Nalu Scientific
Data Acquisition Systems

Graphical User Interface Instructions
Nalu Evaluation Cards

V0.1.16 - ALPHA
May 30, 2019

Configuration(s):
ML605 + ASoC V1 Eval card
AC701 + ASoC V1 Eval card
Nexys video + SiREAD v1 Eval card
Nexys video + ASoC v2 Eval card

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Installation

Figure 1, The ASoC evaluation board installed on the ML605.

The program comes as an installer executable, due to the application being in early testing the installer is not signed and your antivirus program might complain. This warning can safely be ignored.

The application will be writing log files in the applications installation folder and the application needs write access to the folder where it's installed. It's recommended to install the application as a subfolder to the root directory on windows (or $HOME on Linux), this makes it easy to upgrade to a newer version and to remove the application when it's no longer needed.

UART driver update for the ML605 board.
If the Application is to be used with a ML605 board on windows the UART driver may need to be updated to the latest version. Please download and install from:
https://www.silabs.com/products/development-tools/software/usb-to-uart-bridge-vcp-drivers
Virtual machine Linux port access:
If the application is used in a virtual machine on linux the access rights to the port might need to be modified. Find which usb port the board is connected to /dev/ttyUSB* where * is the port number, then:
>> sudo chmod 777 /dev/ttyUSB* (Replace the start with the port number)

Starting the application

Setting up a connection:
When opening the GUI, an initial connection dialog will appear. On the left side of the dialog are options to either create a new project or load and old project. There is also a list of recent projects.

