Getting Started - Clock Tools

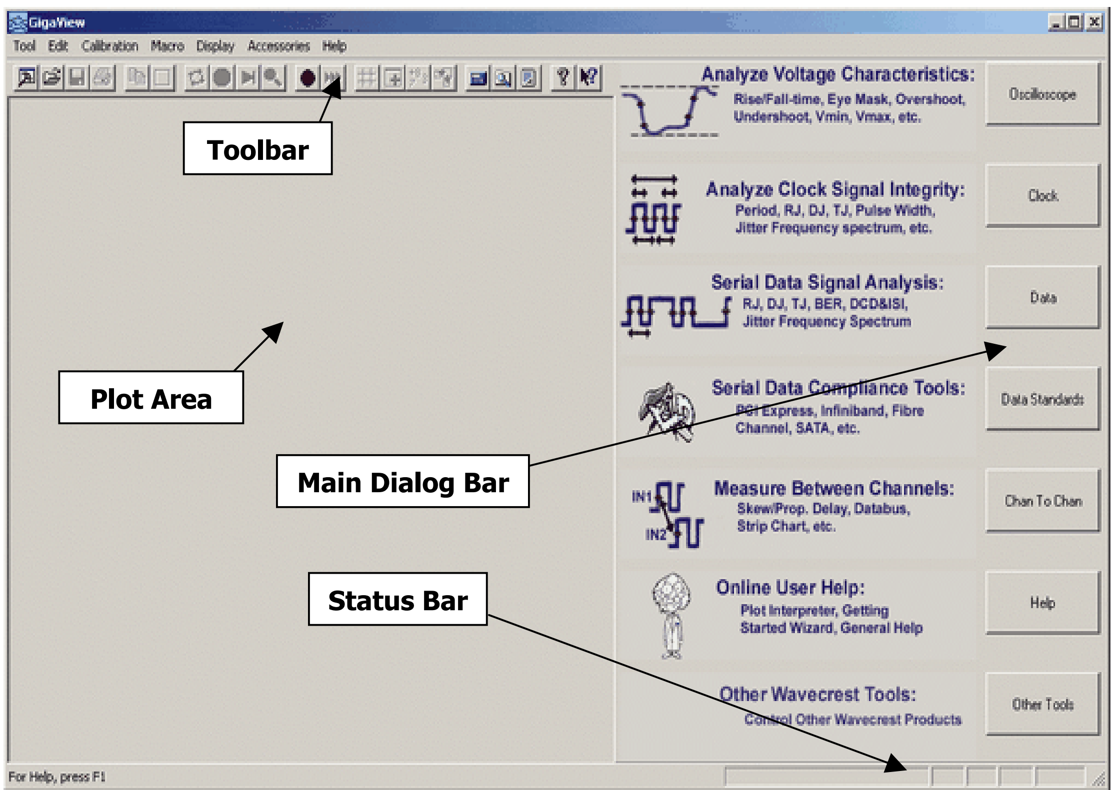
For the SIA

The purpose of this paper is to provide a brief introduction to the SIA and making clock measurements.

The SIA is a hybrid instrument that combines the measurement capabilities of a sampling oscilloscope, for measuring Rise/Fall times, Voltage amplitude and Eye Masks; and time measurement circuitry for measuring timing parameters, Period, Pulse widths, Skews and components of Jitter.

Understanding the GigaView User Interface

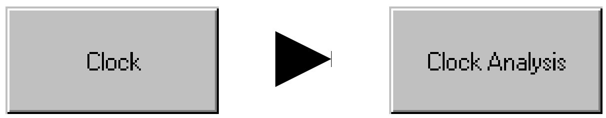
The Dialog Bar on the Right of the display is the main interface with the instrument. The figure shows the Main menu. The Oscilloscope is the only tool directly opened from this menu. The other buttons lead to choices of specific measurement tools such as data compliance and clock characterization.



Making a measurement

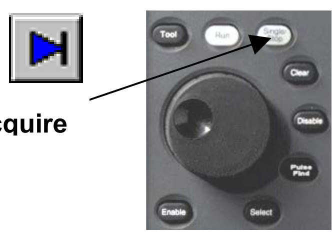
- Connect your signal to Channel 1. Most Tools default to Channel 1, though this can be changed. For single-ended measurements, use just the top input SMA leaving the bottom unconnected. For differential measurements, connect to Input and /Input/.

