

# TopoToolbox Tutorial

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# Outline

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- Angle test: individual analysis
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- Projection test: individual analysis
- Projection test: group analysis
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- Angle dynamics: group analysis

# About TopoToolbox

TopoToolbox is a free open-source software platform for analyzing electrophysiological data based on topographic information in event-related EEG/MEG responses. This toolbox provides a tool for researchers to directly derive robust measures of response pattern (topographic) similarity and psychological meaningful response magnitude using electromagnetic signals in sensor space. These measures are useful for testing psychological theories without anatomical descriptions.

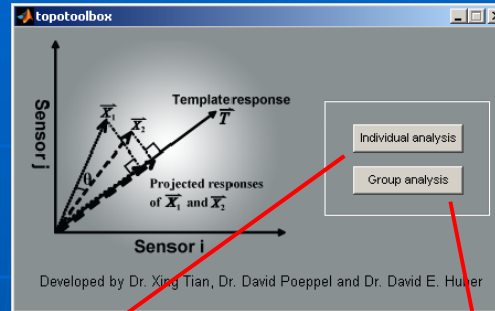
This toolbox is developed by Dr. Xing Tian, Dr. David Poeppel and Dr. David E. Huber.

# Install TopoToolbox

- MATLAB required
- Download TopoToolbox and unzip it.

The screenshot shows the MATLAB 7.7.0 (R2008b) interface. The 'Set Path' dialog box is open, displaying the MATLAB search path. The 'TopoToolbox' folder is selected in the list. The 'Add with Subfolders...' button is highlighted with a red box and the number 2. The 'Browse For Folder' dialog box is also open, showing the 'TopoToolbox' folder selected in the file tree. The 'OK' button in the 'Browse For Folder' dialog is highlighted with a red box and the number 3. The 'Set Path' dialog has a 'Save' button highlighted with a red box and the number 4. The Command Window shows the command 'topotoolbox' entered, with the command text highlighted by a red box and the number 5. The 'Set Path' dialog has a 'Set Path...' button highlighted with a red box and the number 1.

# Overview



Individual analysis for all data first, then Group analysis

Function selection

Data loading area

Function selection

Individual results loading area

The screenshot shows the "topo\_individual\_analysis" window. On the left, under "Function selection", there are three radio buttons: "Angle test" (selected), "Projection test", and "Angle dynamics". To the right, under "Data location", there are two "Load experimental file" buttons, each with "remove" and "reset" sub-buttons. Further right, under "Parameters and load", there are input fields for "sampling frequency" (set to "HZ"), "enter pre-trigger time" (set to "in ms"), and "enter post-trigger time" (set to "in ms"). There are also "load" and "plot average responses" buttons.

The screenshot shows the "topo\_group\_analysis" window. On the left, under "Function selection", there are three radio buttons: "Angle test" (selected), "Projection test", and "Angle dynamics". To the right, under "Load individual results", there is a "Load individual results" button with a dropdown arrow, and "remove" and "reset" sub-buttons. There is also a "load" button.

