

# SEC2020 SPECTROMETER SYSTEM USER'S GUIDE - SOFTWARE -



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# 1. About SEC Spectra

SEC Spectra is a software program for the portable spectrometers system "SEC2020 Spectrometer system". It offers a wide variety of optical measurements including spectrum, absorbance, transmittance, reflectance, Relative Irradiance, and concentration.



## 2. Minimum System Requirements

Before installing SEC Spectra, ensure that your computer meets the following minimum requirements:

Minimum System Requirements	
Processor	1 GHz or higher
RAM	4 GB or higher
Hard Disk	100 MB or higher
Screen Resolution	1024 x 768 or higher
Operating System	Windows 10, Windows 11
Software	Microsoft .NET Framework 3.5*

**IMPORTANT:** Versions other than Microsoft .NET Framework 3.5 will not work.

## 3. Installing SEC Spectra

### 3-1. Before Installation

Before installing SEC Spectra, ensure that you have the administrator privilege to the computer.

**Note:** If your PC does not have the Windows feature "Microsoft .NET Framework 3.5" installed, please install it before installing SEC Spectra. The detailed procedure is described in "3-5. Installing .NET Framework 3.5".

The spectrometer should not be connected to the PC during installation and uninstallation of SEC Spectra.

### 3-2. Installing SEC Spectra

Insert the USB memory supplied with the device into your PC. There are two folders in the USB memory, "Manual" and "SEC Spectra \_ \*\* (software installer)". Open the "SEC Spectra\_\*\*" folder and double-click "setup.exe" to start the program installation.

The setup wizard starts up. On the **Welcome** screen(Figure 3-1), click **Next** to proceed the installation.

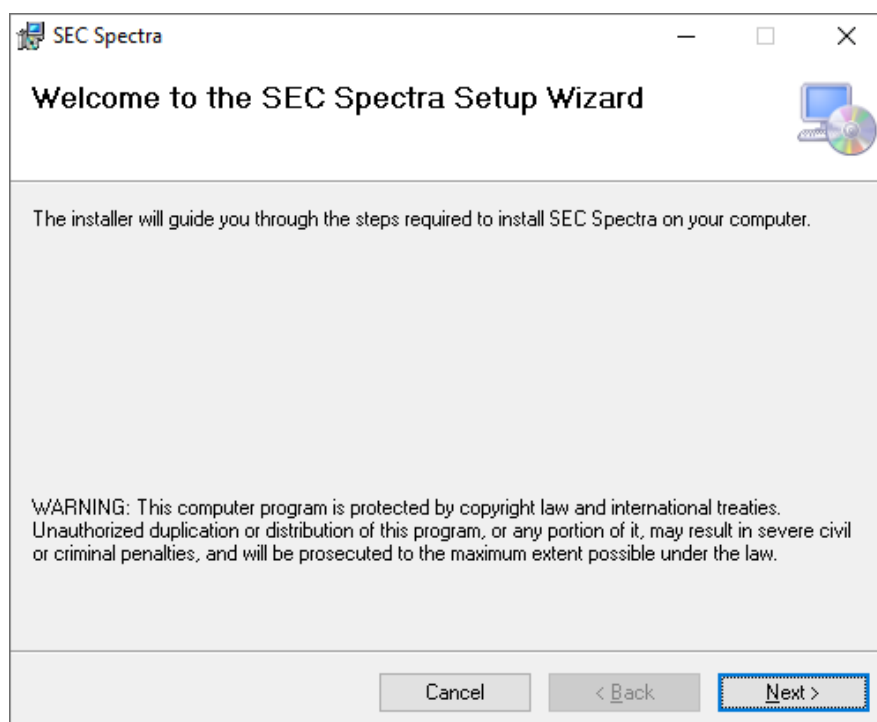


Figure 3-1. Setup Wizard -- **Welcome**

On the **Select Installation Folder** screen, select **Everyone** or **Just me** and click **Next**.

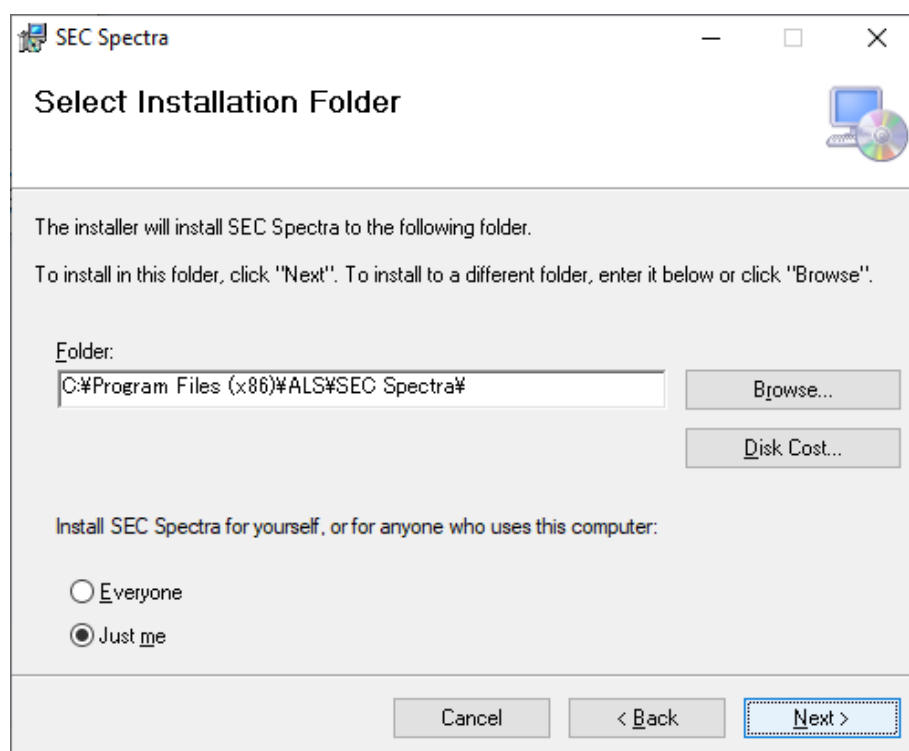


Figure 3-2. Setup Wizard -- **Select Installation Folder**

On the **Confirm Installation** screen, click **Next**.

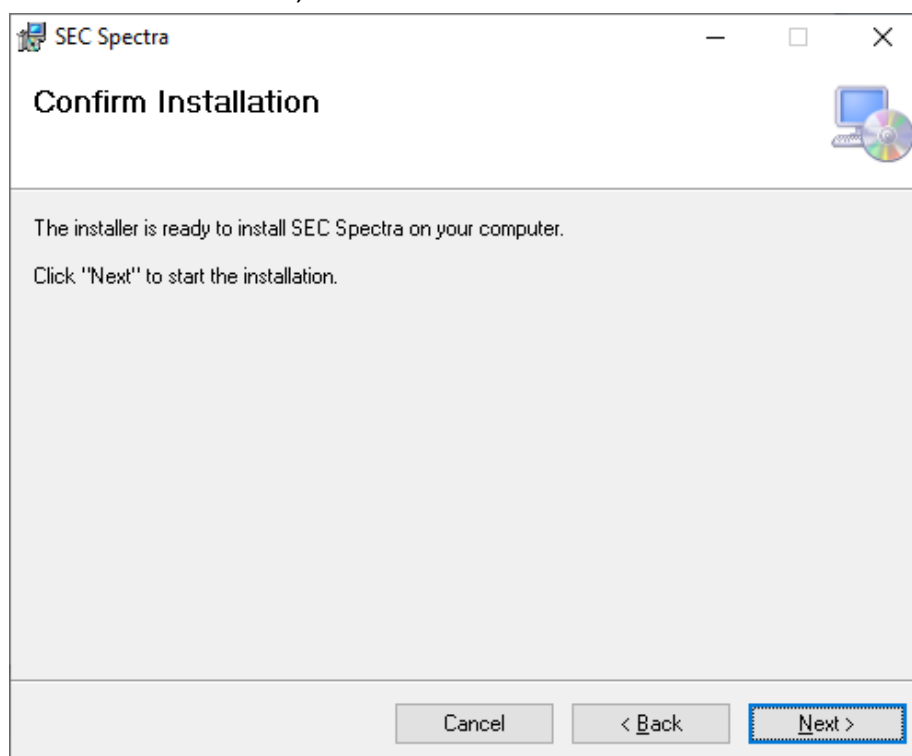


Figure 3-3. Setup Wizard -- **Installation Complete**

If a Windows security alert is displayed, select **Run** to proceed. Program will execute the installation, please wait for a while.

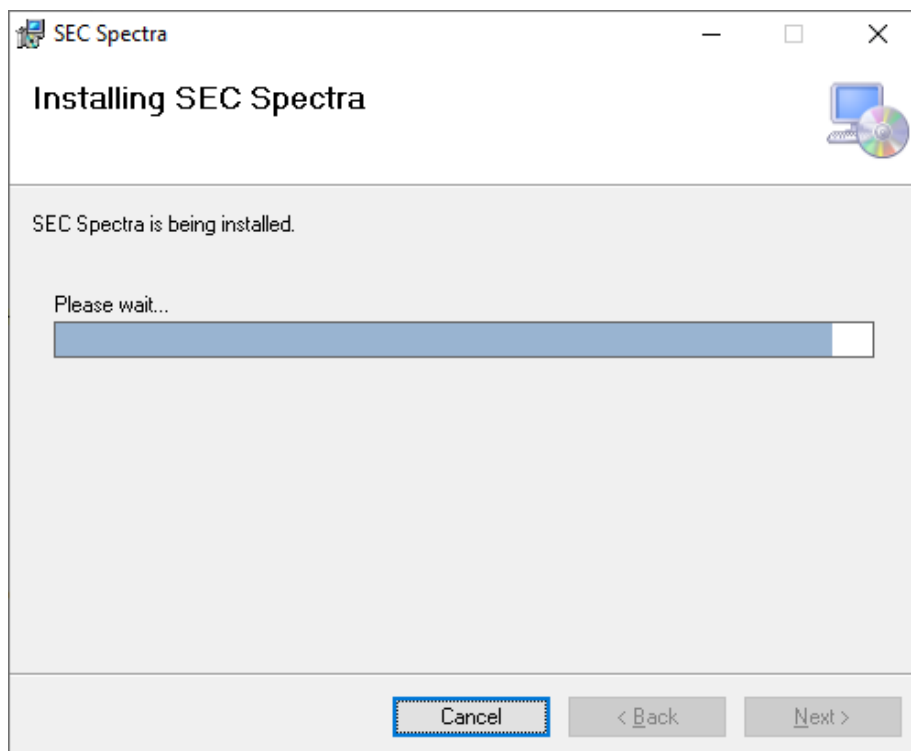


Figure 3-4. Setup Wizard -- **Installation Complete**

When you see the **Installation Complete** window(Figure 3-5), it means that SEC Spectra has been successfully installed. Click **Close** to finish.

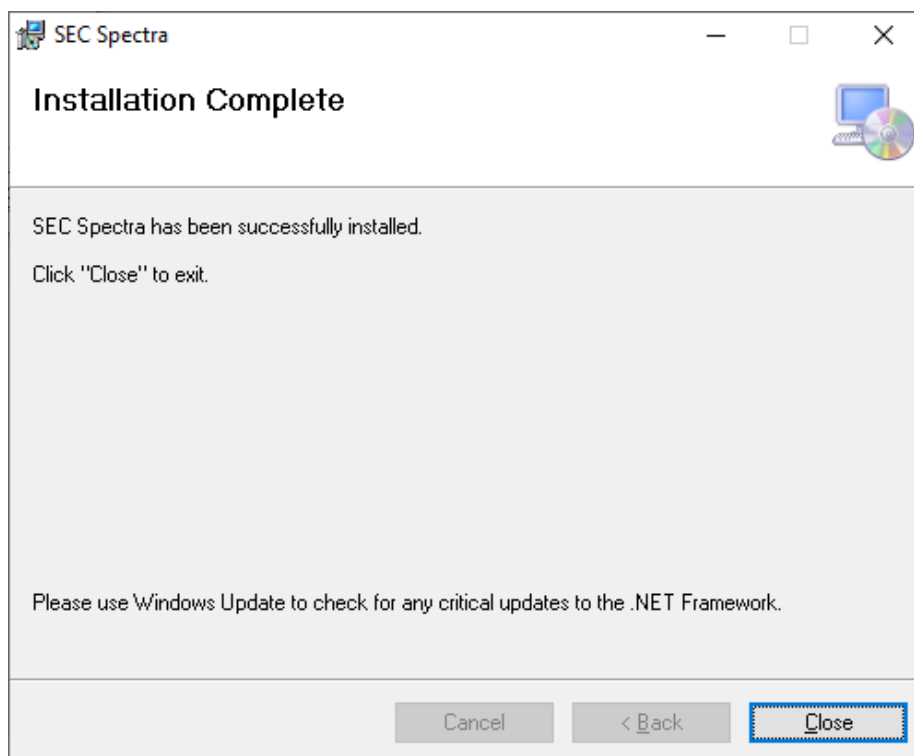


Figure 3-5. Setup Wizard -- **Installation Complete**



### 3-3. Installing Device Driver

Normally, device drivers for supported spectrometers will be installed with SEC Spectra as part of the setup process. The device is usually displayed as "Taurus" in Device Manager (Figure 3-6).

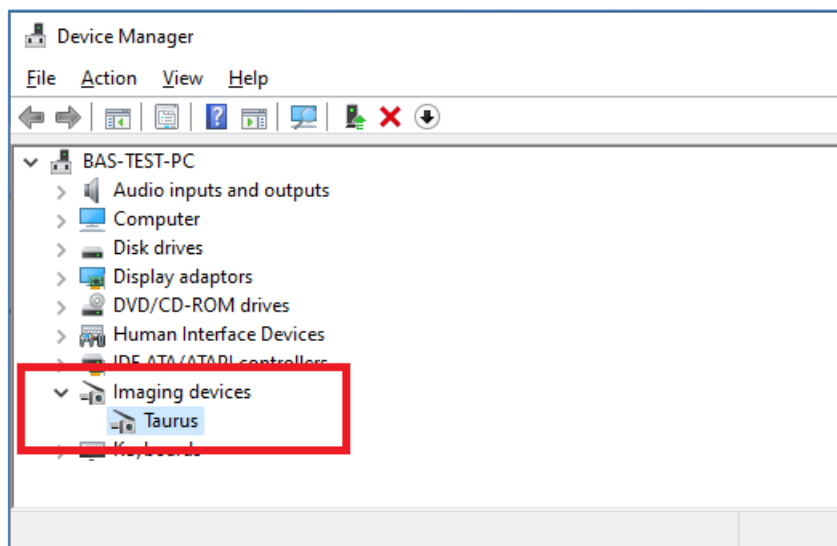


Figure 3-6. Taurus is displayed correctly in Device Manager

The driver may not be installed due to unexpected errors. Figure 3-7 shows an example when the device is not recognized correctly. It will be recognized as a device called "SCAN" with a "!" mark.

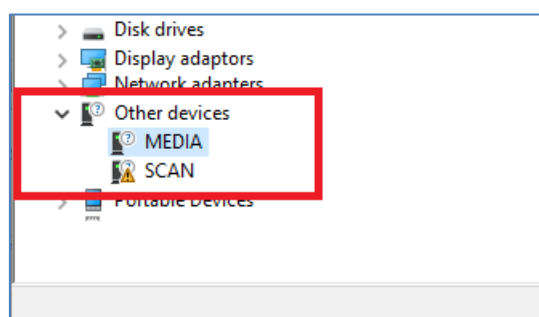


Figure 3-7. when the device is not recognized correctly

In that case, you need to install the driver manually.

**Follow the steps below to manually install the driver:**

Connect the spectrometer to a computer and start "Device Manager". If you see an unknown icon like "SCAN" as shown in Figure 3-7, right click on it and select "Update driver".

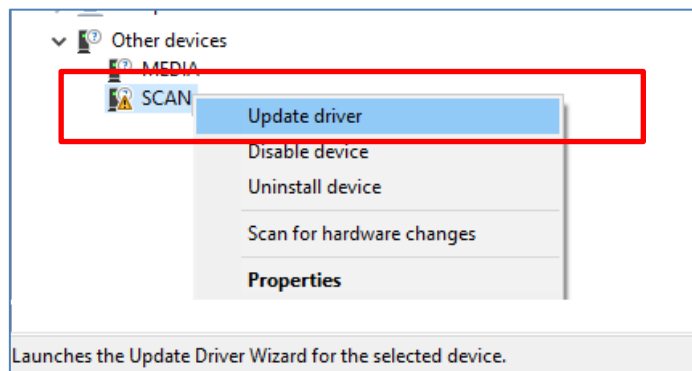


Figure 3-8. Select "Update driver" in Device Manager

Select "Browse my computer for driver software" and manually specify the folder containing the "TAURUS" device driver and update the driver.

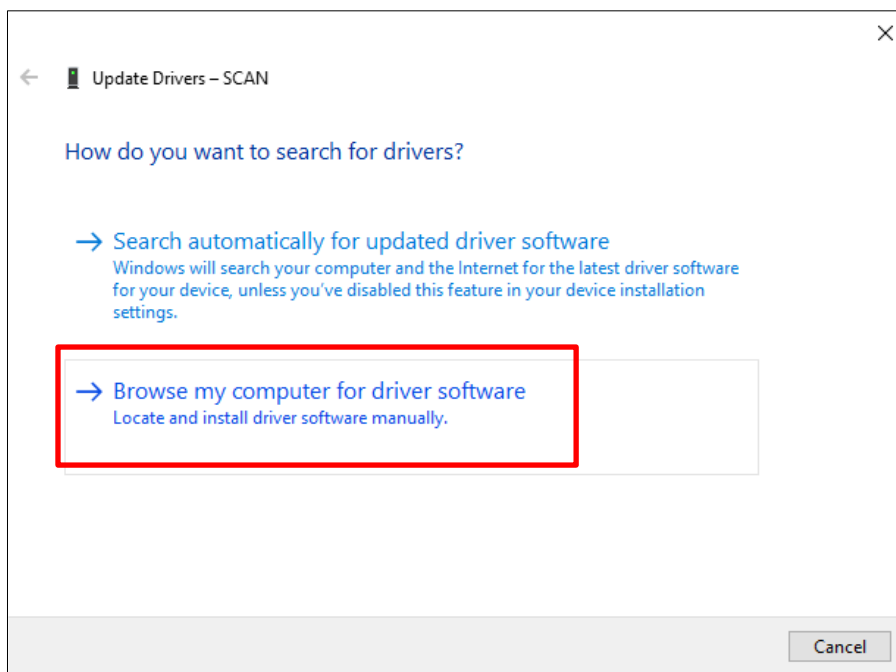


Figure 3-9. Select "Browse my computer for driver software" in Update Drivers

After you have specified the path, click **Next** to finish driver installation.

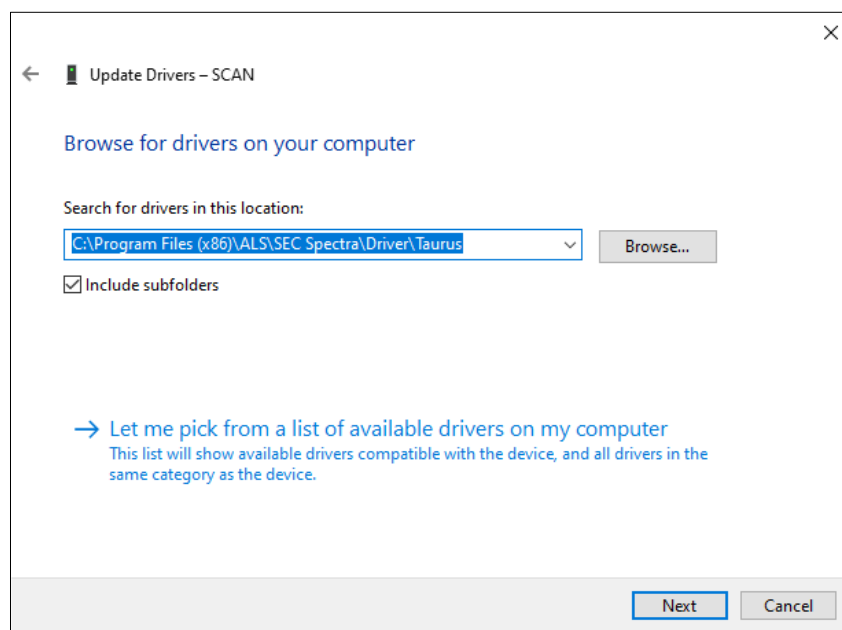


Figure 3-10. Manually specifying the location of drivers on 64-bit Windows

Files for these drivers will be copied to the "Driver" folder under the installation path for SEC Spectra during the setup. The default path will be:

C:\Program Files\ALS\SEC Spectra\Driver\Taurus (32-bit systems)

C:\Program Files (x86)\ALS\SEC Spectra\Driver\Taurus (64-bit systems)

When the driver is updated successfully, the following screen will be displayed, and click "Close" to complete the manual installation of the driver.

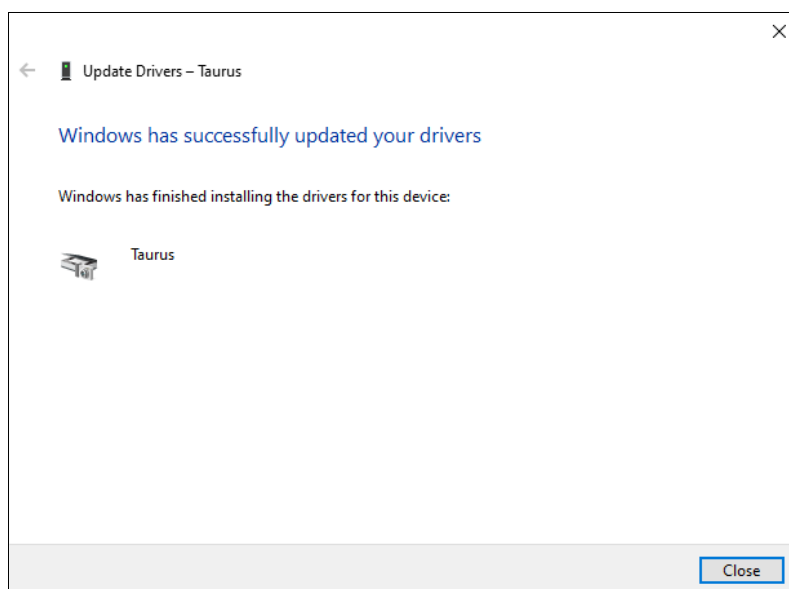


Figure 3-11. Screen when the driver was successfully updated

If you need more detailed explanation, please contact us ([16. Contact Information](#)).

## 3-4. Removing SEC Spectra

If you need to remove SEC Spectra, go to the **Control Panel** and follow the instructions below:

Open the **Control Panel**. Navigate to **Programs** and then **Programs and Features**. Select **SEC Spectra** from the list, and then click **Uninstall**. The system will ask you to confirm the removal. After the confirmation, you will see a message box showing the removal progress. When it is finished, this message box will close.

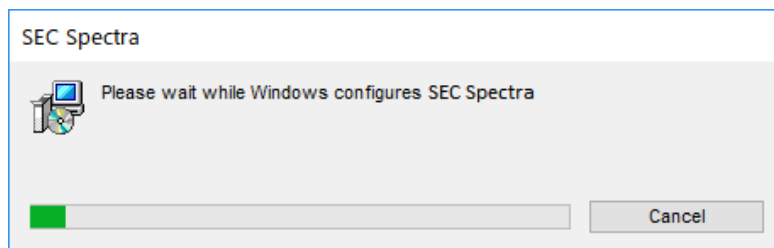


Figure 3-12. The system is removing SEC Spectra (on Windows 10 systems)

## 3-5. Installing .NET Framework 3.5

**Note:** If the Windows function **.NET Framework 3.5** is not installed on your computer, SEC Spectra cannot be installed and executed normally.

### 3-5-1. Online Installation

If your PC is connected to the network, open the "DotNetFX35" folder in the USB memory, click on the file "dotnetfx35.exe", and follow the on-screen instructions to install the **.NET Framework 3.5**.

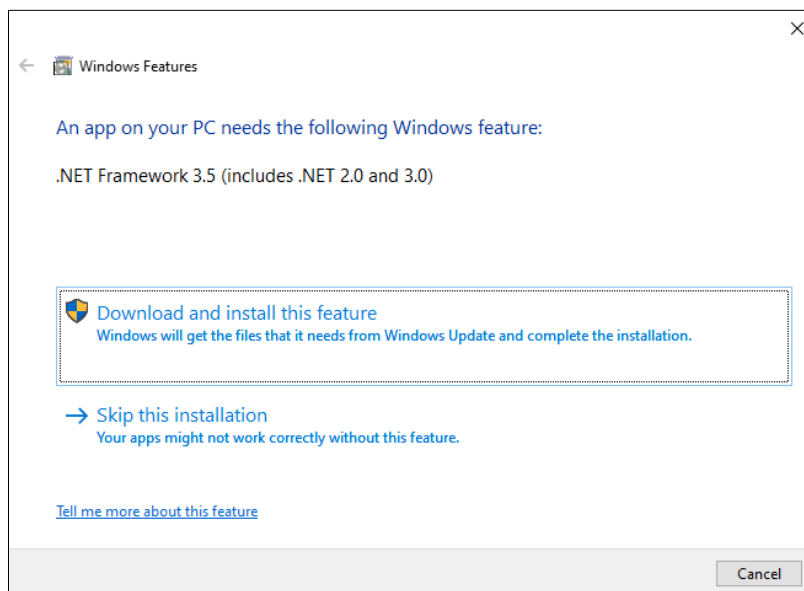


Figure 3-13. Installing .NET Framework 3.5 components

After the installation is complete, click **Close** to finish the installation.

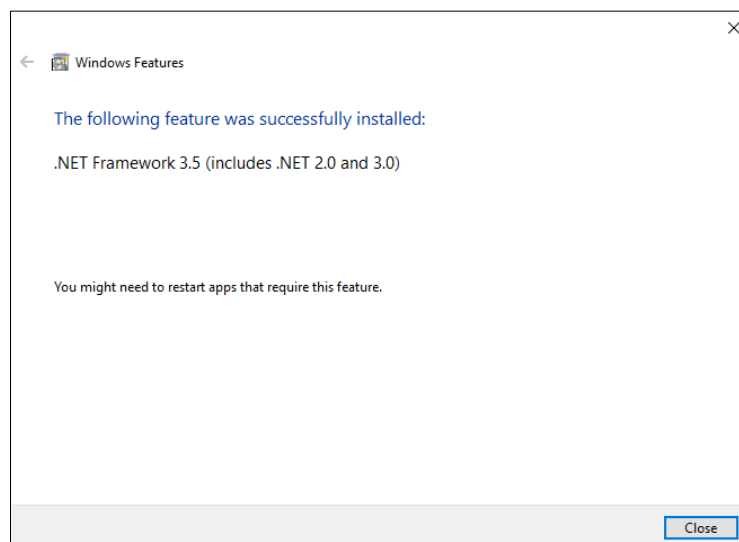


Figure 3-14. .NET Framework 3.5 installation complete

### 3-5-2. Offline Installation

**Online installation is recommended.** If your PC is not connected to the network, you can try offline installation of **.NET Framework 3.5** by following method.

- ① Open the "DotNetFX35"--"OffLine NET35" folder in the USB memory and copy the file "netfx3.cab" to the Windows system folder (C: \ Windows). If the message "Administrator privileges are required" is displayed \*, click **Continue**.

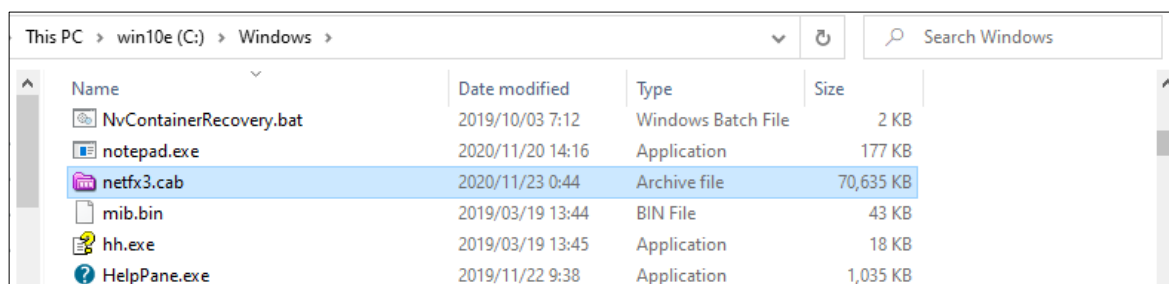


Figure 3-15. Copy files into a Windows system folder

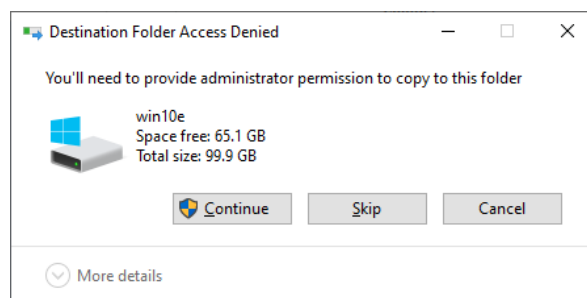


Figure 3-16. Click "Continue"

**Note:** If you have any questions about "Administrator authority", please contact your system administrator.

- ② Right-click the file "OffLine Install NET35.bat" in the "OffLine NET35" folder and select **Edit**.

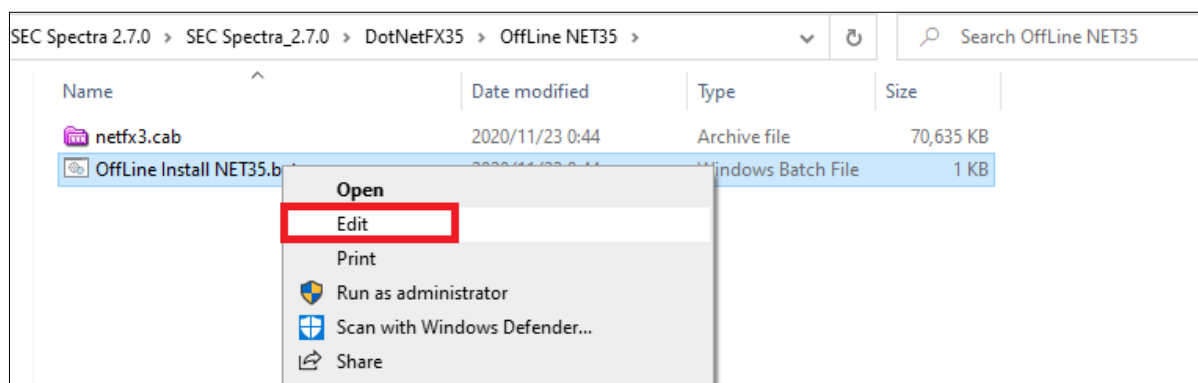


Figure 3-17. Open file from editCopy the second line.

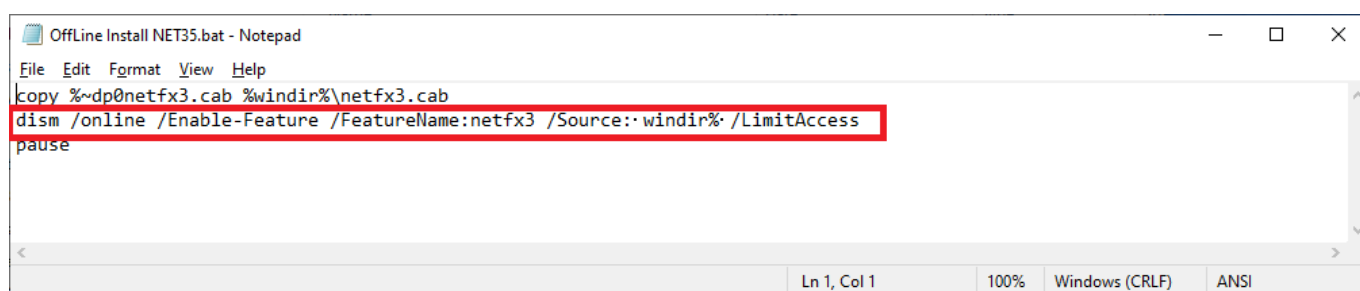


Figure 3-18. Copy the second line.

- ③ Right click on "Start " icon , click on "Command Prompt (Admin)".

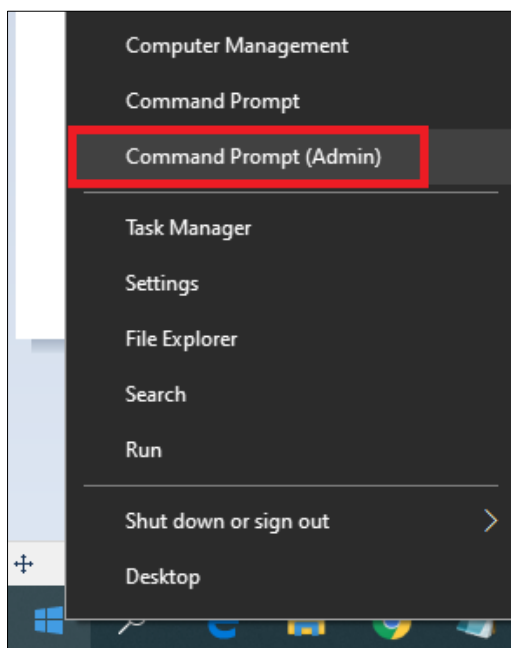


Figure 3-19. Open "Command Prompt"

- ④ The "Administrator: Command Prompt" window will open.

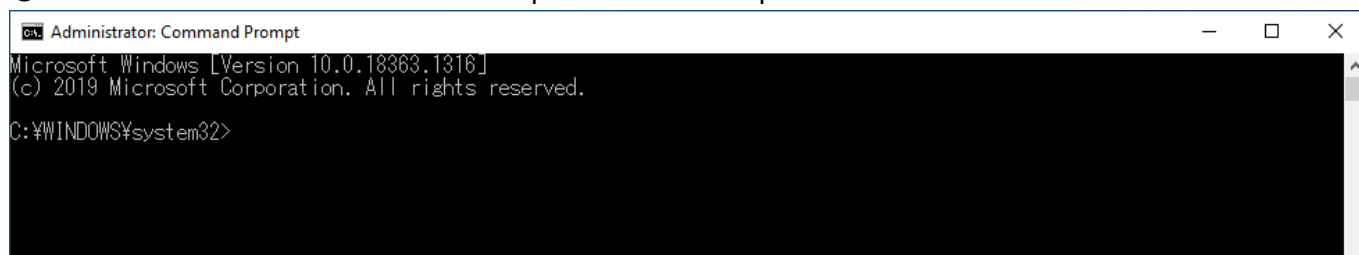


Figure 3-20. "Administrator: Command Prompt" screen

- ⑤ Paste the content copied in ③ after "C: ¥ WINDOWS ¥ system32>". Press **Enter** key to install.

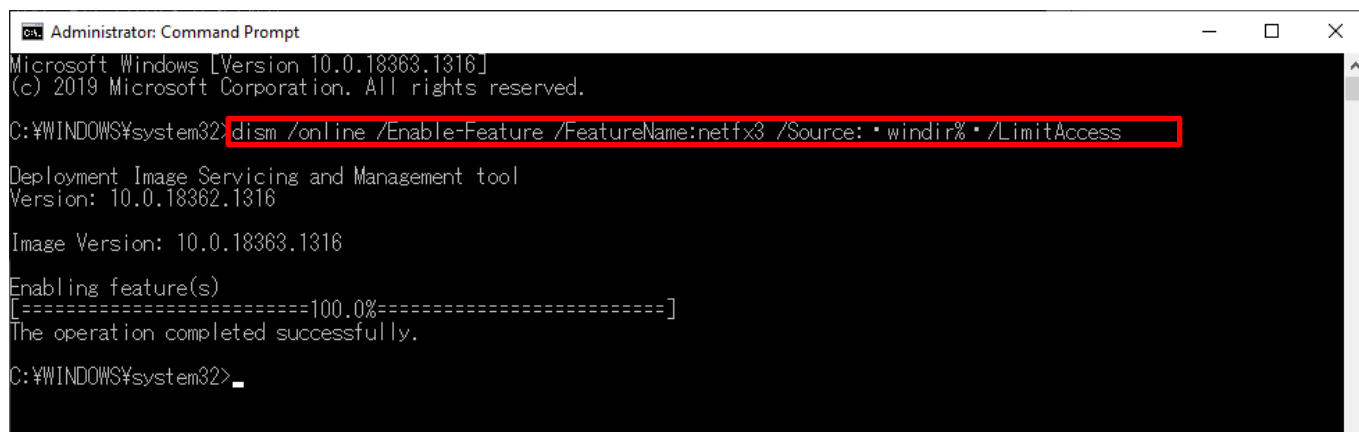


Figure 3-21. "Administrator: Command Prompt" execution screen

- ⑥ The message "Operation completed successfully." is displayed and the offline installation is complete. Close the screen and exit.
- ⑦ Now, you can install SEC Spectra software.

**Note:** Please also refer to the official Microsoft website for installing **.NET Framework 3.5**.

## 4. Getting Started with SEC Spectra

### 4-1. Starting SEC Spectra

A shortcut is created on your desktop when the SEC Spectra is installed.



Figure 4-1. SEC Spectra program shortcut on the desktop

Double-click the shortcut to launch the SEC Spectra.

#### 4-1-1. If you connect the spectrometer first...

If you connect the spectrometer to your computer before starting SEC Spectra, the **Spectrum\_0** will be displayed automatically under the default settings of the connected spectrometer.

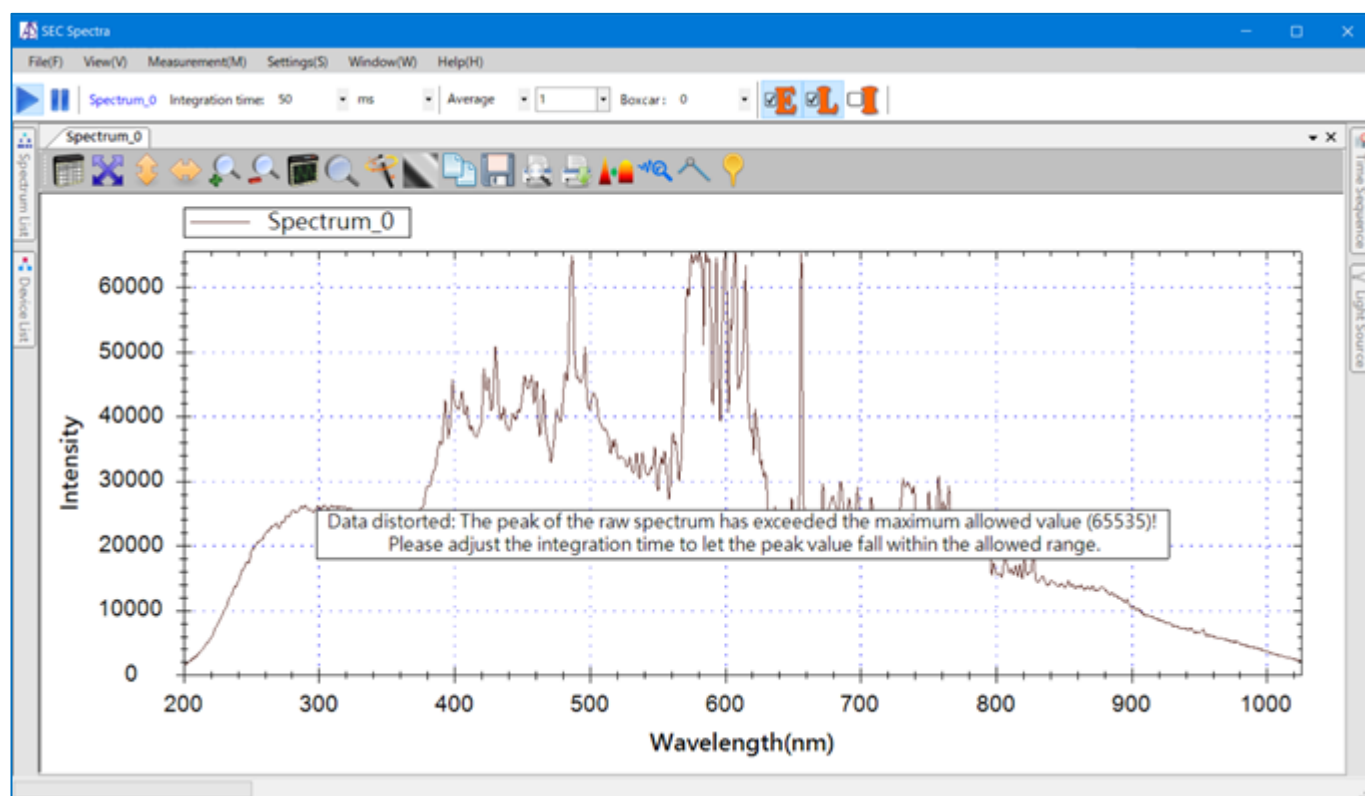


Figure 4-2. The spectrometer is connected when the SEC Spectra is started



### 4-1-2. If the spectrometer is not connected

When the spectrometer is not connected, after starting the program, the following screen will be displayed.

