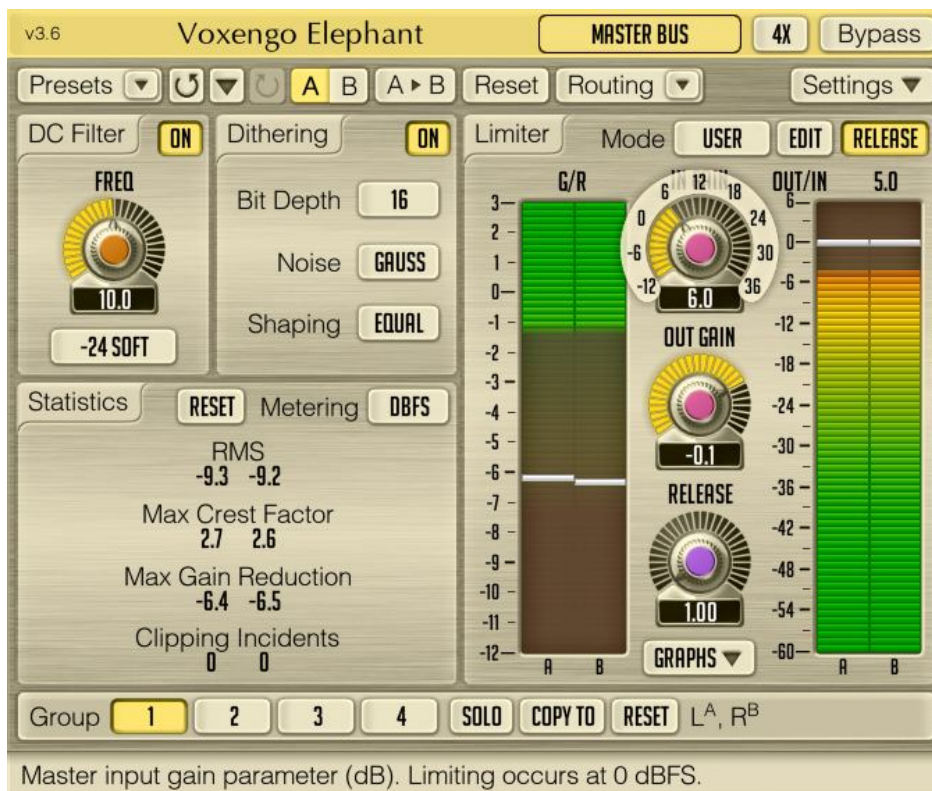




Voxengo Elephant User Guide



Software version 3.6

<http://www.voxengo.com/>

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Introduction

Voxengo Elephant is a mastering limiter plug-in for professional music production applications. The most remarkable feature of this signal limiter is its ultimate transparency. Elephant brings sound limiting and loudness maximization without any audible “pumping” effects.

Elephant is a highly competitive plug-in for mastering applications: it features a variety of limiter modes that can be deeply customized, and a comprehensive set of level metering tools. Elephant's built-in linear-phase oversampling is a new standard in quality peak limiting and loudness maximization.

Elephant limiter can be used for mixing and mastering of both stereo and multi-channel music and sound material, at any standard sample rate.

Elephant, also featuring a DC offset filter, and a high-quality bit-depth converter with an optional noise-shaping, allows you to finish your music and audio production with a spark.

Features

- Transparent signal limiting action
- 10 predefined limiter modes
- Limiter mode editor
- Optional release stage
- Noise-shaped bit-depth converter
- DC offset removal filter
- Waveform graph view
- Multi-channel processing
- Internal channel routing
- Channel grouping
- Up to 8x linear-phase oversampling
- 64-bit floating point processing
- Preset manager
- Undo/redo history
- A/B comparisons
- Contextual hint messages
- 22-millisecond processing latency

Compatibility

This audio plug-in can be loaded into any audio host application that conforms to the AudioUnit or VST plug-in specification.

