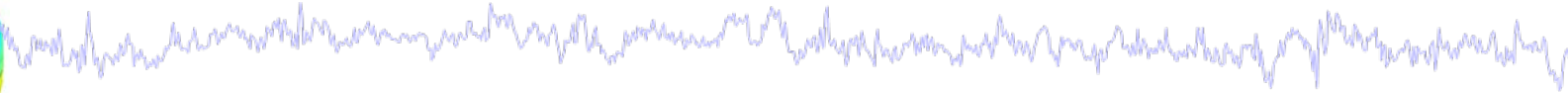


DIPFIT and model co-registration



Task 1

Co-register electrodes with model

Task 2

Autofit equivalent dipoles

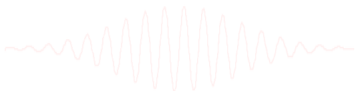
Task 3

Fine fit options

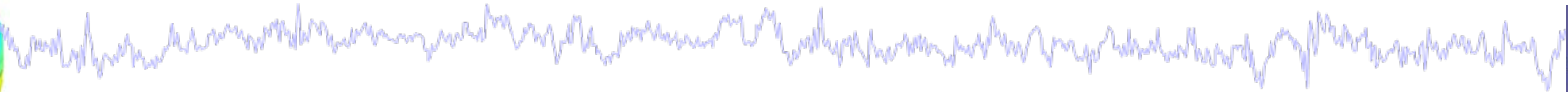
Task 4

3D *headplot()* co-registration

Exercise...



DIPFIT and model co-registration



Task 1

Co-register electrodes with model

Task 2

Autofit equivalent dipoles

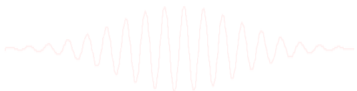
Task 3

Fine fit options

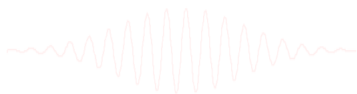
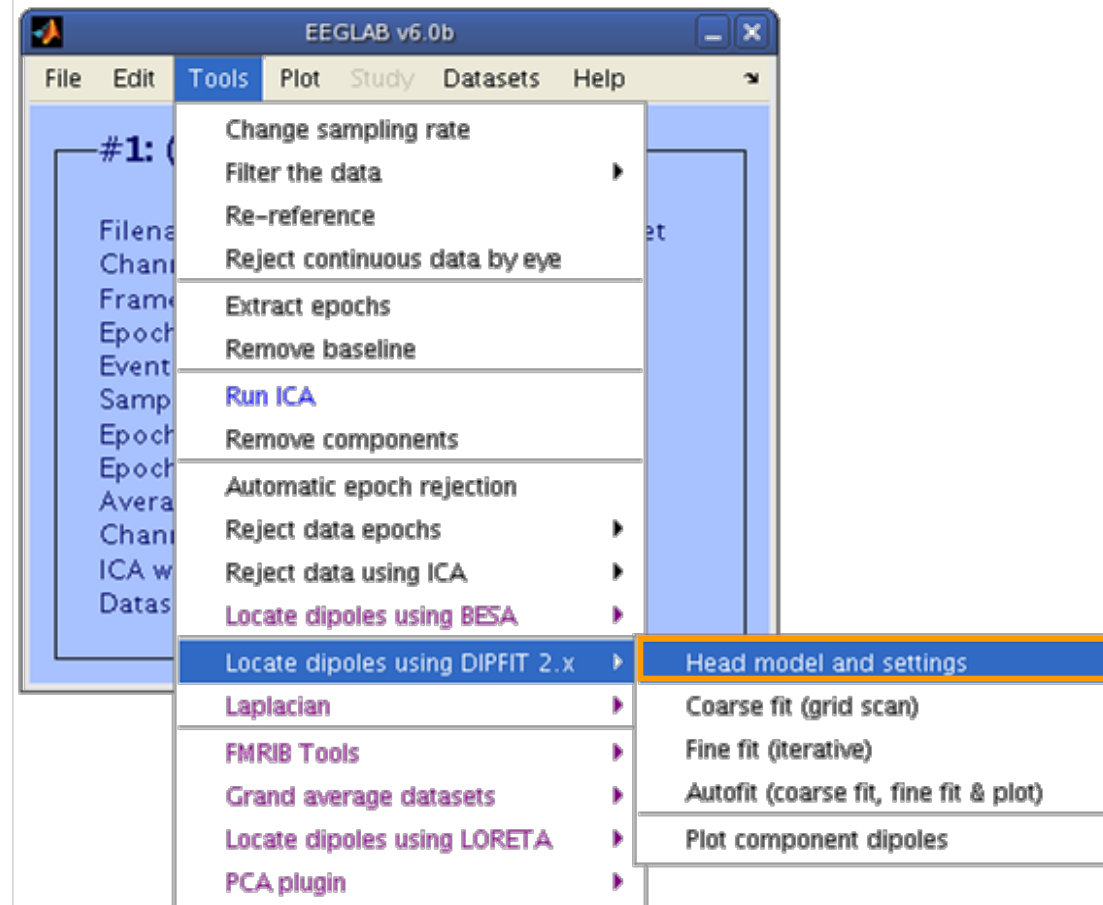
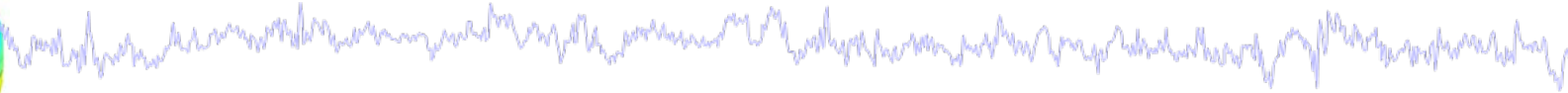
Task 4

3D *headplot()* co-registration

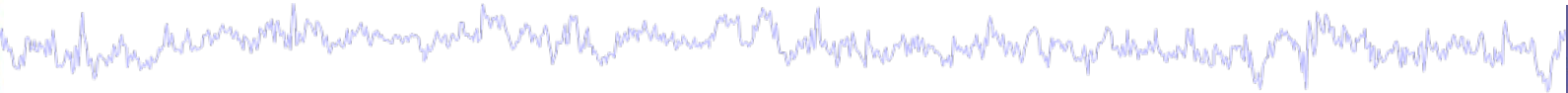
Exercise...



Finding dipole locations



Co-register to model



Dipole fit settings - pop_dipfit_settings()

Head model (click to select): Spherical Four-Shell (BESA), **Boundary Element Model (MNI)**, CTF MEG, Custom model files

Head model file: g:\lab\plugins\dipfit2.2\standard_BEM\standard_vol.mat [Browse] [Help]

Output coordinates: MNI [Click to select]

MRI file: g:\lab\plugins\dipfit2.2\standard_BEM\standard_mri.mat [Browse] [Help]

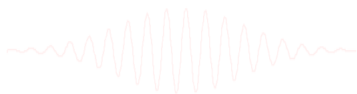
Model template channel locations file: \plugins\dipfit2.2\standard_BEM\elec\standard_1005.elc [Browse] [Help]

Co-register chan. locs. with head model: Manual Co-Reg. No Co-Reg.

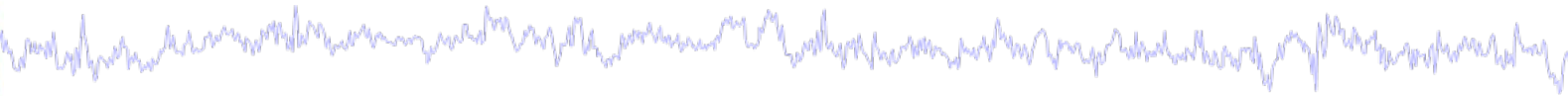
Channels to omit from dipole fitting: [List]

Note: For EEG, check that the channel locations are on the surface of the head model (To do this: 'Set head radius' to about 85 in the channel editor).

