1. Topas4 Introduction

WinTOPAS4 is the main control application for Light Conversion optical parametric amplifiers, also referred to as OPAs. It is designed to provide simplified control of the device, while also maintaining advanced configuration options.

Start by launching the application . You will be greeted with the main application window (see Figure 1). It consists of three basic components:

1. A tool bar, where you can add new windows or devices and access various tools.
2. Tab control, where you can see your active devices. In this instruction we only have one active device.
3. Control window. This window corresponds with the selected device.

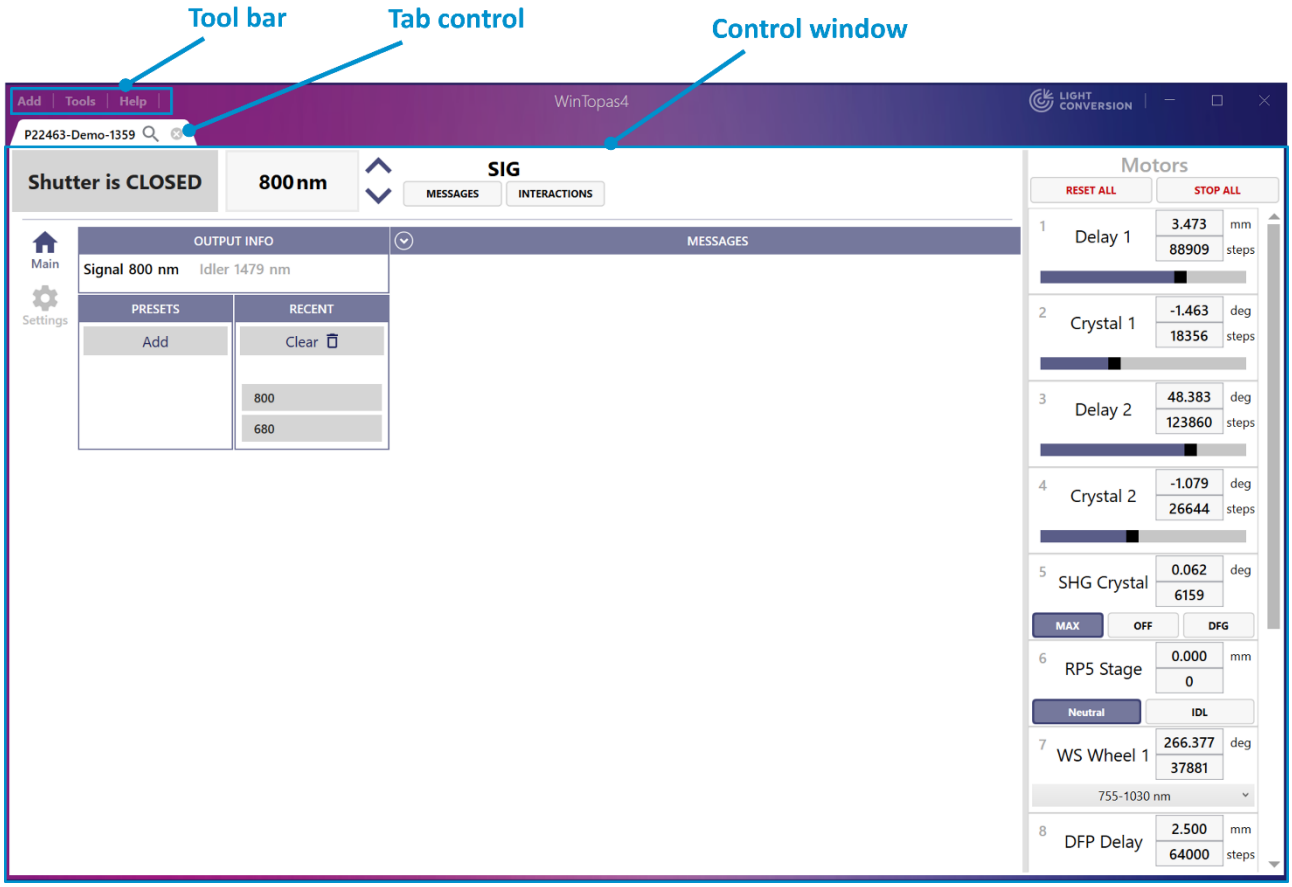

Figure 1. Main window of the WinTopas4 user application

WinTOPAS4 works in tandem with the server application which is running in the background (see Figure 2). It manages all the device logic and must be running to control the OPA. Server application launches automatically and once WinTOPAS4 is connected we can start using the application.

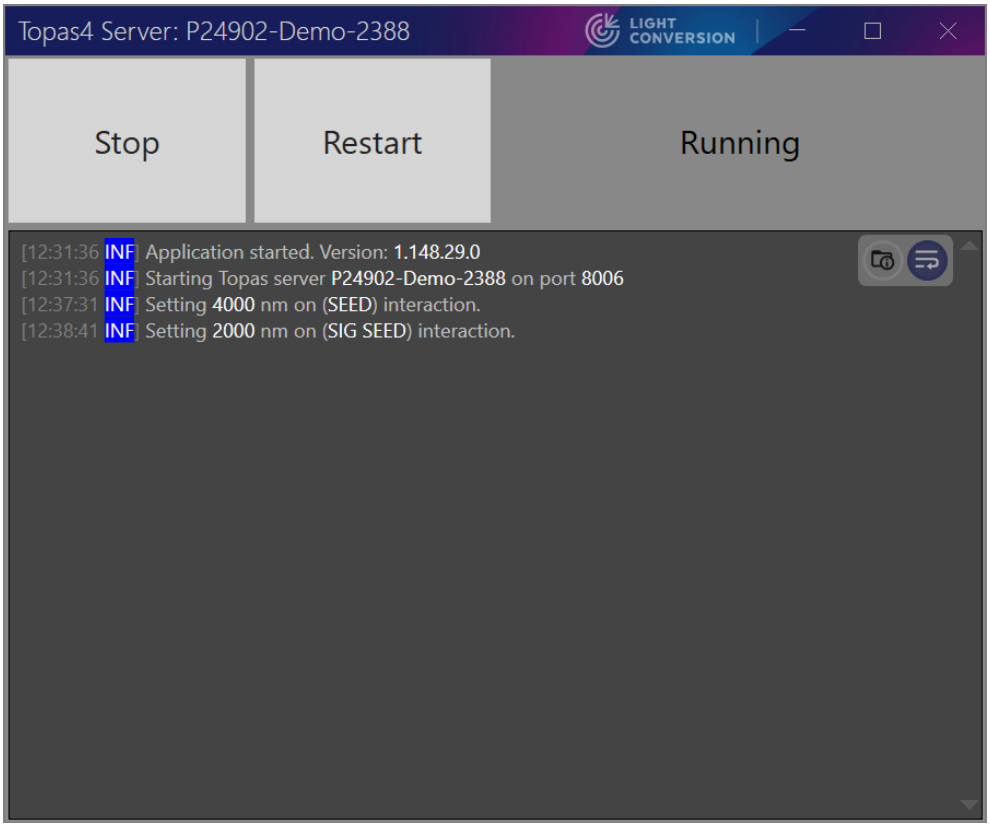

Figure 2. Main window of the Topas4 server application

Optical parametric amplifiers have many motors inside. Each of them has a different function and can be controlled separately (see Figure 3). Fortunately, every device is calibrated carefully so you do not have to worry about the individual motors.

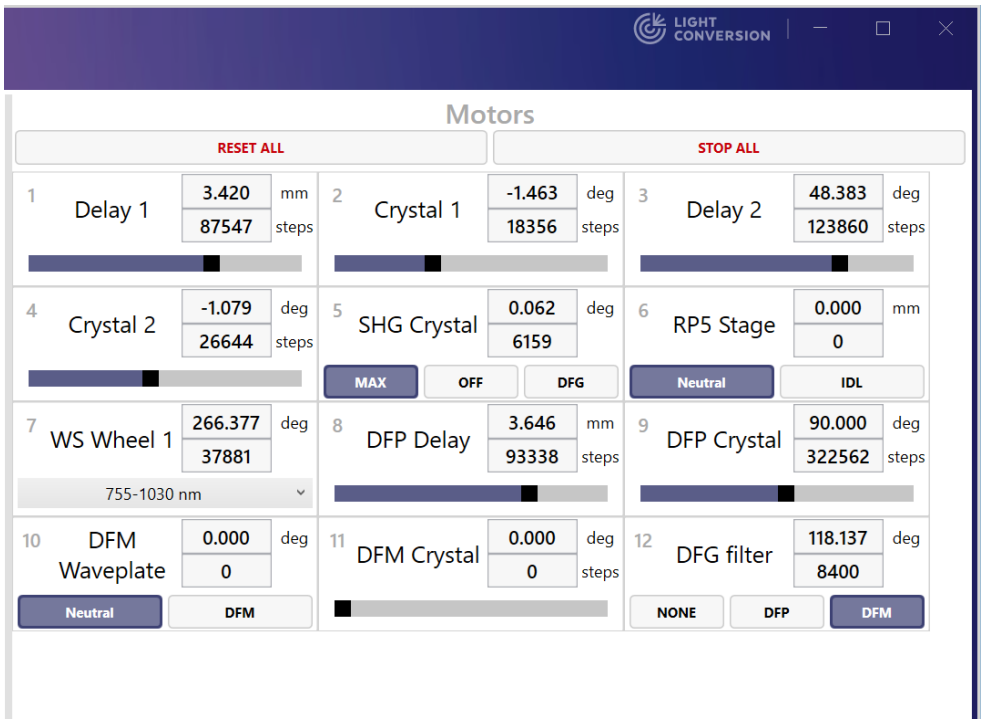

Figure 3. WinTopas4 motor control

Calibration is applied to various parametric interaction types, so you simply have to select the desired interaction, enter the wavelength and let WinTOPAS4 do its magic. Afterward simply open the shutter to emit your ultrashort pulses.

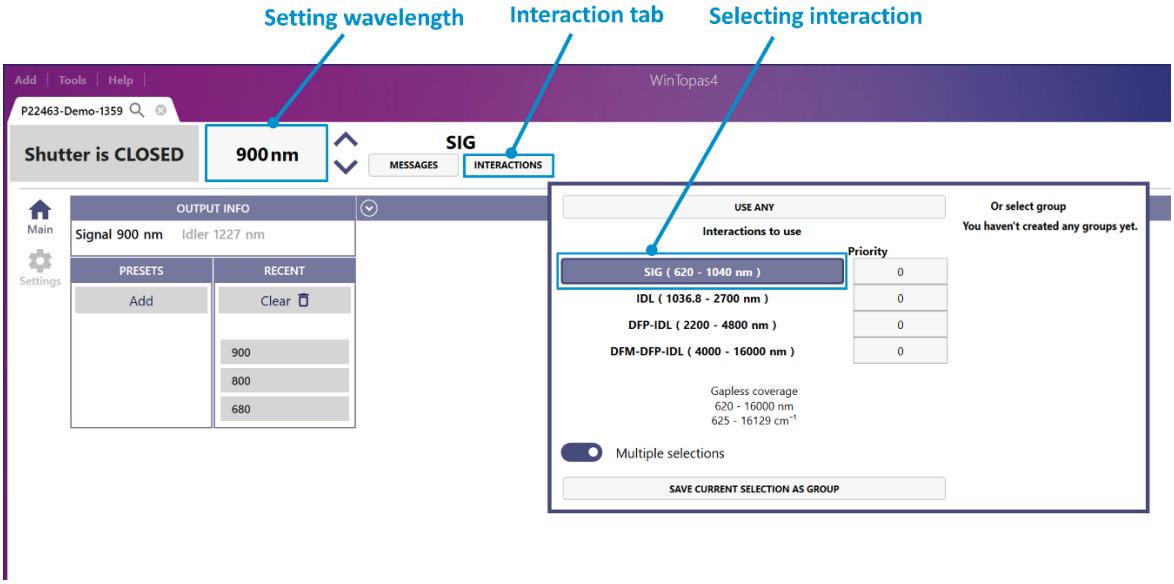

Figure 4. Selecting interaction type and setting wavelength in WinTopas4

The message window will show the information specific to the selected interaction. It contains important information, such as output beam polarization or additional steps required to use the selected interaction (see Figure 5).

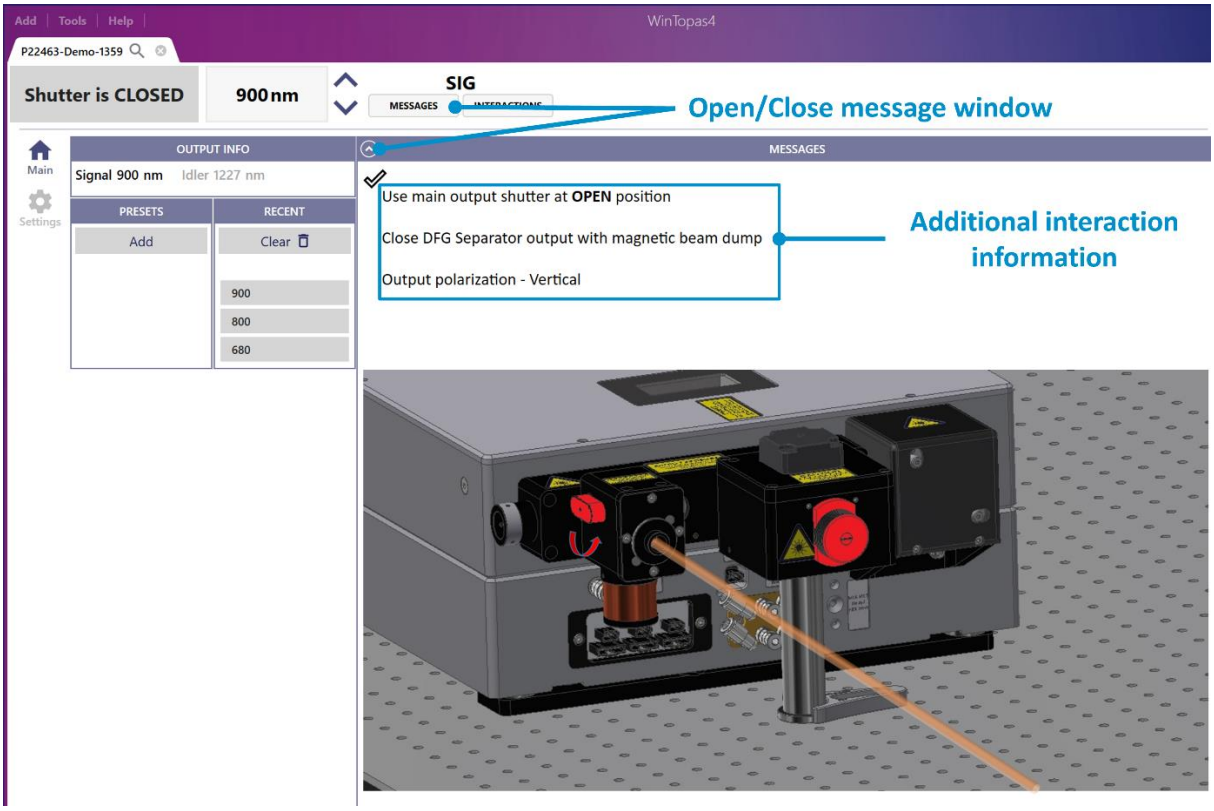

Figure 5. WinTopas4 message window

Recently used wavelengths can be accessed below “OUTPUT INFO” tab for faster navigation. You can also create and name presets for specific user defined motor positions.

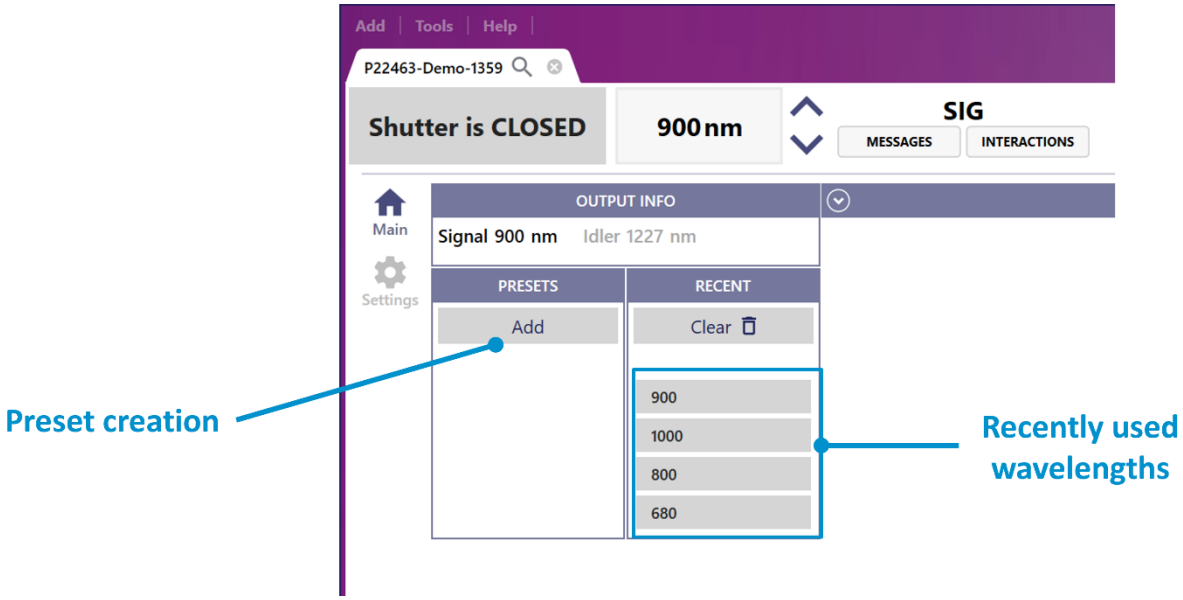

Figure 6. Addition of presets and access to recent wavelengths in WinTopas4

2. Select interaction(s) to use and create interaction groups

Light Conversion's optical parametric amplifiers cover a broad range of wavelengths. This is achieved by utilizing various optical parametric interactions, which cover different wavelength regions and have different properties such as pulse duration and spectral bandwidth. The list of available interactions can be seen by clicking the interactions button (see Figure 7). There are various ways to switch between the interactions. If a single interaction is selected other interactions will not be utilized when changing wavelength. The accessible wavelength range is thus limited to the range of that single interaction.

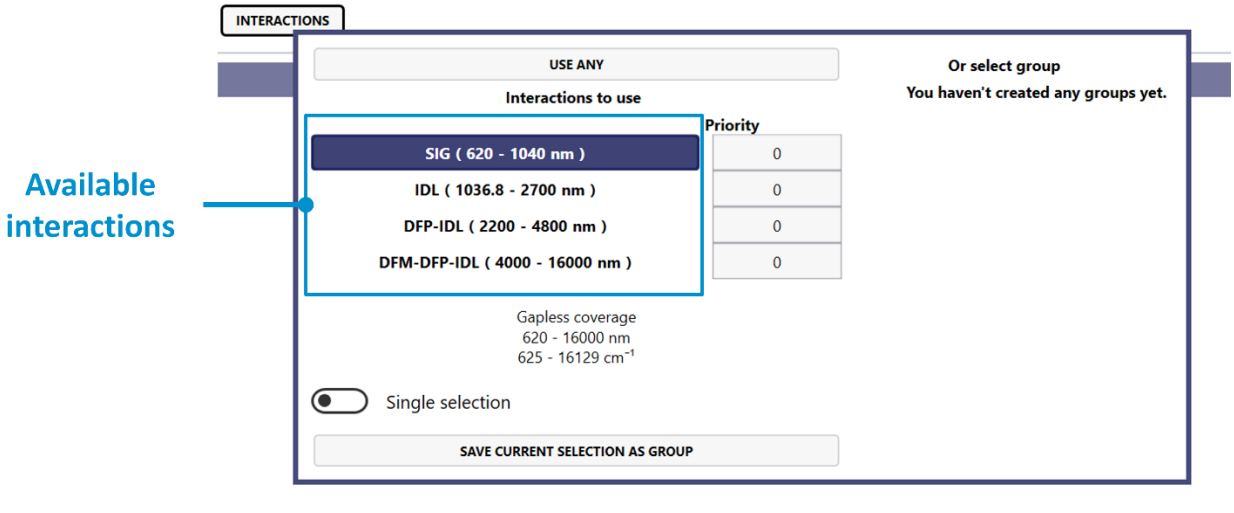

Figure 7. Interaction list in WinTopas4

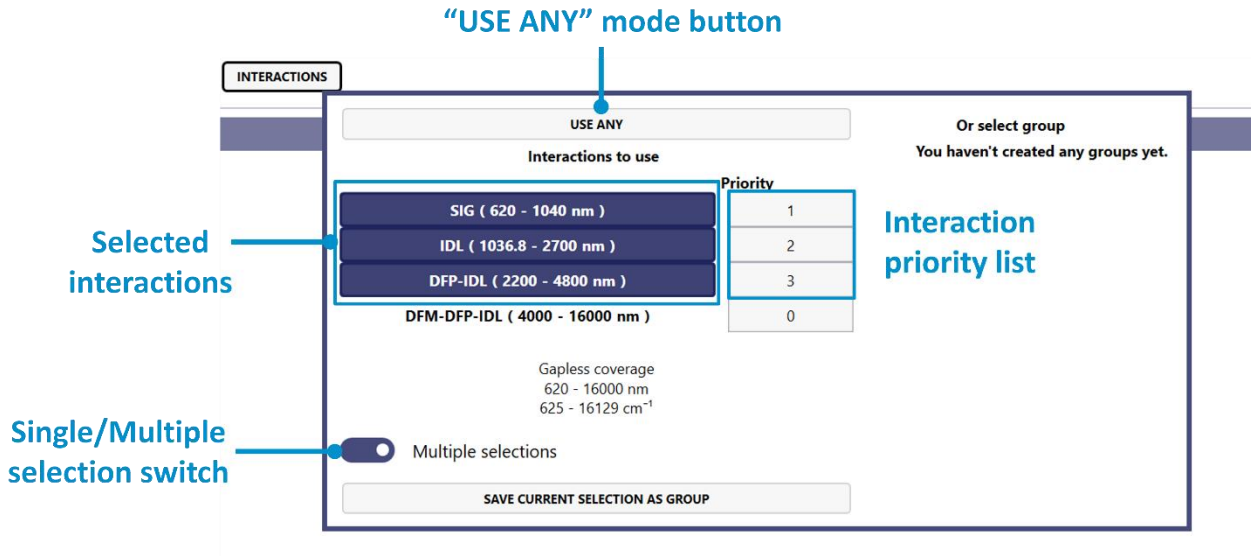

Figure 8. Multiple selection option in WinTopas4

To extend the wavelength range multiple selection feature can be enabled (see Figure 8). This allows selecting several interactions which will be automatically activated based on the entered wavelength. If the wavelengths overlap on different interactions, each interaction can be assigned a priority value. The interaction with a higher priority number will be preferred when entering the wavelength. This is especially useful if “USE ANY” mode is activated, and all the interactions are being used.

Additionally, interactions can be nested into groups. These groups can be named and can be quickly accessed later (see Figure 9).

