# GEMINI

## INTERFEROMETER

# Getting Started


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Subject to change without notice

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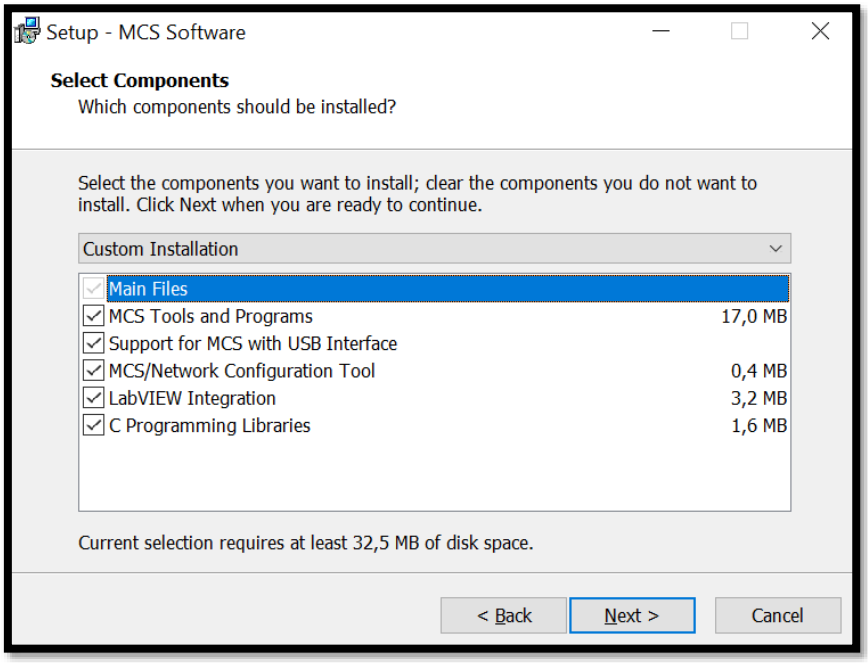
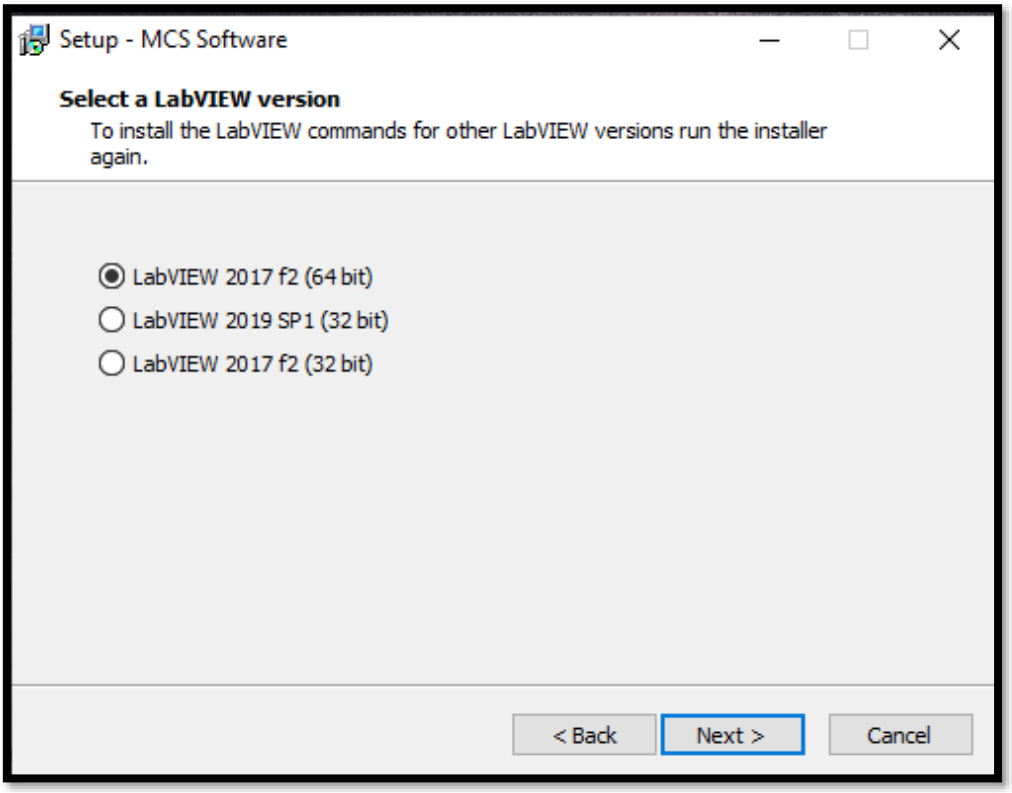
# 1. How to install the software

In the provided NIREOS USB pendrive, open the folder “Drivers”.

