SSUV300 User Manual

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1. System Overview

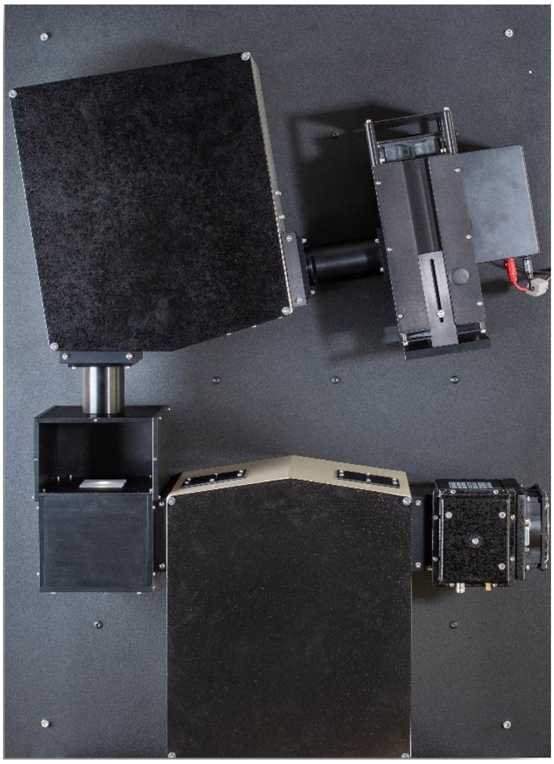

Figure 1: SSUV300 System; comprising of a DTMc300 monochromator, sample chamber and integrating sphere, IL7 150W xenon light source and DH00 TE side-windowed photomultiplier tube (PMT)

A monochromatic illuminator is based on an IL7 Xenon lamp (supplied by a 610 power supply) mounted to the entrance slit of TM300 (labelled mono A).
Mono A is fitted with a 1200g/mm grating. On the exit slit of mono A is an aperture.

Mono A and the IL7 are located above the sample chamber on the base plate. The output from mono A is collimated, the light should not clip the sides of the sphere port.

The integrating sphere is mounted to the entrance slit of Mono B. Mono B is fitted with a 2400g/mm grating. A cooled PMT is adapted, via quick change plate to Mono B exit.

Detection electronics are found in the 417 bin. The signal from the PMT (SMA connector) goes to 487 input 1. The high voltage from the PMT (thick BNC) goes to 215 module and the cooler control 15-way goes to CPS1M.

2. Installation Guide

2.1 Installing BenWin+

Before installing any hardware it is necessary to install the software as this will assist in setting up the sphere. Simply load the Setup.exe file on the supplied USB stick and click BenWin+.

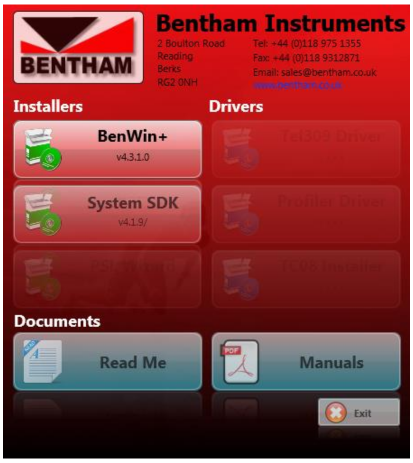

Figure 2: Bentham software installer front panel. This screen allow the user to to install BenWin+ or to install the SDK should they wish to.

Then simply follow the instructions laid out in each window to finish the software installation.

2.2 Mounting the Monochromators

The monochromators have been shipped with base plates fitted. These should be removed and kept should they be required in future.

The monochromators attach, without the monochromator base plate, to the system base plate by passing 4 M6 screws/ washers from the underside of the base plate. Elevate base plate (for example support on sturdy boxes) ensuring that one can access screw points to attach monochromators.

