



OPTOGAMA

FEMTOSTRAY

Auto-correlator



QUICK START GUIDE



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1. Introduction

The FEMTOSTRAY Autocorrelator was designed to monitor the pulse width of both oscillators and amplifiers of ultrafast systems in the range of **15 fs** to **150 fs** and wavelength range of **750nm -850nm** (other range optional).

To measure the pulse duration of single ultrashort laser pulses in a single-shot autocorrelator, a technique based on the detection of the spatial distribution of second harmonic (SH) energy is used. This SH energy is generated in a nonlinear crystal when two non-collinear beams interact at a known angle.

The method relies on splitting the original laser pulse into two identical beams using a beam splitter (BS). These beams are then directed to overlap inside the nonlinear crystal. As they interact, second harmonic generation (SHG) occurs at their overlap region, creating a superimposed pulse field. By analyzing the SHG's spatial distribution, the pulse duration can be determined.

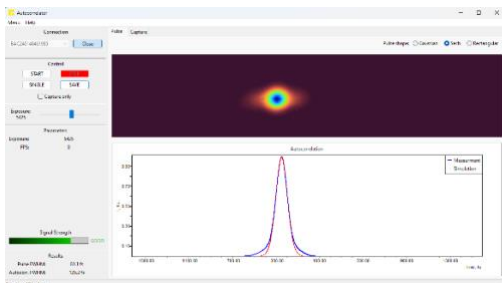
2. Package contents



Autocorrelator main unit



USB Cable



Software



Triggering Cable (optional)



3. Safety information



To ensure safety, please read this manual carefully before operating the device. Complete everything step by step. In case of any uncertainties contact the vendors.



Exposure to laser radiation may be harmful. Always wear suitable laser goggles to protect your eyes when working with the laser. All apertures which can emit laser light more than levels which are considered safe are identified with laser beam warning stickers.