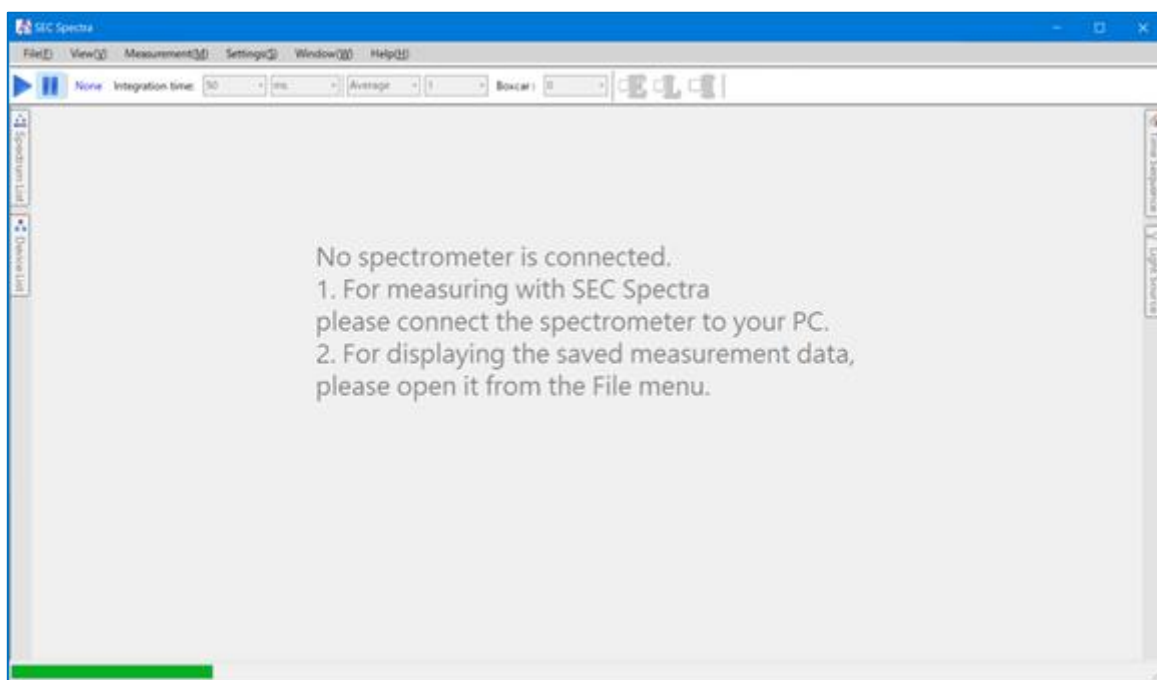


Figure 4-3. The spectrometer is not connected when the SEC Spectra is started

Next, connect the spectrometer to the computer. SEC Spectra initializes the device. Measurement is possible when initialization is completed. When the following screen appears, it means that SEC Spectra is ready for measurement.

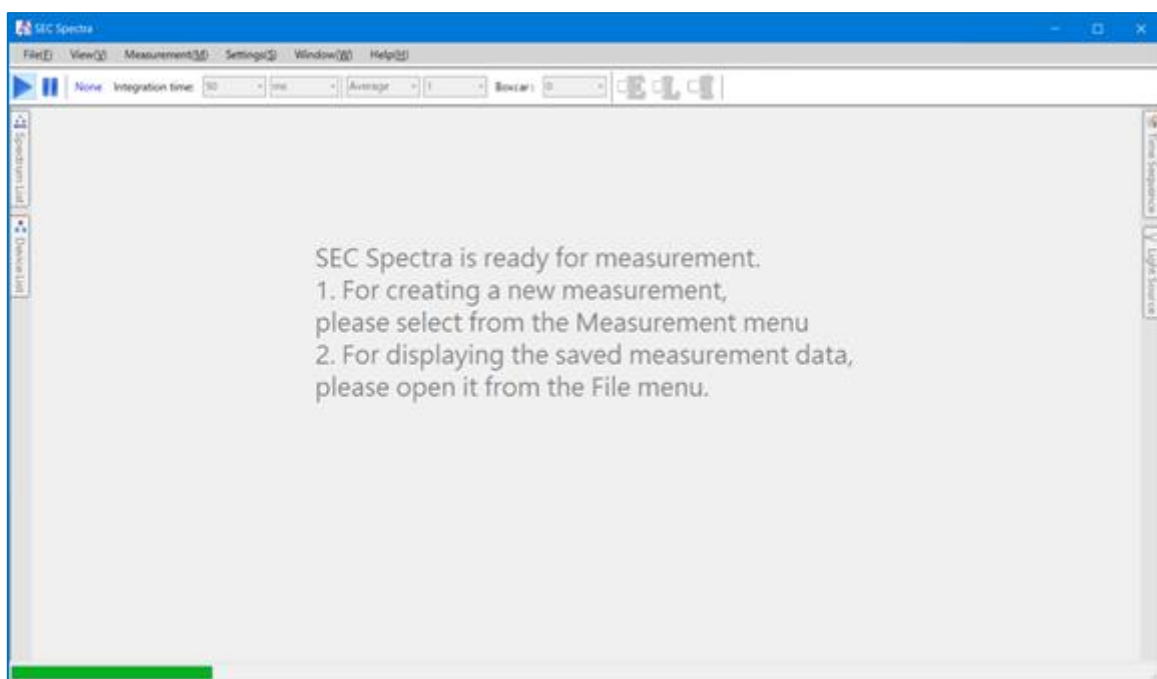


Figure 4-4. SEC Spectra is ready for measurement

## 5. Spectrum Measurement

SEC Spectra supports a wide range of measurements using the SEC2020 spectrometer system, including Spectrum, Absorbance, Transmittance, Reflectance, Concentration and Relative Irradiance. All measurements start with a Spectrum measurement. This chapter describes how to create basic Spectrum measurements. The following chapters describe other measurement methods based on the Spectrum measurements in this chapter.

### 5-1. Before the Measurement

Before starting various measurements, you should set the measurement equipment. When measuring absorbance, secure the spectrometer, light source and cuvette holder on the platform, and connect a fiber collimator between the spectrometer and the cuvette holder. For details of the method of setting the measuring device, please refer to "SEC2020 Spectrometer System User's Guide - Device -".

### 5-2. Creating a Spectrum Measurement

To create a spectrum measurement, select **Spectrum** from the **Measurement** menu to open the **New Spectrum** window, as shown in the following:

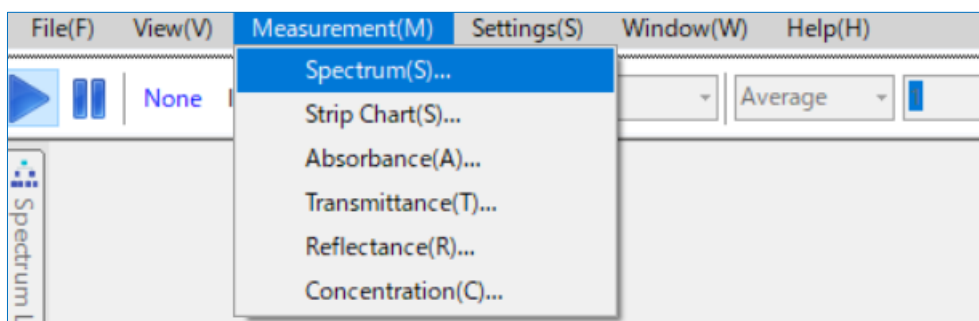


Figure 5-1. Selecting **Spectrum** from the **Measurement** menu

**Note:** If you start the SEC Spectra software with the spectrometer connected to your PC, a spectrum measurement will be created automatically. Refer to "4-1-1. If you connect the spectrometer first...".

On the **New Spectrum--Live Spectrum Settings** window, select a source device (identified by its serial number). Then, enter an integration time (default: 50 ms, i.e. the exposure time for the light sensor) and a wavelength range to display on the X-axis (default: 200 nm~1025 nm, the range in the parentheses indicates the range supported by the selected device).

Then, click **Next**.

New Spectrum...

Live Spectrum Settings

Select source device:

Serial Number  
OS361AC\*\*\*\*\*

Integration time: 50 ms

Wavelength display range: 200 ~ 1025 (200 nm ~ 1025 nm)

Note: The allowed display range for the selected source device is shown in the parentheses.

Next > Cancel

Figure 5-2. New Spectrum - Live Spectrum Settings

On the **Display Settings** window, specify whether to display the new spectrum curve in a new or an existing window. If this is the first spectrum measurement you create, you can only select a new window. This window also allows you to specify a name for the window, as well as a title and a color for the spectrum curve.

To specify a color, click the color patch to the right of **Graph Color** and select the desired color.

You may simply leave the default names unchanged. When all settings are done, click **OK**.

The screenshot shows a dialog box titled "New Spectrum..." with a blue header bar containing standard window controls. The "Display Settings" tab is selected. It features two radio buttons: "Display in new window" (selected) and "Select existing window". To the right of the first radio button is a text field labeled "Name:" containing "Spectrum\_0". Below these is a table with two columns, "Window Name" and "Spectrum Type", which is currently empty. Further down is a "Spectrum title:" label followed by a text field containing "Spectrum\_0". Below that is a "Graph color:" label followed by a red color patch. At the bottom are three buttons: "< Back", "OK", and "Cancel".

Window Name	Spectrum Type
-------------	---------------

Figure 5-3. New Spectrum - Display Settings

SEC Spectra will display the newly created spectrum measurement as follows:

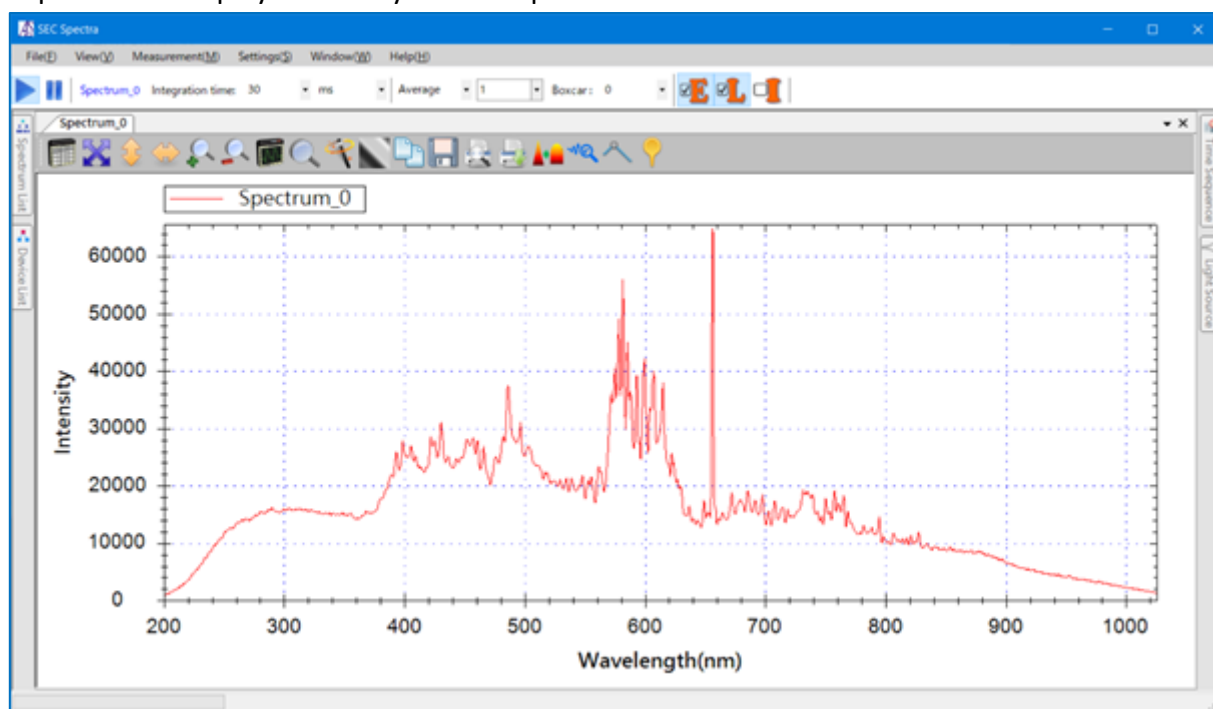


Figure 5-4. Newly created spectrum measurement (Spectrum\_0)

### 5-3. Change Spectrum Acquisition Settings

There are several setting icons related to spectrum acquisition in the "Quick Adjustment Field" below the main menu. You can adjust the data acquisition settings (Integration time, Average, Boxcar). For the functions of other icons, please refer to the detailed explanation in "14-5. Quick Adjustment Field".

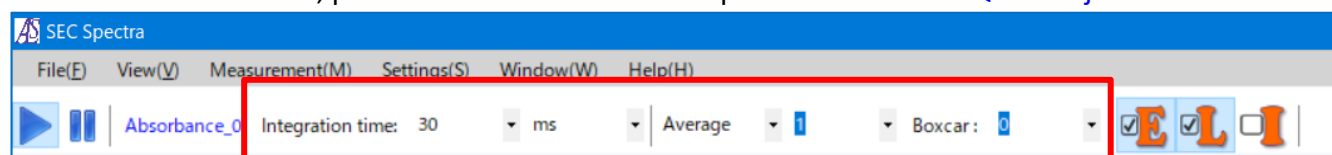


Figure 5-5. Icons related to spectrum acquisition

#### Integration time

Adjust the exposure time of the sensor. The higher the value, the greater the Intensity (Y-axis value) displayed in the Spectrum graph.

#### Average

Set the number of scans to calculate the average value. The higher the value, the lower the variation of the curve.

#### Boxcar

Smooths the spectrum curve. Sets the number of data to be used for the moving average calculation. The higher the value, the smoother the curve and the less prominent the changes.


## 5-4. Graph Toolbar

The toolbar icons are located at the top of the spectrum diagram. It can be adjusted to the optimum scale for each measurement to display the spectrum properly. See the detailed explanation in "[14-6. Graph Toolbar Icons](#)".




Figure 5-6. Graph toolbar icons

## 5-5. Show Spectrum Data

Press the **Show Spectrum Data** icon  on the toolbar to show or hide the window. For details, please refer to "[14-7. Spectrum Data Pane](#)".

## 5-6. Saving a Spectrum



If you want to save the spectrum to a file for future reference, you can press the **Save selected spectrum as ...** icon  on the toolbar.

In addition to the **Save selected spectrum as ...** icon on the toolbar, you can also save the spectrum curve from the spectrum data pane. For details, refer to "[14-8. Saving Current Spectrum](#)".

## 5-7. Loading Saved Spectrum

You can load a previously saved spectrum curve (extension .sps) and analyze the data on the software or compare it with the current spectrum curve. For details, refer to "[14-1-1. Open Spectrum File](#)".

## 5-8. Print and Preview of Spectrum

If you want to print the current spectrum, use the **Print Preview**  and **Print**  icons on the toolbar at the top of the spectrum diagram. Please refer to "[14-9-3. Print Preview and Print](#)" for further information.

## 6. Absorbance Measurement

Absorbance measurement using the SEC2020 spectrometer system and SEC Spectra is calculated from the spectrum of light that has passed through the reference object (inject blank solvent into the cuvette) and the object to be measured (inject sample solution into the cuvette). Therefore, to measure the absorbance, first measure the transmitted light spectrum of the reference object (baseline measurement), then set the object to be measured and measure the transmitted light. When the measurement is completed, the program automatically calculates the absorbance spectrum.

### 6-1. Creating an Absorbance Measurement

For the measurement of the absorbance, select **Absorbance** from the **Measurement** menu and open the **New Absorbance Measurement** window, as shown below:

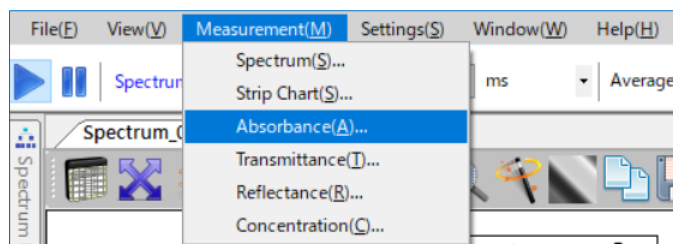


Figure 6-1. Selecting **Absorbance** from the **Measurement** menu

#### 6-1-1. Selecting a Source Device

On the **Source Device** window, please select a source device (identified by its serial number). Then, click **Next**.

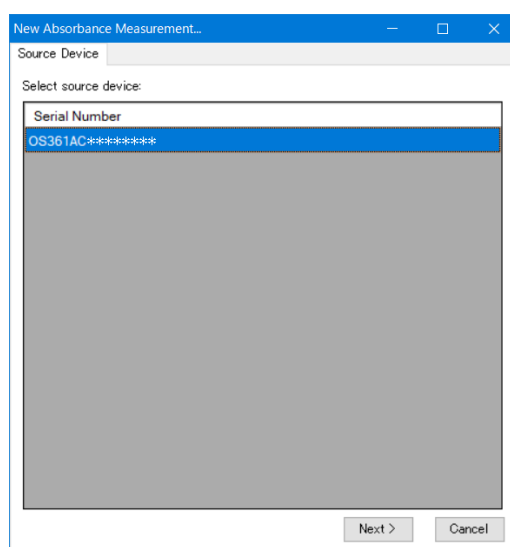


Figure 6-2. **New Absorbance Measurement - Source Device**

## 6-1-2. Setting Acquisition Parameters

Set the data acquisition related parameters on the next screen.

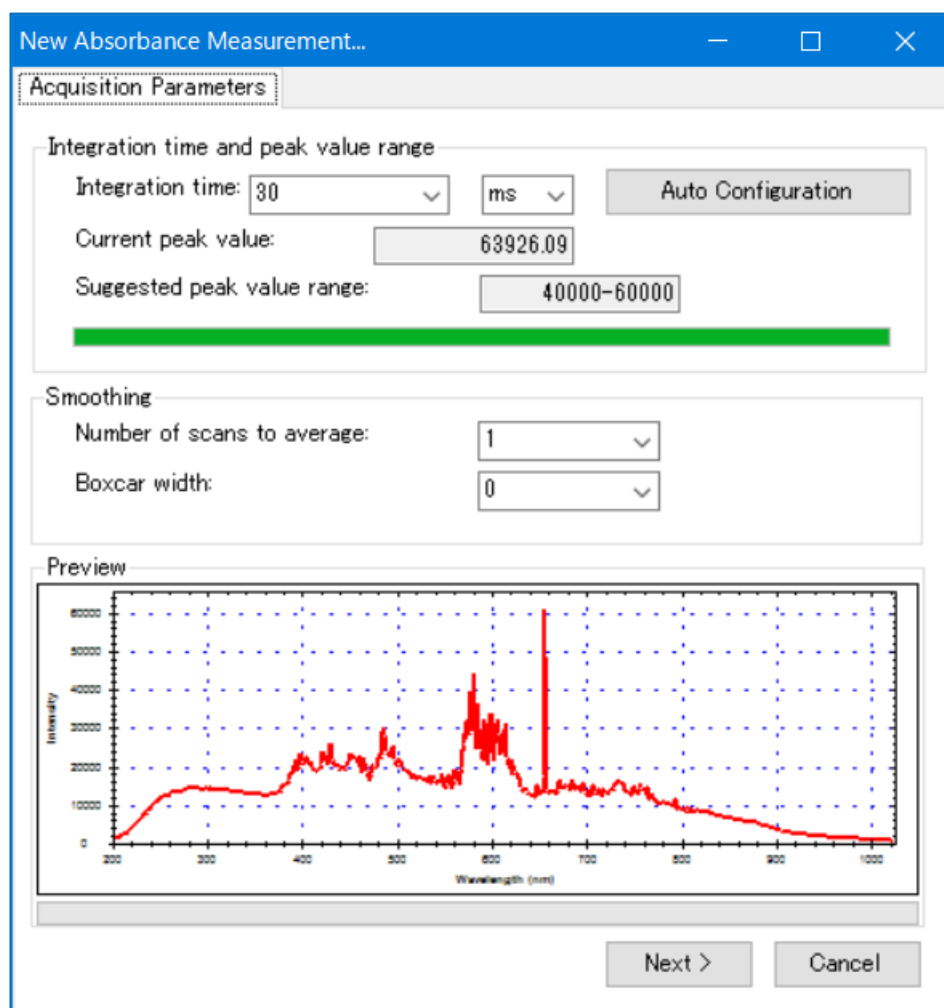


Figure 6-3. New Absorbance Measurement - Acquisition Parameters

### Specifying Integration Time

Then specify the integration time (sensor exposure time) on the Acquisition Parameters window. In the program, the default integration time is set automatically when the window is opened. Adjust the integration time while referring to the preview at the bottom of the screen as necessary. The preview will change as you adjusted, so set the peak value within the Suggested peak value range on the window. In figure 6-3, the peak value is set within the range of 40000-60000.

If the adjustment does not work, you can press **Auto Configuration** to set it automatically.



## Setting Smoothing

You can also choose whether to smooth out the curve. Specify the number of scans to calculate the average value for **Number of scans to average**. This makes it possible to reduce curvature fluctuation more than a single data acquisition. In the **Boxcar width**, specify the number of data used for moving average calculation. This smooths out the sharp variations on the curve: the bigger the Boxcar width of, the smoother the curve. The following figure demonstrates the smoothing effect when Boxcar width is 10 (maximum value). Compare it with the original Figure 6-3 without smoothing.

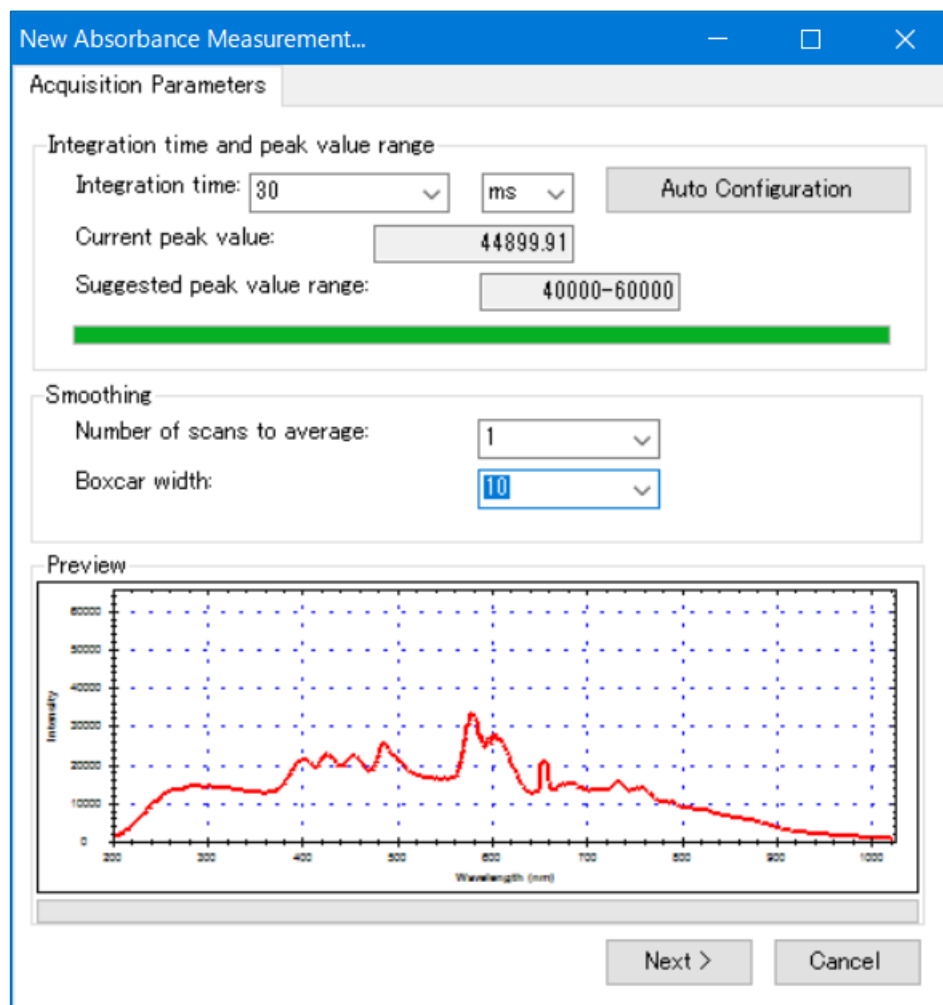


Figure 6-4. Acquisition Parameters - the smoothing effect

Note: Even if the **Intensity** is within the range due to the smoothing, overloading will occur if the pre-smoothing value exceeds the range. If the **Boxcar width** value is set too high, the resolution will decrease and it will not be possible to separate adjacent peaks, so set an appropriate value for your experiment.

After setting all the data acquisition parameters, click **Next**.

### 6-1-3. Setting Reference Spectrum

Next, you need to set transmitted light spectrum of the reference material (**Reference Spectrum**), which is basically the spectrum of the light source before set the test object in place. Here, you can click on the color patch on the window to acquire the live spectrum as the reference. Or, if you previously saved the reference spectrum file you can read it using the **Browse** button. In this example, the current light source is being read as a reference spectrum (as such, please don't put the test object in place). Once the reference spectrum is captured, you can check the spectral data in the preview at the bottom of the screen. Then click **Next**.

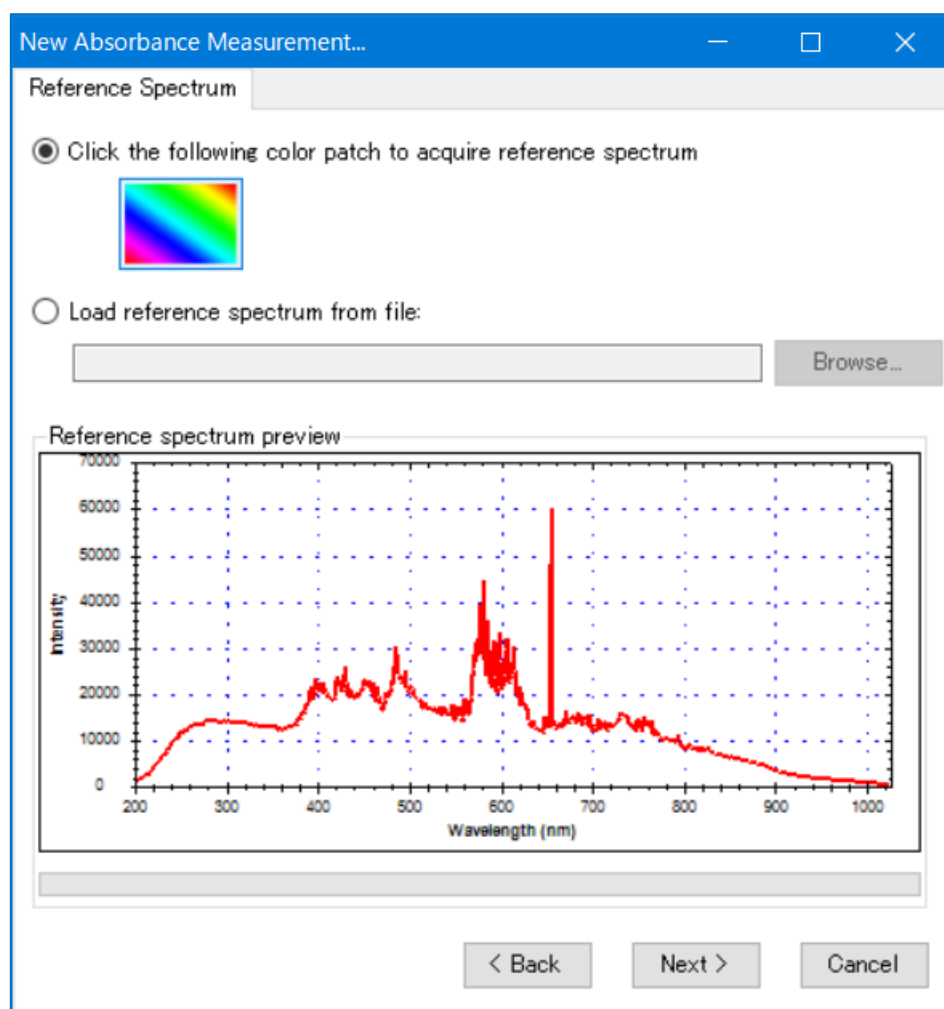


Figure 6-5. New Absorbance Measurement - Reference Spectrum

### 6-1-4. Setting Dark Spectrum

After setting the reference spectrum, set the measurement value when light sensor is not exposed to light to establish a baseline, i.e. the "dark spectrum." So, please cut off or block the light source which is connected to the spectrometer. Then, click on the black-and-white patch on the window to acquire the dark spectrum.

If the "Lamp Control" function of the software is activated (see "14-2-3. Lamp Control"), check on **Shutter (light blocked)**, the shutter of the light source operates to block light. If unchecked, the optical path will open. If you check on **Shutter (light blocked)** and press **Next**, the light source control will be released, but to prevent malfunction, it is recommended to manually uncheck it and then press **Next**.

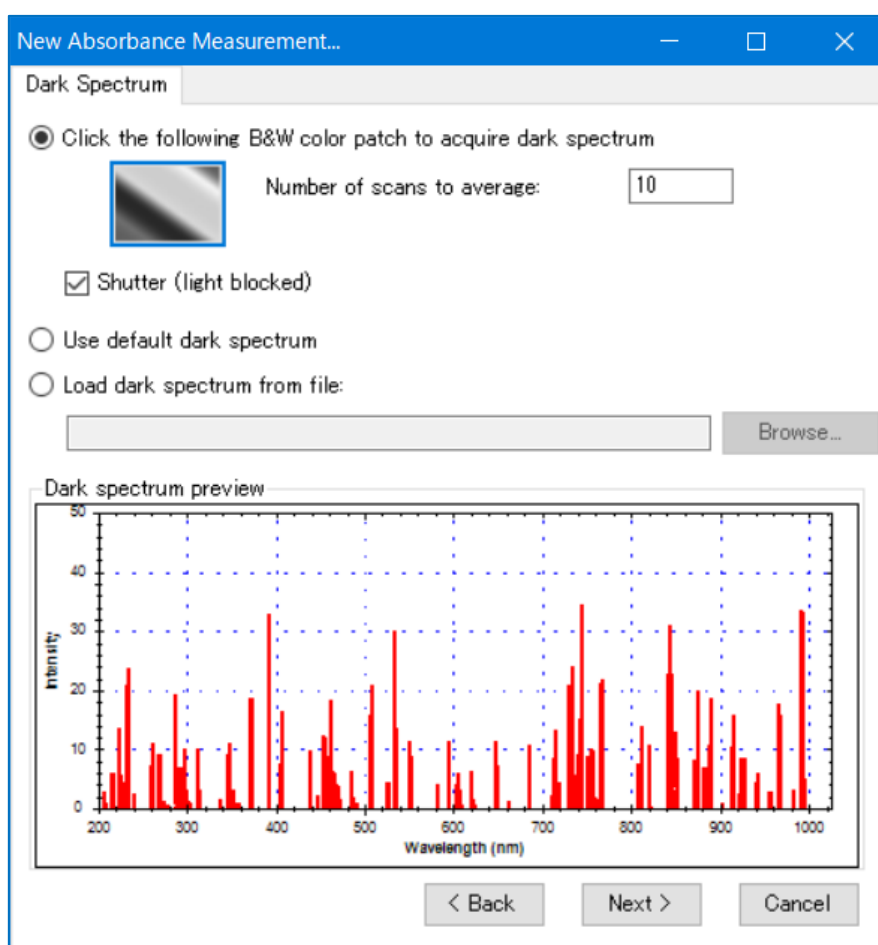


Figure 6-6. New Absorbance Measurement - Dark Spectrum

The default value of **Number of scan to average** is 1, but you can also set it for multiple acquisitions. In the example here, 10 is used, instead of the default 1. Once the dark spectrum is acquired, you can confirm the acquired spectrum in the preview at the lower half of the window. Also, "Acquiring Dark Spectrum ..." is displayed while acquiring the dark spectrum.

Other than actually acquired dark spectrum, it is also possible to use the default dark spectrum, or to use a previously saved dark spectrum file. The default dark spectrum is for test purposes only, please be carefully when using. The following figure shows the case when Use default dark spectrum is selected.

**Note:** The default dark spectrum is for testing purposes only and should be used with caution.

Once the dark spectrum is set, click **Next**.

### 6-1-5. Display Settings

Next, you can specify a name for the measurement graph window, as well as a spectrum title and a color for the graph. To specify the color, you can click on the color patch and select the desired color from the palette.

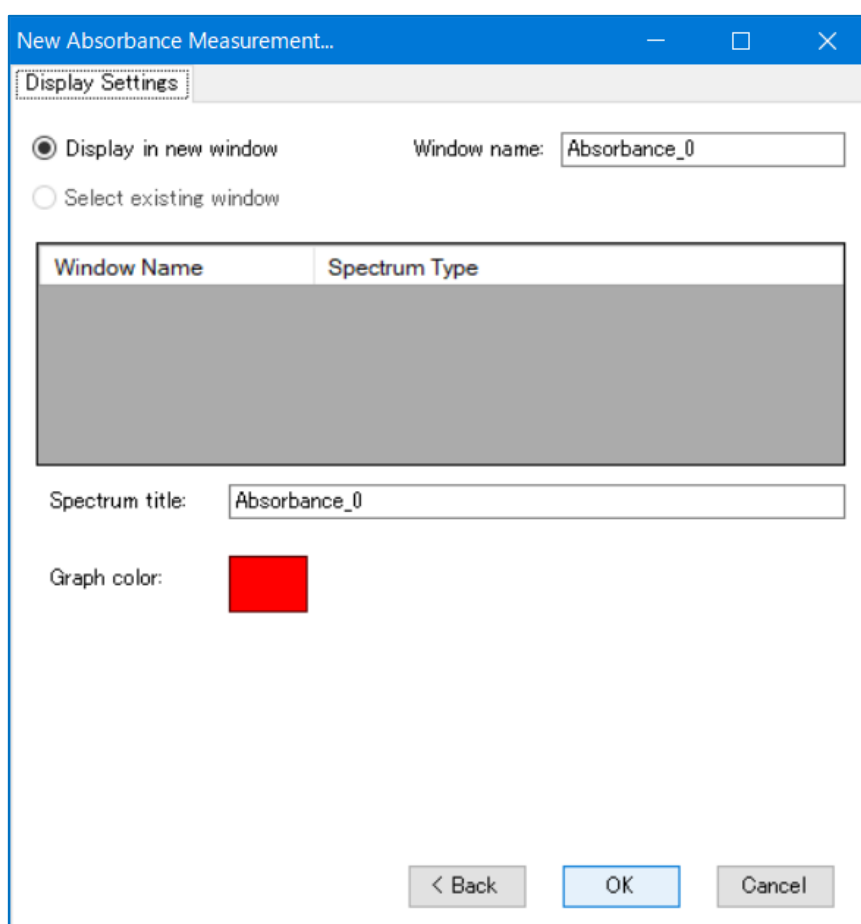


Figure 6-7. New Absorbance Measurement - Display Settings

When you finish setting the display, click **OK**. The measurement graph is displayed as shown below.

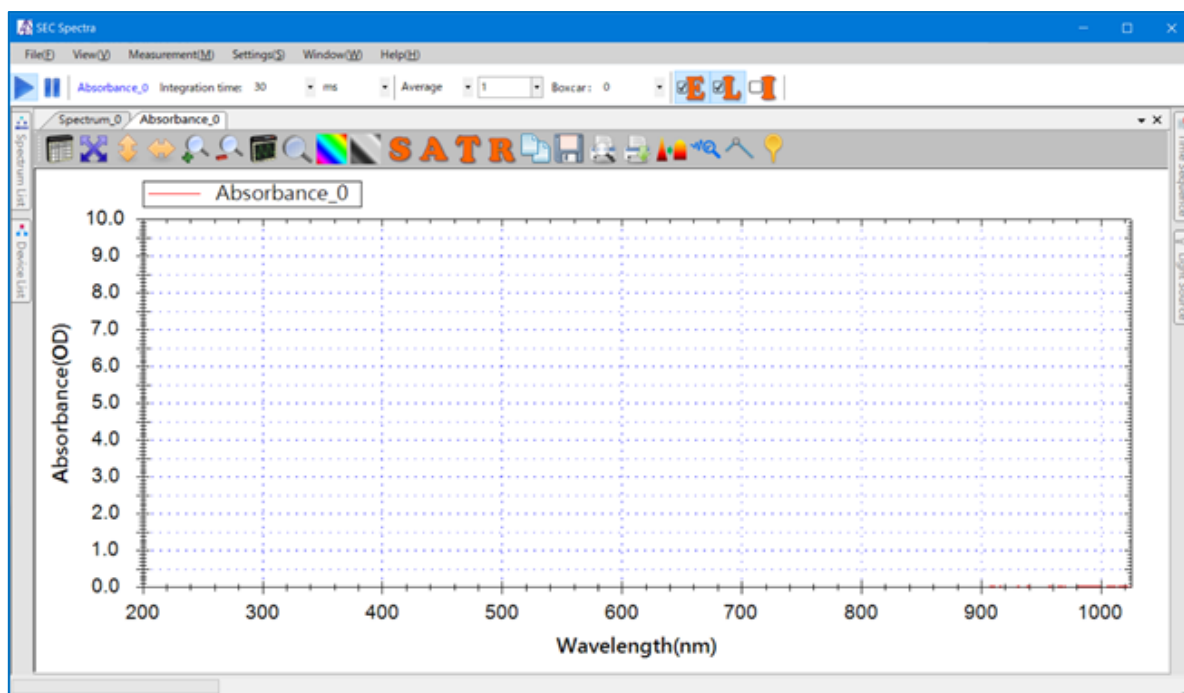


Figure 6-8. Newly created absorbance measurement window

## 6-2. Absorbance of Sample

After setting the absorbance measurement, set the sample to be measured in the cuvette holder. The figure below is an example of absorbance measurement of sample solution.

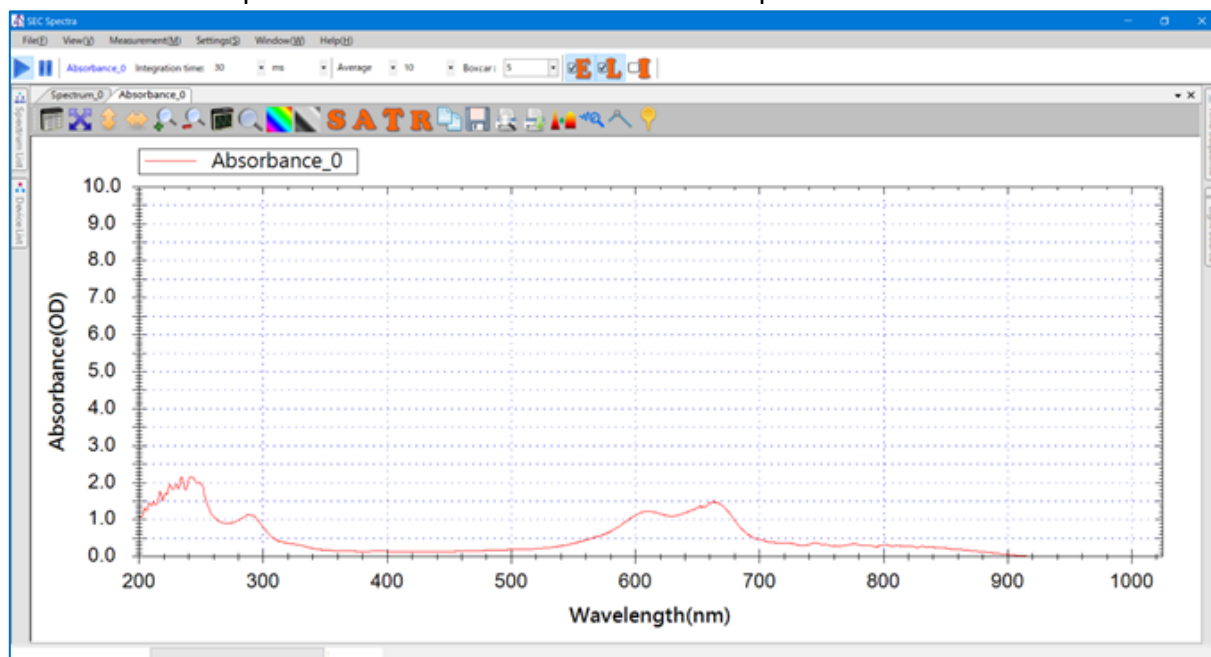


Figure 6-9. Absorbance of methylene blue solution

## 6-3. Graph Toolbar Icons

The graph toolbar icons in the absorbance measurement window include icons for adjusting the spectrum scale, similar to the graph toolbar in the Spectrum measurement window.

### 6-3-1. Measurement Mode Switching Icons

In addition to the common toolbar icon, there are a set of measurement mode switching icons for measuring absorbance, transmittance, and reflectance.



Figure 6-10. Measurement mode switch icons

By clicking the icons, you can switch among four modes: **S** (spectrum), **A** (absorbance), **T** (transmittance) and **R** (reflectance). The four figures below show the results of switching the sample measurement results in Figure 6-9 to four modes: **S**, **A**, **T**, and **R**.

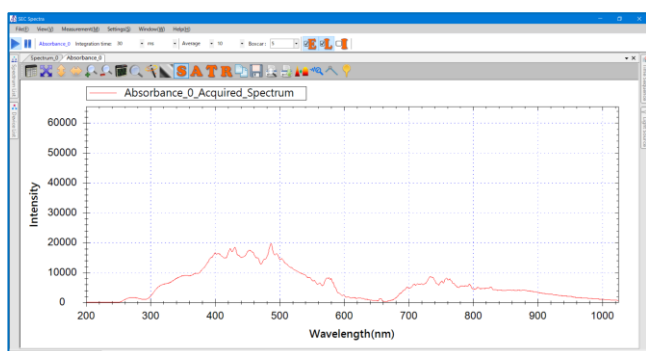


Figure 6-11. Switch to spectrum mode with **S** icon

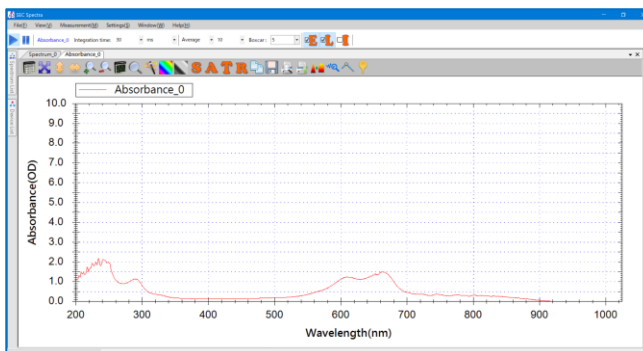


Figure 6-12. Switch to absorbance mode with **A** icon

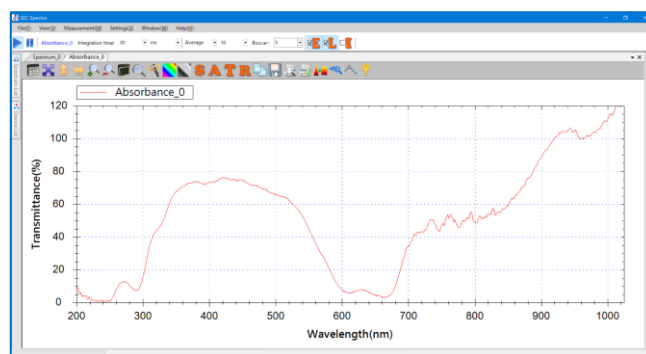


Figure 6-13. Switch to transmittance mode with **T** icon

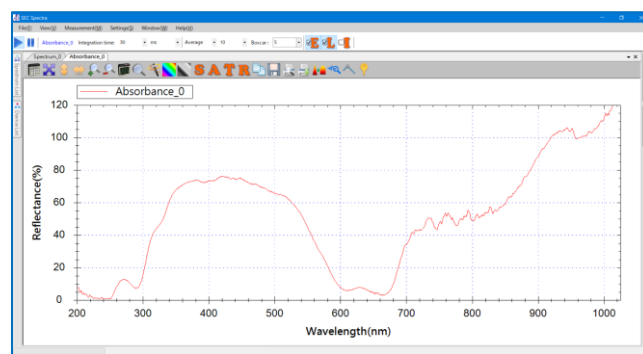


Figure 6-14. Switch to reflectance mode with **R** icon

**A** (absorbance) represents the light absorbed by the sample, and **T** (transmittance) represents the light passed through the sample, so the two are contradictory. In addition, **T** (transmittance) and **R** (reflectance) are similar, because **R** (reflectance) measures the reflected light, which is the light

remaining after the light from the light source hits the object to be measured and is absorbed by the object.