This plug-in is compatible with Windows (XP and later versions, 32- and 64-bit) and Mac OS X (10.4.11 and later versions, Intel and PowerPC) computers (2 GHz dual-core or faster processor with at least 1 GB of system RAM recommended). A separate binary distribution file is available for each target computer platform for each audio plug-in specification.

User Interface Elements

Note: Most interface elements (buttons, labels) located on the top of the user interface and on the bottom are standard among all Voxengo plug-ins and do not require much learning effort. For an in-depth description of these and other standard user interface elements and features please refer to the “Voxengo Primary User Guide”. Learned once it will allow you to feel comfortable with all pro audio plug-ins from Voxengo.

DC Filter

This group of controls allows you to enable and fine-tune the DC filter. DC filter is applied before all other processing stages, and is usually used for removing unwanted signal's DC (constant) offset which reduces headroom of a sound track and may affect playback quality of this track due to non-symmetry induced by DC offsetting.

The “Freq” parameter specifies the corner frequency of the DC (high-pass) filter.

The type selector specifies DC filter type. The “Steep” filter types offer a steeper cutoff frequency response, but a higher phase shift. The “Soft” filter types have a smoother cutoff frequency response and a lower overall phase shift. The number before the filter type denotes dB/octave roll-off of the filter (e.g. “-18 Soft” means “-18 dB/octave soft filter”).

Note, however, that DC removal filter induces phase shift and thus may affect sonic character of a sound material. Another possible disadvantage of such phase shift is that it changes envelope of the signal, having potential of introducing higher peak levels. For best results you may specify DC filter frequency as low as possible and use non-steep filter types.

Dithering

Dithering stage – when enabled – is applied last in the processing chain of this plug-in. Dithering allows you to perform finalizing bit-depth conversion. If you plan to perform further processing on the track where this plug-in is inserted to, you should probably leave the dithering stage disabled since the dithering effect will be lost if you apply any further processing. Note that dithering stage settings are applied to all channel groups.

The “Bit Depth” parameter allows you to specify dithering depth with 1-bit steps. This should be usually equal to 16-bit for CD production, 24-bit for pre-mastering and storage purposes. Lower and intermediate bit depth settings are provided for non-conventional uses.

The “Noise” parameter controls probability density function (PDF) of the dithering noise. The “TPDF” is a triangular PDF (2-bit peak-to-peak) while the “Gauss” is an approximation of the Gaussian PDF. Note that it may be hard for you to decide which one is better. The “Gauss” mode is the mode used in the original Elephant 2 version while the “TPDF” is an industry standard PDF for sound signal dithering.

The “Shaping” parameter affects noise-shaping function selection. Noise-shaping is used to increase the signal-to-noise ratio (SNR) in the lower spectral regions at the expense of lowering the SNR in the higher spectral regions which are usually cannot

be heard by human hearing system. When left “Off” no noise-shaping will be performed. The “Equal” setting enables equal-loudness contour noise-shaping which follows human hearing threshold envelope thus greatly enhancing a subjective SNR. The “Classic” setting enables noise-shaping originally introduced in Elephant version 2.

Limiter

The “Mode” selector loads a pre-defined factory or user mode preset. Press the “Edit” button to open limiter mode editor popup window. If changes were made to a loaded preset, the name of the loaded preset will be changed to “User”.

The “In Gain” knob is used to control the volume of the signal that enters the limiter stage. Internally, audio signal is limited to 0 dBFS. So, if the audio signal's level is mostly staying below 0 dBFS threshold, you should increase the In Gain in order for the limiter to start working. Note that the “Knee” specified in the Limiter Mode Editor may decrease the threshold level at which the limiter starts working.

The “Out Gain” knob can be adjusted to change the output volume after the limiting was performed. This is not a ceiling-like control, it is strictly a “post” type control. Note that you can drag either the “In Gain” or “Out Gain” knob with the right mouse button to enable inversely linked adjustment of both knobs.

