Quickstart Guides for Modular Systems

Introduction to Modular Systems

StellarNet's lines of compact and modular spectrometers are ideal for a variety of different applications. Customer can purchase one spectrometer and perform many types of measurements. Our modular spectrometer's versatility is one of their largest benefits. In the quickstart guides to follow, we will provide a setup diagram of components as well as preliminary instructions on how to perform the measurements. Likewise we will include some useful considerations and pointers for a beginner with our systems.

If you ever have interest in performing another type of measurement that wasn't your initial intention contact one of our spectroscopy experts to see what additional components you may need.

Spectroradiometry

Many SpectroRadiometric measurements are similar but many require different instrumentation setups and calibrations. Please review calibration file installation section found in Chapter 2 before proceeding with the following quickstarts.

LED Measurement

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram to the right.
2. Turn on your LED or device to be tested and look at its raw signal in SCOPE mode.
3. In SCOPE mode set the integration time so that your spectrum is not saturated but as close to 65,000 counts as possible. Click on the integration time icon or use sliding scale . A signal with a flat top indicates that you are saturating the detector and should decrease your integration time. If you do not see any signal increase your integration time until you do.

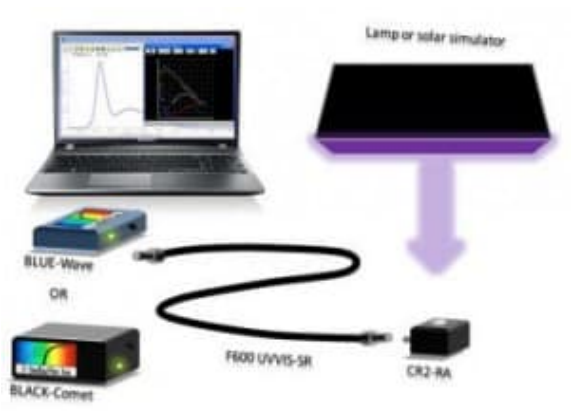
StellarNet LED Measurement System consisting of Black Comet spectrometer, F600-VISNIR fiber, IS6 6" integrating sphere, & a RAD-FLUX calibration service.

4. In SCOPE mode choose your favorite settings such as spectral smoothing controls or samples to average. A pixel box car set to 3 and averaging set to 5 often gives nice results.
5. Now, cover or turn off your LED. Wait several collection cycles and hit the dark light bulb icon in the toolbar at the top of the screen. You will see your baseline drop to zero.
6. Click on Watts mode to see your LEDs spectral curve and power output. Click CIE Color Measurement icon or from the Applications Menu to see colorimetric values.

Warning: If your system saturates at all integration times or you need to reduce your exposure time <15ms to get a signal, then you must use a CR2-Aperture (CR2-AP) or inline neutral density filter to reduce light intensity to your system's detector. There are other possible solutions as well. Please contact a StellarNet technical sales associate to choose which solution is best for your application. For Radiometric applications it is recommended to use exposure times >15ms.

Solar & Grow Lamp Analysis

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram on the right.



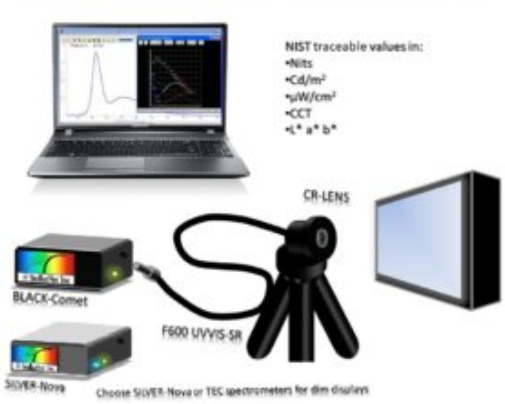
StellarNet SolarRAD System consisting of Black Comet spectrometer, F600-VISNIR fiber, CR2 or CR2 Right Angle, & an IRRAD-CAL Irradiance calibration service.

2. Turn on your Grow Light or point your CR2 towards the sun initially to see its raw signal in SCOPE mode. For solar applications try to make sure you do this initial setup when the sun is at its brightest and there are no clouds.
3. In SCOPE mode set the integration time to 90% of full saturation or approximately 60,000 counts. Click on the integration time icon or use sliding scale. A signal with a flat top indicates that you are saturating the detector and should decrease your integration time. If you do not see any signal increase your integration time until you do.
4. In SCOPE mode choose your favorite settings such as spectral smoothing controls or samples to average. A pixel box car set to 3 and averaging set to 5 often gives nice results.
5. Now, cover or turn off your grow light or cover your CR2's active surface. Wait several collection cycles and hit the dark light bulb icon in the toolbar at the top of the screen. You will see your baseline drop to zero.
6. Click on Watts mode to see your Grow Lamp/Solar spectral curve and power output. Click CIE Color Measurement icon or from the Applications Menu to see colorimetric values. Click the Solar Monitor icon to start the Solar Match & UV monitoring applications.

Warning: If your system saturates at all integration times or you need to reduce your exposure time <15ms to get a signal, then you must use a CR2-Aperture (CR2-AP) or inline neutral density filter to reduce light intensity to your system's detector. There are other possible solutions as well. Please contact a StellarNet technical sales associate to choose which solution is best for your application. For Radiometric applications it is recommended to use exposure times >15ms.

Display Measurement

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram to the right.



StellarNet Display Measurement System consisting of Black Comet-TEC or SILVER-Nova spectrometer, F600-VISNIR fiber, CRLENS, & RAD-CAL Radiance calibration service.

2. Turn on your Display, Monitor, or Backlit LED. Display Measurements require RAD-CAL Radiance calibrations for results in W/m^2/sr or Cd/m^2.

3. In SCOPE mode set the integration time to 90% of full saturation or approximately 60,000 counts. Click on the integration time icon or use sliding scale. A signal with a flat top indicates that you are saturating the detector and should decrease your integration time. If you do not see any signal increase your integration time until you do.

4. In SCOPE mode choose your favorite settings such as spectral smoothing controls or samples to average. A pixel box car set to 3 and averaging set to 5 often gives nice results.

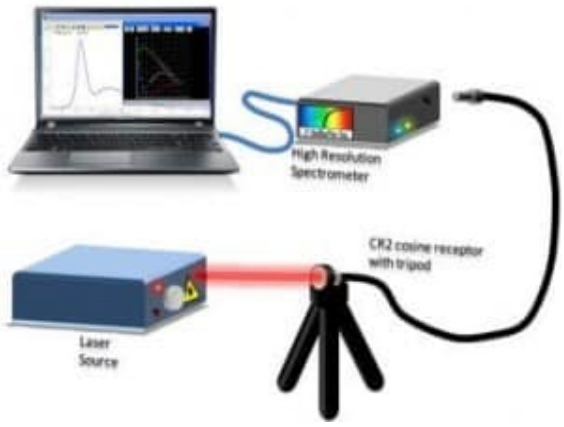
5. Now, cover or turn off your Display or cover your CRLENS. Wait several collection cycles and hit the dark light bulb icon in the toolbar at the top of the screen. You will see your baseline drop to zero.

6. Click on Watts mode to see your Display's spectral curve and power output. Click CIE Color Measurement icon or from the Applications Menu to see colorimetric values.

Warning: If your system saturates at all integration times or you need to reduce your exposure time <15ms to get a signal, then you must use a CR2-Aperture (CR2-AP) or inline neutral density filter to reduce light intensity to your system's detector. There are other possible solutions as well. Please contact a StellarNet technical sales associate to choose which solution is best for your application. For Radiometric applications it is recommended to use exposure times >15ms.

Laser Monitoring

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram to the right.
2. Laser monitoring is one of the easiest applications for a StellarNet system. Simply shoot your laser into a entrance diffuser such as the CR1-UVN and couple to your spectrometer.
3. In SCOPE mode you will see you laser's spectral profile and be able to use our peak tool icon  to calculate AreaPSD, Centroid, Peakwave, FWHM, and Centbase of a peak.
4. If you have a high power laser it is advised to use more entrance diffusers and a small detector exposure time and slowly remove diffusers and increase your detector exposure time.



