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Summary

The JITKIT, Clock and Clock-Data Jitter Analysis option package makes it simple and easy to understand the basic system jitter performance of clock signals and clock-data activities.

The JITKIT, Clock and Clock-Data Jitter Analysis Package makes it simple and easy to understand the basic system jitter performance of clock signals and clock-data activities, including period, half period, cyclecycle, skew, amplitude, differential voltage crossing, slew rate, and a wide variety of other common jitter measurements.

Any measurement parameter set up from within the JITKIT user interface will have data presented in a jitter format that includes a direct readout of the max deviation positive and negative, worst case deviation, peakpeak deviation, and standard deviation. Up to eight measurement parameters with jitter statistics may be viewed at one time.

Up to four views of jitter statistics for any one jitter measurement parameter can be plotted simultaneously. It is easy to quickly re-define the source jitter parameter for all four jitter views, making validation and analysis a simple matter. Source(s) for the jitter measurements and other time correlated causal signals can be simultaneously viewed with the jitter views to quickly understand the root cause of the high jitter.

Displays shown in the tutorial are based on the following initial setup on a WaveRunner 6 Zi scope:

1. Connect a coaxial cable from channel 1 to the Aux connector on the front panel.
2. Recall the default setup: File pull down > Recall Setup> Recall Default.
3. Turn off channel 2.
4. Set the input coupling on Channel 1 to be 50 Ohms: Touch or click the channel 1 annotation box>touch or click on the coupling field >select DC 50 Ω.
5. Set up the Aux output to be the Fast Edge signal. Utilities pull down > Utilities Setup >Aux Output Tab>touch or click on Fast Edge. The Fast Edge signal is a 5 MHz, 450 mVp-p, square wave.
6. Auto Setup the scope: Press Scope Setup then select Auto Setup from the fly-out menu.
7. Set the channel 1 signal amplitude using the C1 dialog box. Set the vertical scale to variable gain by checking the Var Gain checkbox. Adjust the vertical scale of channel 1 to maximize the C1 signal amplitude on the display. It should be 90% of full scale
8. This completes the initial setup. The scope display should be similar to Figure 1.

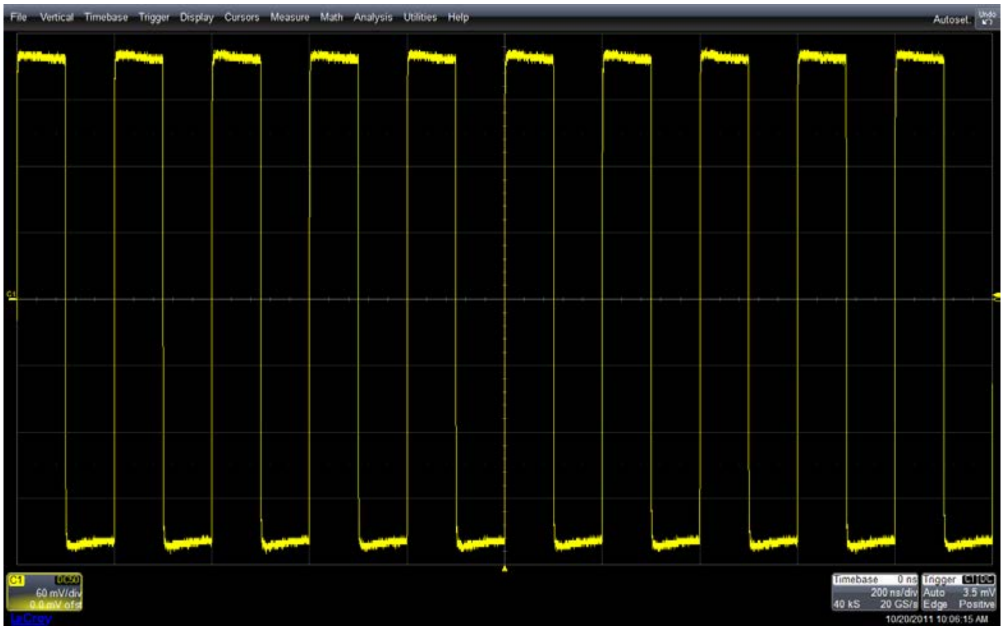

Figure 1: ***The oscilloscope initial setup showing 10 cycles of the FastEdge signal***

Start JitKit by using the Analysis pull down menu and selecting Jitter Kit.

Figure 2: *Use the Analysis pull down menu and select Jitter Kit to display the Jitter Kit dialog box*

The easiest way to start JitKit is to use the QuickView button on the Jitter Kit dialog box. The QuickView button in the lower left hand corner of the Jitter Kit dialog box provides a near instant setup. This includes the four views of jitter, and the key jitter parameters. Manual jitter measurement setup is guided by the simple flow diagram in the Jitter Kit dialog box.

