

EEGLAB plugin Darbeliai

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1 Purpose and features

EEGLAB plugin **Darbeliai** was created with intention to facilitate batch processing of selected EEG data files in graphical user interface (GUI). **Darbeliai** uses EEG data files in various formats (*.set, *.edf, *.cnt and others) as input directly, and outputs processed data directly to files in EEGLAB data format (*.set), so this in contrast to EEGLAB itself where user must work with EEG datasets. So (in most cases) you no longer need to care about EEG data importing from raw EEG files into EEGLAB dataset and writing processed data back to file.

In Lithuanian – the most archaic live Indoeuropean language – *darbeliai* means *the little works*.

As of **Darbeliai** 2015.04.15 version, this EEGLAB plugin allows you to accomplish these jobs:

- **rename** EEG data files according dataset attributes (like subject, group, experiment condition or session), also **extract** these **attributes** from filenames and edit them manually (only EEGLAB *.set files supported);
- **execute sequence** of selected EEG processing tasks; results of each separate task can be saved with different filename suffix and/or into different subfolder.
- simple and **conditional epoching** (e.g. by particular stimulus if particular response exist);
- **ERP visualization** and **feature extraction, exporting** not only file-by-file, but also averages for subjects, groups, sessions, conditions separately, filtered by event type, channels and for custom time window;
- EEG spectrum visualization and **spectral power** analysis for both absolute and relative power in separate customisable power bands, though delta, theta, alpha, beta are predefined;
- **custom command** execution for list of data files.

Other features:

- **filename filtering** separately for listing available files and for selecting them;
- ability to work with **multiple subdirectories**;
- Loading files into EEGLAB as datasets after completing job;
- **RAGU** integration in menu, ERP data exporting for RAGU;
- two **languages** supported (Lithuanian and English) and it would be easy to add more;
- **multiplatform**: tested in Windows and Linux, with systems of different encodings.

2 Requirements

Before using **Darbeliai**, you must install:

- MATLAB
- EEGLAB 12 or newer is recommended

3 Installation

You can install Darbeliai plugin for EEGLAB by one of three ways. Note: Last two methods will (or will not) install a bit different version compared to installation via EEGLAB plugins' menu.

3.1 From EEGLAB v13 menu

Users of EEGLAB v13 (or newer version) can install plugin by these steps:

1. In MATLAB start EEGLAB.
2. EEGLAB menu *File* → *Manage EEGLAB extensions* → *Data processing extensions*.
3. Navigate dialogs by 'Prev. Page' and 'Next page' buttons to find plugin **Darbeliai**.
4. mark it for installation and press 'OK'.

3.2 Installation script

You can run MATLAB script, that automatically download plugin and extract it into EEGLAB plugins directory: https://github.com/embar-eeglab_darbeliai/raw/stable/UTF-8/atnaujinimas.m

3.3 Manually

You can download https://github.com/embar-eeglab_darbeliai/archive/stable.zip achive manually and extract it into EEGLAB installation subdirectory named 'plugins'. This method must work for all users of any supported EEGLAB version.

4 Usage

4.1 Common behaviour

Then EEGLAB is started, you can see menu **Darbeliai** (Fig 1).

Common elements in dialogs (see 2 Fig.):

1. File loading options allows to select main directory for input files, and (sometimes) file loading order between functions.
2. Selection of files for processing.
3. Options of tasks.
Dialog-specific part.
4. File saving options. Allow change output directory (and some parameters).
5. Behaviour at termination of tasks.
6. Button for execution of functions.