1. Install the **MCS_Installer_3.8.9.exe** located in NIREOS\Driver
   During the installation:
   - If you wish to use the provided open access SDK for Labview, please make sure you select LabVIEW Integration and C programming Libraries, as shown below.




   - The installer automatically recognizes all the versions of Labview that you have installed in your PC. **Select the version of Labview that you will use when running the NIREOS Complete Example.vi**.




If you do not want to use the Labview-based SDK, and if you do not have Labview installed on your PC, then do not select the Labview integration option.

2. Install the **CDM21226_Setup.exe** located in NIREOS\Driver

   This procedure is done to make sure that the USB drivers of your PC are up to date. If not updated, this may cause issues of connections of the GEMINI.

# 2. NIREOS Complete Example Software

In the provided NIREOS USB pendrive, open the folder "NIREOS Complete Example V.1.2_MCS".

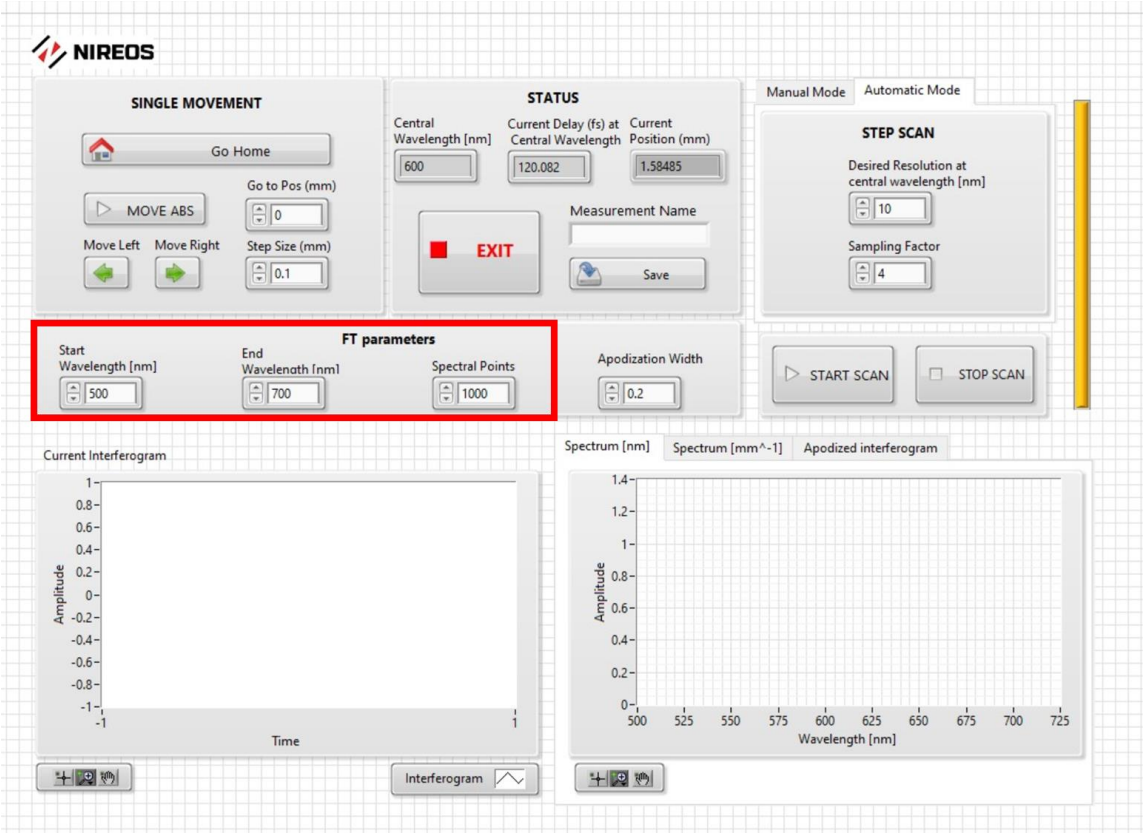
Open the LabView example NIREOS Complete Example V.1.2_MCS.vi located in NIREOS\NIREOS Complete Example V.1.2_MCS

