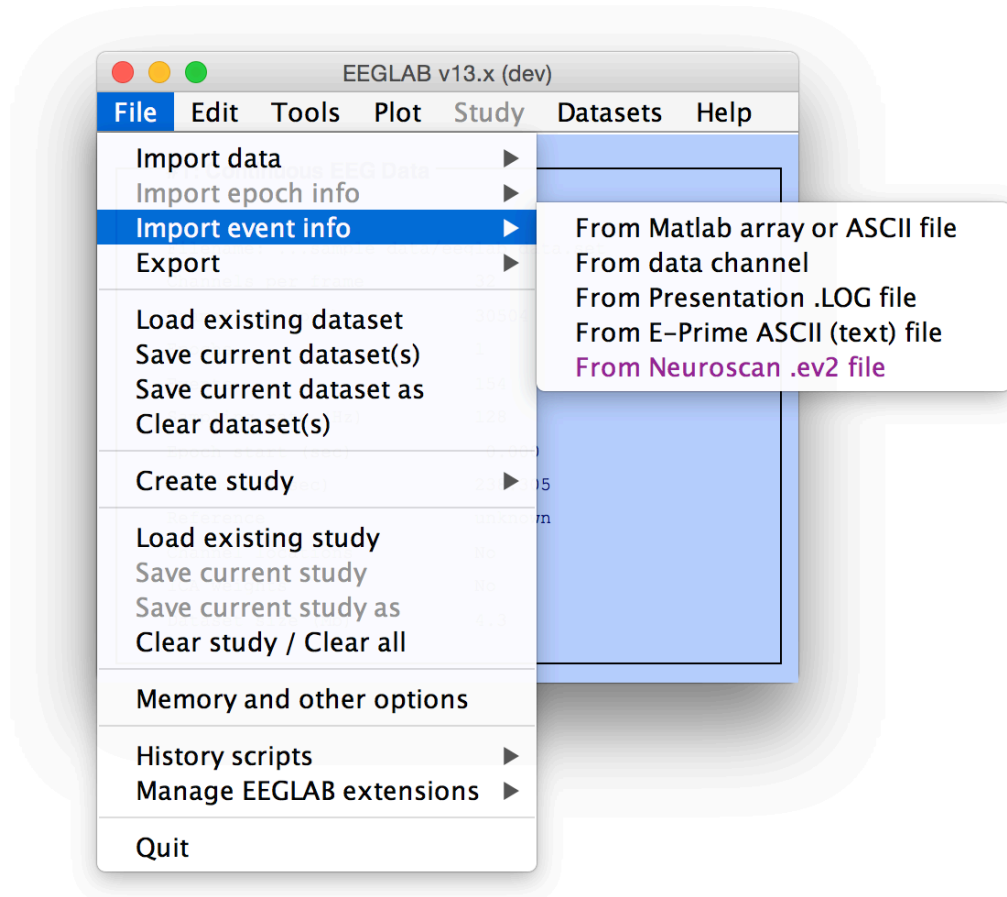
From Brain Vis. Rec. .vhdr file
From Brain Vis. Anal. Matlab file

From ERPSS .RAW or .RDF file
From EGI .MFF file

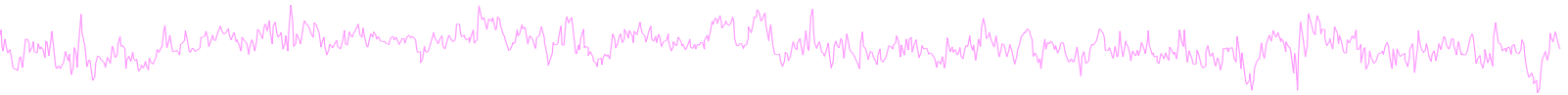
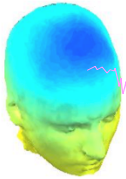
1. Importing data



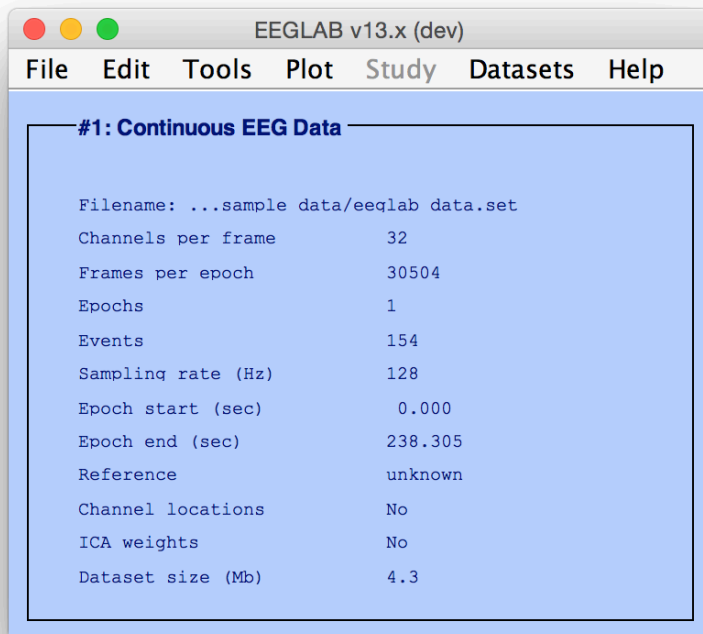
Import events



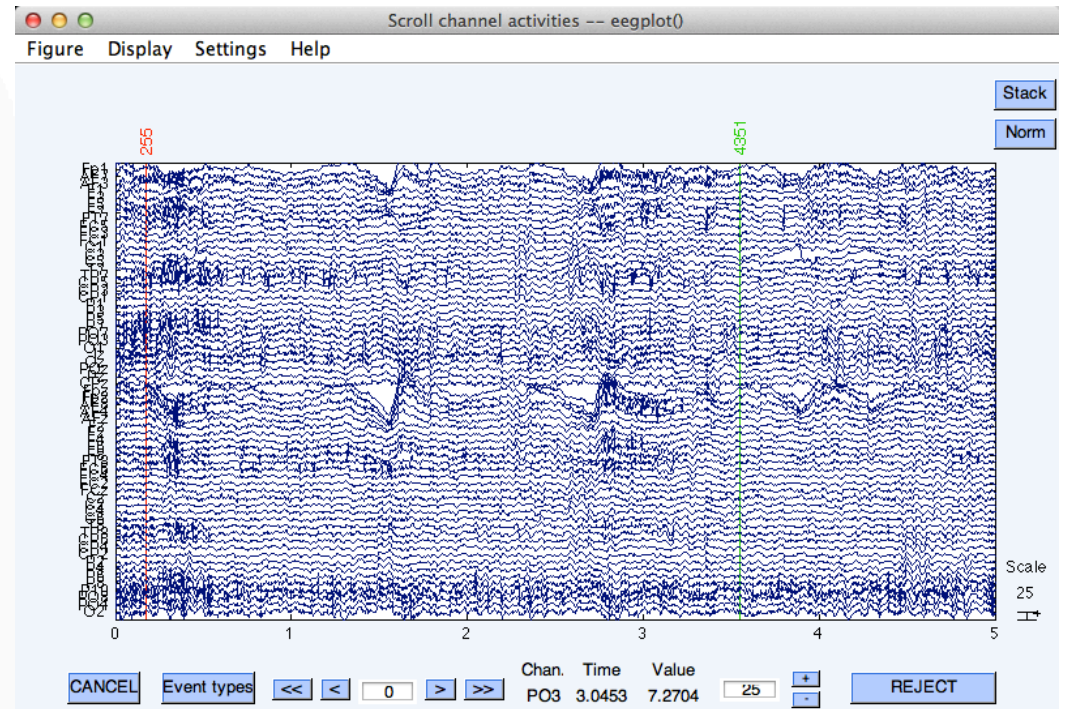
1. Importing data



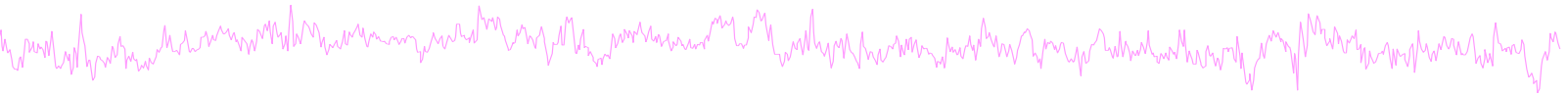
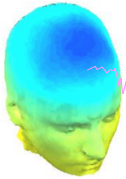
Data info



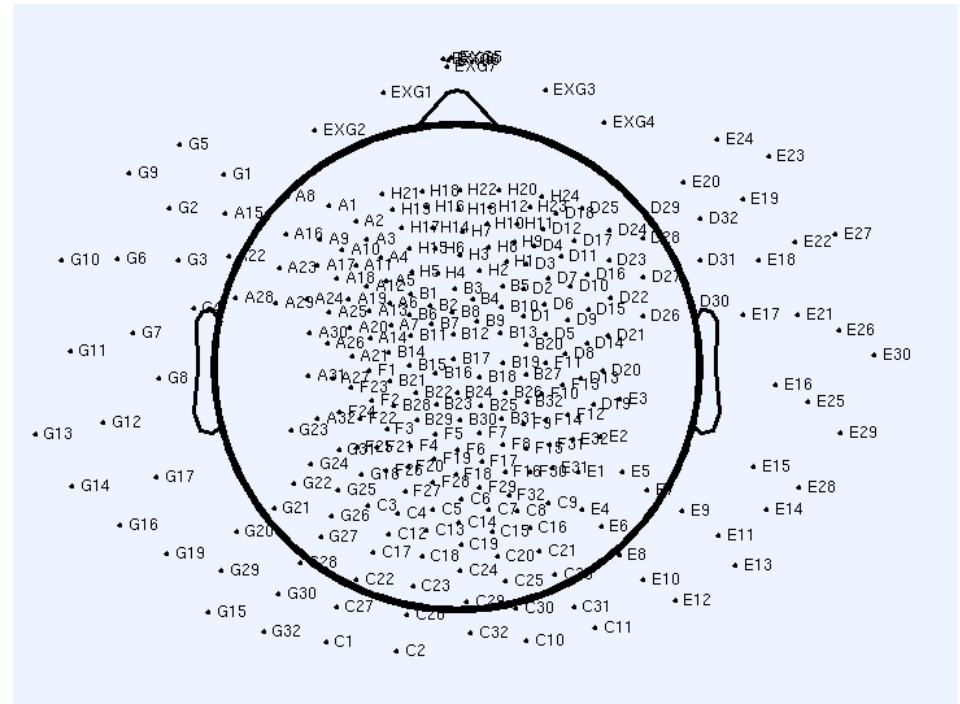
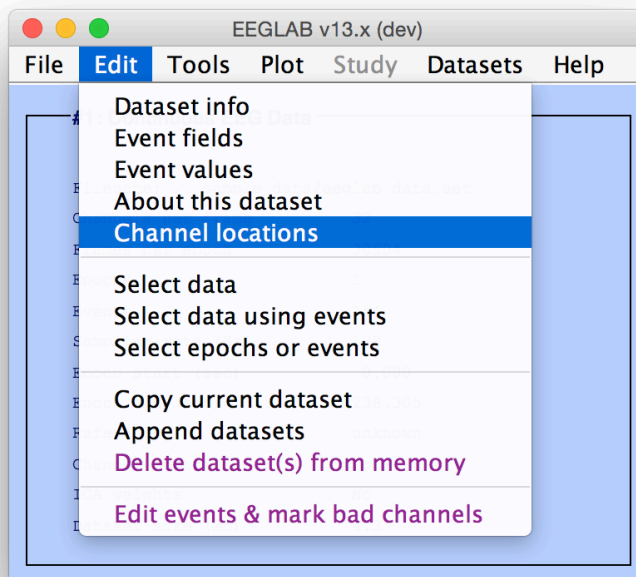
Scrolling data



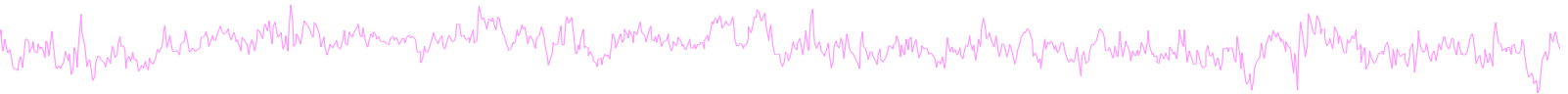
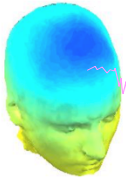
1. Importing channel location



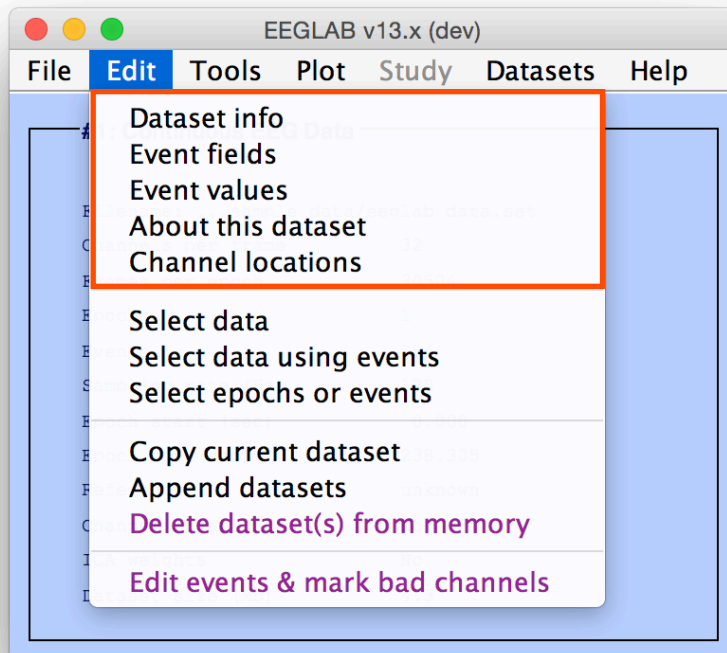
Import channel location



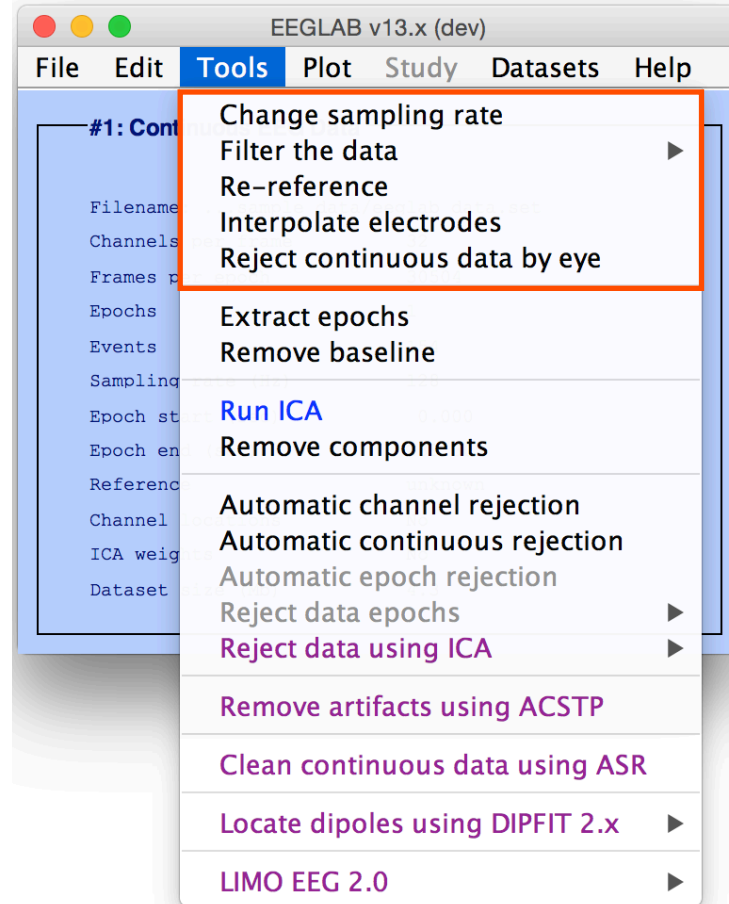
2. Edit, Re-reference, Resample, High pass filter data



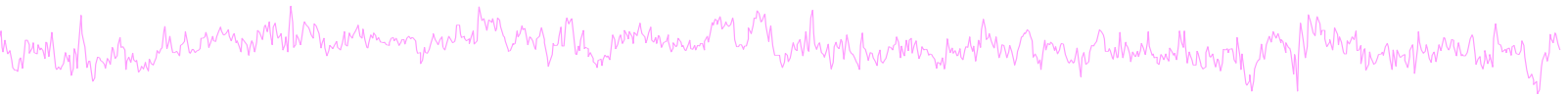
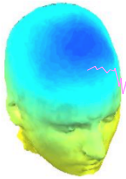
Edit/select data



