

Appendix C:

A brief tour of the Windows™ application software.

In Chapter 2, a Windows™ application was described. A brief outline of the functional aspects of this software are given here, but no source code is included due to space constraints. Once the application is launched, the main window as given in Figure C.1 is displayed.

The menu items provide the following functions:

- ***File*** - Operations to load/save materials databases and program setup information
- ***Setup*** - Allows configuration of the hardware, temperature controller, digital signal processing options, and test-cell configurations
- ***Experiment*** - Functions for starting and stopping experiments, and for configuration of experimental setup, eg. modes of operation, number of measurements.
- ***Plot*** - Configuration dialog boxes for the four plot windows. Allowing axis selection, titling, and plotting styles.
- ***Postprocess*** - Allows previously saved data to be reprocessed using currently defined settings, and for conversion between different data formats.
- ***Help*** - Simple "about" dialog box.

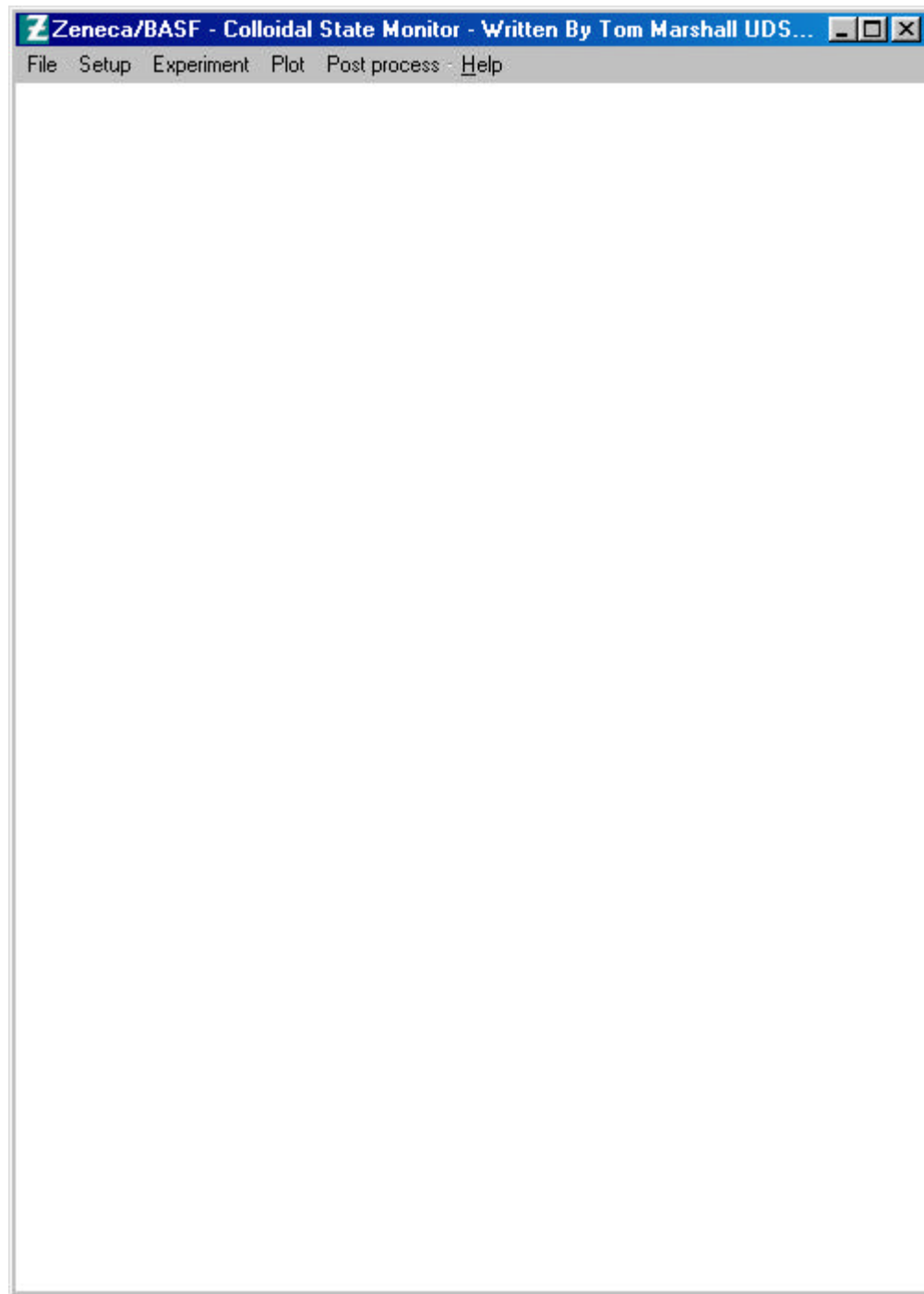


Figure C.1: Application main window

The *File* menu item.

