Sample Champion - Application note # 10

The Waterfall Plot

This application note describes how to use the Sample Champion Waterfall plugin.

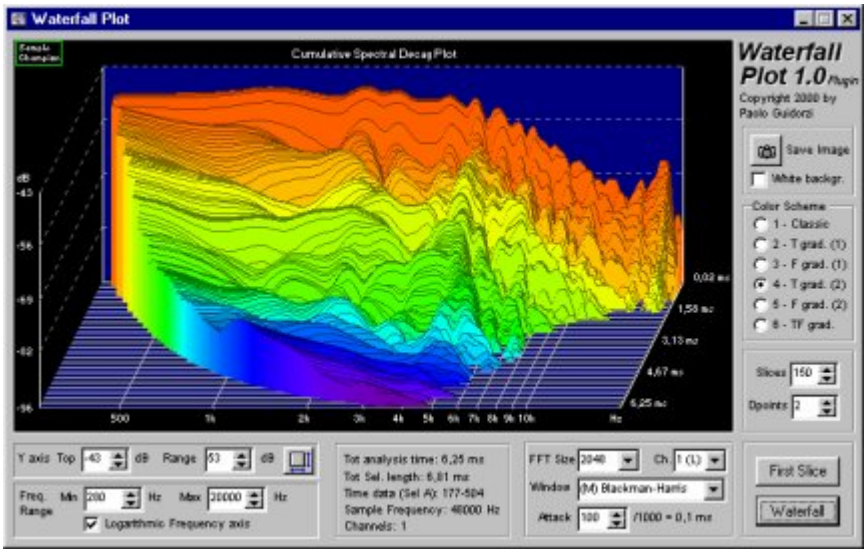

Figure 1 - Waterfall plugin

This module computes and plots (see the figure above) a 3D **Cumulative Spectral Decay** of an Impulse Response. This is a well-known way to present and analyze an Impulse Response and to detect loudspeaker and box resonances. One of the first articles about this method is the following:

> **Berman J.M.**, *Loudspeaker evaluation using digital techniques.* Presented at the Audio Eng. Soc. 50th Convention, London, 4th March, 1975.

How is the plot generated?

First of all, an Impulse Response must be measured or loaded in Sample Champion. The anechoical part of the Impulse Response must be selected by using "Selection A" (in case of 2 channels measurements, the second channel must be selected with "Selection B" or vice versa, depending on the options set in the Settings|FFT menu).

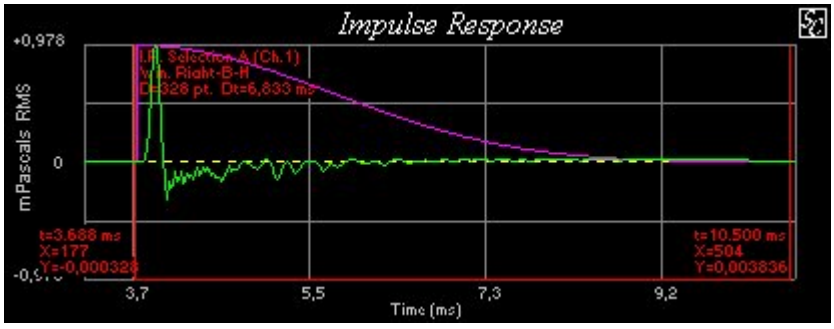

Figure 2 - Waterfall plugin

Now the Waterfall plugin can be opened (from the "New Measurement" Window); the dialog in figure 1 will appear (without any plotting).

Press F5 to transfer the time data from the main program to the plugin and plot the result of the FFT of the selected data. This spectrum is computed with the parameters (FFT Size and Weighting Window) set in the plugin. The selected Weighting Window (Half-Right Blackman-Harris, Half-Right Hamming or Rectangular) is modified with an initial short Half-Left Blackman-Harris Window, long as specified in the "Attack" field (values between 0 and 0.4 msec).

The Y scale of the FFT plot can now be set automatically by pressing the "Y Autoscale" button inside the plugin. The spectrum plot obtained in this way is the first slice of the waterfall. It can be shown in logarithmic or linear scales and it is also possible to select the desired frequency range.