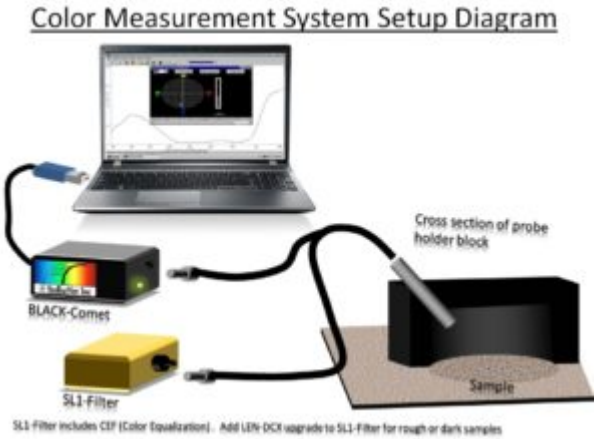
StellarNet Laser Monitoring System consisting of a High Resolution (HR) spectrometer, F600-VISNIR fiber, and CR1-UVN diffuser.

Plasma Optical Emission Spectroscopy

1. Plasma monitoring can also be a very simple application which typically only requires a spectrometer and an optical fiber collecting the signal.
2. Add Lens-Col to the end of your optical fiber to collect more light to your spectrometer and collect light from a small spot.
3. Add Jack-in TTL trigger to enable a spectrometer scan.

Color Measurement

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram to the right. With the instrument and accessories connected, open the SpectraWiz program.



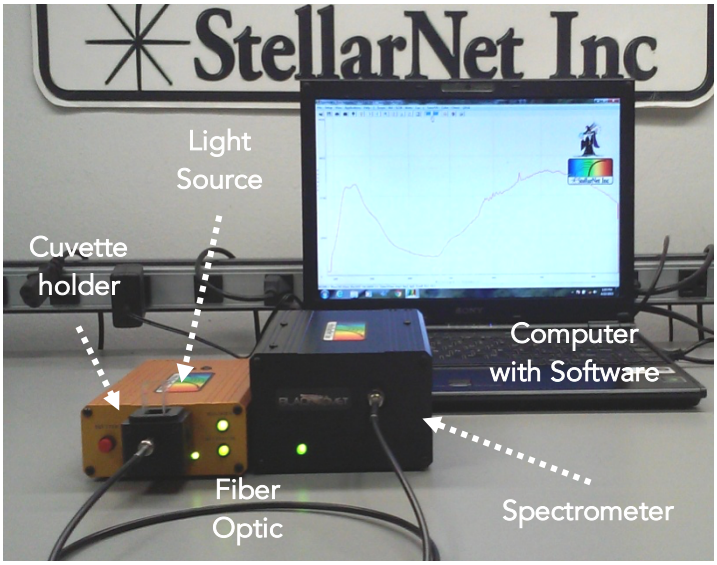
StellarNet Color Monitoring System consisting of a BLACK-Comet or BLUE-Wave spectrometer, SL1-Filter, R600-8-VISNIR reflectance probe, Rs50 white standard, RPH probe holder, and SpectraWiz Software.

2. In SCOPE Mode; adjust the integration time, number of scans to average, and XTiming resolution control.
3. With the light source off, and no sample under the probe, wait several collection cycles and hit the dark light bulb icon  in the toolbar at the top of the screen. You will see your baseline drop to zero.
4. Place the RS50 White Reflectance Standard under the probe and turn on light source; Take the *light reference* by clicking on the yellow light bulb icon  in the toolbar at the top of the screen.
5. Enter into Transmission Mode and place sample under probe.
6. Begin collecting data. Click CIE Color Measurement icon  or from the Applications Menu to see colorimetric values.

Chemical Absorbance Measurement

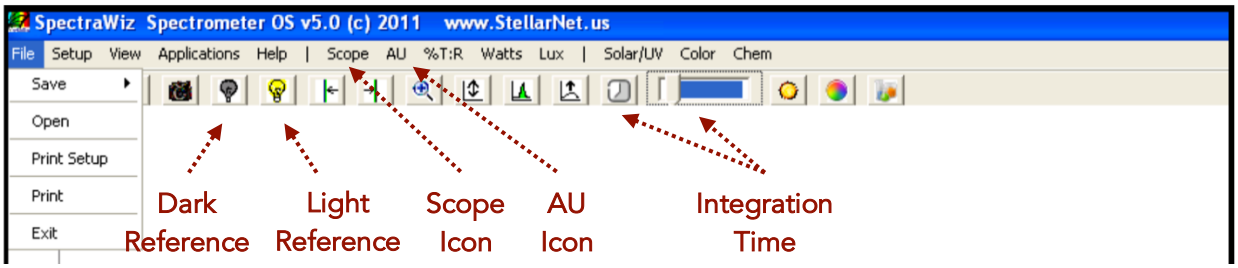
Spectrometer Setup

1. Review the spectrometer system setup. Make sure that the spectrometer system resembles the diagram to the right.
2. Remove the cuvette holder cap. Place your **blank** cuvette into the cuvette holder and replace the cuvette holder cap.
3. Turn on the computer. Open the StellarNet software by double clicking on the desktop icon ***SpectraWiz*** to open the application.



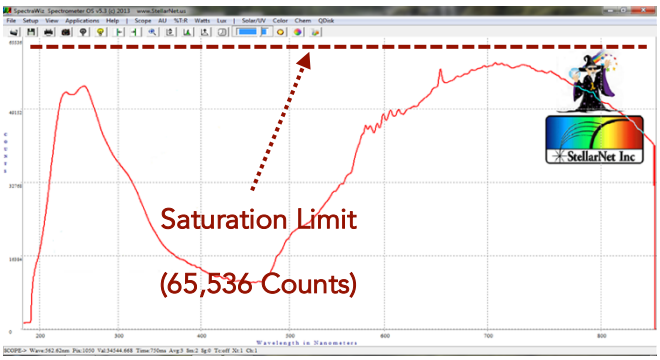
StellarNet spectrometer system (Black Comet spectrometer and SL5-CUV deuterium and halogen light source)

4. When you first open the software, you should see a screen similar to the one below:

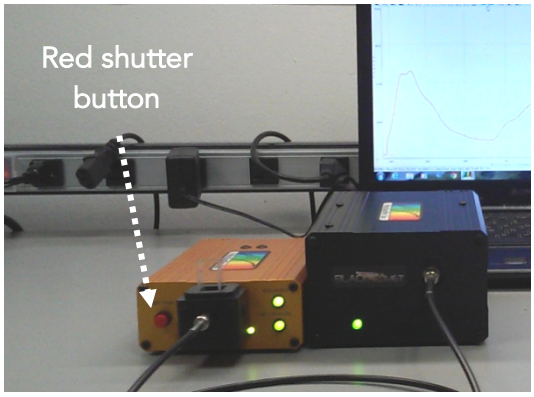


5. Click on the Scope icon. This will show you the number of counts (photons) the detector receives. You should see a spectrum of counts versus wavelength.
6. Set the integration time so that your spectrum is not saturated but as close to 65,000 counts as possible. Click on the integration time icon  (and type in a value between 1 and 1000 ms) or use sliding scale  .

   In the picture to the right, the spectrum is correctly optimized to be right below the saturation limit (65,536 counts). If a portion of the spectrum is off the screen reduce the integration time.