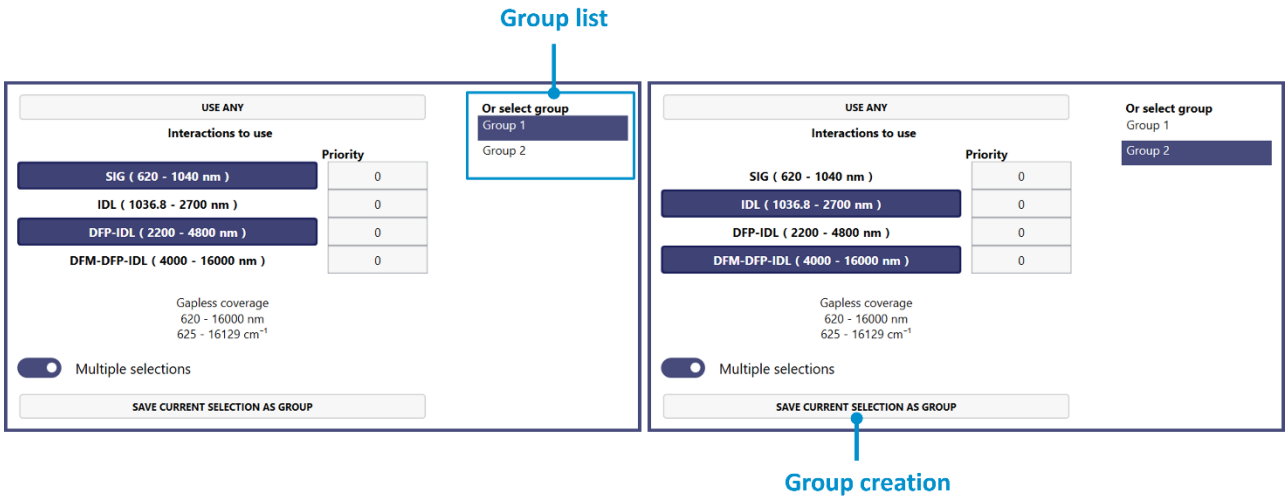

Figure 9. Multiple interaction grouping in WinTopas4

3. Calibration overview

Light Conversion optical parametric amplifiers are wavelength calibrated with the help of multiple motors inside. Every interaction has a set of motor positions which correspond to the given wavelength. The information about these positions is stored in calibration data.

Device calibration is an advanced WinTopas4 feature. It can only be accessed by experienced users thus elevated access is required. To unlock the calibration view, click “Access level” under the tools menu and enter password “1600” as shown in Figure 10.

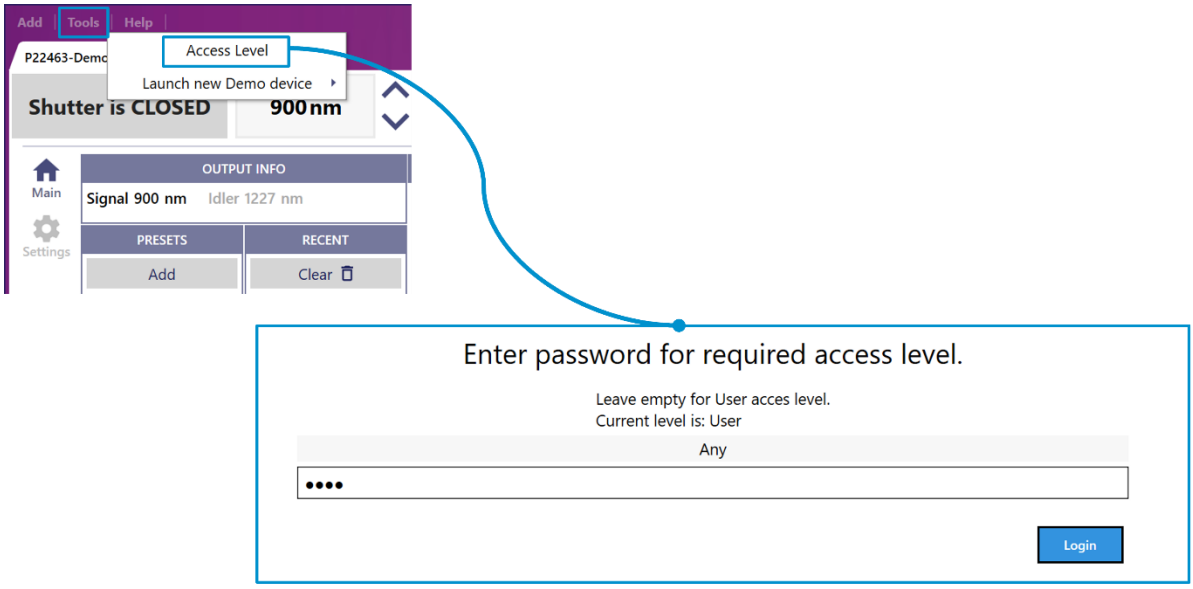

Figure 10. Unlocking calibration view in WinTopas4

New tabs “Calibration” and “Motors” will appear on the main window (see Figure 11). Calibration window consists of four tabs as shown in Figure 12.

The main tab under the calibration window is called “Optical”. It contains the most important data such as interaction relationships, wavelength curves, motor positions and more (see Figure 13 and Figure 14). Device calibration is usually performed after physical modifications inside the device, alignment procedures or significant changes in the pump laser. The “Separation” tab (see Figure 15) is dedicated to the elements that are used to separate different interactions or certain wavelength regions. These elements are usually filters, mirrors or waveplates. They are switched based on interaction or wavelength. The “Create interaction” menu (see Figure 16) allows setting up new interactions or modifying the existing ones. The “Sense” tab (see Figure 17) is dedicated to various additional sensors such as power meters.

The motors window is also divided into four tabs. The motors window shows the physical properties of the motors, their positions, ranges and more (see Figure 18).

Most of the tabs and parameters mentioned here are set up at the factory and will never require any modifications. In fact, some of them even require “Engineer access level”. Wavelength calibration,

however, might need some adjustments from time to time. We recommend becoming familiar with this feature by reading extended instructions about wavelength calibration.

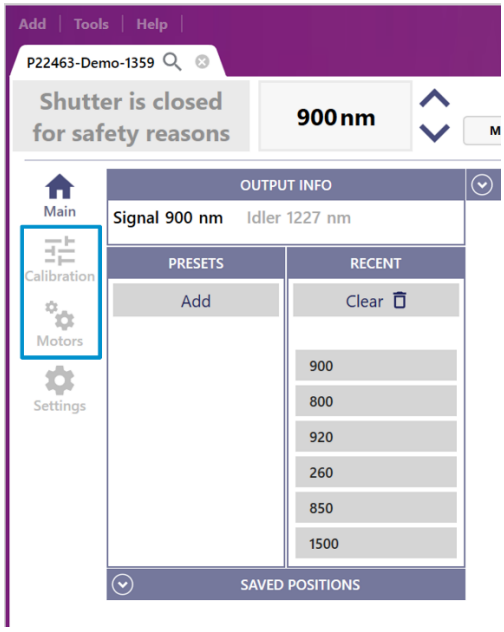

Figure 11. WinTopas4 calibration and motors tabs

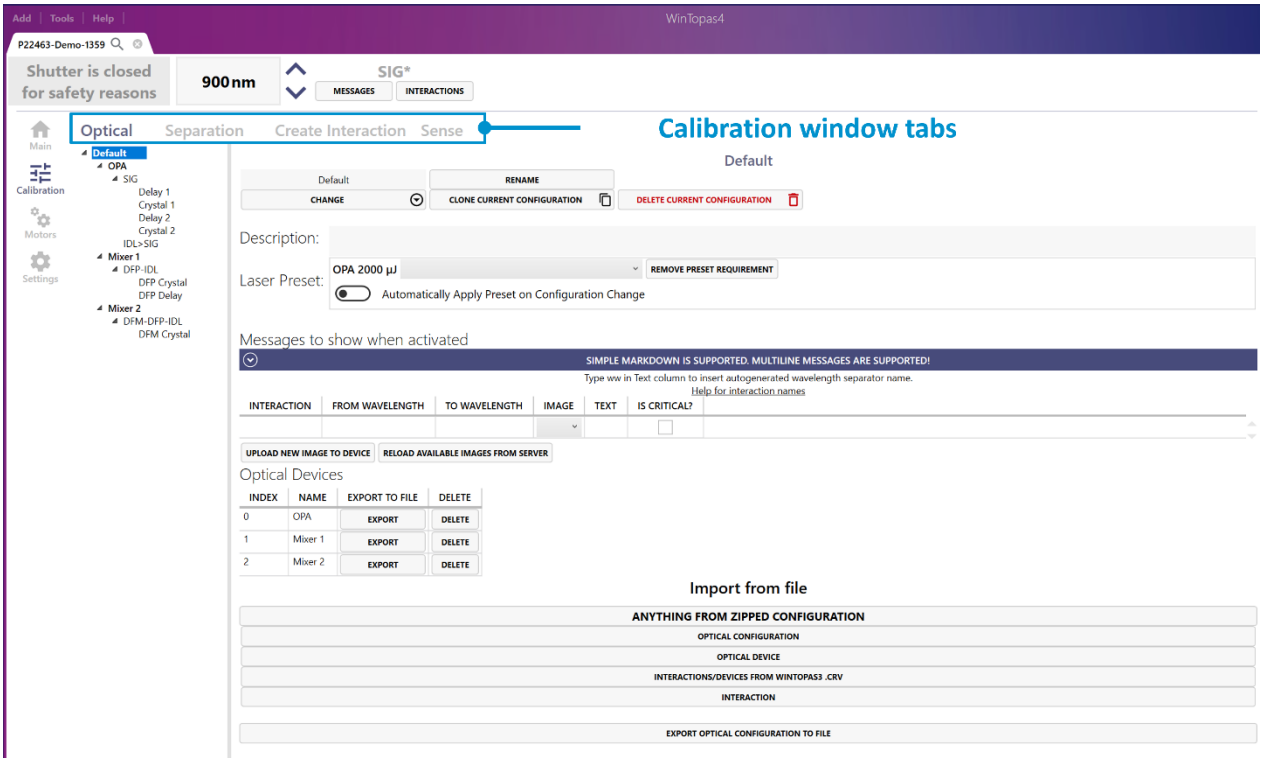

Figure 12. WinTopas4 calibration window tabs

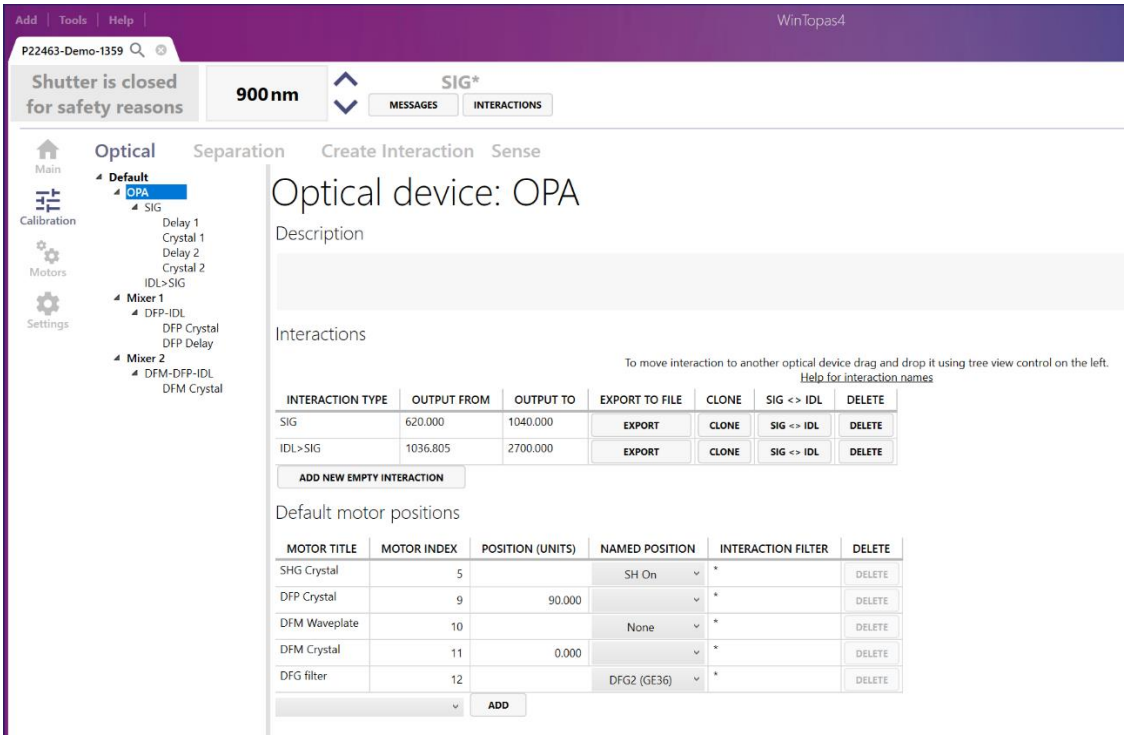

Figure 13. Interaction relationships and motor positions in WinTopas4

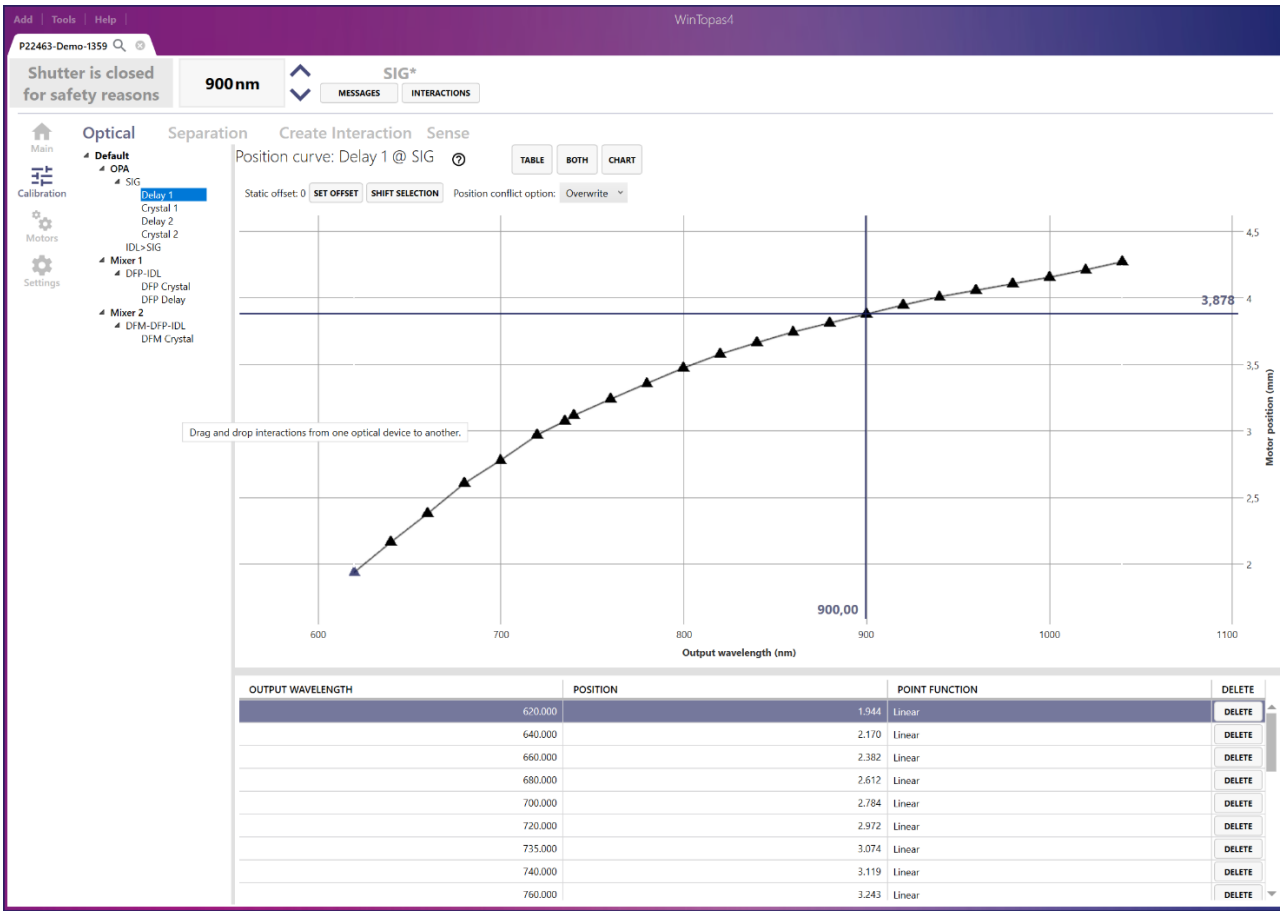

Figure 14. Wavelength curves in WinTopas4

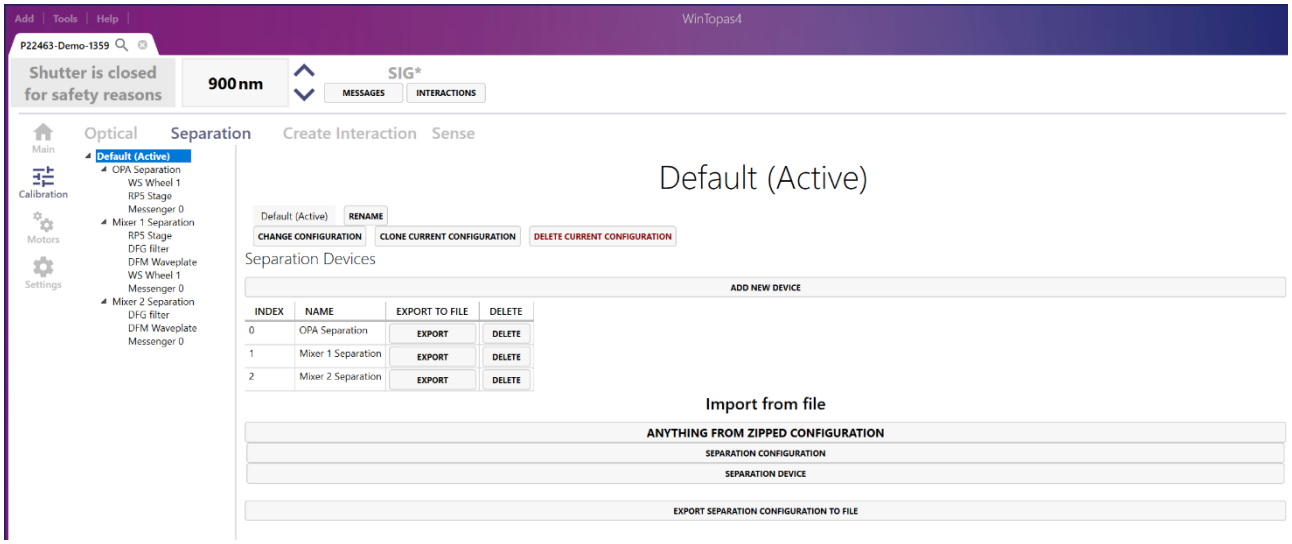

Figure 15. WinTopas4 separation tab in calibration window

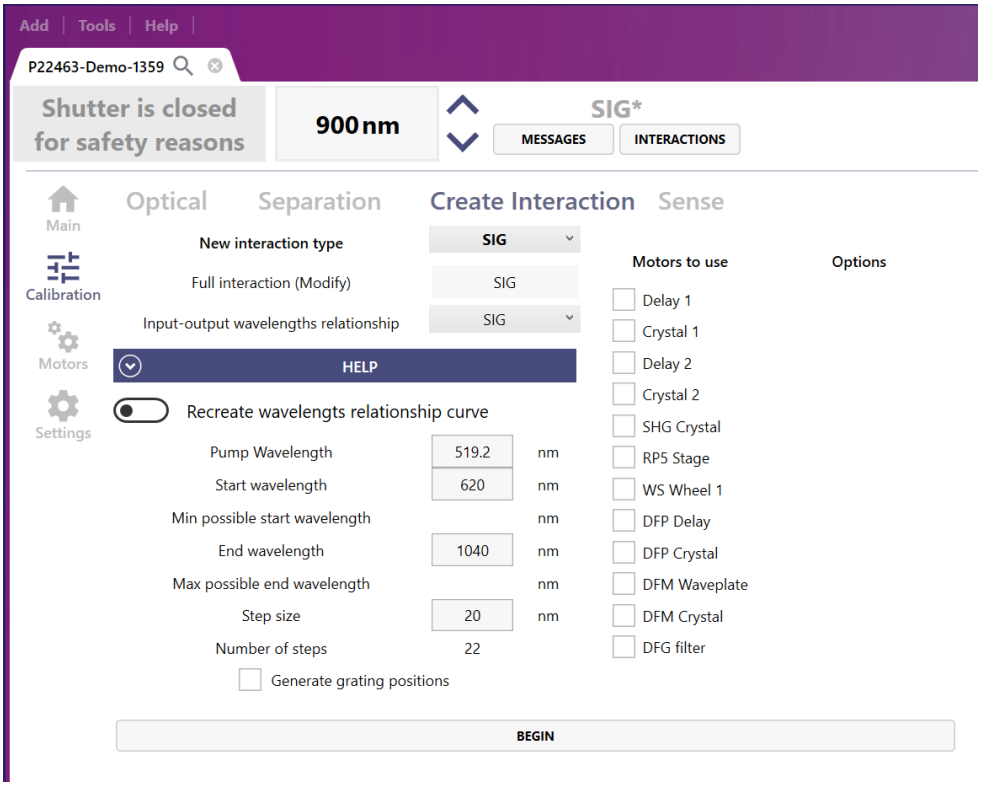

Figure 16. WinTopas4 interaction creation tab in calibration window

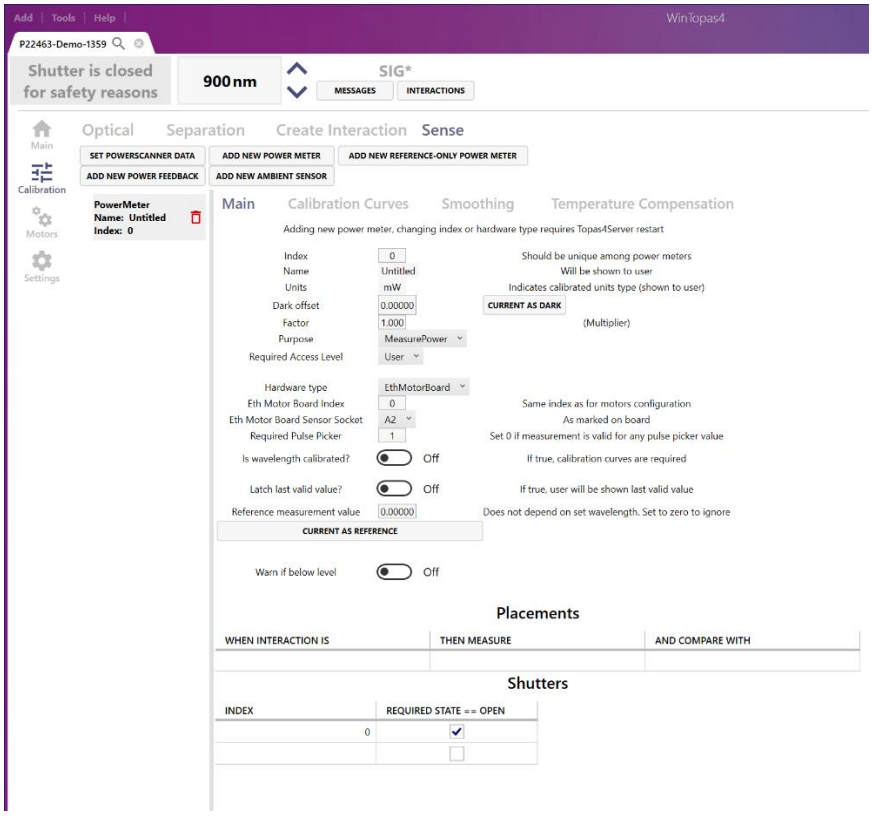

Figure 17. WinTopas4 sense tab in calibration window

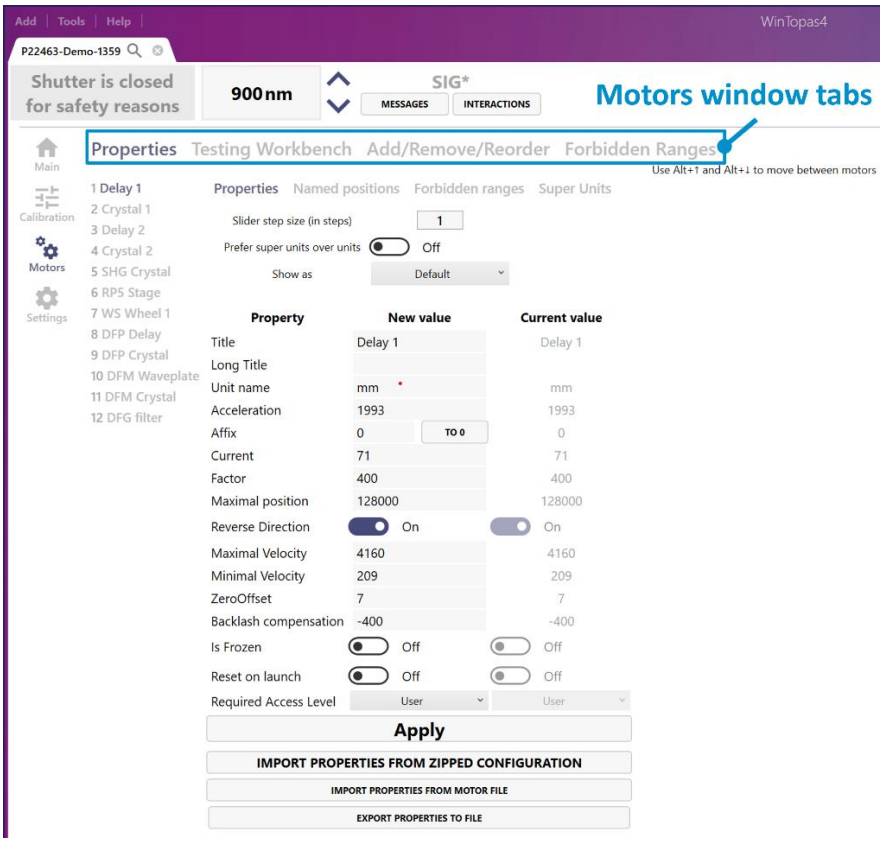

Figure 18. WinTopas4 motors window

4. Calibration tuning

In this instruction we will cover calibration curve adjustment procedures. They are usually performed when the OPA requires some power or wavelength optimizations. To access the calibration menu elevated access must be granted first. After entering password “1600”, the calibration window will appear.