The user may wish to reload or save an experimental setup. This can be useful where a large number of parameters have been set, and a large number of experiments of a

similar sample are to be conducted over a period of days. All the file dialog boxes are of the generic type, such as the one given in Figure C.2.

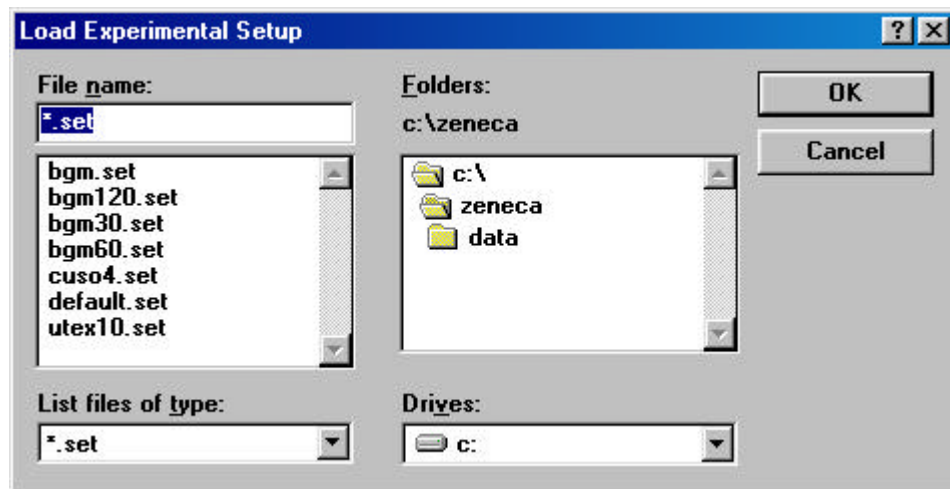


Figure C.2: An example *file* dialog box. Loading an experimental setup file.

It is also possible to load and save small materials databases containing parameters which are required for signal processing. The option to *Create a new experiment* is also provided in the *file* menu item. This prompts the user with a simple dialog box for an experiment name which is used as a directory path to store the experimental data. The user also has to type a mandatory number of characters in the *notes* edit box which is used to create a file for relevant information about the experiment, eg. hardware used or sample tested.

The Setup menu item.

The setup menu item contains a number of dialog functions intended for the configuration of the software package. The number of active transducers, their operating mode, effective path length, transducer buffer material and thickness may all be selected using the dialog box given in Figure C.3.

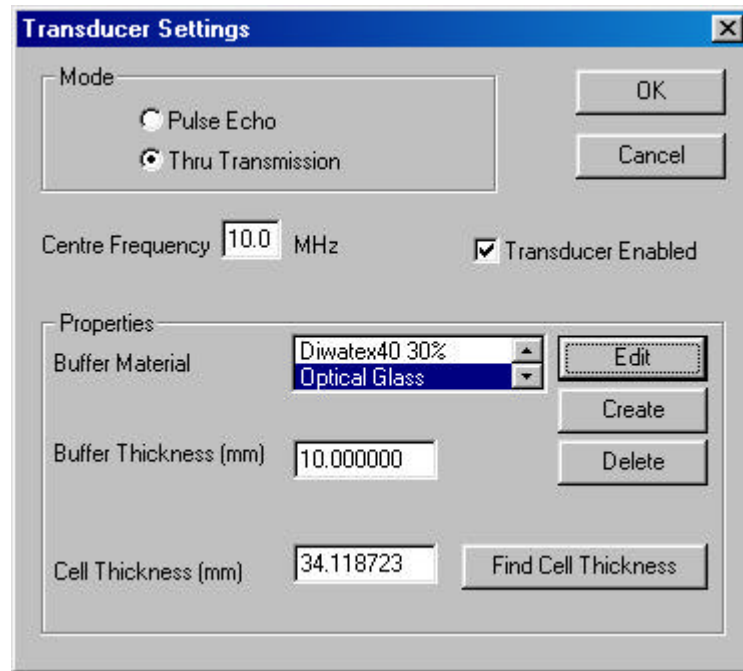


Figure C.3: Transducer settings dialog box.