[Cancel] [Help] [Ok]



Co-register to model, cont'd



coregister() File Edit View Insert Tools Desktop Window Help

Labels on
Electrodes
Labels on
Electrodes
Mesh off

Help me
Funct. help

coregister() File Edit View Insert Tools Desktop Window Help

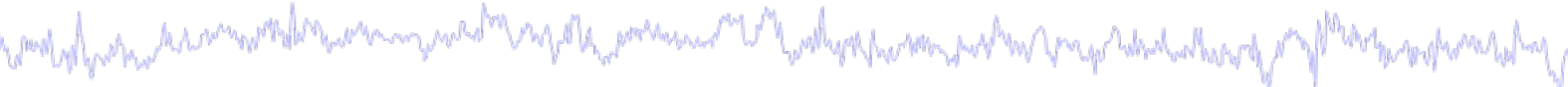
Labels off
Electrodes
Labels on
Electrodes
Mesh off

Help me
Funct. help

Move right (mm)	0	Pitch (rad)	0	Resize (x)	99.05	Align fiducials
Move front (mm)	0	Roll (rad)	0	Resize (y)	99.05	Warp montage
Move up (mm)	0	Yaw (rad)	0	Resize (z)	99.05	Cancel Ok

Move right (mm)	0	Pitch (rad)	0	Resize (x)	99.05	Align fiducials
Move front (mm)	0	Roll (rad)	0	Resize (y)	99.05	Warp montage
Move up (mm)	0	Yaw (rad)	0	Resize (z)	99.05	Cancel Ok

Perform translation of electrode positions



coregister()

File Edit View Insert Tools Desktop Window Help

Labels off
Electrodes
Labels on
Electrodes
Mesh off

Help me
Funct. help

Move right (mm)	0	Pitch (rad)	0	Resize (x)	99.05	Align fiducials
Move front (mm)	0	Roll (rad)	0	Resize (y)	99.05	Warp montage
Move up (mm)	0	Yaw (rad)	$-\pi/2$	Resize (z)	99.05	Cancel Ok

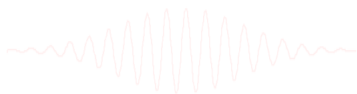
coregister()

File Edit View Insert Tools Desktop Window Help

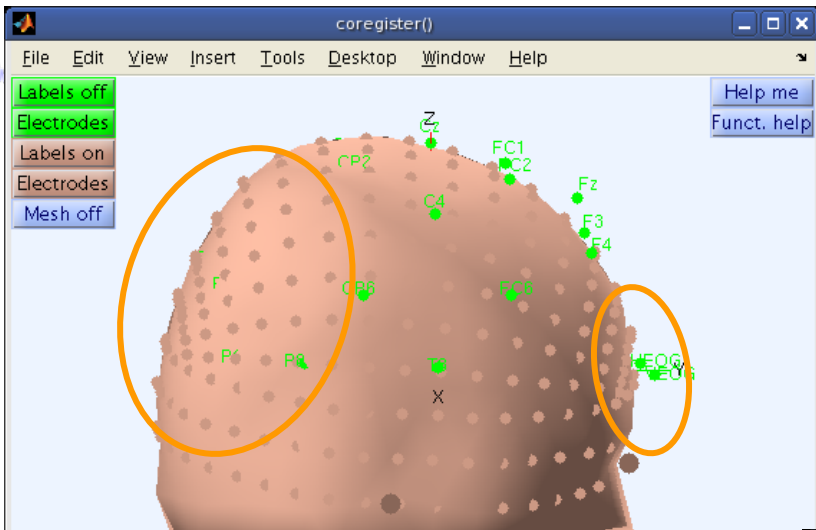
Labels off
Electrodes
Labels on
Electrodes
Mesh off

Help me
Funct. help

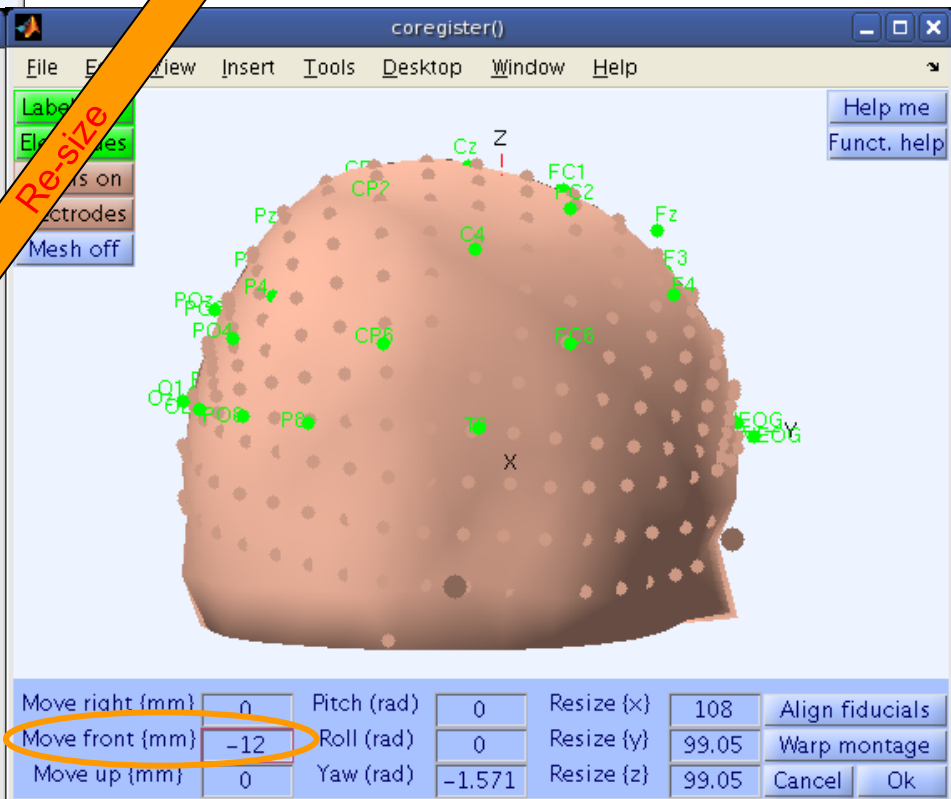
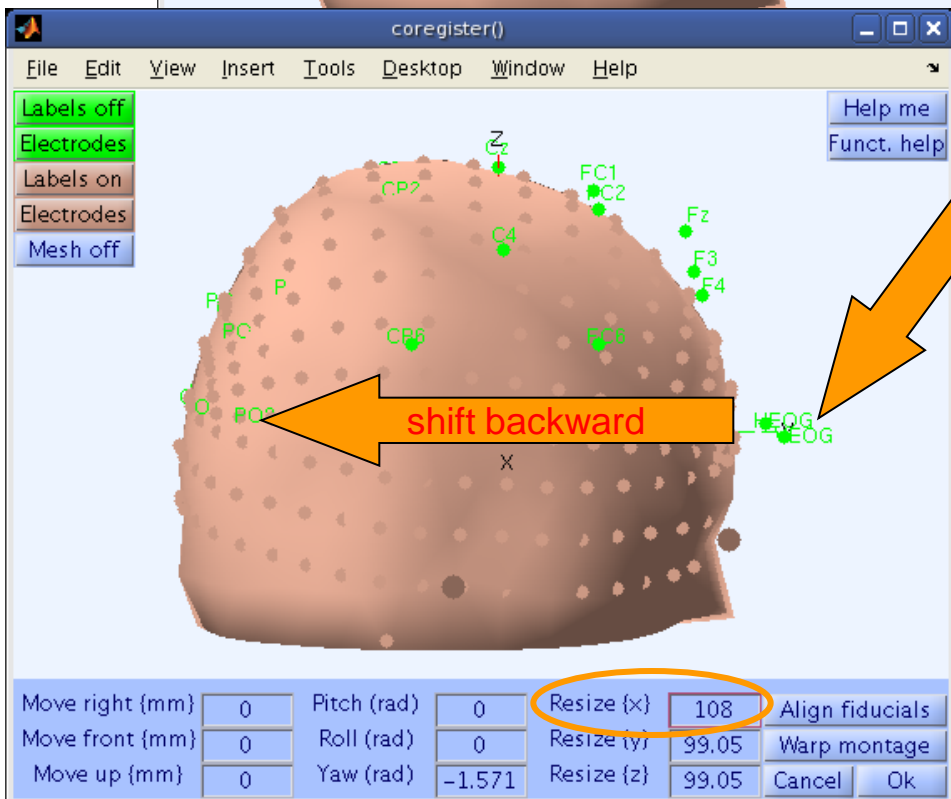
Move right (mm)	0	Pitch (rad)	0	Resize (x)	99.05	Align fiducials
Move front (mm)	0	Roll (rad)	0	Resize (y)	99.05	Warp montage
Move up (mm)	0	Yaw (rad)	-1.571	Resize (z)	99.05	Cancel Ok