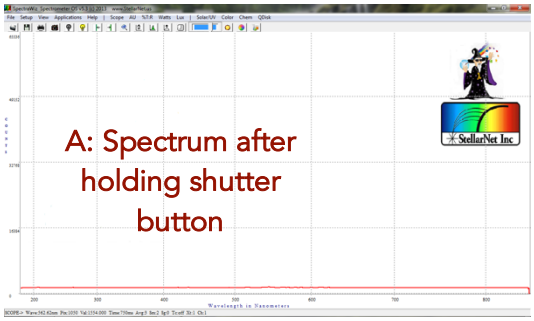
Dark and Light References

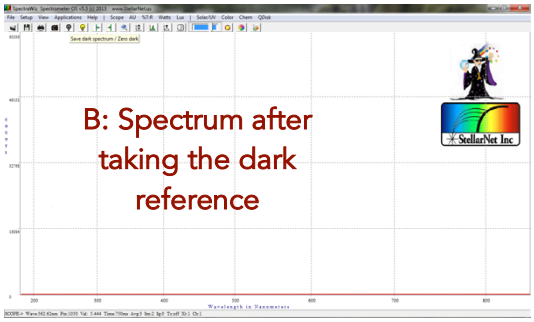


1. Make sure that your **blank cuvette** is in the cuvette holder and the cap is on the cuvette holder. **Take the *light reference*** by clicking on the **yellow light bulb** icon in the toolbar at the top of the screen.
2. **Take the *dark reference***. First, hold the red shutter button for at least three seconds. You should see the spectrum fall flat everywhere on your graph (A).

   Second, while still holding the shutter button, click on the **dark light bulb** icon in the toolbar at the top of the screen. The baseline will drop to zero (B).

   Finally, you can release the shutter button. You should see the spectrum return to its original profile.
3. Now that you have taken the dark and light reference, click on the **AU (absorbance)** icon in the toolbar at the top of the screen to display a spectrum in absorbance units.
4. You should see a nearly flat absorbance spectrum once you switch to absorbance if you have blanked and zeroed the spectrometer correctly.

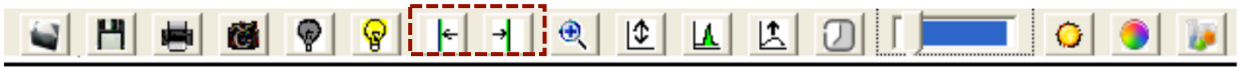




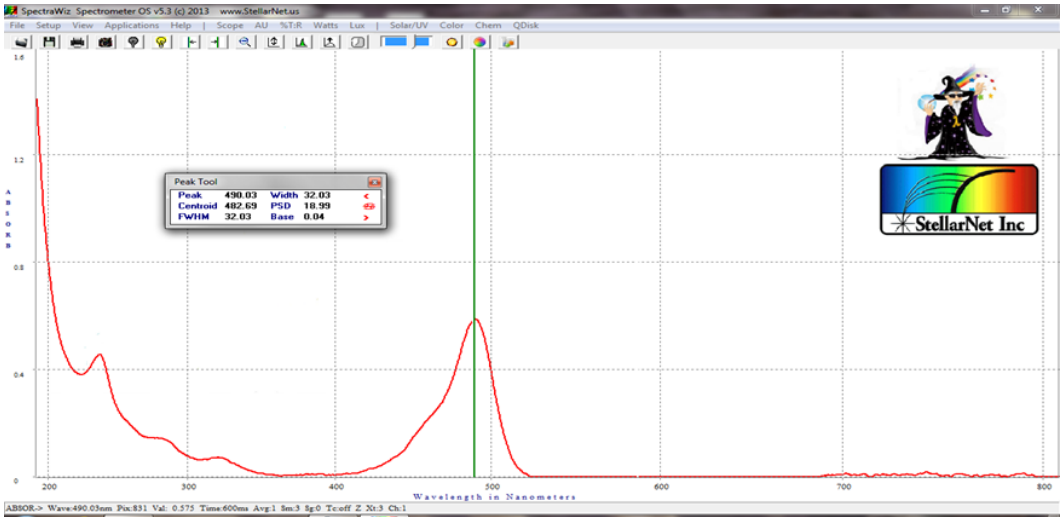
Depending on the cuvettes you use, you may see fluctuations below 300 nm. This is simply due to the cuvette absorbing UV radiation at these wavelengths.

Taking Absorbance Measurements

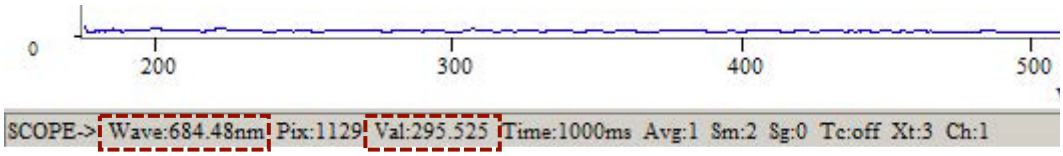
1. Remove your blank sample from the cuvette holder. Place the most concentrated standard cuvette in the holder and replace the cuvette cap. The instrument will now display absorbance in real time.
2. Look at the spectrum and select the wavelength of maximum absorbance.
3. To find a peak, use the mouse to **right click** on either of the following icons:



The left arrow will find a peak to the left of the vertical line in the spectra. The right arrow will find a peak to the right of the vertical line in the spectra.



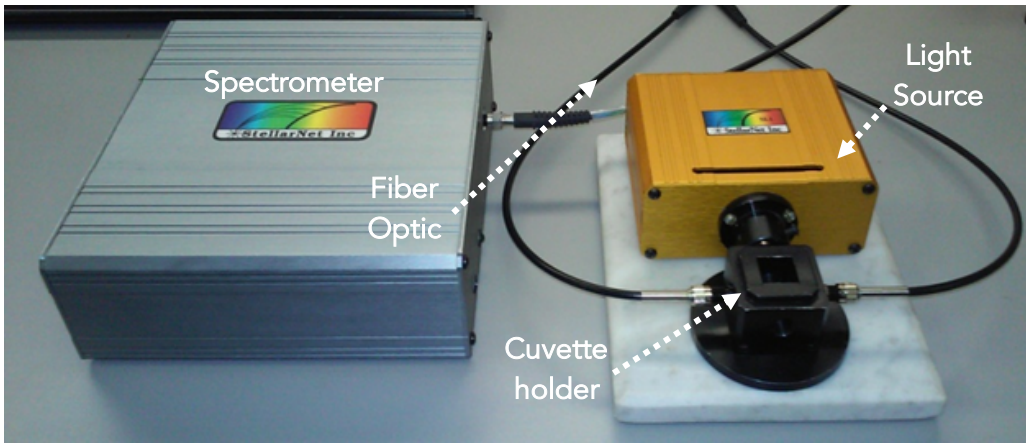
4. You can also **right click** directly onto the spectrum to find the absorbance of a specific point. To find the specific wavelength your cursor is at, look to the bottom of the spectrum. Wave gives the specific wavelength and Val gives the absorbance for that particular point in the spectrum.



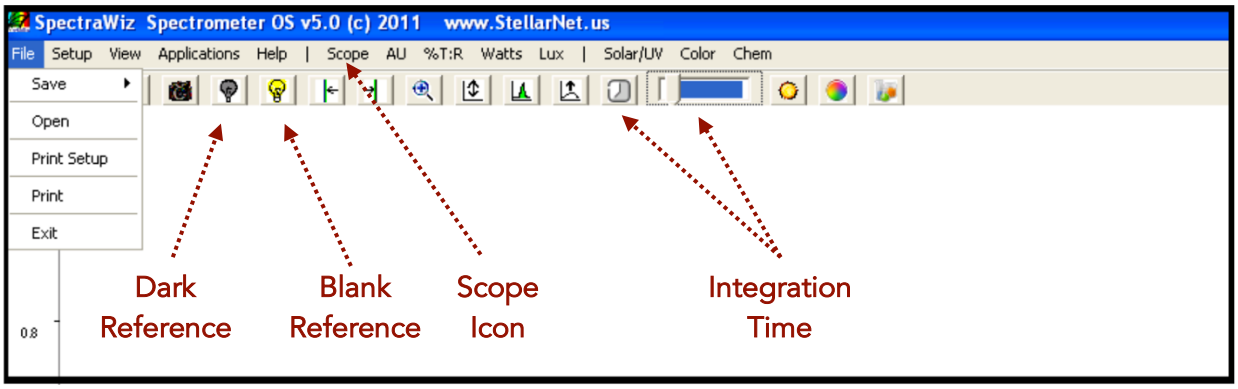
Fluorescence Measurement

Spectrometer Setup

1. Transfer your standard cuvettes to the spectrometer. Make sure that your cuvettes are capped so you don't accidently spill solution on or near the spectrometer.
2. Review the spectrometer system setup. Make sure that the spectrometer system resembles the setup below. Make sure that you can identify all the components of the spectrometer system.