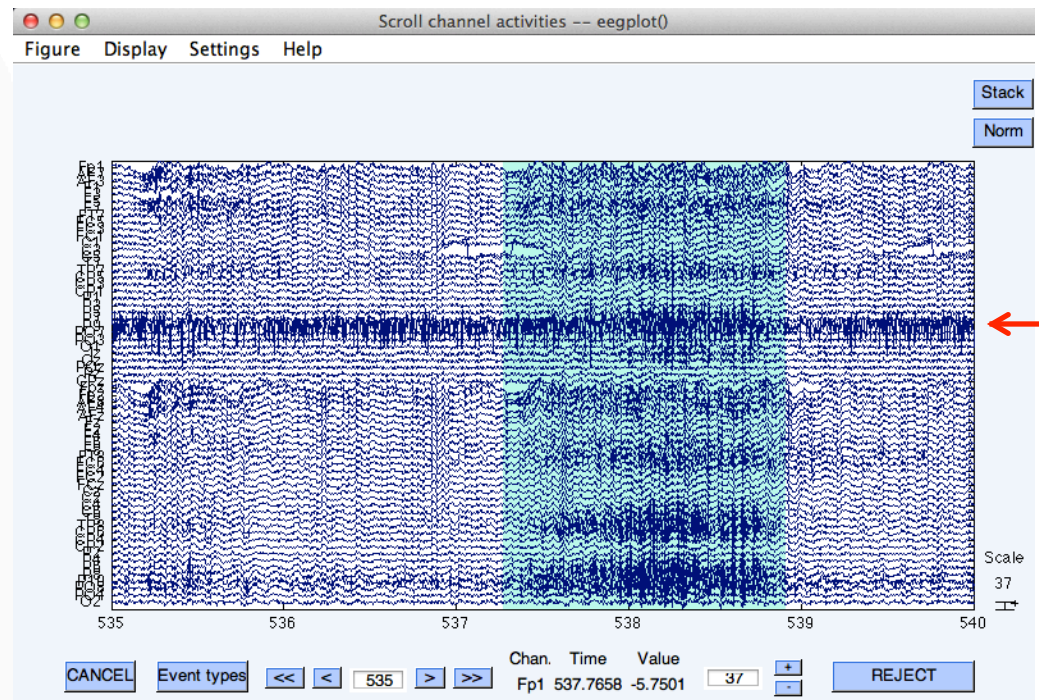
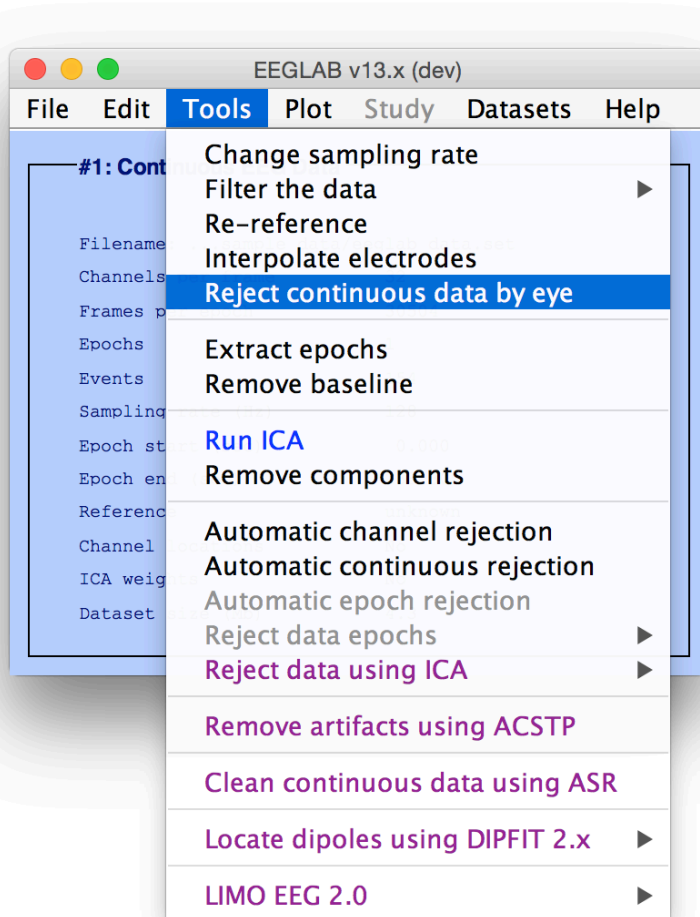
Preprocessing data



3. Reject artifacts in continuous data by visual inspection



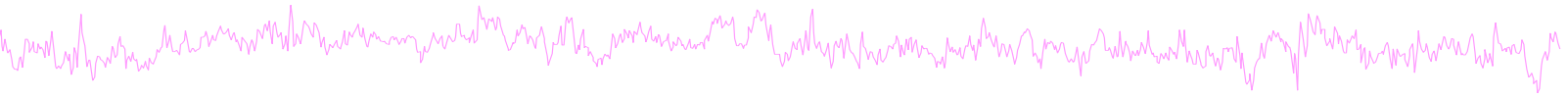
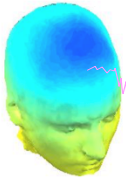
Reject portions of continuous data



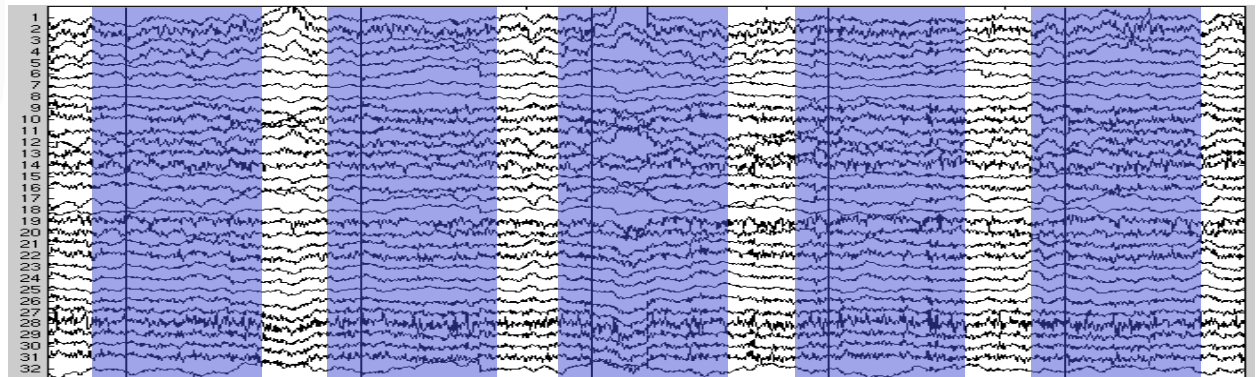
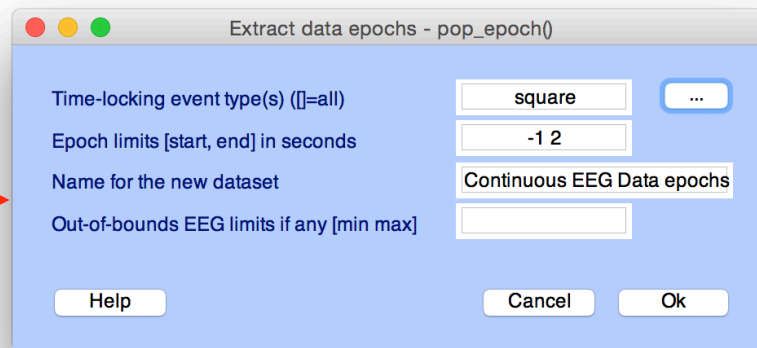
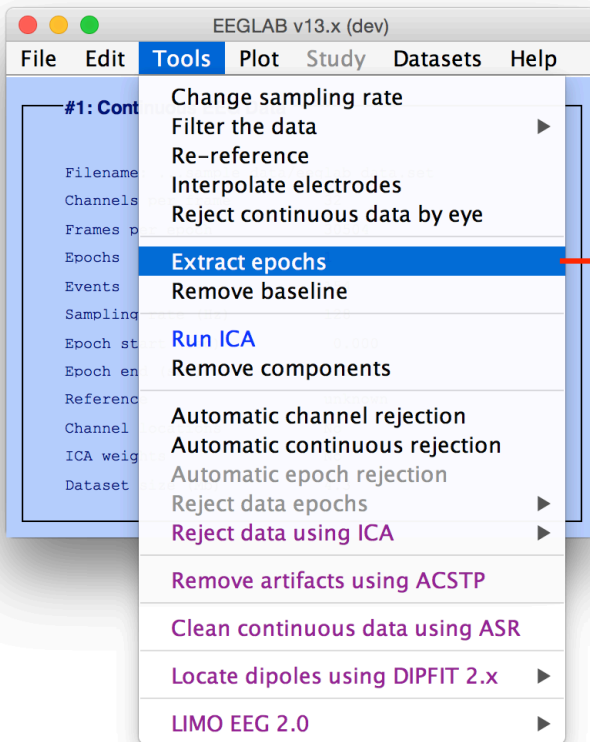
Bad channel

Bad portion of data

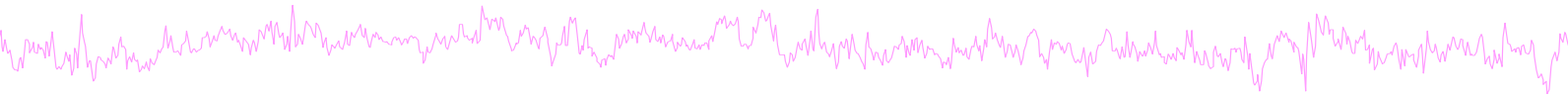
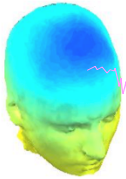
4. Extract epochs from data & reject artifactual epochs



Preprocessing data



4. Extract epochs from data & reject artifactual epochs



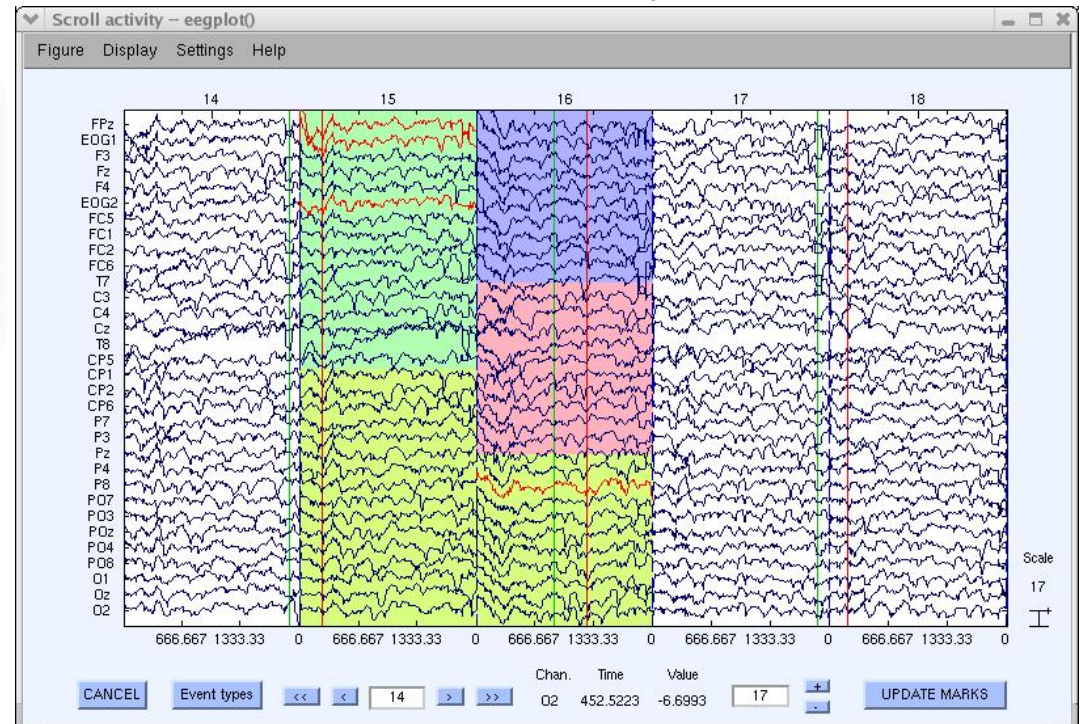
EEGLAB v13.x (dev)

File Edit **Tools** Plot Study Datasets Help

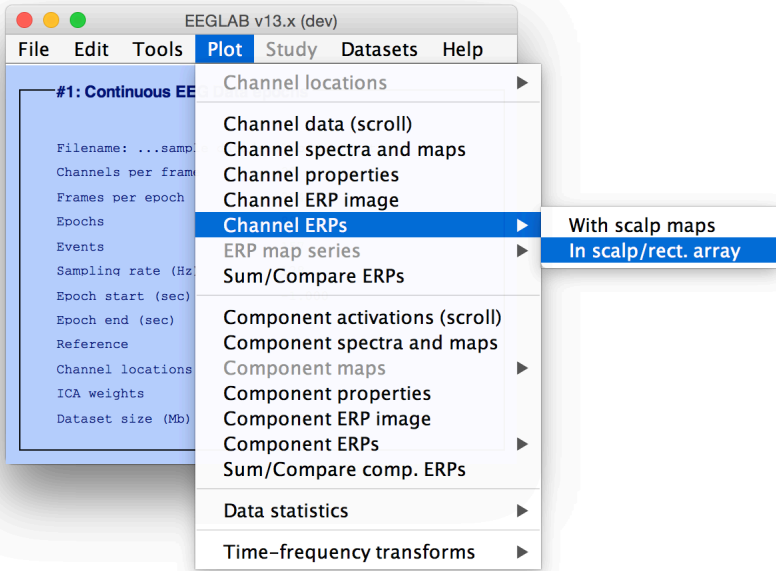
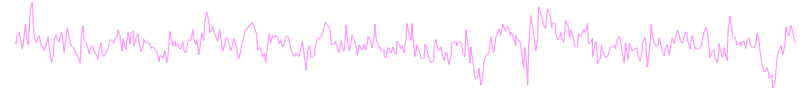
- #1: Cont
- Filename
- Channels
- Frames p
- Epochs
- Events
- Sampling
- Epoch st
- Epoch en
- Referenc
- Channel
- ICA weig
- Dataset

- Change sampling rate
- Filter the data
- Re-reference
- Interpolate electrodes
- Reject continuous data by eye
- Extract epochs
- Remove baseline
- Run ICA
- Remove components
- Automatic channel rejection
- Automatic continuous rejection
- Automatic epoch rejection
- Reject data epochs
 - Reject data (all methods)
 - Reject data using ICA
 - Reject by inspection
 - Reject extreme values
 - Reject by linear trend/variance
 - Reject by probability
 - Reject by kurtosis
 - Reject by spectra
- Remove artifacts using ACSTP
- Clean continuous data using ASR
- Locate dipoles using DIPFIT 2.x
- LIMO EEG 2.0
 - Export marks to ICA reject
 - Reject marked epochs

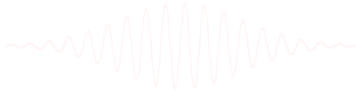
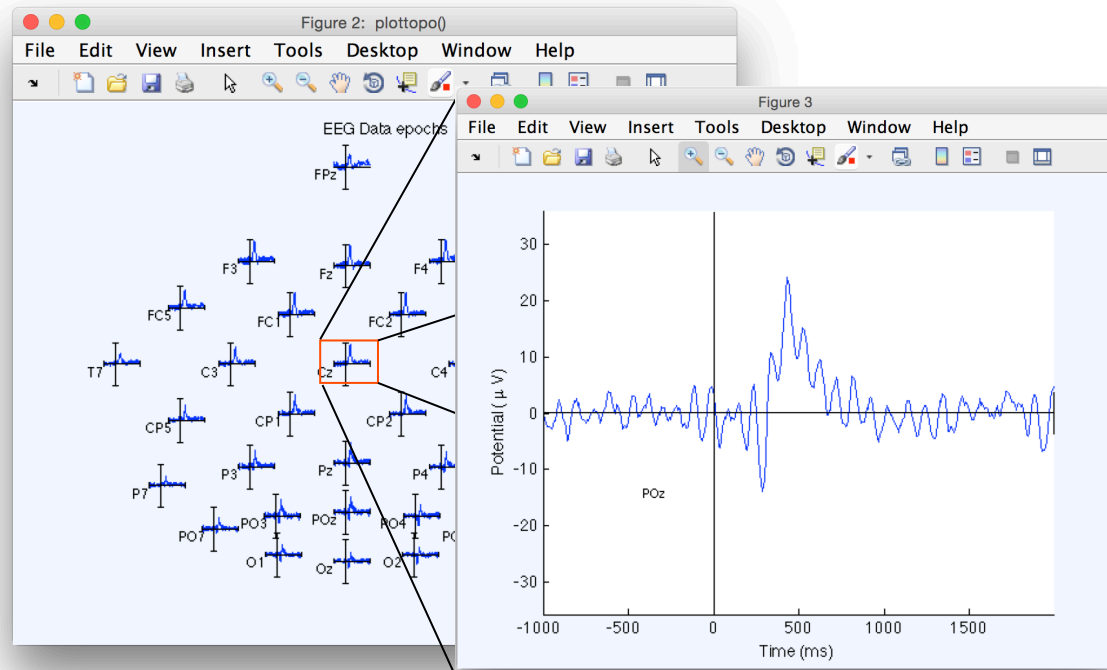
Different color = different rejection methods



