Visualizer

Operation Manual

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Introduction

Visualizer is a comprehensive, user definable real-time audio analysis tool designed to give you rapid access to the information you need to fully understand your audio. Visualizer is capable of providing a great deal of detailed information, coupled with options that allow a high degree of user customisation. This manual is intended to help both the novice and professional quickly navigate the interface and achieve the results desired.

The manual is divided in to several sections, as listed on the contents page (2).

The overview section is intended to give the new user a broad run-through generic operations such as selecting different views, opening control panels, etc. This section is recommended reading for anyone new to the software, introducing concepts and highlighting themes that run through the interface, improving workflow and intuitive operation.

The displays and controls section is a detailed reference to every available parameter view by view. Visualizer cannot be 'broken' by changing parameters and it is recommended that the user refer to this section whilst using Visualizer in practice so that the direct result of modifications can be seen in the displays.

An introduction to FFT analysis is also provided for those who are interested in understanding how digital audio analysis works within Visualizer. The strengths and weaknesses of this approach are discussed, which will allow the more advanced user to make informed decisions, particularly with respect to the Set-up options, which allow the user to adjust several of the underlying algorithmic parameters.

Interface Overview

The Visualizer interface is divided into three main sections. The graphical view display area [1], the view selector controls [2] and the control panel [3]. The top edge of the interface also contains several generic functions described below [4, 5 & 6].
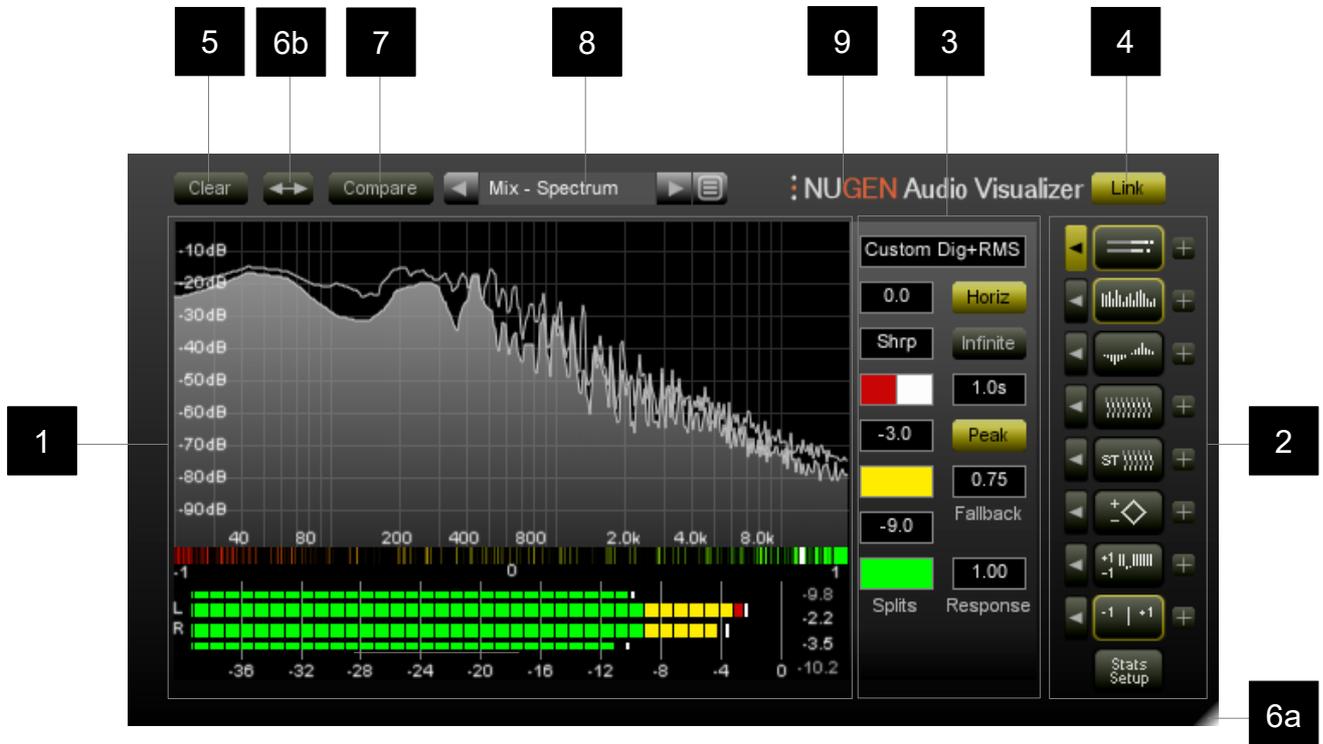
1   **Graphical View Display Area.** This is where the results of the audio analysis are displayed.

This area is treated as 'soft space' and can be configured to show a variety of different views. This is a distinct advantage over many audio analysis tools, which often require the user to select another interface module in order to change the display, or even prohibit certain view combinations entirely.
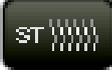
Visualizer uses 'intelligent window optimisation' to reconfigure the displays, changing size and positioning to allow the optimum view possible automatically, without the user needing to juggle them around by hand.

2   **View Selectors.** This column of controls selects the various views available for display. Clicking a control 'on' will cause the corresponding view to appear in the graphical display area [1], clicking an active control will remove that view from the display. The icons on the controls depict the view in question as shown below.
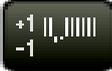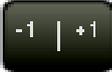
    Level Meter

    Spectrum Analyser

	Stereo Spectrum Analyser
	Spectrogram
	Stereo Spectrogram
	Vectorscope
	Correlation by Frequency
	Correlation Meter
	Statistics and Setup

 Alongside most of the view selectors is an edit selector control. These are used to select the controls available in the Edit Control Panel [3]. Click the control adjacent to the View Selector you wish to adjust and the Edit Control Panel will display the controls available for adjusting that view. To hide the Edit Control Panel all together, click the active Edit Selector to turn it off.

 Most of the views also have a view solo control. This control can be used to fill the graphics display area [1] entirely with the chosen view to allow an instant detailed inspection of the chosen view. This control operates as an exclusive solo, and is available even when a view is not currently displayed.

3   **Edit Control Panel.** The Edit Control Panel is where the various controls for adjusting the different displays are shown and is accessed via the edit selectors [2]. What is shown here will depend upon the active edit selector. The panel can be hidden from view so as to maximise the available view space by clicking the active edit selector.

