The Value of Surface Mapping

LeCroy's Surface Map option provides you with a method to study time-varying phenomena over many waveform acquisitions. Surface Map is a 3-dimensional, color-graded display that identifies otherwise invisible trends in your waveforms. The "surface" of this display shows signal modulation, jitter, and other effects in a single view. You can make surface maps of time-domain waveforms, FFTs, or other types of data.

Surface Map uses each horizontal line of pixels in the scope's display to depict a separate waveform. Up to 6000 waveforms (in Sequence Mode) are stacked one on top of the other. As each new waveform is acquired, it is added to the bottom of the grid while the oldest waveform is pushed off the grid at the top. This overhead view (surface map) of these waveforms reveals high and low spots that vary in position from one waveform to the next.

The Surface Map representation is an ideal way to view signal variations in applications such as echo ranging (radar, sonar, lidar, ultrasound), packetized serial data streams (magnetic storage and network communications), and control system dynamics (power supplies, automatic gain and frequency controls, phase-locked loops).

Saturation Levels

You can raise or lower the floor and ceiling of the map by setting high and low saturation levels. In so doing, you determine the voltage levels (or other units) for which the spots will be displayed. The color scheme of the map conforms to the spectrum of visible light: red for the highest levels to violet for the lowest levels. Peaks and valleys between these extremes are represented by 64 intermediate colors.

Last Trace Display

You have the option also of displaying the normal profile view of the last waveform. When **Last Trace** is enabled, this last waveform can be superimposed on the Surface Map (if you are displaying a single grid) or displayed on another grid.

Examples

Figure 1 shows the surface map of an FFT. The trace in the lower grid is the latest and corresponds to the bottom line of the map in the upper grid. You can easily see the variation in signal frequency and amplitude over time.

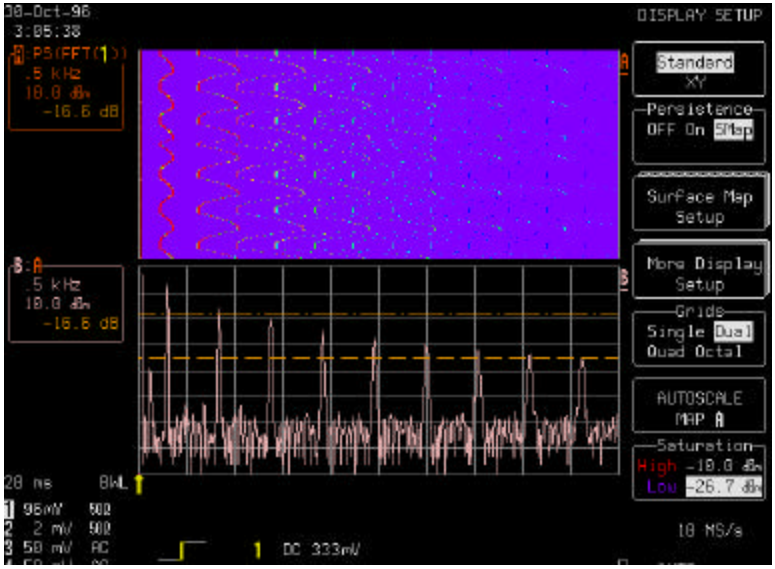


Figure 1. Surface Map of the Spectrum of a Swept Square Wave Showing a History of Frequency Variation over 250 Acquisitions

In Figure 2 the surface map of a series of 250 acquisitions of disk drive sector data. The data have been acquired in sequence mode for minimum dead time between acquisitions. Note that all fields of the sector data are being held constant except for the data field. Vertical lines in the surface map indicate no change in data. Changes show up as broken vertical lines. Since the data is digital, the color variation is limited to two basic colors.