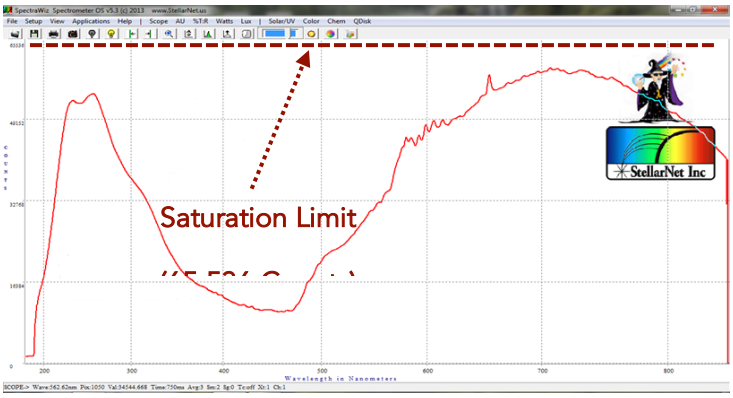


3. Turn on the computer. Open the StellarNet software by double clicking on the desktop icon *SpectraWiz* to open the application
4. When you first open the software, you should see a screen that looks like:



5. Click on the Scope icon (highlighted above). This will show you the number of counts (photons) the detector receives. You should see a spectrum of counts versus wavelength.
6. Remove the cuvette holder cap. Place your **most concentrated standard** cuvette into the cuvette holder and replace the cuvette holder cap.

7. Set the integration time so that your spectrum is not saturated but as close to 65,000 counts as possible. Click on the integration time icon (and type in a value between 1 and 1000 ms) or use sliding scale .



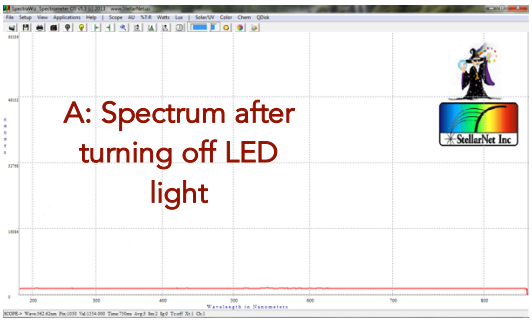
In the picture to the right, the spectrum is correctly optimized to be right below the saturation limit (65,536 counts). If a portion of the spectrum is off the screen reduce the integration time.

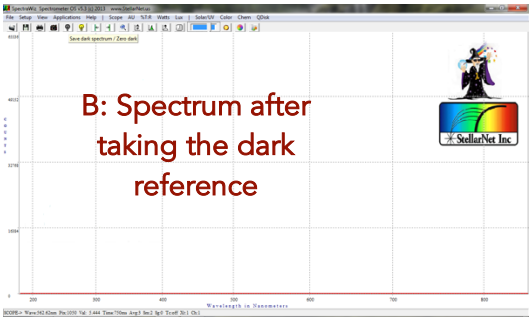
Dark Reference

1. Take a *dark reference*. Press the red button on the back of the light source (orange box). The button will be pressed in if the LED light is on. If the button is not pressed in then the LED light is off. After several minutes, the baseline will settle (A).
2. Once the baseline has settled, click on the dark light bulb icon in the toolbar at the top of the screen. The baseline will drop to zero (B).

Taking Fluorescence Measurements

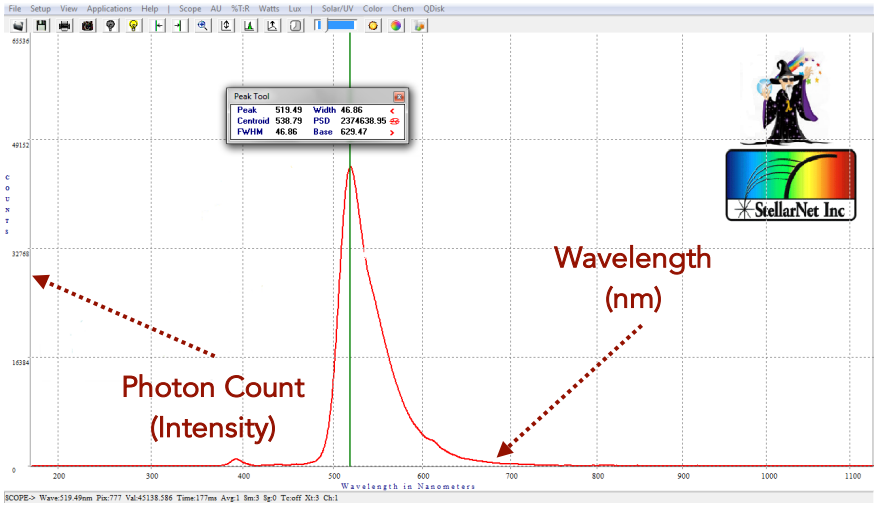
1. Turn LED light on. Press the red button on the back of the light source (orange box). The button will be pressed in if the LED light is on. If the button is not pressed in then the LED light is off.
2. Remove the cuvette holder cap. Place the most concentrated standard cuvette in the cuvette holder and replace the cuvette holder cap.
3. Remain in Scope mode. The instrument will now display the photon count (intensity) versus wavelength in real time.



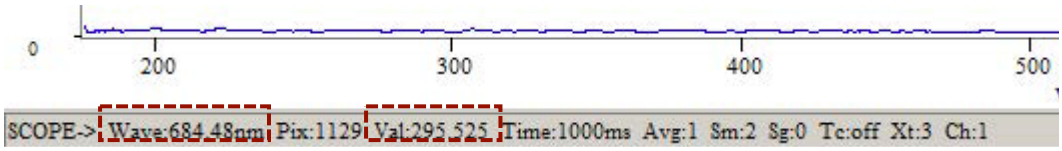


4. To find a peak, use the mouse to **right click** on either of the following icons:

The left arrow will find a peak to the left of the vertical line in the spectra. The right arrow will find a peak to the right of the vertical line in the spectra.



5. You can also **right click** directly onto the spectrum to find the photon count of a specific wavelength. To find the specific wavelength your cursor is at, look to the bottom of the spectrum. Wave gives the specific wavelength and Val gives the photon count for that particular point in the spectrum.



Raman Systems

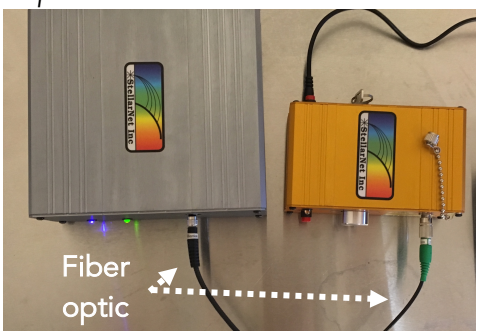
CAUTION

The Raman spectroscopy system uses a laser source. Visible and/or invisible laser radiation can be emitted from the Raman probe. Appropriate laser safety procedures should be observed when operating the probe with a laser source, including the use of protective eyewear. Read StellarNet laser manual for precautions before operating this system.

