STUDY analysis

Task 1

Cluster ERP image (IC polarity)

Task 2

Cluster cross coherence

Task 3

Dipole density

Exercise...

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Exercise...

Cluster ERP image

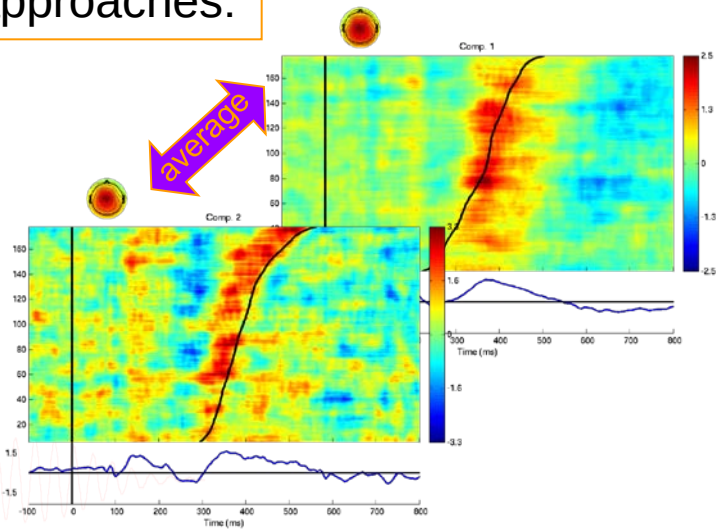
Purpose of ERP image:

- Observe single-trial dynamics of an IC activation (or power)

Purpose of *CLUSTER* ERP image:

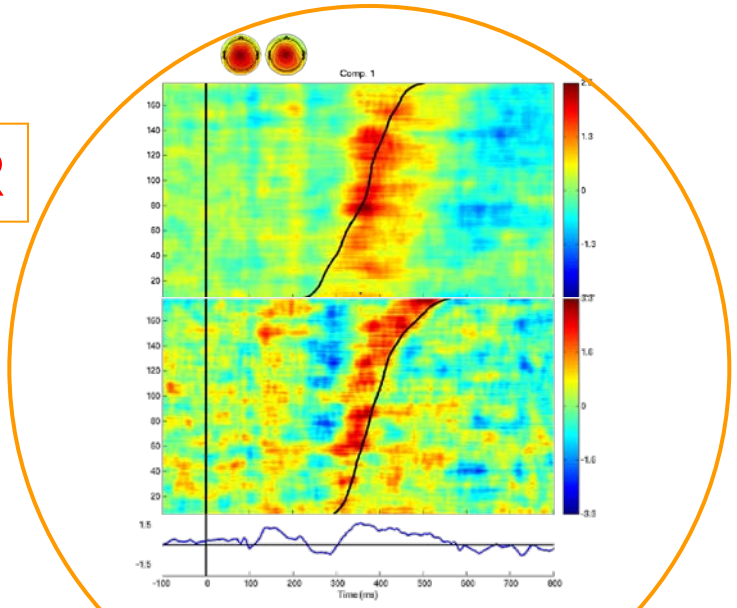
- Observe single-trial dynamics of multiple *matched* ICs from several subjects

Two approaches:



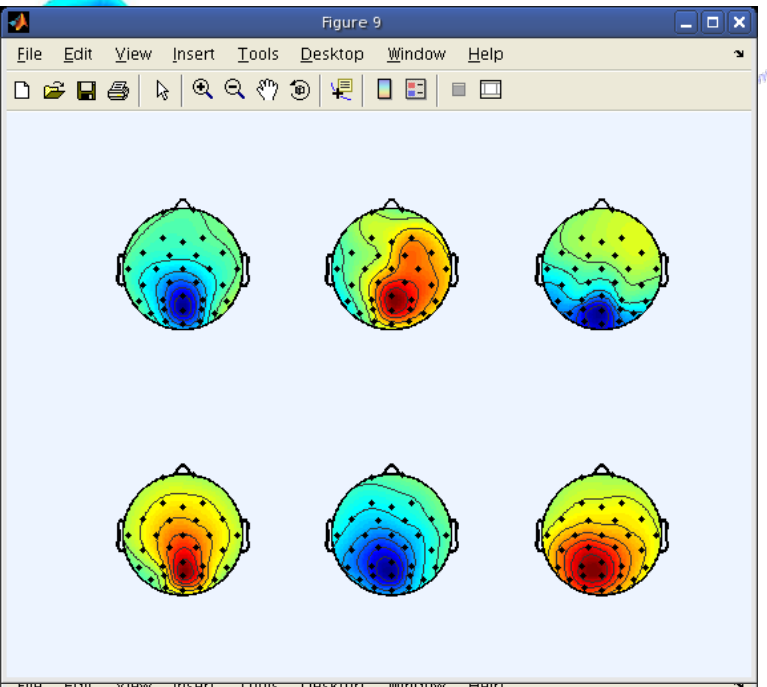
Average ERP images across ICs

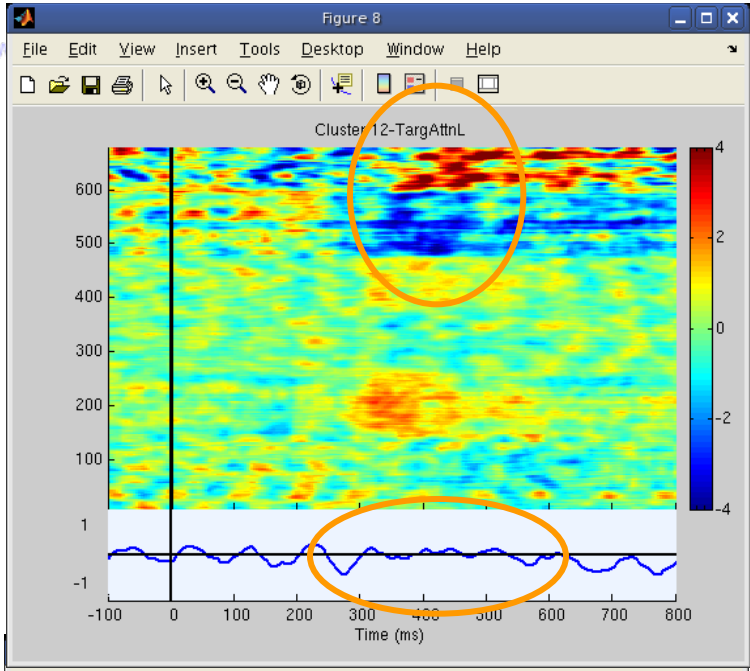
OR



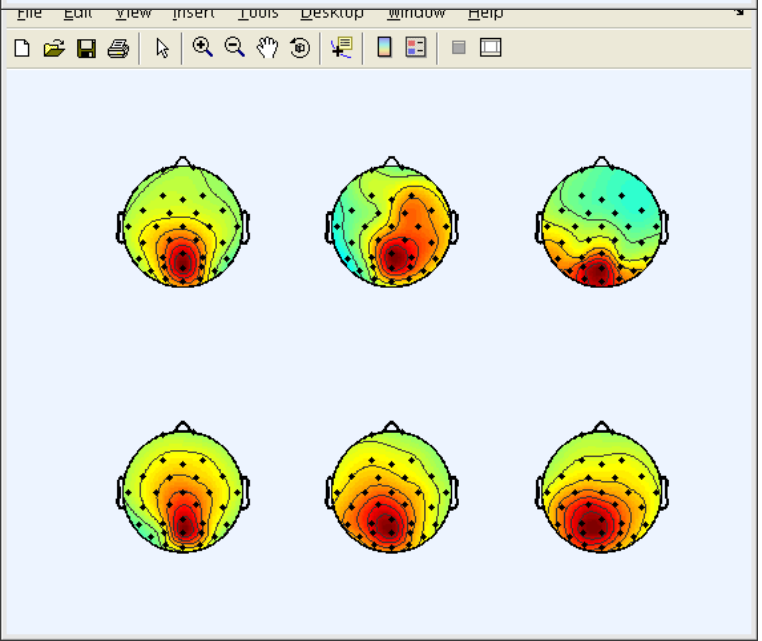
Merge trials across ICs

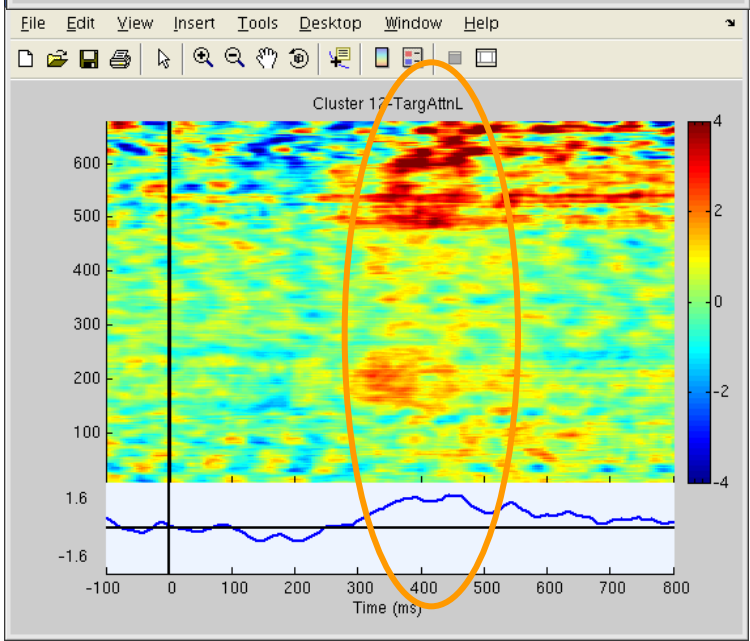
Cluster ERP image: match polarity





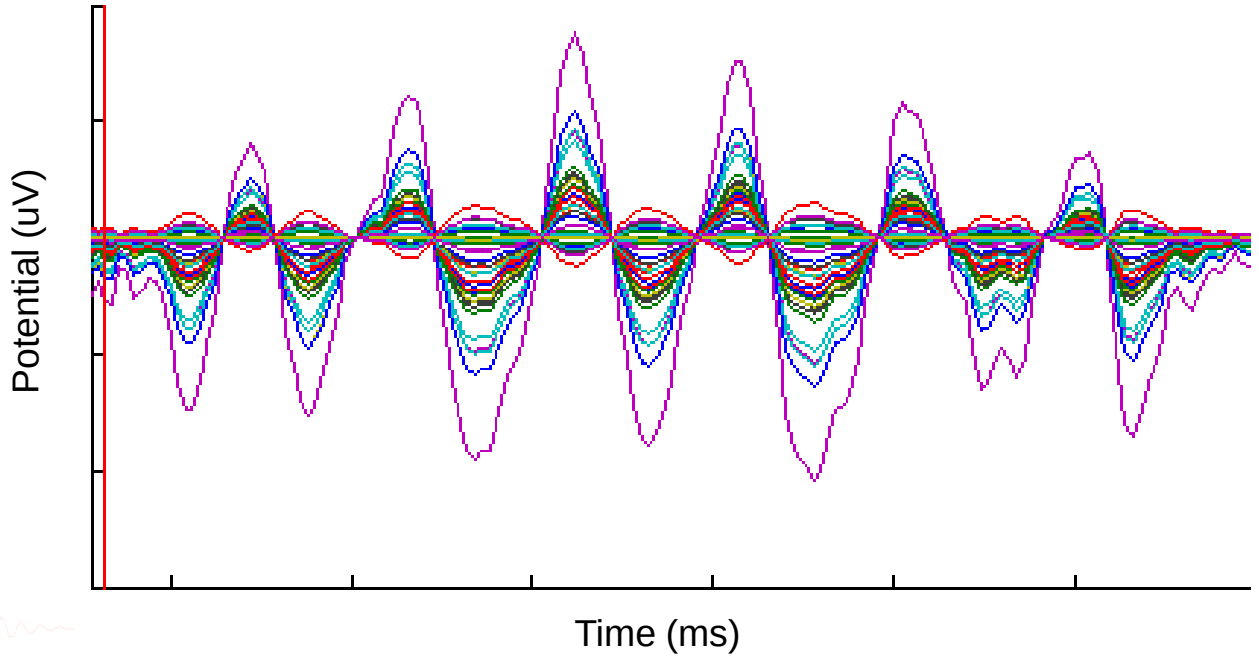
reversed polarities reflect mismatched scalp maps