# Enjoy!

# 3. Software and Fourier Transform Tips

The GEMINI is based on Fourier Transform approach. In the following, some tips to work properly with the GEMINI are explained:

## FT parameters

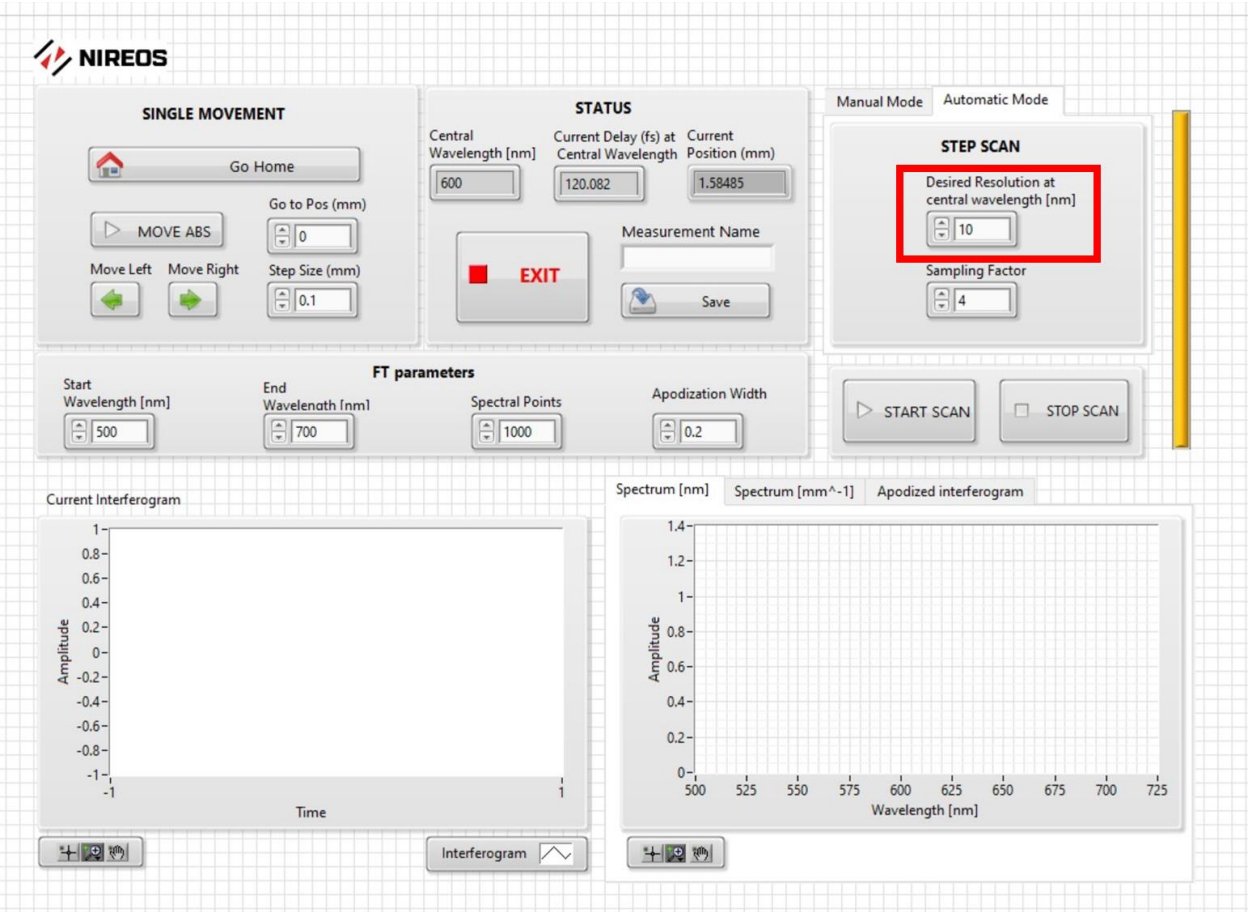



**Start Wavelength** and **End Wavelength** define the limits of the spectral range where the Fourier Transform is computed. In order to optimize the measurement parameters, please select the proper spectral limits depending on your measurements.

Example: if you expect to have a signal in the range 600 – 700 nm, you can type e.g. Start Wavelength = 550 nm and End Wavelength = 750 nm.

**Spectral Points** defines the number of points used to plot the spectrum after the Fourier Transform. This parameter does not define the spectral resolution of your measurements! You can update this parameter also after the measurement. Upon updating this parameter, a new Fourier Transformation is computed and a new spectrum (with the updated Spectral Points value) is plotted.