Data plotting area

Plotting area

Individual results area

Group results area

# Angle test: Individual analysis

- Loading individual data

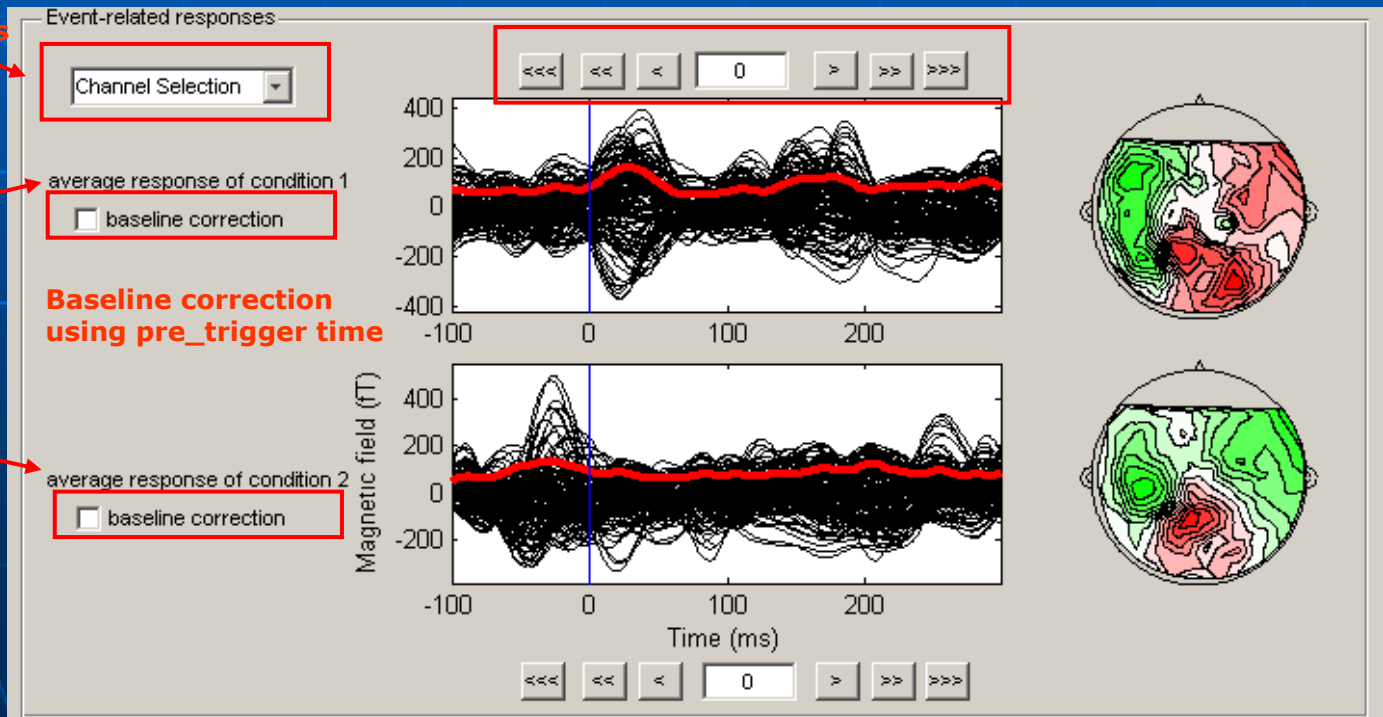
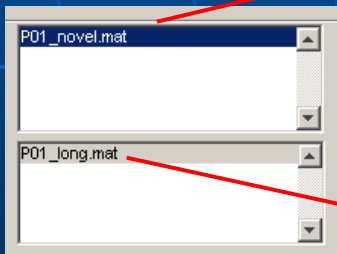
The screenshot shows the 'topo\_individual\_analysis' window with the following components and annotations:

- Function selection:** The 'Angle test' radio button is selected and highlighted with a red box. An annotation 'Select Angle test' points to this box.
- Data location:** A list of files is shown. The first entry is 'import channel configuration' with a checked box and the file 'P01\_novel.mat'. Below it are 'Load experimental file1', 'Load experimental file1', 'Load .mat file' (with 'long.mat' selected), 'From EEGLAB (CURRENT SET)', and 'Load experimental file2'. An annotation 'Load channel file in ...\TopoToolbox\samples\sample\_channel\_coordinates.txt' points to the 'import channel configuration' entry. Another annotation 'File names for each condition' points to the 'long.mat' file.
- Parameters and load:** A section with three input fields: 'sampling frequency' (500), 'enter pre-trigger time' (100), and 'enter post-trigger time' (298). These fields are enclosed in a red box with an annotation 'Specifying parameters'. Below the fields are 'load' and 'plot average responses' buttons. An annotation 'Load the files' points to the 'load' button.
- Buttons:** 'remove' and 'reset' buttons are located below the file list. An annotation 'Specify sample data for each condition (only 4 epochs included) from ...\TopoToolbox\samples\data\_for\_individual\_analysis\PRMT\' points to the 'remove' button.