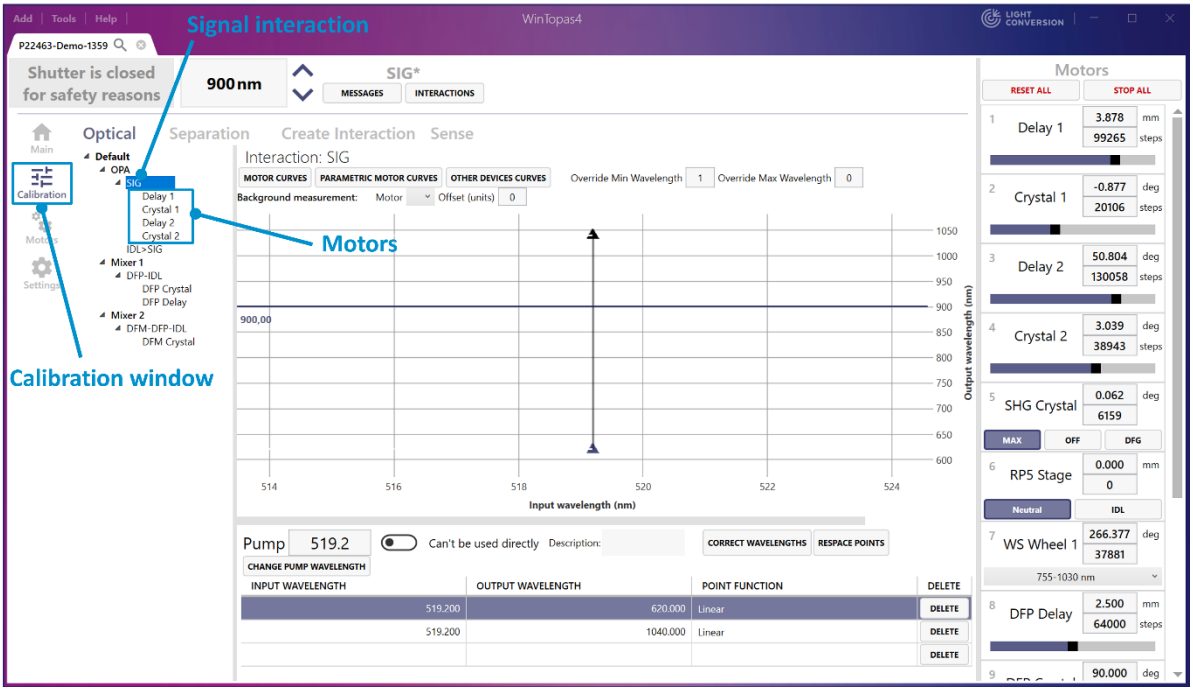

Figure 19. WinTopas4 Signal interaction calibration tuning

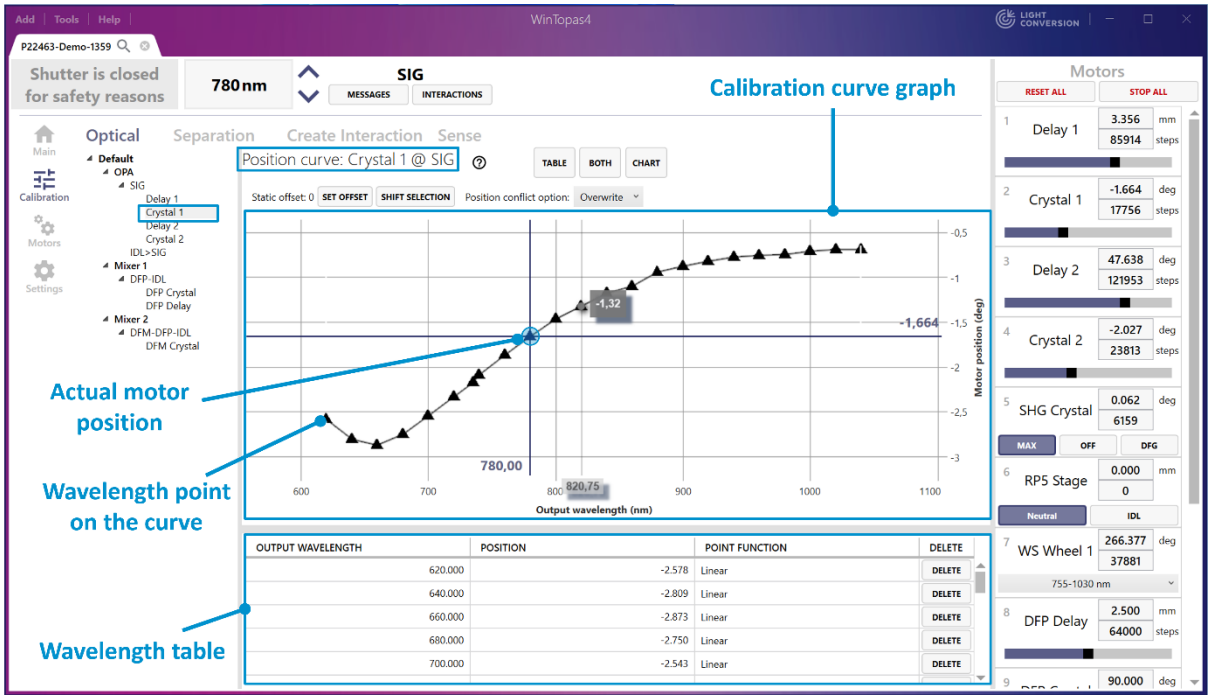

Figure 20. WinTopas4 Signal interaction motor “Crystal 1” calibration curve

We will be tuning the Signal interaction (see Figure 19) which has 4 motors with their corresponding curves (see Figure 20). Each individual wavelength point in the curve can be modified either with a mouse, keyboard shortcuts or by editing the wavelength table. Tuning is performed by changing the motor position at a specific wavelength in the Motors control window (see Figure 21) while adjusting the crosshair of the calibration curve with the arrow keys on the keyboard. After adjustment, measure the OPAs output parameters and once the output parameters are as desired press “Enter” and the motor position on the curve will be overwritten as shown in Figure 22.

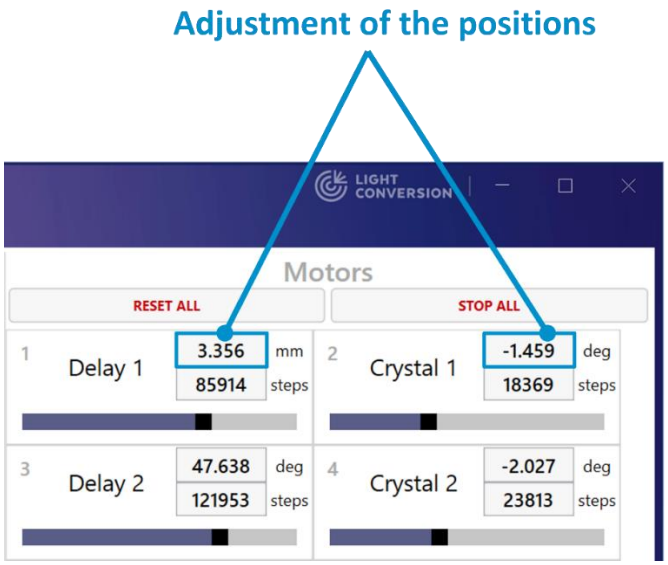

Figure 21. Adjusting motor positions in WinTopas4

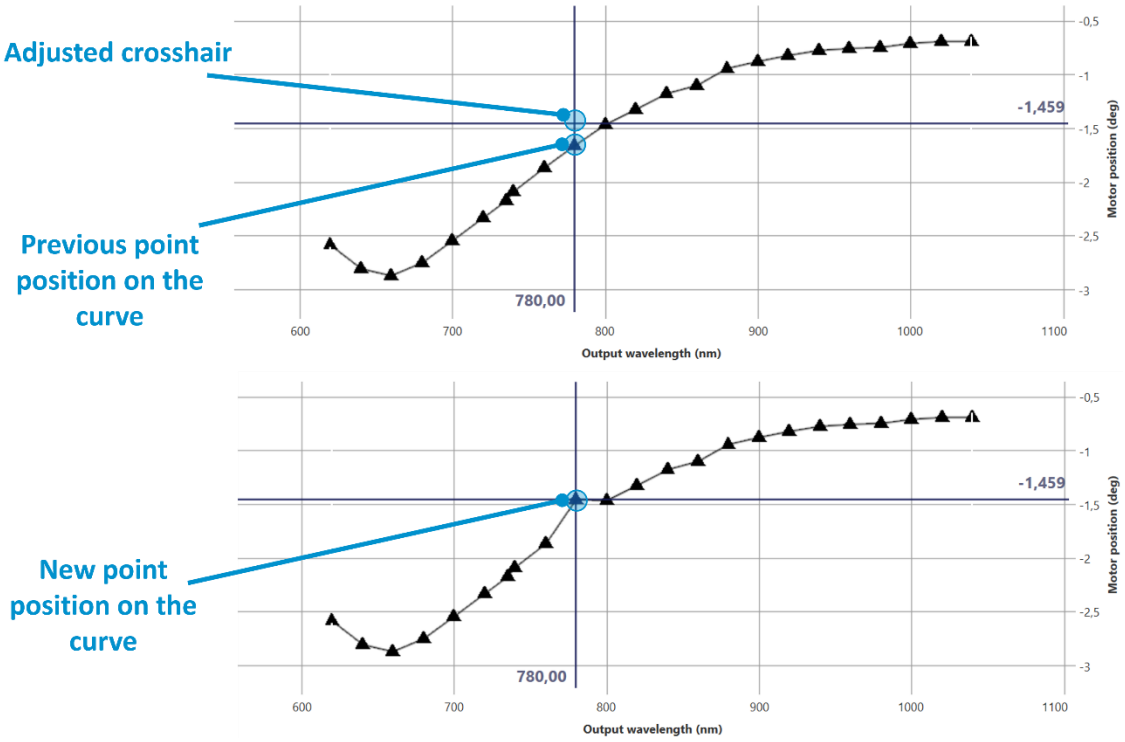

Figure 22. Adjustment of the motor position on the calibration curve in WinTopas4

Navigating between the motors can be done by clicking on the desired motor in the Motors control window. To simplify switching between the motors, motor selection shortcuts can be utilized. Each motor has an assigned number (see Figure 23) and can be quickly activated by holding the left “Alt” key and pressing its corresponding number on the keyboard.

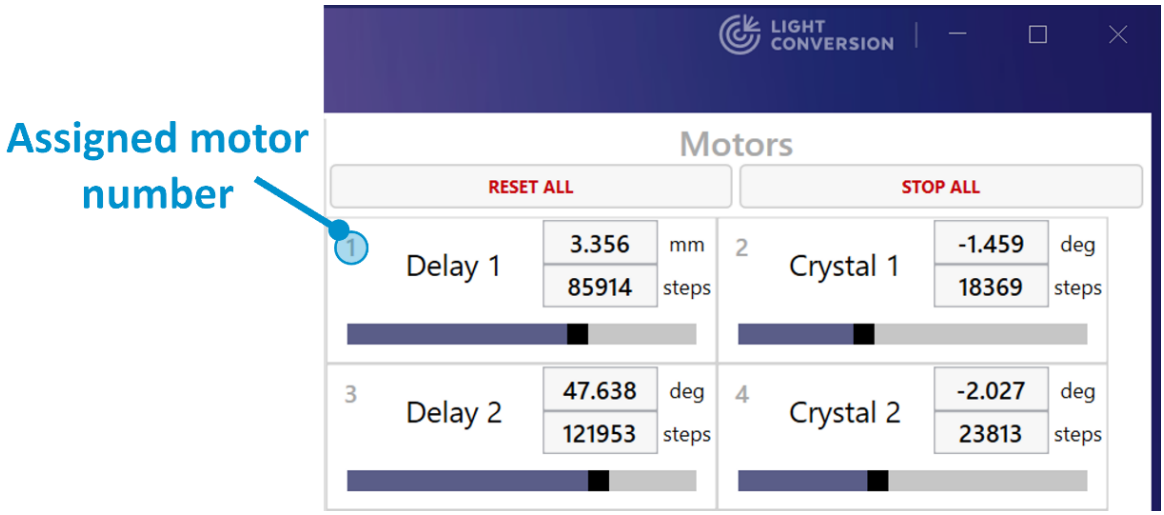

Figure 23. Assigned motor numbers in WinTopas4

Usually, several motors need to be adjusted for each wavelength on the curve. If there is more than one motor that was moved during the adjustment “Alt + Enter” keyboard combination can be used. This keyboard shortcut will save all altered motor positions and automatically move to the next point on the curve. Perform these actions for the whole curve to finish the tuning. The list of shortcuts can be accessed by clicking the “Question mark” as shown in Figure 24.

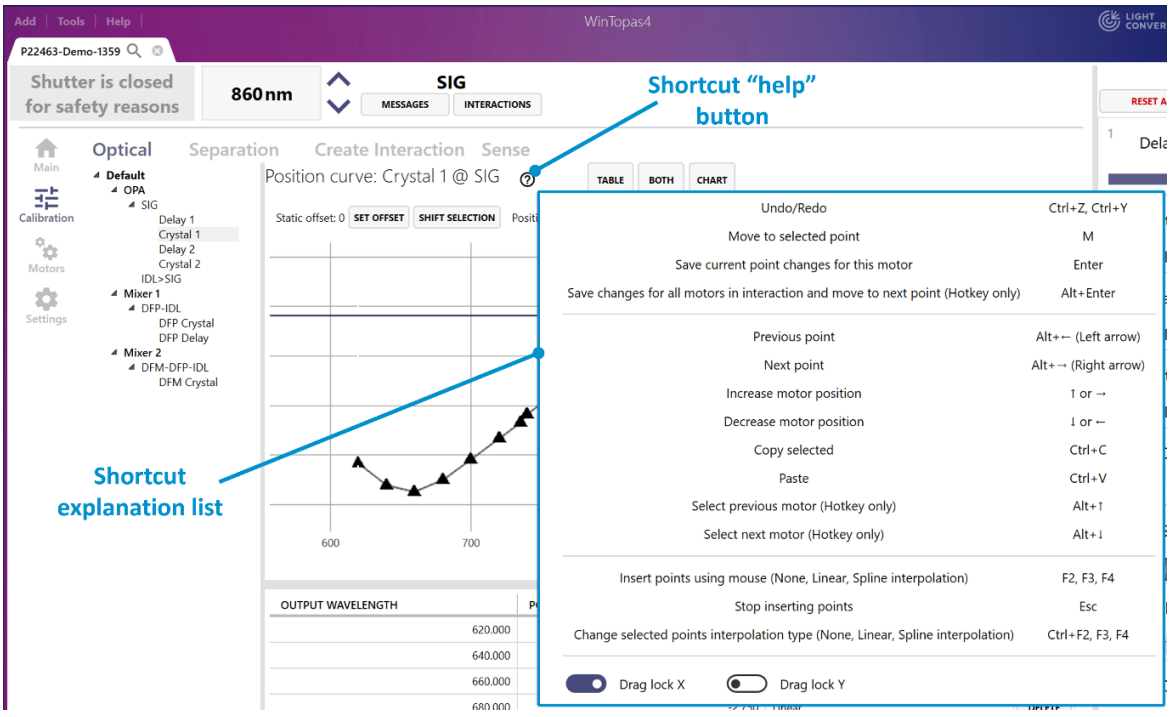

Figure 24. Shortcut list in WinTopas4

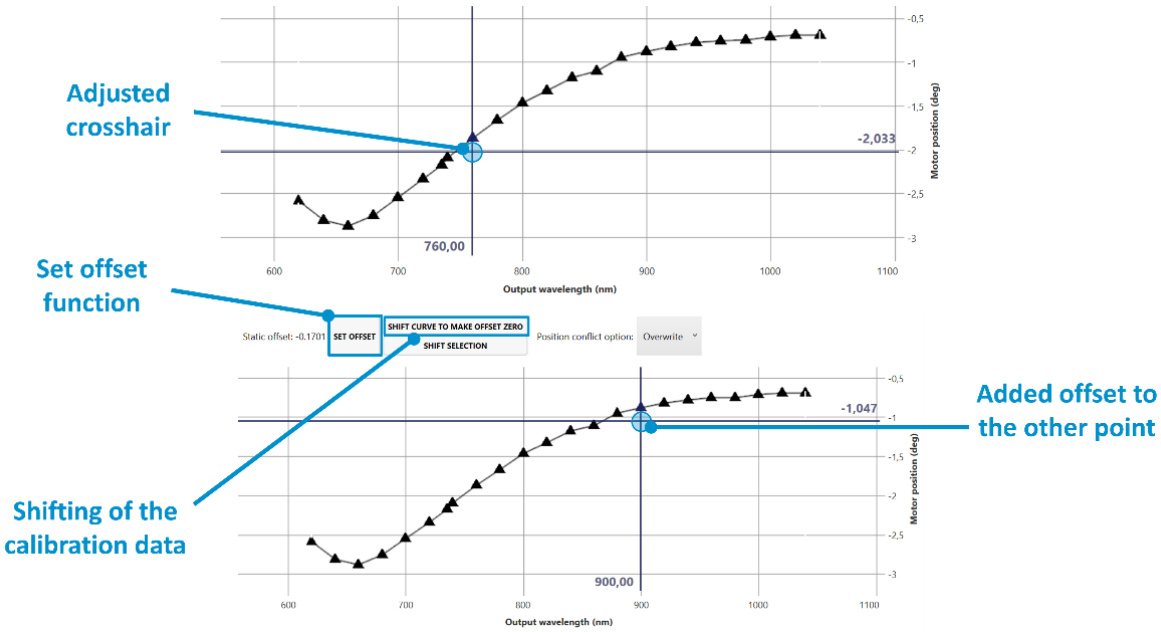

Figure 25. Offset function on wavelength points in WinTopas4

If the whole curve needs to be shifted by some amount the “Offset” function can be used. Select any point on the curve and adjust the motor position. Clicking the “Offset” button will add the offset to all the points in the curve (see Figure 25). Afterwards, the actual calibration data can be shifted by pressing “Shift curve to make offset zero” button and the offset becomes zero as shown in Figure 26.

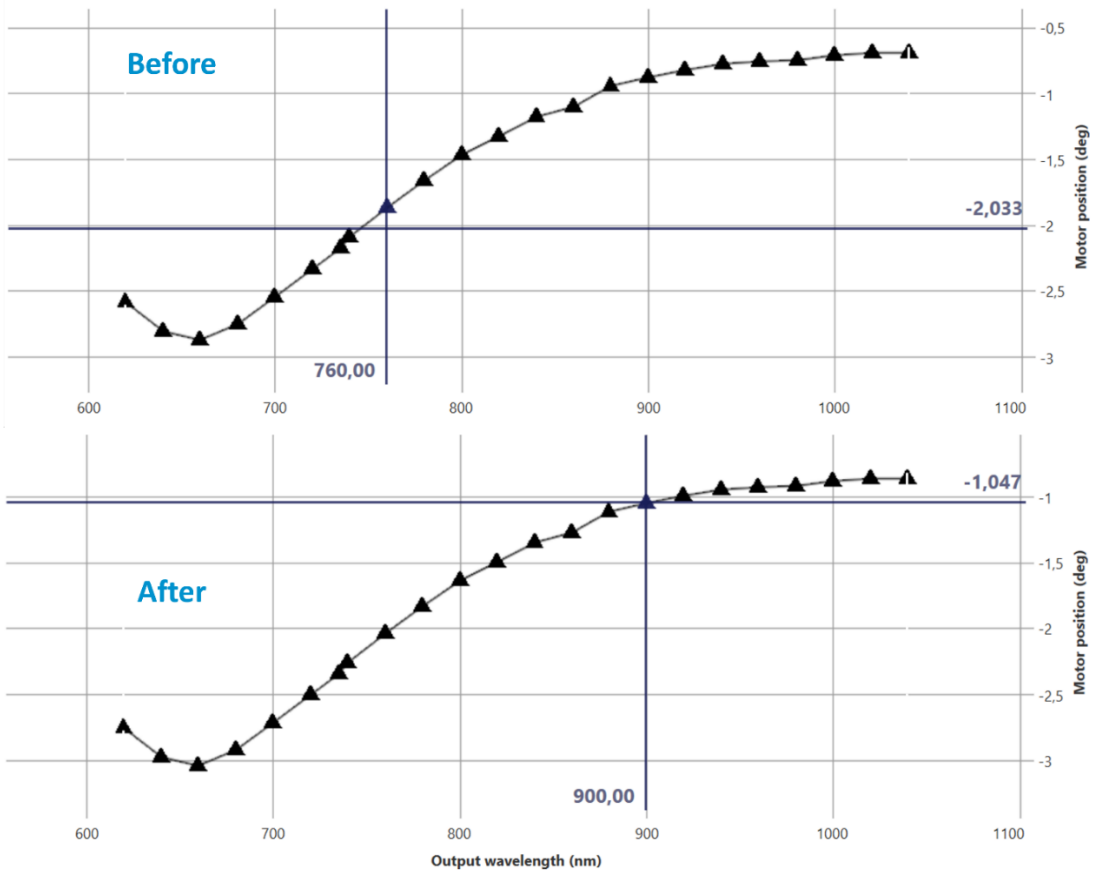

Figure 26. Shifted calibration curve in WinTopas4

5. Modify calibration, correct wavelengths

Besides curve tuning the calibration menu also offers other calibration features. It allows extending the wavelength range of the curve, respacing the points, correcting the wavelengths and more.

5.1 Wavelength correction

There can be cases when output wavelengths of the OPA differ slightly from the real measured values. Re-tuning all the curves can be a tedious task for small corrections. In such cases wavelength correction function can be used (see Figure 27). We can fix the mis match by measuring the real output wavelength of each point with the spectrometer and entering in the measured values. This task could also be automated with Light Conversion spectrum measurement tool called “spectraLight”. After this procedure the points in the curve will be respaced, interpolated and the output wavelength should correspond well with the software.