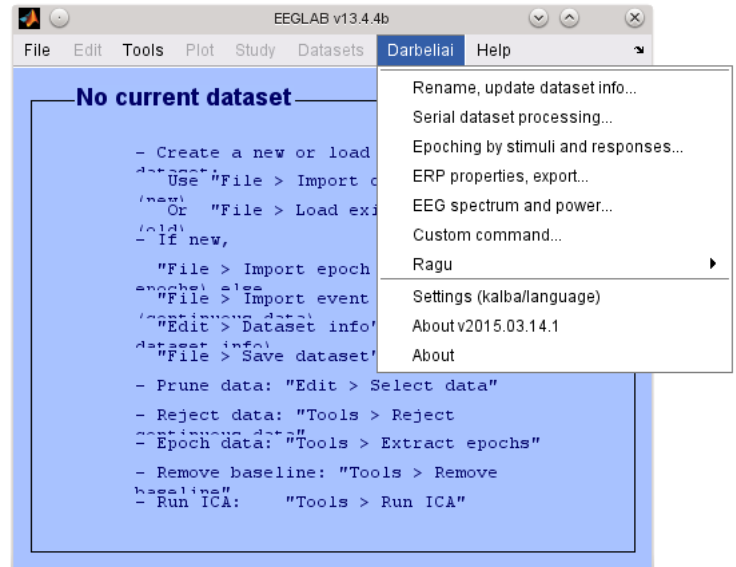


Fig 1: Darbeliai in EEGLAB

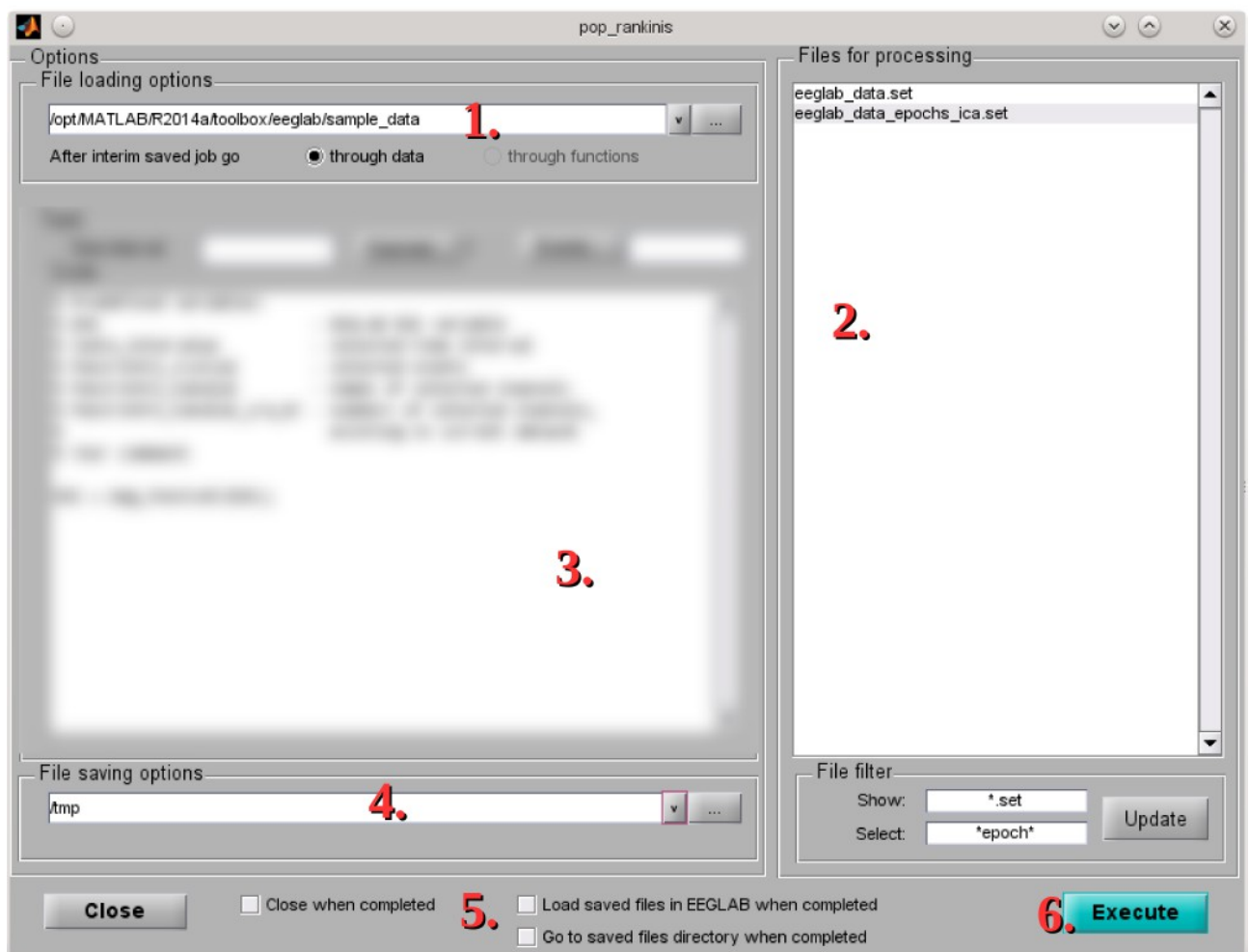


Fig 2: Typical dialog

- Ways to select directory for input or output (1 and 4 in Fig 2):
 - Enter path manually. If directory does not exist, program will ask about creation of it.
 - Press [...] to navigate for existing directories.
 - Or press [v] to choose one from list: any level parent directory, one level subdirectory, directory of EEGLAB sample files (for input), temporary directory (for output) or some folder from history.
- Tips for selection of files (2 in Fig 2).
 - Files (to be displayed for selection) can be determined by entering filter string at 'Show';
 - '*' means all files;
 - 'x*' means all files, beginning with x;
 - '*.set' means all files ending with '.set';
 - multiple rules can be separated by semicolon (;), e.g. '*.set;*.edf;*.cnt';
 - you can search for files in subdirectories:
 - './/*/*.set' – search *.set format files in one level subdirectories in Linux/MAC;
 - './/*/*/*.set' – search *.set format files in two level subdirectories in Linux/MAC;
 - './*/*.set' – search *.set format files in one level subdirectories in MS Windows;
 - './*/*/*.set' – search *.set format files in two level subdirectories in Windows;
 - you can search for files in parent directories:
 - '../*.set' – search *.set format files in parent directory in Linux/MAC;
 - '../../*.set' – search *.set format files in two levels up directory in Linux/MAC;
 - '..*.set' – search *.set format files in parent directory in MS Windows;
 - '..\..*.set' – search *.set format files in two levels up directory in MS Windows;
 - Some more complex example for Linux/MAC (in Windows folders separated by '\'):
 - '../m*.set;v*.set;./t*.set;./u*.set' – search *.set files, but in main directory look for files beginning with 'u', in parent – with 'm' or 'v', in subdirectories – with 't'; i.e. if directory is not specified in some part of filter, filter is applied for last directory; to search in main directory, you must begin part of filter with './' for Linux/MAC or './' for Windows.
 - Files can be selected (marked) by entering filter strings at 'Select'. Rules same as above.
 - You can select multiple files by mouse (hold Ctrl), by keyboard (hold Ctrl or Shift, move with ↑ and ↓, select with space).
- Dialog-specific options for particular tasks.
 - Options can provide button to select EEG channels and/or events (that exist in selected EEG data files), but this feature will work only with EEGLAB *.set files.
- Button for execution activation (6 in Fig 2).
 - You must select some files and choose correct parameters of tasks/functions, otherwise you can not press this button. Problematic area usually will be marked by yellow color.
- 'Closing then completed' closes active dialog of 'Darbeliai' then all task in it are done; EEGLAB or MATLAB program will not be closed.
- 'Go to saved files directory then completed' option will change main directory for opening of files by value of output directory.
- 'Break work' checkbox will appear at execution. If checked, program will stop execution of job not immediately, but safely after completing tasks with current data file. This checkbox will be automatically checked, if you press [Close] button in dialog or if you try to close window itself; if you do so and if checkbox is already checked, program may ask you about terminating of jobs.

4.2 Renaming datasets and/or updating dataset information

Go *Darbeliai* → *Rename, update dataset info...* Opened dialog (3 Fig.) is not typical in this plugin.

1. Choose directory and select *.set files to be renamed, copied and/or updated.
2. Choose output directory and see new names for appropriate original files.
3. Program try automatically construct unique filenames by rules. At first it try split original filenames by guessing its schema (influenced by separators). Rules can be defined manually.
4. Press 'File name parts' to see result of filename analysis (see table in 4 Fig.).
5. Define new information by these parts (%N format) or manually, press [*Copy*] or [*Rename*].