# Angle test: Individual analysis

- Plotting the average responses

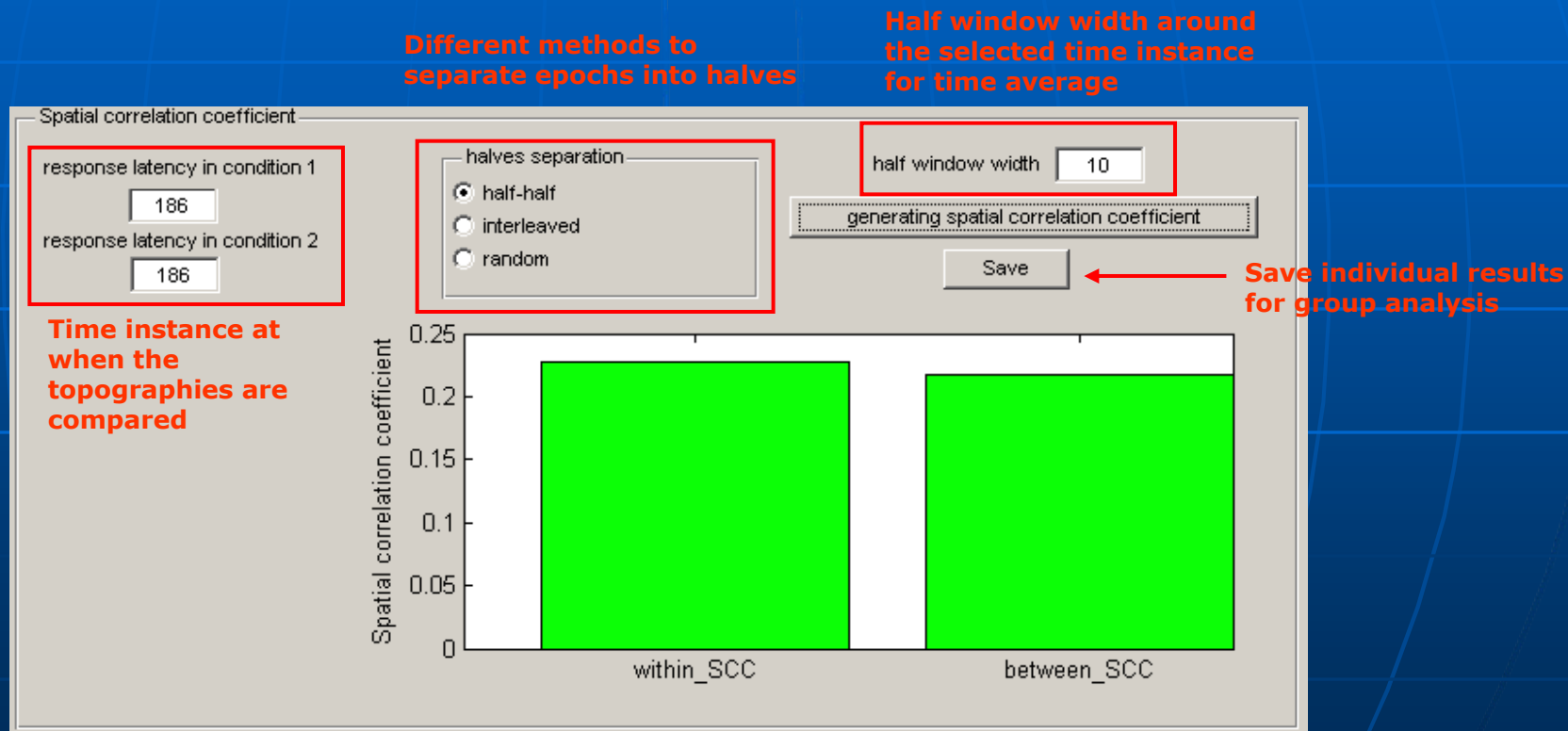
Can select subgroup of channels for further analysis



Select one time instance for plotting topography on the right, time selection also sync with latency used in stats (see next slide)

# Angle test: Individual analysis

## ■ Individual stats results

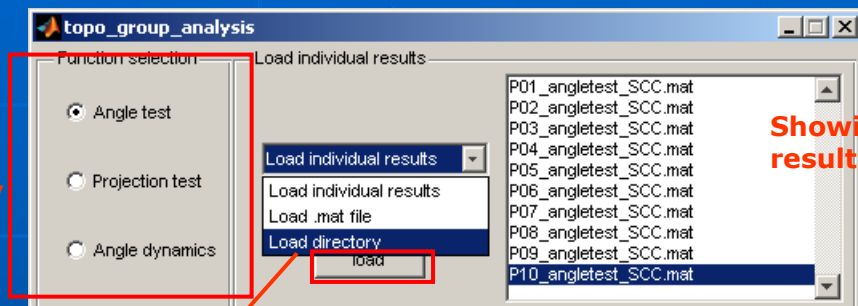




# Angle test: group analysis

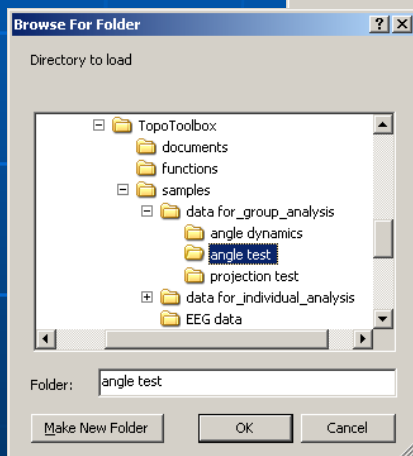
Select Angle test

Load all individual results in directory  
... \TopoToolbox\samples\data  
for\_group\_analysis\angle test\

