

# **Clustering of ICA components**

Arnaud Delorme

(with Julie Onton, Romain Grandchamp, Nima Bigdely Shamlo, Scott Makeig)

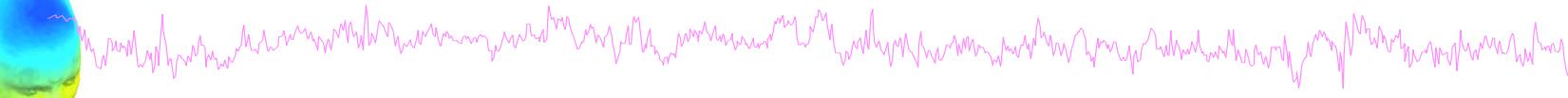




## Outline

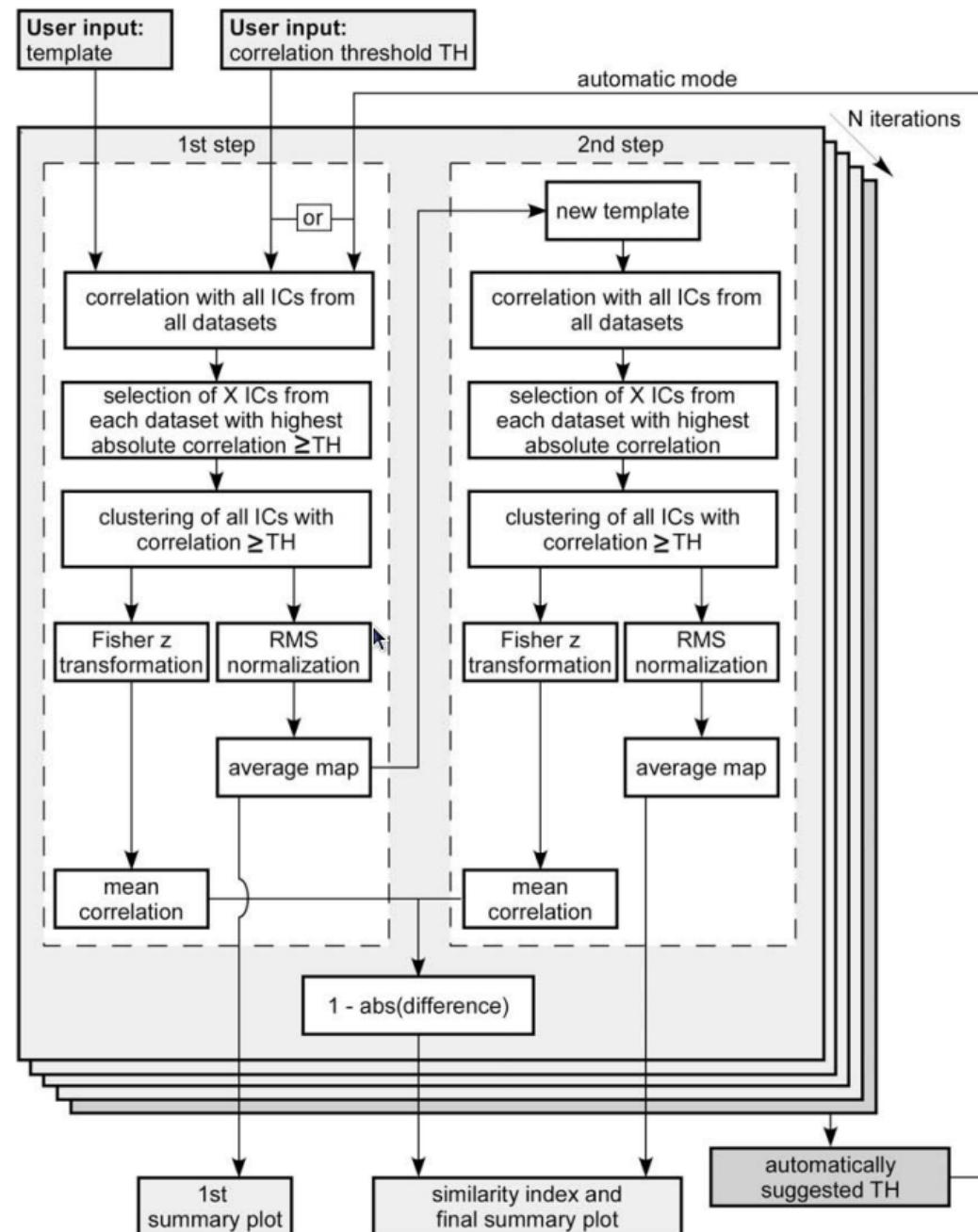
- ICA clusters and reliability within subjects  
REF: Grandchamp, Makeig, Delorme, IEEE, 2012
- ICA clusters and reliability across subjects  
REF: Delorme et al., PLOS One, 2012
- Clustering in EEGLAB theory & Practice

See <http://sccn.ucsd.edu/~arno> to download papers



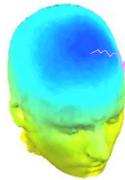
## ICA decomposition of multiple data sets from the same individuals

- Experimental protocol
  - Mind wandering experiment
  - 2 subjects
  - 11 x 30 min. sessions
  - 2 sessions per week
  - EEG from Biosemi 64 channels
  - Fs=1024 Hz



F. Campos Viola et al., "Semi-automatic identification of independent components representing EEG artifact," Clinical Neurophysiology 120, no. 5 (2009): 868–877.

# Results (Cluster 1)

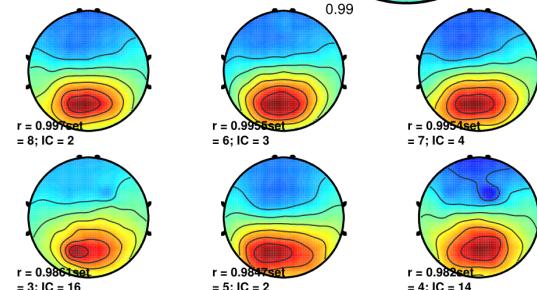
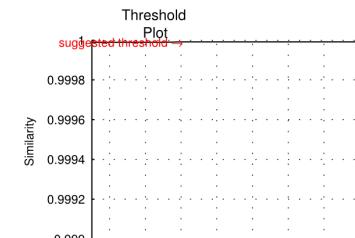
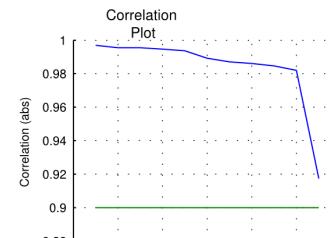
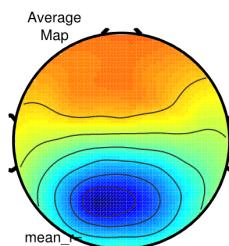


100 % Sessions contribute

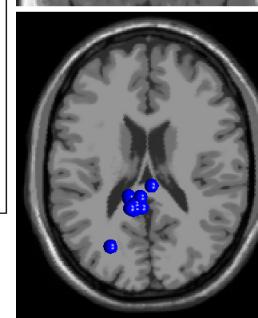
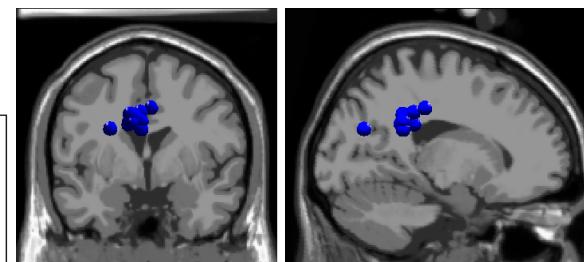
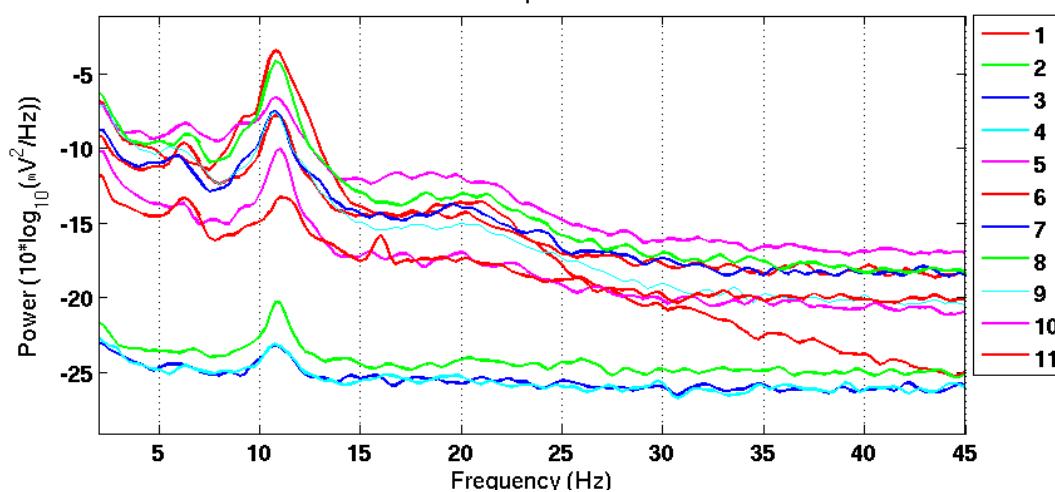


INFO:  
Template: CB Session 7 PREPROC:STEP 2; Set 7; IC 3;  
Number of datasets: 11  
Correlation threshold: 0.9 (green line)  
Max ICs from each dataset: 1  
Cluster: 11 ICs from 11 sets  
All datasets contribute.

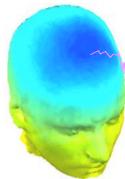
Similarity = 1.0000



Cls 3 Spectrum



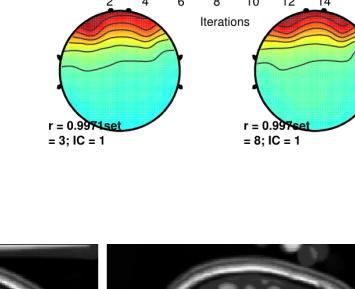
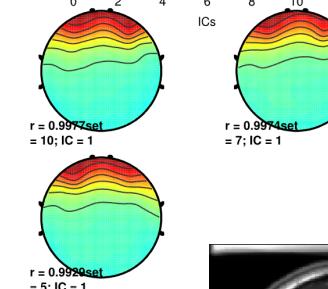
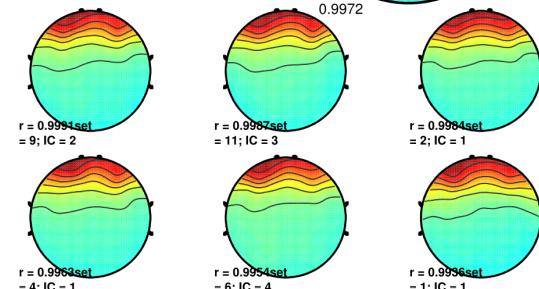
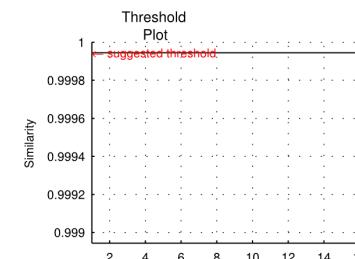
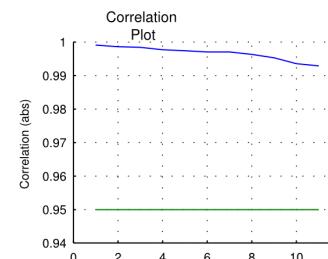
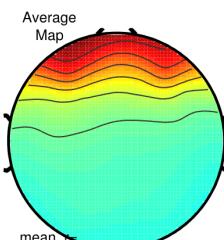
# Results (Cluster 2)



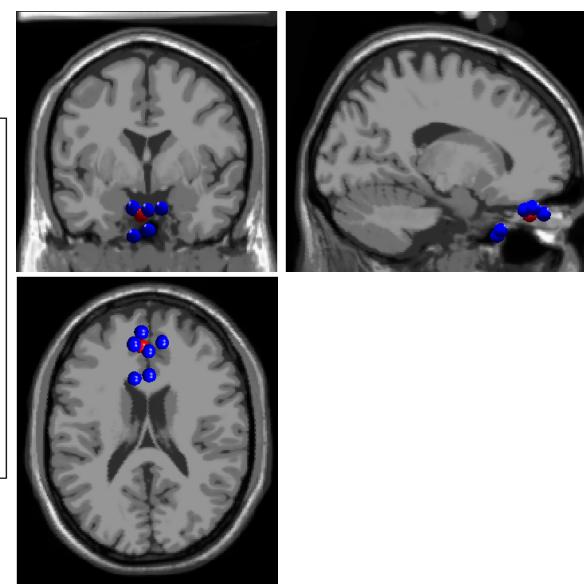
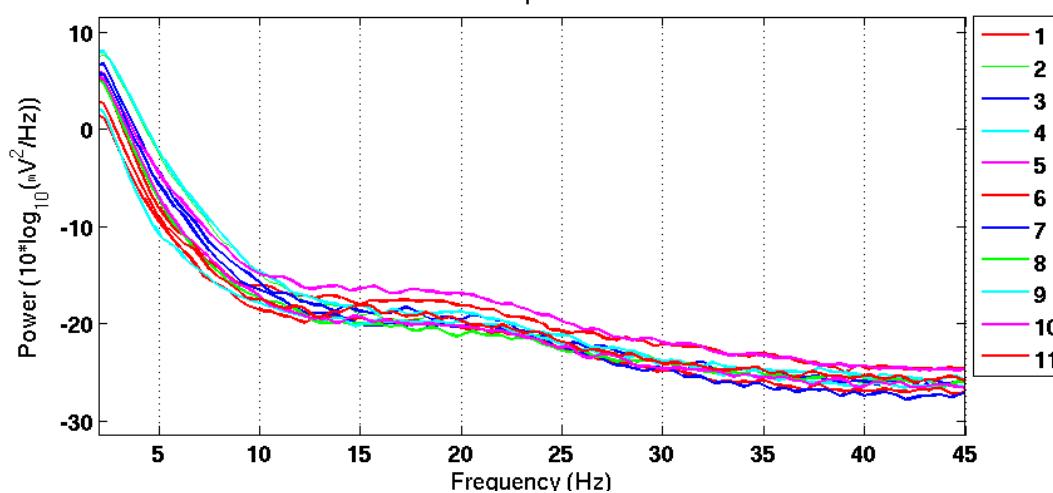
100 % Sessions contribute

INFO:  
 Template: CB Session 5 PREPROC:STEP 2; Set 5; IC 1;  
 Number of datasets: 11  
 Correlation threshold: 0.95 (green line)  
 Max ICs from each dataset: 1  
 Cluster: 11 ICs from 11 sets  
 All datasets contribute.

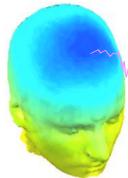
Similarity = 0.9999



Cl 4 Spectrum



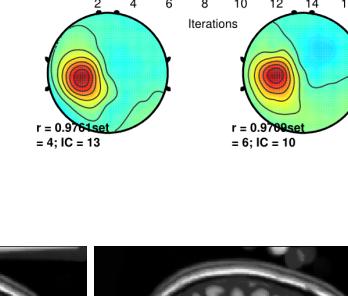
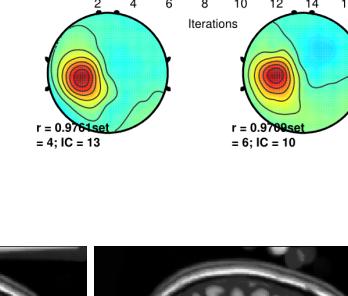
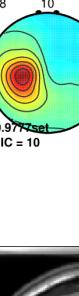
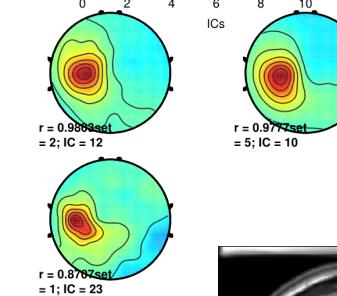
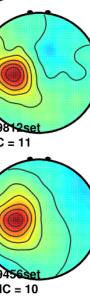
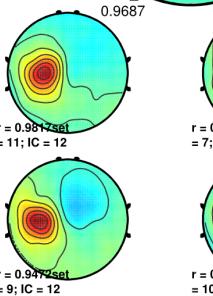
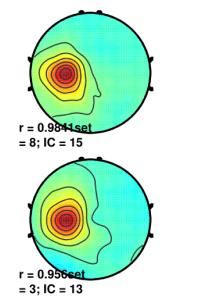
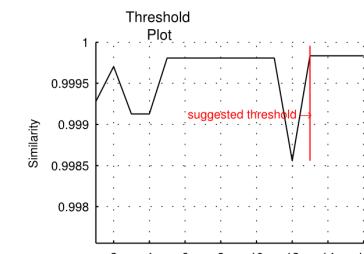
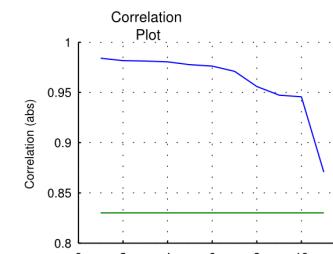
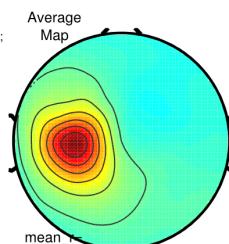
# Results (Cluster 8)



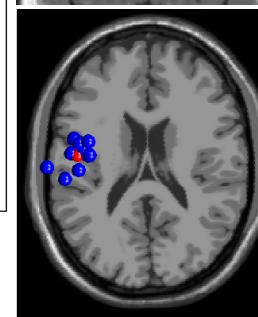
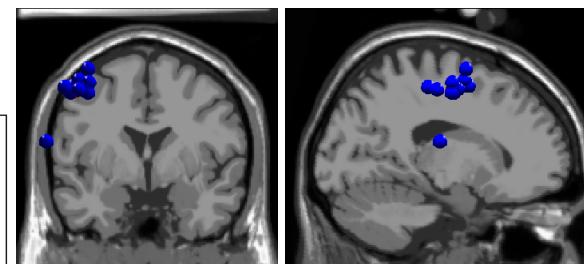
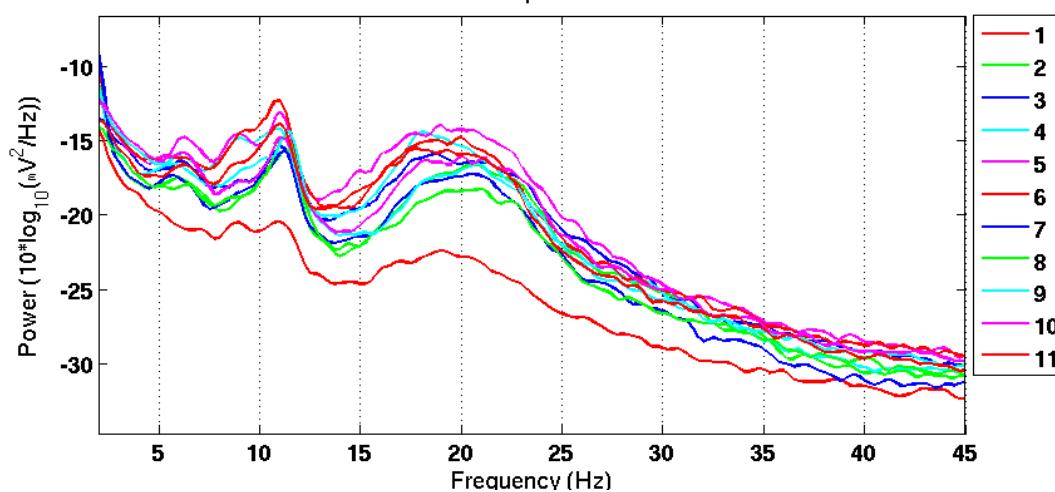
100 % Sessions contribute

INFO:  
 Template: CB Session 7 PREPROC:STEP 2; Set 7; IC 11;  
 Number of datasets: 11  
 Correlation threshold: 0.83 (green line)  
 Max ICs from each dataset: 1  
 Cluster: 11 ICs from 11 sets  
 All datasets contribute.

