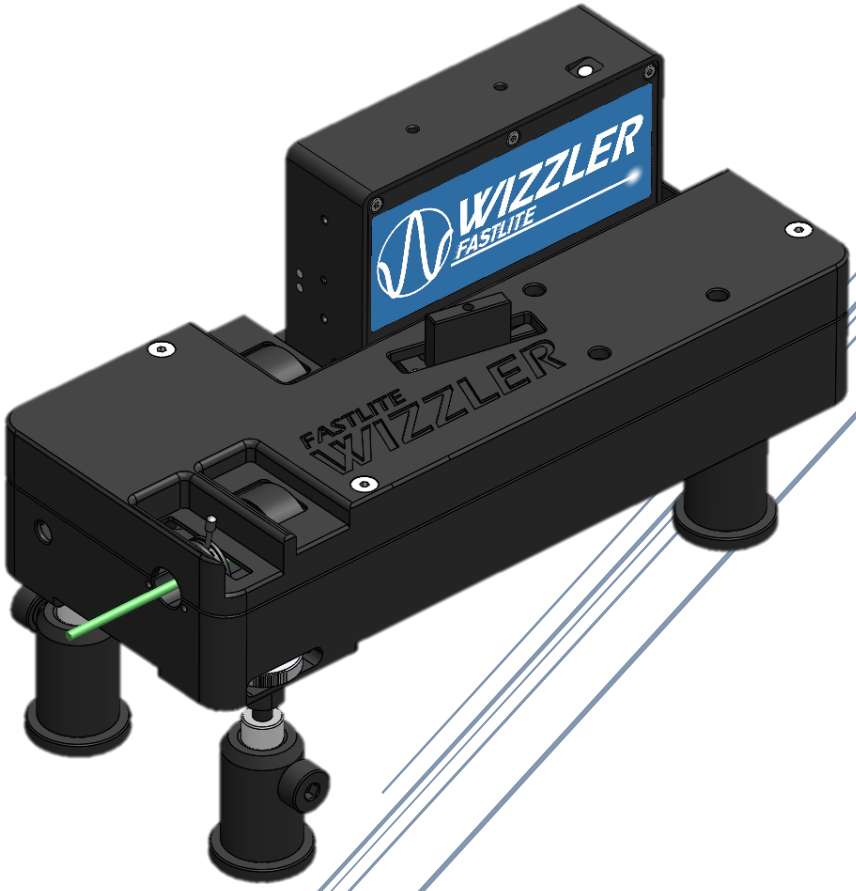
WIZZLER USP SYSTEM

OPERATING MANUAL



V2.0

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CHAPTER 1

Introduction

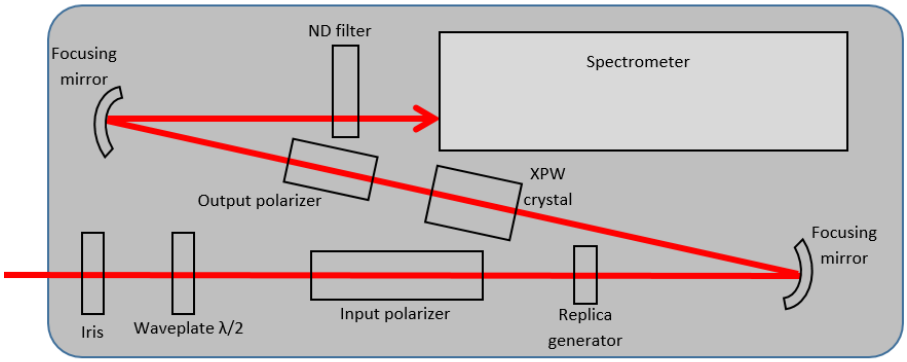

Figure 1.1: Wizzler™ USP optical setup

The Wizzler™ is a pulse measurement system designed to measure accurately the spectral phase of amplified ultra-short, near Fourier-Transform Limited laser pulses. It is based on a pulse characterization technique invented and patented by FASTLITE: Self-Referenced Spectral Interferometry (SRSI). It is single-beam, single shot, and delivers both spectral phase and amplitude measurements, i.e the complete temporal characterization of an ultrashort pulse.

The Wizzler™ system is a standalone instrument with its hardware, implementing the optical setup that generates the SRSI signal and the spectrometer that records it, and its software, which extracts the pulse characterization from the SRSI interferogram. In case a DAZZLER pulse shaper is integrated in the laser chain, the software has also the capability to send the phase information back to this device to perform pulse optimization.

The Wizzler™ is an ultrashort pulse characterization tool. Such a sophisticated function, despite all efforts we put into designing this device as user-friendly as possible, cannot be carried out without an intelligent operator, understanding at least the basic principle and limitations of the technique. We hope the reading of this document will give you the necessary insights and allow you to take full advantage of the Wizzler™ astonishing capabilities.

CHAPTER 2

SRSI Theory

2.1 Fourier-Transform Spectral Interferometry

Fourier-Transform Spectral Interferometry (FTSI) [1][2], is the treatment of the frequency-domain interference pattern between 2 pulses delayed in the time domain. Inverse Fourier transform of the spectral interferogram results in a 3 peaks structure in which the oscillating term in the spectral domain, centered at the delay τ between the 2 pulses in the temporal domain, is numerically filtered. A Fourier transform convoluted with this filter provides information about the difference of the spectral phases and the product of the spectral intensities. Additionally, a similar treatment of the continuous term in the spectral domain, centered at delay 0 in the temporal domain, provides information about the sum of the spectral intensities, which enables the reconstruction of the 2 spectral amplitudes provided that the 2 spectral intensities do not overlap.

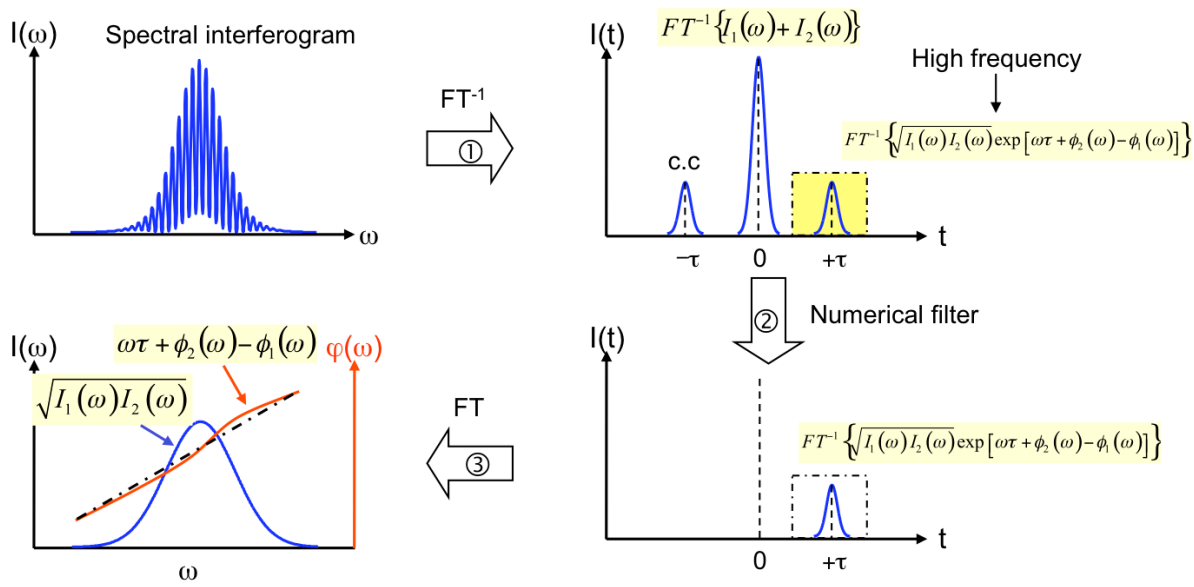

Figure 2.1: FTSI

2.2 XPW effect

Cross-Polarized Wave Generation (XPW) [3][4] is a third-order nonlinear effect. As its name suggests, it is the generation of a linearly polarized wave, orthogonally to the polarization of a high-intensity linearly polarized input wave (see fig 2.2).

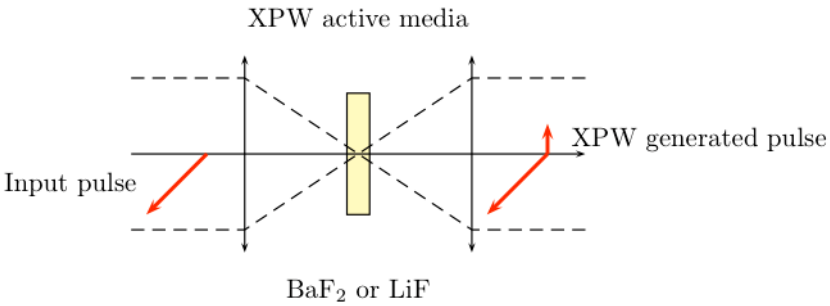

Figure 2.2: XPW generation

Within the slowly-varying envelope, the undepleted regime and the thin crystal approximations [5], the XPW temporal amplitude is linked to the input temporal amplitude by the following formula:

$$E_{XPW}(t) \propto |E_{IN}(t)|^2 \cdot E_{IN}(t)$$

As can be seen, the XPW effect acts like a temporal filter: a XPW generated pulse is a replica of the initial pulse, *filtered by its own temporal intensity*. Thus, we expect it to be shorter in time *ie* to have a broader spectrum and a flatter spectral phase than the input pulse. This is true, according to [6], when the pulse is close enough to the Fourier transform limit, *ie* when the spectral phase is flat enough for the pulse to be filtered by the XPW effect. It is worth noting that XPW generation is more sensitive to the chirp than to higher orders of the spectral phase, and that its efficiency vanished for pulses chirped to above 2 times their FTL pulse duration. [6]

2.3 Self-Referenced Spectral Interferometry

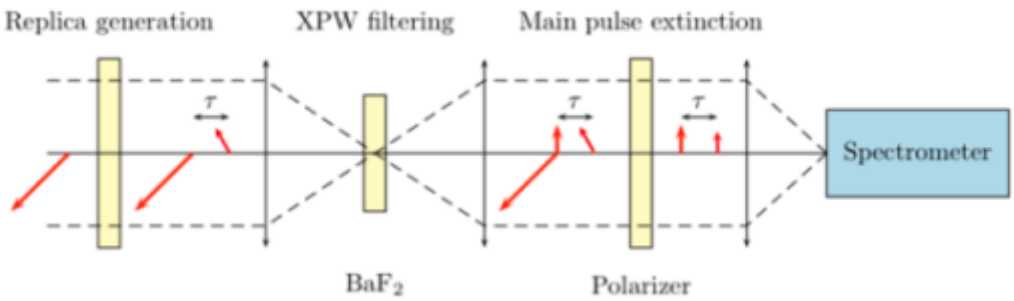

Figure 2.3: SRSI implementation in your Wizzler™

The Wizzler™ measurement technique name is "Self-Referenced Spectral Interferometry" (SRSI). The principle is pretty simple, and described on figure 2.3. From the pulse to be measured, a replica is created on a linear polarization different from the input one and delayed. The main pulse is used to

generate a reference pulse with a broader spectrum and a flatter spectral phase, but with the same carrier frequency, via Cross-Polarized Wave Generation (XPW). This reference pulse is created on the perpendicular polarization, so that a polarizer can transmit the XPW pulse and the replica to a spectrometer which records an interference signal.
FTSI treatment is applied to this interferogram, and both spectral phase and spectral amplitude of the input pulse can be extracted assuming that the spectral phase of the reference pulse Φ1 is known. While Φ1 is not perfectly flat, it can be set to 0 as a first approximation, and the algorithm shown on figure 2.3 improves the accuracy of the reference pulse phase value.

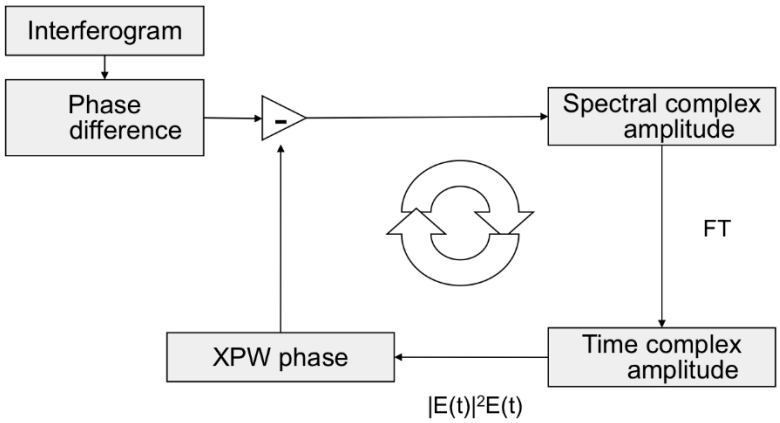

Figure 2.4: Algorithm loop to improve accuracy of XPW phase value

As a result, the accuracy of the Wizzler™ measurement is drastically improved. The accuracy map below shows a calculation of the RMS error (in %) between the measured and theoretical pulse.

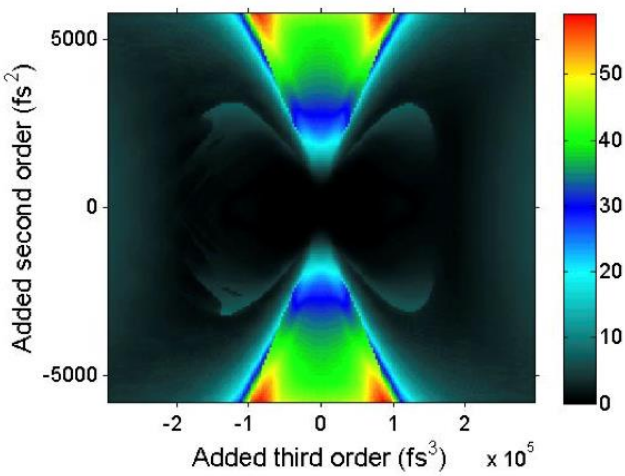

Figure 2.5: Accuracy map of SRSI measurement (20nm FWHM, gaussian pulse)

In the Wizzler™, the algorithm used includes last data processing development and enhancement unpublished and done by FASTLITE. FASTLITE has published a number of articles describing SRSI technique as well as Wizzler™ experimental results. A list of these publications can be found in the bibliography. [7][8][9]

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[4] A. Jullien, O. Albert, G. Chériaux, J. Etchepare, S. Kourtev, N. Minkovski, S. M. Saltiel, "Nonlinear polarization rotation of elliptical light in cubic crystals, with application to cross-polarized wave generation" JOSA B 22, 12-2635 (2005)

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[9] S. Grabielle, A. Moulet, N. Forget,V. Crozatier, S. Coudreau, R. Herzog, T. Oksenhendler, C. Cornaggia, O. Gobert "Self-referenced spectral interferometry cross-checked with SPIDER on sub-15 fs pulses.", Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment DOI information: 10.1016/j.nima.2011.01.007

CHAPTER 3

Discovering your Wizzler™

3.1 Packing list

The Wizzler™ is delivered with the following parts:

- one Wizzler™ optical module including an Avantes Spectrometer
- one set of three Allen keys
- three pedestal posts and posts extensions
- one trigger cable (2.50m) and two USB cables (1.80m and 4.50m)
- one USB key including software and manual
- one USB dongle
- one paper version of this user manual, including the test sheet

All items are packed in one single crate. The Wizzler™ crate is re-usable and should be kept for further servicing.

3.2 Wizzler™ Serial Number

The Serial Number provides essential information about your Wizzler™ and is indicated on the Wizzler™ test sheet, and on a sticker inside the Wizzler™ module.
All Wizzler™ serial numbers have the same structure: **Wx-nn-x-nn-xx-nn** where x are letters and n are numbers. The first 2 numbers indicate the central wavelength of the Wizzler™ spectrum range (in hundreds of nm). The following 2 numbers indicate the value of the delay τ of the pulse replica (in hundreds of femtoseconds). For example, a Wizzler™ Wx08x09xxnn is for 800nm lasers, and the pulse replica is created at 900fs of the main pulse.

Figure 3.1: Wizzler™ Serial Number sticker

3.3 Wizzler™ Test sheet

At the end of the paper version of this manual, the test sheet for your Wizzler™ is provided. This ensures that your Wizzler™'s functionalities have been tested on a real laser, with satisfactory results. This data sheet also provides important information regarding the dispersion calibration of your Wizzler™.

At first use, it is necessary to set, in the advanced mode of the `dispersion calibration` panel, the material and the exact thickness of the birefringent plate as indicated on the Test sheet. See section 5.1.3 for a description of this panel.