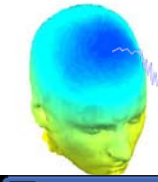


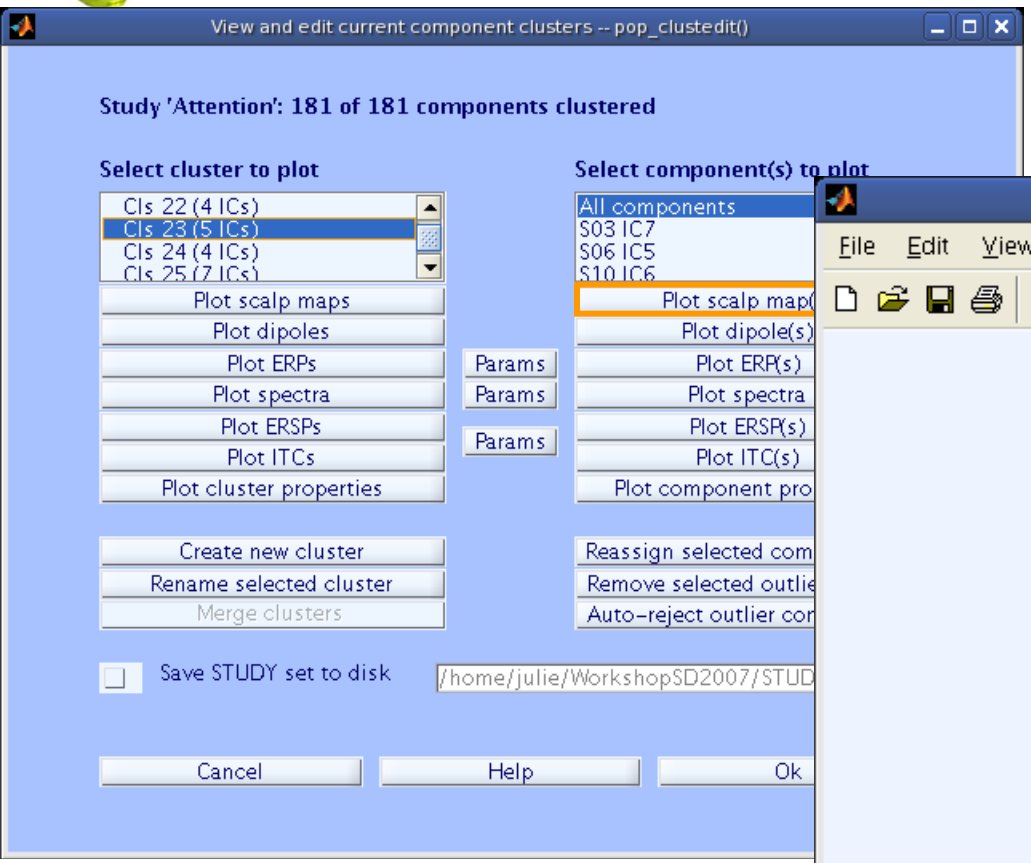
reorienting maps and activations gives a more coherent picture

