LeCroy

PERSISTENCE TRACE DISPLAYS (WR_XI NOTE 5)

The WaveRunner Xi oscilloscope family offers several alternative statistical analysis tools based upon the analysis of persistence displays. These include persistence histograms and persistence trace mean, standard deviation, and range functions. All of these techniques are included in the extended statistical analysis option WRXi-STAT.

Persistence trace functions offer an easy-to-use method for analyzing signal variations such as timing jitter and noise. While persistence displays, such as eye diagrams, offer fast qualitative views of signal jitter, they are often hard to quantify. Persistence trace functions extend the usefulness of persistence displays by clearly showing the average, standard deviation, and range of waveform variations. The functions are derived from existing persistence displays and do not require re-acquisition of the data.

An example of persistence trace displays is shown in Figure 1. The top trace (Channel 2) is a fast WaveStream™ acquisition history of a timing signal. The pulse edge shows a variation in timing.

Trace F1 is the persistence trace range function showing the peak-to-peak timing variation. In the persistence trace range setup, the user can limit the percentage of the total population used to generate the function from 0.5 % to 100.0 %, as shown in Figure 2.

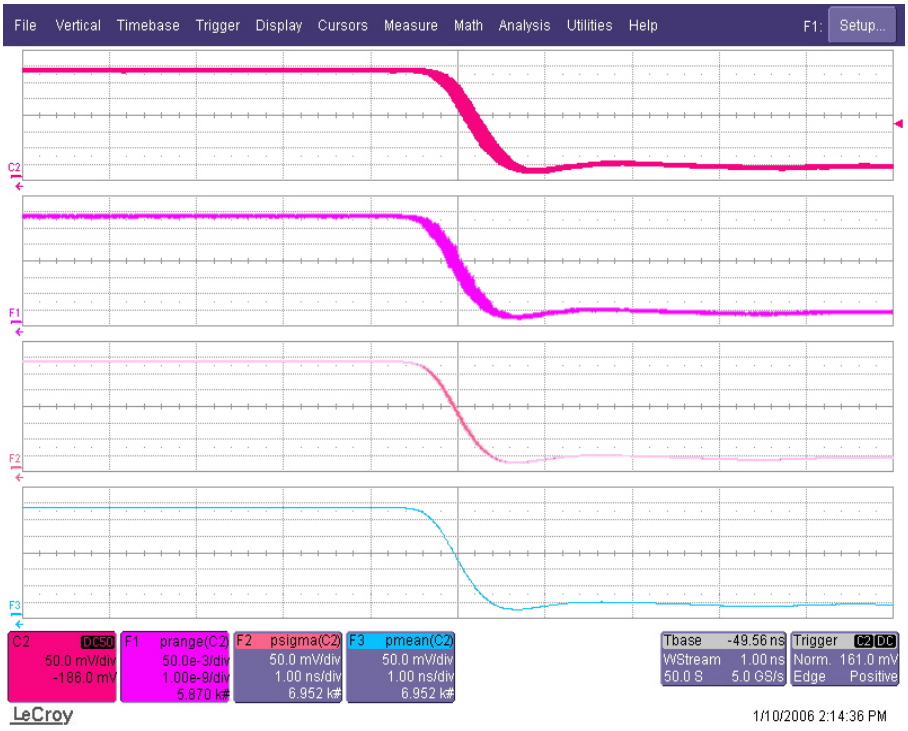

Figure 1: A Fast WaveStream acquisition (Trace C2) along with the persistence trace range (F1), standard deviation (sigma - F2), and mean (F3) functions.

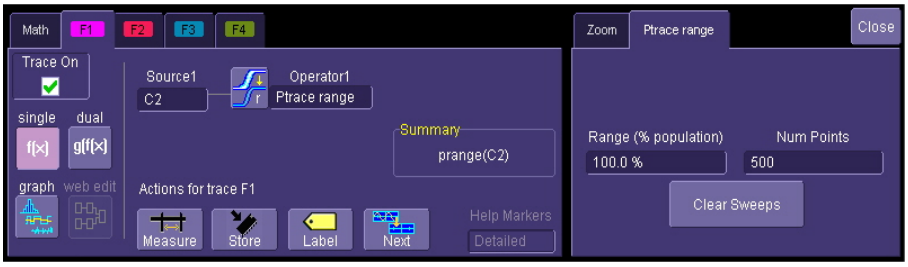

Figure 2: The persistence trace range setup dialog box

Trace F2 in Figure 1 is the persistence trace sigma function. It shows the limits of signal variation corresponding to ±1 standard deviation (±1 σ). The user can set the limits using the "scale to (sigma)" entry field. Limits can be set in the range of 0.5 to10 σ, as shown in Figure 3.

