# CalyoSensus Evaluation App

Documentation for the CalyoSensus Evaluation GUI Application

**Last Updated: 26/06/2024**

## System Requirements

The Calyo Sensus app has been designed to run on any machine with a GPU. Best performance will be achieved with a dedicated graphics card, though this is not a necessity.

The quality presets will allow you to tune the processing load to best suit your machine, below is a table showing an indicative sample of optimal presets for some machines we tested on.

| CPU | GPU | Ded. (Y/N) | Operating System | Quality Preset | ~FPS |
|---|---|---|---|---|---|
| Intel i9 12th Gen | NVIDIA 3080 Ti | Y | Windows 10/11; Ubuntu 20.04 | High | 60 |
| Intel i9 12th Gen | NVIDIA 3070 | Y | Windows 10/11; Ubuntu 20.04 | Medium/High | 60 |
| M1 | M1 GPU | N | OSX | Medium/High | 60 |
| Intel i7 11th Gen | Intel Iris X | N | Windows 10/11 | Low/Medium | 40 |
| ARM Cortex-A57 | NVIDIA Jetson Nano | N | NVIDIA Jetpack 4.5 | Low/Medium | 40 |

## Supported Platforms

The app has cross platform support for Linux, Windows and MacOS. The following platforms have been tested and verified:

- Windows 10/11
- Linux: Ubuntu 20.04

If your system is not found in the list above, it is likely the Calyo Sensus app will still run with no issues, however we have not verified this ourselves so can offer no guarantees.

## Getting Started

First, download the Calyo Sensus app for your platform here. Once downloaded, extract the application to your desired location

### Linux

On Linux, you will need to carry out a few steps to register CalyoPulse as an allowed USB device. See "steps_for_linux_users.md' for more information.

To prepare the environment for the device drivers, you will need to run the following command, before opening the application:

```
sudo rmmod ftdi_sio
```

Alternatively, there is a launch script you can run to automate this process. You can create the script yourself by,

```
cd /path/to/downloaded/Calyo/Application/Folder
nano launch_sensus.sh
```

Paste the following script,

```
#!/bin/bash
sudo rmod ftdi_sio
./CalyoSensus
```

Save the file and make the script executable and run it to launch the application,

```
chmod +x launch_sensus.sh
./launch_sensus.sh
```

> Note: When using the Linux version each time the sensor is removed/uplugged you must re-run the ftdi command or the launch script.