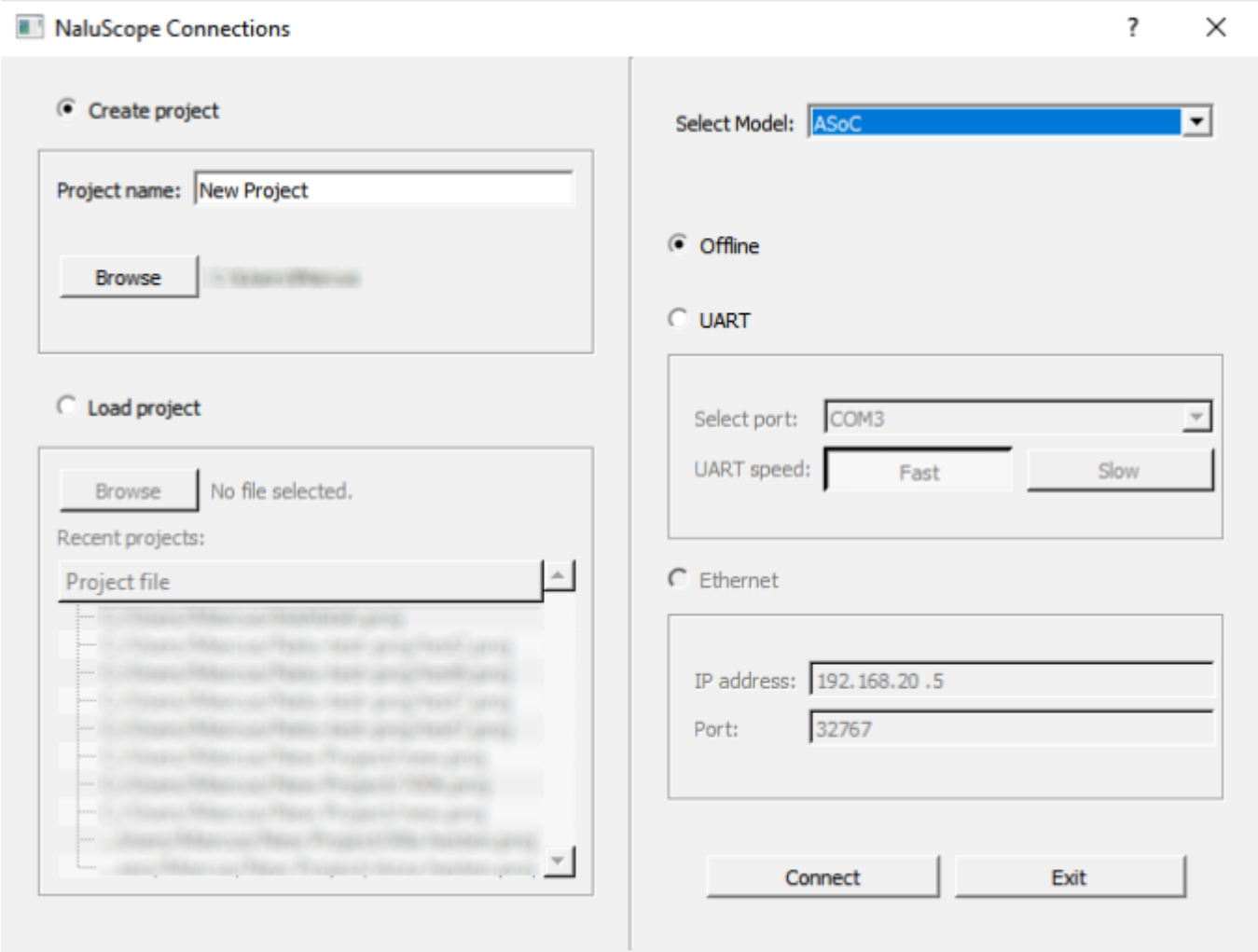

Figure 2, Startup dialog when opening ASoC GUI.

To **Create project** select the option and provide project name and the working directory.

Or **load project** by selecting the option and browser for the project file. It's also possible to select one of the recent projects from the list.

Select the connection on the right side.
First select the hardware **model** from the dropdown list.

Then pick UART as the connection type to use with the board. It's possible to start the application without a connection to view old data, in that case select Offline.
Select the **port** and the **speed**, generally **Fast** is preferred unless there is an issue.

Lastly click connect to create new/load project and establish a connection. Please note establishing the connection and initializing the board can take up to 2 minutes depending on configuration.

Once connected, the application title should reflect a connection by changing from 'DISCONNECTED' to 'Connected'. Please check the application title.

Remember the startup will take 1-2 minutes depending on the machine.

If the application start with DISCONNECTED in the title bar the board didn't initialize correctly.
This can happen with the UART interface, try to reconnect using settings->Disconnect followed by settings->Connect. If this doesn't help, please make sure the power and the usb cables are properly connected by power cycling the board and disconnect/reconnect the usb cable.

Working with the application.

Main window

In the main window, you can capture and view events.The main parts are the Toolbox section (1) on the left, the plot (2) on the right.