The peak positions of **T** (transmittance) and **R** (reflectance) coincide, and these peak positions are reversed with **A** (absorbance).

### 6-3-2. Setting a New Reference Spectrum or Dark Spectrum

In some cases, it may be necessary to set a new reference spectrum or a new dark spectrum during the measurement, you needn't to start the measurement from the measurement menu and make a new setting, SEC Spectra allows you to easily reset the reference spectrum or dark spectrum using the toolbar icons as shown below.



Figure 6-15. Set as reference spectrum icons



Figure 6-16. Set as dark spectrum icons

To reset the reference spectrum, switch the object to be measured to the reference object and press the **Set as reference spectrum** icon. To reset the dark spectrum, turn off the shutter of the light source or block the optical path and press the **Set as dark spectrum** icon.

Basically, whenever a measurement needs a reference or dark spectrum to work, the **Set as reference spectrum** icon or **Set as dark spectrum** icon will appear on the toolbar. This is the same for absorbance, transmittance and reflectance measurement.

## 6-4. Saving Absorbance Measurement

### 6-4-1. Saving Absorbance Spectrum Curve

The method of saving the absorbance measurement spectrum is the same as that of "spectrum measurement". However, in the spectrum measurement, only one curve of the spectrum is saved, and in the absorbance measurement, three curves are saved: reference spectrum, dark spectrum, and absorbance spectrum.

Click the "Save selected spectrum as..." icon  on the graph toolbar to save the spectrum curve.

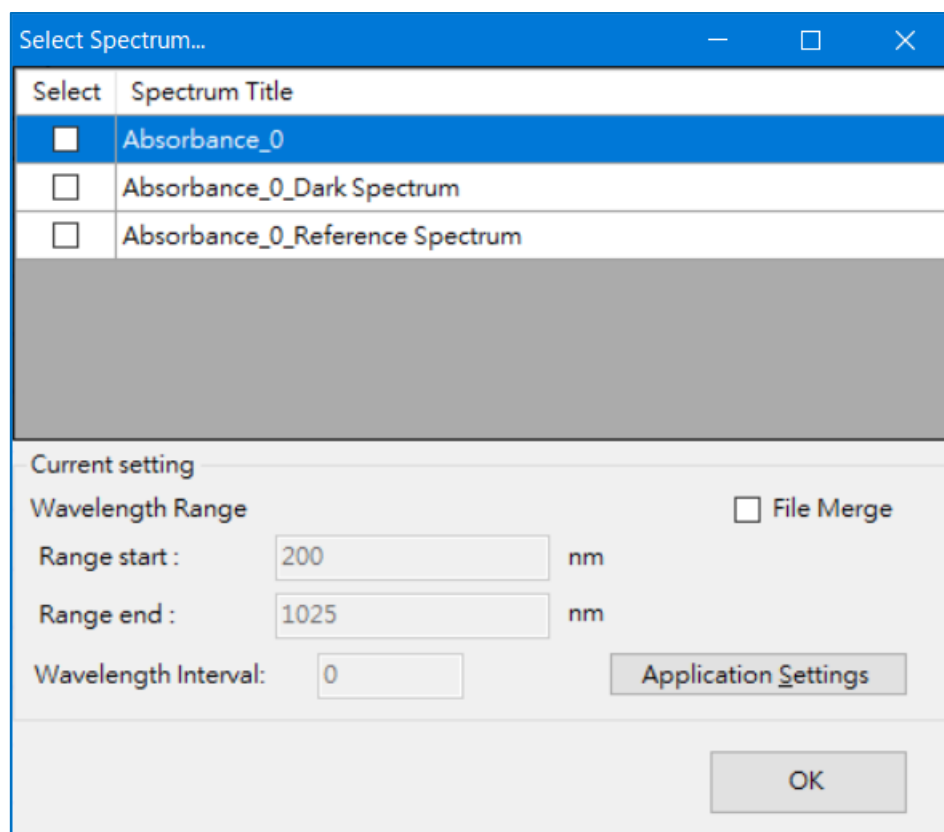
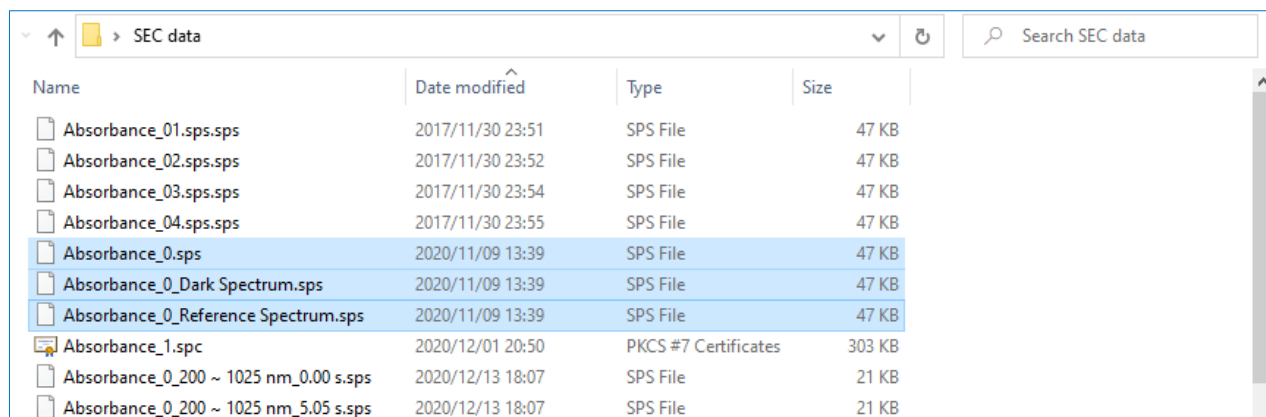


Figure 6-17. Saving absorbance spectrum by **Save selected spectrum as...** icon



Alternatively, select "Save all spectra as ..." from the pop-up menu in the spectrum data window. The three saved curves can be viewed in the specified folder as shown below.

For detailed saving procedure, also refer to "[14-8. Saving Current Spectrum](#)" in the software operation method.



Name	Date modified	Type	Size
Absorbance_01.sps.sps	2017/11/30 23:51	SPS File	47 KB
Absorbance_02.sps.sps	2017/11/30 23:52	SPS File	47 KB
Absorbance_03.sps.sps	2017/11/30 23:54	SPS File	47 KB
Absorbance_04.sps.sps	2017/11/30 23:55	SPS File	47 KB
Absorbance_0.sps	2020/11/09 13:39	SPS File	47 KB
Absorbance_0_Dark Spectrum.sps	2020/11/09 13:39	SPS File	47 KB
Absorbance_0_Reference Spectrum.sps	2020/11/09 13:39	SPS File	47 KB
Absorbance_1.spc	2020/12/01 20:50	PKCS #7 Certificates	303 KB
Absorbance_0_200 ~ 1025 nm_0.00 s.sps	2020/12/13 18:07	SPS File	21 KB
Absorbance_0_200 ~ 1025 nm_5.05 s.sps	2020/12/13 18:07	SPS File	21 KB

Figure 6-18. Saved absorbance spectrum

## 6-4-2. Loading Saved Absorbance Spectrum Curve


To load a previously saved absorbance spectrum, you can click "Open Spectrum File" from the File menu to display the absorbance spectrum in a new or existing window on the software. For details, refer to "[14-1-1. Open Spectrum File](#)".

## 6-4-3. Deleting Absorbance Measurement

The result of the absorbance measurement is calculated by multiple spectral curves. Therefore, do not delete any curve. If you delete any of the curves, the software will not be able to display the absorbance correctly.

## 6-4-4. Print and Preview of Absorbance Spectrum Curve

If you want to print the spectrum of the absorbance spectrum, use the "Print Preview"  and

"Print"  icons on the toolbar. For details, refer to "[14-9-3. Print Preview and Print](#)".

## 7. Transmittance Measurement

The transmittance is calculated from the spectrum of the light has passed through the reference object (blank solvent injection into the cuvette holder) and the object be measured (sample solution injection into the cuvette holder). Similarly to the measurement of absorbance, in order to measure the transmittance, first measure the transmitted spectrum of the reference object (baseline measurement), then set the object to be measured and measure the light transmitted through the object to be measured. When the measurement is completed, the program automatically calculates the transmittance spectrum.

### 7-1. Creating a Transmittance Measurement

For the transmittance measurement, select **Transmittance** from the **Measurement** menu and open the **New Transmittance Measurement** window, as shown below.

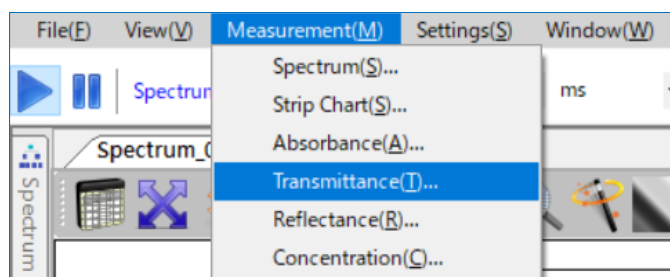


Figure 7-1. Selecting **Transmittance** from the **Measurement** menu

### 7-2. Setting Measurement Conditions

Set the measurement conditions in the same procedure as in "[6-1. Creating an Absorbance Measurement](#)".

On the **Source Device** screen, select the source device (displayed by device serial number) and press **Next**.

First, set the reference material in the cuvette holder. Then, on the **Data acquisition parameter** screen, set the **Integration time**, **Number of scans to average** and **Boxcar width**. When all the parameters are set, click **Next**.

Set the **Reference spectrum** and **Dark spectrum**.

On the **Display Settings** screen, set the **Window name**, **Spectrum title**, and **Graph color**.

When you have finished the display settings, click **OK**. The measurement window is displayed as shown in Figure 7-2.

Since the reference object is set, the transmittance is 100% in Fig. 7-2.

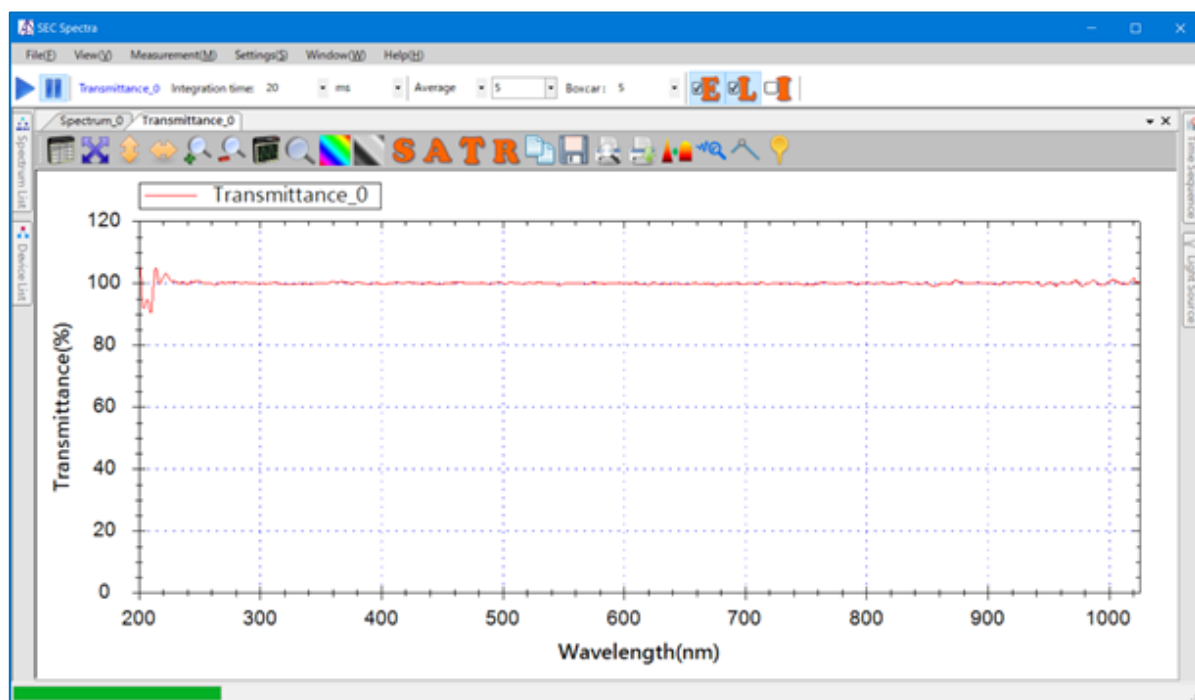


Figure 7-2. Newly created transmittance measurement window

### 7-3. Transmittance of Sample

Next, set the object to be measured and measure the transmittance. The result of measuring the sample is displayed in the figure 7-3.

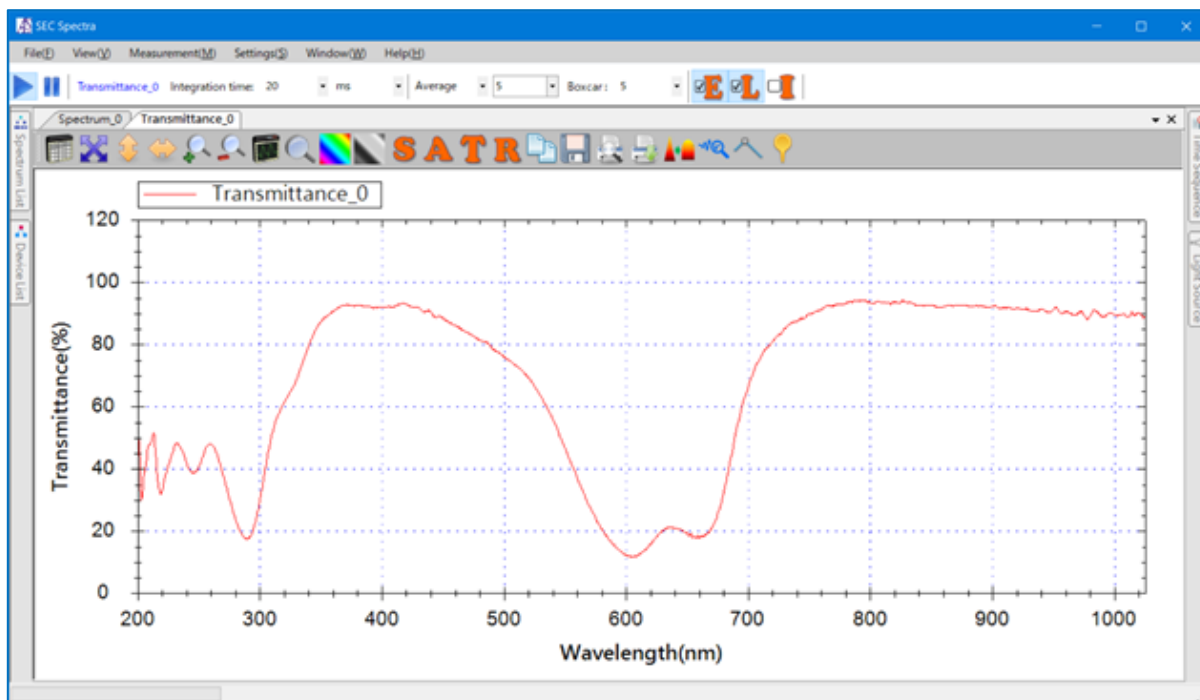


Figure 7-3. Transmittance of methylene blue solution

## 7-4. Saving Transmittance Measurement

The method of saving the transmittance spectrum is the same as that for the absorbance spectrum. For details, refer to "[14-8. Saving Current Spectrum](#)".

To load the previously saved transmittance spectrum, you can display the transmittance spectrum in a new or existing window on the software by clicking **Open Spectrum File** from the **File** menu. For details, refer to "[14-1-1. Open Spectrum File](#)".

If you want to print the spectrum of the transmittance spectrum, use the **Print Preview**  and **Print**



icons on the toolbar. For details, refer to "[14-9-3. Print Preview and Print](#)".

## 8. Reflectance Measurement

Reflectance is calculated from the reflection spectrum from the reference object and the reflection spectrum from the object to be measured. Therefore, to measure the reflectance, first irradiate the reference object with light source and measure the reflected light. Then, irradiate the object to be measured with light source and measure the reflected light. The program will automatically calculate the reflectance spectrum when the measurement is complete.

### 8-1. Creating a Reflectance Measurement

For reflectance measurement, select **Reflectance** from the **Measurement** menu to open the **New Reflectance Measurement window**, as shown below.

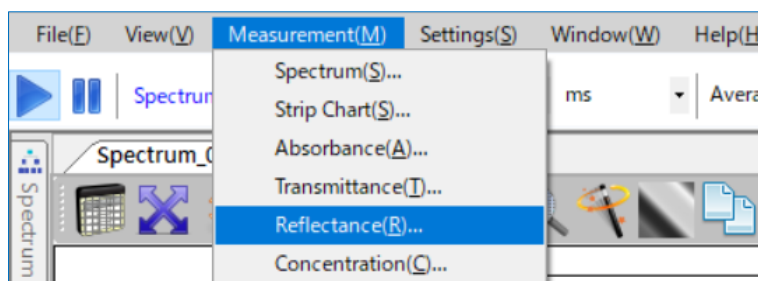


Figure 8-1. Selecting **Reflectance** from the **Measurement** menu

### 8-2. Setting Measurement Conditions

Set the measurement conditions in the same procedure as in "[6-1. Creating an Absorbance Measurement](#)".

On the **Source Device** screen, select the source device (displayed by device serial number) and press **Next**.

First, set the reference material in the cuvette holder. Then, on the **Data acquisition parameter** screen, set the **Integration time**, **Number of scans to average** and **Boxcar width**. When all the parameters are set, click **Next**.

Set the **Reference spectrum** and **Dark spectrum**.

On the **Display Settings** screen, set the **Window name**, **Spectrum title**, and **Graph color**.

When you have finished the display settings, click **OK**. The measurement window is displayed as shown in Figure 8-2.

In Figure 8-2, the reference object is set, so the reflectance is 100%.

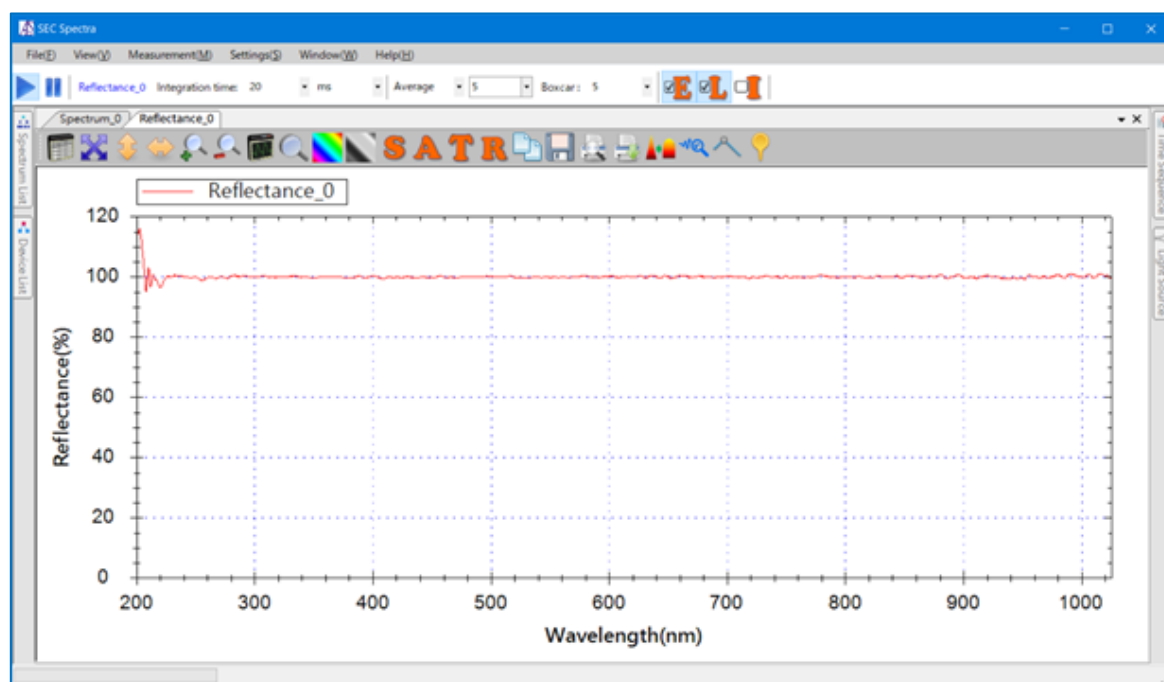


Figure 8-2. Newly created reflectance measurement window

### 8-3. Reflectance of Sample

Next, set the object to be measured and measure the reflectance. The figure below shows an example of the result of measuring the reflectance.

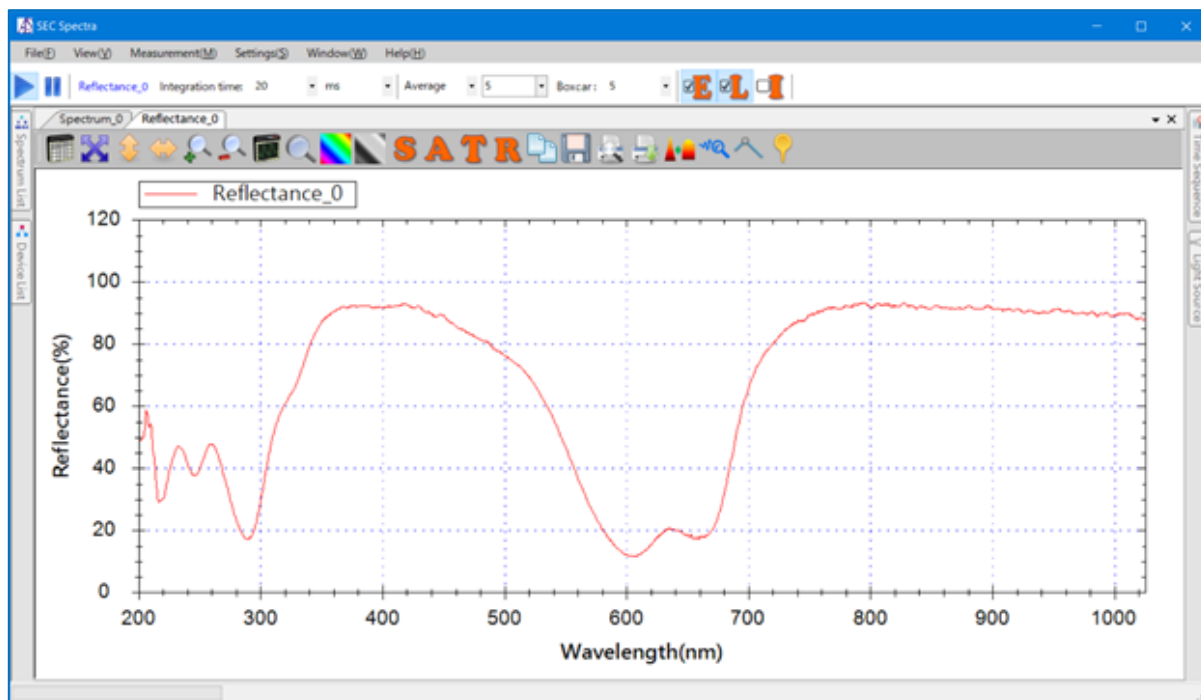


Figure 8-3. Reflectance measurement of a sample

## 8-4. Saving Reflectance Measurement

The method of saving the reflectance spectrum is the same as that for the absorbance spectrum. For details, refer to "[14-8. Saving Current Spectrum](#)".

To load the previously saved reflectance spectrum, you can display the reflectance spectrum in a new or existing window on the software by clicking **Open Spectrum File** from the **File** menu. For details, refer to "[14-1-1. Open Spectrum File](#)".

If you want to print the spectrum of the reflectance spectrum, use the **Print Preview**  and **Print**



icons on the toolbar. For details, refer to "[14-9-3. Print Preview and Print](#)".

## 9. Strip Chart (Recording Specific Wavelength)

SEC Spectra provides a **Strip Chart** for continuous observation of numerical changes in a specific wavelength or wavelength range. Since it is necessary to create the target spectrum in advance for the **Strip Chart** measurement, the following explanation is from the state where the "Absorbance\_0" spectrum curve has been created in advance.

### 9-1. Creating a Strip Chart Measurement

From the **Measurement** menu, select **Strip Chart** to open a **New Strip Chart** window:

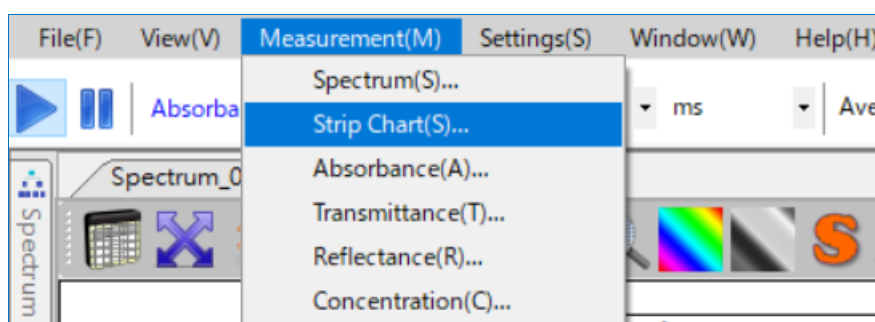


Figure 9-1. Selecting **Strip Chart** from the **Measurement** menu



### 9-1-1. Strip Chart Settings

The **New Strip Chart** window is shown in Figure 9-2.

First select the desired source spectrum from the **New Strip Chart-Strip Chart Settings** window. Software automatically selects the target measurement window that is currently open. You can also click manually. Figure 9-2 shows the case where **Absorbance\_0** is automatically selected.

Then, select the wavelength or wavelength range and press **Add**. If you want to add multiple wavelengths, repeat the operation selecting the desired wavelengths and press **Add**.

**Note:** The software will automatically select the closest wavelength.

**New Strip Chart...**

Strip Chart Settings

Select source spectrum:

Spectrum Title	Integration Time	Index
Spectrum_0	30000	0
Absorbance_1	30000	0

Wavelength to track

☒ Specific wavelength: 600.03 nm **Add** **Del**

☐ Wavelength rang (Average) 200.00 ~ 1025.00 nm

☐ Wavelength ratio Numerator 200.00 nm  
☐ range Denominator 200.00 nm

Select	Track Wavelength(nm)	Track DataName	Title Name	Track Type
<input checked="" type="checkbox"/>	299.91	Absorba...	Absorbance_1 299.9...	Specific ...
<input checked="" type="checkbox"/>	600.03	Absorba...	Absorbance_1 600.0...	Specific ...

**Record Setting** **Next >** **Cancel**

Figure 9-2. New Strip Chart - Strip Chart Settings

### 9-1-2. Record Settings

When you press **Recording Setting** button in Figure 9-2, the **Recording setting** screen (Figure 9-3) is displayed, and you can set the data acquisition **Interval** and **When to stop**. After completing the settings, press **OK**, and then press **OK** in the dialogue that appears.

After completing the settings, click **Next** in the **New Strip Chart-Strip Chart Settings** window (Figure 9-2).

#### Interval

If you check on **Synchronize with source**, it will be the same as the acquisition interval of the original spectrum. If you uncheck it and enter the acquisition interval, data will be acquired at the set interval. The default setting is 500 ms and can be changed to sec, min, hr as needed.

#### When to stop

Next, set the stop time. If you check on **Continue until stopped by user**, it will continue until you stop it by pressing the **Stop** icon on the toolbar of the Strip Chart measurement screen that opens in the next step. You can uncheck it, enter the recording time, and set the time until it stops.

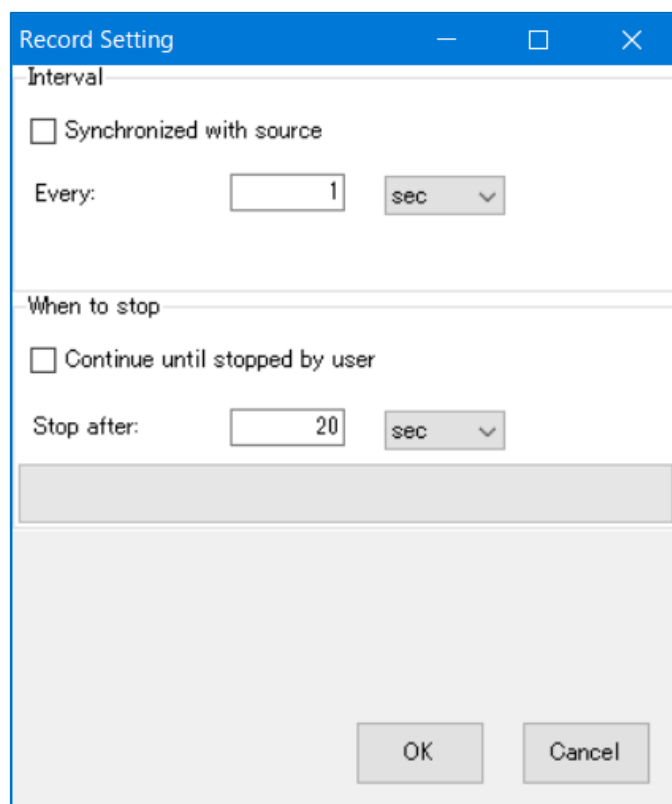


Figure 9-3. Strip Chart Settings - Record Setting

### 9-1-3. Display Settings

Now, on the **Display Settings** window, specify name for the new strip chart window. When all settings are done, click **OK**. SEC Spectra will display the newly created strip chart, as in the following figure:

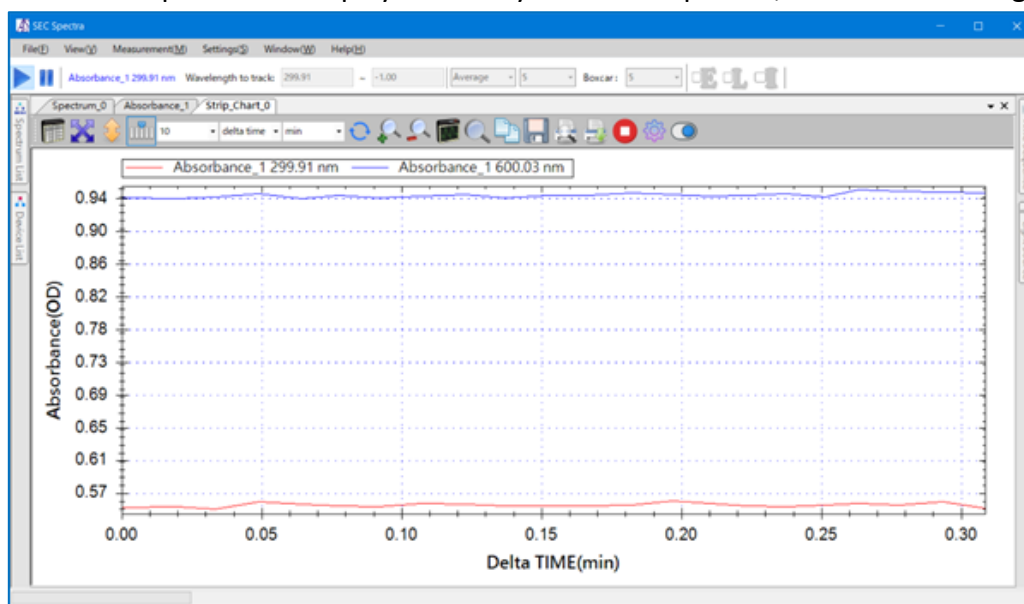


Figure 9-4. Newly created Strip Chart window

In figure 9-4, strip chart curves are displayed at 10-minute intervals. The X-axis scale has a default interval of 10 minutes. The X-axis width is automatically adjusted up to the default 10 minutes, and automatically scrolls to the left if it exceeds 10 minutes.

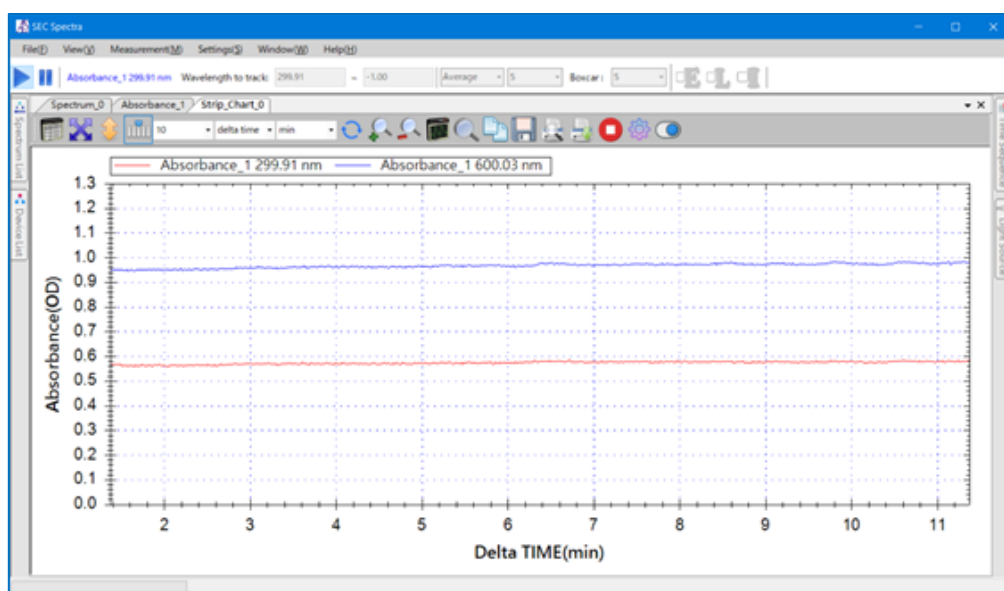


Figure 9-5. The chart starts scrolling after ten minutes

**Note:** When multiple wavelengths are added in the **Strip Chart Settings**, not all curves may be displayed. In this case, press the **autoscale** icon on the toolbar to show all curves.

## 9-2. Toolbar Icons

In the graph toolbar, in addition to the icons for scale adjustment, saving, printing, etc., which are similar to spectrum measurement, there are icons dedicated to the Strip Chart (where marked with a red border).



Figure 9-6. The toolbar icons of Strip Chart

### 9-2-1. Strip Chart View

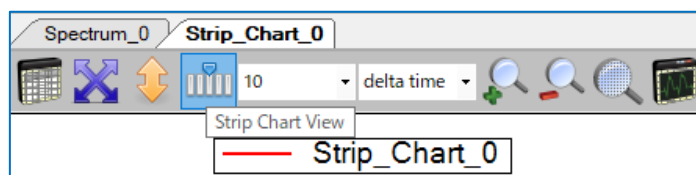


Figure 9-7. The **Strip Chart View** icon

This icon allows you to stop scrolling the Strip Chart window. Strip Chart emulates a continuous chart paper, so the graph will scroll to the left. Pressing this button will temporarily freeze the scrolling. Press the button again can unfreeze it. Freezing the strip chart will not stop it from capturing new data. The software will keep recording new data in the background, so you will see continuous data when you unfreeze the chart.

When scrolling is active, this icon has a blue frame, and when scrolling is inactive, it lacks the frame. See the following figure:

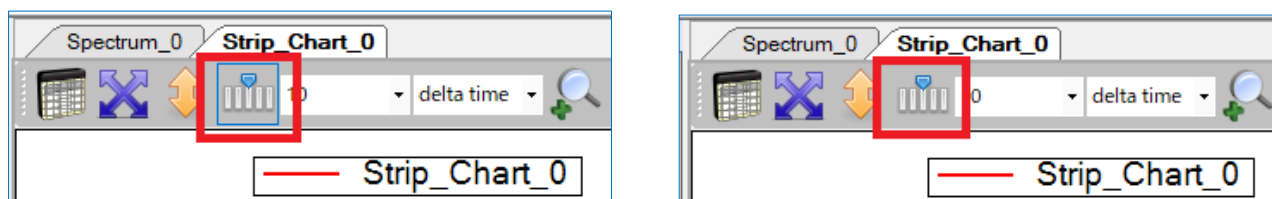


Figure 9-8. The "active"(left) and "inactive"(right) states of the **Strip Chart View** icon

### 9-2-2. Data Display (X-axis)

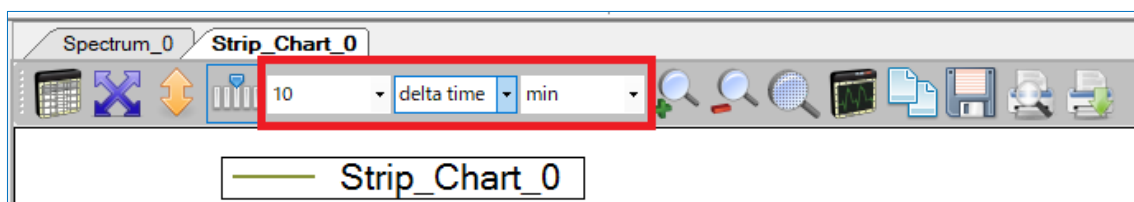


Figure 9-9. The control for modifying the time period for data display

Here, you can specify the X-axis display of the strip chart. The display format can be selected from: **delta time** (the elapsed time from the start of acquisition), **delta data** (the number of data from the acquisition start), and **min, hour, day** (time, date).

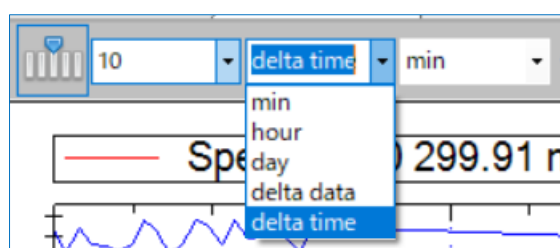


Figure 9-10. X-axis display of Strip Chart

When setting to **delta time**, the unit can be selected from: **s** and **min**.

For **delta time** and **delta data**, the width can be selected from: 10, 20, ..., 100.

The default X-axis display is delta time, with a width of **10** and units of **min** (minutes).

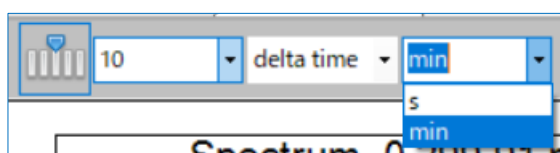


Figure 9-11. Unit of delta time

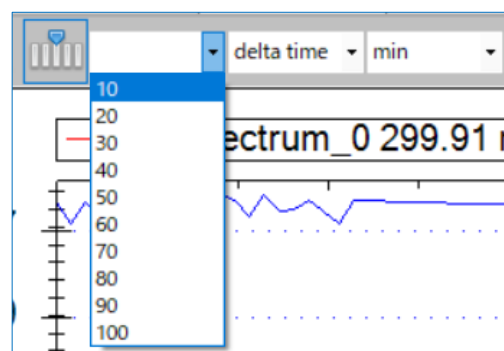




Figure 9-12. Display width of delta time

### 9-2-3. Reset and Stop Icon

Press the reset icon  to reset the acquired data of the Strip Chart. The newly imported data will be

the first data. Press the stop icon  to stop the Strip Chart screen.

### 9-2-4. Record Setting Icon

When you press the recording setting icon , the recording setting window

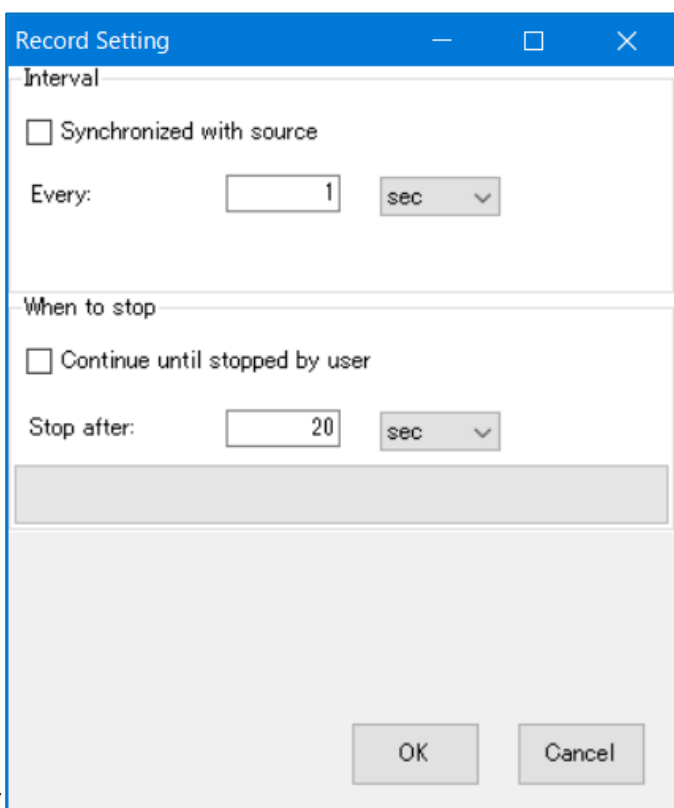


Figure 9-3. Strip Chart Settings - Record Setting) is displayed. You can edit the recording conditions.