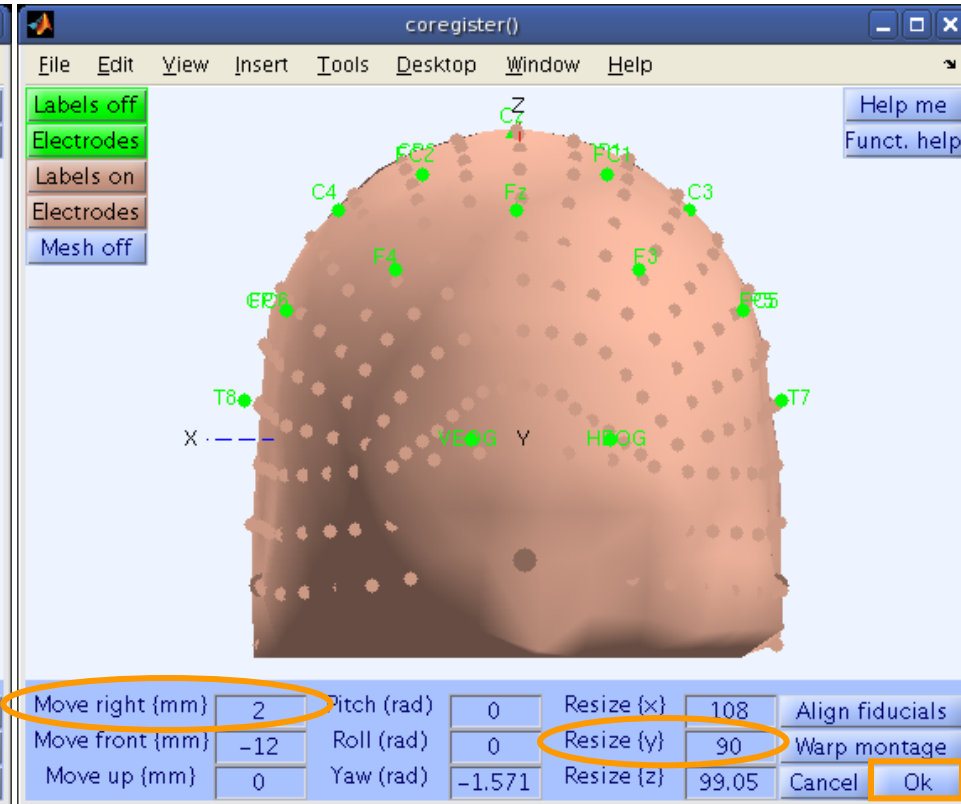
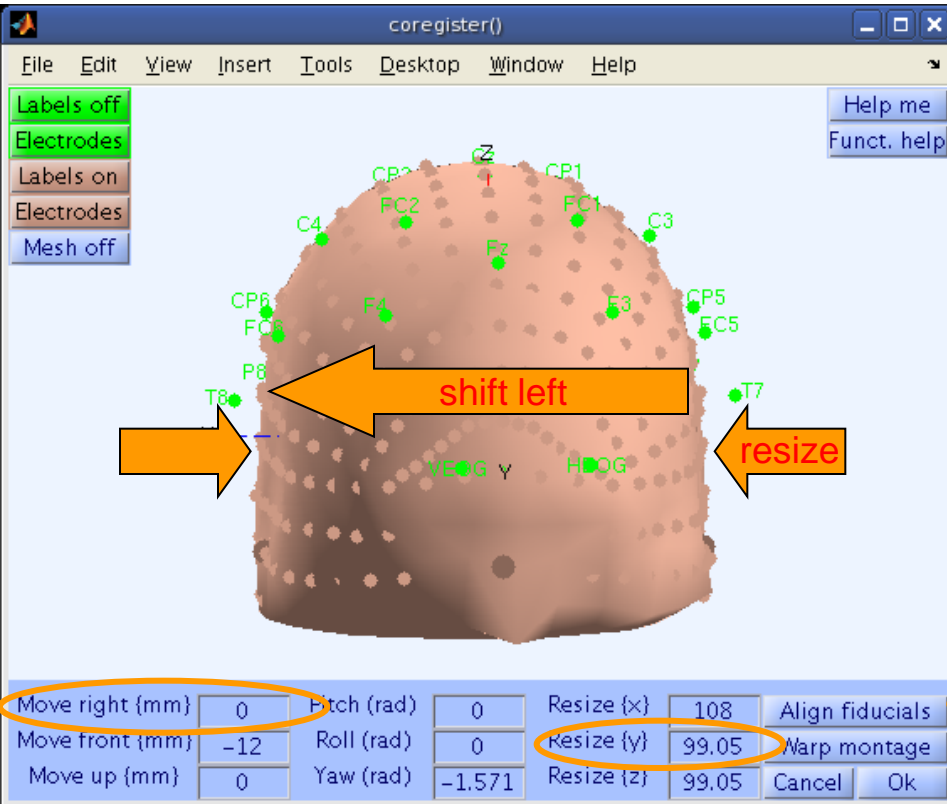
Perform translation of electrode positions



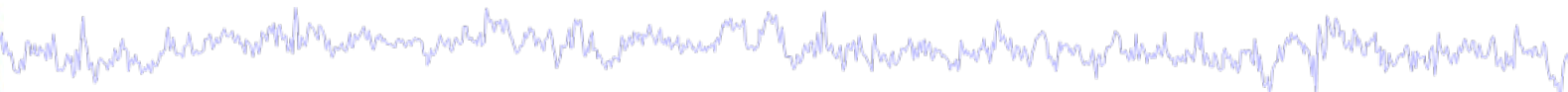
Requires a shift toward back of the head
 AND
 an expansion along the X-axis



Perform translation of electrode positions



Confirm electrode transformation



Dipole fit settings - pop_dipfit_settings()

Head model (click to select): Spherical Four-Shell (BESA), Boundary Element Model (MNI), CTF MEG, Custom model files

Head model file: g:\lab\plugins\dipfit2.2\standard_BEM\standard_vol.mat

Output coordinates: MNI

MRI file: g:\lab\plugins\dipfit2.2\standard_BEM\standard_mri.mat

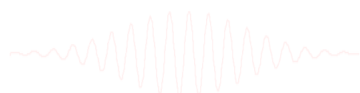
Model template channel locations file: g:\lab\plugins\dipfit2.2\standard_BEM\elec\standard_1005.elc

Co-register chan. locs. with head model: **0 -1.570796 108 90 99.05485** Manual Co-Reg. No Co-Reg.

Channels to omit from dipole fitting: List

Note: For EEG, check that the channel locations are on the surface of the head model (To do this: 'Set head radius' to about 85 in the channel editor).

