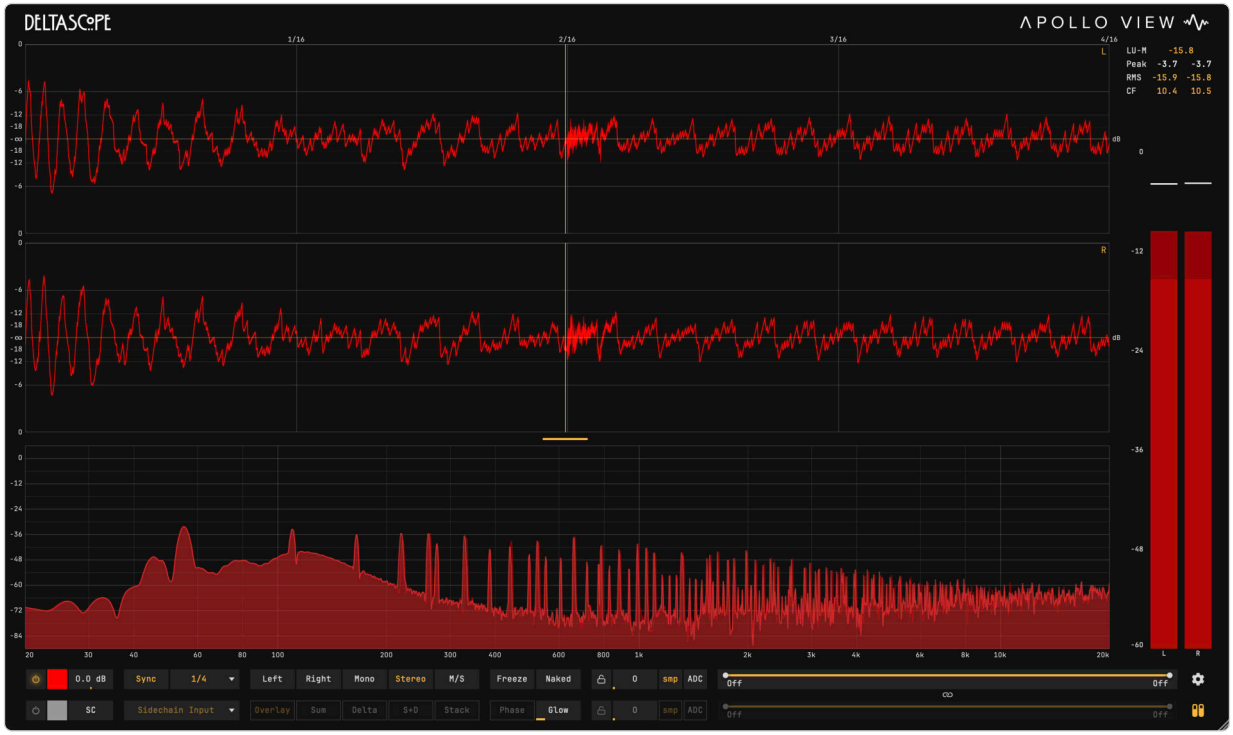
DELTASCOPE

SEE THE DIFFERENCE



MANUAL V1.2

APOLLO VIEW

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INTRODUCTION

WHAT IS IT?

Oscilloscope and spectrum analyser, with a second input and a difference view.

DeltaScope draws your audio as it happens. The waveform is at the top of the window and the spectrum analyser is below it. A divider between them sets how much of the window each one gets, and you can close either one to give the other the whole window. A new instance starts slim, showing the scope alone; the analyser appears as soon as you make the window taller. The stretch of audio on screen can follow the beat, span a set length of time, or lock to the cycle of the note you're playing. DeltaScope can also show a second signal at the same time: a reference from the sidechain input, or from another DeltaScope anywhere in the project. You can overlay the two, stack them, add them together, or show the delta: the difference between them. The delta appears on screen, and you can also listen to it on its own.

Most of the time you'll live in the scope and the analyser. The delta is there for the moment you need to see what a processor is doing.

WHY IS IT USEFUL?

A scope shows what a meter can't: the shape of a sound, whether a hit lands on the grid line or after it, and whether the low end is one clean wave or two waves cancelling each other. It also shows clipping the moment it happens: flat tops on the waveform, often the sign of a gain stage set too high. The analyser shows the same audio by frequency. The delta shows what a plugin is actually changing. Subtract the original from the processed signal and only the change is left:

- **An EQ**: the delta shows what the curve is really doing, level and timing together. Most EQs are "minimum-phase": they shift the frequencies near each band slightly in time as well as changing their level, and that time shift appears in the delta too.
- **A compressor**: the delta is what the compressor is changing, drawn in time. With make-up gain off, it's the part of the signal the compressor is taking away. Its envelope rises and falls with the gain reduction, and it is larger where the signal itself is louder. You see how much of each transient passes before the gain reduction starts, and how far the gain recovers between hits. That's the compressor's attack and release, as a waveform.
- **Which frequencies a processor changes most**: open the spectrum in Delta mode and the peaks are the frequencies where the two signals differ most, in level or in timing. The height of each peak also depends on how loud your material is at that frequency, so a small change on a loud bass can show a taller peak than a larger change on quiet high frequencies. A peak means *changed*, not necessarily removed: an exciter adds, a compressor mostly takes away. Either way, the delta shows you where the change carries the most energy. The Magnitude view, described next, removes that dependence on the material's level.

Delta's Magnitude view draws the frequency response of whatever processing is between the two signals: how much it boosts or cuts at each frequency. That's an EQ's actual curve, traced live on your own material wherever the material has energy, with no test signal involved.

DeltaScope is made by Apollo View Modular. We build Eurorack modules and audio plugins, and we like a tool that knows its job and looks good doing it.

WHAT IT DOES TO YOUR AUDIO

Nothing, unless you ask it to. DeltaScope passes the signal through unchanged and reports zero latency to your DAW. Once it's licensed, the only things it can do to your audio are let you hear the delta, or the sum. Hear the Delta is on by default. When you choose the `Delta` comparison mode, the plugin's output becomes the difference signal: you're listening to what a processor is changing. `Hear the Sum`, off by default, does the same for the `Sum` comparison mode: the output becomes the two signals added together. Choose any other comparison mode, or switch the monitor switches off in Settings > General, and the output is the unchanged track again. Nothing else in the plugin changes the sound. Gain and the band filters change only what's drawn, never what passes through. The alignment offsets move the traces in time on screen. While you're hearing the delta or the sum they also change that signal, because both are taken from the two signals after alignment. (Without a licence, demo mode also mutes the audio briefly at intervals; see Demo mode.)

FEATURES

- **Delta**: subtract a reference from the track and see what differs; identical signals draw a flat line
- **Hear the Delta**: listen to the difference signal on its own, isolated in your monitors
- **Hear the Sum**: listen to the two signals added together, so Sum and Delta become a one-click polarity check
- **Magnitude view**: the live frequency-response curve of whatever processing is between the two signals, drawn from your own material; no test signal needed
- **Instance linking**: compare against another DeltaScope in the project (same plugin format), picked by track name; no routing needed
- **Sidechain input**: route a reference into it, the same way you route a key signal to a sidechain compressor
- **Comparison modes**: Overlay, Sum, Delta, S+D and Stack, against either kind of reference
- **Alignment**: offset either signal in samples or ms, to single-sample precision, or type a chain's latencies as a sum; ADC (auto delay compensation) measures a chain's latency for you, on either signal row or across linked instances
- **Multi FFT**: multiresolution analysis that resolves sub-bass detail without slowing the rest of the spectrum
- **Spectrum analyser**: FFT from 2048 to 65536 points, peak hold, tilt, crosshair with note and level readouts
- **Phase correlation**: the track against the reference, shown along the waveform, so you see where they are in phase and where they cancel
- **Band filters**: zero-phase high-pass and low-pass on main and sidechain, linkable
- **Level meters**: sample or true (inter-sample) peak, momentary, short-term and integrated LUFS (ITU-R BS.1770), RMS, crest factor
- **Mid-Side**: Mid (sum) and Side (difference) in stacked lanes, alongside Left, Right, Mono and Stereo
- **MIDI note-lock**: send it the note you're playing and the window sizes itself to that pitch and holds the wave still; synth tuning at any pitch, without touching a slider
- **Freeze**: hold the picture while the audio keeps playing, then zoom, pan and measure it at leisure
- **Zoom and measurement**: zoom to 64×, pan, and click-drag measurement with frequency, note and level readouts
- **Naked mode**: hide every control and border for a clean overlay in videos, tutorials and livestreams
- **Export**: high-resolution image export, and settings export/import for moving between machines
- **Everything in our free oscilloscope, Scope**: beat-synced and Free-run display, clip indicators, Rolling mode, resizable to 4096 x 2160

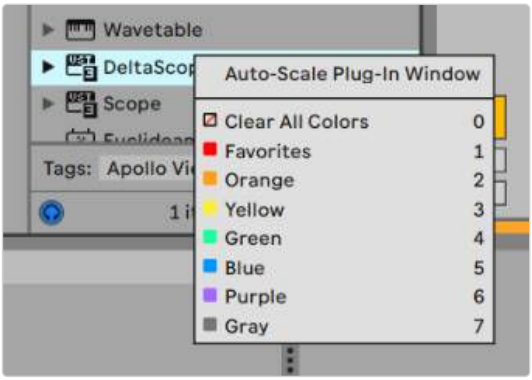
SYSTEM REQUIREMENTS

Requirement	Minimum
OS	macOS 13 (Ventura) or later, or Windows 10 or later
Mac	Any Intel or Apple silicon Mac that runs macOS 13
PC	Any 64-bit PC that runs Windows 10
GPU	Any GPU with OpenGL 3.2 support
Formats	VST3, AU, CLAP, AAX (AU is macOS-only)

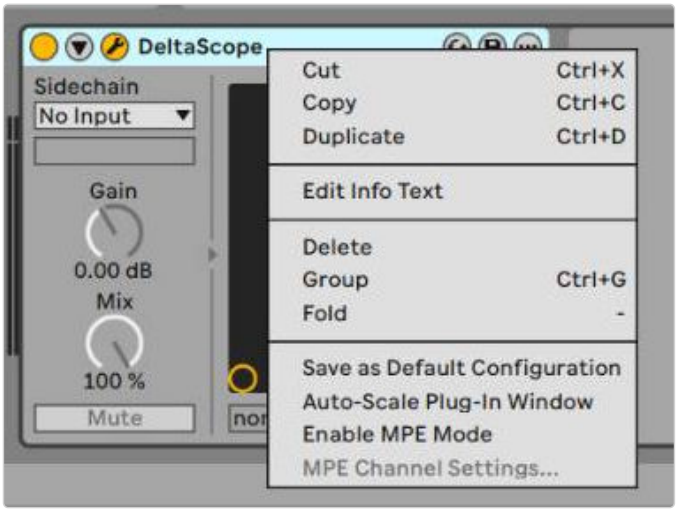
ABLETON LIVE ON WINDOWS

On Windows, Live enlarges every plugin window by your desktop's scale factor. That's Live's `Auto-Scale Plug-In Window` setting, and Live ships with it ticked (on) for every plugin. DeltaScope draws at the screen's real resolution, so Live's enlargement only blurs it: for DeltaScope you want this setting unticked (off). Right-click the plugin in Live's browser and click `Auto-Scale Plug-In Window` so it's unticked — that covers every instance you add from then on. For an instance already in your set, right-click the device's title bar and untick the same entry there. If you're unsure, open the menu again: no tick beside the entry means Live is leaving the window alone.