3.4 Feet assembly

The Wizzler™ foot are made of 5 parts:

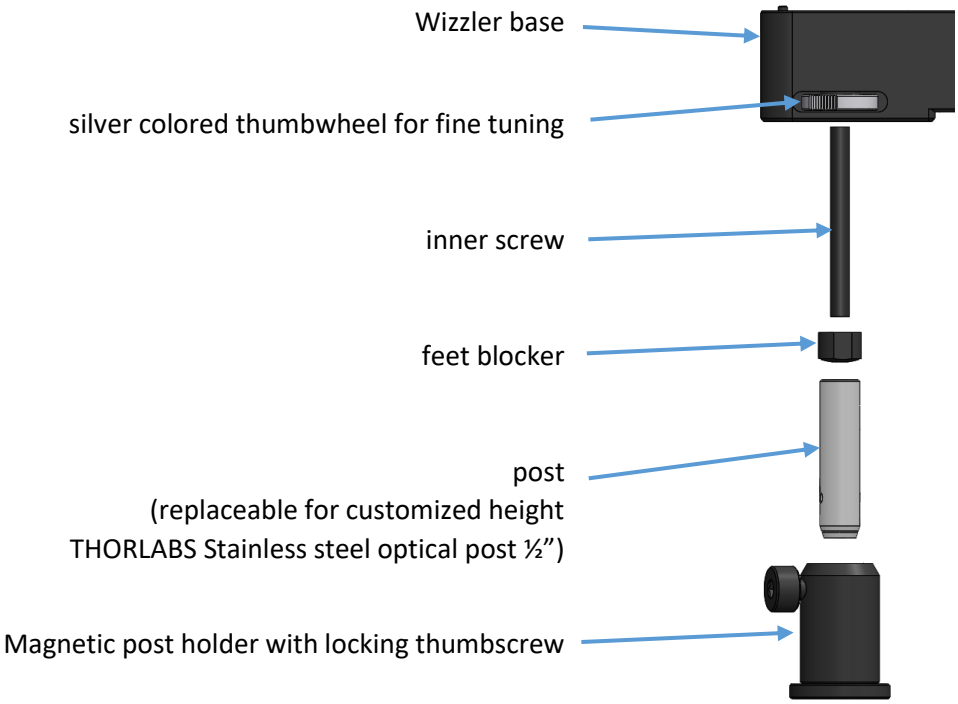


Figure 3.2: Wizzler™ feet assembly description

Unscrew the silver colored thumbwheel from the feet and insert it in one of the 3 dedicated slots on the Wizzler™ side. Screw the remaining part of the feet through the Wizzler™ body and the thumbwheel until the blocker touches the Wizzler™ body. Height can be adjusted by changing the post position in the post holder, and by rotating the thumbwheel. For an optimum stability, block all 3 foot rotations with the blockers.

CHAPTER 4

Software installation and starting

The Wizzler™ is delivered with a USB key including all the components of the Wizzler™ software to be installed:

4.1 LabView™ run-time support

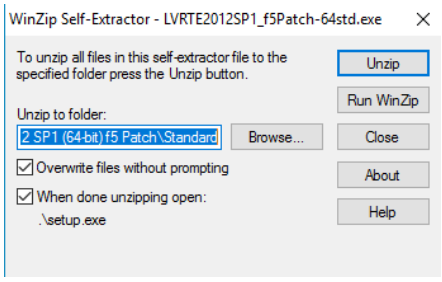
The application programs are written in LabView[1]. The LabView "run-time" is installed by executing the file, leave all default options

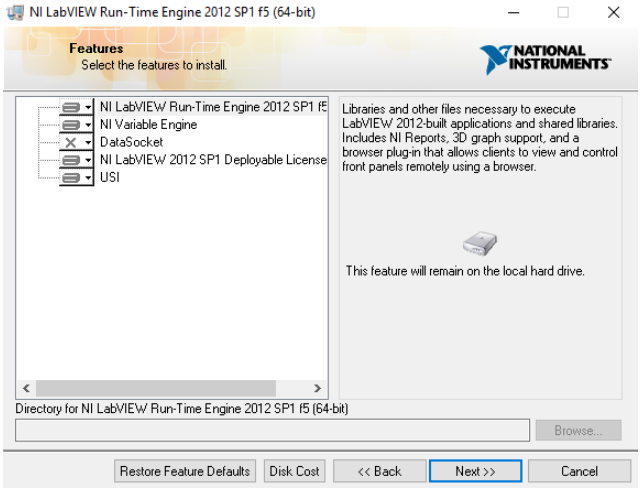
- USB key: **/LabView-runtimes2012_visa /LVRTE2012SP1_f5Patch(-64)stdstd.exe**

Note that **several** versions of the "run-time" can coexist on the same system. It is also necessary to install NI-VISA, done by executing

- USB key: **/LabView-runtimes2012_visa/visa540_runtime.exe**

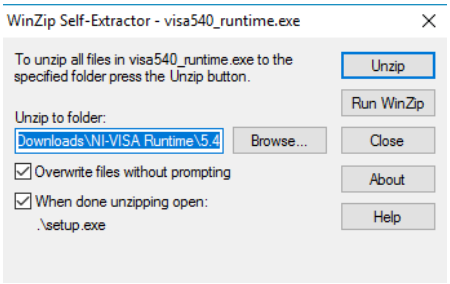
You can either leave all the options or only let the options as described in the screen-dumps following[2].

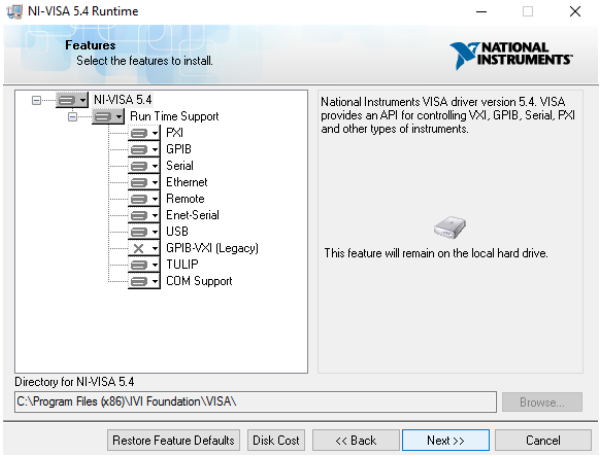




[1]Registered by National Instruments

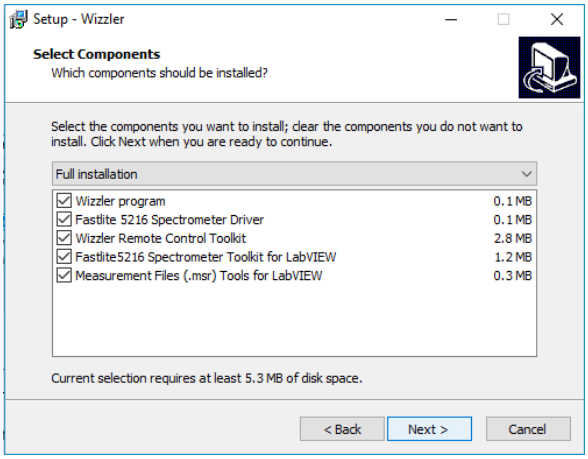
[2]pictures not updated for each version of LabView

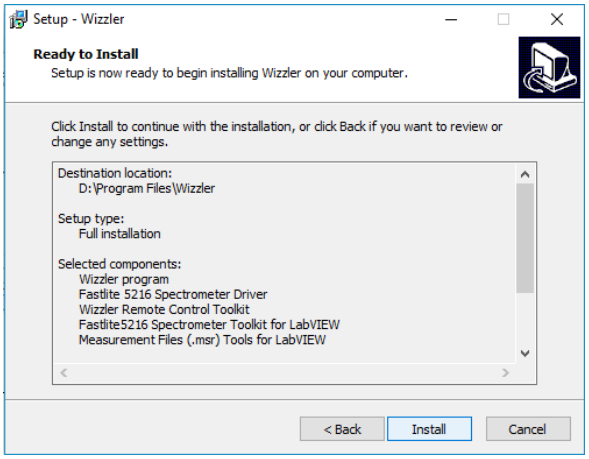




4.2 Wizzler™ application software

The “installer packet” is found in USB key: **/setup-wz-1.4.5-r0.exe**
Windows XP and Windows 7 are supported.



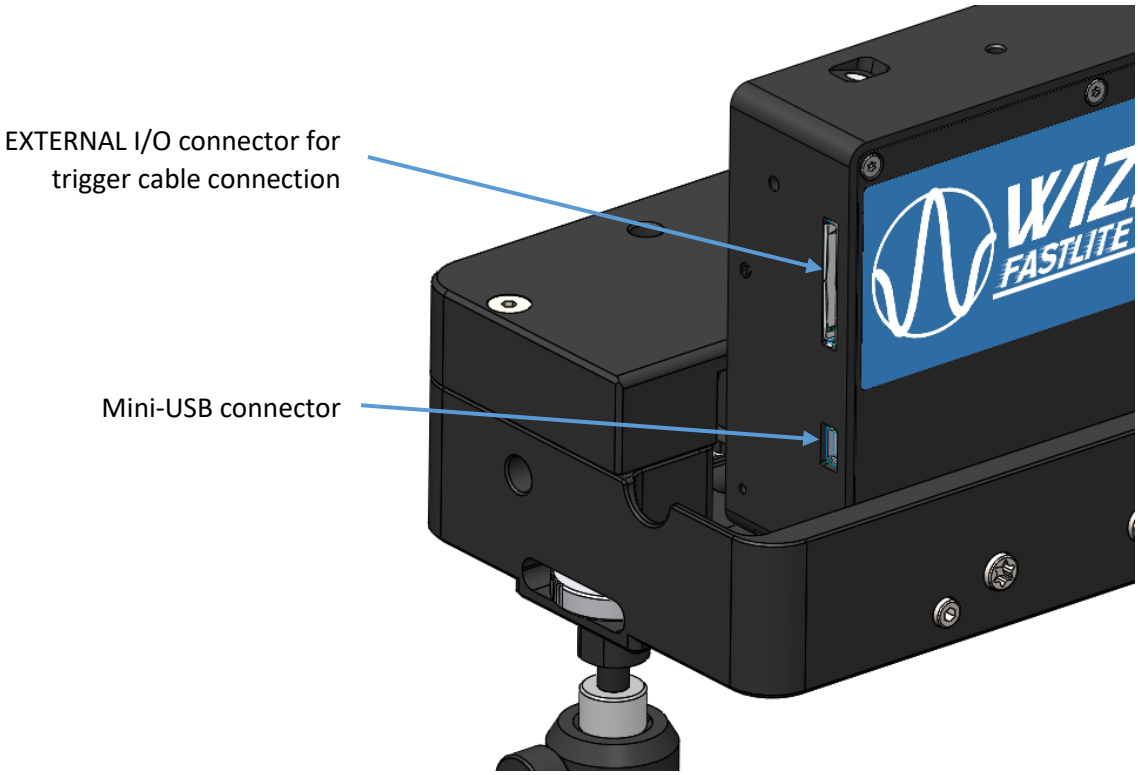


This will create the icon:

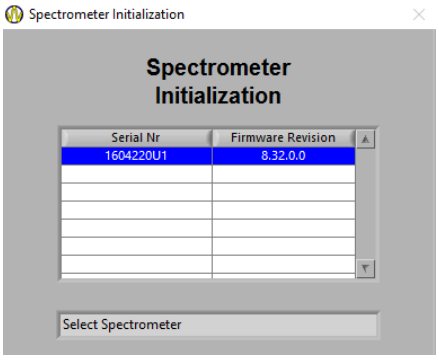
4.3 Connections and starting

Plug the USB dongle into the computer and connect the spectrometer to the computer via the USB cable. Several cables are provided with the Wizzler™. To prevent for electro-magnetic perturbations of the USB connection, the shortest USB cable should be used when possible.

For low repetition rate laser amplifiers, a TTL trigger signal may be necessary. This is done by connecting the Trigger cable to the EXTERNAL I/O connector.



Double-click on the Wizzler™ icon. The software detects the spectrometer automatically.



You are now ready to use the Wizzler™ software... For a complete description of the Wizzler™ software functionalities, please refer to chapter 5.

In order to perform an accurate measurement, it is necessary to adjust settings described in sections 5.1.2 and 5.1.3.

CHAPTER 5

Software guide

A USB Dongle is provided together with the Wizzler™. This software can not operate if the dongle is not plugged into the computer.

When starting the Wizzler™ software, the following window appears:

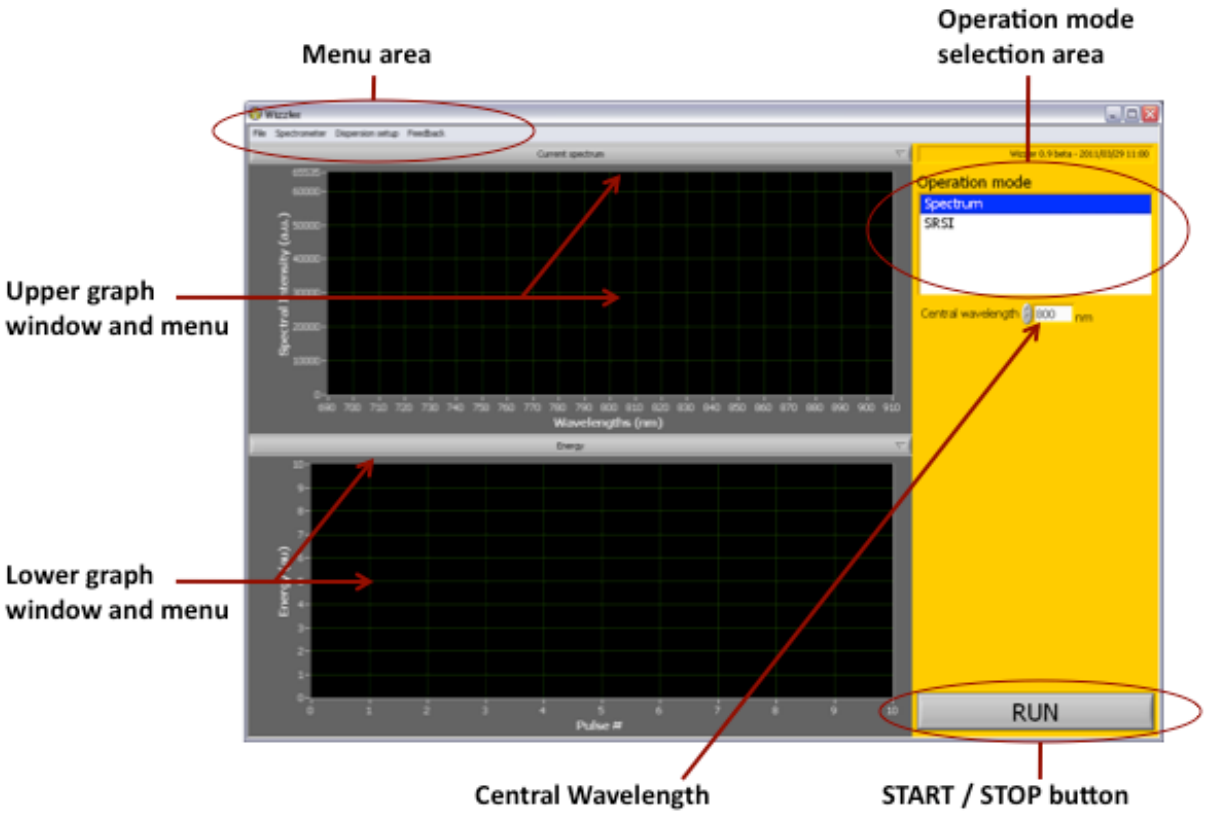


Figure 5.1: Wizzler™ software main window

Menu area gives access to File, Spectrometer, Dispersion setup and Feedback settings, as described in section 5.1

Operation mode selection area allows to select the operation mode of the Wizzler™ software as described in sections 5.2 and 5.3. A single click selects the operation mode, a double click opens the configuration panel for this mode.

RUN starts or stops the measurement selected in the Operation mode selection area. Note that it is not possible to switch from one mode to another when measurement is running.

Central Wavelength sets the central wavelength used for the calculation of the spectral phase polynomials and the dispersion calibration. This setting is not accessible when any measurement is running.

Graphs windows and menus are selectable display areas. The available contents depend on the selected operation mode. A description of these displays is included in each operation mode description.

5.1 Menu area

5.1.1 File menu

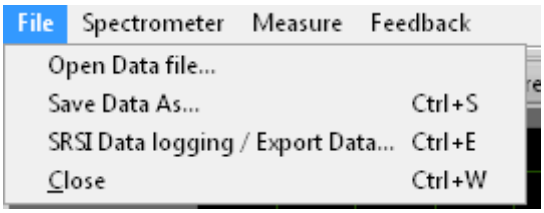


Figure 5.2: File menu

Open Data file... launches a browser window to select and read the datas saved by Save Data As... (.msr format), or raw spectrum datas (.text format).

Save Data As... opens a browser window enabling to save the raw data and operation mode parameters as .msr format. File name format is: year-month-day-hour-minute second-measurement type.

SRSI Datalogging The SRSI datalogging can be used to save automatically the measurement data. The datalog control panel gives access to different options. The data are export once the acquisition is finished. In case of vefy low trigger rate or single shot, the datalog wait until a measurement is done to save the relevant data.