### 9-2-5. Scroll Bar State Icon

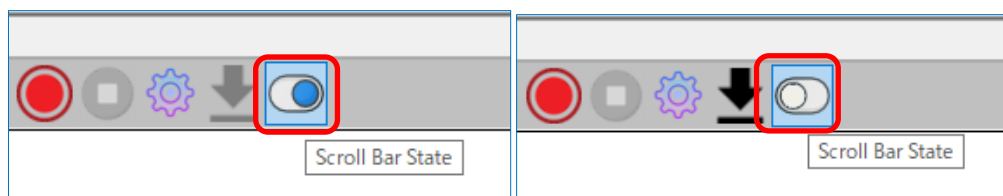



Figure 9-13. Scroll Bar State icon

If you press the **Scroll Bar State** button to make it the blue state shown above, the spectrum data will always be displayed with the latest data (lower region of the data frame). When **Scroll Bar State** is white, it is displayed in the normal order(upper region of the data frame).

## 9-3. Saving Strip Chart

Click the save icon  on the graph toolbar to save the Strip Chart data. A file will be formed for each wavelength measured. You can save the spectrum checked for selection at the same time. Click the save icon on the graph toolbar to save the Strip Chart data. A file is formed for each measurement

wavelength. You can save the spectrum checked in **Select** at the same time. You can select the file type from **spt** and **csv** by clicking the **Application Settings** icon (refer to "14-3-2. Save").

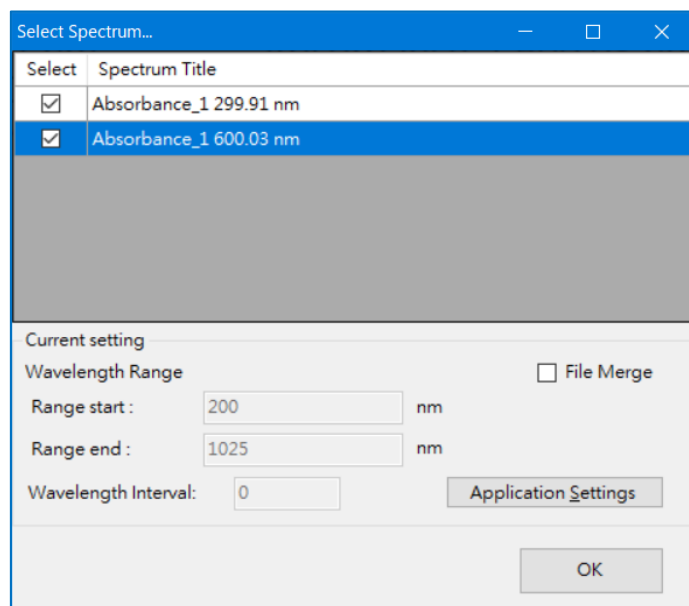


Figure 9-14. Saving a Strip Chart

## 9-4. Loading Strip Chart File

To load a previously saved Strip Chart result (extension **spt**), you can view the Strip Chart result in a new/existing window on the software by clicking **Open Spectrum File** from the **File** menu. For details, refer to "14-1-1. Open Spectrum File、14-1-2. Open Strip Chart File" .

The following is an example of displaying multiple items in a **New window-Same window**.

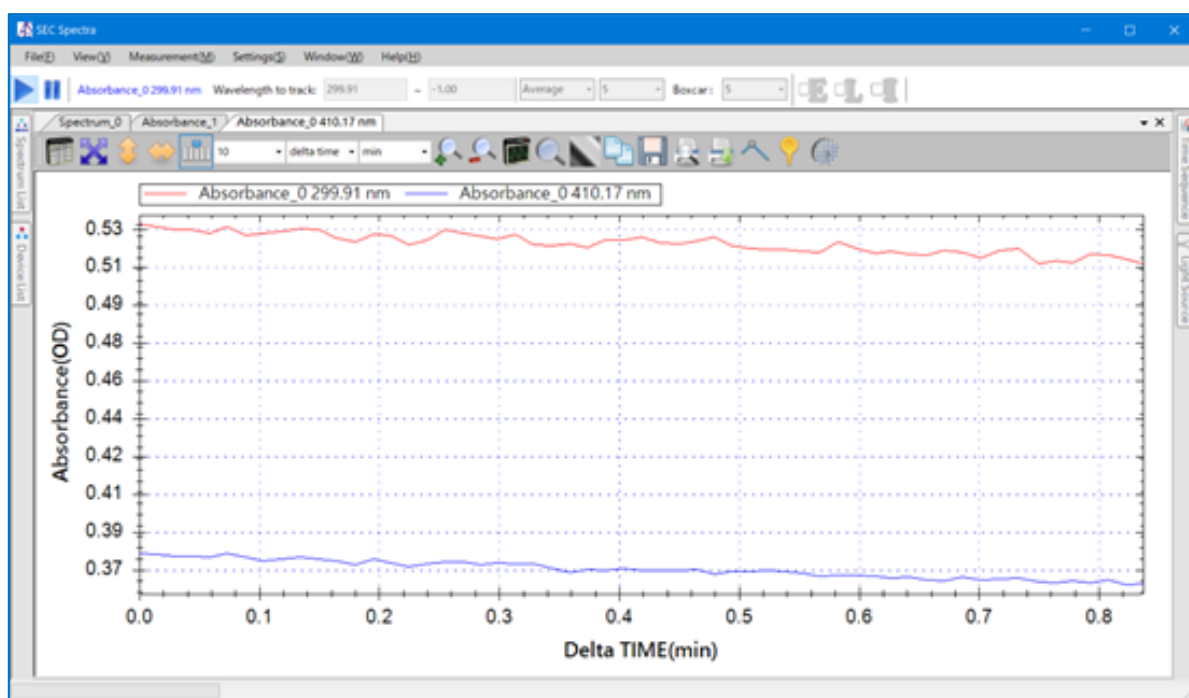


Figure 9-15. Displaying the StripChart results in a **New window-Same window**

## 10. Time Sequence Measurement (Recording Full Wavelength)

### 10-1. Time Sequence Window

SEC Spectra provides a **Time Sequence** function that records changes in full wavelength range (or the save wavelength range set in "14-3-2. Save") over a period of time. From **View--Time Sequence Measurement** on the menu bar, or by moving the mouse cursor over **Time Sequence** button on the right edge of the SEC Spectra window, the **Time Sequence** window is displayed.

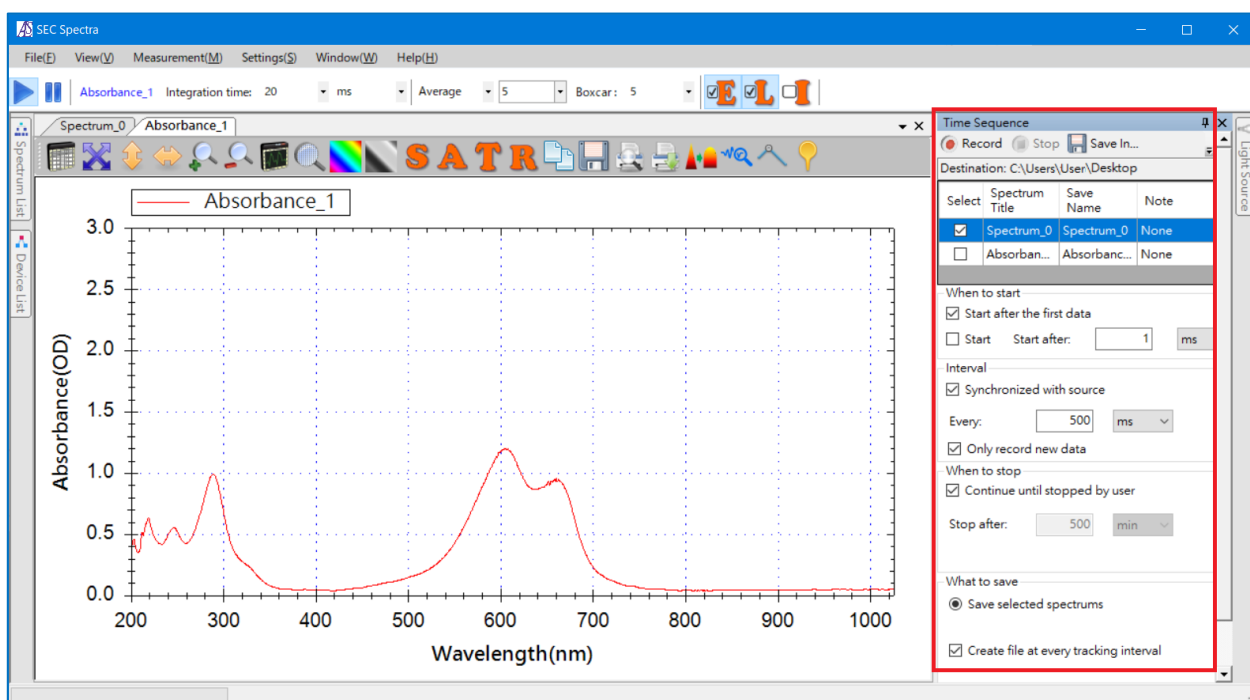


Figure 10-1. The **Time Sequence** button and the **Time Sequence** window

When you move the mouse, the window closes automatically. If you want it to stay on the screen, you can click on the push-pin icon on the upper-right corner of the pane to fix it. See the following figure:

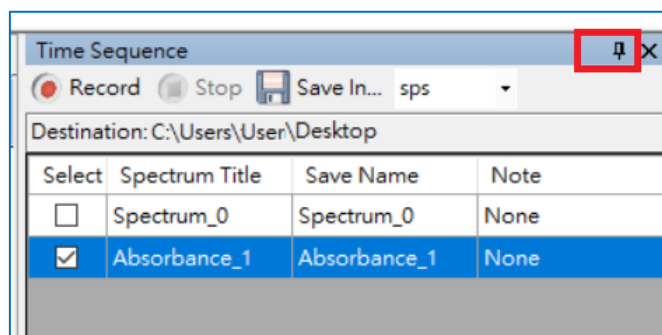


Figure 10-2. The push-pin for pinning the **Time Sequence** window



## 10-2. Settings of Time Sequence Measurement

### 10-2-1. Selecting Spectrum

First, select the spectrum to be recorded. The software will automatically select the currently open measurement window. Figure 10-3 shows an example where **Absorbance\_0** is automatically selected. You can also select it manually by checking **Select** box to the left of the spectrum name.

**Note:** Do not change the window while recording as this will be deselected if you open or work with another window during recording. Also, if you press the record icon and the message "Spectrum is not selected" is displayed, the selection may have been disabled by some operation, so please check on the **Select** frame again manually.

### 10-2-2. Specifying the save destination folder

First, you need to specify the folder to save the recorded data. The default is the desktop. If necessary, it is possible to change it using the **Save In...** icon on the top of this window.

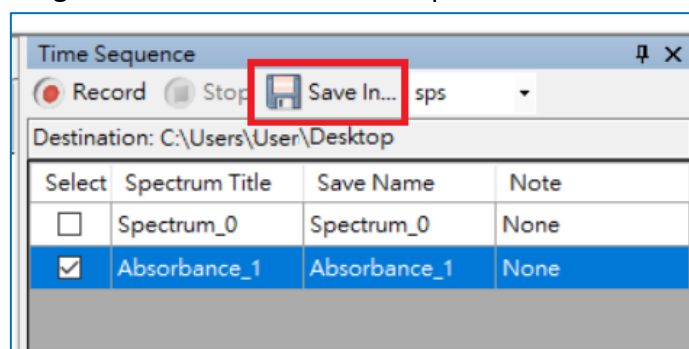


Figure 10-3. **Save In** icon in the **Time Sequence** window

### 10-2-3. When to Start

Next, specify the start time. The default setting is **Start after the first data**. You can set the delay time for synchronization with the quiet time of the electrochemical measurement. The default setting is **1 ms** (millisecond). In effect, recording starts as soon as you click the **Record** button. **Never set to zero (0) here, or there will be an error.**

If you want to start recording immediately by pressing Record icon, please check on **Start**.

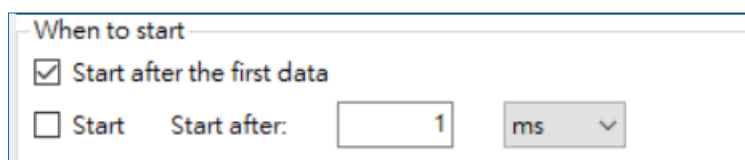
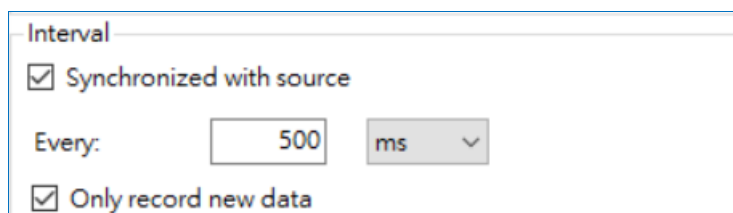


Figure 10-4. Setting **When to start**

### 10-2-4. Interval

You can set an acquisition interval for the recording. The default interval is **Synchronize with source** to keep an equal acquisition interval of the original spectrum. If unchecked, it will be acquired at the input interval (default setting: 500 ms). If necessary, it can be changed to **sec**, **min**, **hr**.



Interval

☒ Synchronized with source

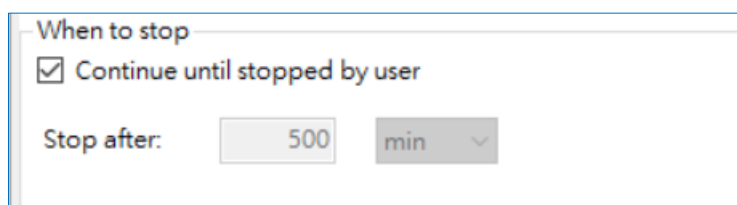
Every:  ms

☒ Only record new data

Figure 10-5. Setting **Interval**

### 10-2-5. When to Stop

Next, specify the stop time. The default is **Continue until stopped by user**, until you press the **Stop** icon at the top of the pane to stop recording. If it is unchecked, it automatically stops at the set time.



When to stop

☒ Continue until stopped by user

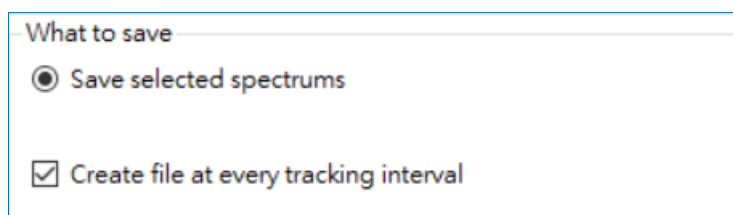
Stop after:  min

Figure 10-6. Setting **When to Stop**

### 10-2-6. What to Save

By default, **Create file every data acquisition interval** is checked. Each data acquisition interval is saved in a file format according to each measurement mode (file type: **sps**), and can be opened from **File-> Open Spectrum File**.

Next, specify the spectrum to be saved. The default is all the measured spectrum curves. If **Create file at every tracking interval** is unchecked, it will be saved as a file format dedicated to time sequence measurement (file type: **sps**), and can be played from **File -> Open Time Sequence File**. For details, refer to "10-4. Loading and Playing Time Sequence File".



What to save

☒ Save selected spectrums

☒ Create file at every tracking interval

Figure 10-7. Setting **What to save**

### 10-2-7. Selecting File Format

As mentioned above, the save file format is **sps** or **spc** depending on whether **Create file at every tracking interval** is checked, but it is also possible to use **scv** format.

It can be selected in the dropdown Menu next to the **Save to ...** icon at the top of the window.

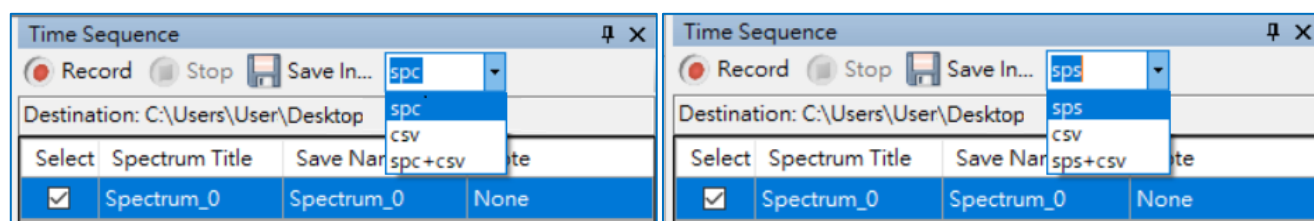


Figure 10-8. Select the save file format

## 10-3. Recording Time Sequence Measurement

After setting the above options, press the **Record** button at the top of the window to start recording.

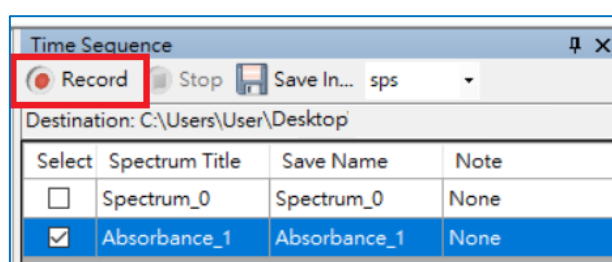


Figure 10-9. **Record** icon

**Note:** If you make multiple measurements and record, you will see the message "Please make only one measurement for each spectrometer. You may lose some of your data.", please click on **Continue**.

During and after recording, a green band may appear on the software screen, indicating that the spectrometer is communicating with the computer. Regardless of this indication, data will be recorded and saved according to the setting conditions.

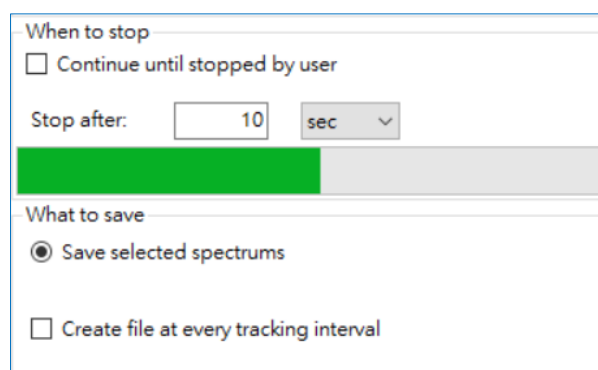


Figure 10-10. Green band display

## 10-4. Loading and Playing Time Sequence File

The file (extension **sps**) saved in **Create file at every tracking interval** can be opened by selecting **Open spectrum file** from the **File** menu. For details, refer to “14-1-1. Open Spectrum File”.

The data saved without checking **Create file at every tracking interval** (extension **spc**) can be read from **Open Time Sequence File** in the File menu.

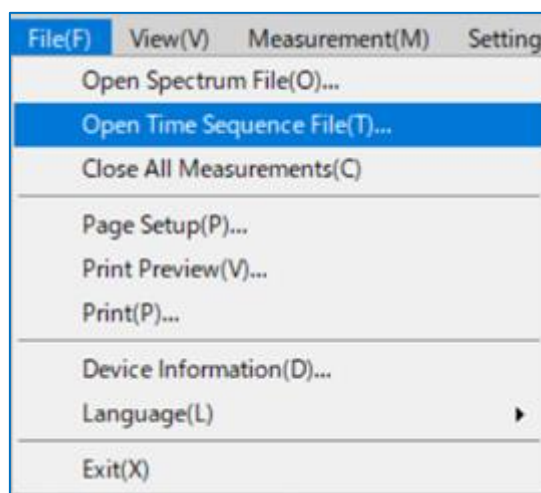


Figure 10-11. Selecting **Open Time Sequence File** from the **File** menu

This opens the system standard **Open** window. Now locate the file you saved earlier, and then click the **Open** button.

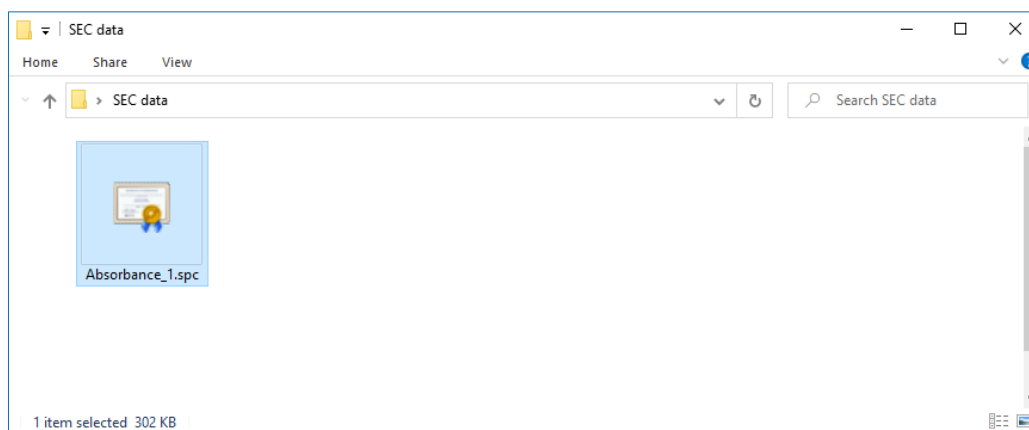


Figure 10-12. Selecting previously saved file in the **Open** window

Once the file is opened, SEC Spectra will display the playback tools for the time sequence file.

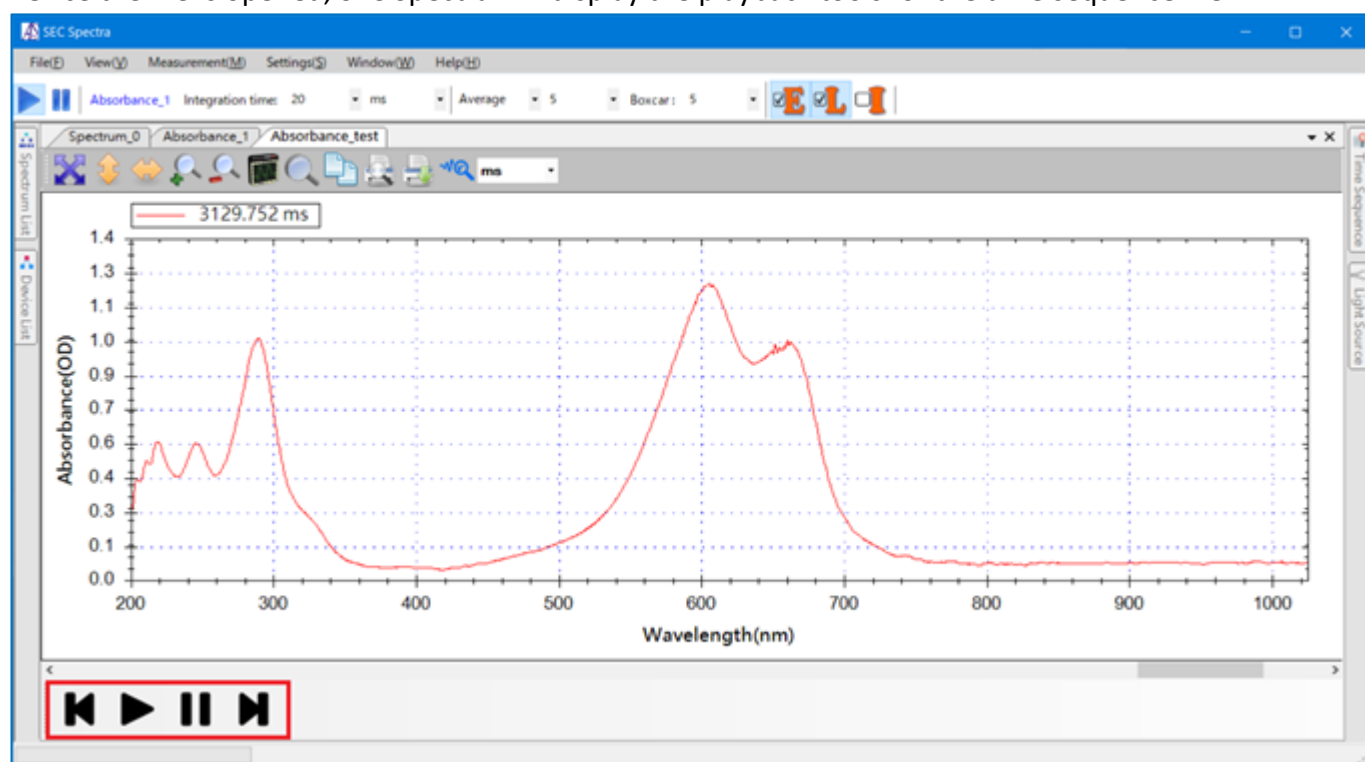


Figure 10-13. The playback tools for the time sequence file

As shown in the above figure, there are icons that allow the user to **Fast-rewind**, **Play**, **Pause**, and **Fast-forward** the playback of time sequence (see the red highlighted area near the bottom). These icons work just like the way they do in video playback. Through playback, you can easily go back and forth to find out how the measurement reading changes. Moreover, you will notice that the time sequence file will keep playing over and over again once it is loaded until you press the **Pause** button.

# 11. Relative Irradiance Measurement

Relative Irradiance measurement is a measurement method for confirming the spectral waveform of a luminescent sample such as fluorescence or electrochemical emission to a reference light source with a known color temperature.

## 11-1. Creating a Relative Irradiance Measurement

To start a new relative irradiance measurement, press "I" icon at the top of the toolbar to open the setting screen.



Figure 11-1. **Relative Irradiance** from the I icon

Next, please select source device on the **Source Device** window. Then, click **Next**.

### 11-1-1. Color Temperature

Set the color temperature of the reference light source. Example: It is 5500K when both the D2 and HAL lamp of the SEC2020 spectrometer system are used. It is 2800K when only the halogen lamp is used.

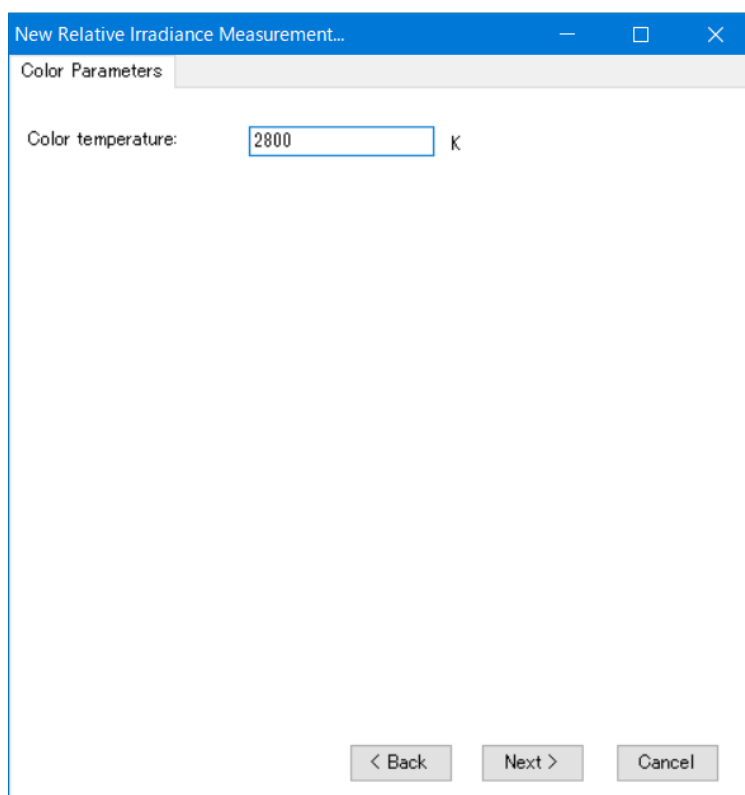


Figure 11-2. Setting color temperature

## 11-1-2. Setting Measurement Conditions

Next, set the Integration time, Average, and Boxcar in **Data acquisition parameters**. When you have finished setting all the parameters, click **Next**.

Set the reference spectrum when the reference light source is on and the dark spectrum when it is blocked.

Specify the graph window name, spectrum name, and graph curve color in **Display Settings**. Press **OK**.

When the setting is completed, SEC Spectra will display the relative irradiance measurement graph. The figure below is an example of the relative irradiance spectrum when only the halogen lamp of the SEC2022 light source is turned on.

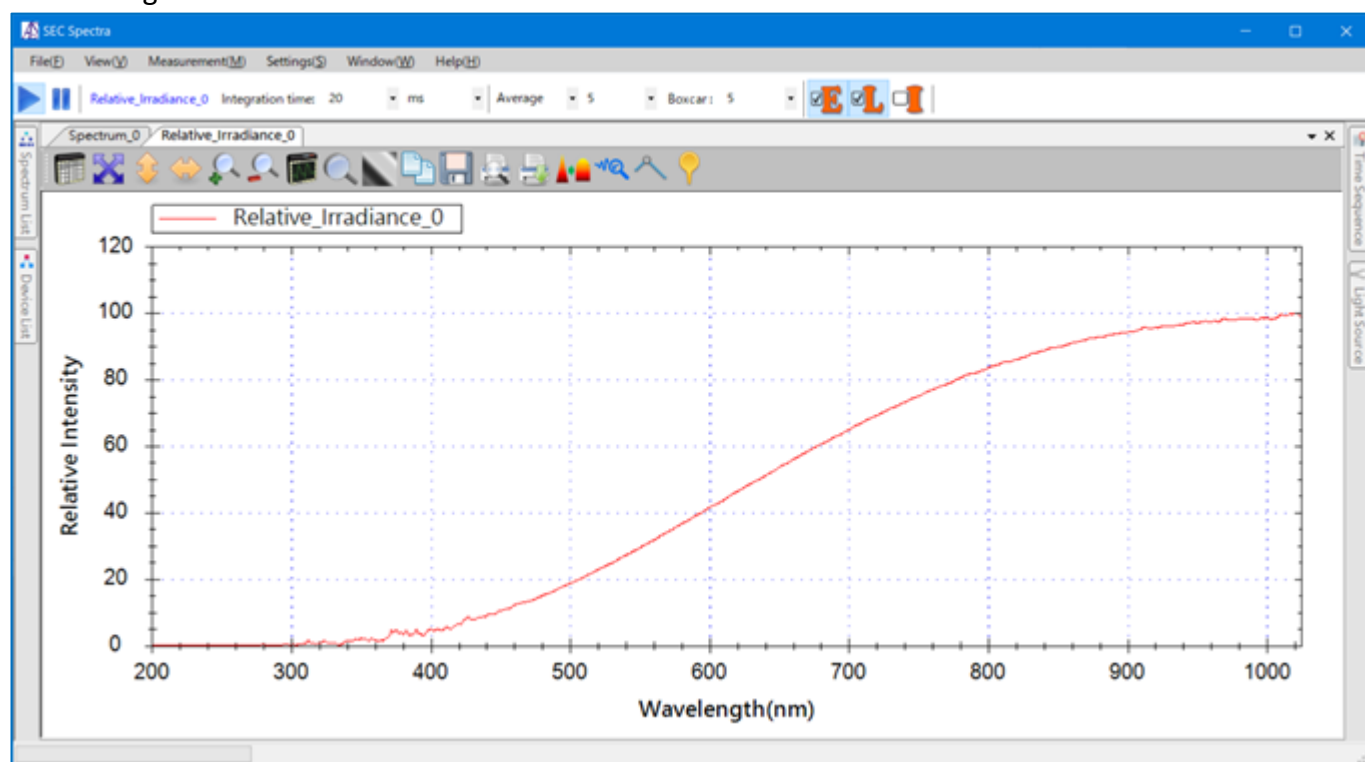


Figure 11-3. Newly created Relative Irradiance measurement window

## 11-2. Relative Irradiance Sample Measurement

Install a sample and measure the Relative Irradiance.

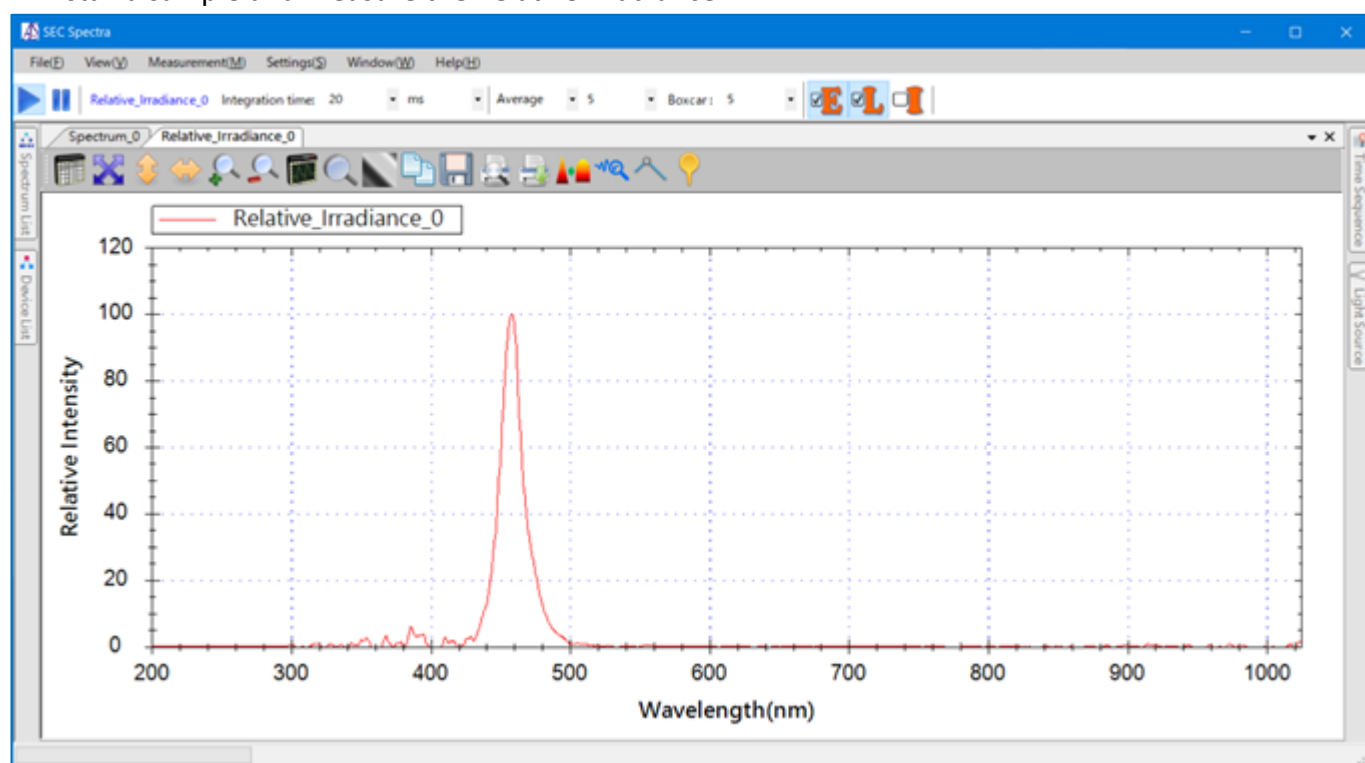




Figure 11-4. The Relative Irradiance measurement graph for a LED lamp

## 11-3. Saving Related Irradiance Measurement

The method of saving the current Relative Irradiance spectrum is the same as that for the absorbance spectrum. For details, refer to "[14-8. Saving Current Spectrum](#)".

To load a previously saved Relative Irradiance spectrum, you can display in a new or existing window on the software by clicking **Open Spectrum File** from the **File** menu. For details, refer to "[14-1-1. Open Spectrum File](#)".

If you want to print the spectrum of the Relative irradiance spectrum, use the **Print Preview**  and **Print**  icons on the toolbar. For details, refer to "[14-9-3. Print Preview and Print](#)".



## 12. Concentration Measurement

Spectrum-based concentration measurement captures the spectrum of a light source after it passes through the test solution, and then compares the spectrum with the light source's original spectrum to come up with the concentration of the solution by applying a known calibration table or the Beer's Law. Accordingly, as in the absorbance measurement, the spectrum of reference solution is measured first, then the spectrum of the test solution. SEC Spectra provides a straightforward procedure to measure concentration. All you have to do is follow the step-by-step windows to create a concentration measurement.

### 12-1. Creating a Concentration Measurement

To create a concentration measurement, please select **Concentration** from the **Measurement** menu to open the **New Concentration Measurement** window, as shown in the following:

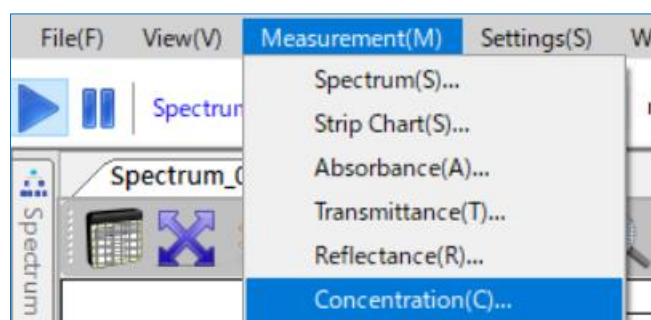


Figure 12-1. Selecting **Concentration** from the **Measurement** menu

#### 12-1-1. Setting Measurement Conditions

Set the measurement conditions in the same procedure as in "6-1. Creating an Absorbance Measurement".

On the **Source Device** screen, select the source device (displayed by device serial number) and press **Next**.

First, set the reference material in the cuvette holder. Then, on the **Data acquisition parameter** screen, set the **Integration time**, **Number of scans to average** and **Boxcar width**. When all the parameters are set, click **Next**.

Set the **Reference spectrum** and **Dark spectrum**.

On the **Display Settings** screen, set the **Window name**, **Spectrum title**, and **Graph color**.

## 12-2. ConcentrationSettings

After completing the display settings, press **OK** to open the **Concentration Settings** screen. Set the information to calculate the concentration from the measured spectrum. There are two calculation methods: one is to create a calibration curve from samples with known concentration (Figure 12-2), and another is to specify the parameters of Lambert-Beer's law (Figure 12-3).

Figure 12-2. Concentration Settings - Calibration Table From Known Concentration

Figure 12-3. Concentration Settings - Beer's Law Settings

### 12-2-1. Creating a Calibration Curve from Known Concentration

The following is an example of how to create a calibration curve from a sample with a known concentration.

- ① Place the solution of known concentration (No. 1) in the cuvette holder, and enter **Specific wavelength** (420 nm in this case) in the **Wavelength** field of the **Create calibration data from known concentration** screen, and the software will automatically select the closest wavelength.
- ② Next, enter the value corresponding to **Concentration** in the **Calibration data** field and press **Get** icon to measure the absorbance.
- ③ Click **Add to list** icon. Add this absorbance to the table list on the right.
- ④ Then, place a solution of known concentration (No.2) in the cuvette holder. Then enter the **Concentration** value and press **Get** icon to measure the absorbance of this concentration.
- ⑤ Repeat the same operation using solution of known concentration. If you get 2 points, the parameters of the regression curve will be displayed.
- ⑥ If you want to delete the data, select the data row in list and click **Delete** icon to delete the point.
- ⑦ **Compound name** and **Concentration unit** entered here will be displayed in the concentration measurement graph (Figure 12-5).

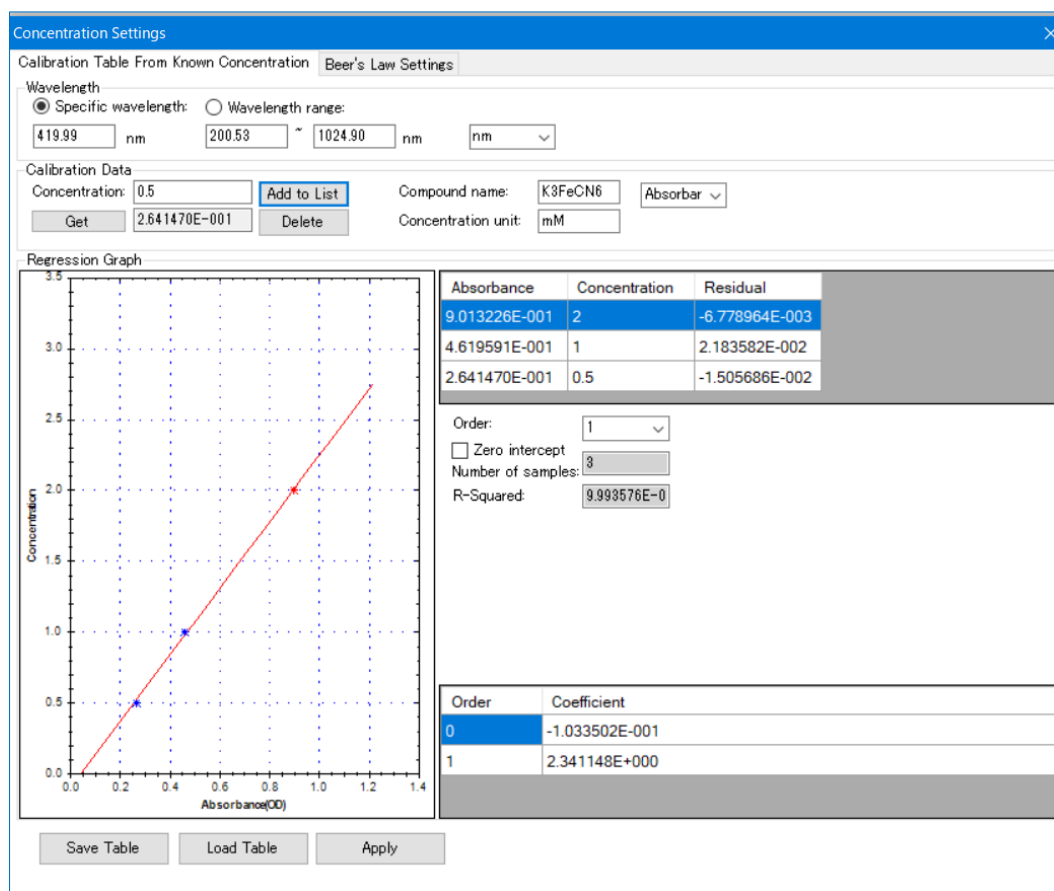


Figure 12-4. Configuration of **Concentration Settings - Calibration Table From Known Concentration**

When you have finished setting the concentration curve, you can save the concentration calibration data using **Save Table** button at the bottom of the screen. The saved data can be loaded using the **Load Table** button. When you have finished the settings, click **Apply**. Once the settings have been applied, the concentration curve will be displayed in a measurement window similar to the Strip Chart, as shown below.