Buttons: Cancel, Help, Ok



Alternatively, warp to standard montage



coregister()

File Edit View Insert Tools Desktop Window Help

Labels off
Electrodes
Labels on
Electrodes
Mesh off

Move right (mm) 0 Pitch (rad) 0 Resize {x} 99.05 Align fiducials
Move front (mm) 0 Roll (rad) 0 Resize {y} 99.05 **Warp montage**
Move up (mm) 0 Yaw (rad) 0 Resize {z} 99.05 Cancel Ok

Check to see that electrodes are correctly matched

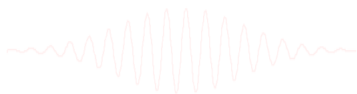
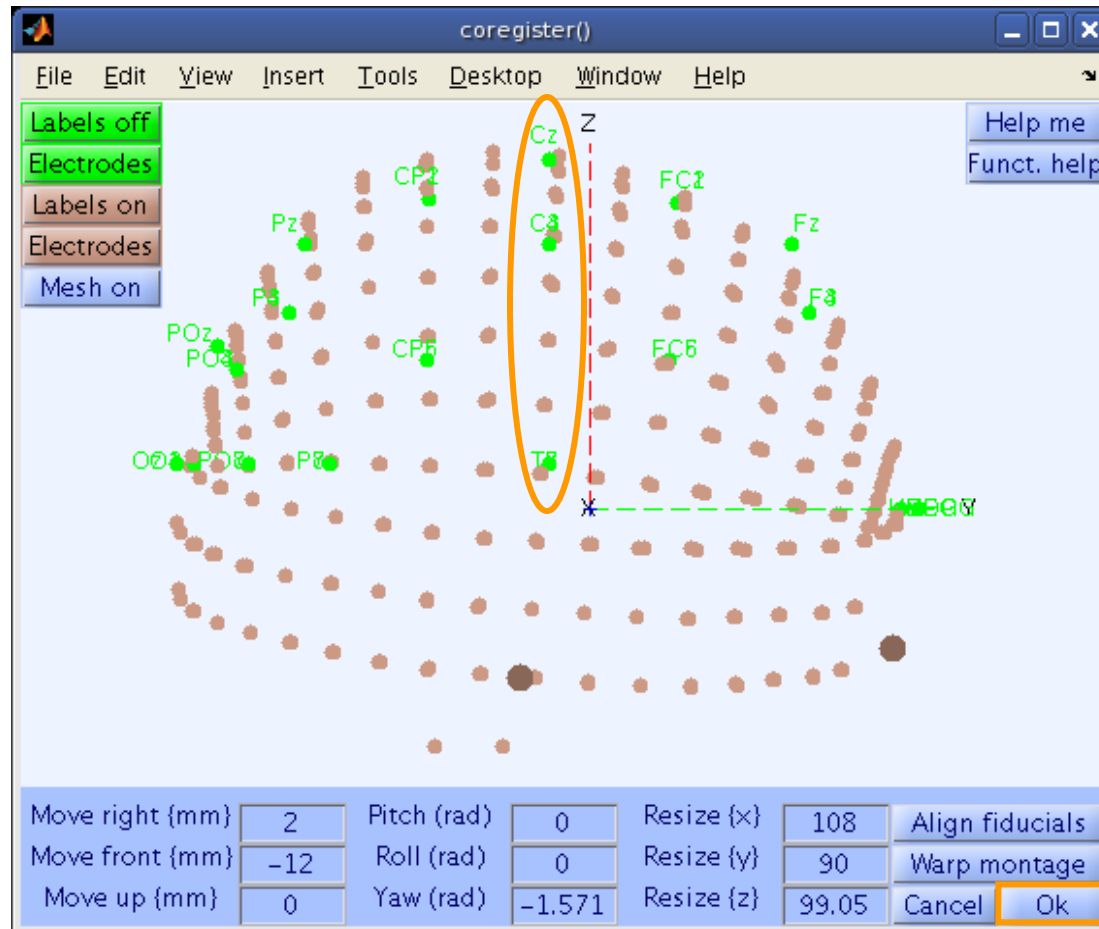
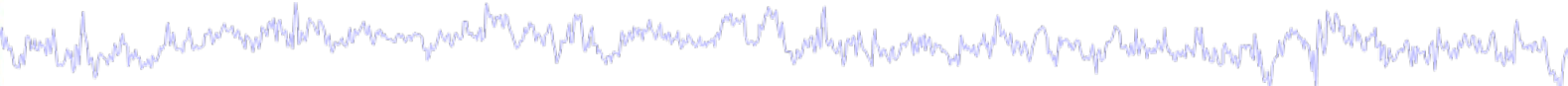
Select corresponding channels to pair

Plot new montage	Plot ref montage
1 - VEOG	1 - LPA
2 - F3 -> 21 - F3	2 - RPA
3 - Fz -> 23 - Fz	3 - Nz
4 - F4 -> 25 - F4	4 - Fp1
5 - HEOG	5 - Fpz
6 - FC5 -> 31 - FC5	6 - Fp2
7 - FC1 -> 33 - FC1	7 - AF9
8 - FC2 -> 35 - FC2	8 - AF7
9 - FC6 -> 37 - FC6	9 - AF5
10 - T7 -> 41 - T7	10 - AF3
11 - C3 -> 43 - C3	11 - AF1
12 - C4 -> 47 - C4	12 - AFz
13 - Cz -> 45 - Cz	13 - AF2
14 - T8 -> 49 - T8	14 - AF4
15 - CP5 -> 53 - CP5	15 - AF6
16 - CP1 -> 55 - CP1	16 - AF8
17 - CP2 -> 57 - CP2	17 - AF10
18 - CP6 -> 59 - CP6	18 - F9
19 - P7 -> 63 - P7	19 - F7
20 - P3 -> 65 - P3	20 - F5
21 - Pz -> 67 - Pz	21 - F3 -> 2 - F3
22 - P4 -> 69 - P4	22 - F1
23 - P8 -> 71 - P8	23 - Fz -> 3 - Fz
24 - PO7 -> 74 - PO7	24 - F2
25 - PO3 -> 76 - PO3	25 - F4 -> 4 - F4
26 - POz -> 78 - POz	26 - F6
27 - PO4 -> 80 - PO4	27 - F8
28 - PO8 -> 82 - PO8	28 - F10
29 - O1 -> 84 - O1	29 - FT9
30 - O2 -> 85 - O2	30 - FT7
31 - O2 -> 85 - O2	31 - FC5 -> 6 - FC5
32 - O2 -> 86 - O2	32 - FC3

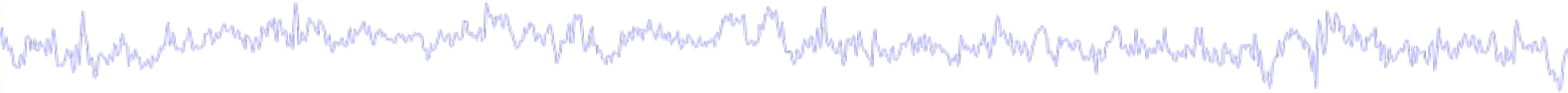
Pair channels
Clear all pairs
Cancel
Clear this pair
Auto select
Ok

stats toolbox required for warping

Check coregistration with model



EEG.dipfit structure



```
>> EEG.dipfit
```

```
ans =
```

```
    hdmfile: [1x76 char]
```

```
    mrifile: [1x71 char]
```

```
    chanfile: [1x83 char]
```

```
    chansel: [1x33 double]
```

```
    coordformat: 'spherical'
```

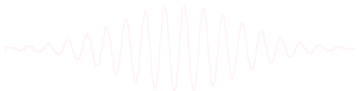
```
        model: [1x33 struct]
```

```
    current: 32
```

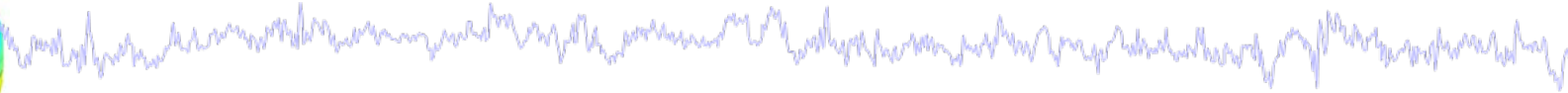
```
        vol: [1x1 struct]
```

```
    coord_transform: [0 0 -1.570796 100 76 90.87264 1 1 1]
```

From head model transformations



DIPFIT and model co-registration



Task 1

Co-register electrodes with model

Task 2

Autofit equivalent dipoles

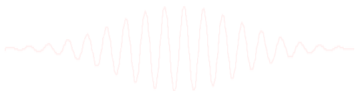
Task 3

Fine fit options

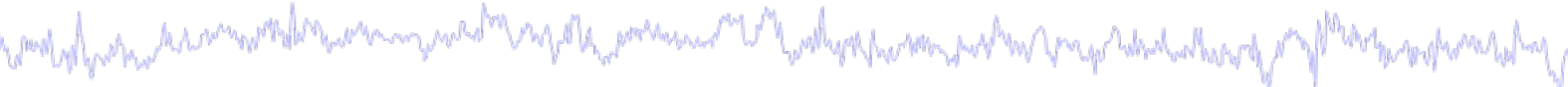
Task 4

3D *headplot()* co-registration

Exercise...