The setting is per plugin, so if you use Scope as well, untick it for Scope too. Live also ticks it again whenever the plugin is updated, so expect to repeat this after installing a new version. If the display goes soft again, with a thin light line along the top of the scope, the setting is back on.



In Live's browser: right-click the plugin, untick `Auto-Scale Plug-In Window`.



Or on an instance already in the set: right-click the device title bar.

QUICK START

1. Install, open your DAW, insert DeltaScope on a track.
2. The first time you open it you'll see the activation screen. Enter your email and licence key and click `Activate`, or click `Continue in demo mode` to try everything first (see Demo mode).
3. Press play. The timebase starts in Sync at the 1/4 division, so one beat holds still against the grid.
4. DeltaScope opens slim: a scope on its own, the same shape as our free Scope. Make the window taller and the spectrum appears below the scope, with a gold pill between the two. Drag the pill to set how much of the display each pane gets; drag it to the bottom to show the scope alone, or to the top to show the spectrum alone.
5. To compare two signals, add a second DeltaScope on the track you want to compare against (no routing needed), or route a reference into DeltaScope's sidechain input the same way you'd route a key signal to a sidechain compressor.
6. Press `SC` the source picker beside it is greyed out until SC is on. Pick the other instance by track name, or `Sidechain Input`, then click `Delta`. The display now shows the difference between the two signals. Hear the Delta is on by default, so the difference is also what you hear: the processing on its own, with everything the two signals share cancelled out.
7. If the two signals are identical they cancel completely, a "null": the line is flat and the output silent (see The perfect null in Delta and Hear the Delta). Click `Overlay` and the output is the unchanged track again.

> **TIP:** The quickest way to learn the controls is to hover over them: with tooltips on, every control describes itself in the title bar.

OVERVIEW

DeltaScope, numbered to match the key.

KEY

1 Main row: power, waveform colour, gain.

2 Timebase: Sync / Free / MIDI, with the division, window or octave beside it.

3 Channel modes: Left, Right, Mono, Stereo, M/S.

4 Freeze and Naked.

5 Main alignment: padlock, sample offset, units, ADC.

6 Main band filter (HP/LP handles) and band link.

7 Sidechain row: power, colour, SC, source picker.

8 Comparison modes: Overlay, Sum, Delta, S+D, Stack.

9 Phase and Glow.

10 Sidechain alignment and band filter.

11 Settings cog and meters button.

12 The divider: the gold pill between the panes. Drag it to set how much of the display the scope and the spectrum each get, or drag it to either end to show one pane alone.

13 The display: scope lanes above, spectrum pane below.

The top row of controls belongs to the **main** signal, the bottom row to the **sidechain**. Everything above the controls is the display, and it's two panes: the scope, and the spectrum analyser under it. You can drag the divider between them (see Two panes, one divider).

RESIZING

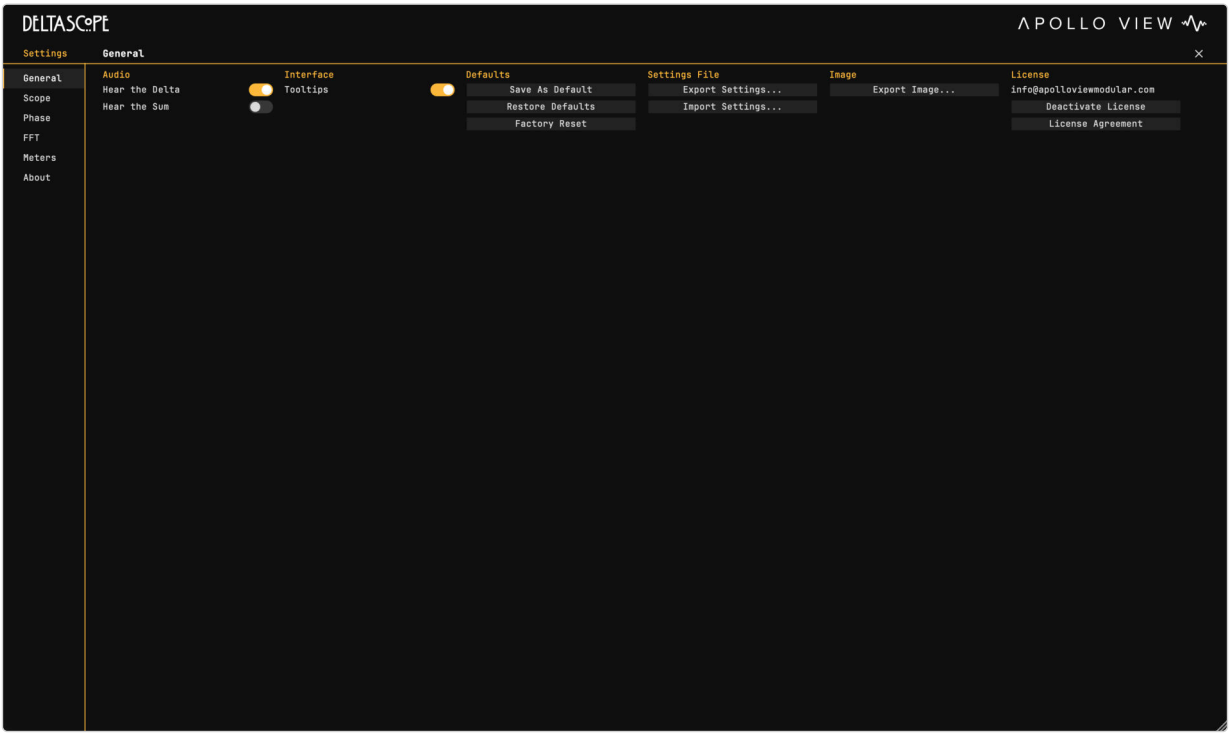
Grab any edge or corner and resize. DeltaScope works from 1230 x 300 pixels up to 4096 x 2160, so a full-screen analyser fits on a 4K display; on anything larger than 4K the plugin window stops growing at 4096 x 2160. The size is remembered per instance, and `Save As Default` in Settings makes your preferred size the default for new ones.

SLIDER GESTURES

Every value slider responds to the same gestures. Drag it to adjust: the faster the drag, the more the value changes. A plain click never jumps the value to the click point. Click it to type an exact value (Enter commits, Esc cancels). Alt-click resets it to its default. The mouse wheel also adjusts it: slow wheel clicks change the value in fixed steps; a fast spin moves it a long way across the range. The two-handle band sliders are drag-only. On Windows, Alt is simply the Alt key; on a Mac it's the key marked Option. The plugin's own tooltips say Alt, so we do too.

SETTINGS AT A GLANCE

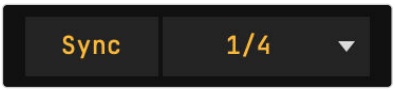
The cog at the bottom right opens Settings over the display. The pages are listed down the left — `General`, `Scope`, `Phase`, `FFT`, `Meters` and `About` — and clicking a name opens that page. Every change applies as you make it. Close it with the × at the top right, or with Escape. Each feature's Settings page is explained in that feature's chapter; the Settings chapter covers the rest — saving defaults, moving settings between machines, and exporting the display as an image.



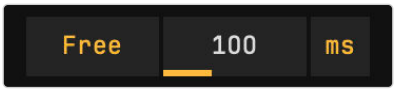
Settings, open on the General page: the pages listed down the left, the × at the top right closes it.

TIMEBASE

The timebase decides how much time the screen spans, and what the display is locked to, if anything. The mode button cycles `Sync`, `Free` and `MIDI`.



Sync: the beat-division menu.



Free: the window slider and its units button.

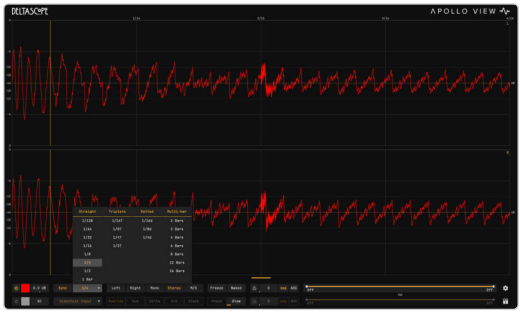
MIDI: the octave slider.

SYNC

Locks the display to the host's tempo and transport, so a beat or a bar stays in the same place against the grid, and the same hit is drawn in the same place on every repeat. The beat-division menu sets how much time the screen spans: short divisions to study the shape of a single hit, 1/4 for a beat, multi-bar spans to watch dynamics across a phrase.

Group	Divisions
Straight	1/128, 1/64, 1/32, 1/16, 1/8, 1/4 (default), 1/2, 1 Bar
Triplets	1/16T, 1/8T, 1/4T, 1/2T
Dotted	1/16d, 1/8d, 1/4d
Multi-bar	2 Bars, 3 Bars, 4 Bars, 6 Bars, 8 Bars, 12 Bars, 16 Bars

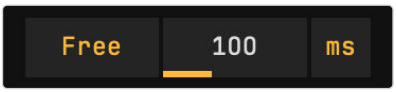
Every instance reads the same host position, in every timebase mode. That's why traces on different tracks line up on the same grid, once any plugin latency ahead of them is compensated (see Alignment). It's also what lets a linked instance (see Sidechain) align its audio with yours once the transport has run.



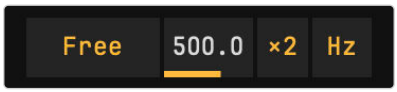
The beat-division menu.

FREE-RUN

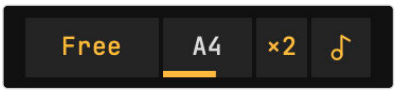
Free-run unlocks the display from the tempo, for audio with no transport or tempo to lock to: a synth you're playing by hand, hardware running on its own clock, a sample you're auditioning.



Free in time units: the window length and the units button.



Free in frequency units: the frequency, the cycle button and the units button.