4   **Link control.** The link control is a handy feature designed to allow rapid changes to be made to multiple displays simultaneously. Simply put, when 'Link' is selected, the interface automatically updates 'equivalent parameters' for all views, including the one being adjusted on screen. E.g. If the link is selected and a view is magnified using the zoom feature, all other views with a like scale will also be magnified in the same way. If 'Link' is not selected, then only the individual control being adjusted will be affected. Another example would be using the link control to turn on/off all the peak hold views at once.

5   **Clear.** The clear button can be used to reset current views, removing peak hold envelopes. This can be useful when a specific section of audio is being inspected in a larger piece.

6   Resize. The Visualizer interface is fully resizeable via the bottom right-hand corner [6a] (drag click to choose the aspect ratio and size desired). There are also two size memories that can be toggled using the resize button [6b]. This can be especially useful if screen real estate is at a premium, allowing a 'compact' display which can be immediately expanded for detailed inspection if required.

7   Compare. The compare function allows two different audio streams to be overlaid in the one interface for direct comparison and is described in its own section of the manual below.

8   Presets. Visualizer comes with a number of preset configurations. Most Visualizer parameters can be stored with a preset, allowing rapid reconfiguration for different tasks by recalling a previously stored setting. Use the arrow controls to step up/down through the available presets, or click the end control to bring up a preset menu.

9   Plugin Title. Click in this area to open the credits and licensing screen.

Zoom and Scroll. Several views within Visualizer are scaled (either in dB or against frequency – or both). These views can be adjusted to show ranges in greater detail by zooming and/or scrolling the scales. This is achieved by moving the mouse over the scale in question and dragging along the line of the scale to scroll, and dragging in a perpendicular direction to zoom in/out. To reset the scale to the full range hold down control (Ctrl) and click the scale.

Numeric Windows. The numeric values indicated in Visualizer can be adjusted either by click and dragging vertically, or double clicking and entering the desired value directly.

Default values. Holding down control (Ctrl) and clicking a control will return the control to the default position.

Level Meter
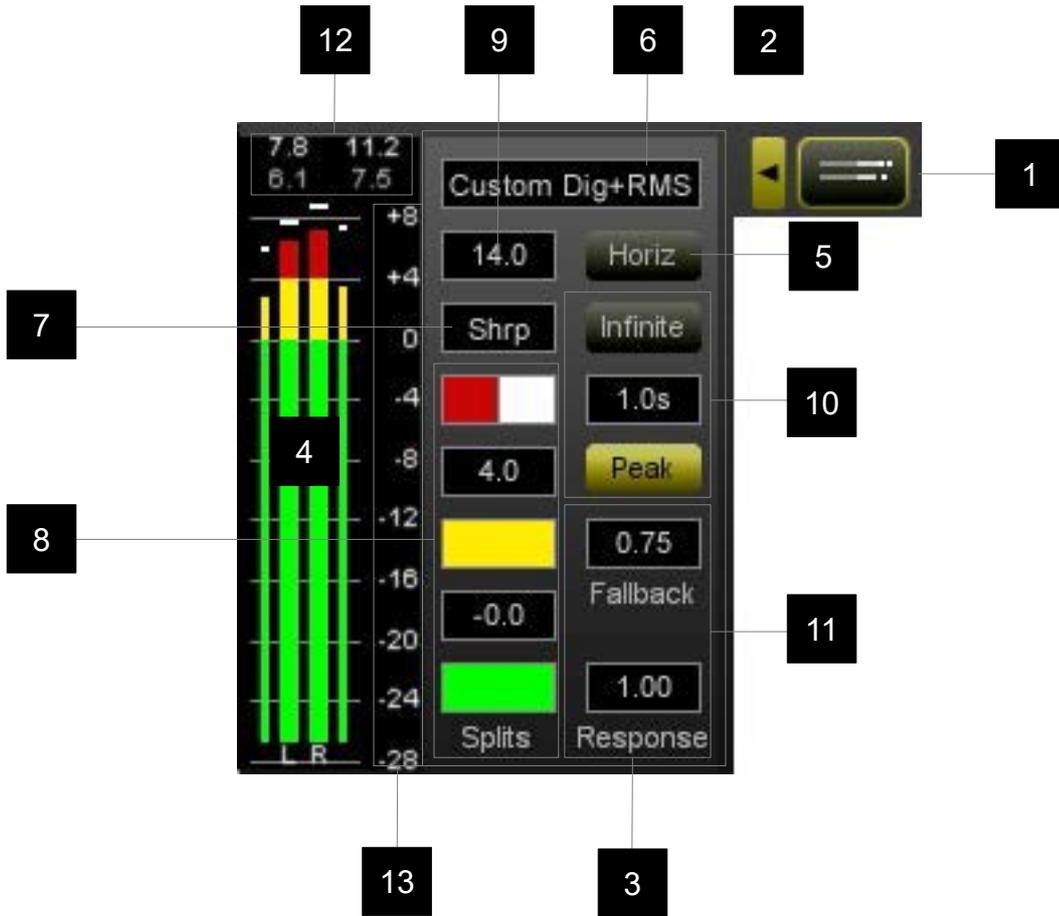
The level meter view is turned on using the level meter View Selector control [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

The level meter offers several pre-set scales and is also fully customisable to suit individual requirements using the following controls.

NB: To adjust both primary and secondary meters together [4], activate the 'link' control. If you wish to adjust the meters independently, ensure 'link' is not active. The parameters will then only affect the 'primary meter'.

4   **Level Meter Display.** Shows the level meter bars, as configured by the controls below. The centre two bars are the 'inner' primary meter the 'outer' bars secondary meter, when this is active.

5   **Meter Orientation.** Toggles horizontal mode on and off. The meter will automatically resize and position itself to make the best use of the screen space available.

6   **Pre-set selector.** Clicking in this area will call up a drop-down menu showing various pre-set options for the level meter. Click on a choice from the list to automatically configure the various settings to your selection. Where two

meter-types are chosen, the first named will be the inner, primary meter, and second the outer, secondary meter.

7   **Appearance setting.** Using this drop-down menu, you can select the appearance of the meter to suit personal preference, or the audio material in question.

8   **Splits.** These controls define the split points and colours for the 3 sections of the meter. To understand these options more clearly try adjusting the settings with the meter appearance set in 'Sharp' mode [7], if you get lost simply select a pre-set [6]. and begin experimenting again.

