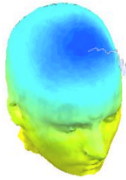
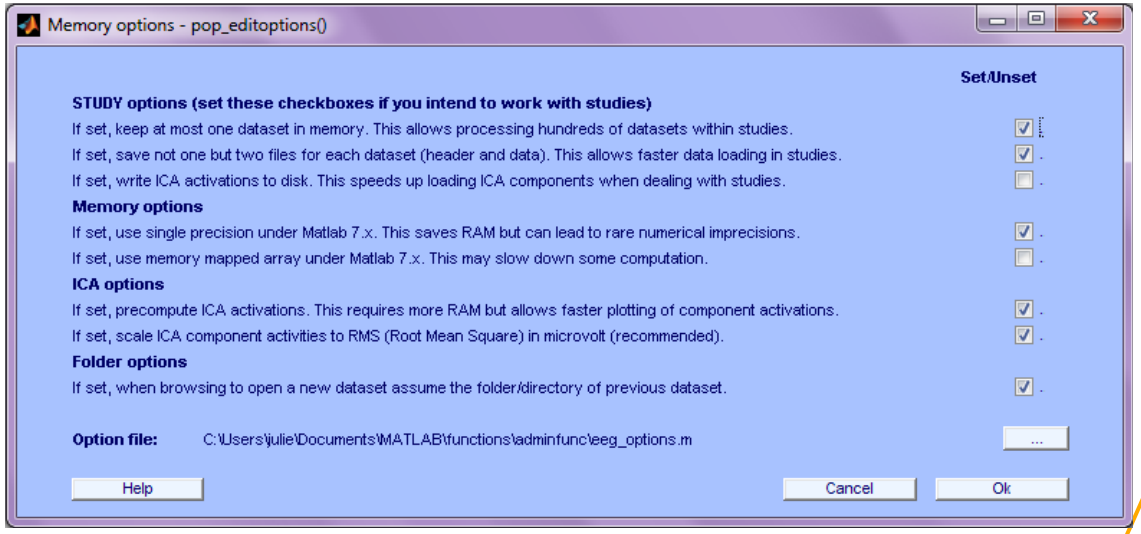
STUDY scripts



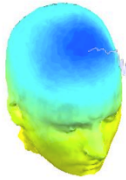


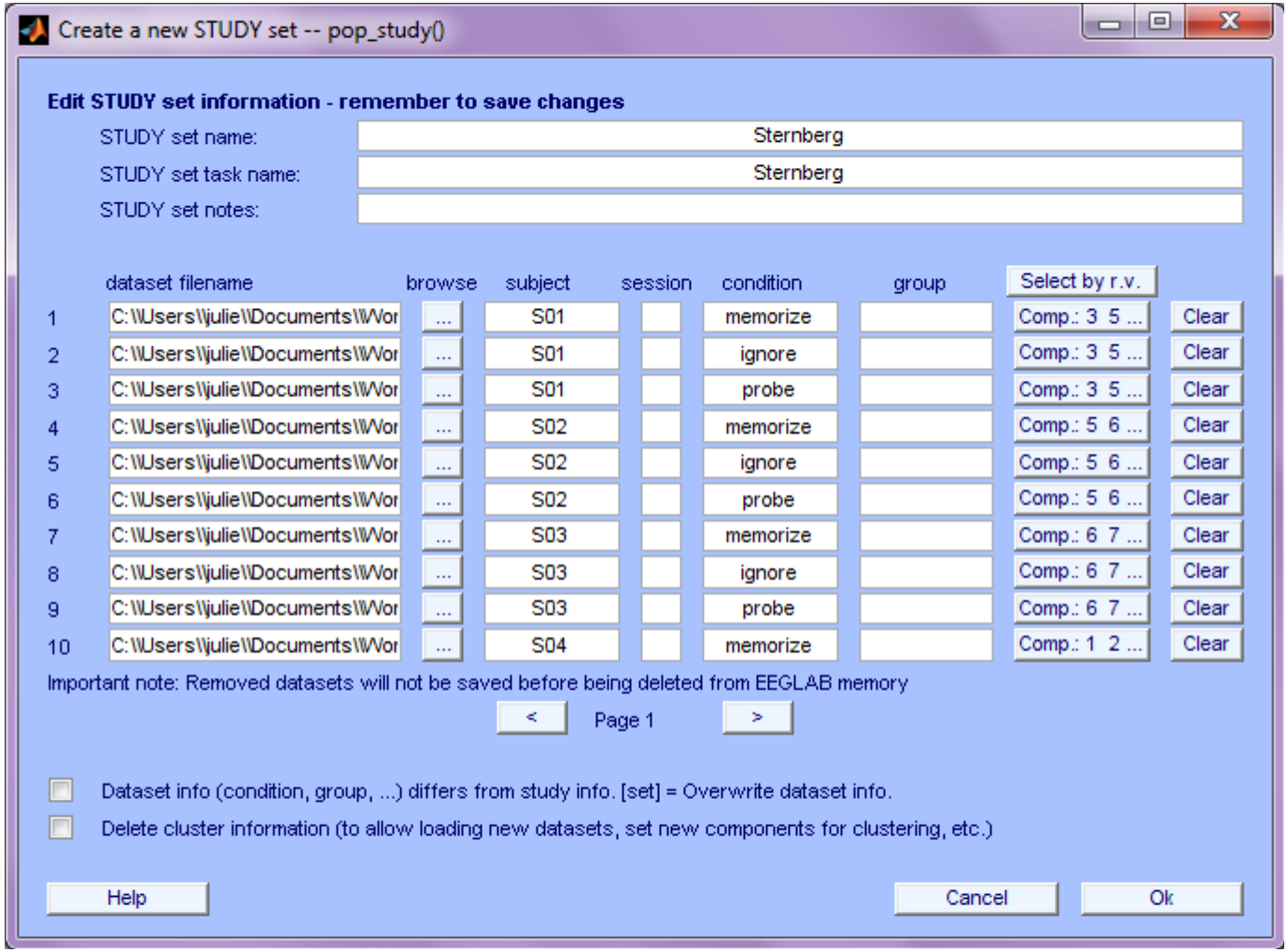
Most important option:

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

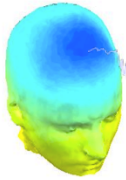
```
% Set memory options:
pop_editoptions( 'option_storedisk', 1);
```

Edit dataset info



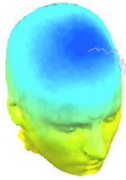


Load dataset info from commandline



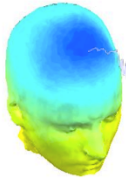
```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
         'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

% 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

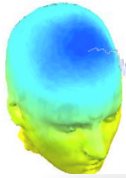


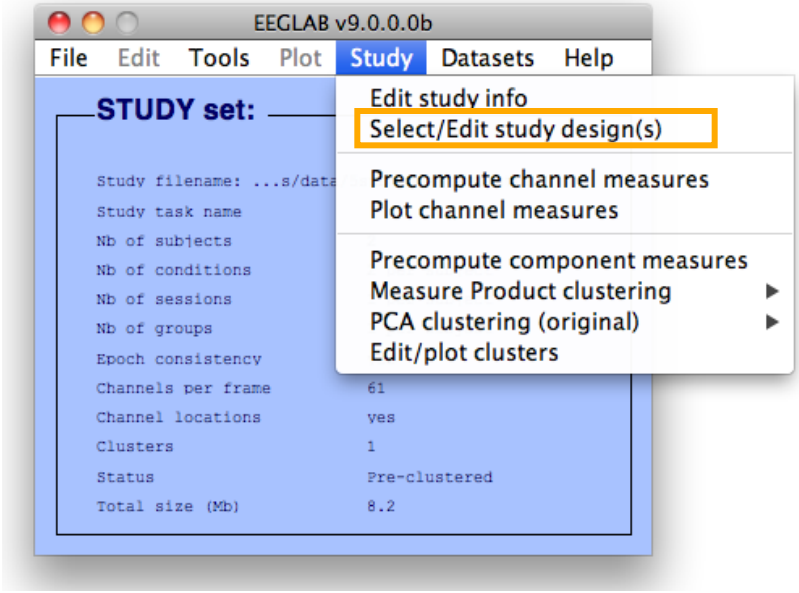
```
>> STUDY.datasetinfo(11) % access dataset 11
ans =
       filepath: [1x61 char]
      filename: 'S04.set'
       subject: 'S04'
       session: []
     condition: ''
         group: ''
     trialinfo: 1x350 struct
         index: 11
         comps: [1x24 double]
```

Subject 4!

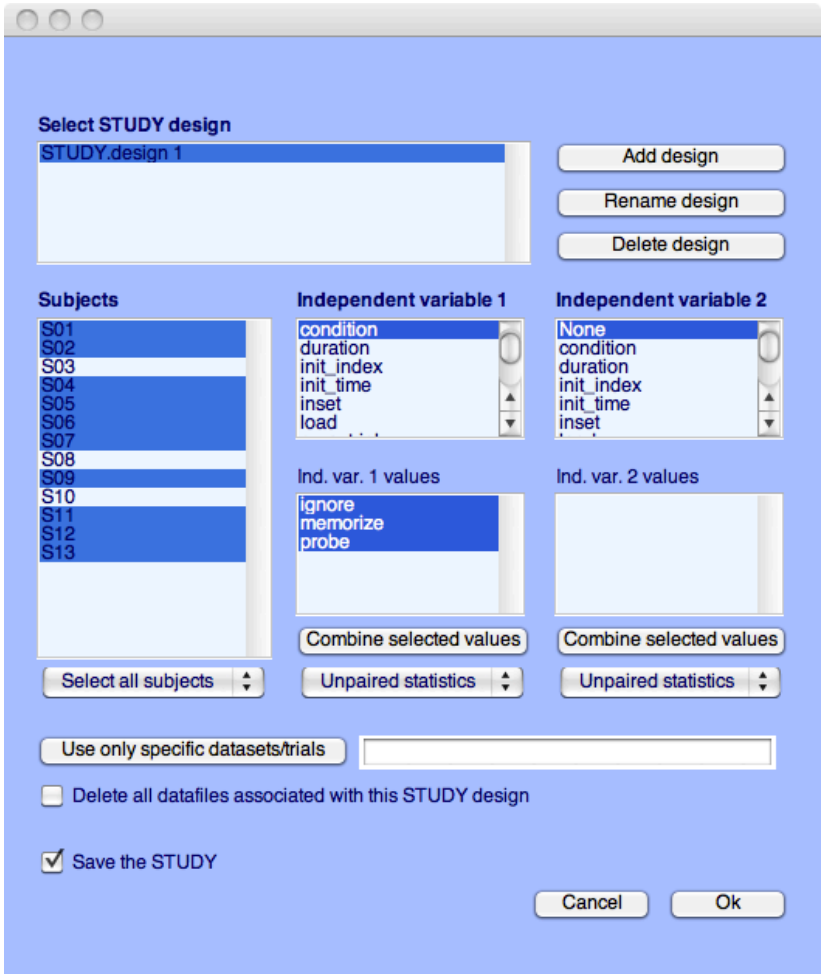
```
>> trialinfo(163) % access trial 163
ans =
       stimtype: 'Memorize'
        latency: 13201
       duration: 0
       ...
```

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



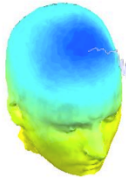


Select subjects



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

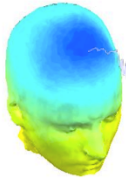


