



Spectrometry User's Guide

Computer/Tablet

1.0

Teacher and Technical Support

For help with Spectrometry and other PASCO products, you can contact PASCO Teacher and Technical Support staff by phone, email, or on the Web.

Phone: **1-800-772-8700 (in the U.S.)**
+1 916 786 3800 (worldwide)

Email: support@pasco.com

Web: www.pasco.com/support/

Tech Notes: www.pasco.com/support/technical-support/technote/

Spectrometry Resources



More 21st century science lab resources available online!

<http://pasco.com/spectrometer/>

- Software Download
- Video Tutorials & User Guide
- Replacement Parts
- Accessories
- Sample Labs

Contents

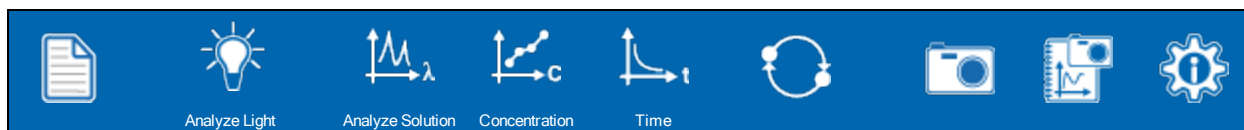
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1 About PASCO Spectrometry

The PASCO Spectrometry software works with the [PASCO wireless Spectrometer](#) as well as Ocean Optics Red Tide Spectrometers*.




Version 1.0 is freely available to download for Macs & PCs. The free app for iPads is available in the App Store®.

2 Application Tools






Tool Icon States

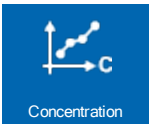








Icons indicate state as follows:

| Example | State |
|--|---|
|  | Yellow: Selected (currently in use) |
|  | White: Active (available for use) |
|  | Grey: Disabled (not available for use) |

Application Tool Descriptions

Application Toolbar Functions:

| Icon | Description |
|---|--|
|  | Experiment Options Opens the file structure of the software to Open, Create and Save the .sp files |
|  | Analyze a graph of Intensity vs. Wavelength Analyze a Solution in terms of Intensity vs Wavelength. |
|  | Analyze a graph of Absorbance vs. Wavelength Analyze a Solution in terms of Absorbance, Transmittance and/or Fluorescence vs wavelength. |

| Icon | Description |
|---|--|
|  | Analyze a solution's concentration Analyze a Solution in terms of Absorbance, Transmittance and/or Fluorescence vs solution concentration. |
|  | Analyze a solution's reaction over time Analyze a Solution in terms of Absorbance, Transmittance, Fluorescence and/or concentration vs reaction time. |
|  | Connection Status Error |
| OR | OR |
|  | Connected |
|  | Take Journal Snapshot |
|  | Show Journal Snapshots |
|  | Info and Settings Software information and settings |
| | Export Snapshots To HTML |
|  | Sharing Options (Tablet only) Open in Another App: Save the .sp file into Google Drive, DropBox, Evernote ... that are installed on the device. Open in iTunes: Save the .sp file into iTunes. |
|  | Import Document From iTunes Import from iTunes (Tablet only) Import a .sp file from the iTunes account associated with the device. |







3 Analyze Light


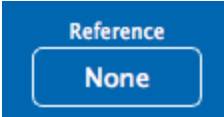


Procedure

1. Attached a Fiber Optics Cable to your Spectrometer.
2. Point the Fiber Optics Cable at the Light Source.
3. Start Data Recording
4. Autoset the Integration Time in the Left-Hand Tools panel
5. Stop Data Recording
6. Select the Source to either Rename or Delete
7. Analyze the Graph with the Options Below

Graph Tools




Analyze Light Graphing Functions:

| Icon | Description |
|--|---|
|  <p>OR</p>  | <p>Record</p> <p>Start recording data.</p> <p>OR</p> <p>Stop recording data.</p> |
|  | <p>Scale to Fit</p> <p>Scale to Fit the Graph.</p> |
|  | <p>Add Coordinate Tool</p> <p>Add Coordinates tool to select points on the graph.</p> <p>Note: For additional Solution Analysis with Concentration and Time experiments, an Analysis wavelength MUST be selected.</p> |
|  | <p>Add Annotation Tool</p> <p>Add Text Annotation.</p> |
|  | <p>Show Comparison Mode</p> <p>Compare spectra of multiple light sources.</p> |

| Icon | Description |
|---|--|
|  | <p>Show Color Spectrum Background Show Color Spectrum Background.</p> |
|  | <p>Reference Spectra Add Reference Lines. Lines include: Hydrogen, Helium, Argon, Xenon, Mercury Sodium, Neon from NIST (National Institute of Standards and Technology) Atomic Spectra Database.</p> |
|  | <p>Previous reference</p> |
|  | <p>Next reference</p> |

