Demo of EEG REST

Install REST (EEGLAB Plugin version)

- To install REST, download the zip file (http://www.neuro.uestc.edu.cn/rest/)
- Unzip and place the folder in the 'plugins' folder of your existing EEGLAB installation (so something like ~/eeglab14_1_0b/plugins/REST_reference_v1.1_20190818/eegplugin_rest.m exists).

Dong, L., et al. (2017). "MATLAB Toolboxes for Reference Electrode Standardization Technique (REST) of Scalp EEG." Front Neurosci 11.

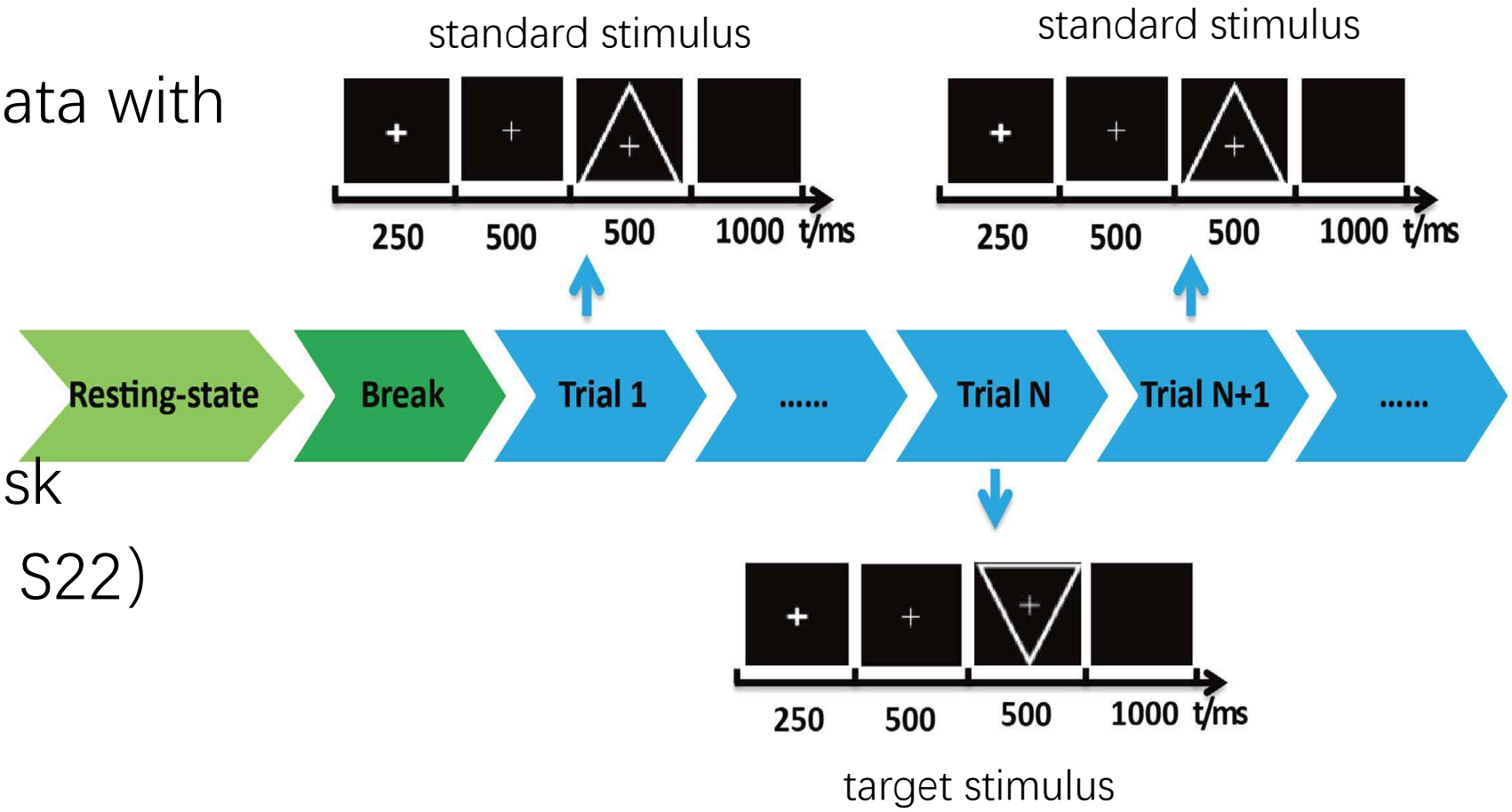
Run REST (EEGLAB Plugin version)

- To run REST, ensure that the correct EEGLAB folder is in your current Matlab path, and run 'eeglab' as a command from the Matlab Command Window.

