WEARABLE Sensing

DSI-STREAMER TO EEGLAB EXTENSION

USER MANUAL

Version 1.07

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1. DISCLAIMER

Wearable Sensing's DSI-Streamer to EEGLAB Extension is provided to facilitate import of DSI-Streamer files into EEGLAB.

The DSI-Streamer to EEGLAB Extension is provided on "AS IS" basis. *WEARABLE SENSING*, INCLUDING ITS SUBSIDIARIES, DISCLAIMS ANY AND ALL WARRANTIES EXPRESSED, STATUTORY OR IMPLIED WITH RESPECT TO THE SYSTEM OR THE MATERIALS, INCLUDING BUT NOT LIMITED TO ANY IMPLIED WARRANTIES OF MERCHANTABILITY, NON-INFRINGEMENT OR THIRD PARTY RIGHTS

2. QUICK GUIDE

2.1 System Requirements:

- MATLAB*, 2008 or more recent recommended*
- EEGLAB, *v.12 or more recent recommended.*
    - *See: hthttps://sccn.ucsd.edu/eeglab/downloadtoolbox.php*
- DSI-Streamer to EEGLAB Extension
    - *See: http://sccn.ucsd.edu/wiki/EEGLAB_Extensions*
    - *Or Install directly from EEGLAB menu tab* ***File > Manage EEGLAB Extensions***
- Wearable Sensing DSI-Streamer files (.csv format)

2.2 10 Steps to Load .CSVs into EEGLAB

1. Open EEGLAB through MATLAB
2. Install the Wearable Sensing DSI-Streamer to EEGLAB Data Import Extension directly from EEGLAB menu tab **File > Manage EEGLAB Extensions.**

   Alternatively, you can:

    a. Download from http://sccn.ucsd.edu/wiki/EEGLAB_Extensions

    b. Unzip the extension manually into \eeglab_(version)\plugins\
3. In the EEGLAB window, click on the **File** menu.
4. In the **Import Data** submenu, go to **Using EEGLAB Plugins and Functions.**
5. Click **From WearableSensing .CSV Files (WearableSensing Plugin).**
6. Navigate to a .CSV you want to open, select it, and click **Open**.

7. In the window that appears, you may specify channels, the time range, and a low-pass filter.
8. After modifying these values or choosing to accept the defaults, press the **OK** button.
9. In the prompt that appears, you may give the dataset a name for internal EEGLAB use.
10. Click **OK**. You may now use EEGLAB to process and observe the data you have loaded.

3. DESCRIPTION OF EEGLAB AND EEGLAB EXTENSION

3.1 What is EEGLAB?

Taken from the SCCN Website (sccn.ucsd.edu/eeglab):

> EEGLAB is an interactive MATLAB toolbox for processing continuous and event-related EEG, MEG and other electrophysiological data incorporating independent component analysis (ICA), time/frequency analysis, artifact rejection, event-related statistics, and several useful modes of visualization of the averaged and single-trial data. EEGLAB runs under Linux, Unix, Windows, and Mac OS X.

From the perspective of a person using DSI-Streamer, EEGLAB is a free MATLAB-based tool that can be used to analyze the EEG data recorded with DSI-Streamer. Its GUI enables people with minimal MATLAB experience to perform spectral and ERP analysis, ICA decomposition, dipole fitting, and several methods of visualizing EEG data. For those with more MATLAB experience, EEGLAB also conveniently loads DSI-Streamer's .csv files into the MATLAB workspace that makes it available for many more methods of analysis.