Light Analysis Tools

Left-Hand Tools Slider can be Revealed or Hidden:

| Icon | Description |
|---|--|
|  | <p>Pick the best integration time Integration Time is analogous to the shutter speed of a Camera. With a Higher Integration time, the spectrometer is more sensitive to less intense light. The “Auto Set” Button will automatically adjust the Integration time to maximize the current sample spectrum.</p> |
|  | <p>Number of Scans to Average This property specifies the number of discrete acquisitions that are collected and averaged before displaying and recording a spectrum or data point. A higher the value results in a better the signal-to-noise ratio.</p> |
|  | <p>Smoothing Average groups of adjacent data points.</p> |

4 Analyze Solution

Note: You MUST select an Analysis Wavelength with the Coordinates Tool to perform subsequent Concentration and Time based Experiments for the solution you are studying.

Procedure

1. Insert a cuvette containing the blank (solvent)
2. Perform a Dark Calibration
3. Allow the Light source to warm up (~1-2 minutes)
4. Perform a Light Calibration
5. Start Data Recording
6. Insert the cuvette containing the sample
 - a. Adjust the concentration of the solution if the spectrum is too low or too high
7. Stop Data Recording
8. Select the Solution to either Rename or Delete
9. Analyze the Graph with the Options Below

Details

Analyze Solution Absorbance / Transmittance Details

- Select “Absorbance” on the Graph to Switch from Absorbance to Transmittance

Analyze Solution Fluorescence Details

- A Calibration is not required for this Measurement
- After Data Collection is Started, Auto Set the Integration time to obtain the best spectrum.






Solution Types






Solution Analysis types in “Analyze Solution”, “Concentration” and “Time” Experiments.

| Solution Type | Description |
|--------------------------|---|
| Absorbance/Transmittance | Absorbance/Transmittance Analysis of the Absorbance / Transmittance of a white light source through the sample. |
| Fluorescence (405 nm) | Fluorescence (405 nm) Analysis of the Fluorescence of the sample with 405 nm excitation. |
| Fluorescence (500 nm) | Fluorescence (500 nm) Analysis of the Fluorescence of the sample with 500 nm excitation. |

Graph Tools




Analyze Solutions Graphing Functions::

| Icon | Description |
|--|--|
|  OR  | Record Start recording data. OR Stop recording data. |
|  | Calibrate Dark |
|  | Calibrate Reference |
|  | Scale to Fit Scale to Fit the Graph. |

| Icon | Description |
|--|--|
|  | <p>Add Coordinate Tool Add Coordinates tool to select points on the graph.</p> <p>Note: For additional Solution Analysis with Concentration and Time experiments, an Analysis wavelength MUST be selected.</p> |
|  | <p>Add Annotation Tool Add Text Annotation.</p> |
|  | <p>Show Comparison Mode Compare spectra of multiple light sources.</p> |
|  | <p>Show Color Spectrum Background Show Color Spectrum Background.</p> |
|  | <p>Show Dual Y-Axes Show Dual Y axes of Absorbance and Transmittance data only.</p> |

Solution Analysis Tools

Left-Hand Tools Slider can be Revealed or Hidden:

| Icon | Description |
|---|---|
|  | <p>Pick the best integration time</p> <p>Note: For Fluorescence Only.</p> <p>Integration Time is analogous to the shutter speed of a Camera. With a Higher Integration time, the spectrometer is more sensitive to less intense light.</p> <p>The “Auto Set” Button will automatically adjust the Integration time to maximize the current sample spectrum.</p> |
|  | <p>Number of Scans to Average</p> <p>This property specifies the number of discrete acquisitions that are collected and averaged before displaying and recording a spectrum or data point.</p> <p>A higher the value results in a better the signal-to-noise ratio.</p> |
|  | <p>Smoothing</p> <p>Average groups of adjacent pixels.</p> |

5 Analyze Concentration

Procedure

1. Select the Concentration Units in the Table Header to modify (if necessary)
2. Select the Concentration Values in the Table to modify (if necessary)
3. Select the empty Absorbance cell next to the appropriate Concentration value
4. Start Data Recording
5. Press “Check” to Keep the Spectrometer Data
6. Continue for each of the known standard concentration values
7. Stop Data Recording
8. Analyze the Graph with the Options Below

Note: You can always edit the concentration value in a cell. If you suspect the Absorbance value is incorrect, simply select the cell again while the data is being recorded and press “check” with the new Absorbance value.

