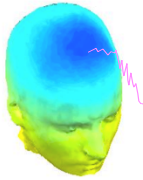
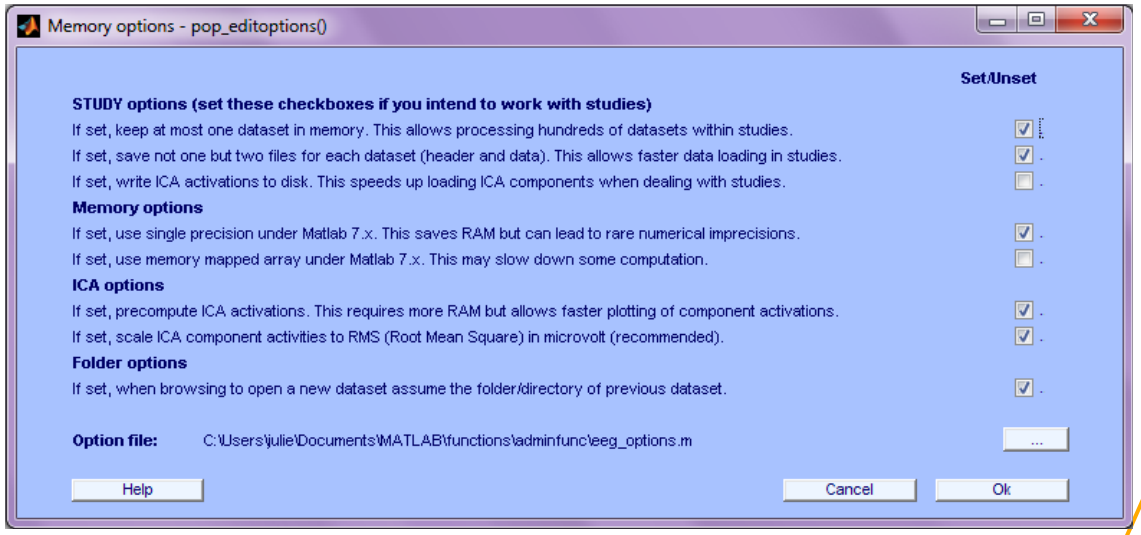
STUDY scripts



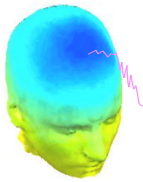


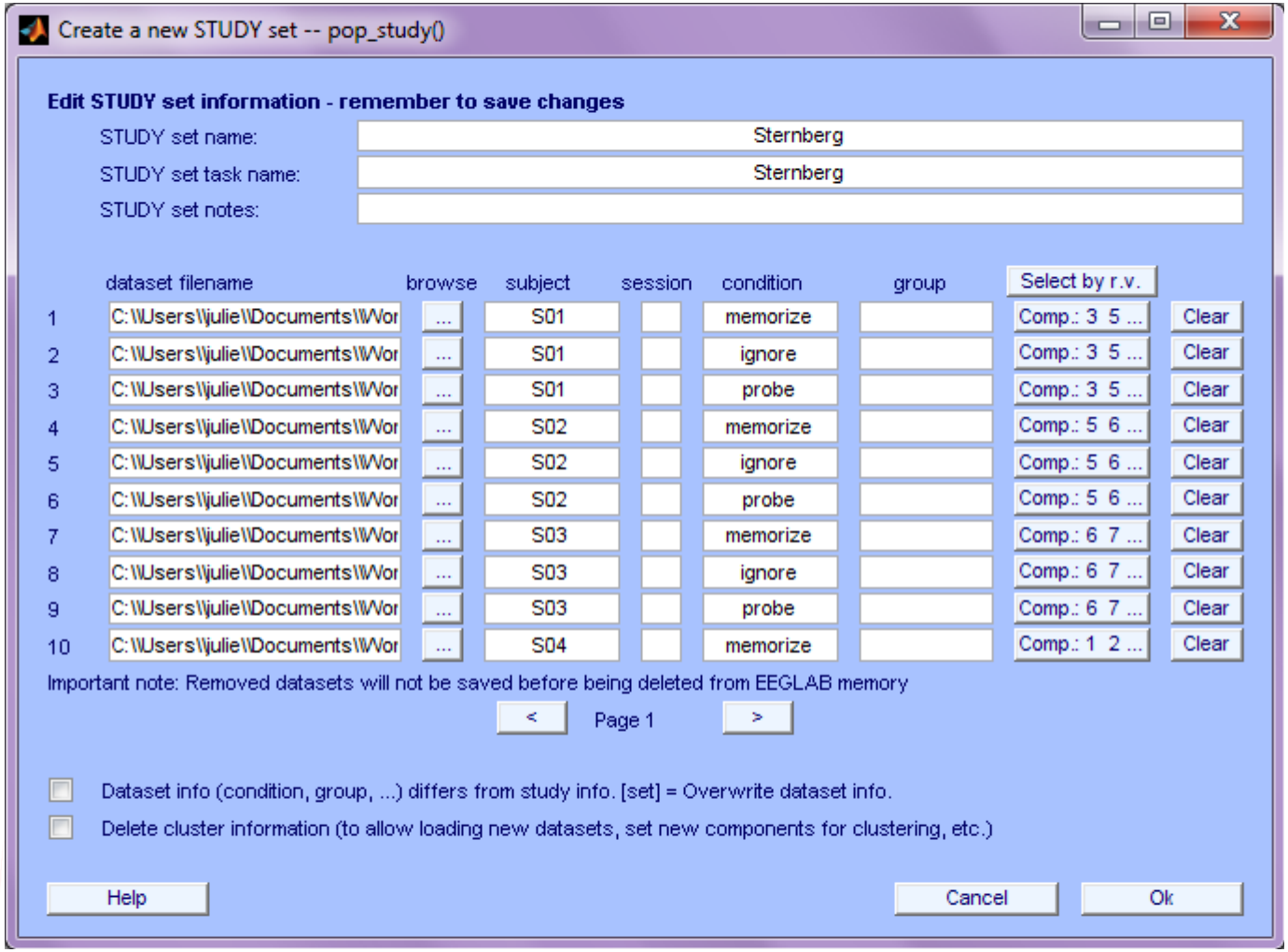
Most important option:

- Allows only one dataset to be loaded at once.
- Most STUDYs are too big to have all data loaded at once.