- For measuring a clock or PLL signal, the most comprehensive analysis is to use the "Clock Analysis" Tool. Press 'Clock' and 'Clock Analysis'.

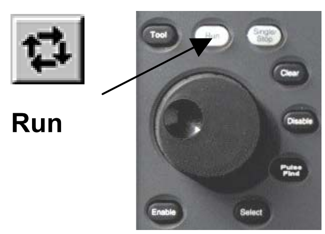


- This opens the Clock Analysis Tool. Initially, the screen is blank. To perform an Acquisition, press Single/Acquire on the toolbar or the Single/Acquire button on the front panel. Some results require repeated runs to acquire; you can press Run to get those values.

Single/Acquire



Run



Refer to the Measurement Technique quick reference guide for a detailed description of how the measurements are made using the unique dual engine measurement hardware.

Tools and Views

An important concept when using the SIA is Tools and Views. Each Tool has a separate measurement function and associated settings (such as two different tools like 'Oscilloscope' and 'Strip-chart'). When selecting a Tool from the Dialog bar, it is important to note that you can open and run multiple Tools at one time and these Tools can measure separate channels. The dialog bar will show the settings and controls for the current active tool window.

Tools also have a subset of 'Views' that are different ways of displaying the measurements made by the Tool. A Tool may have many available Views. Multiple views can also be opened at the same time. When a Tool is run, all opened Views associated with that tool will be updated.

Understanding Your Results

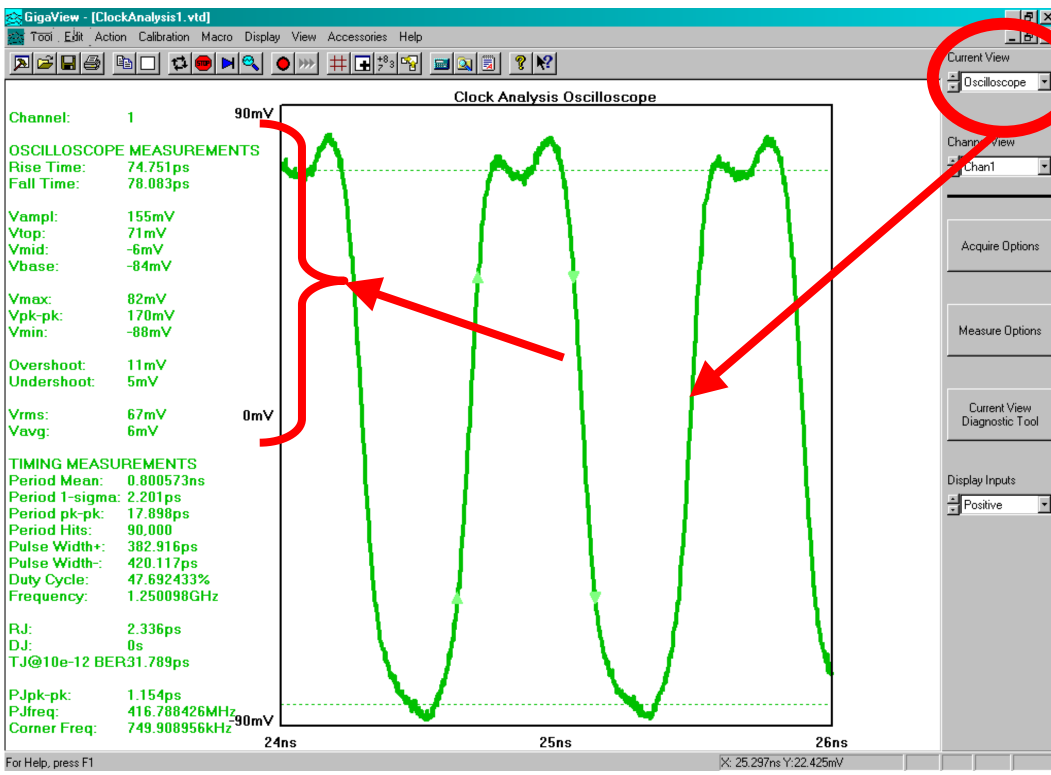
The Clock Analysis Tool has a variety of views. The results displayed are determined by the selections in the Measure Options menu. The default is to perform all measurements. A description of these measurements is below.