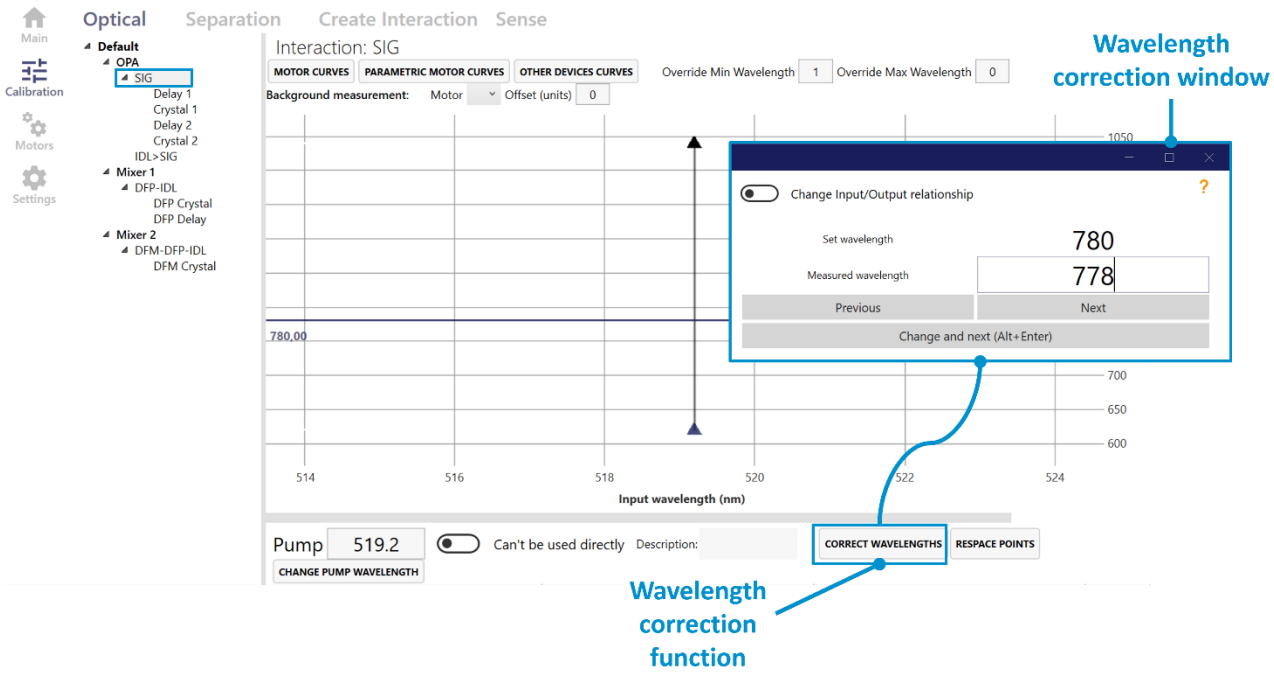

Figure 27. Wavelength correction function in WinTopas4

5.2 Respacing the points

The spacing between the calibration points in the curve can be changed by clicking the “respace points” button (see Figure 28). This will create or delete the points in the curve to make the spacing equal to the set value. In this example we respace the calibration points at 10 nm intervals (see Figure 29).

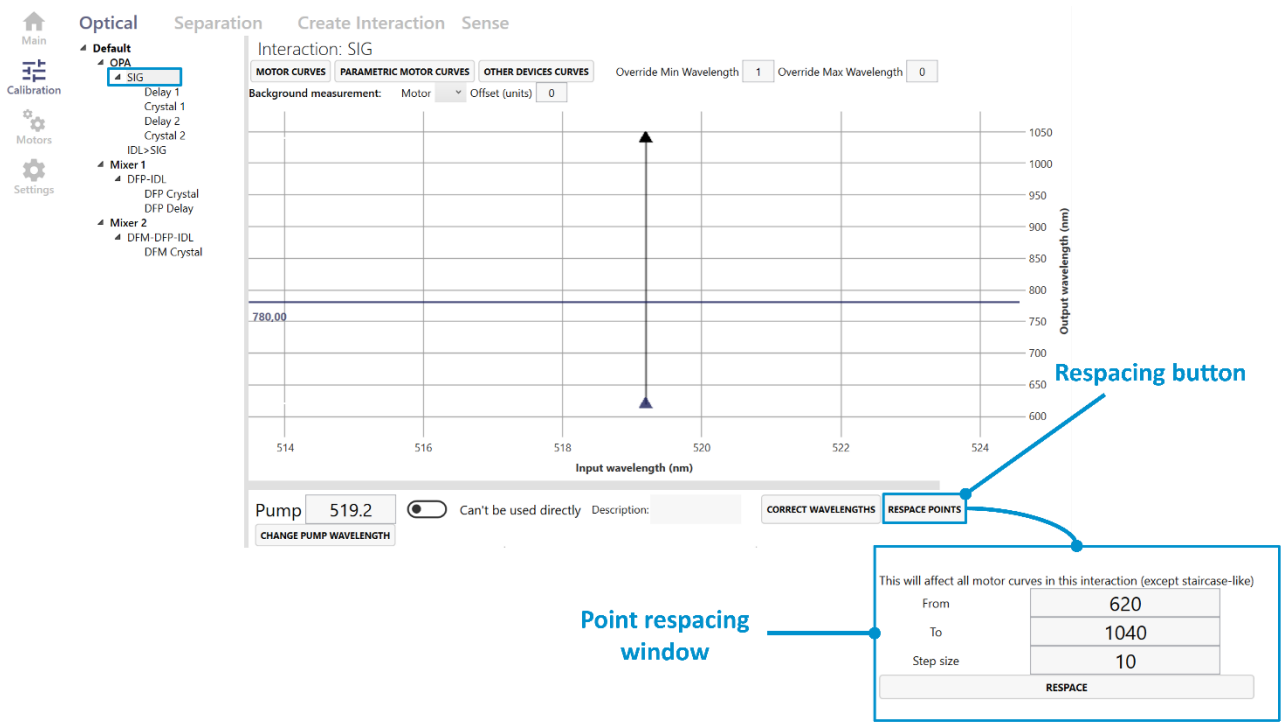

Figure 28. Respace points function in WinTopas4

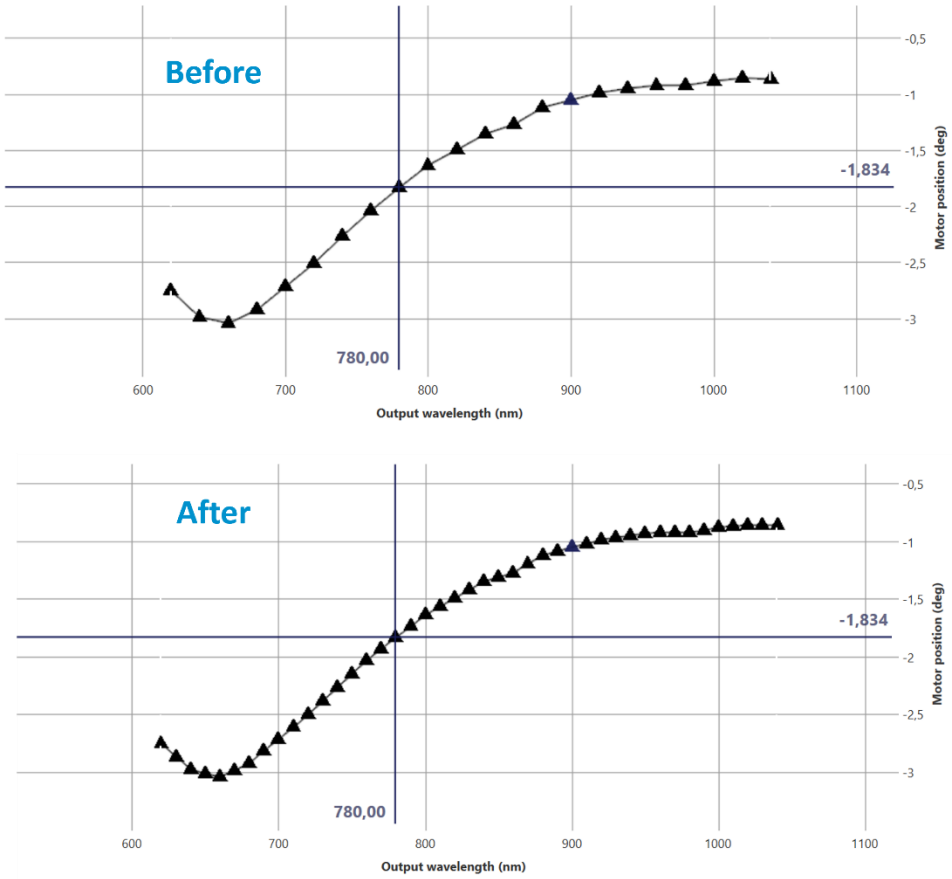

Figure 29. Calibration curve before and after respacing in WinTopas4

5.3 Extending the calibration range

The range of the tuning curve can also be modified. In this example the lowest wavelength of this signal is restricted to 620 nm. To extend the range of the tuning curve open the interaction creation window select the signal interaction and overwrite it with the extended range as show in Figure 30.

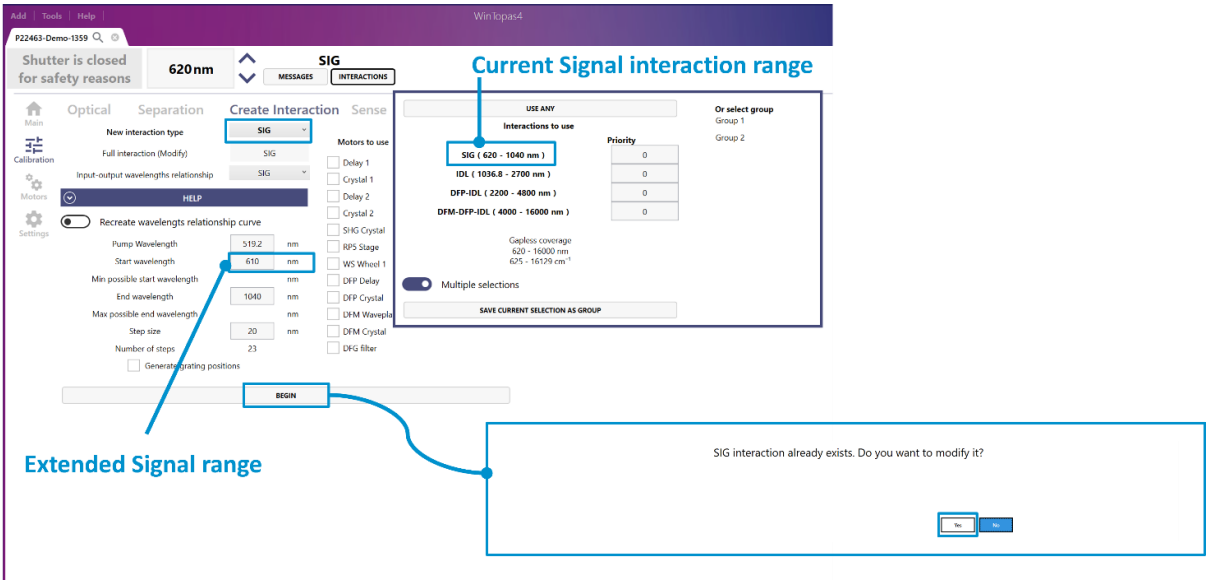

Figure 30. Extending Signal interaction range in WinTopas4

Newly added points will have to be calibrated for all the required motors (see Figure 31). After it is done the calibration curve and the interaction range will be extended.

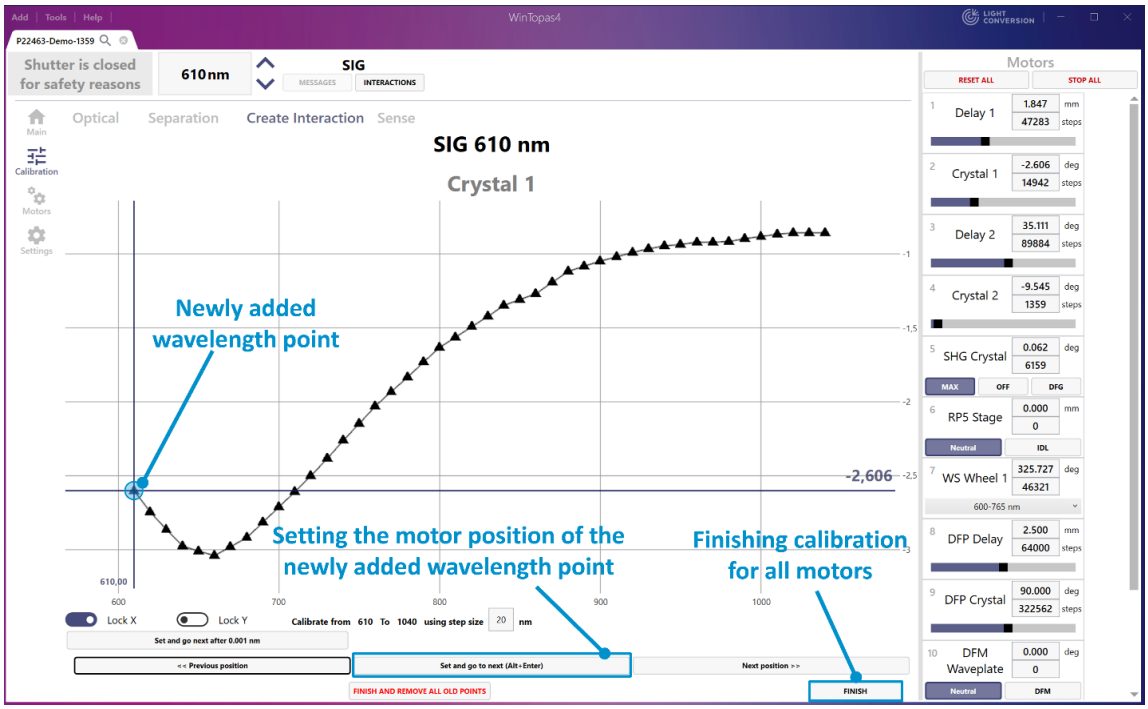

Figure 31. Motor calibration after extending interaction range in WinTopas4

Another way to extend the tuning curve is by adding wavelength points in the “Output wavelength” table and setting the position below the calibration curve (see Figure 32).

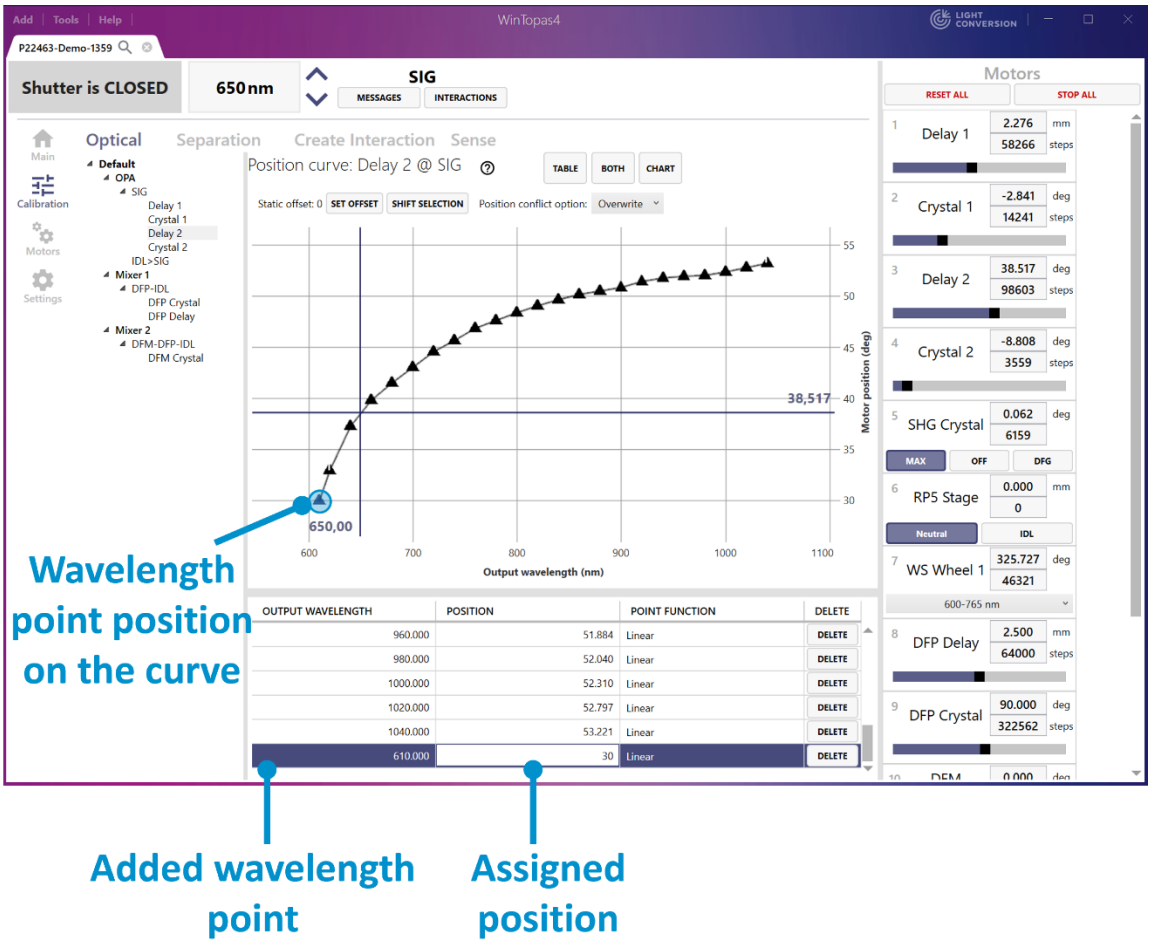

Figure 32. Addition of a wavelength point in WinTopas4

Wavelength points must be added to all the motors of the signal interaction and the signal interaction’s output wavelength must be adjusted as shown in Figure 33.

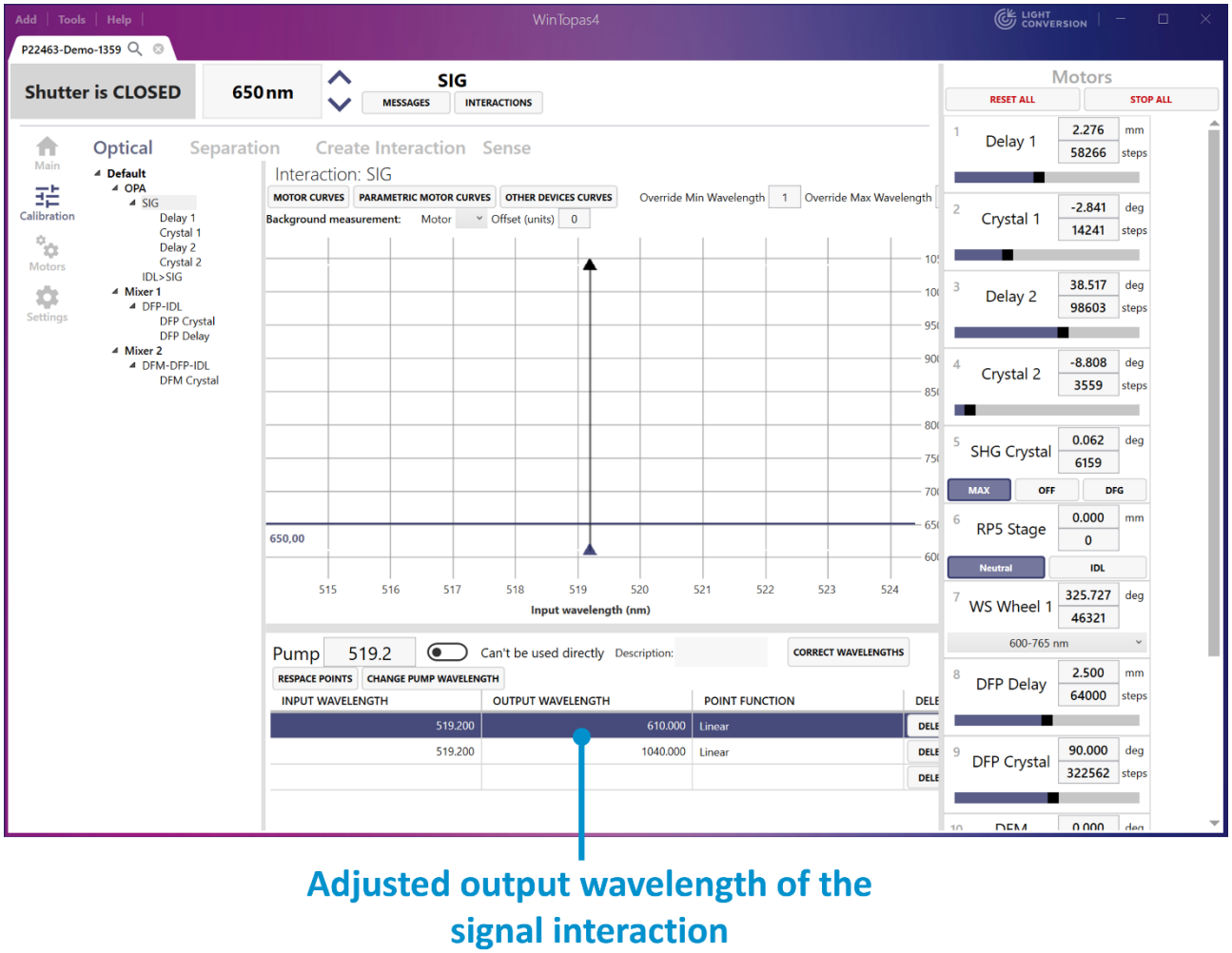

Figure 33. Adjusting output wavelength in WinTopas4

5.4 Changing the pump wavelength and regenerating the idler

Some interactions cannot be directly tuned, instead they are derived from the parent interaction according to the optical parametric relationships. In this example the signal is the calibrated interaction, and the idler is derived from it (see Figure 34).