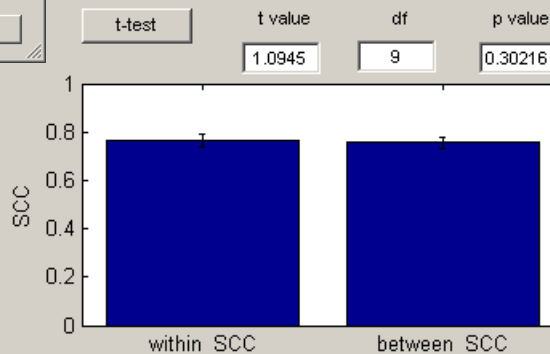


Showing all individual result files

Load these files

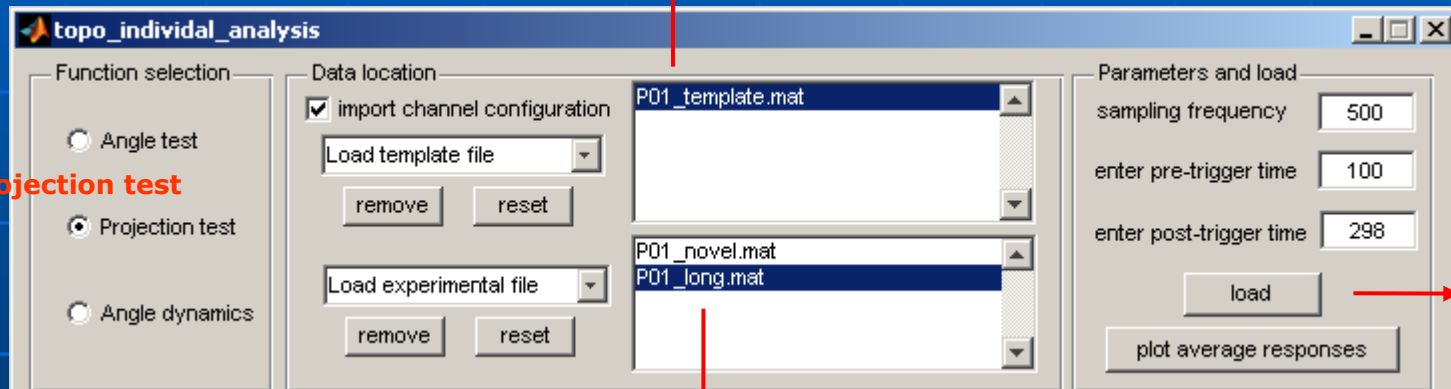


t-test and stats results



# Projection test: individual analysis

## ■ Loading individual data



Specify a template file  
... \TopoToolbox\samples\data  
for\_individual\_analysis\PRMT\