```
STUDY.design(1)

ans =

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

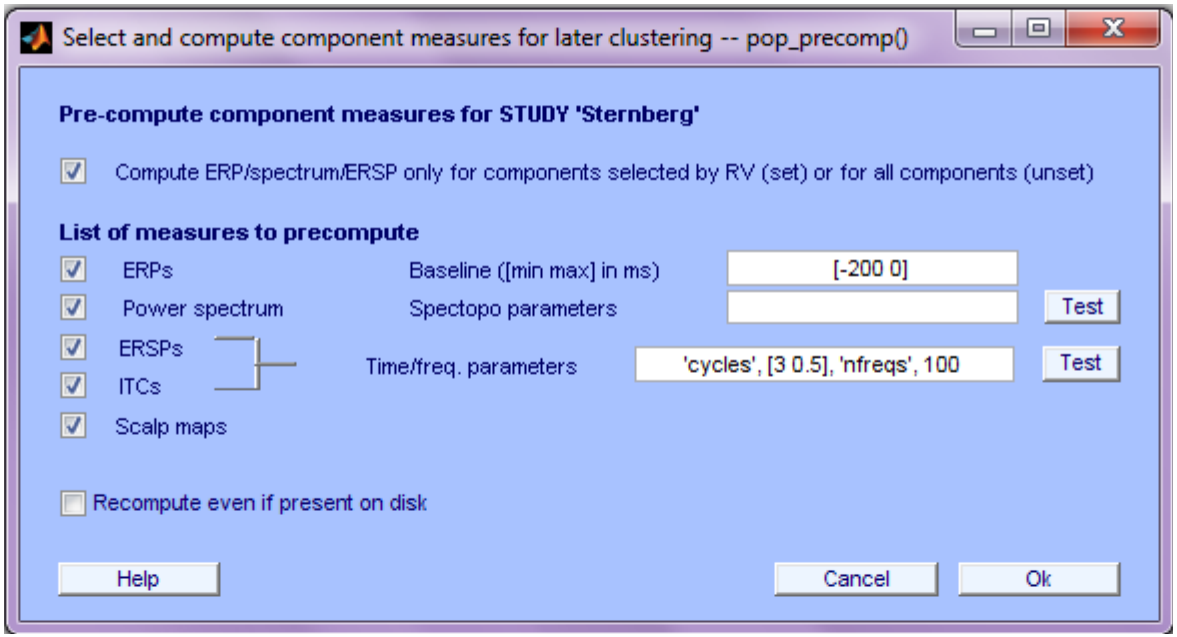
Exploding the contents of each of these sub-structures, we obtain

```
           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

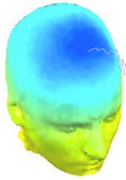


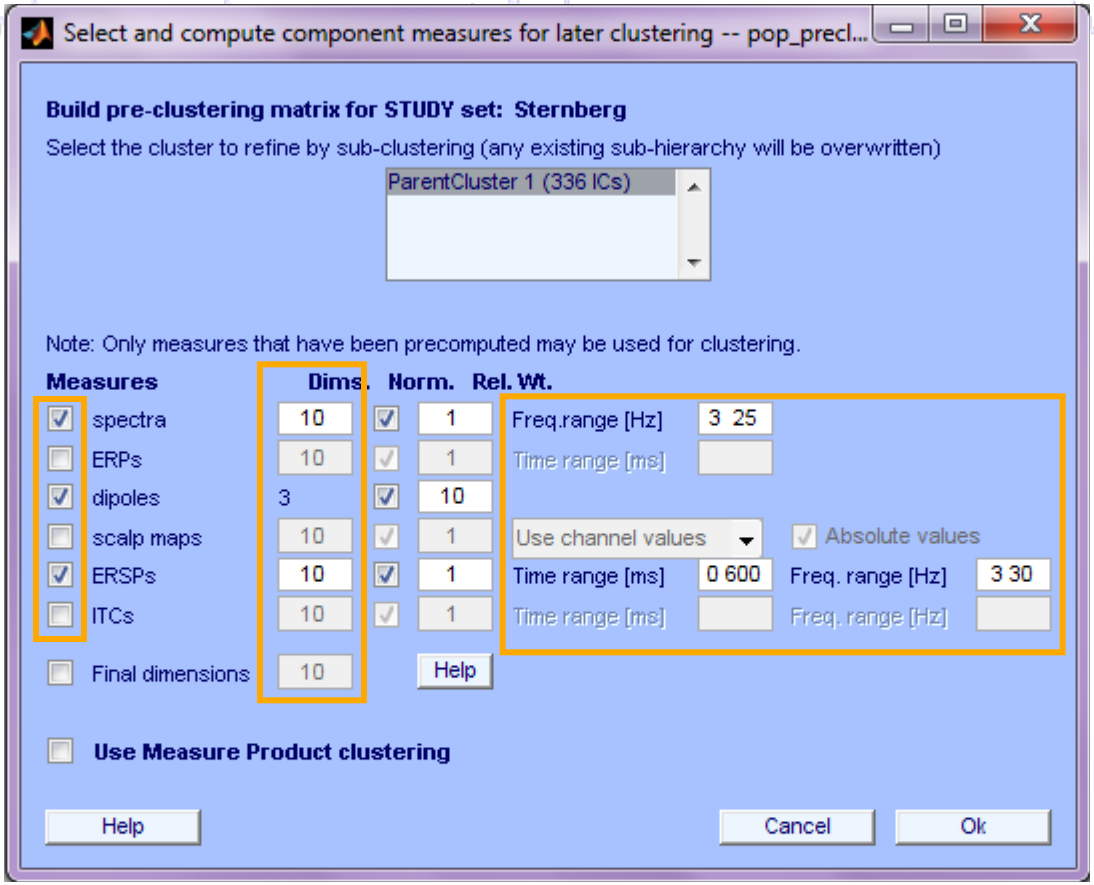
TIP: Compute all measures so you can test different combinations for clustering