Spectrometer Setup

1. Review the spectrometer system setup and make sure that the spectrometer system resembles the setup below.

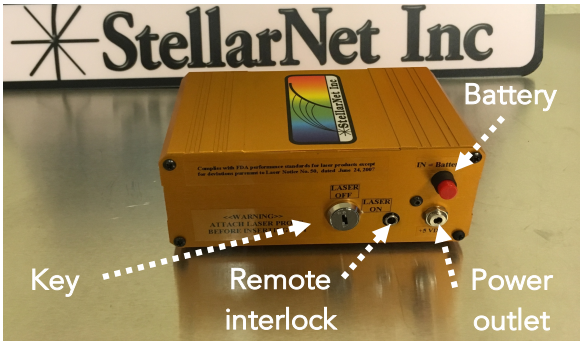
Top view

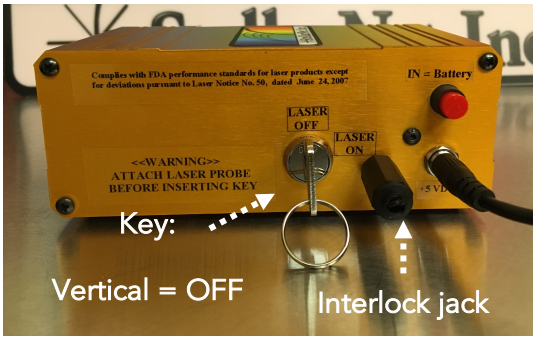


Front view

Make sure the Raman probe fiber optic is securely connected to the laser. While working with this spectrometer never remove Raman probe from the sample holder. **The laser is powerful enough to cause serious eye injury.**

2. Look at the back of the laser. First, make sure the key is not in the laser yet. If you are running the laser **on battery power** push the red button on the back of the laser in. If you are **NOT running the laser on batter power** first make sure the red button on the back of the laser is not pressed in. Then make sure the power adaptor is connected to the outlet on the back of the laser.

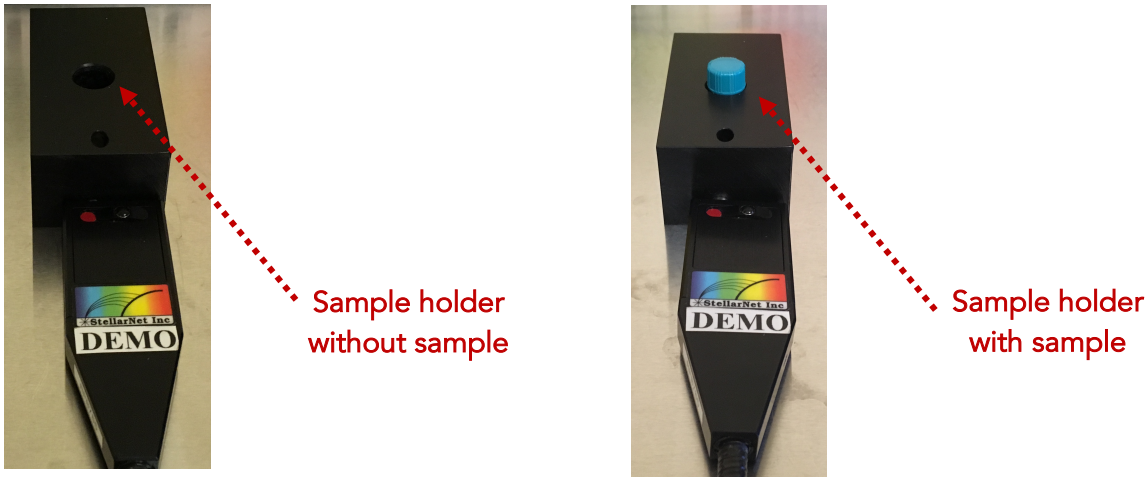




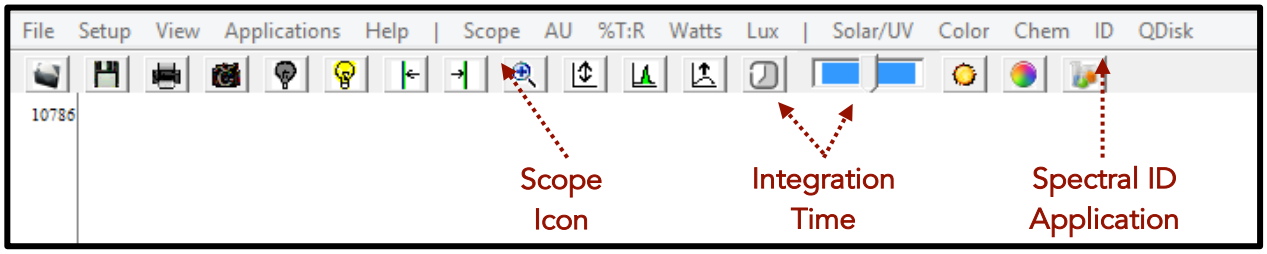
3. Make sure the interlock jack is placed in the remote interlock on the rear panel of the laser.
4. You may now you insert key into OFF (vertical) position.
5. You may now enable the laser power by turning the key to the ON (horizontal) position.

Taking Raman Measurements

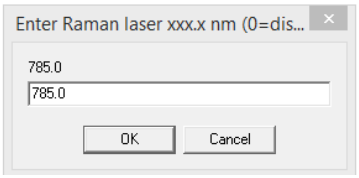
1. Load your sample vial may be loaded into the sample holder.



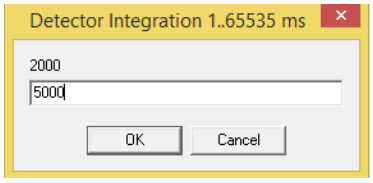
2. Turn on the computer. Open the StellarNet software by double clicking on the desktop icon *SpectraWiz* to open the application
3. When you first open the software, you should see a screen that looks like:



4. Click on the Setup dropdown menu and then select the Raman laser wavelength and enter the wavelength for the laser (xxx nm).

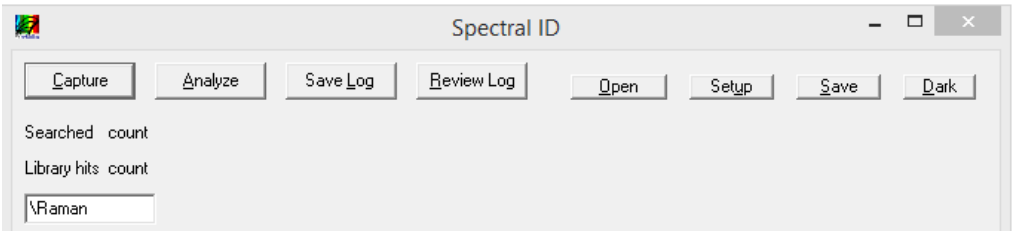


5. Click on the integration time icon and increase the exposure time to 5000 ms (5 sec). You may need to increase the integration time depending on your sample.



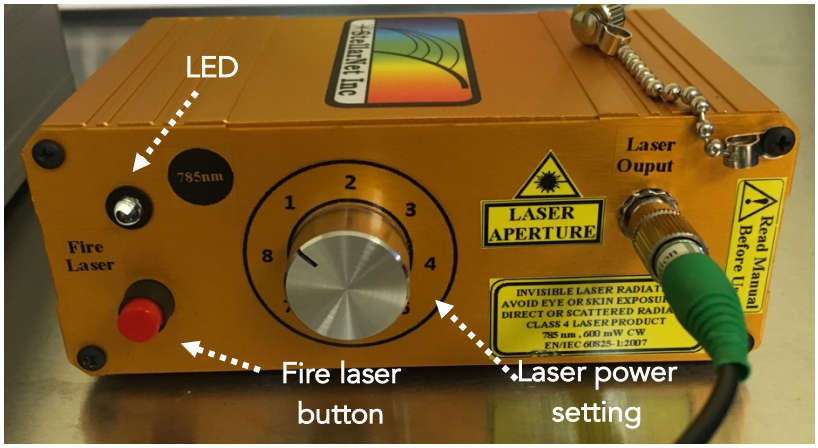
6. Click on the Scope icon (highlighted above). This will show you the number of counts (photons) the detector receives. You should see a spectrum of counts versus Raman shifts [cm^{-1}].

7. Click on the ID icon to open the Spectral ID application. You should see a panel like:

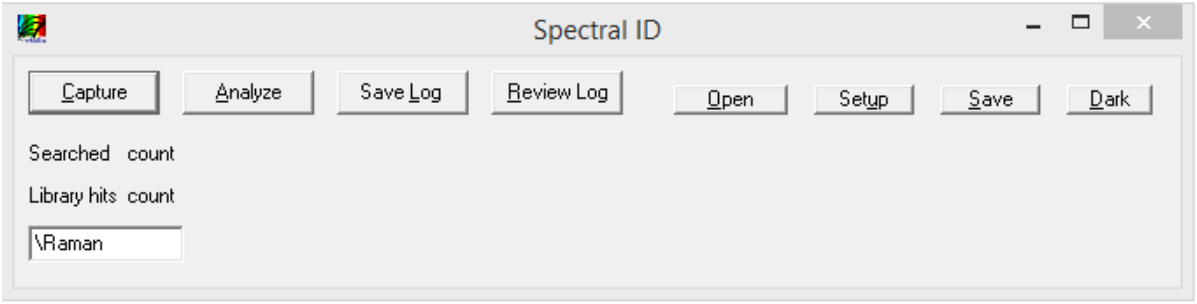


8. Turn the laser power to the lowest setting for your first trial spectrum. You should always start with the laser power as low as possible and then slowly increase it.