5. Visualize data measures

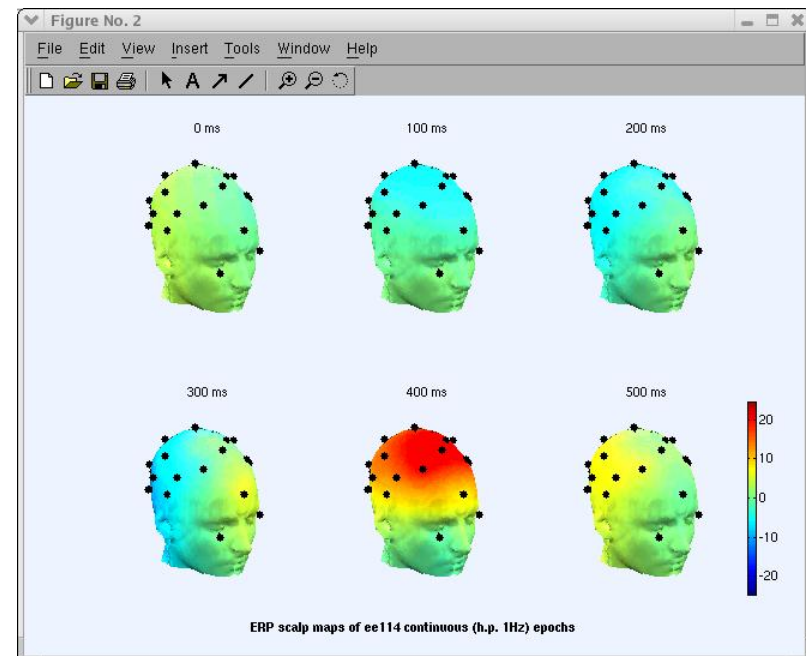
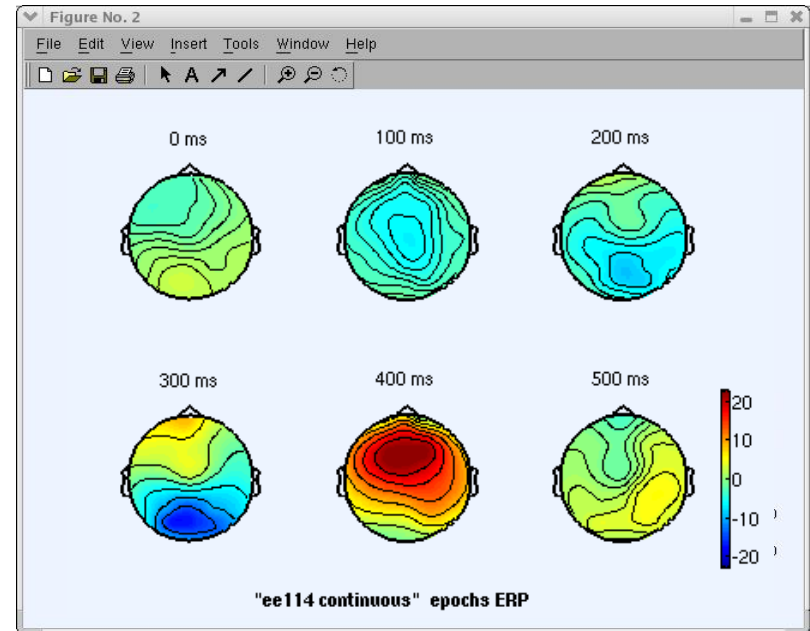
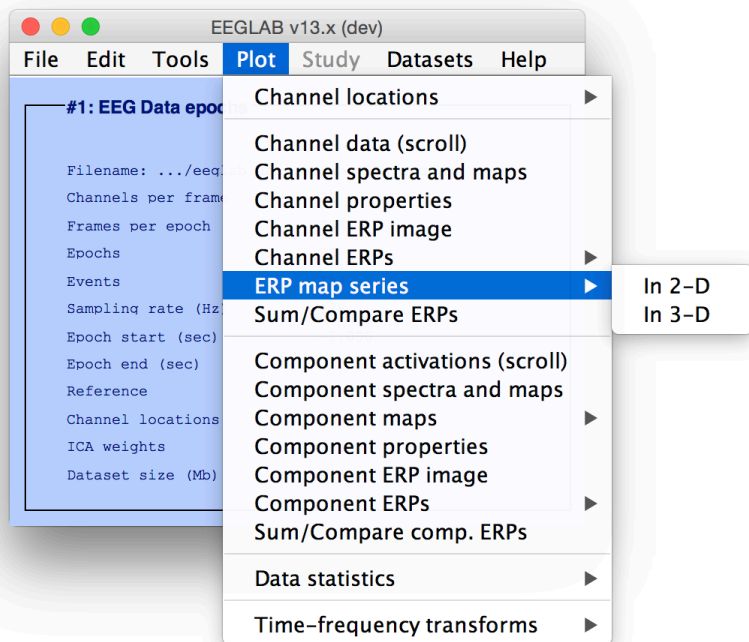


Plot ERP

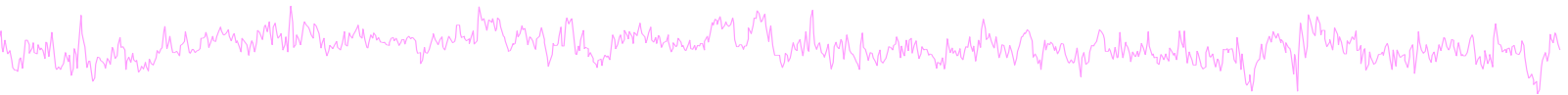
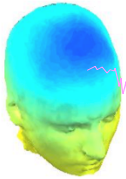


5. Visualize data measures

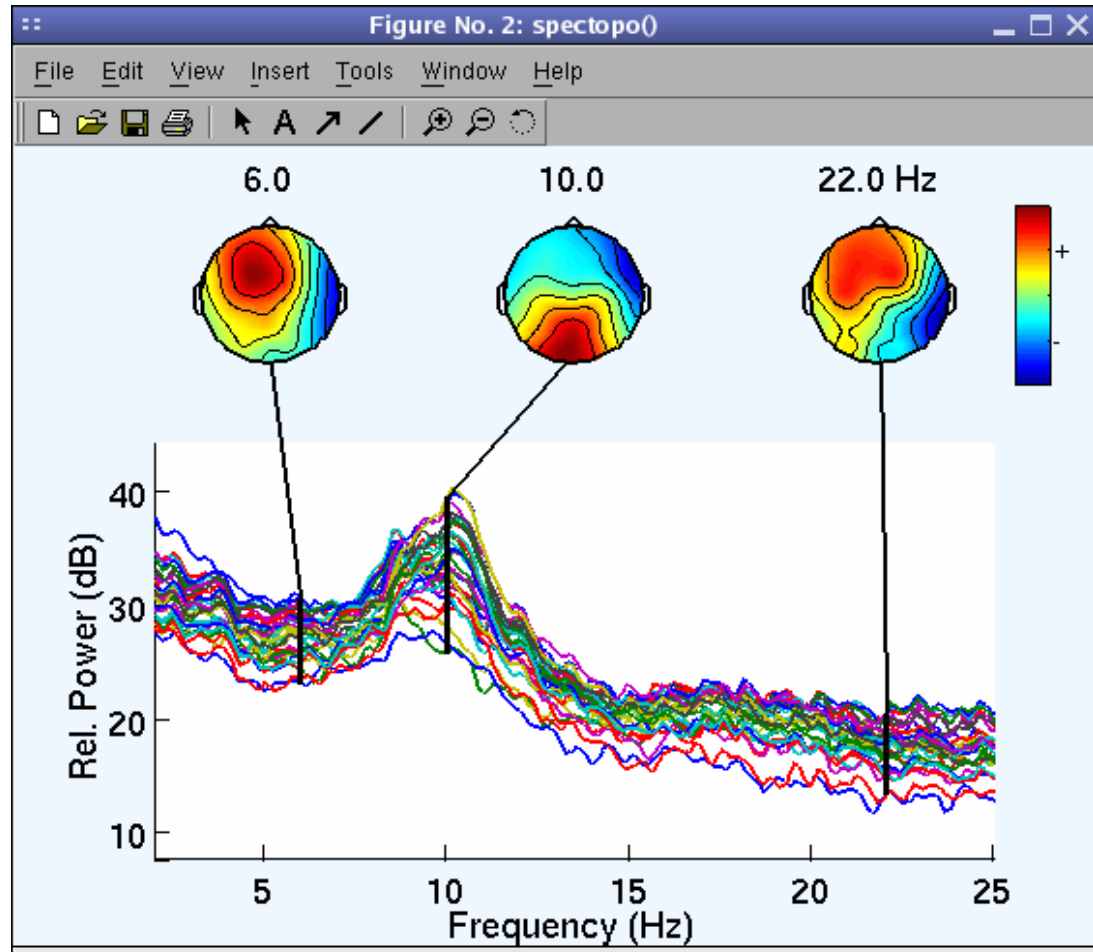
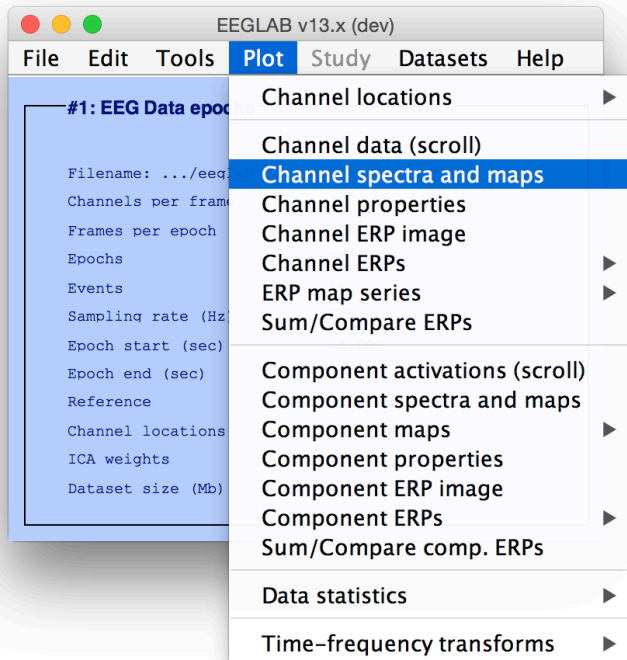
Plot ERP map series



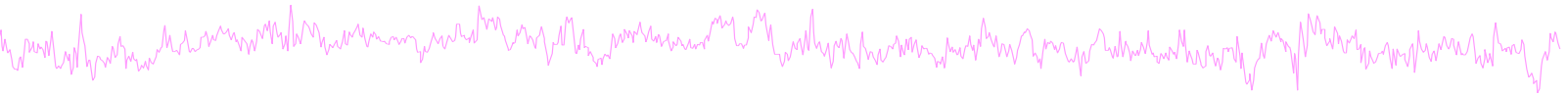
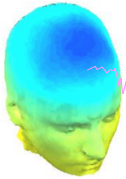
5. Visualize data measures



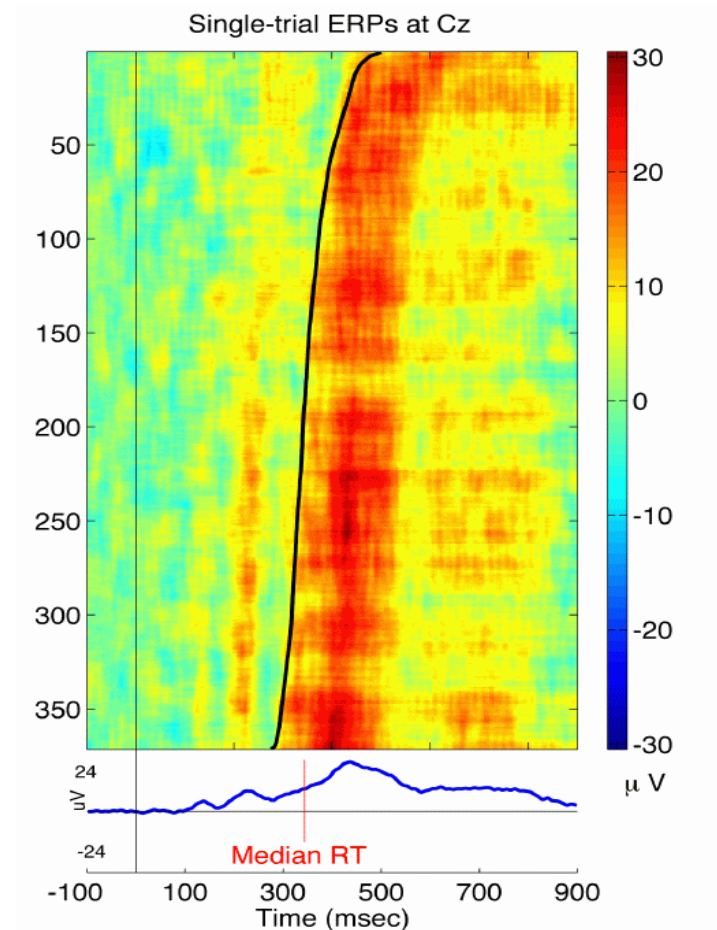
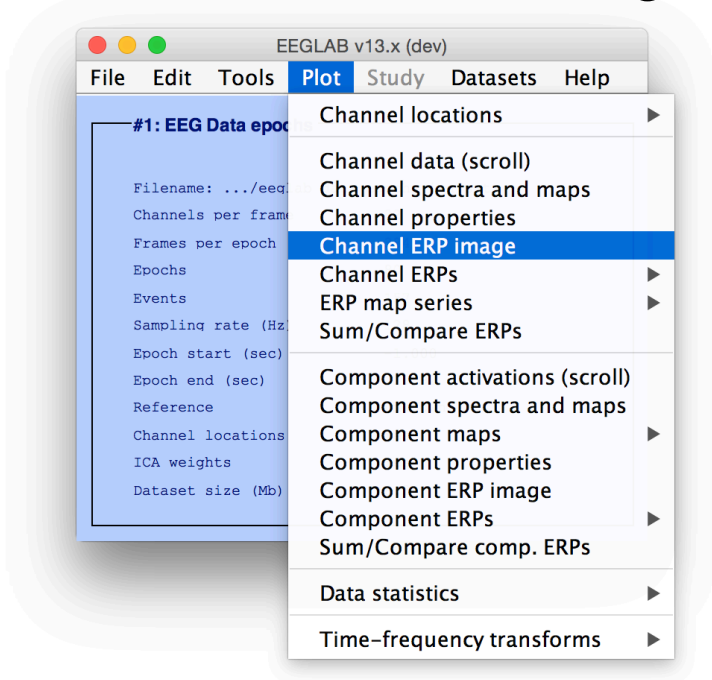
Plot data
spectrum and
maps



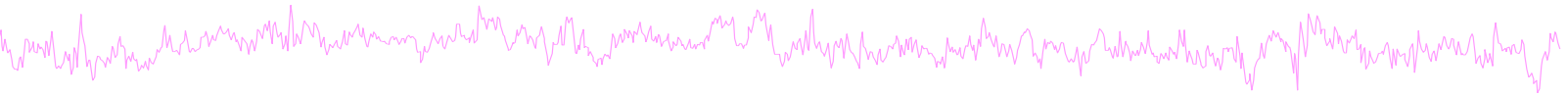
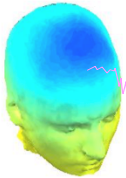
5. Visualize data measures



Plot channel ERP image



EEGLAB standard processing pipeline



Single subject

1. Import binary data, events and channel location
2. Edit, Re-reference, Resample, High pass filter data
3. Reject artifacts in continuous data by visual inspection
4. Extract epochs from data & reject artifactual epochs
5. Visualize data measures
6. Perform ICA decomposition
 - Perform source localization of components
 - Analyze components contribution to ERP
 - Analyze components contribution to spectrum

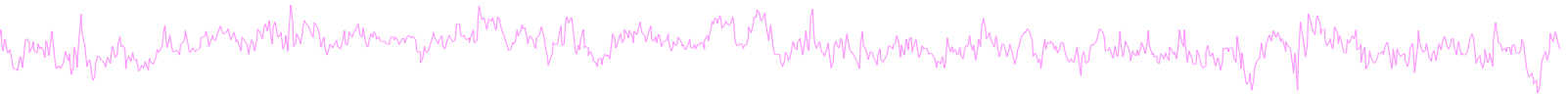
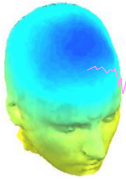
Multi-subjects

1. Build study
2. Pre-compute measures
3. Cluster components
4. Analyze clusters



Advanced analysis using scripting and EEGLAB command line functions

6. Perform ICA decomposition



EEGLAB v13.x (dev)

