Dynamic Light Scattering (DLS)

Introduction

This experiment is used to measure the hydrodynamic diameter of particles. The mechanismof calculation is based on Brownian motion of particle and determination of diffusion coefficient. This is subsequently converted into the diameter using appropriate autocorrelation equations within the Zetasizer Nano.

Materials

- Zetasizer Nano
- Cuvettes (resistant up to 50 ^{o}C)
- Material to be analysed - min volume 400 µL

Procedure

- **Initiating the Instrument**

This must be done simultaneously while opening the computer.
A total of 4 beeping sounds must be heard. The last 2 consecutive sounds indicate that the cuvette holder has reached 25^{o}C.

- **Initiating the Software**

1. Choose the:

shortcut on the Desktop screen only once the instrument in set-up.

- **Creating New SOP**

1. Select File→New→SOP. This will open the SOP Editor.
2. Select the Measurement type required.
3. Change the settings within the SOP windows. These are described in the following pages under the Measurement type selected (e.g. Size SOPs).
4. When all the SOP settings have been completed, select File-Save or press the Save icon, and enter a name. Save the new SOP.
5. A new wizard will open so that you set your parameters. These include material, temperature, viscosity, dispersant composition etc.

- **Creating New Measurement File**

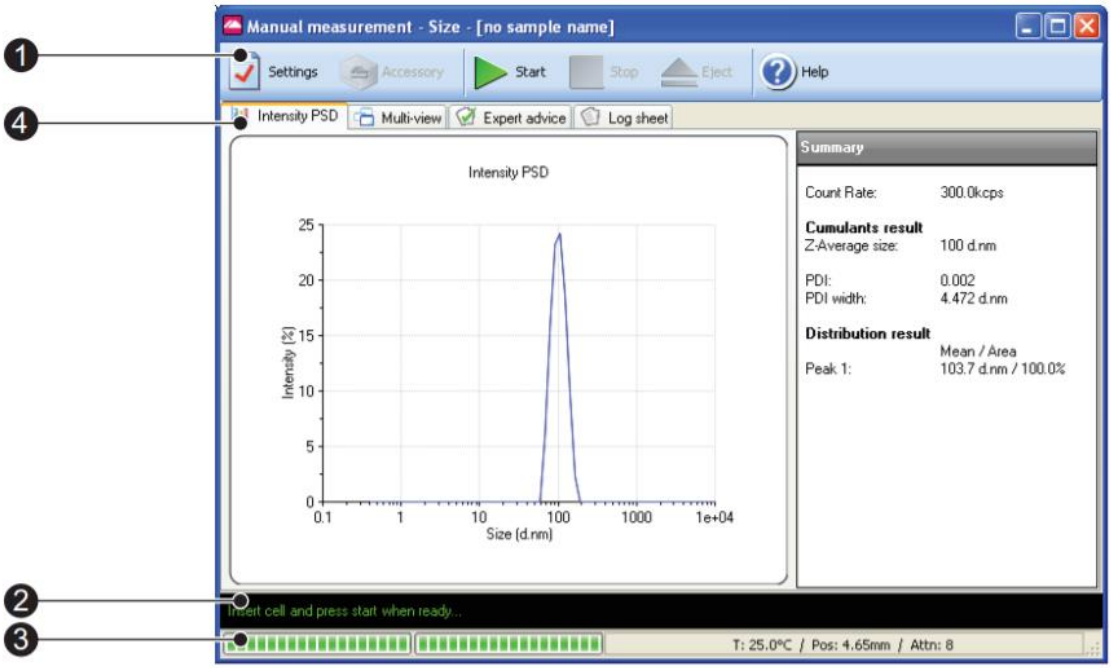
1. Select File→New→Measurement File.
2. A window is displayed allowing the new measurement file to be named and specify where it will be saved.

3. Select Save.

- **Making a SOP Measurement**

1. Open (or create) a new measurement file.
2. Select Measure→Start SOP from the Zetasizer software.
3. Select the SOP→Open.
4. Follow any on-screen instructions that are displayed. The Measurement display will now be shown.
5. Insert the cell into the instrument and wait for the temperature to stabilise.
6. Click Start. The measurement will be made, and the results displayed and saved to the measurement file that was selected when the SOP was started.