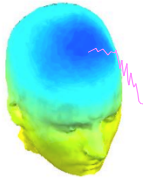
```
% Set memory options:
pop_editoptions( 'option_storedisk', 1);
```

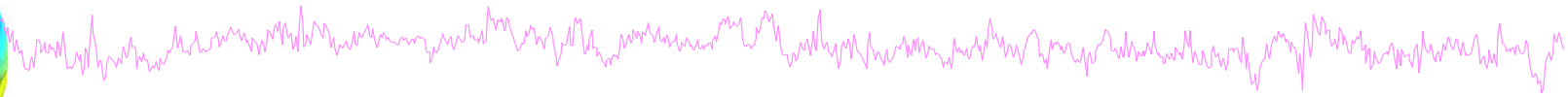
Edit dataset info





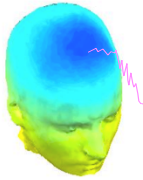
Load dataset info from commandline





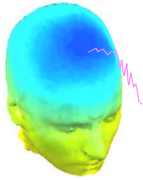
```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
         'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

% Now loop through subjects and add to the STUDY
for subj = 1:length(subjs) % for each subject
    fileIgnore   = fullfile(basedir, subjs{subj}, 'Ignore.set');
    fileMemorize = fullfile(basedir, subjs{subj}, 'Memorize.set');
    fileProbe    = fullfile(basedir, subjs{subj}, 'Probe.set');
    commands = { commands{:} ...
           {'index' 3*subj-2 'load' fileIgnore   'subject' subjs{subj} 'condition' 'Ignore' } ...
           {'index' 3*subj-1 'load' fileMemorize 'subject' subjs{subj} 'condition' 'Memorize' } ...
           {'index' 3*subj   'load' fileProbe    'subject' subjs{subj} 'condition' 'Probe' } };
end;
commands = { commands{:} { 'dipselect', 0.15 } };
[STUDY ALLEEG] = std_editset( STUDY, ALLEEG, 'name', 'Sternberg', ...
     'task', 'Sternberg', 'commands', commands, ...
     'updatedat','off', 'filename', fullfile(basedir, 'stern_autogenerated.study'));

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

STUDY structure



```
STUDY =
                name: 'Sternberg'
                task: 'Sternberg'
          datasetinfo: [1x39 struct]
               notes: ''
            filename: 'stern.study'
            filepath: 'C:\Users\julie\Documents\Workshops\Finland\STUDY'
             history: [1x7332 char]
             subject: {1x13 cell}
               group: {''}
             session: []
           condition: {'ignore'  'memorize'  'probe'}
              setind: [3x13 double]
                 etc: [1x1 struct]
            preclust: [1x1 struct]
             cluster: [1x1 struct]
             changrp: [1x71 struct]
               saved: 'yes'
```

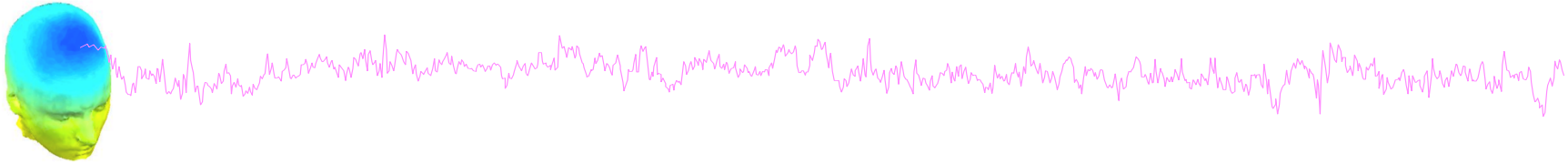
Understanding STUDY structure

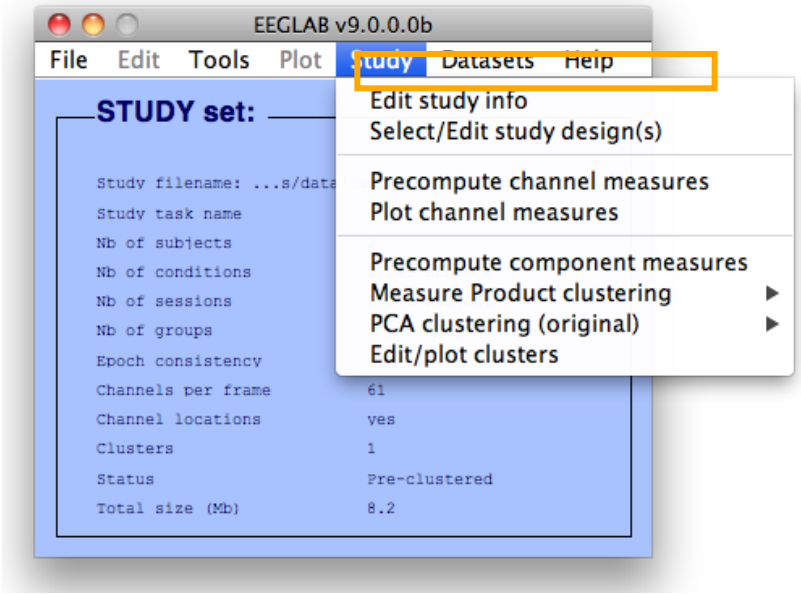


```
>> STUDY.datasetinfo(11) % access dataset 11
ans =
       filepath: [1x61 char]
      filename: 'S04.set'
       subject: 'S04'
       session: []
     condition: ''
         group: ''
     trialinfo: 1x350 struct
         index: 11
         comps: [1x24 double]
```

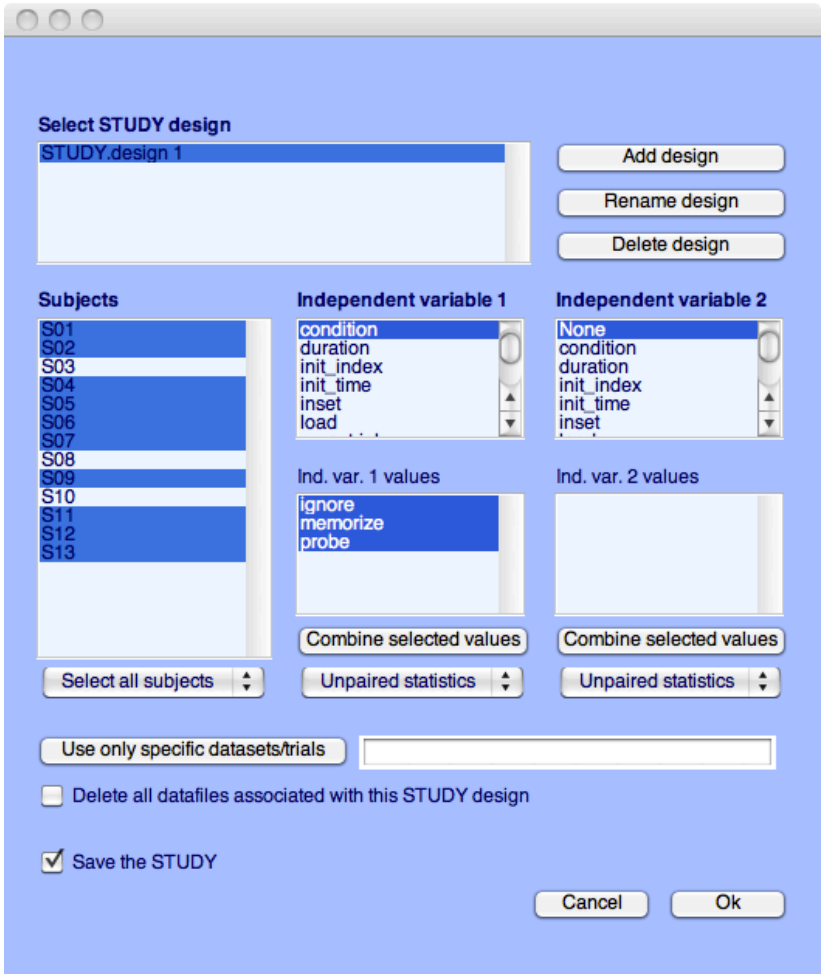
Subject 4!