- Menu bar enable either to export the data once immediately, or automatic saving of selected data at the set time period for the number of logs to save.
- Number of logs to save sets the number of logs that will be saved.
- Time between two logs sets the time between data saving.
- Total logging time sets the total time the datalogging will be applied.
- Data to save allows to select 4 types of data as detailed in table 5.1:

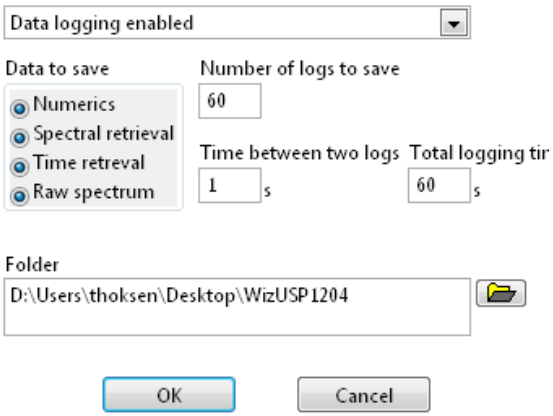


Figure 5.3: Datalogging configuration panel

Data type	Saved data (by column)				File name format
Numerics	All values as displayed in the numerics panel				Date_Time_ SRSI_nums.txt
Spectral domain	λ (nm)	Spectral intensity (a.u.)	Spectral phase (rad)	Polynomial fit of spectral phase (rad)	Date_Time_ SRSI_spectral.txt
Time domain	Time (fs)	Input pulse amplitude (a.u.)	Temporal phase (rad)		Date_Time_ SRSI_time.txt
Raw spectrum	Saves the data as a .msr file				Date_Time_ SRSI_raw.msr

Table 5.1: Datalogging description table

• **Folder** allows to select the folder where data will be saved. Pay attention to the fact that the folder has to exist. The first datalogging requires to select an existing folder on the computer, the preset one may not exist on your computer.

Close: Shuts down the Wizzler™ software.

5.1.2 Spectrometer menu

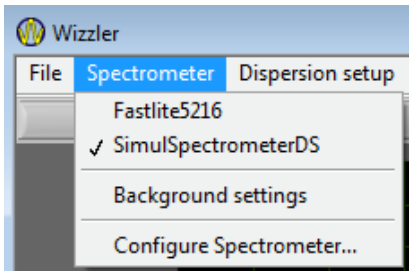


Figure 5.4: Spectrometer menu

Fastlite5216 selects the Wizzler™ spectrometer

SimulSpectrometerDS is automatically selected in case of communication problem with the Wizzler™ spectrometer. This mode allows to simulate the response of the Wizzler to a predefined input beam. Background settings allow to acquire and remove background noise from the spectrometer. It is strongly recommended to do this in order to perform an accurate spectra acquisition. To do so, block the input beam, click on Start Background Acquisition and wait until the displayed spectrum is stabilized. Then click on Apply and Exit.

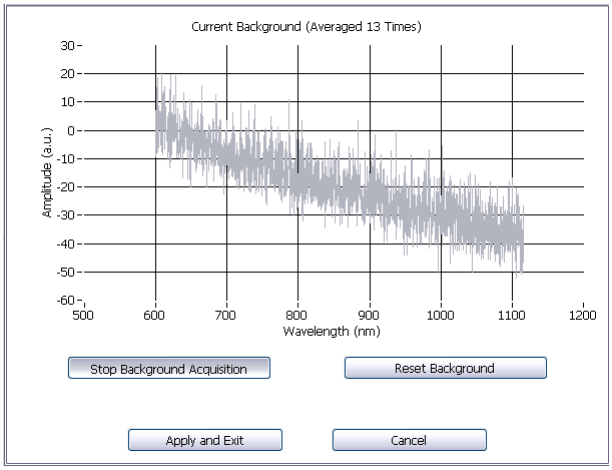


Figure 5.5: Background acquisition panel

Configure Spectrometer... Depending on the selected spectrometer, this may either launch the Wizzler spectrometer configuration panel as shown on figure 5.6, or the simulation mode configuration panel as shown on figure 5.8.

- **Wizzler spectrometer settings:**

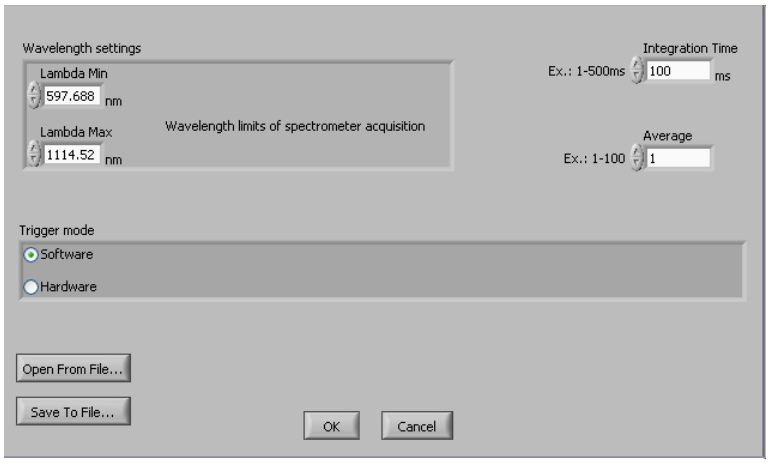


Figure 5.6: Spectrometer configuration panel.

- **Integration time** sets the integration time of the spectrometer expressed in the units indicated on the right on the numeric control.

- **Average** sets the number of spectra to acquire. The displayed spectrum is the average of all acquired spectra.
- **Lambda Min** sets the lowest wavelength to acquire (expressed in the units specified on the right side of the numeric control). Limited by the built-in spectrometer range.
- **Lambda Max** sets the highest wavelength to acquire (expressed in the units specified on the right side of the numeric control). Limited by the built-in spectrometer range.
- **Trigger Mode** allows to select the trigger source for the spectrometer. Select Hardware if the trigger cable is connected to the spectrometer and if a TTL signal synchronized with the laser is available.
- **Reset To Default** resets the parameters to their default values.
- **Make Default** sets the current parameters as default parameters.

• **Simulation spectrometer settings:**

Figure 5.7: Simulation spectrometer configuration panel.

- Integration time sets the integration time of the spectrometer expressed in the units indicated on the right on the numeric control.
- Lambda Min sets the lowest wavelength to simulate (expressed in the units specified on the right side of the numeric control)
- Lambda Max sets the highest wavelength to simulate (expressed in the units specified on the right side of the numeric control)
- Simulated Laser Pulse allows to define the spectral amplitude and phase of the pulse used for the simulation. Values can be entered by using dials or .txt files.

5.1.3 Measure menu

This menu defines the parameters used in the SRSI measurement.

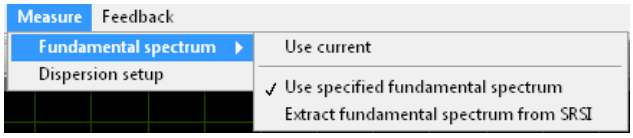


Figure 5.8: Measure menu.

Fundamental spectrum
The user can choose either to use, for the pulse reconstruction, the spectral amplitude obtained directly by the SRSI measurement or by a specified fundamental spectrum. This specified fundamental spectrum can be either measured by the device in the spectrum measurement settings or by selecting a spectral file opened in the Spectrum measurement setting by the File/Open data file menu. Once the spectrum displayed in the upper graph "Current spectrum", just specify in the menu Measure/Fundamental spectrum Use Current.

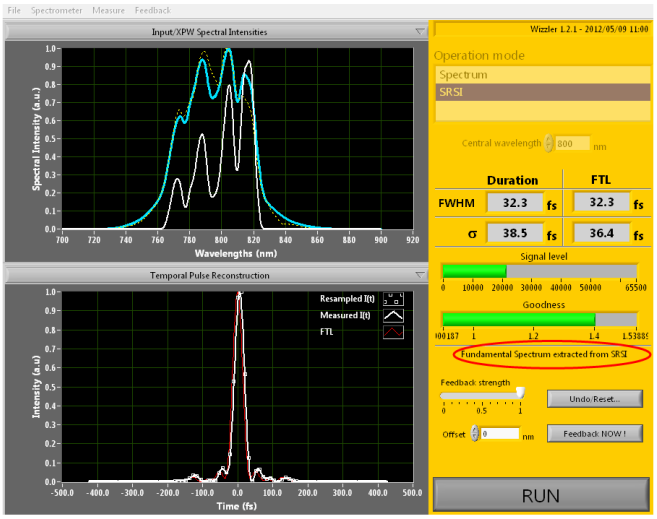
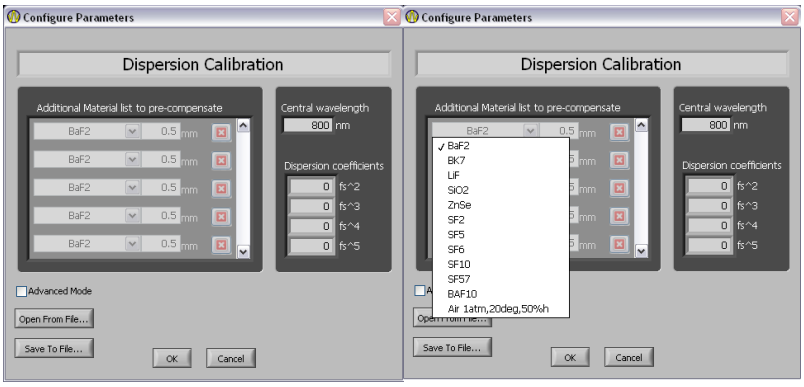


Figure 5.9: Spectrum Selected Indicator (extracted from SRSI by default as shown on the figure).

Dispersion calibration This panel allows additional dispersive elements to be taken into account for the spectral phase calculation. Please note that XPW effect, and thus Wizzler™ measurement, vanishes for strong chirps. See Chapter 2 for a complete explanation of the validity range of SRSI measurement.



Additional material list to pre-compensate provides a selection of common materials, the material thickness can be adjusted. The red cross removes the material from the list. Dispersion coefficients are automatically calculated and displayed according to the list of additional materials and the central wavelength set in the main software window.

Advanced Mode: Wizzler components shows the list of optical components used in the Wizzler™. The birefringent plate thickness needs to be adjusted at first startup. Correct values are indicated on the Wizzler™ test sheet, included at the end of the paper version of this user manual. For Wizzler USP, the Replica generator is simulated by an UWB material ¯ .

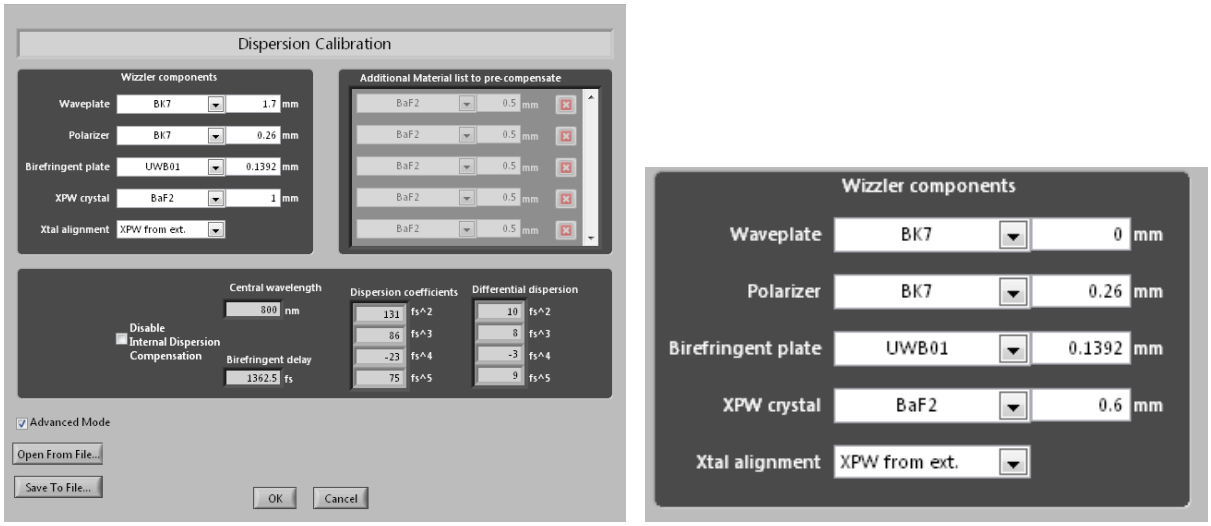


Figure 5.10: Dispersion calibration panel - Advanced mode

The option "Disable Internal Dispersion Calibration" lets the possibility to take or not into account the dispersion introduced by the components preceeding the XPW generation.

- **Disable Internal Dispersion Calibration ON:** No dispersion is introduced in the SRSI algorithm. The consequences are: the pulse is measured at the XPW crystal position, for a flat phase optimization, the XPW pulse is maximized and has its broader spectrum, the minimum pulse duration that can be measured is only limited by the differential dispersion (10fs2) ie about 5.5fs FWHM for a Gaussian pulse.

- **Disable Internal Dispersion Calibration OFF:** The dispersion of the components is introduced in the SRSI algorithm. The consequences are: the pulse is measured at the input of the optical components taken into account for the dispersion, the XPW pulse is not maximized anymore and its spectrum is not the broadest one for flat phase optimization. The minimum pulse duration that can be measured is limited by the total dispersion (131fs2 on our example, mainly due to the $\lambda/2$) ie about 16fs FWHM for a Gaussian pulse.

This effect can be visualized by using the simulation spectrometer.

5.1.4 Feedback

This menu provides settings allowing spectral phase feedback to a Dazzler™. A complete chapter is dedicated to the Wizzler™ operation when combined to a Dazzler™ (see chapter 7)

5.2 Spectrum mode

This mode is mainly used during the alignment process and for using a specified fundamental spectrum for the SRSI measurement (cf 5.1.3). The upper graph displays the acquired spectra. The lower graph displays the evolution of the spectral intensity versus time, making it a convenient tool to maximize or minimize the signal on the spectrometer.

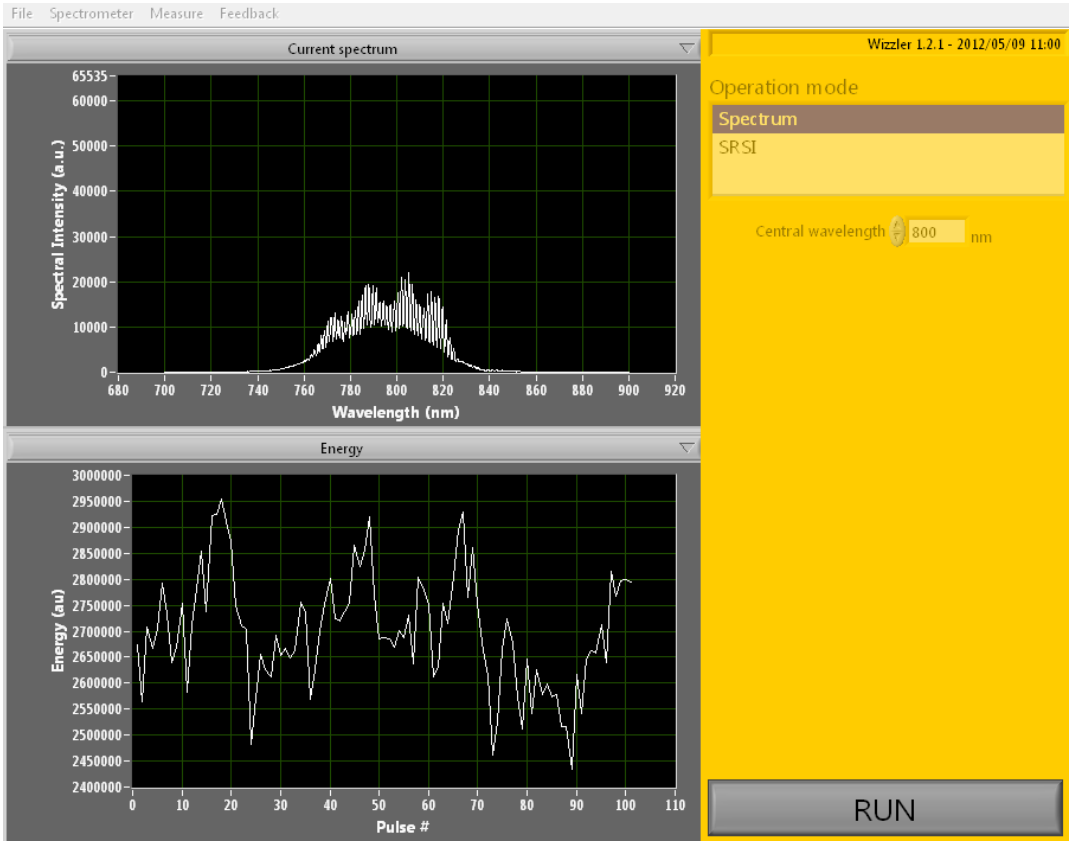


Figure 5.11: Spectrum mode software window

There is no configuration panel for this mode.

5.3 SRSI mode

Once the Wizzler™ is aligned using the Spectrum mode, and rough compression is done, Self-Referenced Spectral Interferometry measurement can be performed using this mode.

5.3.1 General indicators and settings

The main SRSI mode software window shows the following controls and indicators:

Pulse duration indicator gives the pulse duration values, as well as the Fourier-Transform Limited (FTL) values, for both full width half max (FWHM) and standard deviation (σ_T) calculated on the Wizzler temporal window T of measurement defined later. Those values are calculated on the retrieved pulse intensity distribution in time. All values are expressed in femtoseconds.

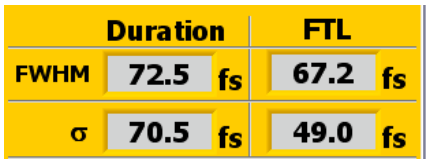


Figure 5.12: Measured pulse duration values indicator

Signal Level indicates the spectral intensity level on the spectrometer, and turns to *red* when level is too low or when the spectrometer is saturating. Wizzler™ measurement is correct only when this indicator is *green*

Goodness indicates the value of XPW spectral broadening ratio, and turns to *red* when spectral broadening is not sufficient (<1) and when it is too large (white light generation in XPW crystal). Wizzler™ measurement is correct only when this indicator is *green*.
The Troubleshooting chapter contains tips to set these 2 indicators to *green* (section 8.7).