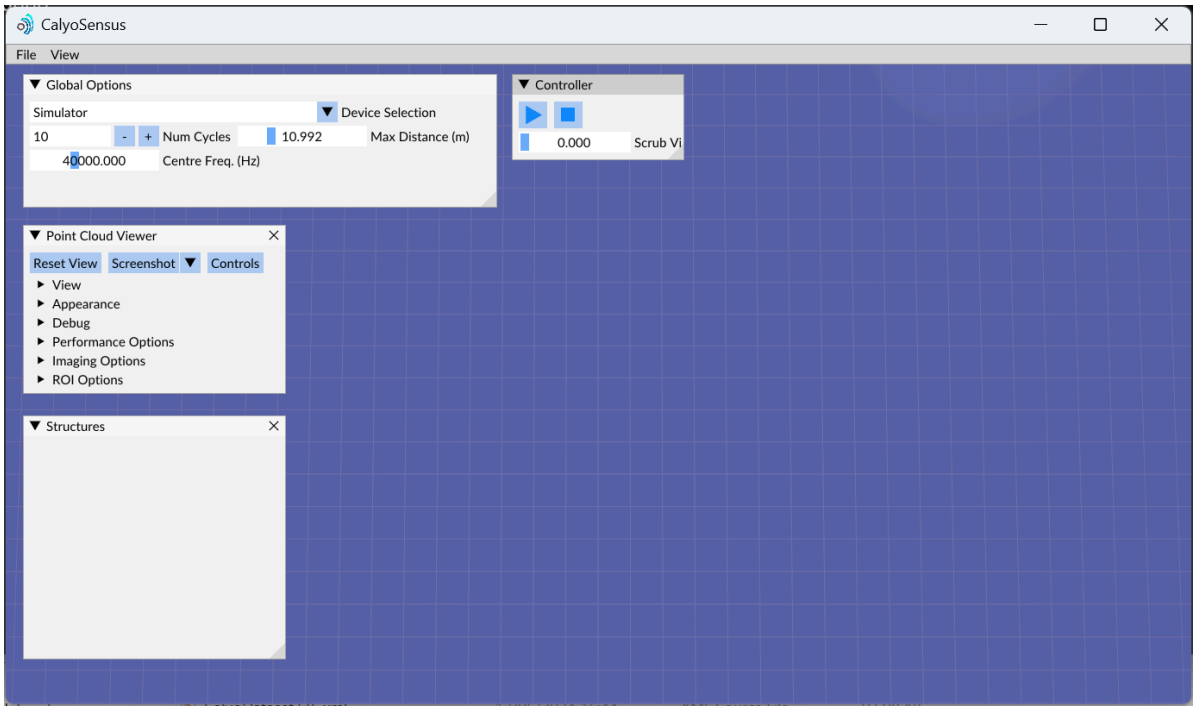
### Windows

Open the downloaded and extracted software folder and run the `CalyoSensus.exe`

## Using Calyo Sensus Evaluation App

Calyo Sensus Evaluation GUI is an application that is available to evaluators to demonstrate this functionality in a convenient, visual, cross-platform package.

Upon opening the app, you will see a blank project page ready for loading in datasets or physical devices and running various algorithms, as shown below

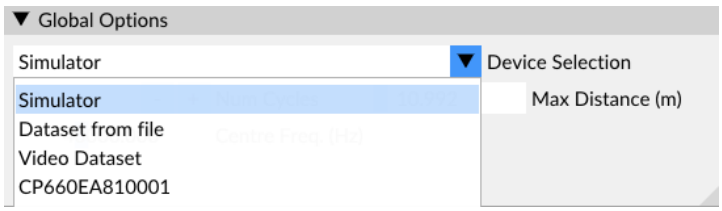



### 1. Global Options (Before Running)

These parameters are sent to the device on startup so must be selected before turning the sensor on.

#### Device Selection

The Device Selection dropdown allow various application modes and the device selection.




Device Selection Dropdown

**Devices:**

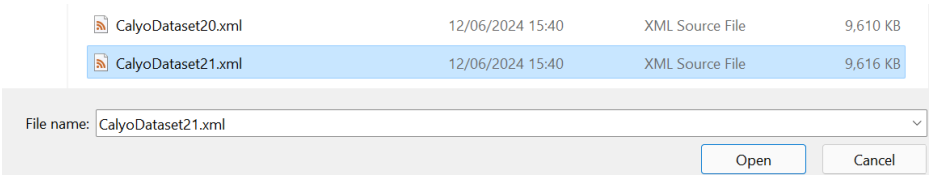
Once your device is plugged in you will be able to selected it from the dropdown. All CalyoPulse sensor begin with the prefix "CP" e.g. (CP660EA810001).

*If you are unable to see your device please ensure it is plugged in correctly using a USB data and power cable. If issues persist please try unplugging the sensor and restarting the software before reaching out for additional support. Linux users please refer to the note below.*

**Linux Note:** For the sensor to be detected by the software you must first plugin the sensor and then run the `sudo rmod ftdi_sio` command before launching the app. Alternatively, plug-in the sensor and then run the launch script. You will see and additional "*Scan Devices*" button which you must click before you will see the device in the device selection dropdown.

**Dataset from file:**

This option allows you to load and image a single frame of raw signal data (XML) from a previously captured dataset. After selecting this option a file section window will popup and prompt you to choose a raw dataset frame file.