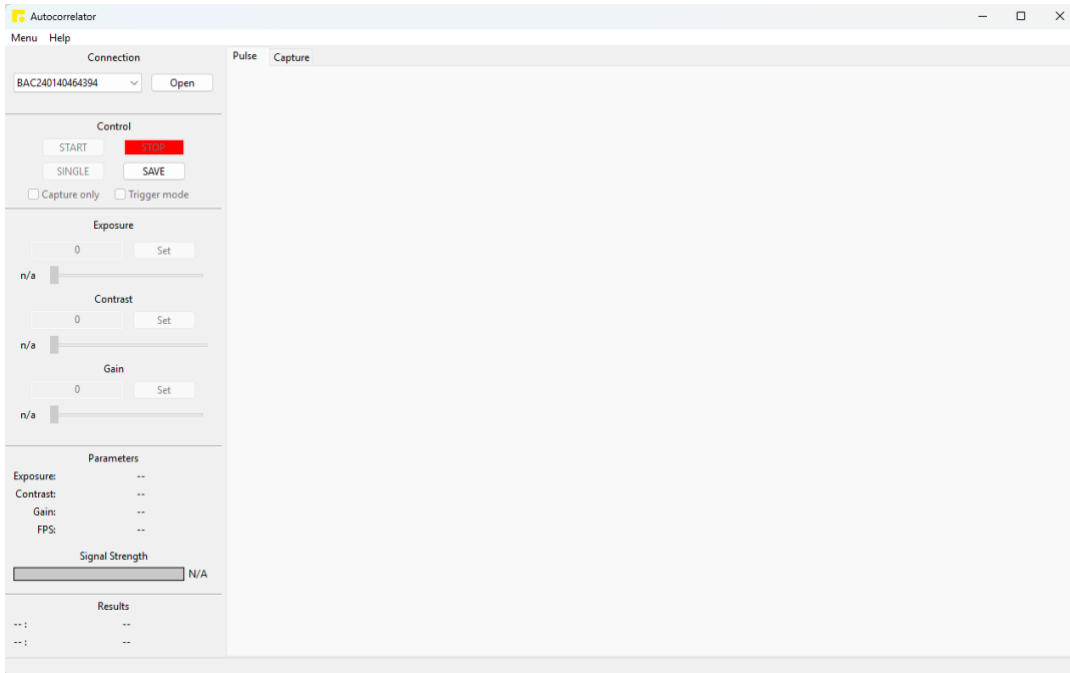




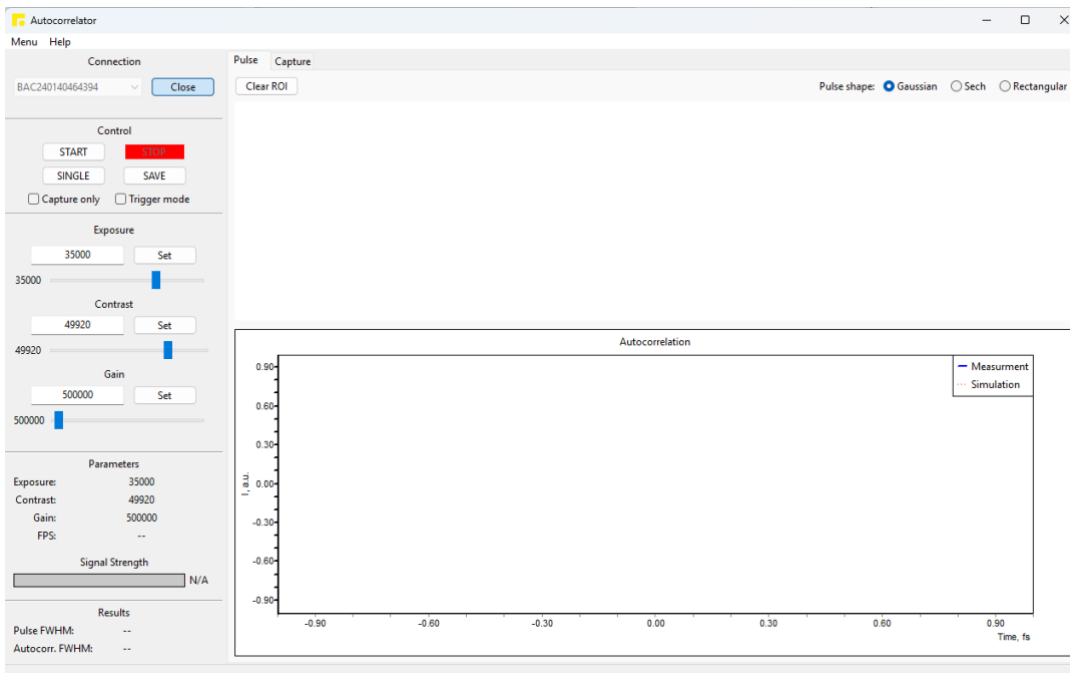
4. Quick start guide

This is a quick start guide for fast guidance to start using the instrument.

1. Install FEMTOSTRAY control software and camera drivers. For the software installation instructions please refer to chapter 5.
2. Connect provided USB3 cable to autocorrelator camera and PC.
3. Open Autocorrelator UI software and press “Open” button to open connection to the camera.