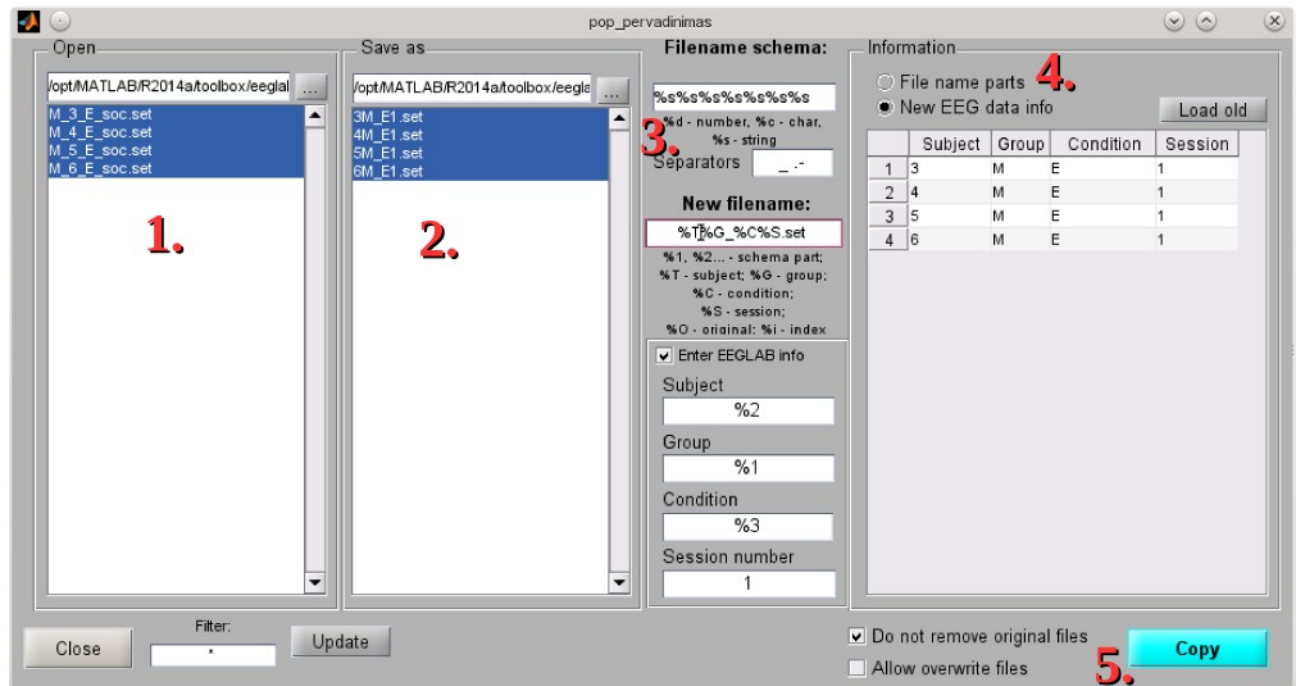


Fig 3: Dialog for renaming and updating information in datasets

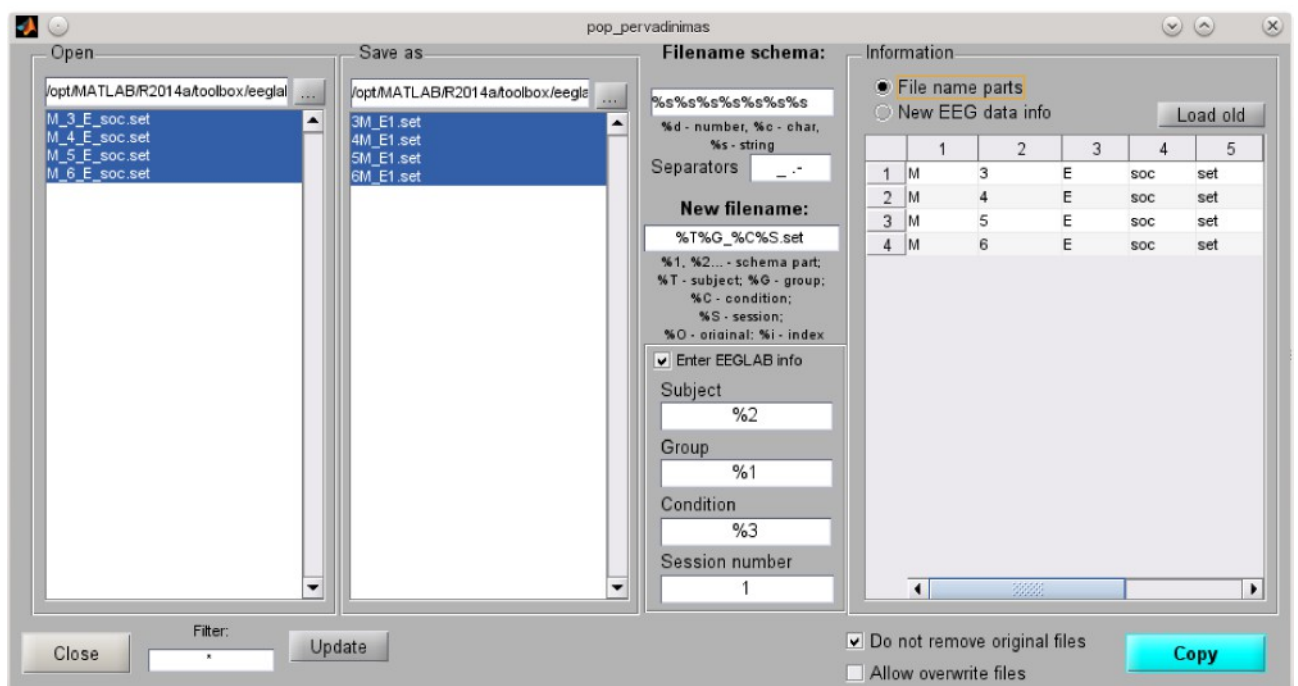


Fig 4: Review analysed parts of original filenames

4.3 Serial EEG data processing

Go Darbeliai → Serial processing...

Features:

1. Almost 20 selectable tasks can be done within this dialog.
 - Note: Some functions may be grayed, if required plugin was not found in EEGLAB.
 - Note: You can interpolate electrodes only according built-in 64 electrodes schema.
2. You can specify filename suffix then saving file after appropriate task.
3. If you mark checkbox for subdirectory, result of particular task will go into it. If you don't mark these checkbox, result will not be written to disk, unless that task is the last one.
4. After saving interim result, you can
 - continue to do next tasks with just processed EEG data file, and switch to next original data file only after completing all selected tasks (option '*After interim saved job go through data*');)
 - or open next file(s) to do same task(s) until saving result to disk, and switch to next task(s) only after processing all original (or interim) EEG data files (option '*After interim saved job go through functions*').