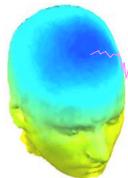
Similarity = 0.9998



Cl 8 Spectrum



# Results (Cluster 13)

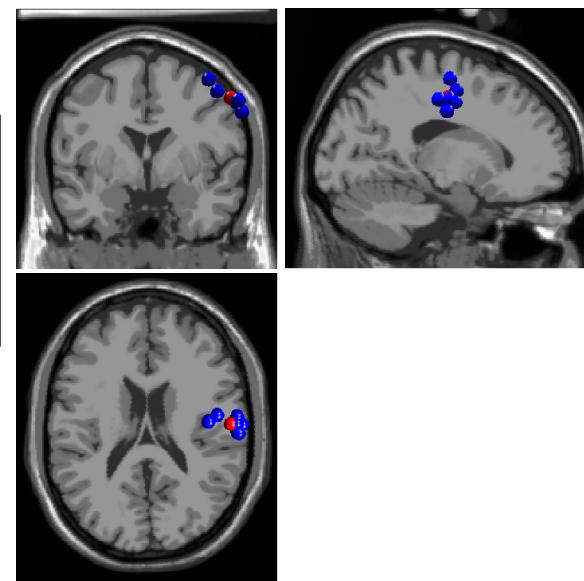
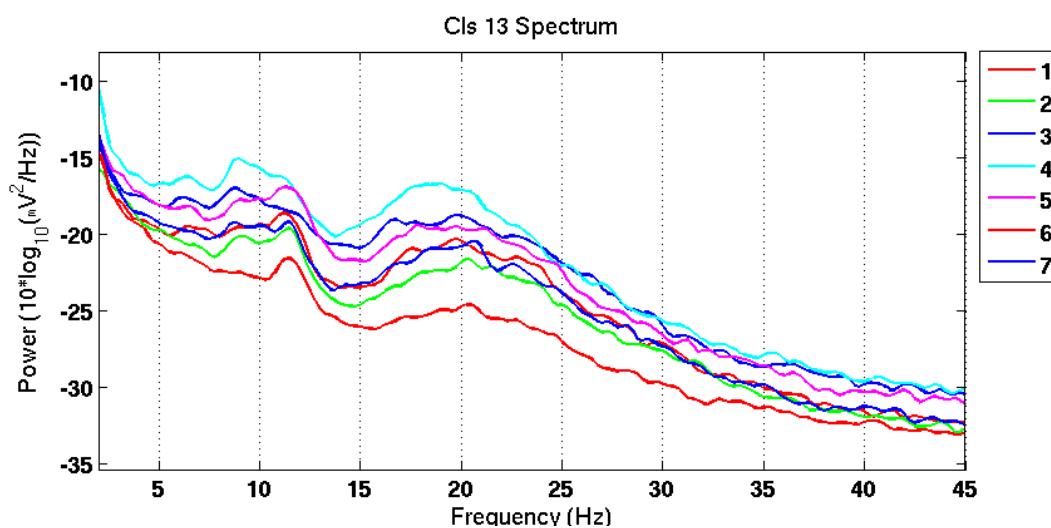
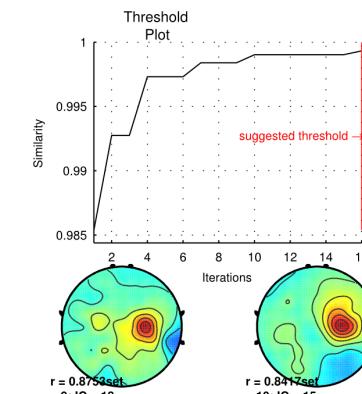
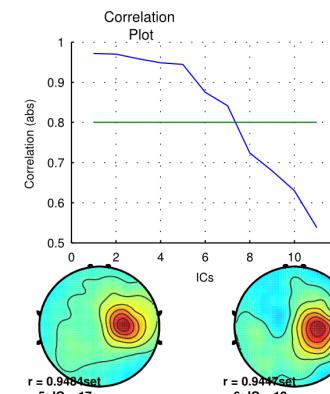
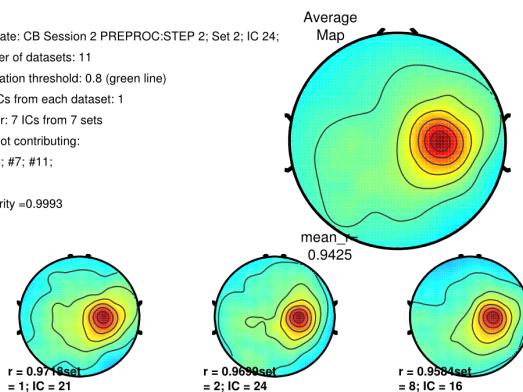


63.64% Sessions contribute

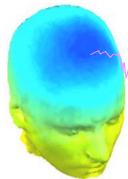


INFO:  
 Template: CB Session 2 PREPROC:STEP 2; Set 2; IC 24;  
 Number of datasets: 11  
 Correlation threshold: 0.8 (green line)  
 Max ICs from each dataset: 1  
 Cluster: 7 ICs from 7 sets  
 Sets not contributing:  
 #3; #4; #7; #11;

Similarity = 0.9993



# Results (Cluster 14)

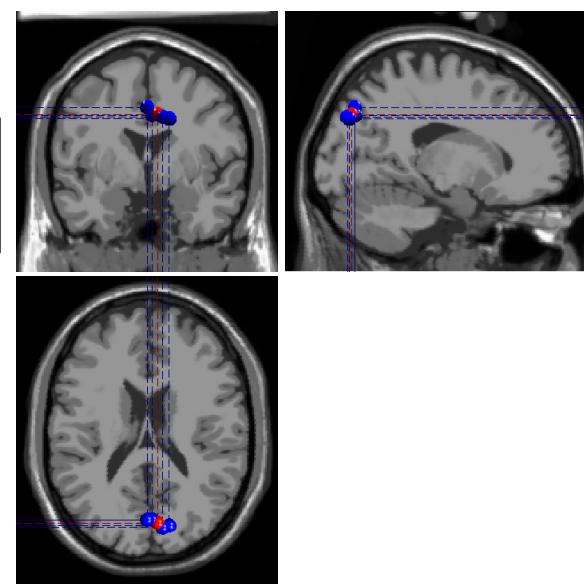
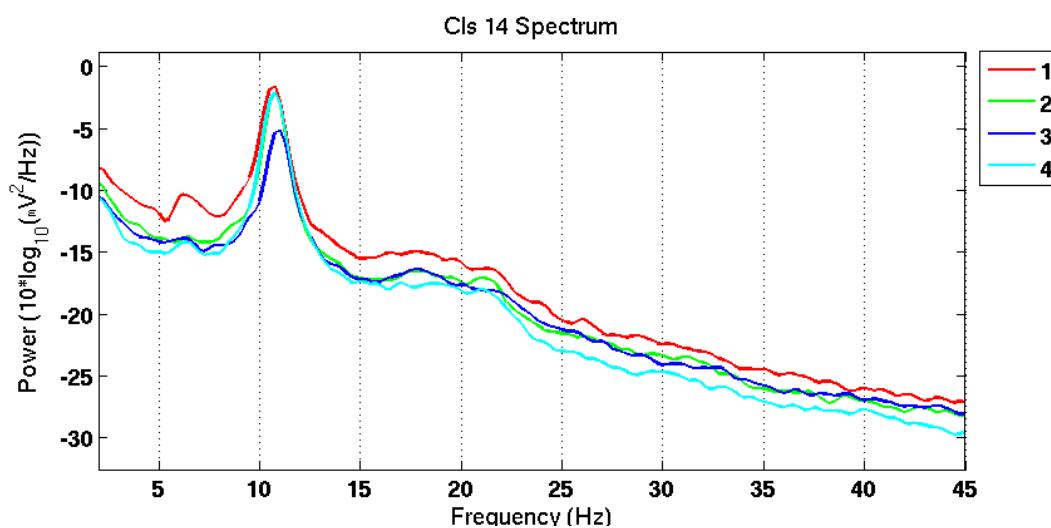
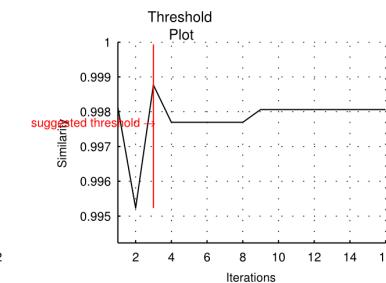
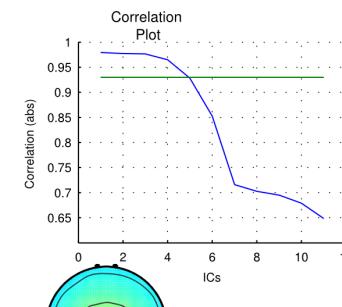
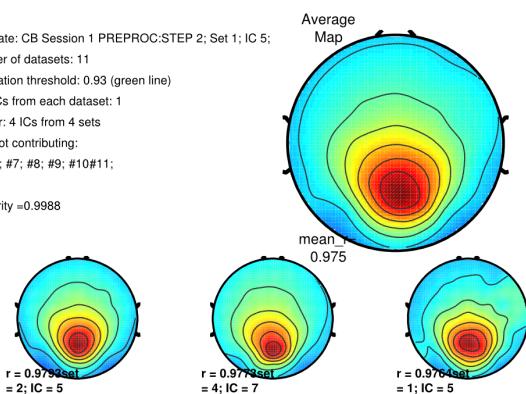


36.36% Sessions contribute

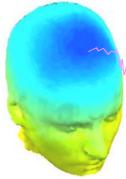


INFO:  
 Template: CB Session 1 PREPROC:STEP 2; Set 1; IC 5;  
 Number of datasets: 11  
 Correlation threshold: 0.93 (green line)  
 Max ICs from each dataset: 1  
 Cluster: 4 Cs from 4 sets  
 Sets not contributing:  
 #5; #6; #7; #8; #9; #10#11;

Similarity =0.9988



# Inter iteration Cluster Consistency



## Iterations

	1	2	3	4	5	6	7	8	9	10	Mean
Clusters	3	100	100	100	100	100	100	100	100	100	100
4	100	100	100	100	100	100	90	100	100	100	99
5	90	40	10	90	90	60	100	10	60	90	64
6	60	0	100	60	100	90	60	60	90	60	68
7	90	100	90	90	60	90	90	100	90	90	89
8	80	80	60	80	40	80	80	80	80	100	76
9	60	90	50	60	80	60	0	10	60	50	52
10	40	90	10	40	0	50	50	0	50	60	39
11	60	20	0	0	10	60	10	90	60	60	37
12	100	50	50	100	50	100	100	50	100	50	75
13	50	10	20	50	90	50	50	10	50	20	40
14	20	10	10	20	20	30	20	20	30	30	21

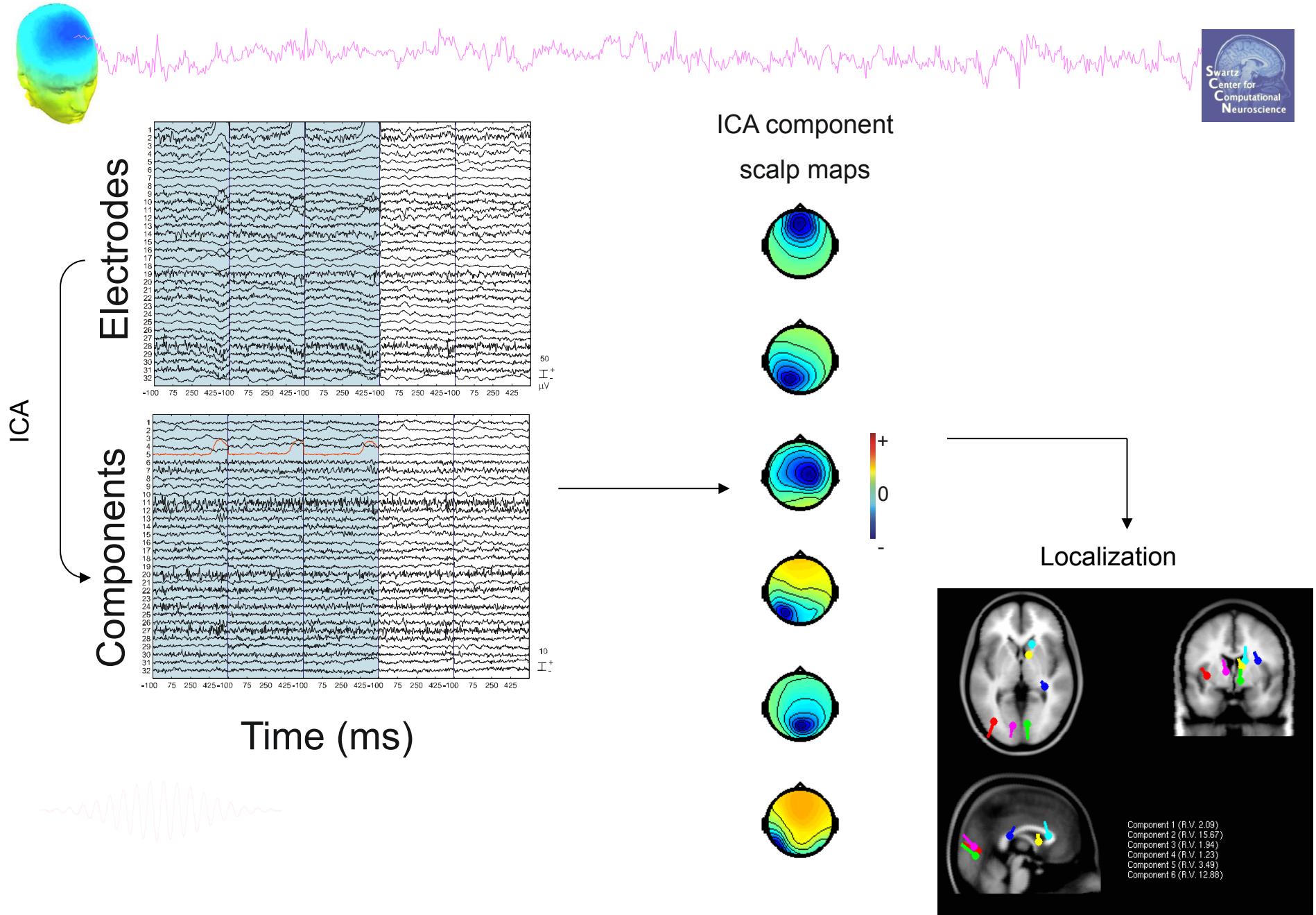


## Outline

- ICA clusters and reliability within subjects
- ICA clusters and reliability across subjects
- Clustering in EEGLAB theory & Practice



# Localization

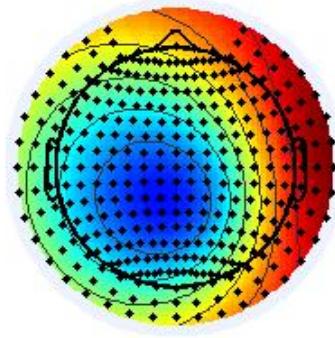




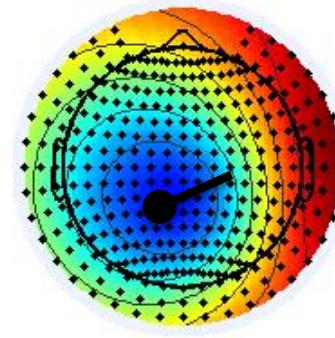
# Computing residual variance (%)



Actual



Dipole projection



$$r = \sum (x_i - \tilde{x}_i)^2 / \sum x_i^2$$





# Validation of the ICA algorithm for EEG



## Data

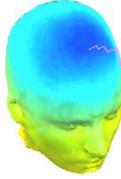
- 13 subjects performing a memory task
- 71 electrodes including EOGs
- more than 300,000 data points/subject

## Decomposition

- 23 ICA algorithms plus PCA and Promax

## Analysis

- Localization of all components with a single dipole  
(4-shell spherical model)

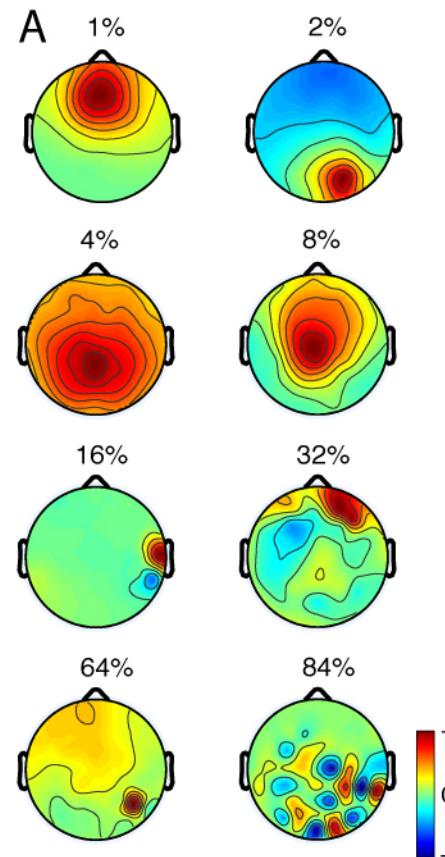
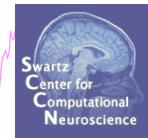


Algorithm (Matlab func.)	D%	LL	Origin
Extended Infomax (runica)	29.9	178	EEGLAB 4.515
Pearson	29.1	169	ICAcentral (6)
Infomax (runica)	28.2	160	EEGLAB 4.515
ERICA	26.9	184	ICALAB 1.5.2
SONS	25.4	183	ICALAB 1.5.2
SHIBBS	23.7	169	ICAcentral (5)
FastICA*	23.5	169	ICAcentral (2)
JADE (jader)	23.4	169	EEGLAB 4.515
TICA	23.4	169	ICALAB 1.5.2
JADE optimized (jade_op)	21.4	169	ICALAB 1.5.2
JADE w/ time delay (jade_td)	20.2	169	ICALAB 1.5.2
eeA	19.0	305	ICAcentral (8)
Infomax (icaML) †	18.8	212	ICA DTU Tbox
FOBI	18.6	169	ICALAB 1.5.2
SOBIRO (acsobiro)	17.9	167	EEGLAB 4.515
EVD 24	17.7	169	ICALAB 1.5.2
EVD	17.0	169	ICALAB 1.5.2
SOBI	16.1	583	EEGLAB 4.515
icaMS†	10.6	169	ICA DTU Tbox
AMUSE	8.5	169	ICALAB 1.5.2
PCA	3.1	583	EEGLAB 4.515
Promax	33.7	467	EEGLAB 4.515
Whitening/Sphering	57.6	164	EEGLAB 4.515