The next slices of the waterfall are computed by pressing the "Waterfall" button. For every successive slice, the plugin shifts to the right the beginning of the selection (by the number of points indicated in the "Dpoints" value), computes the FFT and plots the obtained spectrum.

The FFT size can be chosen between 256 and 16384 points (using zero padding). Since the lower resolution limit depends (for every measurement method) on the weighting window length and type, the plugin automatically excludes from the plot all unreliable results concerning low frequencies. This is performed by computing the lower frequency limit for every slice and its corresponding window length.

The plugin allows choosing different color schemes.
Figure 3 shows a waterfall where plot colors vary between red and blue with time.

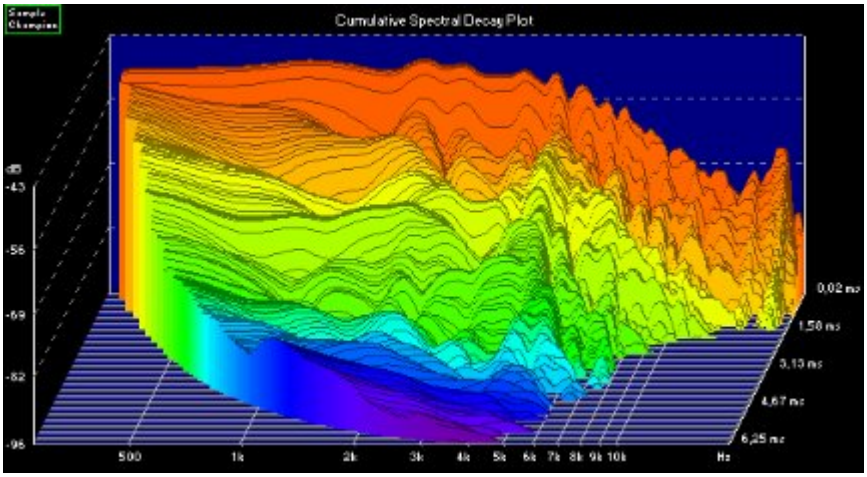

Figure 3 - Waterfall plugin

Figure 4 shows a waterfall where plot colors vary between red and blue with frequency.

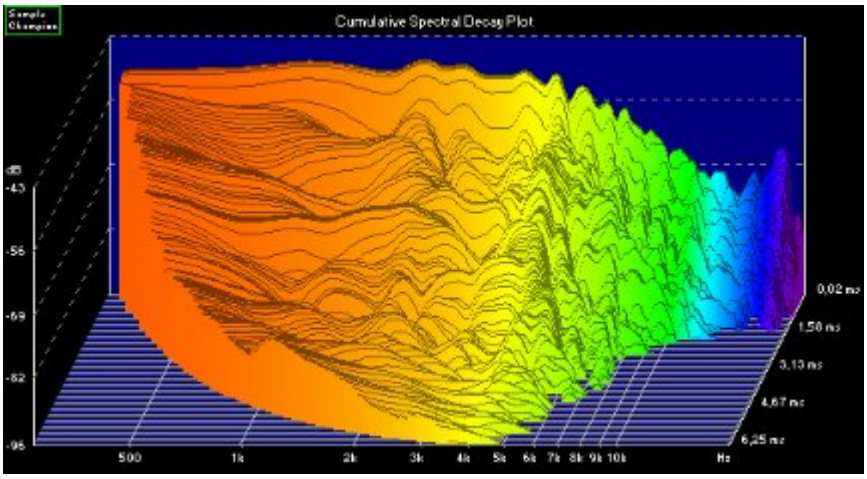

Figure 4 - Waterfall plugin

Figures 5 and 6 show color schemes similar to those in figures 3 and 4, but with thin lines.

