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Operation

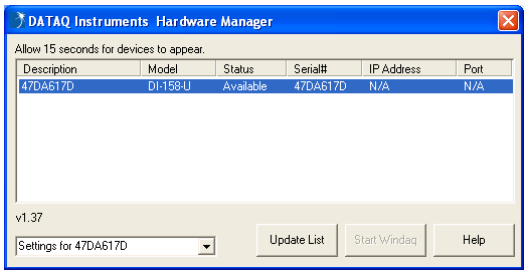
Turn on the Lambda 3B and the Computer

Remove all samples from the sample chamber. Turn on the lamp for the range being investigated using the switches on the front-lower-right of the unit: UV (380-190nm), VIS (400-900nm). Turn on the spectrophotometer, the switch is on the right rear of the machine beside the power cord.

> **NOTE:** The UV lamp is a deuterium lamp which is valued at $746.05
> Use this lamp sparingly only if investigating the UV region.
> (i.e. using quartz NOT glass substrates)

You must now wait for one minute while the machine initializes - the display will show a countdown while this occurs.

Double-click the **DATAQ Instruments Hardware Manager** icon on the desktop or from the start menu. The hardware manager window will open and after 15 seconds will list the DATAQ device. Select the device and then click **Start WinDaq**.



Setting the Wavelength

The leftmost display should display **o** under normal operation. If the leftmost display is showing 'C', then the Lambda is performing background calibration.

When the unit is ready, Depress $\lambda_{\mathbf{LIM}}$ on the Lambda to verify the wavelength limits are 800-315. The upper limit will be on the left display and the lower limit will be on the right display. If you wish to scan a different range, you can change the limits by keying in the upper value (ex. 900nm), pressing $\lambda_{\mathbf{LIM}}$, then keying in the lower value (ex. 190nm) and pressing $\lambda_{\mathbf{LIM}}$ a second time. Press the $\lambda_{\mathbf{LIM}}$ again to confirm the limits have been changed.

Next, key in the upper limit and press the ***GOTO λ*** button. When you start the scan from the upper limit, it will scan down to the lower limit and automatically return to the upper limit for the start of the next scan. The display will show the current wavelength. In the photo on the right, the wavelength is seen as 800.0nm. Press the **MODE** button until the **%T** indicator is lit (usually this is the default). Press the ***SCAN SPD*** button until the desired scan speed is selected, normally 120nm per minute is used.

Depress **ORD LIM** to verify the limits are 100-0; this is the default and should not be changed under normal circumstances. This only affects the signal the Lambda outputs to the DataQ and does not affect the display on the Lambda itself.

On the computer, the WinDaq program should now be displaying the wavelength as Channel 1 and percentage on Channel 2 with 1.0 as 100% (78.6% will display as 0.786).

In WinDaq, Select **File > Open Reference File**. Select the file located in the **Lambda 3B** folder on the Desktop, **<u>Lambda 800-315 Reference,WDQ</u>**. This will configure Windaq for operation with the Lambda and it is recommended to reopen this reference file at the start of each session to ensure configuration changes were made by another user.

Inserting the sample

Press the ***AUTO ZERO*** button with NO SAMPLE INSTALLED and the SAMPLE DOOR CLOSED. This will set the 100% Transmission reference and the rightmost display will now read 100.0.

Open the sample door and place the substrate in the sample holder. You may also place a blank substrate in the reference holder to compensate for the substrate itself.

Take care not to break the glass substrates when inserting or removing as the glass substrates are very thin.

Starting the Scan

In WinDaq, go to **File > Record** and specify the location for the data file. You can create a temporary folder on the desktop to save your scans in, however you must copy the files to a flashdrive or email them as the files are deleted on a regular basis. It is recommended to include details of the scan and substrate in the filename.

Click **OK** to accept the default file size, this is only an upper limit and the default is more than sufficient as the scan itself only takes a few minutes. Once you have clicked open, the Status at the bottom of the screen will change from **SET-UP** to **RECORD*** as shown below. The asterisk indicates that recording is paused while the spectrophotometer is not scanning. The asterisk will disappear once scanning begins.

Press **RUN** on the spectrophotometer and the status will change to **RECORD** and the spectrometer will start scanning.