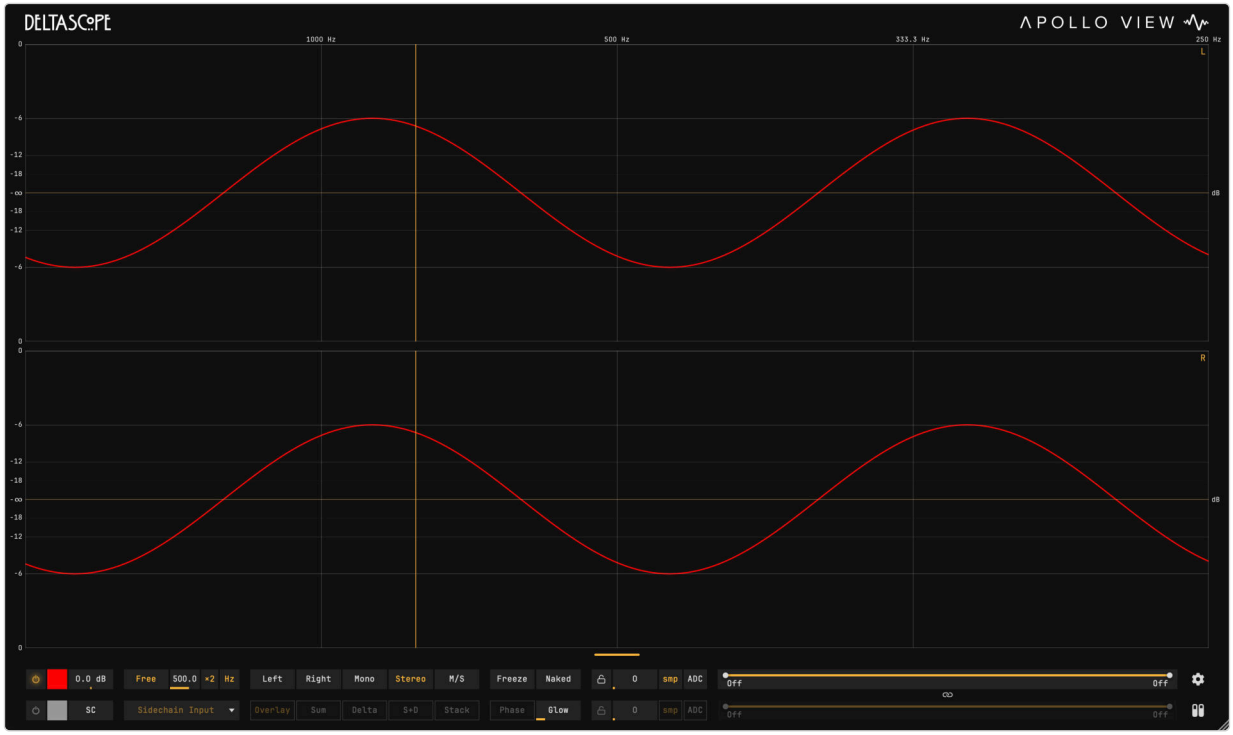


Free in note units: the note, the cycle button and the units button, now showing the note glyph.

- **Window**: the slider sets how much time the screen spans, 10 ms to 10 s. Click it and type — “250”, “250 ms” or “1.5 s” — and Alt-click returns it to 500 ms. From one second up the readout switches to seconds: “1.50” is 1.5 s.
- **Units**: the gold button at the end of the slider changes what the slider sets: a length of time, a frequency or a note. Click it to cycle through the three. It always shows the unit you’re in: `ms` or `s`, `Hz` or `kHz`, or a note glyph. It stays gold in every mode because it’s a button, not a label.
- **Frequency**: dial or type a tone’s frequency, up to 10 kHz (you can type “2k”; from 1000 Hz the readout is in kHz), and the window holds a whole number of its cycles. Alt-click resets to 500 Hz. The lowest frequency depends on the cycle count, because the whole window can never be longer than ten seconds: 0.1 Hz at ×1, 0.2 Hz at ×2, 0.4 Hz at ×4.
- **Note**: the same idea with the arithmetic done for you: for a bass line in E you pick E1 instead of working out that it’s 41.2 Hz. Pick the note, C0 to C8 a semitone at a time (A4 is 440 Hz). Type a note name, “C#2” or “Db2”, or type a frequency and the nearest note is chosen. Alt-click resets to A4. The grid labels stay in Hz.
- **Cycles**: in frequency and note units, the button between the value and the units button sets how many cycles of the tone fill the screen: `×1`, `×2` or `×4`. Two by default; Alt-click returns it to ×2.

> **PRO TIP:** Two cycles are easier to read than one. A free-running sweep starts at whatever point of the wave the audio has reached: with one cycle on the display, the shape’s recognisable features are split between the two edges, and there’s no repeat to compare against. That’s why the cycle button defaults to `×2`. The MIDI octave slider is the same idea, driven by the played note instead of a value you set: MIDI starts at one cycle, and setting its octave slider to −1 shows two (see MIDI).

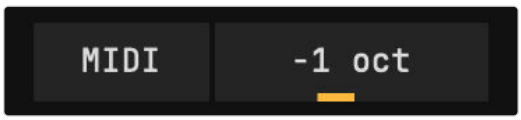
Free-run makes no attempt to hold the waveform still; each sweep draws the latest stretch of audio. A real tone is rarely at exactly the frequency you dialled in, so the stretch on screen is rarely a whole number of the signal’s actual cycles. Each sweep then starts at a slightly different point in the cycle, and a steady tone drifts slowly across the screen. Holding it still is what MIDI note-lock is for.



Free-run in Hz units at the ×2 default: the frequency set to 500 Hz for a 500 Hz tone, and two whole cycles filling the screen.

MIDI

`MIDI` locks the window to the note you're playing. Send MIDI to DeltaScope's input and the display sizes its window to one cycle of that note's pitch; the octave slider widens or narrows the window in whole octaves, −4 to +4. At −1 the window is sized for the note an octave below, so two cycles of the played note fit; at +1, half a cycle.



The octave slider at −1: two cycles of the held note.

This is the mode for synth tuning: hold a note and see its actual cycle shape at any pitch, without adjusting any slider.

MIDI setup by DAW

Getting notes into DeltaScope usually takes one routing step. In most hosts the notes on an instrument track go to the synth and stop there; the effects after it never receive them.

REAPER: REAPER passes MIDI along the FX chain, so no extra routing is needed.

1. Insert DeltaScope on the instrument's track, after the synth. It already receives the notes.
2. To send it notes from a different track instead, add a send from that track to DeltaScope's track and enable MIDI on the send.
3. Play a note and click the mode button until it reads `MIDI`.

Ableton Live: the notes have to be sent to DeltaScope from a MIDI track.

1. Create a MIDI track carrying the same notes as the instrument: duplicate the clip onto it, or point the instrument track's `MIDI From` at the new track so one clip plays both.

2. On the new MIDI track, set `MIDI To` to the audio track hosting DeltaScope, then choose DeltaScope in the second chooser beneath it.
3. Play and click DeltaScope's mode button until it reads `MIDI`.

Logic Pro: MIDI routing is not possible. Logic sends notes only to plugins loaded in a track's instrument slot, never to an effect sitting in the Audio FX chain, which is where DeltaScope runs. This is what Free-run's note units are for: set the timebase to `Free`, click the units button until it shows the note glyph and pick the note you're playing. At `×2` two cycles fill the screen, framed the way the note-lock would frame them. Without the lock the picture drifts slowly rather than standing still, but there's nothing to route and nothing to work out.

Other hosts: anything that can route a MIDI track's output to an effect plugin can send notes to DeltaScope's MIDI input. A host that only sends MIDI to instruments can't; there, use Free-run in note units with the note picked by hand, as for Logic.

A held C3 saw, note-locked: the window is sized from the note's pitch and snapped to the same point in the wave on every redraw. The picture stays motionless, even from a source that drifts in pitch.

The octave slider at −1: the same locked note with two whole cycles framed, the MIDI-mode version of ×2.

A locked wave can be measured like a frozen one (see Zoom, pan and measurement): drag across a cycle for its frequency, nearest note and level. The edges snap to the *fundamental's* zero crossings; on a saw that's the reset itself, so the selection runs from one reset to the next.

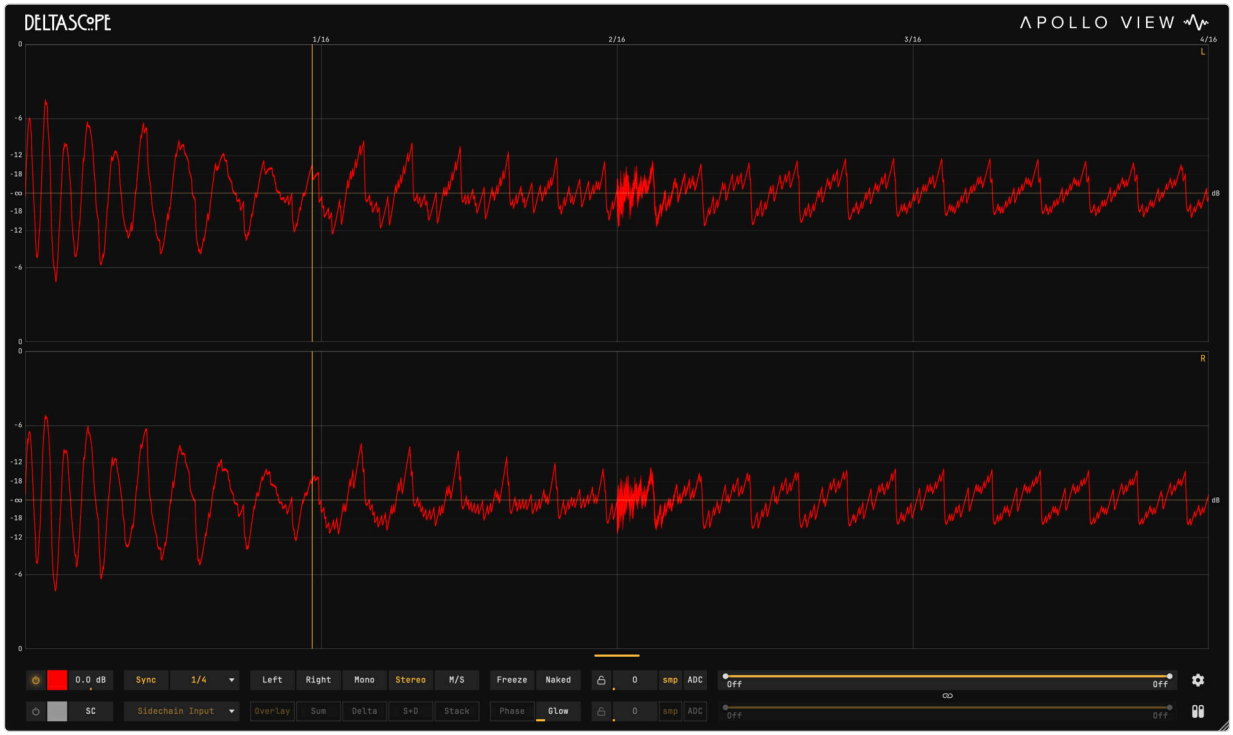
On every redraw, DeltaScope finds the same rising zero crossing of the wave (the same upward crossing of the centre line) and places it at the same position on screen, to within a fraction of a sample. It ignores the small variations that noise adds around that point, so it's

far less likely to pick the wrong crossing. That's why a note stays motionless on screen even from an analogue source that drifts in pitch.