```
>> trialinfo(163) % access trial 163
ans =
       stimtype: 'Memorize'
        latency: 13201
       duration: 0
       ...
```



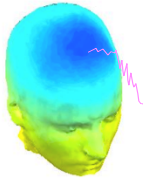


Select subjects




```
STUDY = std_makedesign(STUDY, ALLEEG, 3,
'variable1','condition',
'variable2','',
'name','Design 3',
'values1',{'ignore' 'memorize' 'probe'},
'subjselect',{'S02' 'S03'},
'dataselect',{'condition' {'probe'}});
```

STUDY design structure

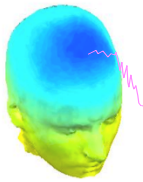


```
STUDY.design(1)

ans =

           name: 'Design 1 - compare letter types'
       variable: [1x2 struct]
          cases: [1x1 struct]
        include: {}
          cells: [1x39 struct]
```

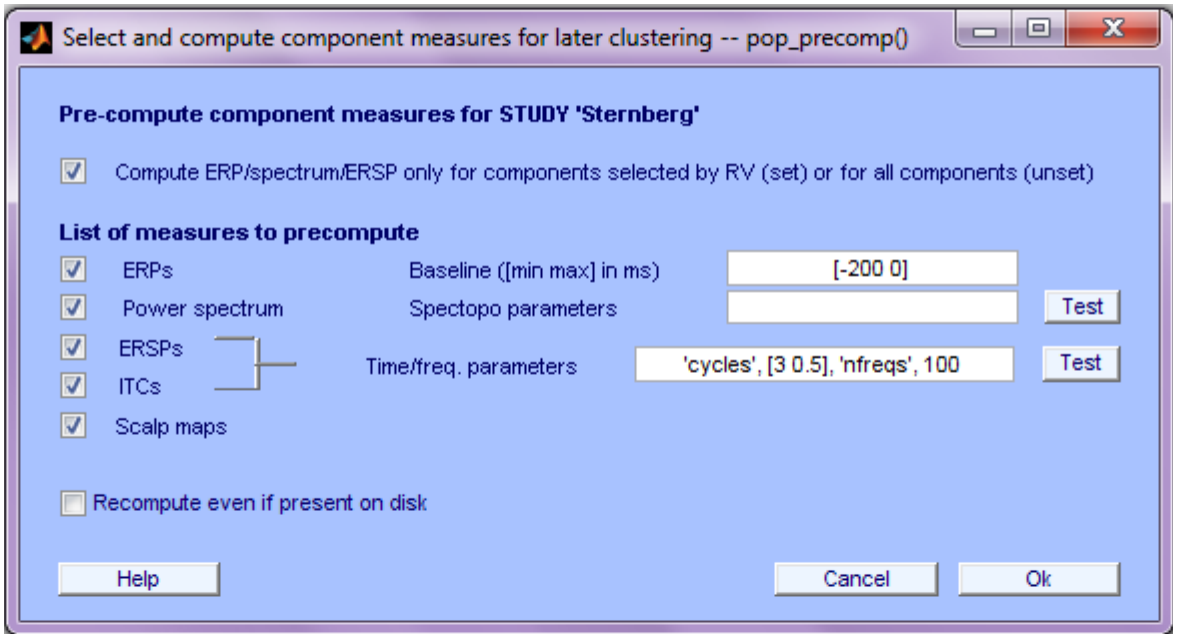
Exploding the contents of each of these sub-structures, we obtain

```
           name: 'Design 1 - light and audio all subjects'

       variable: [1x2 struct]
            (1).label  : 'condition'
            (1).pairing: 'on'
            (1).value  : {'ignore'  'memorize'  'probe'}
            (2).label  : ''
            (2).pairing: 'off'
            (2).value  : {}

         cases: [1x1 struct]
            label: 'subject'
            value: {'S01'  'S02'  'S03'  'S04'  'S05'  'S06' }

       include: {}

         cells: [1x39 struct]
             dataset : 2
             trials  : {[1x267 double]}
             value   : {'ignore'  ''}
             case    : 'S01'
             filebase: '/Volumes/donnees/data/STUDYstern/S01/Ignore'
```

Precompute data measures

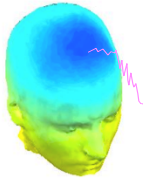


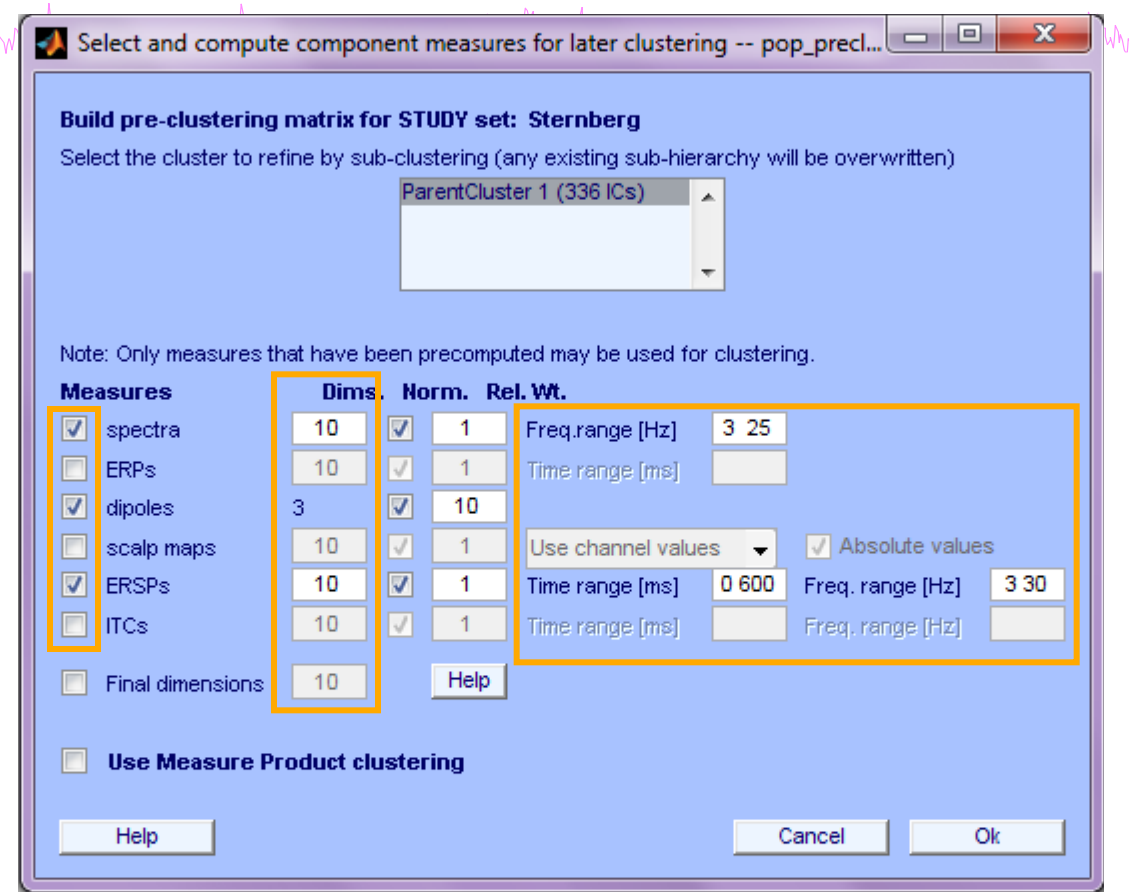
TIP: Compute all measures so you can test different combinations for clustering