## Spectral Resolution

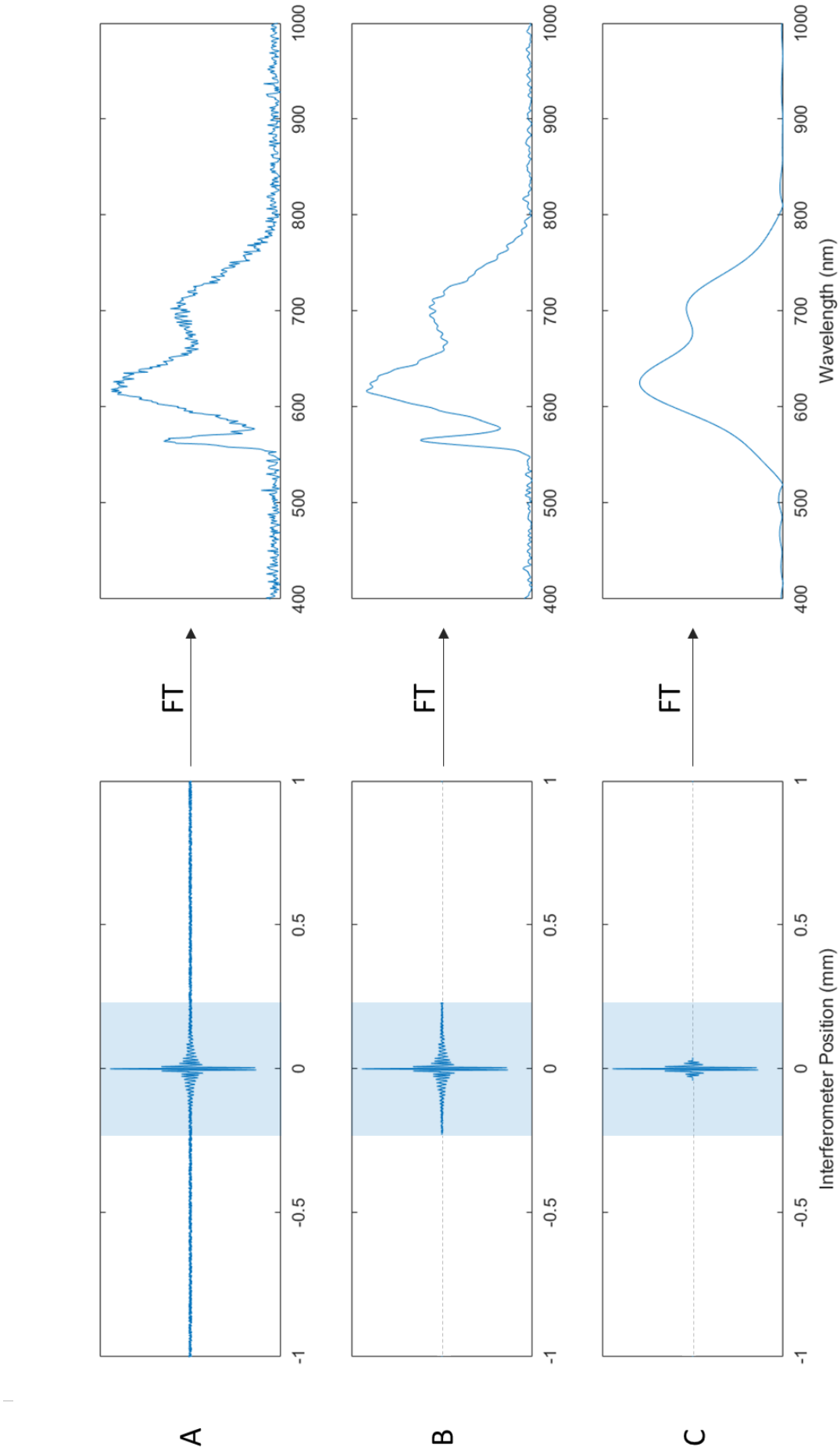



Please type the spectral resolution (in nanometers) that you want to achieve in your experiment in the field “Desired Resolution at central wavelength (nm)”.

The central wavelength is the mean value of the spectral range defined in the FT parameters (see the previous paragraph). Please note that, being based on a Fourier Transform approach, the spectral resolution increases as a function of wavelength.

