

Getting started with the Sleep Micro-Waves Toolbox

After copying the *Sleep Micro-Waves Toolbox* files to a folder on your computer, launch MATLAB and check that you're in the folder that contains the toolbox, or that the path to the folder has been added to the MATLAB search path.

From the Matlab command window, type:

```
>> Sleep_Micro_Waves
```

This will launch the main toolbox window with the possibility to launch one of the three main modules:

- 1) Visual Detection
- 2) Automatic Detection
- 3) Visual Correction

The basic principles of how to use each one of these modules will be described below.

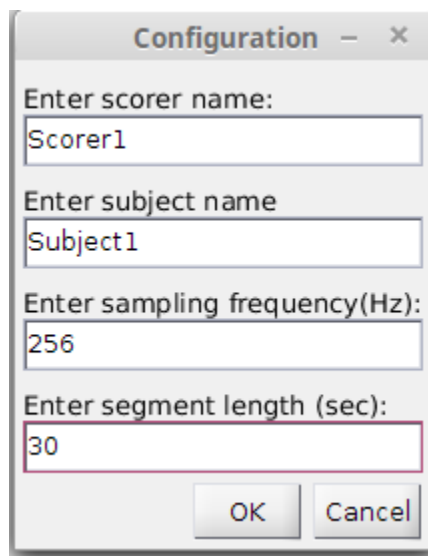
1) Visual Detection

-To load data go to the menu: File\Load EEG Data and select the file to import

e.g. test_data.mat

(If the data file contains more than one channel, you will be asked to choose one channel index)

The following message box will appear when you select a data file :



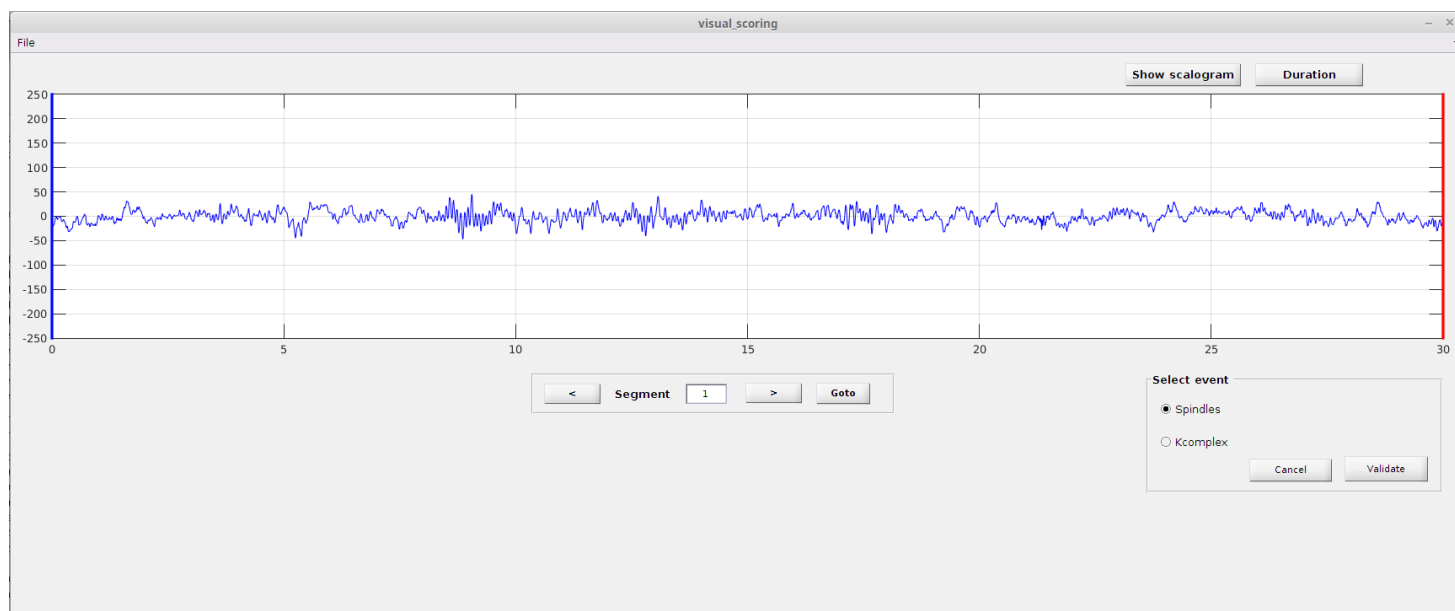
The image shows a 'Configuration' dialog box with four input fields and two buttons. The fields are labeled 'Enter scorer name:', 'Enter subject name', 'Enter sampling frequency(Hz):', and 'Enter segment length (sec):'. The values entered are 'Scorer1', 'Subject1', '256', and '30' respectively. The 'OK' and 'Cancel' buttons are at the bottom right.