9. Press and hold left front panel button (marked Fire Laser) to fire the laser. The LED bulb next to this button will light up red indicating that the laser is in operation. You should see a spectrum appear on the computer screen in the SpectraWiz software.



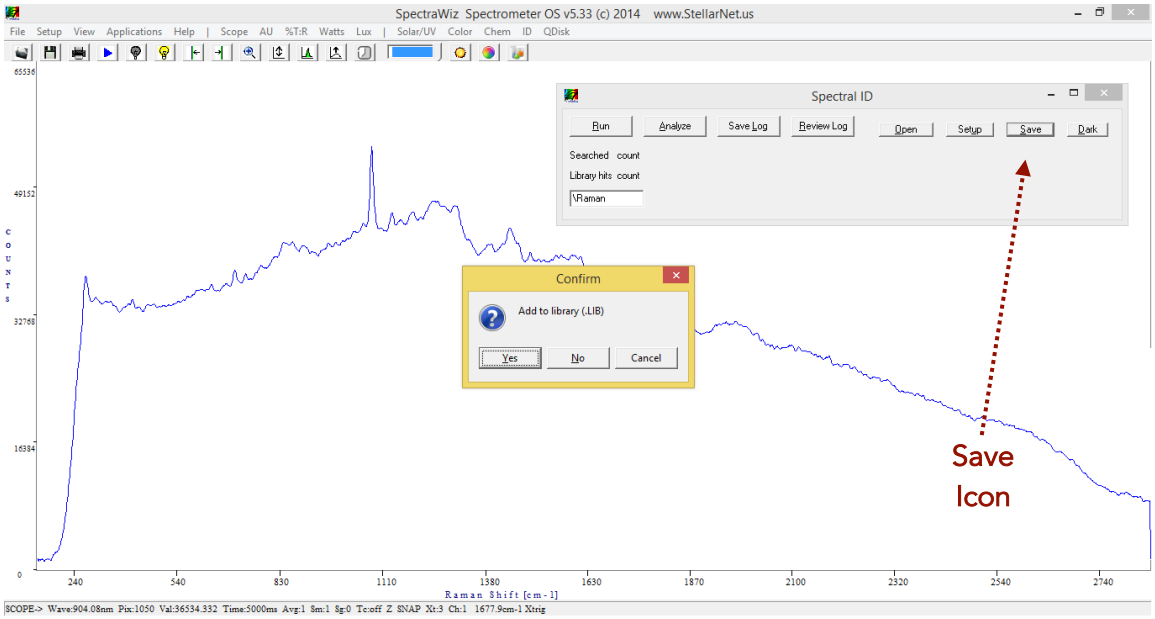
10. While still holding the Fire Laser button, click on the Capture button on the Spectral ID application to collect the displayed Raman spectrum. You can then release the Fire Laser button.



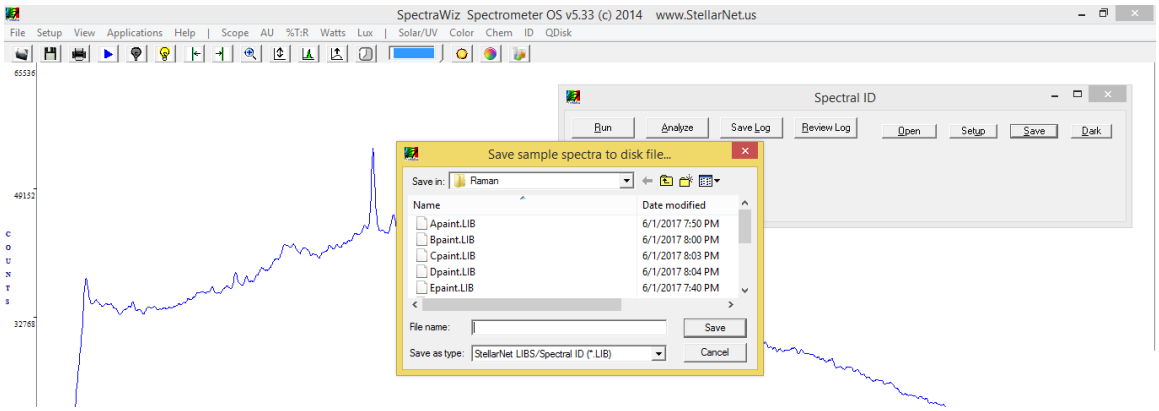
11. Adjust your integration time and laser power setting until you achieve the highest count spectrum without burning the sample.

Building a Spectral Library

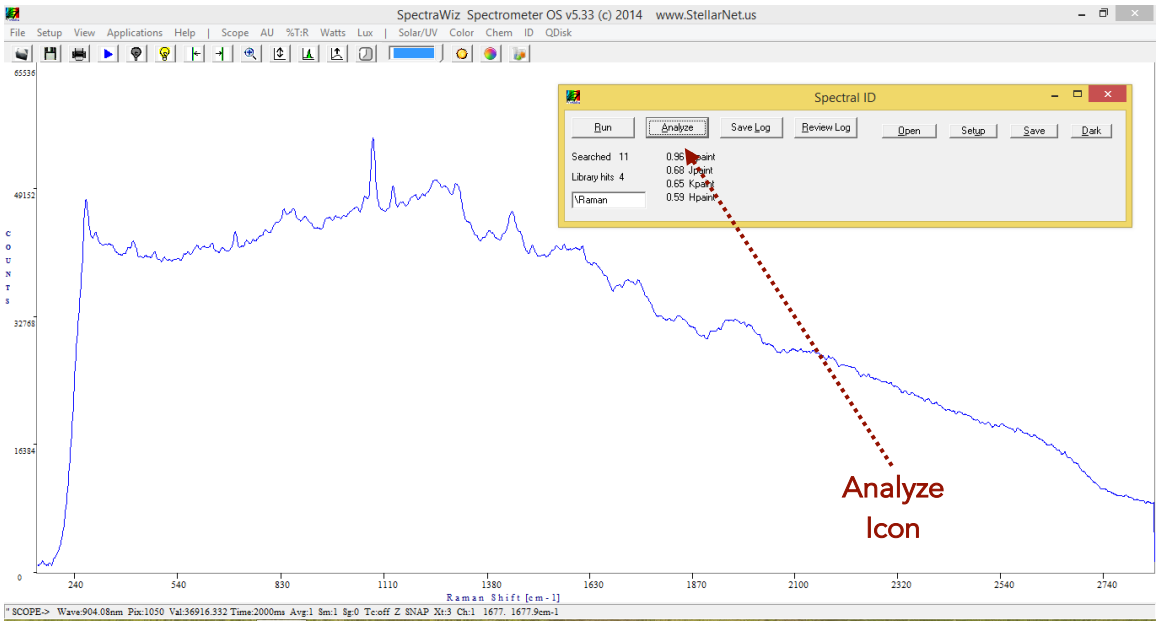
1. After you have collected a spectrum you can save it to a spectral library. Click on Save to add a spectrum to the library. This spectrum can then be used as a reference to identify unknown compounds in other samples.



2. Choose a logical name for your sample and save.



3. After you have added samples to your library you can then use it to identify unknown components in a sample. Obtain a spectrum of your unknown sample (i.e. a painting) and click on the Analyze button. This will match the unknown spectrum to spectra in your library. The number next to each match indicates how closely the spectrum in the library matches the unknown spectrum (i.e. 1 indicates a perfect match).