File Edit **Tools** Plot Study Datasets Help

#1: EEG

- Change sampling rate
- Filter the data
- Re-reference
- Interpolate electrodes
- Reject continuous data by eye
- Extract epochs
- Remove baseline
- Run ICA**
- Remove components
- Automatic channel rejection
- Automatic continuous rejection
- Automatic epoch rejection
- Reject data epochs
- Reject data using ICA
- Remove artifacts using ACSTP

Filename
Channels
Frames p
Epochs
Events
Sampling
Epoch st
Epoch en
Referenc
Channel
ICA weig
Dataset

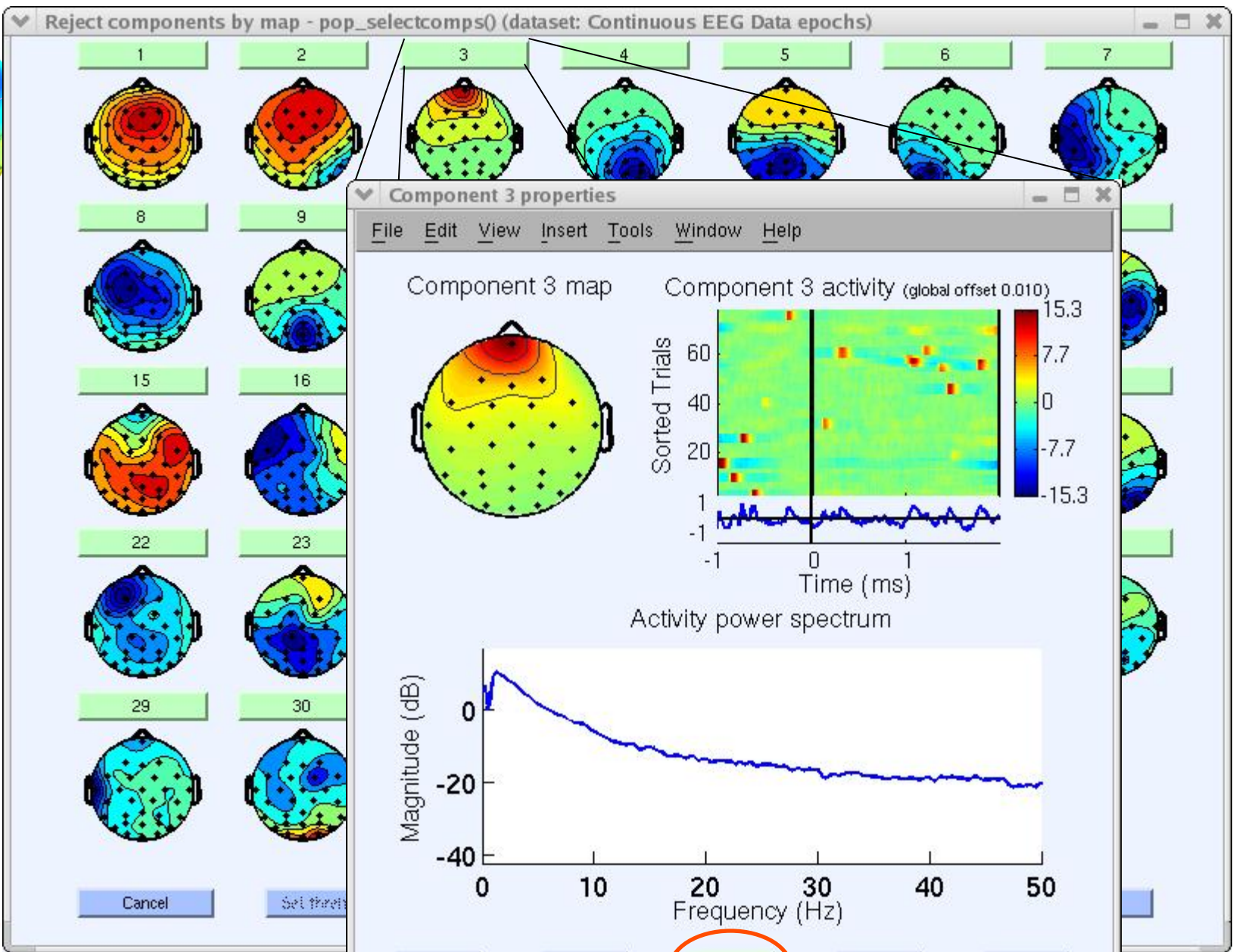
Run ICA decomposition -- pop_runica()

ICA algorithm to use (click to select)

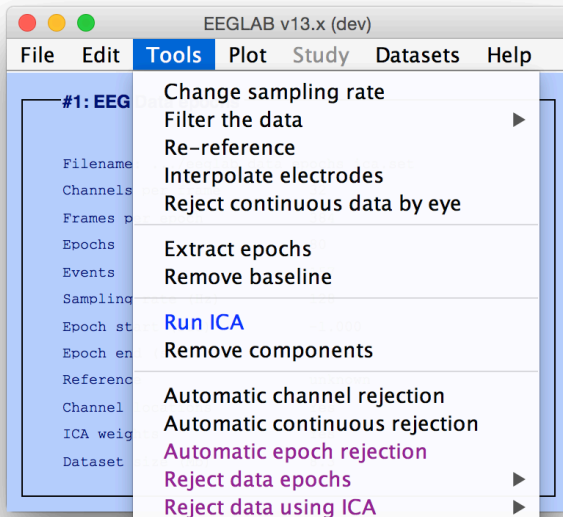
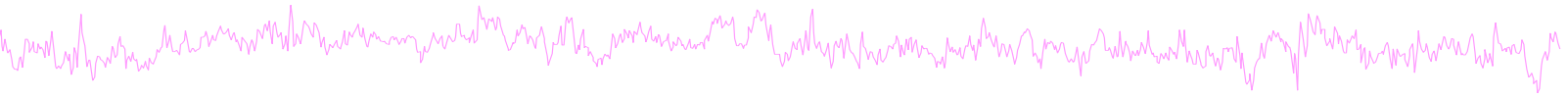
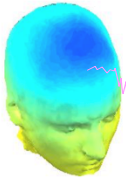
Commandline options (See help messages)

Channel type(s) or channel indices ... types ... channels

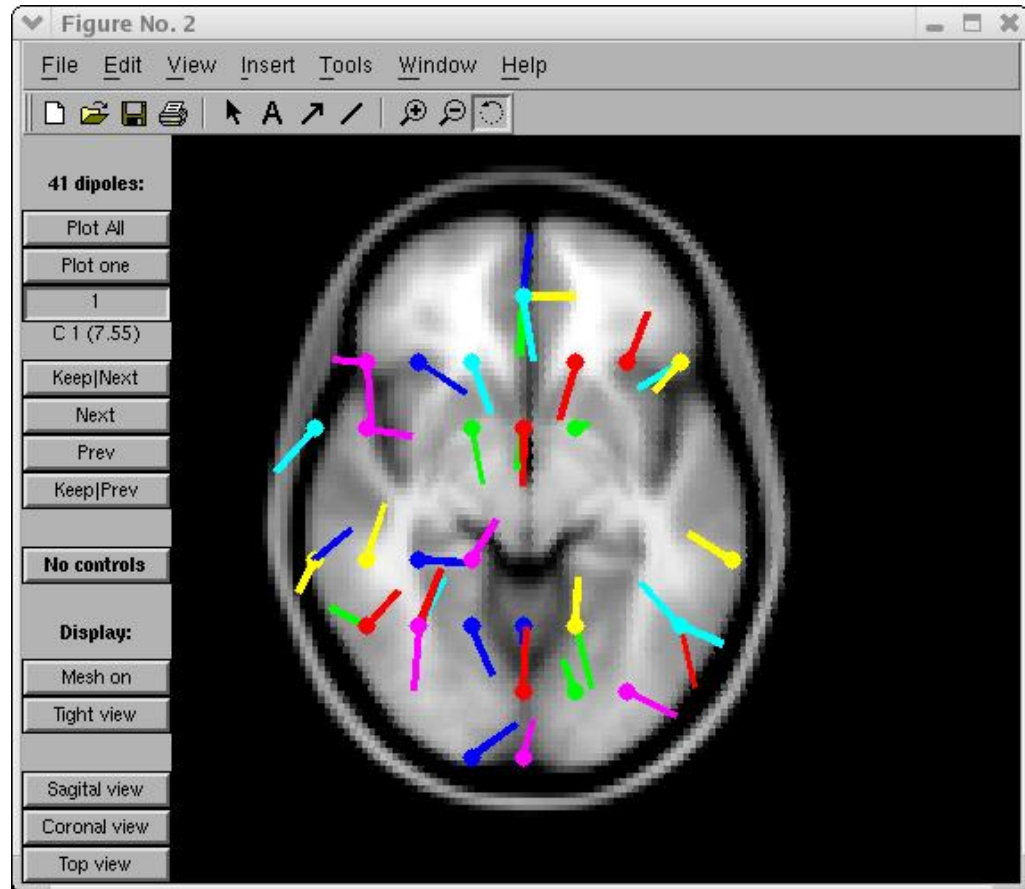
Help Cancel Ok

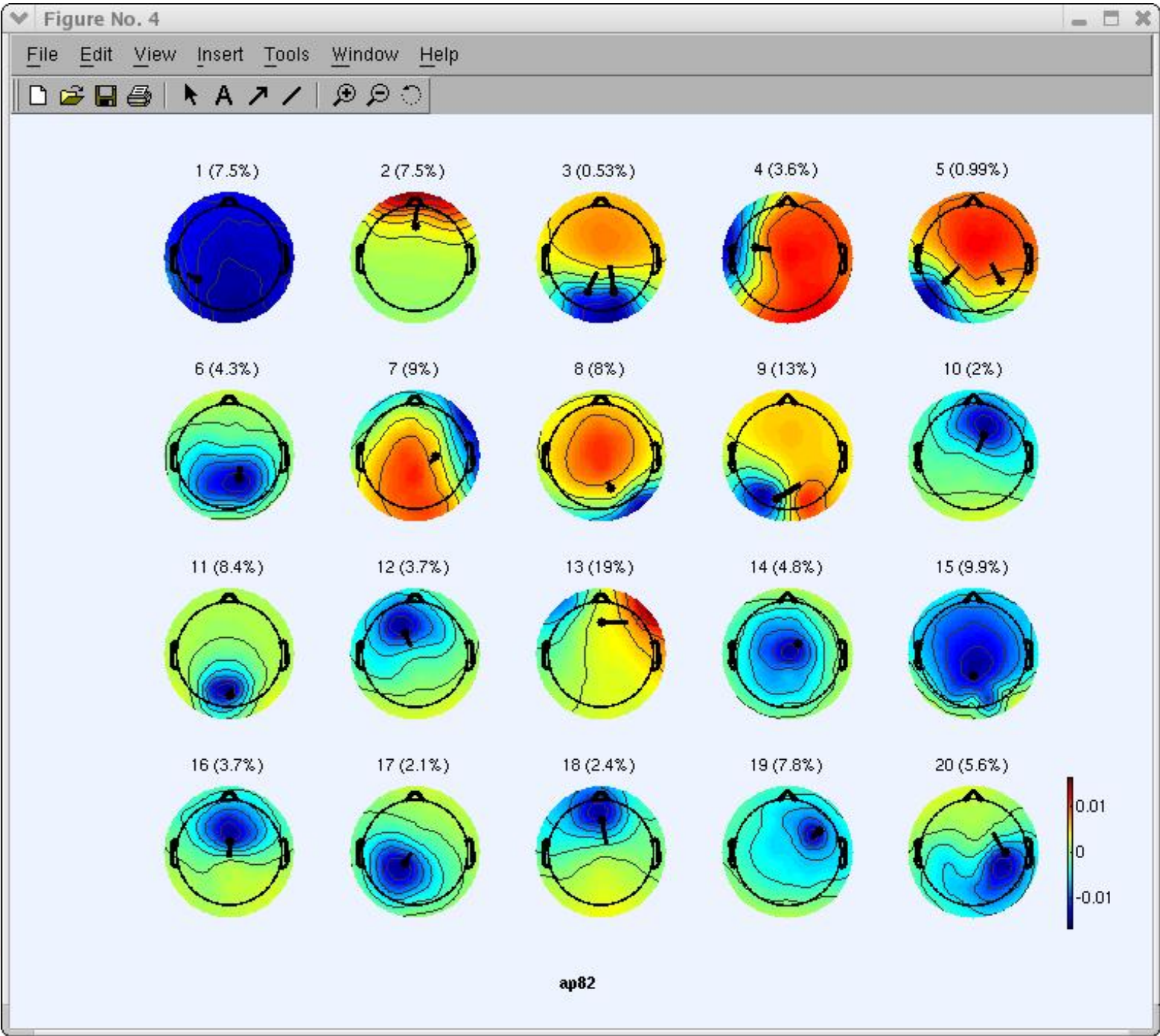


Localizing components

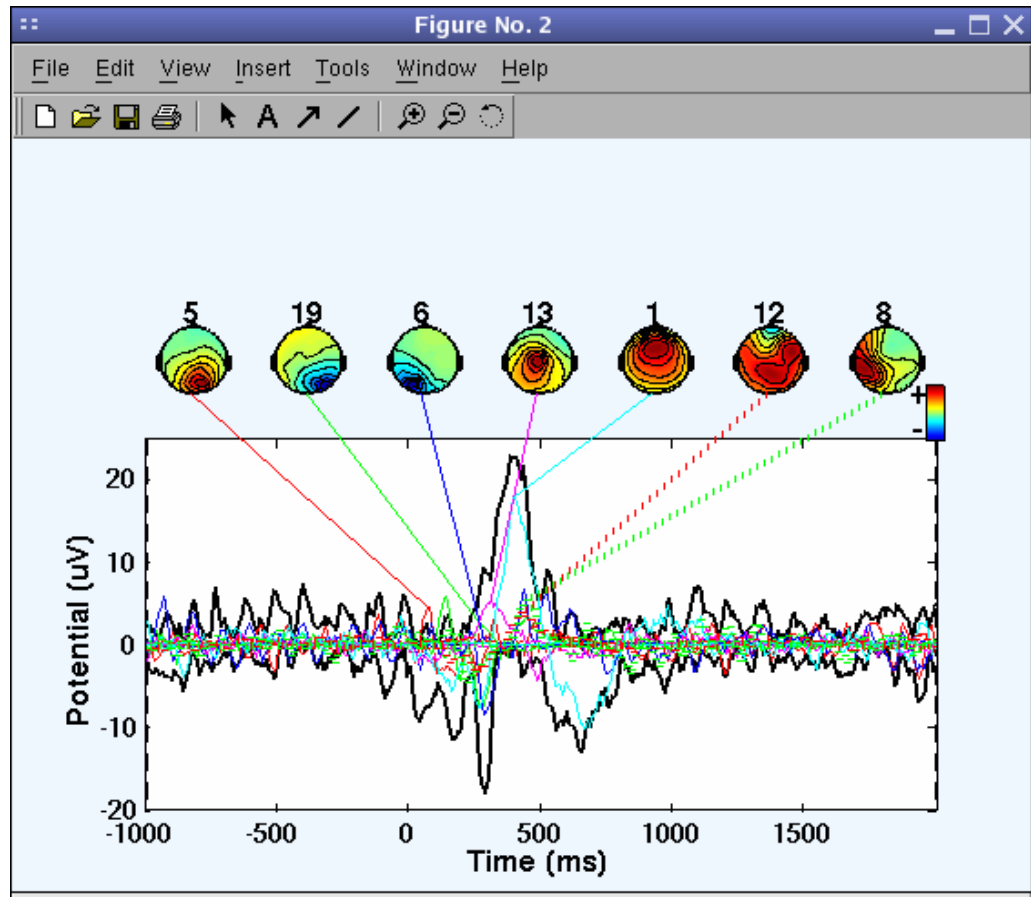
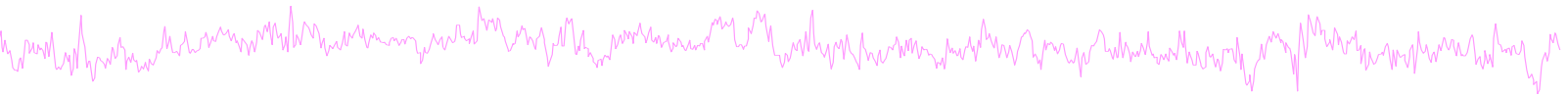
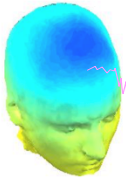


- Head model and settings
- Coarse fit (grid scan)
- Fine fit (iterative)
- Autofit (coarse fit, fine fit & plot)
- Plot component dipoles





Component contribution to the ERP



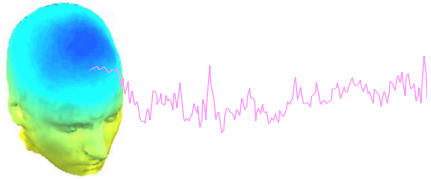
EEGLAB v13.x (dev)