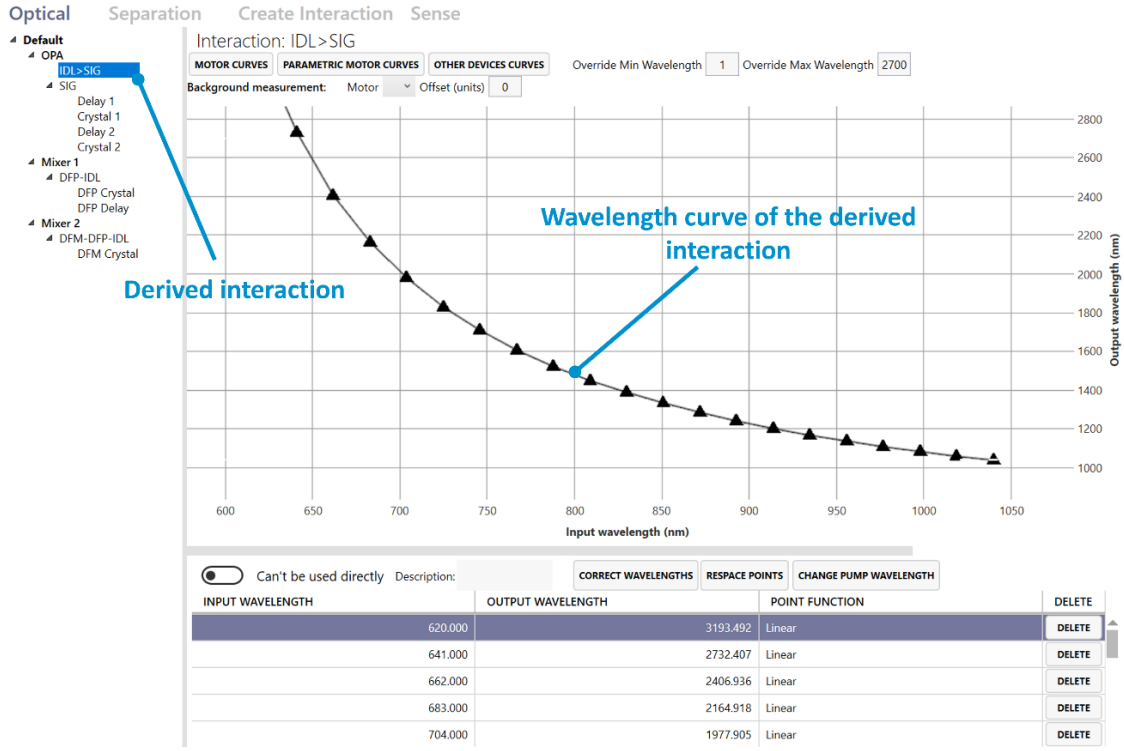

Figure 34. Derived interaction in WinTopas4

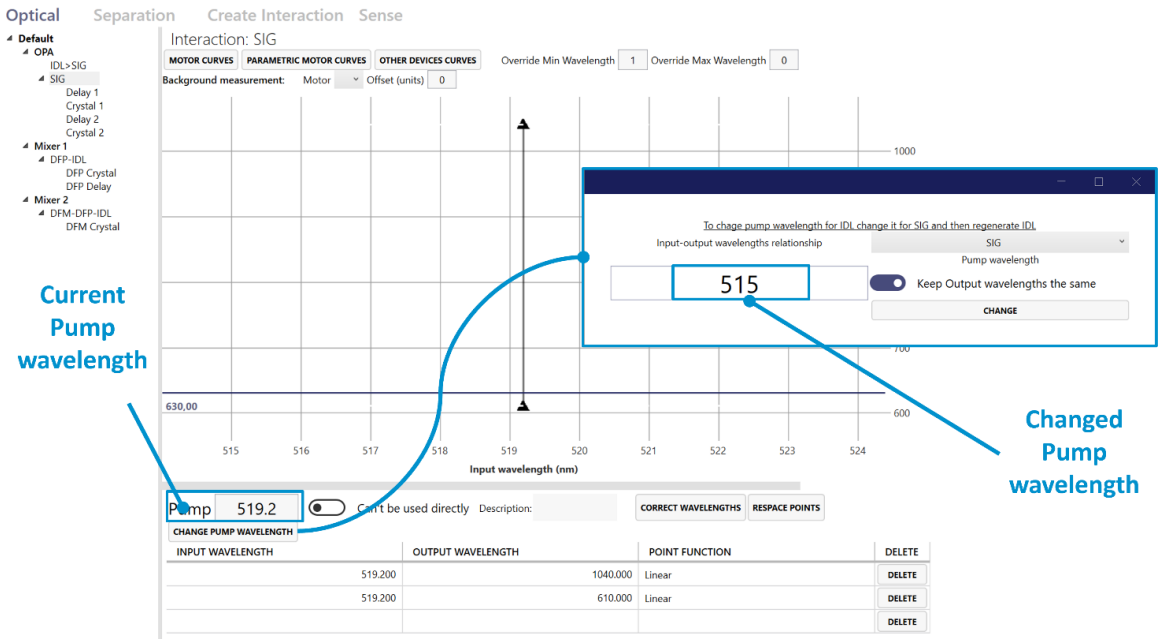

Figure 35. Changing Pump wavelength for idler wavelength precision in WinTopas4

The pump wavelength is assigned to the parent and is used to calculate the wavelength relationships of the derived interactions. It can be changed to increase the wavelength precision of the idler (see Figure 35). Changing it does not affect the signal in any way, but the idler will have to be recalculated. The easiest way to do that is to delete the old idler interaction and generate the new one as shown in Figure 36. The newly generated idler will appear with wavelength relationships that better match the actual output values.

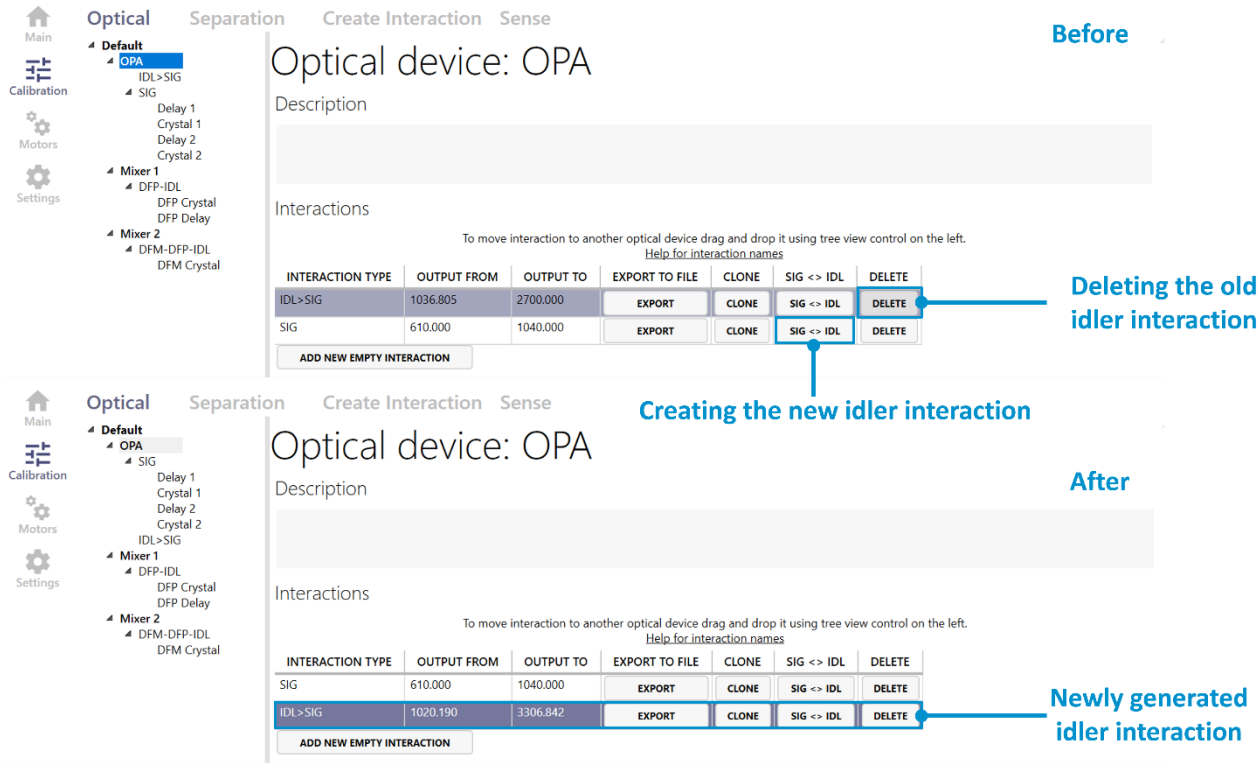

Figure 36. Regenerating the idler in WinTopas4

6. Named motor positions

Motors in WinTopas4 application are controlled in steps, units, or discrete positions. Named positions (see Figure 37) are useful to quickly move a motor to a defined point. They are also used to make sure the motor stays in the correct position at specific wavelengths or interactions.

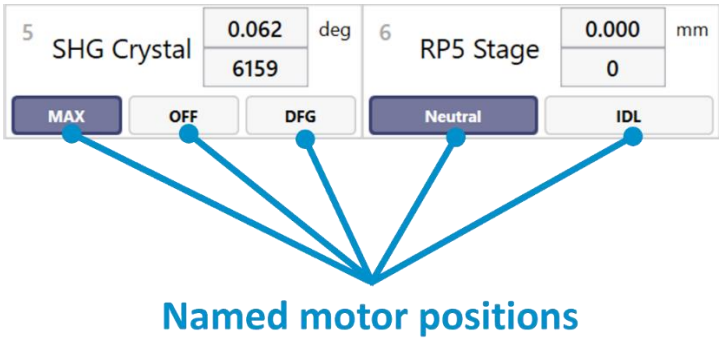

Figure 37. Named motor positions in WinTopas4

6.1 Modifying positions

To modify named positions advanced user password “1600” must be entered. A new view will appear with a list of motors and their positions. The existing positions can be easily modified by entering their name and value. The changes will take effect immediately after “Apply” button is clicked. Adding a new position works the same way and a new indicator will appear (see Figure 38).

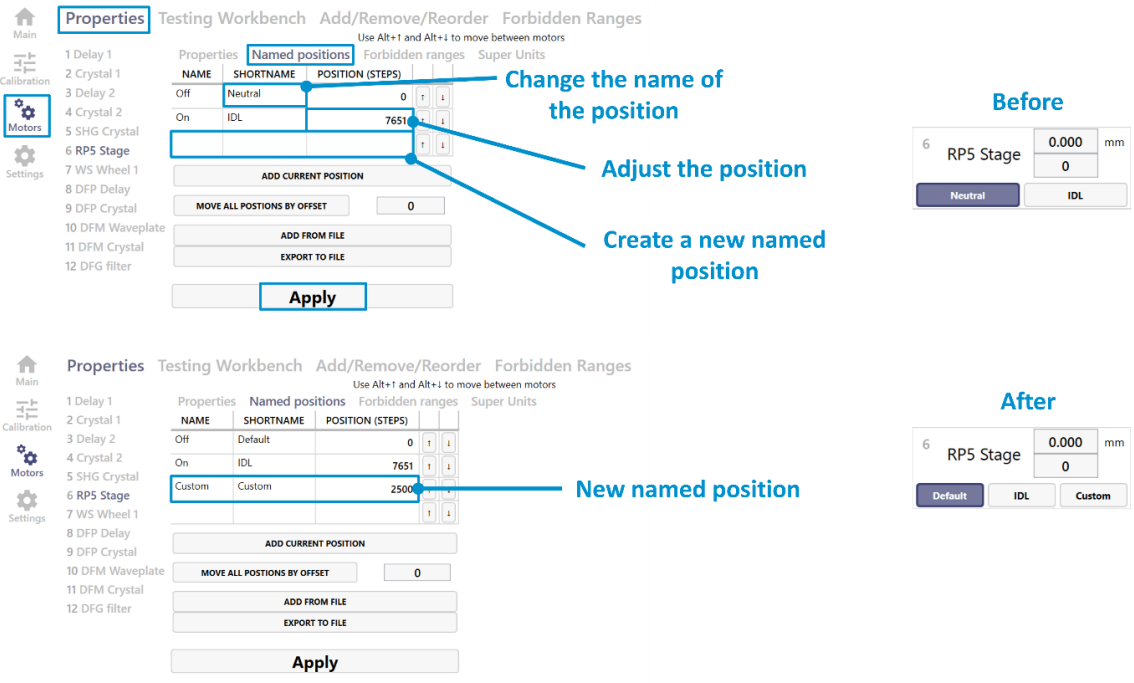

Figure 38. Modifying named motor positions in WinTopas4

You can also change the default position by right clicking the indicator as shown in Figure 39 and clicking “Save current position as this”.

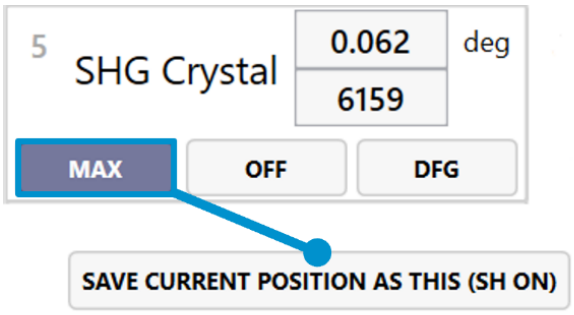

Figure 39. Changing the default position in WinTopas4

6.2 Assigning to calibration

Named positions are often used in the device calibration too. If the motor is not directly used in the tuning curves, it can be assigned a default position. These settings can be modified in “Default motor positions” table. Here we can edit, delete, or add new elements with specified motors and their named positions. “Interaction filter” function allows specifying interactions to be used with this position. The “asterisk” means that the position will be applied to all the interactions. In this example the signal will be using a custom position, while the default position is assigned to all the other interaction (see Figure 40).

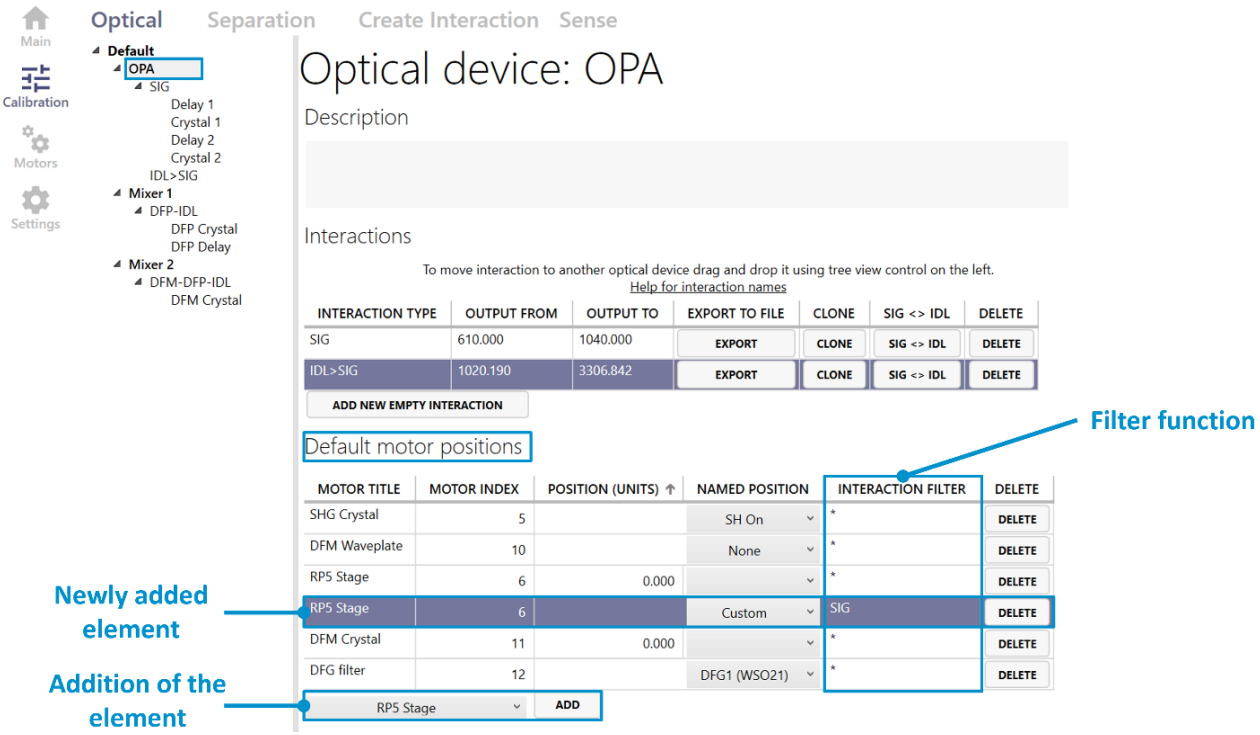

Figure 40. Assigning default positions in WinTopas4

6.3 Named positions in separation configuration

Named positions are also used in “Separation” configuration. Here they can be assigned not only to different interactions but also to wavelength regions (see Figure 41).

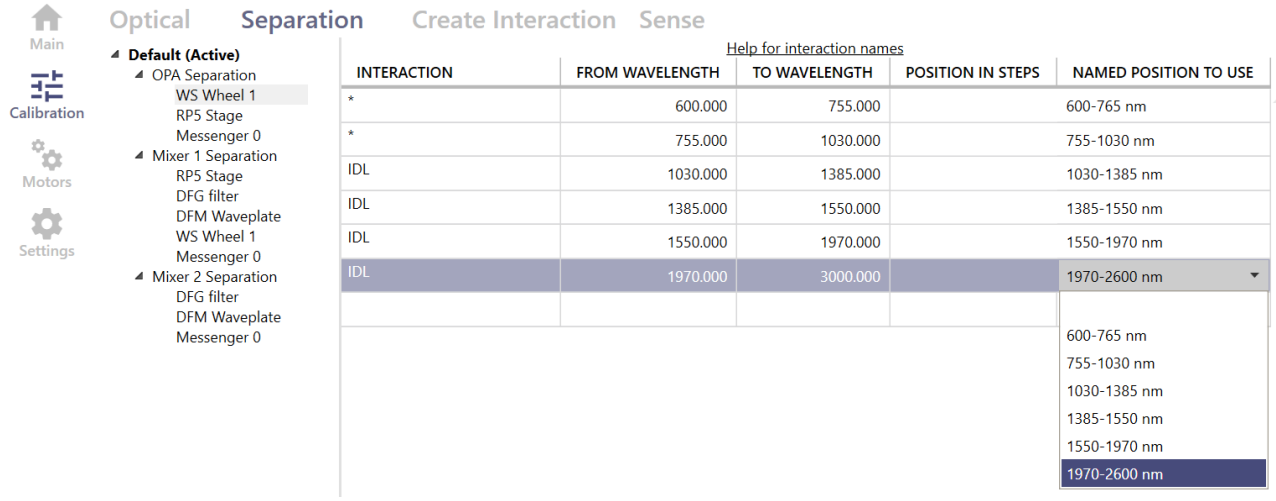

Figure 41. Assigning named positions to wavelength regions in WinTopas4

7. Device <-> zip, automatic configuration changes history

WinTopas4 application provides convenient ways to save and restore calibration data. This ensures that any modifications to the device calibration can be reverted if anything goes wrong. There are several ways to save and restore the calibration.

7.1 Automatic backup

The first is automatic backup (see Figure 42). WinTopas4 checks for any modifications every 15 minutes and saves them to the log file (see Figure 43).

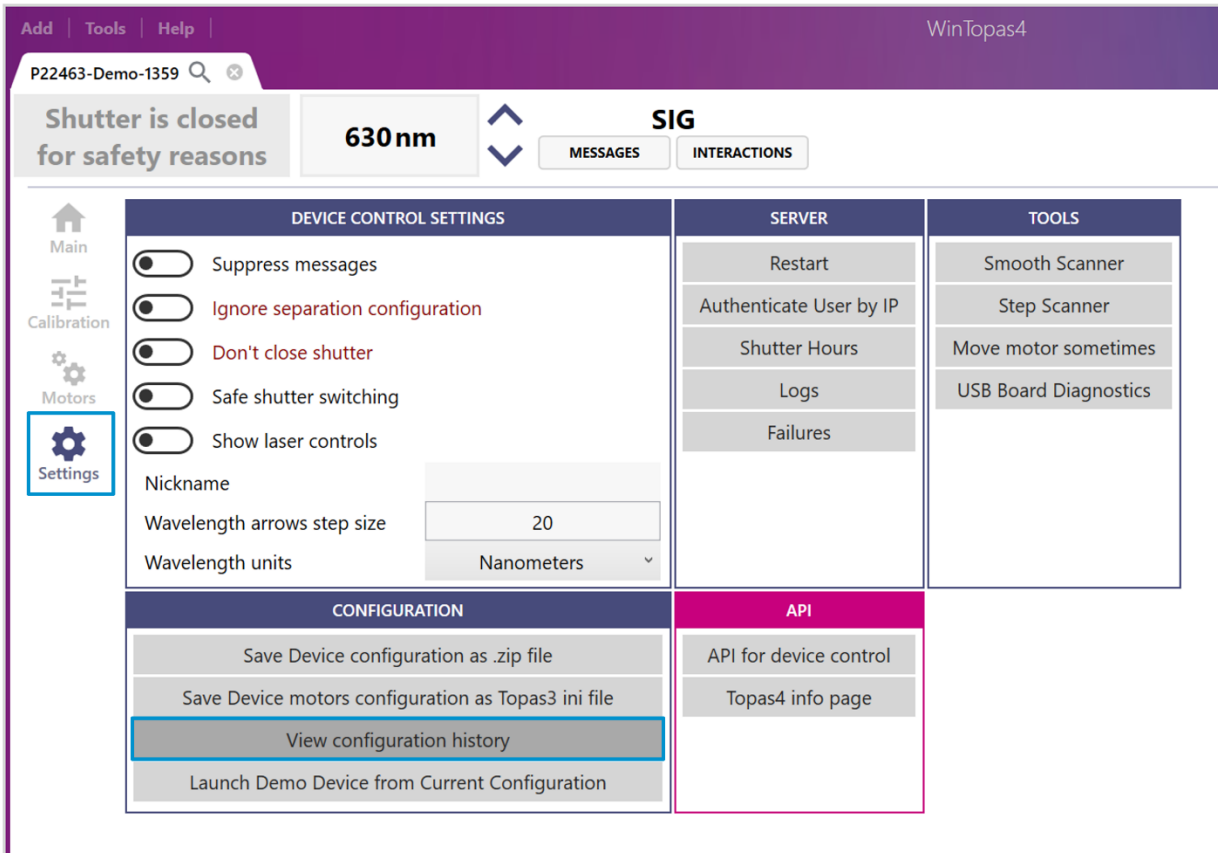

Figure 42. Automatic backup in WinTopas4

After any mistake such as deleting Signal interaction, you can restore it by opening the configuration history log and selecting the backup entry. Only the modified files will be available for selection. In this case, we need to restore the optical device file (see Figure 44). WinTopas4 server will restart, and the Signal interaction will be back.

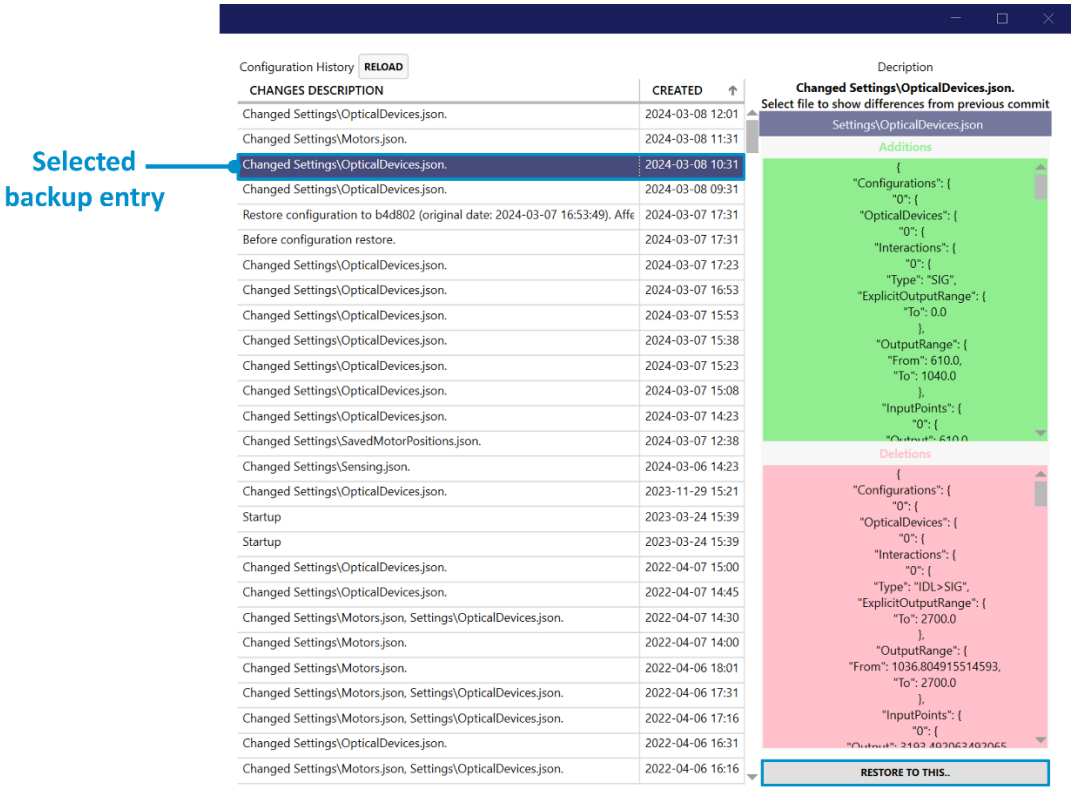

Figure 43. Configuration history log in WinTopas4

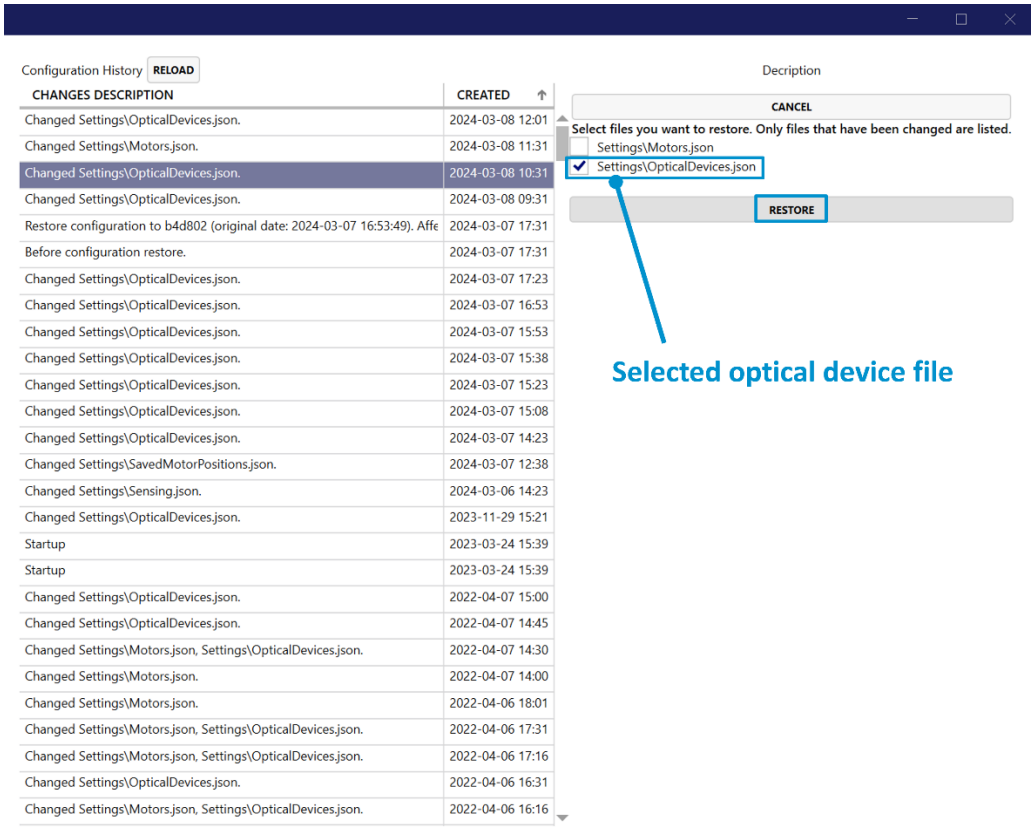

Figure 44. Restoring optical device file in WinTopas4

7.2 Zipped configuration

Another method to manage the device backup is by storing it in the zipped configuration file. This will save all the necessary data of the OPA into a single file which can be loaded later (see Figure 45).