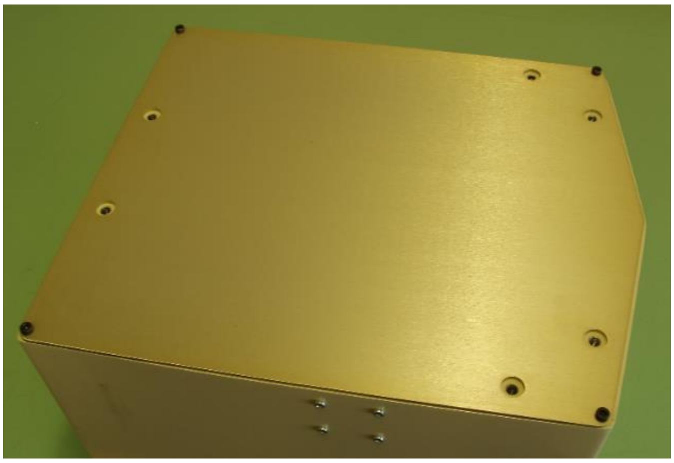

Figure 3: Underside of one half of the DTMc300 monochromator. These panels should be removed before mounting the system to its stand

Install monochromators in correct locations on base plate. The position are indicated on the base plate, in both cases the connector-side of the monochromator points out (right/ left).

2.3 Installing the Light Source

The IL7 can be mounted to the entrance slit of mono A using the 4 M3 screws provided. Connect the 610 to the IL7 ensuring correct polarity and that the fan is connected.

2.4 Installing the Sphere and Optics

The sphere, optics and sample chamber have been shipped in one piece. The sphere is to be removed from its housing to attach to the second monochromator.

The sphere is held in place by 8 M2.5 screws. Remove these gently and use the improvised handle to remove the sphere.

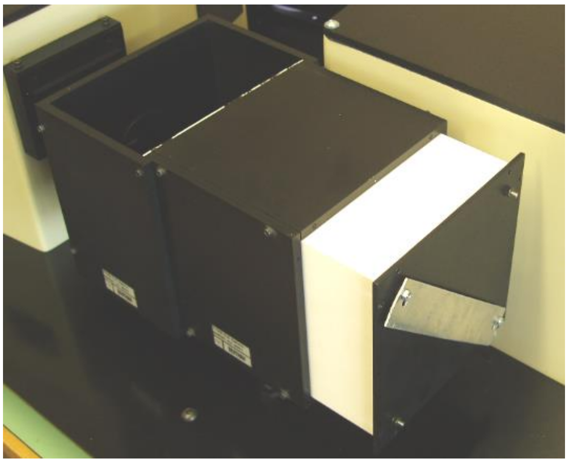

Figure 4: The SSUV300 50mm integrating sphere being inserted back into its housing after the sample chamber is fitted to the monochromators

Using 4 M3 screws and washers provided loosely attach sphere metalwork to Mono B and the optics side to Mono A. Return sphere into housing, ensuring that the disused monitor port be upright.

It is necessary that the light issued from Mono A be central and not clipped by the sphere port walls. To do this connect both monochromators and the 417 bin via USB to the computer. The monochromators and 417 bin on power-up should be found and recognised by windows first time.

Load BenWin+ and click the lightbulb icon. This should initialise the software and park the monochromators.

In preparation for the next part, switch the Xenon lamp on (ensuring 610 set to 8.50A setting, and fan connected. In BenWin+ go to signal setup. In target wavelength type 555 and hit go to target wavelength. Green light should issue from the monochromator.

One can then make the following adjustments to ensure that light enters the sphere without clipping the edges:

1. Move mono A back and forth for lateral position of the beam spot.
2. Move metal work, pivoting on mono B side for some height variation.

Once position is correct, tighten the M6 screws beneath the monochromators and the M3 screws on the two monochromator slits. Ensure supporting foot is in place to bear weight of sphere.

Figure 5: Integrating sphere and sample chamber fitted to the DTMc300

The screws of the front face of the sphere housing have been slackened to permit removing the sphere. These can now be tightened gently.

At this point, it is possible to remove base plate from supports and to place in destination location. Pay attention not to pull on monochromator supply leads whilst doing so.

2.5 Installing the PMT

The PMT has been shipped with a cover over the window. Remove this. The PMT is adapted to the exit slit of Mono B via the quick change adapter. Slide the PMT into place and tighten two side screws well to hold in place.