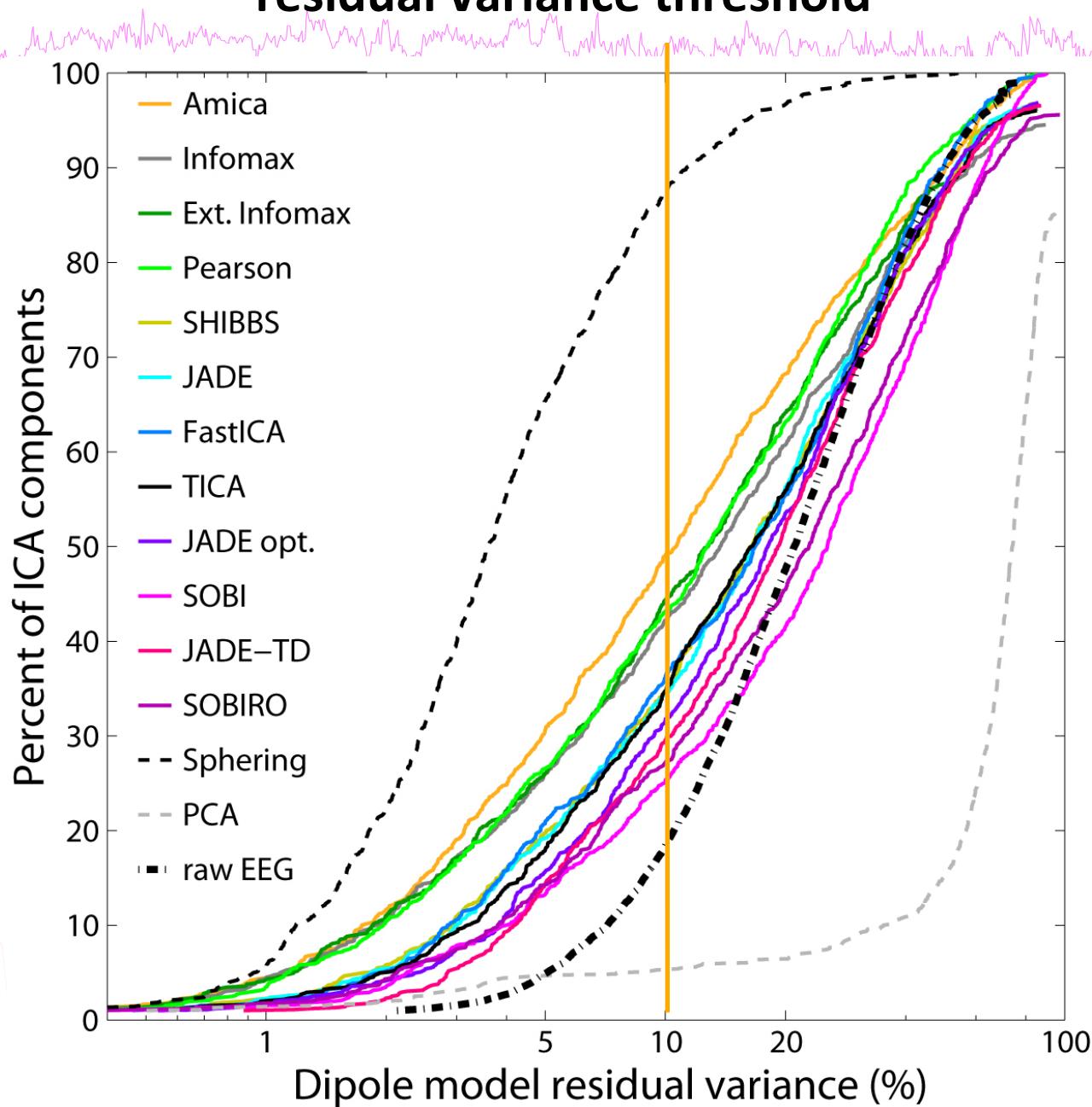




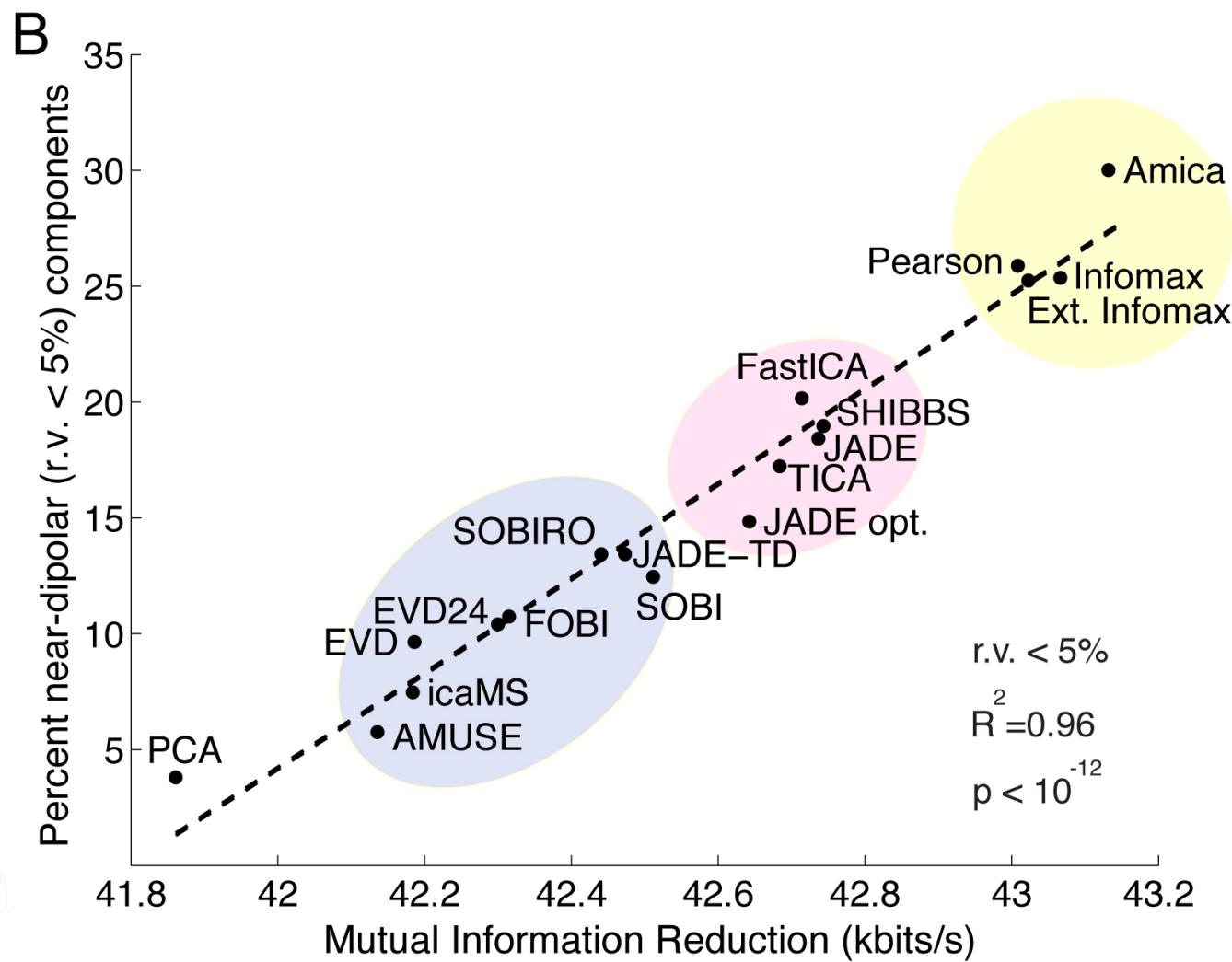
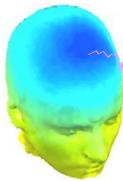
# Component examples

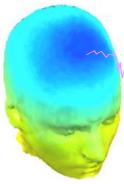


# Cumulative number of component below residual variance threshold

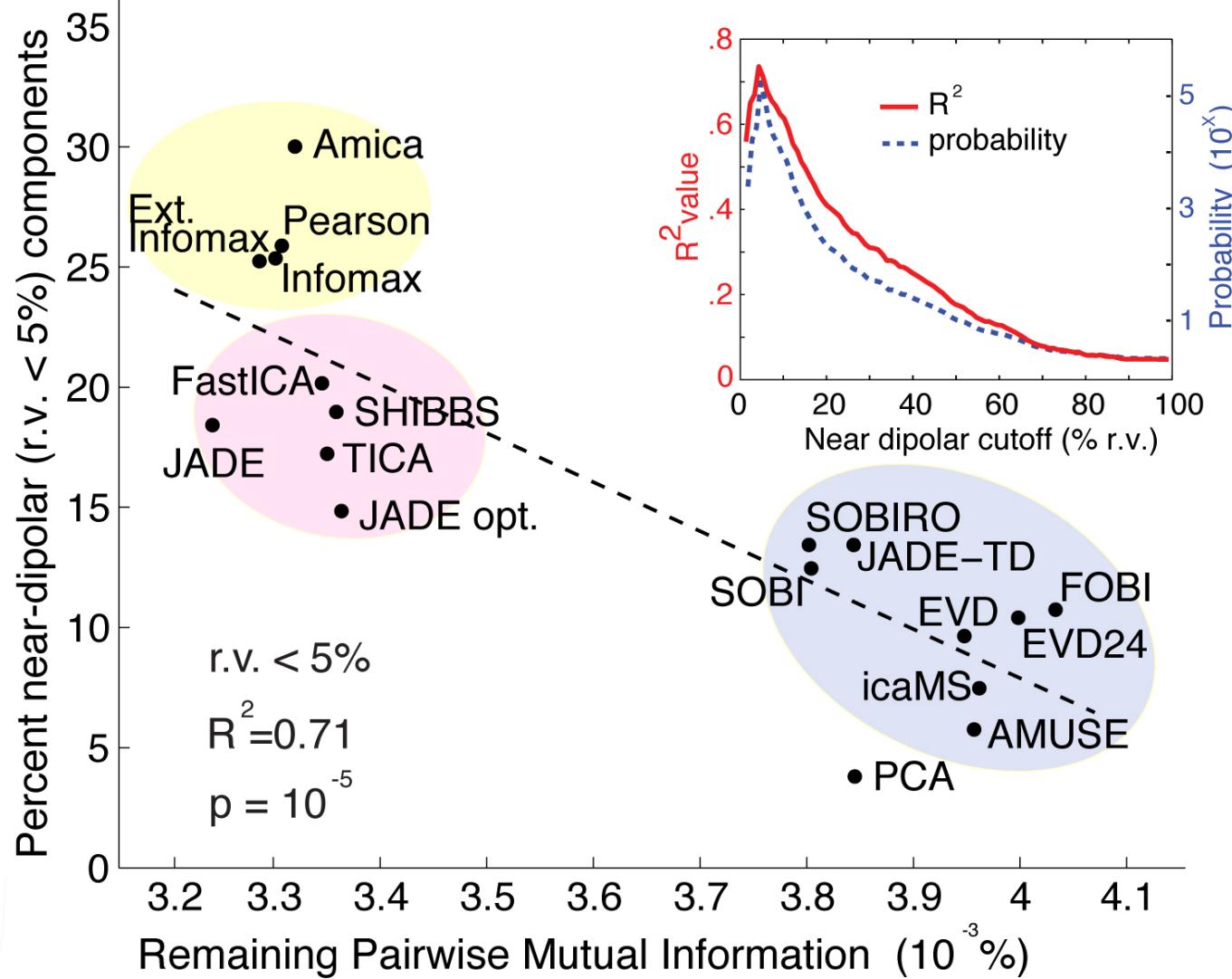


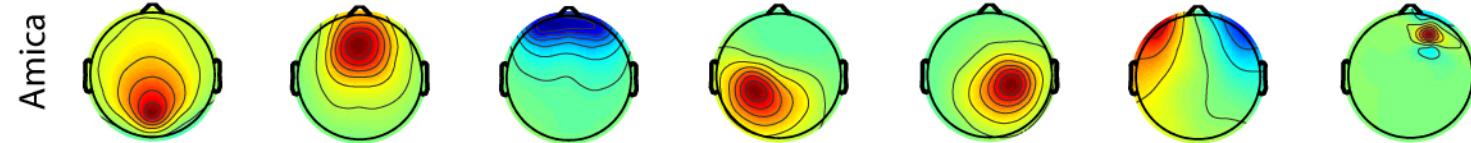
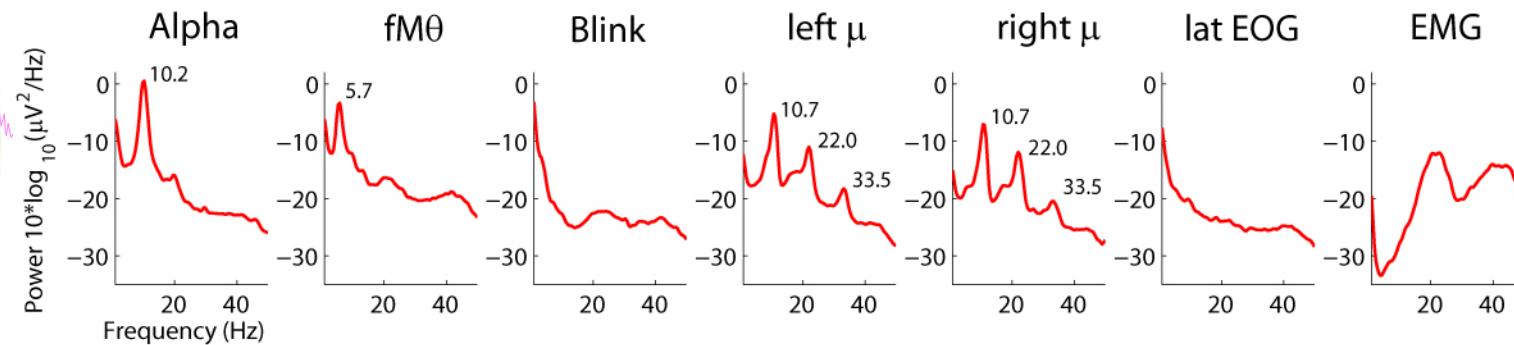
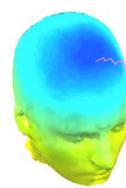
# More independence -> more biological components

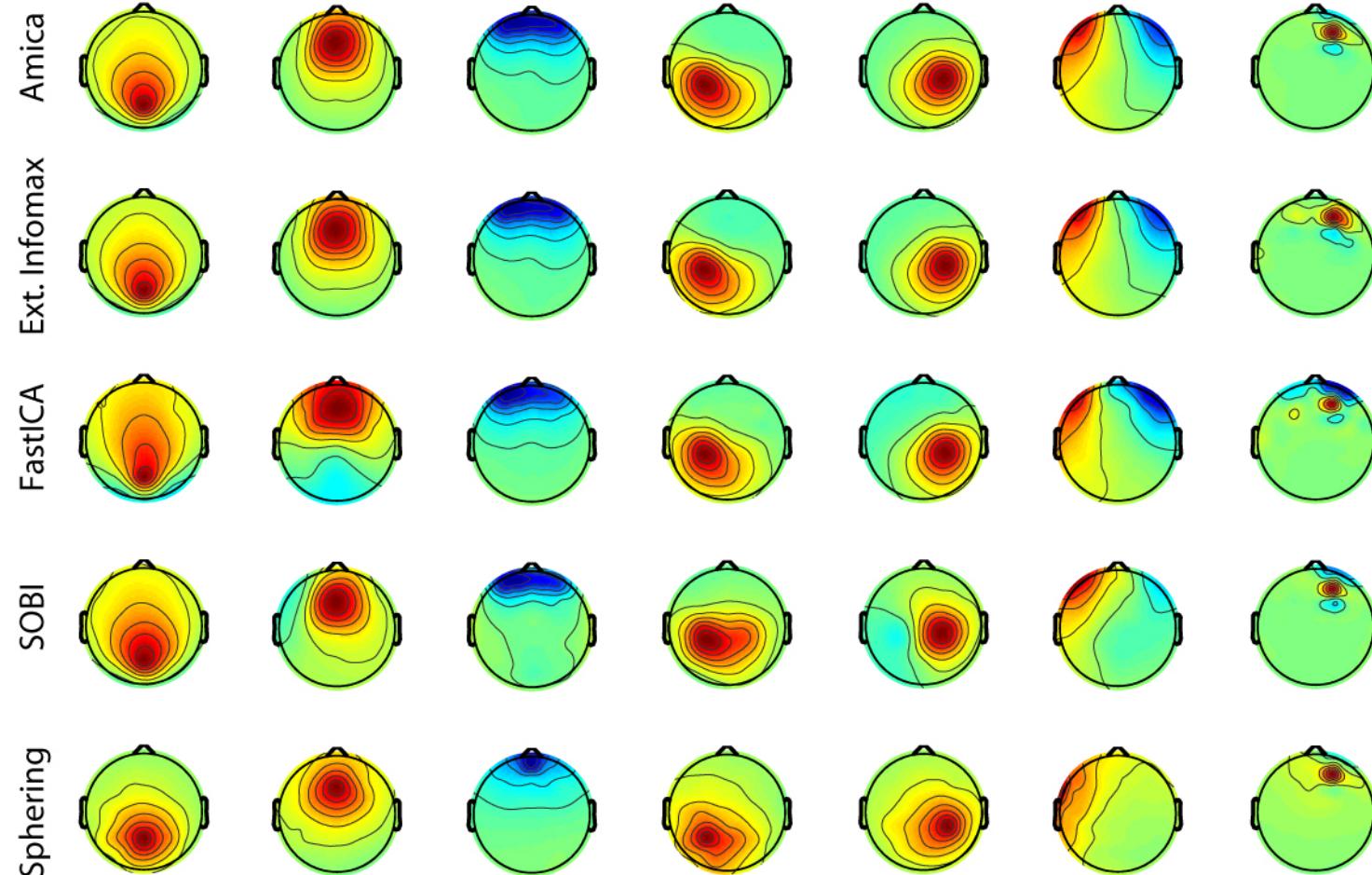
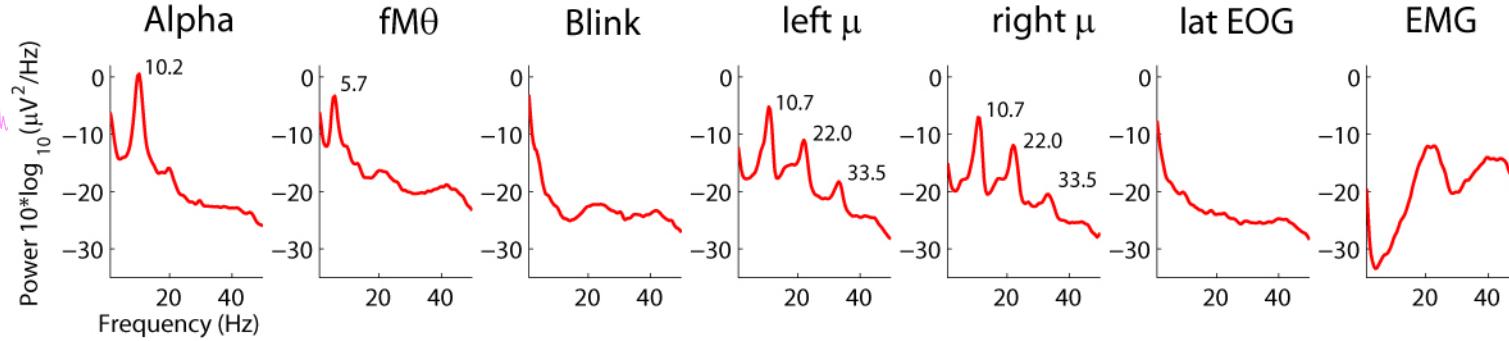




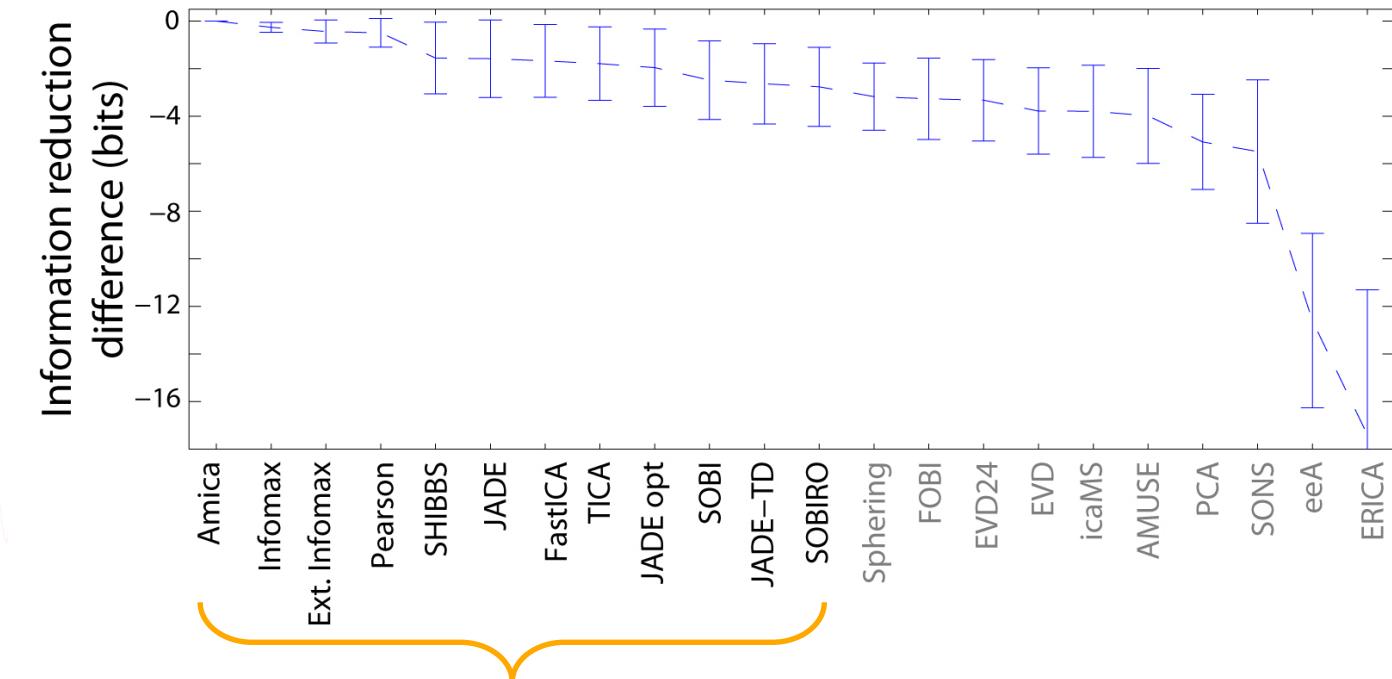
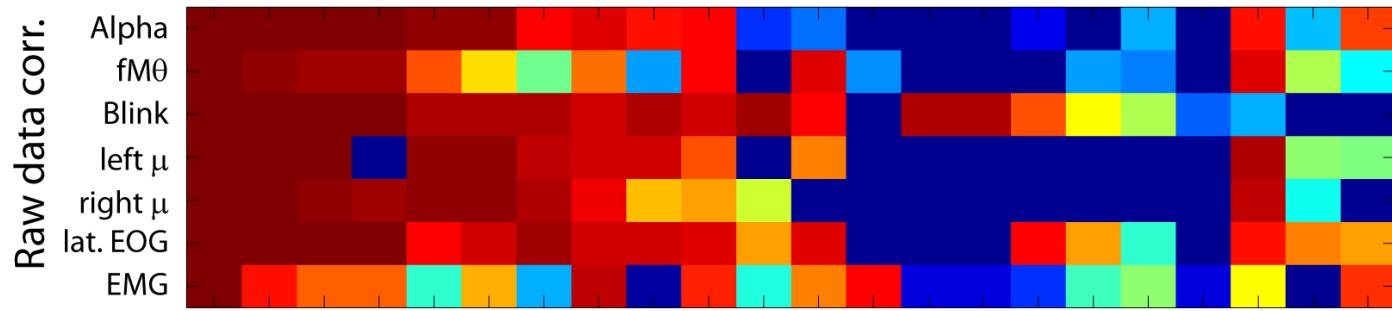
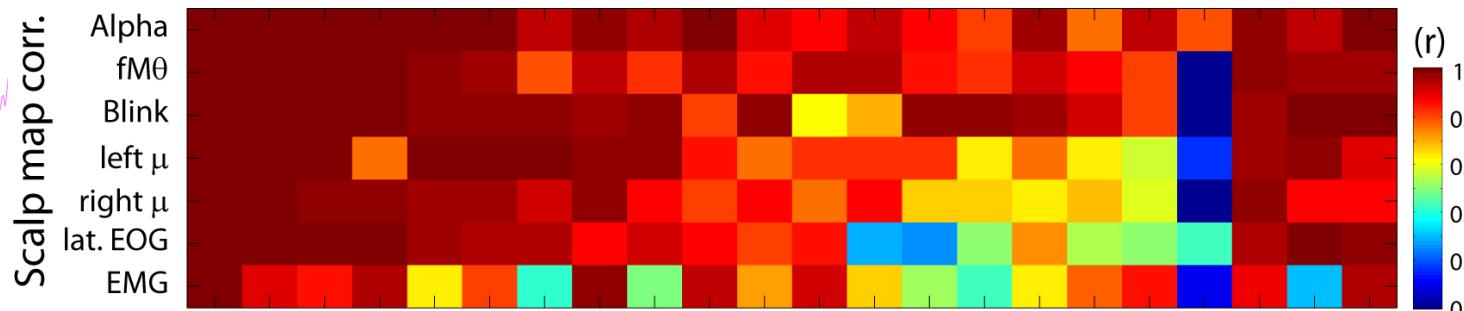
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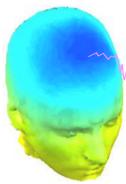