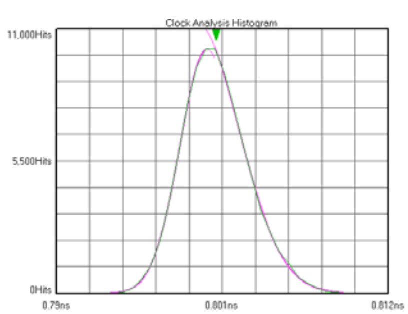
Oscilloscope View

This Tool performs a number of measurements and summarizes the results on the left side.

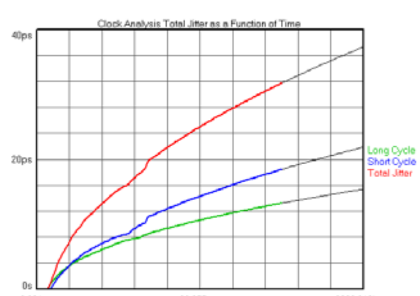
These results are associated with different Views. In this example the Current View selected is Oscilloscope. The "Oscilloscope Measurements" displayed to the left are made using the 6GHz sampling oscilloscope (Amplitude Engine).

Other Views in this Tool are 'Histogram', 'Total Jitter', 'FFT' and 'Summary'. These other Views relate to the "Timing Measurements" on the left of the Tool.

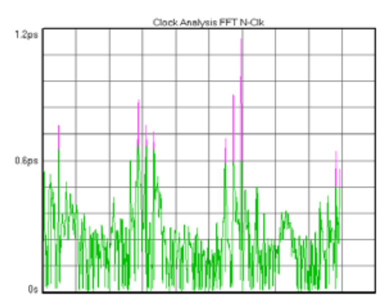




Histogram



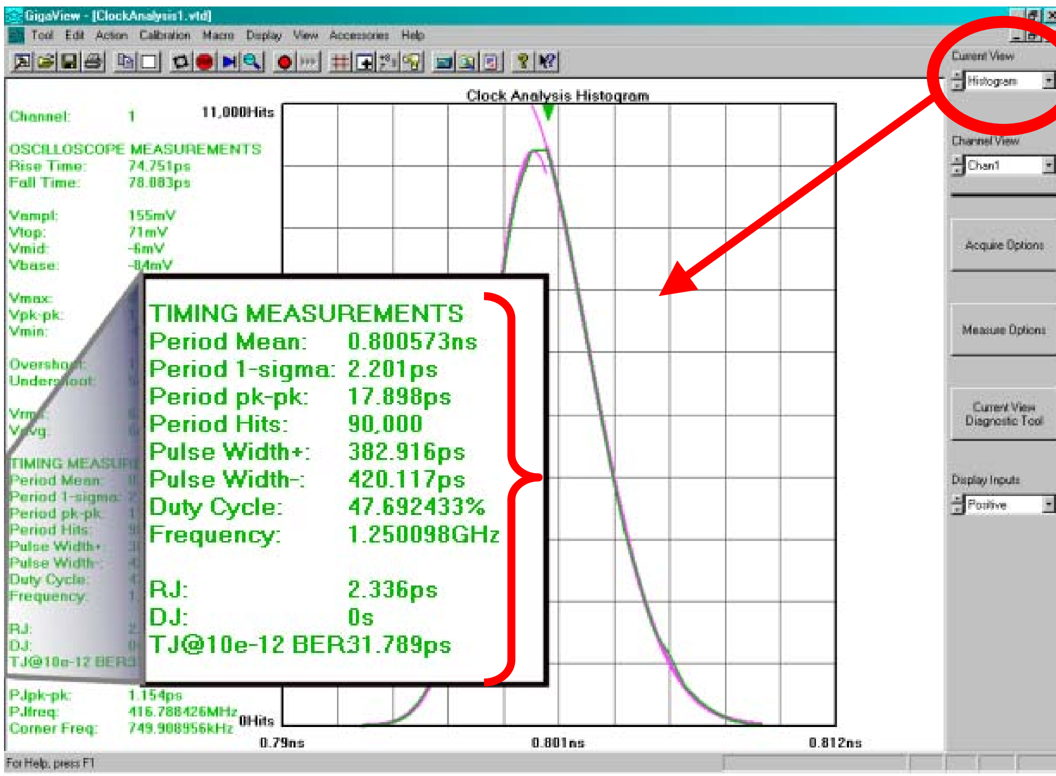
Total Jitter vs. Time



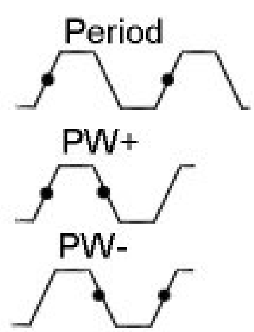
FFT Frequency vs. Amplitude

Histogram View

The Histogram View shows the results of a Period Jitter histogram.