The “Release” control affects release stage duration. Note that you should enable the “Release” switch before this release stage control becomes available for adjustment. Release setting is unavailable when the “Clip” algorithm is active. The release stage in the “AIGC” algorithms produces a very strong “pumping” action at high time settings: this may or may not be desirable depending on your needs, but such operation is intentional. Long “Release” settings reduce distortion and retain transients at the expense of both overall achieved loudness (which becomes lower) and an increased “pumping”. For best results you should probably use low “Release” values since they allow Elephant to retain transients without reducing the overall achieved loudness much.

The “Graph” button opens real-time gain reduction and waveform graphs popup window. The gain reduction graph displays average gain reduction happening in all channels of the current channel group. The waveform graph displays peak input and output waveform levels in all channels of the current channel group.

Limiter Mode Editor



This popup window offers you an opportunity to define limiter's operation mode precisely. The "Mode Presets" button opens the preset list where you can store or recall your own limiter mode presets. These user presets – when defined – are also displayed in the main limiter mode selector list.

The "Alg" selector allows you to select the limiting algorithm used by the current limiter mode. All algorithms offer a brick-wall limiting operation meaning input signal you are limiting would not go over 0 dBFS level (given the "Out Gain" parameter stays at or below 0 dB). Note that algorithm has no direct correspondence to the mode you choose via the "Mode" selector ("mode" is a complex intermix of parameters while the algorithm is a single parameter of the mode). Each algorithm has its own distinctive features:

- The "Clip" algorithm works as a "clean" hard saturation limiter: it sounds cleaner than the ordinary clipping you can get overdriving the signal in a sound editor. The "Clip" algorithm is not a suggested type of limiting since it can create much distortion and many harmonics. At the same time, this algorithm allows you to preserve the frequency balance of the sound material you are working on, and it also tends not to smooth out the attack transients. The "Clip" algorithm is best used with oversampling enabled.
- The set of "AIGC" algorithms represents algorithms with a built-in "automatic input gain control" (AIGC), each with a specific dynamic response. The "AIGC" algorithm internally adjusts the specified "In Gain" value striving to deliver a cleaner limiting sound. Even though AIGC can give a cleaner sound, at high "In Gain" settings it can create a "pumping" sound.
- The "EL-1" algorithm is a legacy limiter algorithm which was introduced in the very first version of Elephant mastering limiter. With this algorithm you can usually achieve high loudness, but at the expense of a relatively high distortion.
- The "EL UNI" algorithm is a "unified" limiting algorithm, implementing best limiting techniques and offering the highest level of flexibility. This algorithm implements distortion minimization technique and also contains several dynamic response types that adjust the dynamic response of the limiter.

The "Ch. Linking" knob controls amount of link between channels in the group. In a fully unlinked mode Elephant limits all channels of a group independently of each other. This mode can give a higher signal gain in comparison to the linked mode. However, unlinked mode can also damage the stereo-field information. For example, if you have a floor tom panned to the left with some signal in the right channel, unlinked limiting can bring the right channel up, destroying the original panning of a floor tom. Fully linked mode limits all channels simultaneously, preserving the stereo-field information.

The "Knee" parameter allows you to control soft knee of the limiter's transfer function. A wider knee allows you to achieve a smoother overall sound, lower knee values are best used for harder sound. This parameter is available for the "EL-1" and "EL UNI" algorithms only.

The set of the "Trans" controls affects limiter's transient form. Using these controls you can trade between sonic cleanness of limiting and maximal achieved loudness.

- The "Trans" switch selects transient form. This switch affects overall coloration and transient response. The "Classic" option implements transient

response originally introduced in the Elephant version 2. The “Sharp” option offers a sharper and more instant transient response which, however, adds more harmonic coloration in comparison to the “Classic” option. The “Asymm” option offers you an asymmetric transient form which can be also called an “analog” transient form since it features a causal response (in terms of digital signal processing); the coloration strength of this option is in-between the “Classic” and “Sharp” options.