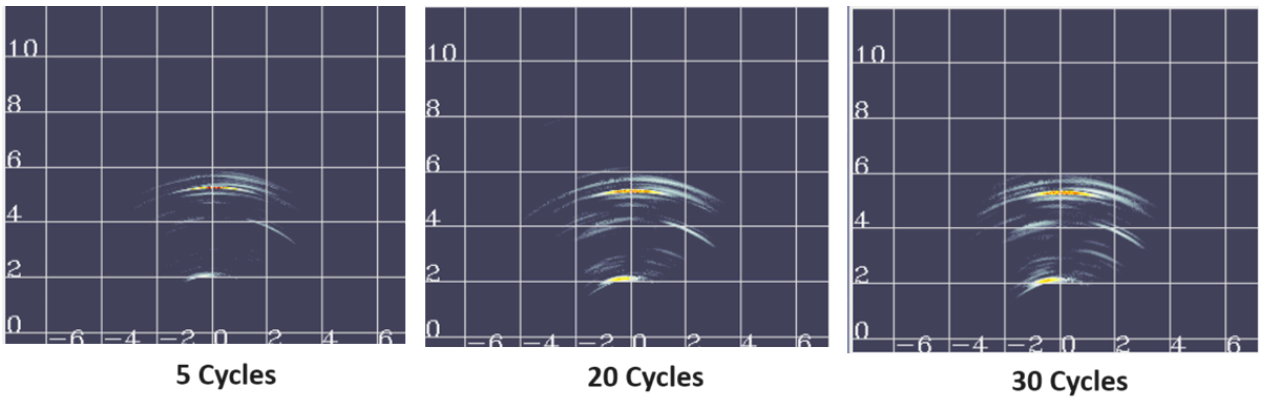

Dataset from file, File section Window

### Num Cycles

The Num Cycles parameter, defines the number of cycles in each transmission pulse.


This is loosely correlated to the output power of sensor in transmission. Larger values maybe improve detections and the signal to noise ratio but results in an increased in 'thickness' of detected objects and increased strength multi-path reflections potentially reducing precision for some applications. Thus higher values are not always better, a balance is preferred, its recommend to test how this value effects your results, within the ranges shown below.

| Suggestions | Num Cycles | Notes |
|---|---|---|
| Maximum | 30 Cycles | 30 Cycles **MUST** not be exceeded or you risk damaging your device. |
| Recommended | 20 Cycles | The provides a good balance between power and precision. |
| Minimum | 5 Cycles | Below this value may not provide consistent results. |




Example of the effect of number of cycles in office environment on the XZ images where all other parameters stayed constant.

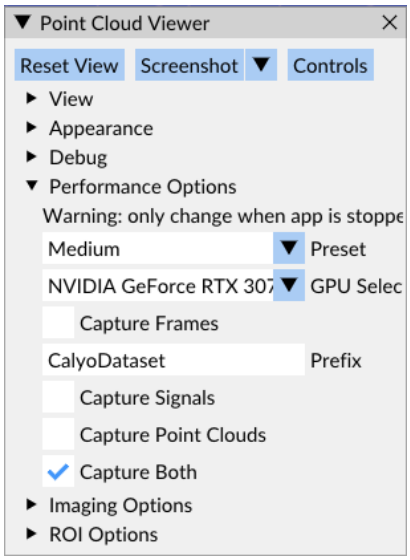
**Max Distance (m)**

The Max Distance parameter directly impacts the signal windowing, and therefore how far the sensor can detect. Smaller value are preferred as they increase the update rate of the sensor by reducing the wait time to receive echos, so aim to set the value only as far as you need. Recommend maximum value is approximately **15 meters**.


## 2. Performance Options (Before Running)

This window allows you to tune the performance of the app depending on your available computer hardware.

The performance pre-set will scale point-cloud and image resolution to an appropriate level (see System Requirements table above). In general, computers with dedicated GPUs will be able to provide higher performance, however it may be worth testing to see which pre-set works best for you.