If the display glitches after you change MIDI routing, DeltaScope may still be holding the last note it received. Play a fresh note and it locks again.

The octave slider moves one octave per unhurried wheel click — a fast spin accelerates through more — and dragging it steps through the octaves with no acceleration.

THE DISPLAY



Stereo lanes in Sync at 1/4: one beat against the 1/16 grid, with the cursor marking where the newest audio is being drawn.

DeltaScope draws the incoming waveform against a dB-calibrated grid:

- **Amplitude labels**: the dB levels of each lane, down to the minus-infinity centre line.
- **Time labels**: beats in Sync. In Free-run's time units, the elapsed time; in Hz or note units, the frequency of the tone whose cycle lasts that long. No time labels in MIDI: the window is one cycle of whatever note you play, so its length changes with the pitch.
- **Cursor**: the thin vertical line marks where the newest audio is being drawn. Switch it off with `Cursor` in Settings if you'd rather have a clean frame.
- **Lanes**: Stereo splits into L and R lanes, M/S into Mid and Side, and the comparison modes add or merge lanes (see Sidechain).

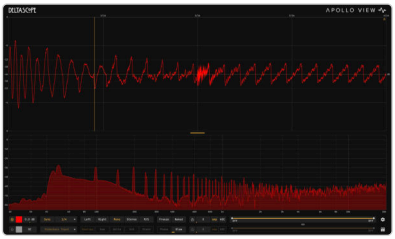
Turn the display gain up or down and the lines and labels move with it, so a label always tells you the real level of the audio, not the boosted picture.

TWO PANES, ONE DIVIDER

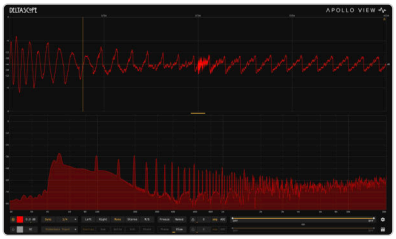
The display is two panes: the scope on top, the spectrum analyser below. You decide how much of the display each one gets. The gold pill on the line between them is a handle: drag it and the split follows your mouse. Near the middle the pill holds for a moment on an exact even split, which is also where a new instance starts; keep dragging and it follows the mouse again. The spectrum can be a small share under a large scope, the two can share the display evenly, or the spectrum can take most of the window with a short scope above it. Each pane has a minimum height: drag past it and that pane closes completely, with a short animation. Push the pill to the bottom and you have the scope alone; push it to the top and you have the spectrum alone. The pill stays where you left it. Drag it back to reopen the other pane.

The divider pill, on the line between the two panes.

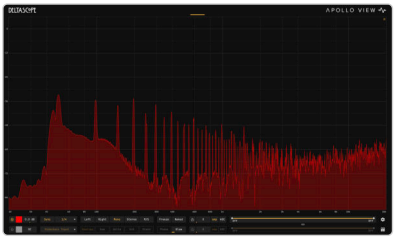
A new instance opens slim on purpose: a scope strip, the right height to leave open on many busy tracks at once, with the spectrum closed. Make the window taller and the spectrum opens beneath the scope as soon as there is room for both panes. You can also stay slim and swap panes instead: drag the pill to the top and the analyser takes the strip in place of the scope. The split is saved with your project per instance, and `Save As Default` in Settings makes your preferred layout the starting point for new ones. Naked mode hides the pill along with the rest of the controls, but keeps whatever split you had.



Both panes.



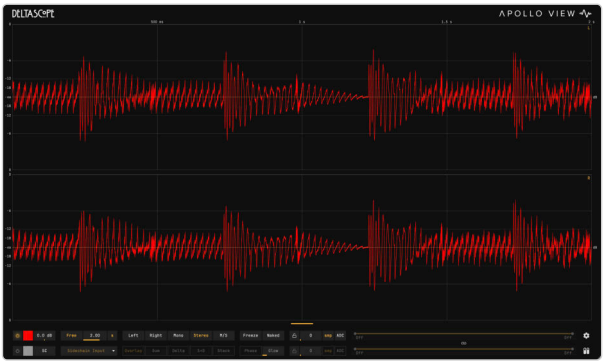
Scope only: pill dragged to the bottom.



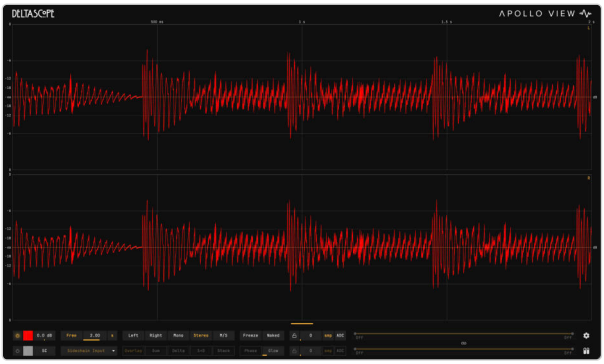
Spectrum only: pill dragged to the top.

ROLLING MODE

Rolling mode scrolls the waveform instead of redrawing it in place: the newest audio enters at the right edge and everything slides left, the way DJ software scrolls a waveform. The display still spans your chosen division, time window or note cycle; only the way the audio moves through it changes. To use it, enable `Rolling` in Settings. Zoom, the cursor, click-drag measurement, the band filters, Glow, the phase correlation display and the MIDI note-lock are inactive while rolling. Freeze a rolling display and measurement works again on the still waveform.



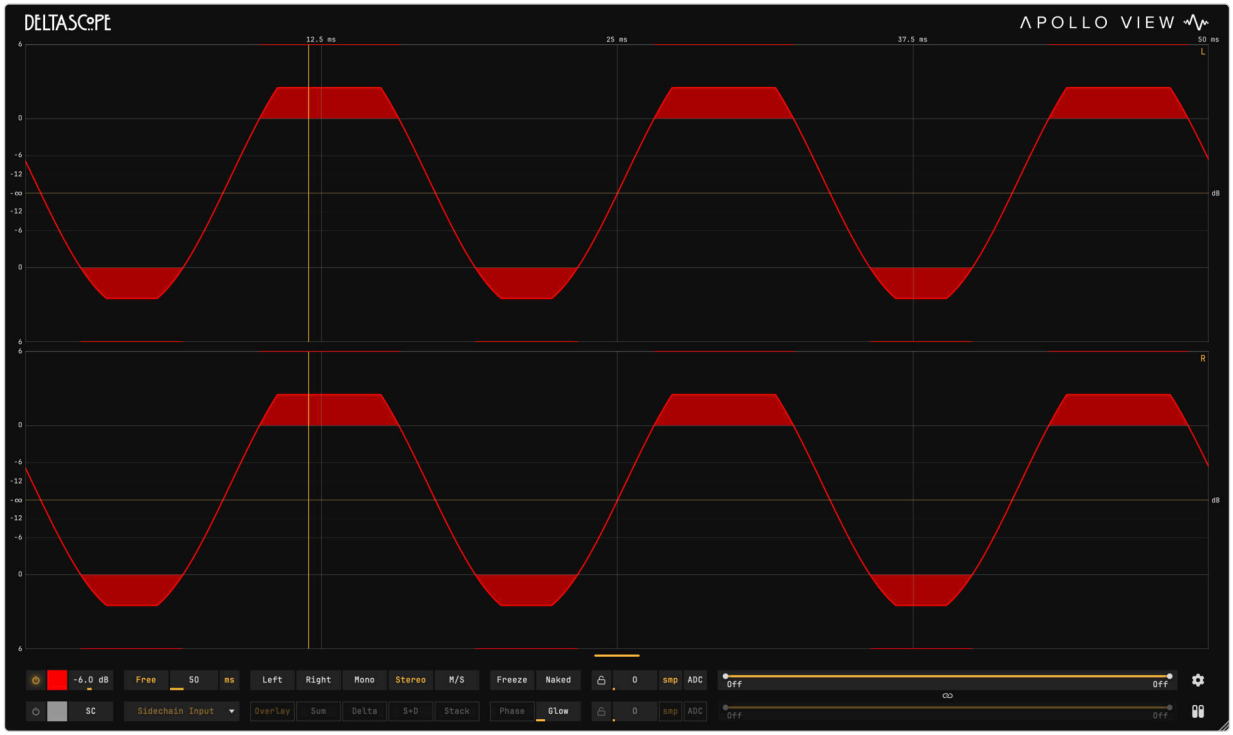
Rolling mode, Free-run at a 2 s window: the newest audio enters at the right edge…



…and a moment later everything has slid to the left.

CLIP INDICATORS

The display edge lights red where samples rise above 0 dBFS: top border for positive clipping, bottom for negative. Samples above 0 dBFS can happen inside a DAW, after a gain stage set too high, for instance. The mixer itself has headroom above 0 dBFS, but your converters and any fixed-point export don't. The clipped stretch of waveform is also drawn highlighted, so it stays visible in place. The border flash and the clip highlight each have their own switch in Settings.



A signal driven above 0 dBFS: border flash at the edges plus the highlighted clip overlay. Display gain at −6 dB keeps the waveform away from the border.

POWER, GAIN AND COLOUR

POWER

The power button switches the main signal's display on and off, both the scope trace and the spectrum curve. It never changes the audio. The sidechain row's power button does the same for the reference. Power buttons are for switching a signal's picture off while you work. They're never saved with the project: reopen it and every trace is on.

Power, colour swatch and the gain slider.

GAIN

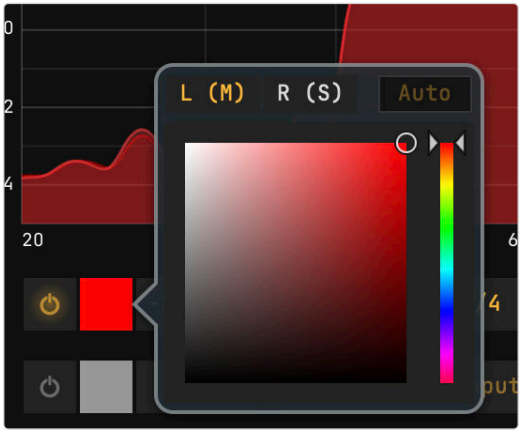
Scales the displayed amplitude, −36 to +36 dB in 0.1 dB steps. It changes only the picture, never the audio. A new instance starts at −3 dB on purpose: many instrument plugins output a signal close to full scale. With 3 dB of headroom, the 0 dB line sits 3 dB inside the border, so a loud signal's peaks are still drawn as a shape instead of a flat line along the top and bottom borders. Alt-click returns it to −3 dB; typing and the wheel behave as they do on every other slider (see Slider gestures).