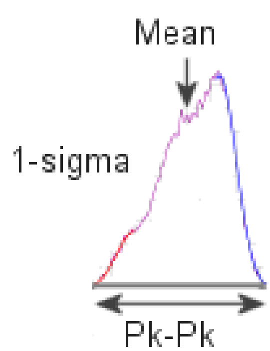


The Period samples are made from a rising edge to a rising edge of a single period (using Timing Engine). The Period Mean, 1-Sigma and Pk-Pk relate to the displayed histogram. Period Hits is the number of samples in the histogram.



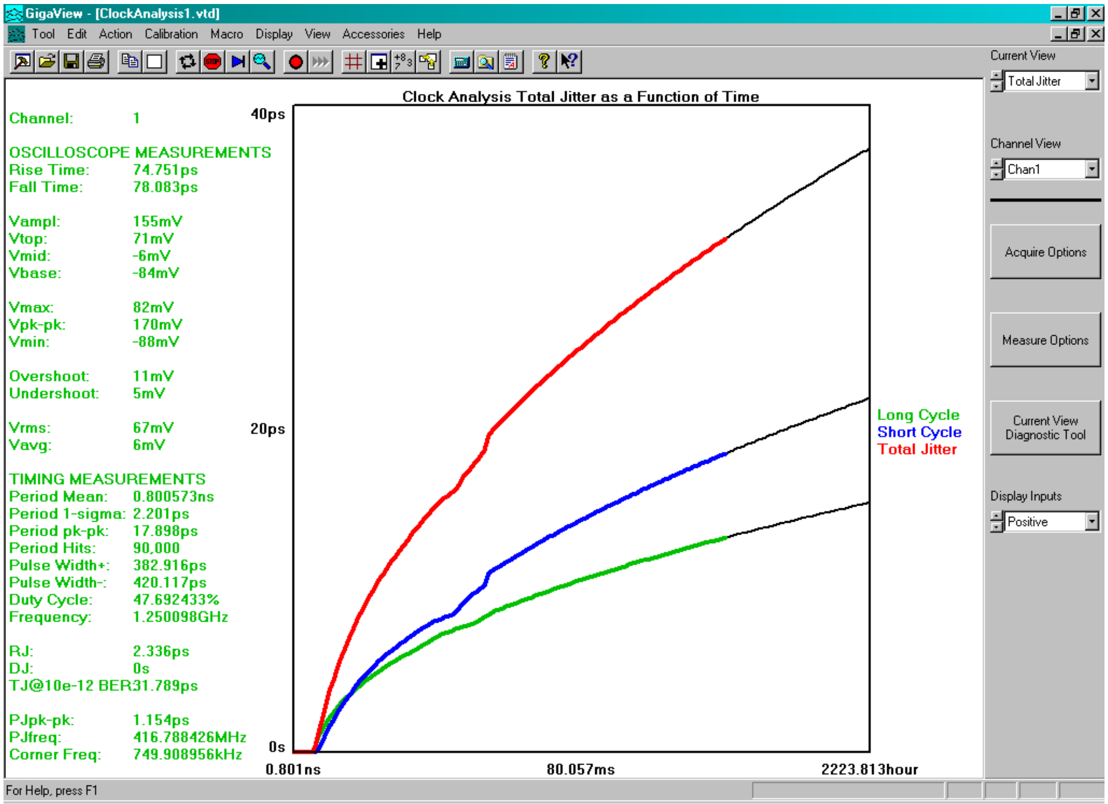
Pulse Width+ and Pulse Width- are also calculated from a histogram of measurements. This histogram is not displayed. Duty cycle and Frequency can then be calculated from these measurements.

The values for RJ (Random Jitter), DJ (Deterministic Jitter) and TJ (Total Jitter) are calculated using Tail-Fit™. Tail-Fit determines an accurate RJ when DJ is present. TJ is a predicted Pk-Pk value based on the RJ and DJ measured and is bounded at some level of probability or some elapsed time. The default for this is 1e-12.