3.2 What is the Wearable Sensing EEGLAB Extension?

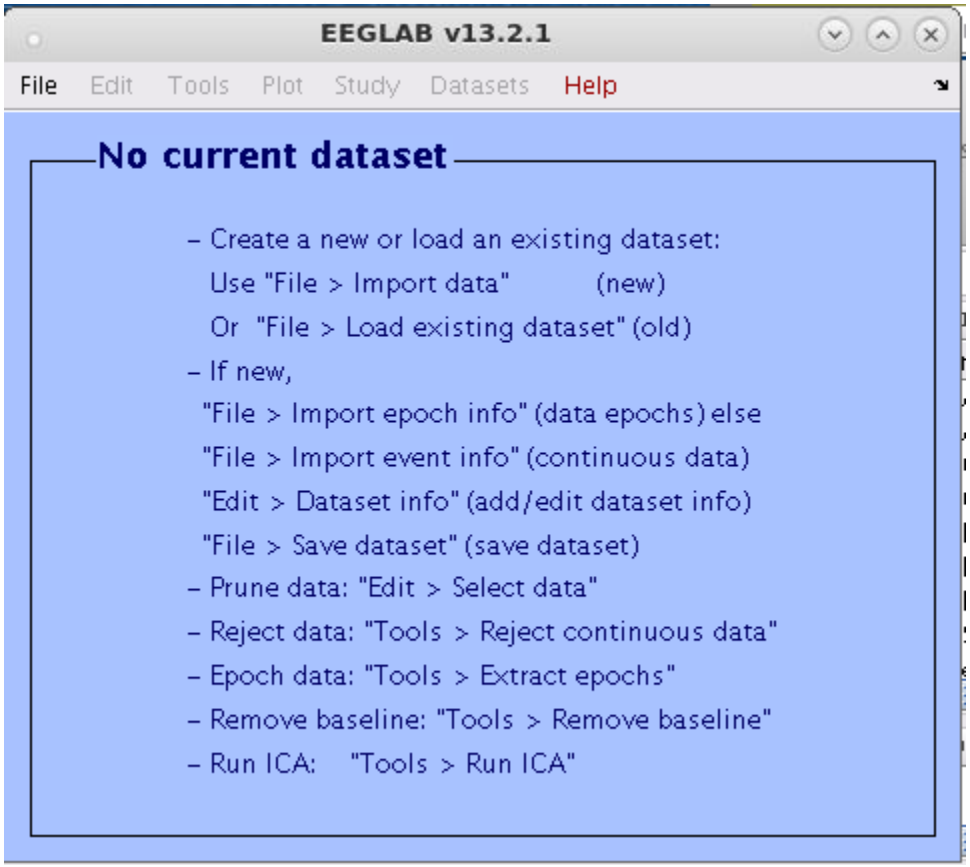
The Wearable Sensing DSI-Streamer to EEGLAB data import extension is a series of MATLAB scripts that allow users to load .csv files generated by Wearable Sensing's DSI-Streamer software into EEGLAB

This extension enables users of DSI-Streamer to access the many tools EEGLAB offers.

4. INSTALLATION OF EEGLAB EXTENSION

4.1 Installing EEGLAB

1. Download EEGLAB from the SCCN website: sccn.ucsd.edu/eeglab
2. Extract the contents of the .zip file, taking note of its destination directory.
3. In MATLAB, navigate to the directory of the EEGLAB folder, and enter it.
   Note: “eeglab.m” should be visible in the MATLAB file directory display.
4. Either right-click “eeglab.m” and select “run”, or type “eeglab” into the command line.
5. EEGLAB will take a minute or so to load all of its scripts and include all of its pathways.
   When it is done, you should see a window like below:



This means you have successfully installed and run EEGLAB.

4.2 Installing the Extension through EEGLAB

1. In EEGLAB, select **File > Manage EEGLAB Extensions > Data Import**
2. Go to the page with Wearable Sensing's Extension, select install and follow the prompts

4.3 Manually

1. If EEGLAB is currently open, make sure to close it.
2. Download the Wearable Sensing EEGLAB Extension from this website: https://sccn.ucsd.edu/wiki/EEGLAB_Extensions
3. In EEGLAB's file directories, there should be a folder that looks like this:

   \eeglab_(version)\plugins\

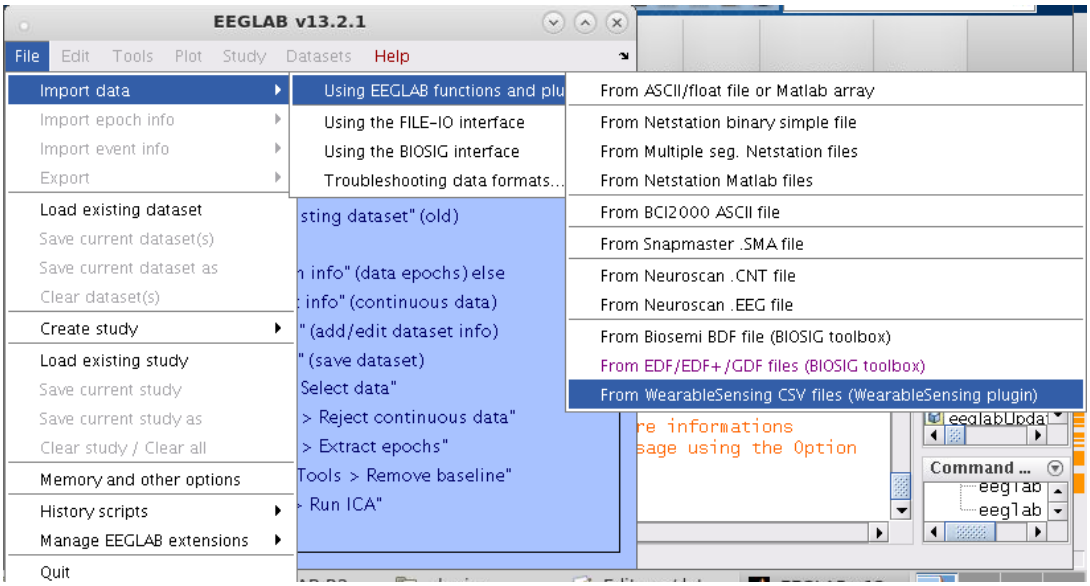
   For instance, observe the image below:

   This is the folder where you will want to extract the extension.

4. Place the extension into the folder, so that it appears as below:

5. Run EEGLAB.

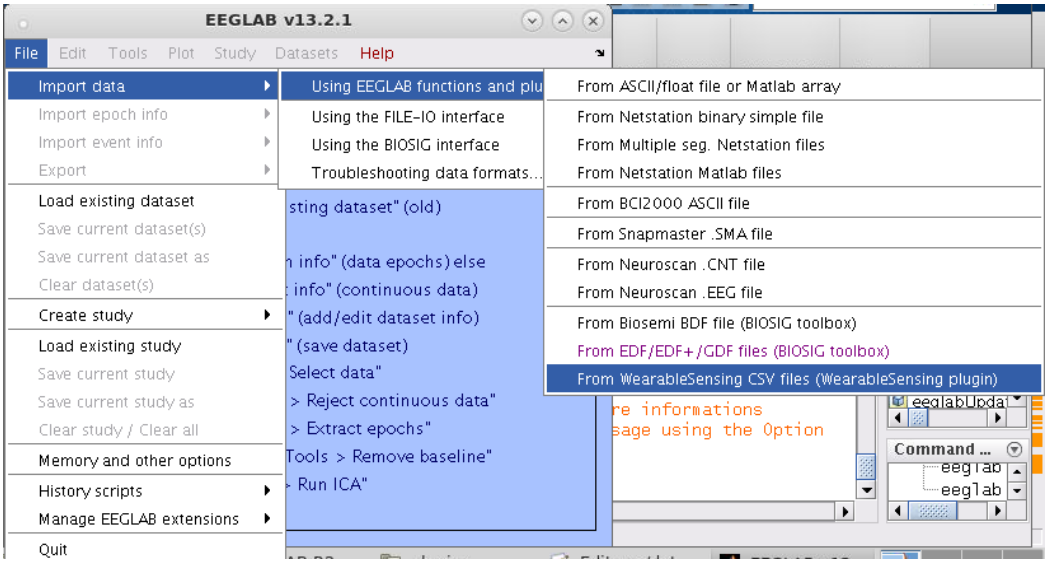
6. In the **Import Data** submenu, go to **Using EEGLAB Plugins and Functions.**