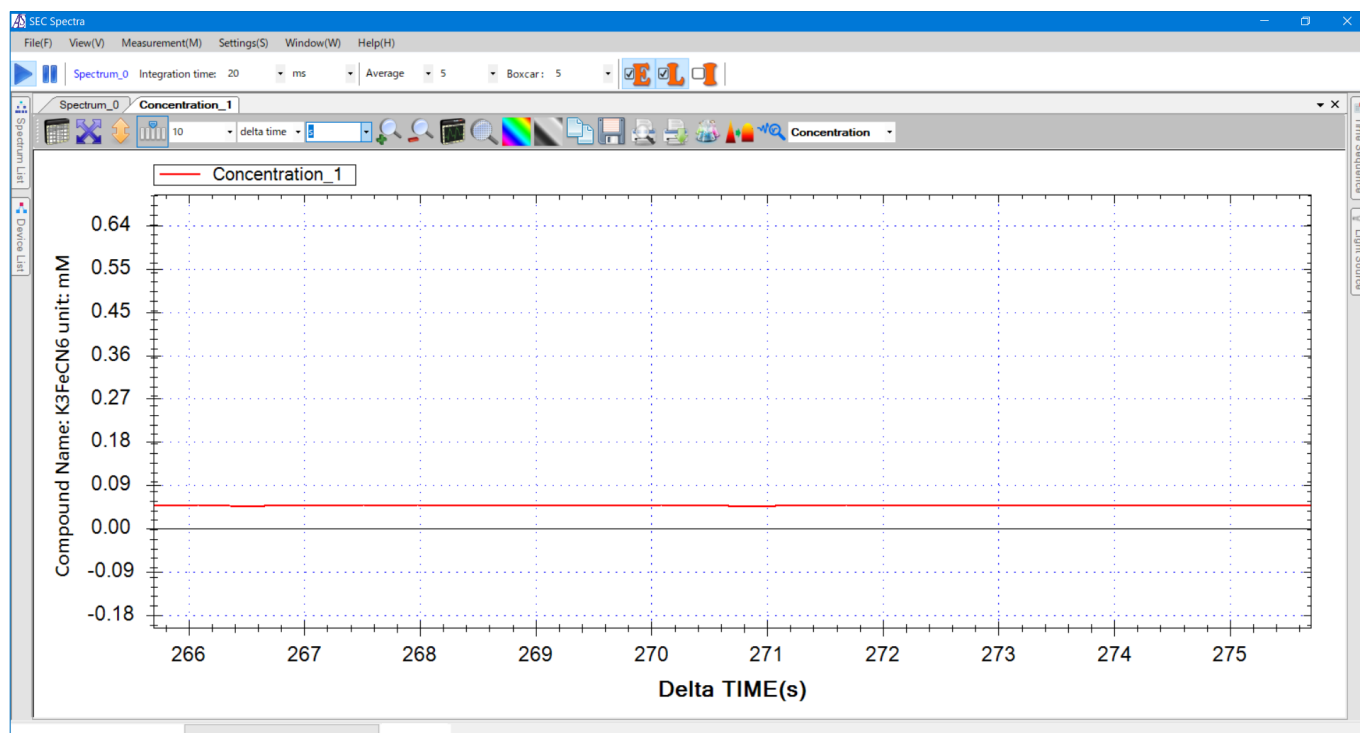


Figure 12-5. Newly created concentration measurement graph

### 12-2-2. Beer's Law Settings

If you want to measure the concentration from Lambert-Beer's law, click on the **Beer's Law Settings** tab, set the parameters in the following screen and click **Apply** to create the measurement diagram (Figure 12-5).

**Molar absorptivity ( $\epsilon$ ):** Enter the absorption coefficient of the compound. Enter the coefficient according to the concentration unit you want to display.

If the concentration unit is molar (M), enter the coefficient unit in " $\text{M}^{-1} \cdot \text{cm}^{-1}$ ";

if the concentration unit is mmol (mM), enter the coefficient unit in " $\text{mM}^{-1} \cdot \text{cm}^{-1}$ ".

**Path length:** Enter the optical path length (cm) of the cell used for measurement.

**Wavelength:** Enter the absorption peak wavelength (nm) to be measured.

Once the **Compound name** and **Concentration unit** have been entered, they will be displayed as **Compound Name** and **unit** in the concentration measurement graph.

Concentration Settings

Calibration Table From Known Concentration   Beer's Law Settings

Molar absorptivity ( $\epsilon$ ):   $1/(\text{cm} \cdot \text{mol})$

Path length:  cm

Wavelength:  nm

Compound name:

Concentration unit:

Figure 12-6. Beer's Law Settings

### 12-3. Start Measuring the Concentration of Test Solution

The solution to be measured is then placed in the cuvette holder and the concentration is measured. Use the **Auto scale** icon to adjust the display.

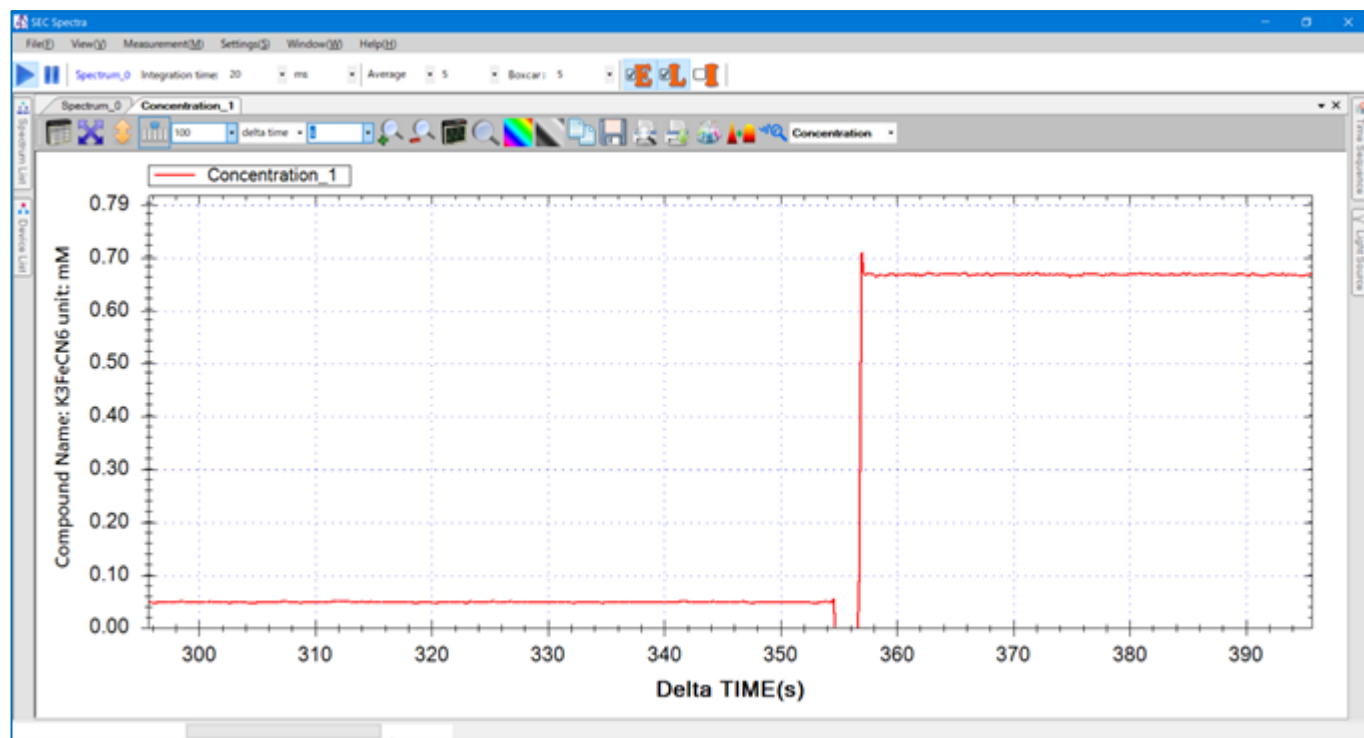


Figure 12-7. The concentration graph of the test solution

### 12-4. Concentration Setting Icon


Except for the same toolbar icons as in Strip Char, there is a button dedicated to **Concentration Setting** for concentration measurement. See the following figure:



Figure 12-8. **Concentration Setting** icon

**Concentration Setting** icon opens the window for you to specify the **Calibration Table From Known Concentration** and **Beer's Law Settings**.

## 12-5. Saving the Concentration Measurement

The procedure for saving the concentration measurement results is the same as for Strip Chart, using the **Save** icon  on the toolbar. Please refer to "9-3. Saving Strip Chart" of Strip Chart measurement.

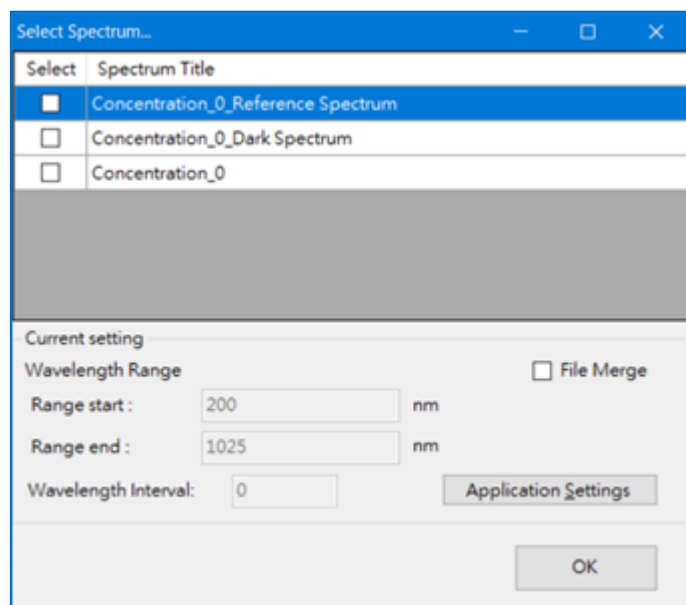


Figure 12-9. Saving the concentration measurement

To load the previously saved concentration measurement result, open it from **Open Spectrum File ...** in the **File** menu. For details, refer to "14-1-2. Open Strip Chart File".

The result of one concentration measurement is calculated by multiple spectral curves. Therefore, **do not delete any curve**. If you delete any of the curves, the result will not be calculated correctly.

## 13. Trigger Mode Settings

The SEC2020 spectrometer system supports "trigger mode". The external TTL signal applied to the spectrometer's I/O port controls data acquisition of the spectrometer.

Please refer to chapter "Synchronization with other devices" of "SEC2020 Spectrometer System User's Guide -Devices-".

### 13-1. Enable Trigger Mode

To use the trigger function, the instrument must be set to trigger mode. Prepare a spectrum such as Spectrum or Absorbance measurements in advance.

Select **Trigger Settings** from the **Settings** menu.

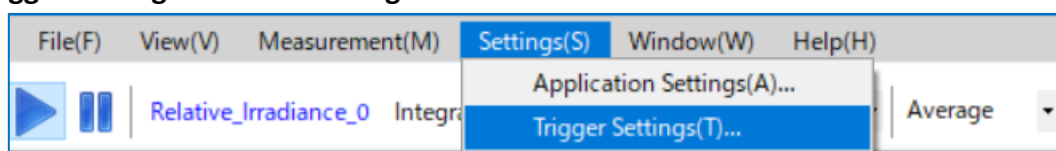


Figure 13-1. Select **Trigger Settings** from the **Settings** menu

The **Trigger Settings** window shows:

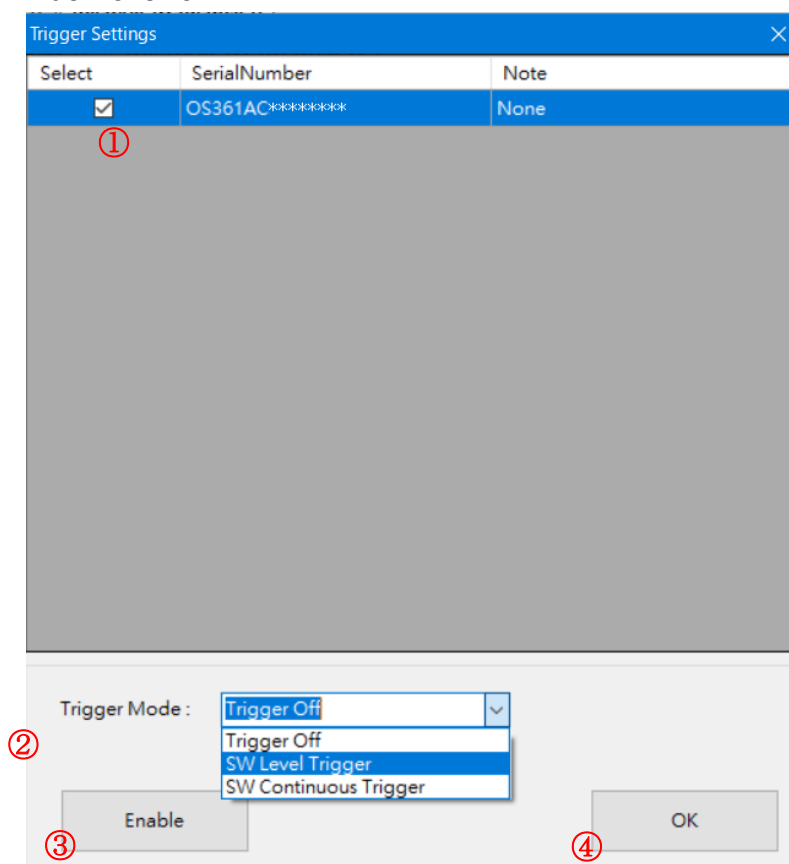


Figure 13-2. Setting Trigger Mode



Follow the steps below to set up trigger mode.

① Check the selection (serial number).

② Select the trigger mode:

**SW Level Trigger:** Starts/Stops software measurement by TTL signal.

**SW Continuous Trigger:** Starts software measurement with TTL signal. To stop it, manually stop the software.

③ Click **Enable** icon to activate the trigger mode setting.

④ Click **OK** icon to exit the screen.

The spectrum acquisition mode is now the trigger mode.

At this time, the signal on the spectrum screen stops and the data acquisition is stopped. The external TTL signal applied to the I/O port of the spectrometer is at “Low level” and the spectrometer is in standby mode.

**Note:** If data acquisition does not stop after switching to trigger mode, confirm the TTL signal applied to the I/O port or the software settings, as data acquisition starts when the TTL signal goes to “High level”.

You can check the current mode status from **Spectrum List--Mode: \*\***. The figure below shows the state set for **SW Continuous Trigger** mode.

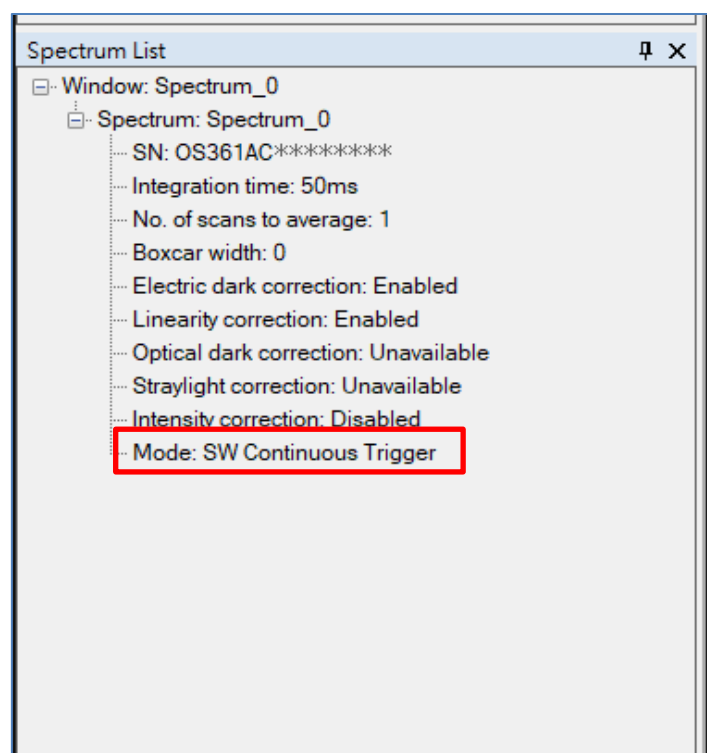


Figure 13-3. Spectrum List-- Mode: SW Continuous Trigger

## 13-2. Trigger Off (Normal Mode)

To return from trigger mode to normal mode (trigger off), select **Trigger Settings** from **Settings** menu and set according to the following procedure.

- ① Check the selection (serial number).
- ② Select the trigger mode:  
**Trigger Off**: Releases from the trigger state.
- ③ Click **Enable** icon to activate the changing of the mode.
- ④ Click **OK** icon to exit the screen.

At this time, the signal on the spectrum screen moves and data is acquired.

You can check the current mode status from **Spectrum List--Mode: \*\***. The figure below shows the state set for **Trigger Off** (normal) mode.

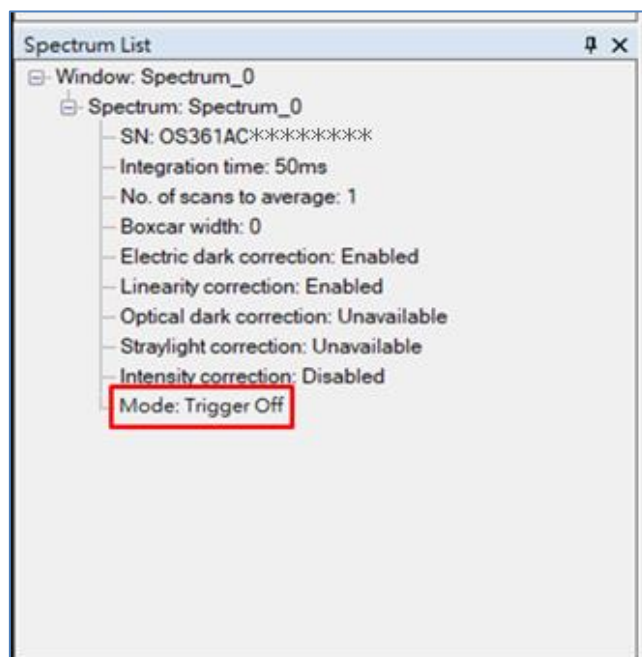


Figure 13-4. Spectrum List-- Mode: Trigger Off

## 14. Software Operation Methods

This chapter describes the basic operation methods such as software menus and icons.

### 14-1. File Menu

#### 14-1-1. Open Spectrum File

You can read the saved spectrum curve (extension **sps**) and analyze the data on the software or compare it with the current spectrum.

The procedure is as follows.

From the **File** menu, click **Open Spectrum File ...**

The **Open Existing File** screen is displayed. Use the **Browse** icon to select a previously saved file. Then click **Next** to display the **Display Settings** screen.

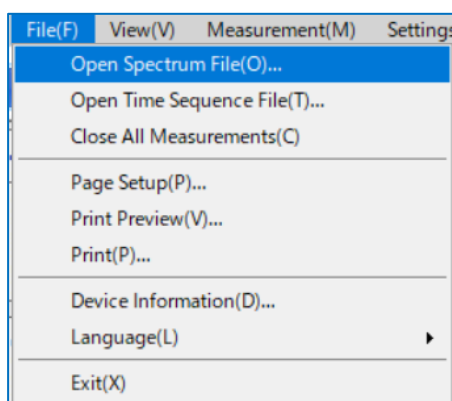


Figure 14-1. Select **Open Spectrum File** from the **File** menu

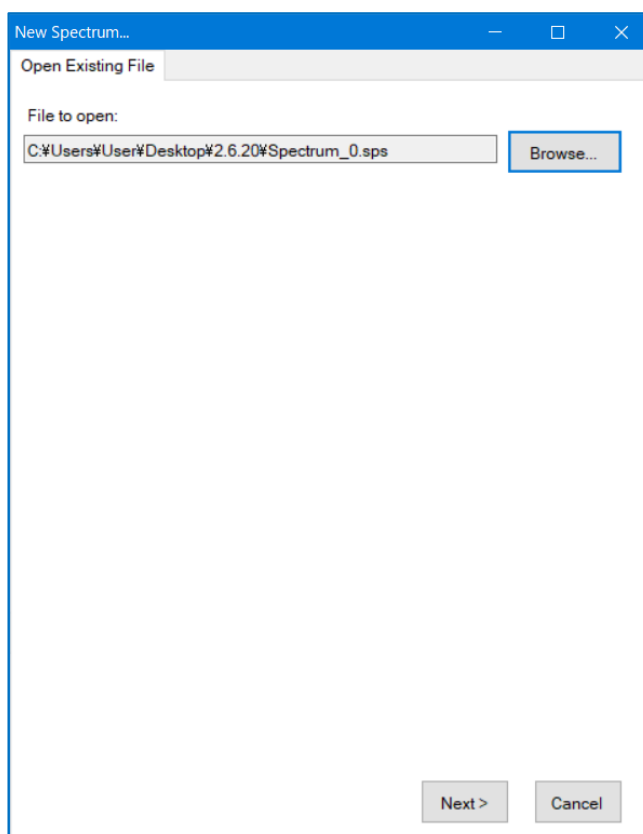


Figure 14-2. **Open Existing File**

On the **Display Settings** screen, select **Select existing window** to display the spectrum in the current **Spectrum\_0** window. **Display in new window** creates a window separate from **Spectrum\_0**. Press **OK**.

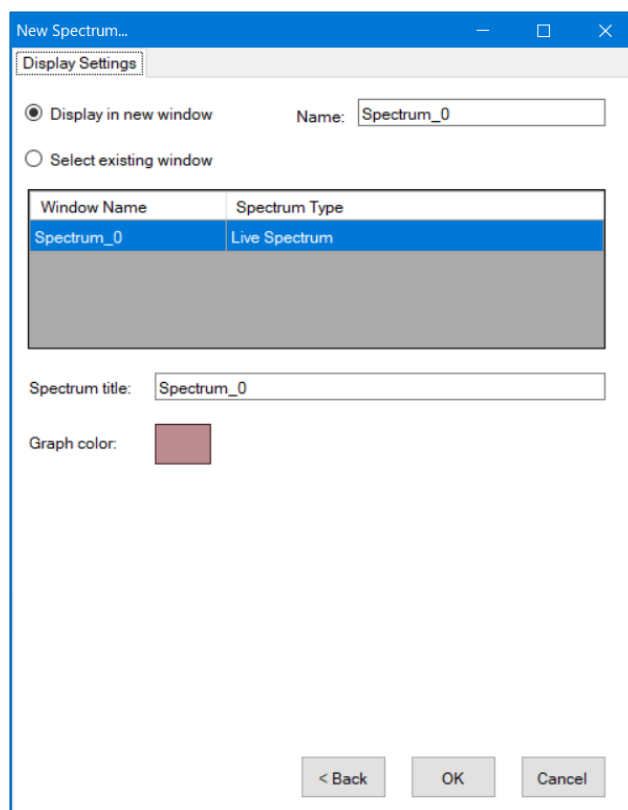


Figure 14-3. Open Existing File-- Display Settings

The figure below shows the result of opening **Spectrum\_1** when the wavelength interval is set to 10 nm and **Spectrum\_0** when the default setting is set at the same time. The spectra are overlay in this way, making it easy to compare spectral differences.

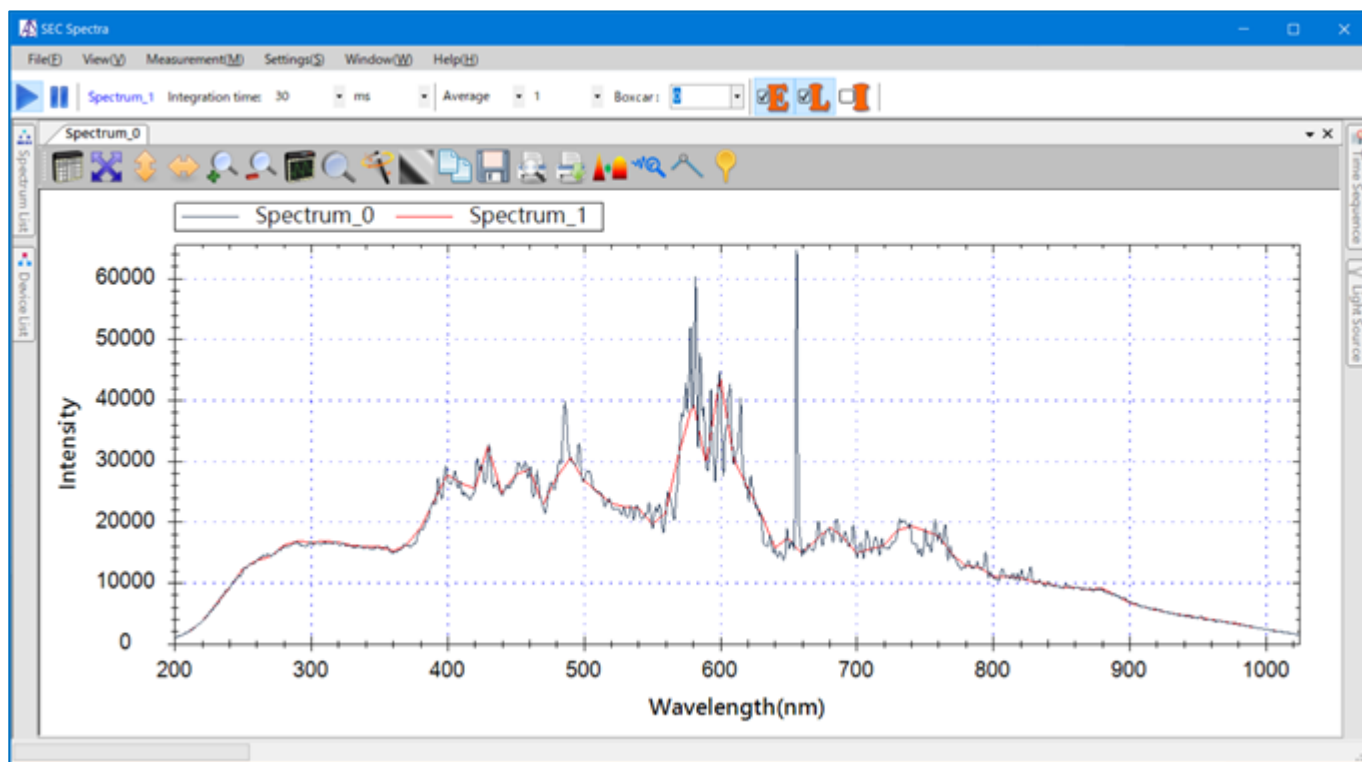


Figure 14-4. Select existing window to display the spectrum

To open multiple spectrum files at the same time, select multiple files from **Open Spectrum File**.

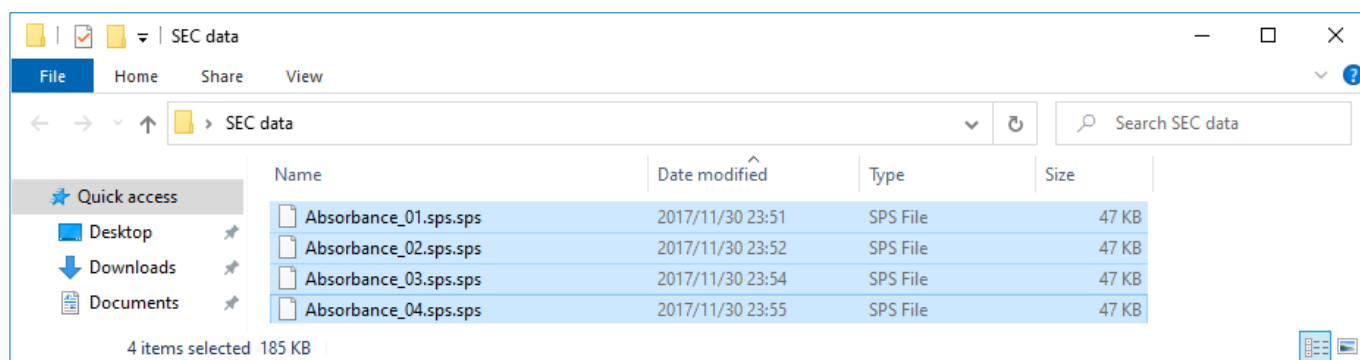


Figure 14-5. Open multiple spectrum files

On the **Display Settings** screen, check **Same Window** under **Display in new window**. If you do not check Same Window, a window will be created for each file.

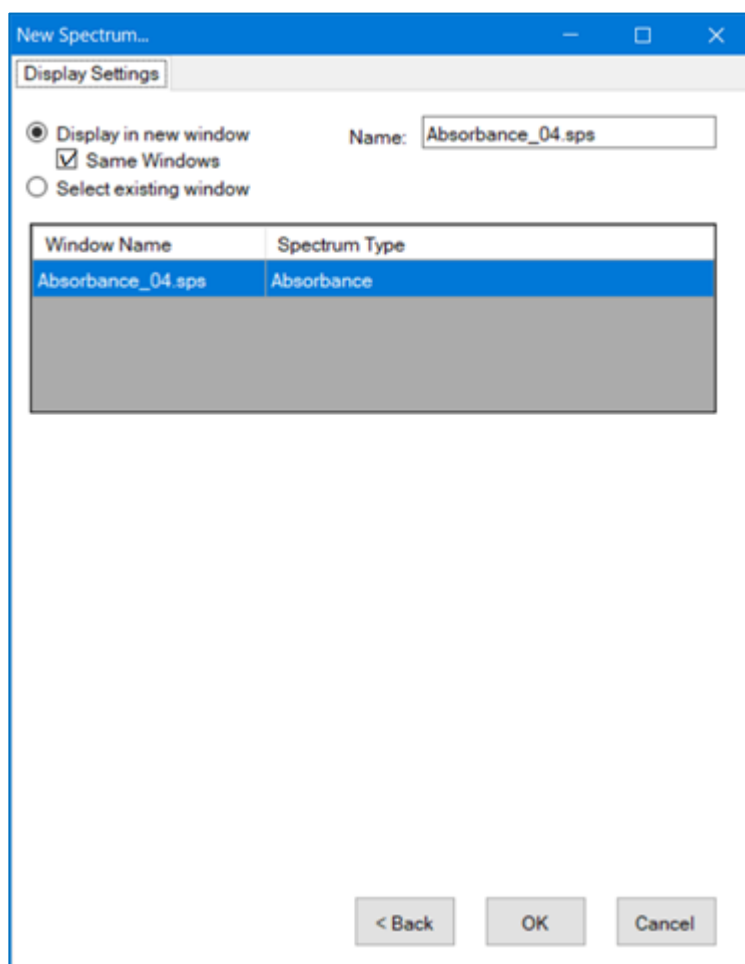


Figure 14-6. Display in new window -- Same Window

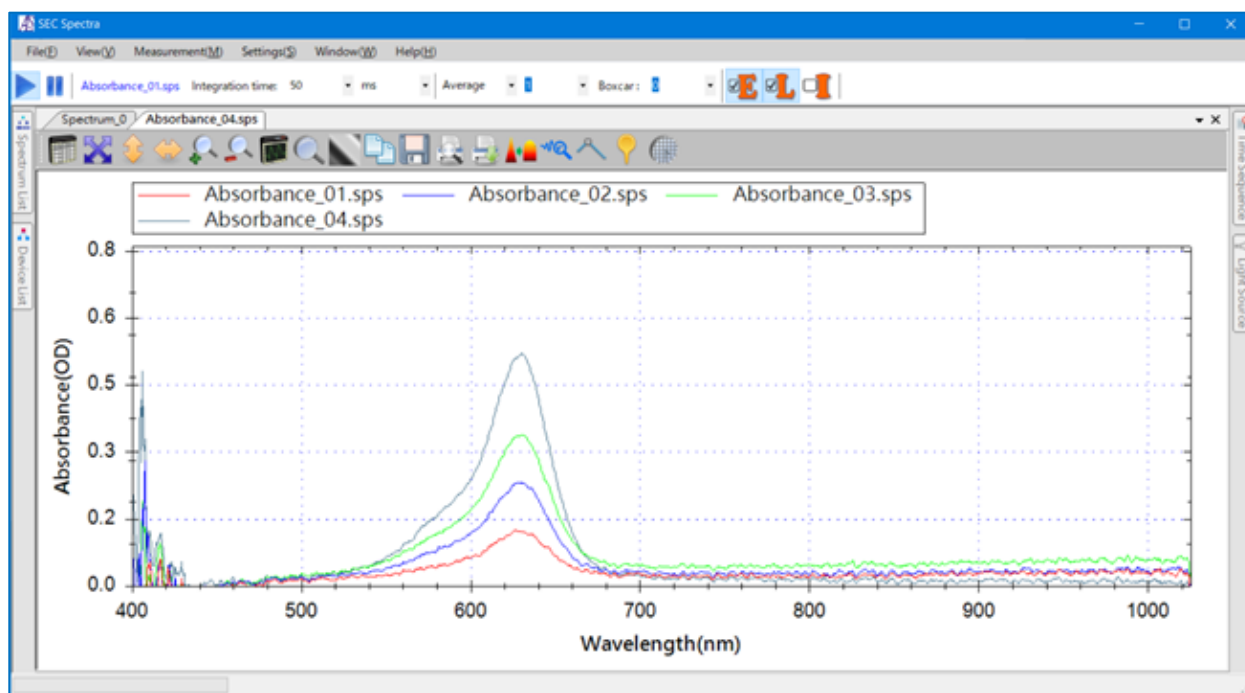


Figure 14-7. Display spectrum in new window -- Same Window

### 14-1-2. Open Strip Chart File

You can load the saved Strip Chart file (extension **spt**) and analyze the data on the software or compare it with the current spectrum.

Click **File -> Open Spectrum File** in the same way that you open a spectrum file. On the **Display Settings** screen, select **Show in New Window** or **Select Existing Window** to display the spectrum.

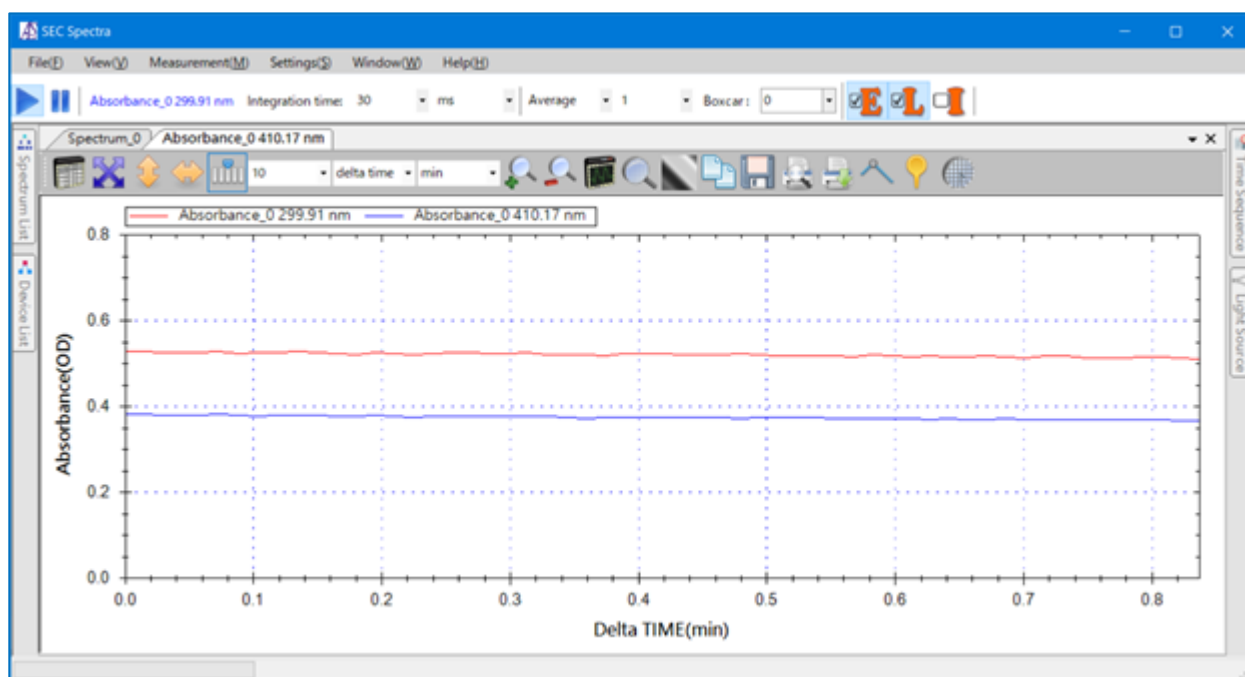


Figure14-8. Display the saved Strip Chart in New Window--Same Window

### 14-1-3. Open Time Sequence File

Load the previously saved time series measurement file (video) and analyze it on the software. For details, refer to "10-4. Loading and Playing Time Sequence File".

### 14-1-4. Close All Measurements

SEC Spectra can "close all measurements". It is very useful when closing a large number of windows. Select **Close All Measurements** from the **File** menu.

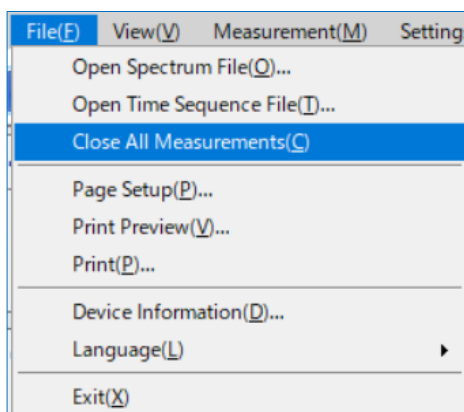


Figure 14-9. File -- Close All Measurements

### 14-1-5. Page Setup and Print

Press **Print Preview** from the **File** menu to open the Print preview window and display the current spectrum diagram.

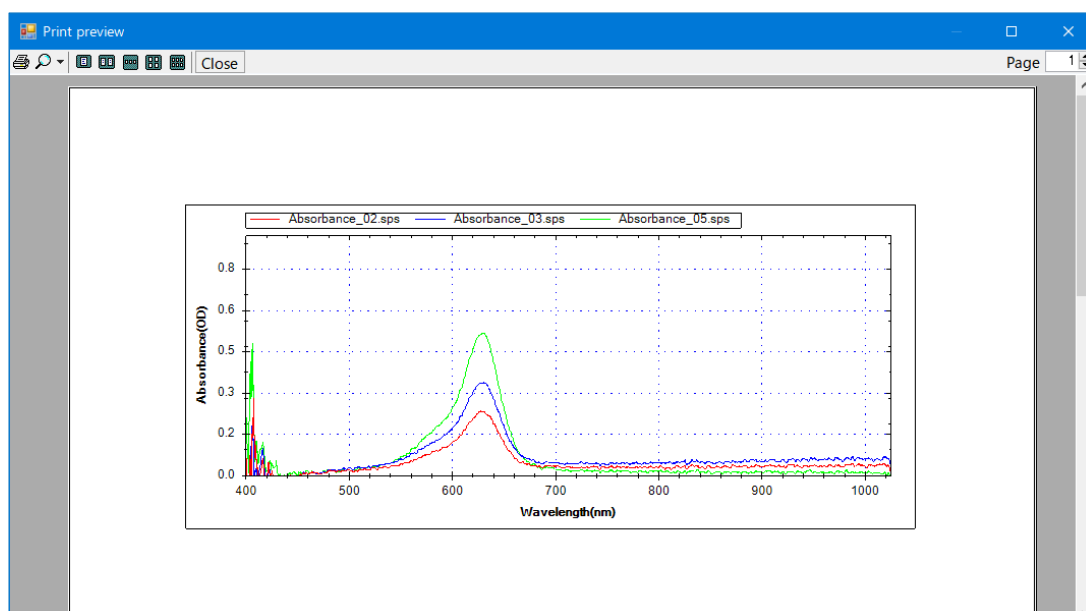


Figure 14-10. Print Preview window

You can zoom in to check the details and make sure this is the way you like it. Click the printer icon on the upper-left corner of the **Print Preview** window to start printing. If you don't need to preview the graph before you print it, you can simply press the **Print** button on SEC Spectra's graph toolbar to open the standard **Print** window:

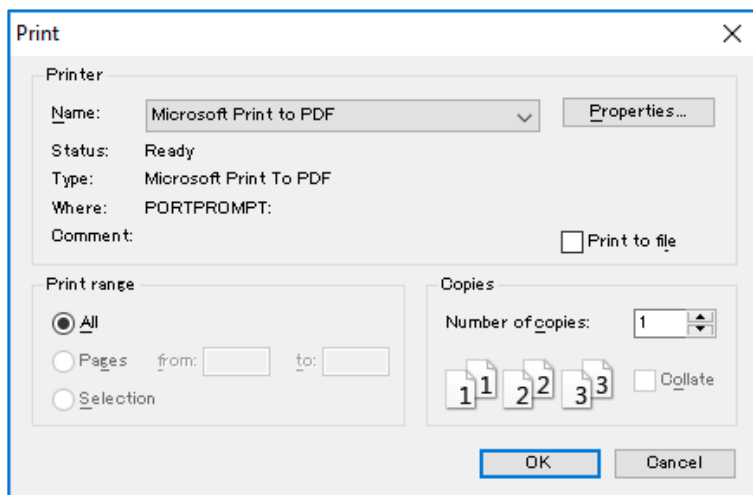


Figure 14-11. Print window

In addition, the **File** menu also provides a **Page Setup** option. This feature lets you select the desired paper, orientation, and margins.

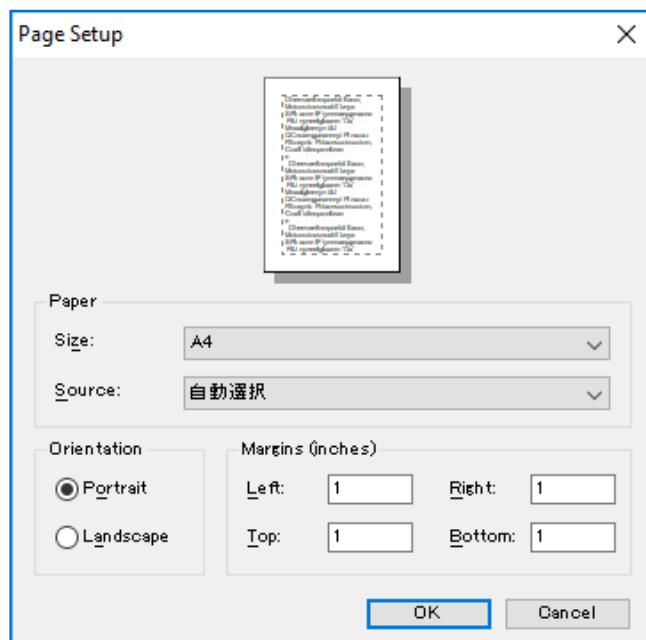


Figure 14-12. Page Setup window



### 14-1-6. Language

The language used in the program interface can be changed. In the **File** menu, select **Language**. When you finish selecting, the program screen will switch to the supported language. Figure 14-13 is an example of switching from English to Japanese.