Output subdirectories are always numbered. You can set value at '*# of done jobs for subdir names*' to change initial number in name of subdirectory (default 0, means that there is zero already numbered subdirectories, so numbering starts from 1)

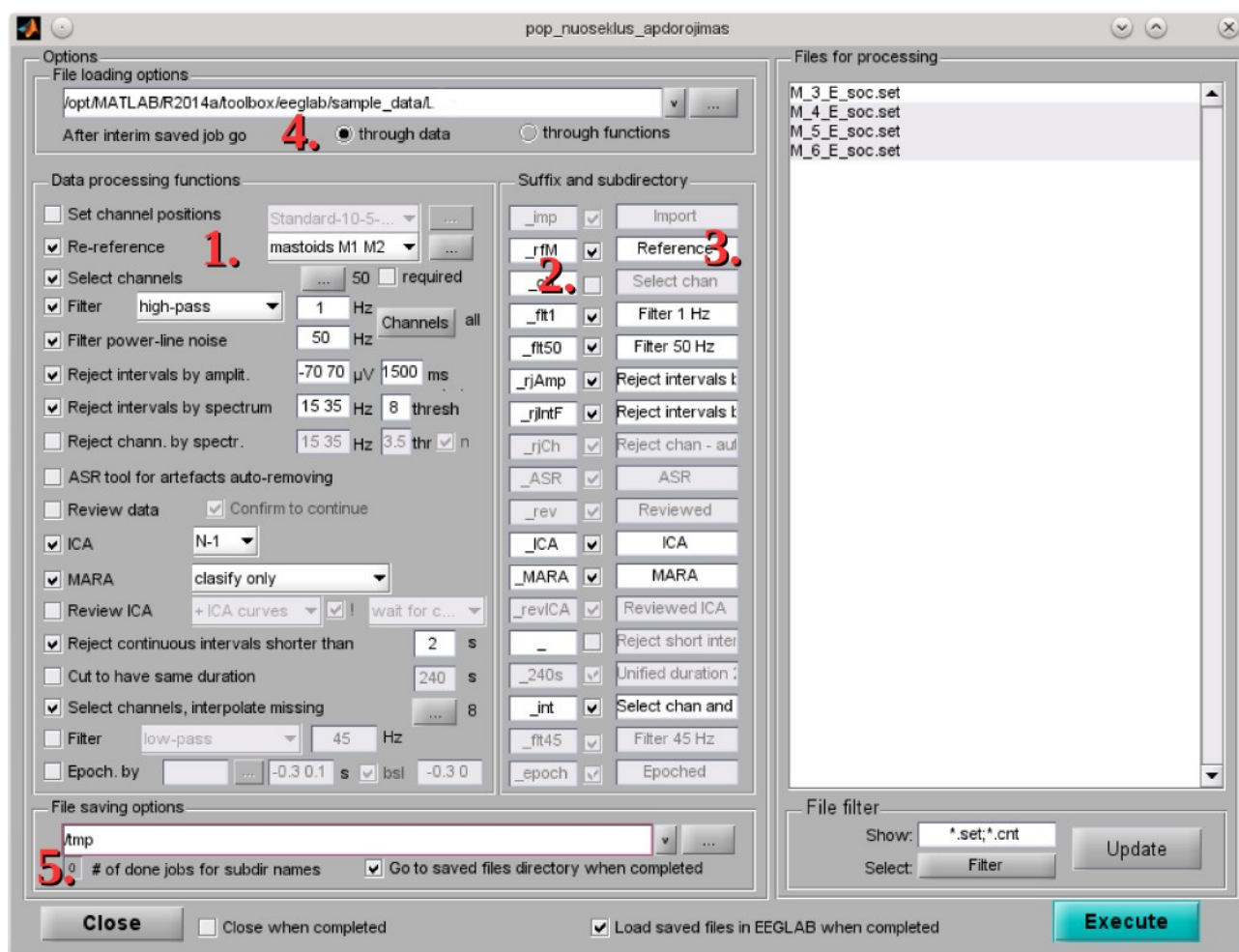


Fig 5: Serial processing

4.4 Complex epoching

Go Darbeliai → Epoching by stimuli and responses...