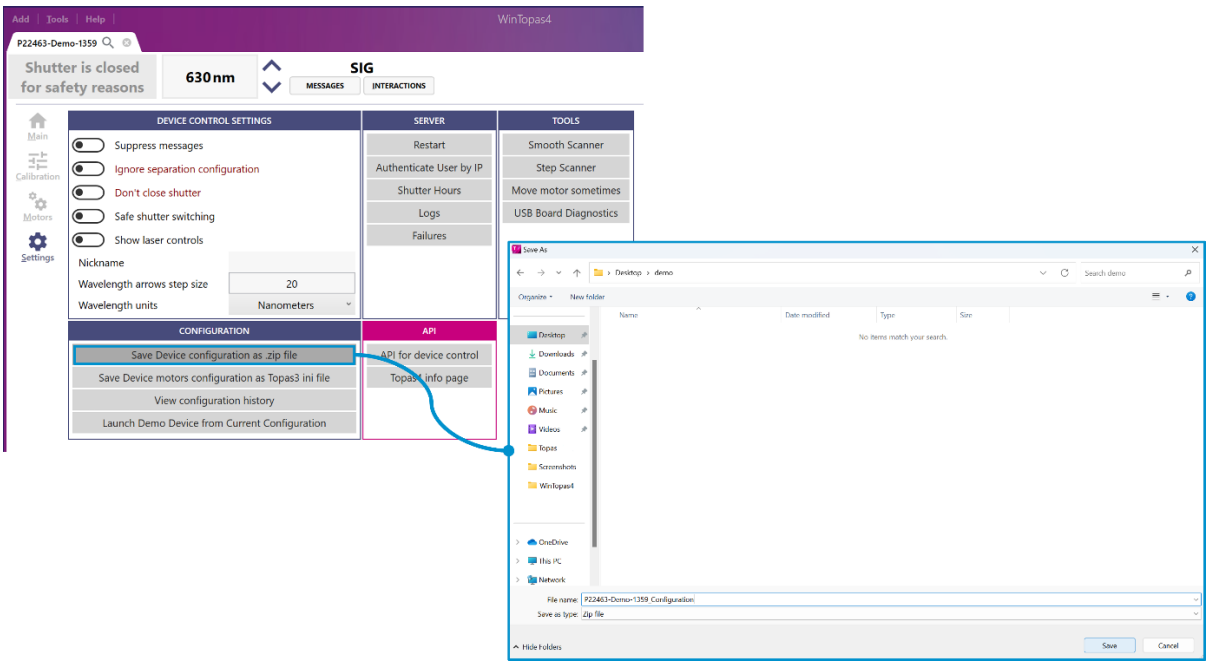

Figure 45. Creating zipped configuration file in WinTopas4

To restore, for example, mistakenly deleted Signal interaction, select the parent element in the configuration list then click the “import” button and select the saved configuration as shown in Figure 46.

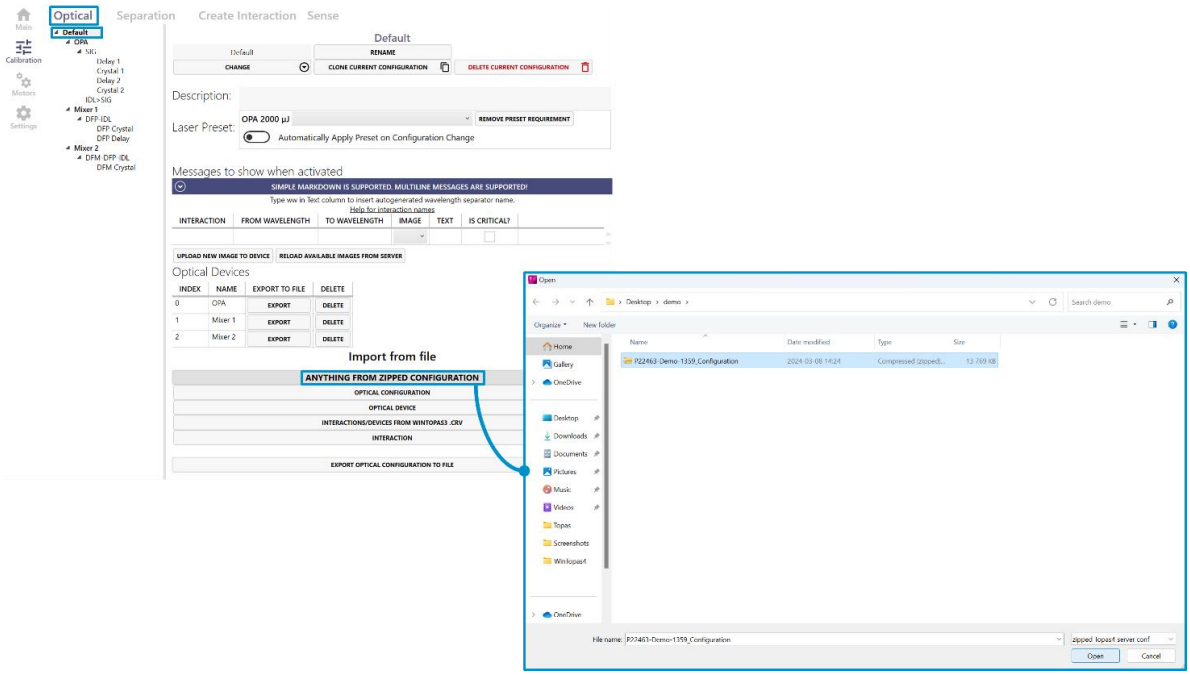

Figure 46. Importing zipped configuration file in WinTopas4

A new window will open, which allows importing any specific item from the saved configuration (see Figure 47). In our case, we want to restore the Signal interaction. After importing, the interaction will be restored.

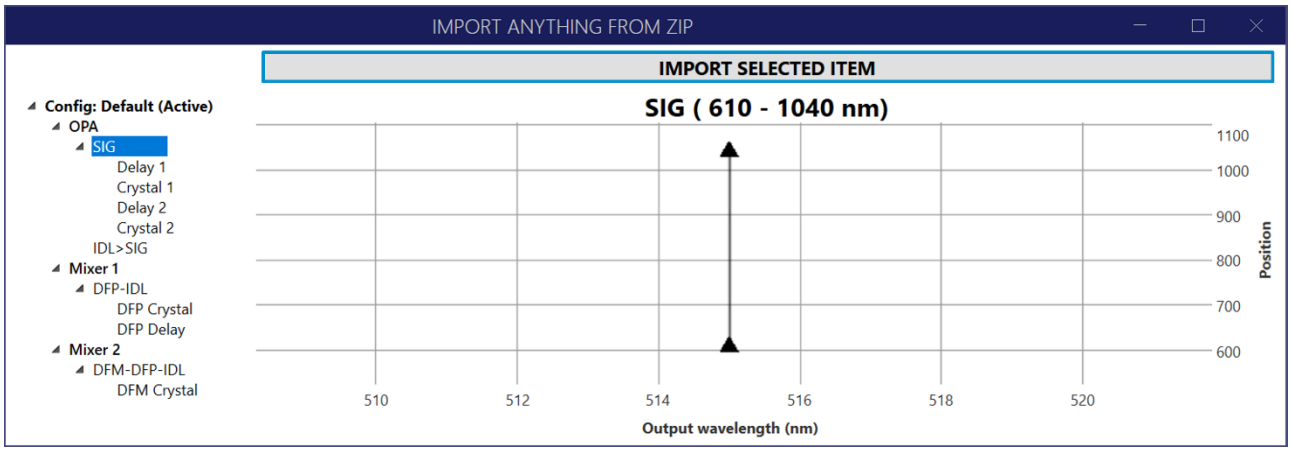

Figure 47. Zipped file importing window in WinTopas4

The saved configuration contains much more information inside and the same restore procedure can be applied to different WinTopas4 elements. For example, “Separation” configuration can be restored in a similar way.

8. Control multiple devices, manage devices

WinTopas4 provides several different ways to control your devices. Let's investigate each of them.

8.1 Controlling OPA

By default, there is only one tab available, and we can connect to any OPA server that is running on the same network. If multiple devices are present, we can add an additional control window as show in Figure 48. A new tab will appear providing full control of the device.

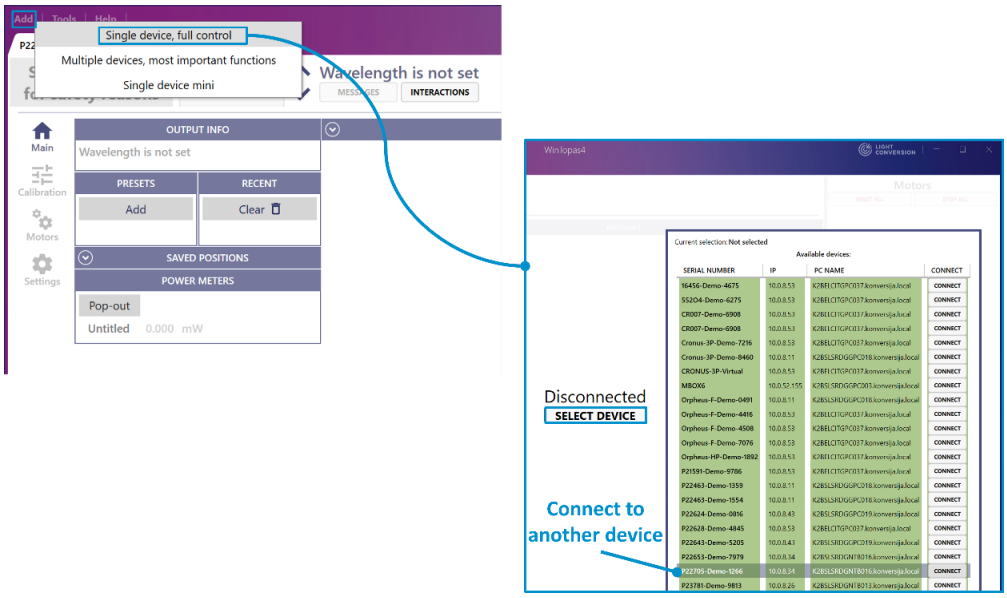

Figure 48. Adding another control window for different device in WinTopas4

Each device can be assigned with a nickname. This provides an easier way to identify and distinguish several devices.

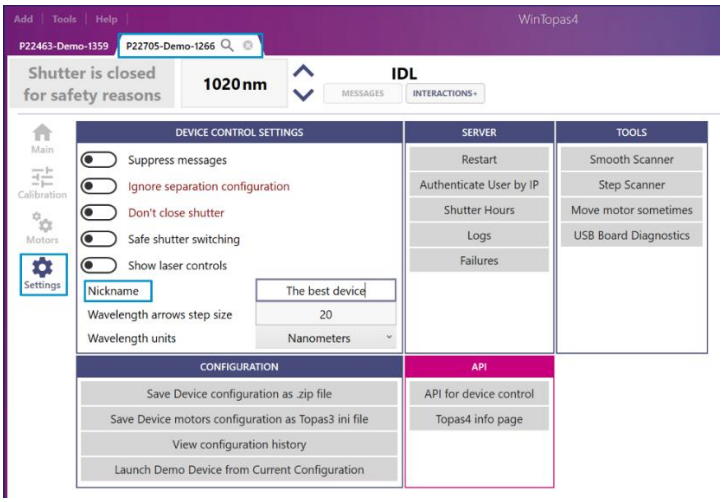

Figure 49. Naming the device in WinTopas4

Another way to control the devices is to add the “Multiple devices” window as shown in Figure 50.This will create a view with a simplified interface which still maintains the most important controls of both devices (see Figure 51).

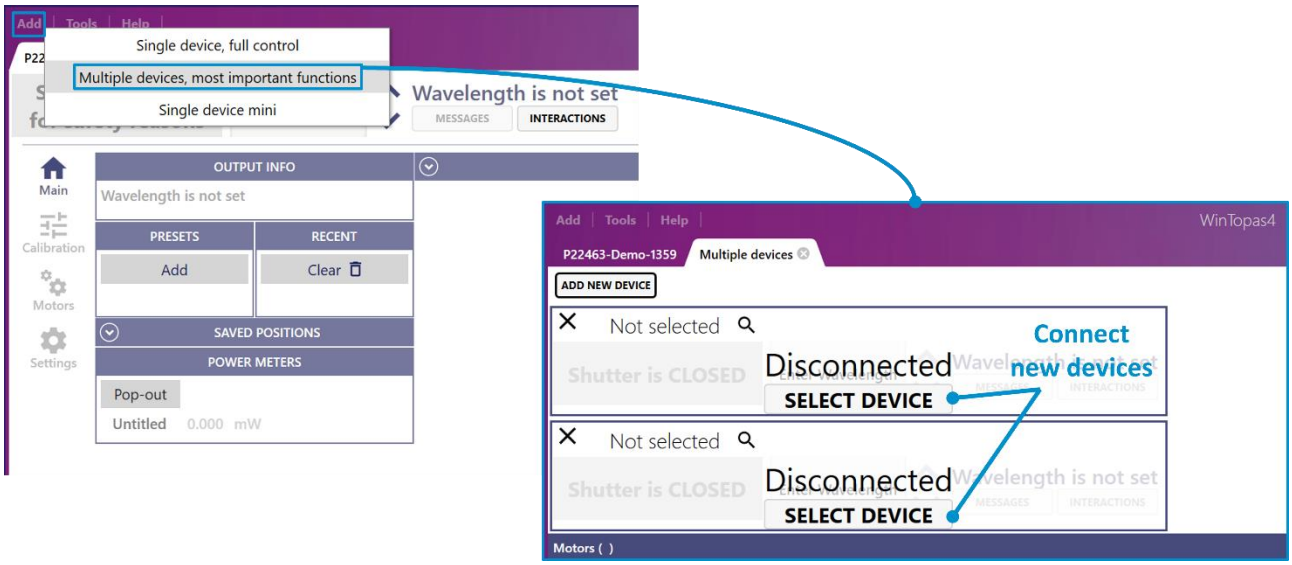

Figure 50. Adding multiple devices window in WinTopas4

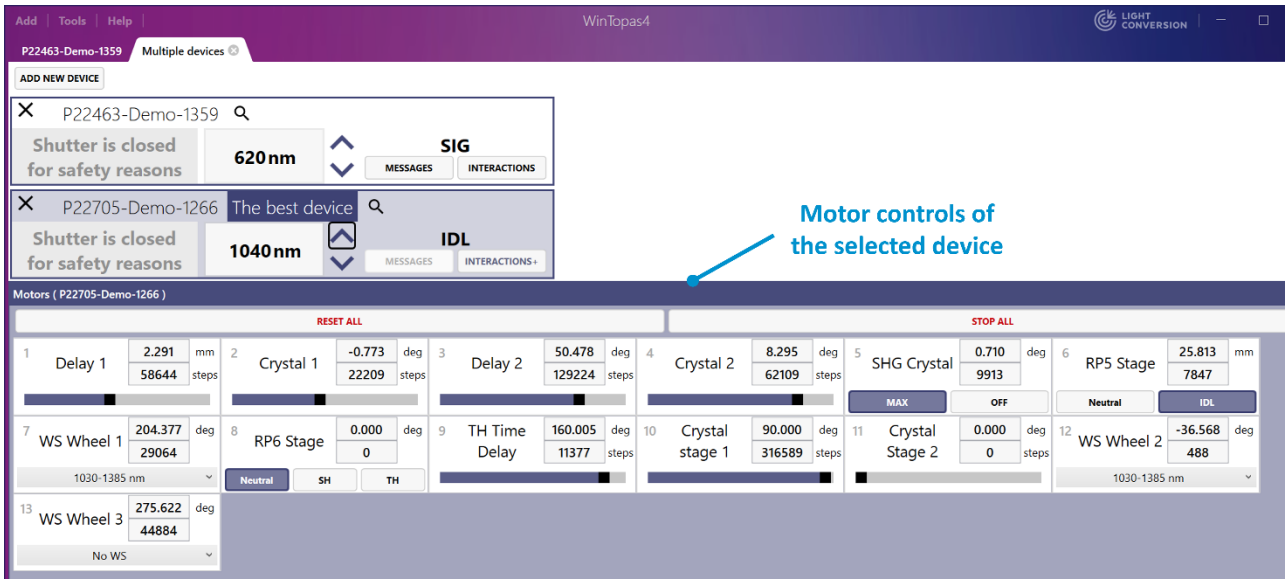

Figure 51. Multiple devices window interface with controls of the device in WinTopas4

The last and most minimal way to control the OPA is by using the “Mini” view. A new window will be created providing access to the most basic controls only (see Figure 52). This window can also stay in the foreground of other applications.

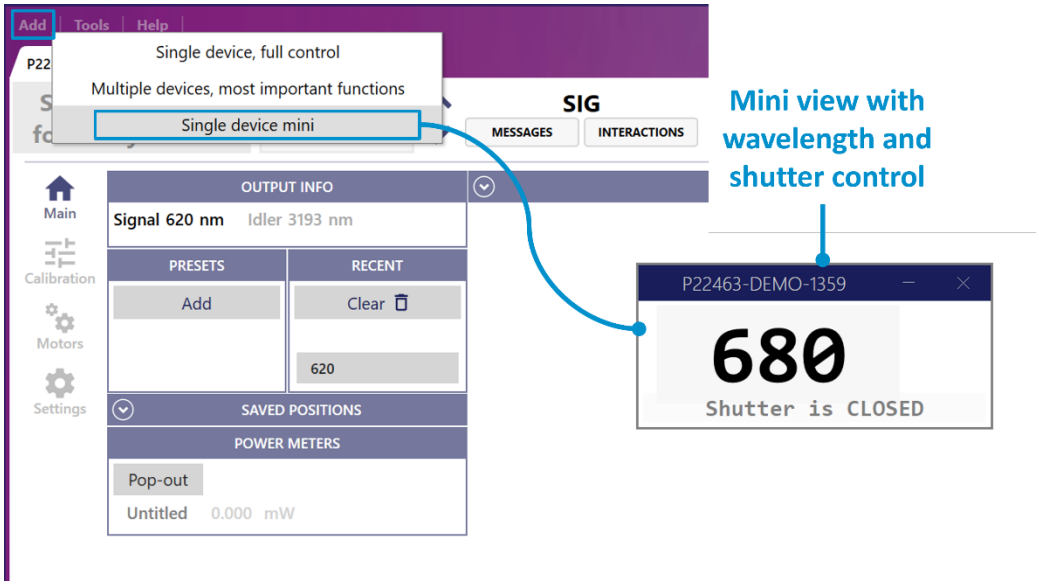

Figure 52. Mini view control interface in WinTopas4

8.2 Managing devices

Active server hosts can be managed in the tools section. Demo device host will simulate a real device behavior. This can be useful for testing or learning WinTopas4 features. Once added (see Figure 53) demo configuration will be created, and the server application will launch in the background. Add a new single device window to connect to a newly added demo device. Demo OPA can be controlled in the same way as the real device.

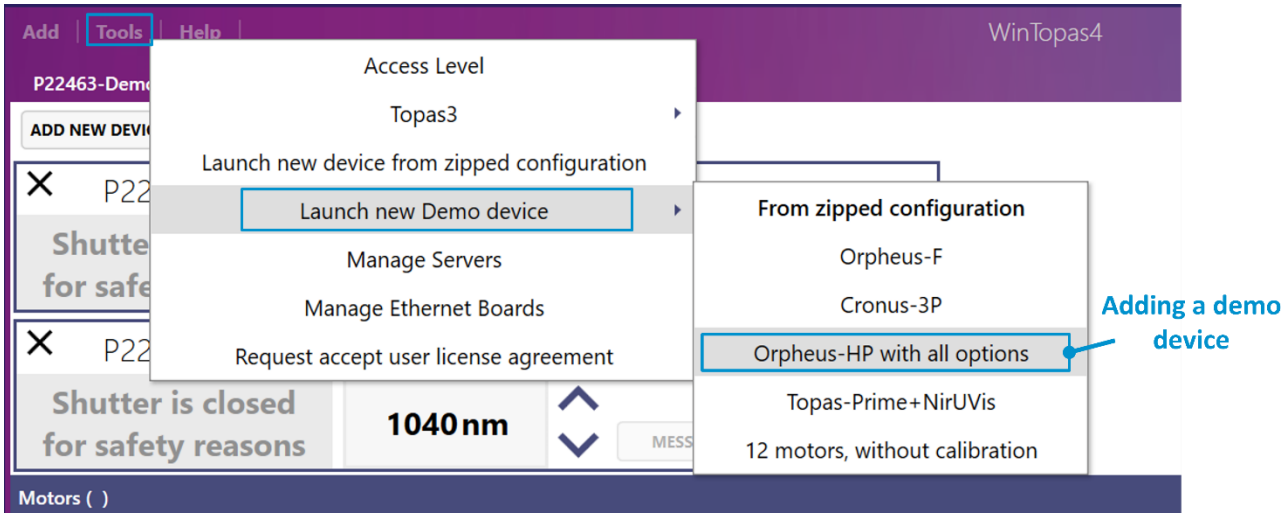

Figure 53. Adding a demo device in WinTopas4

To add a new physical device elevated access must be granted. Then a new host server can be launched from the zipped configuration (see Figure 54).