Field Label	Value
Enter scorer name:	Scorer1
Enter subject name	Subject1
Enter sampling frequency(Hz):	256
Enter segment length (sec):	30

After entering the required information, press OK to launch the "visual_scoring" interface

To perform visual scoring

1. Mark the beginning and the end of the event you wish to score by moving the blue (begin) and red (end) lines using the mouse (click & drag).
2. Select the event type using radio buttons (on "Select event" panel)
3. Click on the "Validate" button to save the results (This will generate scorer "name_subject name_kcomplex.txt" and/or scorer "name_subject name_spindles.txt")
4. Move to the next/previous segment using the next/previous arrow buttons or go directly to a desired segment by typing in the data segment number in the text box and click the **goto** button



Note:

- 1) The generated text files will be saved in the Matlab **current directory**.
- 2) The **Cancel** button only allows the user to cancel the last marked event.
- 3) The **Duration** button is used to compute the duration of an event delimited by the two lines.
- 4) The **Show/Hide Scalogram** button computes and displays the Time-Frequency map of the current segment

2) Automatic Detection

i. Find the main Sleep_Micro_Waves window and select "Automatic Detection", this will close the Visual Detection window if it was open.

ii. Load data on which you wish to detect spindles and/or K-complex events. To do this, go to the menu: File\Load EEG Data and select the file to import

e.g. test_data.mat

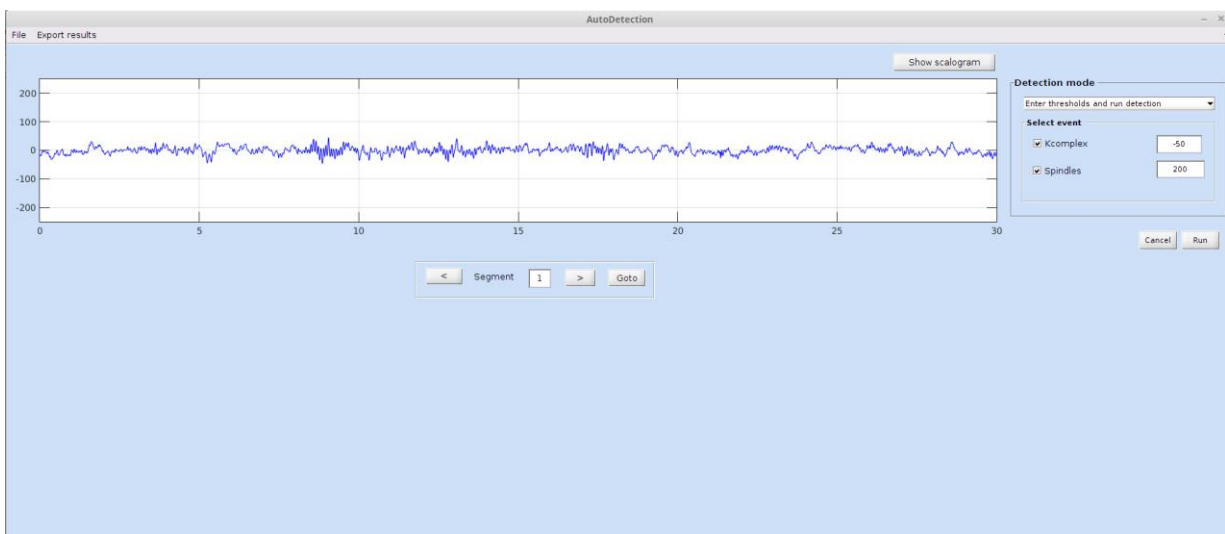
(If the data file contains more than one channel, you will be asked to choose one channel index)

iii. Select detection mode from the list menu (upper right corner)