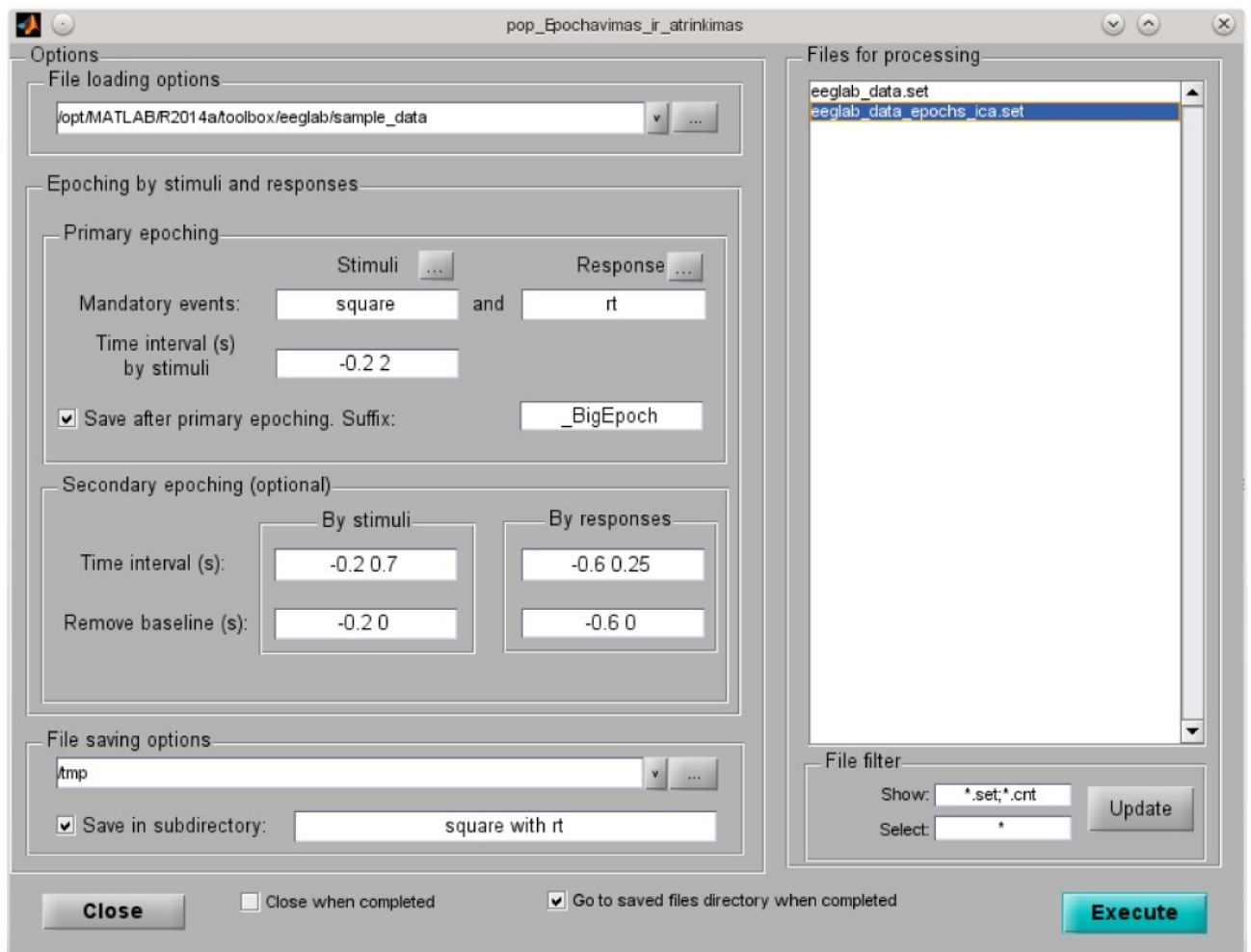


Fig 6: Epoching by stimuli and responses

This dialog allows to create epochs by events (usually – by stimuli; by any event at 'Stimuli' in 'Primary epoching' section) and select only those epochs, that contains particular events (usually – responses; any event at 'Responses' in 'Primary epoching' section). Multiple stimuli and responses can be entered at once: numeric events can be entered manually, or by pressing [...] button and selecting in pop-up dialog; string events can be selected only in pop-up dialog. If such big epochs are all what you need, then make sure to check 'Save after primary epoching' and clear parameters in 'Secondary epoching (optional)' section.

Optionally you can further split generated epochs to get files, containing one particular stimulus (but any response), one particular response (but any stimulus) or both (with one particular stimulus and one particular response). This is meaningful, if primary epoching was done with multiple stimuli and responses. To do so, enter time window values for stimulus and/or responses at 'Time interval (s)' in 'Secondary epoching (optional)' section. If values at 'Remove baseline (s)' are not empty, baseline remove will be removed.

Note: If option 'Save after primary epoching' is not checked and parameters in 'Secondary epoching (optional)' section are cleared, no output will be generated!

4.5 ERP properties, ERP export

Go Darbeliai → ERP properties, export...

Features:

- ERP visualization with optional legend (check 'Preview')
 - for separate files or for averages of subjects, groups, conditions, sessions, custom filter;
 - for each selected channel or for mean of these channels;
 - for selected events (current version merges all events, don't display event separately);
 - click ERP image to open it in separate window.
- ERP properties calculation
 - in all or selected time interval,
 - mean, minimum and maximum amplitude, area; time and amplitude at half area.
- ERP properties export to text (TXT), Excel (XLS) or MATLAB (MAT) file.
- ERP export to text (TXT), RAGU or Excel (XLS) file.