Unknown Concentration Analysis Details

After multiple known concentration samples have been recorded, an unknown can be analyzed

1. Select the empty Absorbance cell in the Determine Unknown Concentration Table
2. Start Data Collection
3. Press “Check” to Keep the Spectrometer Data
4. Enter a value for the concentration of the Unknown based on the Absorbance Data and a graphical analysis of the known samples.
5. Verify a correct determination of the unknown based on the Graph
6. Reassess if necessary.





Solution Types




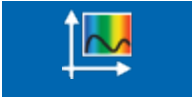
Solution Analysis types in “Analyze Solution”, “Concentration” and “Time” Experiments.

| Solution Type | Description |
|--------------------------|---|
| Absorbance/Transmittance | Absorbance/Transmittance Analysis of the Absorbance / Transmittance of a white light source through the sample. |
| Fluorescence (405 nm) | Fluorescence (405 nm) Analysis of the Fluorescence of the sample with 405 nm excitation. |
| Fluorescence (500 nm) | Fluorescence (500 nm) Analysis of the Fluorescence of the sample with 500 nm excitation. |

Graph Tools

Analyze Concentration Graphing Functions:

| Icon | Description |
|--|--|
|  OR  | Record Start recording data. OR Stop recording data. |
|  | Active Solution Pick the Active Solution for Analysis. <div style="border: 1px solid gray; padding: 5px; margin-top: 10px;"> Note: Active solutions MUST have a wavelength selected to perform Concentration Experiments. </div> |
|  | Scale to Fit Scale to Fit the Graph. |

| Icon | Description |
|---|--|
|  | <p>Add Coordinate Tool Add Coordinates tool to select points on the graph.</p> <p>Note: For additional Solution Analysis with Concentration and Time experiments, an Analysis wavelength MUST be selected.</p> |
|  | <p>Add Annotation Tool Add Text Annotation.</p> |
|  | <p>Show Linear Fit</p> |
|  | <p>Show Live Scan Display</p> |

6 Analyze Time

Procedure

1. Start Data Recording
2. Allow the desired amount of time to pass
3. Stop Recording
4. Analyze the Graph with the Options Below.

Analyze Time Details

- Select “Absorbance” on the Graph to Switch from Absorbance to Transmittance or Concentration (Concentration data will only be meaningful if the Absorbance and Concentration relationship is established in a Concentration experiment or by manually adding the slope and intercept.)
- Select the “Calculator” button on the Graph to switch through QuickCalcs of Y, Y^{-1} or $\ln Y$.









Solution Types



Solution Analysis types in “Analyze Solution”, “Concentration” and “Time” Experiments.

| Solution Type | Description |
|--------------------------|---|
| Absorbance/Transmittance | Absorbance/Transmittance Analysis of the Absorbance / Transmittance of a white light source through the sample. |
| Fluorescence (405 nm) | Fluorescence (405 nm) Analysis of the Fluorescence of the sample with 405 nm excitation. |
| Fluorescence (500 nm) | Fluorescence (500 nm) Analysis of the Fluorescence of the sample with 500 nm excitation. |

Graph Tools




Analyze Time Graphing Functions:

| Icon | Description |
|--|---|
|  OR  | <p>Record Start recording data.</p> <p>OR</p> <p>Stop recording data.</p> |
| <p>Reference Spectra</p> | |
|  | <p>Pick the Active Solution for Analysis.</p> <p>Note: Active solutions MUST have a wavelength selected to perform Concentration Experiments.</p> |
|  | <p>Scale to Fit Scale to Fit the Graph.</p> |
| <p>Add Coordinate Tool</p> | |
|  | <p>Add Coordinates tool to select points on the graph.</p> <p>Note: For additional Solution Analysis with Concentration and Time experiments, an Analysis wavelength MUST be selected.</p> |
|  | <p>Add Annotation Tool Add Text Annotation.</p> |
|  | <p>Show Linear Fit Apply a Linear Fit to the Data.</p> |
|  | <p>Show Selection Tool Selection tool to highlight a range of data.</p> |

| Icon | Description |
|---|--|
|  | Show Comparison Mode Compare multiple runs of kinetics data. |
|  | Show Live Scan Display |

Time Analysis Tools

Left-Hand Tools Slider can be Revealed or Hidden:

| Icon | Description |
|---|---|
|  | Sample Rate The number of measurements taken per unit of time. |
|  | Bandwidth Bandwidth specifies the range of wavelength that will be measured in time acquisition mode. The Bandwidth value is equal to the number of pixels on either side of the pixel specified by the Wavelength parameter. Therefore, the total number of pixels that will contribute to a measurement equals "Bandwidth" \times 2 + 1. |
|  | Absorbance vs. Concentration The slope and intercept values that relate the Absorbance to concentration of the sample. These constants are determined by the software on through a "Concentration" experiment, or they can be manually entered. |