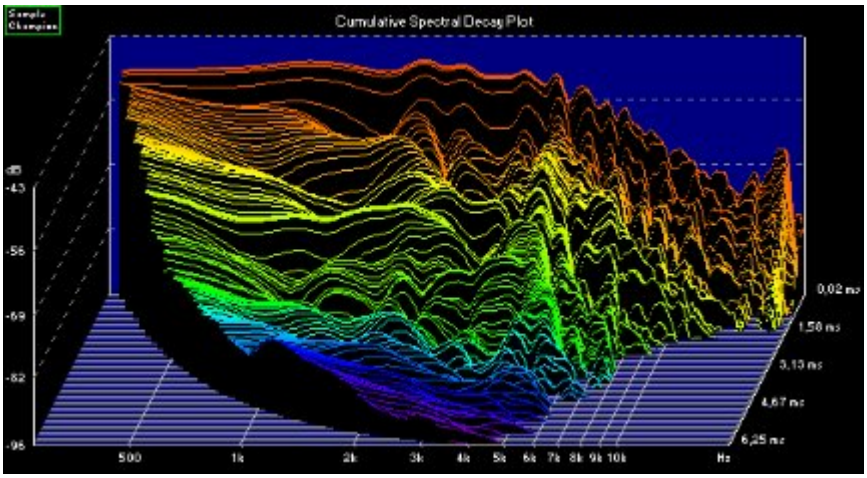

Figure 5 - Waterfall plugin

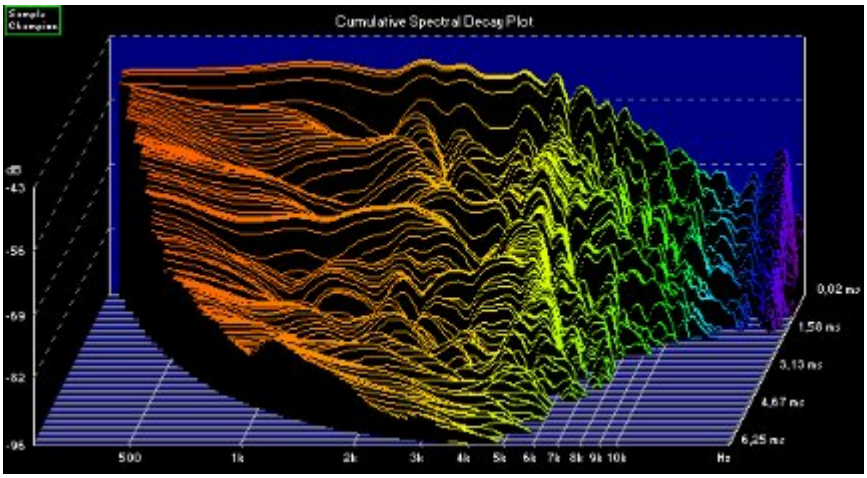

Figure 6 - Waterfall plugin

Figure 7 shows the waterfall plot with a *classic* color scheme.

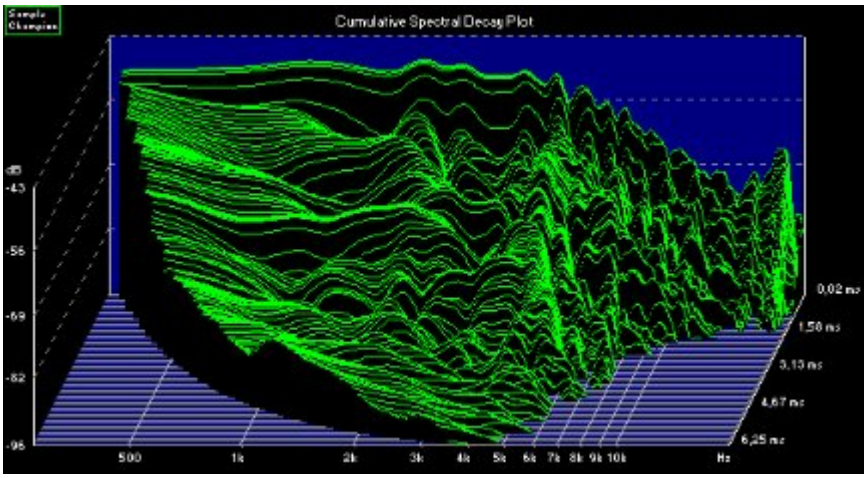

Figure 7 - Waterfall plugin

Figure 8 shows a frequency zoom of the waterfall plot.