Performance Options Dropdown

## 3. Dataset Collection (Before Running)

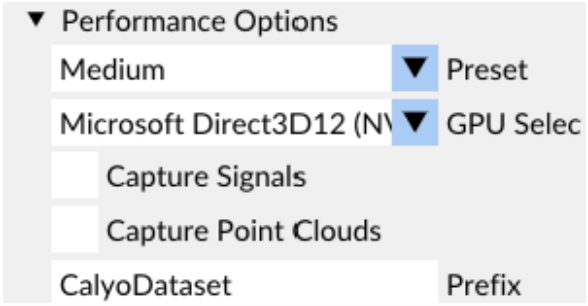
> Point Cloud Viewer > Performance Options

The application has the ability to collect data in the form of raw RF signals and point cloud data.

Before starting the sensor you can configure dataset collection by ticking the "Capture Signals" or "Capture Point Clouds" checkboxes (Or Both). You can name the dataset in the Prefix textbox.

- Signals: Captures the raw RF sensor data in a custom XML format. This format is useful as it allows you to tune the sensor settings after capture for further refinement.
- Point Clouds: This directly stores the point clouds in real time that you see on your screen.

> All files are stored in a new directory according the prefix directly to the application folder.




Data Capture Options

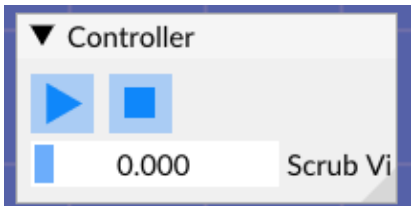
## 4. Controller

The controller window allows you to start, stop and pause the processing of the sensor data.

Please ensure you have setup the following settings before pressing play:

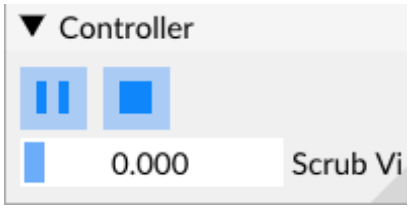
- Global Options
- Performance Options

- (Optional) Dataset Collection Parameters




Controller Window, Startup

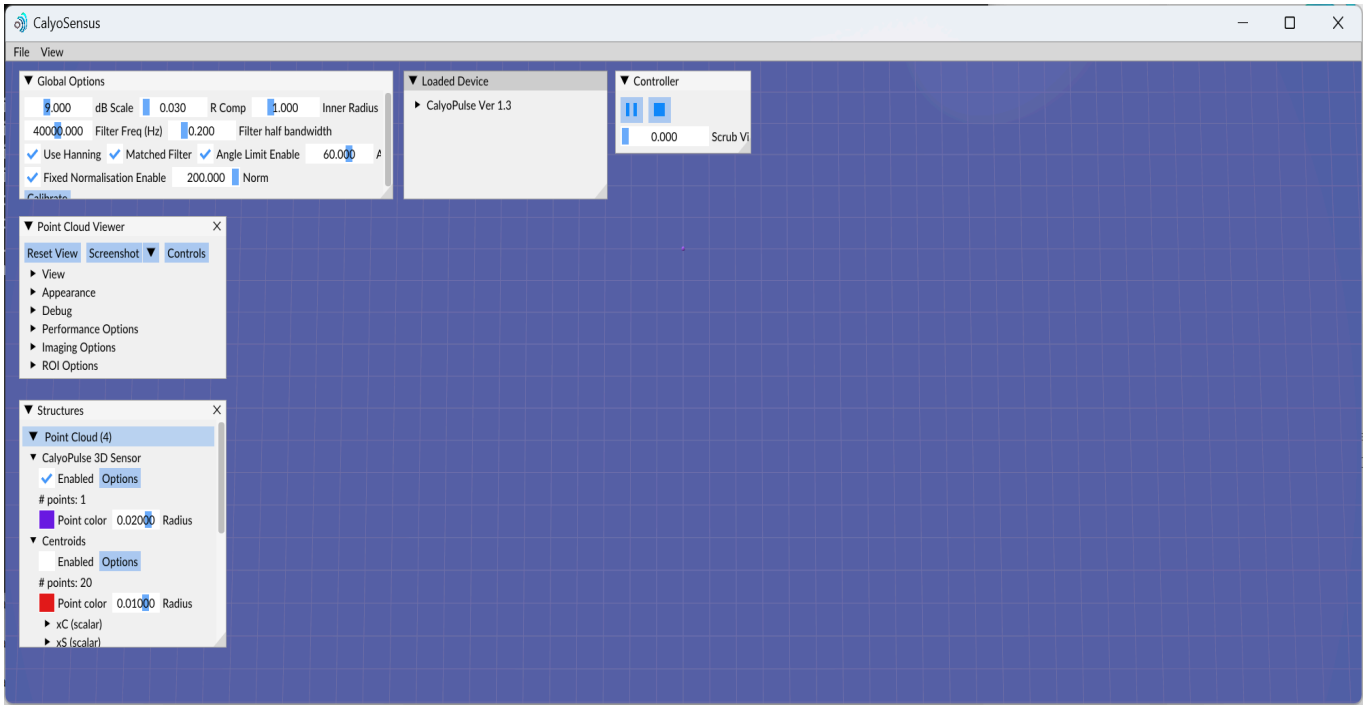
Once the previous parameters have been configured click play to start the sensor.