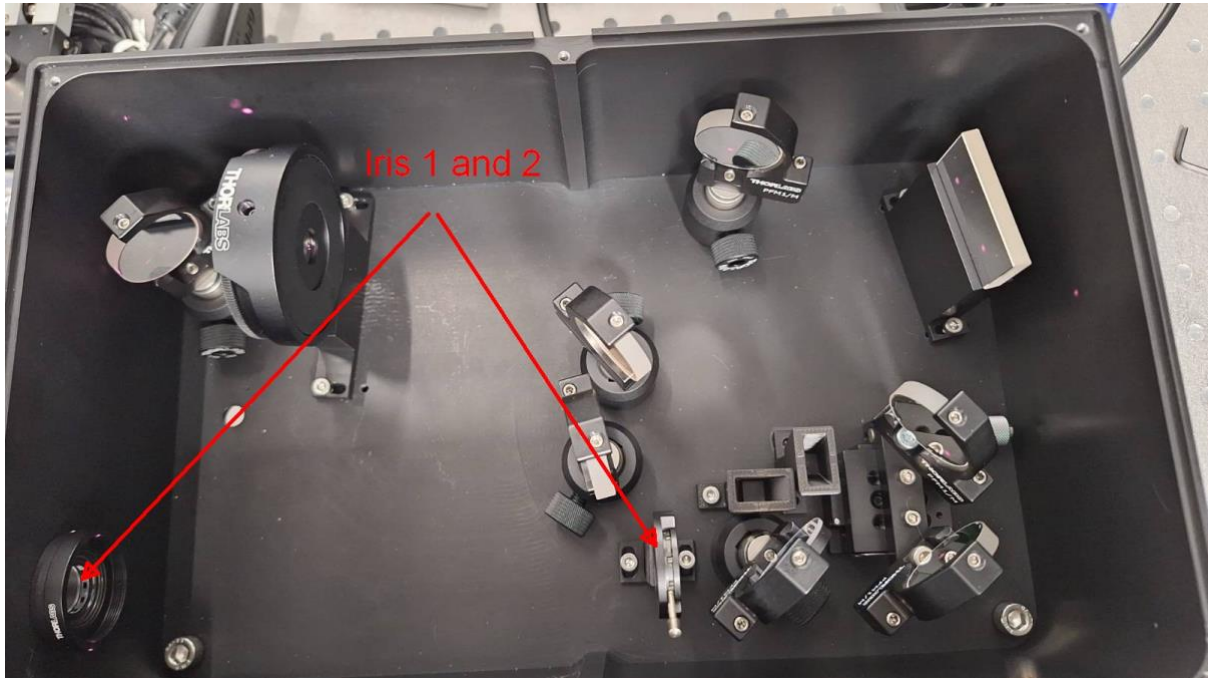


4. If camera is connected properly main window will change and buttons “START” and “SINGLE” will become active.

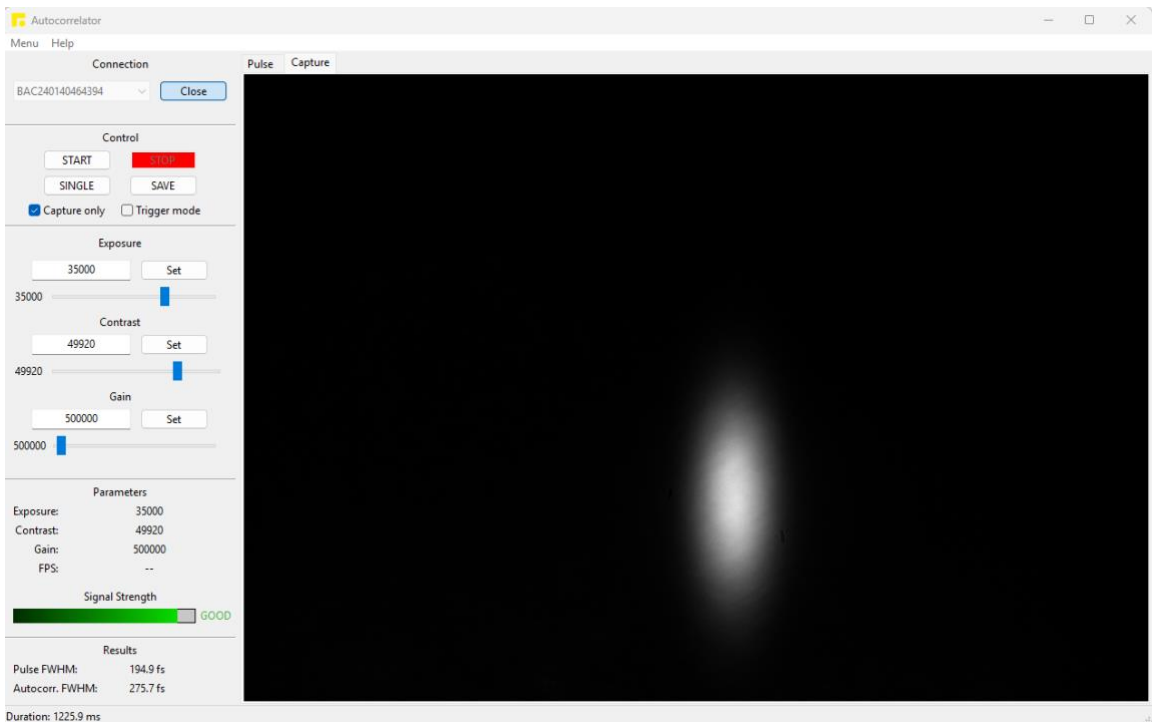




5. Close (reduce the aperture to a minimum) both Irises shown below. Orientate the autocorrelator so that laser beam goes through both irises. Open Iris 1 and 2.