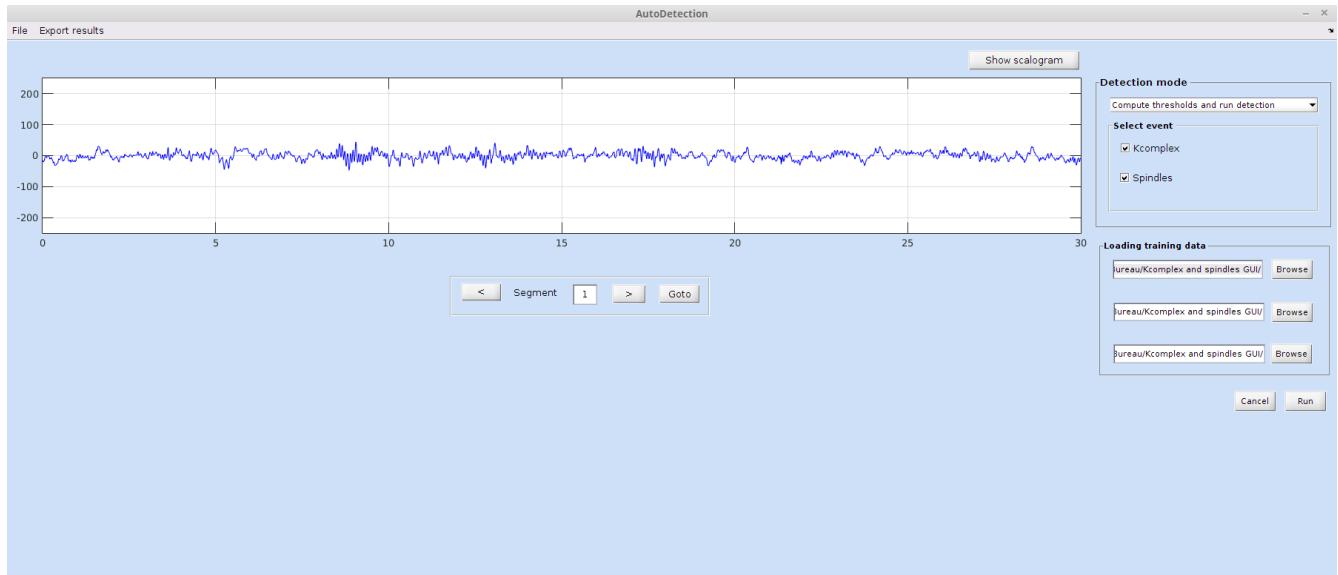
a) If you already know the thresholds you want to use (for example based on previous training) you can choose the "Enter thresholds and run detection"

Example values for the Kcomplex and spindle values are -50 and 200, but these values can change a lot depending on your data.

Example



b) If you wish to use the data as training to identify the best threshold values (recommended), select "Compute thresholds and run detection". This will require that you then select the training files to use for spindles and/or K-complex events and which visual scoring files to use for each.



Important:

- The visual scoring file should either be the output of the Visual Scoring module, or a text file in the exact same format (see appendix A).
- Note that training procedure can take several minutes, depending on the size and sampling rate of the training data.
- The results of the detection in this module are automatically saved in separate txt files (see Appendix B for the format)

OPTIONAL:

After the detection is complete, you can compute statistics on the detected events for the whole data sets (all epochs) by clicking on the menu button Export results. This function will compute statistics and save them to a .txt or .mat file.

The currently available statistics are:

- K-complex: Total number, Density, Frequency, Mean amplitude,
- Spindles: Total number, Density, Mean duration, Frequency, Mean amplitude,

3) Visual Correction

This module allows the user to manually correct the output of the automatic detection procedure (previous step).

i. Load data on which you wish to correct spindles and/or K-complex automatic detection. To do this, go to the menu: File\Load data and select the file to import

e.g. test_data.mat

(If the data file contains more than one channel, you will be asked to choose one channel index

ii. The visual correction interface allows two types of corrections:

- False negative corrections : add event that the automatic detector missed
- False positive detection: delete events has detected but the corrector don't agree