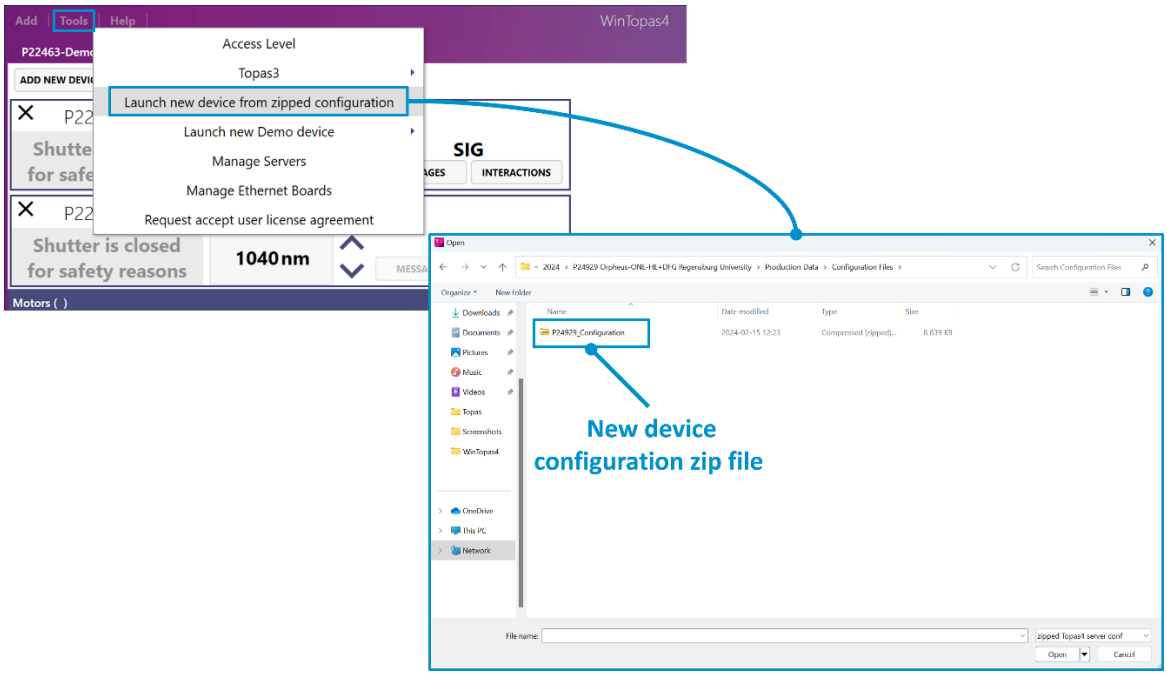

Figure 54. Launching a new physical device in WinTopas4

The hosts servers we have created will automatically launch with WinTopas4 application. They can be managed under “Manage Servers” section (see Figure 55). Each of them can be deactivated or deleted. Deactivation means that the server will not launch upon WinTopas4 start up, but the configuration files will be preserved. Deleting them will erase the files completely without the possibility to restore them.

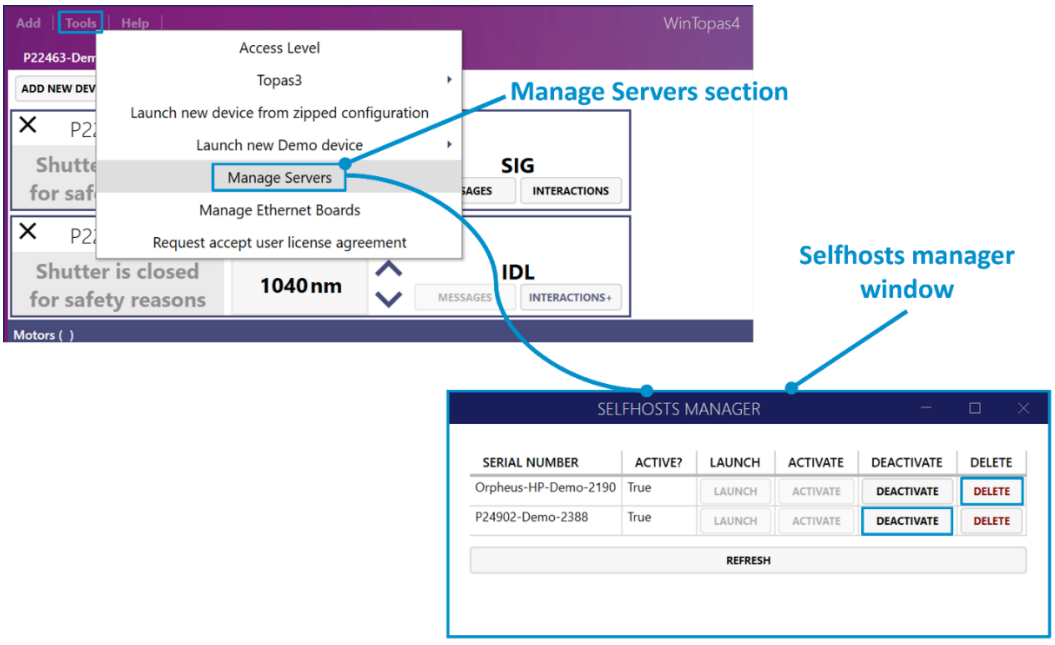

Figure 55. Managing host servers in WinTopas4

9. Laser control from WinTopas4

If a Light Conversion laser is used as a pump source of the OPA a simplified control of the pump laser can be integrated into WinTopas4. This feature allows controlling the whole laser system with a single application. Laser control can be enabled by clicking “Show laser controls” switch button in the Settings menu. If the laser has been previously set up a new row of controls and indicators will appear (see Figure 56).

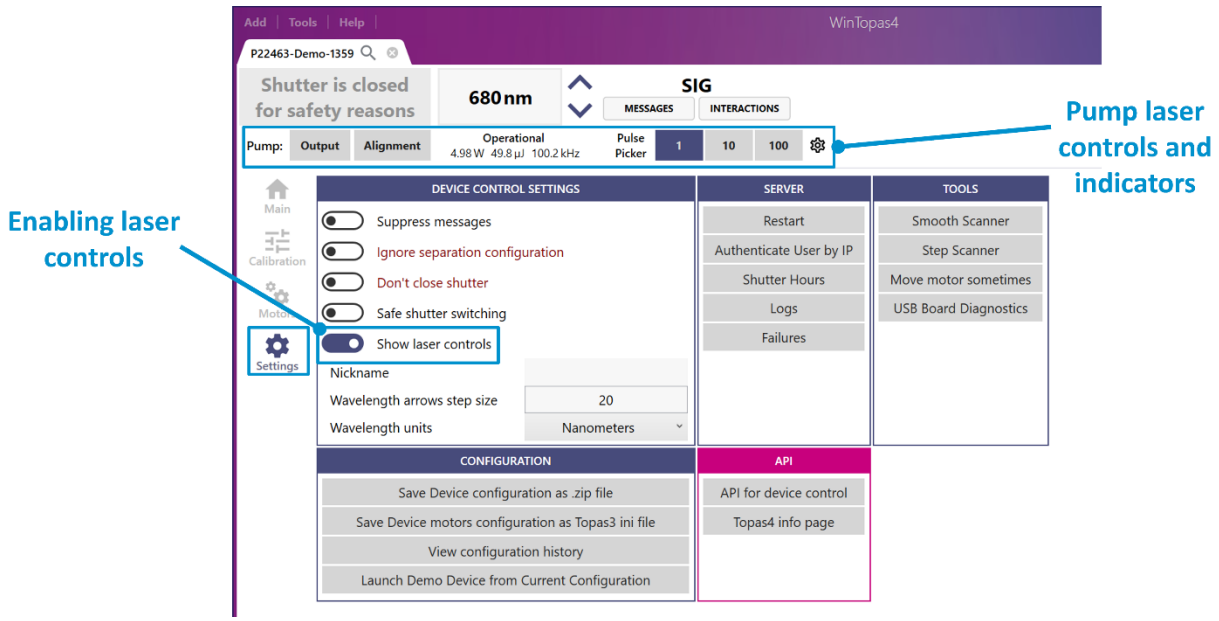

Figure 56. Enabling laser controls in WinTopas4

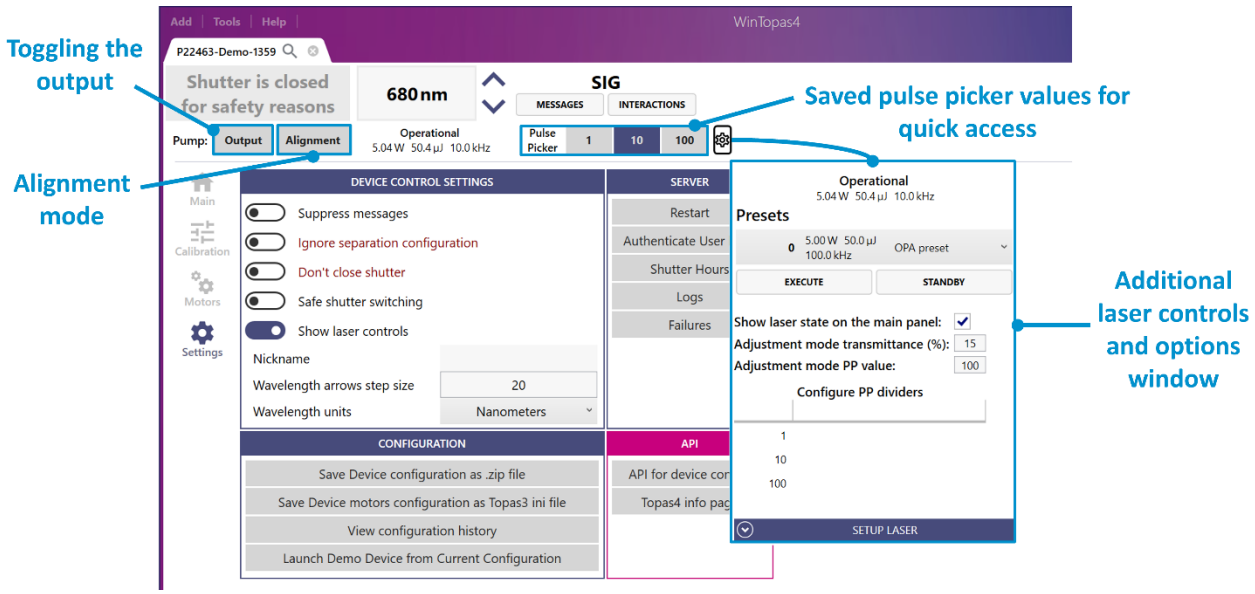

Figure 57. Controls, indicators and options of a pump laser in WinTopas4

As shown in Figure 57, here we can toggle the output state of the connected laser. Alignment mode allows temporarily reducing the energy and power of the laser during the alignment procedures. The laser will go back to the previous state once the alignment mode is disabled. Dedicated pulse picker buttons allow quickly changing the repetition rate. Additional controls and options can be found under the setting menu.

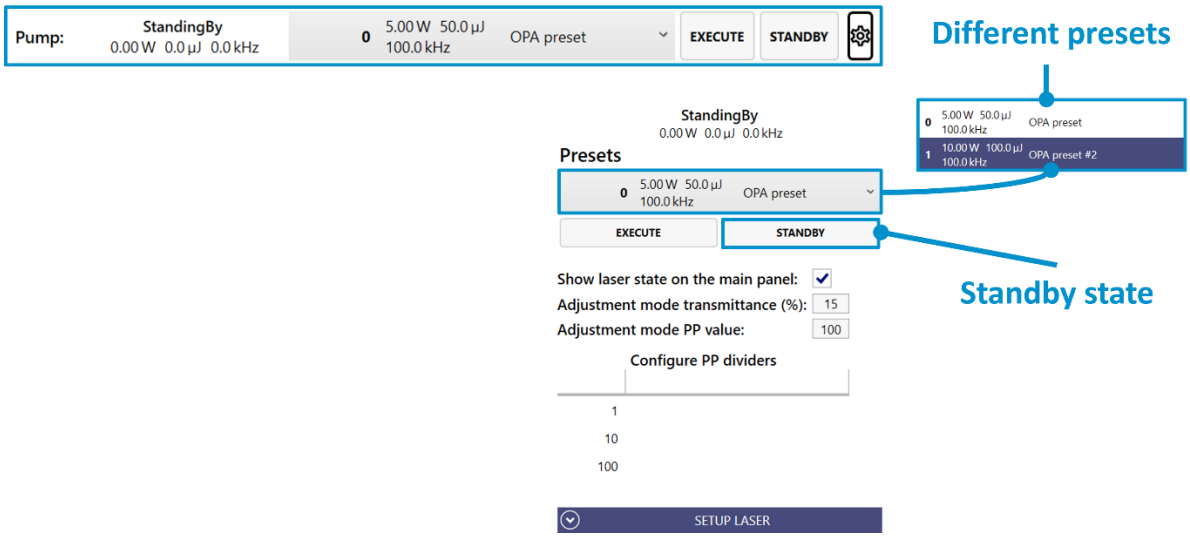

Figure 58. Standby state of the pump laser in WinTopas4

The laser can be put into standby state, or a different preset can be executed as shown in Figure 58.

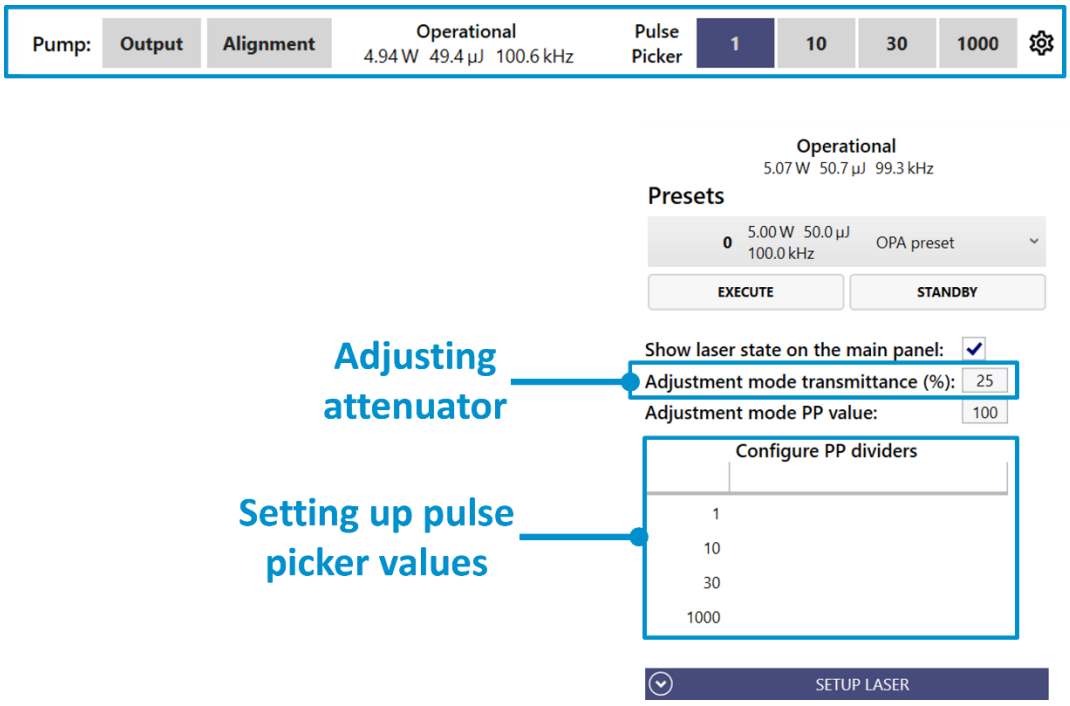

Figure 59. Adjusting attenuator and pulse picker values of the pump laser in WinTopas4

We can modify the attenuator and pulse picker values that are used in the alignment mode or customize the existing pulse picker controls and add new ones (see Figure 59). If the laser has not been set up yet, it can be set up in “Setup Laser” window as shown in Figure 60. Usually, it is enough to search for the default IP configurations to initialize your laser. However, if the laser’s IP address has been modified the laser can be found by entering a custom IP address.

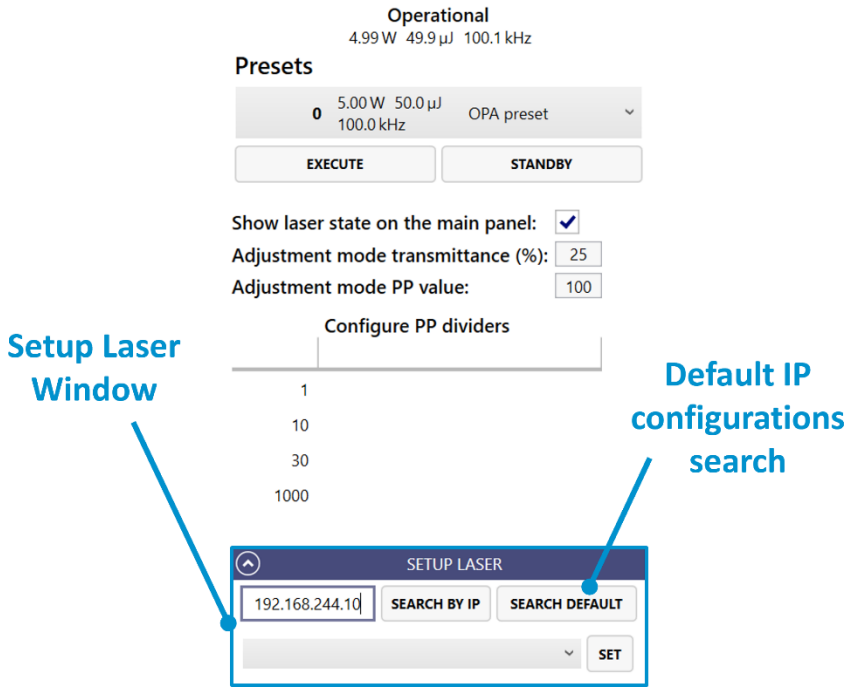

Figure 60. Pump laser setup in WinTopas4

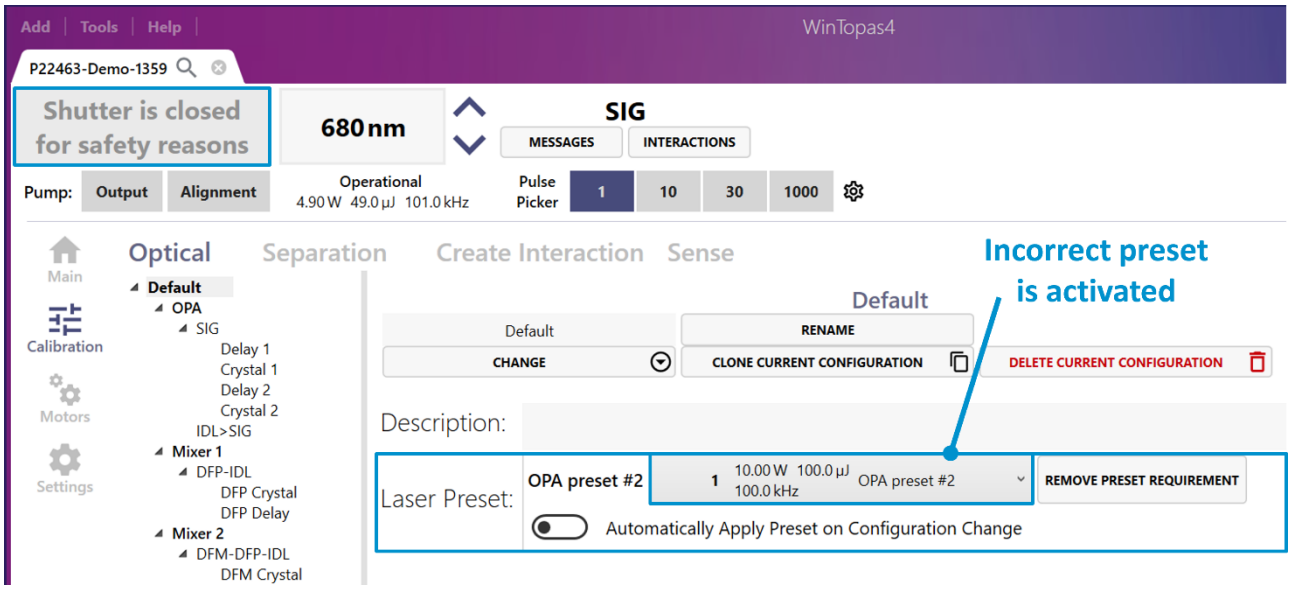

Figure 61. Closed shutter due to incorrect activated pump laser preset in WinTopas4

OPA calibration can also benefit from laser integration. A specific laser preset can be assigned to the optical calibration. Under this condition the shutter will only open if the preset is active. As shown in Figure 61, a wrong preset is active, so the shutter control is disabled for safety reasons. It becomes available once the correct preset is launched (see Figure 62).

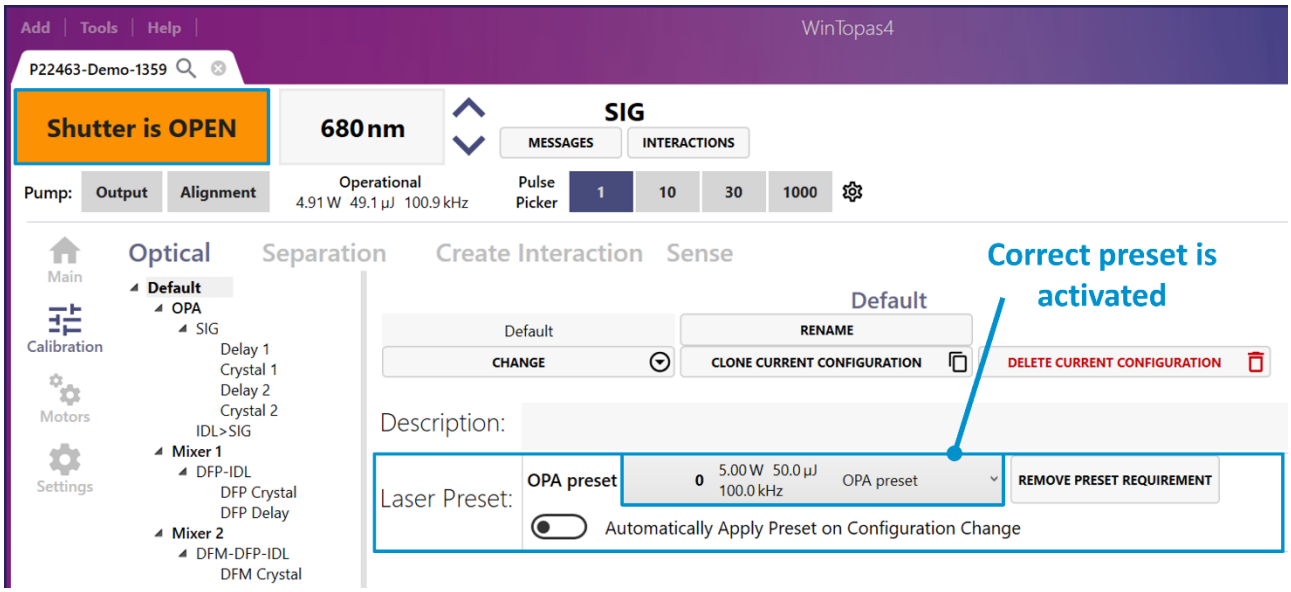

Figure 62. Opened shutter with correct pump laser preset being activated in WinTopas4

By enabling “Safe switching shutter” (see Figure 63) function laser output will be temporarily closed when the mechanical shutter of the OPA is in motion. This feature is usually set up at the factory and does not have to be changed.

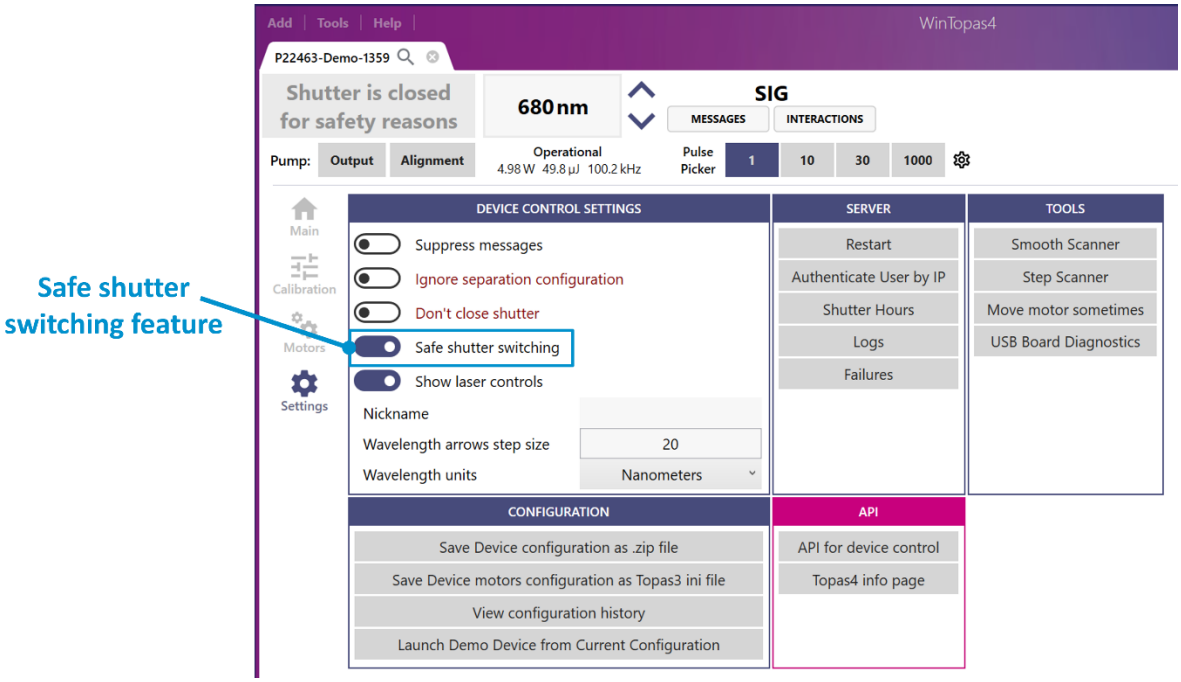

Figure 63. “Safe shutter switching” option in WinTopas4

In case you want to add PHAROS laser, which is connected to another PC than Topas4Server is running.