- The “Trans Time” knob adjusts transient’s duration. A lower time value usually sounds “harsher”, but provides a higher loudness boost. Higher time values sound smoother, retain transients better, and provide lower overall loudness boosts. Since this parameter affects plug-in’s internal signal path, quick changes made to this parameter produce “stuttering” sound. It is suggested that you use the keyboard entry when changing this parameter.
- The “Trans Shape” parameter further adjusts the transient form. Values below “0” produce a smoother form, values above “0” produce a sharper form.

The “EL Dyn” control selects additional dynamic response type used when the “EL-1” or “EL UNI” algorithm is engaged. Depending on the selected type Elephant will reveal or hide subtle features of the sound when limiting happens. The “Off” option can be used to disable additional dynamic response. Note that sonic difference between all the offered response types is subtle – you may choose the type in accordance with your subjective feelings alone. E.g. one mode may recover a little bit faster after gain reduction happened, another mode may recover later: this – in turn – produces a little bit different subjective “feel” of the sound.

Statistics

This pane displays statistical information for each channel of the currently selected channel group.

The “RMS” indicator displays un-weighted RMS signal power estimation.

The “Max Crest Factor” indicator shows maximum crest factor (difference) between the RMS and peak RMS values reached. Peak RMS value is not displayed anywhere on the user interface. 50 ms time window is used to estimate the peak RMS value. You may add the “RMS” and “Max Crest Factor” values together to obtain a peak RMS value.

The “Max Gain Reduction” indicator shows a maximal instant gain reduction value reached.

The clipping indication is useful when using noise-shaping at low bit depth dithering settings since noise becomes powerful enough to go over 0 dBFS. Another possible situation when the clipping indication may be useful is when the “Clip” limiting mode and oversampling are used together, and when oversampling is used together with any other mode with transient time set to a small value. In either case, when clipping indicator grows it is a sign that you should lower the “Out Gain” setting. Note that Elephant itself does not perform clipping on the output stage. This indicator detects samples that will be clipped if signal is converted to a limited bit depth.

The “Reset” button can be used to reset counters and start statistical accumulation over.

The “Metering” selector allows you to choose the meter biasing mode. The “dBFS” mode applies no biasing. The “dBFS+3” mode adds 3 dB to level meter indicators

and RMS value (peak level indication on the level meter is unchanged in comparison to the “dBFS” mode). The “K-20”, “K-14” and “K-12” modes offer various K-system biasing modes originally offered by Bob Katz. The “K-20 C”, “K-14 C” and “K-12 C” implement level calibration modes.

Level Meters

Elephant features two RMS level meters, with scales shown in deciBel. Peak level indication is present on both meters. The “G/R” is a gain reduction meter showing gain reduction changes relative to the 2-second average gain reduction. Second meter shows plug-in’s master output level.

Credits

This plug-in was produced by Aleksey Vaneev in Syktyvkar, Komi Republic, Russia.

DSP algorithms and internal signal routing code were created by Aleksey Vaneev.

Graphics user interface code and the “standard” graphics design were created by Vladimir Stolypko.

Plug-in is implemented in multi-platform C++ code form and uses “zlib” compression library (written by Jean-loup Gailly and Mark Adler), filter design equations by Robert Bristow-Johnson, FFT code by Takuya Ooura, VST plug-in technology by Steinberg, AudioUnit plug-in SDK by Apple, Inc. (used under the corresponding licenses granted by these parties).

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Beta-Testers

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Niklas Silen

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Special thanks go to Niklas Silen for several plug-in preset ideas.

Additional Information

Oversampling

Voxengo Elephant features linear-phase oversampling with 150 dB stop-band attenuation and 4% transition band width (centered at $F_s/2$). Note that when using oversampling while working at 44.1 kHz sample rate, the oversampling filters will cut frequencies above 20 kHz. This is a standard side-effect of oversampling and should be considered normal.

Questions and Answers

Q. Why does this plug-in have latency?

A. This plug-in has latency due to the look-ahead analysis algorithms it utilizes. The latency depends on the project's sample rate. At 44.1kHz it equals to 959 samples, and grows steadily with the sample rate.