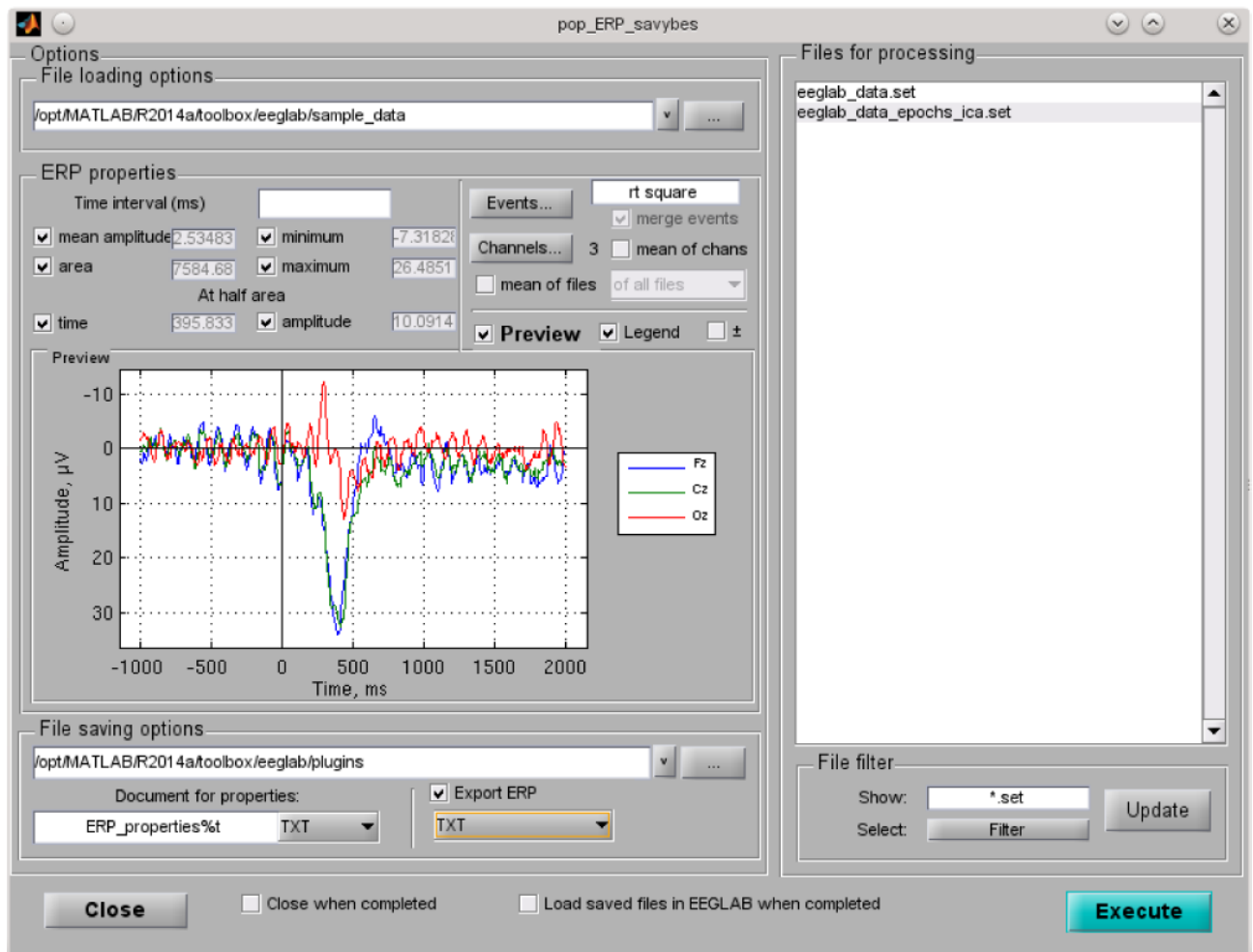


Fig 7: Dialog for ERP and its properties visualization, exporting

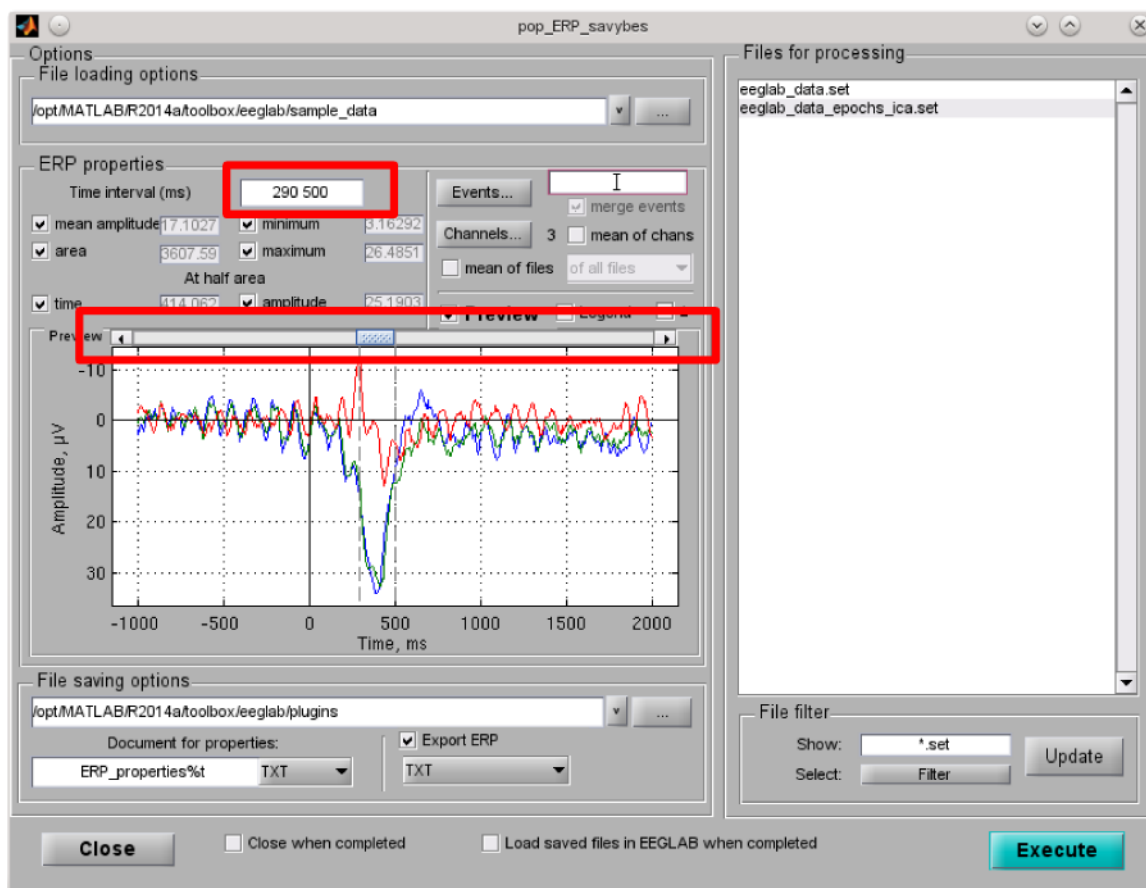


Fig 8: Then time interval is specified, it can be moved by slider

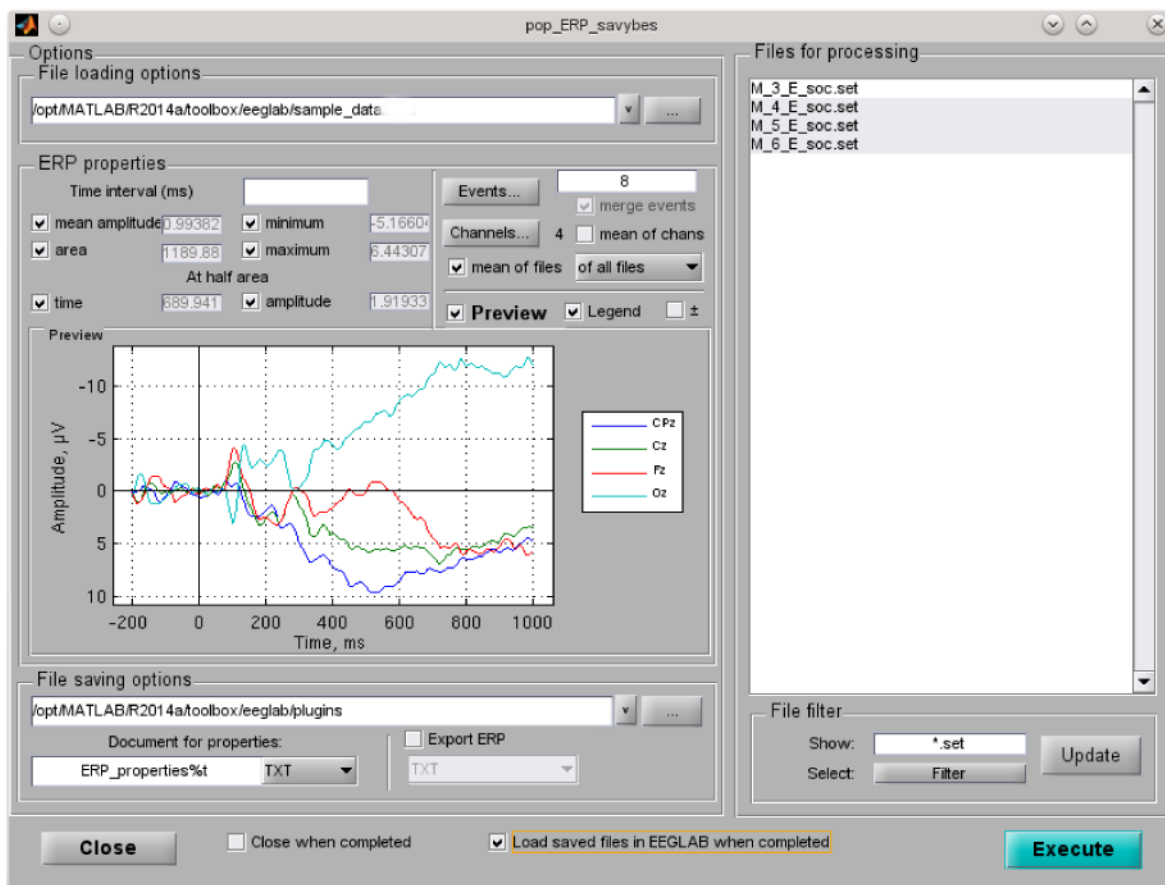


Fig 9: ERP can be averaged for all files or by subject, groups, session, condition...

4.6 Spectral power

Go Darbeliai → EEG spectrum and power...

Features:

- absolute and relative spectral power calculation (Fast Fourier Transform (FFT) algorithm);
- spectrum, absolute and relative spectral power visualization;
- customizable spectral bands: press [+] to add new band or [-] to remove last line;