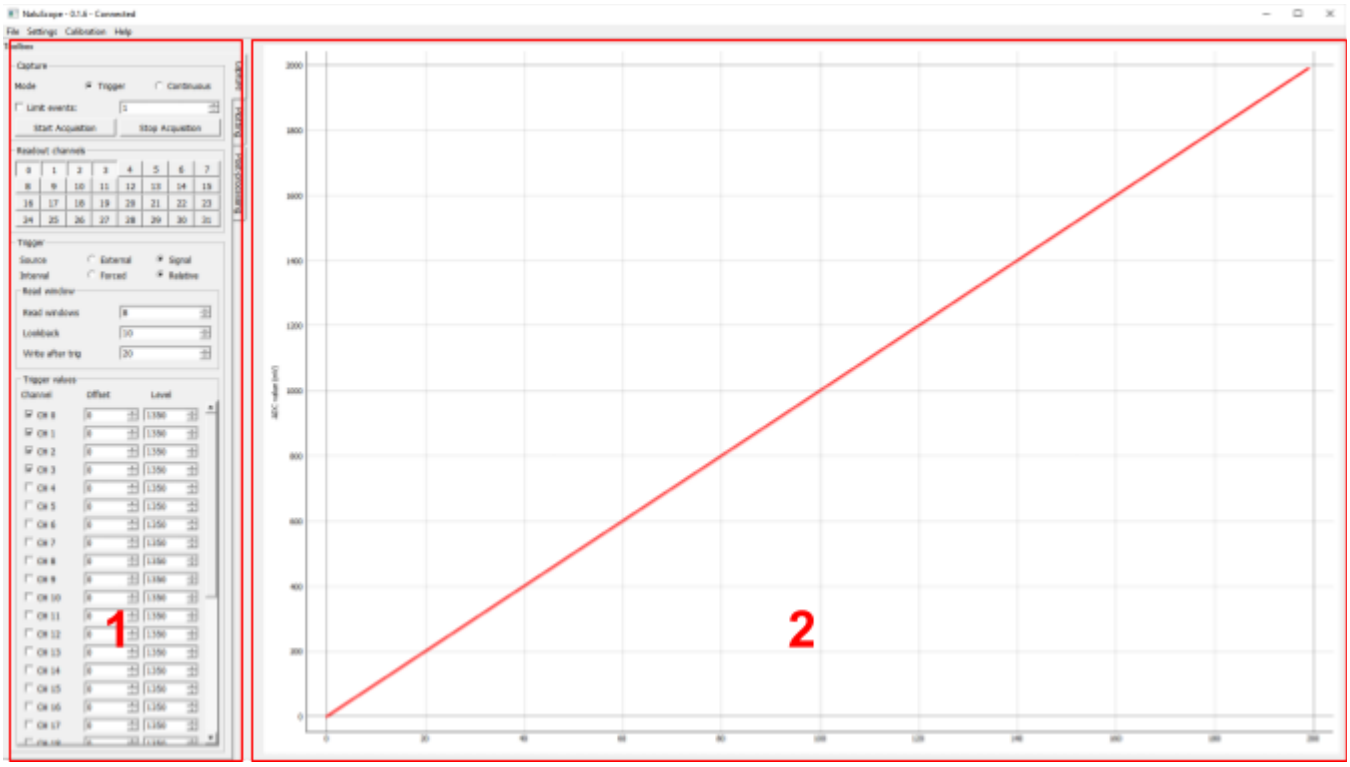

Figure 3, Layout of the main window

Capture:

The first tab **Capture** in the Toolbox section there are options for event acquisition.
The first choice to make is the Acquisition mode: **Continuous** or **Trigger**

Continuous mode is used to capture data without a trigger. It will read out data in a stream and is a good way to capture background data and noise.
Trigger mode will only capture an event when the trigger conditions are met. This is the primary mode to capture events. It requires the user to setup the trigger conditions correctly or no data will be captured.

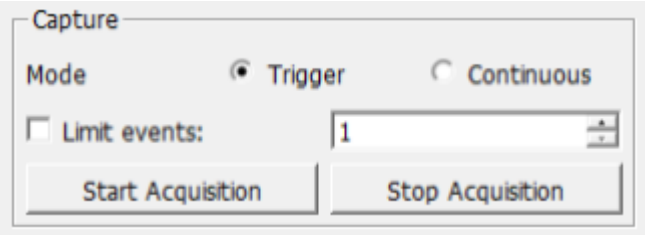

Figure 5, Capture events

Limit events is an option to limit the amount of events captured in an acquisition. In the current version of the software all captured events are stored in memory until saved to disk. There is currently a command line version for capturing to disk and this feature will be implemented in future versions. Press limit events and set the amount to limit the amount of events to capture. This works with both continuous and trigger mode.
Start/Stop Acquisition to start and stop capturing data. When acquisition starts it is not possible to change settings on the board and all options are grayed out. This feature will help the user to avoid accidentally changing the experiment parameters during the acquisition.

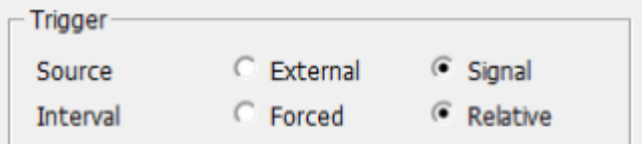

Figure 6, Trigger settings

There are two types of **sources** for the trigger:
External uses a separate connector on the board to receive a trigger and triggers when a pulse is received. Currently disabled in the firmware.
Signal, trigger on the received signal when it reaches a certain threshold and reads an event.