File Edit Tools **Plot** Study Datasets Help

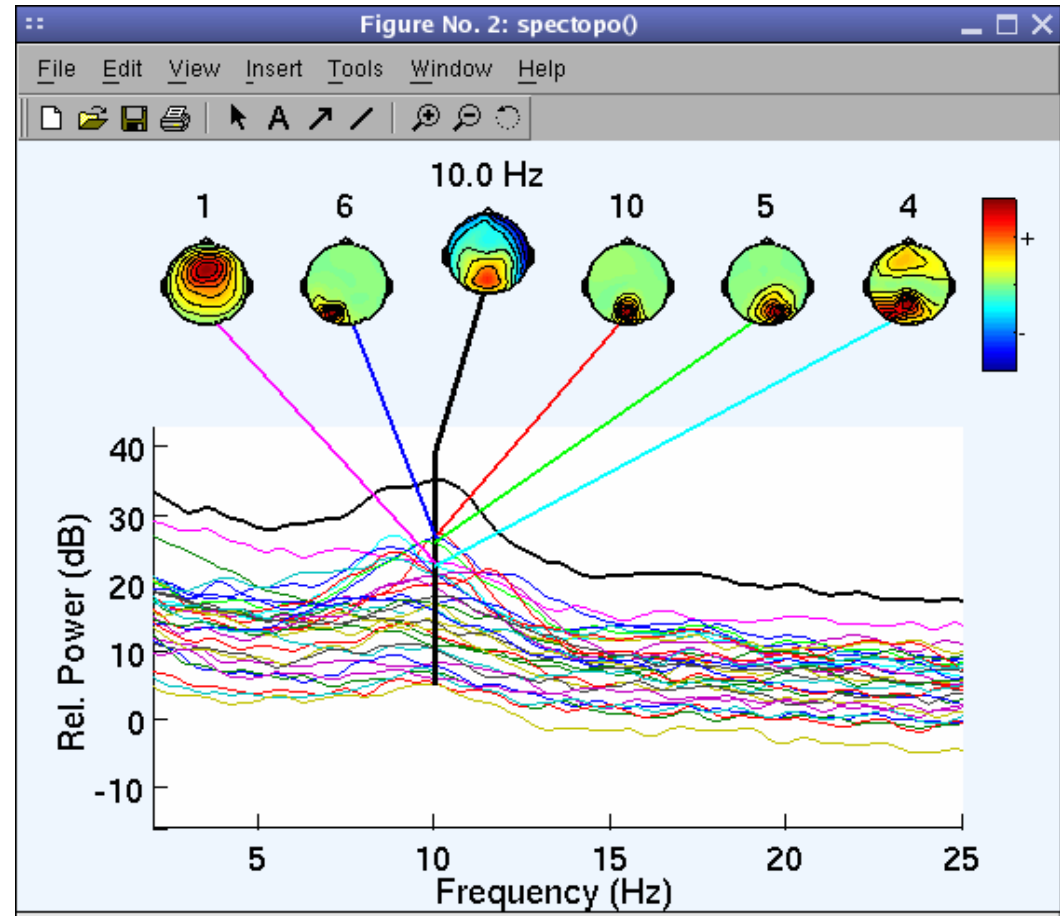
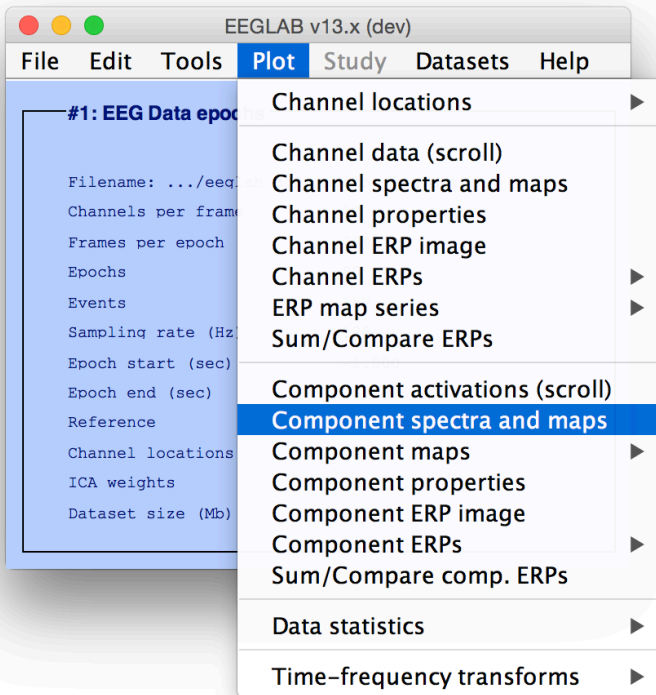
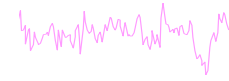
#1: EEG Data epoch

- 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

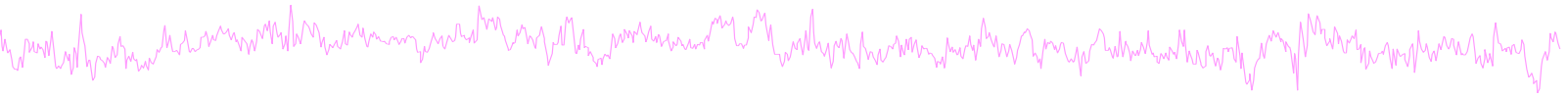
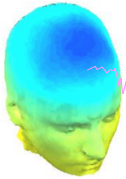
With component maps
With comp. maps (compare)
In rectangular array



Component contribution to the EEG spectrum



Component time-frequency



EEGLAB v13.x (dev)

File Edit Tools **Plot** Study Datasets Help

#1: EEG Data epoch

- Filename: .../eeq...
- Channels per frame
- Frames per epoch
- Epochs
- Events
- Sampling rate (Hz)
- Epoch start (sec)
- Epoch end (sec)
- Reference
- Channel locations
- ICA weights
- Dataset size (Mb)

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

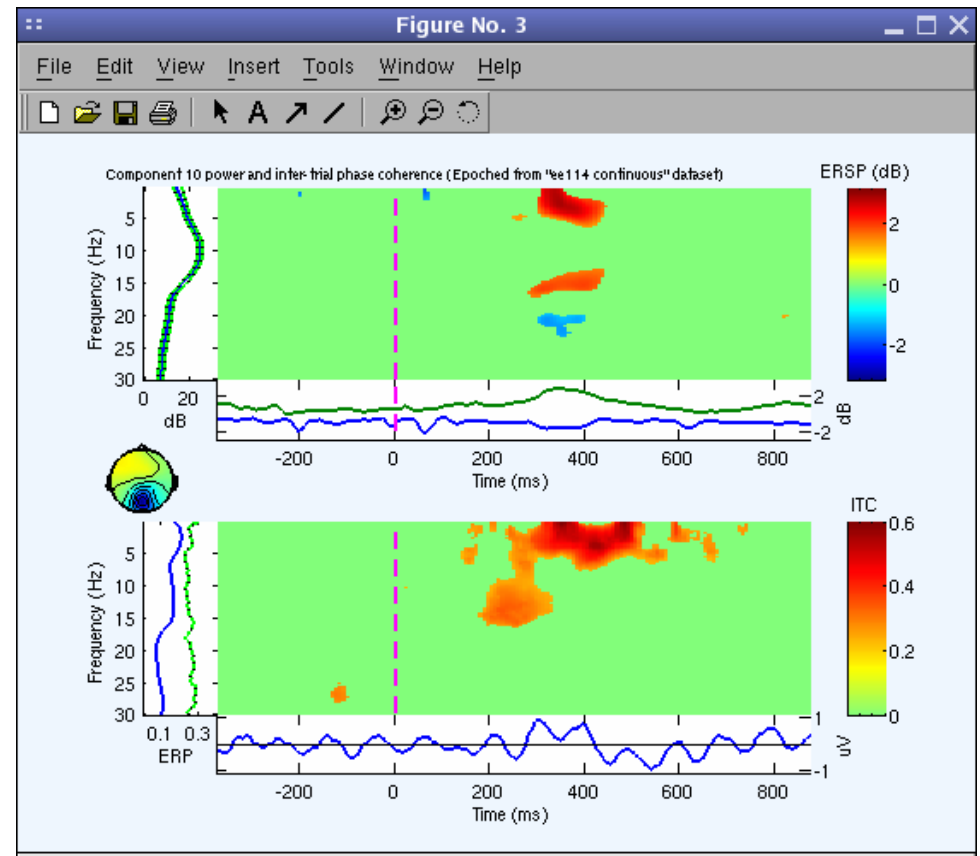
Component ERPs

Sum/Compare comp. ERPs

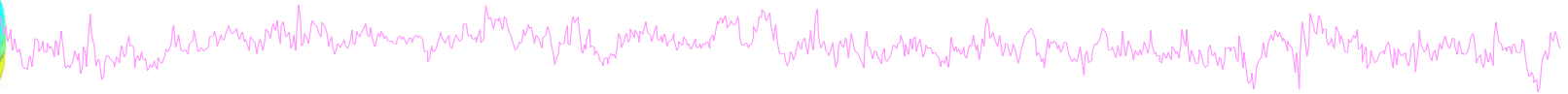
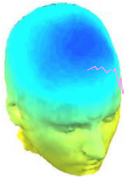
Data statistics

Time-frequency transforms

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



EEGLAB standard processing pipeline



Single subject

1. Import binary data, events and channel location
2. Edit, Re-reference, Resample, High pass filter data
3. Reject artifacts in continuous data by visual inspection
4. Extract epochs from data & reject artifactual epochs
5. Visualize data measures
6. Perform ICA decomposition
 - Perform source localization of components
 - Analyze components contribution to ERP
 - Analyze components contribution to spectrum

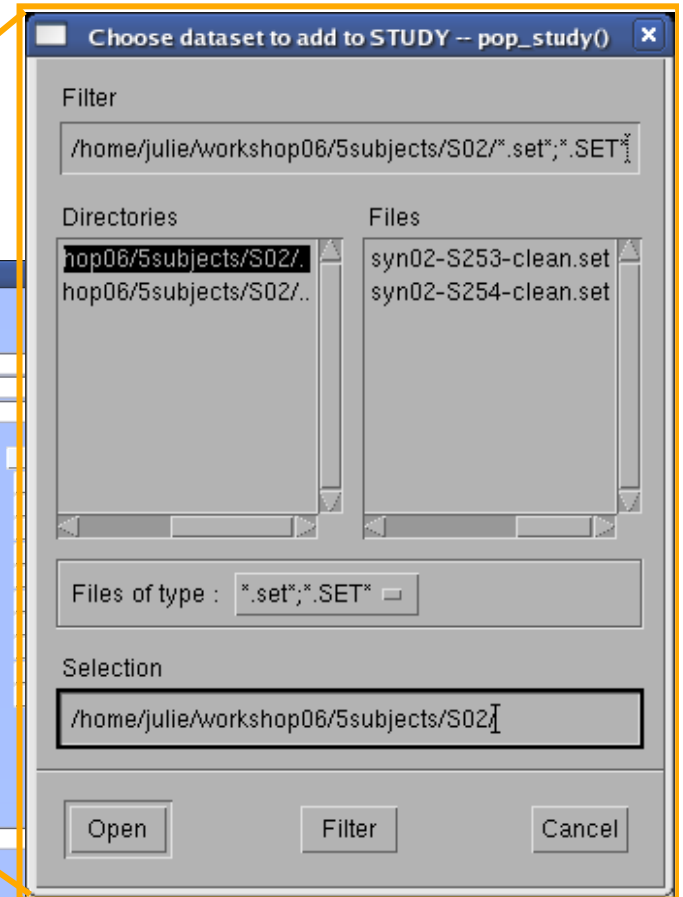
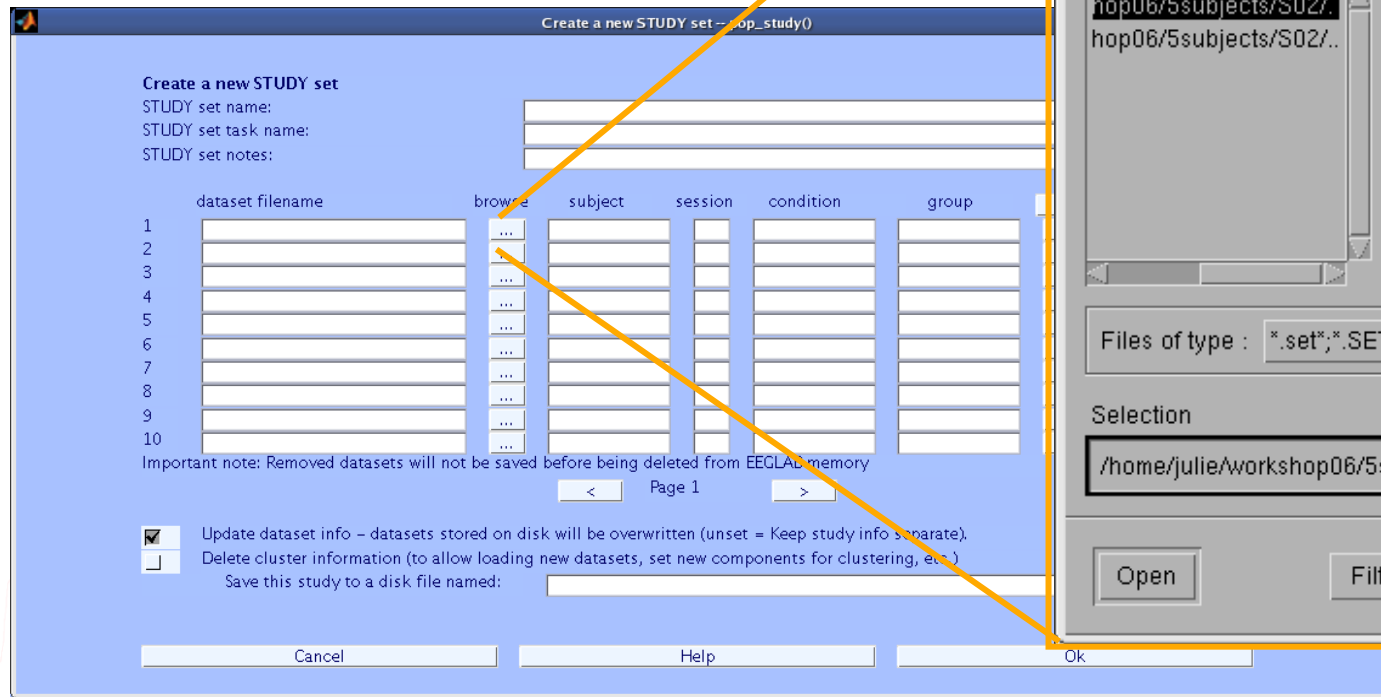
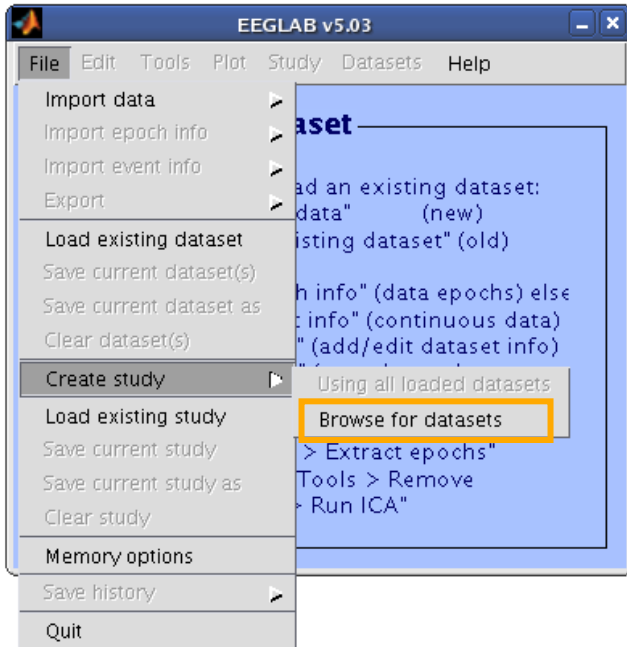
Multi-subjects

1. Build study and STUDY design
2. Pre-compute measures
3. Cluster components
4. Analyze clusters



Advanced analysis using scripting and EEGLAB command line functions

1. Build a STUDY



EEGLAB v9.0.0.0b

File Edit Tools Plot **Study** Datasets Help

STUDY set:

Study filename: ...s/data
 Study task name
 Nb of subjects
 Nb of conditions
 Nb of sessions
 Nb of groups
 Epoch consistency
 Channels per frame 61
 Channel locations yes
 Clusters 1
 Status Pre-clustered
 Total size (Mb) 8.2

Edit study info
Select/Edit study design(s)
 Precompute channel measures
 Plot channel measures
 Precompute component measures
 Measure Product clustering ▶
 PCA clustering (original) ▶
 Edit/plot clusters

Edit STUDY design



Edit STUDY design -- pop_studydesign()

Select STUDY design New Rename Delete Design Matrix

Comparing conditions
 Memorize-Ignore -- Load
 Probe Only -- Load
 Design 4
 Ignore+Memorize vs Probe
 My design

Resave STUDY

Edit selected design

Independent variables New Import Edit Delete

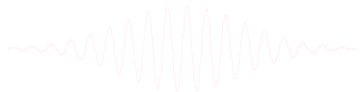
Categorical variable: condition - Values (ignore - memor)