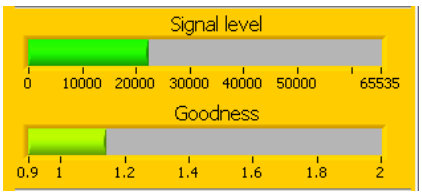


Figure 5.13: Signal Level and Goodness indicators

Configuration panel for the SRSI mode can be opened when the measurement is stopped, double-clicking on SRSI in the Operation mode area. The window shown on figure 5.14 appears.

- **Poly fit Order** sets the maximum order used for calculation of the spectral phase fit. Orders 2, 3 and 4 only are displayed in the Numerics display.

- **Text Disp.Average** sets the number of shots used when calculating the average. Averaging only applies to the Numerics display, and this setting is equivalent to the right-click menu on Numerics display described in section 5.3.4, figure 5.26.

• **N XPW Loop** sets the number of loops for the algorithm described in figure 2.3. Default value is 5. Spectral intensity of the computed XPW pulse is displayed in the INPUT/XPW Spectral Intensities graph. (figure 5.17).

• **Normalize XPW on Retreived Spectr.Graph** modifies the display of the XPW spectrum in the "Retreived Spectral intensity & phase" graph (cf fig.5.16).

• **Apodize Automatically** automatically sets the bandwidth for which spectral intensity is above noise level when checked. Values outside this area will be set to 0. Uncheck to enable manual setting.

• **Sensitivity** indicates the value of the Sensitivity filter used to adjust the part of the spectrum for which spectral phase will be calculated. This setting is equivalent to the adjustment of the horizontal cursor on the Spectral Intensity and Phase display. (figure 5.16)

• **Filter Tau(fs) and fwhm(fs)** indicate the values of the cursors settings in the Temporal Filter graph. (figure 5.21)

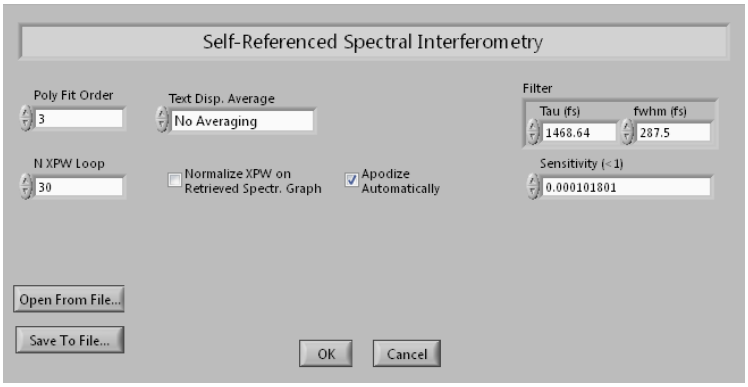


Figure 5.14: SRSI mode configuration panel

5.3.2 Upper display area

The upper graph can display one of the following data:

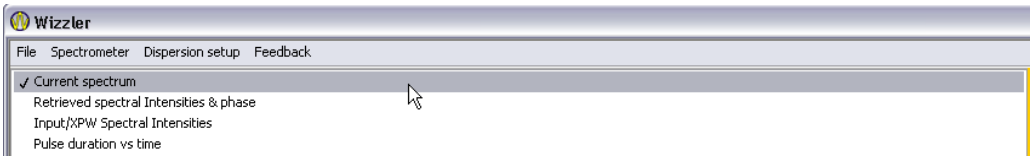


Figure 5.15: Upper graph area menu

• **Current Spectrum** displays the raw data acquired by the spectrometer. This is equivalent to what is displayed in the Spectrum mode.

• **Retrieved Spectral intensity** & **phase** displays the results of SRSI algorithm:

- **Input pulse spectrum (*white*)** is the extracted spectral intensity of the laser pulse.

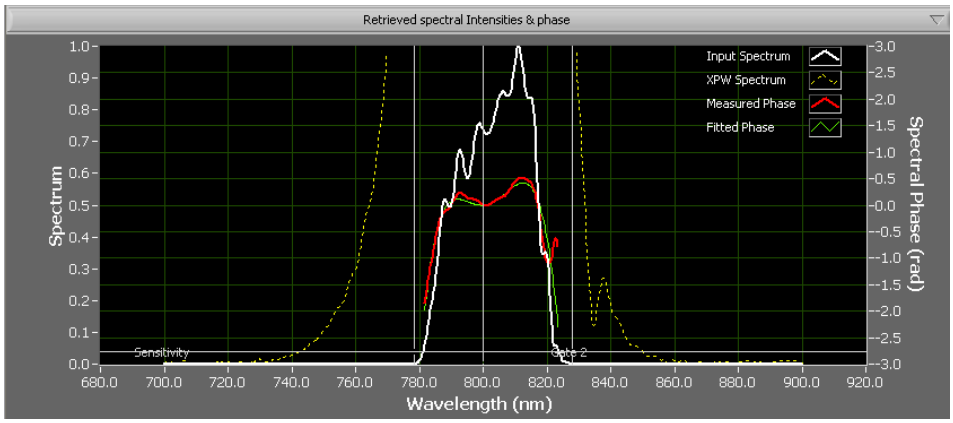


Figure 5.16: Spectral intensity and Phase display

- **XPW pulse spectrum (***dashed yellow***)** is the extracted spectral intensity of the XPW reference pulse. For correct pulse measurement, this spectrum should always be broader than the input pulse spectrum, and the 2 spectra should not cross.
- **input pulse spectral phase (***red***)** is the measured spectral phase of the laser pulse.
- **spectral phase fit (***green***)** is the polynomial fit of the measured spectral phase.
- **Sensitivity filter (***horizontal white line***)** is used to adjust the part of the spectrum for which spectral phase will be calculated. The value of this setting is shown in the SRSI configuration panel. (5.14)
- **Apodizing filter (***vertical white lines***)** sets the bandwidth for which spectral intensity is above noise level. Values outside this area will be set to 0. Default setting for this filter is automatic, See section 5.3.1 to switch to manual setting.

• **INPUT/XPW Spectral amplitudes** selects normalized spectral intensities of both input and reference pulse, in order to visualize XPW spectrum broadening.

- **Input pulse spectrum (***white***)** is the extracted spectral intensity of the laser pulse.
- **XPW pulse spectrum (***dashed yellow***)** is the extracted spectral intensity of the XPW reference pulse.
- When N XPW loop>0, **Computed XPW spectrum (***blue***)** shows the result of XPW spectral intensity, calculated from the measured input pulse, after N XPW loop iterations. The difference between extracted and computed XPW spectra is a good indication of the accuracy of the Wizzler™ measurement. A low difference between the 2 spectra means an accurate measurement.

• **Pulse duration vs time** displays the evolution of the measured FWHM pulse duration with time.

5.3.3 Lower display area

The lower graph can display one of the following data:

• **Temporal Pulse Reconstruction** displays the temporal profile of the measured laser pulse (*white*) as well as the Fourier-Transform temporal profile (*red*). Note that the time range is set by the width of the numerical filter described below.

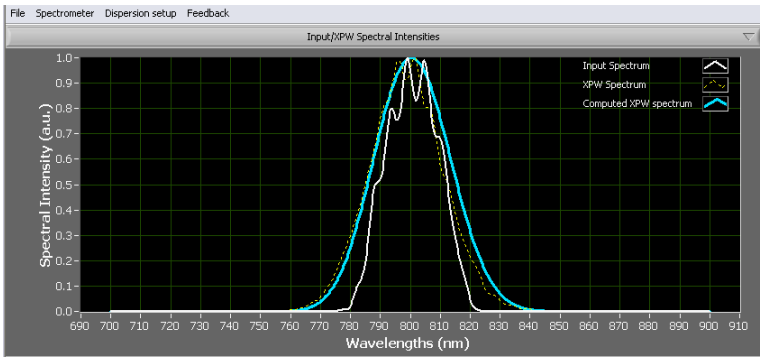


Figure 5.17: INPUT/XPW spectral intensities graph

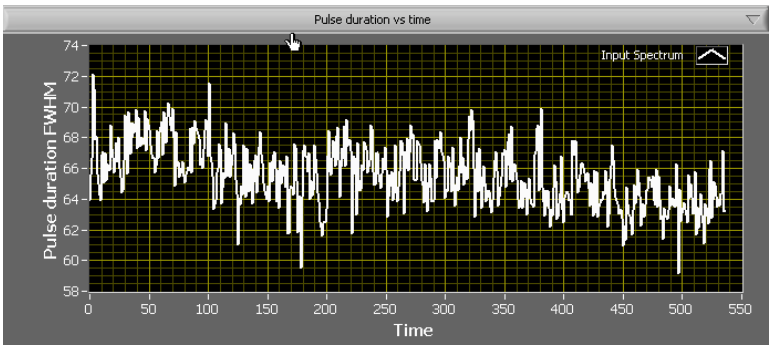


Figure 5.18: Pulse duration versus Time display

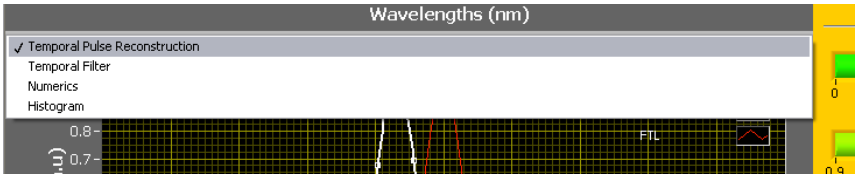


Figure 5.19: Lower graph menu in SRSI software window

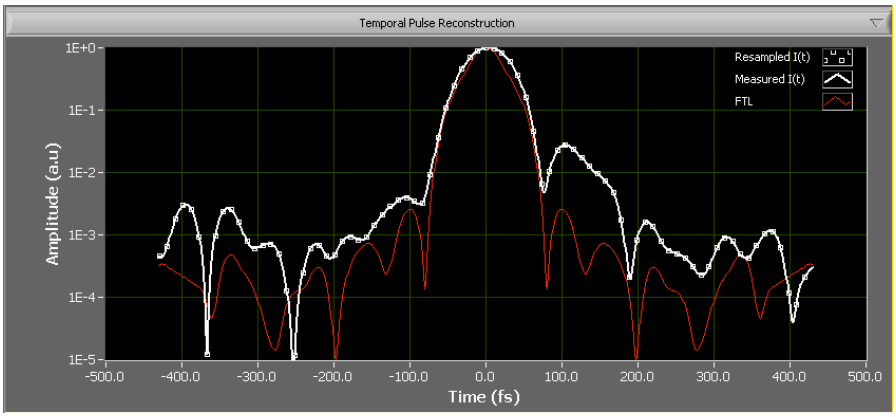


Figure 5.20: Temporal Pulse Reconstruction (logarithmic scale)

• **Temporal Filter** shows the inverse Fourier-Transform of the spectrogram and the applied numerical filter. The white dashed line indicates the theoretical delay introduced by the birefringent plate thickness set in the Dispersion calibration panel (section 5.1.3).

It is necessary to adjust:

- **Numerical filter central position (***dashed yellow***)** should be placed on the peak of the pulse replica.

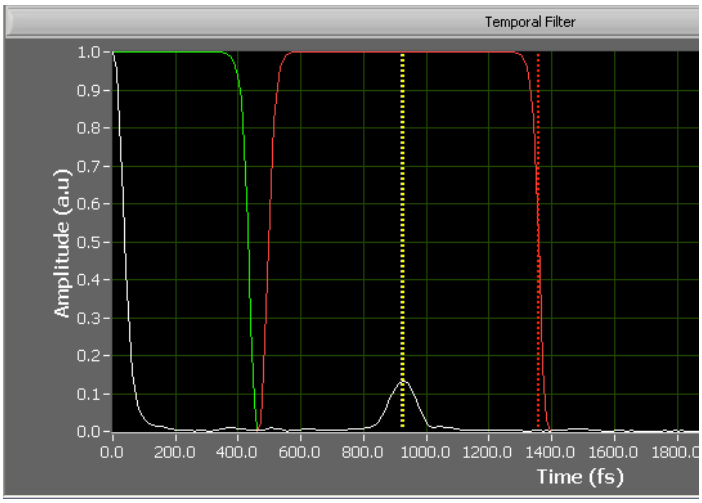


Figure 5.21: Numerical filter settings

When spectral phase is flat, this corresponds to the white dashed line position. However, when strong odd order phase aberrations exist, the pulse envelope is not symmetric anymore, and the peak of the pulse replica is not located at the theoretical delay. Accurate spectral phase and intensity measurement is only achieved when the numerical filter is centered on the pulse peak. This setting can be set numerically in the SRSI configuration panel (section 5.3.1)

- **Numerical filter width** can be adjusted at will between almost 0 and half τ (the delay between the input pulse and its replica) by dragging the red dashed line to the desired position. This setting acts as a low-pass filter on the spectral phase and intensity oscillations: a narrow width will remove high frequency oscillations. This setting also defines the maximum time range on which the temporal profile will be calculated. This setting can be set numerically in the SRSI configuration panel (section 5.3.1)

• **Numerics** selects the display of the following numbers:

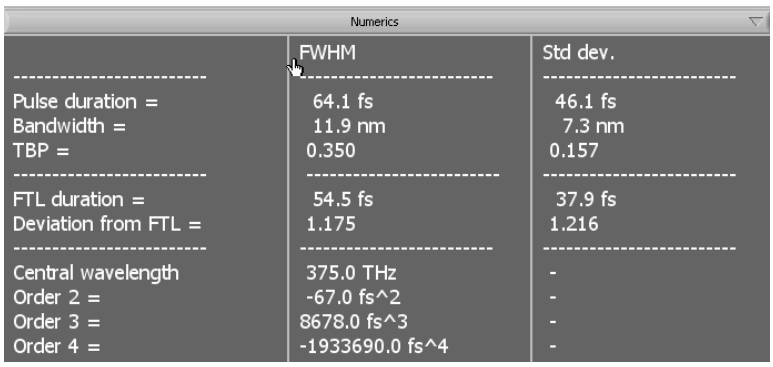


Figure 5.22: Numerics window

- FWHM pulse duration, bandwidth and Time-Bandwidth Product
- FWHM Fourier-Transform-Limited pulse duration
- FWHM deviation from FTL pulse duration
- Standard deviation(σ) pulse duration, bandwidth and Time-Bandwidth Product
- Standard deviation(σ) Fourier-Transform-Limited pulse duration
- Standard deviation(σ) deviation from FTL pulse duration
- Frequency for which polynomial fit is calculated (defined by the Central Wavelength setting in the main software window)
- GDD, TOD and FOD of polynomial fit

• **Histogram** displays the statistical repartition of measured pulse duration values.

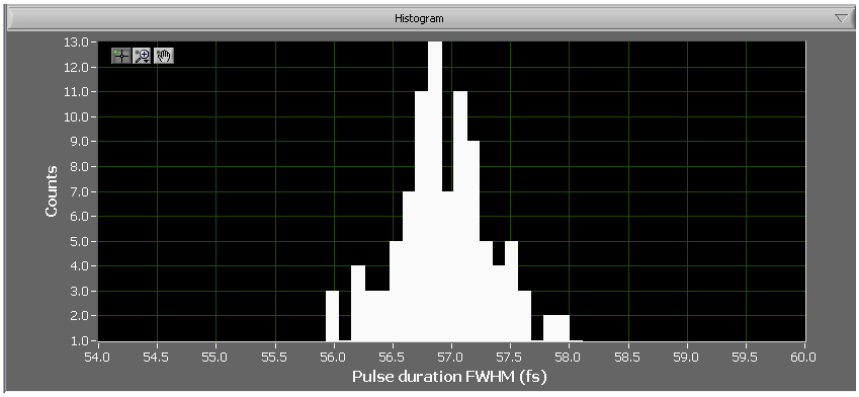


Figure 5.23: Histogram of measured pulse duration values

5.3.4 Displays export and customization menus Relative size of the 2 displays can be adjusted by dragging up and down the center line between displays. Upper and lower displays can be individually customized by a right-click on the display area. Data displayed on each graph can also be exported with the same menu.

• **For graphs showing pulse measurement in the temporal or spectral domain** the menu shown on figure 5.24 is available.

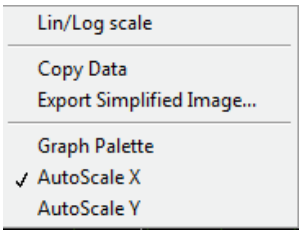


Figure 5.24: Right-click menu on display area

- **Lin/Log scale** Selects Linear or Logarithmic scale
- **Copy Data** allows to export data of each graph to an external software. For each graph, the exported datas contains the columns displayed in table 5.2, separated by a tab:
- **Export Simplified Image** opens a standard dialog box proposing various options to save the selected display as an image file.