```
[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, 'components', 'erp', ...
'on', 'rmbase',[-200 0] , 'scalp', 'on', 'spec', 'on', ...
'specparams',{}, 'ersp', 'on', 'erspparams', {'cycles' [3 0.5] ...
'nfreqs',100, 'freqs',[3 70] }, 'itc', 'on');
```

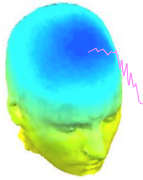
Precluster the data

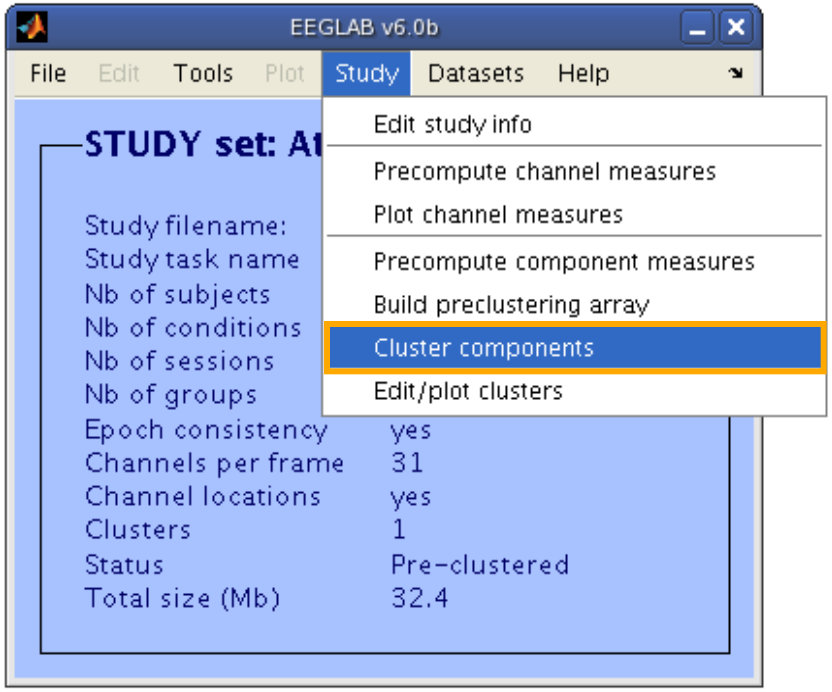


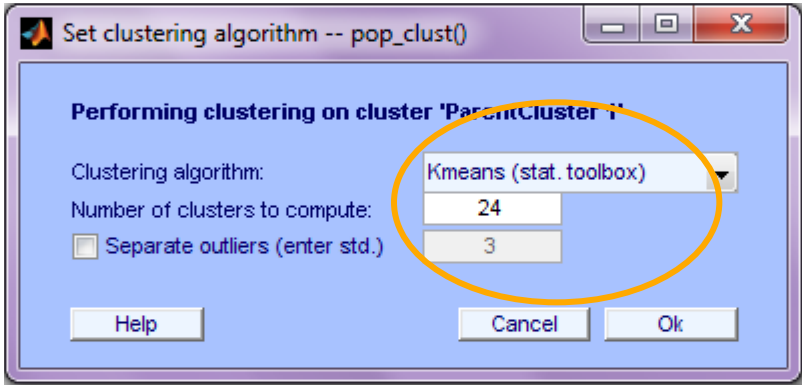



```
parentclust = 1;
[STUDY ALLEEG] = std_preclust(STUDY, ALLEEG, parentclust,{'spec','npca',5,…
   'norm',1,'weight',1,'freqrange',[3 25]},{'erp','npca',6,'norm',1,…
   'weight',1, 'timewindow',[0 400]},{'scalp','npca',10,'norm',1,'weight',1,…
   'abso',1},{'dipoles','norm',1,'weight',10},{'ersp','npca',20,…
   'freqrange',[3 30] ,'timewindow',[0 600],'norm',1,'weight',1},{'itc',…
   'npca',6,'freqrange',[3 30],'timewindow',[0 400] , 'norm',1, 'weight',1});
```

Cluster components

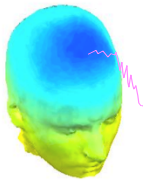


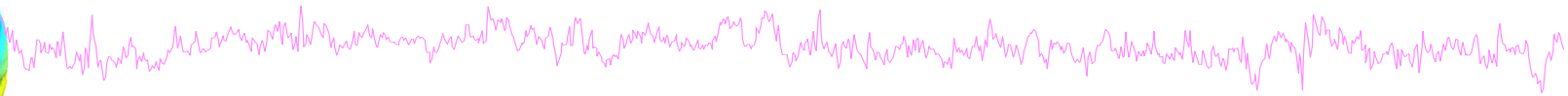





```
nclusts = 25; % choose # of clusters to create
[STUDY] = pop_clust(STUDY, ALLEEG,'algorithm','kmeans','clus_num',nclusts);
```

Understanding STUDY structure





26 = # of clusters

```
>> STUDY.cluster
1x26 struct array with fields:
    parent
    name
    child
    comps
    sets
    algorithm
    preclust
    dipole
    allinds
    setinds
```

One cluster:

```
>> STUDY.cluster(6)
ans =
        parent: {'ParentCluster 1'}
          name: 'Cls 6'
         child: []
         comps: [35 7 12 35 10 23 7 30 4 …]
          sets: [1 2 3 4 5 6 7 8 9 10 1 2 …]
     algorithm: {'Kmeans'  [24]}
      preclust: [1x1 struct]
        dipole: [1x1 struct]
       allinds: { [...] [...]; [...] [...]}
       setinds: { [...] [...]; [...] [...]}
```

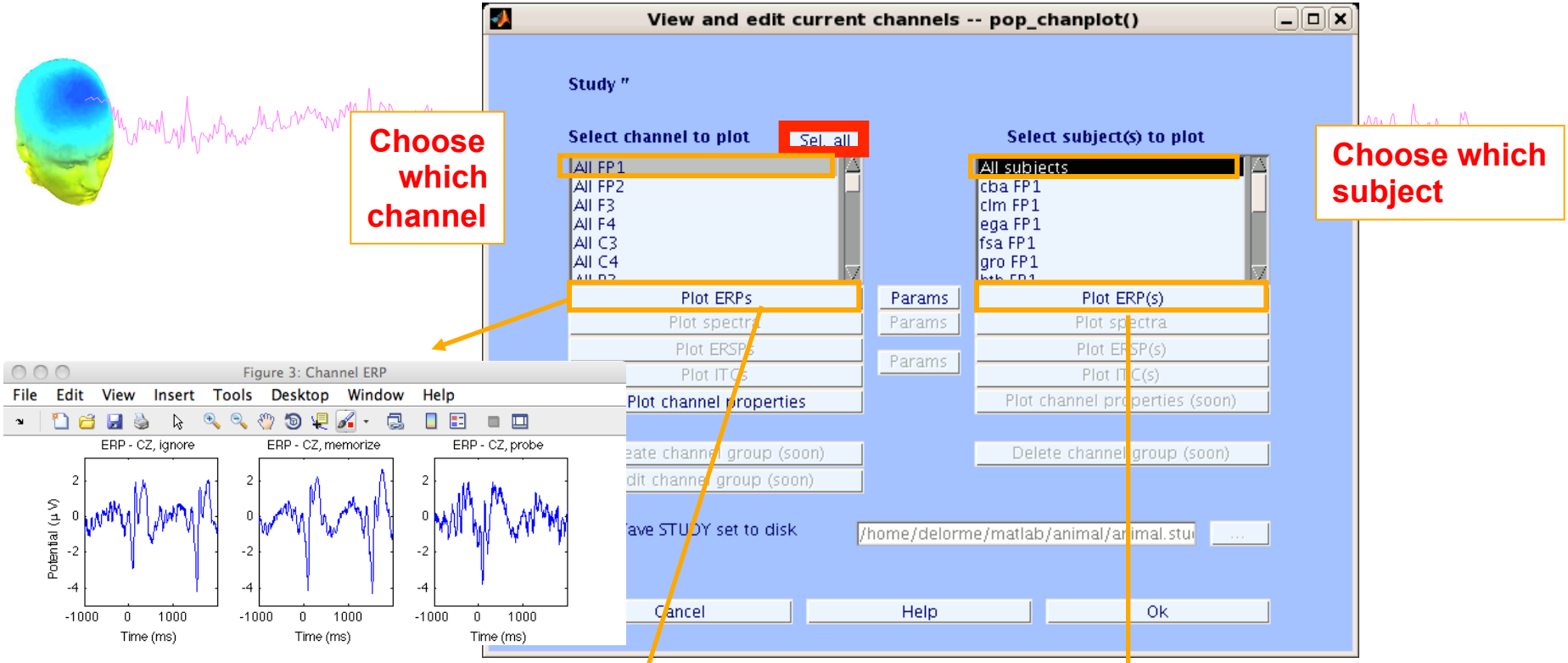
6 = cluster index

IC indices

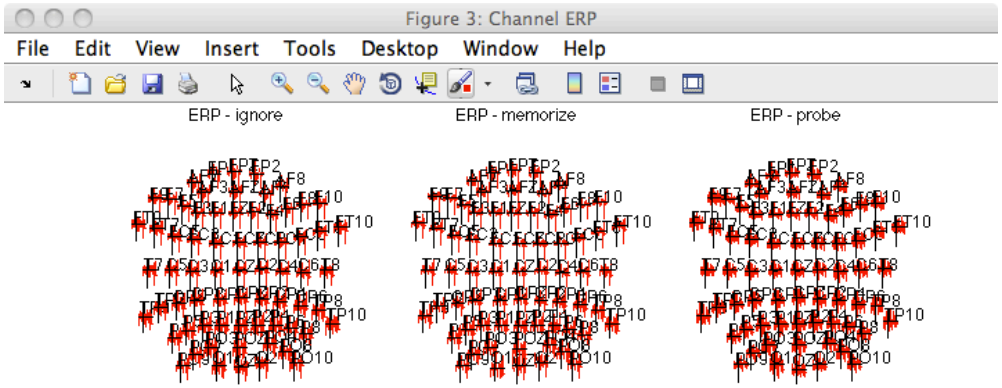
dataset indices for ICs

Design IC indices

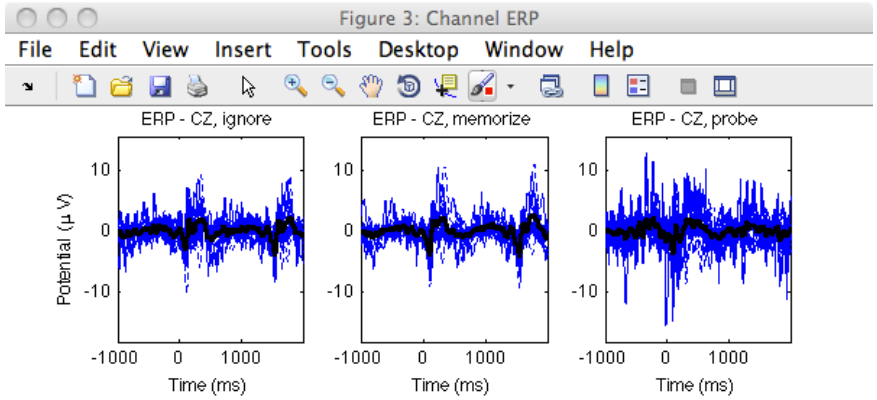
Design indices



STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1'});

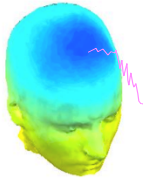


STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1' … });



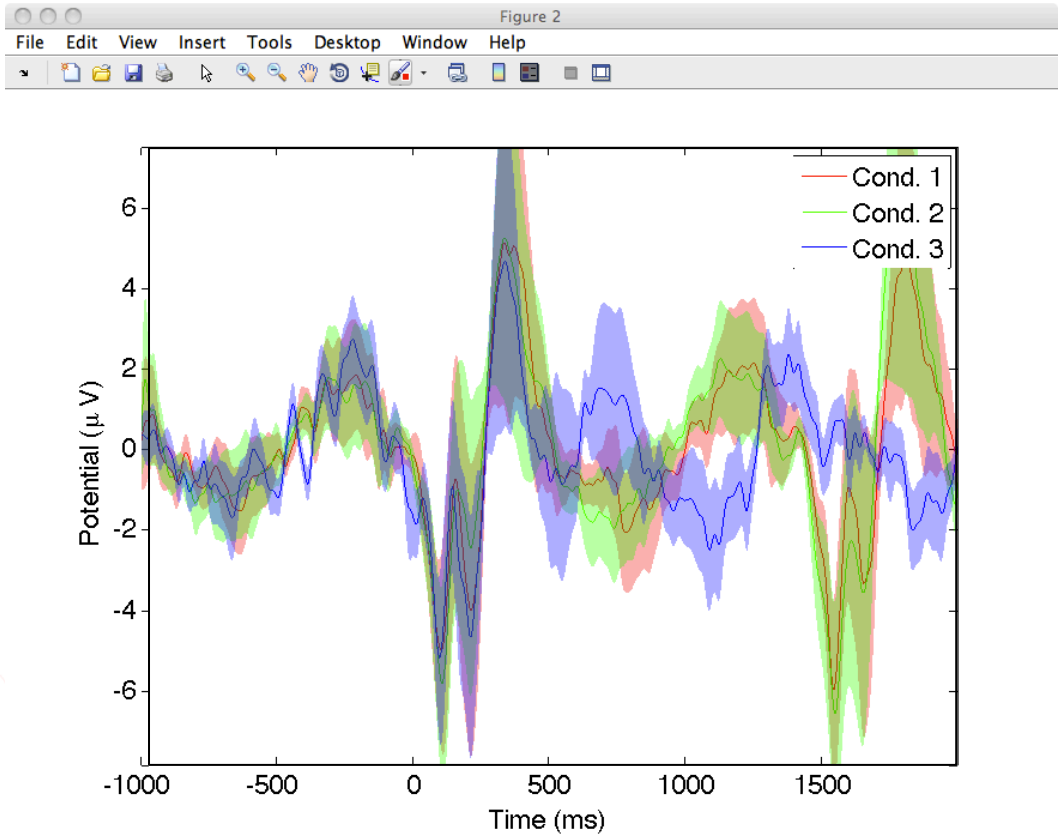
STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1'}, 'plotsubjects', 'on');

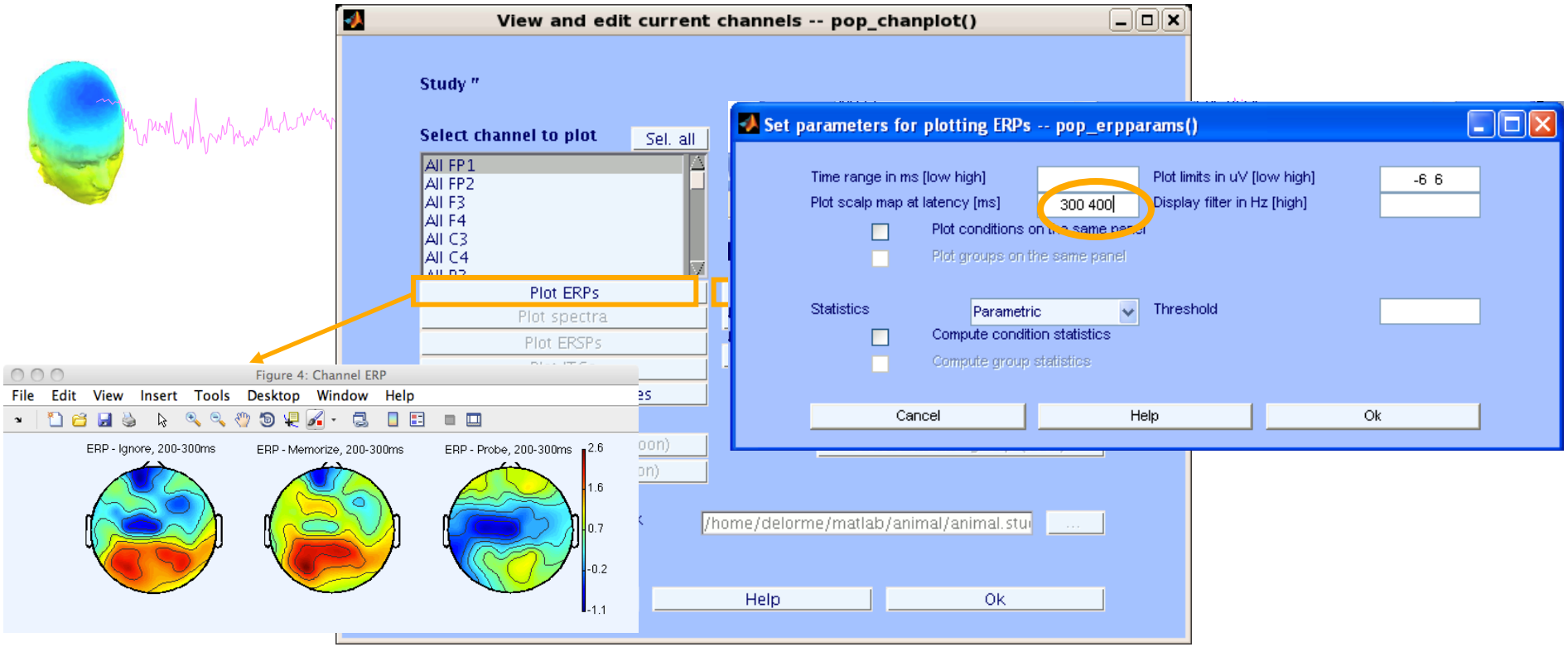
Advanced plotting features



STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'CZ'});

std_plotcurve(STUDY.changrp(39).erptimes, STUDY.changrp(39).erpdata,
'plotconditions', 'together', 'plotstderr', 'on', 'filter', 30);





STUDY = std_erpplot(STUDY,ALLEEG, 'topotime',[200 300] , 'channels',{'OZ' 'O2' 'FP1' 'FPZ' 'FP2' … });