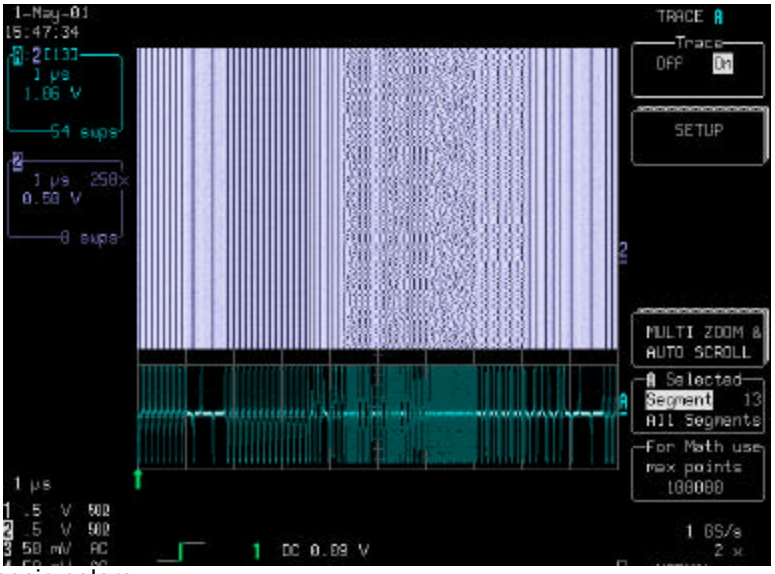


Figure 2. Surface Map of Disk Drive Sector Data Showing Variations in Data Field

Figure 3 shows activity on an Ethernet local area network. The scope triggers on the first pulse encountered. When the network is quiescent, the scope triggers on the link pulse, which appears as a vertical line on the left-hand side of the map. The lower trace shows two packets captured in the 25th segment. Sequence mode time stamps document when each packet was captured.

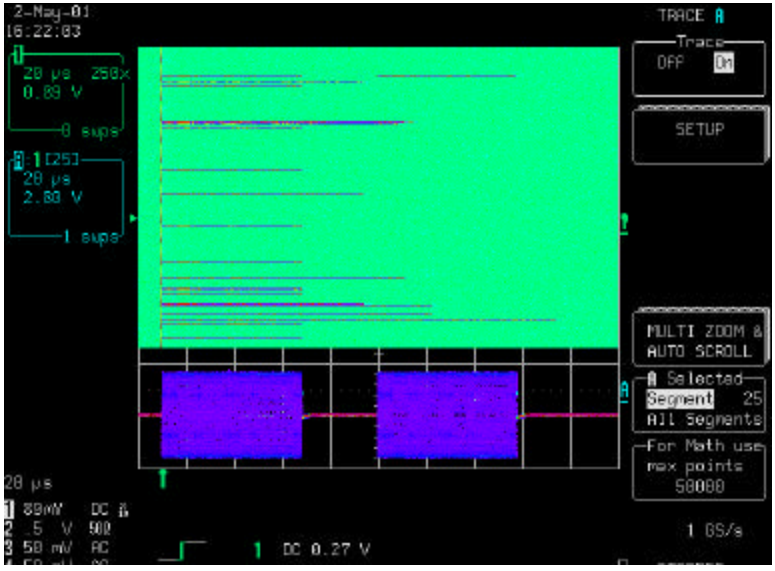


Figure 3. A Surface Map of Ethernet Activity on a Local Area Network

Figure 4 shows the surface map obtained during a beam adjustment on a particle accelerator. The color variations show that the peak amplitude of the signal, read from bottom to top, increased as the adjustment progressed. This is an example of the interactive nature of these displays and illustrates another type of operation supported by surface maps.

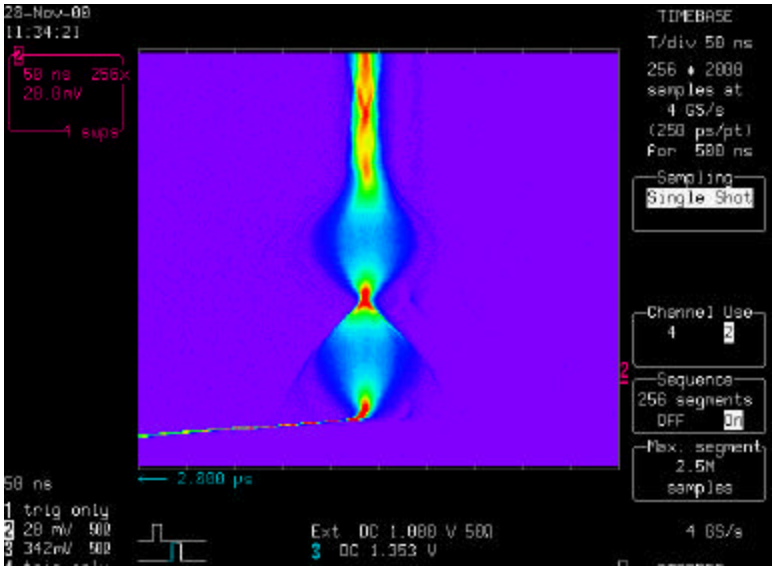
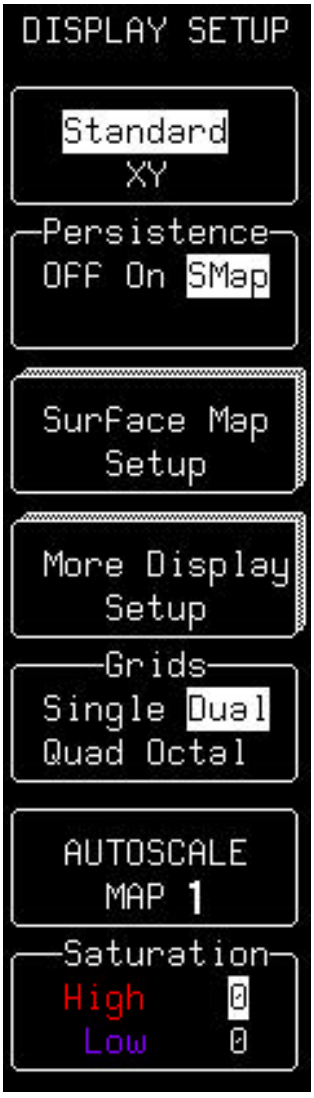