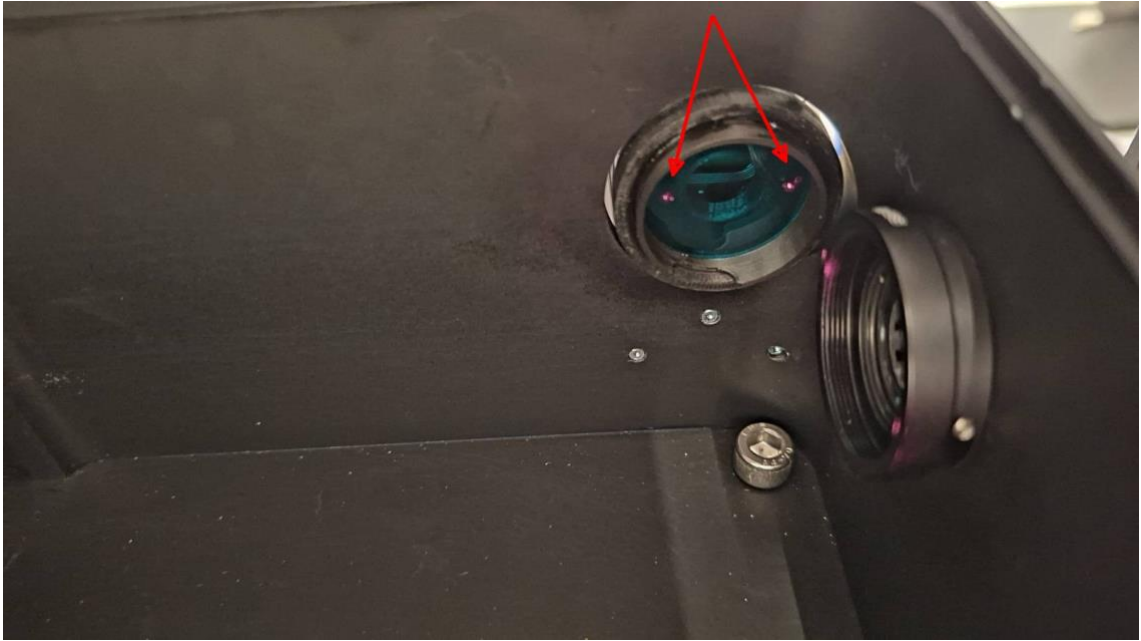


6. Check the box "Capture only" and press button "START". If the incoming laser beam **polarization is horizontal**, then SHG signal should be seen as shown below. If you have a weak signal or do not see signal at all, try to increase the exposure until you see the SHG signal clearly.

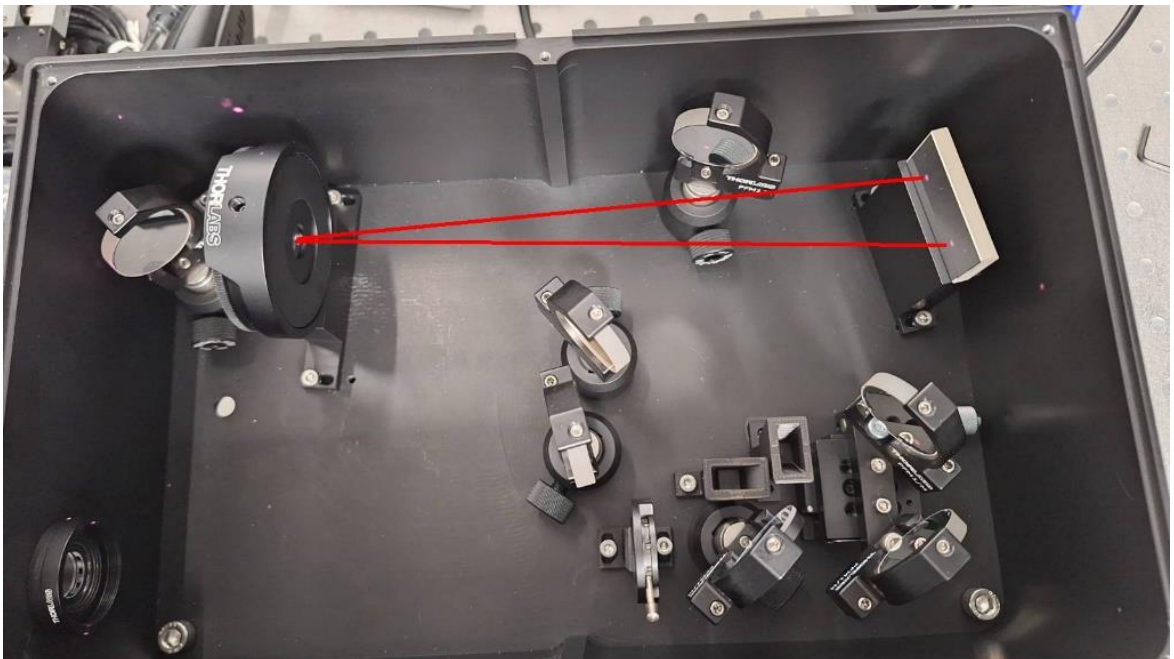




7. If you do not see SHG signal in the software, check if laser beams paths are correct. In a correctly aligned system, there should be the two beams visible on the filter before the camera as shown below. And in the middle between these beams there should be low intensity SHG spot which can be seen only in the dark environment on the white card.

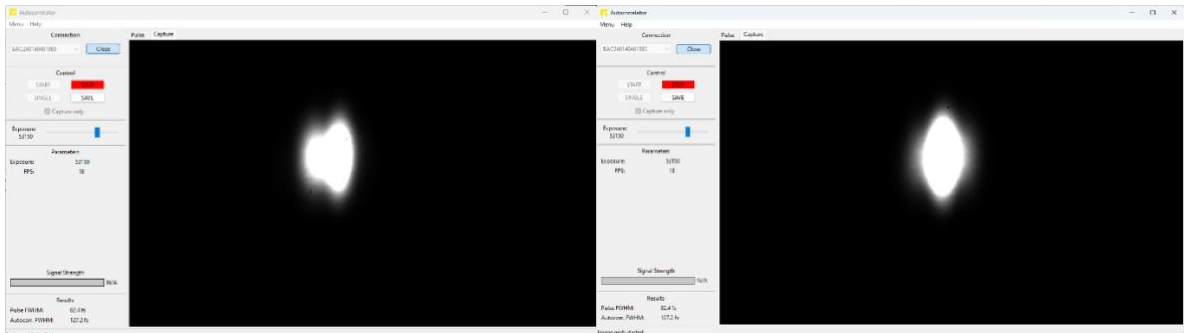


8. Also, check if two beams are overlapping inside the nonlinear crystal. Beam paths should be like in the picture below.