- Then, load data using EEGLAB, click 'REST'--> 'Re-referencing to REST'

Example data

- A preprocessed EEG data with average reference
- 62 channles
- Sampling rate 500Hz
- Visual oddball P300 task
- 30 target trials （label S22）



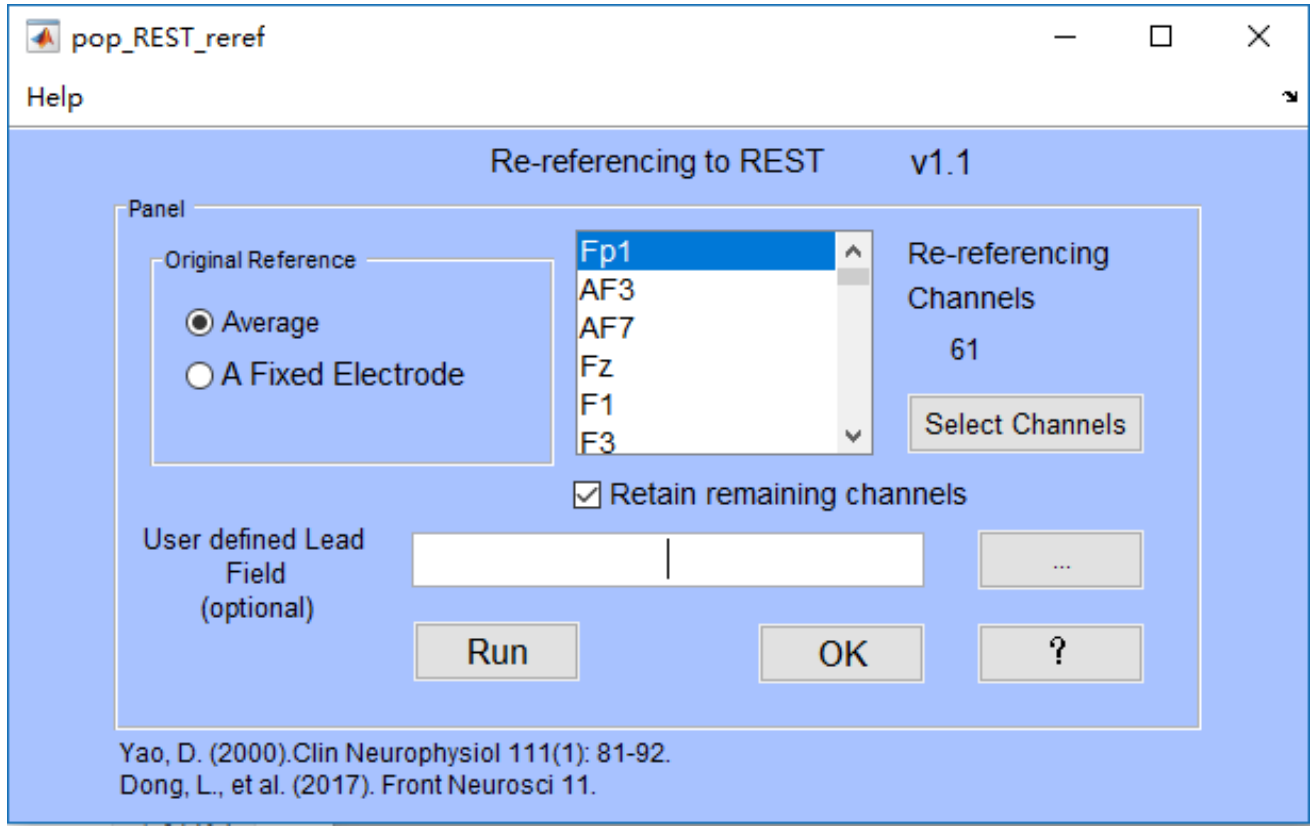
Li, F. L., et al. (2015) Scientific Reports 5.