Total Jitter View

The Total Jitter View shows how the Pk-Pk grows over time.

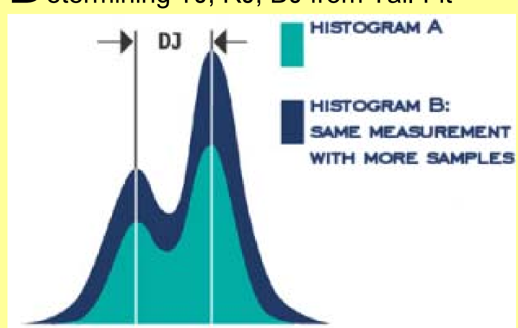


Pk-Pk of a histogram is not a meaningful metric if not bounded in some way. There are various bounds that can be used, such as sample size or acquisition time. The SIA defaults to a bound of 1e-12 level of probability. This means that TJ is the predicted Pk-Pk of a histogram at some point in time. The point where the color changes to gray is the bound for the TJ (this can be changed).

The Total Jitter View shows three lines. The vertical axis is the Total Jitter. The horizontal axis is elapsed time. The highest line is the Total Jitter predicted from Tail-Fit (See Sidebar). The other two lines show the jitter for Short periods and Long periods.

For a detailed description of the Histogram Measurement theory, refer to the "Histogram Getting Started Guide".