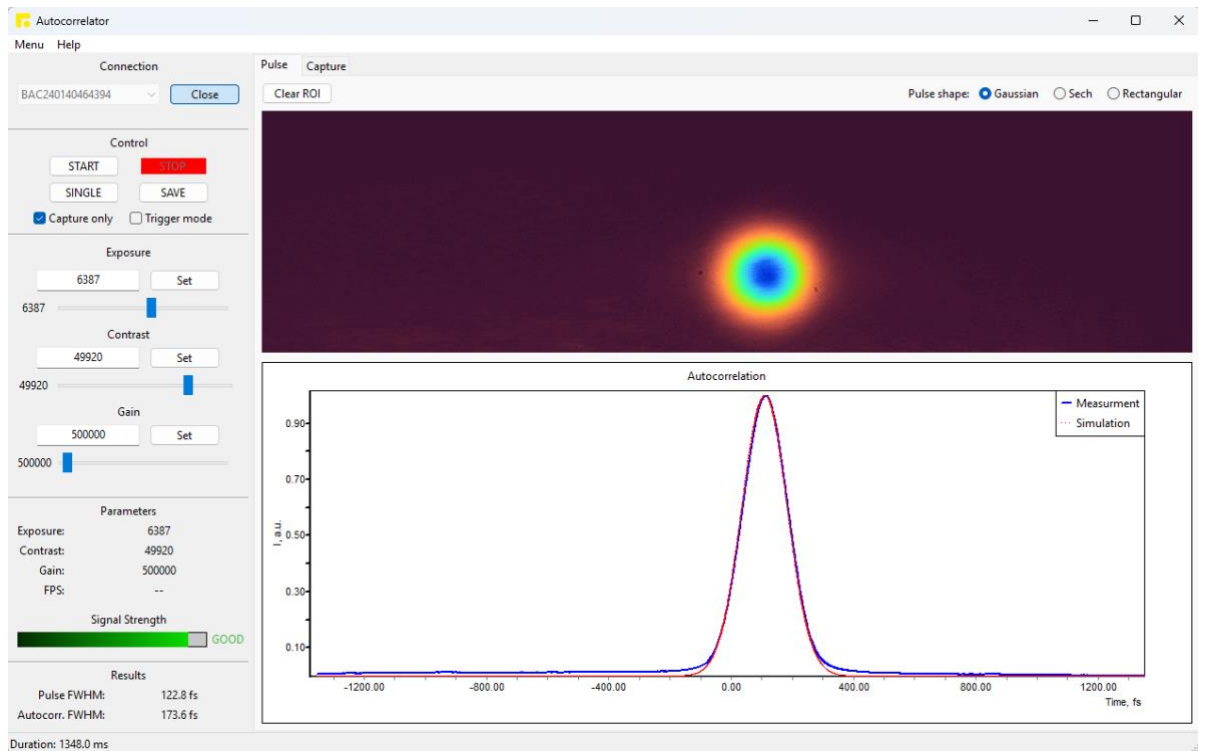




9. Once you can register beam spot, adjust the camera exposure until the image appears saturated. Then, align the autocorrelator by tilting its housing front or rear relative to the laser beam. **DO NOT ADJUST ANY OF THE MIRRORS OR OTHER OPTICAL COMPONENTS!** Ensure that the second harmonic generation (SHG) signal appears symmetric, as shown in the reference image on the right.

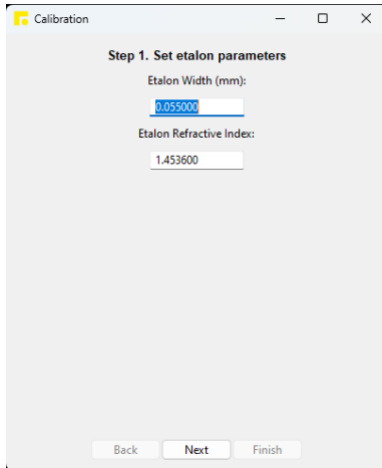


10. Switch from “Capture” to “Pulse” TAB to see autocorrelation images. Adjust the exposure to ensure the image is not saturated. Click the “Stop” button. Then, uncheck the “Capture only” option and click the “SINGLE” button. If the signal indicator shows “GOOD,” proceed to the calibration step. If the indicator displays “LOW” or “HIGH,” adjust the exposure, then press the “SINGLE” button again, and wait for the result. Repeat this process until the signal level reads “GOOD.”