The mode of operation may be selected as either *Pulse Echo*, or *Thru Transmission* for operation in either mode, the centre frequency of the transducer must be specified, and the transducer (or pair of transducers) may be disabled or enabled. The buffer material may be selected from the list, or a new material created. The user may also edit the current properties of a given material, or delete the material from the database. The thickness of the buffer material is also required. The cell thickness may be entered manually, or automatically found by filling the test-cell with distilled water and inserting the temperature probe. Clicking the *Find Cell Thickness* button allows the software to capture a long time domain record from the receiving transducer using the DSO, and calculate the cell thickness from the buffer thickness, buffer material, and the velocity of water at a given temperature (Del Grosso, V.A. and Mader, C.W., 1972).

The test medium may be selected as shown in Figure C.4. The data storage directories can be set as shown in Figure C.5. If the user has just created a new experiment, the appropriate fields are automatically filled.

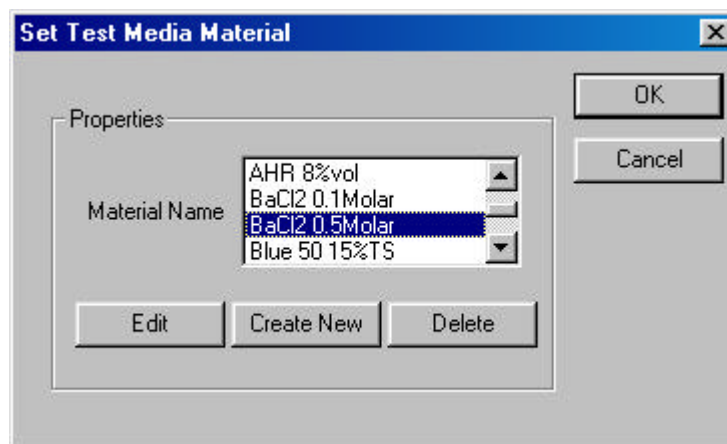


Figure C.4: Selecting the appropriate test medium.

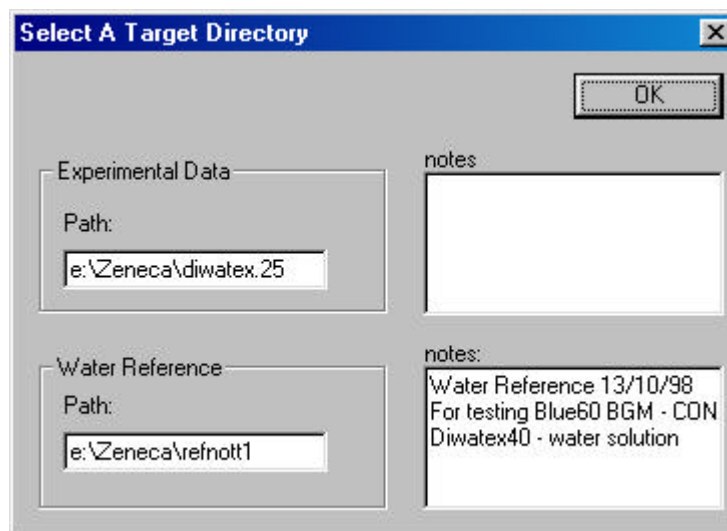


Figure C.5: Selecting directories for water reference data and experimental data storage.

The signal processing parameters can be altered as shown in Figure C.6. The hardware sample rate, oversampling rate, and phase unwrapping threshold may be set by the user. For the calculation of attenuation spectra, it is possible to use a number of sources for the acoustic velocity in the sample. The *Help me* button supplies a messagebox with information regarding the correct choice. It is also possible to output data in DOS or SUN binary formats.