Quick View will prompt the user with a pop up menu shown in Figure 3. The user enters the signal source, either as a single ended input, in our case C1, or as a differential source. After that set the crossing thresholds you want to use. The most commonly used values (10, 50, 90% or 20, 50 80%) are available as buttons. Alternatively, the users may manually enter the low mid and high thresholds either as a percent of signal amplitude or as an absolute voltage value. After making your selections touch or click OK to proceed.

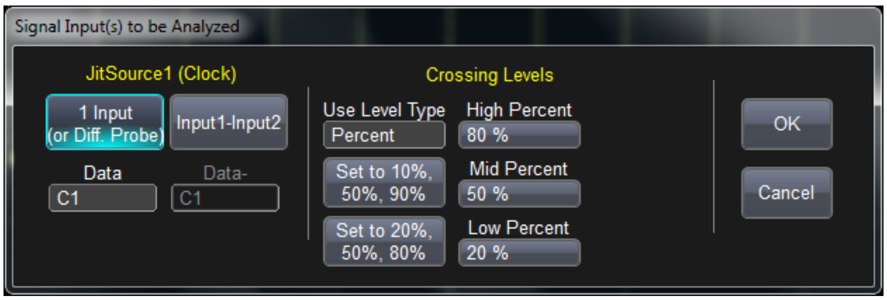

Figure 3: *The Quick View pop up menu. Select signal source and crossing threshold then click OK*

Figure 4: *The initial QuickView display showing 8 jitter parameters, and plots of jitter overlay, JitterTrack, Jitter Histogram, and Jitter Spectrum*

Let's customize this view. This will give you a chance to learn how to set up JitKit manually. First, turn off channel 1 (Touch or click the C1 trace annotation box to bring up the C1 dialog box. Uncheck the Trace On checkbox or press the channel 1 button in the Vertical section of the front panel until C1 trace turns off).

Touch any of the trace annotation boxes marked Jitxxxxx. This will bring up the JitKit dialog box. Select the Jitter Kit tab. The JitterKit tab uses a flow diagram to show the order of operations in setting up this option. Touching or clicking on the Source Setup button or selecting the Source Setup tab will evoke the Source Setup tab shown in Figure 6. This tab allows you to setup the signal source and threshold levels for the two inputs. In this example, we have already setup channel 1. The second channel is used for clock to data measurements. The Global Source Setting control allows individual or common (shared) setups for each input.

Figure 5: *The Jitter Kit tab uses a flow diagram to show the order of operations in setting up the JitKit option*

Figure 6: *Source setup tab for JitKit*

Touch or click on the measurement tab. This tab allows the user to select the desired measurements. Figure 7 shows the default measurement selection. There are seven of eight possible measurements selected. The measurement table includes readout of the mean value, standard deviation (rms jitter), peak to peak jitter, maximum positive deviation from the mean, maximum negative deviation, and the maximum or worst case deviation. It also reports the number of measurements included in the statistics.

Figure 7: *The measurement tab of JitKit allows the users to select up to 8 jitter parameters*

If you touch or click on the numbered boxes to the left of any measurement it will bring up a right hand tab. In our example we used shared threshold settings. Touch or click on the “Source Setup” tab. Change the “Global Source Setting Control” to use individual settings. Return to the Measurements tab. Note that if you select a measurement number the right hand tabs will show the individual settings that are available for that measurement.

Touch or click on the Remove All Measures button. This will clear all the preset measurements. Turn on measurement 1 by touching or clicking the button marked 1. Touch or click on the “On” checkbox immediately to the right of that button to turn on the parameter readout table entry. Click or touch the measurement definition box located to the right of the “On” checkbox. A scroll box will appear. Use the slider on the right of the scroll box to bring the TIE@level parameter selection into view as shown in Figure 8. Touch or click on the TIE@level entry to select that as measurement #1.

Figure 8: *Setting up the TIE@level measurement using the JitKit measure tab controls*

TIE@level stands for time interval error at a user selected threshold level. Time interval error is the time difference between a measured signal edge and the ideal location of that edge. It is essentially the instantaneous phase of the signal. It is the most basic and commonly used jitter measurement.

Touch or click on the “TIE” tab on the right hand side of the Jitter Kit measure dialog box as shown in Figure 9. This is the setup for the TIE @level measurement. You can choose the signal type (clock or data) and set the measurement amplitude thresholds. This tab Verify that the “Input Is” field is set to clock and click or touch the “Find Level” to set the threshold level to 50%.

Touch or click on the “V Clock” tab on the right hand side of the Jitter Kit measure dialog box as shown in Figure 10. This tab sets up the TIE@level virtual clock. You can enter the signal frequency manually or allow the oscilloscope to determine it by pressing the “Find freq” button. Verify that the “Always” checkbox under “Find freq” is checked. This means that the oscilloscope will automatically determine the clock rate for each acquisition.

The locked indicator the the left of the "Always" check box should be green indicating the scope's software phase locked loop (PLL) has acquired the clock frequency.