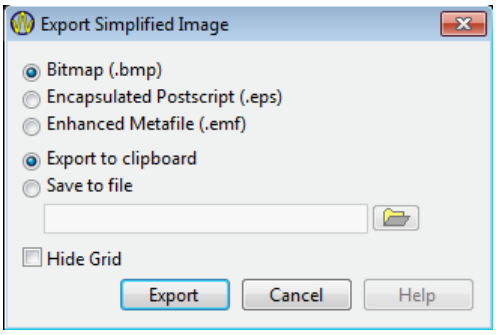


Figure 5.25: Export Simplified Image dialog box

Display	exported data (by column)							
Current Spectrum	λ (nm)	Intensity (a.u.)						
Retrieved spectral intensity and phase	λ (nm)	Input spectral intensity (a.u.)	λ (nm)	XPW spectral intensity (a.u.)	λ (nm)	Spectral phase (rad)	λ (nm)	Polynomial fit of spectral phase (rad)
Input/XPW spectral intensities	λ (nm)	Input spectral intensity (a.u.)	λ (nm)	XPW spectral intensity (a.u.)	λ (nm)	Computed XPW spectral intensity (a.u.)		
Temporal pulse reconstruction	Time (fs)	Input pulse amplitude (a.u.)	Time (fs)	FTL pulse amplitude (a.u.)				
Temporal Filter	Time (fs)	Pulse amplitude (a.u.)	Time (fs)	AC numerical filter value (a.u.)	Time (fs)	DC numerical filter value (a.u.)		

Table 5.2: Data export description table

- **Autoscale X** and **Autoscale Y** turn autoscaling ON or OFF for X and Y axis. Scales can then be set manually, clicking on the graph scale numbers.

• **For Numerics display** the menu shown on figure 5.26 is available.

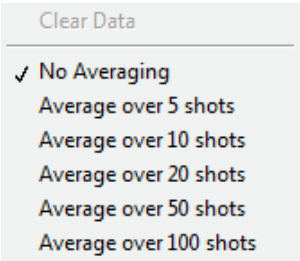


Figure 5.26: Right-click menu on Numerics display

This menu gives the possibility to adjust the number of shots used when calculating the average. This setting is also available in the SRSI configuration panel.

• **For Pulse duration vs time display** the menu shown on figure 5.27 is available.

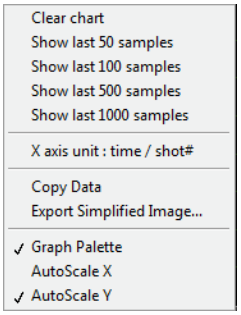


Figure 5.27: Right-click menu on Pulse duration vs time display

New options are:

- **Clear chart** resets the display
- **Show last xxx samples** sets the number of shots displayed at the same time
- **x axis unit: time / shot#** set the unit of x axis: time (hour:minute:seconds) or shot number.

Data exported when selecting Copy data are:

Display	exported data (by column)	
Pulse duration vs time	time (hh:mm:ss) or shot#	Pulse duration FWHM (fs)

Table 5.3: Data export description table

• **For Histogram display** the menu shown on figure 5.28 is available.

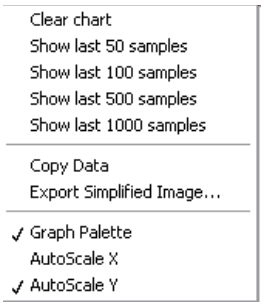


Figure 5.28: Right-click menu on Histogram display

Options in this menu are same as for the Pulse duration vs time menu, except for the x axis unit selection which is not available. Data exported when selecting Copy data are:

Display	exported data (by column)	
Histogram	Pulse duration FWHM (fs)	number of events

Table 5.4: Data export description table

CHAPTER 6

Alignment

Wizzler™ alignment implies manipulation and observation of compressed femtosecond pulses with hazardous energy levels. Follow as strict safety rules when aligning the Wizzler™ as when operating your laser.

The Wizzler™ requires a linearly vertically polarized, collimated beam with an energy between 2 and 20μJ on a 2mm diameter beam. Average power should not exceed 1W.

The Wizzler™ is delivered with feet allowing to set the input beam height between 95 and 135mm. It is however possible to change the posts for customized height down to 35mm, and for higher beam height. See section 3.4 for more details.

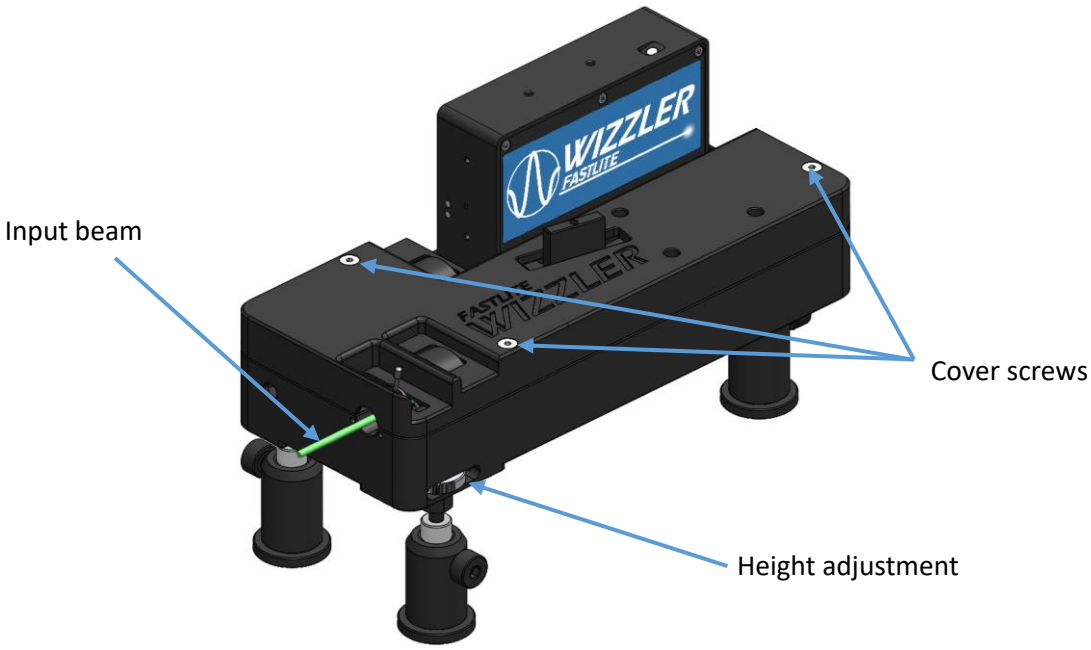


Figure 6.1: Wizzler™ outside view

This chapter gives a step by step alignment procedure of the Wizzler™ and a short reminder of this procedure. If it is the first time you are using the Wizzler, please read first chapter 5 for a complete description of the Wizzler™ software functionalities. A troubleshooting guide is available in chapter 8. The Wizzler™ module is factory-aligned and internal settings should not be modified unless indicated in the following procedure.

6.1 Coarse alignment

• Set a pickup of the laser beam with special emphasis on preserving the spectral and spatial integrity of the beam. In order to ensure a meaningful pulse measurement, it is necessary to check the spectrum and beam quality have not been altered before and after the pickup

• Adjust the beam direction to be horizontal.

• SRSI measurement relies on a third order nonlinear effect, XPW, which efficiency vanishes for highly chirped pulses. Therefore, start by roughly optimizing the pulse duration using a convergent lens and tuning the compressor settings, so that the pulse duration is roughly optimized.

• Remove the Wizzler™ cover (cf fig.6.1).

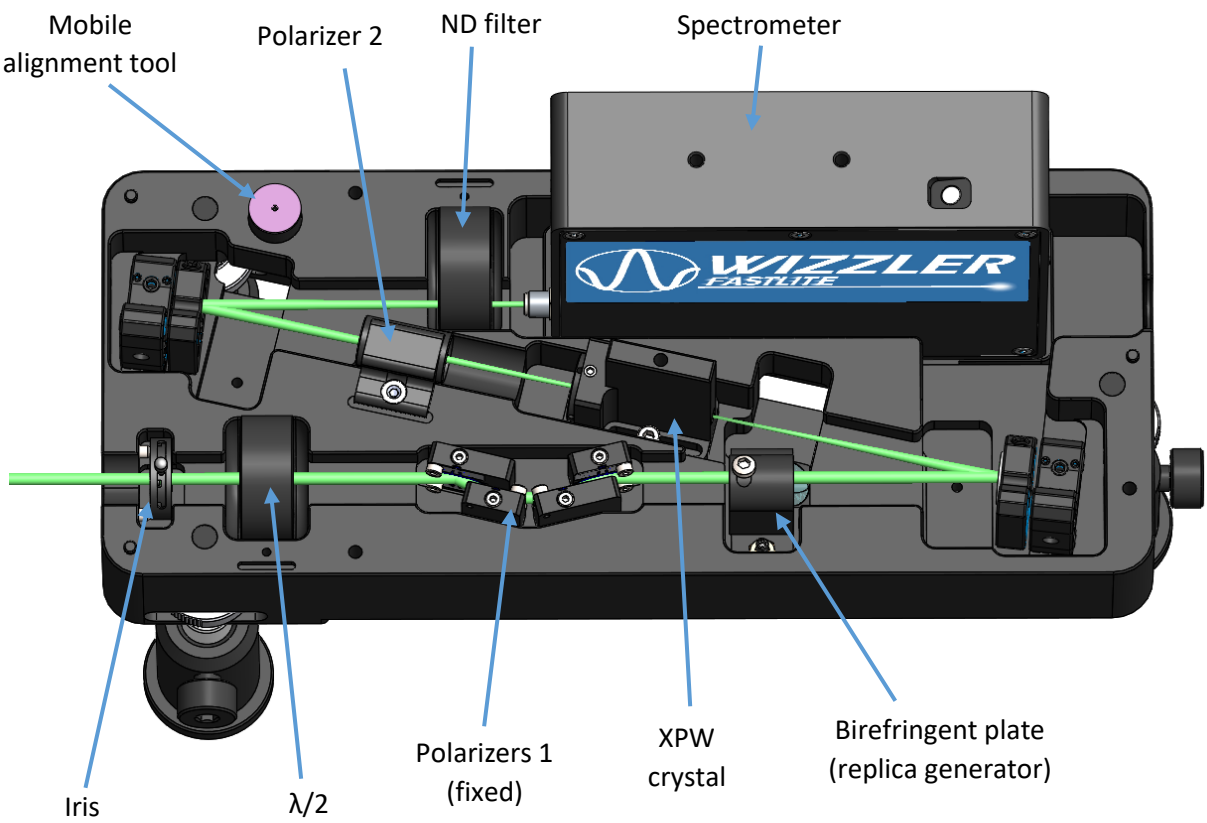
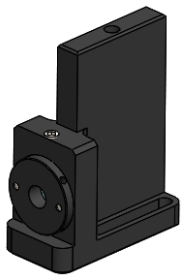


Figure 6.2: Wizzler™ inside view

• Remove the XPW crystal if in position. Unscrew the lateral M3 screw.



• place the Wizzler optical module and adjust its height in order to center the beam on the first iris and on the alignment tool. Start by placing the alignment tool before the first polarizer, then move it after the birefringent plate.

• Verify that the spectrometer is connected. Start the software and select the SPECTRUM mode, then click on RUN. If it is the first time you are using the Wizzler™, you may want to check the spectrometer settings as indicated in section 5.1.2.
You should now see a signal measured by the Wizzler™ spectrometer. The lower graph shows the evolution of the signal intensity measured by the spectrometer. Use the ND filter manual rotation setting and the alignment tool rotation to avoid saturation on the spectrometer and be above the noise level (there is a $\lambda/4$ plate mounted on the alignment tool, so that its rotation affects the transmission of the second polarizer). Check the Wizzler™ module alignment again to maximize the signal on the spectrometer and confirm that the beam is still centered on the pinhole.

• Clamp the Wizzler™ and remove the alignment tool from the beam (put it back to its storage position). The signal intensity on the spectrometer should be significantly reduced.

• Maximize the signal using the half-wave plate rotation setting. If the spectrometer gets saturated, attenuate the signal with the ND filter (rotation setting) and continue the maximization.
The Wizzler™ is delivered pre-aligned but optical mounts could move during transportation, you can use the mirror mounts settings to maximize the signal if needed.

• The input polarizers are initially set to select the vertical polarization and polarizers 1 and 2 are already crossed during factory alignment. Check that there is light before polarizer 2. If not, check the input polarization and rotate the $\lambda/2$ waveplate. When there is light before polarizer 2, check the signal on the spectrometer. Finely tune the replica generator using the fine adjustment setting to minimize the pulse replica on the Temporal Filter graph (the pulse replica delay is provided in the test sheet). The replica generator adjustment plate should almost touch the board.

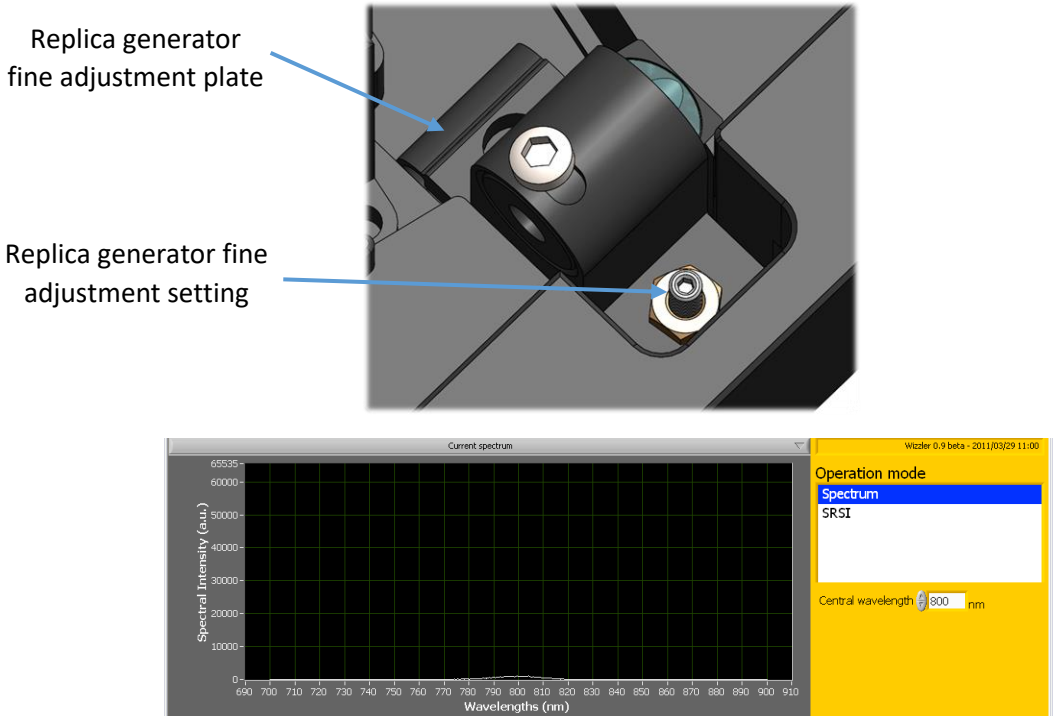


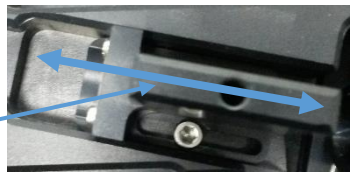
Figure 6.3: Replica generator fine adjustment (up) and spectra measured with crossed polarizers (bottom)

6.2 XPW generation

• Put the XPW crystal back in the beam (screw centered in the groove).
You should see a change in the signal shape and amplitude, created by the XPW effect as shown on 6.4 (to compare with figure 6.3). The XPW signal should be larger and smoother than the input signal previously seen.

You can scan the XPW position to improve XPW signal.

XPW crystal manual translation



If the spectrum shape is tortured and unstable, the white light regime has probably been reached. Reduce the iris aperture to decrease the energy and/or rotate the half wave plate until you get a nice and relatively smooth signal. It is preferable to reduce the iris aperture rather than rotating the half wave plate to reduce the risk of polarizer damage.

Use the second alignment mirror settings to maximize the XPW signal on the spectrometer.

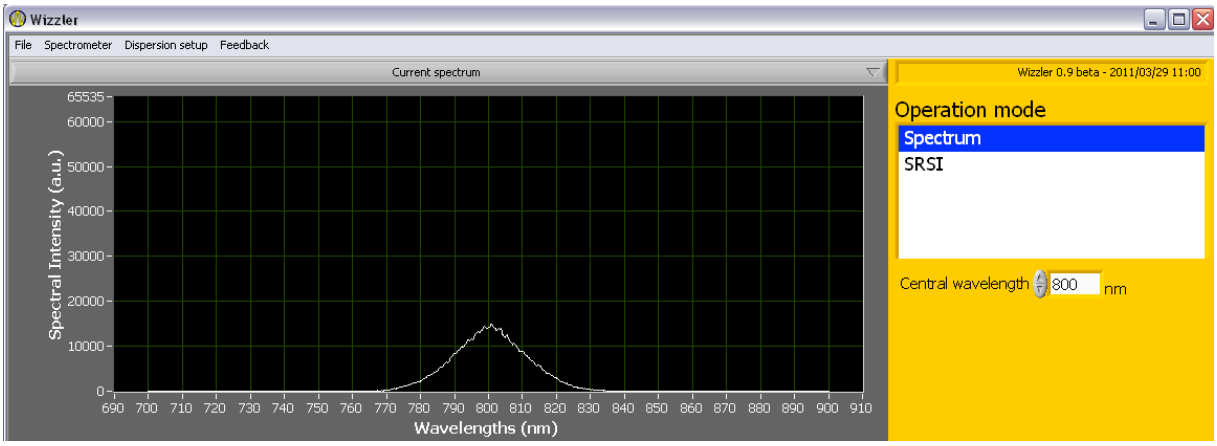


Figure 6.4: Spectra measured with crossed polarizers, XPW crystal in the beam and fringes minimized

Remove the XPW mount and check that the signal level is much lower (cf. test sheet). If the signal level is much higher than the one given in the test sheet, go to section 8.3 to optimize polarizers extinction.