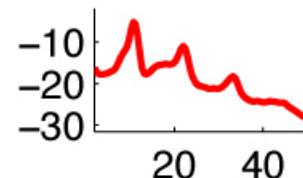
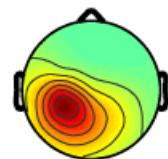
# Correlations between decompositions



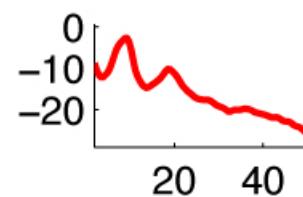
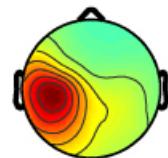
# Left $\mu$ cluster



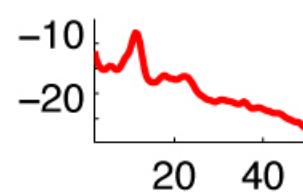
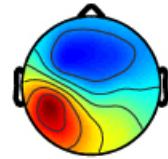
S2 IC47



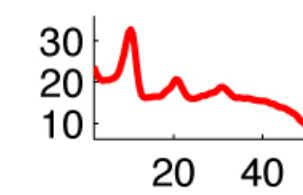
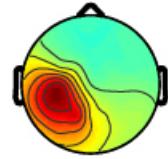
S4 IC37



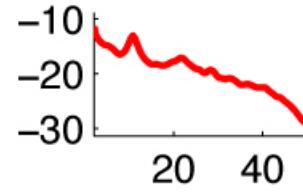
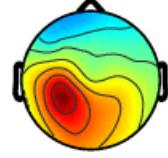
S6 IC46



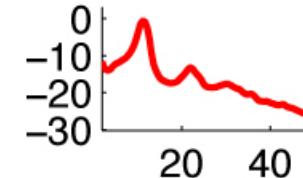
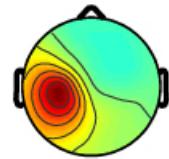
S9 IC7



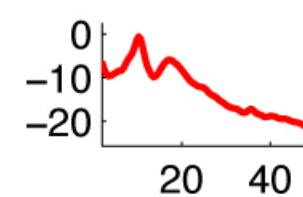
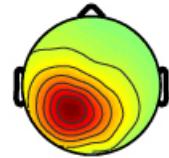
S12 IC45



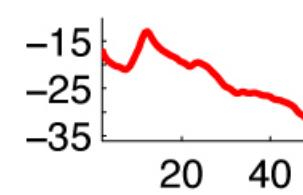
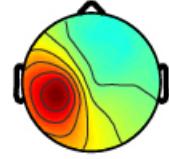
S3 IC47



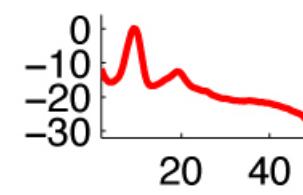
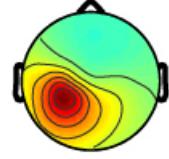
S5 IC48



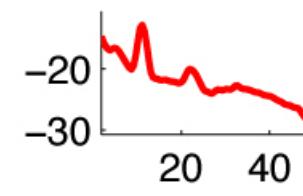
S7 IC35



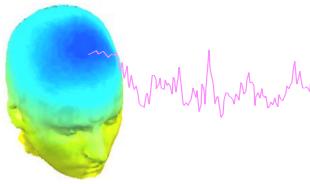
S11 IC45



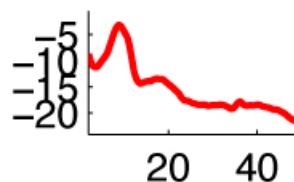
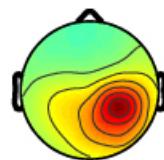
S14 IC45



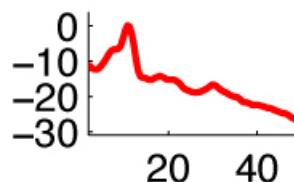
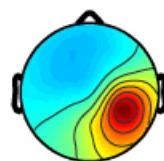
# Right $\mu$ cluster



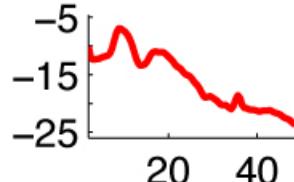
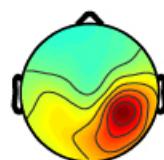
S1 IC51



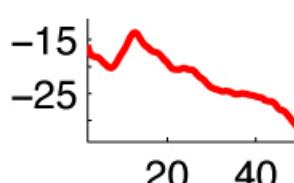
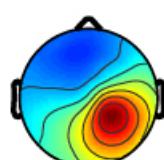
S3 IC41



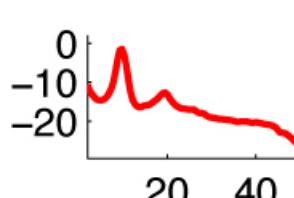
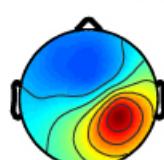
S5 IC51



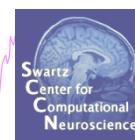
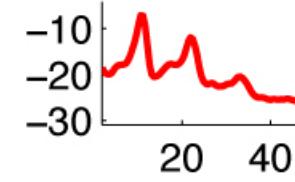
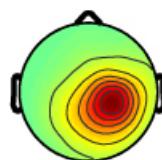
S7 IC48



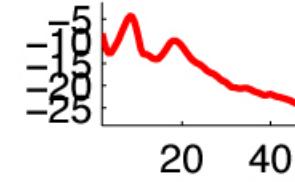
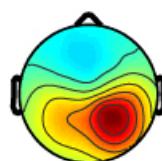
S11 IC49



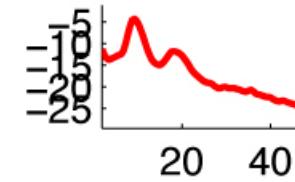
S2 IC41



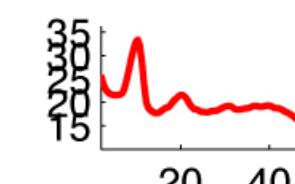
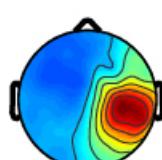
S4 IC50



S6 IC6<sup>0</sup>

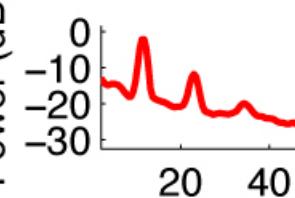
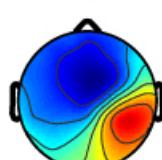


S9 IC39



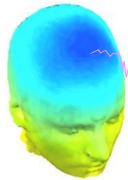
Power (dB)

S14 IC49

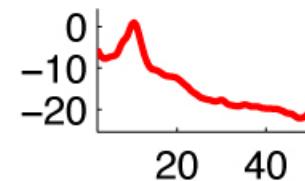
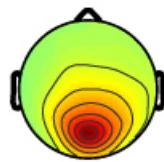


Frequency (Hz)

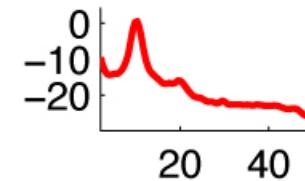
# Occipital $\alpha$ cluster



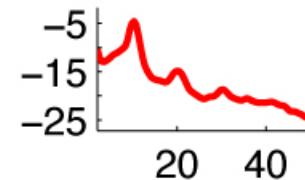
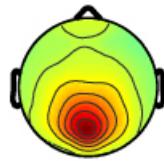
S1 IC67



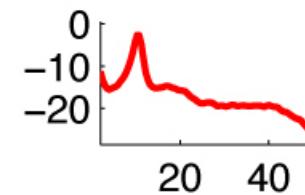
S2 IC67



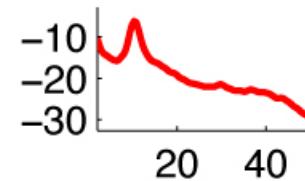
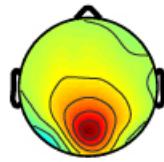
S3 IC51



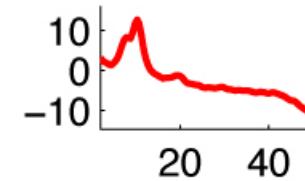
S11 IC65



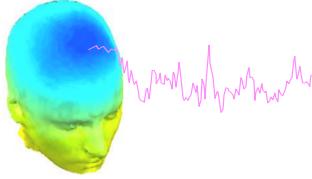
S12 IC3<sup>8</sup>



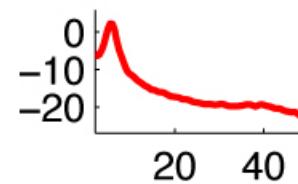
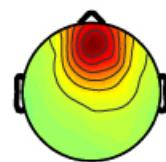
S13 IC65



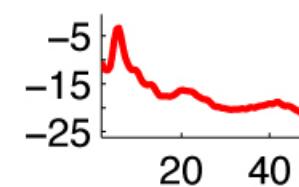
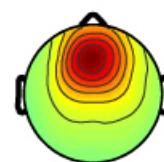
# Frontal Midline $\theta$ cluster



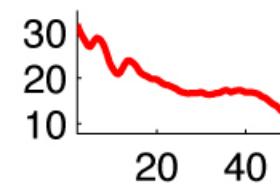
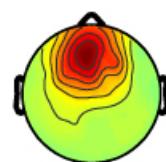
S1 IC63



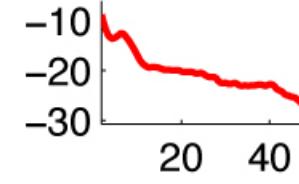
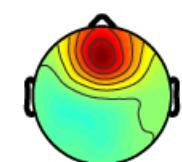
S2 IC18



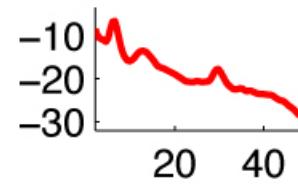
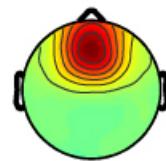
S9 IC16



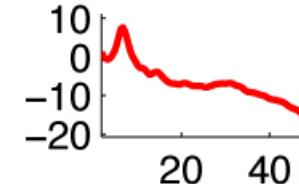
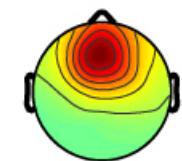
S11 IC16



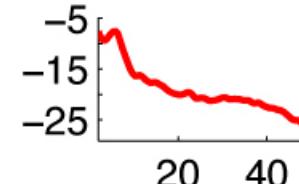
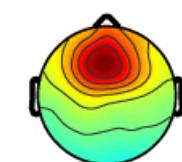
S12 IC15

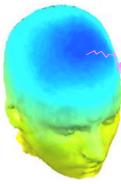
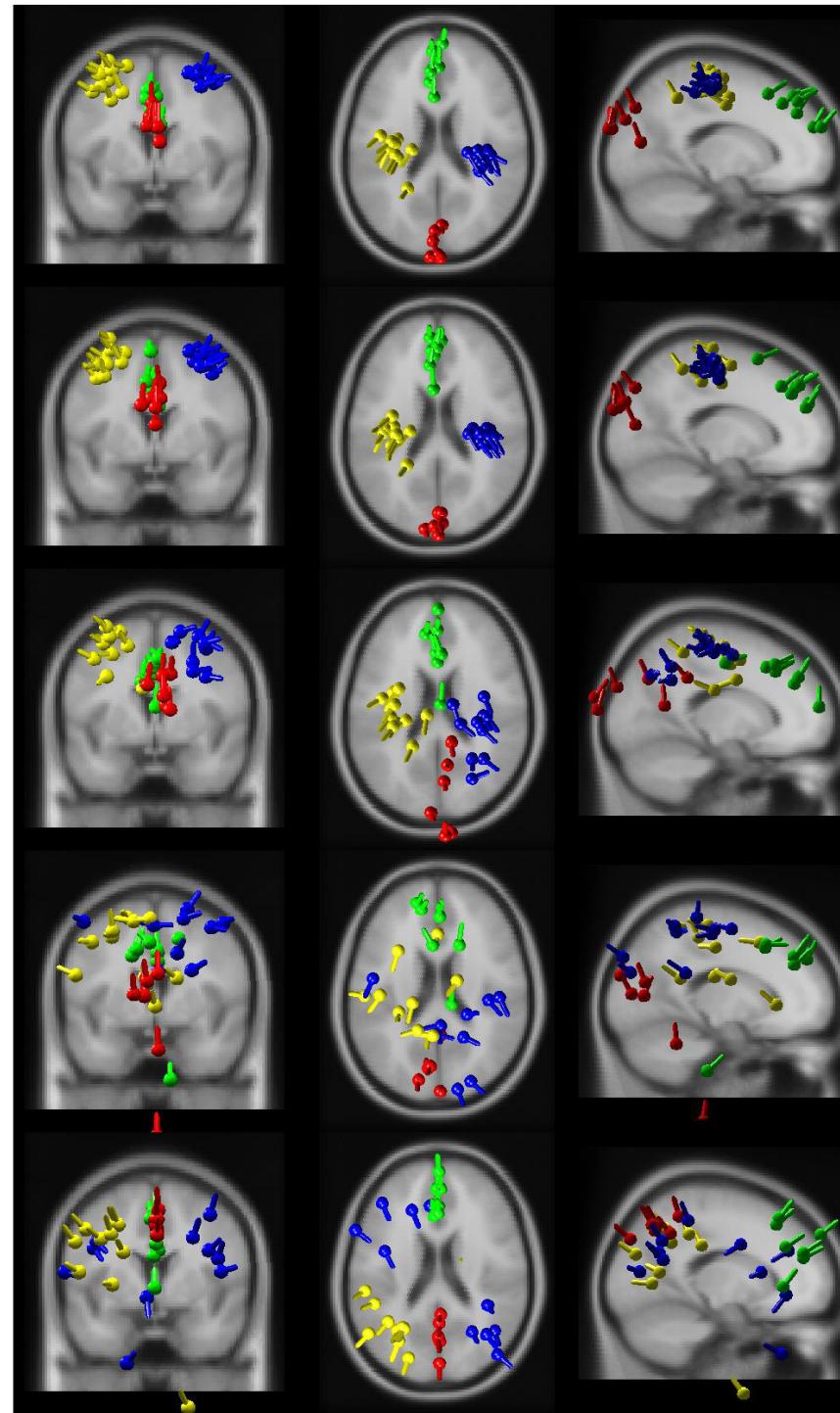


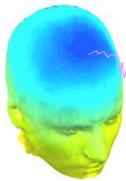
S13 IC15



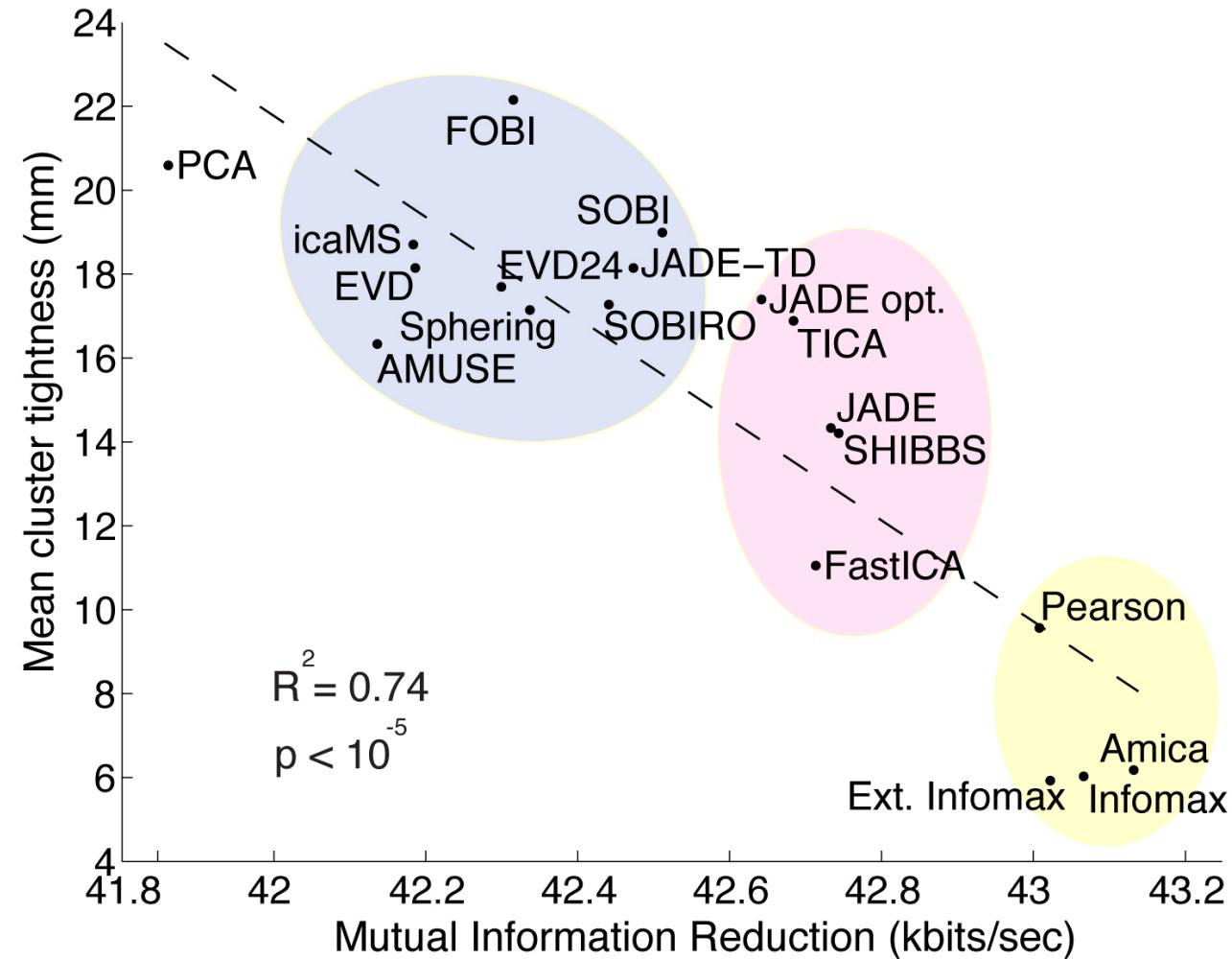
S14 IC16







D



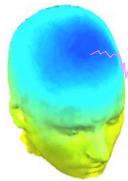


## Outline

- ICA clusters and reliability within subjects
- ICA clusters and reliability across subjects
- Clustering in EEGLAB theory & Practice



# Edit dataset info



pop\_study(): Pre-select components

Enter maximum residual (topo map – dipole proj.) var. (in %)  
NOTE: This will delete any existing component clusters!

