Accumulated Jitter

Measuring Accumulated or Long Term Jitter

Accumulated jitter is a measurement of the timing uncertainty at user defined time offset from the acquisition trigger point. Historically, accumulated jitter was determined by using an analog oscilloscope and measuring the width of a single clock edge over multiple acquisitions. The data is generally presented in a statistical format based on an analysis of the histogram of the variation in edge locations. The most appropriate function available in a LeCroy oscilloscope is The JitterTrack™ of Time Interval Error, or TIE, available in LeCroy's Jitter and Timing Analysis (JTA) option as diagrammed in figure 1.

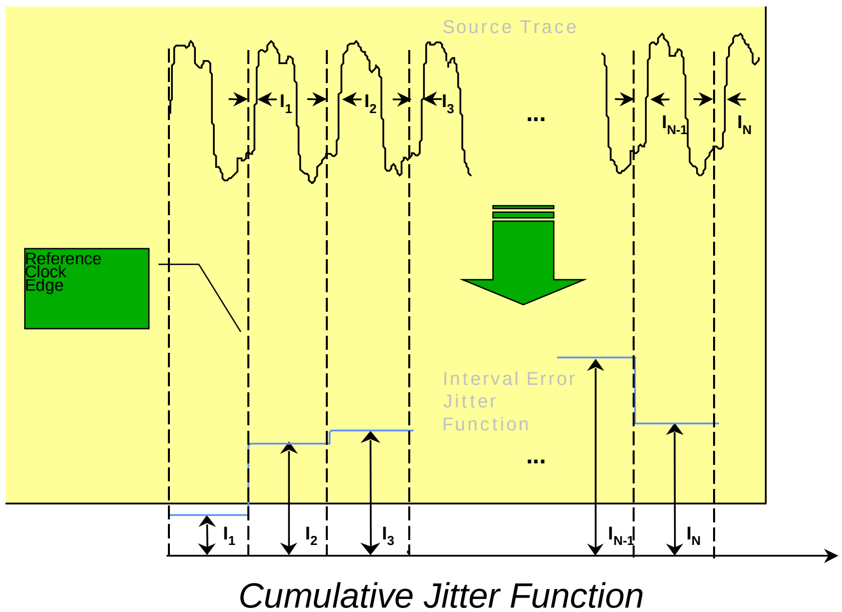

Figure 1 - A conceptual drawing of the operation of the Time Interval Error (TIE) Function

The JitterTrack of TIE plots the time difference between a waveform edge and an ideal clock edge as a function of time. It does this starting with the first edge on the display, which is used for the zero reference for the ideal clock. The vertical units can be displayed in time (seconds) or unit intervals (UI). The unit interval is equal to the period of the user selected reference clock. Time interval error matches each acquired edge with the next reference clock edge even if the acquired edge is displaced by more than a period.

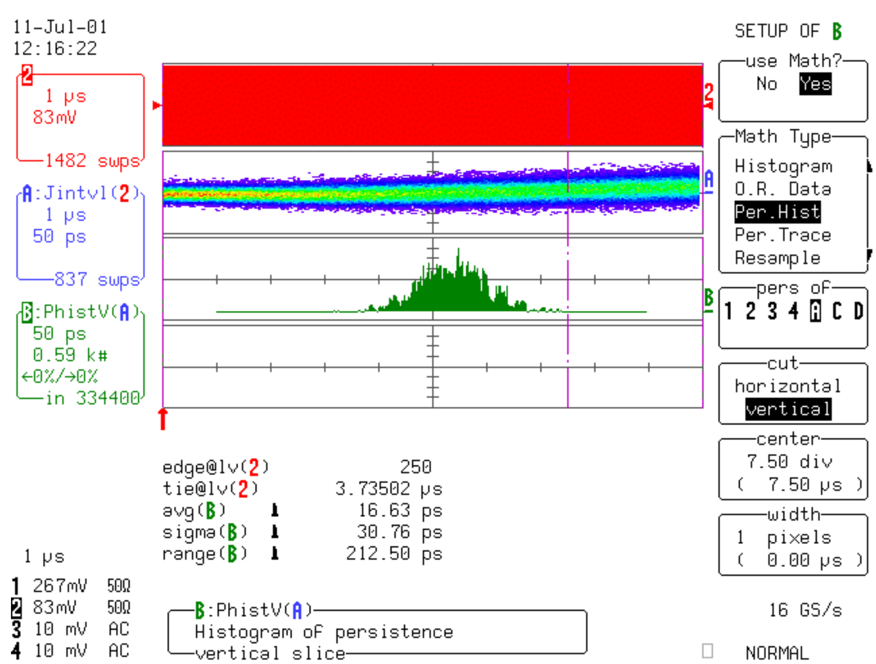

Figure 2 The scope configuration to read accumulated jitter using a LeCroy WavePro960 with the JTA option.