9   **Splits.** These controls define the split points and colours for the 3 sections of the meter. To understand these options more clearly try adjusting the settings with the meter appearance set in 'Sharp' mode [7], if you get lost simply select a pre-set [6]. and begin experimenting again.

10   **Peak Controls.** This section, outlined in grey, contains the parameters for adjusting the peak-hold bar. The 'Peak' button toggles the function on/off. The numeric window allows the peak hold time to be adjusted to suit personal preference. The 'infinite' button overrides the peak hold time, setting it to hold forever.

11   **Meter ballistics.** These values adjust the way in which the meter responds to the incoming audio signal. The 'Response' parameter determines how quickly the meter will jump up to the level of the audio, and the 'fall-back' parameter determines how rapidly it falls back down again.

12   **Margin.** The margin indicates the dB remaining below true digital Full Scale. If the audio clips (see the Setup and Stats module) this will be indicated with a red warning light. Click in this area to reset the margin. The white, lager size figure reflect the margin for the inner, primary meter, the smaller sized grey figures represent the value for the outer, secondary meter (where appropriate).

13   **Zoom and scroll zone.** This is achieved by moving the mouse over the scale and dragging along the line of the scale (vertically) to scroll, and dragging in a perpendicular direction (horizontally) to zoom in/out. To reset the scale to the default range hold down control (Ctrl) and click the scale. When zooming the level meter, additional divisions at 1dB, 0.5dB and 0.1dB will show once the scale is significantly expanded.

Note: RMS levels apply the standard –3dB correction so that pure sine waves read at the same level on both RMS and Peak meters in accordance with hardware mastering meters (Dorrough etc.) and the K-Metering mastering system.
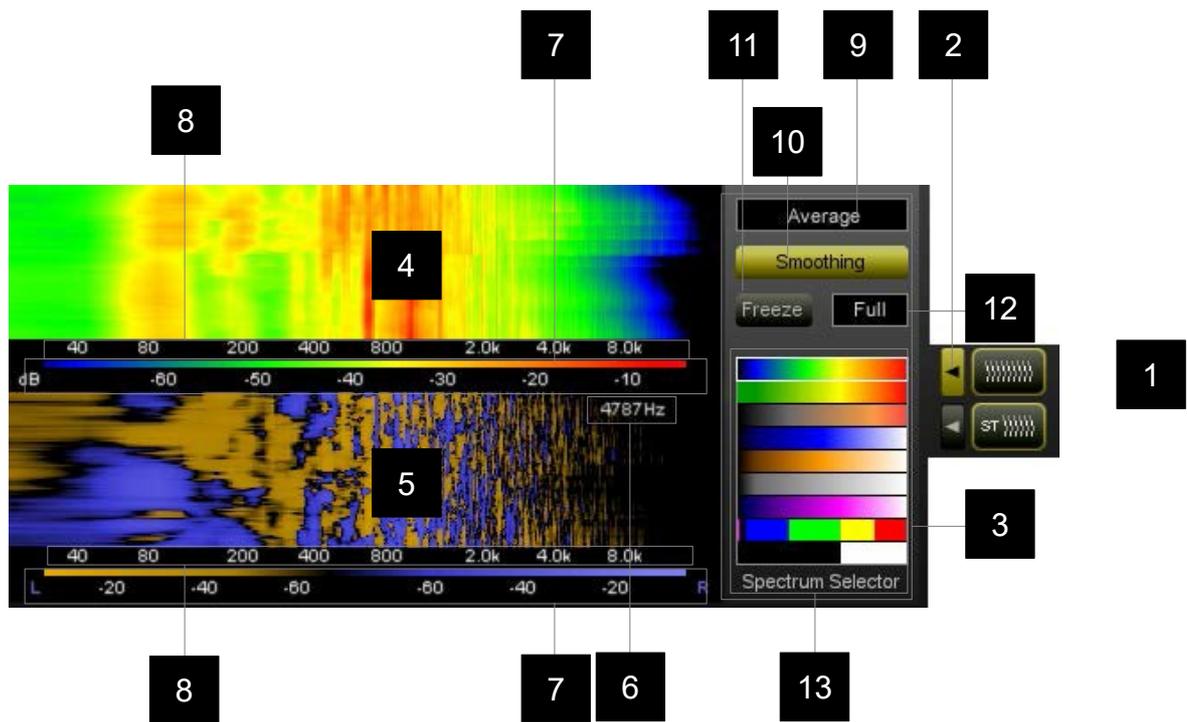
Spectrum Analysers
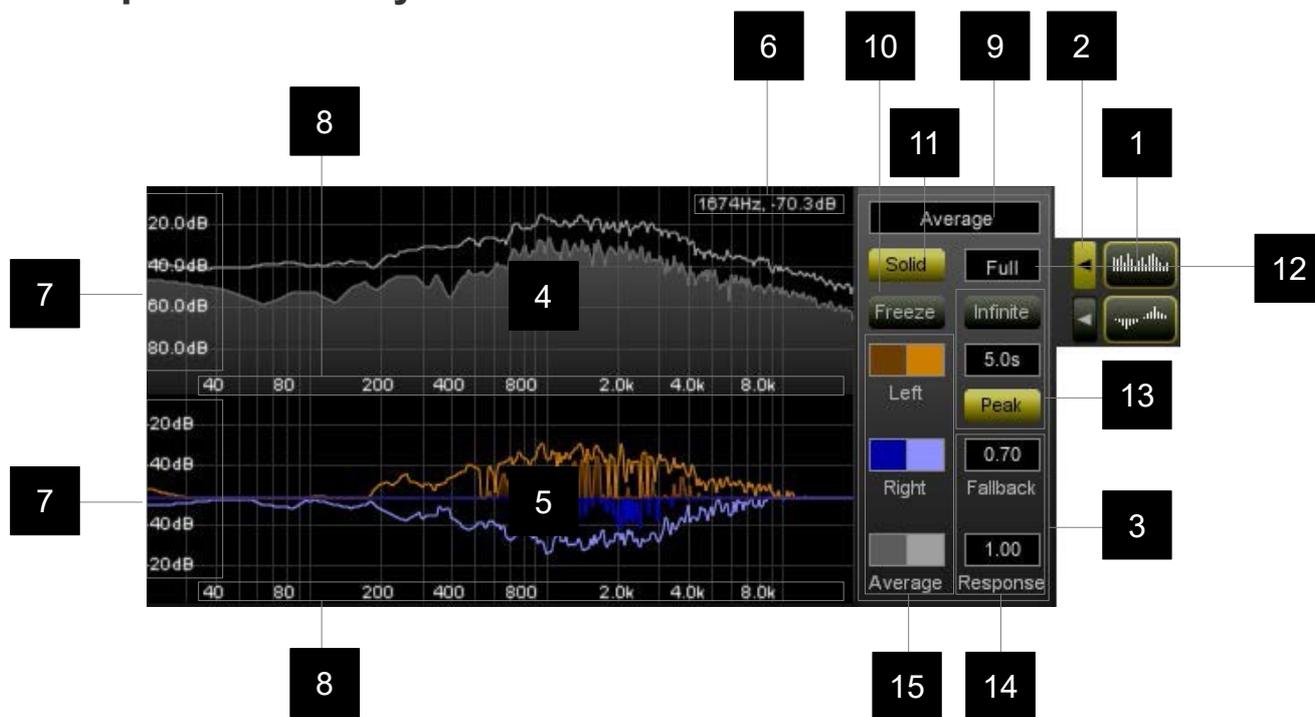
The spectrum analyser views are turned on using the spectrum analyser View Selector controls [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Spectrum Analyser display.** This is an FFT (Fast Fourier Transform) spectrum analysis view, graphing level against frequency. The FFT settings for all FFT windows can be adjusted globally via the Stats and Setup control.