15

Keep only in-brain dipoles.

Cancel Help Ok

Create a new STUDY set -- pop\_study()

Edit STUDY set information - remember to save changes

STUDY set name: Sternberg

STUDY set task name: Sternberg

STUDY set notes:

	dataset filename	browse	subject	session	condition	group	Select by r.v.	
1	C:\Users\julie\Documents\Wor	...	S01		memorize		Comp.: 3 5 ...	Clear
2	C:\Users\julie\Documents\Wor	...	S01		ignore		Comp.: 3 5 ...	Clear
3	C:\Users\julie\Documents\Wor	...	S01		probe		Comp.: 3 5 ...	Clear
4	C:\Users\julie\Documents\Wor	...	S02		memorize		Comp.: 5 6 ...	Clear
5	C:\Users\julie\Documents\Wor	...	S02		ignore		Comp.: 5 6 ...	Clear
6	C:\Users\julie\Documents\Wor	...	S02		probe		Comp.: 5 6 ...	Clear
7	C:\Users\julie\Documents\Wor	...	S03		memorize		Comp.: 6 7 ...	Clear
8	C:\Users\julie\Documents\Wor	...	S03		ignore		Comp.: 6 7 ...	Clear
9	C:\Users\julie\Documents\Wor	...	S03		probe		Comp.: 6 7 ...	Clear
10	C:\Users\julie\Documents\Wor	...	S04		memorize		Comp.: 1 2 ...	Clear

Important note: Removed datasets will not be saved before being deleted from EEGLAB memory

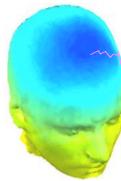
< Page 1 >

Dataset info (condition, group, ...) differs from study info. [set] = Overwrite dataset info.

Delete cluster information (to allow loading new datasets, set new components for clustering, etc.)

Help Cancel Ok

# ICs to cluster



Create a new STUDY set -- pop\_study()

Edit STUDY set information - remember to save changes

STUDY set name: Sternberg

STUDY set task name: Sternberg

STUDY set notes:

dataset filename

1	C:\Users\julieW
2	C:\Users\julieW
3	C:\Users\julieW
4	C:\Users\julieW
5	C:\Users\julieW
6	C:\Users\julieW
7	C:\Users\julieW
8	C:\Users\julieW
9	C:\Users\julieW
10	C:\Users\julieW

select components

ic 19	ic 20	ic 21	ic 22	ic 23	ic 24	ic 25	ic 26	ic 27	ic 28	ic 29	ic 30	ic 31	ic 32
Cancel	Ok												

Important note: Removed datasets will not be saved before being deleted from EEGLAB memory

< Page 1 >

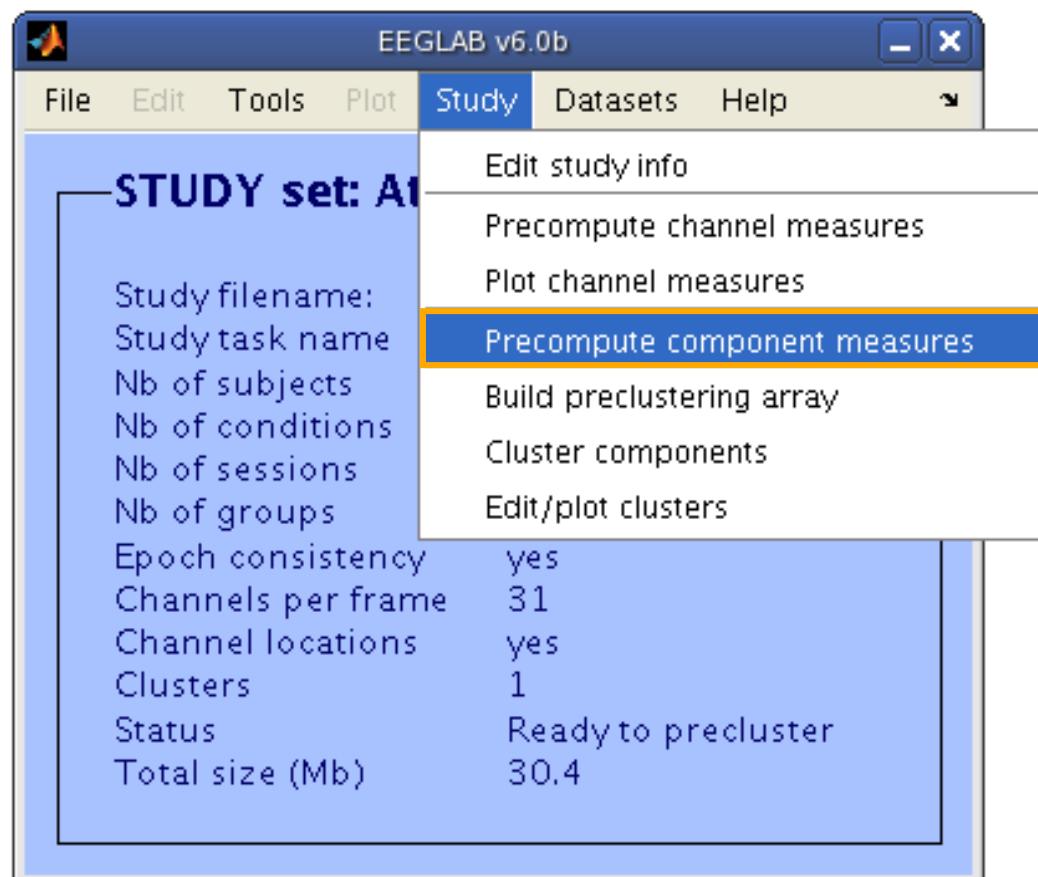
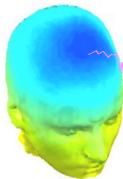
Dataset info (condition, group, ...) differs from study info. [set] = Overwrite dataset info.

Delete cluster information (to allow loading new datasets, set new components for clustering, etc.)

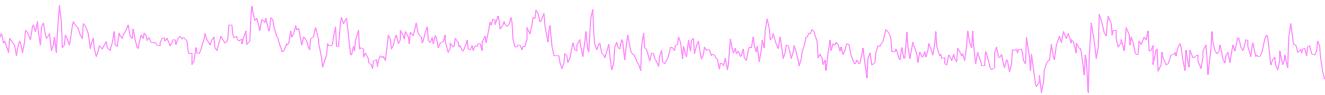
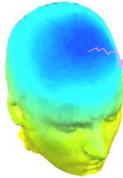
Help Cancel Ok



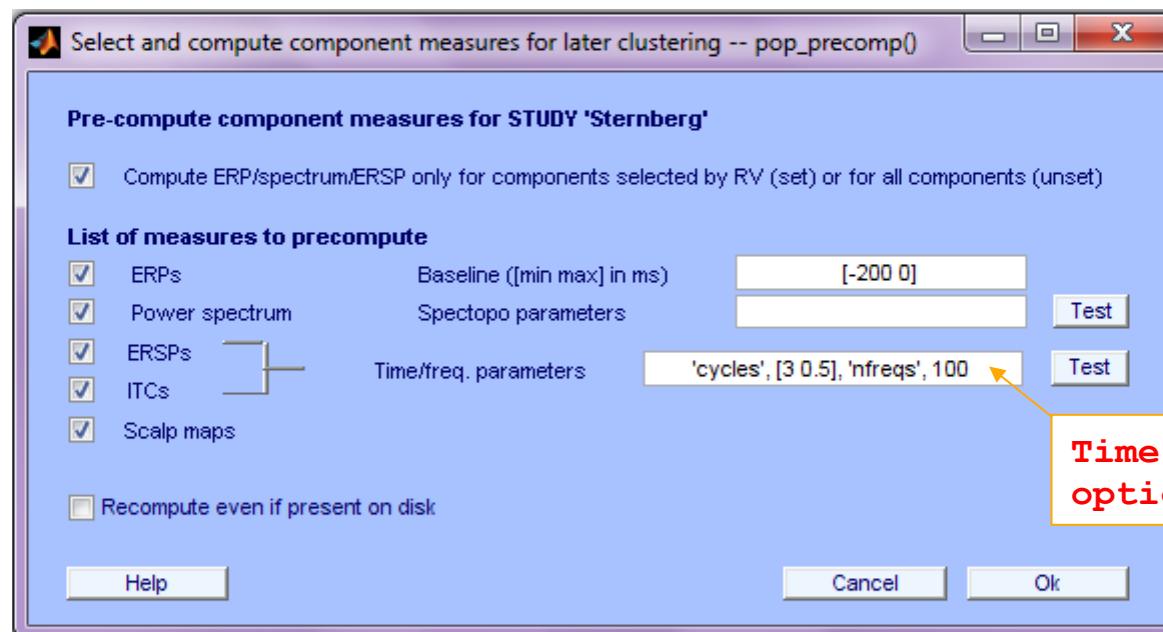
# Precompute data measures



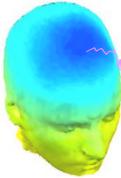
# Precompute data measures



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



# 3. Cluster components



EEGLAB v6.0b

File Edit Tools Plot Study Datasets Help

**STUDY set: Attention**

Study filename: Attention  
Study task name: Attention  
Nb of subjects: 1  
Nb of conditions: 1  
Nb of sessions: 1  
Nb of groups: 1  
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\_pclust()

**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
<input checked="" type="checkbox"/> ERPs	10	<input checked="" type="checkbox"/>	1
<input checked="" type="checkbox"/> dipoles	3	<input checked="" type="checkbox"/>	10
<input type="checkbox"/> scalp maps	10	<input checked="" type="checkbox"/>	1
<input checked="" type="checkbox"/> ERSPs	20	<input checked="" type="checkbox"/>	1
<input checked="" type="checkbox"/> ITCs	10	<input checked="" type="checkbox"/>	1
<input type="checkbox"/> Final dimensions	10	<input type="checkbox"/>	Help

Freq. range [Hz] 3.25  
Time range [ms] 0.600

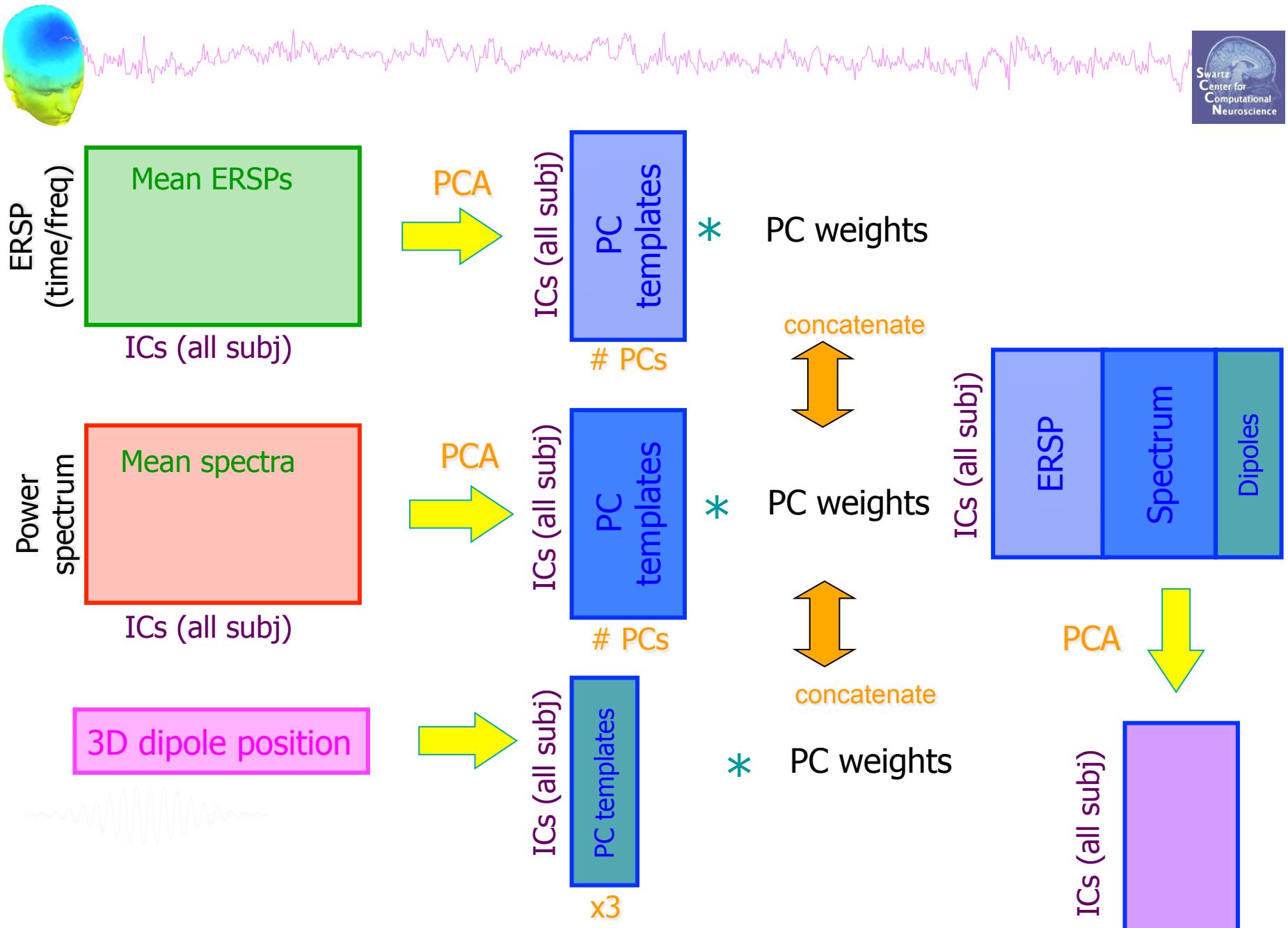
Use channel values  Absolute values

Time range [ms] 0.1500  
Freq. range [Hz] 3.45  
Time range [ms] 0.600  
Freq. range [Hz] 2.30

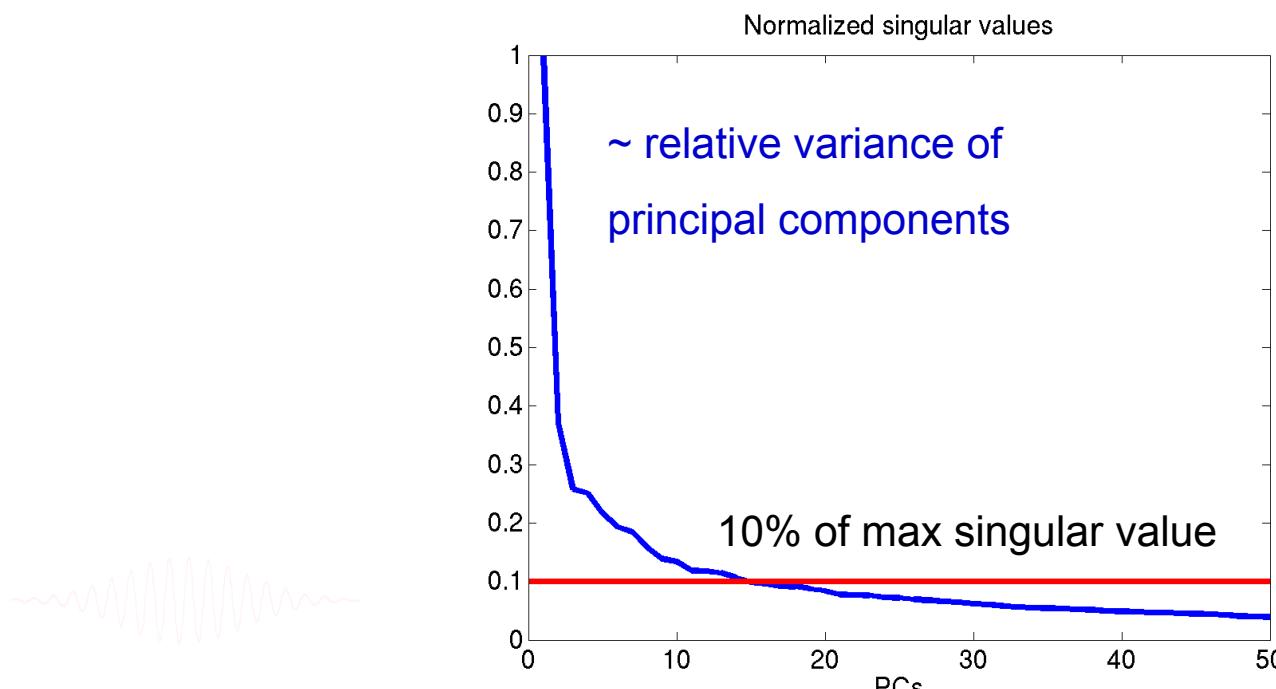
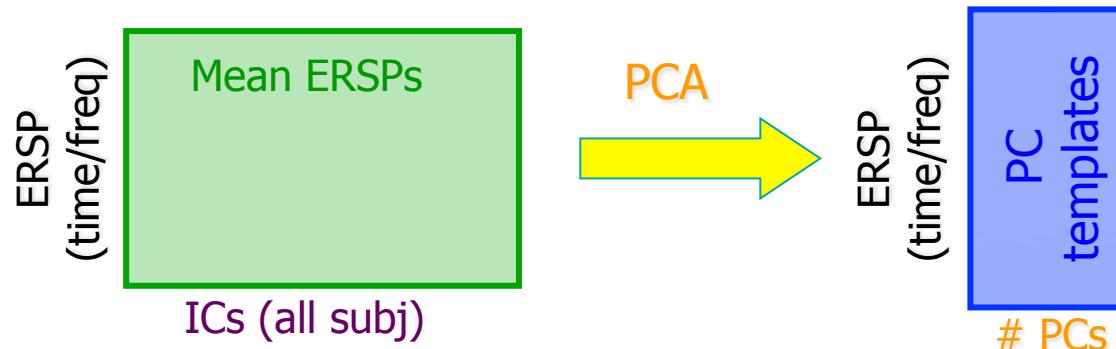
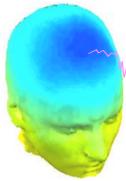
Save STUDY to file /home/julie/WorkshopSD2007/STUDY/attention.study ...