- customizable frequency interval for all power (default auto – from minimum to maximum according specified spectral bands; most meaningful in relative power calculation);
- customizable FFT window length (default 2 s);
- customizable spectral accuracy ('spectrum steps', default 10 points / 1 Hz);
- channel selection for analysis;
- missing channel interpolation using built-in 64 channels schema;
- export of results.

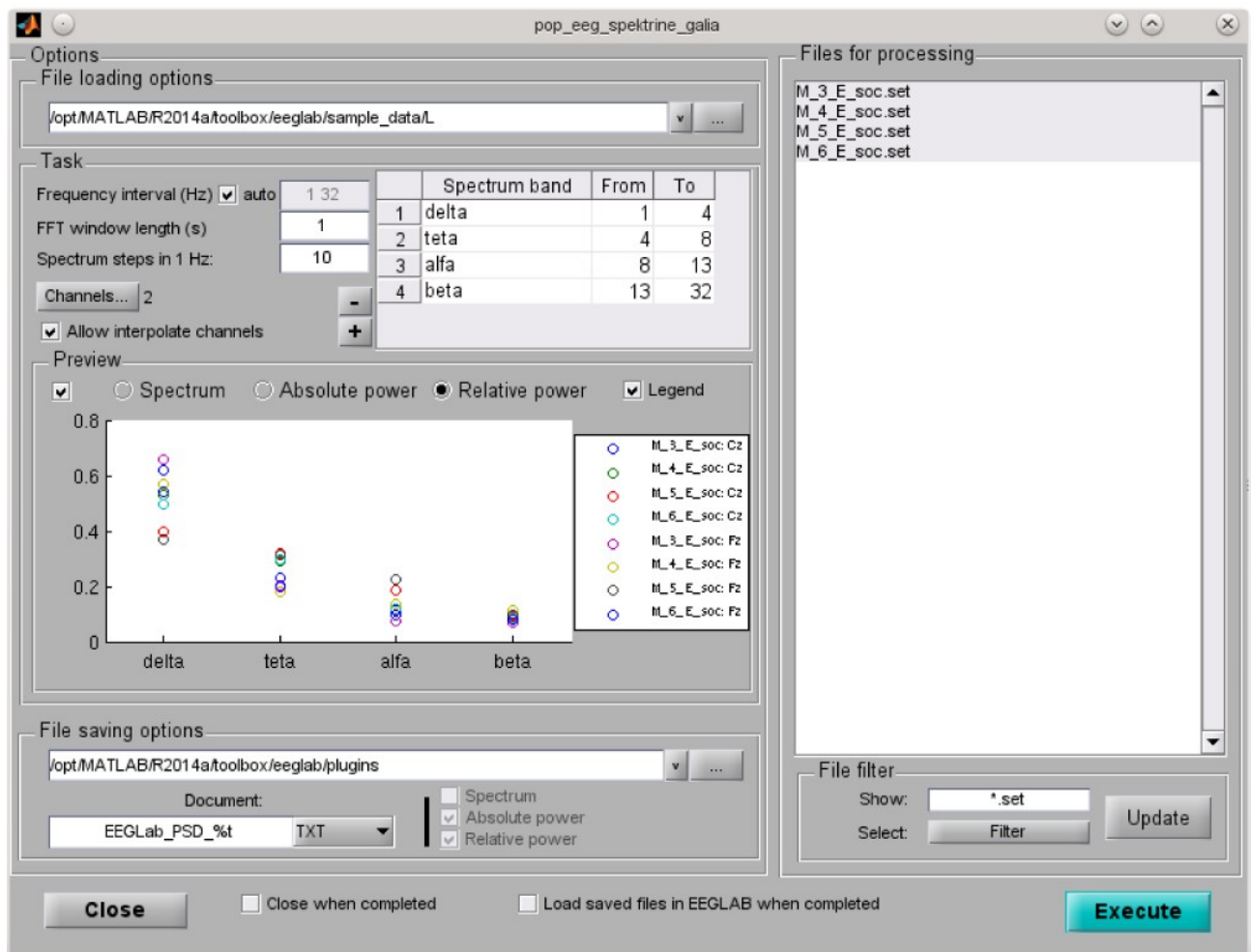


Fig 10: Dialog for spectral power visualization and exporting

4.7 Custom command execution

Go Darbeliai → Custom command...