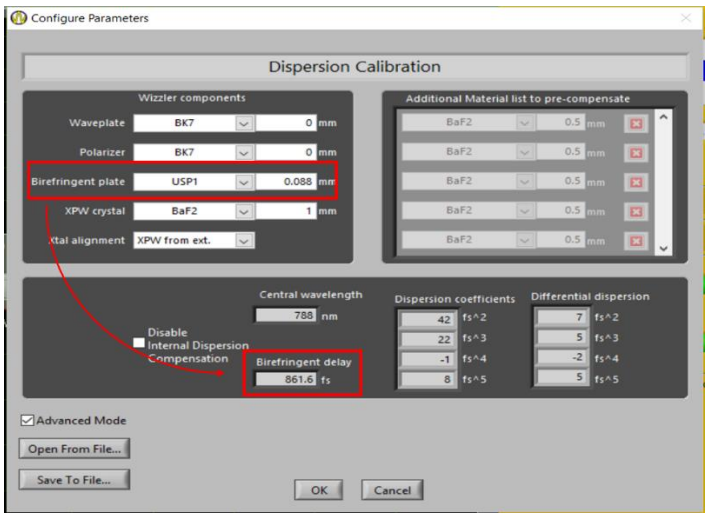
6.3 Creating the pulse replica

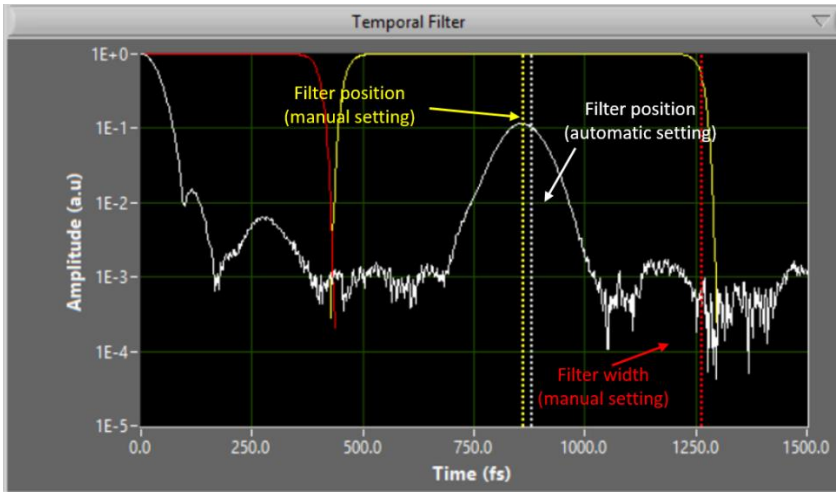
• Stop the acquisition by clicking on RUN again. Select the SRSI mode in the Wizzler™ software and click on RUN. On the lower graph, select Temporal Filter from the graph menu. It shows the Fourier transform graph of the acquired spectrum. RightClick on this graph and select the log scale. Change the X scale range to [0, 3 ps]

• From the optimal position (obtained in section 6.2), introduce some fringes up to few 10^{-1} (10 to 30%) by slightly rotating the Replica Generator with the fine adjustment setting. The upper limit is the amplitude crossing between the XPW pulse and the input one (Input/XPW Spectral Intensities Display on the upper window).

It introduces a pulse replica (which creates fringes on the spectrum) and a secondary peak in the Fourier Transform of the spectrum. This peak should be centered around the delay τ as measured on the test sheet at the end of this manual. Set the fringes depth to about 10^{-1} (30%) of the spectrum amplitude, using replica generator fine adjustment setting.

• Adjust the numerical filter central position on the pulse replica by modifying the white line on the peak of the replica on the lower graph. This white line cannot be dragged on the graph. It is defined by the birefringent plate thickness in the *Dispersion setup* menu (click on Measure→Dispersion setup→Advanced mode). The thickness of each component is given in the test sheet at the end of this printed manual. Please enter these values in the *Dispersion setup* menu and click on OK.





• Adjust the numerical filter central position on the pulse replica by dragging the dashed yellow line on the peak of the replica on the lower graph, and adjust the numerical filter width to its desired value by dragging the dashed red line towards the right side of the graph as indicated in section 5.3.3.
The yellow line should be at the replica maximum superimposed with the white line.

6.4 SRSI measurement

• Put back the XPW crystal if it has been removed.

• Verify that the signal level is satisfying and the XPW spectrum is broader than the input spectrum, by checking the Signal Level and Goodness status bars on the software window. Both indicators should not be colored in red.

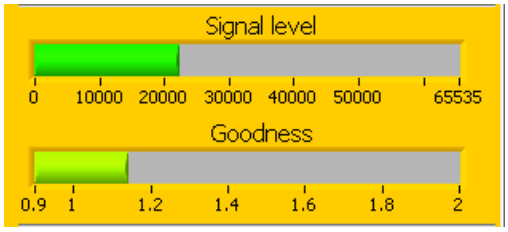


Figure 6.5: Level and Goodness indicators in SRSI software window

XPW spectrum broadening can also be visualized when selecting XPW/input spectrum from the upper graph menu. Adjust the compressor settings to minimize the chirp and increase the Goodness level.

• On the upper graph of the software interface, select Retrieved Spectral Amplitude and Phase. You should now see the spectral phase and amplitude measurement.

• On the lower graph of the software interface, select Temporal profile. You should now see the temporal profile of the laser pulse

• Check that all indicators on the SRSI measurement window are green, and that pulse duration values are displayed. If not, please refer to section 8.7

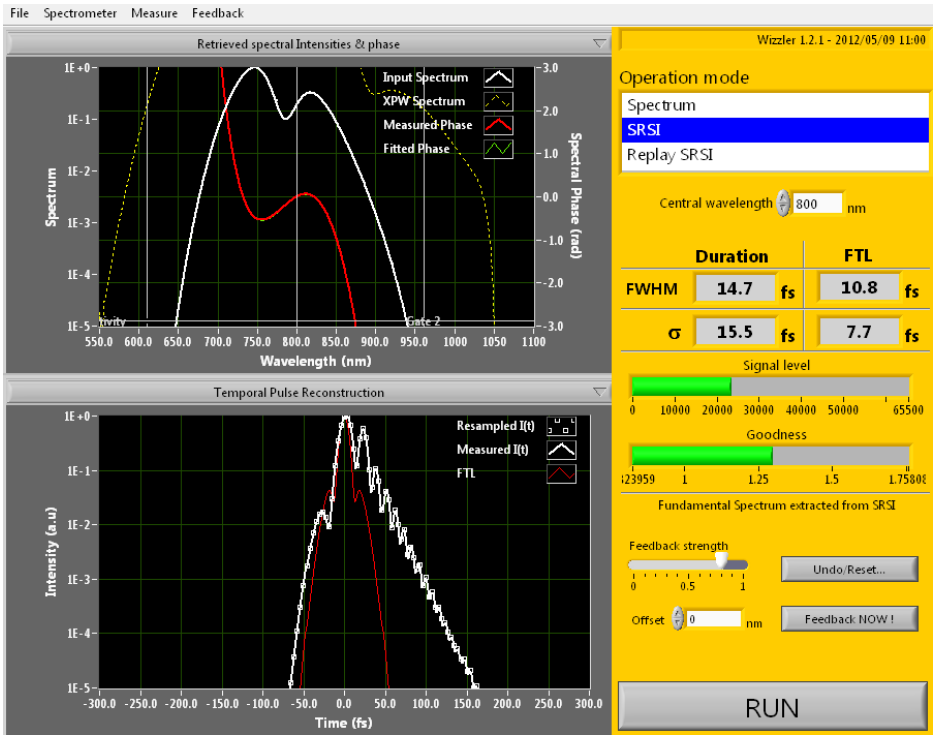
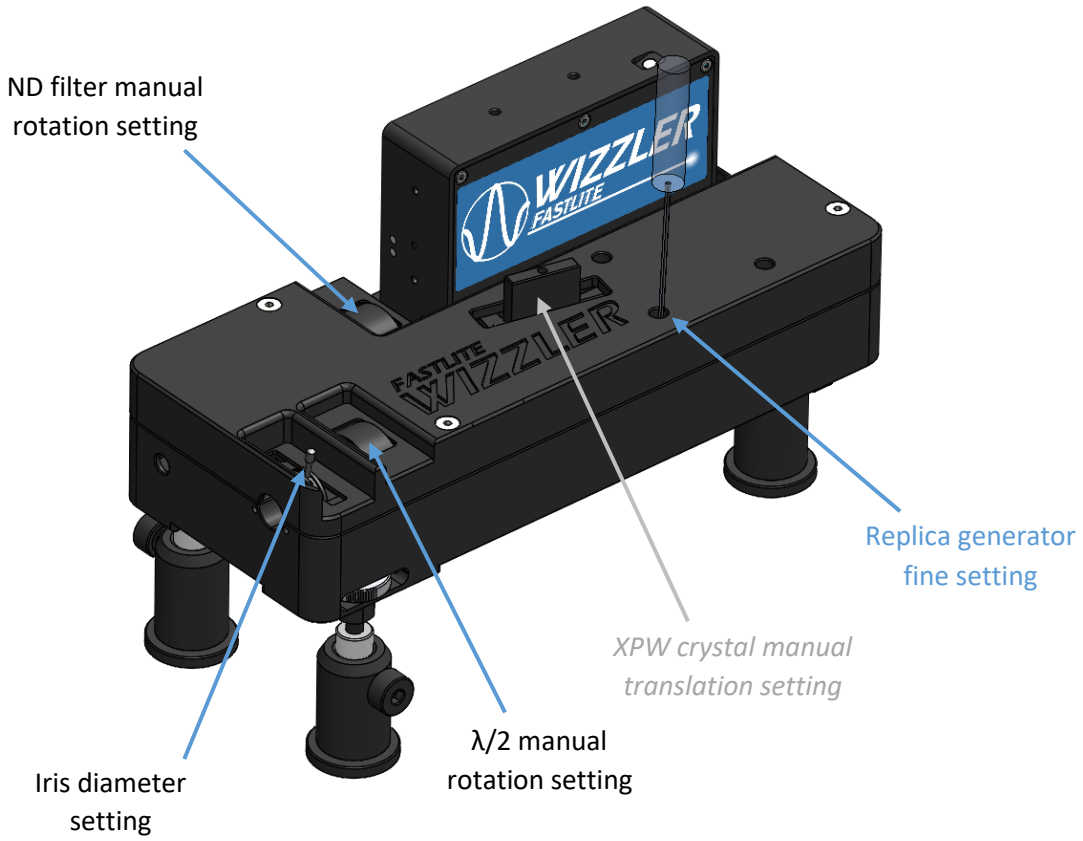


Figure 6.6: Spectral amplitude and phase, temporal profile measurement in SRSI mode

6.5 Operation with closed cover

In order to increase components lifetime, keep cover closed.

For standard operations, you can adjust the fine settings with closed cover.



In grey: alignment operation

Figure 6.7: Operations with cover closed

CHAPTER 7

Compensating the Phase

This chapter explains software settings allowing spectral phase feedback to a Dazzler™, additional features for Dazzler™ users, as well as practical issues regarding precautions to take when doing a feedback of the phase through an amplifier.

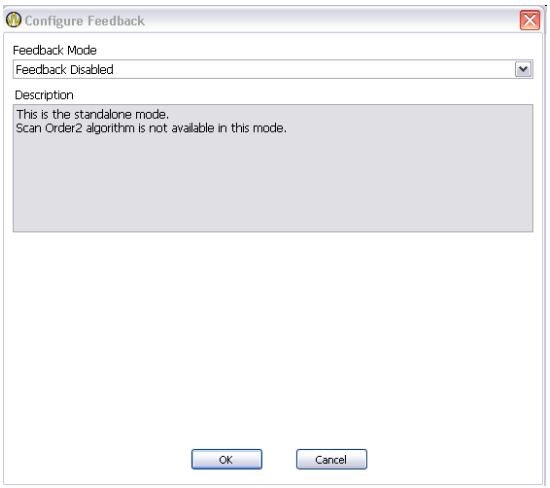
7.1 General precautions – Disclaimer

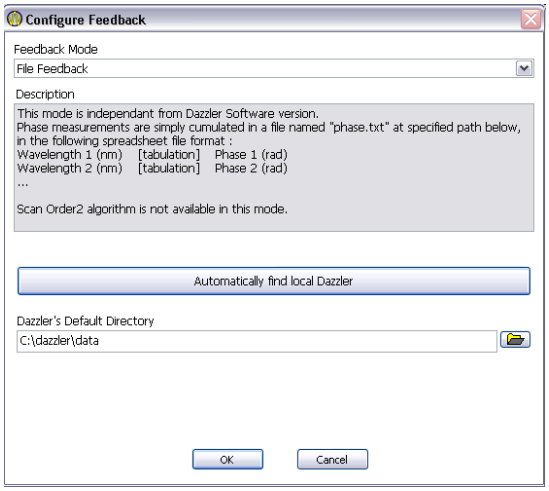
Using an active component at the front end of a laser amplifier implies certain precautions and limitations. Before manipulating the spectral phase with a Dazzler™ / Wizzler™ combination, be sure to read section 7.3

FASTLITE can not be held responsible for any damage caused by the Dazzler™-Wizzler™ loop operation

7.2 Setting communication with a Dazzler™

In the Wizzler™ software, clicking on Menu/Feedback/Configure Feedback opens the following menu:





• **Feedback Mode** provides a list of available feedback methods and is set to disabled by default. Select File Feedback.

• **Description** explains compatibility issues, capabilities, method and limitations for the selected feedback mode

• **Automatically find local Dazzler** launches a search on the computer where the Wizzler™ software is installed, to locate a Dazzler software. The Dazzler's default directory is then automatically set.

• **Dazzler's default directory** is the directory where the request.txt and phase.txt files will be written during the feedback. If the automatic search did not succeed, or if you want to set communication with a Dazzler through a local network, indicate the correct folder here. Make sure all folders and text files are defined with read-write permissions.

Once feedback mode is activated, SRSI software window is modified as shown on figure 7.1.

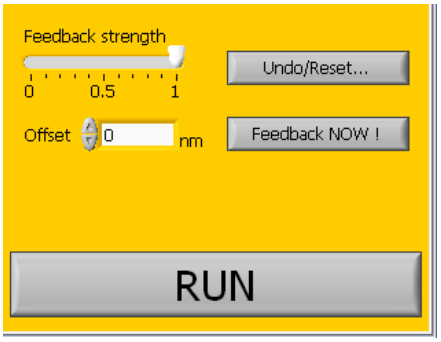
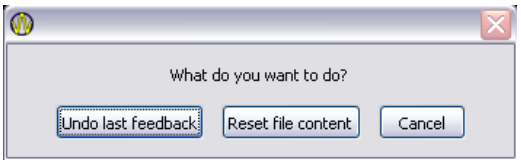


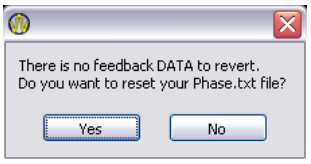
Figure 7.1: Feedback control area in SRSI mode

• **Feedback strength** is the attenuation factor applied to the spectral phase correction.

• **Offset** allows to make Dazzler™ and Wizzler™ calibrations corresponding.

• **Undo/Reset** opens one of the following dialog box allowing to either undo the last feedback or reset phase.txt file to empty.





• **Feedback now!** writes the new phase.txt files in the defined folder.

7.3 Compensating the Phase through a CPA

CPA lasers performances and integrity are strongly depending on the quality of the pulse before amplification. Moreover, CPA lasers apply a non-linear transfer function to the spectral phase and amplitude of the pulse before amplification. In case of saturated amplifiers, phase to amplitude coupling may also occur.

The consequences are (non exhaustive list):

• Pulse duration, and thus peak power during amplification depends on the amount of chirp applied to a fixed input pulse spectral bandwidth. Reduction of the pulse spectral bandwidth may increase the peak power during amplification and thus lead to serious damage of the amplifier. It is mandatory to confirm the compatibility of the programmed phase in the Dazzler™, checking that Spectrum is not clipped, before loading the waveform to the Dazzler™. Figure 7.2 shows the waveform shape and spectral transfer function graphs in the Dazzler™ software in case of a non-truncated waveform. Figure 7.3 shows the same graphs, but for a truncated waveform leading to spectral clipping. The red curve appearing in the Spectral transfer function graph shows the real transfer function, whereas the black curve shows the programmed transfer function. Before loading the waveform, one should confirm that red and black curves are not significantly different.