```
[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');
```

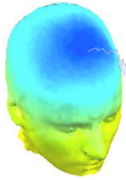
Precluster the data

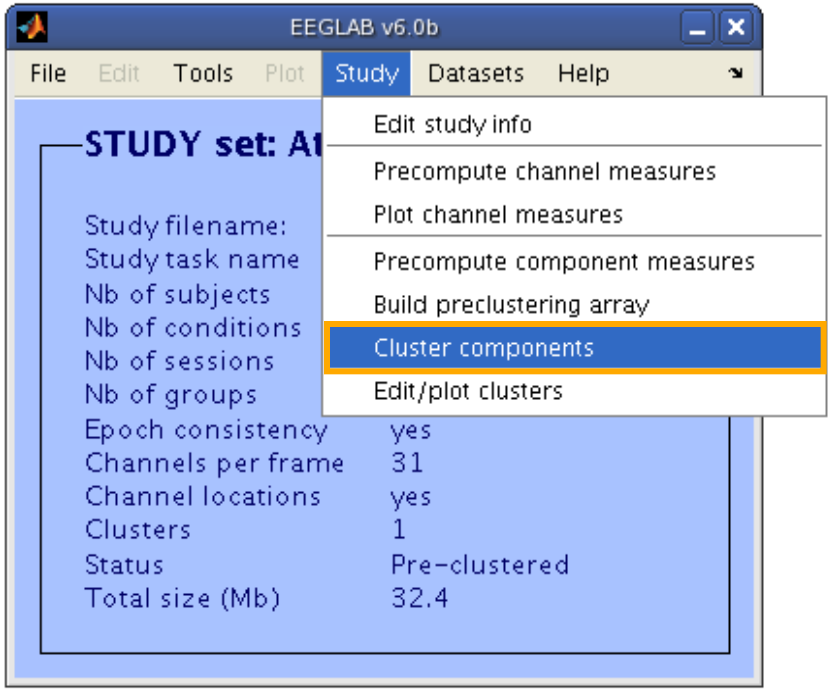


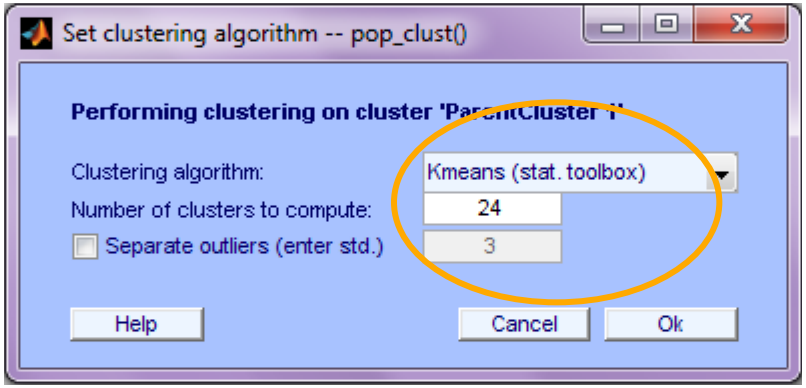



```
parentclust = 1;
[STUDY ALLEEG] = std_preclust(STUDY, ALLEEG, parentclust,{'spec','npca',5,…
   'norm',1,'weight',1,'freqrange',[3 25]},{'erp','npca',6,'norm',1,…
   'weight',1, 'timewindow',[0 400]},{'scalp','npca',10,'norm',1,'weight',1,…
   'abso',1},{'dipoles','norm',1,'weight',10},{'ersp','npca',20,…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

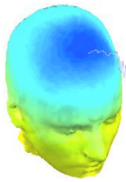







```
nclusts = 25; % choose # of clusters to create
[STUDY] = pop_clust(STUDY, ALLEEG,'algorithm','kmeans','clus_num',nclusts);
```