Once the scan is complete[1] the Lambda will automatically slew back to the top of the range for the next sample. Otherwise enter in the upper wavelength limit and press **GOTO λ** to slew back up to the top of the range for the next sample.

In WinDaq, go to **File > Close** to close the current scan.

Additional scans

Replace the sample with the new sample, close the lid and in WinDaq go back to **File > Record** and specify a new filename to begin another scan. The Lambda should already be at the upper limit (800nm) to begin the scan. Pressing the **RUN** button on the spectrophotometer will begin the scan.

[1] Scan will halt at 315nm if the UV source is off.

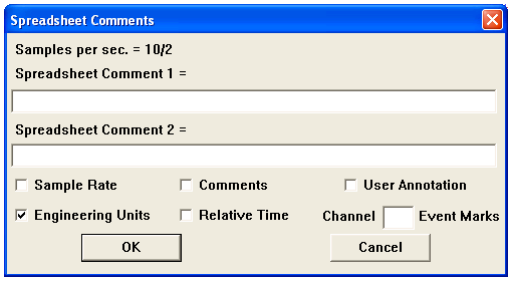
Exporting to Excel

Open WinDaq Waveform Browser from either the start menu or from the desktop

Select the file generated previously by WinDaq.

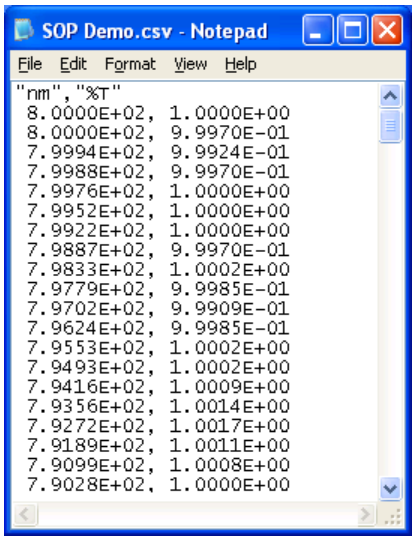
Select **File > Save As** and leave the default filename as is. "Visible channels only" and "Output all values when compressed" should both be unchecked. Verify **5) Spreadsheet print (CSV)** is selected and click **Save**.

When prompted, verify only **Engineering Units** is checked and all other fields are blank, as shown on the right. If desired, adding a **1** to Channel event marks will add a third column to the CSV file which will indicate filter changes.



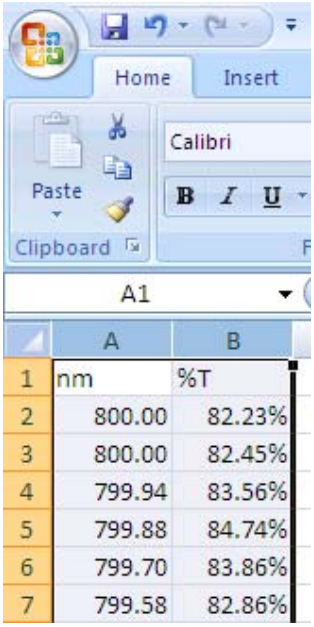
You can now close the file, select **File > Close**. When prompted to save changes to the current file, choose **Exit with no Save**.

Optionally, you can verify the data saved by double-clicking on the CSV file and it will open in Notepad. There will be two columns, the first column is the wavelength and the second column is transmission in percent. This file will open directly in Excel and can be graphed in Excel.



Graphing in Excel

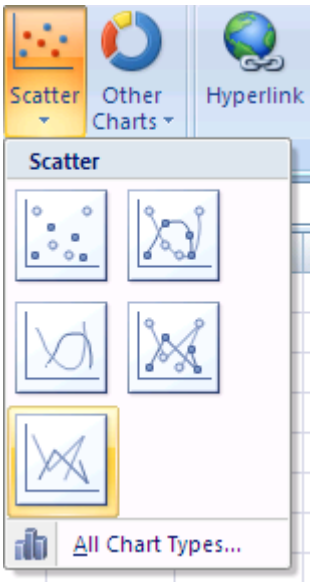
Open the previously saved CSV file in Excel. You should now have two columns labeled “nm” and “%T” respectively.



You can change the formatting on the data by right clicking on the first column header, A, select **Format Cells**. Select **Number** from the category list in the Number Tab. Click **OK**. Perform the same action with the second column header, **B**, and select **Percentage**.