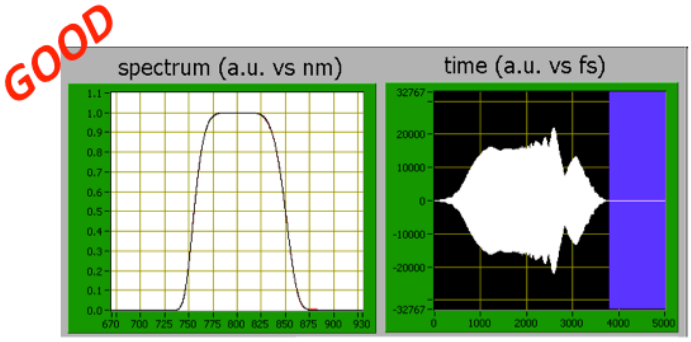


Figure 7.2: Dazzler™ waveform and Spectral transfer function for a non-truncated waveform

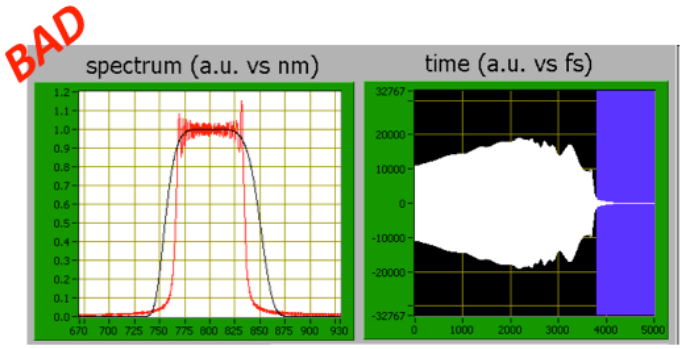


Figure 7.3: Dazzler™ waveform and Spectral transfer function for a truncated waveform

It is the responsibility of the user to check the compatibility of the Dazzler™ waveform and spectral transfer function with the CPA laser!

• Amplified beam energy, contrast and stability depends on the energy of the pulse before amplification. To limit unwanted effects, it is recommended to set the Dazzler™ in Constant Gain mode, in order to avoid strong changes of Dazzler™ diffraction efficiency when complex phase shaping is applied.

WARNING: Amplitude clipping may occur in *constant gain* mode when loading complex waveforms. This may lead to Dazzler™ damage and/or strong modification of the diffracted spectra. Always check the programmed waveform does not exceed the maximum amplitude, and reduce Dazzler™ power if necessary.

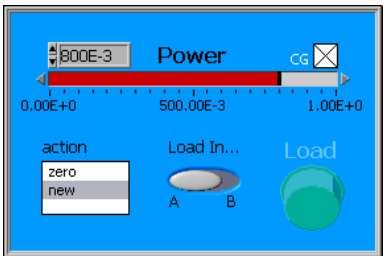


Figure 7.4: Dazzler™ operating in constant Gain (CG box checked)

• When compensating an oscillating or complex phase through a saturated amplifier, phase shape may be transferred to spectral amplitude shape, producing pre-pulses and degrading the pulse contrast. A feedback without attenuation may also lead to spectral phase oscillations amplifications. In order to smoothen the phase shape at the input of the CPA laser, the Wizzler™ software provides a Feedback strength setting (figure 7.5) allowing to attenuate the phase correction. The optimum value for this setting depends on each laser and on the temporal filter width.
Start at 0.5 and adjust up if feedback does not improve significantly the phase, or down if rapid phase oscillations are amplified by the feedback.

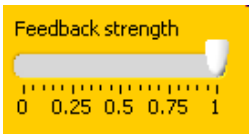
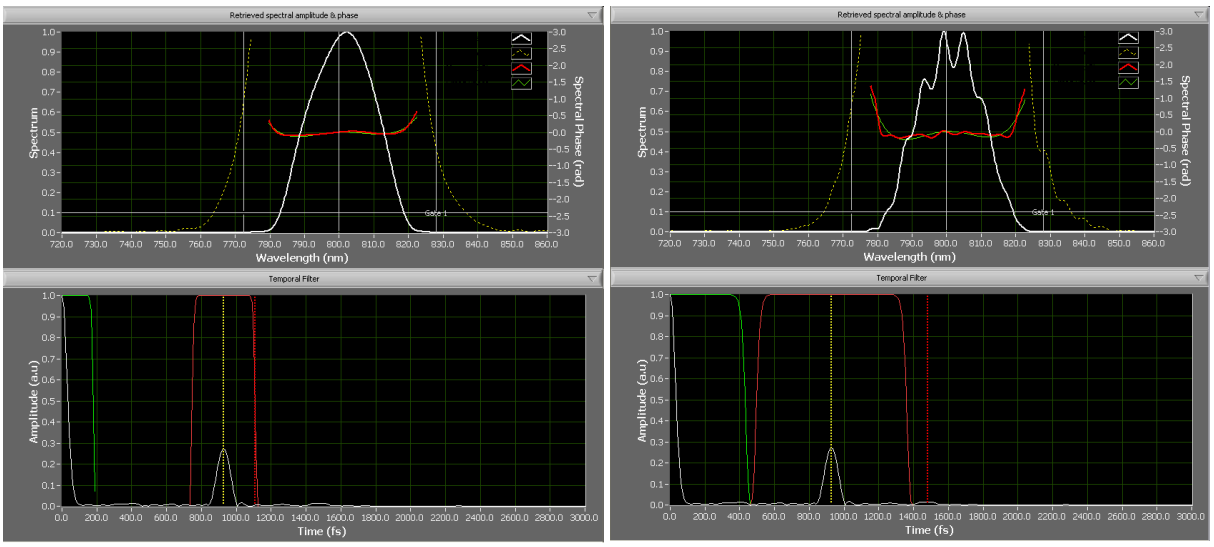


Figure 7.5: Phase feedback attenuation setting

• The Wizzler™ is able to measure sharp modulations of the spectral phase, such as phase jumps and fast oscillating phase. Correction of these very high orders of phase aberrations may be tricky and may create pulse replicas. A good method is to first compensate the low orders, then work on high orders. To do so, the Temporal filter setting described in section 5.3.3 can be used, since it acts as a low pass filter. Reduce the width of this filter until fast oscillations are removed, and compensate the phase with this setting. When phase is flat, increase the width of the filter, and continue the feedback. Note that on most laser systems, the optimum feedback strength setting is higher for a narrow width temporal filter (>0.7) than for a large width temporal filter (<0.7).



7.3.1 Step by step feedback: an example

This example is using the File Feedback Mode.

Setting up: Once communication is set with Dazzler, and the appropriate feedback mode has been selected, start SRSI measurement. Select Retrieved Spectral Intensities and Phase and Temporal Filter graphs.

Calibration: Accurate phase correction requires verification of the Wizzler™ and Dazzler™ relative calibrations. In other words, it is necessary to check that what the Wizzler™ is measuring at 800nm will be corrected by the Dazzler™ at 800nm. To do so, program a sharp hole in the center of your spectrum with the Dazzler™ software (hole position= central wavelength measured by the Wizzler™, hole width=1nm, hole depth=80%), and check that this hole appears at the correct wavelength in the Wizzler™ software. If not, adjust the Offset setting (figure 7.6) by the amount needed to shift the hole to its programmed wavelength. This settings is not changing the spectrum display, it is shifting the phase used for feedback. As example, if the Dazzler is programmed to make a hole in the spectrum at 800nm, due to

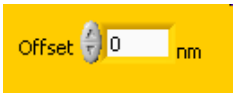


Figure 7.6: Offset setting

miscalibration of the dazzler, the Hole position is measured by the wizzler at 800nm. By using an offset of -1nm, it is possible to feedback without recalibration of the Dazzler.

Temporal Filter settings: Adjust the central position of the numerical filter on the peak of the pulse replica. Set the width so that only smooth phase variations are displayed.

Feedback: Set Feedback Strength level to 0.5 and push the feedback button. On the Dazzler™ Software, Phase source area, click on Polynomial then click on both in order to reload the updated phase.txt file. Check that the displayed waveform is compatible with both Dazzler™ capabilities and CPA laser as indicated in section 7.3. If the proposed waveform is compatible, click on the LOAD button.

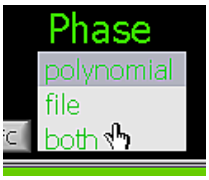
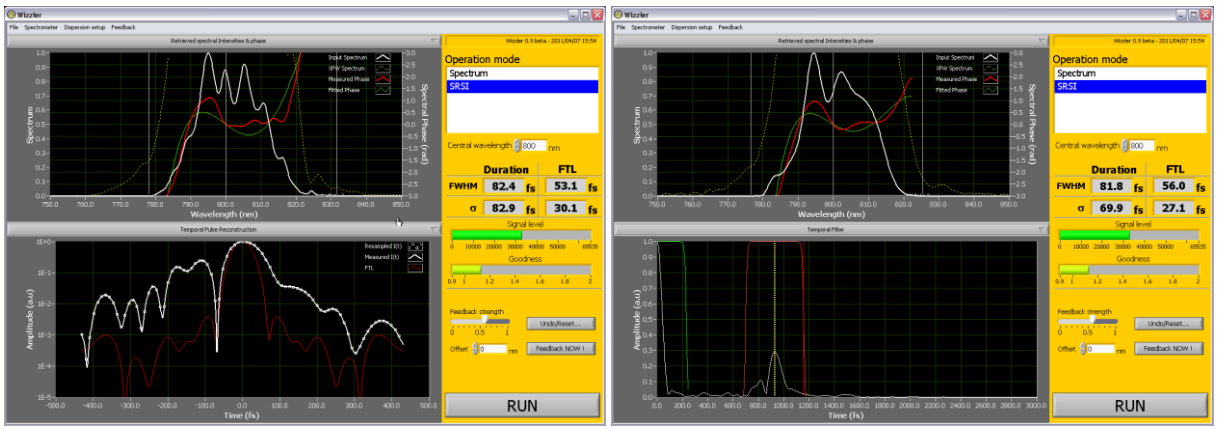


Figure 7.7: Polynomial - Both selection in Dazzler software

Effect of Feedback: Check the effect of the feedback on the measured spectral phase. If amelioration is barely visible, increase the Feedback strength factor. If spectral phase modulations are increased, or if pre-pulses appear, reduce the Feedback strength factor.

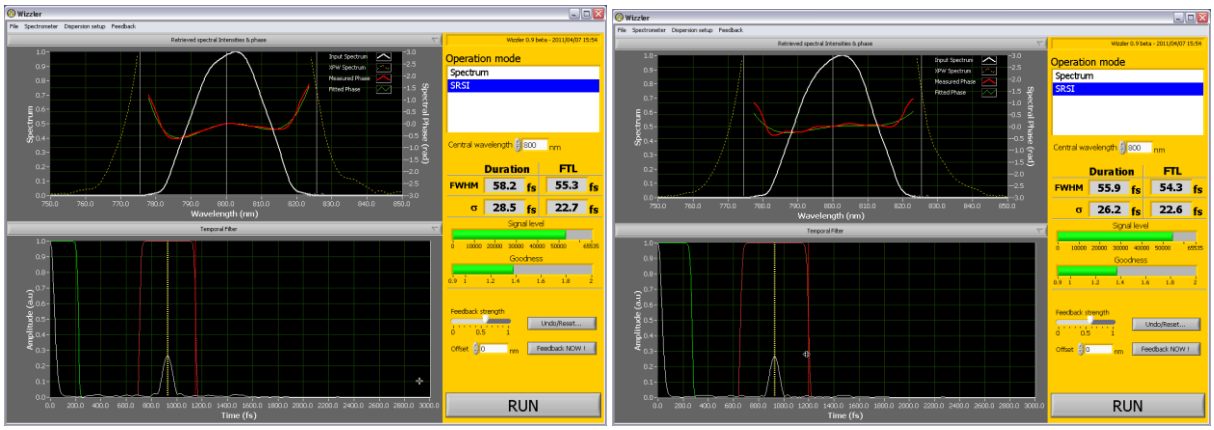
Iterations: Repeat the 2 steps above until measured spectral phase is flat. The Undo-Reset button allows to step back or restart from the beginning if necessary. Once measured spectral phase is flat, increase the numerical filter width to compensate for fast oscillations, and continue the feedback until measured spectral phase is satisfactory.

An example of File Feedback is shown below:

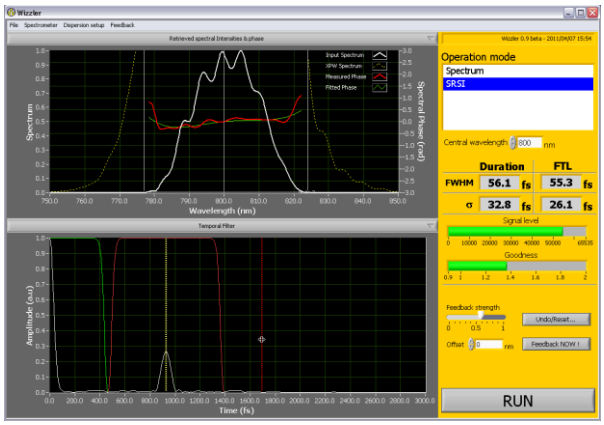


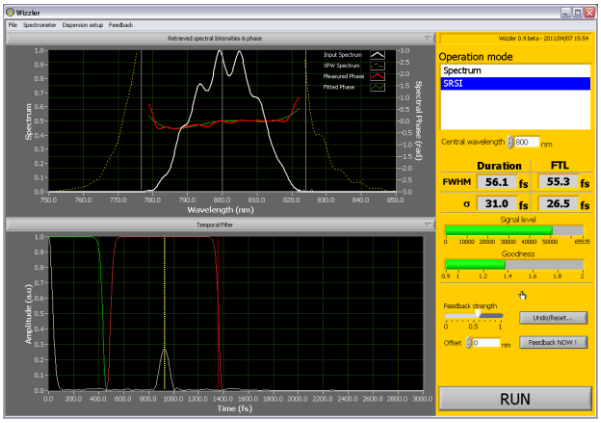
Spectral phase and Temporal profile before feedback, with numerical filter width at maximum. Numerical filter width is then reduced to remove fast oscillations. Feedback strengh is set at 0.6.

Results of Feedback after 1st and 2nd iterations:

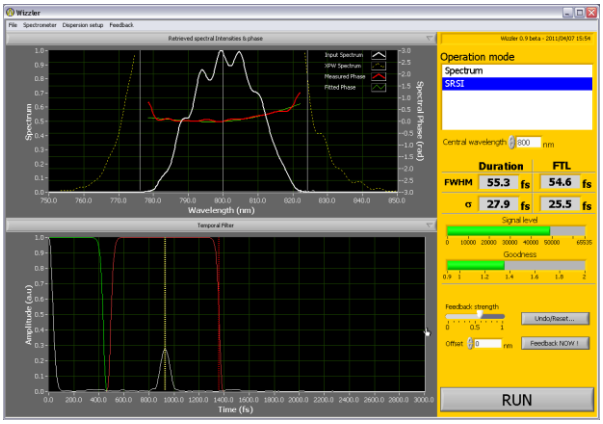


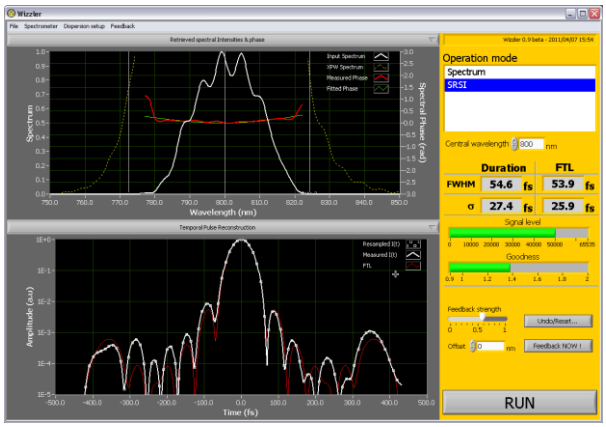
Result after 2nd feedback iteration shown with numerical filter width increased to maximum to measure fast oscillations. 3rd iteration shows reduction of these oscillations:





4th and 5th iterations, with final temporal profile display (logarithmic scale). Pulse duration FWHM is reduced from 82.4 fs to 54.6. *σ* pulse duration is reduced from 82.9fs to 27.4fs:





CHAPTER 8

Troubleshooting

This section provides first help when experiencing troubles with the Wizzler™. In case your specific question or trouble is not solved by the following, or in case an optical damage is detected, please contact FASTLITE at info@fastlite.com

8.1 Software starting problems

• Spectrometer is not recognized:
- Quit the software
- Disconnect and reconnect the spectrometer and wait few seconds.
- Verify that the green LED on the spectrometer front panel is lit. If not, check that it is correctly listed as *FASTLITE5216* in the device manager. If not, update the driver.

• Nothing happens when clicking on RUN:
- Verify that the dongle is correctly plugged into the PC.

8.2 No light on spectrometer

• Verify the beam path with a name card or an IR card, and check that it is not blocked by any part. • Verify the height and horizontality of input beam.

• Verify the presence of the $\lambda/2$ at the input of the Wizzler, rotate it to check it is not set for maximum extinction with the first polarizer.

• Rotate slightly the AlignTool (if present) to change the $\lambda/4$ orientation.

• Set the ND filter to minimum attenuation

• Verify the spectrometer settings as in section 5.1.2. If the spectrometer is trigged by an external signal, check this signal on an oscilloscope.

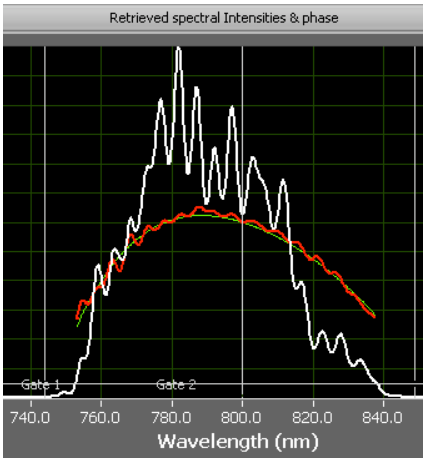
• Move the Wizzler optical module, checking the beam position on the iris and the alignment tool, until the spectrometer detects a signal as detailed in section 6.1.