> **PRO TIP:** Look for overs before you touch the gain. At the −3 dB starting point anything above 0 dBFS still draws as a shape, between the 0 dB line and the border, and the border lights red where it happens (see Clip indicators). Once the level is under control, raise the gain until the waveform fills the lane; the labels follow, so what you read is still the true level.

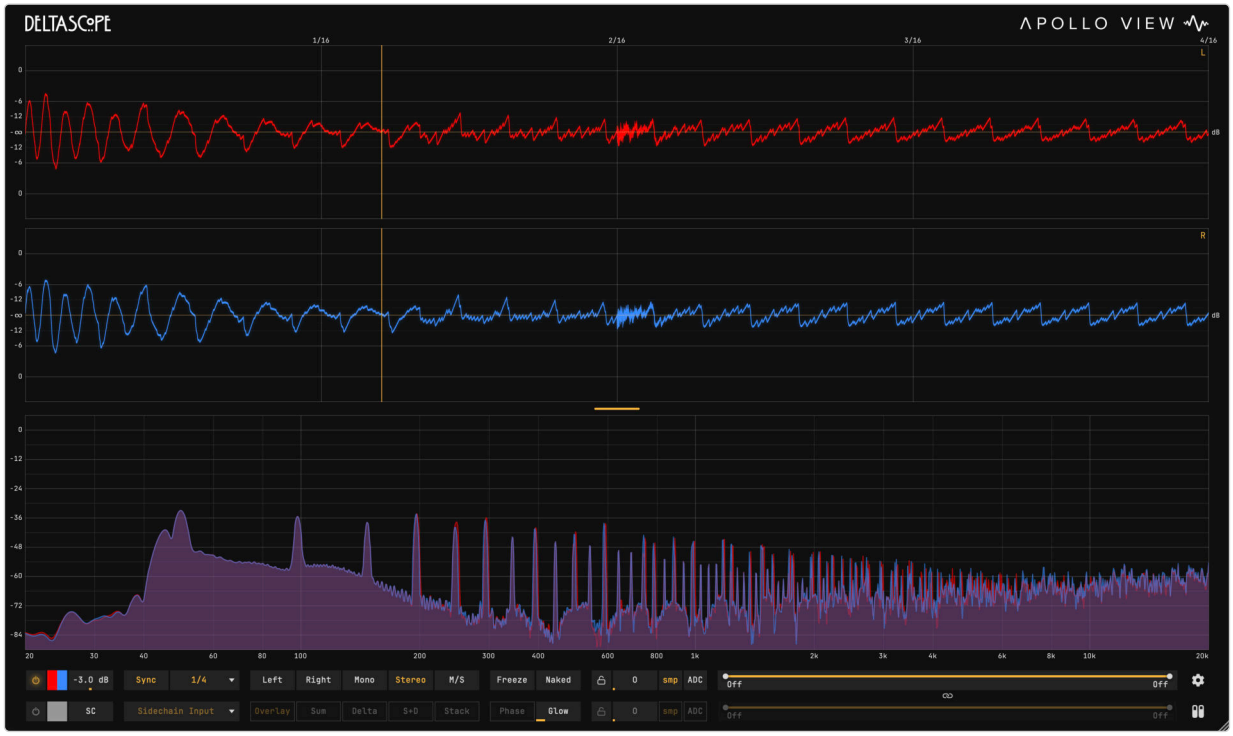
COLOUR

Click the swatch to recolour the main waveform. The sidechain has its own swatch in the row below. Each picker has two tabs. `L (M)` sets the signal's colour. Pick a colour on `R (S)` and the right channel (the side channel in Mid/Side) wears it instead, on the scope and in the analyser; the swatch then shows it as its right half. `Auto` links the second channel back to the first.

The analyser follows the same colours: each curve takes the colour of the signal it carries. With the second channel on `Auto`, the two curves in Stereo or Mid/Side sit either side of your colour, one a little darker and one a little lighter, so they stay apart.



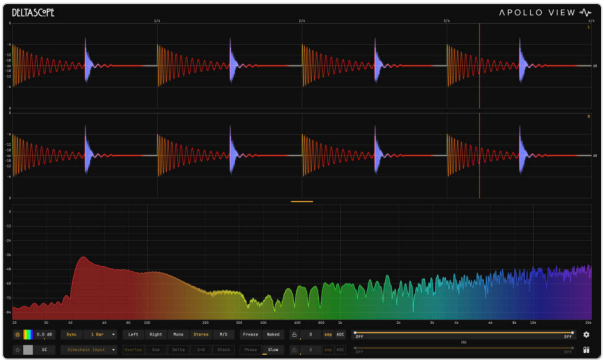
The colour picker, opened by clicking the swatch: the `L (M)` and `R (S)` tabs and `Auto` above the colour field.



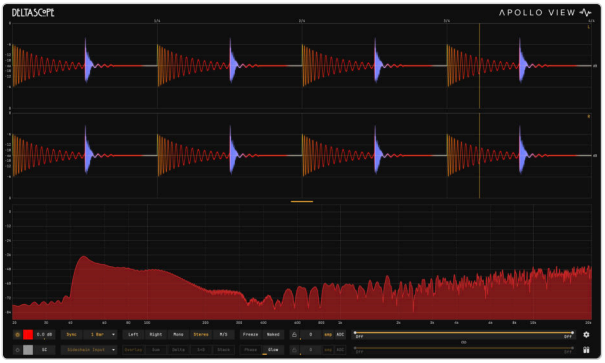
A blue picked on the `R (S)` tab: the right channel wears it on the scope and in the analyser, and the swatch shows it as its right half.

COLOUR BY FREQUENCY

Settings > Scope > Colour by Frequency tints the waveform by what it contains instead of one flat colour. The colours run red through the low bass up to 80 Hz, orange and yellow above it, green through the mids, blue to violet at 20 kHz. It is the same ramp the analyser uses for its own Colour by Frequency (Settings > FFT): switch both on and a note wears one colour on the waveform and on its peak alike. Where several ranges sound at once the colours mix, so a kick reads orange at the hit, a hi-hat violet, and dense full-band material goes pale. It tells you where in the spectrum each part of the waveform lives without opening the analyser. `Main` and `Sidechain` have their own switches, one per signal, and the analyser has its own pair, so a signal can be coloured on the scope, on the analyser, on both, or on neither.

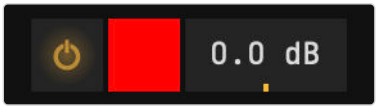


A kick under hats, main signal only, Colour by Frequency on for the scope and the analyser: orange at each hit, violet in the hats, the analyser running red to violet along its axis, and the swatch showing the ramp.



The same audio with only the scope switch on: the waveform is coloured, the analyser wears the swatch's red, and the swatch stays live.

The swatch. A signal's swatch keeps its job for as long as anything still wears its colour. With only the scope switch on, the swatch stays flat and live: clicking it opens the picker as usual, and the colour you pick is what that signal's analyser curve wears (and, for the main signal, the level meters). Only once the analyser colours that signal as well does the swatch go inert and show the ramp; clicking it then does nothing. Switch either display back to flat colour and the swatch returns. Two things on the scope keep the swatch colour for as long as they last: a lane under an active band filter (see Band filters), and the trace while the MIDI note-lock holds it still.



Only the scope colours the signal: the swatch is live, and it colours the analyser curve.

Scope and analyser both colour it: the swatch is inert and shows the ramp.

CHANNEL MODES

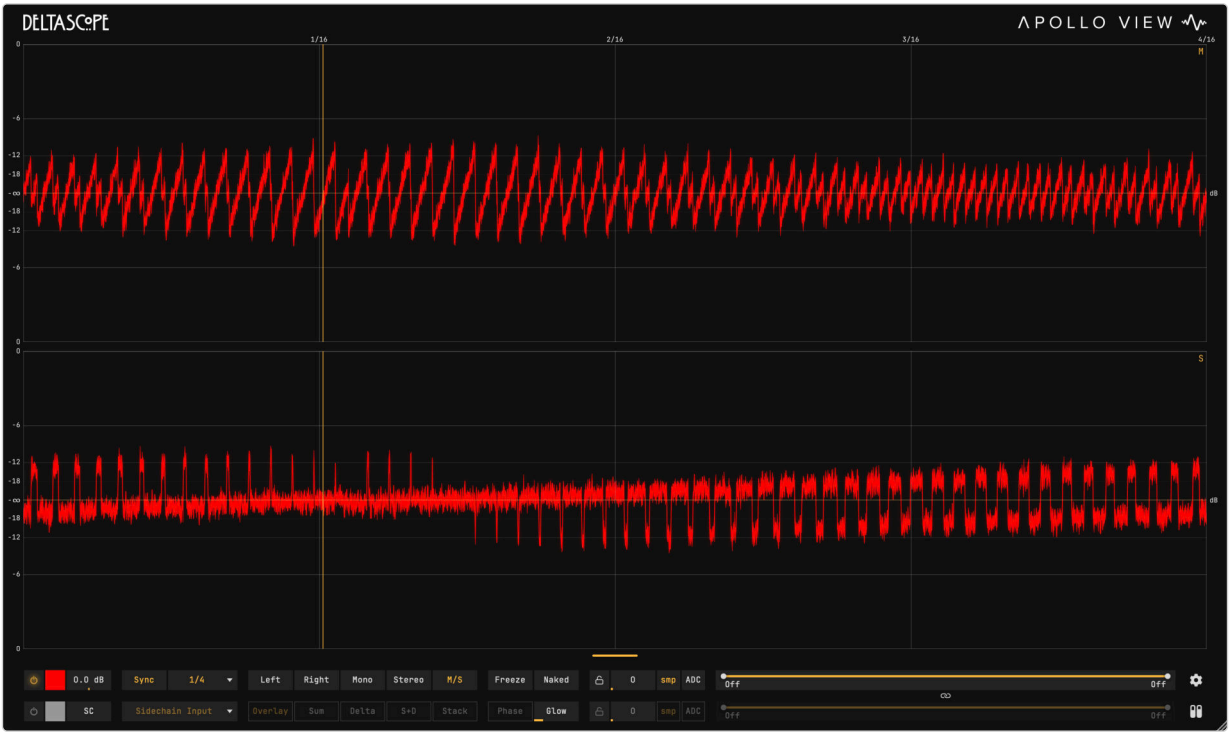
Mode	Shows
`Left`	Left channel only.
`Right`	Right channel only.
`Mono`	The mono average, (L + R) / 2.
`Stereo`	Both channels in stacked lanes. Default.
`M/S`	Mid (sum) and Side (difference) in stacked lanes.

Stereo selected.

M/S selected: the lanes become Mid and Side.