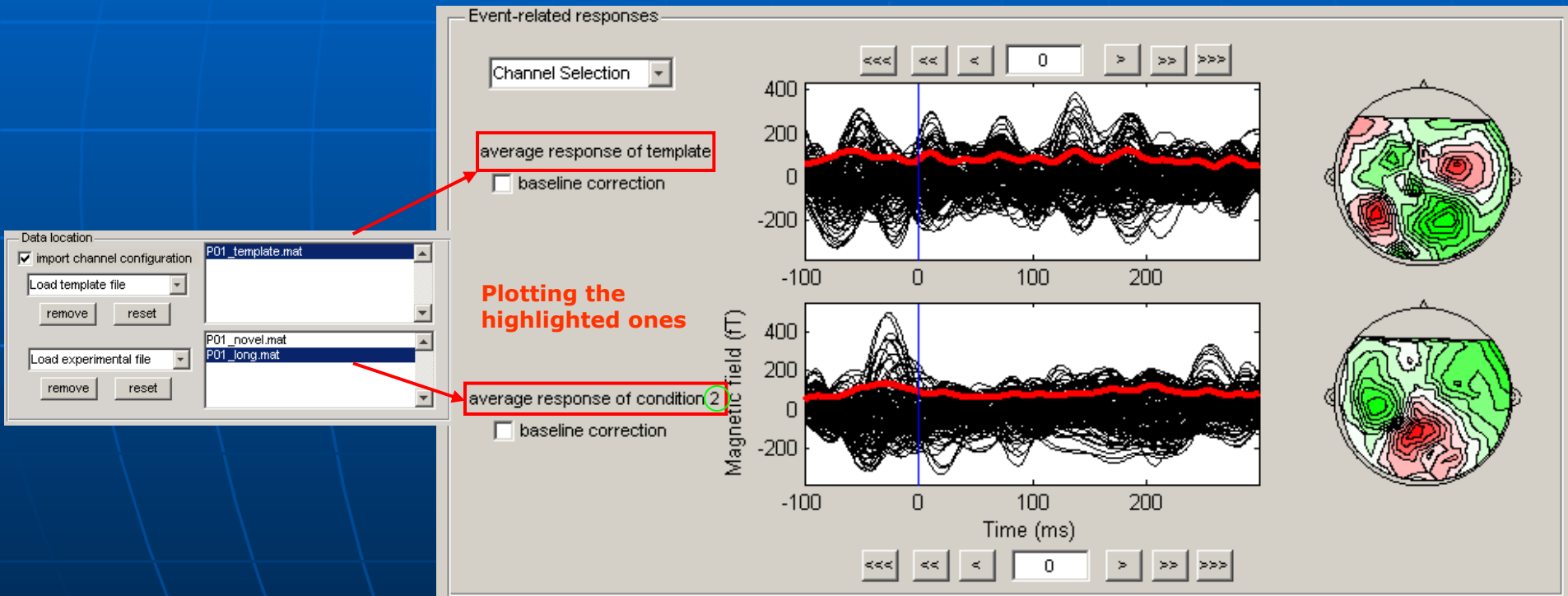
Select Projection test

Load these files

Specify files for two experimental  
conditions  
... \TopoToolbox\samples\data  
for\_individual\_analysis\PRMT\