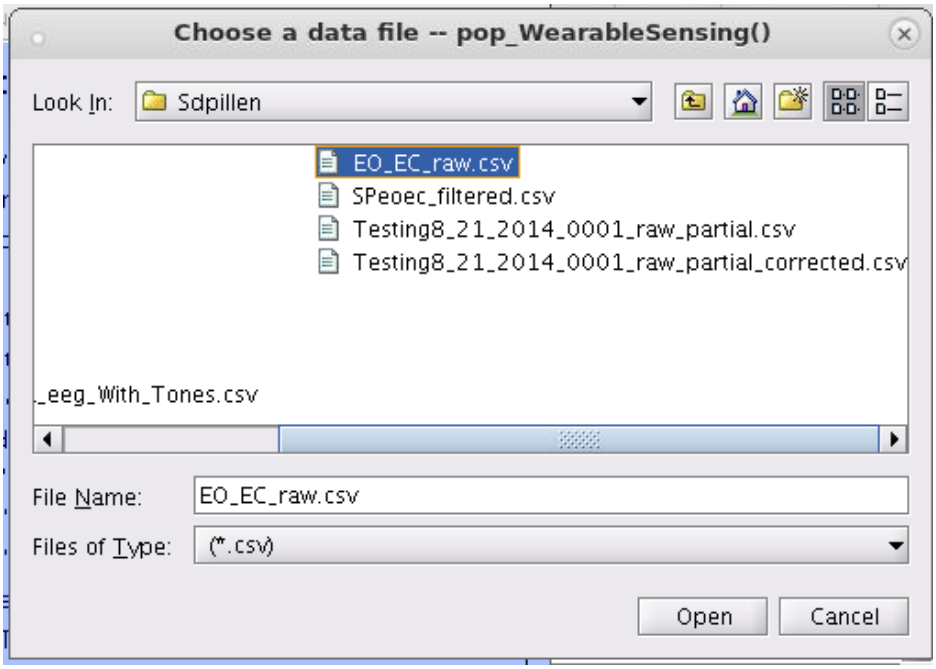
7. If there is an option to “Import Wearable Sensing .csv files” as seen selected in blue above, then you have successfully installed the EEGLAB Extension.

5. RUNNING THE EEGLAB EXTENSION

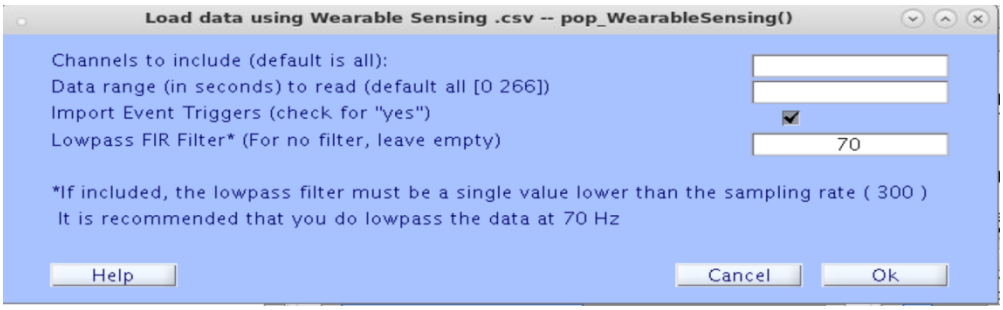
1. Install the extension, as described in section **4.2** of this manual.
2. Open EEGLAB, and wait for the EEGLAB window to populate.
3. As seen below, go to the “Using EEGLAB functions and plugins” submenu of the “File” menu. Select “From WearableSensing CSV files (WearableSensing plugin)”, as seen below.



4. Select an appropriate .csv file that has been generated by Wearable Sensing's DSI-Streamer, as seen below:



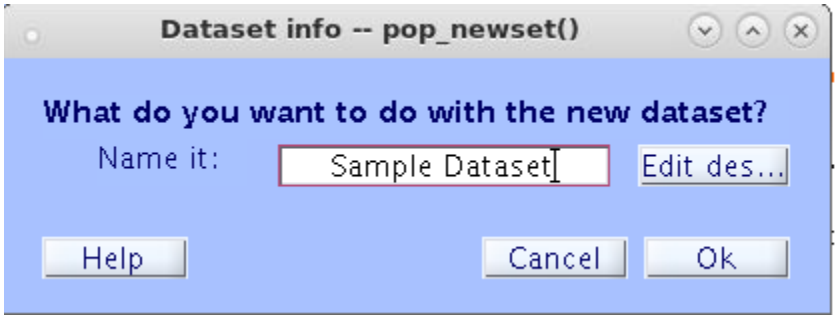
5. The following window should appear:



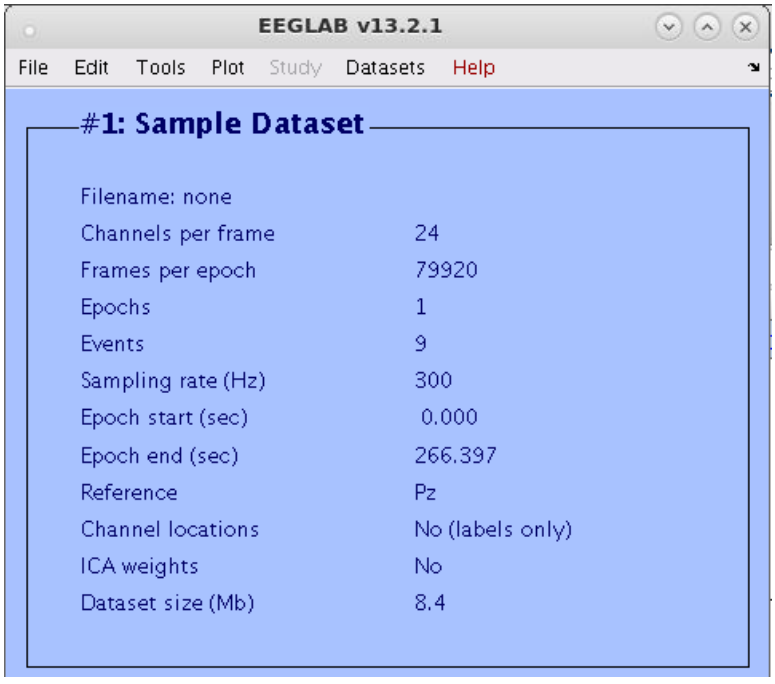
6. Unless you want to specify only limited sections of time, or only some of the channels for EEGLAB to load, you do not need to enter or modify any values here. Click "OK".

7. In the window that appears, as seen below, you will be asked to name the dataset. This is the label with which it will be identified by in EEGLAB, and does not affect the filename of the dataset, should you choose to save it later.

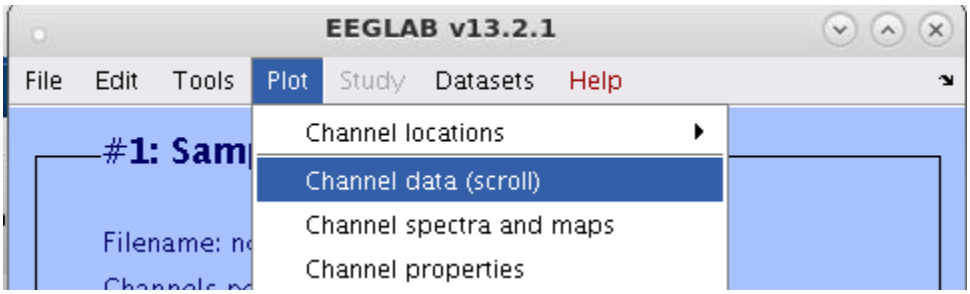
   Enter a name that will help you remember the dataset's origin, if you wish. Hit OK.



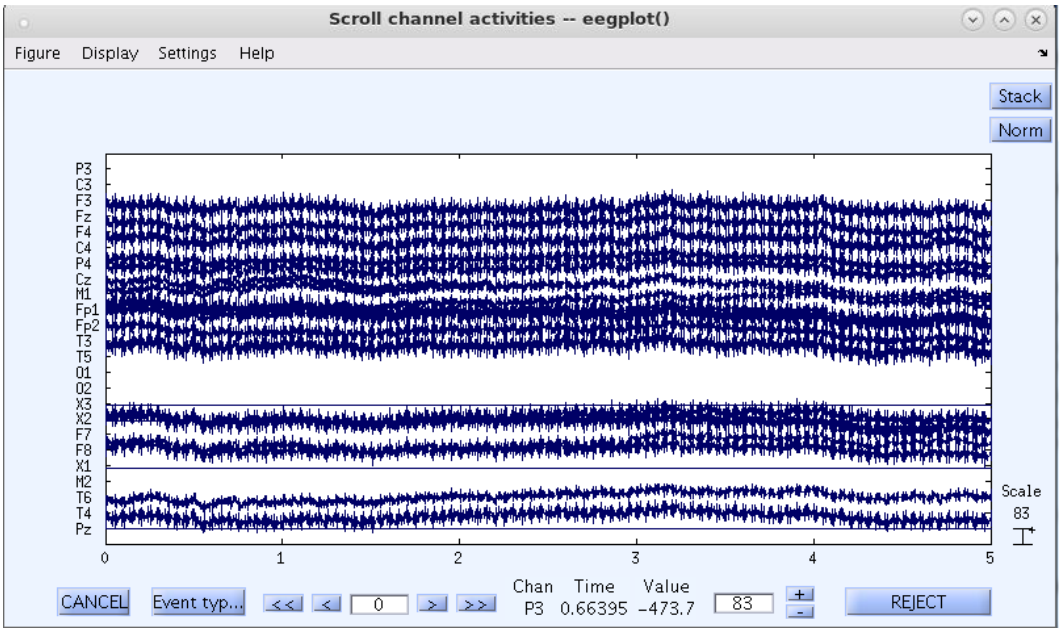
8. When it has loaded, the EEGLAB window should display some basic information about your dataset, as seen below:



9. To visualize the data, select “Channel data (scroll)” from the “Plot” menu, as seen below:

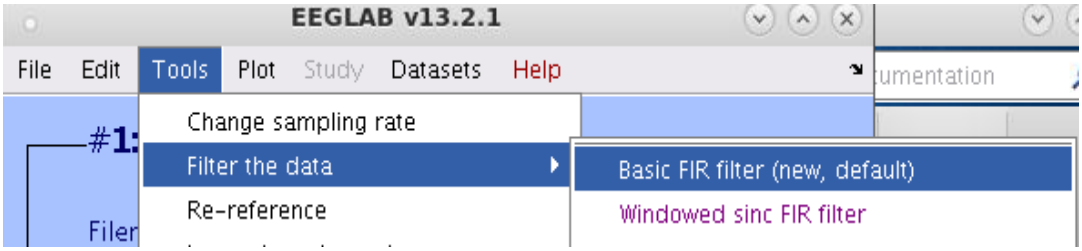


Take a note of the high level of high-frequency noise in the display below: (this is due to the impedance signal carrier being active at 110 Hz and 130 Hz, you can disable continuous impedance monitoring during recording of files if you wish to avoid this.)

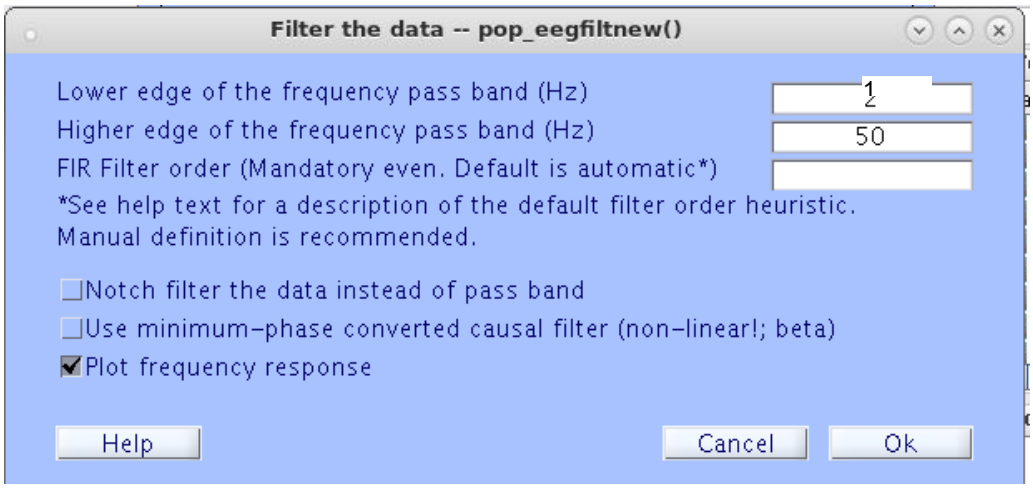


You can remove this carrier with notch filters or a low pass filter, as follows.

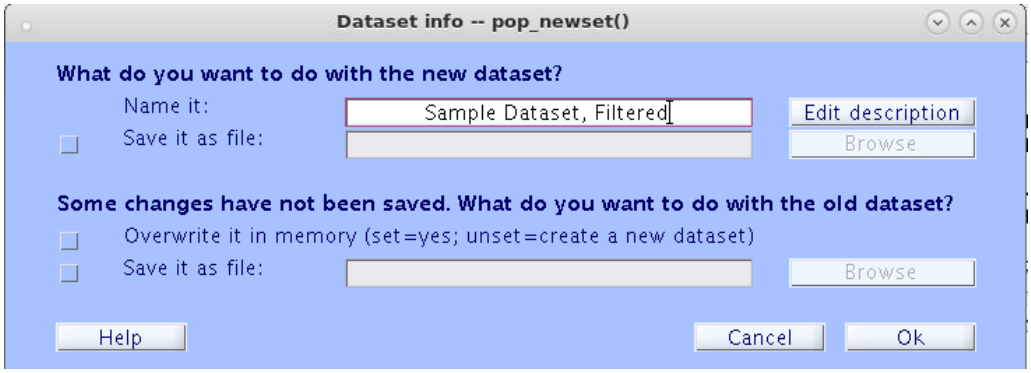
10. Select the “Basic FIR Filter” option in the “Filter the data” submenu of the “Tools” menu:


EEGLAB v13.2.1
File
Edit
Tools
Plot
Study
Datasets
Help
Change sampling rate
Filter the data
Re-reference
Basic FIR filter (new, default)
Windowed sinc FIR filter

11. In the window that appears, specify a high-pass and a low-pass value. We recommend 1 Hz and 50 Hz as the lower and higher edges, as seen below, but it may serve your purposes to use other values. Hit “OK”.



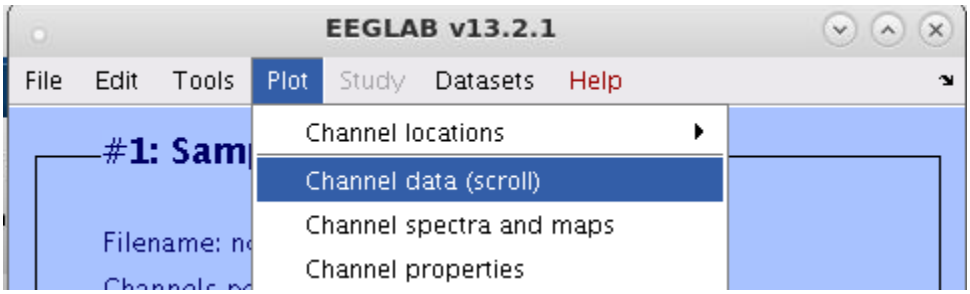
12. You will be prompted with the following window:



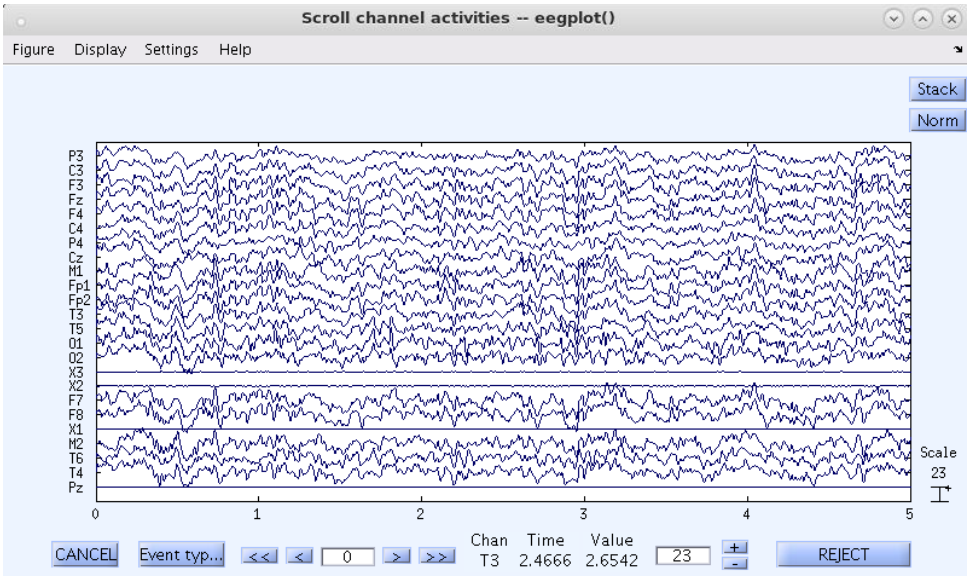
In this window, by default, if you hit “OK”, it will put the filtered data into a new dataset in EEGLAB. You may label the new dataset here by altering the name in the first dialogue box. As an example, the label has been changed from “Sample Dataset” to “Sample Dataset, Filtered” manually in order to differentiate the former dataset from the new one.

Alternatively, you may overwrite the data already loaded into EEGLAB by checking the second box in the window. In either case, hit “OK”.

13. Plot the data again, by selecting “Channel Data (scroll)” from the Plot menu.



The data should now look like this:



Much better. Congratulations, you now have loaded and filtered a DSI-Streamer .csv file through EEGLAB. You may now take advantage of EEGLAB’s many features for data analysis and visualization.