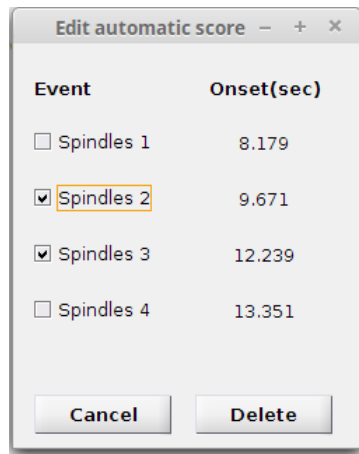
iii. Load Kcomplex and or Spindles automatic scores (the .txt file provided by automatic detection module)

you will be asked if even it is your first correction or not: if you answer 'Yes' a new file called 'automatic_score_kcomplex_corrected_by_experty.txt' will be used to save corrected scores, otherwise corrected scores will be saved in the same txt file previously loaded

Correcting False Positive events

Once the Kcomplex and /or Spindles score is loaded, a “Delete” event panel will appear in the lower right corner. To delete a false positive detection

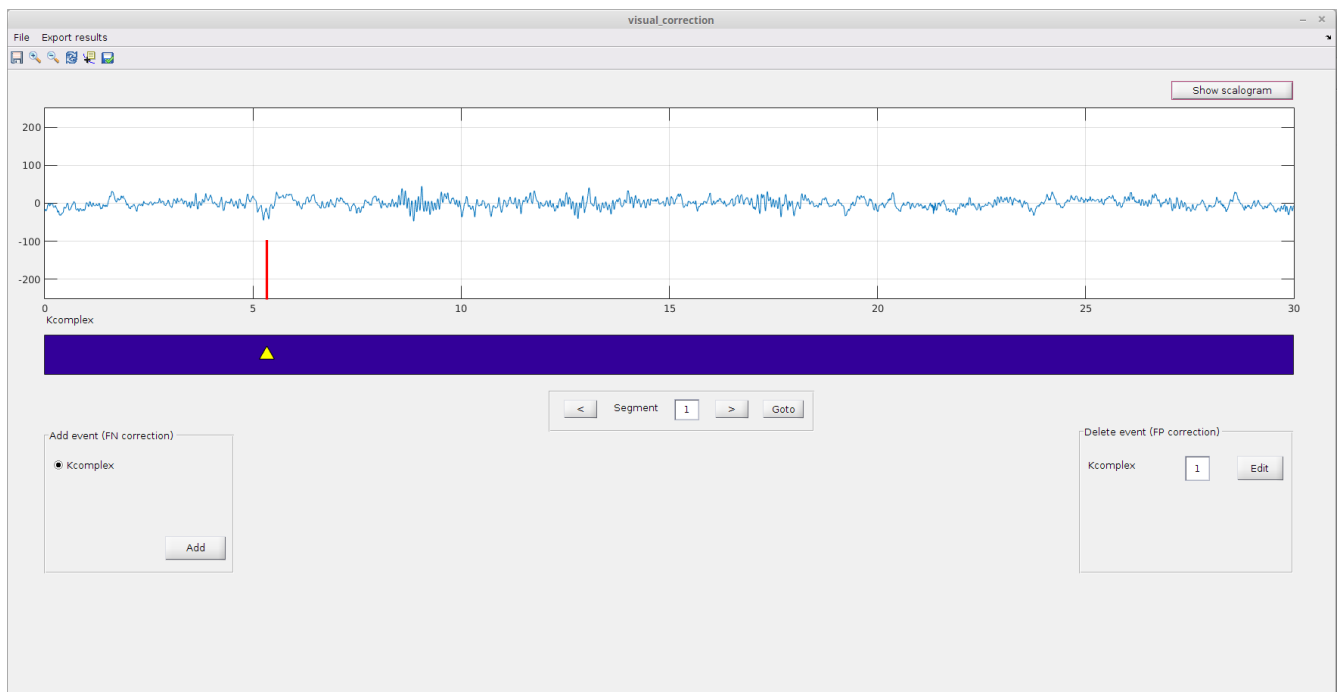
1. Click on edit button, a new interface will be shown
2. Select the event you wish to delete (select corresponding checkbox)
3. Press delete button