# Projection test: individual analysis

- Plotting the average responses

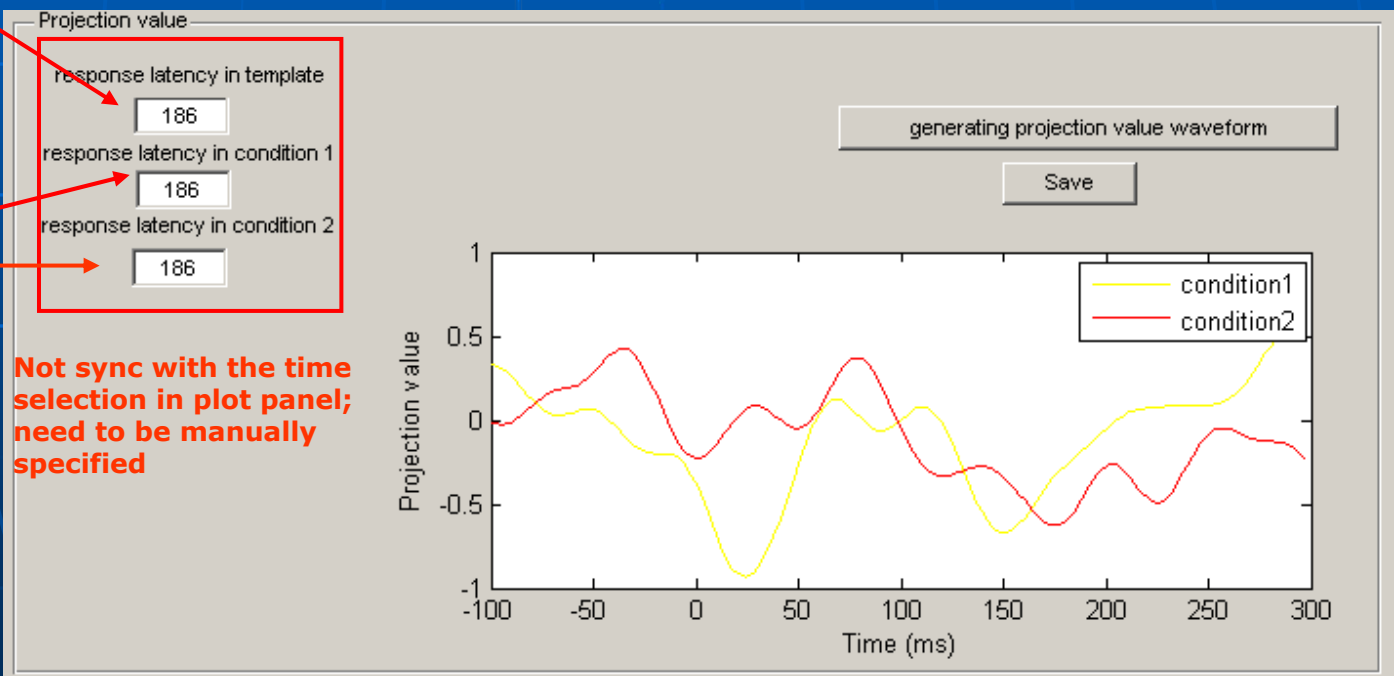


# Projection test: individual analysis

- Individual stats results

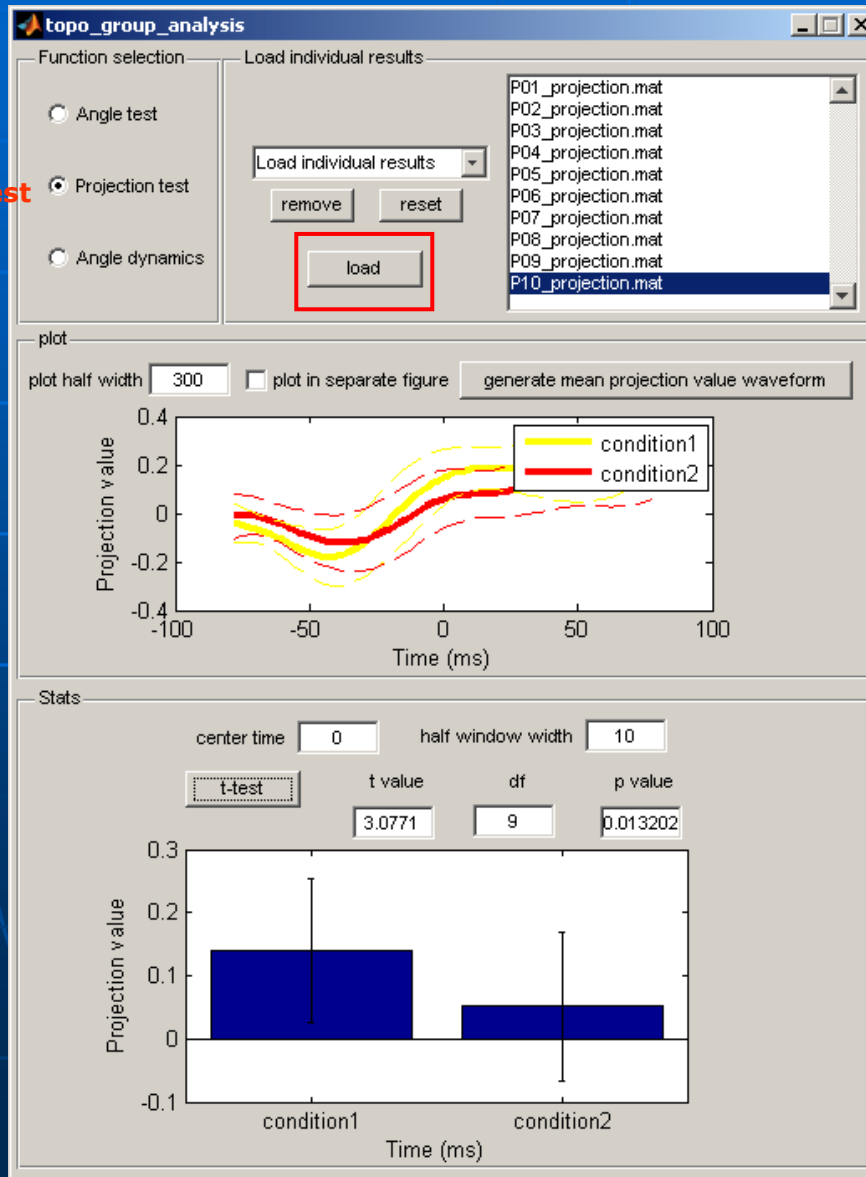
Time instance for the topography of template

Time instance for experimental conditions in group analysis (next slide)



# Projection test: group analysis

Select Projection test



Load all individual results in directory  
... \TopoToolbox\samples\data  
for\_group\_analysis\projection test\

Plotting mean projection value  
with two standard error of the  
means, centered at the  
individual experimental latency  
(specified in previous slide)