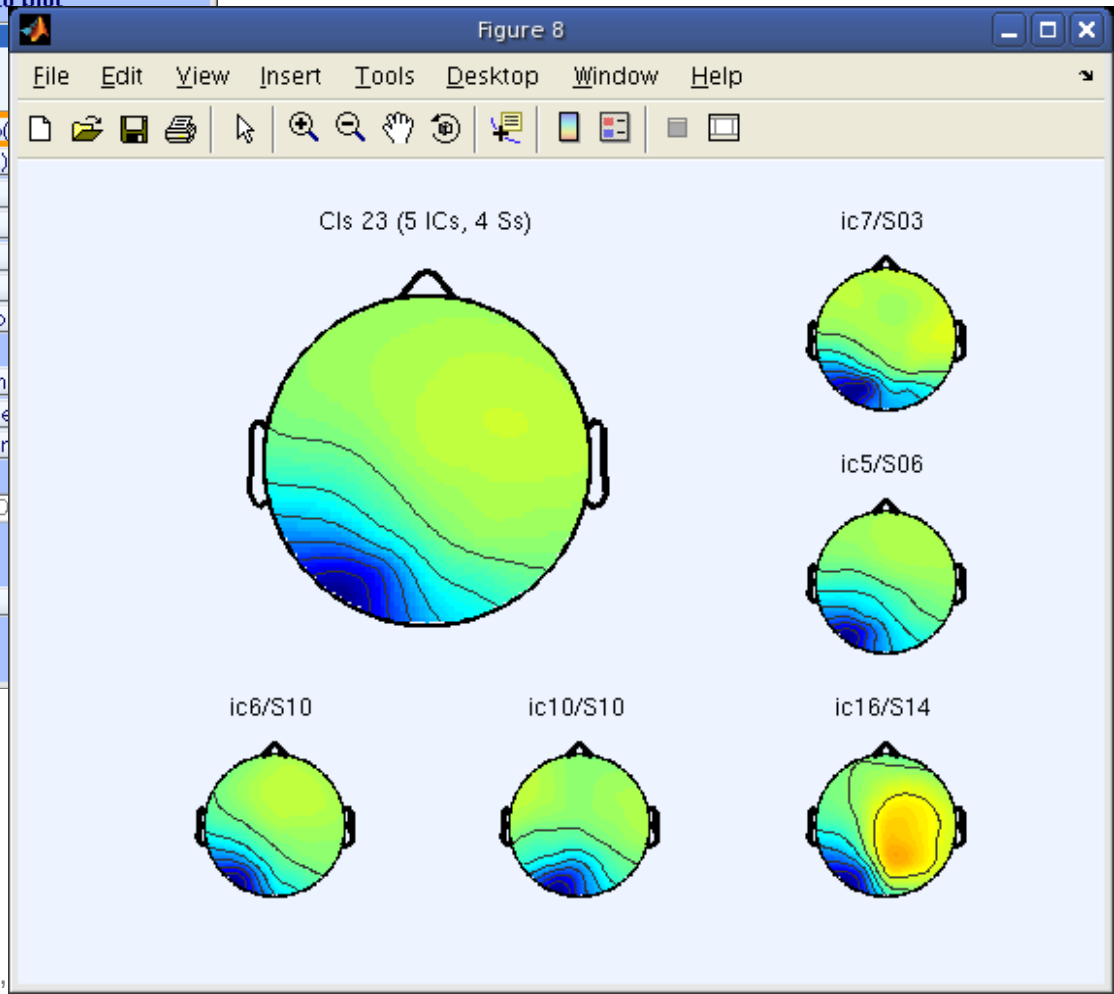
Movie of IC scalp map over time



Matching activation polarity



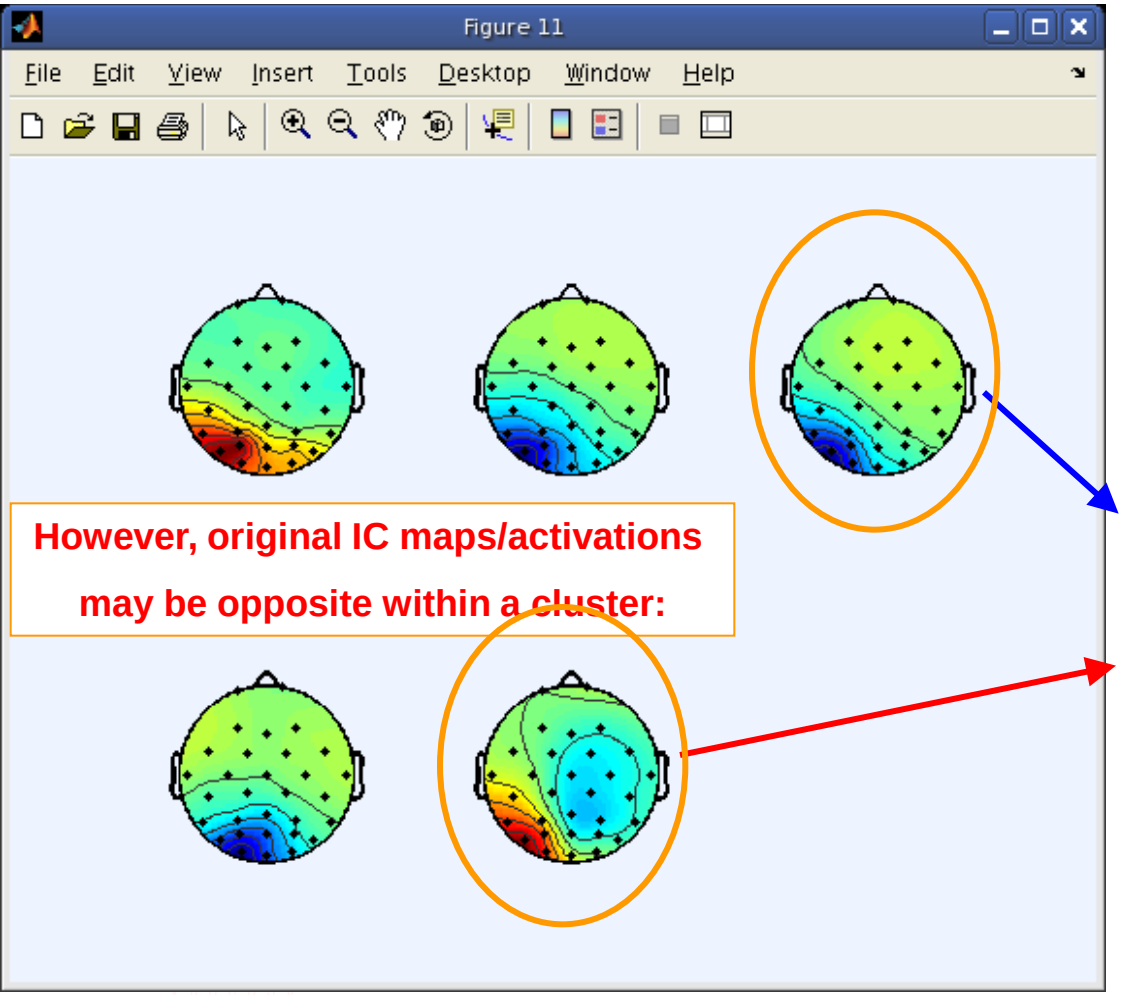


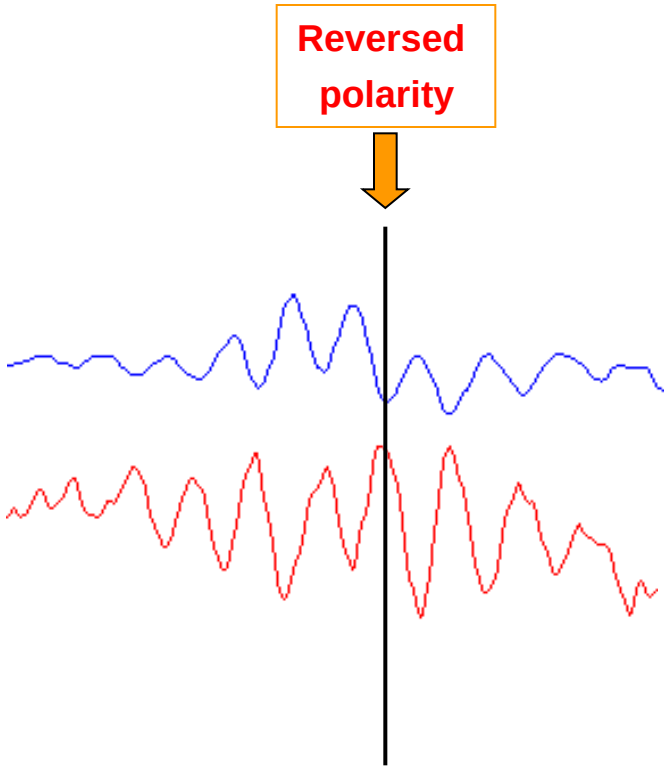


EEGLAB STUDY

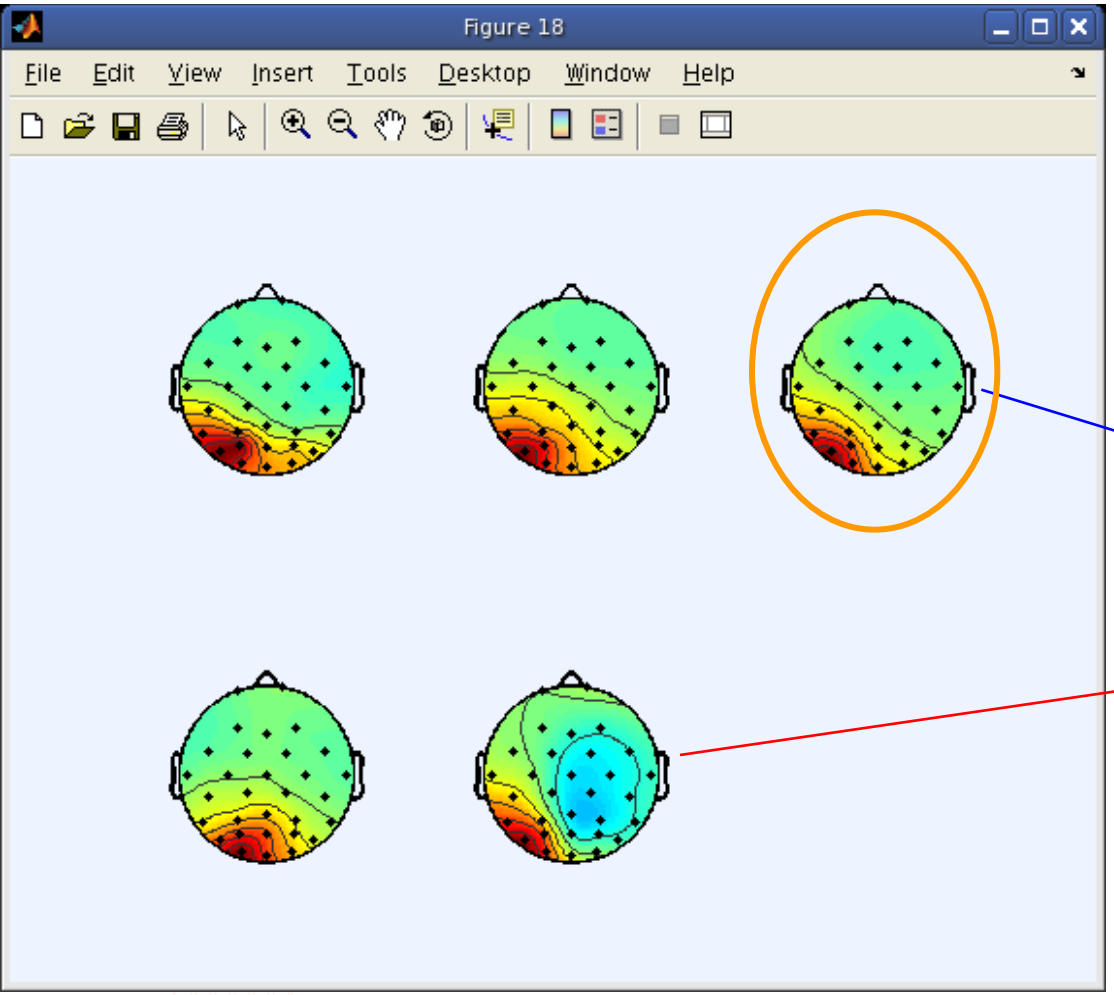
matches polarities for you

Matching activation polarity

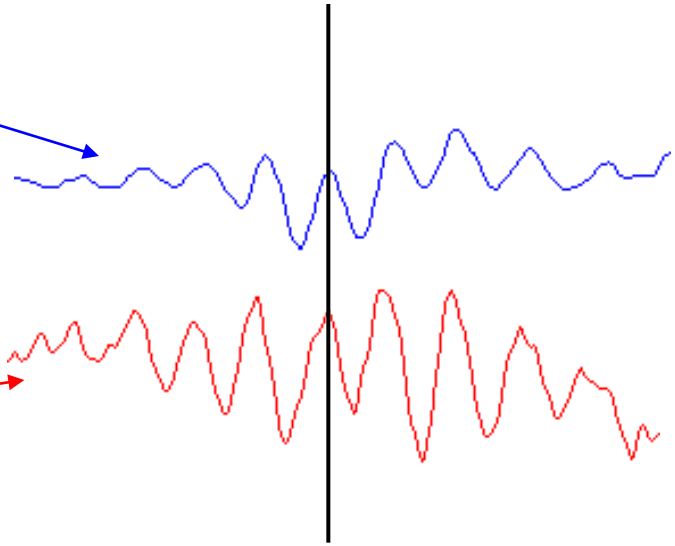