This is what makes it ideal for studying accumulated jitter.

Figure 2 provides an example of an accumulated jitter measurement using an analog persistence display to retain the history of the JitterTrack of TIE. The upper trace in figure 2 is the acquired waveform. In this case, it is a 25 MHz square wave. The trace below that (Trace A) is the JitterTrack of TIE. This traceshows over 800 TIE measurements accumulated using Analog Persistence. The bottom trace (TraceB) is the persistence histogram of a vertical slice, one pixel wide, taken 7.5 µs after the start of the acquisition and marked by the vertical dashed line at that point. The persistence histogram displays the distribution of all samples lying within the 1 pixel wide window. The samples represent the probability distribution of all the measured TIE values. This near Gaussian distribution has a mean, or average, value of 16 ps , an rms jitter of 30 ps, and a peak to peak jitter of 212 ps. These are read from the parameter readouts of avg, sigma, and range, respectively, beneath the display.

Once the persistence view of the TIE function is acquired the persistence histogram of any desired delay from the trigger can be quickly calculated without having to reacquire the data. Figure 3 shows the same analysis with histograms corresponding to time delays of 9, 5, and 1 µs in traces

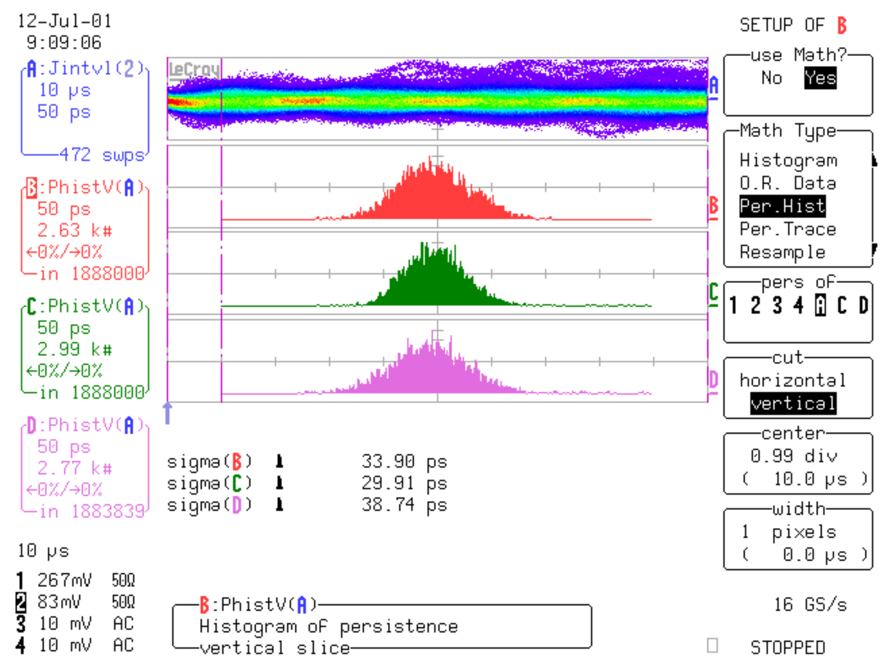

Figure 3 comparing the jitter histograms at 3 different time displacements

B, C, and D respectively. The rms jitter for each histogram is readout using the sigma parameter for each trace. The rms jitter varies from 38.74 ps at a time delay of 1 µs, to 29.91 ps at a delay of 5 µs, and has a value of 33.90 ps at 9 µs from the trigger point.

Alternatively the center of a persistence histogram window , shown in the setup menu in figure 3, can be varied manually to any desired accumulation time(s). The persistence histogram will be recalculated instantly, without requiring the reacquisition of the JitterTrack data.

Long acquisition memories, such as the 32 Msample memory in the LeCroy J260 Jitter Analyzer, allow accumulation times as long as 2 ms while sampling at the maximum sampling rate of 16 GS/s(62.5 ps/sample). Additionally, the J-260, includes an operational interface optimized for jitter measurements. It is an ideal choice for engineers working with jitter and timing measurements on a full time basis

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