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

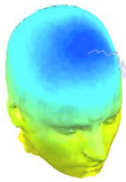
IC indices

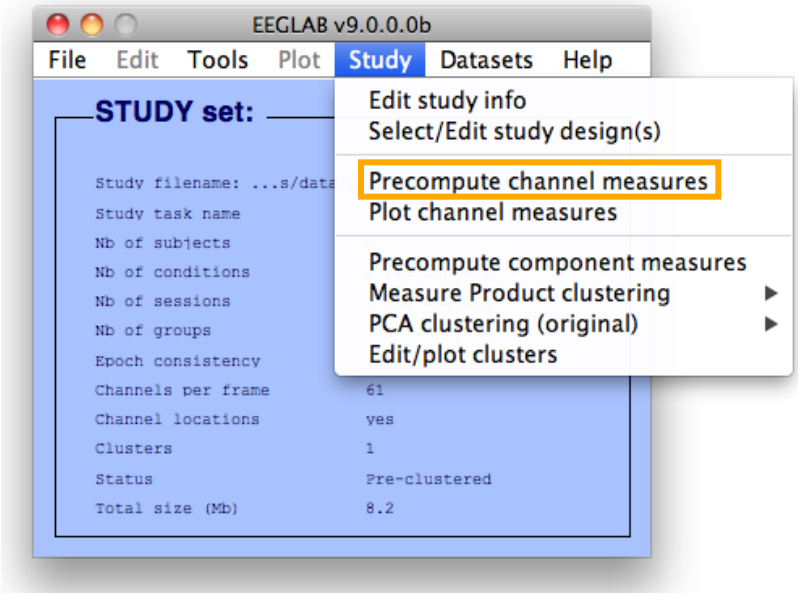
dataset indices for ICs

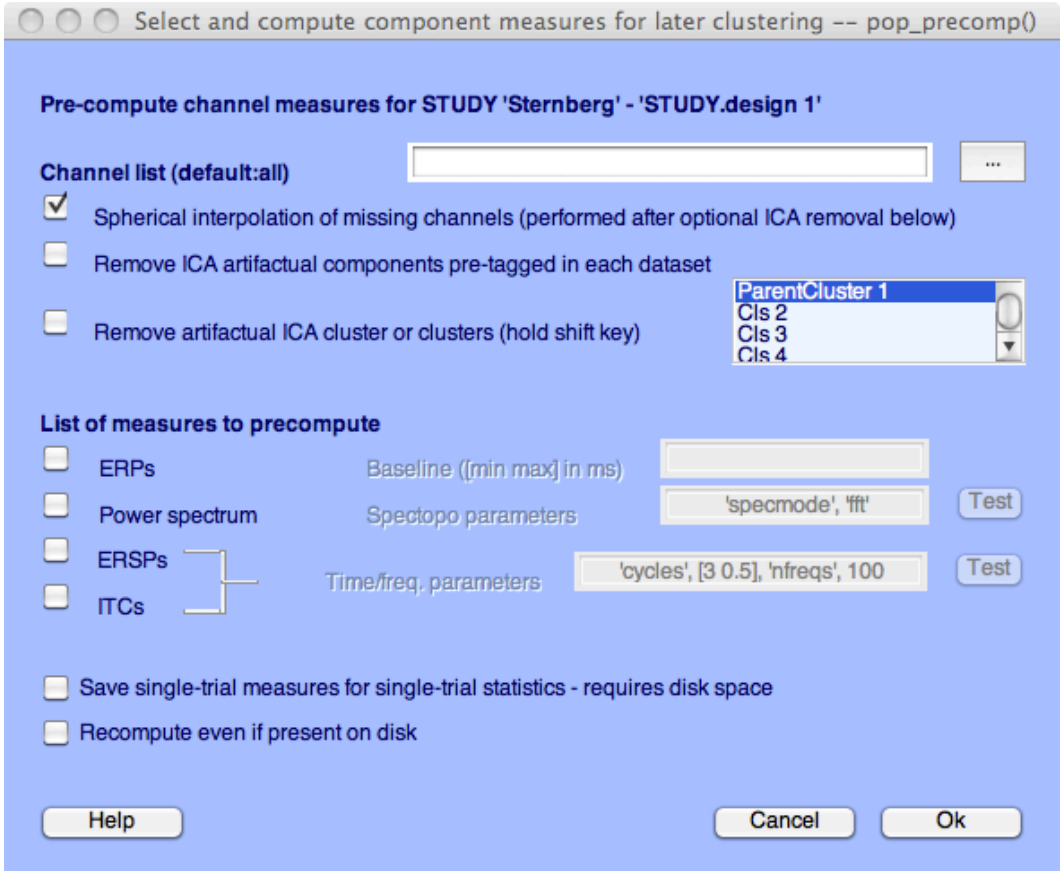
Design IC indices

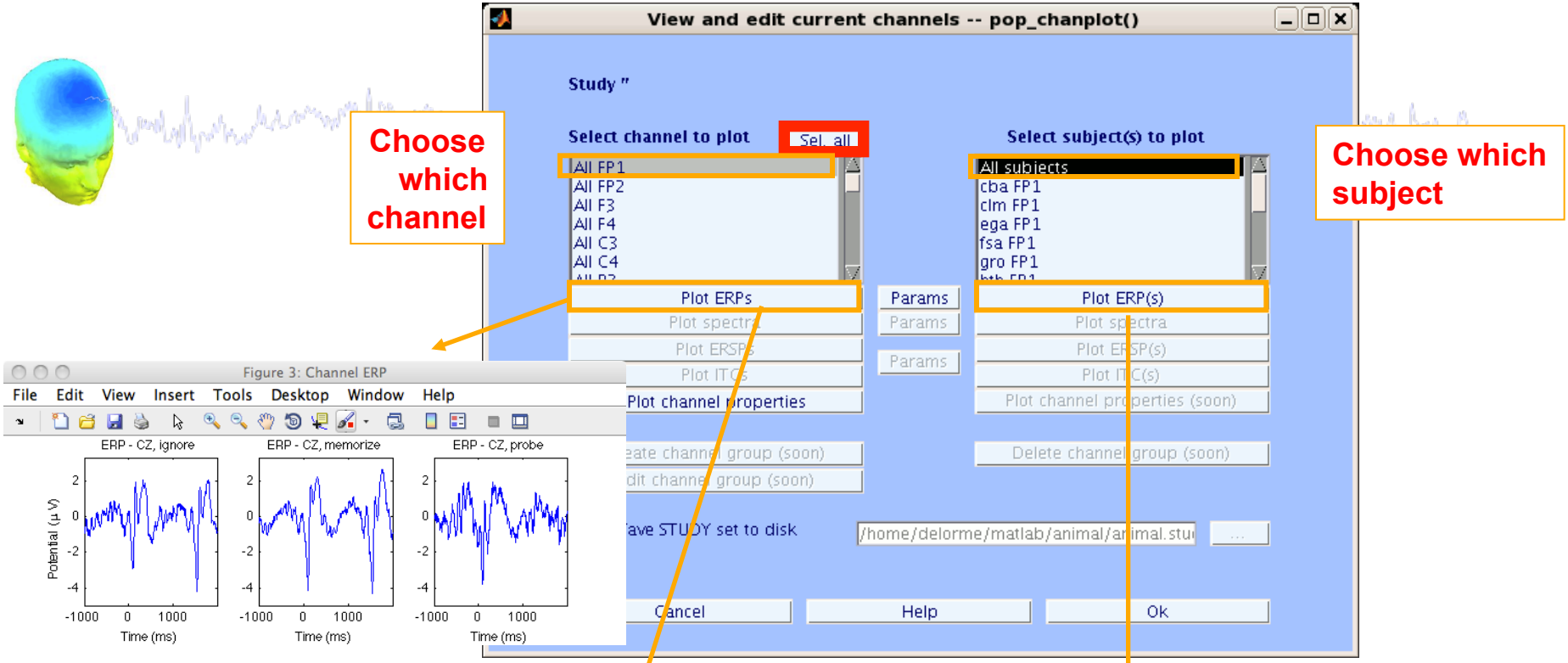
Design indices

Precompute data measures

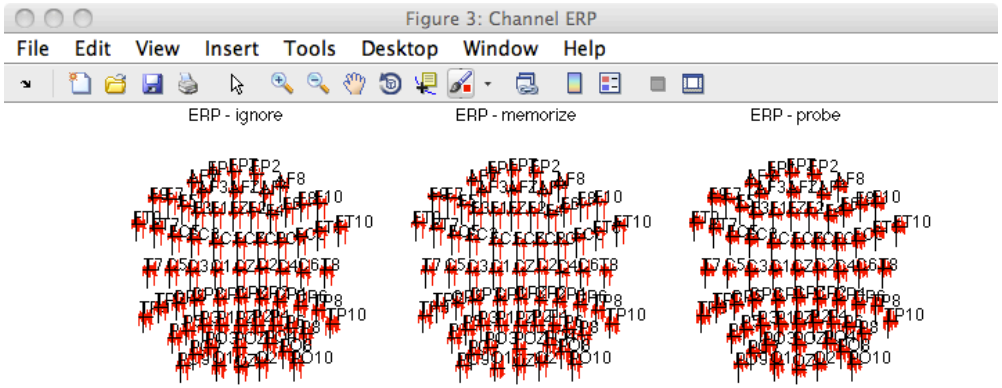