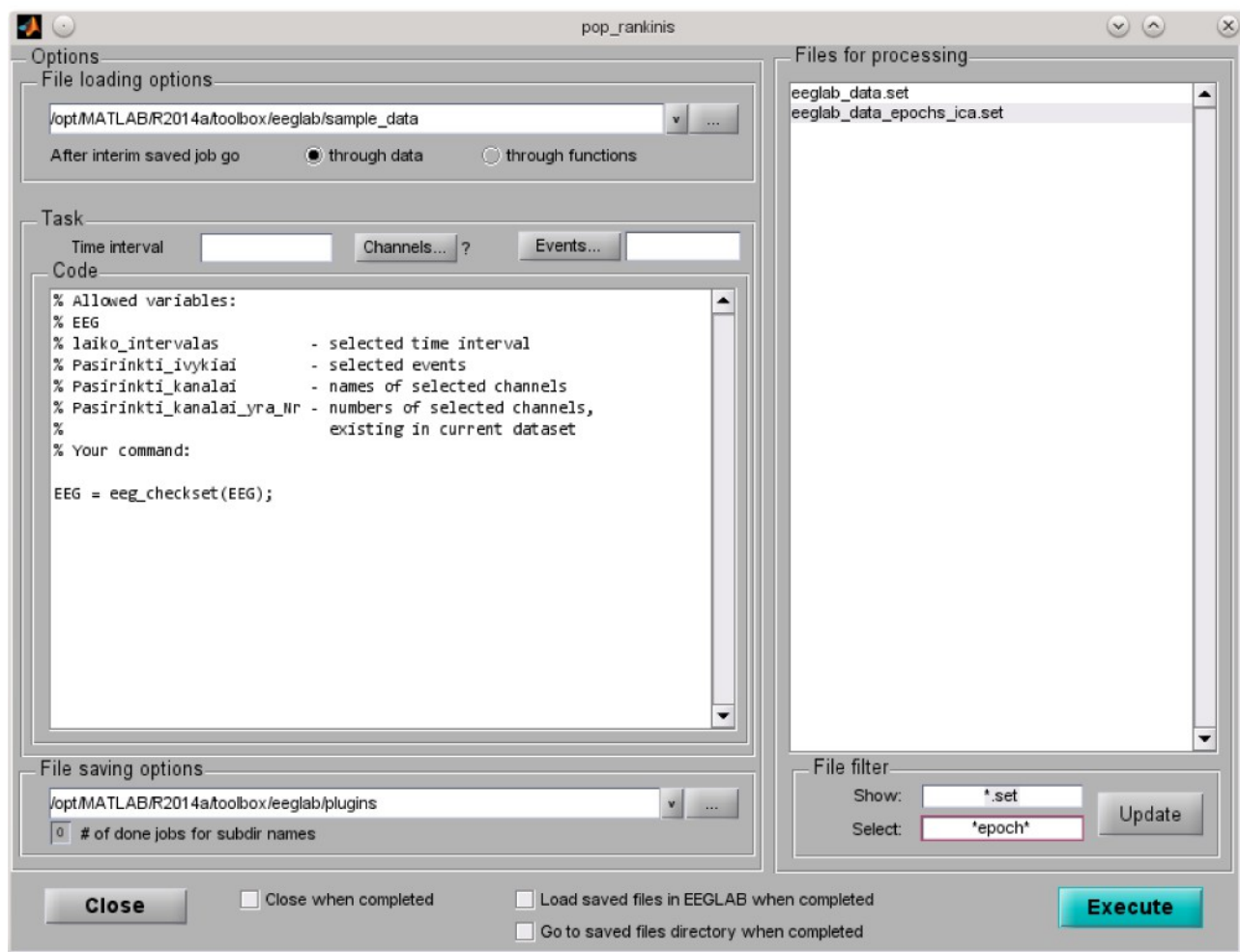


Fig 11: Dialog for custom command

Each your selected file will be processed by your custom script and EEG variable will be saved with same filename as original file in EEGLAB data format (*.set), so if you don't want to overwrite existing file, make sure to set different output directory (at 'File saving options') then input (at 'File loading options').

Predefined variables:

EEG	- main EEGLAB EEG data variable;
laiko_intervalas	- selected time interval or any numeric entry;
Pasirinkti_ivykiai	- selected events;
Pasirinkti_kanalai	- names of selected channels;
Pasirinkti_kanalai_yra_Nr	- indexes of selected channels, but only existing in current dataset.

Strings after '%' symbol are comments (valid only in particular line) – they will not be executed.

For example, to select EEG data only in particular time window (e. g. first 30 seconds) for each file, you can write start and end of this window (e. g. '0 30') at 'Time interval', and at 'Code' put:

```
EEG = pop_select( EEG, 'time', laiko_intervalas );
```

or you can write directly:

```
EEG = pop_select( EEG, 'time', [0 30] );
```

5 Settings

Go *Darbeliai* → *Settings (kalba/language)*

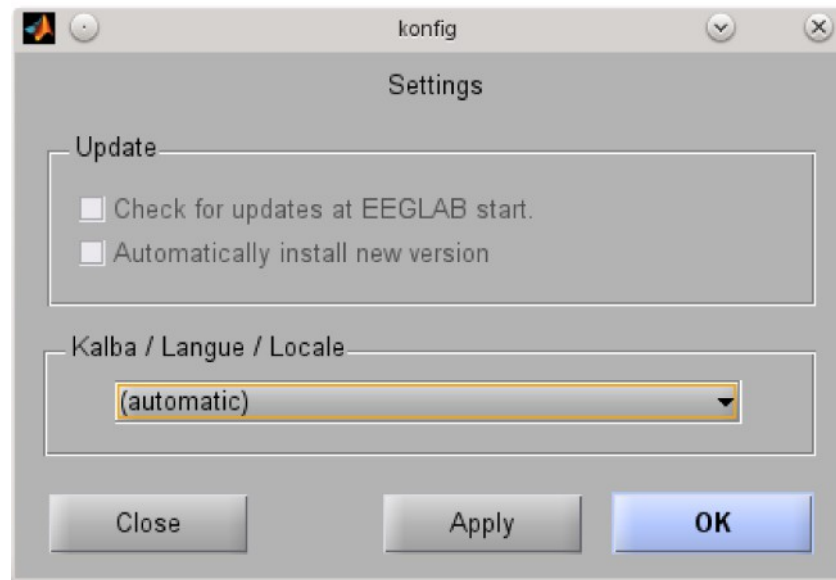


Fig 12: Settings dialog

If you installed **Darbeliai** via EEGLAB 13 plugins menu, you will not be able change options in 'Update' section. Otherwise you can select to check for **Darbeliai** updates at each start of EEGLAB and then to update (or not) to new version of **Darbeliai** automatically.

You can change interface **language**. Currently only Lithuanian and English languages are supported. By default language is set to 'automatic', i.e. guessing according your operating system or MATLAB environment, but with fallback to English in case of not existing translation of **Darbeliai**. Then program fallbacks to English, it prints warning message with instructions how to add new language.

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