MILL UV-Vis Spectrometer SOP

Introduction

The UV-vis spectrometer is a powerful piece of optical measurement equipment. It is able to measure properties such as absorbance, transmittance, and color.

In order to correctly perform measurements, the instrument may need to be reconfigured and calibrated properly. The goal of this SOP is to teach each user the proper way to setup the measurement for each test. If any information in this SOP is not clear or more information is needed the Avantes website has very well made instructional videos that can be used in addition to this SOP.

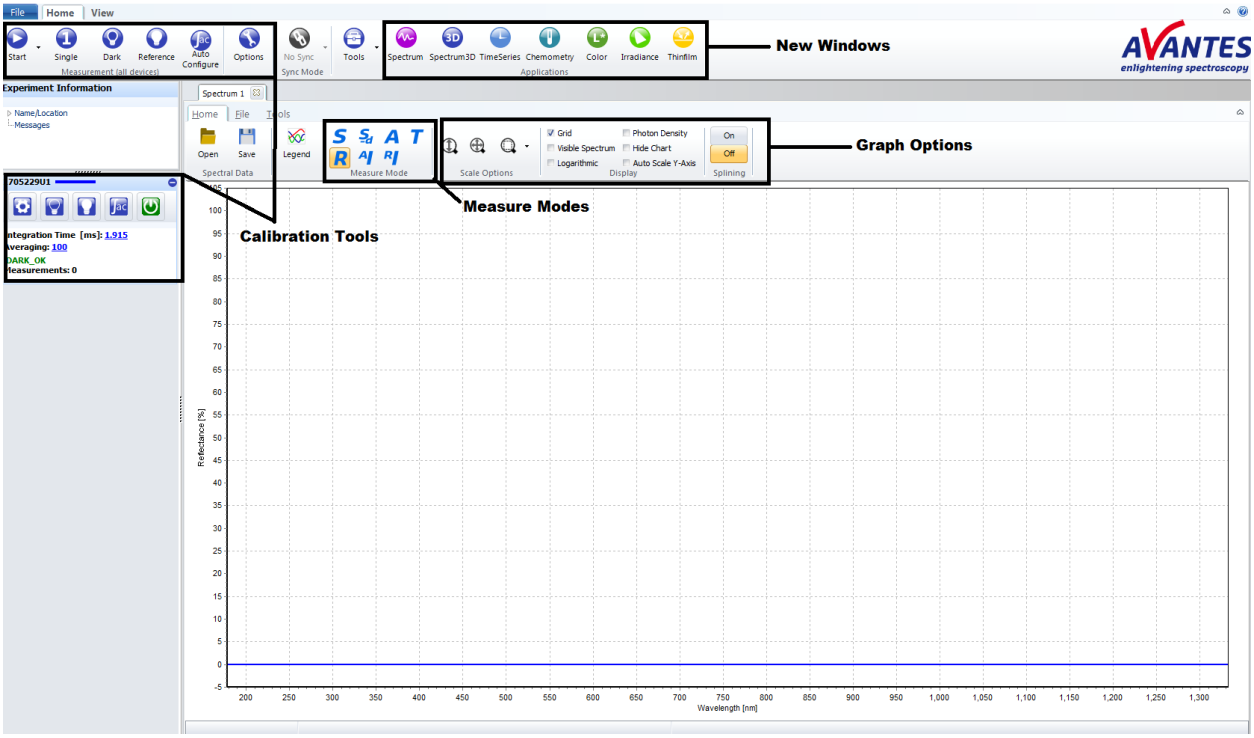
Before taking any type of measurement it is important that the light is allowed to properly warmup before calibrating or testing. Avantes recommends that the lamp is allowed to warm up 15 minutes before use.

Safety / Hazards

There are not many safety concerns when using the UV-vis spectrometer. If used correctly the UV-vis spectrometer should not pose any health risk to the user. The only way this instrument could conceivably harm a user is if the user looks directly into the light or does something entirely outside the realm of reason.

As with all MILL equipment please be careful and respectful when operating the UV-vis.

Software



1. This is the main screen for the AvaSpec 8. Besides sample prep, most of the work for this instrament is done through this screen.
2. The calibration tools are used to start reading the data, take single scope measurements, take the dark spectrum, take the reference spectrum, and autoconfigure.
    - **a.** Start: The software will begin taking measurements
    - **b.** Single: Take a single scope reading
    - **c.** Dark Spectrum: Saves the dark spectrum, must be taking with the spectroscope light turned off for the calibration to work properly
    - **d.** Reference Spectrum: Saves the reference spectrum data, this is similar to the dark spectrum, but it is taken with the spectroscope light on
    - **e.** Autoconfigure: This is used to automatically set the integration time. This does not set the number of scans that are averaged.
3. Measure Mode: Sets which measurement style will be read by the instrument.
    - **a.** Scope Mode: This is the mode that is used for saving dark and reference spectrums
    - **b.** Scope Mode minus Dark: This is the scope minus the saved dark spectrum.
    - **c.** Absorbance Mode: This mode measures how much light is absorbed by the sample.
    - **d.** Transmittance Mode: This mode measures the amount of light that passes through a sample
    - **e.** Reflectance Mode: This mode measures the amount of light that's bounces off of a sample
    - **f.** Absorbance-Irradiance Mode: This mode measures the amount radiant powering being absorbed per unit area. Please note the MILL does not currently have the proper testing stand for this mode.
    - **g.** Reflectance-Irradiance Mode: This mode measures the amount of radiant power being reflected per unit area. Please note the MILL does not currently have the proper testing stand for this mode.
4. Graph Options: Options that allow the user to change the look and scale of the graph
    - **a.** Grid: Turns the grid on and off
    - **b.** Visible Spectrum: Shows visible light on the graph from approximately 380 to 780 nm
    - **c.** Logarithmic: Changes the Y-axis to a log scale
    - **d.** Photon Density: Changes the Y-axis to photon counts, only applicable to Absolute Irradiance
    - **e.** Hide Chart: Hides the entire chart
    - **f.** Auto Scale Y-Axis: Scales the Y-axis so the largest values is 90% of the top part of a the Y-axis
5. New Window: These buttons open a new spectroscope window for various applications.