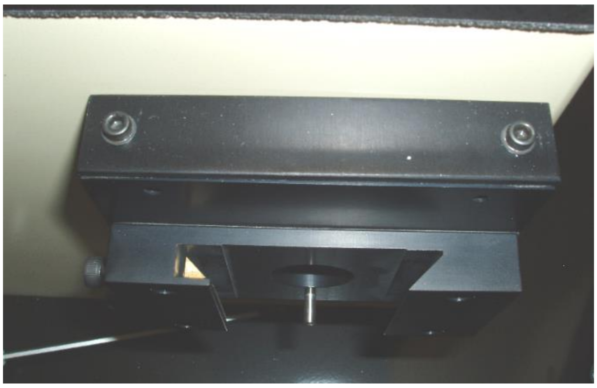

Figure 6: Quick change adapter. Once the PMT housing has been inserted, tighten the screws on the left of the adapter to secure the PMT

Connections from the PMT housing should be made to the following:

- SMA connector to 487 input 1
- HV port to 215 module using BNC (thick) cable
- Cooler control is connected via 15-way connector

2.6 Detection electronics

The high voltage has been set the recommended 750V. Flick the switch to apply. Flick the CPS1M to view target temperature set. This is -20°C. Switch cooler on. It should take a few hours to reach temperature.

3. Performing Measurements with the SSUV300

3.1 Calibration

To calibrate the system please perform the following:

1. Power on the IL7 lamp
2. Power on both monochromators and detection electronics and ensure they connected to the computer
3. Open BenWin+ and initialise the system
4. Place the PMMA plate inside the test chamber over the entrance to the integrating sphere and then replace the cover to the test chamber

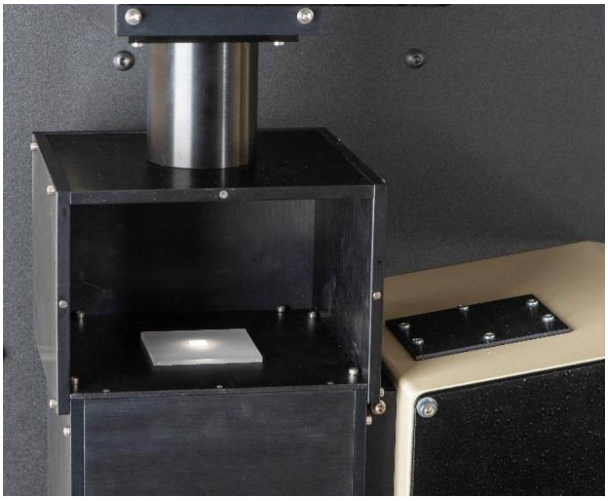

Figure 7: Sample chamber with PMMA sample inside

5. In BenWin+ go to Scan → Scan Setup…

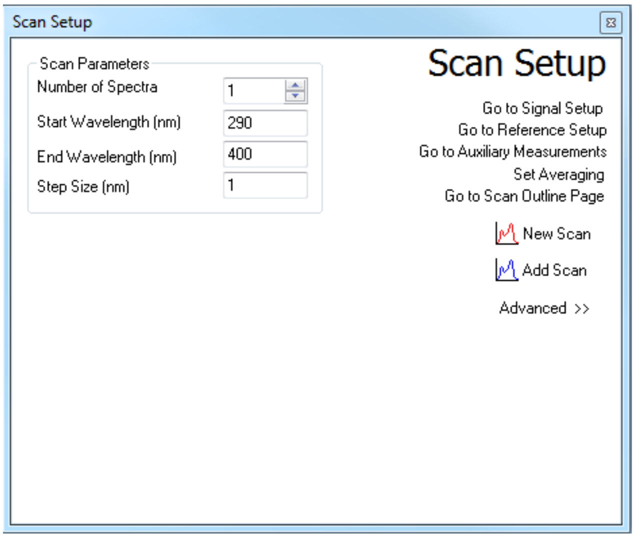

Figure 8: Scan setup window with the necessary start and end wavelengths and step size set

6. Perform 3-5 scans between 290-400nm in 1nm steps. This should provide a scan with a similar shape to the one below with units on the y-axis in terms of nA. Save this scan
7. Go to Analysis → Spectral Average. Click ok to take an average of all the reference scans. Then click save