- **Measurement Display**



1. Start and Stop the measurement. If Stop is pressed while performing a measurement, then the measurement must be started again from the beginning. Stop does not act like a pause. The Settings button opens the measurement settings window.

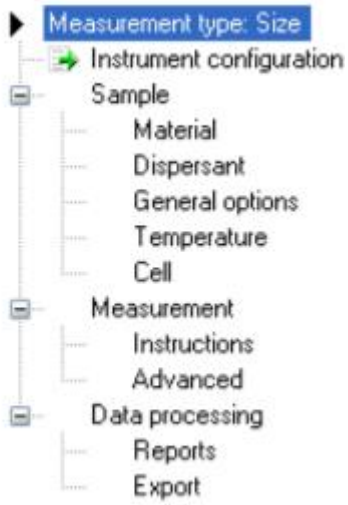
2. The status bar shows instructions and the current operation in the measurement sequence.

3. The progress meter shows how far the measurement has progressed plus the number of measurements performed and the measurement runs completed. Also shown are the temperature, measurement position and attenuator settings.

4. The Tab views enable the progress and results of the measurement to be viewed. The first tab shows the results and will change with respect to the measurement type and results view selected. In the above example, this tab is labelled Intensity PSD to identify that intensity results are being viewed. This tab shows different graph plots relevant to the measurement type selected. The other three tabs windows - Multi-view: displays the results in three smaller windows. Log sheet and Expert advice - are standard for each Measurement type.

- **Parameters to Choose within Size SOPs**

The **Size SOP Editor** menu is:



  - **Within Sample**

    - **Sample Name.** The name entered here should be a description of the sample being measured. If no name is entered the sample name entry in the Records view will be left blank.

    - **Material.** Selecting the Sample - Material window and pressing the button, displays the Material properties manager where these properties can be defined. This included the **Refractive Index and Absorption.**

    - **Dispersant.** From the list displayed, an available dispersant can be selected for inclusion into the SOP; alternatively, a dispersant can be added, modified or deleted from the list.

      To define a new dispersant, press the Add... button and choose from defining either a Simple dispersant or solvent or a Complex solvent

      On selection of a Simple dispersant or solvent the Dispersant Properties window is displayed, allowing new dispersants to be

defined. The dispersant name, refractive index and viscosity can all be specified.

- **Temperature.** Input the Temperature required, and how long the sample should be left to equilibrate before the measurement is started. **Equilibration time** adds a delay before the start of each measurement to ensure the sample temperature is equal to the cell area temperature. The delay starts as soon as the instrument has reached the operating temperature requested.

- **Cell Type.** Select the appropriate cell from the list. The choices match the range of cuvettes and cells available from Malvern Instruments. Once selected a description of the cells is given. N.B.: Each measurement type might require other cuvettes.

- **Data Processing**

If characteristics are already known about the sample being measured, this window will allow an appropriate analysis model to be applied and so optimise the measurement calculation. Choose from these Analysis Models:

  - **General Purpose.** Select this model if the characteristics of the sample to be measured are unknown.

  - **Multiple Narrow Modes.** If it is known that the sample to be measured will give a distribution of one or more narrow peaks (i.e. a multi-modal distribution of latices) then select this model.

  - **Protein Analysis.** The Protein Analysis method is suited to protein applications where samples typically consist of narrow peaks at small sizes plus aggregates.

- **Displaying the Results**

  - The results are displayed in two ways. A Records view that shows a list of the measurement records in a measurement file, and the Report tabs which show all measurement details of a selected measurement record, or records.

  - Once the measurement is complete, a new measurement record will be added to the Records view of the measurement file window. The records will be sequentially numbered. Records are automatically assigned a record number on completion of the measurement.

- Choose one measurement and open the Report Tabs to view your results. Multiple measurements can be chosen in order to observe the results of the repeat measurements collectively.

For more details on the instrument consult: https://www.chem.uci.edu/~dmitryf/manuals/Malvern%20Zetasizer%20ZS%20DLS%20user%20manual.pdf