[STUDY erpdata] = std_erpplot(STUDY,ALLEEG, , 'topotime',[200 300] , 'channels',{'OZ' 'O2' ' … });

[1x67x13 double]

[1x67x13 double]

[1x67x13 double]

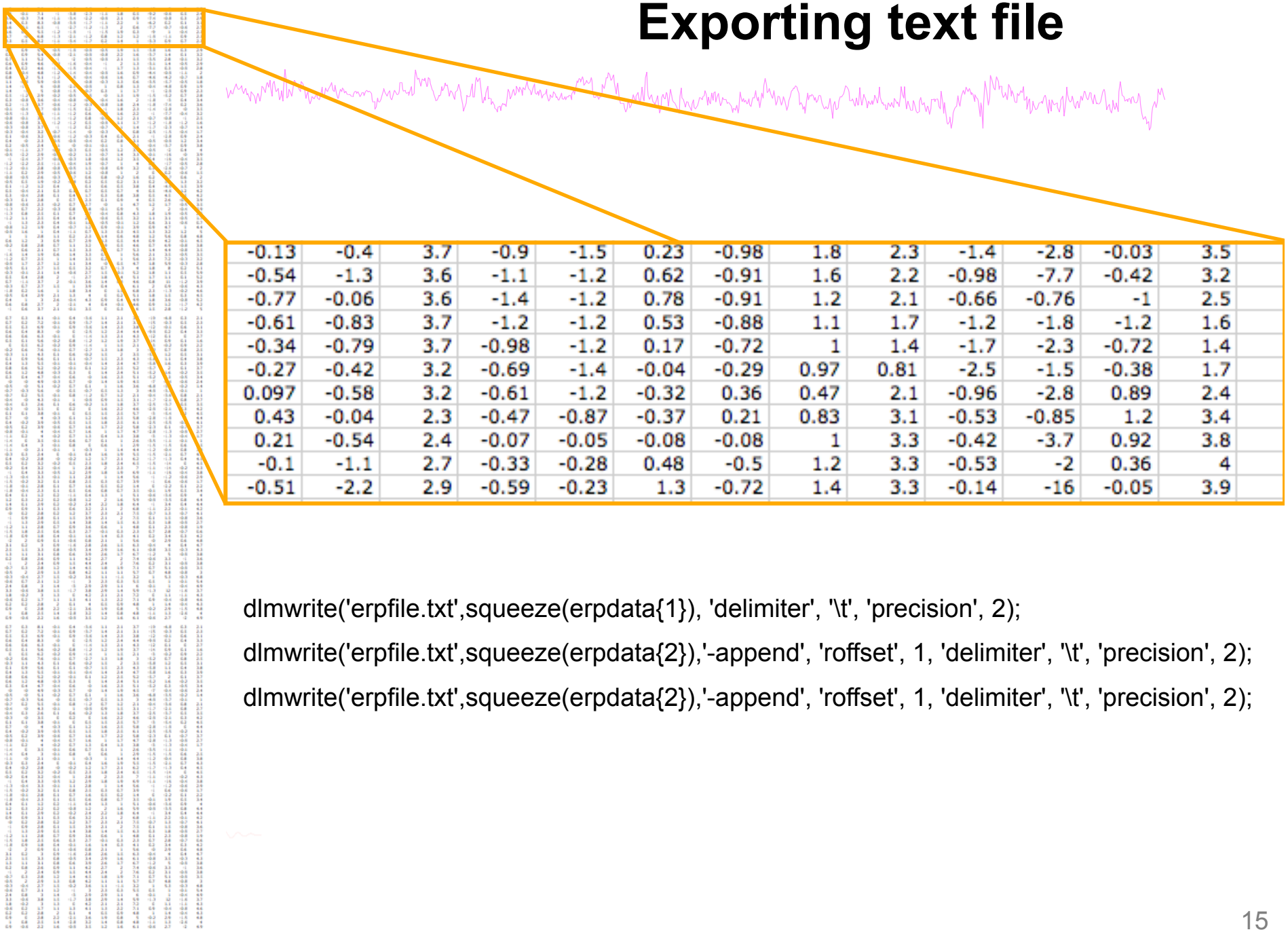
Exporting to excell file

xlswrite('myxlsfile',squeeze(erpdata{1}),1);

xlswrite('myxlsfile',squeeze(erpdata{2}),2);

xlswrite('myxlsfile',squeeze(erpdata{3}),3);

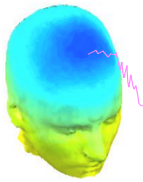
Exporting text file

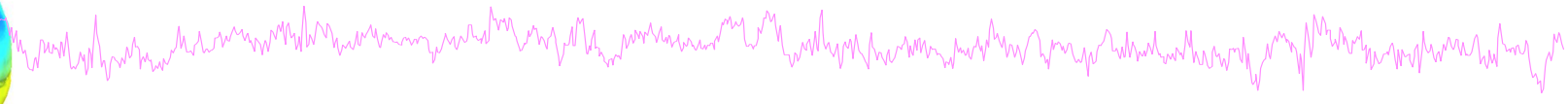


-0.13	-0.4	3.7	-0.9	-1.5	0.23	-0.98	1.8	2.3	-1.4	-2.8	-0.03	3.5
-0.54	-1.3	3.6	-1.1	-1.2	0.62	-0.91	1.6	2.2	-0.98	-7.7	-0.42	3.2
-0.77	-0.06	3.6	-1.4	-1.2	0.78	-0.91	1.2	2.1	-0.66	-0.76	-1	2.5
-0.61	-0.83	3.7	-1.2	-1.2	0.53	-0.88	1.1	1.7	-1.2	-1.8	-1.2	1.6
-0.34	-0.79	3.7	-0.98	-1.2	0.17	-0.72	1	1.4	-1.7	-2.3	-0.72	1.4
-0.27	-0.42	3.2	-0.69	-1.4	-0.04	-0.29	0.97	0.81	-2.5	-1.5	-0.38	1.7
0.097	-0.58	3.2	-0.61	-1.2	-0.32	0.36	0.47	2.1	-0.96	-2.8	0.89	2.4
0.43	-0.04	2.3	-0.47	-0.87	-0.37	0.21	0.83	3.1	-0.53	-0.85	1.2	3.4
0.21	-0.54	2.4	-0.07	-0.05	-0.08	-0.08	1	3.3	-0.42	-3.7	0.92	3.8
-0.1	-1.1	2.7	-0.33	-0.28	0.48	-0.5	1.2	3.3	-0.53	-2	0.36	4
-0.51	-2.2	2.9	-0.59	-0.23	1.3	-0.72	1.4	3.3	-0.14	-16	-0.05	3.9