5   **Stereo Spectrum Analyser display.** This is a stereo-differential FFT (Fast Fourier Transform) spectrum analysis view, graphing level against frequency. Bias to the left is indicated above the centre 'zero' level and to the right below. The FFT settings for all FFT windows can be adjusted globally via the Stats and Setup control.

6   **'Mouse-over' readout.** When the mouse is moved around a Spectrum Analyser display, the pointer becomes a cross-hair, and a readout of the X,Y values at that point is displayed top right.

7   **Zoom and scroll zone.** Click and drag in this area to activate zoom and scroll mode. Movement in a horizontal direction zooms the dB range and movement in a vertical direction scrolls up and down. To reset the scale to the full range hold down control (Ctrl) and click the scale.

8   **Zoom and scroll zone.** Click and drag in this area to activate zoom and scroll mode. Movement in a vertical direction zooms the frequency range and movement in a horizontal direction scrolls to the left and right. To reset the scale to the full range hold down control (Ctrl) and click the scale.

9   **View selector (Stereo Analyser – time averaging only).** Click here to select

various options from a drop-down menu. The Time Averaging modes average the displayed input level over time.

10   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

11   **Fill control.** Use this option to enable solid fill in the graphs displayed.

12   **Frequency Banding Selector.** Choose from smooth multiple point graph into Octave, 1/3 Octave, 1/6 Octave, Bark, Bark thirds, Mel, Mel thirds and Chromatic views. Bark and Mel are pycho-acoustic banding scales which place greater definition in the frequency ranges where the ear is most sensitive.

13   **Peak-hold options.** Turn on and off using the 'Peak' control. The peak-hold time can be set using the numeric window or over-ridden by selecting 'Infinite', which enables 'hold forever' mode.

14   **Display ballistics.** These values adjust the way in which the display responds to the incoming audio signal. The 'Response' parameter determines how quickly the meter will jump up to the level of the audio, and the 'fall-back' parameter determines how rapidly it falls back down again.

15   **Colour Selection.** Click to change the display colours, selecting from a grid of colour options. The left hand side selects the fill colour and the right hand side selects the peak envelope colour.
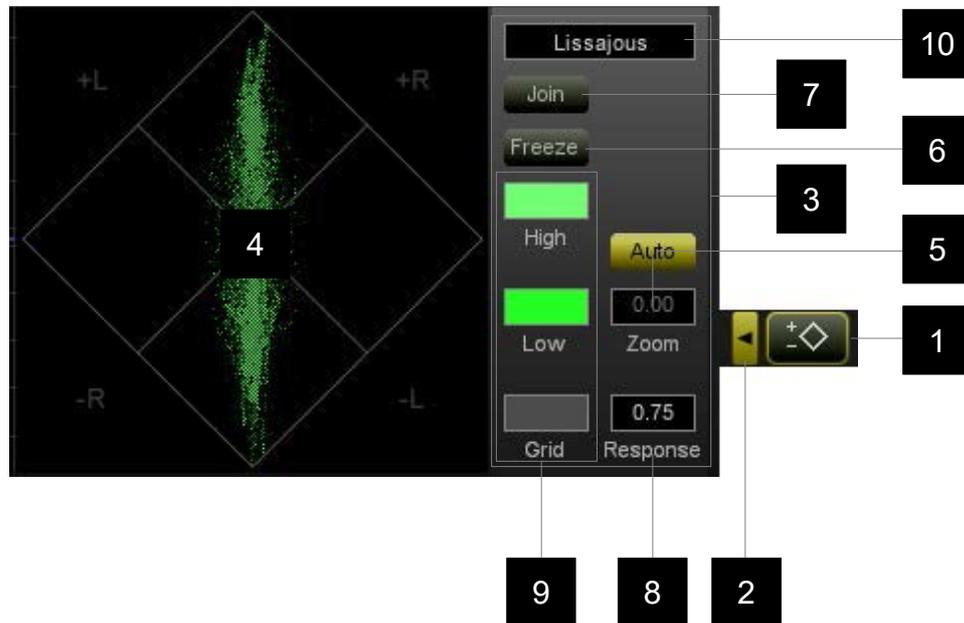
Spectrograms

The spectrogram views are turned on using the spectrogram View Selector controls [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Spectrogram display.** This is an FFT (Fast Fourier Transform) spectrogram plot, graphing level (colour depth) against frequency with respect to time.. The FFT settings for all FFT windows can be adjusted globally via the Stats and Setup control.

5   **Stereo Spectrogram display.** This is a stereo-differential FFT (Fast Fourier Transform) spectrogram plot, graphing level (colour depth) against frequency with respect to time. Bias to the left or right is indicated according to the colour scale displayed at the foot of the view. The FFT settings for all FFT windows can be adjusted globally via the Stats and Setup control.

6   **'Mouse-over' readout.** When the mouse is moved around the Spectrogram display, the pointer becomes a cross-hair, and a readout of the frequency value at that point is displayed top right.