Q. Whenever I change the “Ch.Linking” or “Trans Time” parameters I see overshoot on the host's output level meter. Is this normal?

A. This is normal – this is a short-time overshoot which is produced due to internal signal routing change when these parameters are adjusted. This overshoot does not affect the overall limiting performance afterwards.

Q. Is it just my ears, or does Elephant actually filter out low-end frequencies to attain the higher levels? It seems to have “thinning out” effect.

A. I would not call that a “thinning out effect”, or at least it is not intentional. It's simply a normal effect of limiting where lows are more heavily affected (lowered in volume due to the high amplitude) than highs (which are, to begin with, are usually lower in amplitude than the lows).

If you end up losing some lows, it is suggested to lower the “In Gain” or insert a pre-equalizer with some additional gain set on the lows, or some attenuation set on the highs.

With limiters, pre-equalization is the only way to get the desirable frequency balance after limiting is applied. You can also try to use the “Clip” limiting mode which tends to preserve the lows at the expense of higher overall harmonic distortion.

Q. How much version 3 of Elephant is different from version 2, sound-wise?

A. Version 3 of Elephant recreates sound of version 2 for the most part except minor corrections and enhancements like the “Knee” control and the “EL Dyn” type selection.

It should be also noted that preset format of version 3 is incompatible with version 2 presets, but both version 2 and version 3 plug-ins can be used in the same project without conflicting each other, allowing for a smooth transition from version 2 to version 3.

Q. Do you have any recommendations on the most usable “Trans Time” and “Trans Shape” values?

A. These settings must be selected according to the sound material you are processing. The best way to select some appropriate values is to first overload the Elephant with a high “In Gain” setting. There will be much distortion coming from the plug-in overall, but this is not what you are looking for. In this overloaded mode

you can select both the “Trans Time” and “Trans Shape” values and hear the difference obviously. Values that sound best for the high gain will sound good for the normal gain, too. The “Release” knob can be tuned last, after you have set the “In Gain” to its final position.

You can also use this general tuning sequence:

- Select a desired “In Gain” value.
- Select an appropriate “Trans Time” value. For example, heavy and punchy music needs a lower transient time value. Ballads and soft orchestral-like music usually need higher transient time values to preserve transparency.
- Select an appropriate “Trans Shape” value. Negative values sound “softer” while positive values sound “harder”.
- Set the “Out Gain” value so that the output signal level generally does not go above -0.1 dB.
- Select an appropriate “Release” value. At this stage additional clarity can be achieved. Higher “Release” values usually provide better overall clarity.

Q. I wanted to ask, have you ever considered a next version of Elephant that would have an absolute ceiling (like the L2 does)?

A. Note that the “Out Gain” knob works exactly like a ceiling control, the only difference is that it is a knob – not a slider.

Q. Is AIGC supposed to set the optimal Input gain? Should I take it, that it means it sort of turns the gain down if you overdo it? Is it sort of an intelligent “In Gain” mode?

A. AIGC adjusts the “In Gain” internally, and does it adaptively. It is not supposed to visually adjust the “In Gain” value you specify; it strives to reach that “In Gain” value internally, but at the same time it strives to produce less distortion. In other words, it is exactly an intelligent “In Gain” mode.

Q. I was using the plug-in in the “Clip” mode... Clipping was almost identical to just overloading my DAW!

A. The “Clip” mode is best used with oversampling enabled: this way it will sound much better than a simple overloading you can get from your DAW.

Q. If there are “AIGC” modes available, what is the point of having “EL” modes? Are there certain types of music “EL” modes would work better with or something? Or some sort of other advantage?

A. The “EL” modes can be still useful. As this user guide states, the “AIGC” modes may give some slight pumping. The “EL” mode may work better for the cases where you dislike “AIGC” mode pumping.

Q. How does Elephant handle inter-sample overshoots?

A. Inter-sample overshoots can be handled by Elephant only when oversampling is active. At “4x” oversampling Elephant handles these very well.