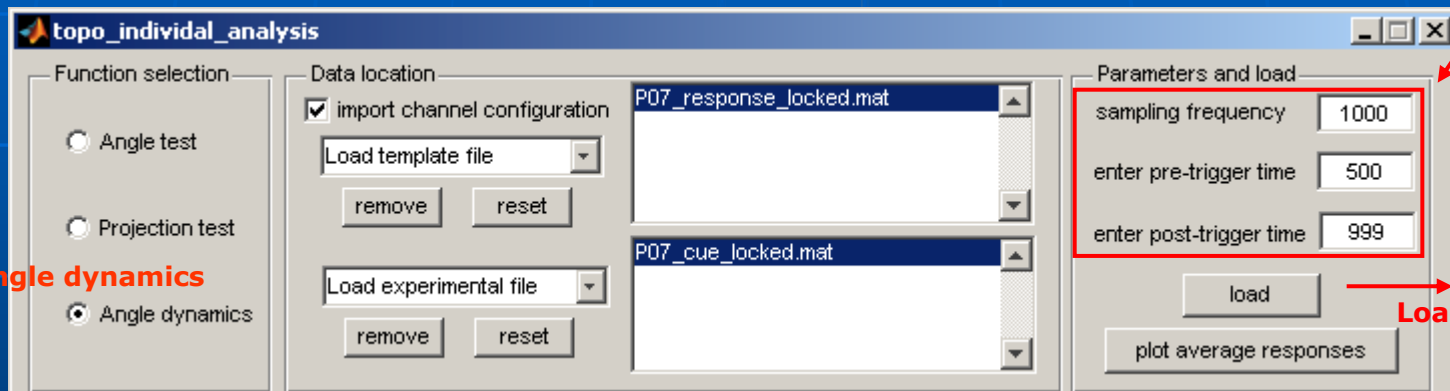
Stats results for group analysis

# Angle dynamics: individual analysis

## ■ Loading data

Specify a template file  
... \TopoToolbox\samples\data  
for\_individual\_analysis\motor\

Specifying parameters



Select Angle dynamics

Load these two files

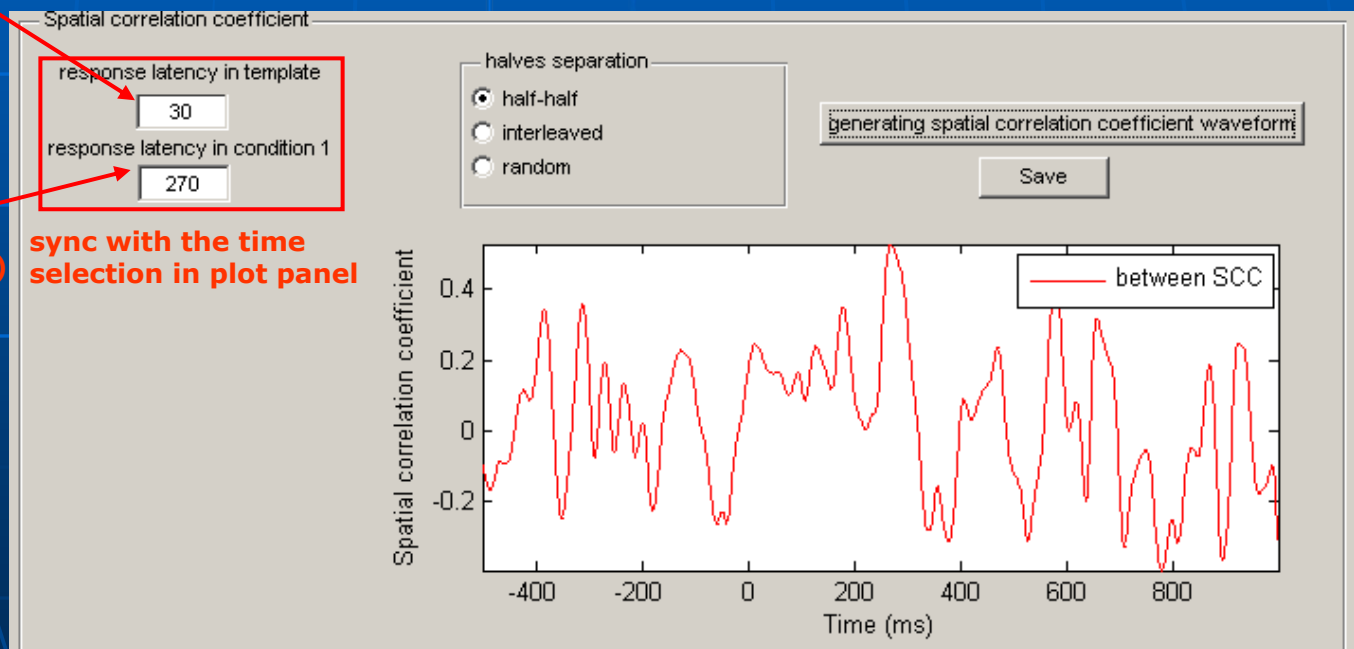
Specify a file for experimental condition  
... \TopoToolbox\samples\data  
for\_individual\_analysis\motor\