A mono track has only one channel, so DeltaScope feeds it to both lanes: Stereo shows the same trace twice, and Mono, Left or Right give you a single lane of it.

M/S shows you the stereo image directly: anything that exists only in the Side lane disappears in mono playback. To check whether two elements are cancelling each other, route one in as main and the other as reference, then turn on the phase correlation display, which shows where they cancel.



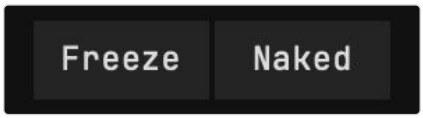
M/S on a wide signal: a Side lane with a lot of signal means a wide image, and anything that appears only in the Side lane is lost in mono.

The low-end mono check that uses M/S is in Use Cases, under Check what survives mono.

FREEZE AND NAKED MODE

FREEZE

`Freeze` holds the picture while the audio keeps playing. A frozen frame can be zoomed, panned and measured. Unfreeze and the live waveform resumes.



The Freeze and Naked buttons, both off.

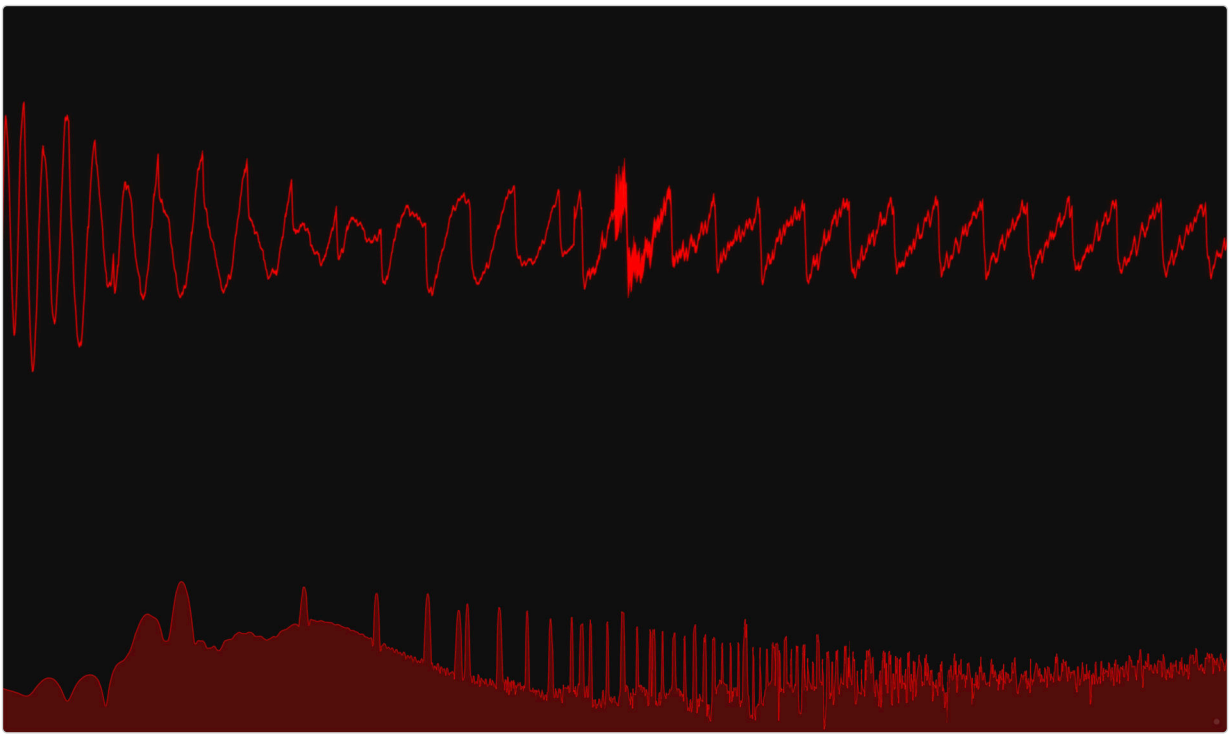
Freeze is per instance and isn't saved with the project, so a reopened project never opens with an old frozen picture.

NAKED MODE

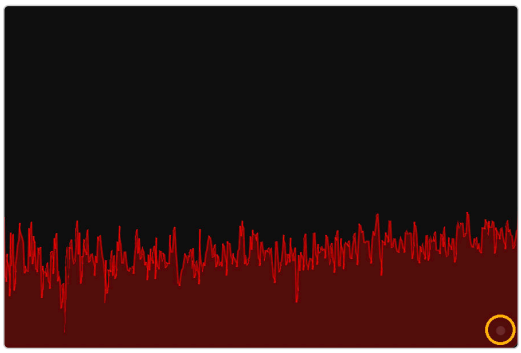
`Naked` hides every control and border, and the display fills the whole plugin window: the waveform, the spectrum, or both, at whatever split you had. For a projector, a second screen, or just concentration.

One dim dot remains in the **bottom-right corner**. Click it (tooltip: "Click to restore controls.") to bring the controls back.

Naked mode works well together with Freeze, and it's made for video. Put the plugin window in a screen recording, or use it as an overlay in a music video, tutorial or livestream.



Naked mode in Mono: waveform and spectrum edge to edge, ready for a video overlay.



Click the dot in the corner to restore the controls. In Naked mode it's the only control left; everything else, the spectrum divider included, is hidden.

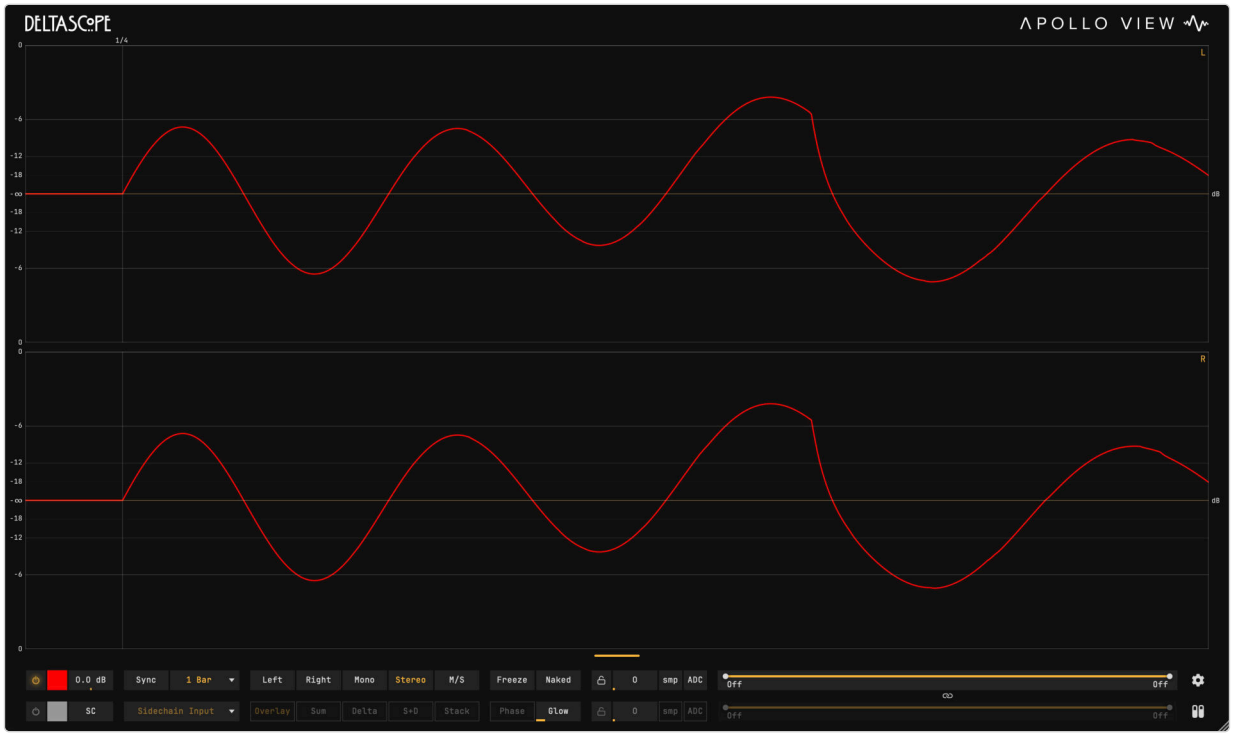
PRO TIP: There's a hidden recording aid. Cmd-Alt-Shift-click the title bar (Ctrl-Alt-Shift on Windows) and the plugin window locks to 16:9 while you resize, so a capture fills a video frame edge to edge with no letterboxing. There's no on-screen indicator; the only sign that the lock is on is that the window keeps 16:9 as you drag a corner. Click the same way to unlock. The lock lasts only while the plugin window is open and is never saved with the project.

ZOOM, PAN AND MEASUREMENT

ZOOM AND PAN

- **Scroll**: zooms the time axis toward the pointer, up to 64×.
- **Cmd-drag** (Ctrl-drag on Windows): pans left and right while zoomed.
- **Double-click**: resets to the full window.

Zoom changes only what you see, never the audio. It works on live or frozen waveforms, but not in Rolling mode. The same gestures work in the spectrum pane, which zooms up to 16× (the next chapter).



Zoomed into the note that starts on the second beat of a one-bar window; whatever is under your pointer stays in place as you zoom. Double-click returns to the full window.