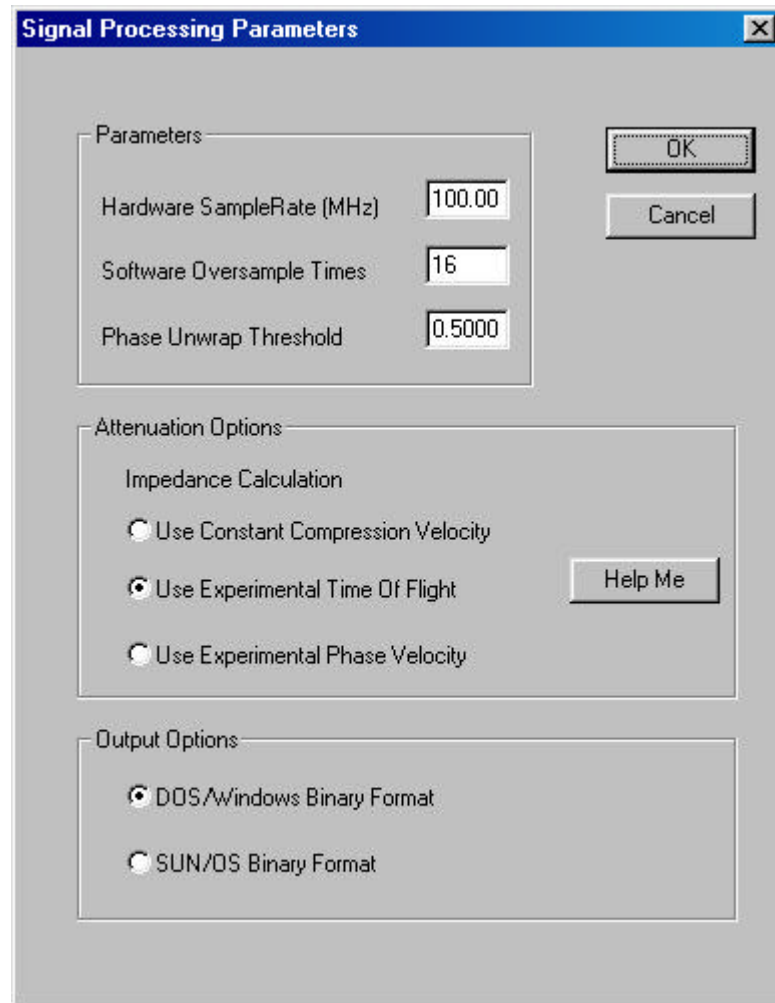


Figure C.6: Signal processing parameters.

Basic parameters for temperature control are also included in the *setup* menu item, as shown in Figure C.7.

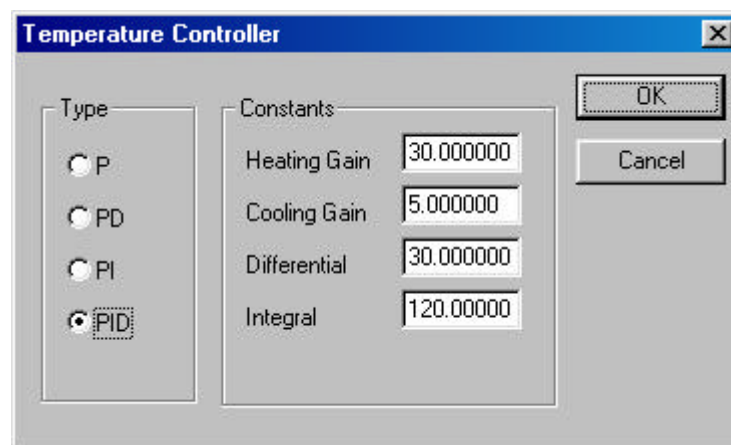


Figure C.7: Setting the required coefficients and mode of operation for the temperature controller.

The *Experiment* menu item.

This menu item allows the user to *start* or *stop* an experiment, and also provides a *setup* dialog box so that additional setup information regarding the nature of the experiment can be altered (Figure C.8).