```
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);
```

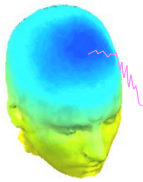
STUDY Script

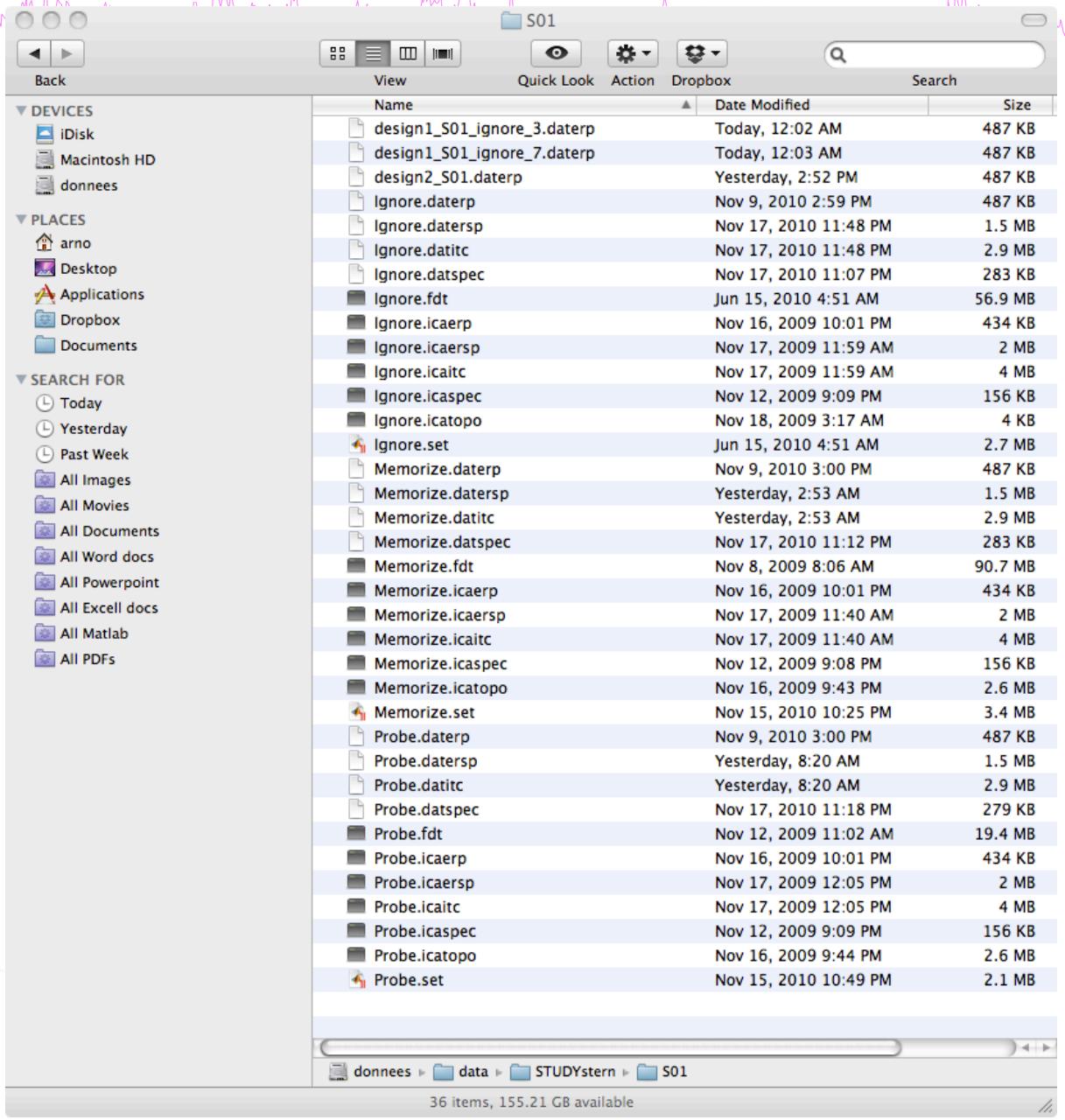




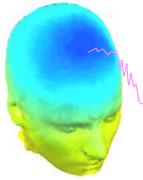
```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
         'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