Demo (step by step)

- [1] Select original reference of your EEG data (default is average).
- [2] Select Channels: Select EEG channels you want to re-reference (EEG channels 1-31, 33-62);

- Retain remaining channels?: if you want to keep un-selected channels in the data, check the box;

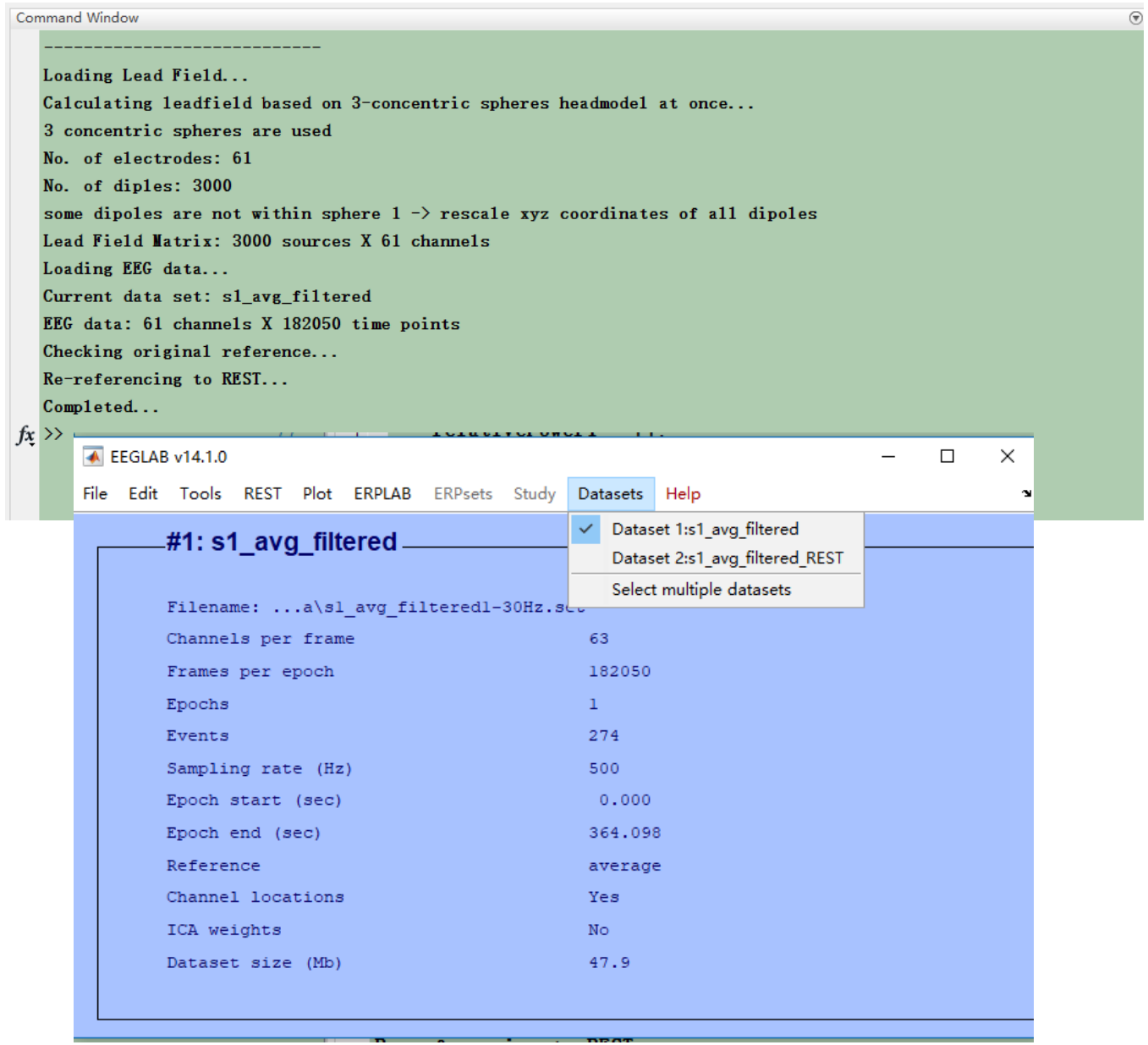
DO NOT select non-EEG channels!!!