Autofit equivalent dipoles



EEGLAB v6.0b

File Edit **Tools** Plot Study Datasets Help

- Change sampling rate
- Filter the data
- Re-reference
- Reject continuous data by eye
- Extract epochs
- Remove baseline
- Run ICA**
- Remove components
- Automatic epoch rejection
- Reject data epochs
- Reject data using ICA
- Locate dipoles using BESA
- Locate dipoles using DIPFIT 2.x**
 - Head model and settings
 - Coarse fit (grid scan)
 - Fine fit (iterative)
 - Autofit (coarse fit, fine fit & plot)**
 - Plot component dipoles
- Laplacian
- FMRIB Tools
- Grand average datasets
- Locate dipoles using LORETA
- PCA plugin

Fit multiple ICA components -- pop_multifit()

Component indices: 1:71

Rejection threshold RV (%): 100

Remove dipoles outside the head:

Fit bilateral dipoles (check):

Plot resulting dipoles (check):

dipplot() plotting options: 'normlen' 'on' Help

Cancel Help Ok

Plot dipoles



Plot dipoles - pop_dipplot

Components indices ([]=all available)

Plot dipoles within RV (%) range ([min max])

Background image /data/common/matlab/eeglab/plugins/c

Plot summary mode

Plot edges

Plot closest MRI slide

Plot dipole's 2-D projections

Plot projection lines

Make all dipoles point out

Normalized dipole length

Additional dipplot() options

Cancel Help

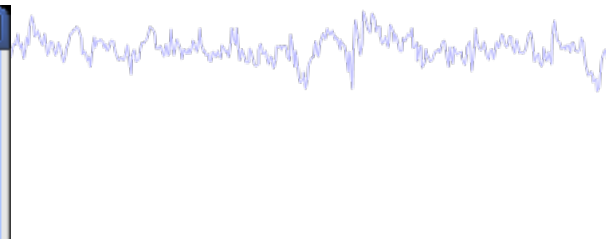


Figure 2

File Edit View Insert Tools Desktop Window Help

71 dipoles:

Plot one

Keep|Next

Next

Prev

Keep|Prev

1

Comp: 1

RV: 9.92%

X tal: 4

Y tal: 67

Z tal: -37

Display:

Mesh on

Tight view

Sagittal view

Coronal view

Top view

No controls

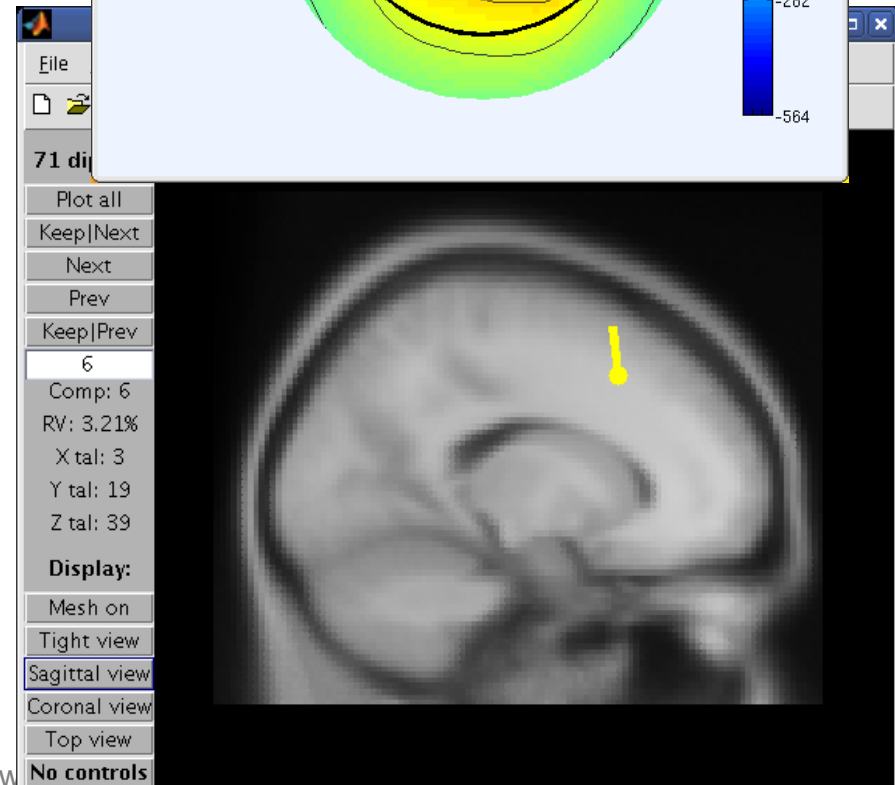
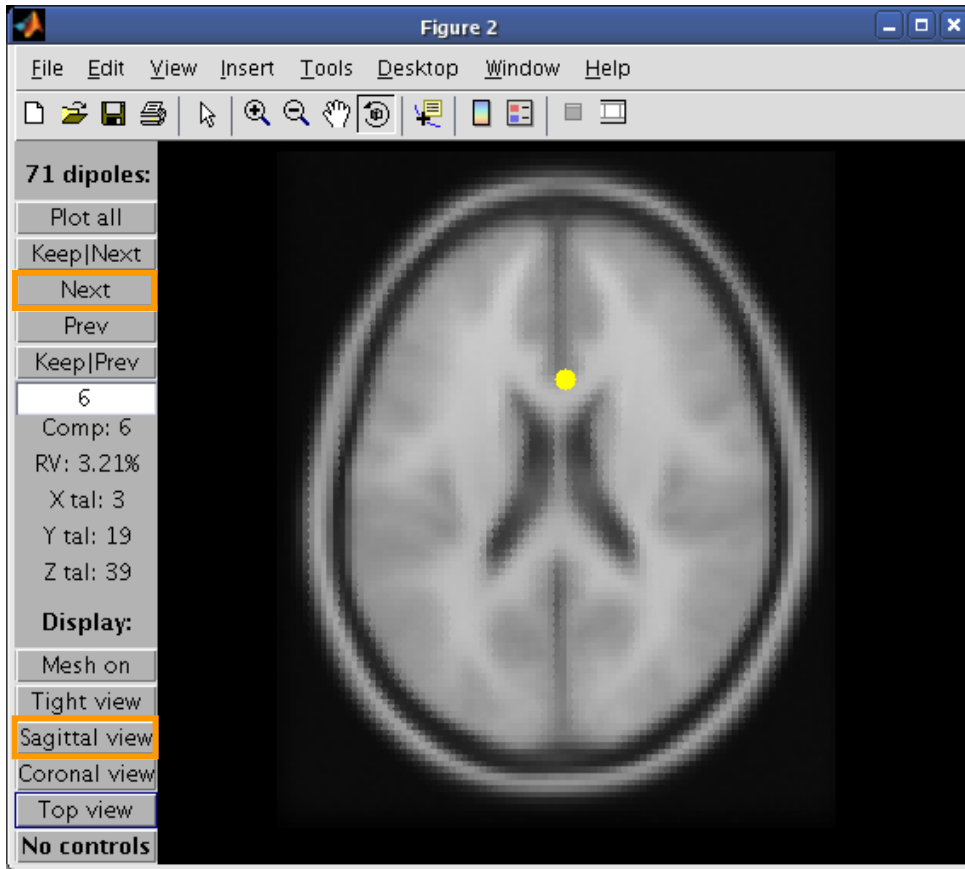
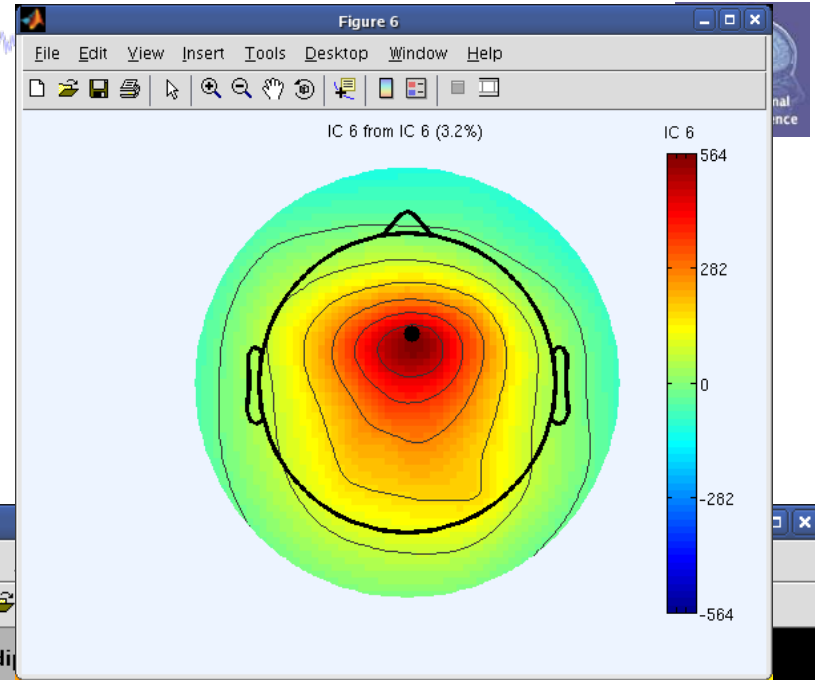
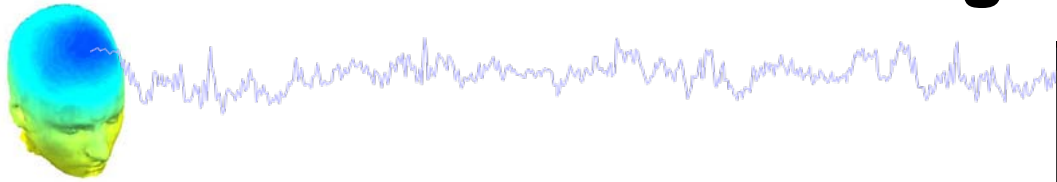
EEGLAB v6.0b