MEASUREMENT

Click and drag across the waveform to measure a region. The selection snaps its edges to zero crossings, and the readout shows:

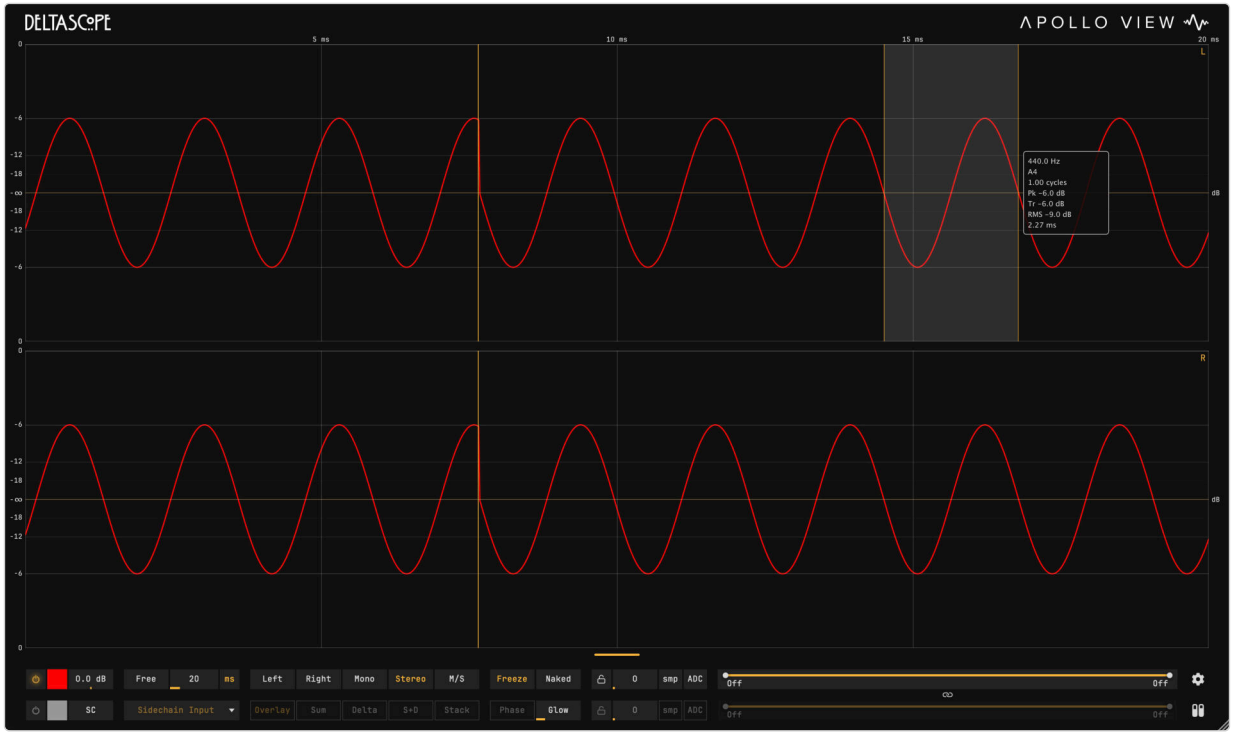
- frequency of the selection (and the nearest MIDI note)
- peak, trough and RMS level in dB
- duration in ms, in beats when the host reports a tempo, and the number of cycles

Zoomed in, drag across what you found. The selection snaps to zero crossings and reads its length and level, plus the frequency and nearest note of the repeating cycle found inside the selection.

Or hold **Alt** and hover. DeltaScope finds where the waveform repeats and selects one full cycle of the note under the pointer for you. It shows the same readout, accurate to within a couple of cents (hundredths of a semitone) on a clean, steady tone.

The selection stays on screen after you let go, until you click the lane again: a right-click clears it, a left click-and-drag starts a fresh one. An Alt-hover selection clears itself when you release Alt. (On a lane too short for the readout, a one-line hint appears instead: “Increase height to see measurements”. Make the window taller, or give the scope more of the split.)

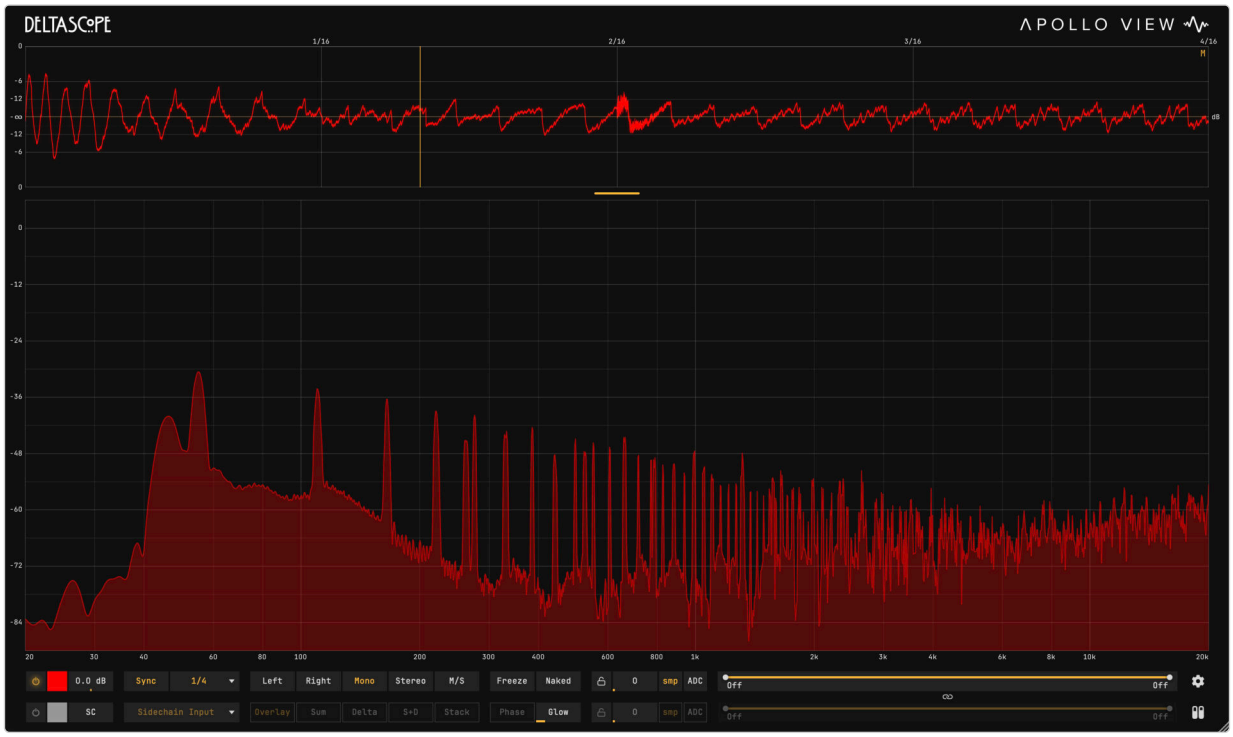
> **TIP:** Measure on a still image. Press `Freeze`, take your time dragging the selection, then unfreeze. On a live display the waveform keeps redrawing under your selection; a looping beat in Sync, or a MIDI-locked note, holds still enough to measure live.



Drag-measuring one frozen cycle of a 440 Hz sine: exactly 1.00 cycles, edges snapped to zero crossings.

SPECTRUM ANALYSER

The scope shows when something happens; the spectrum shows which frequencies it is made of. They answer different questions about the same audio, so DeltaScope can keep both on one screen, or give the whole display to either one (the divider is described under The Display). The analyser is an FFT: the maths that splits a stretch of audio into the frequencies it contains and shows the level of each one. Scroll to zoom, Cmd-drag to pan (Ctrl on Windows) and double-click to reset, as in the scope; the crosshair follows plain mouse movement.

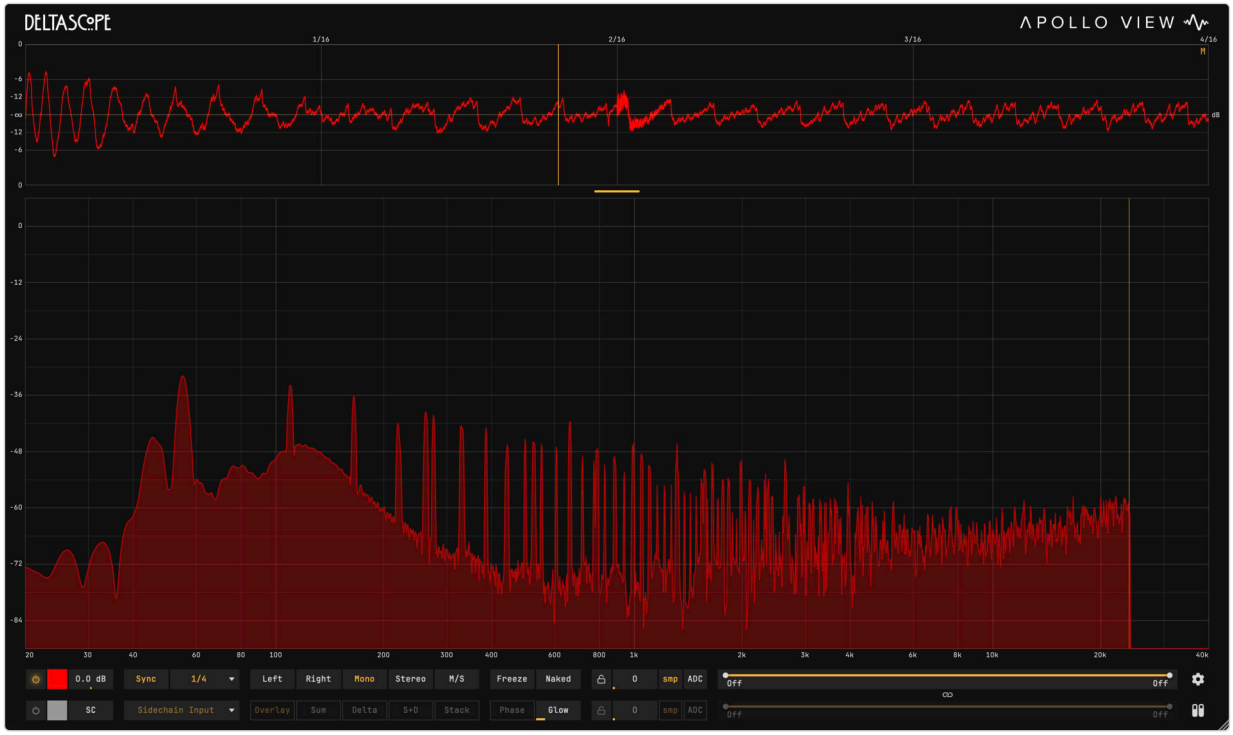


Spectrum pane opened wide (Mono): the live curve, tilted +3 dB/oct so a balanced mix reads flat.

RANGES AND THE NYQUIST LINE

Settings > FFT sets what the pane shows: the **frequency range** (`Min` , adjustable 1 to 100 Hz, default 20 Hz; `Max` , adjustable 6 kHz to 96 kHz, default 20 kHz) and the **level range** (`Floor` , −120 to −30 dB, default −90; `Ceiling` , −24 to +30 dB, default +6). Widen the level range to watch noise floors; narrow it to compare mix balances.

Raise `Max` above half the project's sample rate and a gold vertical line appears at **Nyquist**, the frequency where the digital spectrum ends. Nothing exists to the right of it. In a 48 kHz project it is at 24 kHz; at 96 kHz, at 48 kHz.