Demo (step by step)

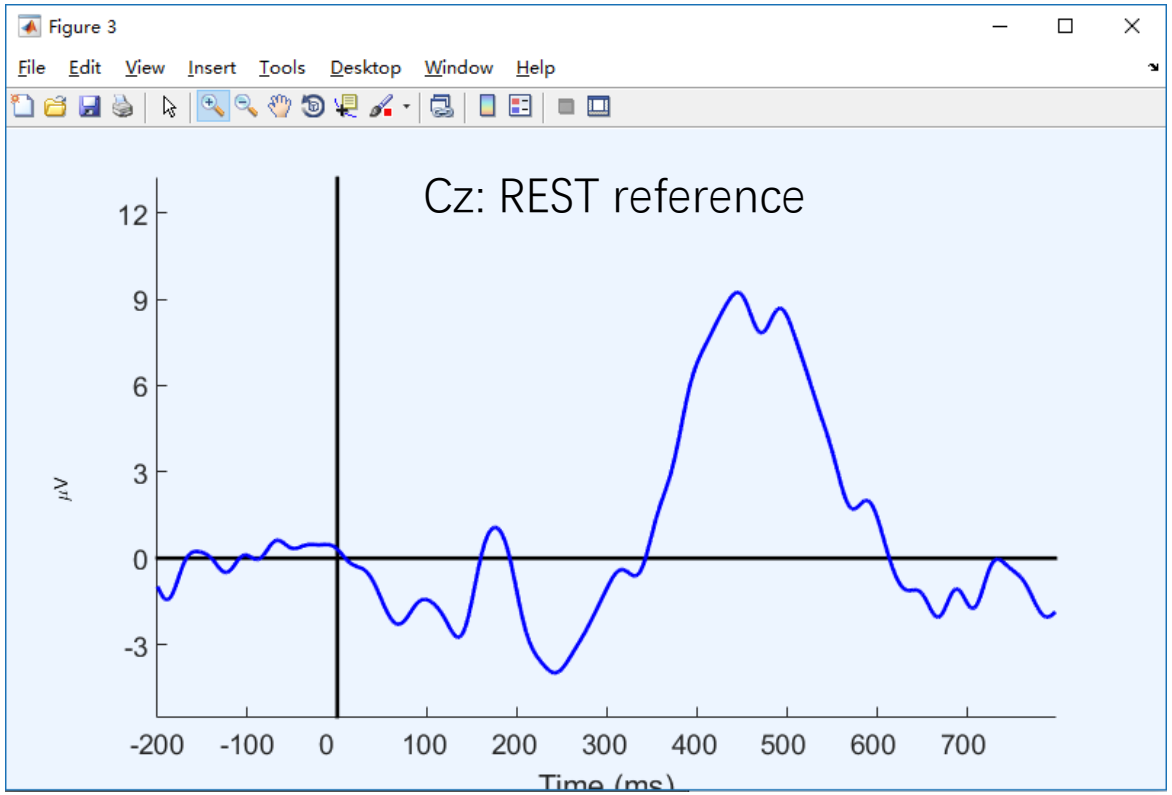
- [3] If channel location has been imported in EEG.chanlocs, press button ''Run'' directly; OR you can select a user defined lead field file, and then Press button ''Run'';

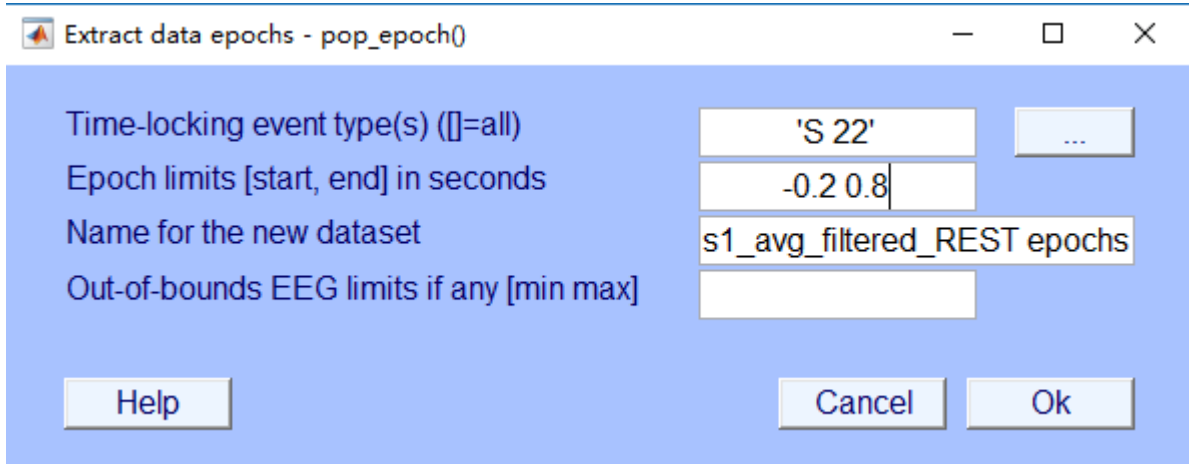
- [4] Press button ''OK'' to save the re-referencing data to workspace (ALLEEG).In EEGLAB, click 'Datasets'-->'*_REST'';