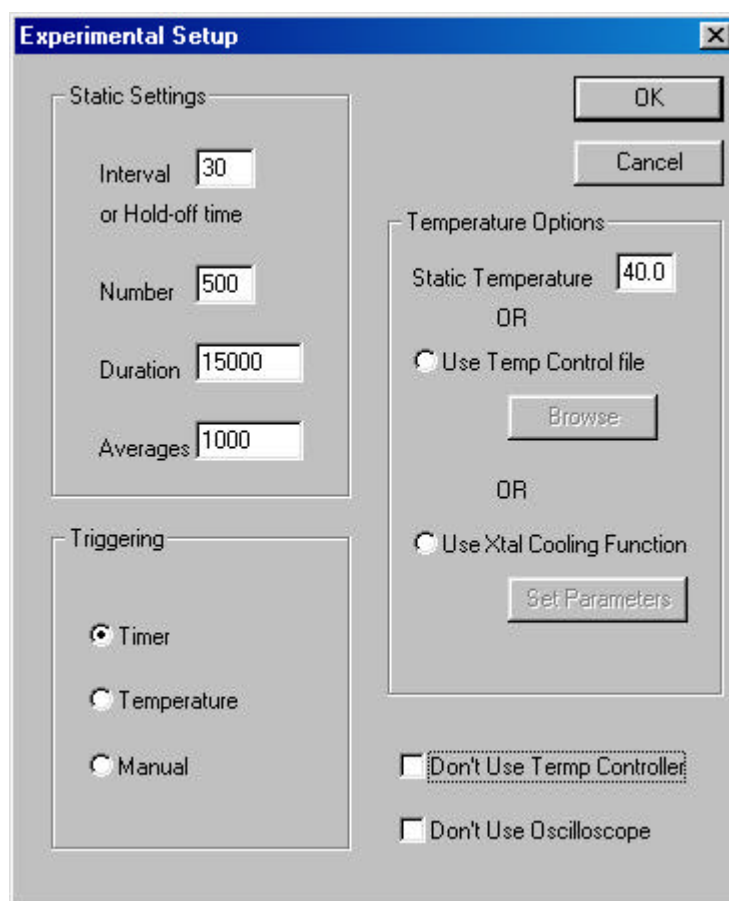


Figure C.8: Setting the experiment configuration.

The dialog box shown in Figure C.8 allows a number of modes of operation.

Triggering.

In *Timer* trigger mode the software will automatically perform measurements at intervals specified in the *Interval* edit box of the *Static Settings* group. This time must be sufficiently long to allow for the DSO used to perform the number of averages specified.

In *Temperature* triggered mode, the software will only take measurements at the static temperature specified in the *Temperature options* group ($\pm 0.1^\circ\text{C}$), or at the temperatures specified by a temperature control file which may be selected. The format of this file is whitespace separated ASCII text containing the next temperature, and the number of seconds to hold at that temperature.

If the *Manual* trigger mode is selected, the *interval* edit box now refers to the amount of time the software will wait before prompting the user to start a new measurement. This is particularly useful for experiments where user intervention is required between each measurement, such as a manual titration (as described in Chapter 6). The software will wait indefinitely for the user before each measurement.

Use of crystallization cooling function

If the *Use Xtal Cooling Function* radio button is selected, the temperature control software will pass back target temperatures and actual temperatures to the main Windows™ application, and it is recommended that the *Timer* triggering mode is used for this method of operation. The crystallization cooling function is presently hard-coded into the temperature control software, as it is not changed frequently in normal use. Batch times, and temperature ranges for the cooling functions are supplied in the parameter file.

The user may select to start an experiment from the *Experiment* main menu, in which case he/she is presented with a message box prompting to continue with the operation, as shown in Figure C.9. A small amount of relevant information is included so that the user does not accidentally erase other experimental data, and a hardware identification string is also included. If no hardware is found, (as shown in Figure C.9) a message box will appear before the experiment starts to run, and the process will abort.