Figure 4. Surface map resulting from beam adjustment on a particle accelerator. *Data courtesy of CERN*

Operation

Accessing Surface Map



To access Surface Map, proceed as follows:

1. Press the **DISPLAY** front panel button.

2. Select **Standard** from the top menu in DISPLAY SETUP. The “Surface Map Setup” menu becomes available.

3. Select **Smap** from the “Persistence” menu.

4. Press the “Surface Map Setup” soft key.

Surface Map Setup

To set the appearance of the map, proceed as follows:

1. From the "Surface Map" menu select **All traces** if you are using more than two channels and you wish to map the traces from all channels. Select **Top 2** if you wish to display only the traces from the top two channels listed on the left side of the screen. **Use more than one grid so that the maps don't lie on top of one another.** If you are displaying only one channel, this toggle has no effect.
2. Select Last Trace **On** if you wish to show the last sweep in normal profile view. The last sweep can be superimposed on top of the map if you are using only one grid; however, it may be difficult to see. Alternatively, you can display it in another grid by selecting multiple grids from the previous menu panel.
3. From the "For trace" menu, select the channel or math trace to be autoscaled and to have its saturation set. The selected trace number will be displayed in the **Autoscale Map** menu that follows. The soft keys below this one pertain only to the trace selected here.
4. Press the **Autoscale Map** soft key to automatically distribute the color spectrum over your range of values. When you press this button, the spectrum is displayed briefly above the grid: 

. The values corresponding to the highest peak and lowest valley are displayed alongside the spectrum and in the "Saturation" menu that follows.
5. Turn the control knobs next to the "Saturation" menu to raise or lower the floor and ceiling of the map. The colors representing the extremes (red and violet) will now correspond to the new high and low values.
6. If you are operating in Sequence Mode, the "Top Segment" menu shows which segment is at the top of the display. In this case, it is the 125th segment (Figure 5).