Correcting False Negative events

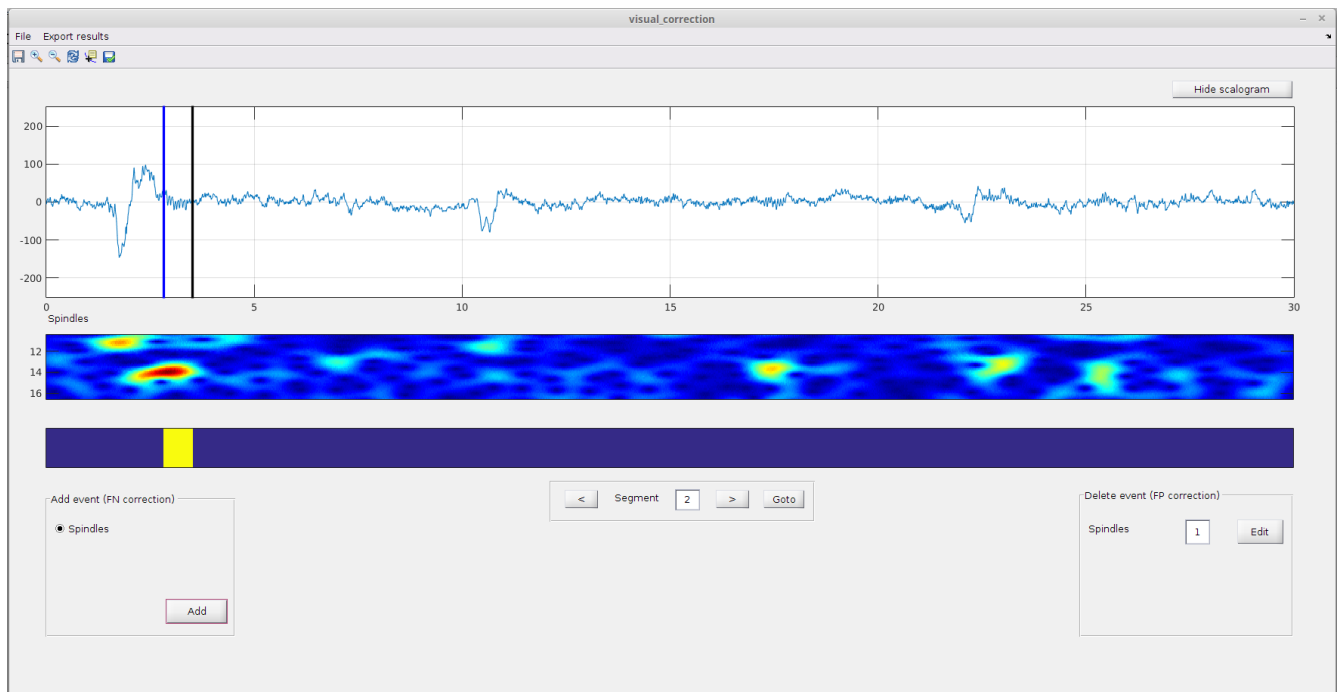
To add Kcomplex events missed by the automatic detector you should:

1. Select Kcomplex on the add event panel
2. Move the red line to the desired position
3. Press add button.



To add Spindles events

1. Select Spindles on the add event panel
2. Move the blue and black lines to delimit the event you wish to add
3. Click the “add” button.



Important:

- Saving the modifications can be done in two ways: the user should either click on the save icon in the toolbar menu (this will save in a .txt file uniquely the modification you made in the current segment), alternatively you can press the “auto save” button in the same toolbar. If this button is activated, all modifications will be saved automatically each time you click on “next” button.
- The “reset” button in the toolbar menu allows the user to reload the first score file, and in this case any modifications made on the current segment will be discarded.

Appendix A:

How to manually create a text file with the visual scoring information that is compatible with the detection module

Segment	Onset time(sec)	Offset time(sec)
1	8.4	9.54
1	12.41	12.94
2	2.16	3.53
2	17.10	17.83
2	21.3234	21.83

Appendix B:

Spindles automatic detection results text file format

Segment	# detected spindles	1 st spindle onset time	1 st spindle offset time	2 nd spindle onset time	2 nd spindle offset time
1	2	8.18	9.67	12.24	13.35
2	0				

Kcomplex automatic detection results text file format

Segment	# detected K-complex	1 st Kcomplex time	2 nd Kcomplex time
1	0		
2	2	1.82	10.71