**NB.** In order to optimize the measurement and the quality of the data, **it is of extreme importance to set the proper spectral resolution**, depending on the signal you are measuring. The spectral resolution affects the scan of the interferometer, as in any Fourier Transform approach.

In order to understand how to set the best spectral resolution, please refer to the following figures:


A
B
C
FT
FT
FT
-1
-0.5
0
0.5
1
Interferometer Position (mm)
400
500
600
700
800
900
1000
Wavelength (nm)

The figure shows 3 sets of an Interferogram (raw measured data) and relative spectrum, retrieved with a Fourier Transform. Each interferogram shows the typical oscillations which carry information on the spectrum of the measured light. Also, there is some noise, which is clearly visible especially in the long tails of the interferogram A.

The three interferograms refer to the very same signal. The only difference is the chosen spectral resolution.

- The interferogram A is measured with a fine spectral resolution (e.g. 1 nm)
- The interferogram B is measured with a medium spectral resolution (e.g. 10 nm)
- The interferogram C is measured with a coarse spectral resolution (e.g. 100 nm)

As the spectral resolution affects the travel range of the interferometer, the three interferograms have a different length, and so different measurement times are needed to sample the 3 interferograms:

- The interferogram A is long → it requires a long measurement time
- The interferogram B has a medium length
- The interferogram C is short → it requires a short measurement time

In general, the shape of the interferogram depends on the spectral features of the signal. The broader the spectrum, the narrower the central burst of the interferogram. On the contrary, the presence of narrow spectral features introduce long-lasting oscillations in the interferogram.

By looking at the Interferogram A, it is possible to notice that the oscillations relative to the signal are characterized by a central burst around time 0, and then they fade towards the tails. Outside the shaded blue area, it is clear that the interferogram shows no more oscillations due to the signal, and only the noise is present. However, as the chosen spectral resolution is too fine, the travel range of the interferometer is too long, and therefore a lot of noise is sampled. This results in 2 bad consequences:

- The measurement time is uselessly long
- A lot of noise (and no signal) is measured: this can be seen in the retrieved spectrum, which shows a proper spectral resolution, but it is very noisy.

By looking at the Interferogram C: as the chosen spectral resolution is too coarse, the travel range of the interferometer is too short, and therefore the oscillations of the signal are not completely sampled. As shown in the figure, the resulting spectrum does not have enough spectral resolution.

The interferogram B is the best scenario: here, a proper spectral resolution has been chosen, so that the oscillations of the signal are entirely sampled up to the point in which they fade and their intensity becomes smaller than the noise.

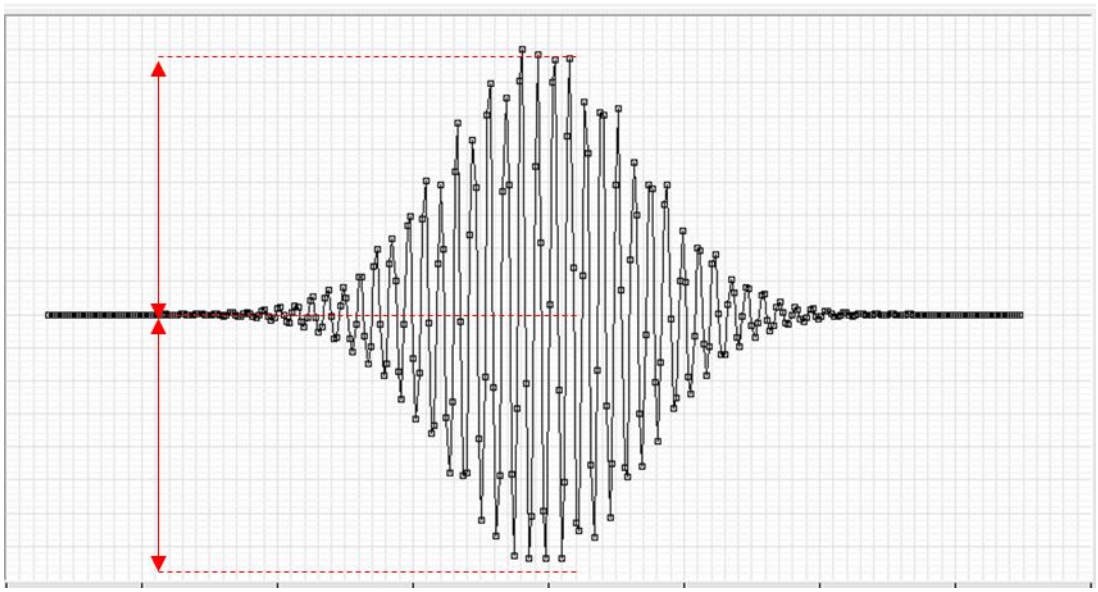
In this case, the resulting spectrum shows a good spectral resolution (as the one in case A), since the signal oscillations have been sampled correctly, and it is less noisy than the spectrum in case A, since the tails of the interferogram where only noise is present were not sampled.