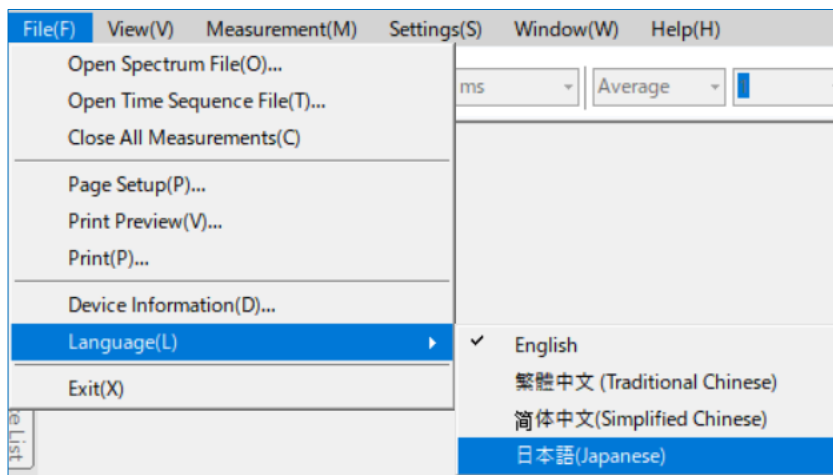


Figure 14-13. Selecting **Language** from the **File** menu

### 14-1-7. Device Information

If you need to view detailed information about a connected device, go to the **File** menu, and then select **Device Information**, as shown in the following figure:

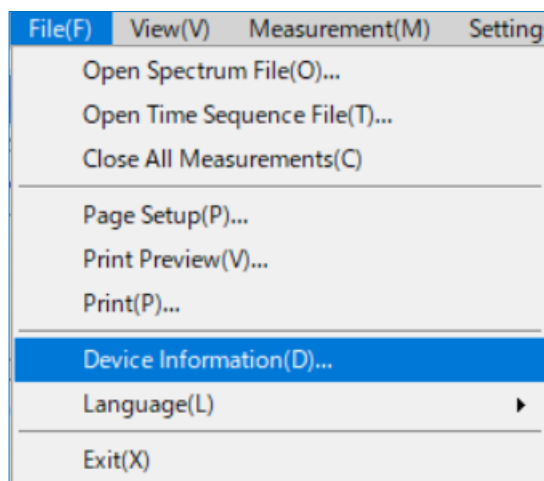
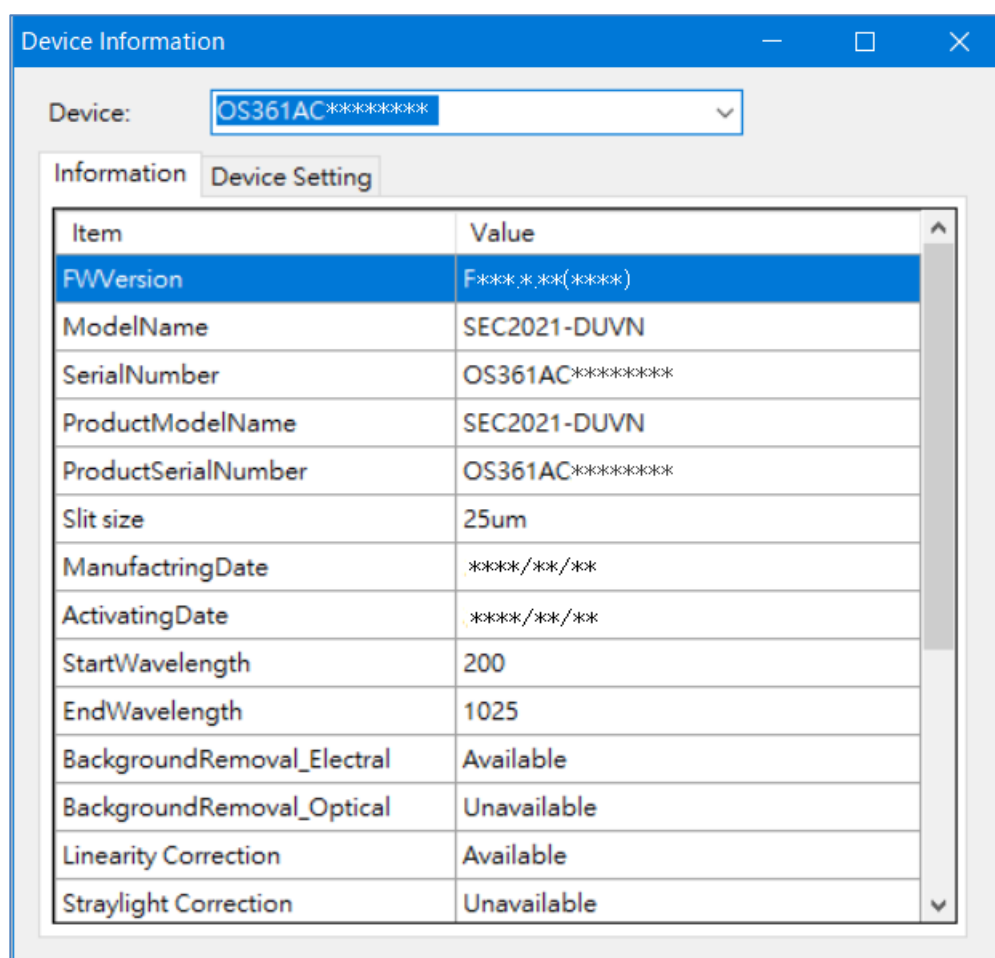


Figure 14-14. Selecting **Device Information** from the **File** menu

Then, the following window appears, showing details about the device:



The screenshot shows a window titled "Device Information" with a blue header bar. Below the header, there is a "Device:" label and a dropdown menu showing "OS361AC\*\*\*\*\*". Below this, there are two tabs: "Information" (selected) and "Device Setting". The "Information" tab contains a table with two columns: "Item" and "Value".

Item	Value
FWVersion	F***.***(***)
ModelName	SEC2021-DUVN
SerialNumber	OS361AC*****
ProductModelName	SEC2021-DUVN
ProductSerialNumber	OS361AC*****
Slit size	25um
ManufacturingDate	****/**/****
ActivatingDate	****/**/****
StartWavelength	200
EndWavelength	1025
BackgroundRemoval_Electral	Available
BackgroundRemoval_Optical	Unavailable
Linearity Correction	Available
Straylight Correction	Unavailable

Figure 14-15. Device information details

## 14-2. View Menu

Each window can be displayed by checking the Device List, Spectrum List, Time Sequence and Light Source control in the **View** menu.

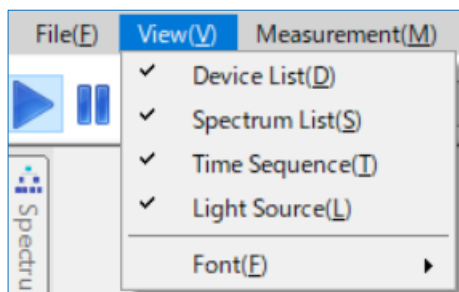


Figure 14-16. **View** menu

### 14-2-1. Device List

Click **Device List** on the left side of the **SEC Spectra** program window as shown below to expand the window and display the connected devices.

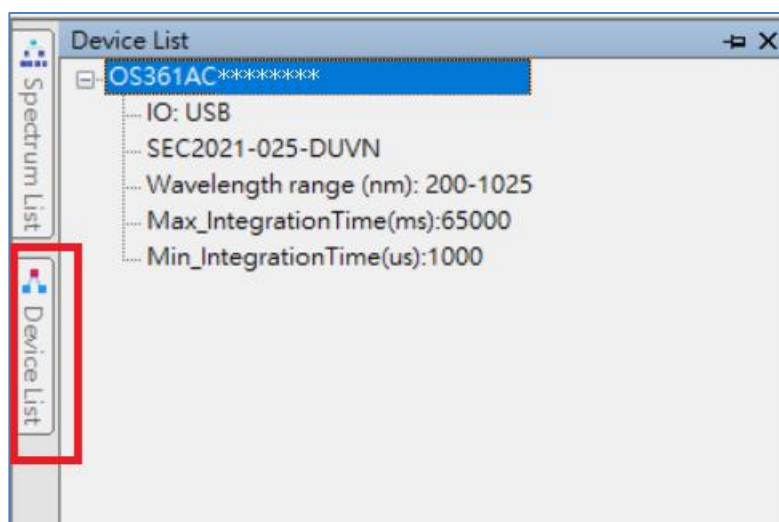


Figure 14-17. **Device List**

**Device List** shows the basic attributes of connected devices, such as models, serial numbers (SN), and wavelength ranges.

**Note:** The serial number is how SEC Spectra identifies each device. This number is also used in several windows where device selection is required.

## 14-2-2. Spectrum List

Click **Spectrum List** on the left side of the **SEC Spectra** program window displays the measured spectrum, absorbance, transmittance, etc., or the opened spectrum.

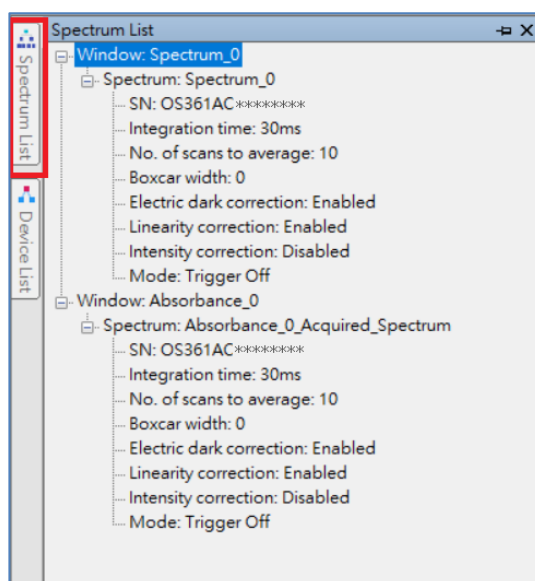


Figure 14-18. Spectrum List

## 14-2-3. Lamp Control

SEC Spectra can control the on/off states of SEC2021 light source by setting it to Auto mode via the I/O port of the spectrometer and the light source. For details on I/O port and connections, refer to the chapter "Device User's Guide, 3-2-2 Automatic Mode". When you move the mouse cursor from **View->Light Source** menu or on the vertical **Light Source** icon on the right edge of the SEC Spectra window, the light source frame is displayed.

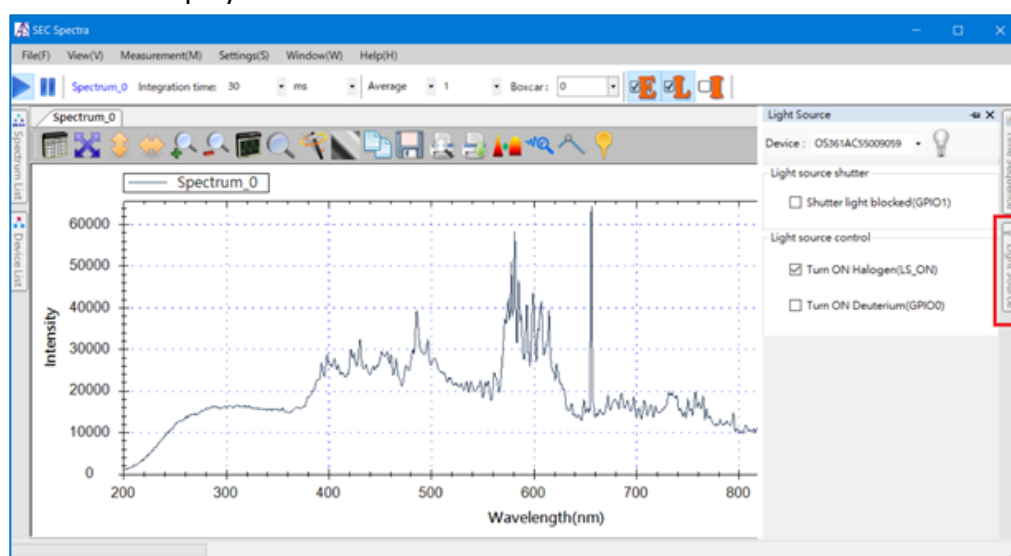


Figure 14-19. Light Source icon

The operation mode of the **Lamp Control** icon has two modes of "Automatic" and "Manual". Press it once to Automatic mode, press it again to Manual mode. In the initial state of the software, the icon is in Automatic mode as shown in Fig. 14-20 (left), only the halogen lamp is checked. If you need to control on/off of the light source on the software, turn on the "Auto" switch of SEC2022 light source(Auto LED lights up) first. Then, as shown in Fig. 14-20 (right), the on/off of the shutter, halogen light source, and deuterium (D2) light source can be controlled on the software while the **Lamp Control** is in Automatic mode.

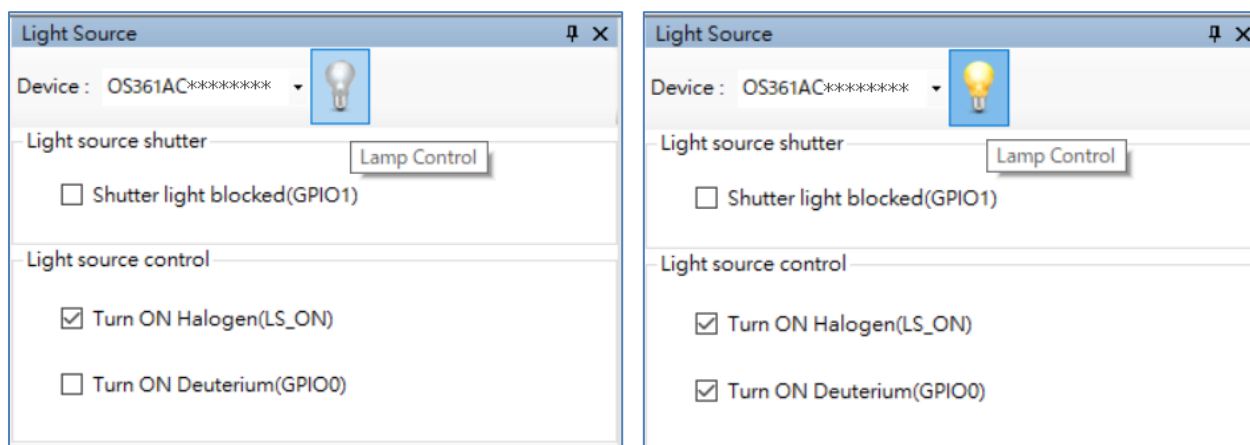


Figure 14-20. **Lamp Control** icon in Manual mode (left) and Automatic mode(right)

## 14-2-4. Font

You can also adjust the size of the font for the user interface. Go to the **View** menu, and then select **Font**. You can choose the font size that best fits your needs.

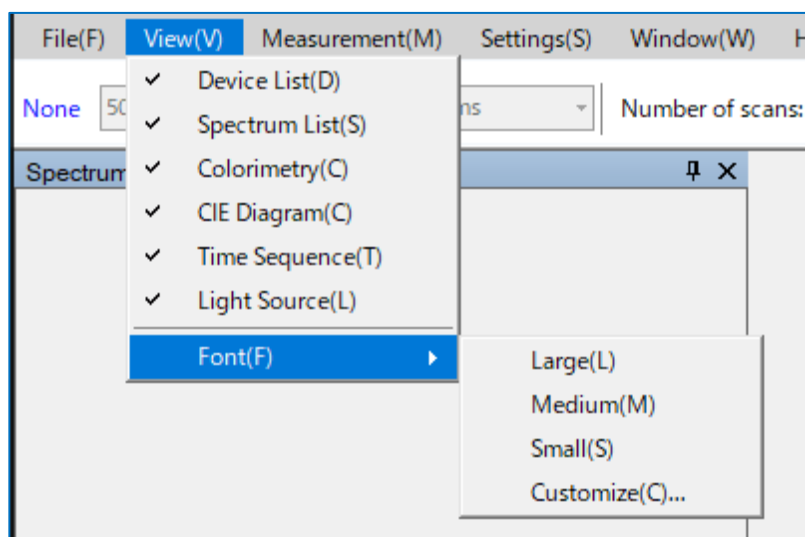


Figure 14-21. Selecting **Font** from the **View** menu

## 14-3. Application Settings

In SEC Spectra, you can customize default values such as wavelength display range, background color of a measurement graph, the default smoothing settings, etc.

To change these settings, select **Application Settings** from the **Settings** menu.

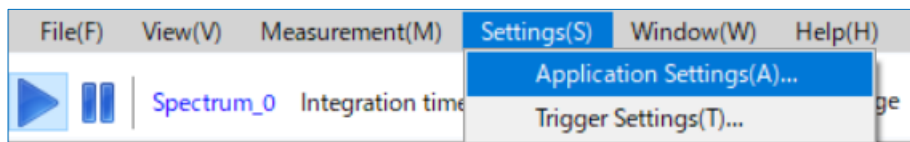


Figure 14-22. Selecting **Application Settings** from the **Settings** menu

Next, the **Application Settings** window opens.

### 14-3-1. Default Settings

**Default Settings** allows you to change the default setting for each measurement (spectrum, absorbance, transmittance, reflectance and relative irradiance). The settings must be made for each measurement.

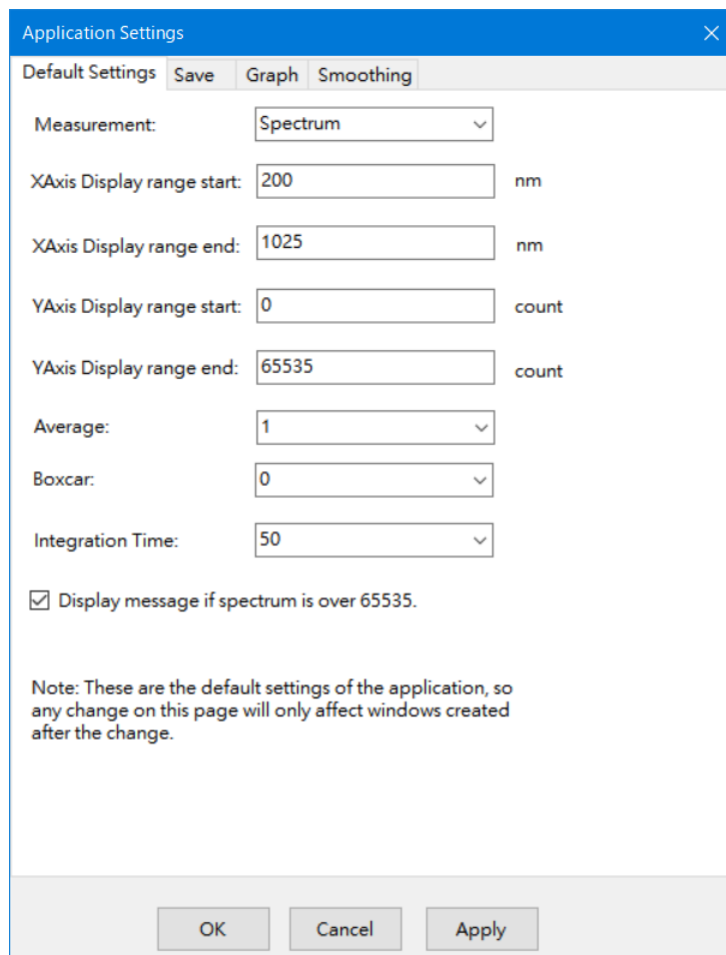


Figure 14-23. **Default Settings** tab of **Application Settings**

### Measurement

Set the default display of the measurement selected from the pull-down on the right side.

## Display Range: Start and End

**Display range start** and **Display range end** of the X-axis and Y-axis can be configured. The Y-axis unit is different for each measurement and must be set individually.

## Average

Here you can specify the default average number of scans. This reduces the effects of noise.

## Boxcar

This setting allows you specifying the default for the Boxcar smoothing. It varies from 0 to 10, the larger the number, the smoother the curve. The default value is 0, i.e. no smoothing.

## Display a Message when the Peak Value in the Spectrum Exceeds 65535

The maximum value supported in the spectrum data is 65535. Therefore, when the "peak value" of the spectrum exceeds this value, the spectrum curve will not be accurate, and a warning message is displayed on the spectrum diagram.

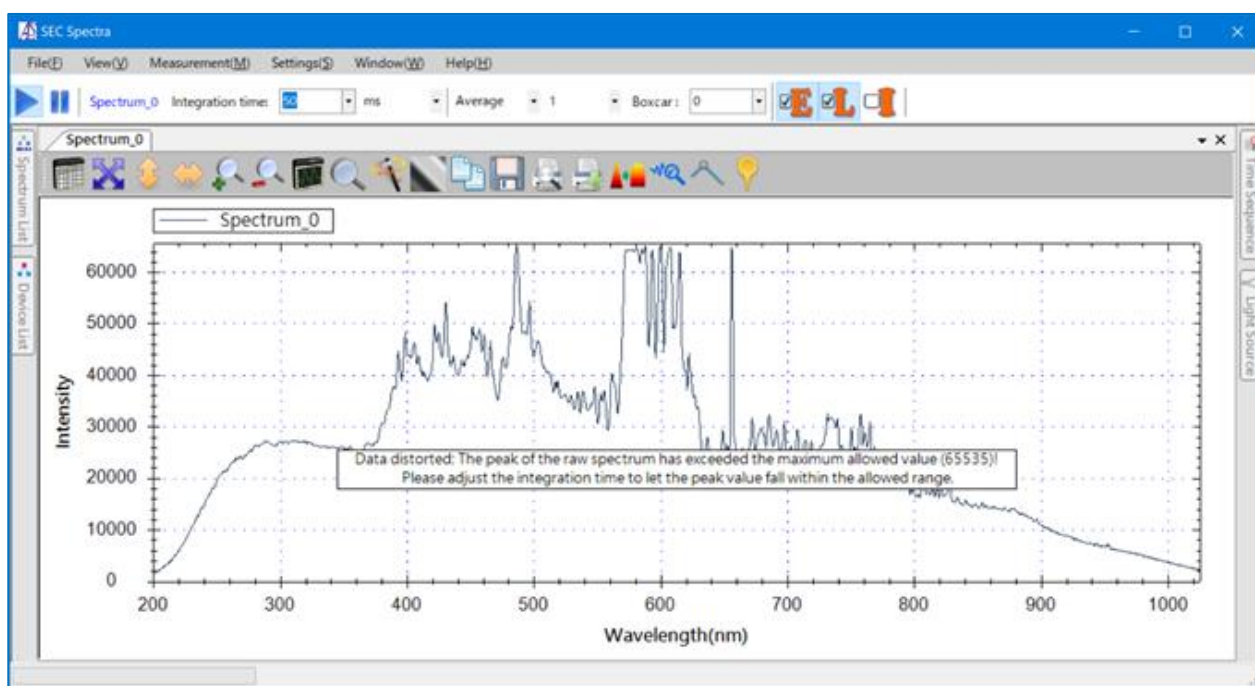


Figure 14-24. **Data distorted** warning message

In some cases, you may see this warning message even if the spectral curve looks normal. This is because the curve displayed on the graph is the result after smoothing, so even if it looks normal, the original data is out of tolerance. Therefore, it is necessary to adjust the total time to be short until the warning message disappears.

### 14-3-2. Save

In **Save** tab, you can set how to save the measurement data (wavelength range, wavelength interval, file format).

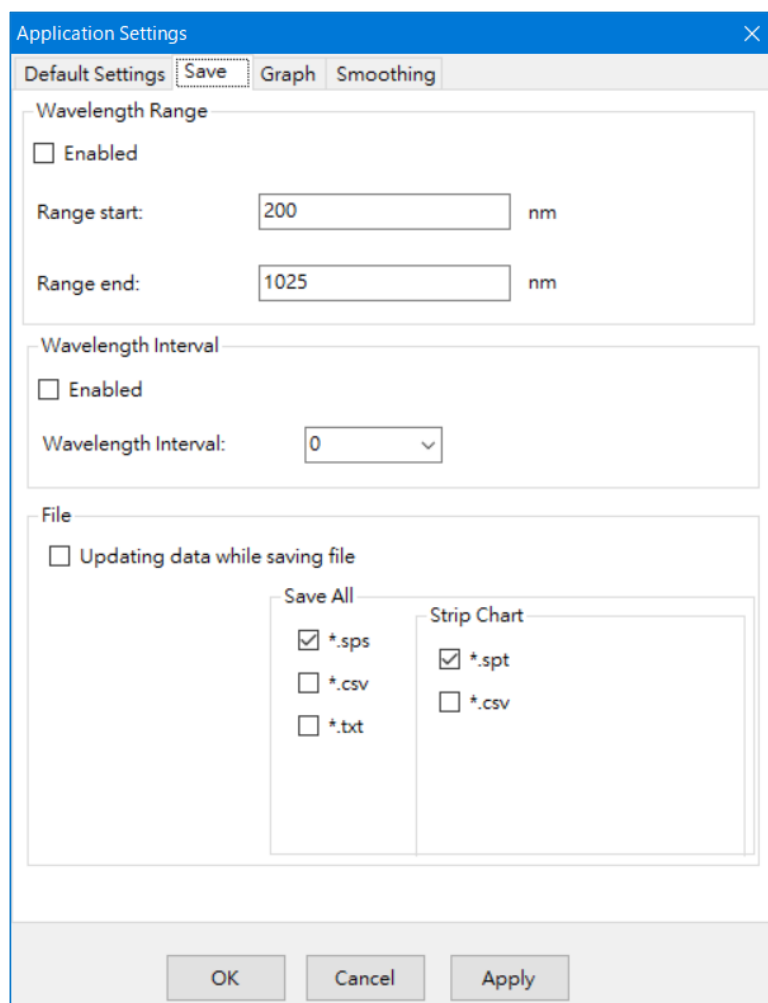


Figure 14-25. **Save** tab of **Application Settings**

#### Wavelength Range

The start and end points can be changed by checking **Enabled**. If **Enabled** is unchecked, the spectrometer-specific wavelength range of 200 to 1025 nm is set.

#### Wavelength Interval

Check **Enable** and set the wavelength interval from the pull-down menu. If **Enable** is unchecked, it will be set at the pixel compatible interval of the spectrometer.

#### File

You can select one or more file formats to save the spectrum, absorbance, transmittance, reflectance, and relative irradiance measurement spectrum from **sps**, **csv**, and **txt**.

You can select one or both file formats to save records in Strip Chart measurement from **spt** and **csv**.



### 14-3-3. Graph

This tab allows you to set the line width, window background, graph background, and whether to show the visible spectrum.

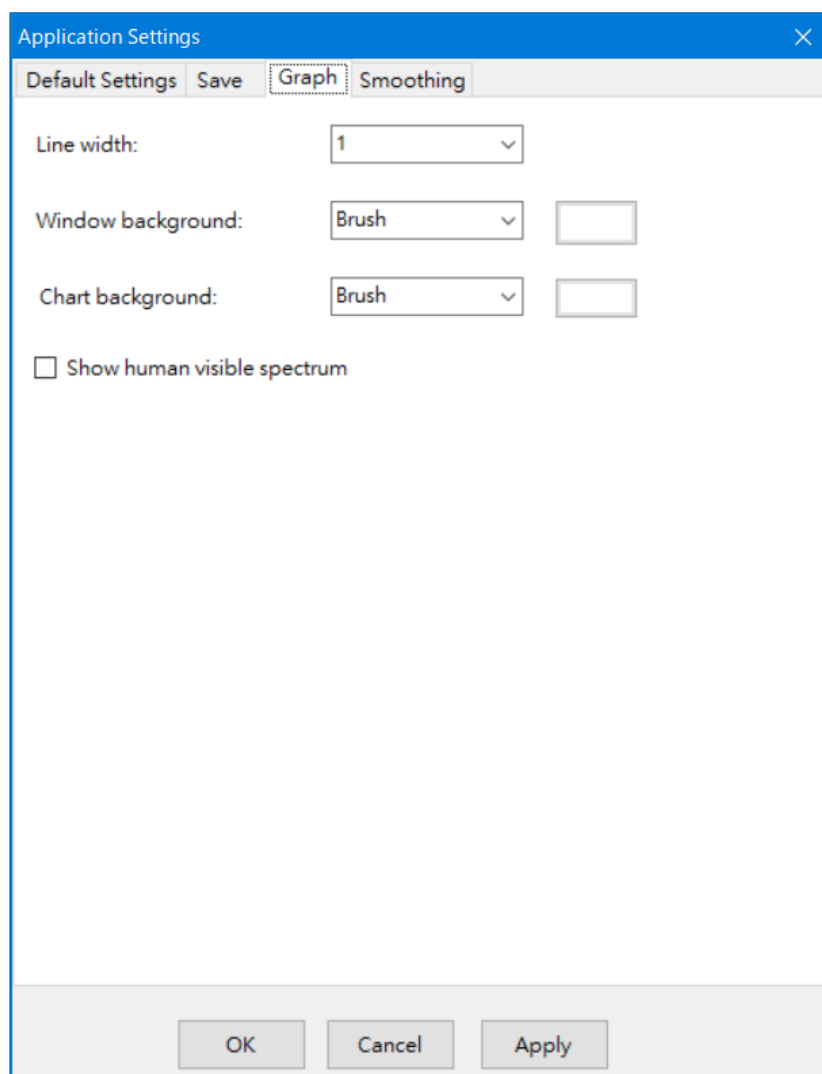


Figure 14-26. Graph tab of Application Settings

#### Line Width

This controls the line width of the curve on a graph.

#### Window Background and Chart Background

These two control the background styles and colors of the measurement window and the measurement graph, respectively. The available styles are **None**, **Brush**, and **Solid**.

## Human Visible Spectrum

This allows you to show the visible spectrum on the graph along with the measurement curve.

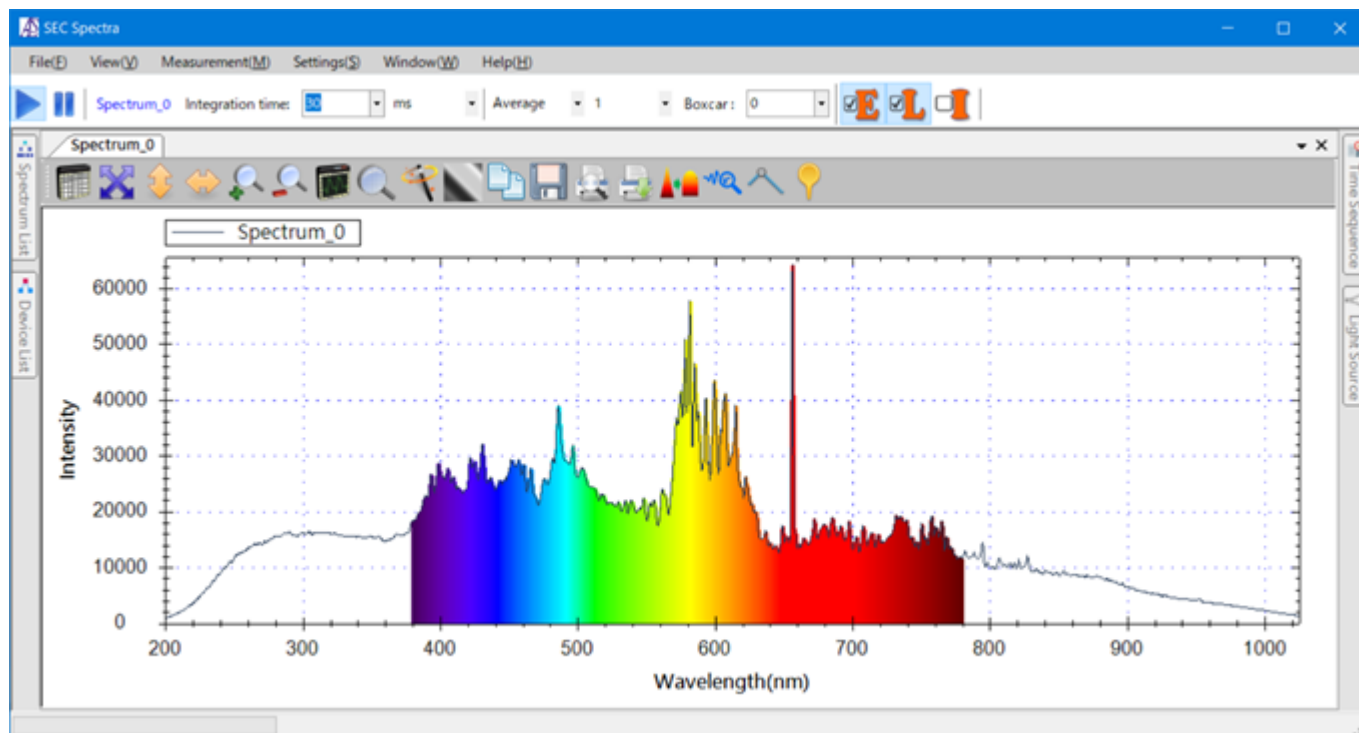


Figure 14-27. Demonstrating **Human Visible Spectrum** effects in the **Application Settings**

**Note:** For these graph settings, you can click "Apply" to see the effect of a change immediately.

### 14-3-4. Smoothing

The original spectral curve is not smooth due to the presence of noise. The SEC Spectra provides a smoothing function to make the curve smoother. You can also open the **Smoothing Settings** screen by

pressing the **Smoothing** icon  on the toolbar.

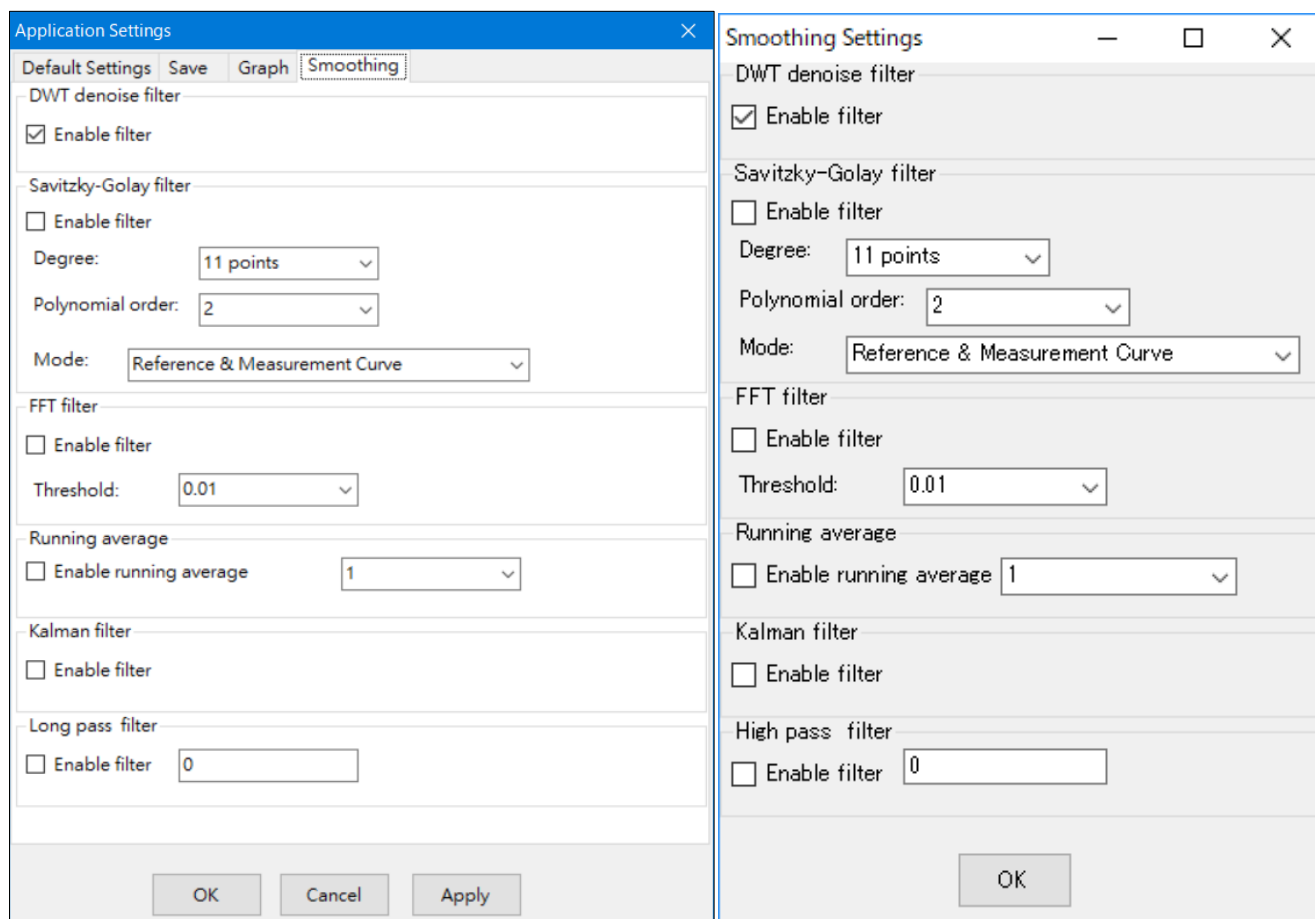


Figure 14-28. Smoothing Settings

On the **Smoothing Settings** screen, you can select multiple methods from 6 types: "DWT Noise Filter", "Savitzky-Golay Filter", "FFT Filter", "Moving Average", "Kalman Filter", and "High Pass Filter".

#### DWT Denoise Filter

Here you specify whether to use the Discrete wavelet transform denoise filter (DWT Denoise Filter). To use it, simply select the **Enable Filter** check box.

#### Savitzky-Golay Filter

Here you specify whether to use the Savitzky-Golay filter. To use it, select the **Enable filter** check box, and then specify the smoothing **Degree** and the smoothing **Mode**. The available modes are **Reference Curve**, **Reference & Measurement Curve**, and **Measurement Curve**.

### **FFT Filter**

Here you specify whether to use the Fast Fourier Transform (FFT) filter. To use it, select the **Enable filter** check box, and then specify a **Threshold** value.

### **Running Average**

Here you specify whether to use the running average algorithm. To use it, select **Enable running average**, and then specify the number of points to include in the average.

### **Kalman Filter**

Here you specify whether to use the Kalman filter. To use it, simply select the **Enable filter** check box.

### **Long Pass Filter**

Here you specify whether to use the long pass filter. To use it, simply select the **Enable filter** check box.

**Note:** Click "Apply" to see the effect immediately after you change these smoothing settings.

## 14-4. Default Layout

Once you have more than one measurement windows and you have moved the windows around, you can go to the **Window** menu and select **Default Layout** to revert to their default layout:

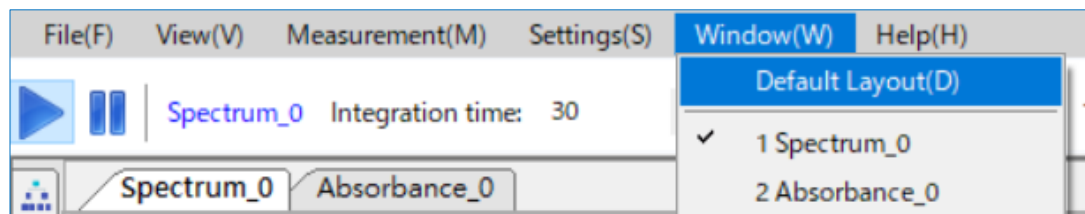


Figure 14-29. Selecting **Default Layout** from the **Window** menu

The window layout now reverts back to the way it originally was:

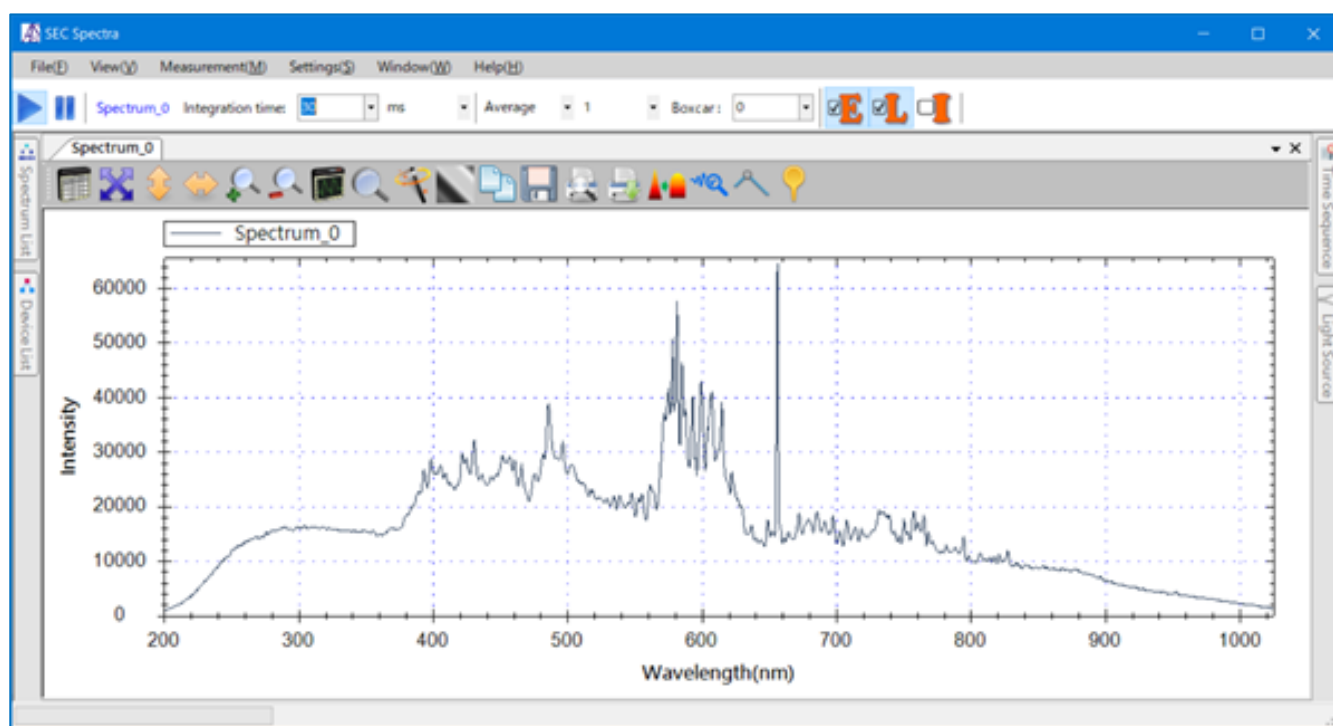


Figure 14-30. The default window layout of the program

## 14-5. Quick Adjustment Field

There are some setting icons related to spectrum acquisition in the "quick adjustment field" at the bottom of the main menu marked with the red border in the figure below. Adjust the data acquisition settings (Integration time, Average, Boxcar) here. There are three icons on the right side of **Boxcar**: "E" (dark current correction), "L" (linearity correction), and "I" (relative irradiance). Further to the left are the "Start" and "Pause" icons for data acquisition (see "14-9-9. Start Acquiring and Pause" for details).