Subjects

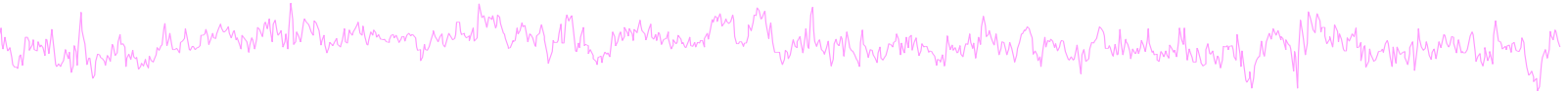
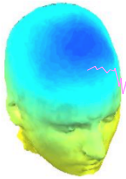
S07
 S08
 S09
 S10
 S11
 S12
 S13

Delete all pre-computed datafiles for this STUDY design

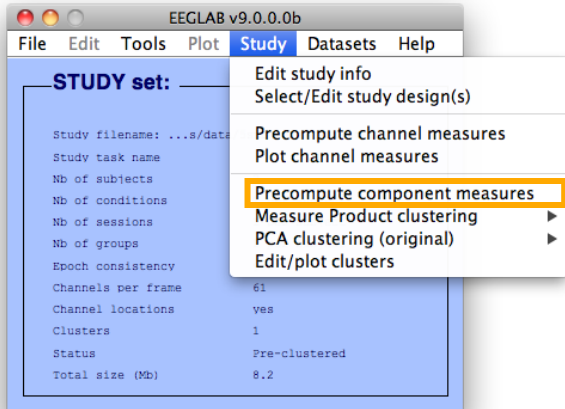
Web help Cancel Ok



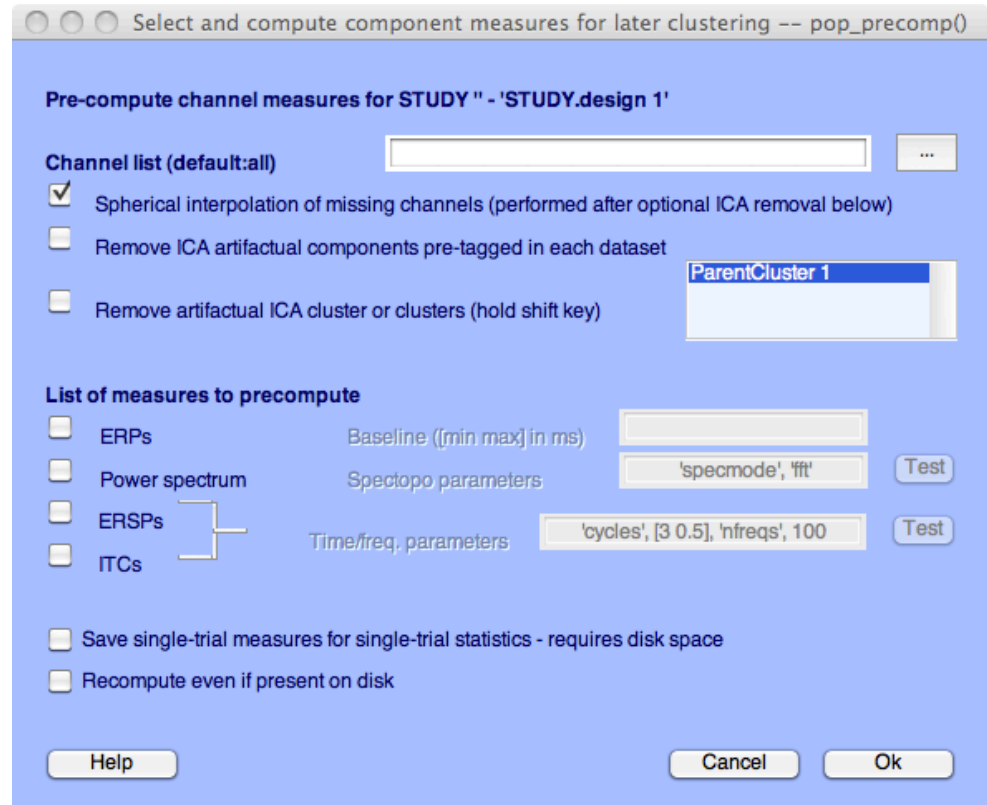
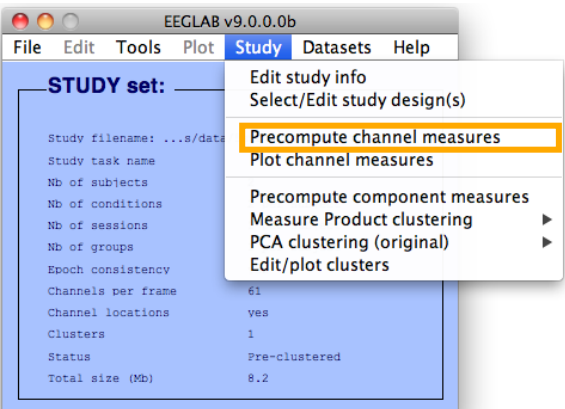
2. Pre-compute measures



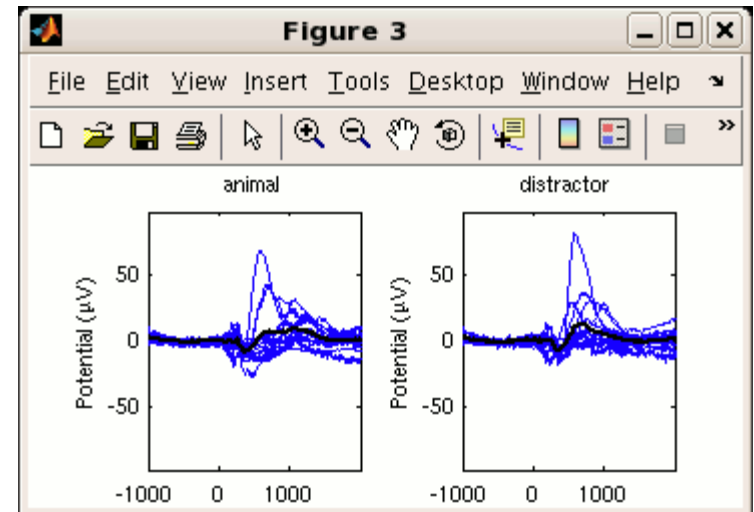
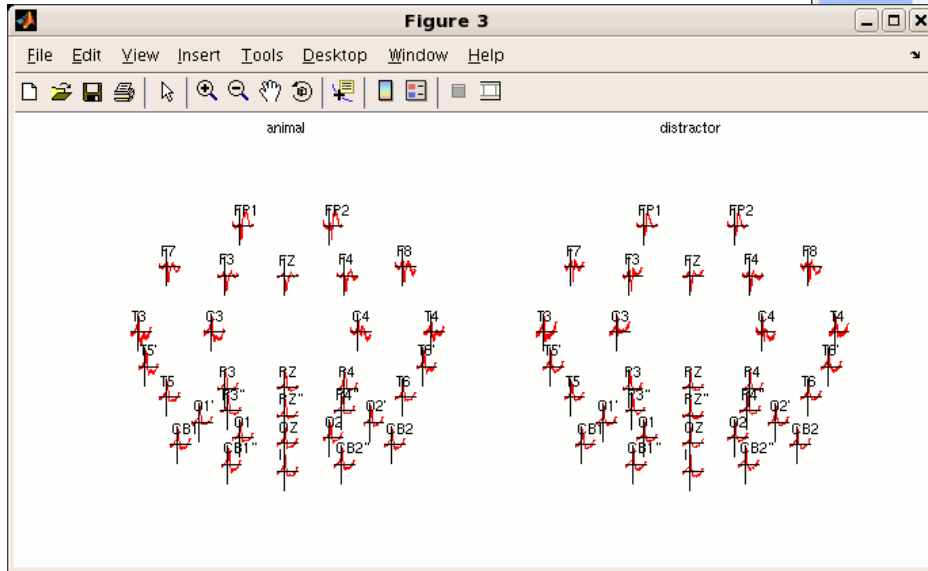
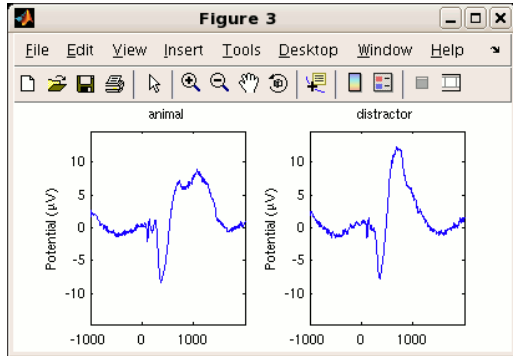
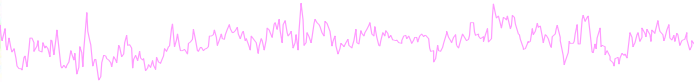
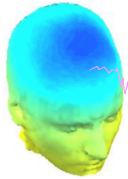
Components



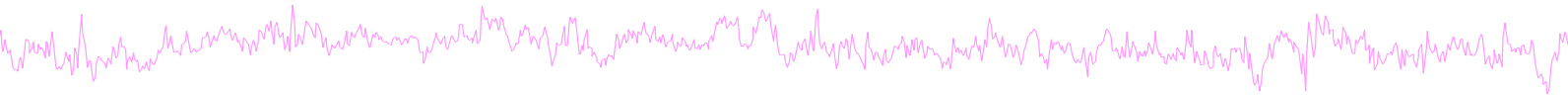
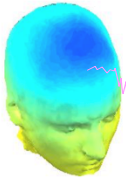
Channels



Channel plotting



3. Cluster components



EEGLAB v6.0b

File Edit Tools Plot **Study** Datasets Help

STUDY set: At

Study filename:
Study task name
Nb of subjects
Nb of conditions
Nb of sessions
Nb of groups
Epoch consistency: yes
Channels per frame: 31
Channel locations: yes
Clusters: 1
Status: Pre-clustered
Total size (Mb): 32.4

- Edit study info
- Precompute channel measures
- Plot channel measures
- Precompute component measures
- Build preclustering array**
- Cluster components
- Edit/plot clusters

Select and compute component measures for later clustering -- pop_preclust()

Build pre-clustering matrix for STUDY 'Attention'
Select the cluster to refine during sub-clustering (any existing sub-hierarchy will be overwritten)

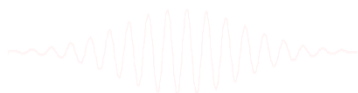
ParentCluster 1 (181 ICs)

(note: only measures that have been precomputed may be used)

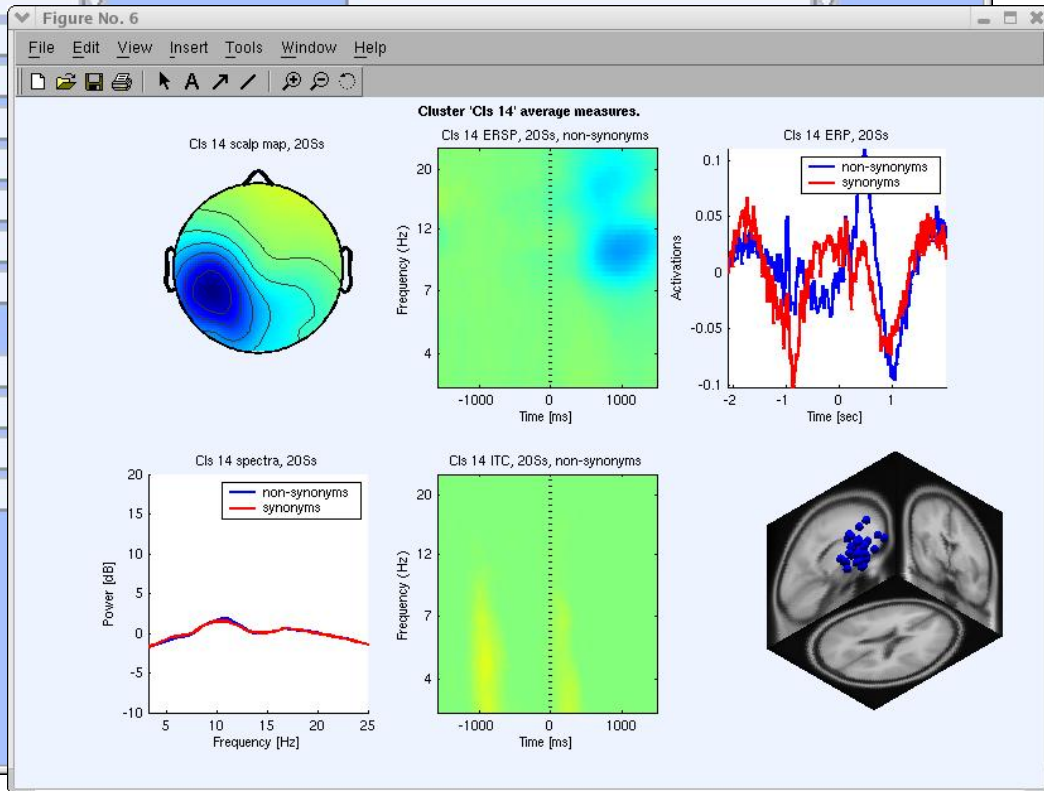
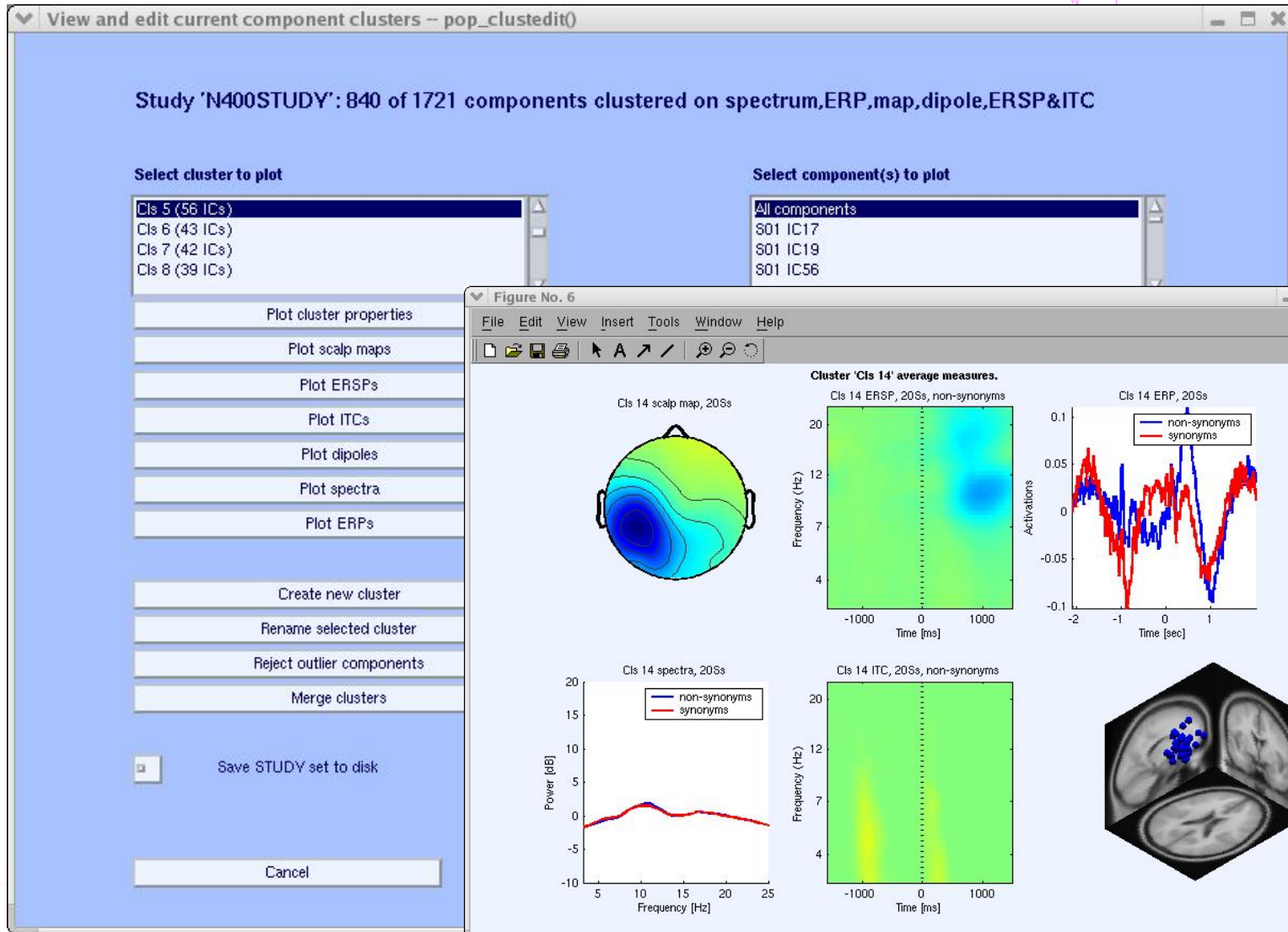
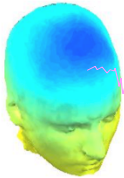
Load	Dims.	Norm.	Rel. Wt.	
<input checked="" type="checkbox"/> spectra	10	<input checked="" type="checkbox"/>	1	Freq. range [Hz] 3 25
<input checked="" type="checkbox"/> ERPs	10	<input checked="" type="checkbox"/>	1	Time range [ms] 0 600
<input checked="" type="checkbox"/> dipoles	3	<input checked="" type="checkbox"/>	10	
<input type="checkbox"/> scalp maps	10	<input checked="" type="checkbox"/>	1	Use channel values <input checked="" type="checkbox"/> Absolute values
<input checked="" type="checkbox"/> ERSPs	20	<input checked="" type="checkbox"/>	1	Time range [ms] 0 1500 Freq. range [Hz] 3 45
<input checked="" type="checkbox"/> ITCs	10	<input checked="" type="checkbox"/>	1	Time range [ms] 0 600 Freq. range [Hz] 2 30
<input type="checkbox"/> Final dimensions	10			

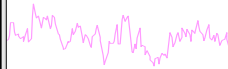
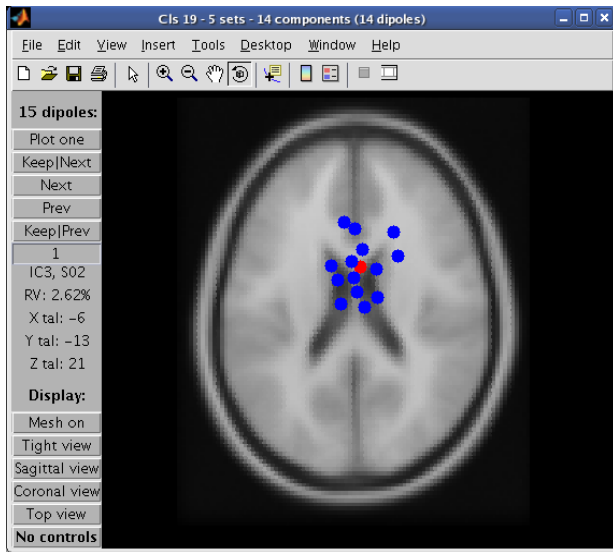
Save STUDY to file /home/julie/WorkshopSD2007/STUDY/attention.study ...