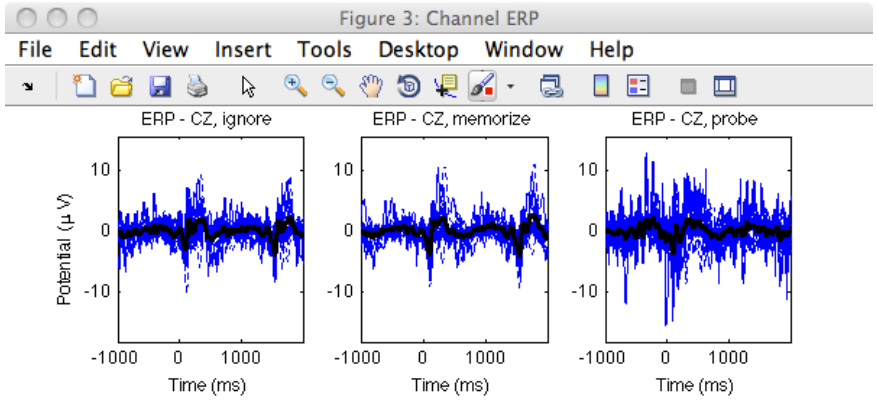




STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1'});

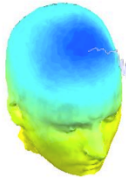


STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1' … });



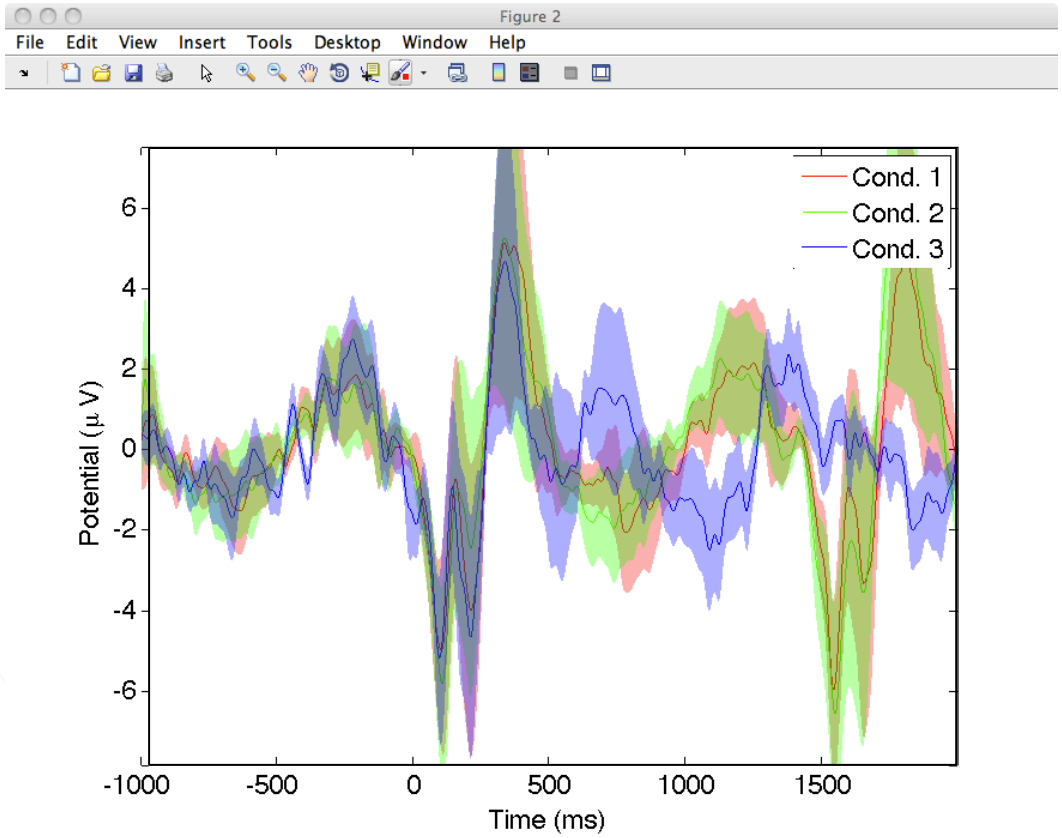
STUDY = std_erpplot(STUDY,ALLEEG,'channels',{'FP1'}, 'plotsubjects', 'on');