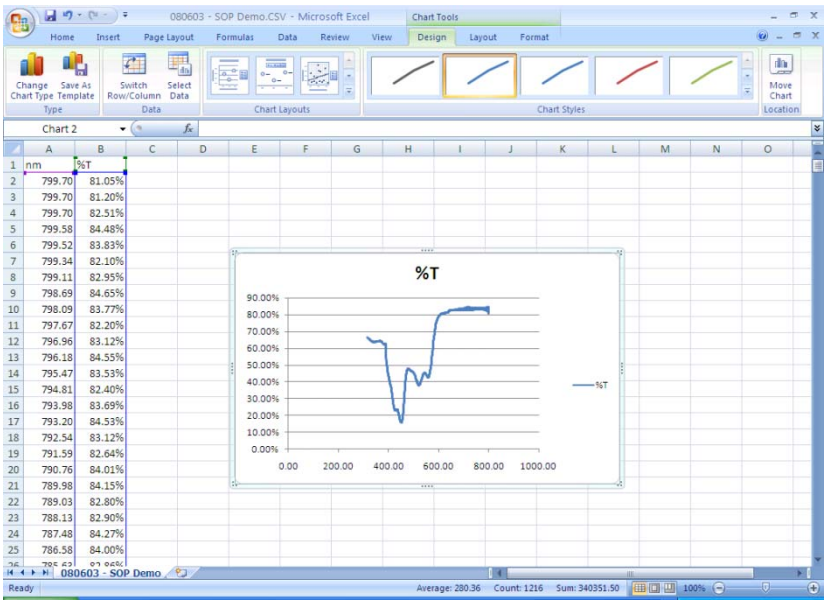
Select the two columns by clicking on the first column header, and dragging the cursor across to the second column header until both columns are highlighted. Alternately the same action can be performed on the keyboard by **Ctrl+Home**, then **Shift+Rt.arrow** then **Ctrl+Space** in order to select both columns.

Excel should now have the two columns highlighted as shown on the right.



Insert a graph by Insert **> Scatter > Straight Lines** as shown on the right.

You should now have a graph in Excel with your spectrum as shown below. You can now adjust the formatting and titles to polish it up for your lab report



Perkin-Elmer Lambda 3B Spectrophotometer
Short Procedure

1) UV Lamp on and Visible Lamp on with the switches on the front right of the machine.
2) Turn on the Lambda 3B, the switch is on the rear-right corner of the machine.
3) Wait X minutes for the background spectrum.
4) Turn on the computer, go to **Start** > **Programs** > **Dataq Instruments Hardware Manager**.
5) Wait 15 seconds for the program to find the Dataq device and click **Start Windaq**.
6) Depress $\frac{\lambda}{\mathbf{LIM}}$ on the Lambda to verify the limits are 800-315.
7) In WinDaq, Select **File > Open Reference File**.
8) The file located in the **Lambda 3B** folder on the Desktop, **Lambda 800-315 Reference,WDQ**.
9) On the Lambda 3B, key in 800 and press $\frac{GOTO}{\lambda}$.
10) Remove any samples and references from the chamber close the sample door.
11) Press the $\frac{AUTO}{ZERO}$ button on the Lambda 3B.
12) Select the scan speed, normally 120 by pressing the $\frac{SCAN}{SPD}$ button.
13) Create a folder for you lab group on the desktop to save the scan data.
14) In WinDaq, **File > Record** and specify a filename to store the scan data, Click **Open**.
15) Click **OK** to accept the default file size.
16) **Status: RECORD*** should now appear in the bottom of the screen
17) Place the sample in the holder and close the sample door
18) Press the **RUN** button on the Lambda 3B.
19) Once the scan reaches 315nm, the Lambda 3B will automatically go back to 800nm.
20) Select **File** > **Close**.
21) Repeat steps 12 through 18 for any additional samples, rezeroing if necessary.
22) **Open the dat**a file with WinDaq Waveform Browser
23) Export the data to CSV by **File > Save As**, then clicking **Save**.
24) Verify only Engineering Units is selected and Click **OK**.
25) Select **File > open for next file**. When prompted to save changes, select **Proceed with No Save**.
26) Repeat steps 20 through 23 for any additional data files.
27) Copy both the WinDaq and CSV files to your USB drive.