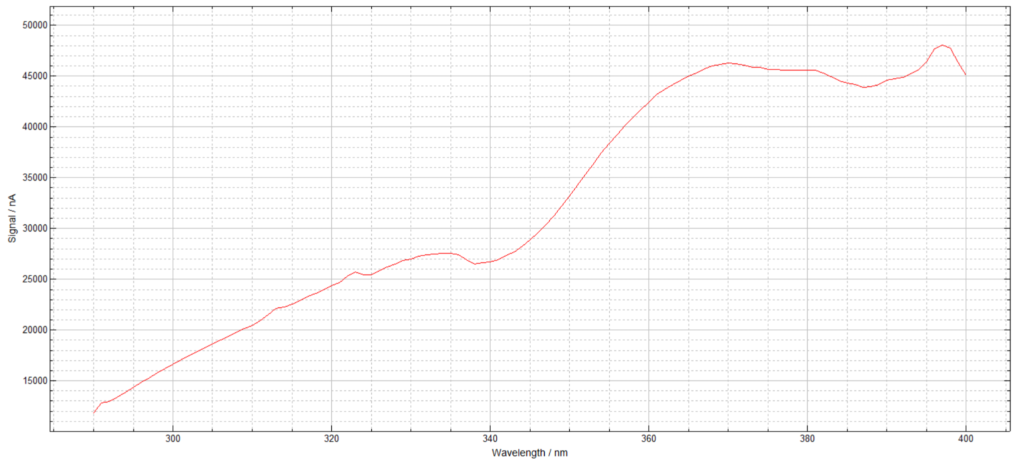

Figure 9: Initial 'raw' scan of the PMMA reference plate. This is used to calibrate the system in section 3.2

3.2 Sample Measurement

Once calibrated the system is ready to measure samples. Perform the following to do so:

1. Go to Scan → Reference Setup. Set the measurement type and units as required. In the 'Reference Source' section, select Spectrum and open the scan saved in step 7 as the Measured Reference File. When asked, select the average reference scan. Ensure 'Use Reference Calculation' is checked and click apply and then return to scan setup

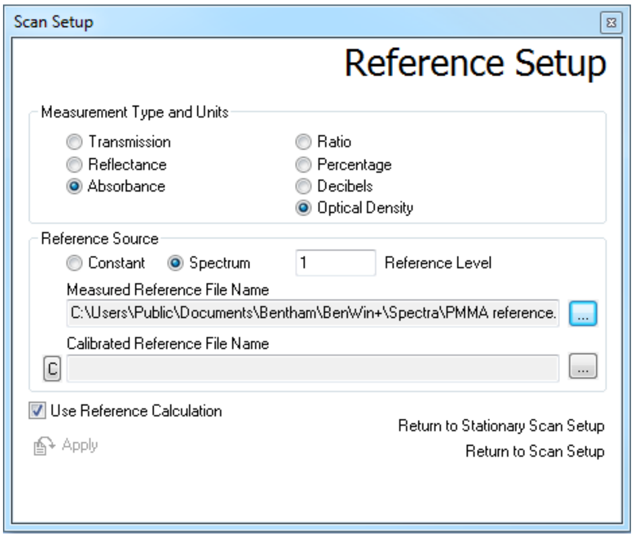

Figure 10: Reference setup window. This allows BenWin+ to calculate the required measurement of the product given the initial 'raw' scan

2. Open the test chamber and apply product to the reference piece as required. However, ensure that product is applied evenly. Then place the sample back into the sample chamber and close
3. Click Scan. This should produce a scan similar to the one below and the data can be exported or analysed as necessary