Demo (step by step)

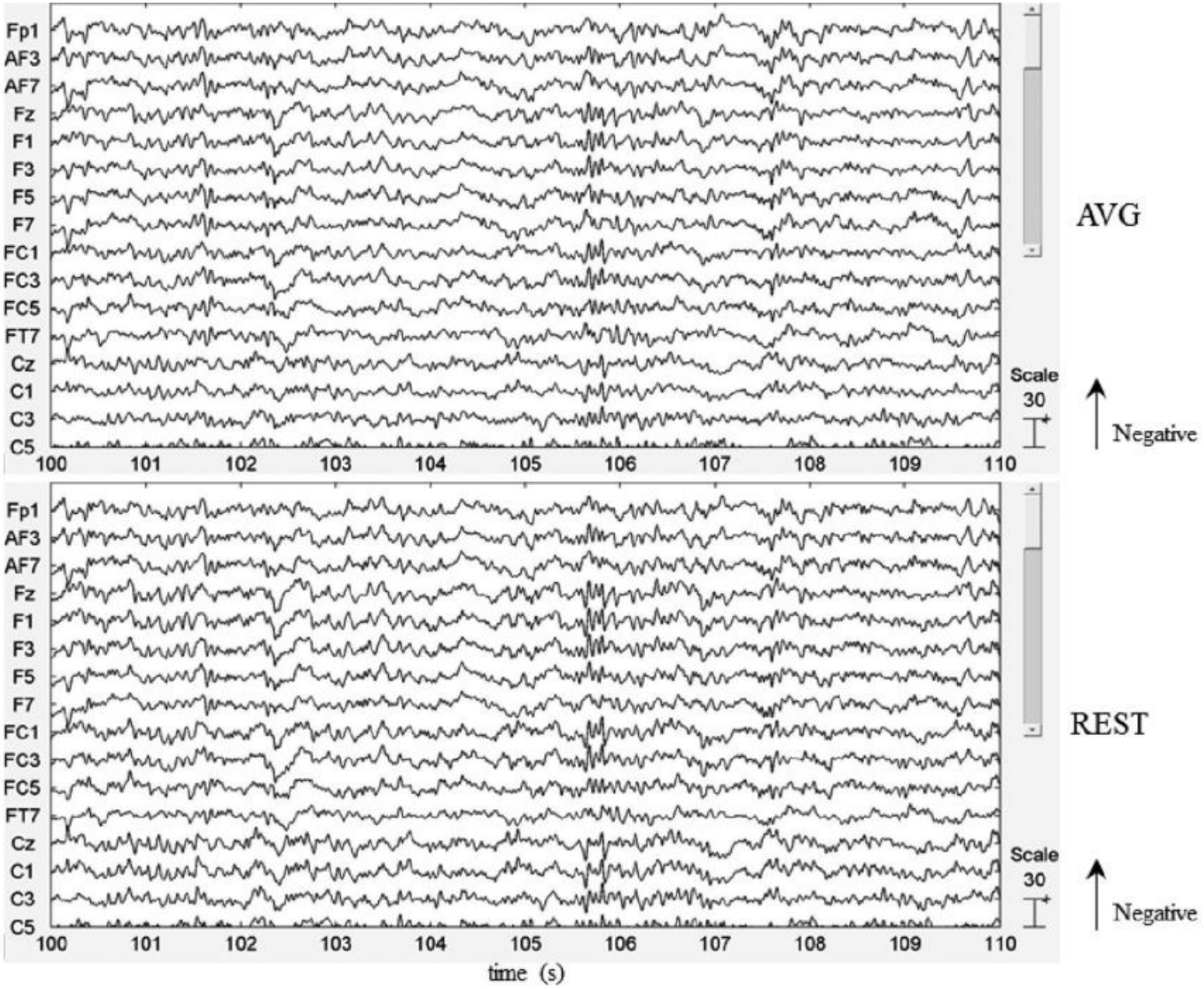
- Show results
- Tools->Extract epochs





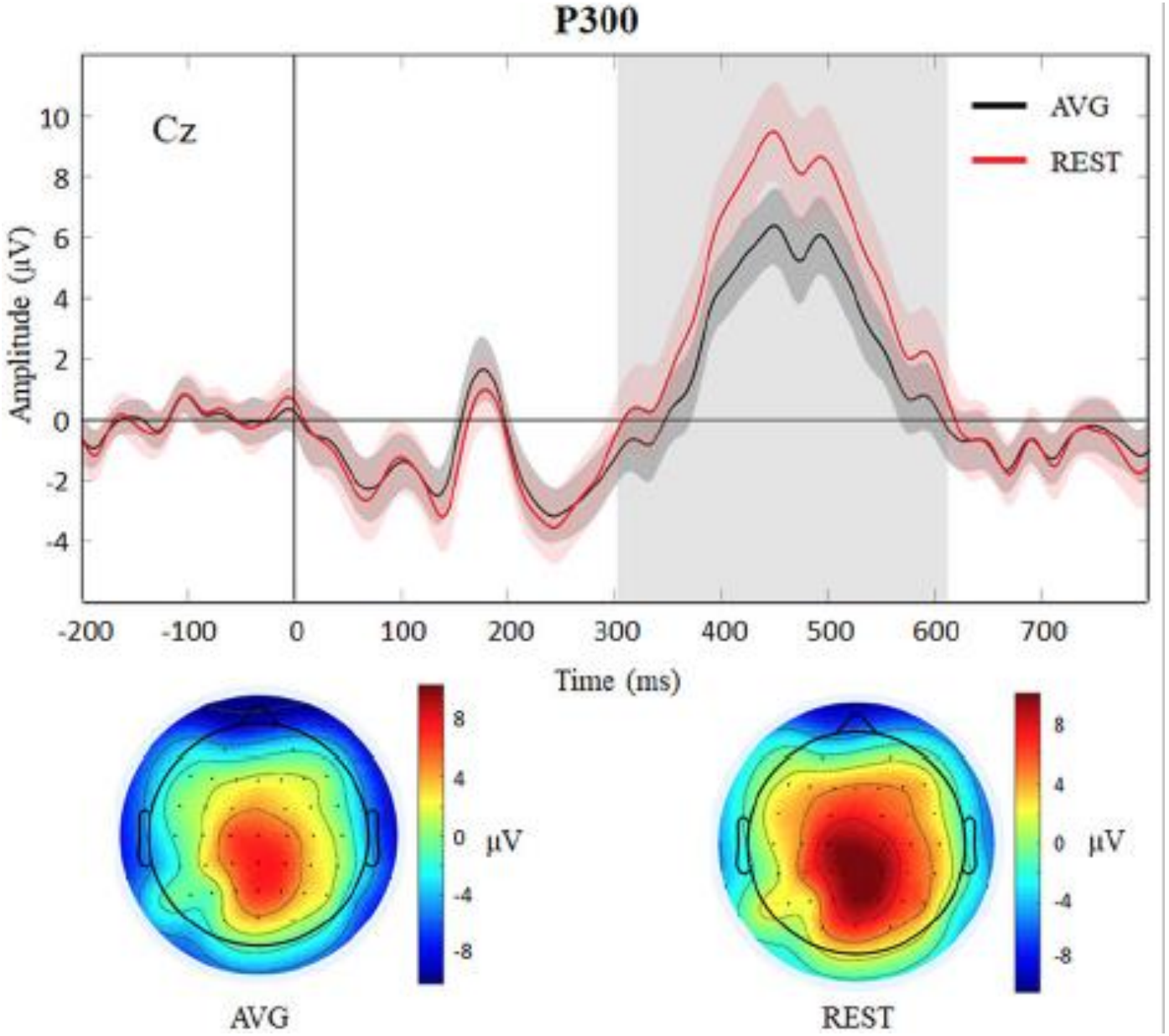
REST vs AVG

Figure shows that by visually inspecting the EEG figures of AVG and REST references, the similar EEG waves were observed, roughly.