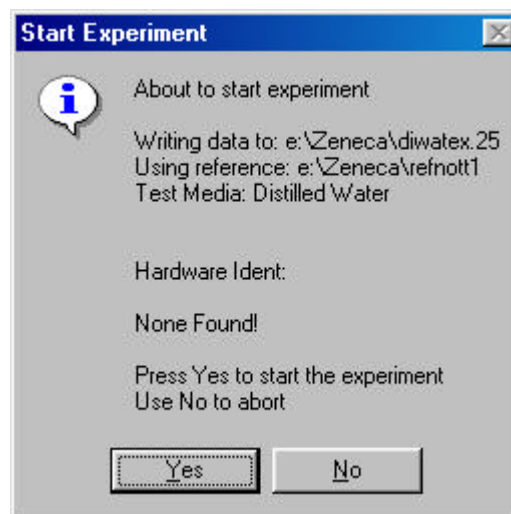


Figure C.9: Message box prompting the user to start or to cancel an experiment.

During the normal running of an experiment, an additional dialog function controls the sequence of events, timers and error handling, as well as displaying useful information, as shown in Figure C.10. The current experiment number is automatically inserted into the dialog box title, and a progress bar indicates the number of experiments performed as a percentage of the total number. The time remaining is also displayed, which counts down in seconds, and a message box is included to inform the user about what action is currently being performed. A warning checkbox is ticked, if the temperature of the current measurement is not in the range of measurements included in the water reference data being used. Data is still processed in the usual manner, the user may discard or keep such data at will. If the temperature controller is being used, the lower section of the dialog box is enabled, and displays current temperature, the desired temperature, output power, and the differential and integral terms of the controller. It is also possible to reset the controller, and a check box is ticked if the controller is cooling the test-cell. The experiment may be stopped at any time using the *Abort* button, or from the main menu.

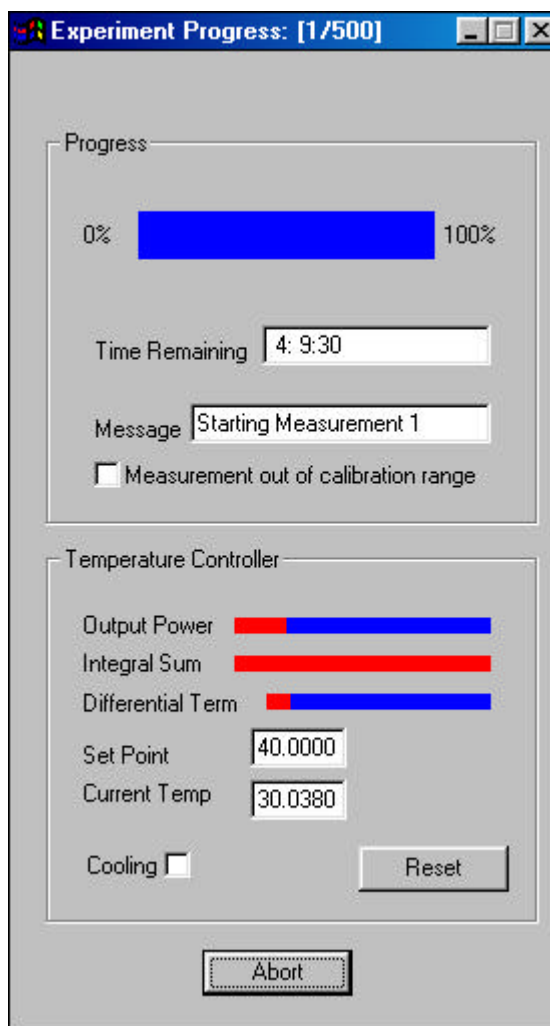


Figure C.10: Experimental progress dialog function.

All the time domain data, temperature data, and processed attenuation and phase velocity spectra are saved as files, with a sequential numbering system in the directory specified by the user, as the experiment progresses. Data displayed such as time histories is not saved to disk.

The *Plot* menu item.

Throughout the course of the experiment, selected data maybe displayed on one of four output windows in graphical form. Each of the four plot setup dialog boxes appears as shown in Figure C.11.