Cancel Help Ok

# Precluster schematic

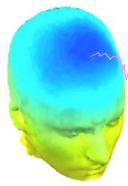


# Precluster: Use singular values from PCA

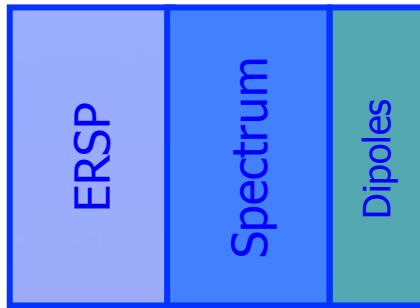


Credit: Julie Onton

# Precluster schematic



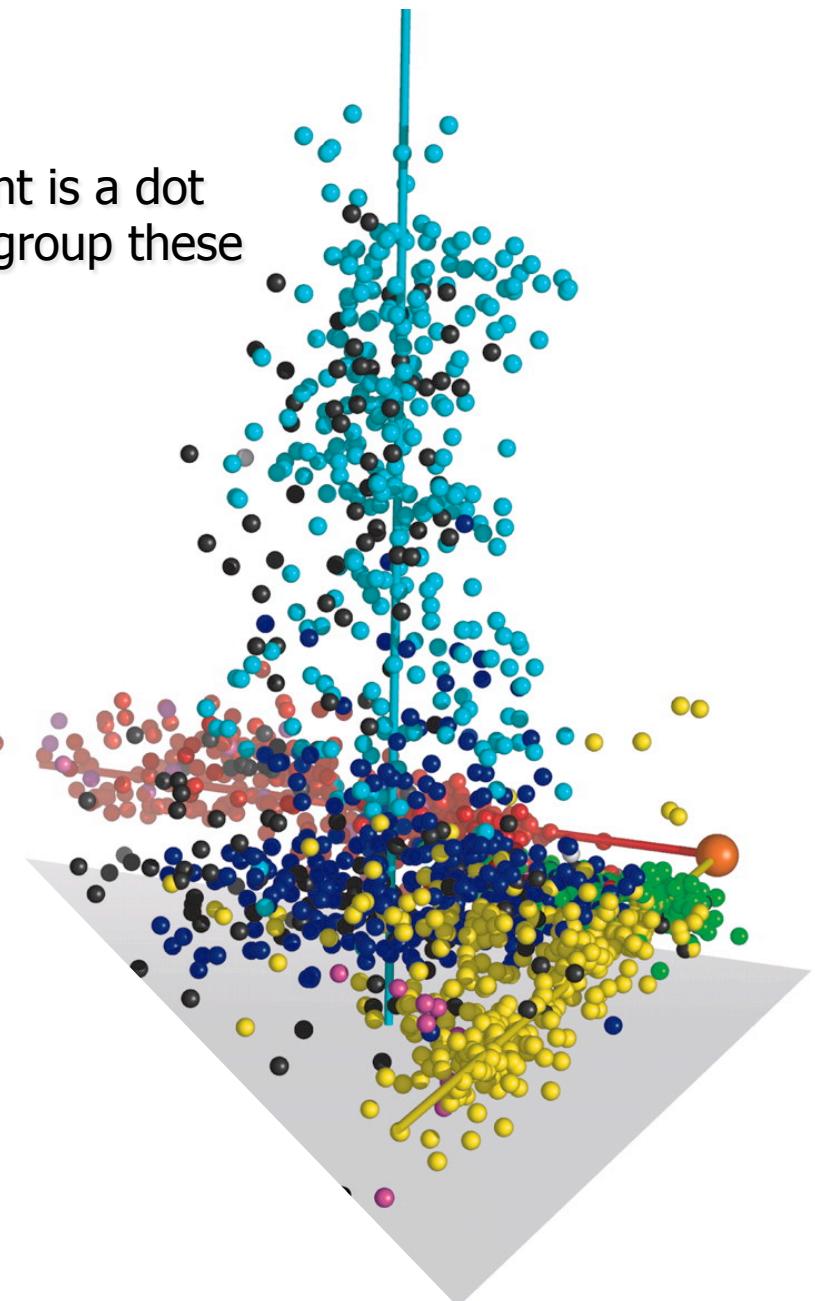
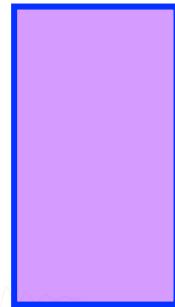
ICs (all subj)



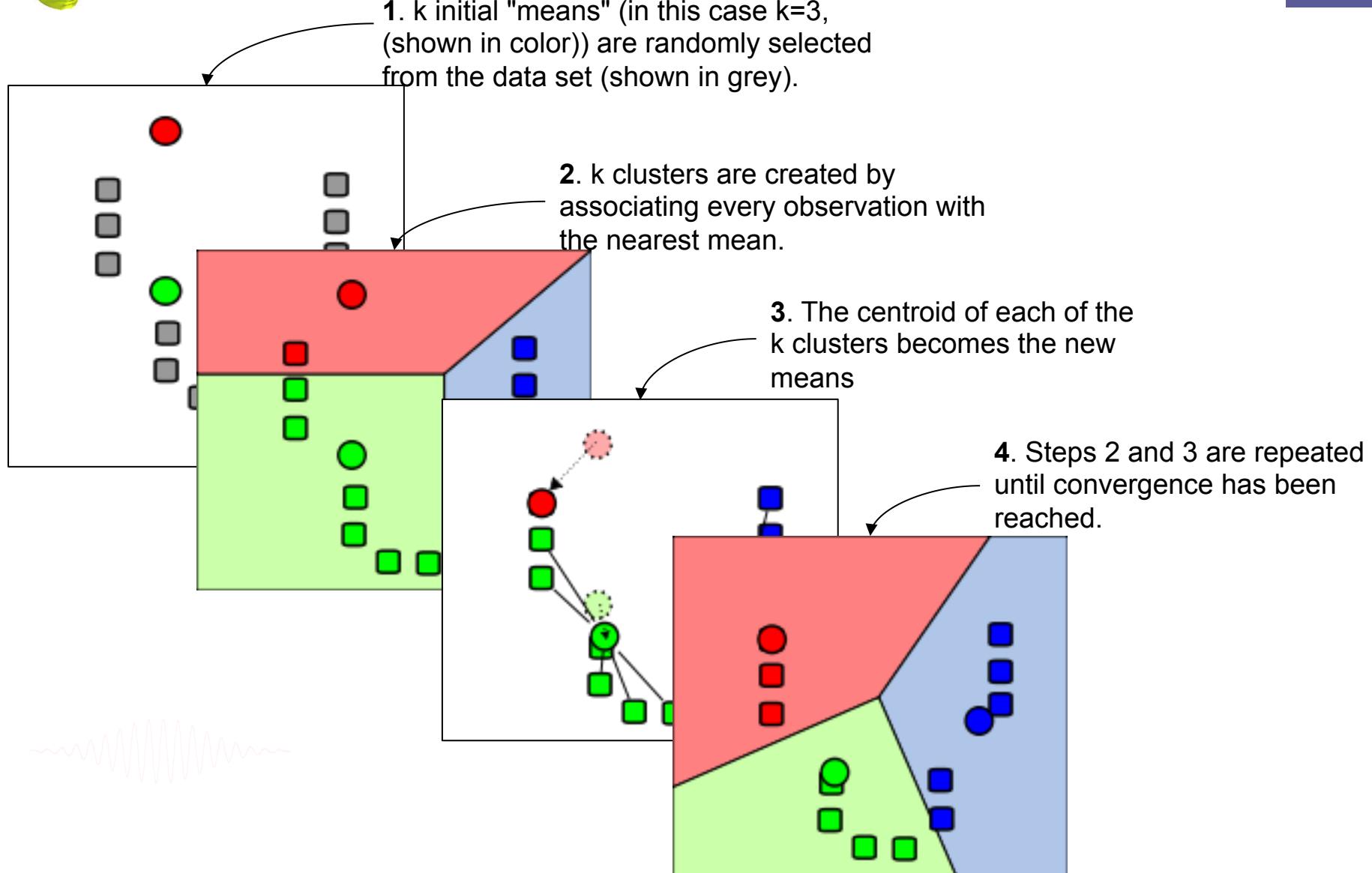
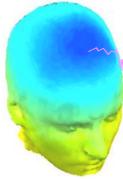
Each component is a dot  
Clustering will group these dots

OR

ICs (all subj)



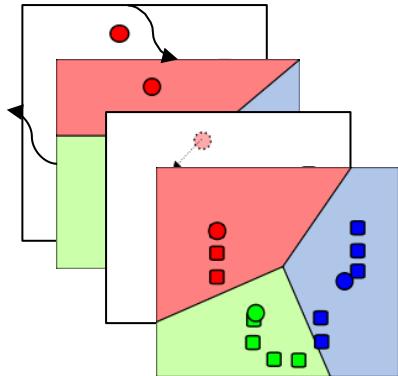
# Classical KMean





# Customized KMean

(no more than 1 session per cluster)



7. Loop until the desired number of selected clusters is reached

1. A first KMean solution is computed for N clusters

2. Select the cluster with minimum residual distance to centroid

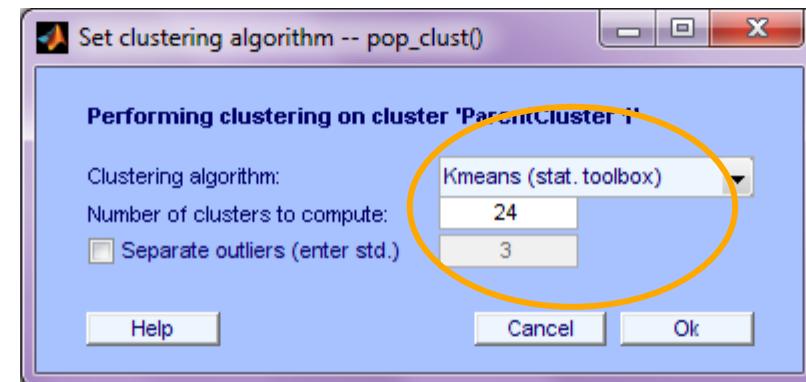
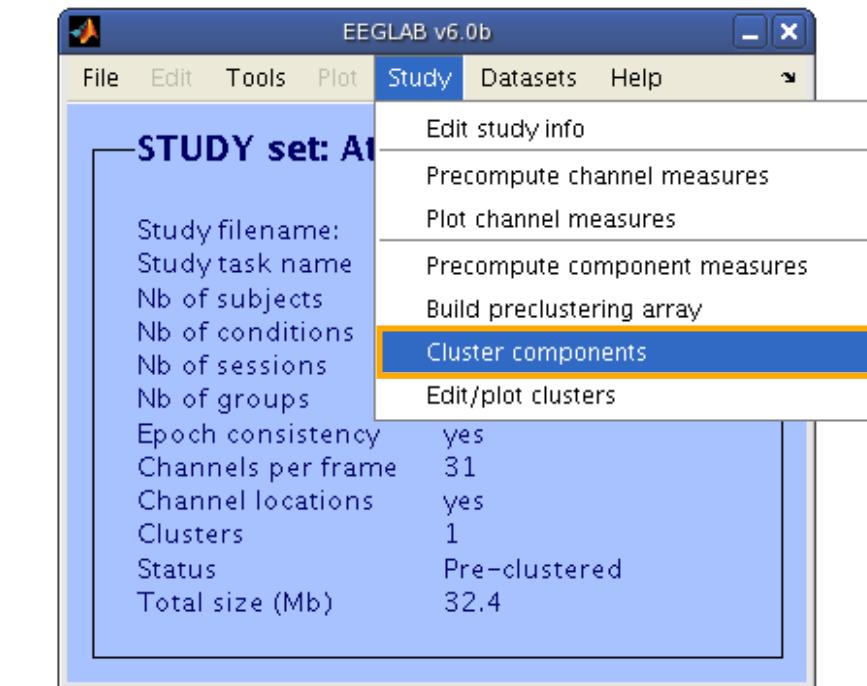
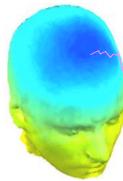
3. Keeps at most one component per session  
(min dist. to centroid)

4. Store the resulting cluster

5. Remove the cluster's ICs from the pool of all ICs

6. Compute a new KMean solution for N-1 clusters on the new pool

# Cluster components



# Choosing data measures



What measure(s) should you use?

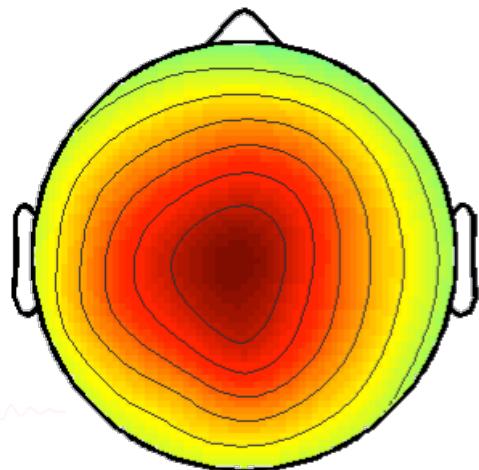


- It depends on your final cluster criteria...
  - If for example, your priority is dipole location,  
then cluster only based on dipole location...

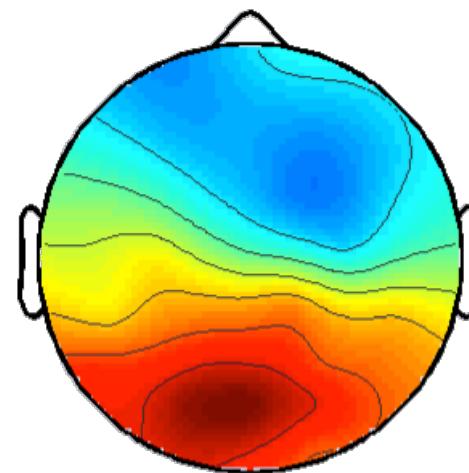
But consider:

- What is the difference between these two components?

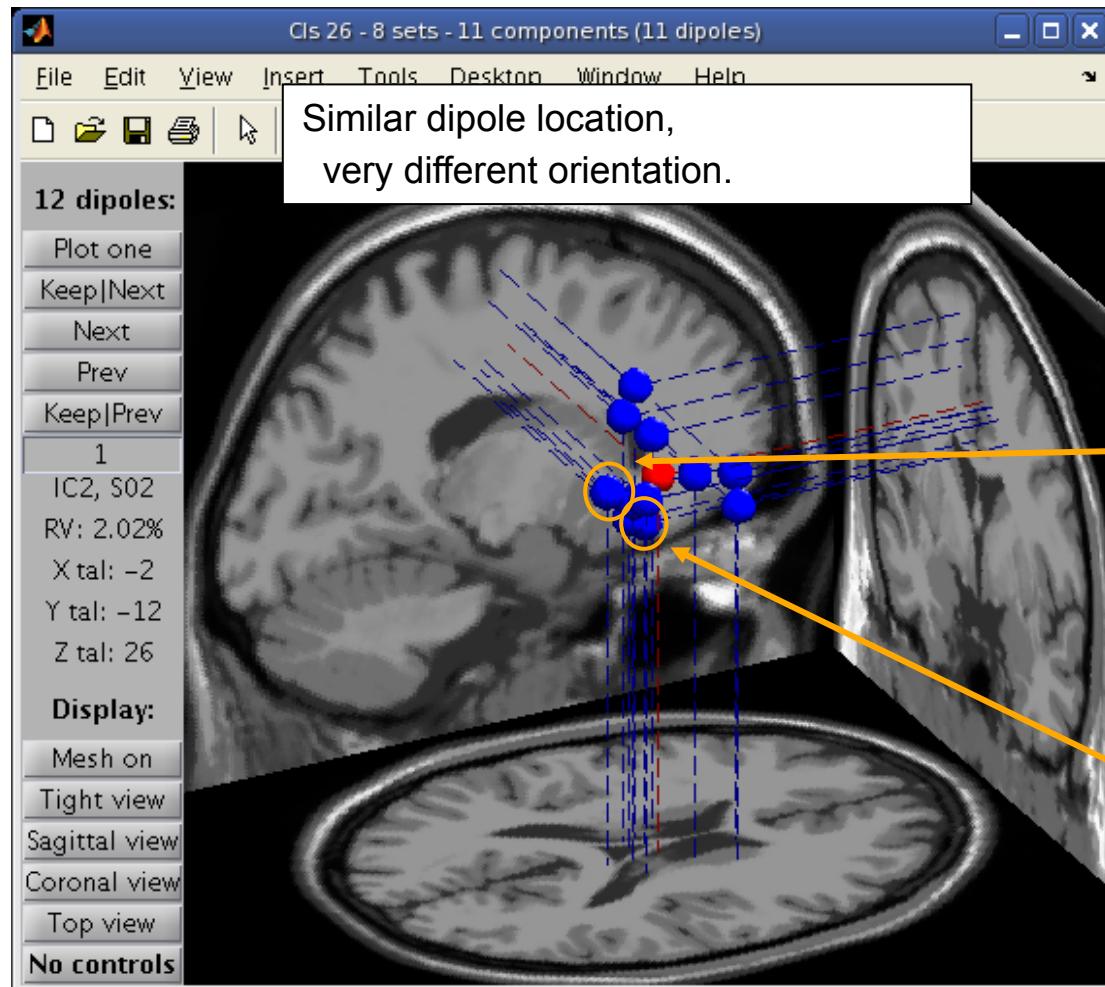
IC2 / S02, Cls 26



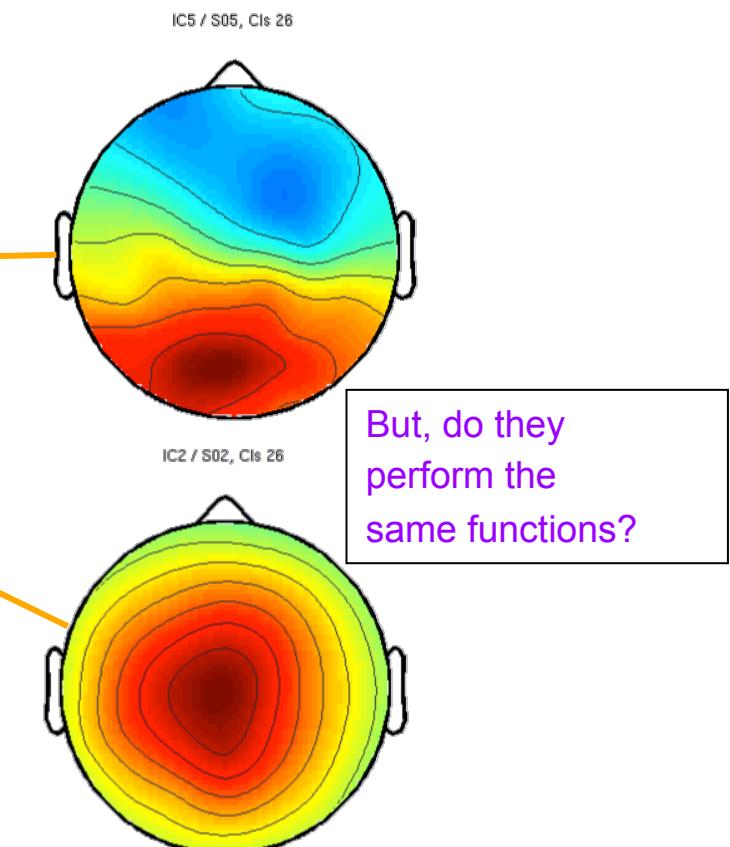
IC5 / S05, Cls 26



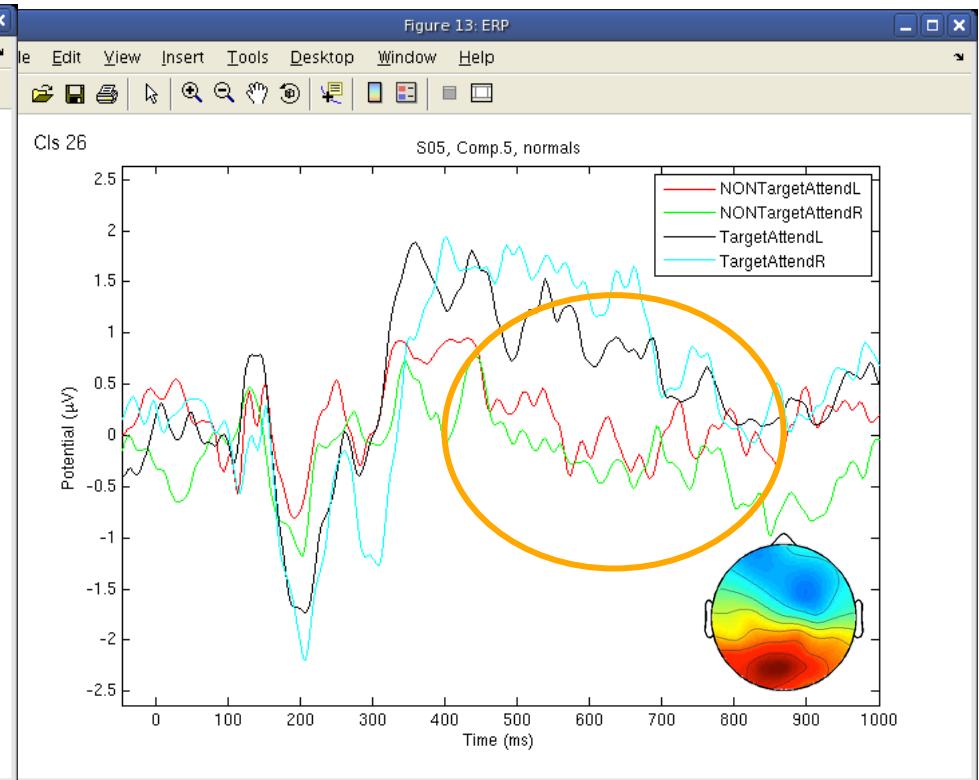
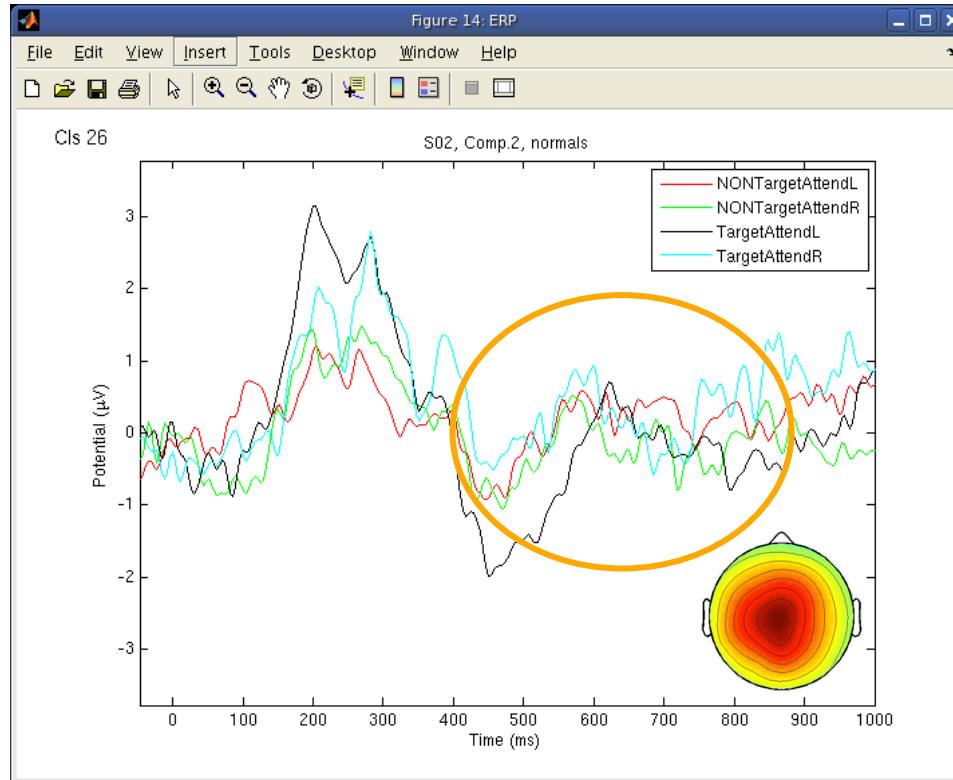
# Choosing data measures