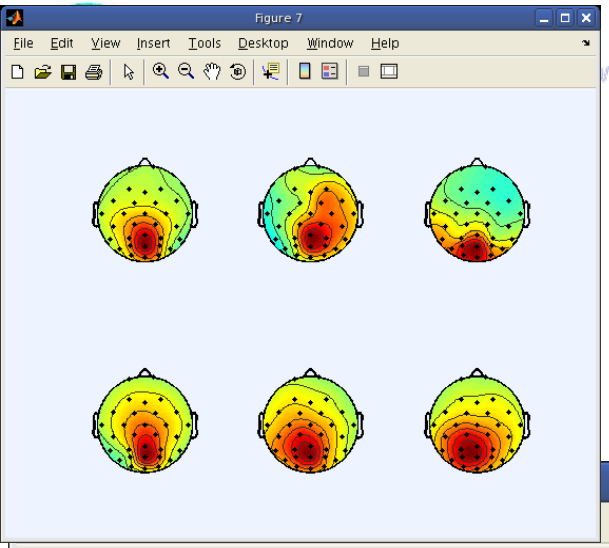
Matching activation polarity

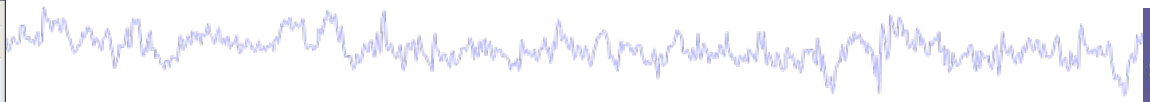


Reorient map AND activation of one IC to align



Cluster ERP image: RT sort





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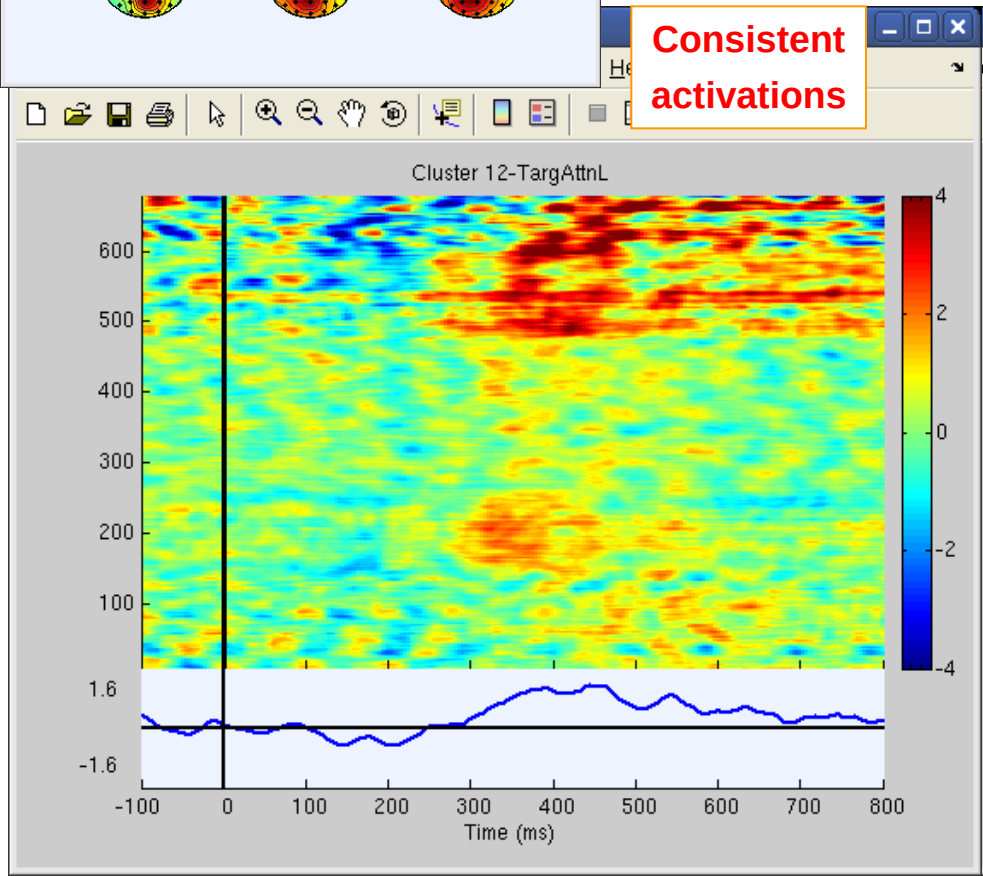