Controller Window, While Running

## Sensor Tuning

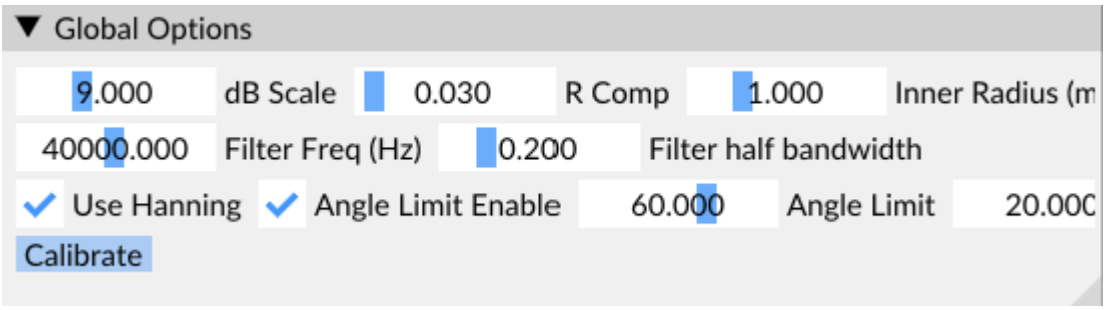
Once the sensor is running you will be presented with a few new windows and options.




Sensor Running

### 1. Global Options (Sensor Running)

The global options window now displays many tunning parameters that you can adjust in real time to configure the sensor for your application.




Global Options (Running Sensor)

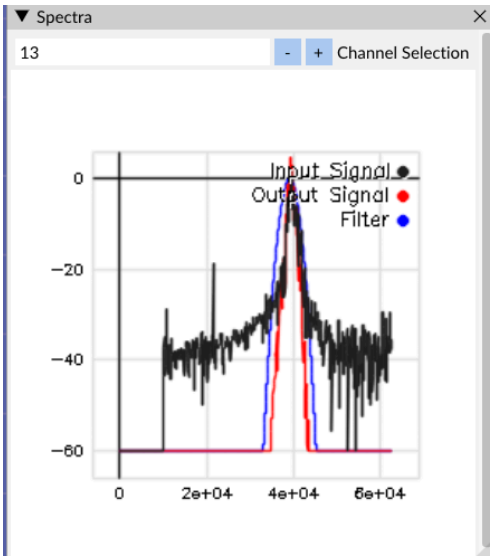
While imaging is running, you can adjust the level of noise present in the image by using the '**dB scale**' slider. Higher levels of noise might be preferable for inference tasks because they contain more detail, but they are harder to interpret.