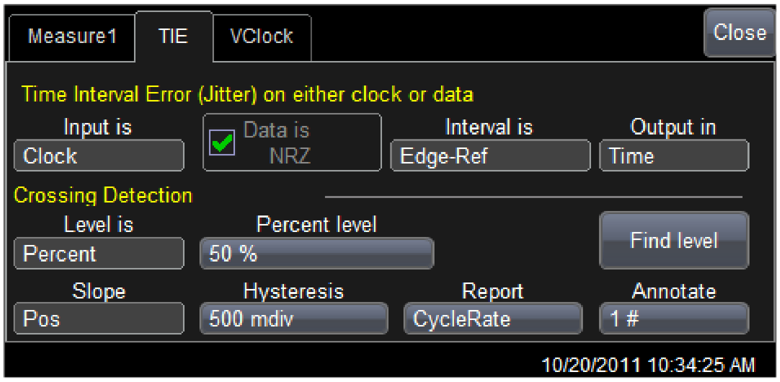

Figure 9: *The TIE measurement tab showing the TIE@level amplitude threshold settings*

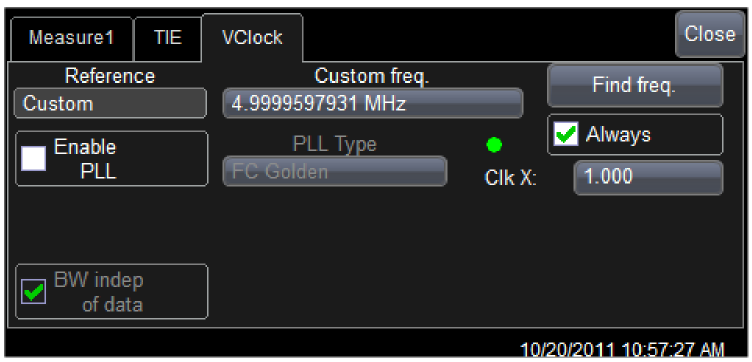

Figure 10: *The V Clock tab showing the TIE@level clock setup*

Note that the frequency is nominally 5 MHz.

Touch or click on the JitKit Plot tab shown in Figure 11.

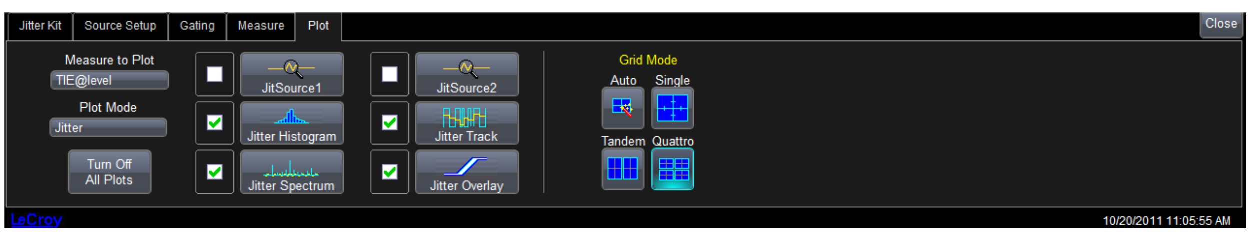

Figure 11: *The JitKit Plot tab is used to select the jitter plots to be displayed. Select the specific measurement to be plotted and the type of plot*

The Plot tab allows you to select the plots you wish to display. You can plot the source traces that were assigned in the Source Setup tab. It also offers four jitter related plots:

Jitter Histogram –the histogram of all measured jitter values
Jitter Track- a plot of every jitter value time synchronous with the source waveform
Jitter Spectrum – the Fast Fourier Transform (FFT) of the Jitter Track
Jitter Overlay – a persistence plot of each cycle of the measured waveform overlaid on the same axes.

The plot tab also allows the selection of the desired grid mode, Auto, Single, Tandem, or Quattro.

Verify that TIE@level is selected in the "MeasureTo Plot" field and that histogram, track,spectrum and overlay are on as indicated by a check in each associated check box.

Note the standard deviation of the TIE@level measurement, it should be about 2 ps.

Touch or click on the Timebase annotation box the display the Timebase dialog. Set the "Maximum Number of Sample Points" Field to 2.5 MS and the "Time/Division" field to 10 μs.

Note that the standard deviation of the TIE @level measurement is now about 7 ps as shown in Figure 12.

Figure 12: *Increasing the acquisition time shows an increase in the TIE@level measurement*

Look at the JitTrack trace. Note that the value of TIE@ Level is varying with time over the 100 us acquisition time. Note that the JitHistogram shows that the mean value is drifting with increasing number of acquisitions. The JitSpectrum shows a peak in the TIE@level track at 25 kHz. The variation of the TIE@level is too small to see on the JitOverlay as it is only on the order of 0.01 degrees.

The FastEdge source is intended to produce a signal with a sub-nanosecond risetime, it is not a high frequency stability source. For short acquisitions the phase of this signal does not vary much. If we increase the acquisition time we can see it drift.

You can see how much you can learn by looking at the jitter plots. This completes the tutorial.