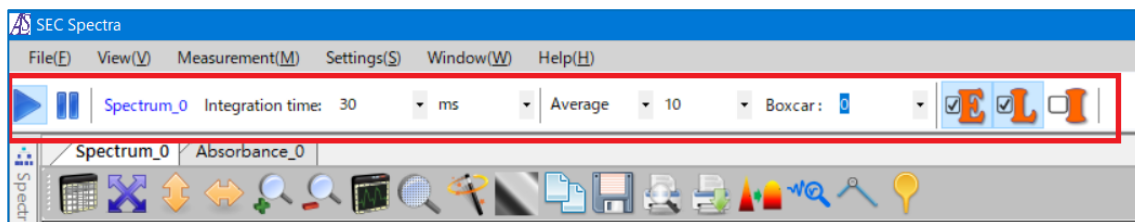


Figure 14-31. Quick adjustment field

### Integration time

Adjust the exposure time of the sensor. The larger the value, the larger the Intensity (Y-axis value) displayed in the Spectrum graph.

### Average

Set the number of scans to calculate the average value. The larger the value, the smaller the fluctuation of the curve.

### Boxcar

Smooths the spectrum curve. Sets the number of data used for moving average calculation. The higher the value, the smoother the curve and the less prominent changes.

### Electronic Dark Correction

When dark current correction is enabled, the dark current is automatically subtracted from the reading. It is a 0-point correction when the spectrometer is not receiving light. For details, refer to "15-1. Electronic Dark Correction".

### Linearity Correction

The sensitivity of the spectrometer CCD is not linear with respect to intensity. When the linearity correction function is enabled, the correction is performed according to the linearity correction table. For details, refer to "15-2. Linearity Correction".

### Relative Irradiance

Start relative irradiance measurement. For details, refer to "11. Relative Irradiance Measurement".

## 14-6. Graph Toolbar Icons

Every measurement graph has a row of toolbar icons at the top of the spectrum windows. These buttons are divided into two major groups: **Scale Adjustment Buttons** and **Other Easy Access Buttons**.

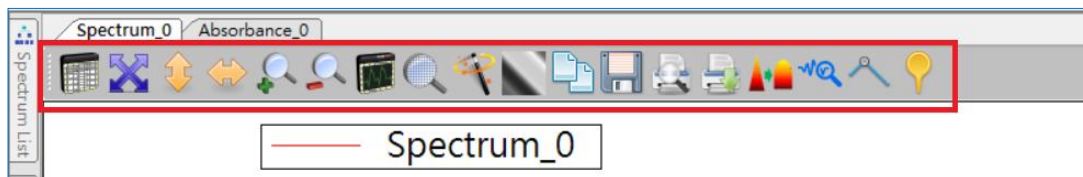


Figure 14-32. Graph toolbar icons

### 14-6-1. Scale Adjustment Icons

SEC Spectra automatically adjusts to the optimum scale for each measurement to display the spectrum properly. It provides a set of toolbar icons for you to customize the scales and display ranges. See the following red highlighted area:

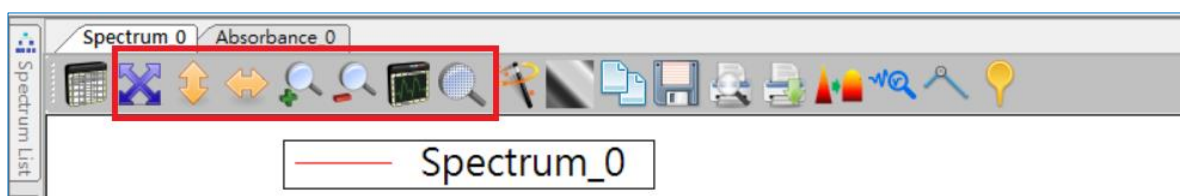


Figure 14-33. Scale adjustment icons of the spectrum graph

These buttons are explained in details in the following.

### 14-6-2. Scale Graph Axes Automatically

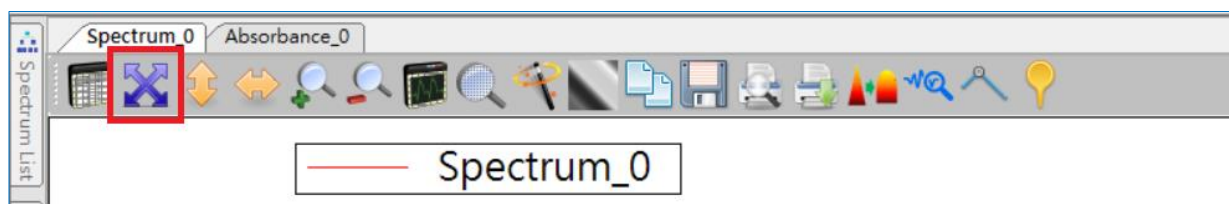
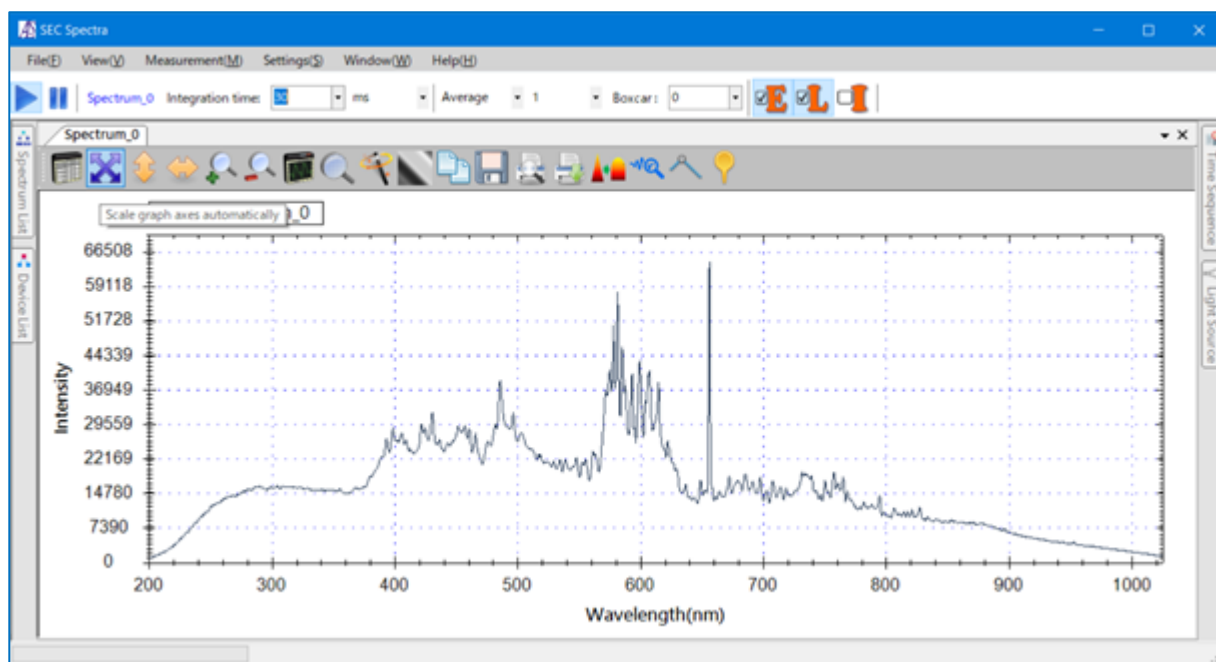
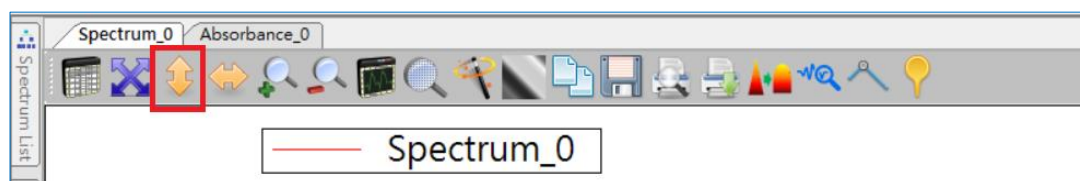


Figure 14-34. Scale graph axes automatically icon

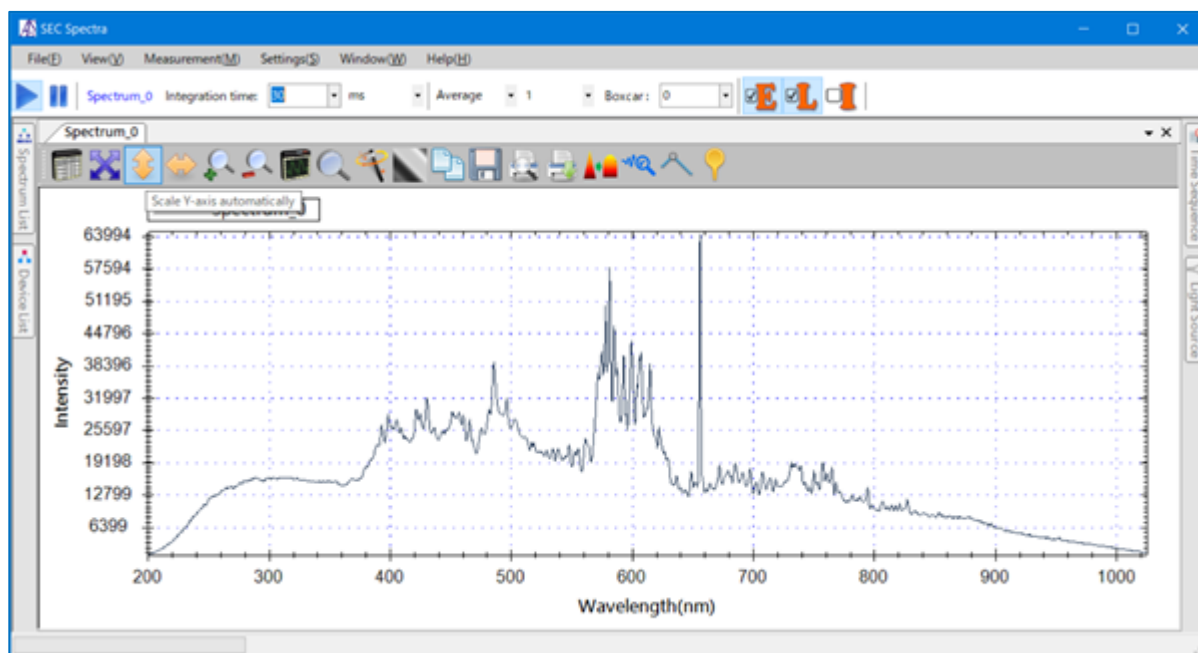
This icon automatically adjusts the X- and Y- axes to their optimal settings. The following figure shows the effect of this icon. In the figure, the X-axis is adjusted to display the entire wavelength range supported by the device, while the Y-axis is adjusted so that the curve fills the entire graph as much as possible:

Figure 14-35. The effect of using **Scale graph axes automatically**

### 14-6-3. Scale Y-axis Automatically

Figure 14-36. **Scale Y-axis automatically** icon

This icon automatically adjusts the scale of Y-axis to show more details. The following figure shows the effect of this button. In the figure, the highest point on the curve is extended to the top of Y-axis:

Figure 14-37. The effect of using **Scale Y-axis automatically**



### 14-6-4. Scale X-axis Automatically

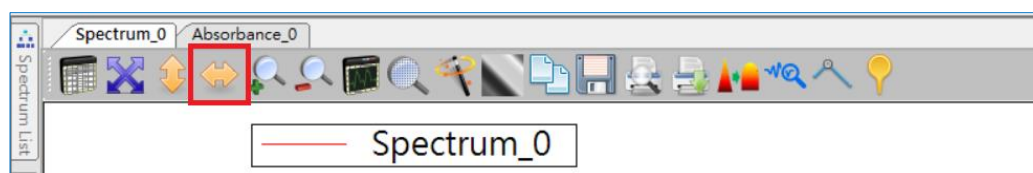


Figure 14-38. Scale X-axis automatically icon

This icon automatically adjusts the scale of X-axis to show more details. Using this button will adjust the X-axis to display the internal wavelength range of the device, as in the following figure:

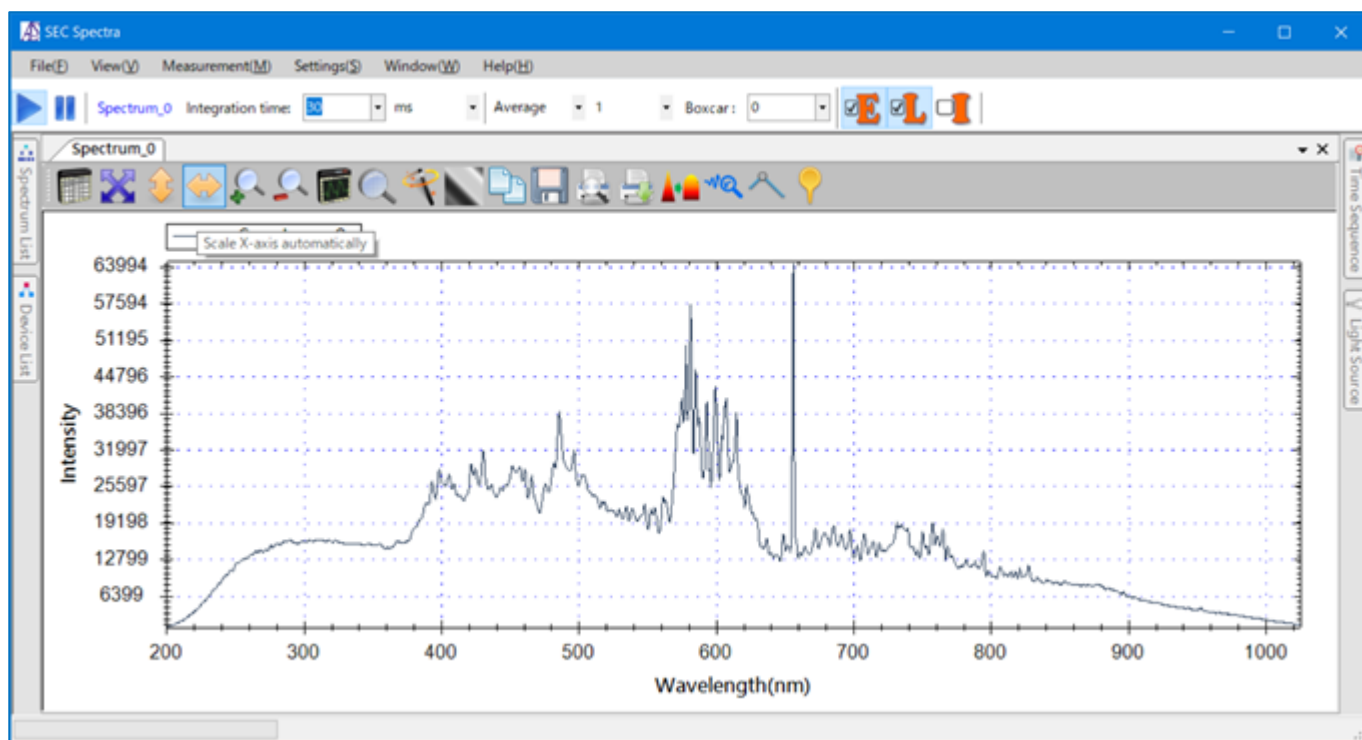


Figure 14-39. The effect of using Scale X-axis automatically

### 14-6-5. Zoom In

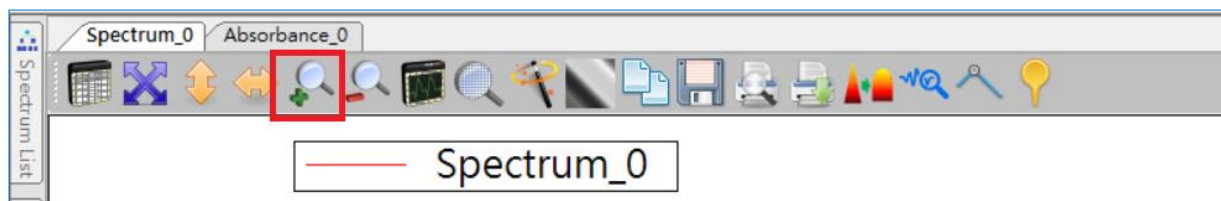
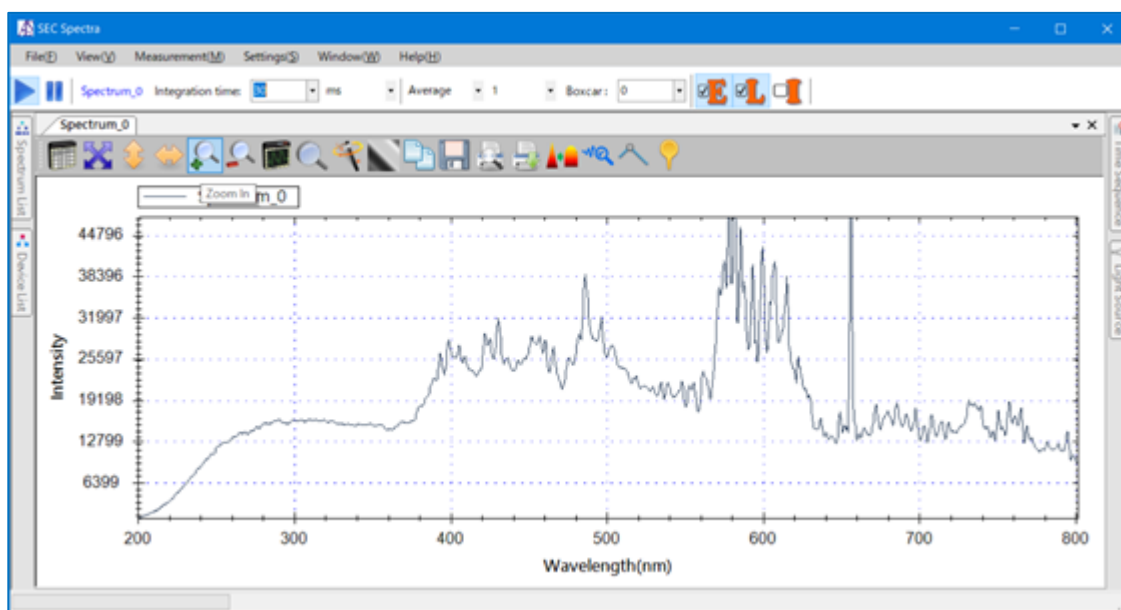
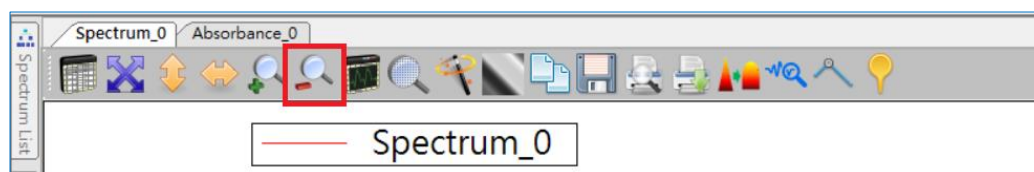


Figure 14-40. Zoom in icon

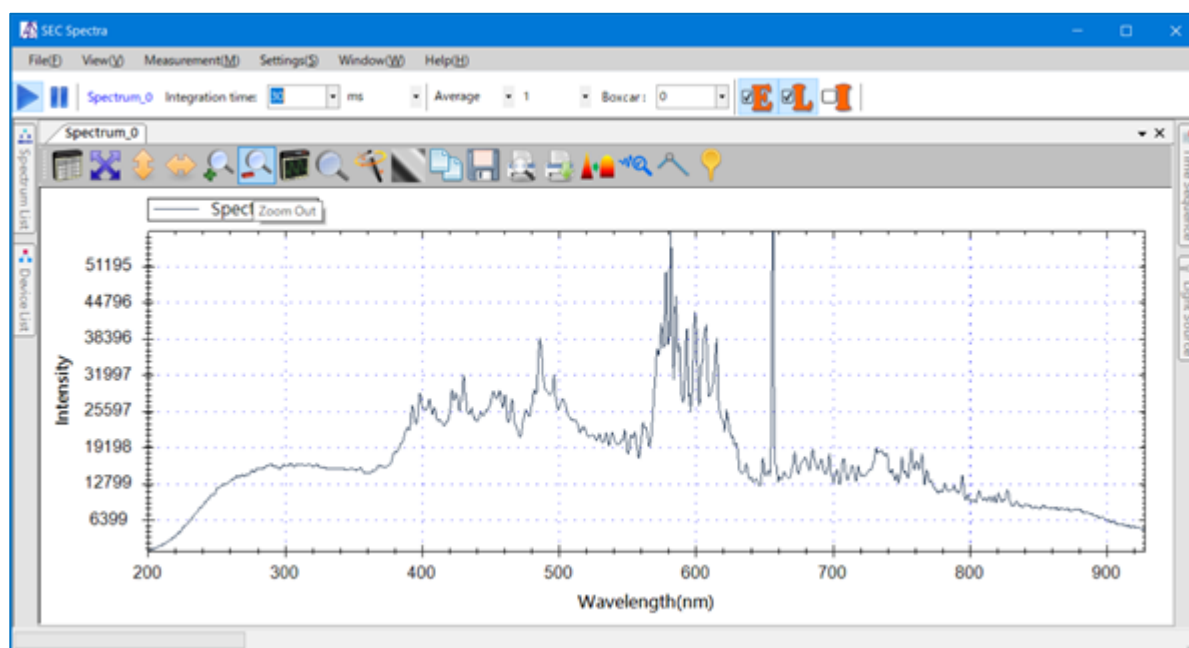
This icon enlarges the graph (pulling it closer to you). Here we press **Scale graph axes automatically** to restore the graph to its optimal display settings, and then press **Zoom In** to demonstrate its effect. The following figure shows the result of pressing **Zoom In** three times:

Figure 14-41. The effect of pressing **Zoom In**

### 14-6-6. Zoom Out

Figure 14-42. **Zoom Out** icon

This icon shrinks the graph (pushing it away from you). Here we first zoom in on the graph three times, and then press **Zoom Out** twice to demonstrate its effect. See the following figure:

Figure 14-43. The effect of pressing **Zoom Out**

### 14-6-7. Revert Graph Settings to Application Defaults

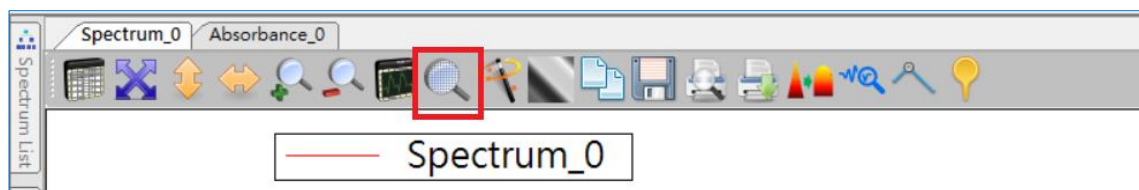


Figure 14-44. Revert graph settings to application defaults icon

This icon restores the graph display settings to application defaults (i.e. the original settings when the graph is created). To demonstrate, we press this button to restore the graph in the former example to its default settings. See the following figure:

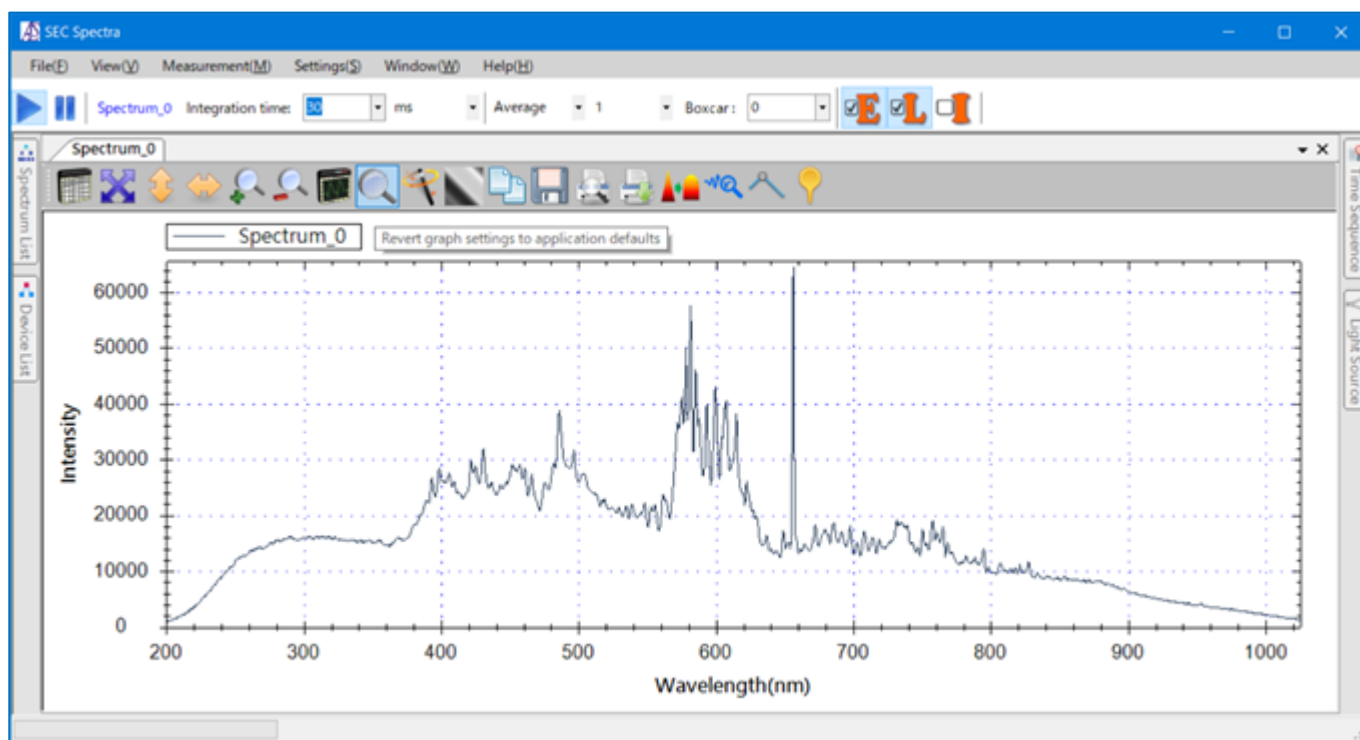


Figure 14-45. The effect of Reverting graph settings to application defaults

## 14-6-8. Graph Settings

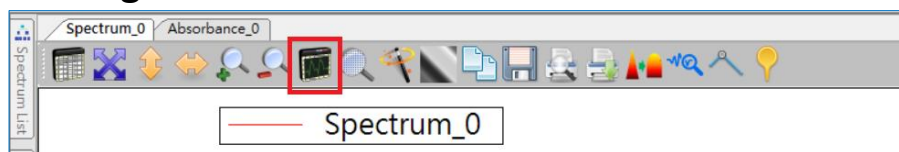


Figure 14-46. **Graph Settings** icon

This button opens the setting details of X- and Y-axes, as shown in the following:

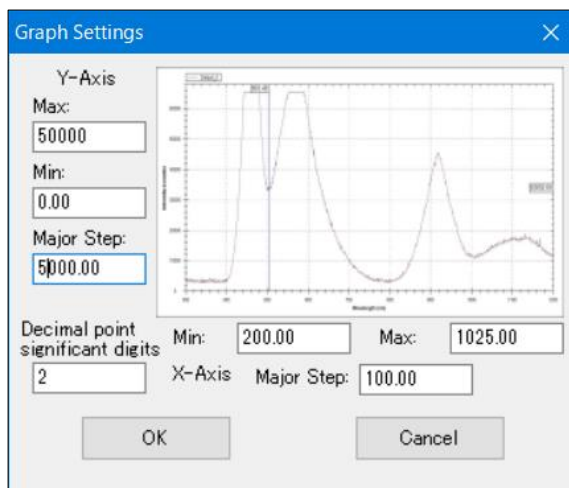


Figure 14-47. **Graph Settings** window

The Graph Settings window allows the user to customize the minimum and maximum values for X- and Y-axes, as well as the size of a major step. Here we configure the X-axis (wavelength) range to fall within 200 to 1025 (nm), with a major step of 100. Then, we configure the Y-axis (signal intensity) range as 0 to 50000, with a major step of 5000. See the following figure for the result:

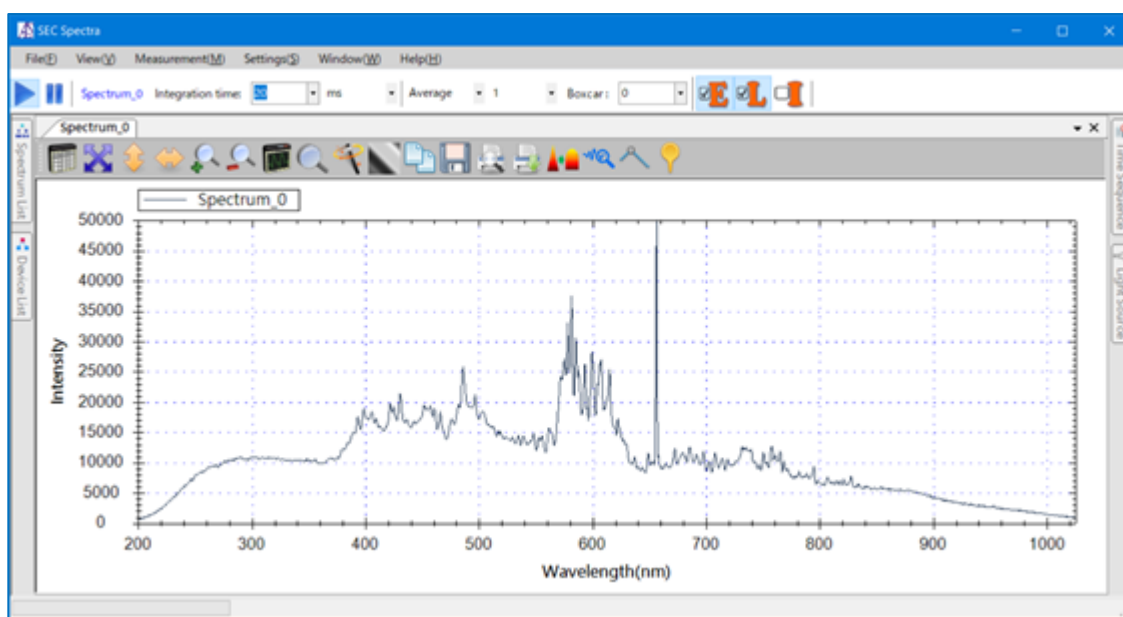


Figure 14-48. Using custom X-, Y-axes settings

### 14-6-9. Checking Spectrum Values

The spectrum curve gives you a quick glimpse of the characteristics of the light being measured. In addition, you can check the actual value of a specific wavelength by placing the mouse cursor over a point on the curve. As shown in the figure below, when you move the mouse cursor to the bright line derived from D2, the actual wavelength (655.82) is displayed at the top of the graph and the data value (52863.78) is displayed on the right side of the graph.

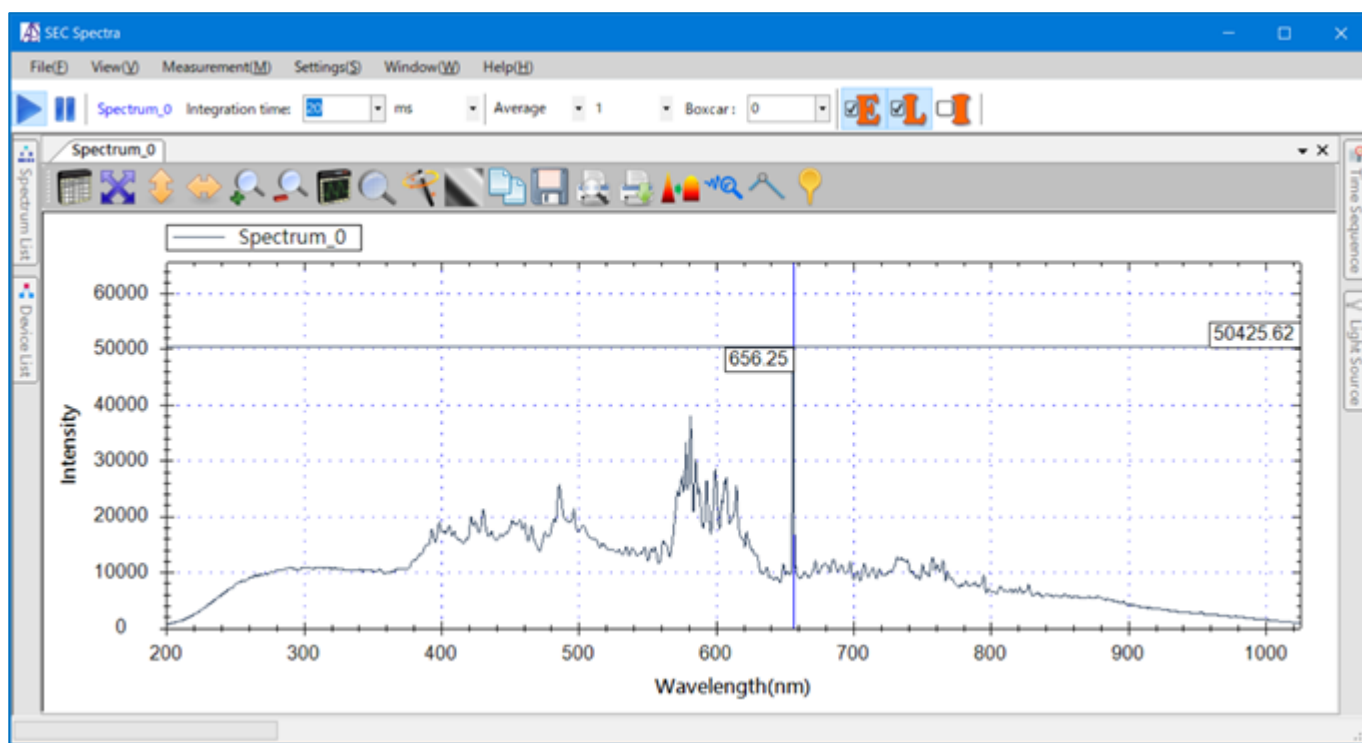


Figure 14-49. Checking the value of a specific wavelength with mouse

The mouse cursor offers a handy way to observing a single point. To display all measurement data, SEC Spectra provides a tabular "Spectral data pane". Details will be explained in chapter 14.7.

### 14-6-10. Placing Marks on the Graph

Press **Placing Marks on the Graph** icon on the toolbar and double-click the left button of mouse at the position where you want to mark, and the data values on the graph will be fixed and displayed.

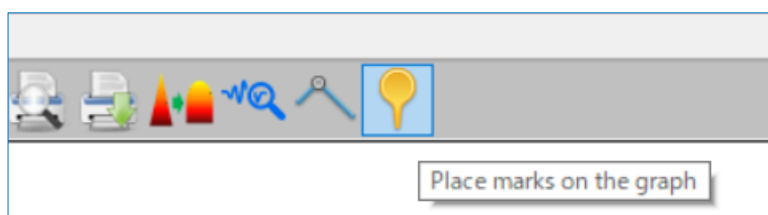


Figure 14-50. Place marks on the graph icon

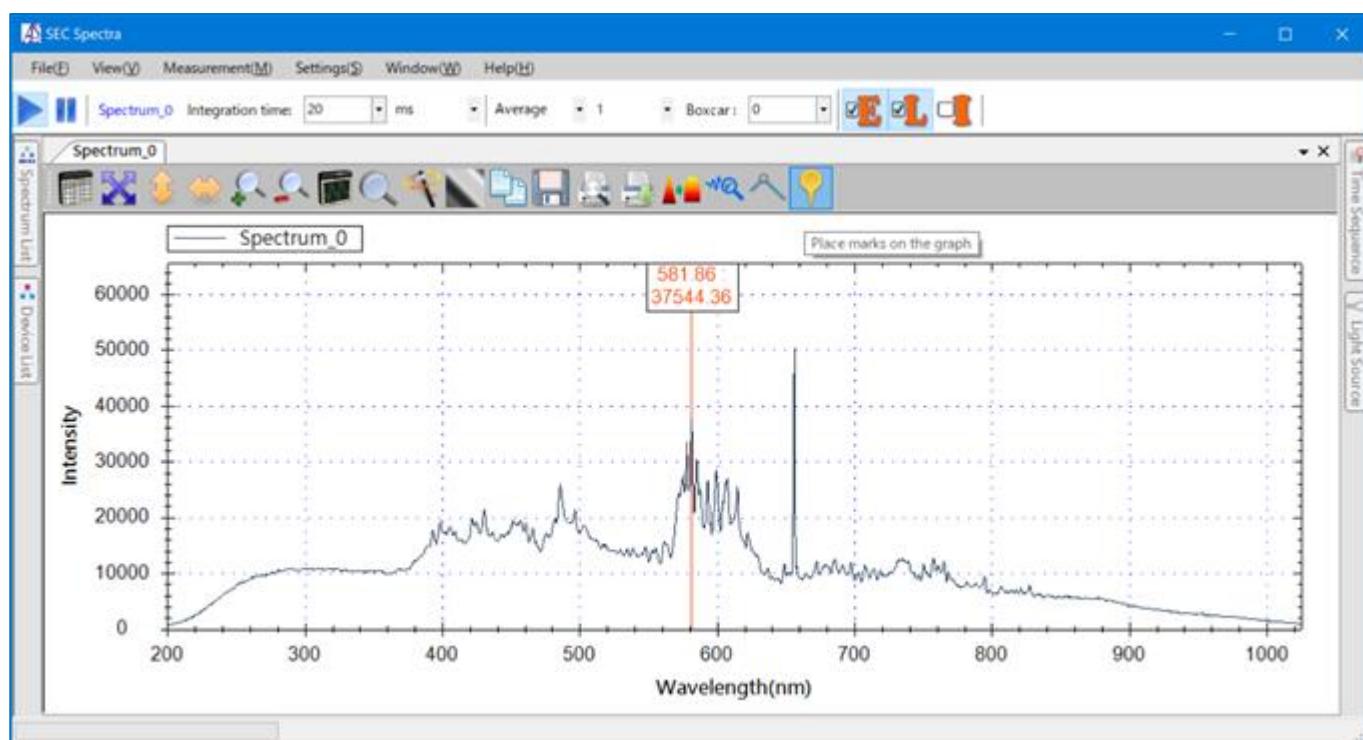


Figure 14-51. The effect of placing marks on the graph

**Note:** When you place a mark with the mouse, the program automatically finds the peak value on the curve near the location you click and places the mark there. As such, it is better to click on the curve at the wavelength position where you want to observe, rather than clicking on the empty space on the graph. Otherwise, the mark may go to where the peak value appears, instead of the X position you click.



## 14-7. Spectrum Data Pane

Press **Show spectrum data** icon on the toolbar can shows / hides the spectrum data pane.

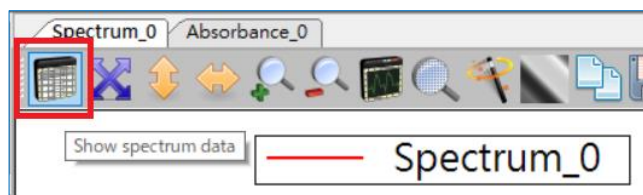


Figure 14-52. Show spectrum data icon

The upper half of the spectrum data pane consists of a list of the underlying spectrum curves of this measurement ("Spectrum\_0" is the only spectrum curve for this case). There are Spectrum Data, Marks and Information tabs at the lower half of the pane.

The **Spectral Data** tab shows a scrollable table and uses the scroll bar on the right to navigate to the wavelength range you want to check.

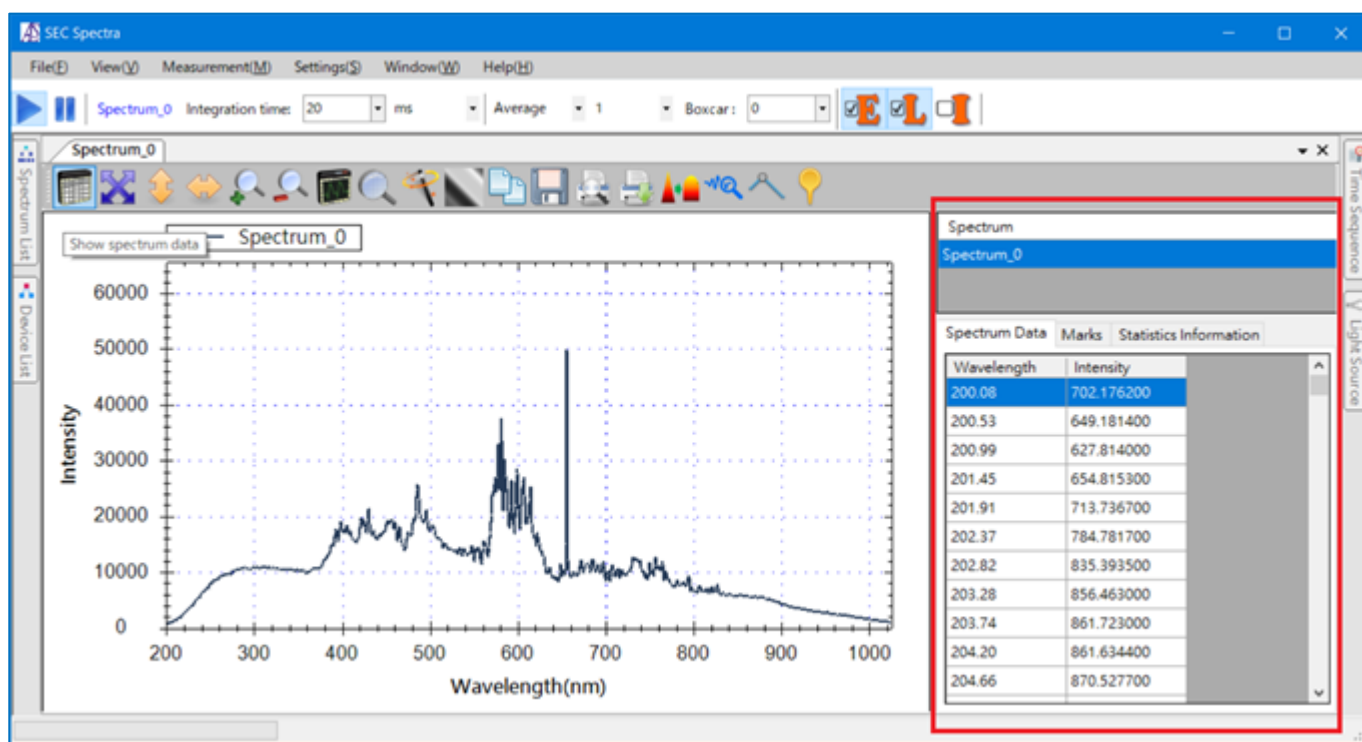


Figure 14-53. Spectrum Data Pane

### 14-7-1. Marks tab

In addition to using the mouse, you can also use the spectrum data pane to put marks on the graph, with the benefit of better accuracy in selecting the exact wavelengths you want.