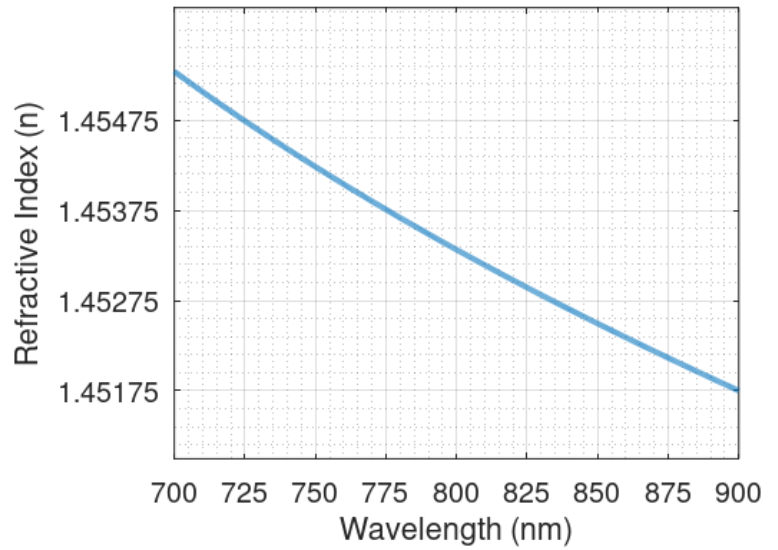




11. To start calibration open the calibration table by pressing "Menu" -> "Calibration". In the calibration dialog box enter the etalon parameters as shown below. For etalon thickness, check the information on the etalon and for the index of refraction check the curve below and enter the value closest to your laser's wavelength, then press "Next" button.