Q. I would like to know what the average window Elephant uses to calculate the RMS power?

A. RMS power on the “Statistics” pane is measured for the whole time duration until you reset the meters or restart playback. So, after adjusting various controls you should reset meters to see the recent RMS power.

Q. Is it a bad idea to dither twice? I believe it does actually sound better, though I may be fooling myself.

A. An added dithering noise can sound nice at times. Probably, there can be no general advice regarding dithering and especially noise-shaping: if you like how it sounds then use dithering twice.

Q. I'm looking for help with DC Filters. I would like to understand applications for DC filters.

A. DC filtering is technically useful to apply below 20 Hz. This removes unnecessary low-frequency oscillation and DC offsetting and in some cases allows one to achieve higher undistorted loudness boosts.

Do not forget that a human generally can't hear anything below 20 Hz and that is the reason various weird things may happen in that region due to lack of audible control. If you are not using subwoofers which can reproduce frequencies below 50 Hz during mixing or mastering it may be useful to unconditionally remove low-frequencies below 40 Hz, because you do not have control over these lower frequencies. Otherwise – when playing back your recording on a subwoofer-powered audio system – some unexpected sounds may pop-up.

Q. I noticed you can choose any DC filter frequency desired. Is this a “shelf” number and works as a filter to remove anything below that number or is it a target Hz to remove that frequency only? What is a good practice or starting point for DC filtering?

A. It is a corner frequency, and everything below it will be removed. DC filter is also known as the “High-pass” filter. The “-24 Soft” at 10 Hz is a pretty good starting choice in my opinion.

Q. When setting the bit depth for dithering in Elephant, what setting is best to use? Specifically, I mix down or render at 24 bit and later to 16 bit for CD burning. Because I ultimately end up at 16 bit, would the 16 bit dither setting in Elephant be appropriate?

A. Yes, 16-bit setting would be appropriate, especially if you are not going to use any other dithering/bit depth conversion process after Elephant.

Q. Can I use Elephant also as protection for my monitors and ears? I mean protection against loud sounds when certain other plugs start to scream?

A. Yes, Elephant can be used for this kind of task. For such task, make sure oversampling setting stays at “1x” – this way no CPU power consuming processing other than peak suppression will be taking place.

Q. K metering – what is it?

A. The “K” signal level metering system was introduced by Bob Katz. You may get more information at <http://www.digido.com/>. Before using this metering system, the sound pressure level of your monitoring environment should be acoustically calibrated according to the specified guidelines. Note that when using K metering you should use 600 ms integration time and 600 ms release time level metering parameters.

Q. Can I use Elephant as a dithering plug, switching off all other processing?

A. Limiter processing cannot be switched off in Elephant. But as long as your material does not have peaks above 0 dBFS and oversampling was left disabled, limiter does nothing except consuming CPU a little. Note that you should also set the “Knee” parameter to 0 so that no soft-knee limiting occurs.

Q. In bouncing a few projects now using Elephant in the “Clip” mode I've noticed that the peaks are perfectly flat-topped. Doesn't the “Clip” mode soft clip the peak, modulating the samples around 0dB? Shouldn't there be some variation in the waveform there?

A. The “Clip” mode in Elephant performs “hard” clipping. But Elephant also uses a bit of compression in this mode in order to minimize distortion.

Q. Is there a sense to put Elephant on each channel to prevent overloading?

A. Generally, no. Elephant is a brick-wall limiter and its main purpose is to limit peaks on the final “limited bit depth” output, where values above 0 dBFS do not exist, and to perform limiting in a sonically pleasant manner. Since modern audio hosts have floating point signal paths on each channel there is no need to use limiters on each channel as values below 0 dBFS can be passed safely within host’s signal paths.

Q. I am wondering if it is correct to assume that if Elephant is used more lightly on mixes (say, reducing 2-3 db) as opposed to reducing 4-6 db's, there is more “purity” of sound, i.e., the sound is ultimately less distorted – would that be correct to assume? Is this also part of the "Loudness Wars" debate?