1. You should have PharosUserApp installed on the PC that is connected to the same local area network (LAN)
2. **Download** and run the script **on the PC where PharosUserApp is installed**. Windows will try to prevent you from running this script with a message 'Windows protected your PC'. Click 'More info' and then 'Run anyway'. Grant Administrator rights. If PharosUserApp is running you will be asked to close it, do so.
3. Follow the "Laser control" instructions above.

10. Add a new group to saved motors positions

In WinTopas4 application after adjustments you can save motor positions into groups in the Main window under the “Saved Positions” tab (see Figure 64). This feature needs elevated access, therefore a password “1600” is required to be entered. To create a group, simply enter desired group name and click “Save current position” after adjusting the motors the way you need it. After these steps, the motor position is assigned to the group and can be enabled by “Go” button.

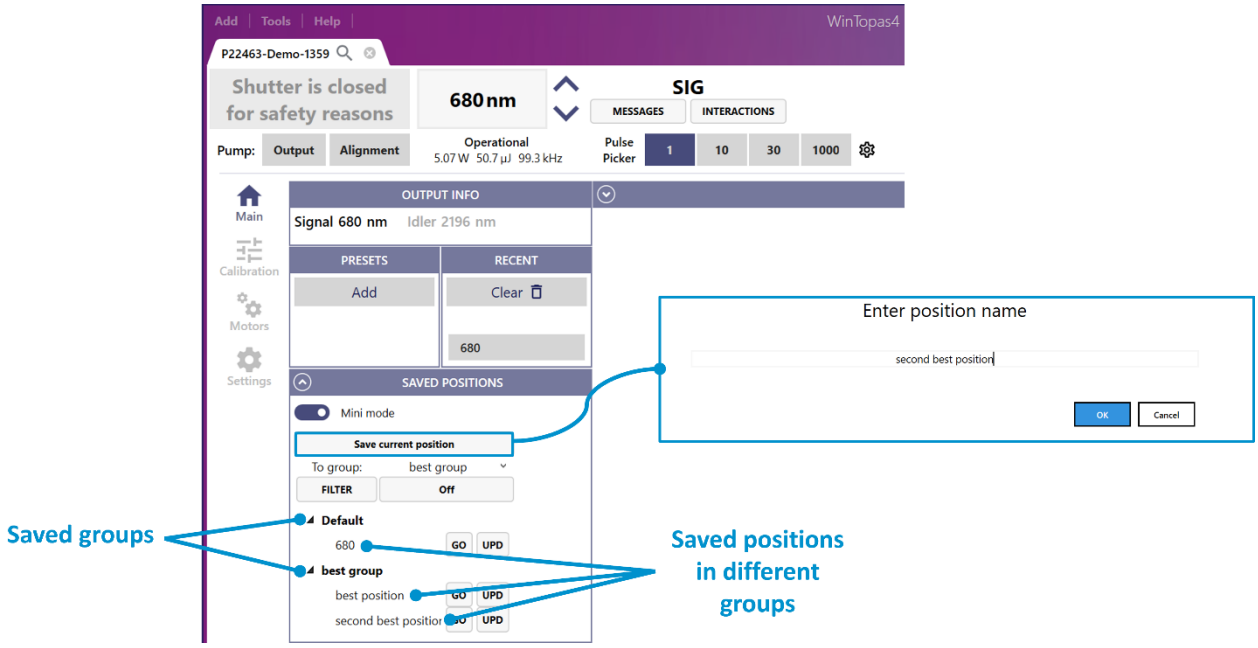

Figure 64. Grouping and saving motor positions in WinTopas4

11. Migrate from WinTopas3

11.1 Why upgrade to WinTopas4?

Access most often used functions quicker and easier!

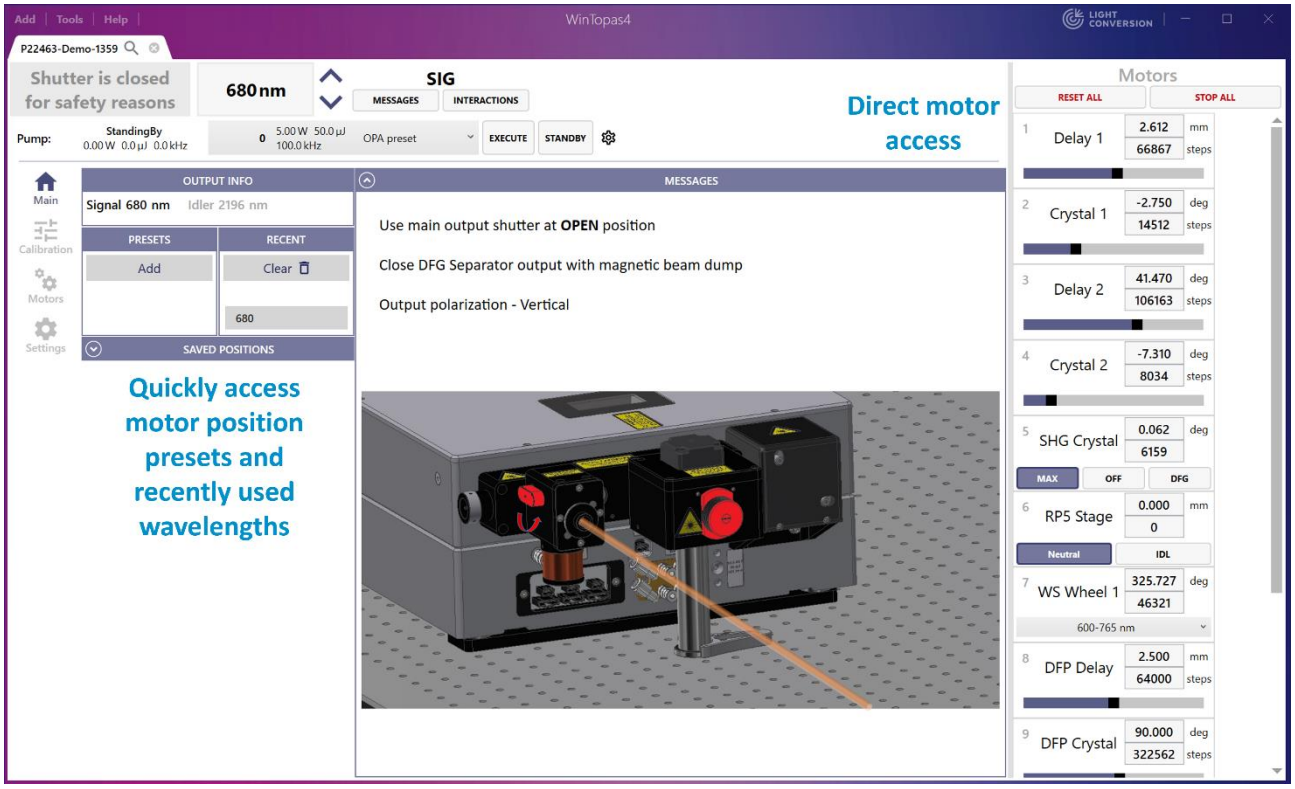

Figure 65. Improved accessibility of often used functions in WinTopas4

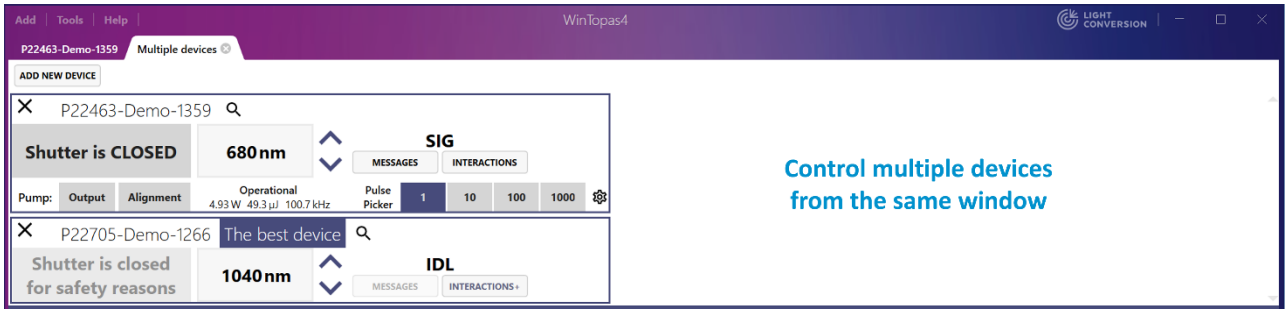

Figure 66. Multiple OPA feature in WinTopas4

Better support for interactions with overlapping wavelength ranges

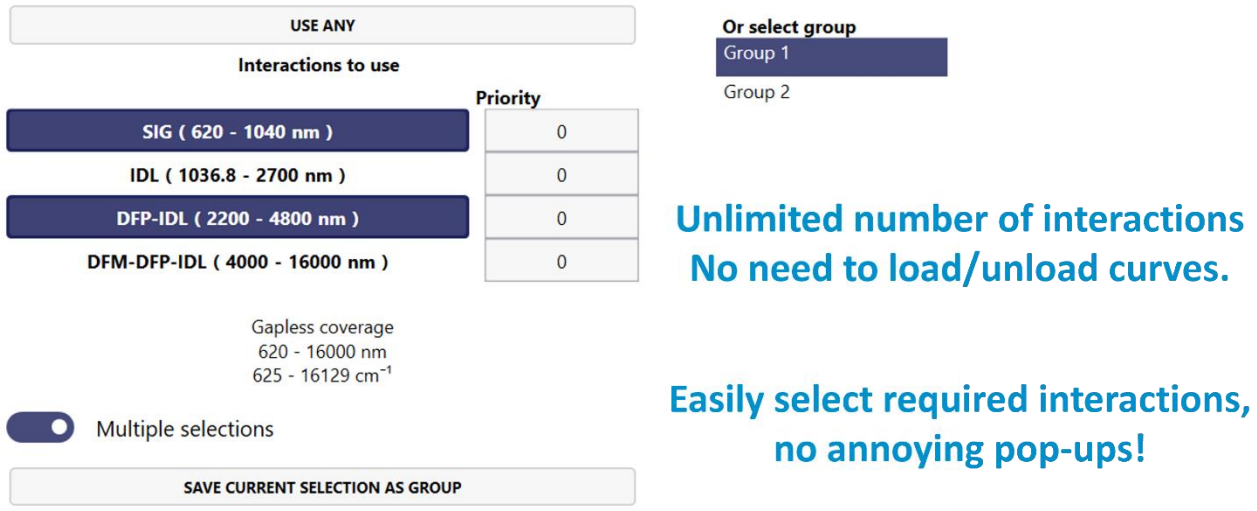

Figure 67. Improved functionality of interactions in WinTopas4

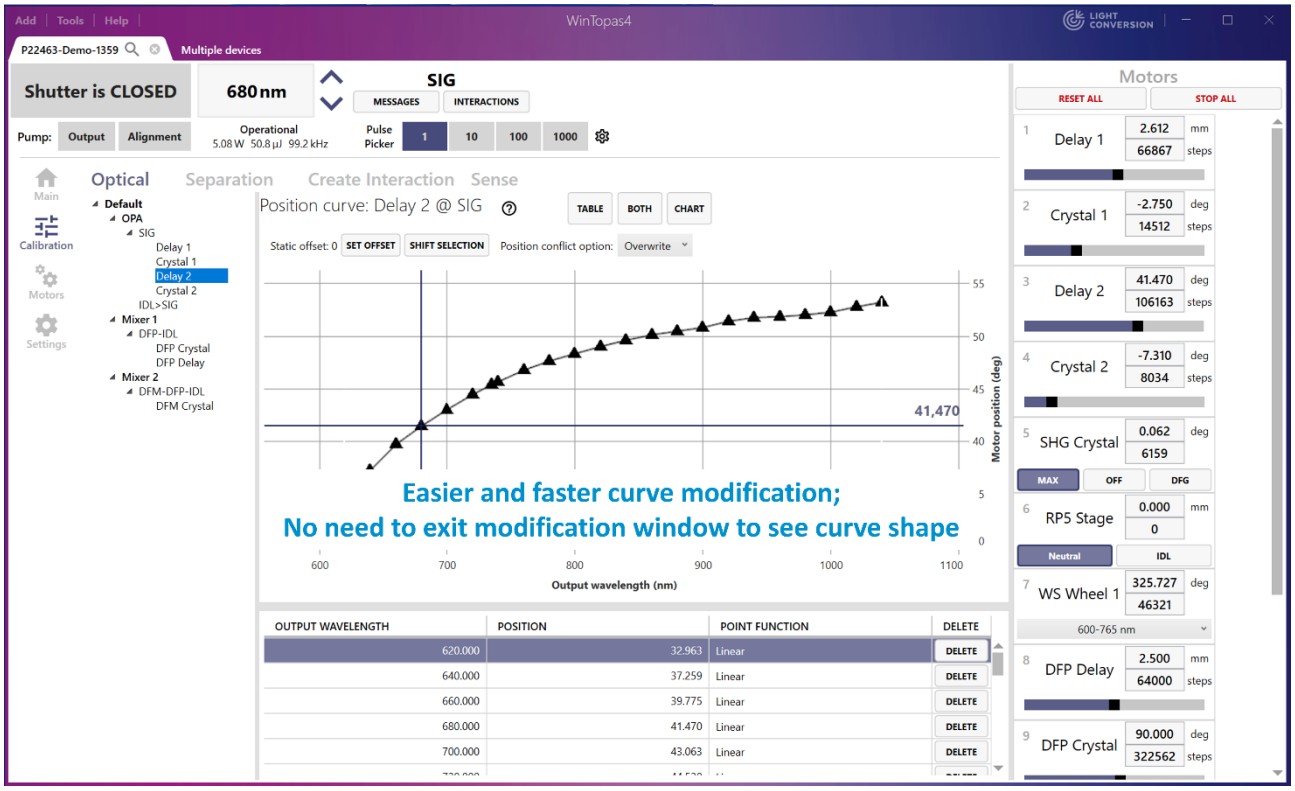

Figure 68. Improved functionality of curve tuning in WinTopas4

Smooth wavelength scanner: scan selected wavelength ranges to quasi-broadband spectrum.

And many other reasons:

1. WinTopas4 looks great on high resolution, high dpi screens
2. Non-intrusive automatic software updates
3. Forbidden motor position ranges increase user safety and lower risk of accidental device damage (need to be configured after migration)
4. Smart integrated device configuration backups every 15 minutes
5. Extensive calibration sanity checks help to avoid common mistakes when creating/modifying interactions
6. All upcoming features will be available only in WinTopas4

11.2 Instructions

System requirements

1. Windows 7 or newer
2. Administrator rights (for installation and first launch only)
3. Topas control board with USB connection (LPT board is not supported)
4. Topas/Orpheus device manufactured or serviced in 2011 or later (**contact Light Conversion for earlier devices**, as there might be conversion problems)
5. It is recommended to use Topas4 software on the PC with internet connection for best user experience

Time required ~ 2 minutes

Case A. Installation on the same PC as WinTopas3 is currently running

Installation is non-intrusive, meaning that WinTopas3 will be able to function as earlier when WinTopas4 application is closed.

1. **Install WinTopas4 using default settings**
2. Close WinTopas3 application if running
3. Launch WinTopas4 using icon on desktop
4. Click 'Tools>Access Level' and enter the password for advanced user or engineer
5. Click 'Tools>Topas3>Convert Topas3 configuration'
6. Select path to the WinTopas3 configuration .ini file from the combo box, click 'Convert', click 'Launch server'.
7. Click yes when Windows UAC prompts for administrator rights. Allow all applications through firewall.
8. If you have multiple devices connected to the same PC, repeat steps 6-7 for each ini file.
9. Enjoy! All motor settings and calibration curves have been imported!

Case B. Installation on another PC

1. **Install WinTopas4 using default settings**
2. Get .ini and .crv files for the device that you want to use from the PC where WinTopas3 is currently running.
3. Connect Topas USB cable to the new PC.
4. Follow the steps 3-9 as in Case A. You'll have to browse to the .ini files yourself in step 5 instead of selecting them from combo box.

11.3 Q&A

1. **I have multiple .crv files for the same stage (e.g. Mixer2). I see that interactions have been imported only from one of them!**

You can easily import additional curves from .crv files after conversion. To begin, you will have to enter the advanced user password “1600” to access device calibration feature. Here, under the Optical tab select and import .crv file of the desired stage as shown in Figure 69.

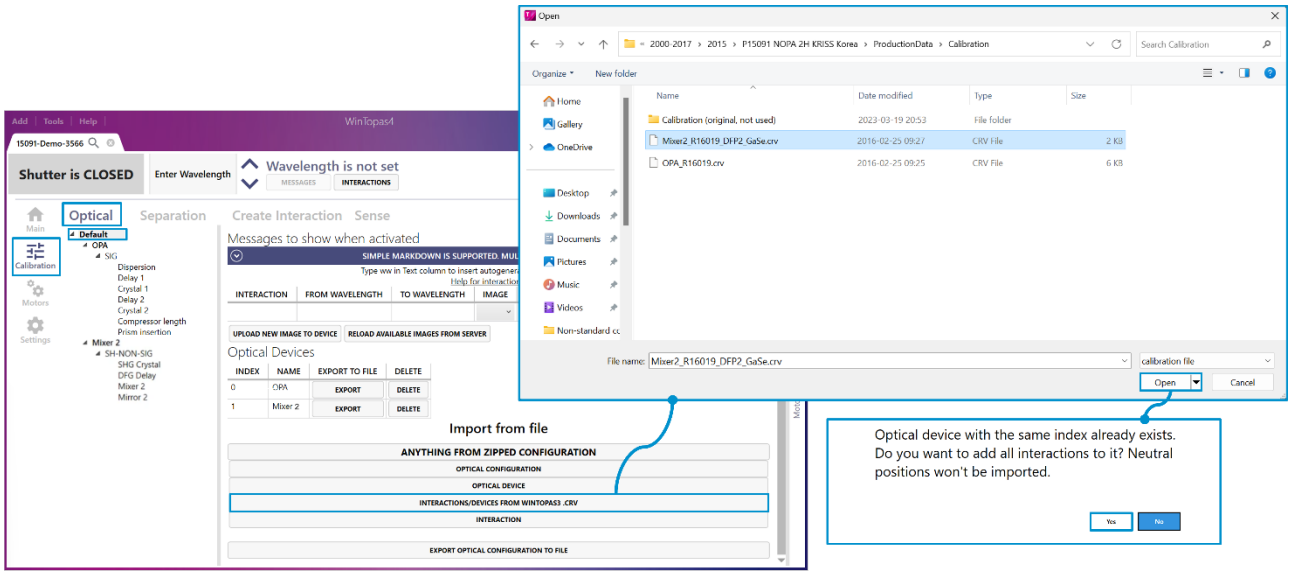

Figure 69. Importing .crv files in WinTopas4

When the .crv file is imported, the missing interaction should appear below the Mixer2 stage as show in Figure 70.

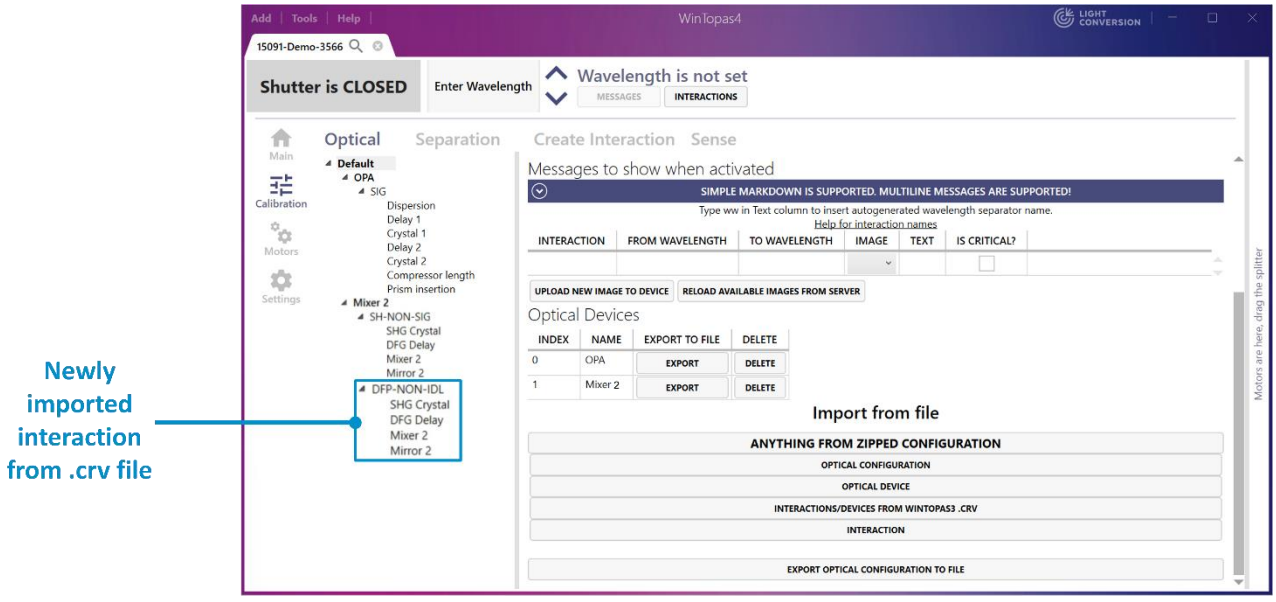

Figure 70. Successfully uploaded .crv file with the missing interaction

2. **Can I quickly return to WinTopas3 if something goes wrong?**

Close Topas4 applications (especially servers, the green ones) and start WinTopas3. Reset all motors in WinTopas3. Any changes you made in WinTopas4 won't propagate to WinTopas3 (and vice versa).

3. **It looks like some interactions have lost calibration curves for some motors (e.g. SIG used to have 5 motor curves, and now only has 3). Is this is a bug?**

If you inspect interaction under 'Calibration>Optical' you might think that not all motor curves have been imported. Instead, they have been imported and converted to separation configuration ('Calibration>Separation'). You do not need to take any further steps, motors will move to correct positions when setting wavelength.

4. **I see orange\red exclamation marks near 'Calibration' tab. What do they mean?**

WinTopas4 performs sanity checks on calibration. Orange exclamation marks are used to denote possible mistakes and give suggestions. Red exclamation marks are used to denote 100% configuration mistakes. Hover over exclamation mark or click on it to read detailed descriptions what's wrong and learn how to fix the issues.

5. **After conversion some of the motors have named positions like 'P 1678'. What does that mean? Can I change their names?**

WinTopas3 to WinTopas4 converter tries to extract discrete motor positions from staircase-like calibration curves and give them meaningful names. This is not always possible, so some motors end up with the named positions like 'P 1678', which is simply motor position in steps when this position is set. See Chapter Named motor positions to learn how to give more meaningful names. Separation configuration will be updated automatically.

6. **Are interaction comments from WinTopas3 gone?**

Yes.

7. **So where is WinTopas4 installer?**

See the first step of the instructions above.