Obvious dramatic effect on  
scalp map topography:

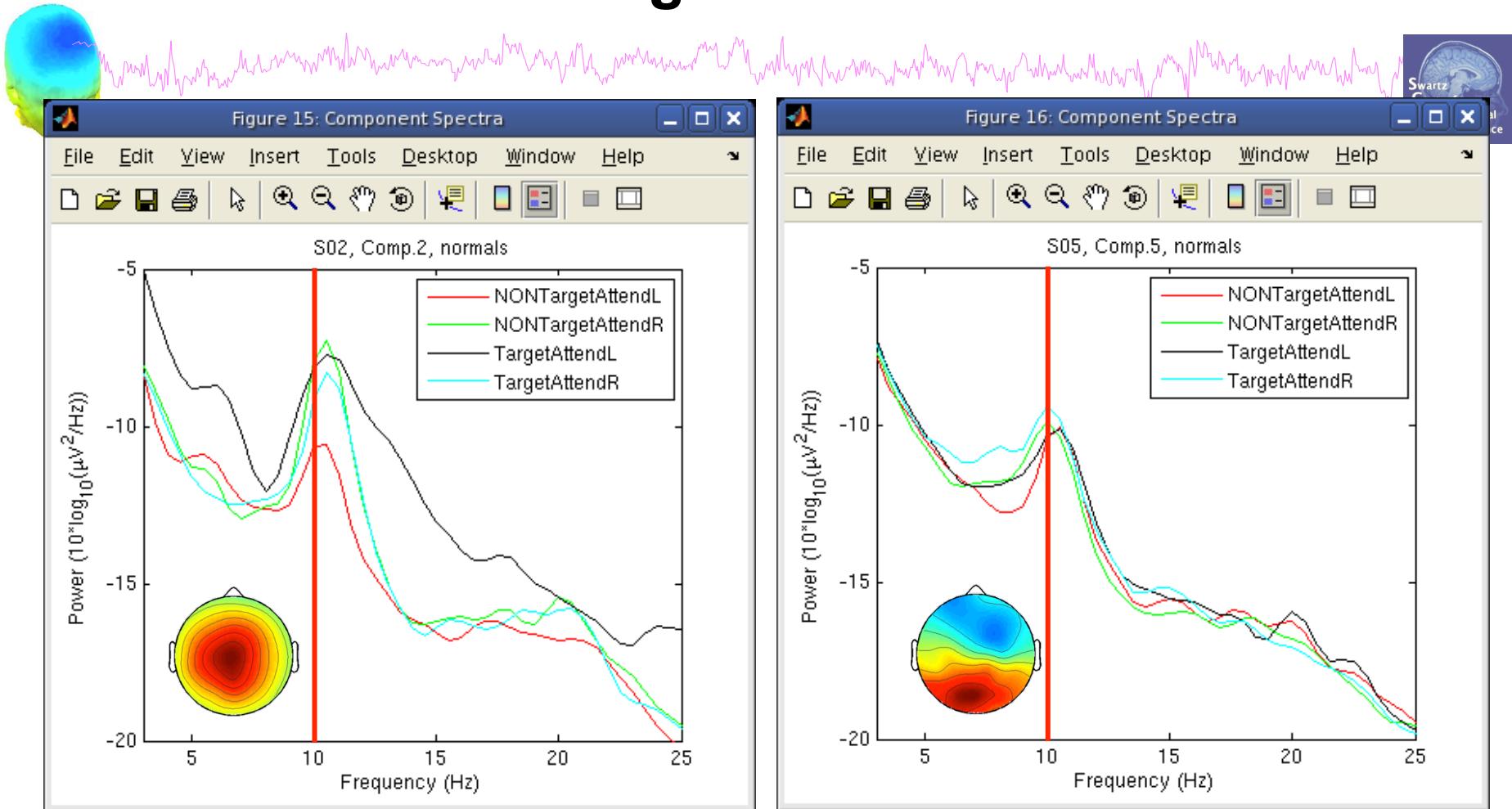


# Choosing data measures



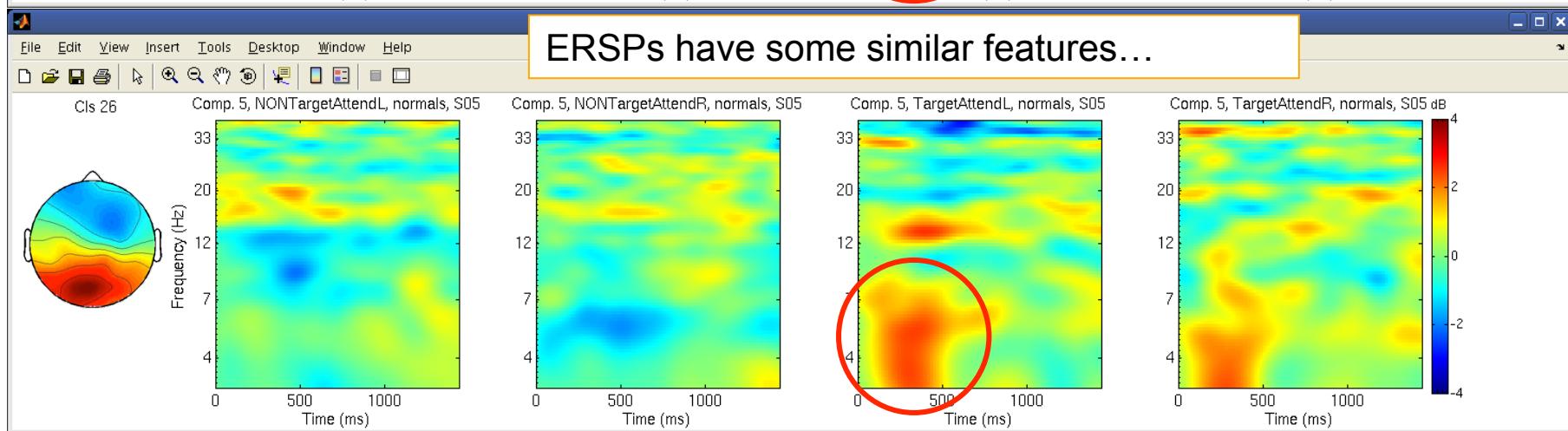
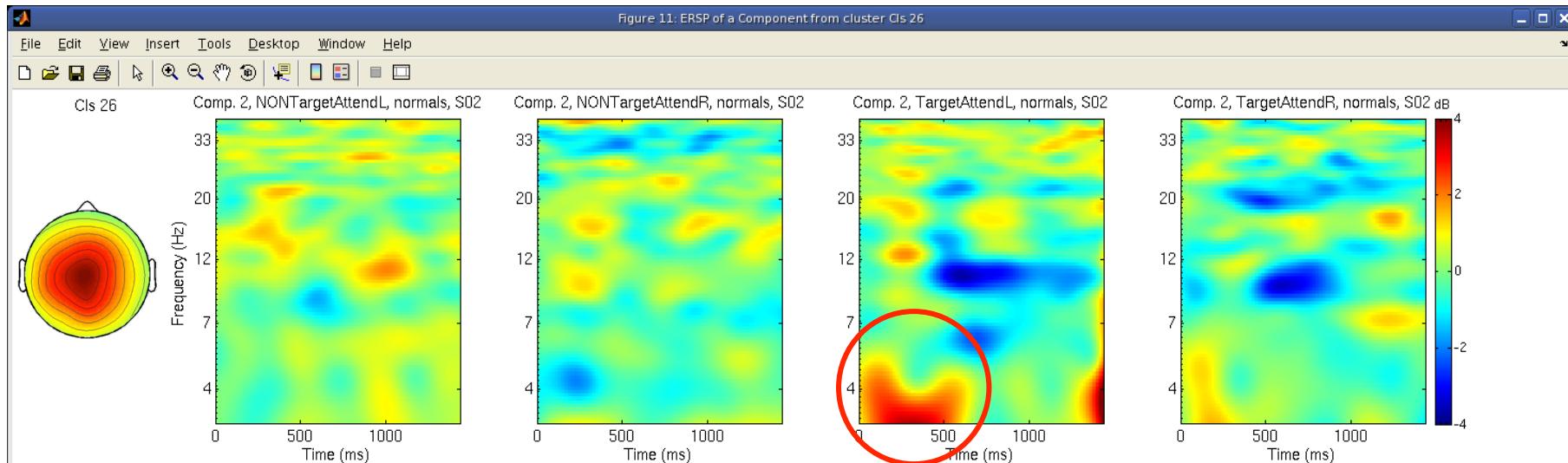
ERPs seem different...

# Choosing data measures

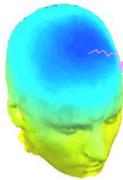


Spectra are similar, but they have  
variable responses to different conditions...

# Choosing data measures



# Choosing data measures

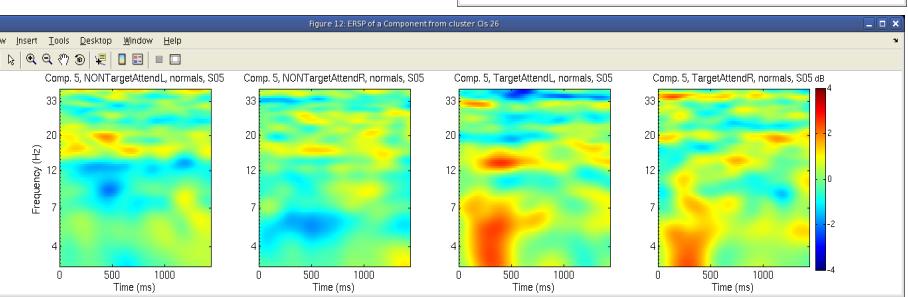
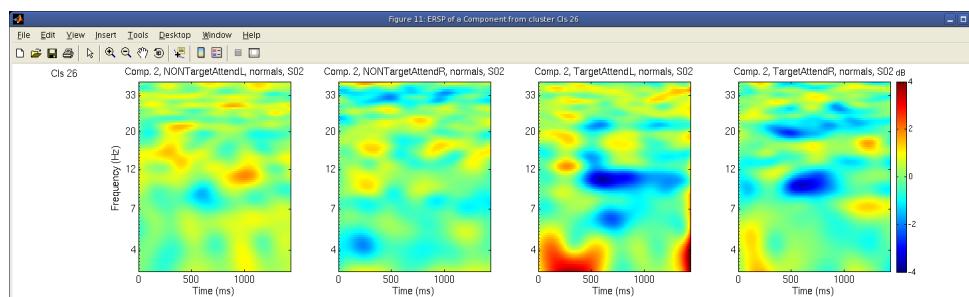
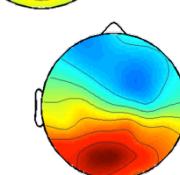
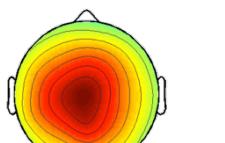
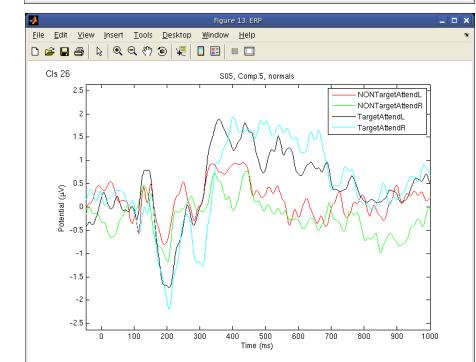
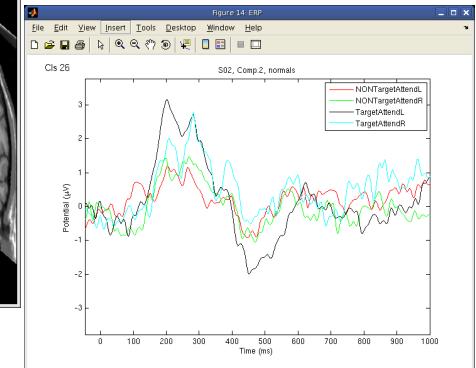
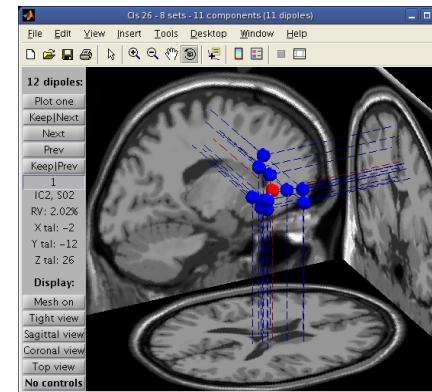
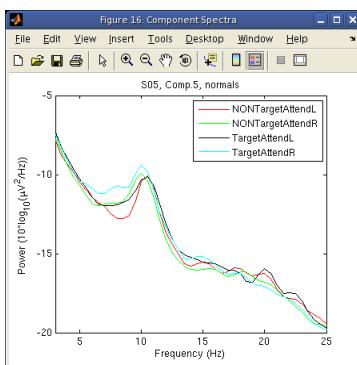
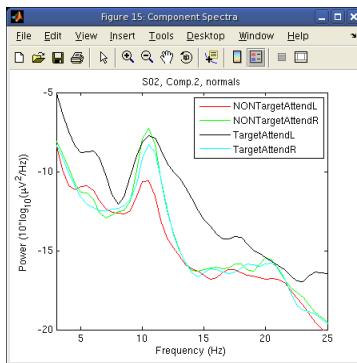


What data measures  
should you use?

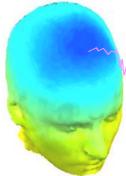
It depends...

- broadly-matched ICs: use many/all of the measures.

- specifically-matched ICs: use one/few of the measures.



# Plot/edit clusters



View and edit current component clusters -- pop\_clustedit()

Study name: 'Sternberg' (336 of 336 components clustered)

Select cluster to plot

- All cluster centroids
- ParentCluster 1 (336 ICs)
- Cls 2 (17 ICs)
- Cls 3 (6 ICs)

Plot scalp maps  
Plot dipoles  
Plot ERPs  
Plot spectra  
Plot ERSPs  
Plot ITCs  
Plot cluster properties

Params  
Params  
Params

Select component(s) to plot

- 'Cls 2' comp. 1 (S01 IC21)
- 'Cls 2' comp. 2 (S03 IC21)
- 'Cls 2' comp. 3 (S03 IC25)
- 'Cls 2' comp. 4 (S04 IC19)

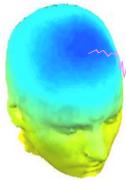
Plot scalp map(s)  
Plot dipole(s)  
Plot ERP(s)  
Plot spectra  
Plot ERSP(s)  
Plot ITC(s)  
Plot component properties

Create new cluster  
Rename selected cluster  
Merge clusters

Reassign selected component(s)  
Remove selected outlier comps.  
Auto-reject outlier components

Help Cancel Ok

# Plot cluster data



View and edit current component clusters -- pop\_clustedit()

Study 'Attention': 181 of 181 components clustered

Select cluster to plot

- All cluster centroids
- ParentCluster 1 (181 ICs)
- outlier 2 (1 ICs)
- Cls 3 (5 ICs)

**Plot scalp maps** (highlighted with a yellow box and arrow)

Plot dipoles

Plot ERPs

Plot spectra

Plot ERSPs

Plot ITCs

Plot cluster properties

Create new cluster

Rename selected cluster

Merge clusters

Save STUDY set to disk /home/julie/

Cancel Help

Select component(s) to plot

- 'outlier 2' comp. 1 (S12 IC12)
- 'Cls 3' comp. 1 (S01 IC1)
- 'Cls 3' comp. 2 (S05 IC11)
- 'Cls 3' comp. 3 (S06 IC15)

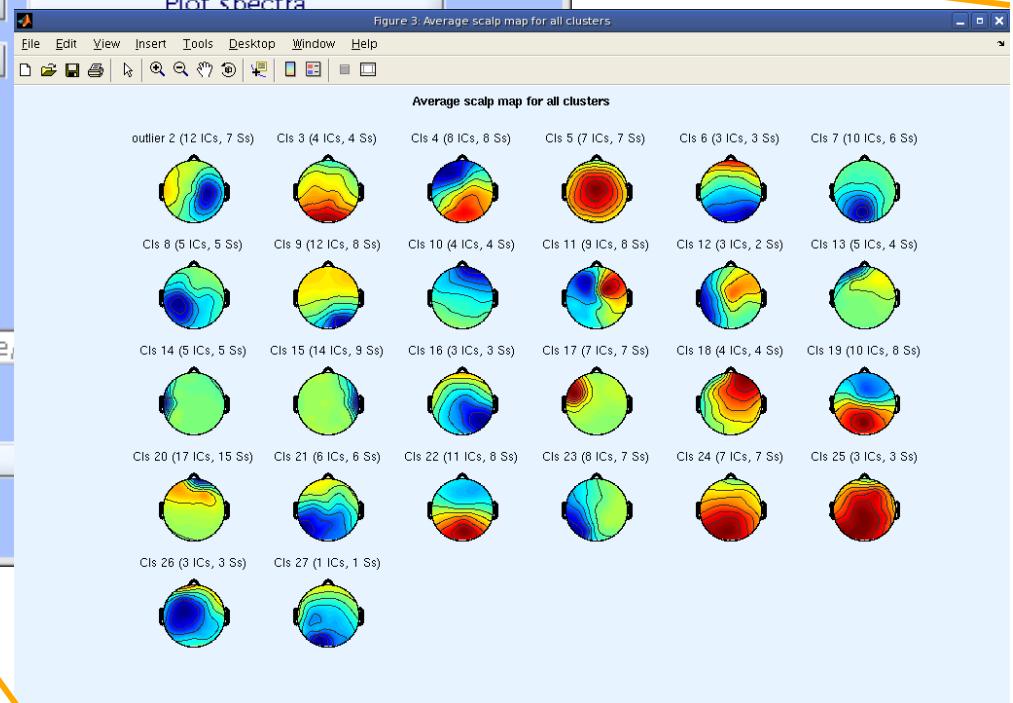
Plot scalp map(s)

Plot dipole(s)

Plot ERP(s)

Plot spectra

Plot mean scalp  
maps for easy  
reference



# Plot cluster data

**Study 'Attention': 181 of 181 components clustered**

**Select cluster to plot**

- Cl 6 (3 ICs)
- Cl 7 (10 ICs)**
- Cl 8 (5 ICs)
- Cl 9 (12 ICs)