8.3 No extinction with crossed polarizers

The level detected by the spectrometer when the 2 polarizers are crossed and without XPW crystal and replica generator, depends on the input energy, the integration time of the spectrometer, the $\lambda/2$ setting and the ND filter setting. It also depends on the input beam diameter and the ASE level of the laser. Set the input iris to a diameter φ=1mm, and check that input energy level is below 20μJ. Spectrum level should be below 5000. Please note that spectral phase measurement is not affected by a rather poor extinction ratio (1000:1) of the polarizers. Dynamics should however be slightly reduced.

8.4 Reconstructed spectral amplitude does not look like input spectrum

As all measurement techniques based on Fourier Transform Spectral Interferometry, the Wizzler™ is quite sensitive to double pulses. A typical example is shown on figures 8.1 and 8.2. The strong modulations appearing on the spectrum are created by interferences between the pulse replica and parasitic pulses. These modulations are not visible when the spectra is measured by a multimodal fibered spectrometer, but can be detected by a monochromator.



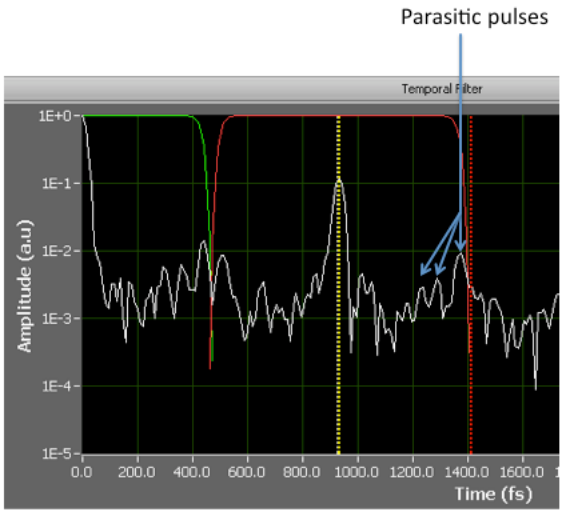
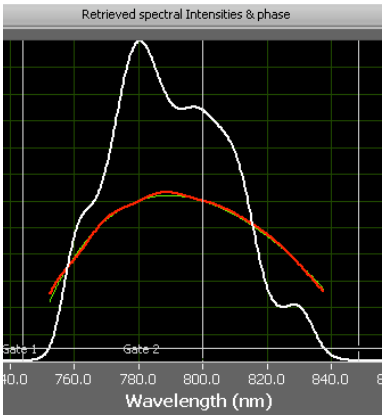


Figure 8.1: (left) Bad spectra reconstruction due to a multiple pulse structure

Figure 8.2: (right) Multiple pulse structure visualized on the filter graph

One solution to get rid of this is to reduce the temporal filter width so that the pulse replica is outside the filter as on figure 8.4. The main drawback of this technique is that if the delay between the parasitic pulse and the pulse replica is small, fast oscillations of the spectral phase will not be measured anymore, since the temporal filter is acting as a low-pass filter for phase and spectrum oscillations. A more elegant way is to identify the cause of this parasitic pulse in your laser system (Pockels cell or crystal orientation problems are potential causes) and to optimize the laser settings to make it disappear.



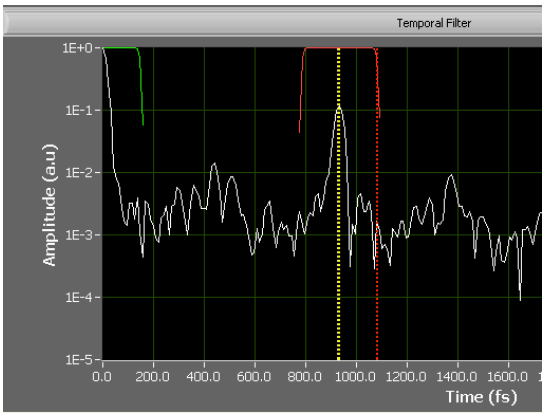


Figure 8.3: (left) Filter width set to remove the parasitic pulses

Figure 8.4: (right) Spectral intensity and phase with parasitic pulses out of the numerical filter

8.5 There are still fringes with crossed polarizers

When the optical axis of the Replica generator is not aligned with the axis of the polarizers, some fringes are still visible on the interferogram as displayed in Spectrum mode.

• Slightly rotate the second polarizer using the setting shown on figure 8.6 to minimize the signal intensity.

• If fringes are still present, slightly rotate the Replica generator and iterate with the output polarizer.

• If fringes are still visible, remove the replica generator and the XPW crystal and reoptimize the extinction of polarizers by tuning the output polarizer.

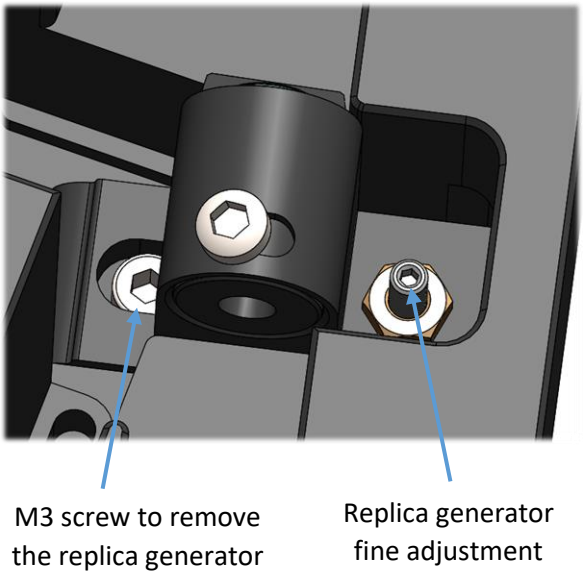


Figure 8.5: Birefringent plate setting

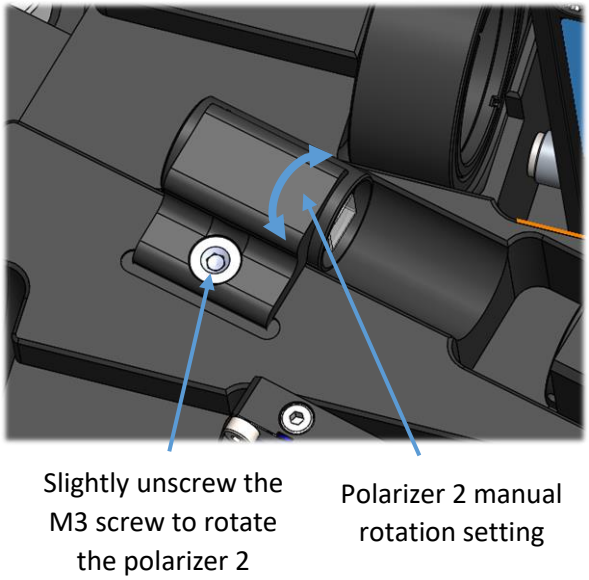


Figure 8.6: 2nd polarizer setting

Do not fully screw the Replica Generator fine setting screw with the Replica Generator out of the board. You will damage the spring plate!

8.6 No pulse duration measurement

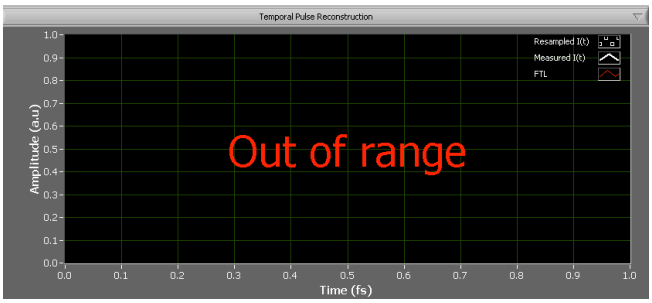
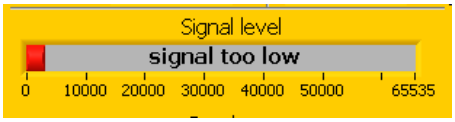


Figure 8.8: Lower display in SRSI mode when input pulse cannot be measured

When the Wizzler software window indicates OUT OF RANGE as on figure 8.8, the Signal Level and Goodness bars give one of the following diagnostics:

• **Signal too low:** The signal measured by the spectrometer is too low and thus the signal too noise ratio is too low to allow SRSI measurement. Increase the signal level on the spectrometer by adjusting the ND filter or by increasing the integration time of the spectrometer.



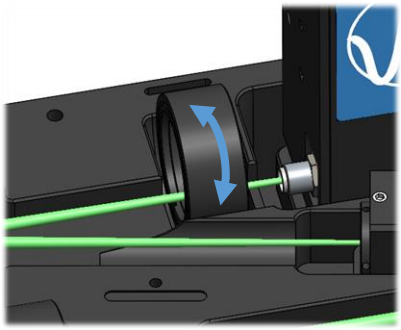


Figure 8.9: Signal level bar indication Figure 8.10: manual ND filter rotation setting

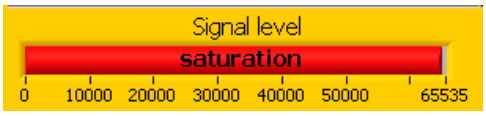


Figure 8.11: Signal level bar indication

• **Saturation:** The spectrometer is saturated. Use the ND filter setting or the integration time setting to reduce the signal intensity.

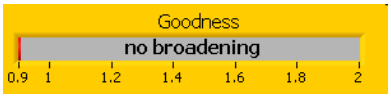


Figure 8.12: Goodness bar indication "no broadening"

• **No spectral broadening:** The XPW spectrum is not larger than the input spectrum, and thus SRSI measurement is not possible.

- The Wizzler™ requires an input energy between 2 and 20μJ. Check that your input beam energy is in this range.
- Rotate the $\lambda/2$ to maximize the signal on the spectrometer. Use the ND filter setting or Spectrometer integration time to decrease the signal if the spectrometer gets saturated.
- XPW is a third order non-linear effect for which efficiency vanishes for chirped pulses. Scan your compressor length until you can generate XPW.
- If there is still no XPW, slightly move the Wizzler™ optical module to check coarse alignment as in section 6.1.

• **White light generation:** The XPW spectrum is larger than the maximum theoretical value of the XPW effect, meaning that additional non linear effects occur in the XPW crystal. Reduce the input beam energy by reducing the input iris aperture or rotating the $\lambda/2$.

Figure 8.13: Goodness bar indication "continuum generation"

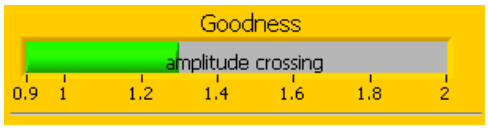


Figure 8.14: Amplitude crossing error message

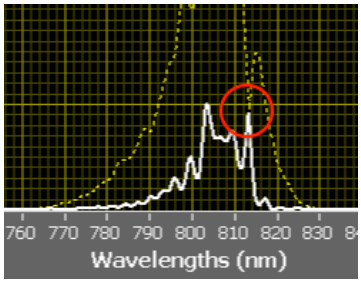


Figure 8.15: Typical SRSI spectral intensity graph during amplitude crossing error message

• **Amplitude crossing:** (Figure 8.14) The spectral amplitudes of the input pulse and the XPW pulse can not be clearly differentiated, leading to spectral phase calculation errors. This can be confirmed by selecting the Retrieved spectral amplitude and phase graph from the upper graph menu as shown on figure 8.15. Try to reduce the pulse replica intensity.

Figure 8.16: Goodness bar indication "low contrast"

• **Low contrast:** Pulse replica's level is too low to allow correct measurement. Increase the level of the pulse replica by slightly tuning the Replica generator. (see section 6.3)

• **Bad convergence:** Either the pulse to measure is at the limit of the validity range of the measurement or the contrast ratio of the polarizer is not high enough. This can be checked by removing the XPW crystal and checking that there is no significant pulse replica on the Temporal Filter graph.

• **OUT OF RANGE:** the pulse to measure is out of the validity range of the measurement. In most of cases, the pulse is too chirped for XPW generation to efficiently filter the spectral phase, or the pulse replica is too strong. Tune the Polarizer 1 to decrease the fringes depth.
If OUT OF RANGE on Goodness bar is still present, remove the XPW crystal, screw the Polarizer 1 to end-course and optimize the extinction of the polarizers. Put back the XPW crystal and check that the XPW spectrum is smoother and/or larger than the input spectrum. If not, the spectral phase of the pulse to measure is out of the range of validity of the measurement. Tune the compressor.

8.7 Numerics display error

The Numerics display in the Lower graph may sometimes under Windows7 have a wrong font assignment. The displayed text is not understandable. Just modify the Wizzler window size to fix it.

CHAPTER 9

Advanced Modes

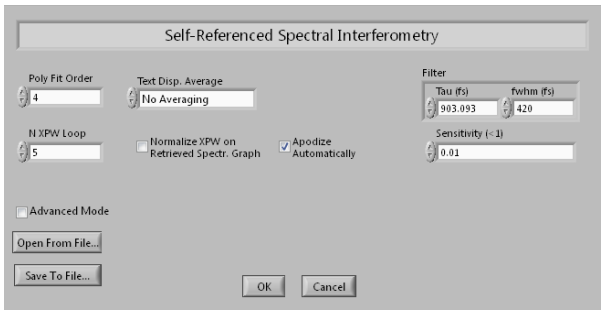
This section provides advanced settings and expert modes that can be used with the Wizzler.
For specific question, please contact FASTLITE at info@fastlite.com.
To enable the Advanced Modes option, in *C:/wizzler/data/* folder create an empty file named Advanced.xml.
Restart the software.

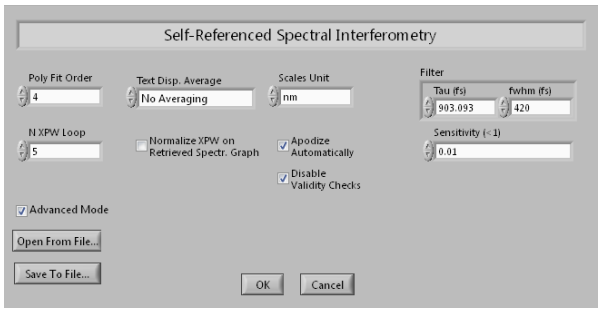
9.1 SRSI configuration panel

In the SRSI configuration panel, you can now access an advanced mode. This mode allows new settings describe here below.

9.1.1 Disable checks

Now in the SRSI configuration panel (opened by double clicking on SRSI in Operation Mode), an Advanced Mode check box appears. By checking it, a "Disabled Validity Checks" option can be selected and a Scale unit option for the graphics porposes either nm, THz or cm-1. If "Disable Validity checks" is selected, the software is forced to display the numerics, temporal reconstruction and durations even if the measure is estimated as not truthful.



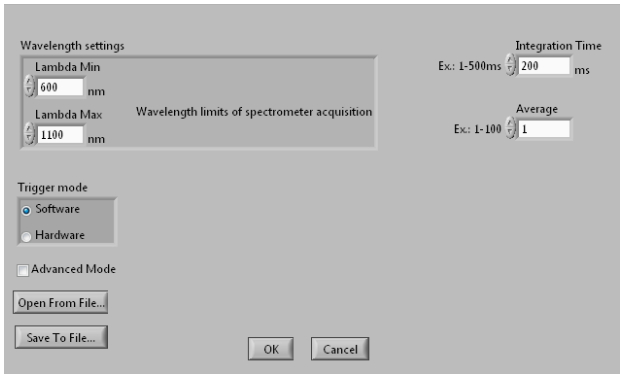


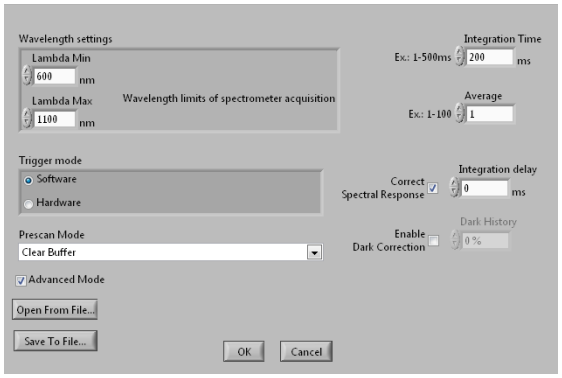
9.1.2 Normalization of the XPW intensity on graph Retrieved spectral intensities and phase

By double clicking on SRSI operation mode, a configuration panel of the main SRSI parameters opens up. An option is "Normalized XPW on Retrieved Spectr.Graph". As defined by its name, this option will force the XPW spectrum to be normalized. In the SRSI.xml file, it corresponds to NormXPW.

9.2 Spectrometer configuration panel

New settings onto the Spectrometer also appear with advanced modes option.





9.2.1 Spectrometer intensity calibration

By checking or unchecking this "Correct Spectral Response" mode you use a preset internal calibration of the device made at Fastlite. This calibration uses an halogene lamp reference to correct the spectrometer energy response and the different optics transmissions of the system versus lambda. This option is not avalaible is the spectrometer was not pre calibrated. In case you need calibration or to adapt the calibration, please feel free to contact Fastlite. (On version V1.3.0 beta, this setting is only take into account if you modify another setting. You can for example check and uncheck the "Enable Dark Correction" to effectively activate or disable the Correct Spectral Response.)

9.2.2 Other spectrometer advanced settings

The other advanced settings are preset to their optimal values and have no significant influence on the measurement. Please do not modify it.