# Angle dynamics: individual analysis

## ■ Individual stats results

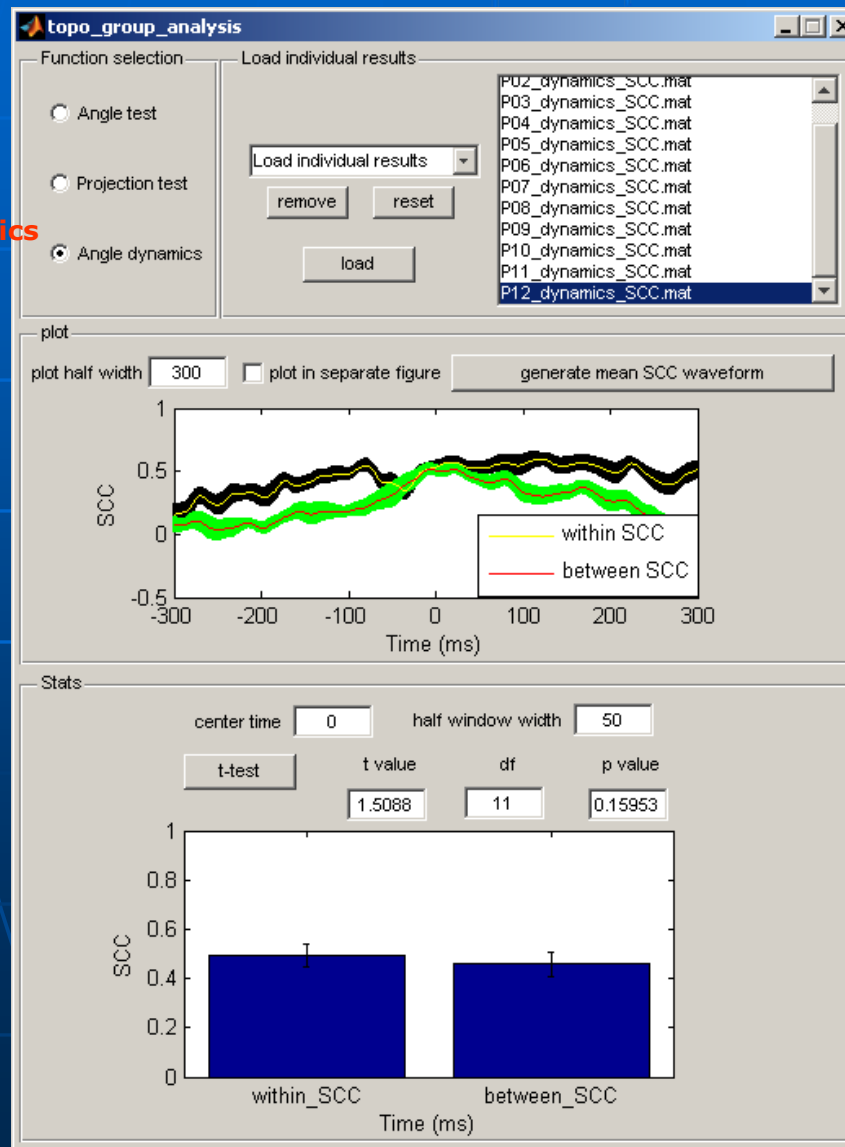
Time instance for the topography of template

Time instance for experimental condition in group analysis (next slide)



# Angle dynamics: group analysis

Select Angle dynamics



Load all individual results in directory  
... \TopoToolbox\samples\data  
for\_group\_analysis\angle dynamics\

Plotting mean spatial correlation  
coefficients with two standard error  
of the means, centered at the  
individual experimental latency  
(specified in previous slide)

Stats results for group analysis