The bottom trace in Figure 1, F3, is the persistence trace mean function. It shows the mean value of signal variation.

The persistence trace functions are based on multiple waveforms acquired and stored in a persistence map. The sample locations on each acquired trace are determined with 10 ps resolution. This

results in a displayed trace with a maximum effective sampling rate of 100 GS/s. The vertical variations in the persistence trace functions are derived from persistence histograms taken within vertical slices uniformly spaced across the waveform.

The persistence trace standard deviation shows the rms jitter of the edge timing in an understandable graphical display.

Similarly, the persistence trace mean function quickly extracts the mean value of all the samples in the persistence map. The advantage of the persistence trace mean is the ability to extract the mean value of an edge and view it. Figure 4 shows the persistence trace mean overlapped with the acquired WaveStream history showing the mean value of the waveform on a point-by-point basis.

The persistence trace range, sigma, and mean functions provide another unique and intuitive view of large amounts of waveform data.

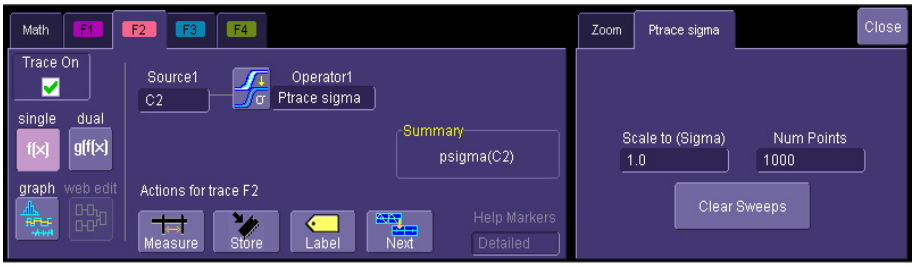

Figure 3: The setup dialog box for the persistence trace sigma function

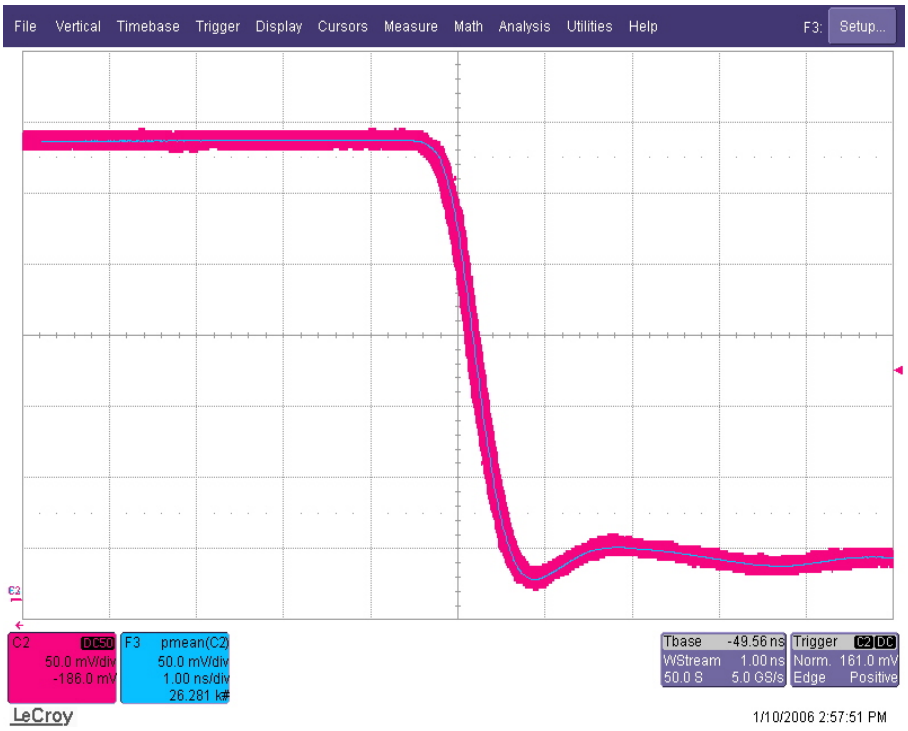

Figure 4: Using the persistence trace mean to extract the mean value of the Fast WaveStream acquisition history. The waveforms are overlapped to show the mean value on a point-by-point basis.