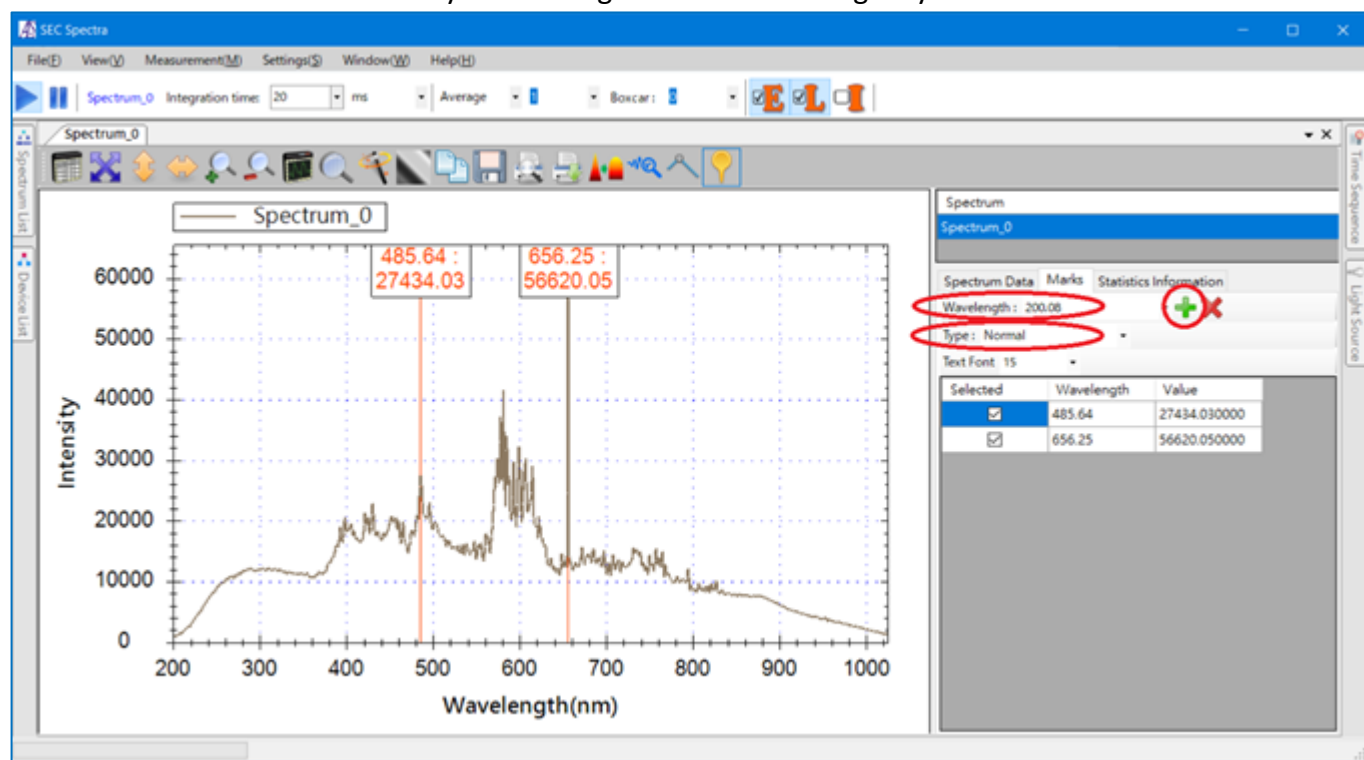


Figure 14-54. Add mark in **Marks** tab

#### Adding Marks

In the **Marks** tab, we can see the mark we created earlier is already in the list. Please enter or select a wavelength (nm) in the **Wavelength** field, and then select the mark type you want in the **Type** field. The available mark types include **Normal**, **Peak\_Intensity**, **Peak\_Lambda**, and **Peak\_FWHM**.

The available four mark types are explained in the following:

- Normal: Shows the intensity of the marked position
- Peak\_Intensity: Shows the intensity of the nearest peak
- Peak\_Lambda: Shows the wavelength of the nearest peak
- Peak\_FWHM: Shows the full width at half maximum of the nearest peak

After specifying **Wavelength** and **Type**, click on the green "+" symbol (i.e. the **Add** button). A new mark will appear at the specified wavelength position.

**Note:** The makeable positions of SEC Spectra are located at specific intervals. As a result, the program automatically places the mark at the position closest to the specified wavelength position.



## Deleting Marks

If you want to delete a mark, you can select the mark you want to delete on **Marks** tab (multiple choices can be selected at a time), and then click on the red "X" symbol (i.e. **Delete** button) to delete it.

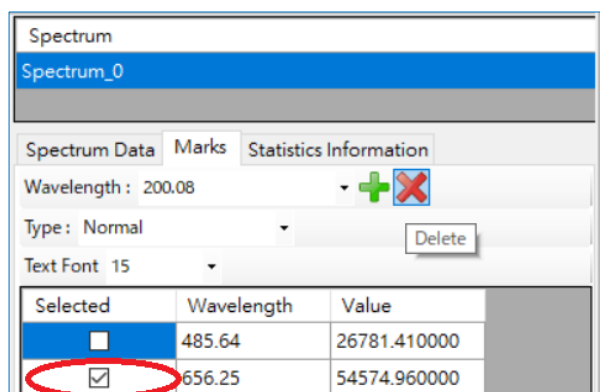


Figure 14-55. Click **Delete** button after selection

## Temporarily erase the mark

If you want to turn off the marks temporarily, you can press the **Place marks on the graph** button. The marks will be erased temporarily. You can simply press **Place marks on the graph** button again to see them.

## 14-7-2. Information tab

On the **Statistics Information** tab, you can see the characteristics of the measurement spectrum (for example: average, minimum, maximum and center of gravity). If you want to observe accurate data for a specific wavelength range, enter the wavelength range you want to calculate on the Statistics tab and read the required information. In the figure below, the table reads the current average, minimum, maximum and center of gravity.

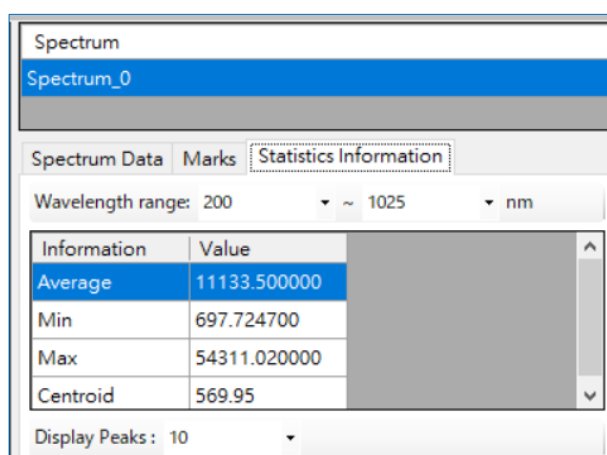


Figure 14-56. **Statistics Information** tab

## 14-8. Saving Current Spectrum

### 14-8-1. Saving Individual Spectrum Curves from the Toolbar

If you want to save the current spectrum measurement to a file, you can use the **Save selected spectrum as...** icon on the toolbar. See the following figure:



Figure 14-57. **Save selected spectrum as...** icon

Pressing this button shows the **Select Spectrum** window for you to choose the spectrum curve that you want to save.

**Note:** The pause icon will automatically activate when the save data icon is pressed. Press the start icon to start measuring again.

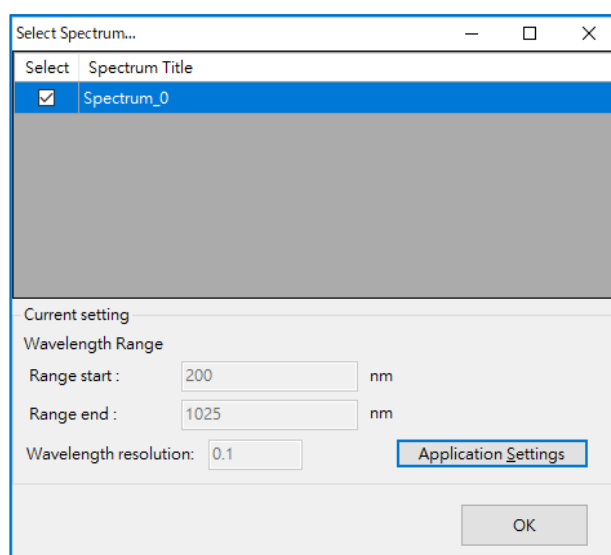


Figure 14-58. **Select Spectrum** window

If there are multiple spectral curves in the same window, save the spectrum individually. Please select the spectrum you want to save and click **OK**. The **Save As** window appears, specify the destination folder and the filename, press **Save**. The spectrum file will be saved. The default file format is SEC Spectra's proprietary file format (extension .sps). You can also save it in CSV or TXT format for use with other software. To save in CSV or TXT format, select **csv files** (extension .csv) or **text files** (extension .txt) in **Save as type** in the **Save As** window.

**Note:** CSV or TXT format can only be used for other software. SEC Spectra can not read spectrum curves in CSV or TXT format.

### 14-8-2. Saving Individual Spectrum Curves from the Spectrum Data Pane

In addition to saving spectrum curves from the **Save selected spectrum as** toolbar icon, you can also save individual spectrum curves from the spectrum data pane. The upper half of the pane consists of a list of the underlying spectrum curves of this measurement. Click on the spectrum curve that you want to save, and then right-click in the list to open the pop-up menu. Next, select **Save selected spectrum as**.

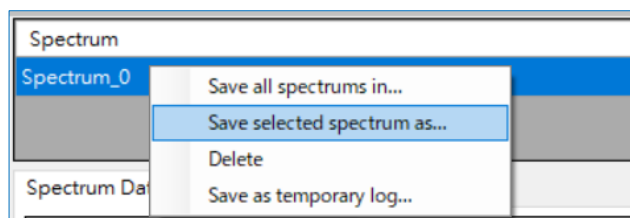


Figure 14-59. Selecting **Save selected spectrum as** on the pop-up menu

Next, the **Save As** window will appear. As in the previous section, please specify the destination folder and the filename, and then press **Save** to save the spectrum as a file.

### 14-8-3. Saving All Spectrum Curves in the Current Window

**SEC Spectra** allows you to display multiple spectrum curves in one window. Accordingly, if you have two or more spectrum curves in a window, you might want to save them all at once, instead of saving them individually. First, press the **Show spectrum data** button on the toolbar (if you have closed the spectrum data pane). Right-click in the **Spectrum** list of the upper half of the spectrum data pane to open the pop-up window, and then select **Save all spectrums in**.

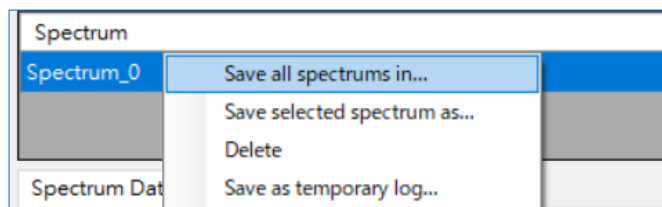


Figure 14-60. Selecting **Save all spectrums in** on the pop-up menu

Next, the **Browse for Folder** window will appear, select the destination folder, and then press **OK** when you have made your selection. All spectrum data files are saved in the specified folder. The file name is the title of the spectrum and the file extension is **.sps**. In this example, the saved file is "**Spectrum\_0.sps**".

### 14-8-4. Saving the Current Spectrum Curves as a Temporary Log

Besides saving the spectrum as a file, SEC Spectra allows you to save the spectrum curve as a temporary log. Temporary logs are displayed on the graph being measured.

Right-click the mouse in the **Spectrum** list in the spectrum data pane to bring up the pop-up menu, and then select **Save as temporary log**.

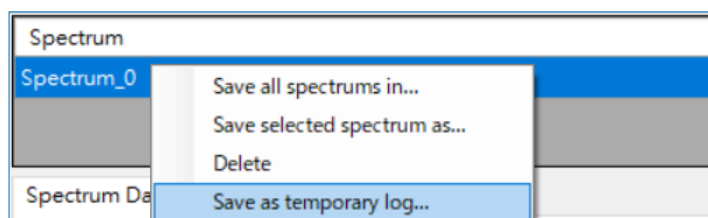


Figure 14-61. select **Save as temporary log...** from the pop-up menu

Next, you will see a **Please enter the temporary log spectrum name** message box, as in the following:

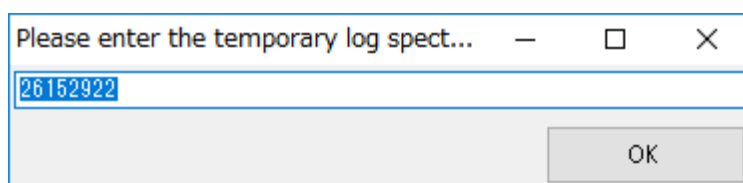


Figure 14-62. **Please enter the temporary log spectrum name** message box

You can specify a name for the temporary log spectrum or simply use the default number as the name. For example, change the number to "intg30" on condition that the integration time is 30 ms.

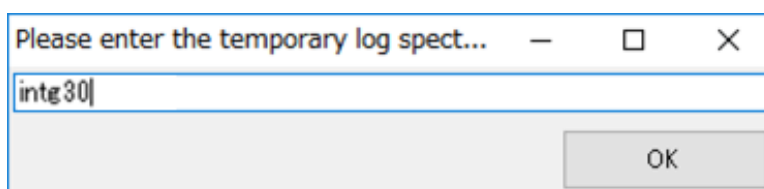


Figure 14-63. Renaming the temporary log spectrum

Press **OK**. A new spectrum curve of "intg30" is created in the spectrum graph. If you change the integration time of the original Spectrum\_0 curve, you can see the difference between the integration time of the two curves.

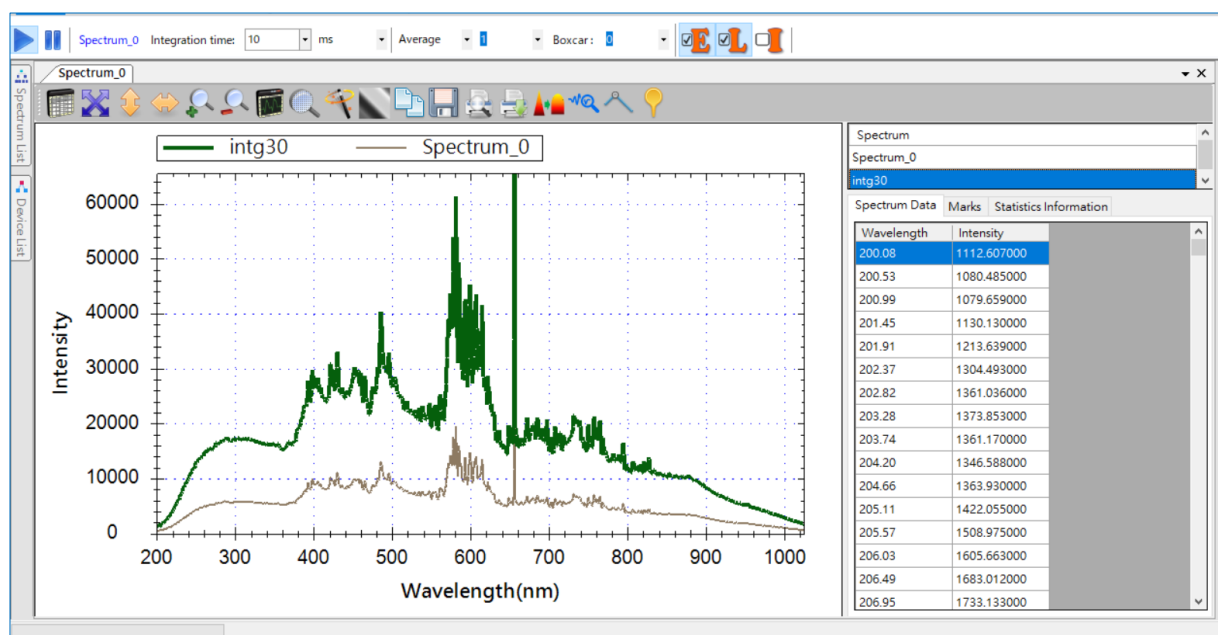


Figure 14-64. Creating a temporary recording spectrum curve

The two curves are displayed as thicker curves when selected in the spectrum list. The figure above shows **intg30** selected.

If you no longer need to display the spectrum temporarily, you can delete it from the Spectrum Data list. For detailed operations, refer to the following section 14.8.5.

### 14-8-5. Deleting Individual Spectrum Curves

If there are many spectral curves in the spectral graph, you can remove the spectral curves you don't need. First, in the **Spectrum** list of the Spectrum Data pane, select the spectrum you want to delete, right-click to open the pop-up menu and select **Delete**. This will delete the selected spectrum curve.

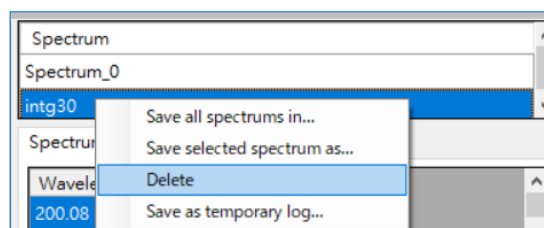


Figure 14-65. Selecting **Delete** on the pop-up menu

## 14-9. Other Tool Bar Icons

### 14-9-1. Smoothing

A raw spectrum curve tends to be jagged and spiky, due to the inevitable noises in the original signal. SEC Spectra provides a feature to eliminate such noises and smooth out the curve. This is an icon called **Smoothing** on the graph toolbar. See the following figure: Refer to "14-3-4. Smoothing" for detailed settings.

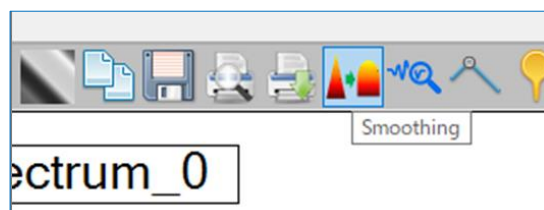


Figure 14-66. **Smoothing** icon

### 14-9-2. Showing Peak Values

Sometimes you need to know the peak values on the curve when you are viewing a measurement graph. SEC Spectra provides a feature to automatically identify the peaks and show their values on the graph. Here is the icon to show the peak values:

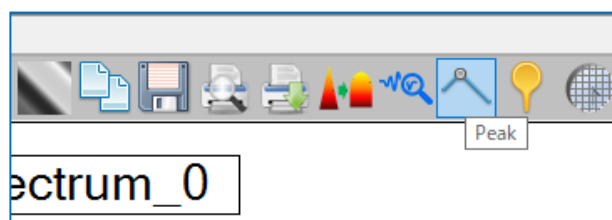


Figure 14-67. **Peak** icon

When pressed, the **Peak** button opens the **Peak Information** window: **Peak Information** window

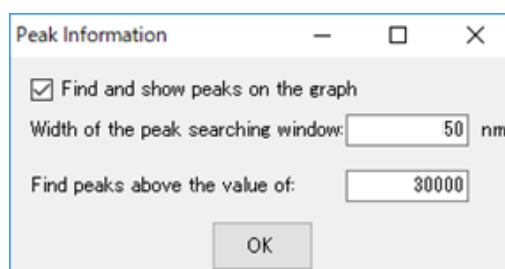


Figure 14-68. **Peak Information** window

Select **Find and show peaks on the graph** and set the **Width of the peak searching window** as well as a minimum value for the peak. Search for all wavelength regions with the set peak value search width and search the maximum value each time. If you increase the width of the search peak, the number of peaks to be searched will decrease. For the minimum value of the peak to be searched, set the lower limit of the peak to be searched. In this example, set the width to 50 nm and the minimum value of the peak to 30000. Click **OK**, and you will see the following result:

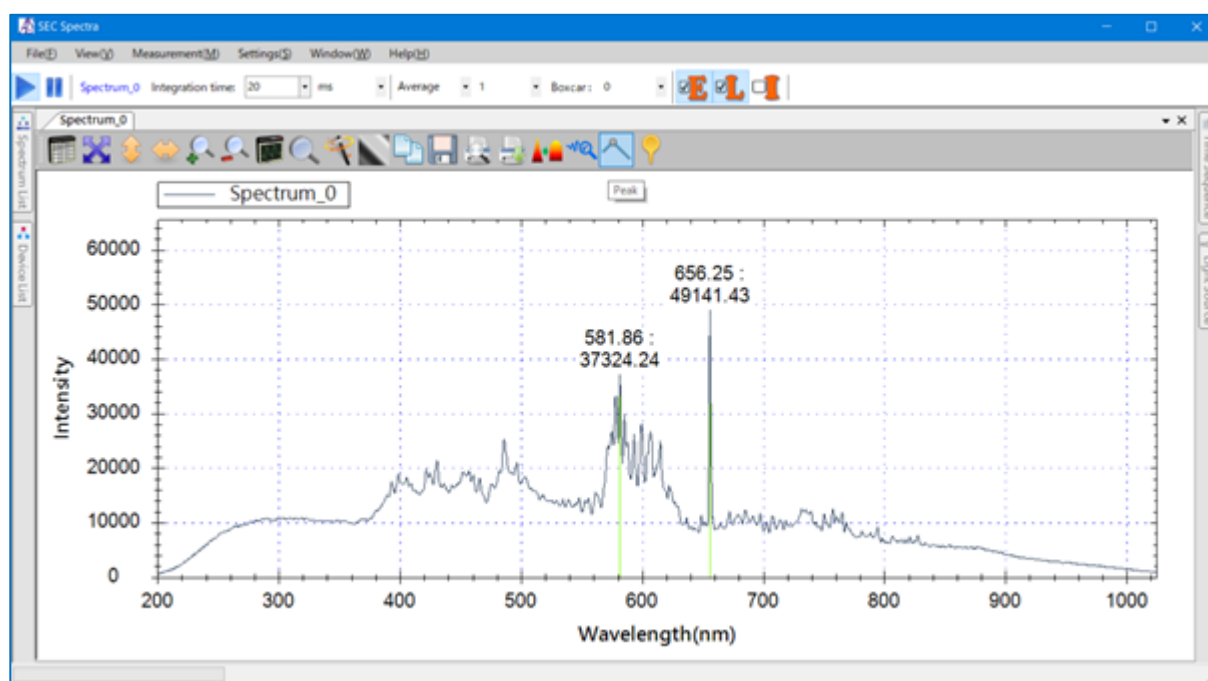


Figure 14-69. The result of enabling **Peak Information**

### 14-9-3. Print Preview and Print

To print the current spectrum measurement, you can use the **Print Preview** or the **Print** icon on the toolbar.

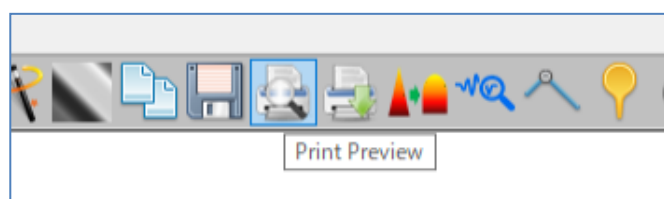


Figure 14-70. **Print Preview** icon

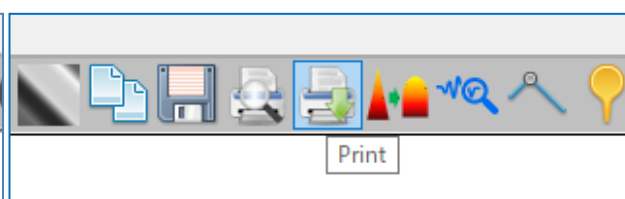


Figure 14-71. **Print** icon

The same window opens as **Print** and **Print Preview** from **File** menu (14-1-5. [Page Setup and Print](#)). Pressing the **Print Preview** icon displays a standard **Print Preview** window, which shows the current spectrum measurement.

### 14-9-4. Set Integration Time Automatically

When creating a spectrum measurement, you need to specify the integration time (sensor exposure time). If you do not know the integration time, first measure the spectrum with the default value (50 ms) and press **Set integration time automatically** icon on the toolbar, then **SEC Spectra** will automatically set the optimum integration time.



Figure 14-72. Set integration time automatically icon

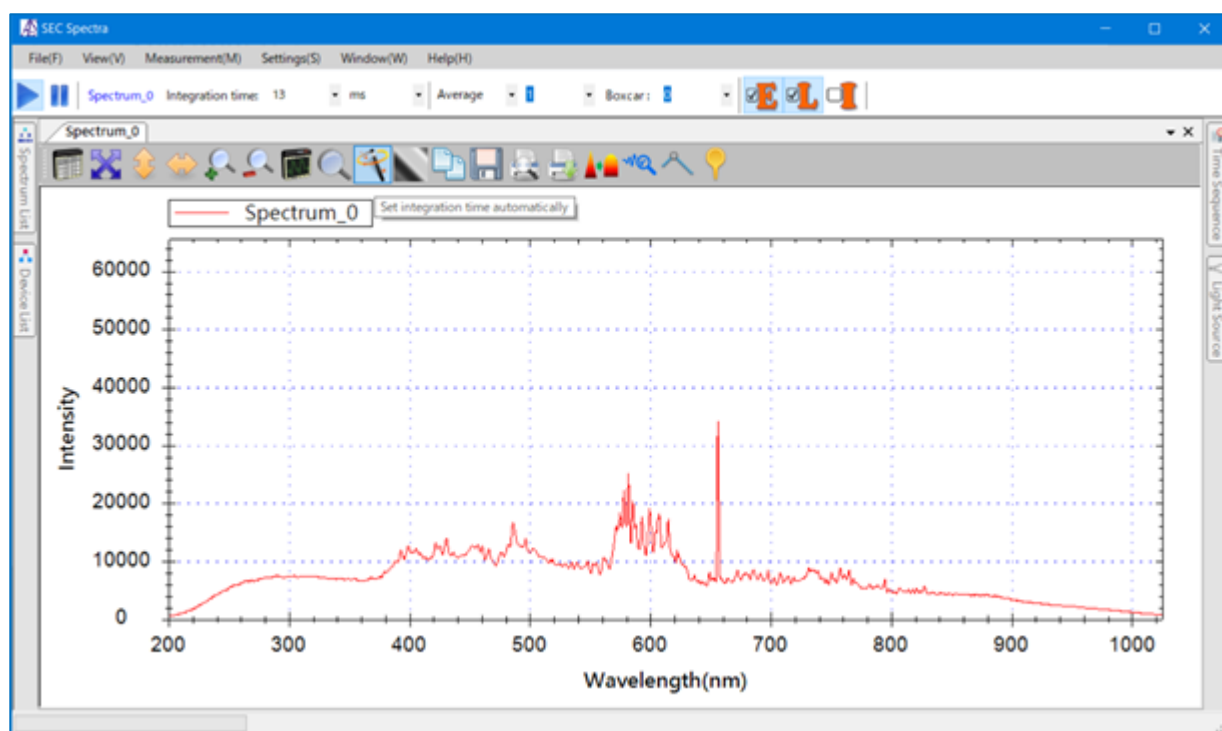


Figure 14-73. The effect of using the **Set integration time automatically** icon

The integration time has changed from 50 ms to 13 ms after the **Set integration time automatically** button is pressed. And the spectrum is corrected slightly downward.



### 14-9-5. Set as DarkSpectrum

**Set as dark spectrum** icon is in the right of the **Set integration time automatically** icon. If you want to reset the dark spectrum, block the light source or disconnect the light source and press **Set as dark spectrum** icon.

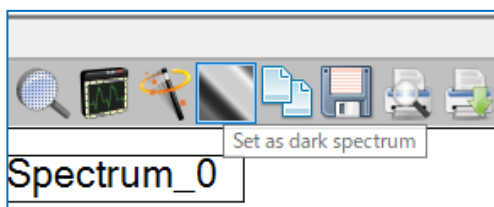


Figure 14-74. **Set as dark spectrum** icon

### 14-9-6. FWHM

SEC Spectra offers the function of displaying FWHM in real time. You can click the **FWHM** icon and click on any wavelength of the spectrum. The program will automatically find the highest peak nearby and measure its FWHM and reflect it in the spectrum.

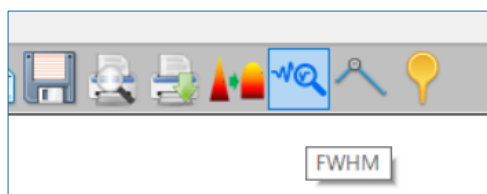


Figure 14-75. **FWHM** icon

### 14-9-7. Copy to Clipboard

Sometimes you might want to copy and paste the spectrum data into other applications. You can do this by using the **Copy to clipboard** icon on the toolbar.

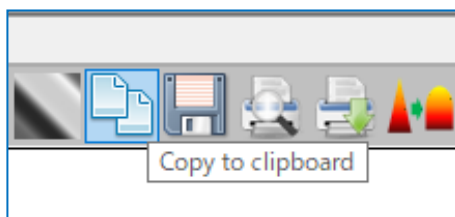


Figure 14-76. **Copy to clipboard** icon

As you press this icon, all data in the spectrum data pane will be copied to the system clipboard. You can then paste the data into the application you want. For illustration, we paste the data into Windows Notepad in the following figures:

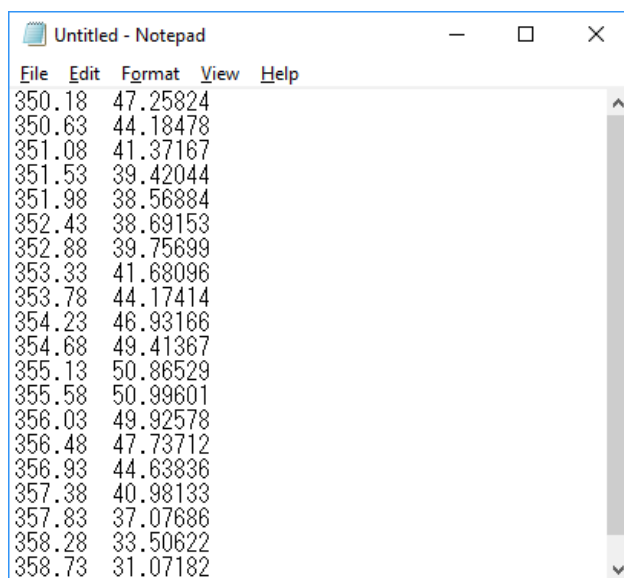


Figure 14-77. Pasting spectrum data into Windows Notepad

### 14-9-8. Close a Measurement

To end the measurement such as spectrum, strip chart, absorbance, etc., you can close it by pressing the **X** icon on the upper right corner of the graph.

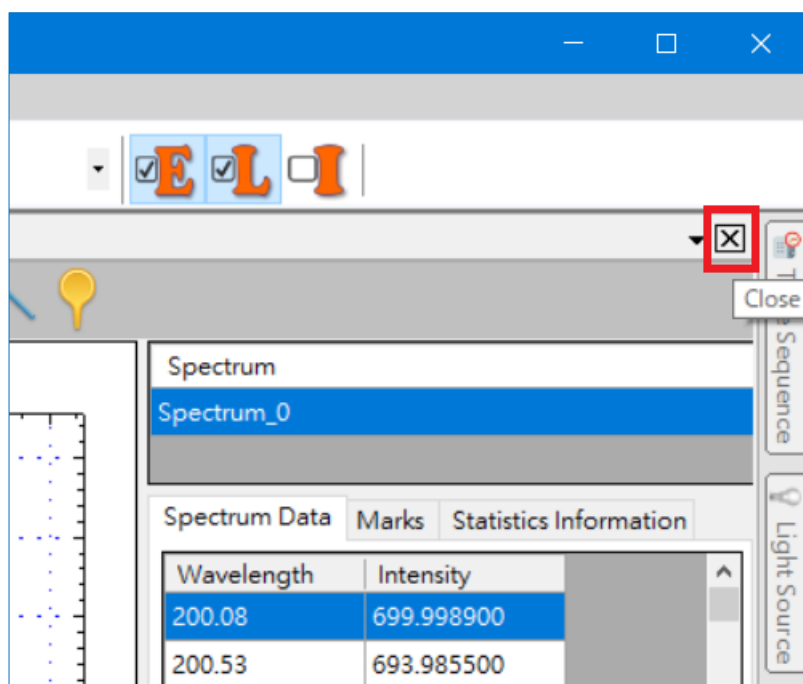


Figure 14-78. The icon to close a measurement

**Note:** When you close the graph, the measurement is also closed. If you need the same measurement later (such as spectrum), you need to create it again.

### 14-9-9. Start Acquiring and Pause

In most cases, SEC Spectra acquires data continuously from the spectrometer. Clicking the **Save** icon will activate the **Pause** icon and pause continuous acquisition. If you want to resume the measurement, press **Start Acquiring** icon to return to continuous acquisition.

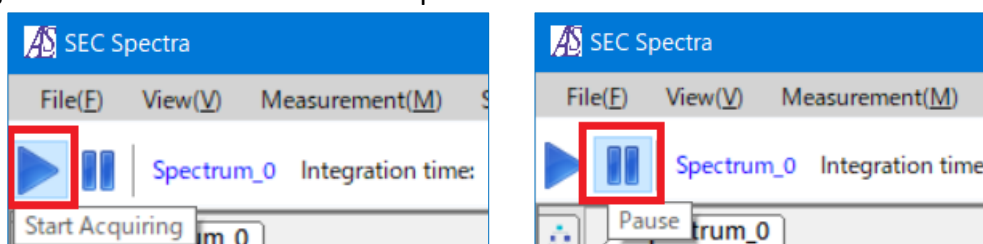


Figure 14-79. Start Acquiring icon and Pause icon

## 15. Spectrum Correction Features

### 15-1. Electronic Dark Correction

A basic electric current constantly flows through the electronic systems (such as the main board and the CCD sensor) of the BAS spectrometer whenever the spectrometer is on. This is called the "dark current," meaning this current exists even though no light enters the spectrometer. The analog-to-digital converter (ADC) will also convert this dark current into measurement readings across the entire spectrum, forming the baseline. Before shipment, BAS spectrometer will be factory-calibrated to an assumed baseline of 1,000 as the dark current. Since the dark current is not triggered by the light entering the spectrometer, this baseline needs to be deducted from the readings. As the level of the dark current can be affected by the device temperature, BAS has designed an algorithm to dynamically correct the readings in relation to the dark current. This is called the "electronic dark correction," a process which each BAS spectrometer must go through before shipment, and the correction data is directly stored within the spectrometer. When the electronic dark correction is enabled in the SEC Spectra software, the dark current will be dynamic removed from the measurement curve. The following figures show two different measurement curves without and with electronic dark correction, respectively:

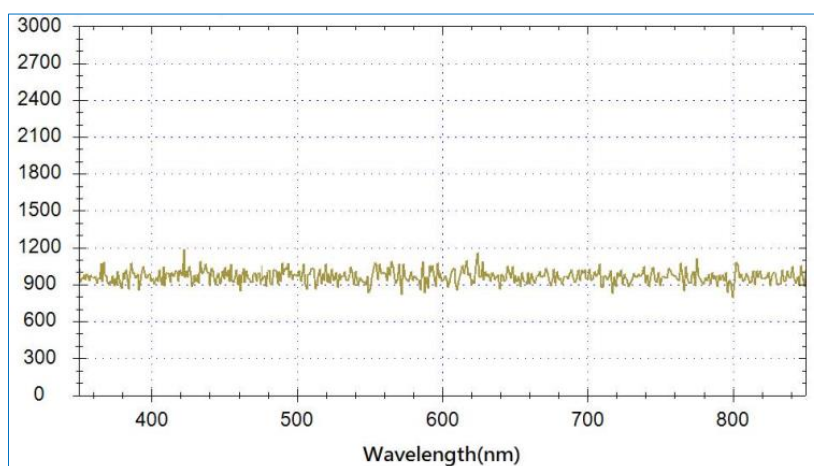


Figure 15-1. Without electronic dark correction

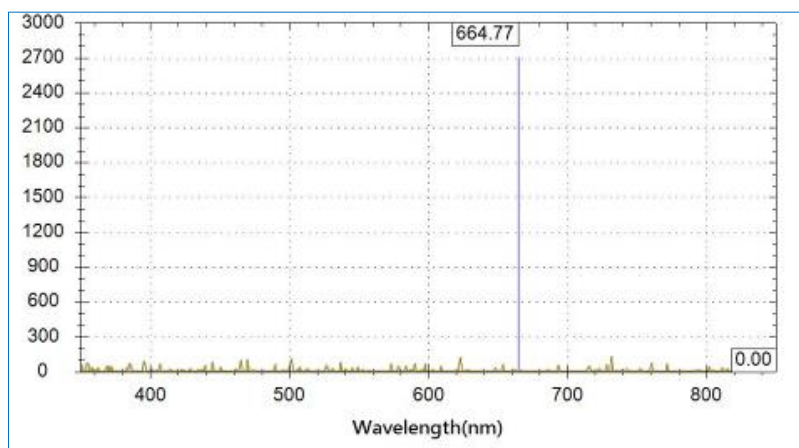
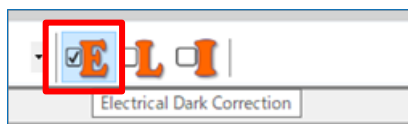


Figure 15-2. With electronic dark correction

To enable electronic dark correction, click on the **Electronic Dark Correction** button above the toolbar. To disable it, just click on the button again. See the following figure:

Figure 15-3. **Electronic Dark Correction** icon

## 15-2. Linearity Correction

The response curve of the CCD sensor in relation to the light intensity is not a perfect straight line. In addition, the response curve of each CCD sensor will not be identical to each other. For this reason, each BAS spectrometer will go through a "linearity correction" process before it is shipped, with its own correction table stored within the spectrometer. As BAS spectrometer uses a 16-bit ADC internally, its output readings will be calibrated to the range between 0 and 65535. When linearity correction is enabled in the SEC Spectra software, the reading for each pixel will be corrected using this table. See the following figure for the difference:

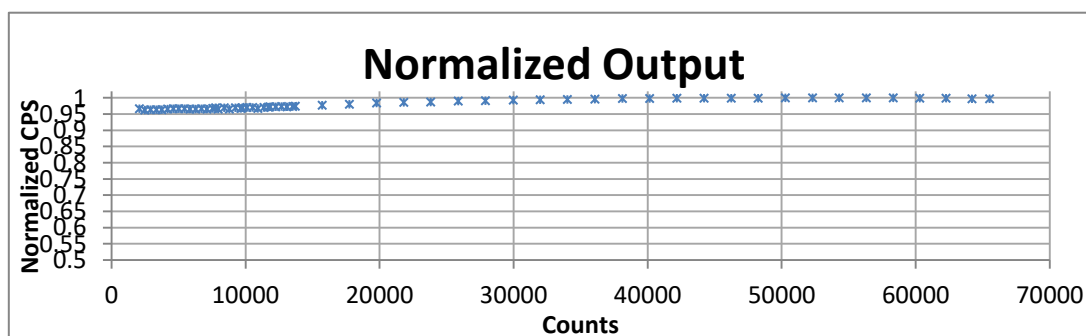


Figure 15-4. Without linearity correction

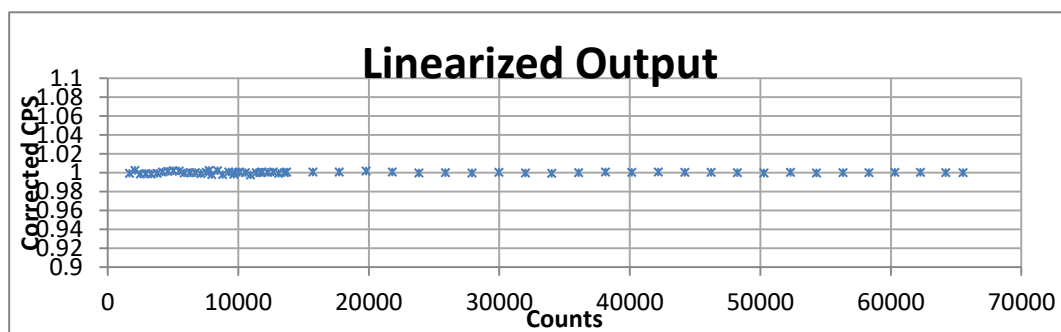


Figure 15-5. With linearity correction

To enable linearity correction in SEC Spectra, click on the **Linearity Correction** icon above the toolbar. To disable it, just click on the button again. See the following figure:

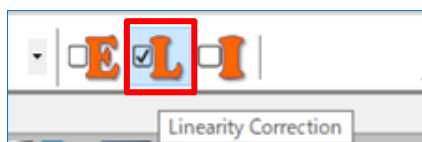


Figure 15-6. **Linearity Correction** icon

## 16. Contact Information

This concludes our introduction to all features of SEC Spectra. Hopefully, these chapters will help you get up to speed with SEC Spectra as a new user. If you have any further questions about SEC Spectra or any suggestions to this guide, please contact us at:

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