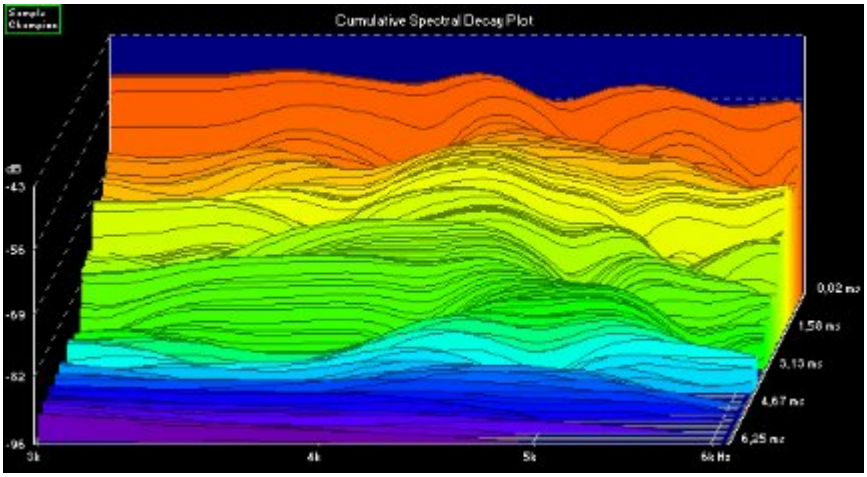

Figure 8 - Waterfall plugin

Figure 9 shows the waterfall plot with a linear frequency axis.

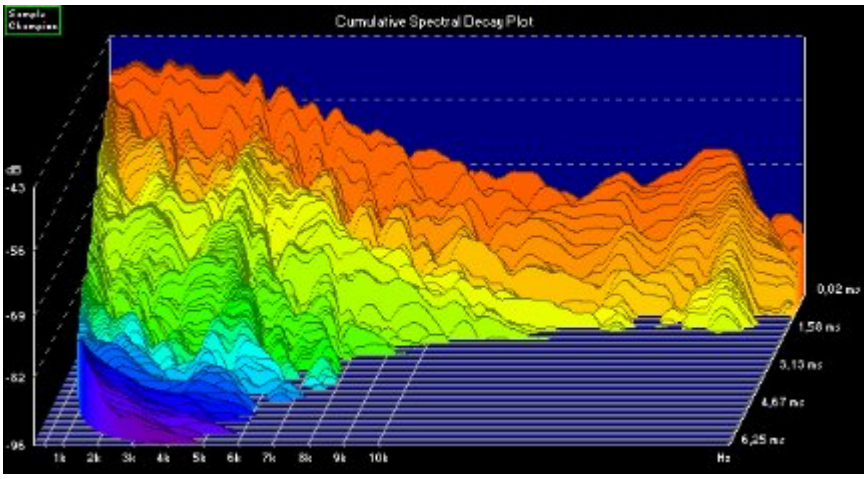

Figure 9 - Waterfall plugin

Figure 10 shows the waterfall plot with a white background color.

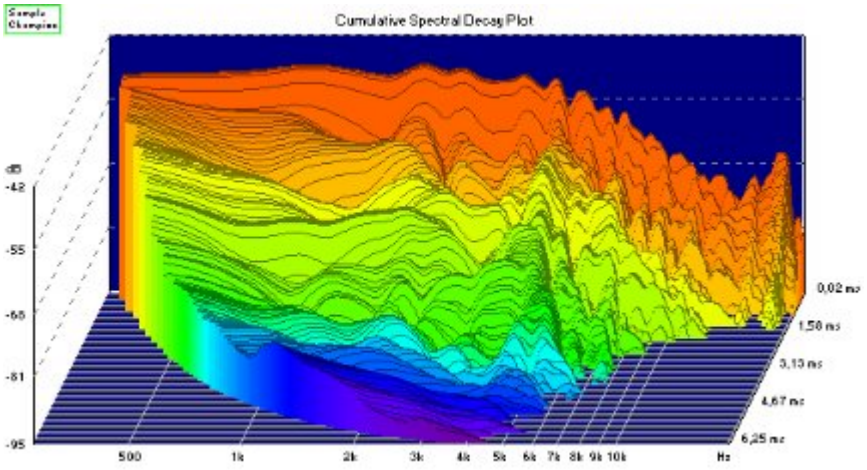

Figure 10 - Waterfall plugin

All pictures can be saved as BITMAP images.

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http://www.purebits.com