**Select component(s) to plot**

- All components
- S01 IC6
- S05 IC9
- S06 IC12

**Choose which cluster**

**Choose which components**

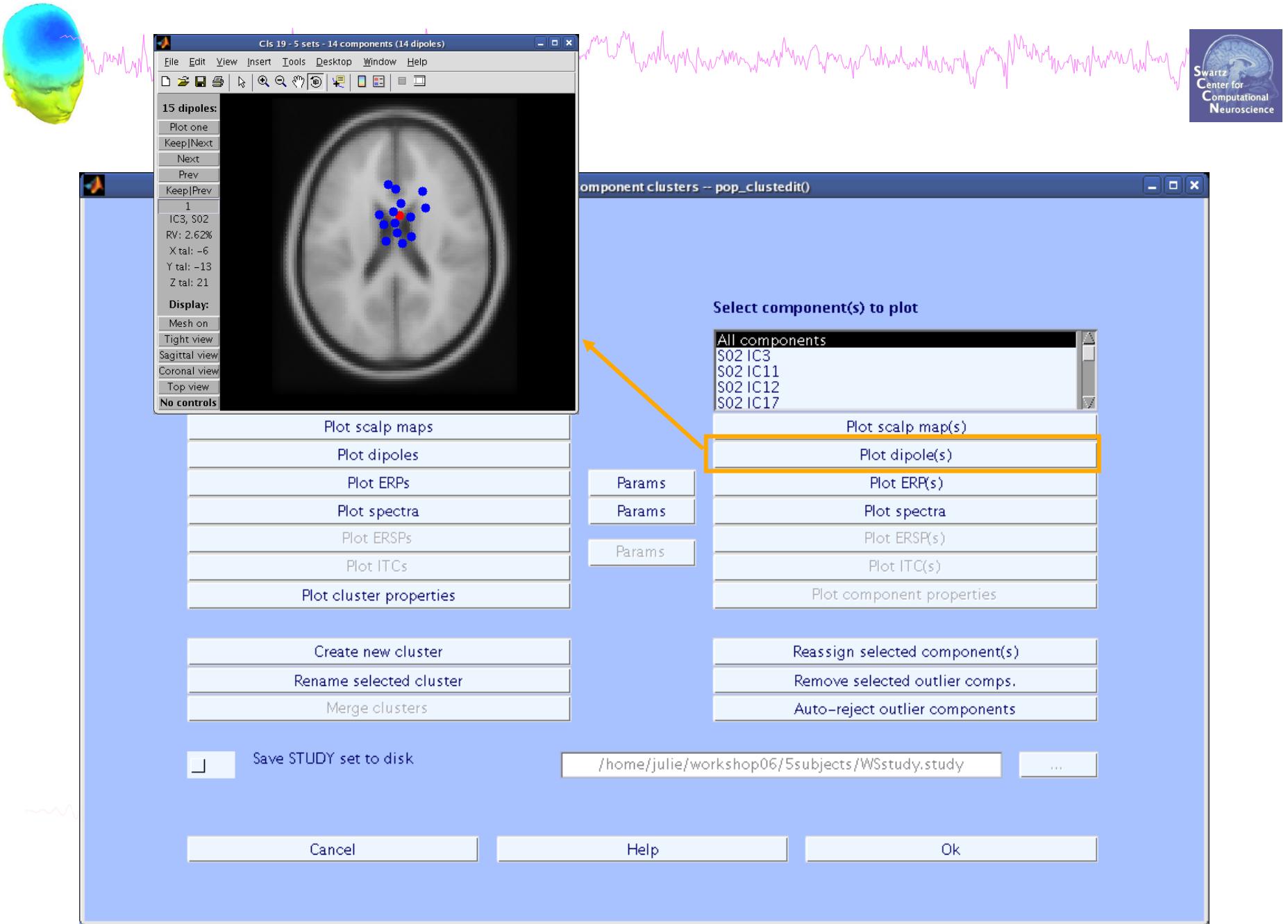
**Figure 4**

File Edit View Insert Tools Desktop Window Help

Cl 21 (7 ICs, 7 Ss)      ic4/S01      ic11/S02  
ic1/S06      ic1/S08  
ic2/S10      ic6/S12      ic3/S15

49

# Plot cluster data



# Plot cluster data



View and edit current component clusters -- pop\_clustedit()

Study ": 151 of 151 components clustered"

Select cluster to plot

- Cls 15 (8 ICs)
- Cls 16 (6 ICs)
- Cls 17 (4 ICs)
- Cls 18 (14 ICs)
- Cls 19 (14 ICs)

Plot scalp maps

Plot dipoles

Plot ERPs

Plot spectra

Params

Parms

Select component(s) to plot

- All components
- S02 IC3
- S02 IC11
- S02 IC12
- S02 IC17

Plot scalp map(s)

Plot dipole(s)

Plot ERP(s)

Plot spectra

Set ERP plotting parameters -- pop\_erpparams()

Time range in ms [low high]

Plot limits in uV [low high]

Plot scalp map at latency [ms]

Display filter in Hz [high]

Plot conditions on the same panel

Plot groups on the same panel

Statistical method to use

Parametric

Compute condition statistics

Compute group statistics

Use single trials (when available)

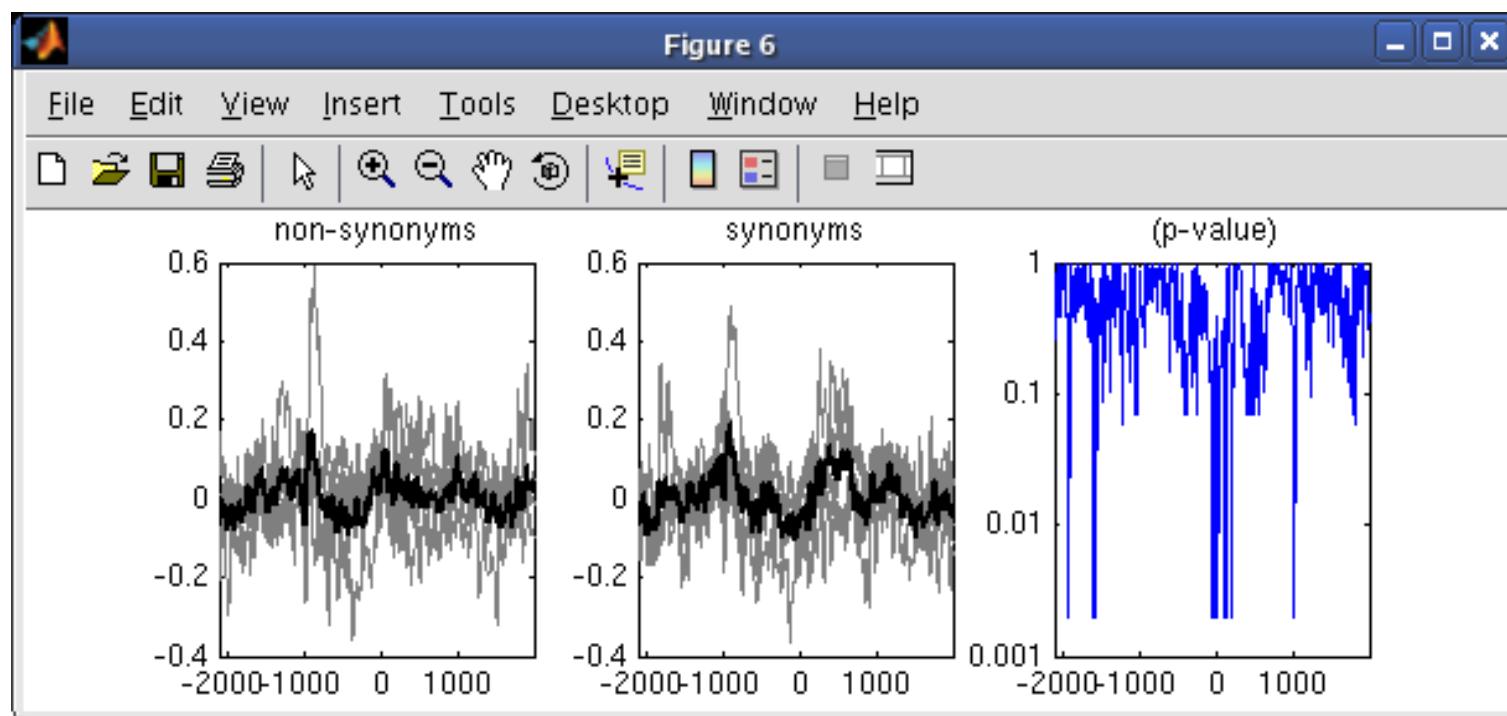
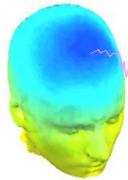
Use False Discovery Rate to correct for multiple comparisons

Statistical threshold (p<)

Help Cancel Ok

A screenshot of a MATLAB dialog box titled "View and edit current component clusters -- pop\_clustedit()". The dialog shows two main sections: "Select cluster to plot" and "Select component(s) to plot". The "Select cluster to plot" section contains a list of 5 clusters (Cls 15-19) with corresponding plotting options: scalp maps, dipoles, ERPs, and spectra. The "Select component(s) to plot" section contains a list of 5 components (All components, S02 IC3-17) with corresponding plotting options. Below these sections is a "Set ERP plotting parameters -- pop\_erpparams()" section with various input fields and checkboxes for time ranges, plot limits, and statistical methods. At the bottom are "Help", "Cancel", and "Ok" buttons.

# Plot cluster ERP



# Other plotting options...

The figure displays three panels of ERP waveforms:

- high dose**: Shows blue and red traces. The blue trace has a sharp positive peak around 300 ms.
- low dose**: Shows blue and red traces. The blue trace has a sharp positive peak around 300 ms.
- placebo**: Shows blue and red traces. A legend indicates "KAN" (blue) and "NONKAN" (red).

The x-axis for all panels ranges from -1000 to 1000 ms, and the y-axis ranges from -4 to 8.

**Set ERP plotting parameters -- pop\_erpparams()**

Time range in ms [low high]:    
Plot scalp map at latency [ms]:  NaN  
 Plot conditions on the same panel  
 Plot groups on the same panel

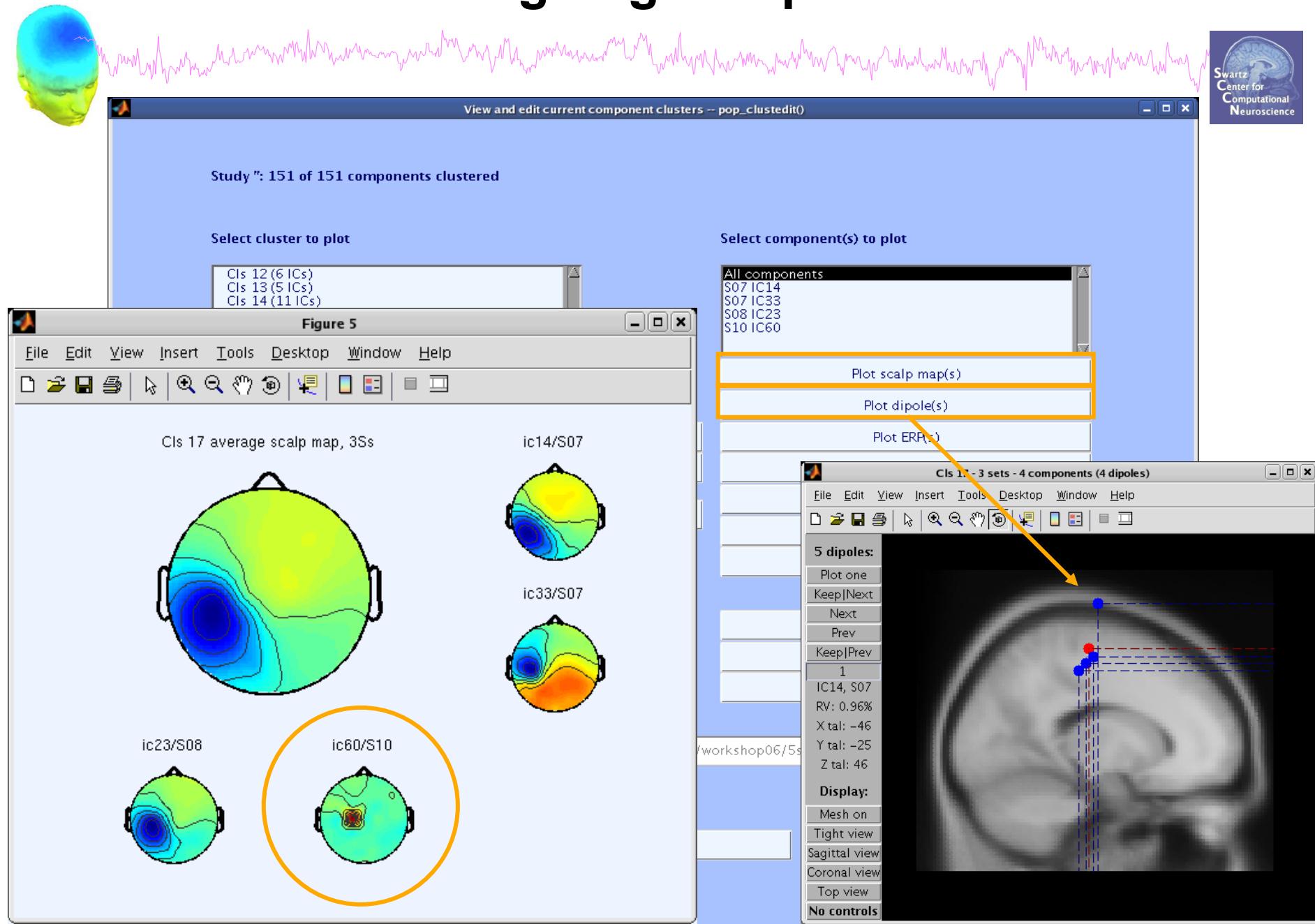
Statistical method to use: Parametric  
 Compute condition statistics  
 Compute group statistics  
 Use single trials (when available)  
 Use False Discovery Rate to correct for multiple comparisons

Statistical threshold (p<):

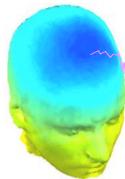
Help Cancel Ok

Swartz Center for Computational Neuroscience

# Reassigning components



# Reassigning components



View and edit current component clusters -- pop\_clustedit()

Study ": 151 of 151 components clustered"

Select cluster to plot

- Cls 13 (5 ICs)
- Cls 14 (11 ICs)
- Cls 15 (8 ICs)
- Cls 16 (6 ICs)
- Cls 17 (4 ICs)

Select component(s) to plot

- All components
- S07 IC14
- S07 IC33
- S08 IC22
- S10 IC60

Plot scalp maps

Plot dipoles

Plot ERPs

Plot spectra

Plot ERSPs

Plot ITCs

Plot cluster properties

Create new cluster

Rename selected cluster

Merge clusters

Remove outliers - from pop\_clustedit()

Remove currently selected component below from Cls 17 to its outlier cluster?

- S10 IC60

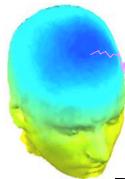
Cancel      Ok

Save STUDY set to disk      /home/julie/workshop06/5subjects/WSstudy.study ...

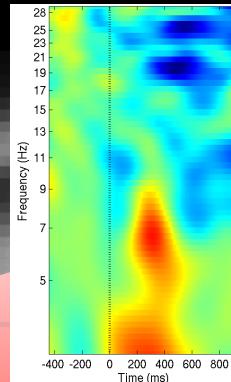
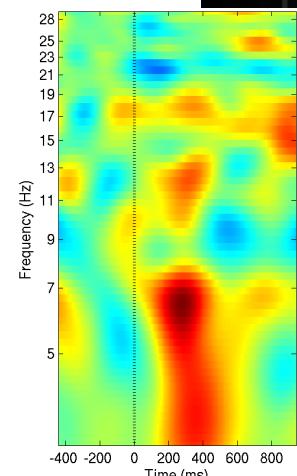
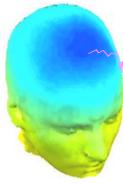
Cancel      Help      Ok

A modal dialog box titled "Remove outliers - from pop\_clustedit()" is displayed in the foreground. It contains a list box with "S10 IC60" selected. Below the list box are two buttons: "Cancel" and "Ok". A yellow box highlights the list box and the "Ok" button. In the background, there is a larger window titled "View and edit current component clusters -- pop\_clustedit()". This window shows a list of clusters (Cls 13-17) and components (All components, S07/S08 ICs, S10 IC60). Various plotting options are listed on the left. At the bottom, there are buttons for saving the study, canceling, helping, and confirming changes.

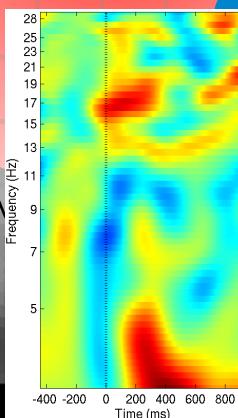
# Outlier cluster reassignment



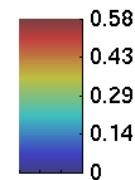
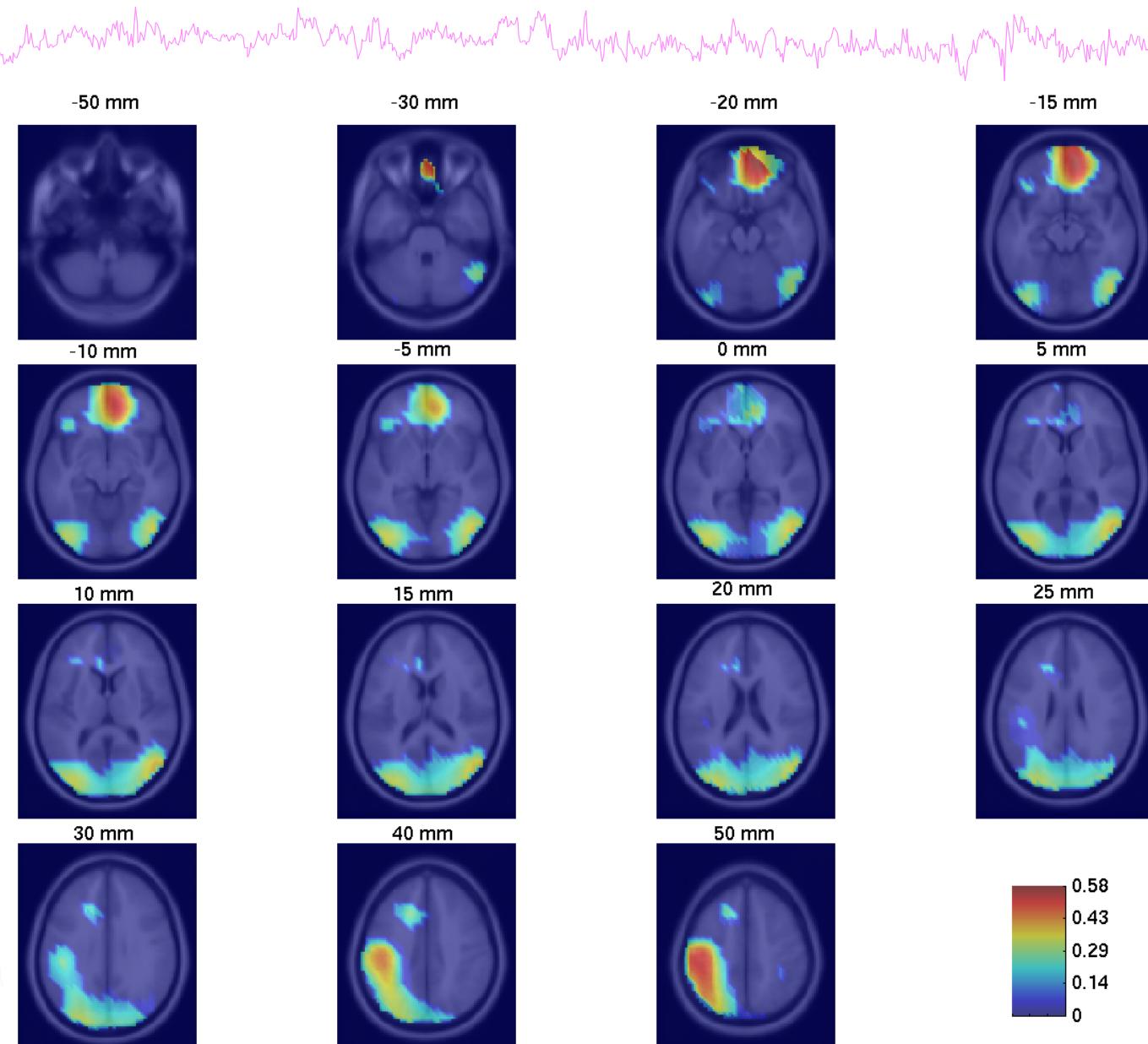
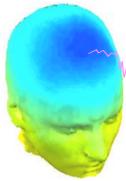
# Measure Projection Toolbox



Projected ERSP



# Measure Projection Toolbox





## Exercise

Precluster (pre-computation already done) and cluster components using measures of your choice. Experiment with different measures.