Cancel Help Ok



4. Analyze clusters





View and edit current

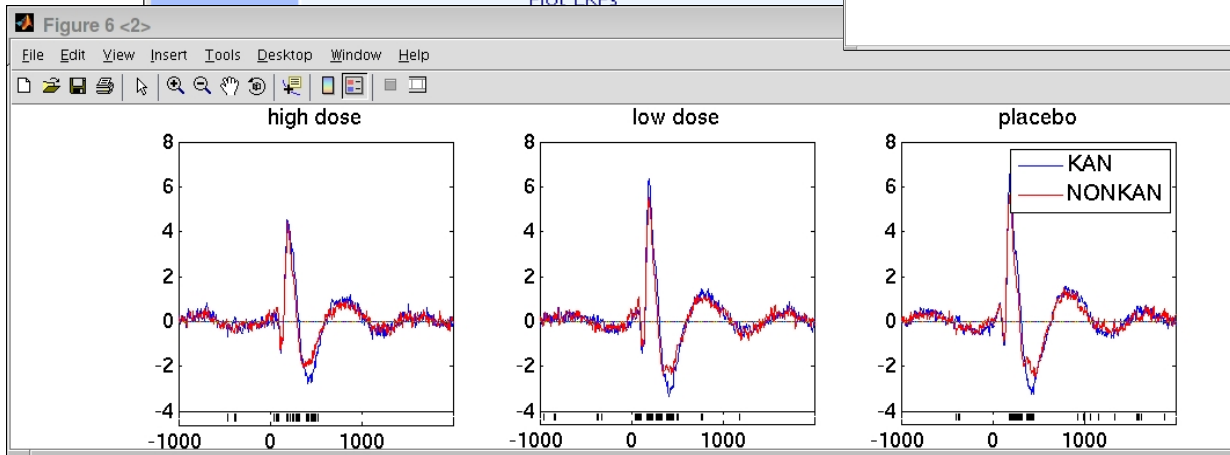
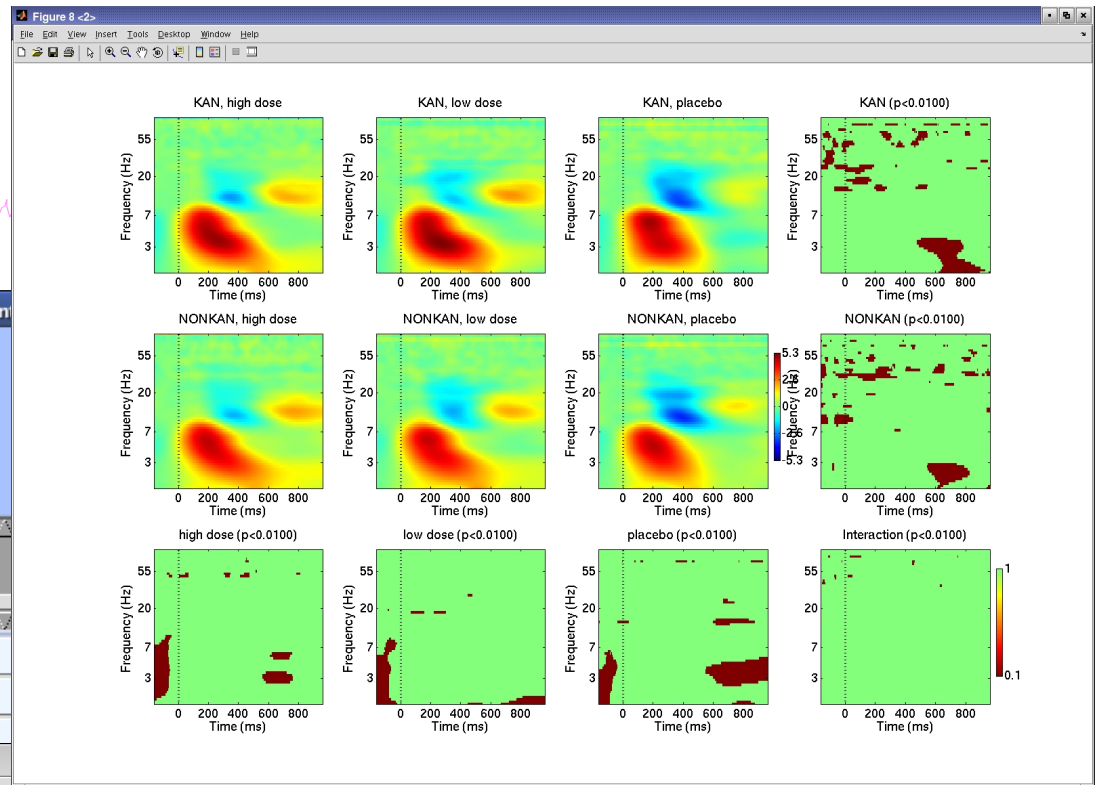
nts clustered

Clis 17 (8 ICs)
 Clis 18 (14 ICs)
 Clis 19 (14 ICs)
 Outliers Clis 17 20 (1 ICs)

Plot scalp maps

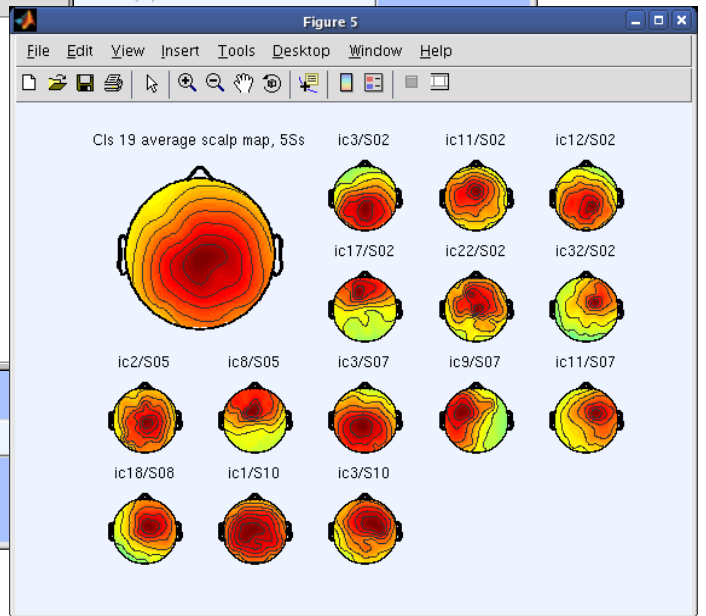
Plot dipoles

Plot FRPs

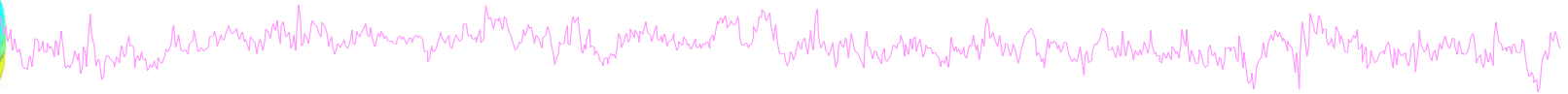
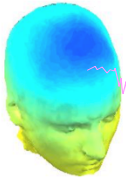


Cancel

Help



EEGLAB standard processing pipeline



Single subject

1. Import binary data, events and channel location
2. Edit, Re-reference, Resample, High pass filter data
3. Reject artifacts in continuous data by visual inspection
4. Extract epochs from data & reject artifactual epochs
5. Visualize data measures
6. Perform ICA decomposition
 - Perform source localization of components
 - Analyze components contribution to ERP
 - Analyze components contribution to spectrum

Multi-subjects

1. Build study and design
2. Pre-compute measures
3. Cluster components
4. Analyze clusters



Advanced analysis using scripting and EEGLAB command line functions

EEG structure

EEG =

```
setname:'Epoched from "ee114 continuous"'
filename:'ee114squareepochs.set'
filepath:'/home/arno/ee114/'
pnts:384
nbchan:32
trials:80
srate:128
xmin :-1
xmax:1.9922
data:[32x384x80 double]
icawinv:[32x32 double]
icasphere:[32x32 double]
icaweights:[32x32 double]
icaact:[32x384x80 double]
event:[1x157 struct]
epoch:[1x80 struct]
chanlocs:[1x32 struct]
comments:[8x150 char]
averef:'no'
rt:[]
eventdescription:{1x5 cell}
epochdescription:{}
specdata:[]
specicaact:[]
reject:[1x1 struct]
stats:[1x1 struct]
splinefile:[]
ref:'common'
history:[7x138 char]
urevent:[1x154 struct]
times:[1x384 double]
```

Number of data points per trial

Number of channels

Number of trials

Sampling rate

Time limits

Data

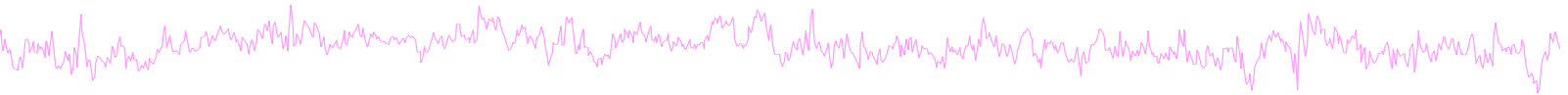
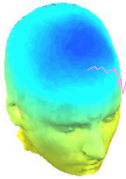
ICA scalp maps

ICA activity

Epoch/event information

Channel location

3 levels of functions



Administrative functions: handle EEG and ALLEEG structures

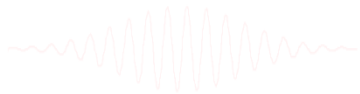
`eeglab()`, `eeg_checkset()`, `pop_delset()`, ...

Pop functions: interactive functions using EEG structure

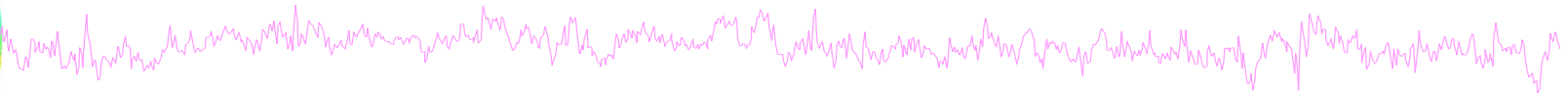
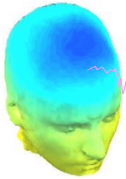
`pop_erpimage()`, `pop_topoplot()`, `pop_envtopo()`, ...

Signal processing functions: perform signal processing

`erpimage()`, `topoplot()`, `envtopo()`, ...

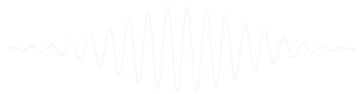


Command line tools



(“eegh” Menus write both dataset and global history)

- Automated processing on groups of subjects (possibly on several processors).
- Richer options for plotting and processing functions (time-frequency decompositions, ...)
- Custom processing...



EEGLAB Scripting

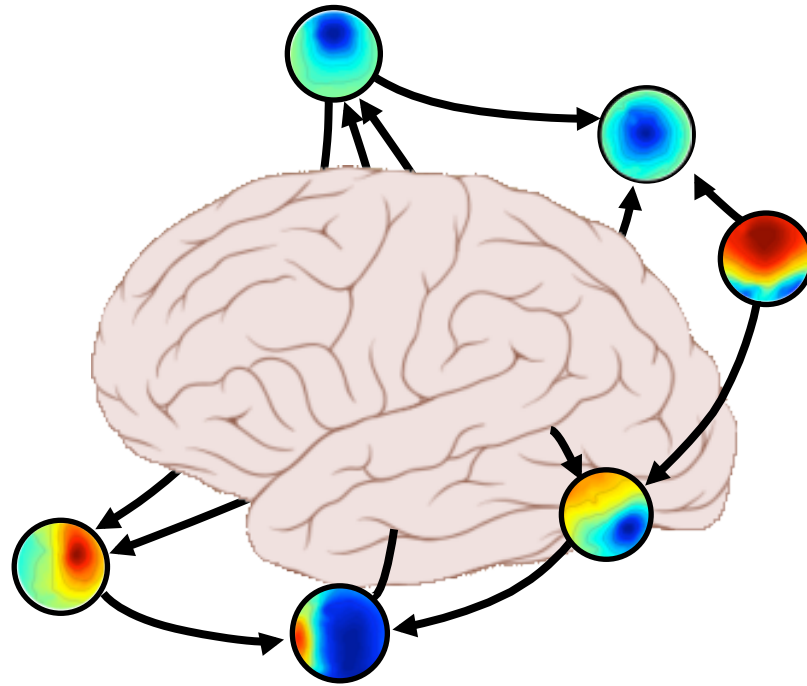
```
% Create Stern STUDY
[ALLEEG EEG CURRENTSET ALLCOM] = eeglab;
pop_editoptions( 'option_storedisk', 1);
subjects = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' 'S08' 'S09' 'S10' 'S11' 'S12'};
filepath = '/Users/arno/temp/STUDY'; % XXXXX Change path here XXXXX
if ~exist(filepath), error('You need to change the path to the STUDY'); end;
commands = {}; % initialize STUDY dataset list

% Loop through all of the subjects in the study to create the dataset
for loopnum = 1:length(subjects) %for each subject
    IgnoreFile = fullfile(filepath, subjects{loopnum}, 'Ignore.set');
    MemorizeFile = fullfile(filepath, subjects{loopnum}, 'Memorize.set');
    ProbeFile = fullfile(filepath, subjects{loopnum}, 'Probe.set');
    commands = {commands{:} ...
        ['index' 3*loopnum-2 'load' IgnoreFile 'subject' subjects{loopnum} 'condition' 'Ignore'] ...
        ['index' 3*loopnum-1 'load' MemorizeFile 'subject' subjects{loopnum} 'condition' 'Memorize'] ...
        ['index' 3*loopnum 'load' ProbeFile 'subject' subjects{loopnum} 'condition' 'Probe']};
end;
% Uncomment the line below to select ICA components with less than 15% residual variance
% commands = {commands{:} {'dipselect', 0.15}};
[STUDY, ALLEEG] = std_editset(STUDY, ALLEEG, 'name', 'Sternberg', 'commands', commands, 'updatedat', 'on');

% Update workspace variables and redraw EEGLAB
CURRENTSTUDY = 1; EEG = ALLEEG; CURRENTSET = [1:length(EEG)];
[STUDY, ALLEEG] = std_checkset(STUDY, ALLEEG);
eeglab redraw

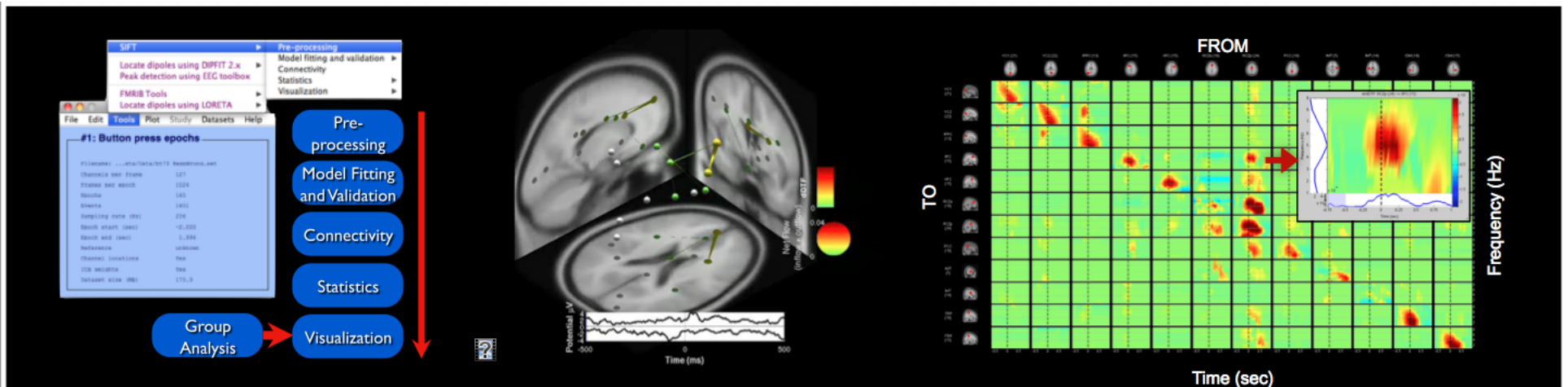
[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, {}, 'rmicacomps', 'on', 'interp', 'on', 'recompute', 'on', 'erp', 'on');
STUDY = pop_erpparams(STUDY, 'topotime', [200 300] );
[STUDY erpdata] = std_erpplot(STUDY, ALLEEG, 'channels', {'LEYE' 'REYE' 'OZ' 'O2' 'FP1' 'FPZ' 'FP2' 'AF7' ...
    'AF3' 'AFZ' 'AF4' 'AF8' 'F9' 'F7' 'F5' 'F3' 'F1' 'FZ' 'F2' 'F4' 'F6' 'F8' 'F10' 'FT9' ...
    'FT7' 'FC5' 'FC3' 'FC1' 'FCZ' 'FC2' 'FC4' 'FC6' 'FT8' 'FT10' 'T7' 'C5' 'C3' 'C1' 'CZ' ...
    'C2' 'C4' 'C6' 'T8' 'TP9' 'TP7' 'CP5' 'CP3' 'CP1' 'CPZ' 'CP2' 'CP4' 'CP6' 'TP8' 'TP10' ...
    'P7' 'P5' 'P3' 'P1' 'PZ' 'P2' 'P4' 'P6' 'P8' 'PO9' 'PO7' 'PO3' 'POZ' 'PO4' 'PO8' 'PO10' 'O1'});

dlmwrite('erpfile.txt', squeeze(erpdata{1}), 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt', squeeze(erpdata{2}), '-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
```