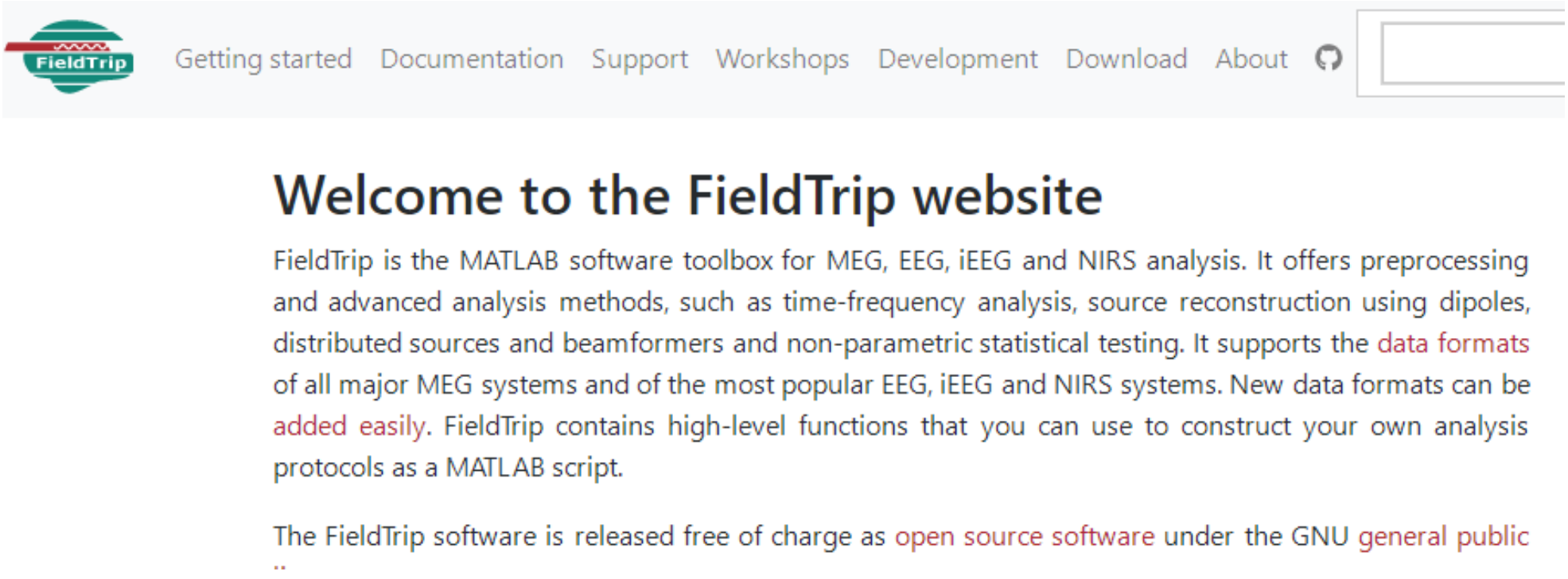
REST vs AVG

- P300 waves (with standard error) of AVG and REST references for Cz are showed and topographies of AVG (peaking at 450ms) and REST (peaking at 448ms) references are displayed.
- The gray region represents significantly (paired t-test, P < 0.05) larger signal intensity of P300 for REST than AVG.



REST in FieldTrip

- REST was integrated in the FieldTrip



http://www.fieldtriptoolbox.org/

REST in FieldTrip

- Usage

See test_ft_preprocessing_REST_574

```
ft_defaults;

load test_pr574.mat % load data and leadfield calculated by FieldTrip
% --------------------------------------------------------------------
% rest re-referencing
cfg = [];
cfg.reref       = 'yes';
cfg.refmethod     = 'rest';     %  if select 'rest','leadfield' is required.
cfg.leadfield = lf;
%               The leadfield can be a matrix (channels X sources)
%               which is calculated by using the forward theory, based on
%               the electrode montage, head model and equivalent source
%               model. It can also be the output of ft_prepare_leadfield.m
%               (e.g. lf.leadfield) based on real head modal using FieldTrip.

% cfg.refchannel = data.label([1:3,5:60],1); % use first 60 channels
cfg.refchannel     = {'all'};    % vector with indices of the selected channels
%                                  %  (re-referenced channels), or 'all'.
data_eeg_rest        = ft_preprocessing(cfg,data);
% --------------------------------------------------------------------
```