Save Settings

1. In order to configure how data is saved by the software click the downward facing arrow next to the Start button, a dropdown menu should appear, click Autosave Spectrum Enabled.
2. This should pull up an interface through which the way the software saves scope data can be adjusted.
3. From this menu the time delay before the first scan, the time delay between scans, and the number of scans should all be adjustable
4. When saving data please create a subfolder with your name under C:\Users\TheMILL\Avantes\Avasoft8

Hardware

Testing Stand

1. The testing stand can be used for absorbance, transmittance, reflectance, and color tests.
2. For reflectance and color testing be sure that the non-threaded attachment is placed into the top part of the testing stand.
3. For absorbance and transmittance testing be sure that the threaded attachment is placed into the top part of the testing stand
4. The threaded and non-threaded attachments should be near the white reflectance tile
5. When testing be sure that the sample is held firmly between the cylinder and the middle plate.
6. For absorbance and transmittance testing be sure that the bottom plate is pressed closely to the middle plate.

Integrating Sphere

1. The integrating sphere can be used for reflectance and color tests.
2. Connect integrating sphere to power outlet and the spectroscope. For the spectroscope both the VGA and fiber-optic cables are needed. Like the light source the integrating sphere must be warmed up for 15 minutes before use.
3. Be sure to change the light source to the integrating sphere by clicking on the gear on the far left side of the software and selecting the integrating sphere.
4. Once the light has warmed up the sphere should be ready for use.
5. The sphere must be calibrated like the normal test setup, but the procedure is the same.
6. Use the white tile as a reference and use scope mode for the calibration.
7.

Cuvette Holder

1. The cuvette holder can be used for absorbance, transmittance, reflectance and color testing.

2. Like the testing stand the cuvette holder the threaded vs. non-threaded attachments control whether it is being used for a reflectance or absorbance/transmittance test.

Measurements

Reflectance

Figure. 1 Reflectance Setup

1. Make sure the proper fiber-optic cable (FCR-7UV400-2-BX) is attached to the testing stand, scope, and light.
2. The cable required has three ends. Two of these ends should be attached to the spectroscope and the light source. The last end should be attached to the testing stand.
3. Place the white reflectance tile into the stand and select the Scope Mode. Press the Auto-Calibrate button.
4. Turn off the light source and save the dark spectrum data once the signal has normalized.
5. Turn on the light source and take a reference spectrum once the signal has normalized.
6. Change from Scope Mode to Reflectance mode. If the calibration was done correctly the spectrum should now have a flat line at 100% reflectance for ~400 to 700 nm.
7. Remove the tile and begin taking measurements.

Transmittance or Absorbance

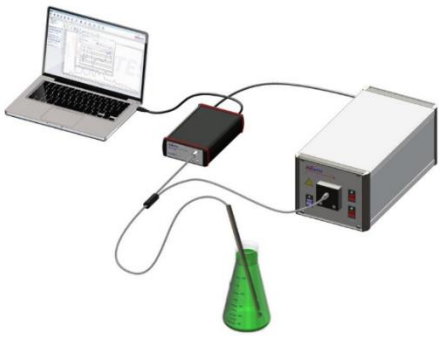


Figure 2. Absorbance / Transmittance Setup

1. Make sure the proper fiber-optic cable (FCR-UV200-2-BX) is attached to the scope, light, and whatever testing stand you are going to use.
2. If doing a measurement with liquid, use and empty cuvette for calibration.
3. Place the instrument in Scope Mode and press the Auto-Calibrate button.
4. Turn off the light source and save the dark spectrum data once the signal has normalized.
5. Turn on the light source and take a reference spectrum once the signal has normalized.
6. Change from Scope Mode to Transmittance mode. If the calibration was done correctly the spectrum should now be a 100% for ~400 to 700 nm.

Color

1. It is possible to take a color measurement using either the reflectance set-up or the integrating sphere.
2. Use the white tile for calibration. Place the white tile in the holder and switch to scope mode. Press the auto calibrate button.
3. Turn off the light source and save the dark spectrum data once the signal has normalized.
4. Turn on the light source and take a reference spectrum once the signal has normalized.

5. Open a color tab.
6. When taking a color measurement a reference file must be loaded in addition to calibration. Currently the reference file in use is the color reading of the white tile. This file should fit most applications, but if needed it can easily be changed by taking a new reference reading. The white tile is recommended as the reference by Avantes.