A. Of course, it is always best to apply the lowest gain – working without any gain reduction happening is the best variant even. On the other hand, do not overestimate ear response – in my opinion, it gets accustomed to dynamics in a song and loses

sensitivity to dynamics: from this point of view loudness maximization is not so “evil”. What's bad in it is distortion and change of timbre it usually produces. This is exactly a part of the “Loudness Wars” debate.

Q. I'm not sure if this is the way it works but when going into the Mode editing and changing the transient time the audio stutters as you change the time.

A. This is intentional and unavoidable as this control affects timing of plug-in's internal signal path. You may simply use the keyboard entry for minimal stuttering.

Q. Just wanted to ask about the release control in Elephant 3. When in the disabled state, what does that mean exactly, does the release control just change to a default setting? Or is that actually some kind of auto release mode, or is it the equivalent of release knob level being set to a value of 1.00?

A. When the release stage is left disabled, no release stage is used at all, and so dynamics become more instant.

Q. Should I be using “8x” oversampling when doing final mixes?

A. This can be beneficial, but “4x” is usually enough.

Q. Could you provide some description on what the “Max” and “Inflate” settings do?

A. The “Max” mode usually provides highest overall loudness, but at the expense of higher distortion. The “Inflate” mode provides a modest, but a clean loudness boost with a large compression curve knee.

Q. Why do I get negative “Max Gain Reduction” readings even if there's nothing to limit (peak @ -7 dBFS for example)?

A. Please make sure you have set the “Knee” parameter to 0%. In this case the limiter will not be adjusting the input signal at all and so the “Max Gain Reduction” reading will not be showing gain reduction happening.

Q. When the “Release” switch is disabled (the “Release” knob gets grayed-out), what does that mean exactly, does the release control just change to a default setting (e.g. 1.00)? Or is that actually some kind of auto release mode?

A. When the release stage is left disabled, no special release stage will used at all. This usually produces a considerably different dynamic behavior in the selected limiter algorithm.

Q. Does Elephant use linear-phase filters for DC filtering?

A. The filters available for selection in the “DC Filter” window are not linear-phase, but they offer differing degrees of minimum phase shift depending on the slope and type. The higher the slope, the higher the overall phase shifting. All “Soft” filter types have produce less extreme phase shifting in comparison to the “Steep” filter types.

Q. Is dithering applied after oversampling?

A. Yes, it is applied after the last oversampling stage.

Q. I'm not really into loudness at all, I'm more into vintage music, organic and natural sounds, I wanted to know your opinion about settings for this.

A. For music with contrabass sounds or low strings using a setting with a larger knee could be preferable.

Q. Am I right in that I hear that limiting shrinks stereo-field a bit?

A. Yes, you are right with this observation. This is easily described mathematically. Widest stereo-field signal can be defined as having zero correlation between left and right audio channels. When stereo-linked limiting happens, the audio signal in both channels is multiplied by the transfer function that is based on a maximum of both signals. This in turn increases correlation between channels leading to a narrower stereo-field impression. This effect cannot be avoided other than by decreasing the stereo-linking parameter in the limiter mode editor.

Q. DC offset measurement tools show that Elephant introduces DC offset when it is limiting a signal.

A. This is to be expected since all dynamic range adjustment processes introduce a small amount of DC offset. This DC offset appears by the virtue of mathematics, not due to an error in Elephant. This DC offset is not constant and is added only when limiting (dynamic range compression) actually happens on peak levels. Note that you won't be able to remove this DC offset without introducing new signal level overshoots.

Q. I seem to get signal level overshoots over 0.0 dBFS when not using the Clip mode. I was expecting Elephant to suppress metering overshoots completely.

A. Overshoots may still be present if the level meter you are using detects the inter-sample overshoots. To fully suppress inter-sample overshoots you should use at least 4x oversampling in Elephant.

Happy Mastering!