The **interval** can be either **Forced** or **Relative**, with this version of the board, setting this to relative is highly recommended. Setting the interval to relative makes the board readout the event relative to the trigger.

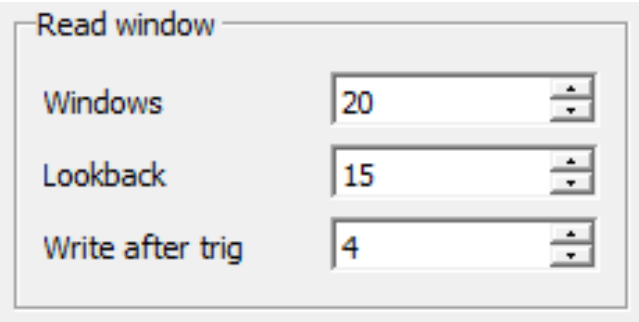

Figure 7, Set the read window

Setting up the read window by setting the amount of **windows**, **lookback** and **write after trigger.**
A **window** is 32(SiREAD) or 64 data points, effectively how long a captured event will be. Setting the amount of windows will impact the readout speed and should be kept as low as possible.
When the board triggers from a signal it will continue writing for **write after trig** windows, the event will start at the **lookback** point and get the specified amount of windows.

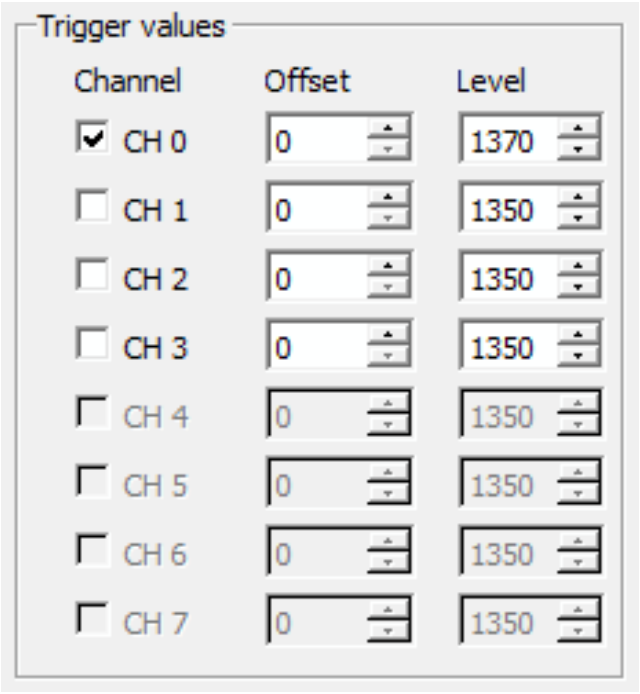

Figure 8, Set the trigger values

Trigger values, it is possible to toggle which **channel** to trigger on and at what level.
Offset changes the 0 point for the trigger, it is useful with a noisy signal to move the offset close to the signal value, the level will then be set relative to the offset.
The **level** is the ADC value.

Plotting

The program will plot the events during capture unless live view is disabled. When **live view** is enabled the program will try to plot any incoming events at a rate of 20 Hz.
Sample markers can be turned on, default they are turned off to avoid cluttering the plot during live view.

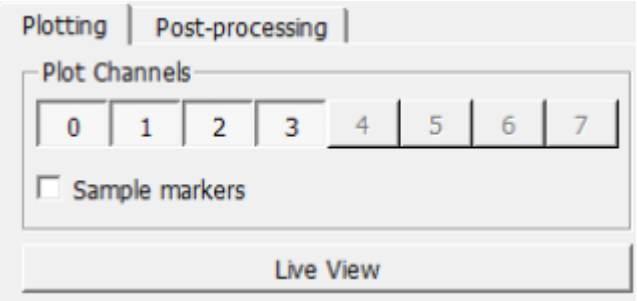

Figure 9, Toggle the channels to plot.