Laser Shutdown

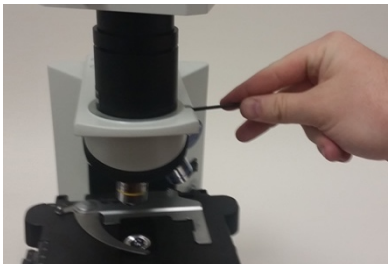
1. Once you have collected all of your spectra you can shut the laser down.
2. Make sure to release the Fire Laser button and observe that the red LED turns off, which indicates the laser is no longer active.
3. For complete shutdown, turn the key switch on the rear panel to the OFF (vertical) position. This allows key removal and disables ALL power.

StellarScope System

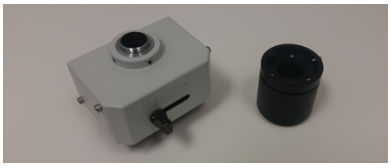
Assembling StellarScope Microscope System

1. Locate all the pieces for the StellarScope Microscope system as shown to the right.

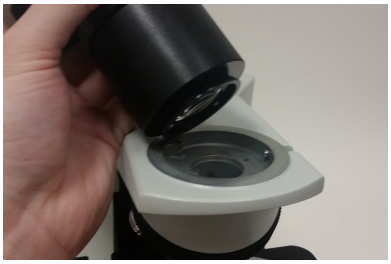
2. Remove Eyepiece: Loosen the eyepiece set screw with a hex key. The set screw is located on the right side of the microscope arm. Carefully remove the eyepiece from the mount.



3. Assemble Upper Mount: Loosen the set screw on the U-TLU with hex key, and carefully insert the U-DPCAD. Once inserted, tighten the set screw to secure the U-DPCAD.



4. Attach Mount to Microscope: Carefully place the entire upper mount where the eyepiece was located. Use the eyepiece set screw on the right side of the arm to secure the upper mount in place.



5. Attach the DinoEye Digital Camera to the Upper Mount: The camera port is located on the opposite side of the view mode switch.
6. For more information about coupling your system to the microscope please review our StellarSCOPE Assembly Instructions

Haze Measurement

Assembly and System Overview

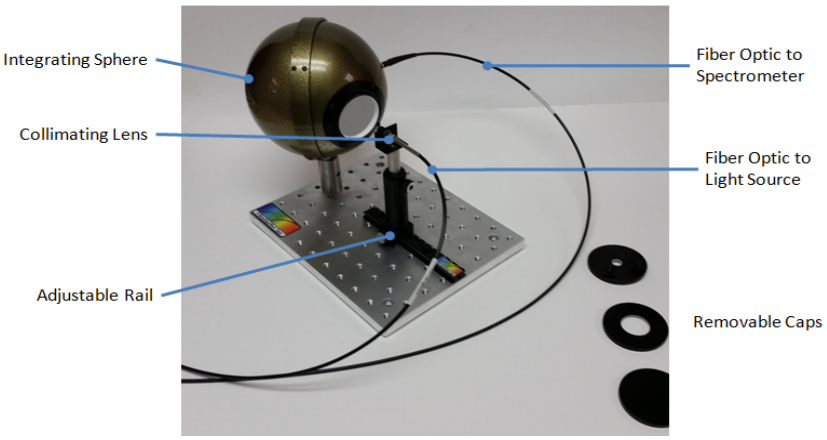
The integrating sphere attaches to the base by screwing directly into the 3-inch post. The fixture for the collimating lens will slide over the rail and can be set in place using the thumbscrew provided.

The sample can be mounted to the face cap by loosening the thumb screws and resting the sample on the threads. Tighten the thumbscrews to secure the sample.

Front Cap
Face Cap with Sample Holder

Back Caps
Diffuse Transmission Cap

Total Transmission Cap

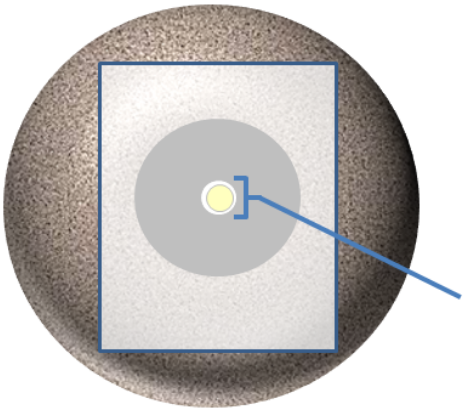


The system comes with three caps: one cap for the front of the sphere, and two interchangeable caps for the back of the sphere.

Aligning Light Source and Sphere for Haze Measurements

The collimating lens, sample, and sphere are adjustable, and have to be properly aligned in order to achieve accurate values. To properly align the system, remove the sample and illuminate the face port of the integrating sphere. The face cap of the system will have a smaller hole than the diffuse transmission cap.

By adjusting the lens, sphere, and rail setup, you should be able to illuminate a small spot on the back of the sphere.



Attach the ***diffuse reflectance cap*** to the back of the sphere.

You can use a piece of paper to view the spot size at the back of the sphere.

When properly aligned, the spot from the lens should be slightly smaller than the port at the back of the sphere.

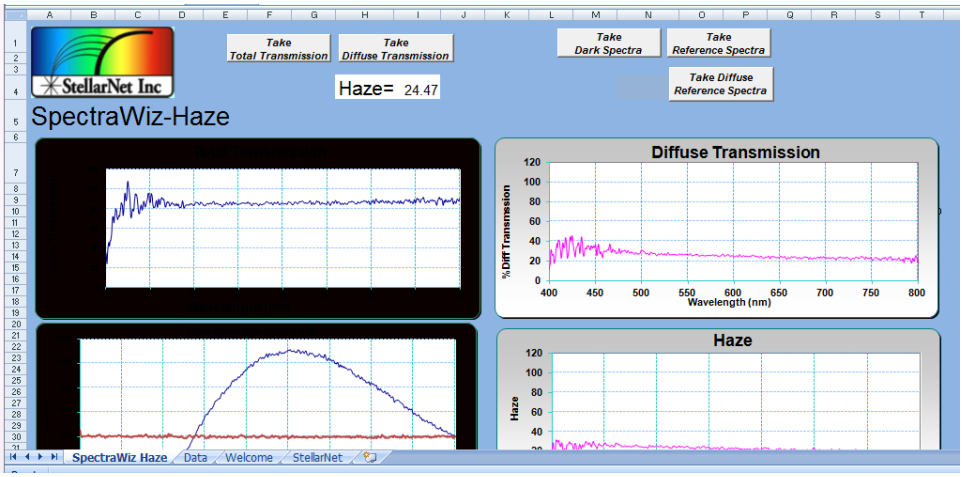
After the sphere is properly aligned, you can begin measurements without any other adjustments.

Haze Software Setup

IMPORTANT: Be sure to read all VBA setup guides before starting the software.

Verify SpectraWiz software is installed and is able to operate on the local computer. Before opening the Haze measurement software, make sure that the SpectraWiz software is closed before opening the Haze software. Open the excel software found on the USB key for Haze measurements.

The software screen will look like this:



At the bottom of the software screen there will be four tabs:

SpectraWiz Haze: Main measurement window

Data: Raw data in counts vs wavelength

Welcome: General operating tips

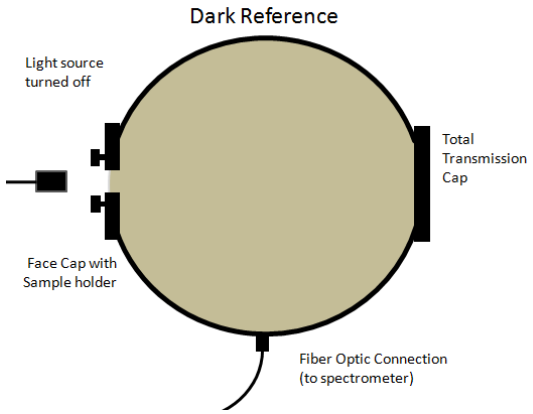
StellarNet: Setting adjustments (integration time, scans to average, etc.)

Verify that the settings in the StellarNet tab are optimized. Make sure the coefficients loaded match those found on the bottom of your spectrometer. Then switch back to the SpectraWiz Haze tab. After the parameters are set, you can begin taking your measurements.