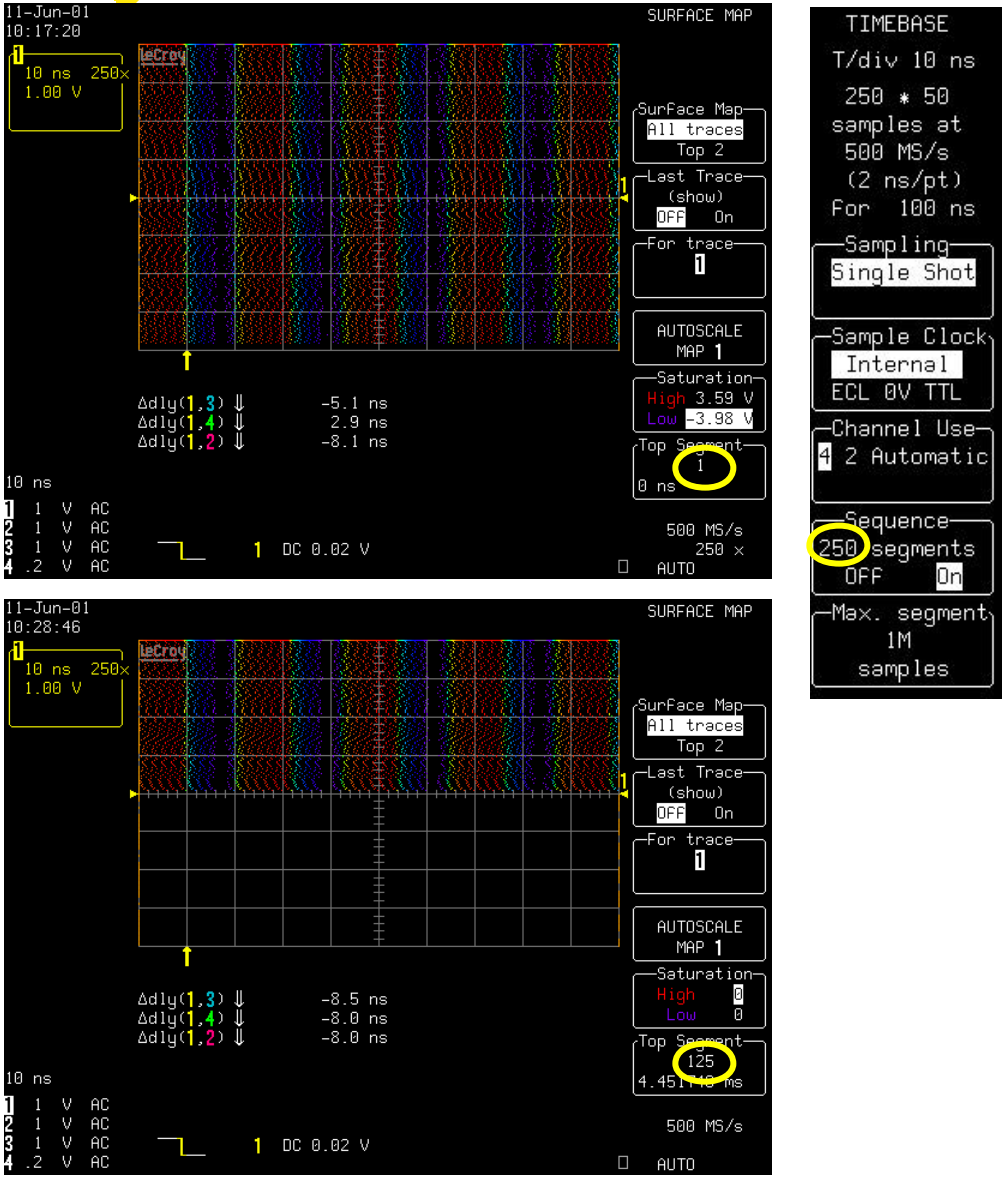


Figure 5. For Sequence Mode set at 250 segments: The top segment in the top display is the first. In the bottom display it is the 125th.

Remote Commands

SMAP_AUTOSCALE, SMAS
Command

DISPLAY

DESCRIPTION

The SMAP_AUTOSCALE command launches the autoscaling of a surface map. Autoscaling automatically distributes the color spectrum over the range of data currently visible within the viewing window.

COMMAND SYNTAX

<trace> : SMap_AutoScale

<trace> : = {C1, C2, C3, C4, TA, TB, TC, TD}

EXAMPLE (GPIB)

The following instruction autoscales the surface map of Channel 2:

CMD$="C2:SMAS": CALL IBWRT(SCOPE%,CMD$)

RELATED COMMANDS

SMAP_BASE_SEG, SMAP_SATURATION

SMAP_BASE_SEG, SMBS
Command/Query

DISPLAY

DESCRIPTION

If you are operating in Sequence Mode, the SMAP_BASE_SEG command sets the base segment for viewing the segmented surface map. This is equivalent to setting “Top Segment” in the SURFACE MAP menu panel. The number of segments that you specify must lie between 0 and the current number of segments generated by the acquisition system (6000 maximum).

The response to the SMAP_BASE_SEG? query yields the base segment for each trace.

COMMAND SYNTAX

SMap_Base_Seg <trace>,<value> [<trace>,<value>]

<trace> : = {C1, C2, C3, C4, TA, TB, TC, TD}

<value> : = 0 to number of segments

QUERY SYNTAX

SMBS?

RESPONSE FORMAT

SMBS <trace>,<value>…<trace>,<value>

EXAMPLE (GPIB)

The following instruction sets the base viewing segment at 100 for Channel 1:

CMD$=“SMBS C1,100”: CALL IBWRT(SCOPE%,CMD$)

RELATED COMMANDS

SMAP_AUTOSCALE, SMAP_SATURATION

SMAP_SATURATION, SMSAT
Command/Query

DISPLAY

DESCRIPTION

The SMAP_SATURATION command allows you to set, in trace units, the high and low saturation levels for surface maps.

COMMAND SYNTAX

<trace> : SMap_SATuration <LOW>,<value> [<HIGH>,<value>]

<trace> : = {C1, C2, C3, C4, TA, TB, TC, TD}

QUERY SYNTAX

SMSAT?

RESPONSE FORMAT

<trace> : SMSAT LOW,<value>,HIGH,<value>

EXAMPLE (GPIB)

The following instruction sets the saturation low level at –100 mV and the high level at 100 mV, on Channel 1.

CMD$="C1:SMSAT LOW,-0.1 V,HIGH,0.1 V": CALL IBWRT(SCOPE%,CMD$)

RELATED COMMANDS

SMAP_BASE_SEG, SMAP_AUTOSCALE

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