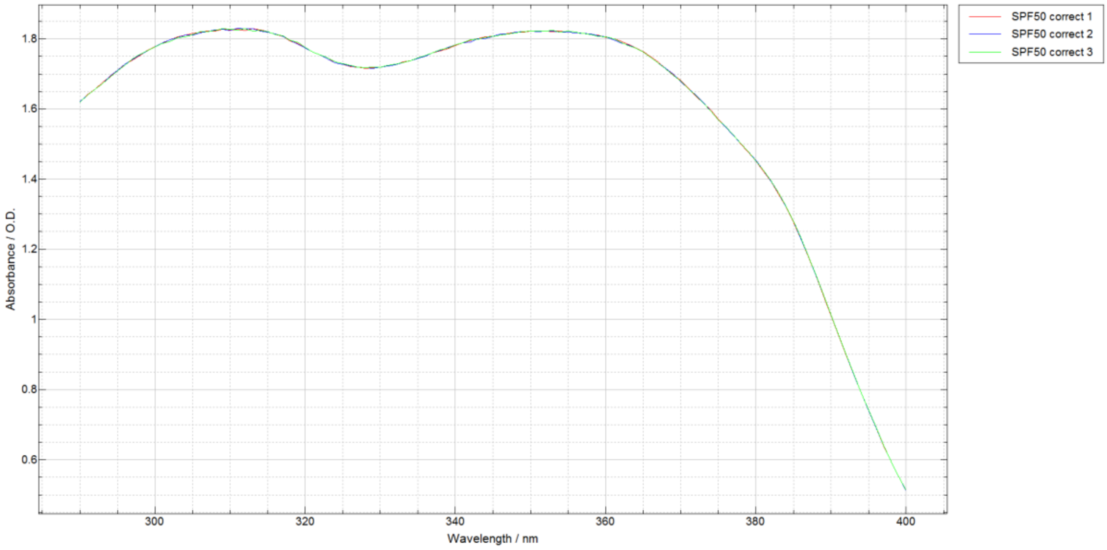

Figure 11: Final measurement, in this case the absorbance (O.D) of the lotion product applied to the PMMA reference plate

Appendix 1: Verification of Monochromator Wavelength Calibration

Wavelength calibration is usually checked using a mercury lamp the output of which consists of discrete lines at defined wavelengths. The presence of mercury in overhead fluorescent tubes can act as a good replacement for a specific lamp.

The following table shows the position of the mercury lines. Those marked in red are particularly strong lines, leading therefore to higher orders with a measurable contribution.

1st Order	2nd Order	3rd Order	4th Order	5th Order	6th Order	7th Order
184.91						
194.17						
226.22						
237.83						
248.2						
253.65	507.3	760.95	1014.6	1268.25	1521.9	1775.55
265.2						
280.35						
289.36						
296.73						
302.15						
312.57	625.14	937.71	1250.28	1562.85		
313.17						
334.15						
365.02	730.04	1095.06	1460.08	1825.1		
365.44						
366.33						
404.66	809.32	1213.98	1618.64			
407.78						
434.75						
435.84	871.68	1307.52	1743.36			
491.6						
496.03						
546.07	1092.14	1638.21				
576.96						
579.07						
690.7						
1013.98						

Figure 12: Mercury (Hg) spectral lines and the nth order of each line

It is of course important to ensure that whilst observing the higher order lines, the order sorting filters of the monochromator are de-activated. This is done by going to Instruments → Filter Wheel and resetting the true insertion wavelengths with 0nm.

Use the Tools → Create custom wavelength file facility of Benwin+ to define a scan around desired emission lines rather than scanning over the full range.

Go to Tools → Create custom wavelength file, to view the following, left.

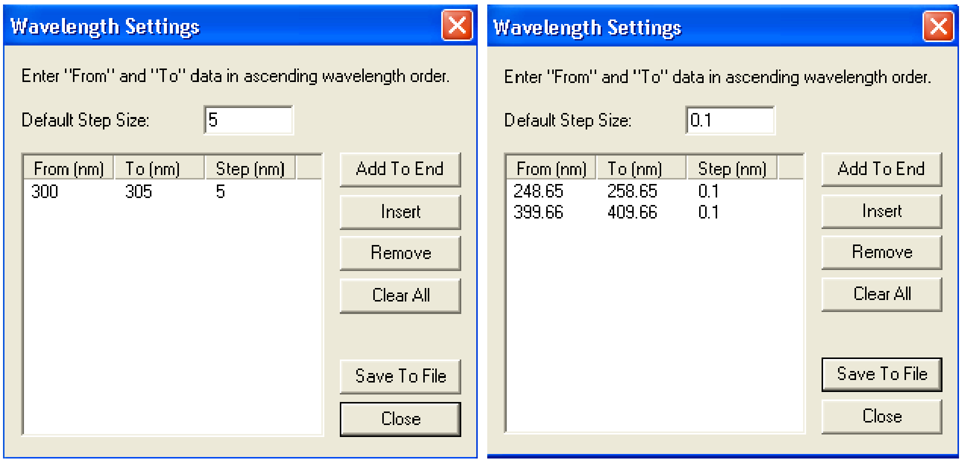

Figure 13: Custom wavelength file used to measure the Hg spectral lines

Set default step size, insert the number of lines required, double click on values to edit and finally save to file.

Choose a step size of minimum 0.15nm to view lines. Scans using this file are initiated by going to Scan → Scan set, click advanced, then select custom wavelength file and load file required, then scan as normal.

Please be aware of the slits presently in system. Having for example 5nm slits present and looking at the lines around 365nm, one will effectively see several lines which can distort the result and wrongly show lack of calibration.