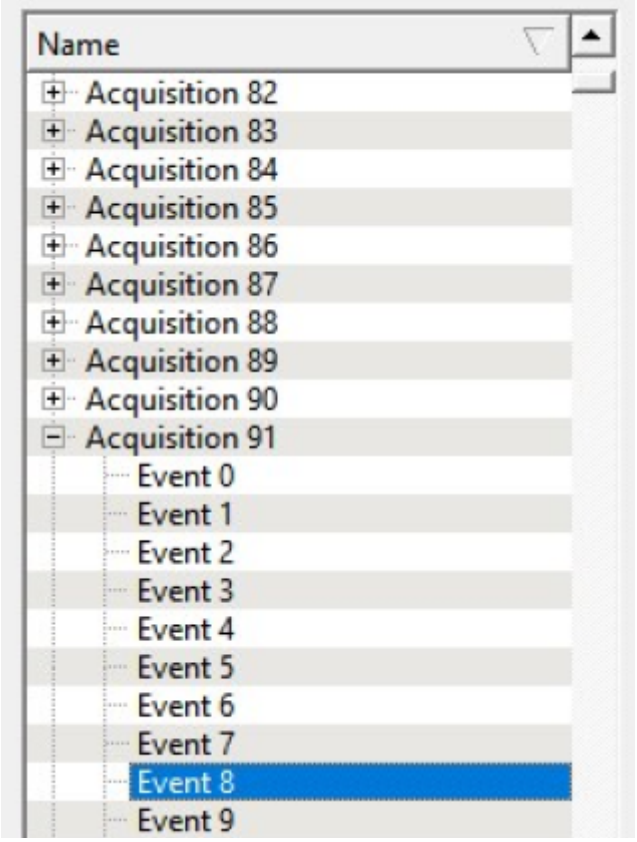

Figure 10, The treeview

When an acquisition is done, the events captured will be displayed in the **Treeview**. All acquisitions are stored in the current project. And an acquisition is a collection of events.
To plot and event simply left click on it when live view is disabled.

To plot several events, select multiple events, right click and select plot. Please note plotting hundreds of events will take a significant amount of time to render.

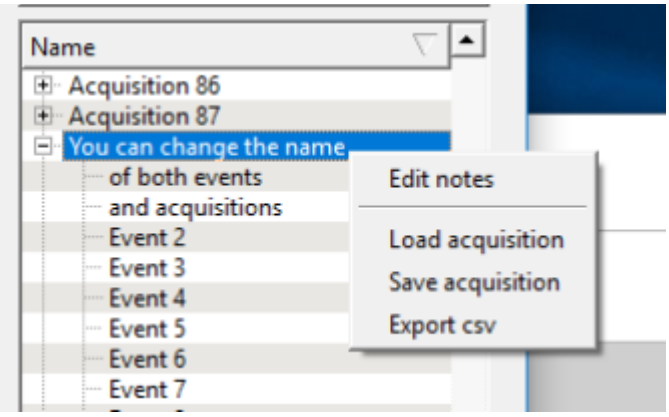

Figure 11, Right click menu on Acquisition w/o pedestals

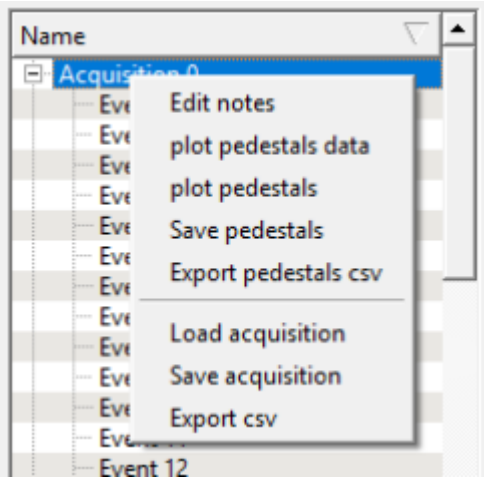

Figure 12, Right click menu with pedestals loaded.