File Edit Tools Plot Study Datasets Help

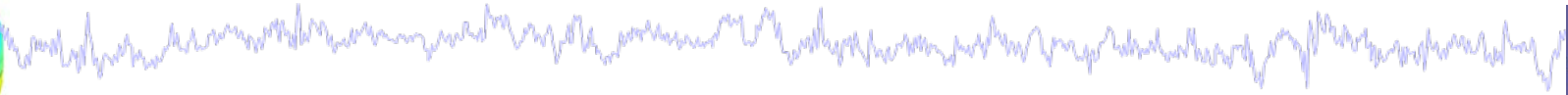
#1: (

- Change sampling rate
- Filter the data
- Re-reference
- Reject continuous data by eye
- Extract epochs
- Remove baseline
- Run ICA
- Remove components
- Automatic epoch rejection
- Reject data epochs
- Reject data using ICA
- Locate dipoles using BESA
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 - Head model and settings
 - Coarse fit (grid scan)
 - Fine fit (iterative)
 - Autofit (coarse fit, fine fit & plot)
 - Plot component dipoles
- Laplacian
- FMRIB Tools
- Grand average datasets
- Locate dipoles using LORETA
- PCA plugin

Scroll through dipoles



DIPFIT and model co-registration



Task 1

Co-register electrodes with model

Task 2

Autofit equivalent dipoles

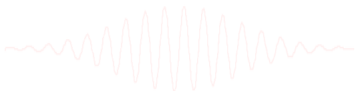
Task 3

Fine fit options

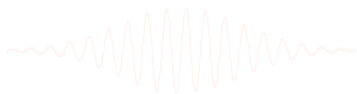
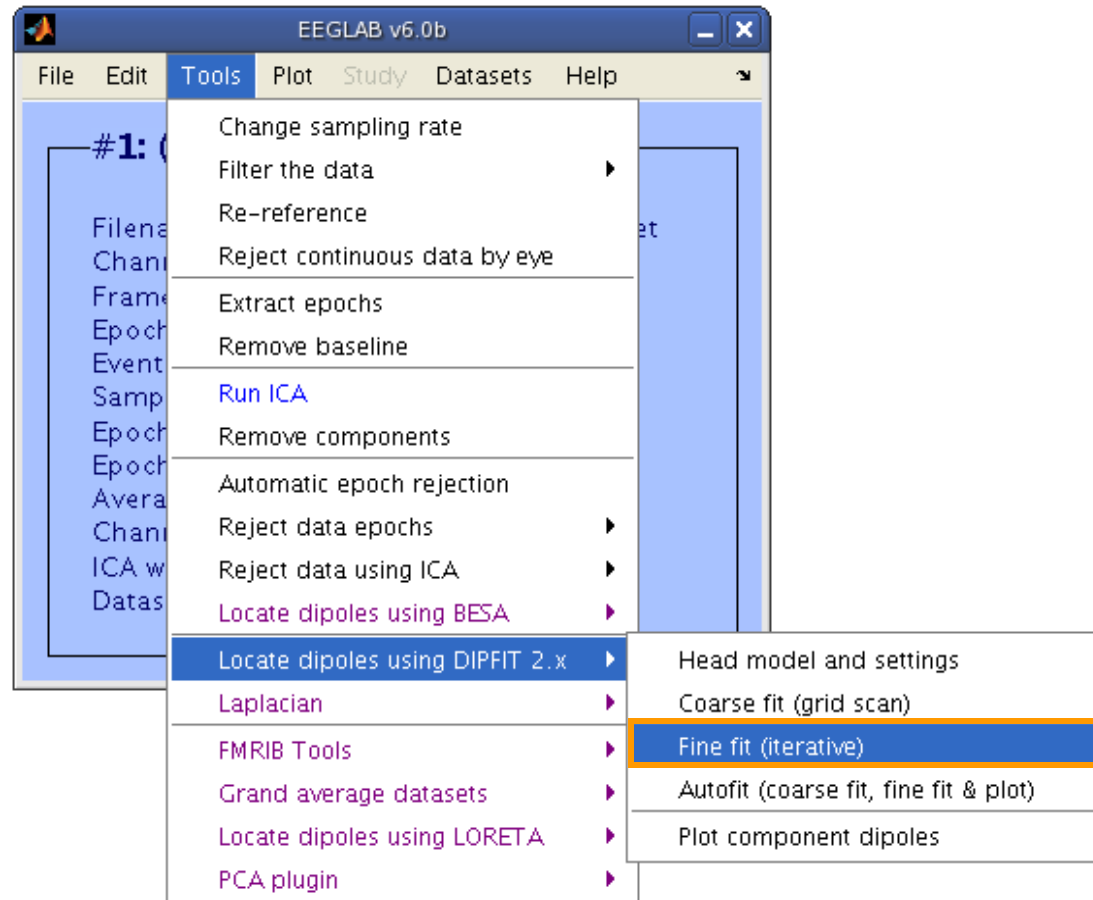
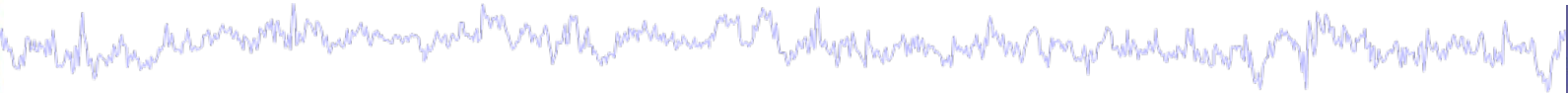
Task 4

3D *headplot()* co-registration

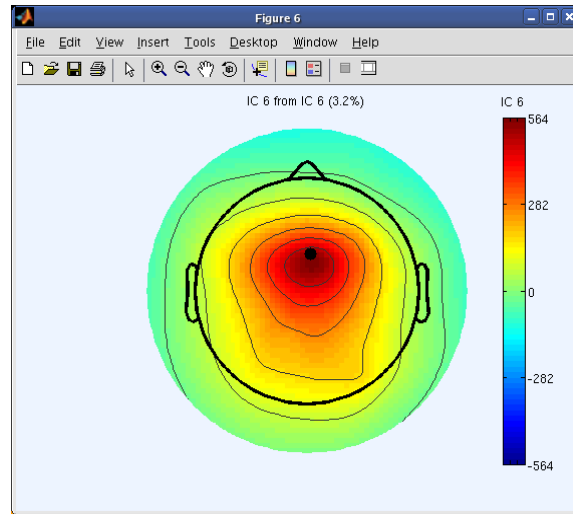
Exercise...