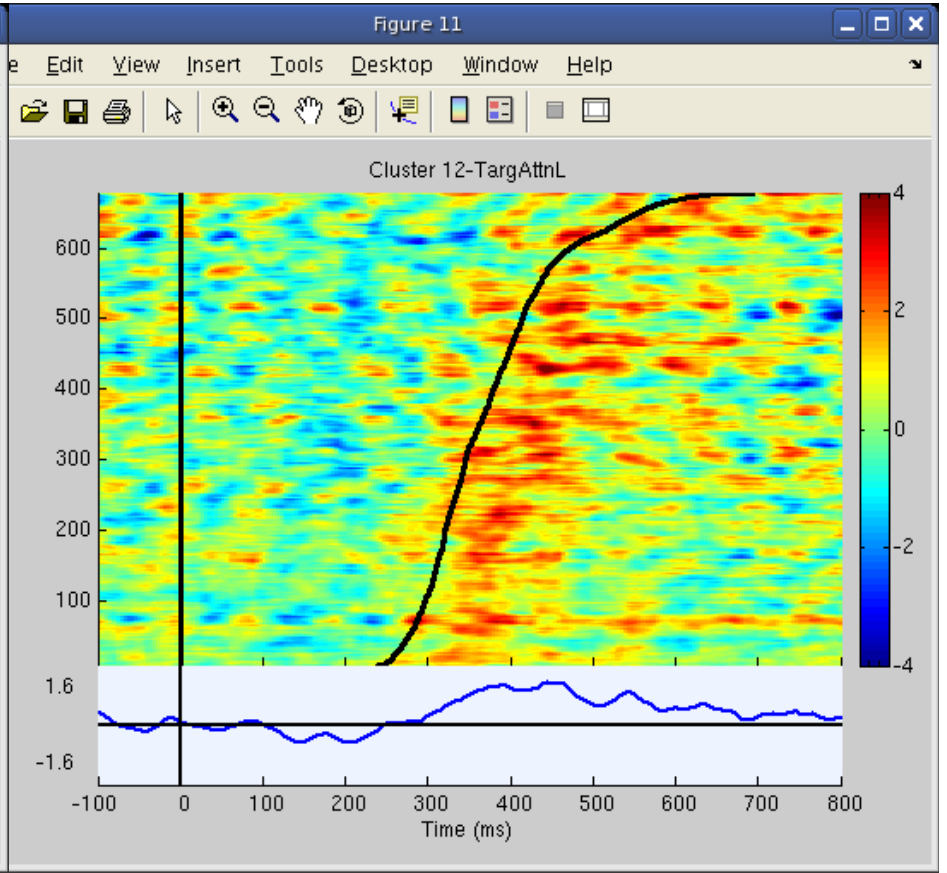
Consistent scalp maps

Consistent activations

Sort cluster ERP image by response time





STUDY analysis

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Cluster cross coherence

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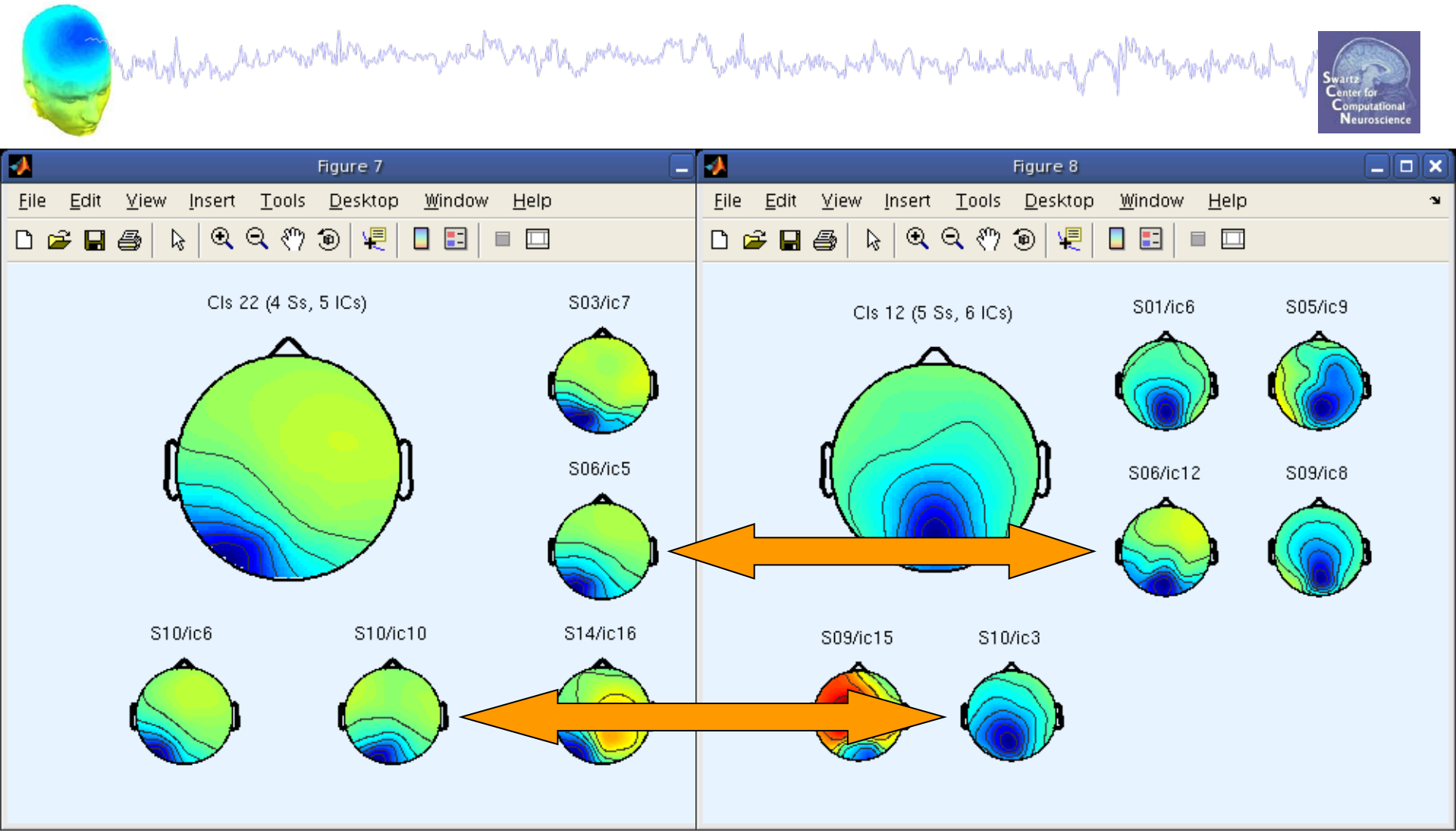
Dipole density

Exercise...