% Now loop through subjects and add to the STUDY
for subj = 1:length(subjs) % for each subject
    fileIgnore   = fullfile(basedir, subjs{subj}, 'Ignore.set');
    fileMemorize = fullfile(basedir, subjs{subj}, 'Memorize.set');
    fileProbe    = fullfile(basedir, subjs{subj}, 'Probe.set');
    commands = { commands{:} ...
           {'index' 3*subj-2 'load' fileIgnore   'subject' subjs{subj} 'condition' 'Ignore' } ...
           {'index' 3*subj-1 'load' fileMemorize 'subject' subjs{subj} 'condition' 'Memorize' } ...
           {'index' 3*subj   'load' fileProbe    'subject' subjs{subj} 'condition' 'Probe' } };
end;
commands = { commands{:} { 'dipselect', 0.15 } };
[STUDY ALLEEG] = std_editset( STUDY, ALLEEG, 'name', 'Sternberg', ...
     'task', 'Sternberg', 'commands', commands, ...
     'updatedat','off', 'filename', fullfile(basedir, 'stern_autogenerated.study'));

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

% compute and plot ERP scalp maps between 200 and 300 ms
[STUDY ALLEEG] = std_precomp(STUDY, ALLEEG, {},'interp','on','allcomps','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'});

% export the data to text file
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);
```

STUDY datafiles





STUDY datafiles



Datafiles (old sheme)

- *syn02-S253-clean.daterp (ERPs)*
- *syn02-S253-clean.datspec (power spectra)*
- *syn02-S253-clean.datersp (ERSPs)*
- *syn02-S253-clean.datitc (ITCs)*

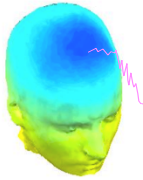
- *syn02-S253-clean.icaerp (ERPs)*
- *syn02-S253-clean.icaspec (power spectra)*
- *syn02-S253-clean.icatopo (scalp maps)*
- *syn02-S253-clean.icaersp (ERSPs)*
- *syn02-S253-clean.icaitc (ITCs)*

Datafiles (new sheme)

- *design1_S01_ignore.daterp (ERPs)*
- *design1_S01_ignore.datspec (power spectra)*
- *design1_S01_ignore.datersp (ERSPs)*
- *design1_S01_ignore.datitc (ITCs)*

- *design1_S01_ignore.icaerp (ERPs)*
- *design1_S01_ignore.icaspec (power spectra)*
- *design1_S01_ignore.icatopo (scalp maps)*
- *design1_S01_ignore.icaersp (ERSPs)*
- *design1_S01_ignore.icaitc (ITCs)*

Exercises



Suggestion for exercises:

Load stern.study in STUDY folder

Choose a cluster to investigate. Plot mean power in a small time/ frequency window across all ICs and conditions for this cluster

~~Run the script to build the STUDY automatically.~~

Modify the script to plot spectrum at 10 Hz instead of ERP.

~~Load an ICA ERSP file Matlab files and use the *tftopo* function to replot one component ERSP.~~