When right clicking on the acquisitions in the Treeview several options are available depending if pedestals are loaded or not.
Edit notes allows the user to add notes to an Acquisition, it will open a separate dialog where the user can type notes freely.
Plot pedestals data and **plot pedestals** will plot all the data used to generate the pedestals, it will take a few seconds to generate the plot.
Save pedestals will save the pedestals used for the selected acquisition, every acquisition store the pedestals used while capturing data.
Export pedestals csv will export the pedestals data to a comma separated datafile easily read by other programs.
Load Acquisition will add the loaded data as a new acquisition at the end of the list.
Save Acquisition stores the data in a binary format.
Export csv will export csv of all events in a csv.

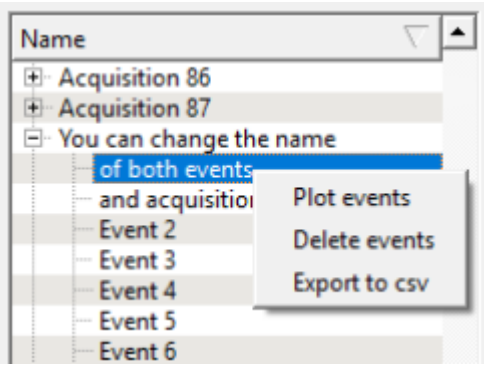

Figure 13, Right click menu on an event.

The user can select multiple events and right click. The menu allows the user to **Plot events**, this will plot the selected events overlayed in the plot window.
The user also has the option to **Delete events** and **Export to csv** file.

Post-processing and Storage

There are options to store both the **Raw** data and the **Parsed** data to disk during capture. Normal operation stores captured data in RAM until saved, with the storage enabled the program will store each event on disk. When an option to store is enabled, a subfolder named “raw” or “Parsed” will be created in the directory selected then all events are saved in the subfolder. Default subfolder is the folder selected as the project working directory.

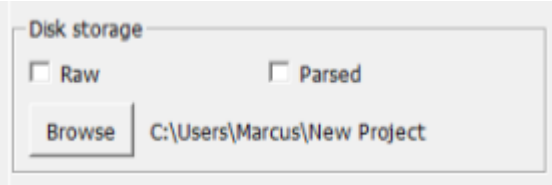

Figure 14, Storage options under post-processing.

The **center on intersection** is a function to center the timeline on the intersection between the trigger value and the captured data. Please note this function is destructive and will change the parsed event package. If it’s important to save the original data please enable the raw data storage.

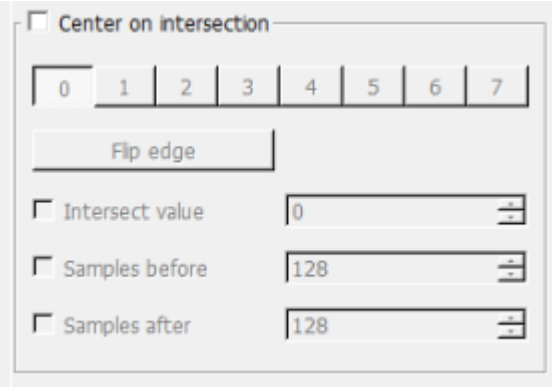

Figure 15, Center on intersection options.

The center on intersection function will only work on pedestals subtracted data and generate pedestals must be used before enabling this.
The **channel selection** is used to pick which channel to check for intersection on, it’s only possible to select one channel to center on.
Flip edge is used to flip between detecting on raising or falling edge. Default the software will try and autodetect what type of edge to use, this button is used for manual control.
Intersect value is the value the function will use to check for intersection, this value can be read out on the Y-axis of the graph.
Samples before and **samples after** are used to trim the events around the trigger. Since this function moves timeline the captured data will no longer have the same starting and end point.

Plot window

When capturing data the plot window will update with the latest acquired event at 20 Hz as long as Live View is enabled. It's possible to select and deselect channels in the Plotting section.
Zoom can be done in two ways. Holding the right button down allows the user to zoom along the x-axis by holding the right button down and moving the mouse left and right. Or along the y-axis by holding the right button down and moving the mouse up and down. The other way is to use the scroll wheel which allows the user to zoom in and out uniformly.
Pan the plot by holding the left mouse button and drag in the desired direction.
Plot menu can be accessed by right clicking.