Determining TJ, RJ, DJ from Tail-Fit

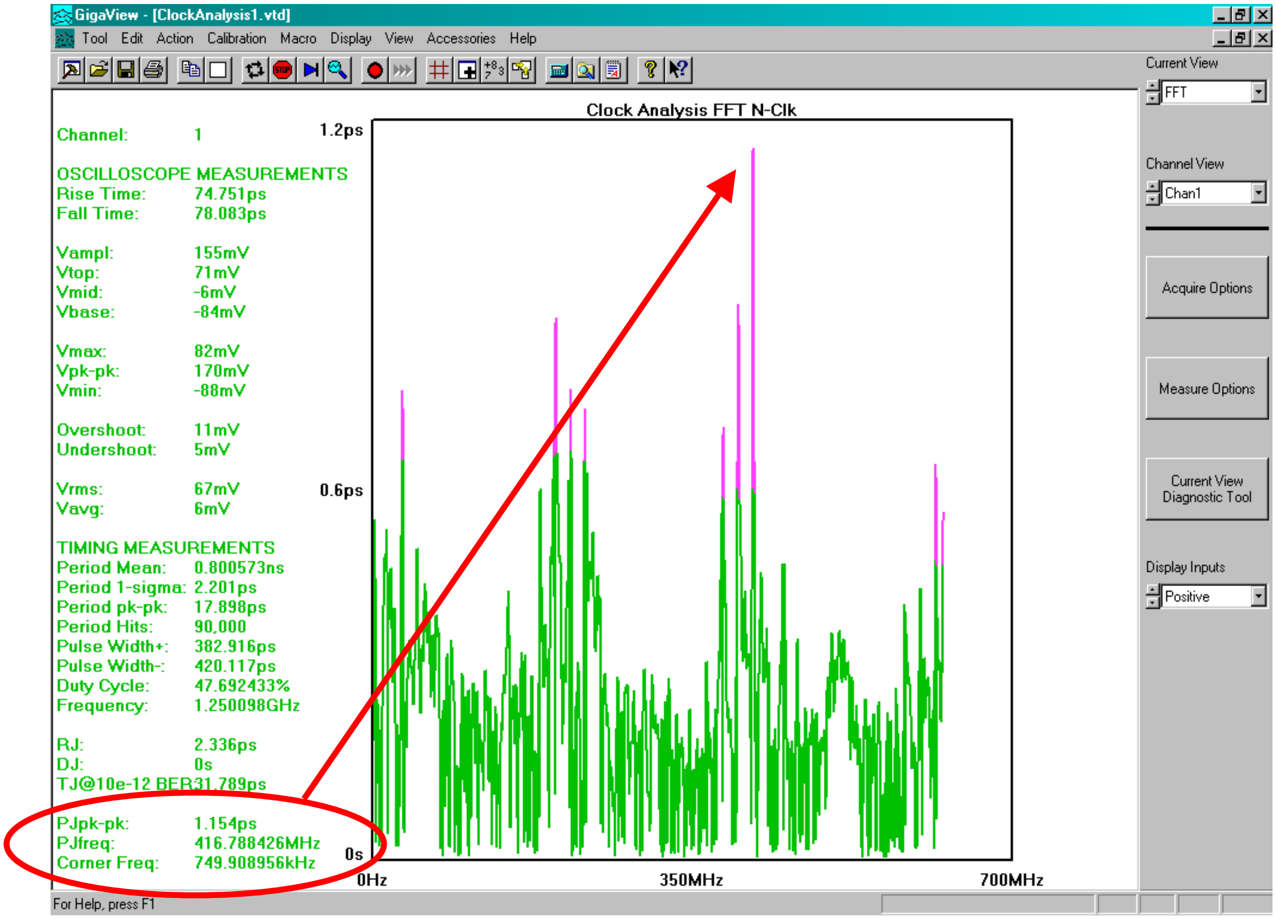


Pk-Pk of a histogram will grow over time. DJ amplitude does not grow with more samples, but the tail regions do because they are dominated by RJ.

The Tail-fit algorithm fits Gaussian curves to the left (short) and right (long) tails. This allows an accurate prediction of TJ pk-pk at any point in

FFT View

The FFT view shows a frequency analysis of the jitter.



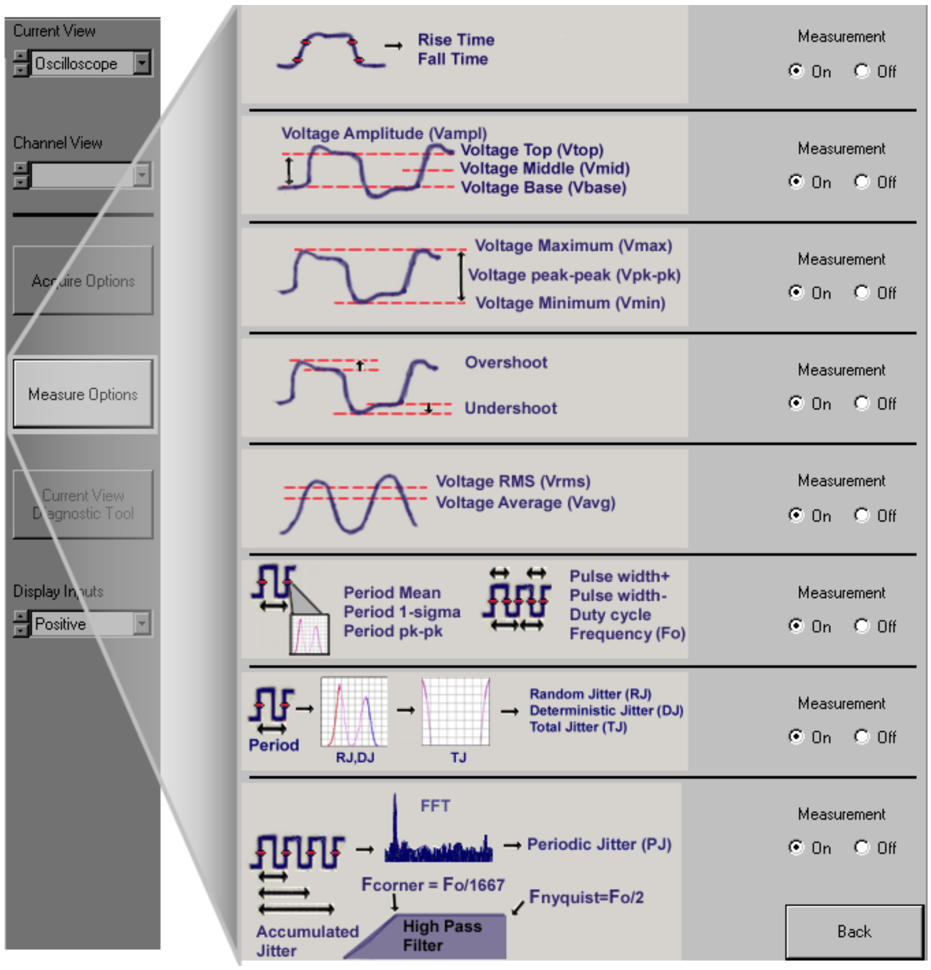
When Deterministic Jitter is present, it is often periodic and can be identified in this jitter spectrum view. The summary on the left shows the amplitude of the largest Periodic Jitter (PJ pk-pk) spike. The frequency of the spike is labeled 'Pjfreq'. By identifying and trying to remove the cause of the largest spikes will reduce overall Deterministic Jitter.