Measurement Procedure

Haze measurements require a few measurements to be included into a formula and generate a haze value. Once all of the measurements are saved under the data tab, the haze value will be displayed on top of the software screen. Please follow the procedure below for the best results:

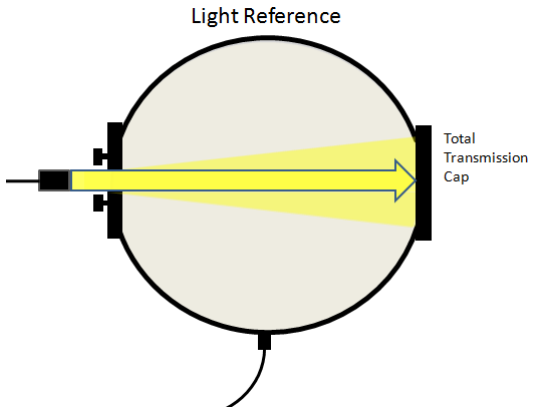
1) Take Dark Spectra



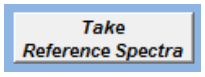
Be sure sample is removed from holder, and that *Total Transmission Cap* is secured on the back of the sphere. Turn off light source and select the *Take dark spectra* button.

Note: *Because the software will update a formula in real time, it is not necessary to take a dark spectrum for every sample. A dark spectrum is only necessary when beginning your measurements for the day.*

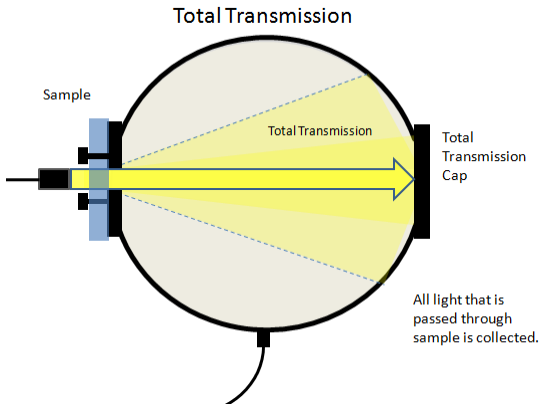
2) Take Reference Spectra



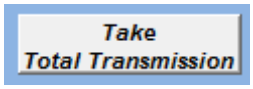
With sample still removed and *Total Transmission Cap* attached, turn on light source. Then select the *Take Reference Spectra* button.



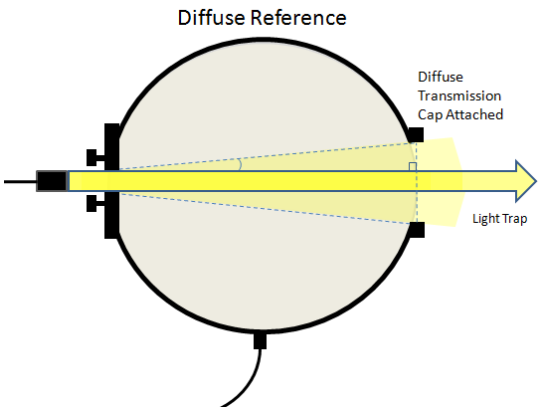
3) Take Total Transmission



Place sample in sample holder. Make sure the port is properly illuminated and *Total Transmission Cap* is still attached. Select the *Take Total Transmission* button.

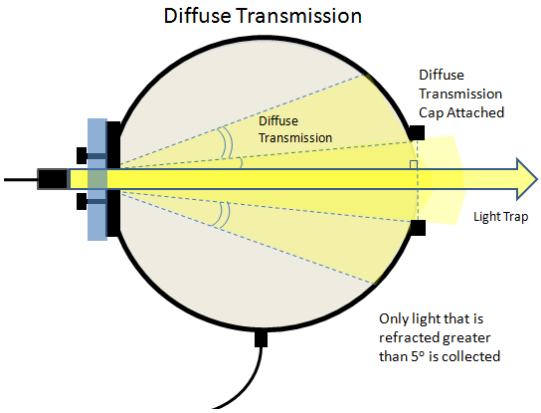


4) Take Diffuse Reference Spectra

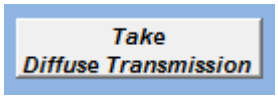


Remove sample, and attach ***Diffuse Transmission Cap*** to the back of the sphere.

5) Take Diffuse Transmission



Place sample in sample holder. Make sure the port is properly illuminated and ***Diffuse Transmission Cap*** is still attached. Select the ***Take Diffuse Transmission*** button.



After the 5 measurements are taken, the correct value will update on the main screen.

Important Notes:

- Because the software will update a formula (found in the data tab) in real time there are few things to remember:
- The order of measurements is not important. It is only important that **all measurements** (measurements 2-5) are taken **for the specific sample** before you record a haze value. Each value in the formula needs to be updated in order to properly produce a haze value.
- Taking light and dark references should factor out ambient light. However, for the most reliable results, it is ideal to turn off room lighting, and make sure any computer displays are not directly illuminating the sphere.

Thin Film Thickness Measurement

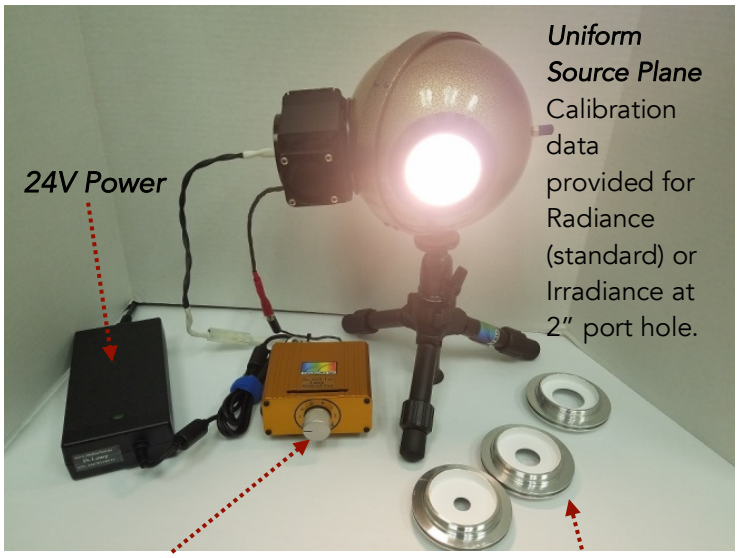
Please refer to our Thin Film System User Guides

Uniform Illumination Sphere – Light Source (UIS-LS)

1. Review the UIS setup. Make sure that the system resembles the Figure.

2. Power Control Module (PCM) supplies power to both the lamp and the fan.

Warning: Do NOT run the lamp without the fan turned ON. Leaving the lamp on without the fan can cause heat damage to entire system and cause failure & permanent damage



Uniform Source Plane Calibration data provided for Radiance (standard) or Irradiance at 2" port hole.

UIS Power Control Module Standard option comes with 9 incremental steps to full power. If not purchased the UIS sphere will still be delivered with gold power box with lamp ON/OFF switch. Also, includes power to cooling fan.

UIS-IRIS Set- For lamp attenuation with constant Color Temperature (K)

3. UIS-IRIS can be added between IS-Lamp housing and integration sphere by screwing in place. IRIS's provide lamp attenuation without changing lamp Color Temperature (K) of the UIS. Make sure the lamp cools down for 3-5 minutes before exchanging IRIS.

4. Spectral calibration data is supplied with each UIS for Radiance (standard) or Irradiance at 2" port hole at the highest power setting. Total Radiance is then included at subsequent lower levels (i.e. with PCM or IRIS's); however, complete spectral curves for lower power levels must be purchased additionally (item: UIS-CAL).

5. Using the UIS – Allow 5 minutes warm up and do not leave the lamp on unattended or for extended periods of time. Use tissue paper or kimwipes when touching the bulb directly to avoid leaving fingerprints.

The IRIS set, IS-Lamp cap, and UIS all have in internal BaSO4 white high reflective coating. Touch up paint is included with each system order and can also be