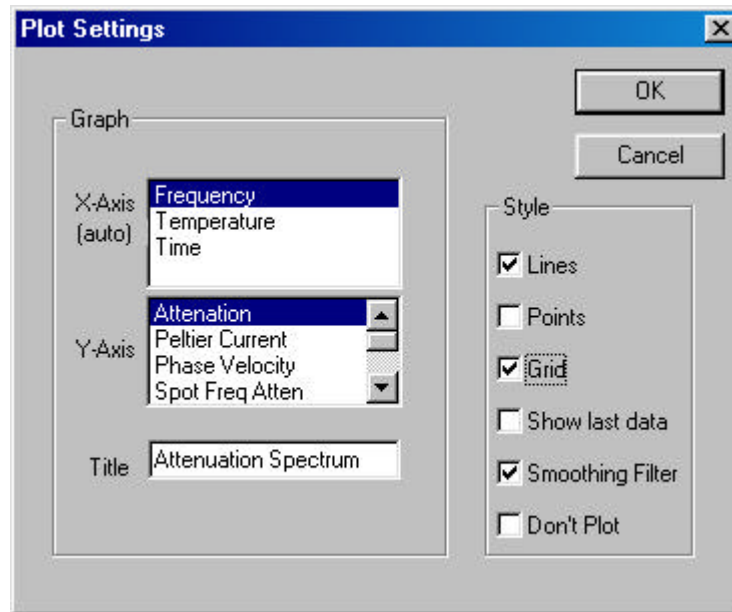


Figure C.11: Changing the settings for plotting data.

The user selects the required Y-Axis, and the software automatically selects the corresponding X-Axis. An arbitrary title may be edited by the user, although the system defaults to sensible strings. The style of the plot may be altered using the check boxes on the right of the dialog box. Any number of these may be selected, allowing, lines, points, the use of a grid, and a smoothing filter to be used. It is also possible to show the last data set obtained, which is useful for comparing successive spectral information. The *Don't Plot* check box prevents this graph from being displayed, although all the settings are remembered.

The *Postprocess* menu item.

The software allows a limited amount of post-processing to be performed on existing data. Using the paths selected by the user, existing time domain data may be re-processed using the current settings, or using saved settings. This can be useful if a parameter was not known during an experiment as can later be corrected for, or for presentation purposes. The post-processing dialog box is shown in Figure C.12.

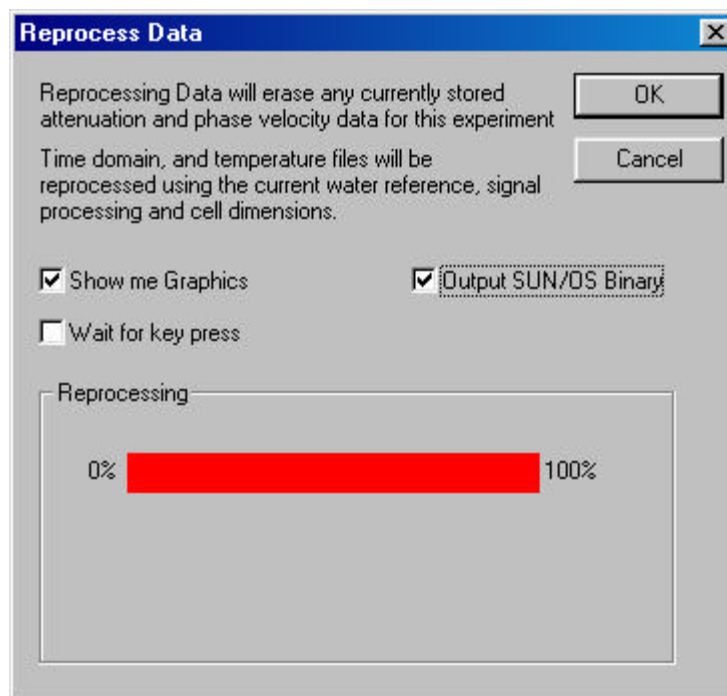


Figure C.12: Post processing previously saved data.

This dialog function performs exactly the same functions as the experimental progress dialog function given in Figure C.10, except data is not obtained from the DSO, but is retrieved from disk or network storage. The user may opt to display the graphs, which will appear in exactly the same manner as during an experiment. The software will run as fast as is possible, unless the user selects to *Wait for key press*, in which case he/she is prompted to continue before *every* measurement. Data may be output in DOS, or SUN binary formats. During post processing the OK and Cancel buttons change function to Restart and Abort.

Concluding comments.

The software was intended primarily as a research tool to provide a constant method for performing a large number of experiments, storing the data in an organised manner, and for the rapid on-line calculation of ultrasonic phase velocity and attenuation spectra using proprietary laboratory equipment.