7   **dB colour depth scale.** Indicating the level in dB's as represented by the Spectrogram. Click and drag left or right to shift the dB bands represented by each colour (not Stereo Spectrogram). Left and Right are indicated separately in the case of the Stereo Spectrogram.

8   **Zoom and scroll zone.** Click and drag in this area to activate zoom and scroll mode. Movement in a vertical direction zooms the frequency range and

movement in a horizontal direction scrolls to the left and right. To reset the scale to the full range hold down control (Ctrl) and click the scale.

9   **View selector (not Stereo Spectrogram).** Click here to select various options from a drop-down menu.

10   **Smoothing.** Select to smooth out the display data or deselect to view the raw values.

11   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

12   **Frequency Banding Selector.** Choose from a smooth multiple point graph , or Octave, 1/3 Octave and 1/12 Octave (chromatic) views.

13   **Spectrum Selector.** Click here to select a colour spectrum to represent the levels within the Spectrogram.
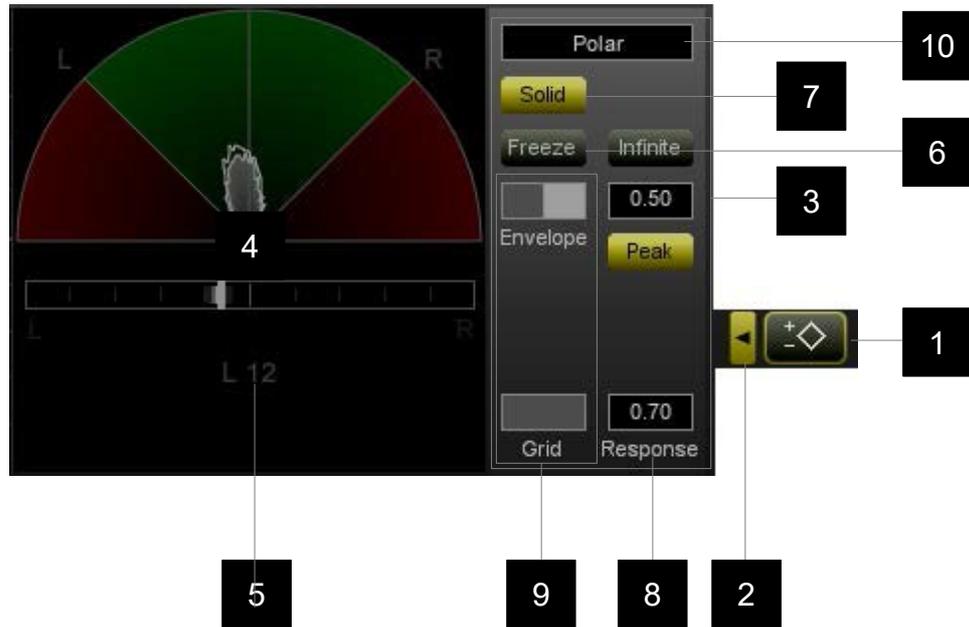
Vectorscope – Lissajous View

The Vectorscope view is turned on using the Vectorscope View Selector control [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Vectorscope display.** Traditional X/Y plot rotated through 45 degrees.

5   **Zoom control.** Use this to zoom in (X/Y simultaneously). Auto zoom will scale the data to automatically fill the screen.

6   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

7   **Join control.** When active, this parameter joins the discreet points of the graph to give a continuous display.

8   **Response value.** Adjusts the response time of the meter (please note - this does not affect the "joined" lines if that option is selected).

9   **Colour Selection.** Click to change the display colours, selecting from a grid of colour options.

10   **View Selection.** Choose between X/Y (Lissajous) presentation and Polar view.
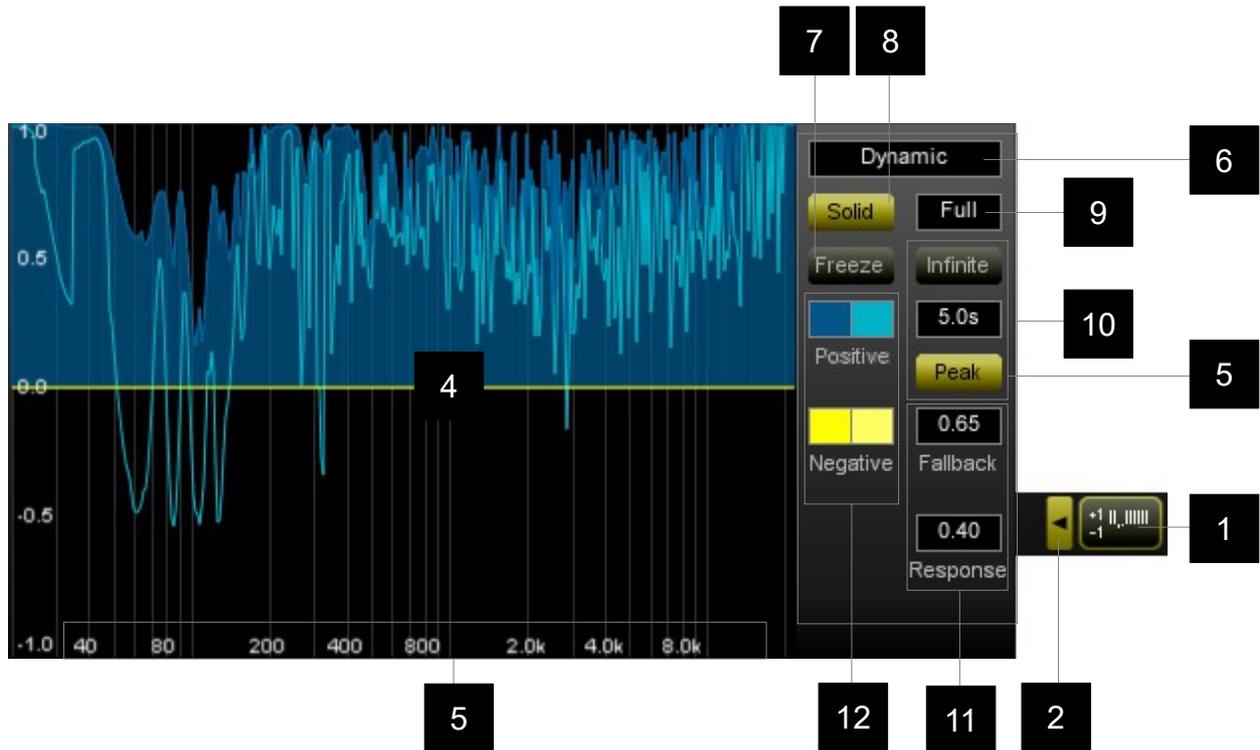
Vectorscope – Polar View

The Vectorscope view is turned on using the Vectorscope View Selector control [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Vectorscope display.** In this view, the rotated X/Y parameters used to construct the traditional Lissajous view are presented in Polar form.