SIFT

Source Information Flow Toolbox

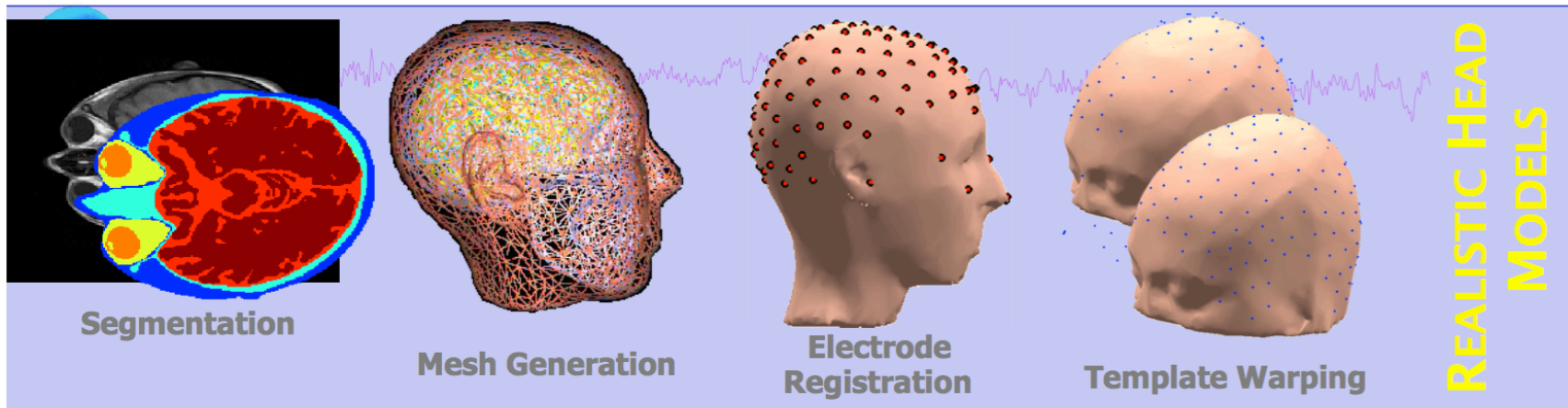


BCILAB - C. Kothe

The screenshot displays the BCILAB 0.9 software interface. The main window is titled "Review/edit approach" and shows a menu with "Train new model..." selected. A dialog box titled "Train a model" is open, showing parameters for training a model, including "Selected approach" (lastapproach ("Spectrally Weighted C..."), "Calibration data source" (lastdata ("imag.vhdr")), "Loss/Performance Metric" (Automatically chosen), "Cross-validation folds" (5), and "Spacing around test trials" (5). A "Figure 2: Common Spatial P..." window is also open, showing six topographic maps of the scalp and corresponding line plots of Spec-CSP patterns. The patterns are labeled "Spec-CSP Pattern 1" through "Spec-CSP Pattern 6". The plots show the amplitude of the patterns over time (0 to 40). The "Train a model" dialog box also shows "Performance estimates" (Cross-validation folds: 10, Spacing around test trials: 5) and "Cluster" options (Node pool: (use current config), Space as: lastmodel, Space as: laststats). A code editor window is visible at the bottom right, showing MATLAB code for training a model.

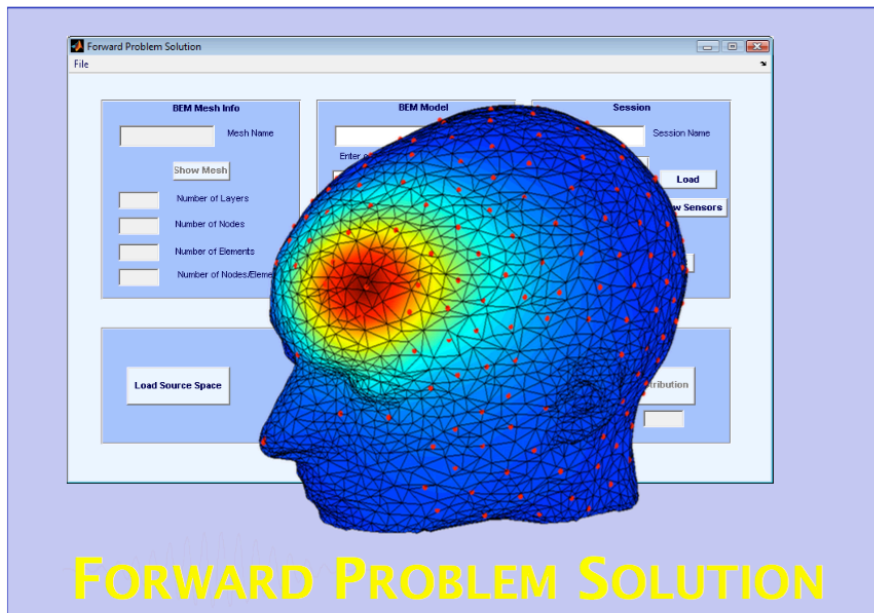
```
on, 'ZO', 0, 'F1', 1, 'Err', 2,  
'n-SlackShrink', 1, '1-Sla  
'poly', 1, 'rbf', 2, 'sigmoid  
SubsetHeuristic', 1, 'FixedI  
1, 'l2', 2);  
ling, 'slack', 1, 'margin', 2
```

NFT: Neuroelectromagnetic Forward Head Modeling Toolbox

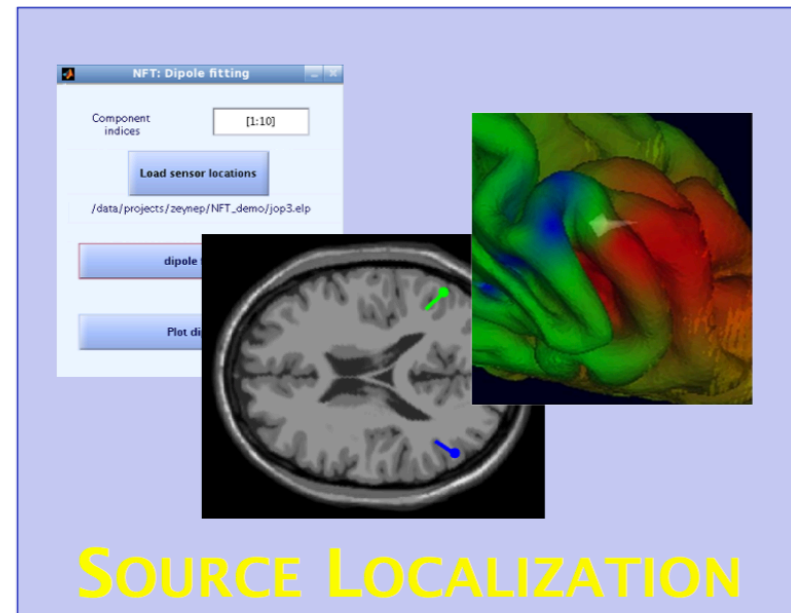


Segmentation **Mesh Generation** **Electrode Registration** **Template Warping**

REALISTIC HEAD MODELS



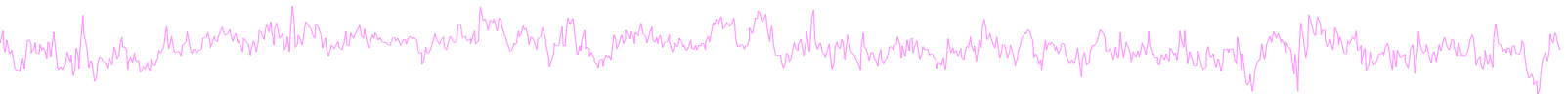
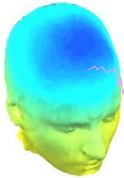
FORWARD PROBLEM SOLUTION



SOURCE LOCALIZATION

<http://sccn.ucsd.edu/nft>

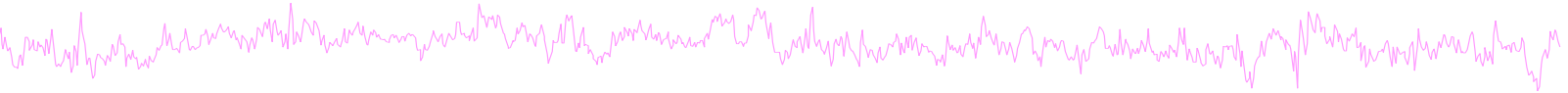
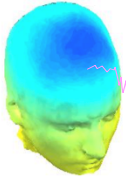
Pros/Cons of Matlab based open source



- Pros
 - Easy to program, highly modular and extendable
 - Not dependent on any platform (64-bit) and highly optimized
 - Large community of users (latest development in signal processing research)
 - Powerful scripting capabilities
- Cons
 - Matlab required for which you have to pay
 - Large memory requirements
 - Matlab bugs, possible version differences, cross-platform compatibility problems
 - Poor graphical interface



EEGLAB articles



Delorme, A., Makeig, S. (2004) EEGLAB: an open source toolbox for analysis of single-trial EEG dynamics including independent component analysis. *Journal of Neuroscience Methods*, 134(1), 9-21.

Makeig, S., Debener, S., Onton, J., Delorme, A. (2004) Mining event related dynamics. *Trends in cognitive Neuroscience*, 8(5), 204-210.

Delorme, A., Mullen, T., Kothe, C., Bigdely-Shamlo, N., Akalin, Z., Vankov, A., Makeig, S. (2011) EEGLAB, MPT, NetSIFT, NFT, BCILAB, and ERICA: New tools for advanced EEG/MEG processing. *Computational Intelligence*, article ID 130714.

Delorme, A., Kothe, C., Bigdely, N., Vankov, A., Oostenveld, R., Makeig, S. (2010) Matlab Tools for BCI Research? In "human-computer interaction and brain-computer interfaces". Editors : Tan, D. and Nijholt, A. Springer Publishing.

Delorme, A., Makeig, S. (2009) Open Source Programming for Interpreted Language: Graphic Interface and Macro Bridging Interface. 2009 Fifth International Conference on Signal-Image Technology & Internet-Based Systems (SITIS, indexed in IEEE), Nov. 29 2009-Dec. 4 2009, 430-434.

Delorme, A., Palmer, J., Onton, J., Oostenveld, R., Makeig, S. (2012) Independent EEG sources are dipolar. *PLoS One*, 7(2).

Delorme, A., Miyakoshi, M., Jung, T.P., Makeig, S. (2014) Grand average ERP-image plotting and statistics: A method for comparing variability in event-related single-trial EEG activities across subjects and conditions. *J Neurosci Methods*. 2014 Oct 22. pii: S0165-0270(14)00363-X. doi: 10.1016/j.jneumeth.2014.10.003

Workshop Program (with corresponding PDFs)

Purple lettering = lecture

Orange lettering = tutorial

Monday, July 3rd

16:30 -- Train station shuttle bus pick up

17:00 -- Airport shuttle bus pick up

19:45 -- Dinner (included in registration)

20:45 – 21:30 -- Optional beginner Matlab course by Ramon Martinez

Tuesday, July 4th

7:00 - 8:30 Breakfast

Overview and ICA Theory/Practice

8:30 – 9:45 -- Mining event-related brain dynamics I (Scott Makeig)

9:45 – 10:15 -- EEGLAB overview (Arnaud Delorme)

-- Break--

10:30 – 11:30 -- ICA theory (Arnaud Delorme)

11:30 – 12:30 -- Data import, Artifact rejection (Tracy Brandmeyer)

12:30-13:45 Lunch --

ICA and time-frequency

13:45 – 14:30 -- ICA decomposition practicum (Arnaud Delorme)

14:30 – 15:15 -- Evaluating ICA components practicum (Arnaud Delorme)

15:15 – 15:45 -- Bootstrapping ICA (Fiorenzo Artoni)

-- Break--

16:00 – 17:00 -- Time-frequency decompositions: Theory and practice (Tim Mullen)

19:45 -- Dinner

Wednesday, July 5th

7:30 - 8:30 Breakfast

Group analysis and ICA clustering in EEGLAB

8:30 - 9:00 -- Why cluster ICA components? (Scott Makeig)

9:00 - 9:30 -- Robust statistics and correction for multiple comparisons (Cyril Pernet)

9:30 - 10:30 -- Creating a STUDY and STUDY design (Arnaud Delorme)

-- Break--

10:45 - 11:45 -- Plotting and computing statistics in channels and components in STUDY (Arnaud Delorme)

11:45 - 12:45 -- Group analysis using EEGLAB studies: Methods to cluster ICA components (Arnaud Delorme)

12:45-13:45 Lunch --

13:45-18:00-- Hiking excursion

19:45 -- Dinner

Thursday, July 6th

7:30 - 8:30 Breakfast

Source Localization

8:30 – 9:30 -- Forward and inverse models - the Dipfit tools (Robert Oostenveld)

9:30 – 10:00 -- Using the Dipfit plugin of EEGLAB (Arnaud Delorme)

-- Break--

General Linear Modeling

10:15 – 12:00 -- Theory and practice of applying general linear models to EEG data using the LIMO EEGLAB plug-in (Cyril Pernet)

12:00 – 12:30 -- The future of LIMO and EEGLAB (Arnaud Delorme)

12:30-13:45 Lunch --

Source information flow

13:45 – 14:30 -- Source information flow and Granger-Causal modeling tools (Tim Mullen)

14:30 – 15:30 -- SIFT toolbox: Theory and live demo (Tim Mullen)

-- Break--

15:45 – 17:30 -- SIFT toolbox: practicum (Tim Mullen)

19:45 -- Dinner

20:00 - 23:00 -- SIFT hackathon, meet with Tim Mullen and his computer at the bar - ask anything you like

20:00 - 23:00 -- LIMO hackathon, meet with Cyril Pernet and his computer at the bar - ask anything you like

[Friday, July 7th](#)

7:30-8:30 -- Breakfast

8:30 – 9:30 -- Mining event-related brain dynamics II (Scott Makeig)

9:30 – 10:00 -- Using and building EEGLAB extensions/plugin-ins (Arnaud Delorme)

-- Break--

10:15 – 11:30 -- Practicum, small group projects

11:30 – 12:00 -- Participant project presentations and general discussion

12:15 -- Lunch

13:00 -- Airport/train station shuttle bus leaves Bois Perche

14:30+ -- Airport/train station shuttle bus arrives in Toulouse