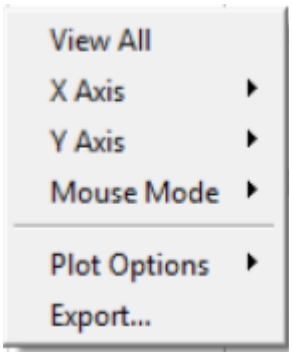

Figure 14, Right click on plot

If **mouse mode** is changed to 1 button, the user can zoom by drag drawing a box around the area of interest.

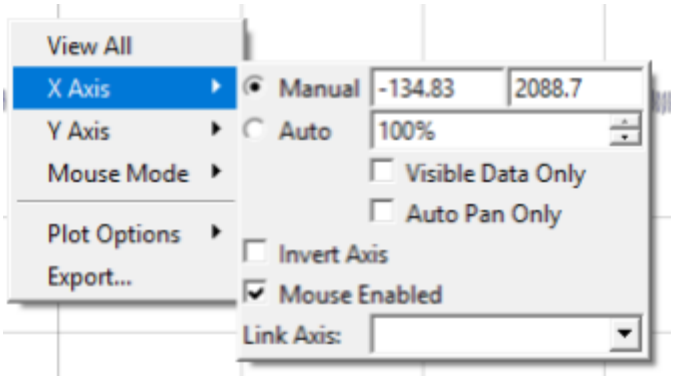

Figure 15, X- and Y-axis can be changed.

One a good interval has been set it's possible to lock the plot from changing by unclicking **mouse enabled**, this will hold that axis still if the zoom and pan are used.

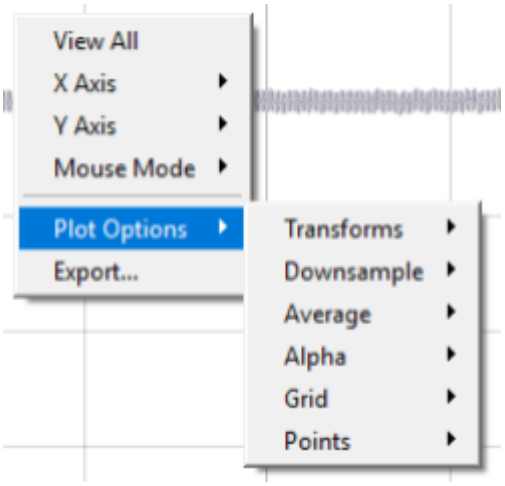

Figure 16, Plot options menu.

It is possible to use standard **transforms** log X, log Y and FFT on the plot.
This menu also gives the user options to **downsample** the plot, compute an **average**, change both the **alpha** and the **grid.**

The last option is to export the plot, here are the options to export the plot as both csv and as an image. The most useful option is to export as a matplotlib plot.

Menu Options

The menu options on the top left of the window provides additional features and configuration options. Here is a breakdown of what's available for each menu:

File:

- New Project: Resets the project and all settings the opens the startup dialog.
- Load another project, will reset the old project.
- Save this current project
- Quit

Settings:

- Connect/Disconnect the UART interface.
- Reset - Resets the board, used in case the board locks up due to a bad settings.
- Reinitialize the ASoc board, resets all settings and runs the initialization sequence.
- Settings will open the settings dialog with advanced settings.

Calibration:

- Generate pedestals to reduce noise.
- Load previously generated pedestals to use with the next acquisition.
- Save the current pedestals as a separate file.
- Reset pedestals

Help:

- Report bugs directly to marcus@naluscientific.com (both the bug reporting and help menu items are disabled in the alpha release)

Advanced use

Settings window.

The settings window contain several advanced options to change settings on the board.
Please don't change any of this settings without consulting with a representative of Nalu Scientific.

Figure 17, The settings dialog.

Accessing saved data outside of the GUI.

Advanced: Acquisitions and projects are intended to be easily exported and are stored as compressed python pickled objects and can be opened using the following python code:

```
import gzip
import pickle
file_to_load = gzip.GzipFile(filename, 'r')
Project_data = pickle.load(file_to_load)
```