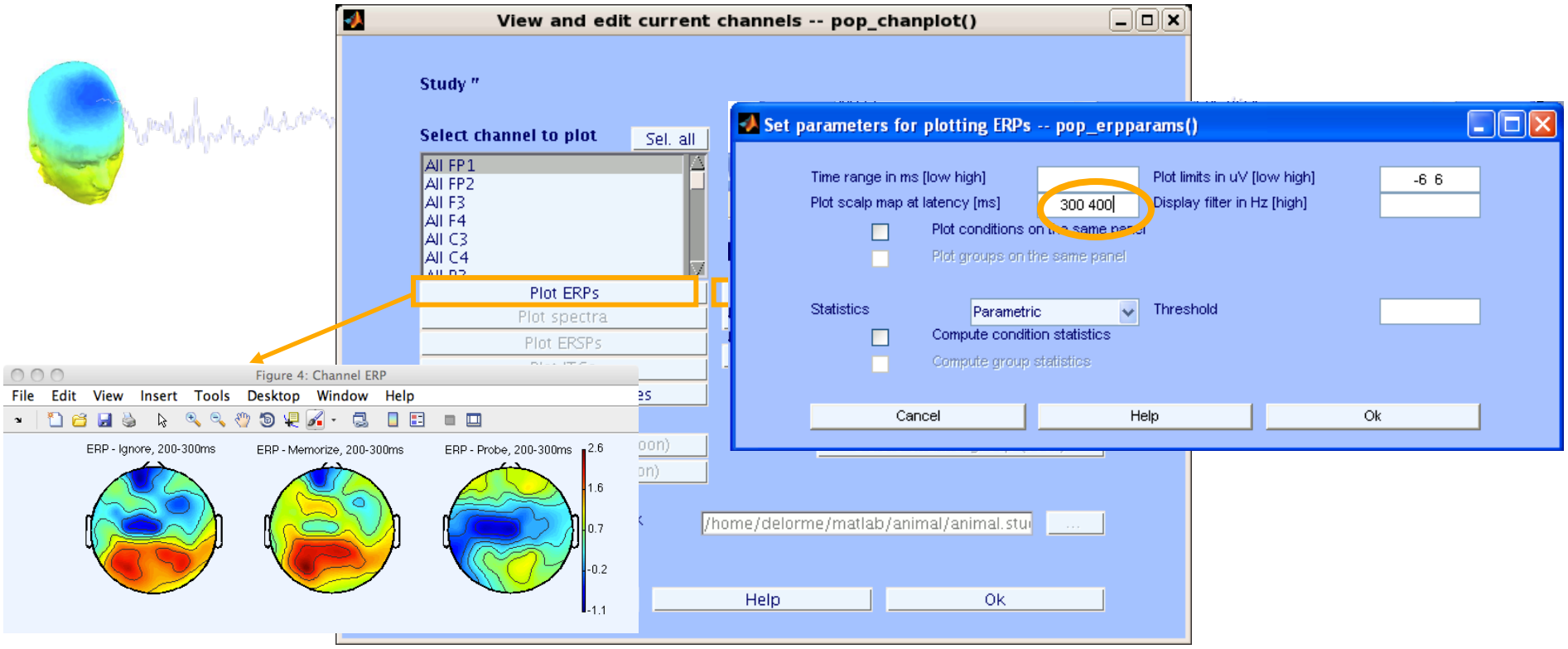
Advanced plotting features



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);

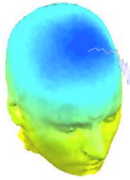
xlswrite('myxlsfile',squeeze(erpdata{3}),3);

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

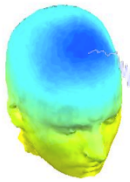
```
dlmwrite('erpfile.txt',squeeze(erpdata{1}), 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt',squeeze(erpdata{2}),'-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
dlmwrite('erpfile.txt',squeeze(erpdata{2}),'-append', 'roffset', 1, 'delimiter', '\t', 'precision', 2);
```