Refractive Index vs. Wavelength

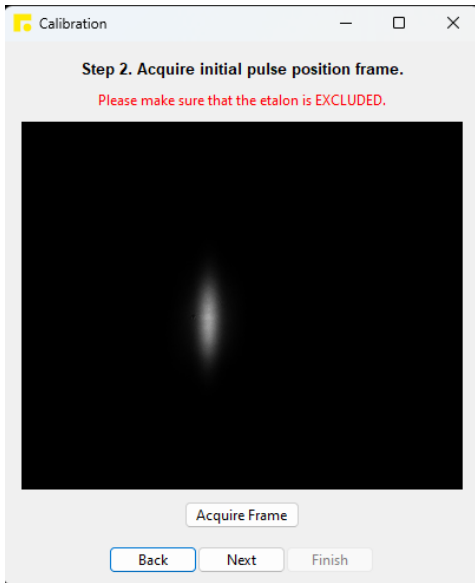


12. Make sure the etalon is not inserted (slit is in down position as in picture below).





13. Then, press “Acquire Frame”.

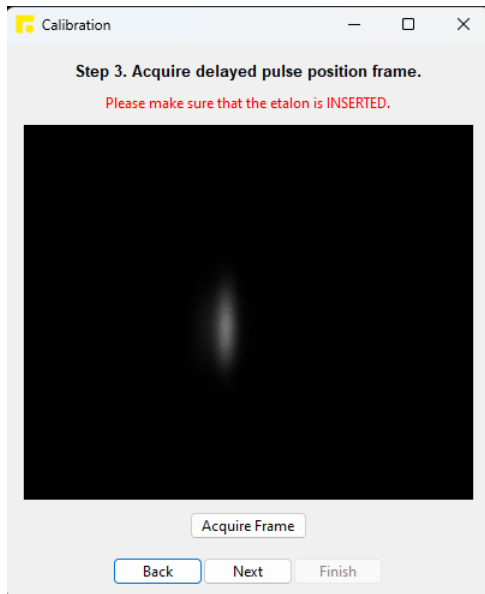


14. Press “Next” and place etalon into the beam path by changing the slit position to “up” as shown in picture below.

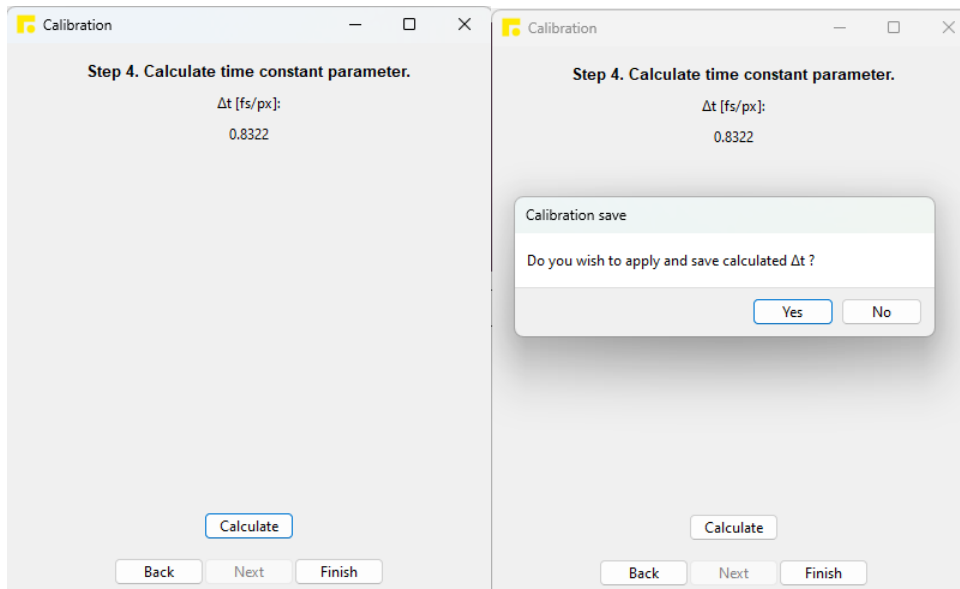




15. Press “Acquire Frame” with etalon inserted. The SHG signal image with etalon should be in slightly different horizontal position. You can check this by pressing “Back” and “Next” buttons to change between acquired images with and without etalon.

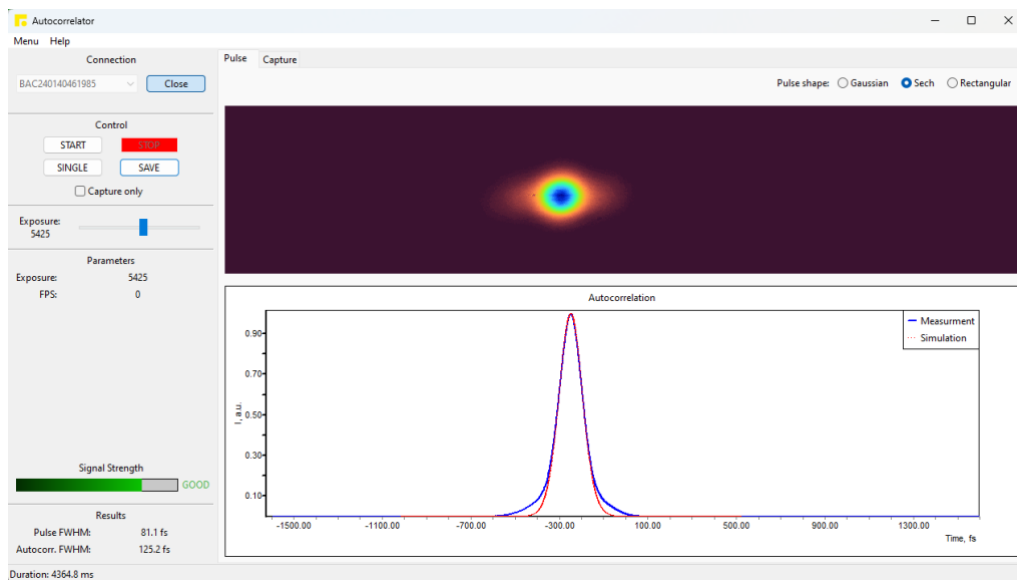


16. Take out the etalon and press “Calculate” in the last calibration dialog box step. Then, if you wish to write calibration data into “Calibration settings” press “Finish” and approve it by pressing “Yes”.

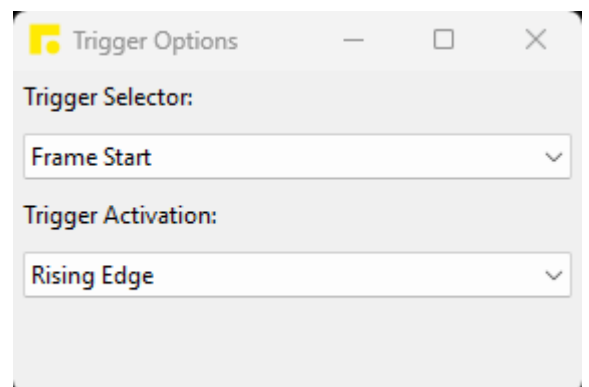
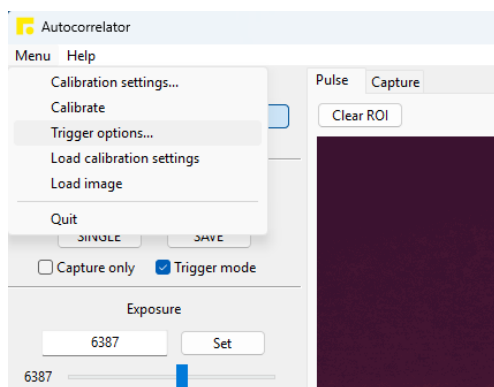




- 17. Close the cover to reduce the amount of stray light to the camera. In case you measure with open cover, the measurement result will be incorrect. Select the desired laser pulse waveform: Gaussian, Sech, or Rectangular (check in laser manual to find out what pulse shape it has). Start the measurement by pressing “START” to continuously monitor the pulse length, or “SINGLE” to measure it once. The processing time for each image depends on the CPU’s performance and may take several seconds (approximately 4 seconds in the example below, using an AMD Ryzen 5). For accurate measurements, adjust the camera exposure so that the signal level reaches 70-90% of the full dynamic range. You should read “Signal strength” indicator “GOOD”. The signal strength indicator updates after each successful pulse calculation.