5   **Stereometer.** Gives an indication of the overall Left/Right balance. The shorter, thin line responds quickly to the input signal, where as the thicker line responds with an inbuilt inertia to give a wider perspective.

6   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

7   **Solid control.** Determines whether the polar envelope is filled or not.

8   **Response value.** Adjusts the response time of the meters.

9   **Colour Selection.** Click to change the display colours, selecting from a grid of colour options.

10   **View Selection.** Choose between X/Y (Lissajous) presentation and Polar view.
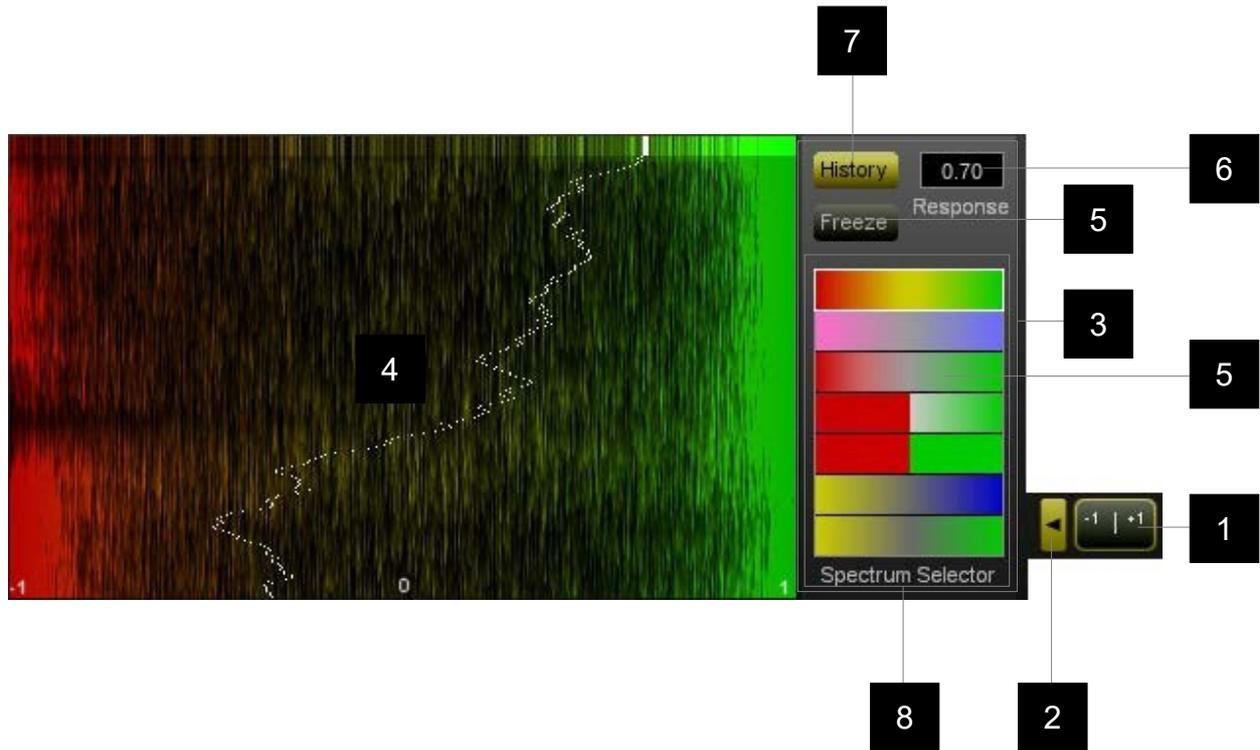
Correlation by Frequency

The correlation meter view is turned on using the correlation meter View Selector control [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Correlation by Frequency display.** This is an FFT (Fast Fourier Transform) spectrum analysis view, graphing level against frequency. The FFT settings for all FFT windows can be adjusted globally via the Stats and Setup control.

5   **Zoom and scroll zone.** Click and drag in this area to activate zoom and scroll mode. Movement in a vertical direction zooms the frequency range and movement in a horizontal direction scrolls to the left and right. To reset the scale to the full range hold down control (Ctrl) and click the scale.

6   **View selector.** Click here to select between dynamic and time averaging modes from a drop-down menu. The Time Averaging modes average the displayed input over time.

7   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

8   **Fill control.** Use this option to enable solid fill in the graphs displayed.

9   **Frequency Banding Selector.** Choose from smooth multiple point graph into Octave, 1/3 Octave, 1/6 Octave, Bark, Bark thirds, Mel, Mel thirds and Chromatic views. Bark and Mel are pycho-acoustic banding scales which place greater definition in the frequency ranges where the ear is most

sensitive.

10   **Peak-hold options.** Turn on and off using the 'Peak' control. The peak-hold time can be set using the numeric window or over-ridden by selecting 'Infinite', which enables 'hold forever' mode.

11   **Display ballistics.** These values adjust the way in which the display responds to the incoming audio signal. The 'Response' parameter determines how quickly the meter will jump up to the level of the audio, and the 'fall-back' parameter determines how rapidly it falls back down again.

12   **Colour Selection.** Click to change the display colours, selecting from a grid of colour options. The left hand side selects the fill colour and the right hand side selects the peak envelope colour.

Correlation Meter

The correlation meter view is turned on using the correlation meter View Selector control [1]. The adjustable parameters are displayed on the Edit Control Panel [3] which is accessed via the adjacent Edit Selector control [2].

4   **Correlation meter.** The meter position represents the correlation between right and left-hand signals. A value of 1 indicates 100% correlation (mono), 0 indicates no correlation and –1 indicates 100% negative correlation (out of phase signals).

5   **Freeze control.** When selected, this control will freeze the view to capture an 'instant' in time. De-select to reactivate the dynamic view.