For each experiment or application, it is suggested to perform some tests with different spectral resolutions to analyse the measured interferogram and set the best spectral resolution.

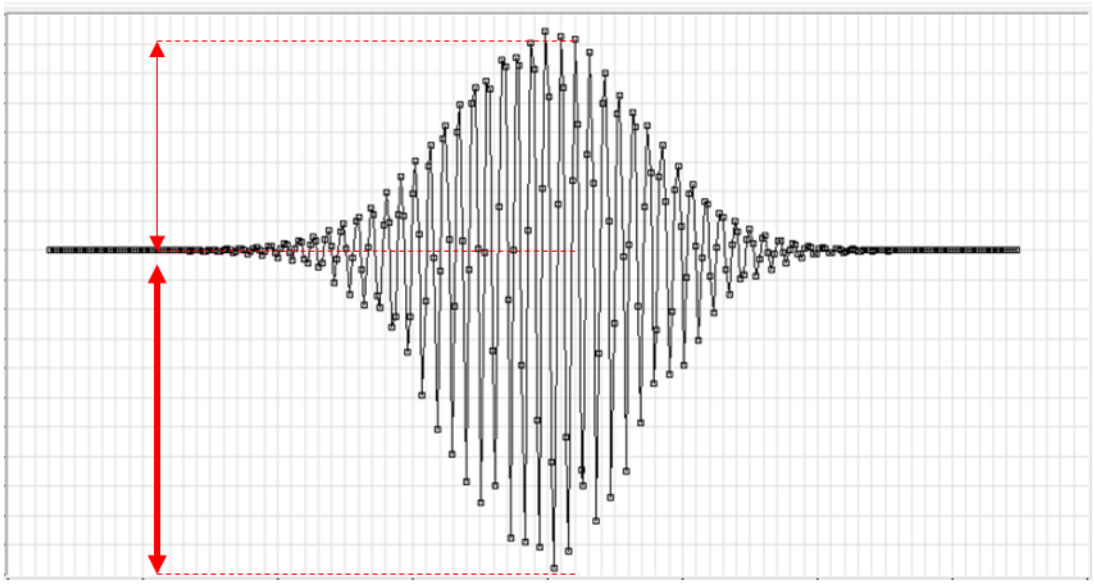
If you already have acquired a data with too fine spectral resolution, and so you notice that the tails contain only noise and no useful signal, you can still improve the SNR without performing another measurement, but simply decreasing the value of the Apodization Width.

## Saturation issues

A good interferogram must be symmetric in the vertical axis, as shown in the image below:



**Please always pay attention not to saturate the detector!** This happens when the interferogram is no more symmetric in the vertical axis, as shown in the image below:



In this case, the saturation of the interferogram typically leads to unwanted artifacts in the spectrum. To correct for this, you can attenuate the light or modify the response of the detector, in order to avoid saturation and measure a symmetric interferogram.

# 4. Troubleshooting

- *I cannot save the measurement, or I cannot find the saved data in the specified path.*

  This error indicates that you do not have permission to write the files in the saving directory. The default saving directory is the application folder. This is probably located close to the root path and you should have the right permission to write in there.

  - Solution #1: Start the application as an administrator.
  - Solution #2: change the saving directory to a user-selected folder where there is no need for special privileges to write a file (e.g. Documents, a folder on the desktop, or any other place which is not close to the root path.
  - Solution #3: Copy and paste the application folder to another place requiring no special administration privileges to write a file.

- *An error message appears when trying to run the software. The software does not run and the GEMINI does not connect / move.*

  Solution:

  - Check that the GEMINI and the controller have been properly connected to the power supply and to the computer.
  - After connecting to the power supply, turn on the controller and check that the Green LED turns on. If the Green LED does not turn on, please contact info@nireos.com for further assistance.
  - Please install the drivers as indicated in the Chapter 1 of this manual.
  - Please make sure that you are using the proper version of Labview corresponding to the one indicated when installing the MCS_Installer_3.8.9.exe (please refer to Chapter 1 of this manual).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