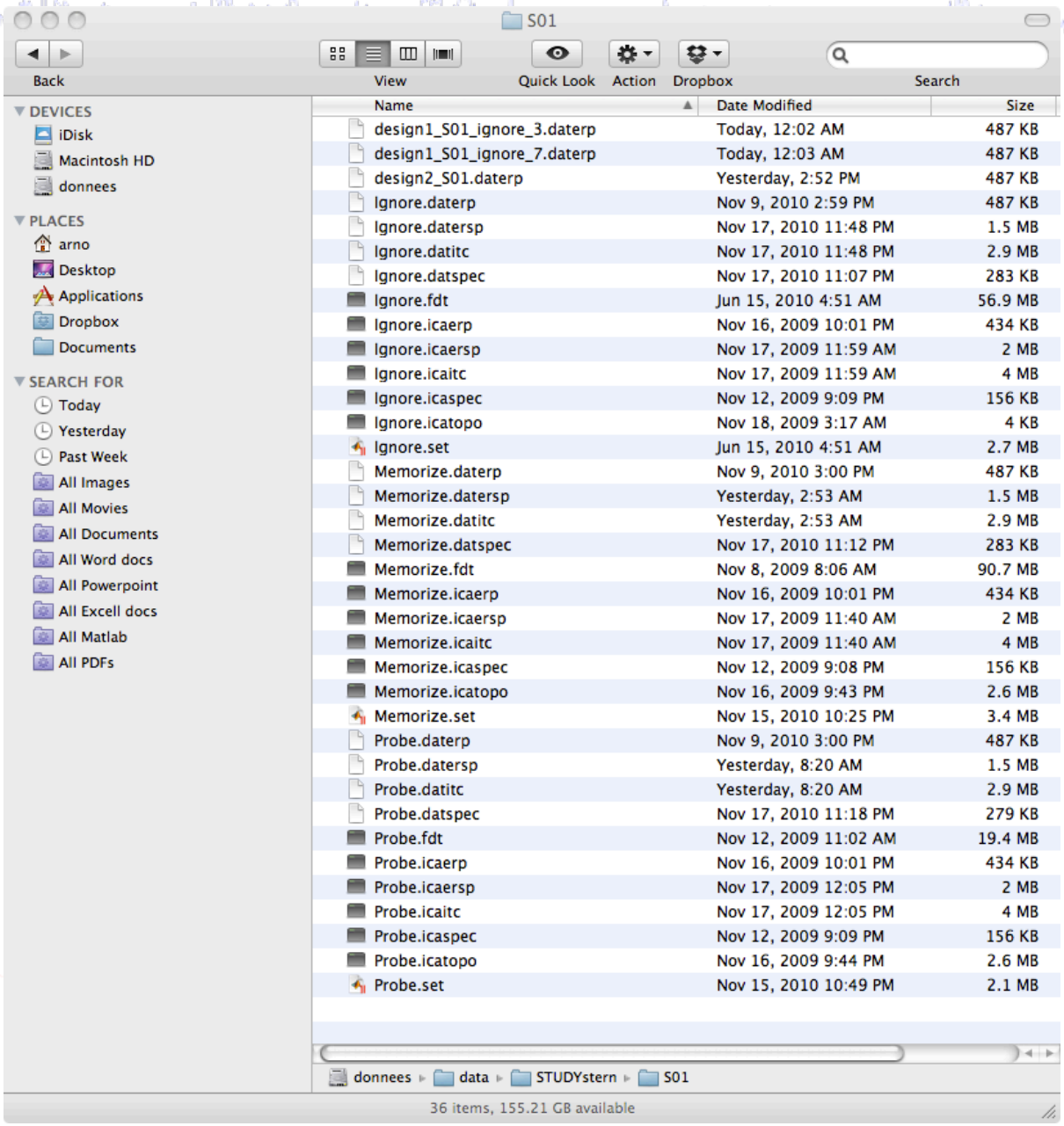
STUDY Script



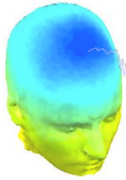
```
% create the STERN STUDY
eeglab
basedir = pwd;
subjs = {'S01' 'S02' 'S03' 'S04' 'S05' 'S06' 'S07' ...
         'S08' 'S09' 'S10' 'S11' 'S12' 'S13'};
commands = {}; % initialize STUDY dataset list

% 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)*

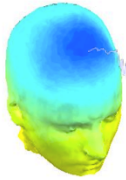
- *syn02-S253-clean.icaerp (ERPs)*
- *syn02-S253-clean.icaspec (power spectra)*
- *syn02-S253-clean.icatopo (scalp maps)*
- *syn02-S253-clean.icaersp (ERSPs)*
- *syn02-S253-clean.icaitc (ITCs)*

Datafiles (new sheme)

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

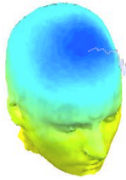
- *design1_S01_ignore.icaerp (ERPs)*
- *design1_S01_ignore.icaspec (power spectra)*
- *design1_S01_ignore.icatopo (scalp maps)*
- *design1_S01_ignore.icaersp (ERSPs)*
- *design1_S01_ignore.icaitc (ITCs)*

STUDY datafiles



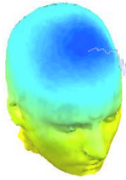
```
tmp = load('-mat', 'design1_S01_ignore.daterp');
>> tmp

tmp =

        chan1:  [1x750 double]
        chan2:  [1x750 double]
        chan3:  [1x750 double]
        chan4:  [1x750 double]
        chan5:  [1x750 double]
        chan6:  [1x750 double]
        chan7:  [1x750 double]
       …
       chan69:  [1x750 double]
       chan70:  [1x750 double]
       chan71:  [1x750 double]
       labels:  {1x71 cell}
        times:  [1x750 double]
     datatype:  'ERP'
   parameters:  {'rmcomps'  {1x1 cell}  'interp'  [1x71 struct]}
     datafile:  '/Volumes/donnees/data/STUDYstern/S01/Ignore.set'
```

STUDY datafiles



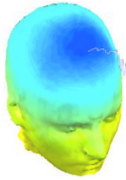
```
>> tmp = load('-mat', 'design1_S01_ignore.datersp');
>> tmp

tmp =

          chan1_ersp:  [50x100 single]
      chan1_erspbase:  [1x50 single]
      chan1_erspboot:  []
          chan2_ersp:  [50x100 single]
      chan2_erspbase:  [1x50 single]
      chan2_erspboot:  []
               freqs:  [1x50 double]
               times:  [1x100 double]
            datatype:  'ERSP'
          parameters:  {1x26 cell}
           chanlabels:  {1x71 cell}
            datafile:  '/Volumes/donnees/data/STUDYstern/S01/Ignore.set
```

STUDY datafiles



```
>> tmp = load('-mat', 'design1_S01_ignore.icaersp');
>> tmp

tmp =

        comp1_ersp:  [50x100 single]
    comp1_erspbase:  [1x50 single]
    comp1_erspboot:  []
        comp2_ersp:  [50x100 single]
    comp2_erspbase:  [1x50 single]
    comp2_erspboot:  []
             freqs:  [1x50 double]
             times:  [1x100 double]
          datatype:  'ERSP'
        parameters:  {1x26 cell}
        chanlabels:  {1x71 cell}
          datafile:  '/Volumes/donnees/data/STUDYstern/S01/Ignore.set
```

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.