- 18. If the FEMTOSTRAY autocorrelator is used in single-shot regime when the camera is triggered from external source be sure that laser pulse is coming at least 35ms after trigger signal. To activate the single shot regime, check the box “Trigger mode”. When Trigger mode is active, camera frame capture is activated from the Rising Edge, Falling Edge, High or Low Level of trigger signal. Default is “Rising Edge”. Camera integrated into this autocorrelator support only two Trigger modes: “Exposure start” and “Frame start”. Default value is “Frame start”.



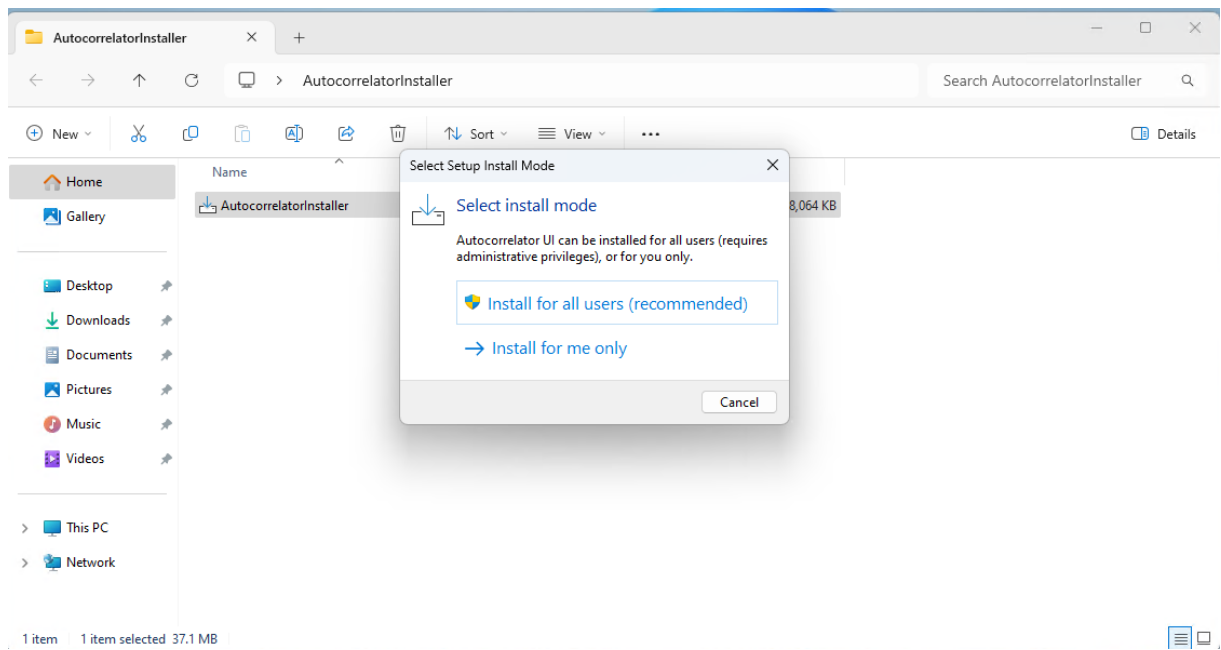


5. The FEMTOSTRAY Control software Installation

The FEMTOSTRAY Control software gives you the ability to control the autocorrelator and perform measurements on a PC equipped with windows or Linux operating systems, save and open acquired pulse images.

Windows OS:

1. Double click the „AutocorrelatorInstaller.exe“ file provided together with the instrument. In the Setup install mode window select install for all users or only the active user as shown below:



2. Accept the license agreement and choose all the standard installation options from the Setup wizard until finished.
3. In case the installer was unable to install drivers, and you do not see camera properly, download and install pylon 7 Camera Software Suite for Windows which include camera drivers from the official Basler website www.baslerweb.de

Linux OS:

1. Download and install "pylon 7 Camera Software Suite for Linux" with camera drivers from the official Basler website <https://www.baslerweb.com/en/downloads/software/3074431539/>
2. Install FEMTOSTRAY software according to README file included in Autocorrelator-v1.2.3.tar.gz