Cross coherence between clusters



cross coherence between clusters
requires 2 clusters with common subjects

STUDY cross coherence

```
clust1 = 6;

clust2 = 23;

% Crossf parameters:-------------------------------

type = 'phasecoher';

alpha = .01;

cycles = [3 0.5]; % wavelet cycles

freqscale = 'log';

frqlim = [3 30]; % calculation frequency limits in Hz

tmlims = [-100 1000]; % [min max] times in ms for window
```

STUDY cross coherence

```
for cond = 1:size(STUDY.cluster(clust1).sets,1)
    ttls = cell(1,0); allrts = cell(1,0); p=1;
    for ic = 1:length(STUDY.cluster(clust1).comps)
        setidx = STUDY.cluster(clust1).sets(cond,ic);
        comp1 = STUDY.cluster(clust1).comps(ic);
        [ALLEEG EEG CURRENTSET] = pop_newset(ALLEEG, EEG, CURRENTSET,…
          'retrieve',setidx, 'study',CURRENTSTUDY);
        subjmatch = find(STUDY.cluster(clust2).sets(cond,:) == setidx);
        for c = 1:length(subjmatch)
            comp2 = STUDY.cluster(clust2).comps(subjmatch(c));
            [coh(:,:,p),mcoh,times,freqs,cohboot(:,p),cohang(:,:,p)] = …
                    newcrossf(EEG.icaact(comp1,:) ,EEG.icaact(comp2,:),…
                    EEG.pnts,[EEG.xmin*1000 EEG.xmax*1000], EEG.srate, cycles,…
                    'alpha', alpha,'winsize',EEG.srate,'newfig','off',…
                    'type',type,'freqs',frqlim,'freqscale' ,freqscale,…
                    'savecoher',0 , 'plotamp' ,'off','plotphase' ,'off' );
              p = p+1;
            ttls{end+1} = [STUDY.datasetinfo(setidx).subject,': ICs ',…
                    int2str(comp1),'-',int2str(comp2)];
        end;
    end;
    condcohs{cond} = coh;
    condboots{cond} = cohboot;
    condang{cond} = cohang;
end;
```

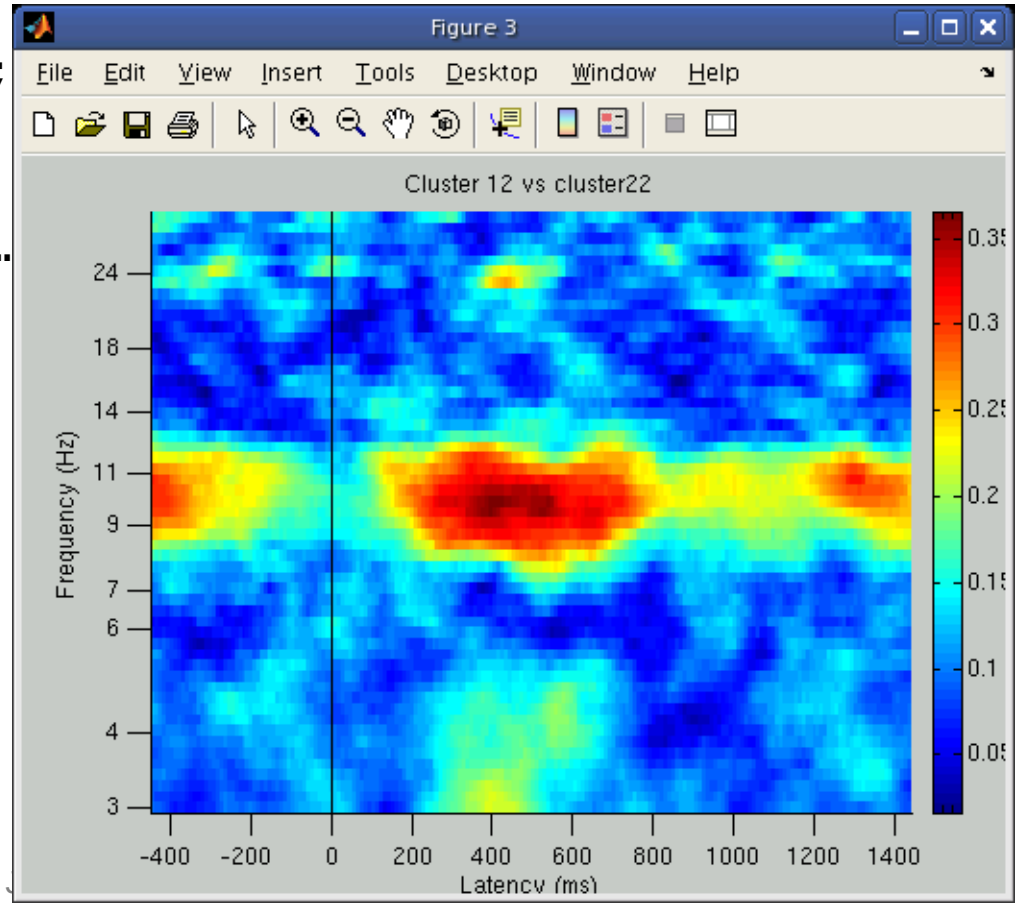
Task 4: Cross coherence between clusters

```
figure;
imagesclogy(times,freqs,mean(coh,3));
set(gca,'ydir','norm');hold on;
plot([0 0],[get(gca,'ylim')],'k-');

title(['Cluster ',…
int2str(clusts(1)),' vs cluster ',…
int2str(clusts(2))]);

% include a colorbar
% for coh values:
cbar;
```