6   **Response value.** Adjusts the response time of the meter.

7   **History.** Toggles the history view on and off.

8   **Colour Selection.** Click to change the display colours, selecting from a grid of colour options.

Statistics and Setup
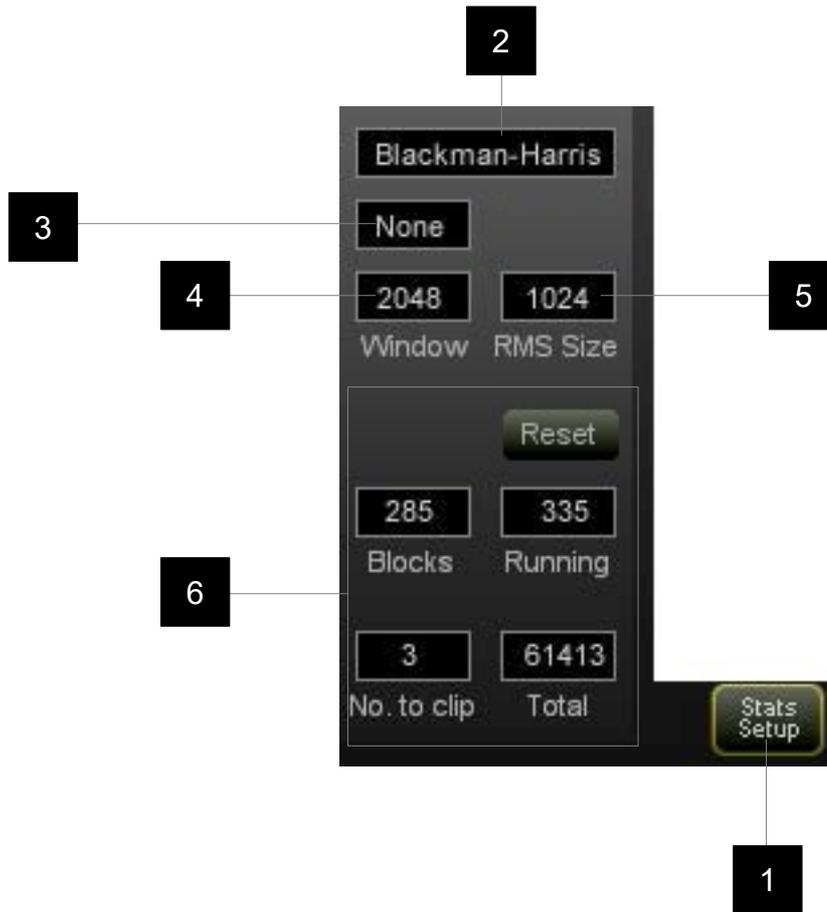
The stats and setup view is turned on using the stats and setup View Selector control [1]. There is no graphical display associated with this selection.

2   **FFT window selection.** Choose from a selection of standard window functions using the drop down menu.

3   **Audio weighting.** Choose from None, A, B, C, D standard equal loudness weightings, or from various log-scale-linear spectrum slopes.

4   **FFT window size.** Choose from the drop down menu. The larger sizes are recommended for use with the Time Averaging modes.

5   **RMS window size.** Choose form the drop down menu.

6   **Clip Counter parameters.** Visualizer constantly monitors the input signal for clipping. The 'number to clip' parameter determines how many digital 'overs' (samples over 0dBFS) are required to be considered a 'clip'. The 'total' parameter counts the total number of such clips. 'Running' records the largest number of consecutive 'over' events in one section of clipped material, and 'Blocks' counts the number of events which qualify as a clip, i.e. the number of events where the 'overs' exceed the number to clip parameter.

Comparison Mode

In addition to the ability to inspect individual audio sources in detail, Visualizer is also equipped with an audio comparison mode. In this mode is it possible to compare the main audio input to the plug-in with a secondary source. This is useful in a number of different situations, for example, when comparing your audio against reference tracks, notching out frequencies to create space for an instrument, or when investigating the effects of a particular plug-in, by comparing the audio before and after the effect.

In order to enter comparison mode, a secondary audio source first needs to be available to the visualizer plug-in. This is achieved by using the NUGEN Audio SEND plug-in, which is included in the Visualizer installer and is automatically available following a standard installation.

To add a secondary audio source, insert the SEND plug-in into your project at the point where you would like to 'tap' the comparison audio. Visualizer will automatically locate the plug-in and activate the 'Compare' control. If multiple SEND plug-ins are active, you may choose the appropriate source using the drop-down menu. For detailed information about the SEND plug-in, please refer to the product manual.
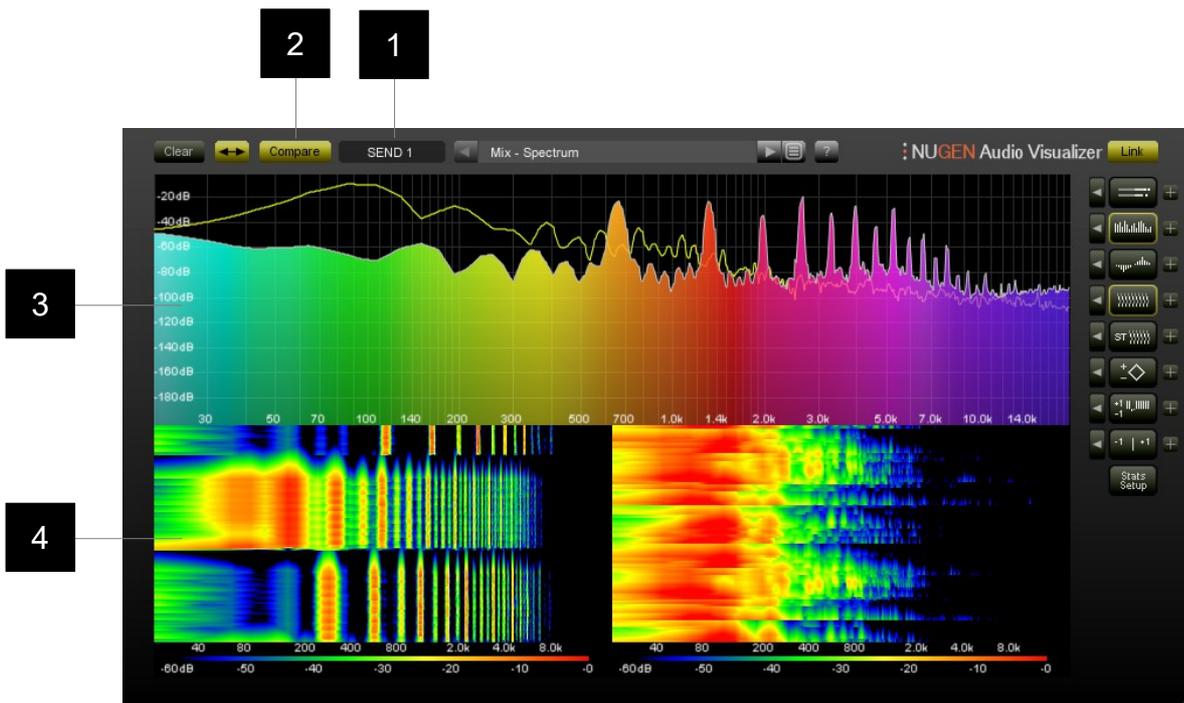
1   **Attached 'SEND' plugin.** If more than one SEND is available, click here to choose from a drop-down list. The SEND plug-in is used as a Side-chain audio reference to provide the secondary audio source for comparison.