This measurement has a fixed –3dB Corner Frequency High Pass Filter that is $F_{carrier}$/1667. Frequencies below this will be significantly attenuated.

For a detailed description of the underlying theory of this measurement, refer to the "High Frequency Modulation Getting Started Guide".

Measure Options

To select which measurements you want to enable, press the Measure Options button. As a default all are selected.

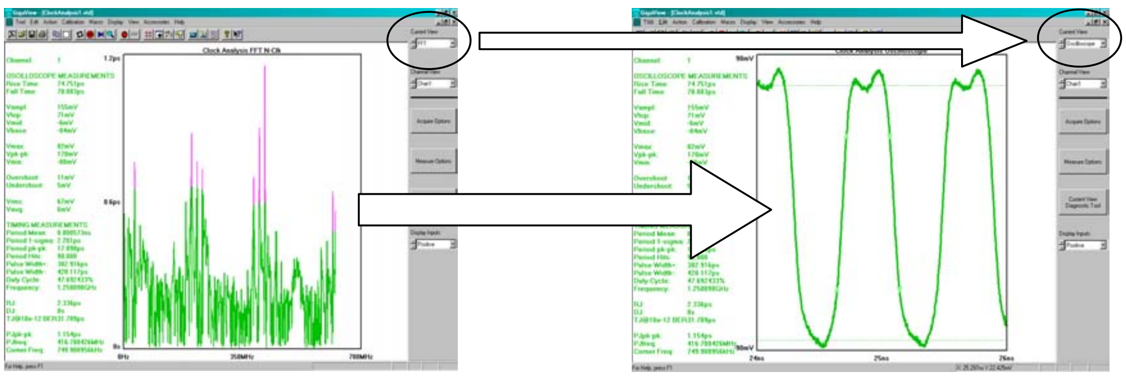


Launching the Signal Diagnostic Tools

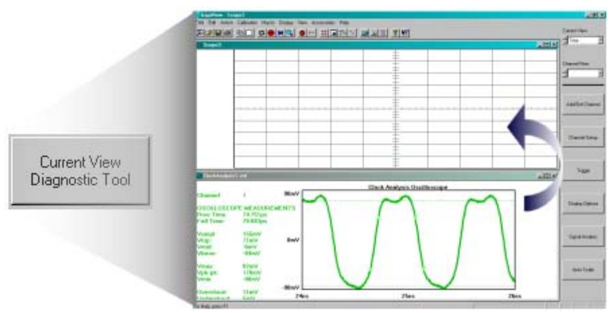
This Clock analysis tool is actually a composite of diagnostic tools that individually have more flexibility of measurement and configuration. Some of these tools can be accessed directly by pressing "Current View—Diagnostic tool".

Say, for instance, you have made a measurement in the clock analysis tool, but when looking at the Oscilloscope view, you would like to change your trigger delay, persistence setting, or any other oscilloscope control. To do this, open the Oscilloscope Tool directly from the clock analysis tool.

Step 1. Change your current active view to the tool you wish to open—Oscilloscope, in this example.



Step 2. Now Press "Current View Diagnostic Tool". This will open the Oscilloscope tool above the current clock tool. The oscilloscope is now the active tool and the dialog bar on the right has changed to reflect its controls. You could now press Run. Using the Horizontal position knob, you can change the Trigger delay, and using the other Vertical and Horizontal knobs the waveform can be scaled or repositioned. Refer to the Oscilloscope Quick Reference Guide.



In the same way, other diagnostic tools could be opened, such as Histogram (bathtub curve, TJ vs. time) and High Frequency Modulation Analysis (FFT and accumulation of jitter). Press "Next" on the front panel, or use the mouse to make the clock tool active. Change the View to Histogram or FFT. And Press "Current View Diagnostic Tool.

There are many more tools available than can be launched from the Clock Analysis tool. To access these tools at any time, press "Tool" on the front panel or on the Toolbar menu, mouse-over "Tool" and choose "New". The dialog bar will change to show the available tools.

FOR MORE INFORMATION CONTACT:

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