Fine fit options in DIPFIT



Fine fit menu



Manual dipole fit -- pop_dipfit_nonlinear()

Component to fit: 6 Plot map Residual variance = 3.21%

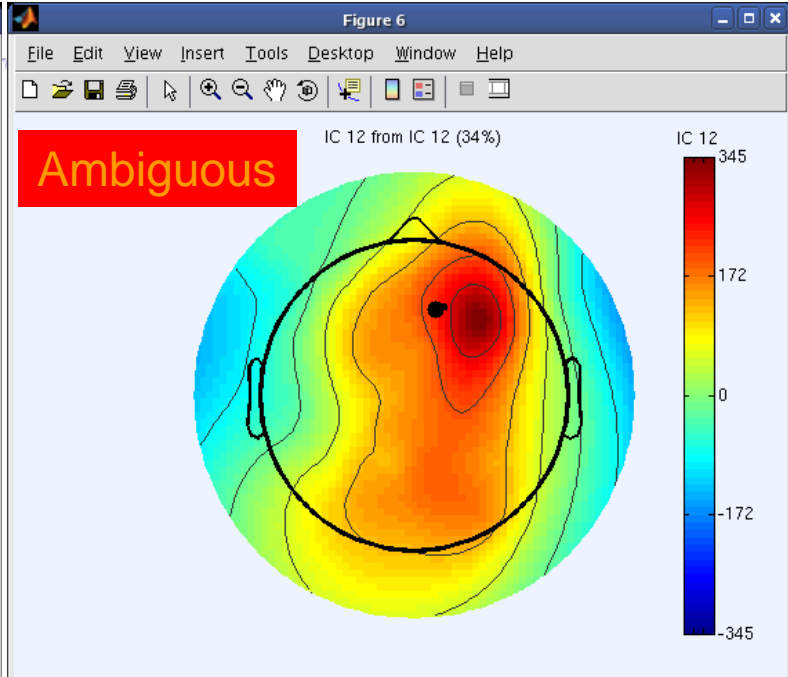
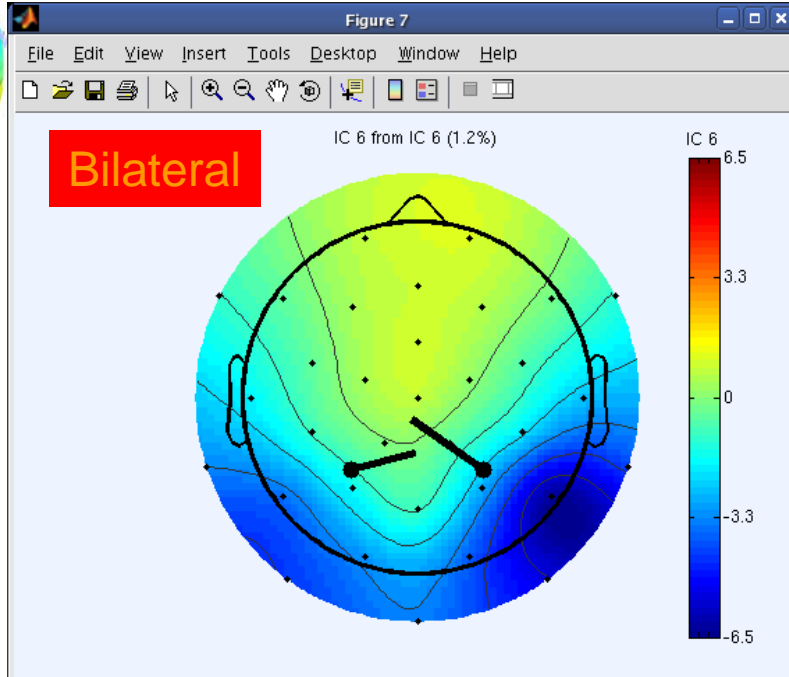
dipole	fit	position	moment	
#1	<input checked="" type="checkbox"/>	28.222 -2.401 37.331	2.380 475942.653 3819304.288	Flip (in out)
#2	<input type="checkbox"/>	0.000 0.000 0.000	0.000 0.000 0.000	Flip (in out)

Symmetry constrain for dipole ...

Fit dipole(s)' position & moment Or fit only dipole(s)' moment Plot dipole(s)

Cancel Help Ok

Bilateral dipoles



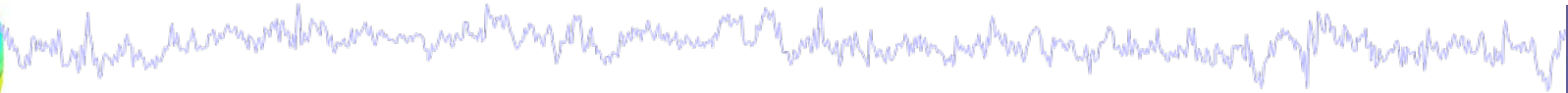
Manual dipole fit -- pop_dipfit_nonlinear()

Component to fit: Residual variance = 1.23%

dipole	fit	position	moment	
#1	<input checked="" type="checkbox"/>	-35.066 -32.492 -4.684	32271.382 46141.284 5880.224	<input type="button" value="Flip (in out)"/>
#2	<input checked="" type="checkbox"/>	-35.066 32.492 -4.684	1005.419 -38050.427 14094.824	<input type="button" value="Flip (in out)"/>

Symmetry constrain for dipole ...

EEG.dipfit structure



```
>> EEG.dipfit.model
```

```
ans =
```

```
1x33 struct array with fields:
```

```
posxyz
```

```
momxyz
```

```
rv
```

```
active
```

```
select
```

```
>> EEG.dipfit.model(1)
```

```
ans =
```

X

Y

Z

[14.9791 -86.0094 47.9448]

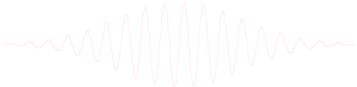
```
posxyz: [1x3 double]
```

```
momxyz: [1x3 double]
```

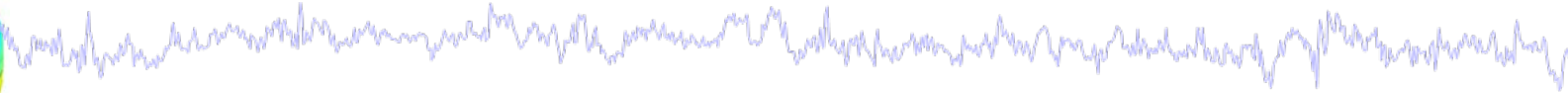
```
rv: 0.0288
```

```
active: 1
```

```
select: 1
```



DIPFIT and model co-registration



Task 1

Co-register electrodes with model

Task 2

Autofit equivalent dipoles

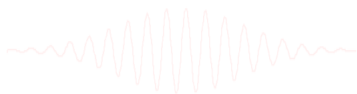
Task 3

Fine fit options

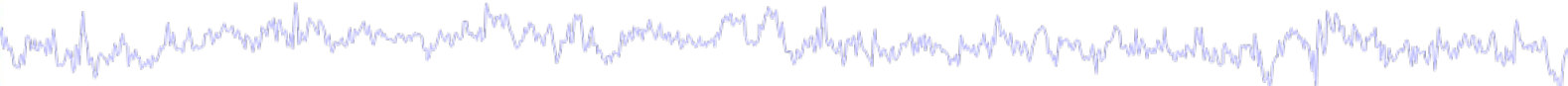
Task 4

3D *headplot()* co-registration

Exercise...



Plot scalp maps in 3D



EEGLAB v6.0b

File Edit Tools **Plot** Study Datasets Help

#1: (no d...)

Filename: ...

Channels pe...

Frames per e...

Epochs

Events

Sampling rat...

Epoch start (...)

Epoch end (s...

Average refe...

Channel loca...

ICA weights

Dataset size

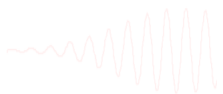
- Channel locations
- Channel data (scroll)
- Channel spectra and maps
- Channel properties
- Channel ERP image
- Channel ERPs
- ERP map series
- Sum/Compare ERPs
- Component activations (scroll)
- Component spectra and maps
- Component maps**
- Component properties
- Component ERP image
- Component ERPs
- Sum/Compare comp. ERPs
- Data statistics
- Time-frequency transforms
- Average time-frequency
- Cluster dataset ICs

- In 2-D
- In 3-D**

Headplot() warning

headplot() must generate a spline file the first time it is called or after changes in the channel location file. You must also co-register your channel locations with the head template.