2   **Compare.** Only available when a SEND plug-in is attached. Click to activate the comparison views. When inactive, any available secondary audio source is ignored.

3   **Overlay views.** When comparison mode is active, some views will operate in Overlay mode. The main audio is shown as it is usually represented, and the secondary audio source is represented as an overlay. This overlay uses the same settings as the primary display, except that in most cases the colour can be adjusted to preference using an additional option in the relevant settings panel.

4   **Side-by-side views.** When comparison view is active and an overlay is not possible due to the nature of the display, a side-by-side comparison will be enabled. The main input is shown on the left, and the secondary view is shown on the right.

An introduction to FFT Analysis

This section is intended as a slightly more technical introduction to the world of FFT analysis. It is not essential to understand the contents of this section to use Visualizer, but a broad understanding of FFT analysis, and the trade-offs involved, may help users appreciate some of the finer points.

Audio signals are represented as digital waveforms of signal value against time, so a pure 1kHz tone signal is represented by a waveform, which rises and falls over time in a sine-wave. However, this is not how the ear and brain perceive audio signals. Our perception of audio is more to do with what frequencies are present in the signal, and at what volumes, so, to give a useful visual representation of an audio signal, a common approach is to try to display a graph showing the strength of any frequencies in the signal.

Unfortunately, finding which frequencies are present in a signal is not a simple matter. The mathematical process used to decompose a signal into its constituent frequencies is known as the Fourier Transform. The simplest way of programming in this transformation is so processor intensive that it cannot be used in real-time applications. Thankfully, there is a well-known, much faster, way of implementing a Fourier Transform, known as the Fast Fourier Transform (FFT), which does make signal to frequency conversions possible in real-time.

Sample Rate:

Digital audio signals contain samples taken at a particular "sample-rate" (for example 44.1kHz). The higher the sample rate, the more disc space you need to store a given length of audio, and the more processor power you need to manipulate it, but also, the higher the frequencies you can store. Each sample rate has a maximum frequency it can represent mathematically (called the Nyquist frequency), although it could be argued that human perception of frequencies would start to degrade below that absolute limit. As an example, a 44.1kHz audio signal, which was transformed by an FFT, would not show any frequencies above 22.05kHz.

FFT Sample Size:

When an FFT is carried out on an audio signal, it is usually on separate chunks of the signal, to give a reading of the frequencies present in each section of the audio. For example, one could carry out an FFT on a 100ms section of audio to find out the strengths of each frequency in that snippet. The number of samples in the chunk that the FFT is applied to is called the "FFT sample size". There are trade-offs involved in choosing the correct sample size to use. A small sample size will only contain a short sample of audio data (for example a sample of 256 values from a 44.1kHz audio signal will only be sampling over approximately 6ms), which means that it will be hard for the FFT to accurately detect low frequencies (in our example, we are sampling over 6ms, which corresponds to the wave-length of a signal near 170Hz, so we couldn't expect any kind of accuracy for frequencies below this). Choosing a larger sample size will give us more detail and accuracy in the lower frequency range, however, as well as increasing the CPU loads slightly, this can lead to a lack of responsiveness in the readings. As an example, if we are using a sample size of 16384 from a 44.1kHz audio signal, each chunk will be over approximately 350ms,

meaning that the frequency view will only be updated less than three times a second, giving a rather sluggish feeling display.

FFT Window Function:

As FFTs are applied to limited sized chunks of an audio signal, they can only approximate the frequencies, which are actually in that signal. Indeed, the frequencies present in the signal might be changing over the period of that chunk. By using different "windowing functions" the approximation of the FFT can be made more precise in some ways at the expense of less accuracy in other ways. The main trade off is of "frequency leakage" against "resolution". To illustrate the meaning of these two terms consider an audio signal with a pure tone at 1kHz. In theory the perfect frequency graph of this would have 0 at every frequency except at 1kHz, where it would have a perfect spike up to the volume of that frequency. In reality, a FFT graph from this signal will show a graph rising to a peak at 1kHz, and then dropping off again. With better, that is less, frequency leakage, the regions of the graph on the two sides of the peak would be lower (ie- less frequencies would be leaking through where they shouldn't be). With better, that is higher, resolution, the actual peak of the graph would be sharper. With a lower resolution, the peak of the graph would be rounded, and flatter at the top. Higher resolution is more important for distinguishing individual frequencies in a signal, lower leakage is more important for signal which contain a lot of different frequencies. For audio signals, lower leakage is usually more important, and so the default FFT window function in Visualizer is chosen to have very low frequency leakage at the expense of some resolution.

Reporting a problem.

If you encounter a problem with any of NUGEN Audio's products, please let us know, to help us improve them.

Please email NUGEN Audio at **support@nugenaudio.com** giving a clear explanation of the problem. Please state how frequently you've experienced the problem. If there are any particular steps you need to go through to see the problem, please detail these.

Please also state your operating system, and the rough specs for your machine (e.g.- CPU speed, RAM) - in Windows XP you can get this information by right-clicking "My Computer" and selecting properties.

Please be patient with any problems you may experience, particularly with products at a beta stage of release. At NUGEN Audio we take problems with our software seriously, and will endeavour to correct them as quickly as possible.

Version History

2.0   Initial release