

Operation of the LabVIEW Pulse Height Analyzer Program

OVERVIEW

This program uses a high-speed digitizer card to read a sequence of pulse trains from the output of a pulse-shaping amp or similar device. The pulses are analyzed according to their height, and a count is added to a corresponding bin for each pulse height. The maximum sample rate of the digitizer is 100 megasamples/second, and the maximum voltage measurable by the digitizer is 10V. The digitizer resolution is 14 bits or 610 microvolts.

OPERATION OF CONTROLS

- The small ARROW BUTTON at the top left starts the program.
- TAKE DATA starts a new data collection process. Some program actions cannot be taken during data collection--these are shown by disabling the relevant buttons. Any new data is added to the existing set.
- CLEAR clears the data set. It may be used at any time.
- SAVE DATA opens a dialog box so the user can save the data file. The file is in the form of two columns of numbers; the first column is the voltage corresponding to a particular bin, the second is the number of counts in each bin. Note: the current data set is also saved by the program when it is exited using STOP PROGRAM. This file is automatically reloaded when the program is started.
- LOAD OLD DATA allows the user to look at a previously saved data set.
- PRINT DATA brings up a black & white dialog box containing a copy of the current graph and some useful parameters. Choosing OK from this dialog prints the contents of the dialog box on the default printer.
- ANALYZE DATA opens a window which allows the user to fit curves to the data. The curves and data can be printed to the default printer. Further instructions on using the fitting window are available in that window.
- STOP PROGRAM stops the program entirely. To restart, use the small ARROW BUTTON.

NUMERICAL CONTROLS:

“Low level disc (V)” sets the trigger point of the digitizer. The digitizer will only respond to pulses above this threshold.

“Hysteresis (V)” sets the value by which the signal must drop before another pulse may be measured. Some hysteresis is necessary to minimize noise pickup.

“Vertical range” sets the maximum voltage that will be read by the digitizer. Any voltage above that value will be read as equal to the vertical range value. Lower values of the vertical range setting can be used if one needs a higher resolution for smaller voltage signals. (An internal amplifier increases the signal sent to the analog-to-digital converter.)

“Sample Rate (Hz)” sets the rate at which the digitizer samples the input waveform. This control should be set high enough to accurately digitize input pulses, but not much higher. If the input pulses have a long time constant, one can lower this value to improve the responsiveness of the program.

“Record Length (points)” sets the size of the input buffer used to hold the digitized waveform. The total time that a single waveform grab takes is (Record Length)/(Sample Rate).

DATA WINDOW OPERATIONS

Pulse height histogram:

The “Total Counts” is equal to the sum of the counts in all bins.

“Update (cyc)” gives the number of acquisition cycles between histogram updates. The graph will appear to update more slowly as this parameter is increased, but the number of counts added will be greater with each update.

“Bins” gives the number of histogram bins chosen. NOTE: this parameter is active only when the data set is empty. Otherwise the number of bins, and their range, is set by the existing data set.

“Min” and “Max” set the minimum and maximum voltage that will be counted. These controls also control the min and max of the graph x-axis itself.

The yellow vertical cursor shows the current value of the low level discriminator.

Digitizer input:

This shows the raw data coming into the digitizer. It is only active when the “Show Input” button is ON and data is being collected. The horizontal yellow cursor shows the current value of the low level discriminator. The horizontal axis length is determined by the “Record length” control.

PROGRAM PECULIARITIES

The maximum count rate achievable depends on many factors, such as the computer speed, the sample rate, record length, and histogram update rate. The default settings are OK for a source of moderate activity, and are a compromise between good count rates and user responsiveness. To maximize the program's ability to count rapid pulses, you should choose a long record length and a large number of acquisition cycles between histogram updates.

When the program first starts, it loads the set of data it had on last closing. This will also force the program to choose that data set's values of histogram bin size and extent. Any

data collected after will be added to the set already in memory. Thus, to start a completely new collection, you should always clear the data first.

If the data collection is started without a (good) signal to the digitizer, the program will timeout with an error message.

The program assumes that data will be coming in on Channel 0 of the digitizer, and that the digitizer has an internal designation of "Dev1".

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