Gives average phase coherence between members of two different IC clusters



STUDY analysis

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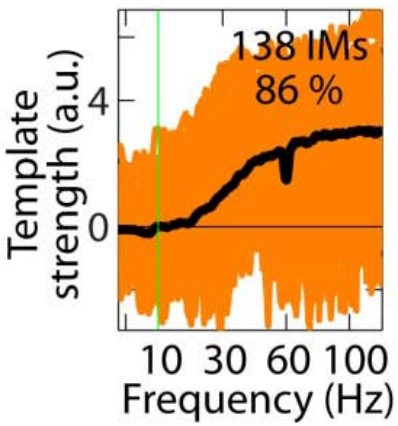
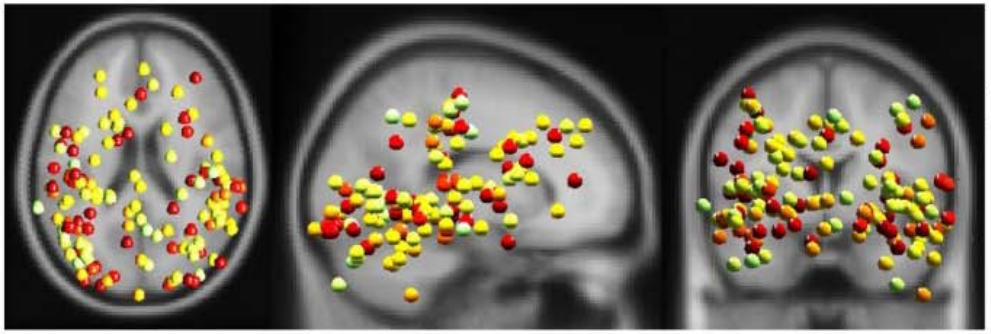
Dipole density

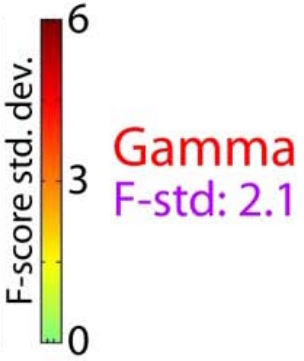
Exercise...

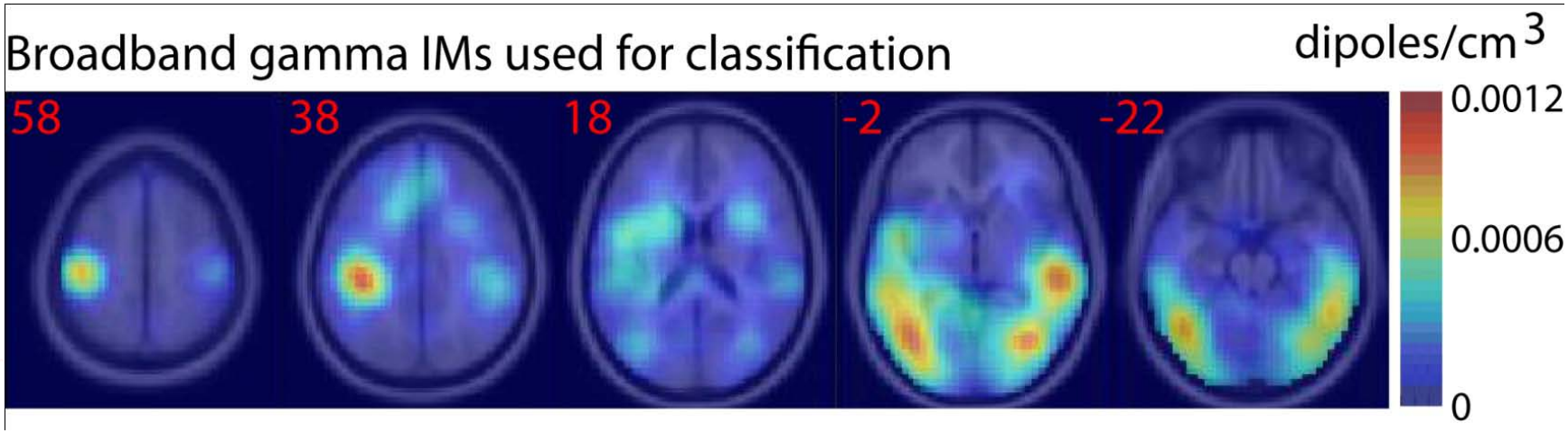
Dipole density plotting

PURPOSE: to visualize distributions of dipoles in ‘MRI-esque’ way









Dipole density plotting

Explanation of 'method' argument

```
'method'  - ['alldistance'|'distance'|'entropy'|'relentropy'] method for
                        computing density:
              'alldistance' - {default} take into account the gaussian-weighted
                        distances from each voxel to all the dipoles. See
                        'methodparam' (below) to specify a standard deviation
                        (in mm) for the gaussian weight kernel.
              'distance' - take into account only the distances to the nearest
                         dipole for each subject. See 'methodparam' (below).
              'entropy' - taking into account only the nearest dipole to each
                         voxel for each subject. See 'methodparam' below.
              'relentropy' - as in 'entropy,' but take into account all the
                        dipoles for each subject.
```

Dipole density plotting – commandline only

```
cond = 1;   clust = 3;
dipsources = struct('posxyz',[],'momxyz',[],'rv',[]);   n = 1;
nowidx = 0; % initialize
for ic = 1:length(STUDY.cluster(clust).comps)
  setidx = STUDY.cluster(clust).sets(cond,ic);
  comp = STUDY.cluster(clust).comps(ic);
  if setidx ~= nowidx % don't call in if already active
    [ALLEEG EEG CURRENTSET] = pop_newset(ALLEEG, EEG, CURRENTSET, …
      'retrieve',setidx, 'study',CURRENTSTUDY);  nowidx = setidx;
  end;
  model = EEG.dipfit.coordformat;
  dipsources(1,n).posxyz = EEG.dipfit.model(comp).posxyz;
  dipsources(1,n).momxyz = EEG.dipfit.model(comp).momxyz;
  dipsources(1,n).rv = EEG.dipfit.model(comp).rv;  n = n + 1;
end;
dipoledensity(dipsources , 'method','alldistance','methodparam',10,...
   'coordformat',model);
```

Exercise

- **ALL**
  - Load workshop STUDY

- **Novice**
  - Load and plot individual ERSPs for one or more clusters.
  - How consistent are the ERSPs in these clusters?

- **Intermediate**
  - Pick a cluster to investigate
  - Plot mean power in a small time/frequency window across all ICs and conditions for this cluster

- **Advanced**
  - Plot ERP image for a cluster sorting for response time (Probe).
  - Try a dipole density plot for one or more clusters of interest
    - try plotting different MRI slices to better view cluster

** All scripts for Intermediate/Advanced exercises can be found in …/workshop/Scripts/Tutorial_9_STUDYanalysis_II.m