Ok



Headplot co-registration



Component head plot(s) -- pop_headplot()

Co-register channel locations with head mesh and compute a mesh spline file (done only once)

Use the following spline file or structure

Or (re)compute a new spline file named:

3-D head mesh file
Mesh associated channel file
Talairach-model transformation matrix

	/home/julie/S01_attend1_pos1.spl	Browse	Help
	mheadnew.mat	Browse	Help
	mheadnew.xyz	Browse	
		Browse	
		Manual coreg.	

1:31

Components of dataset:

Ok

coregister()

File Edit View Insert Tools Desktop Window Help

Labels off
Electrodes
Labels on
Electrodes
Mesh off

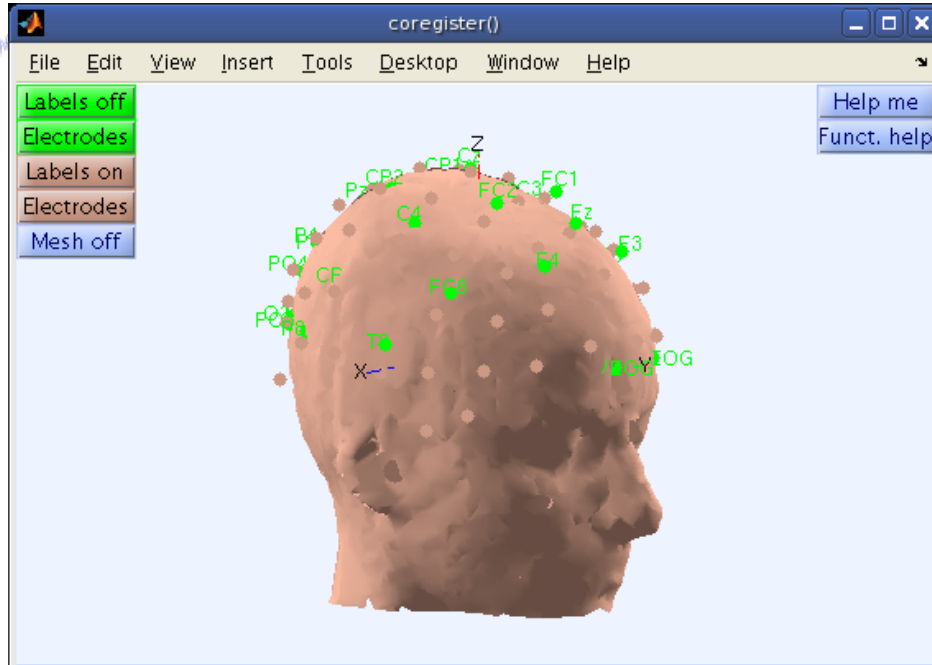
Help me
Funct. help

Go through co-registration
in the same way as
with dipfit co-registration



Move right {mm}	0	Pitch (rad)	0	Resize {x}	90.87	Align fiducials
Move front {mm}	0	Roll (rad)	0	Resize {y}	90.87	Warp montage
Move up {mm}	0	Yaw (rad)	0	Resize {z}	90.87	Cancel Ok

Confirm headplot co-registration



Component head plot(s) -- pop_headplot()

Co-register channel locations with head mesh and compute a mesh spline file (done only once)

Use the following spline file or structure

Or (re)compute a new spline file named:

3-D head mesh file	/home/julie/S01_attend1_pos1.spl	Browse	Help
Mesh associated channel file	mheadnew.mat	Browse	Help
Talairach-model transformation matrix	mheadnew.xyz	Browse	Help

0 0 -1.570796 100 76 90.87264 Manual coreg.

Plot interpolated activity onto 3-D head

Component numbers to plot (negative numbers invert comp. polarities):

Plot title:

Plot geometry (rows,columns): (Default [] = near square)

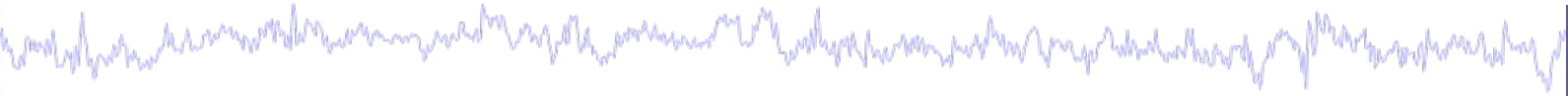
-> headplot() options (See >> help headplot):

1:31

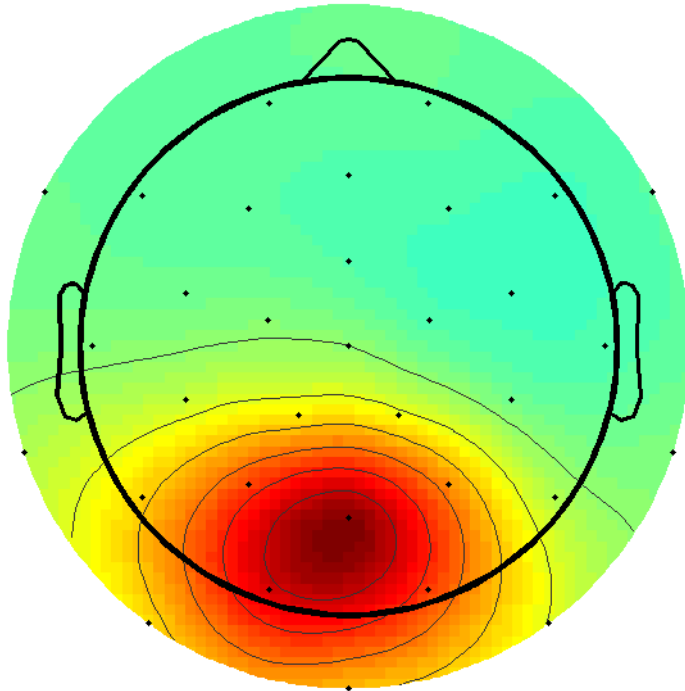
Components of dataset:

Cancel Ok

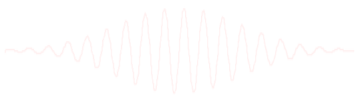
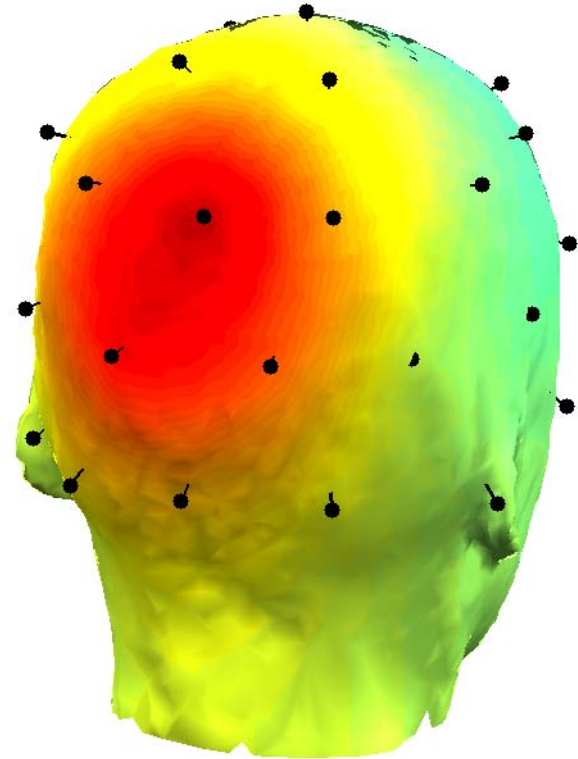
Spline file in EEG structure



2D scalp map for IC 12



3D scalp map for IC 12



Exercise



- **All**
 - Load 'stern.set' from 'data' folder
- **Novice**
 - Plot dipoles from the GUI and scroll through components individually,
 - Try all viewing parameters
- **Intermediate / Advanced**
 - In the Finefit menu, try fitting a bilateral dipole, what happens to the residual variance?
 - Co-register the head model for 3D scalp map plotting. Then plot some ICs in 3D.
 - Can you gain any further insight about source projections using this display?