The '**R Comp**' (short for radius compensation) slider can be used to compensate for distance. At a high level, signals in the far field will be brought up in intensity. It is akin to 'focusing' the sensor at a certain distance.

The '**Inner Radius**' slider can be used to set a deadzone (in metres) from the sensor. This is neccessary because there is a direct transmission from the transmitter that will "drown out" the desired return signals if included in the image.

**Filter Freq** and **Filter Bandwidth** can be used to adjust the filter applied to the raw signals. To view the effect of these parameters, click on `view -> Spectrum Analyzer` to see a frequency domain representation of each signal. A narrower bandwidth will be more effective at filtering out noise, however no filter is perfect and too narrow a filter might cut out some of the desired signal too. If in doubt, the default value will be fine for most circumstances.


Filter Freq and Filter Bandwidth Sliders



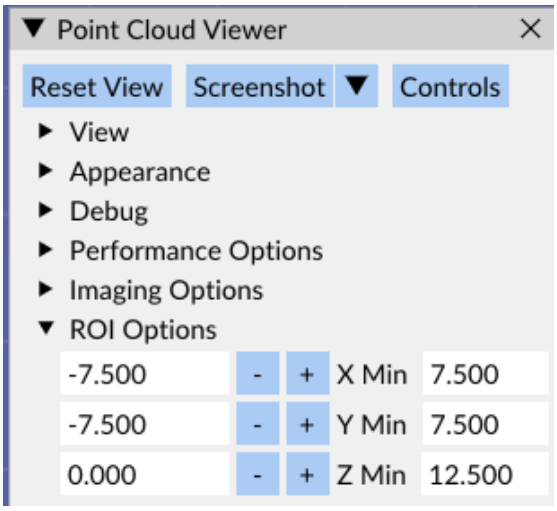

Spectra Plot

Lastly, **Angle Limit** can be used to focus the sensor to varying degrees in the forward direction. A lower angle limit will result in improved resolution in the forward direction but restricts the

peripheral perception. Alternatively, the angle limiter can be turned off, useful if perception at wide (180 degree) FOV is required.

## 2. ROI Options

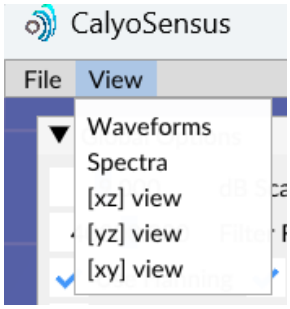
The ROI options allow only a specific area of interest to be set for the 3D point cloud imaging. This will ignore any readings outside of the configured area, useful if you only need readings from a specific volume in the sensors FOV. The units are in meters.




Global Options (Running Sensor)

## 3. View Menu

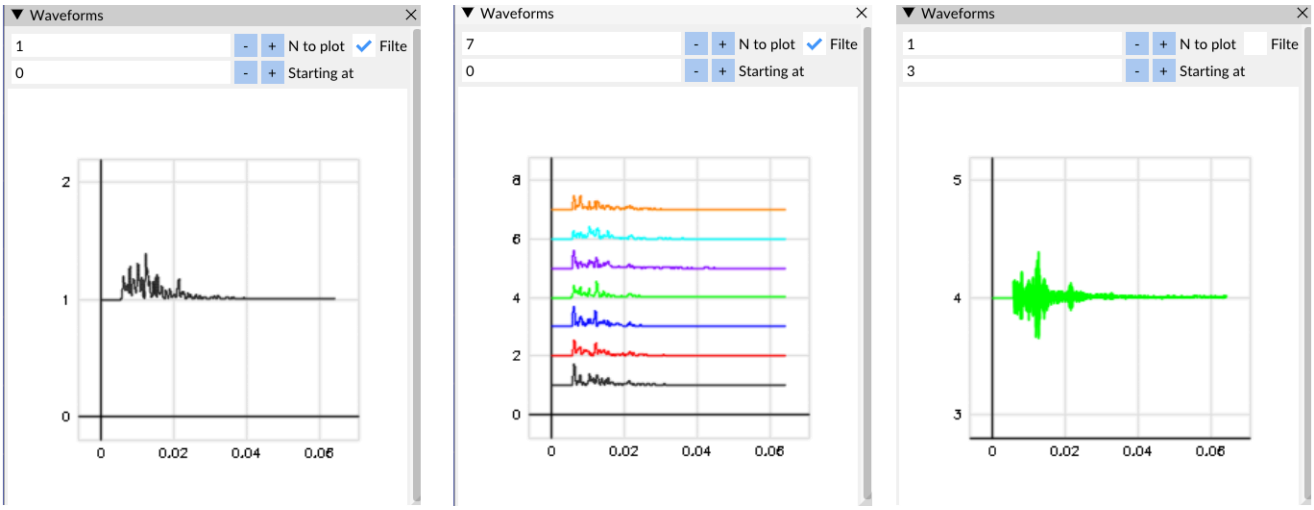
The View Menu allow you to access some additional view and graphs to help visualize or debugging the sensors functionality and performance.




View Menu Dialog

### Waveforms

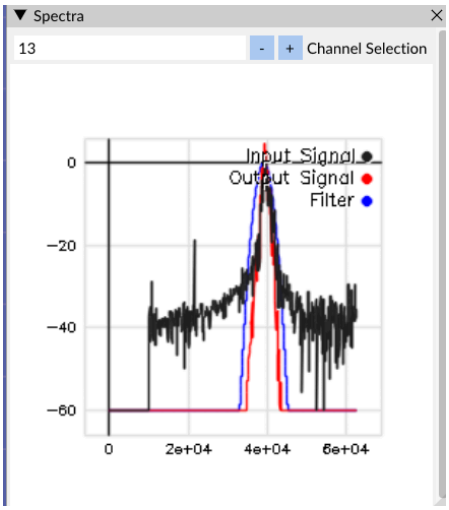
The waveforms view plots the raw or filtered data received on each channels, allowing you to view many or certain channels.




Waveform Window Example

### Spectra

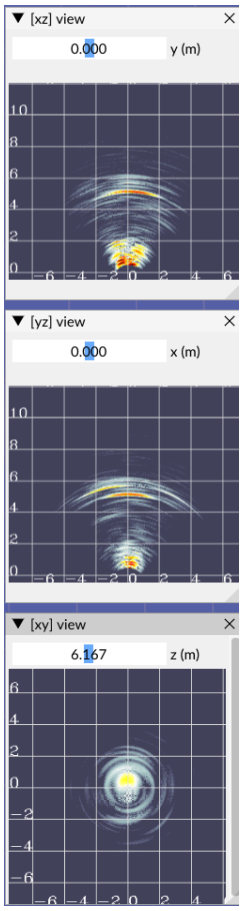
The spectra plot shows the frequency response from a particular channel of the sensor. This should be around 40kHz where a large peak should be observed as shown below. Here you can also see the filtering effect on the signals for fine tunning.




Spectra Window

### [XZ] / [YZ] / [XY] Views

Lastly 2D plots can be visualised. (Z=Range, Y=Elevation, X=Width)



2D Views Window

### 4. Structure

The structure window displays various options to change the look and style of the 3D point cloud. These changes will not reflect in any exported data.

Image TBC

# Device Safety

- Do not hold the sensor near anyone's ears.
- Do not place the sensor facedown on a surface when powered on.
- Do not disassemble the device.
- Do not drop the device.
- Only plug the device into computer (5V).

# Technical Support

This application is for testing and lab evaluation.

Need advice on getting setup, or can’t find the answers you need? Our team are here to help.

https://calyo.com/contact/