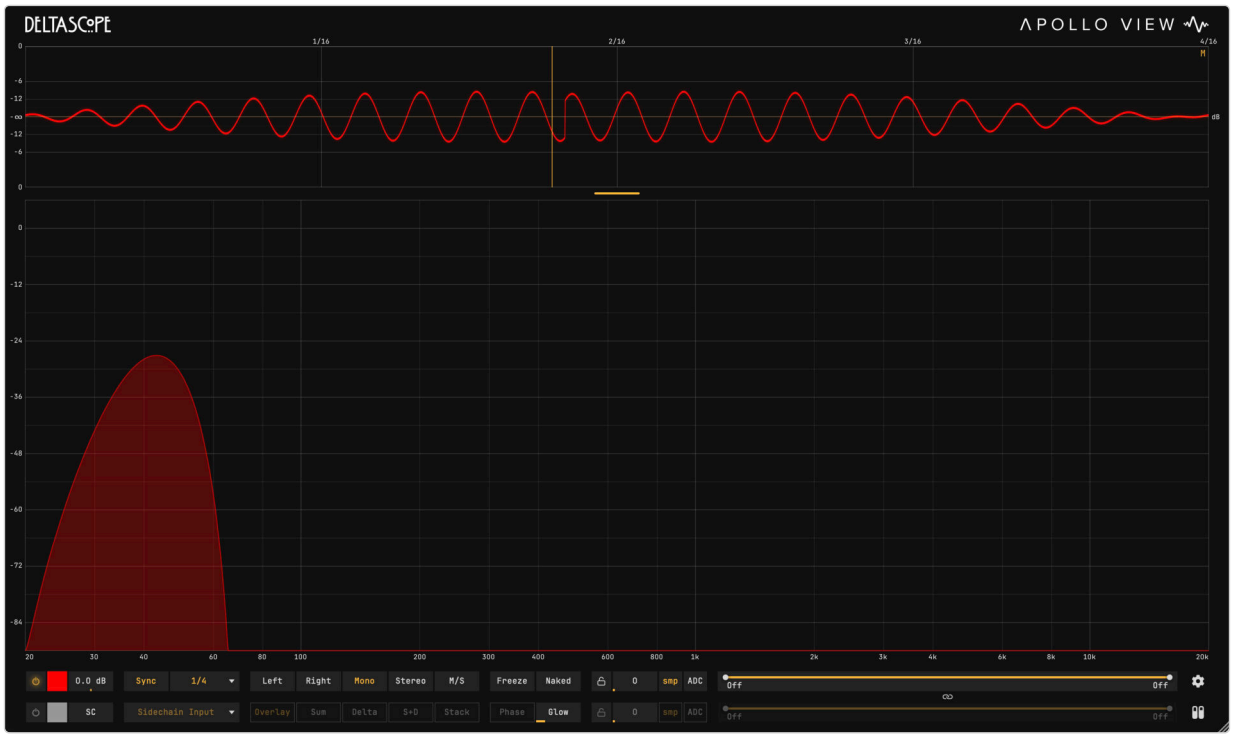


Range extended to 40 kHz in a 48 kHz project: the gold Nyquist line at 24 kHz marks the edge of the spectrum.

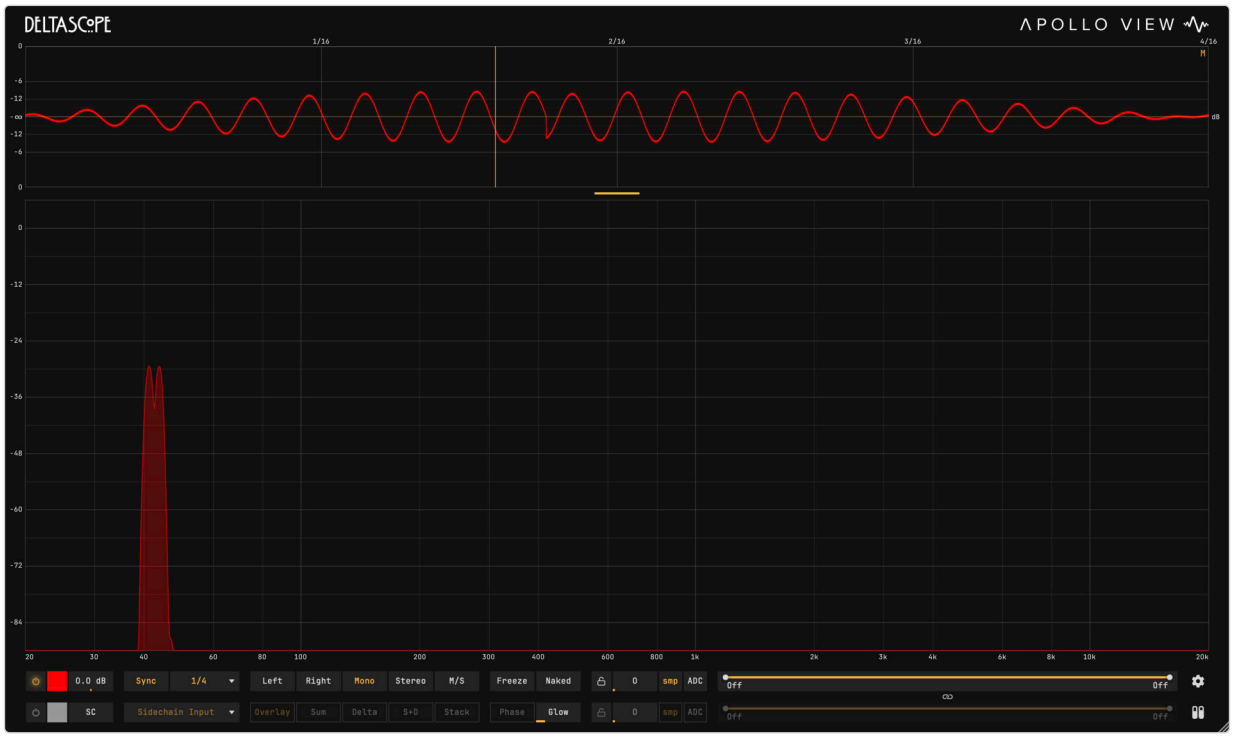
RESOLUTION AND MULTI FFT

An FFT trades time against frequency. The longer the stretch of audio it analyses, the finer the frequency detail it can resolve, and the slower it responds. That's the time-frequency trade of any windowed analysis (the uncertainty principle), not a limit of DeltaScope. Separating two tones a semitone apart at 40 Hz (they differ by about 2.4 Hz) needs about a second of signal through the analyser's window. In a 48 kHz project, only the largest `Size` analyses that much audio.

So a single `Size` forces a choice: fast response with poor low-end detail, or sub-bass detail with a slow display everywhere. `Multi FFT` in Settings > FFT removes the choice. With it on, the spectrum is split into up to four frequency bands. The top band uses your chosen Size. Each band below it uses a longer window than the band above, up to three longer windows in all. Each lower band starts where the shorter window of the band above no longer has enough resolution, with a half-octave crossfade between them. Everything above the first crossover keeps the speed of your chosen Size. The crossovers move with Size and sample rate. At the largest Size there is no window longer than the one you chose, so Multi FFT changes nothing there. Two sustained bass notes that merged into one blurred peak at your chosen Size now separate cleanly, and the rest of the spectrum never slows down to make it happen. One limit: the extra windows go only three steps longer than your chosen Size, so with the two smallest Sizes the longest window is still too short for the sub-bass.



Two sub tones one semitone apart (41.2 and 43.65 Hz), Multi FFT off: one blurred lump.



The same two tones with Multi FFT on: two distinct peaks.

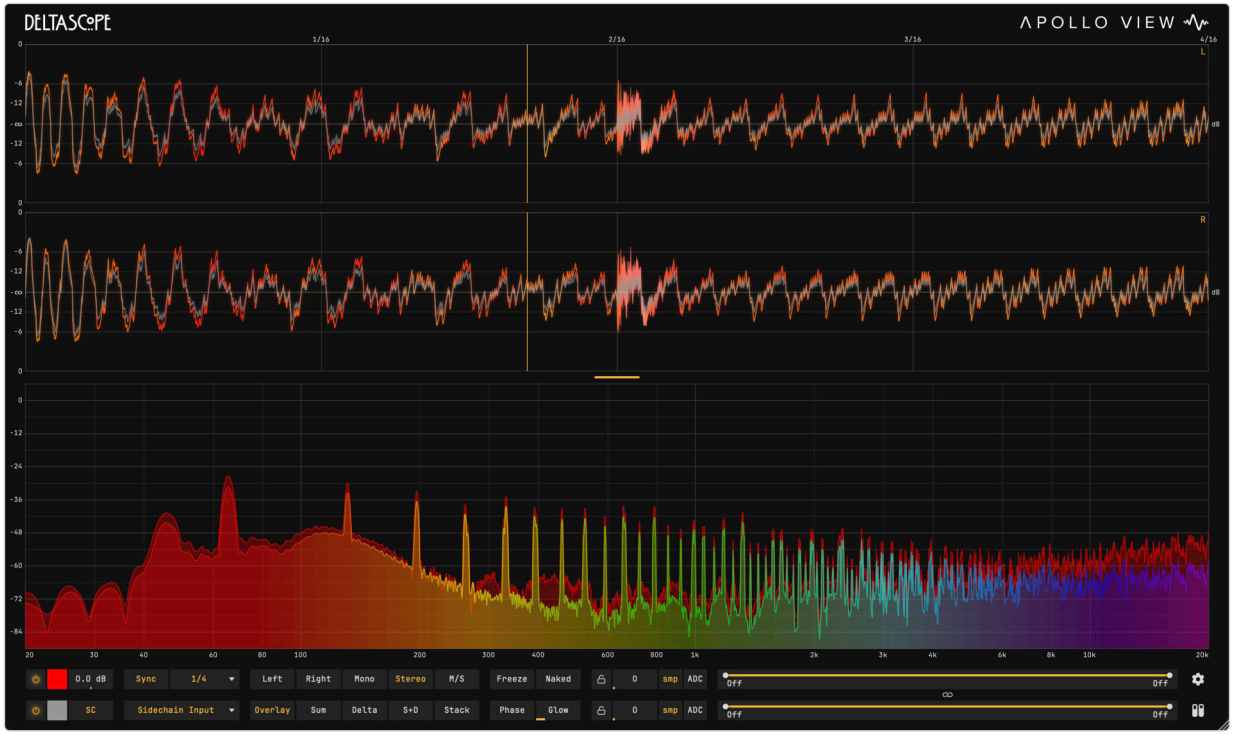
The low end responds later while Multi FFT is on. A long window has to see most of a note before it can draw it, so a new bass note appears in the lowest band about half a window after it starts, up to about 0.8 s at the longest window, while the mids show it within a tenth of a second. The bands redraw as often as the rest of the display; the delay is the window, not a fault.

The shape of the window matters as well as its length. Every window spreads a tone into a peak with skirts either side, and shapes differ in how narrow the peak is against how far the skirts reach. The main band uses a Blackman-Harris window, whose skirts stay below the display floor everywhere, so a loud tone never grows a visible base. The Multi FFT bands use a Blackman window instead: its peak is narrower, so two close bass notes separate when they're about 15 % closer in frequency, and a quieter note beside a louder one gets more room still. Its skirts reach a little further, but at these long windows that's a few hertz beside a loud tone, well below the peak. In a 48 kHz project at the default `Size` the bands take over at about 250, 125 and 63 Hz, and the longest window separates two equal sustained tones a semitone apart down to about 34 Hz.

Multi FFT applies to Delta's Magnitude view too. A narrow low-frequency boost or cut is only a few hertz wide, so a short window draws it lower and wider than it is. With Multi FFT on it reads close to its true height.

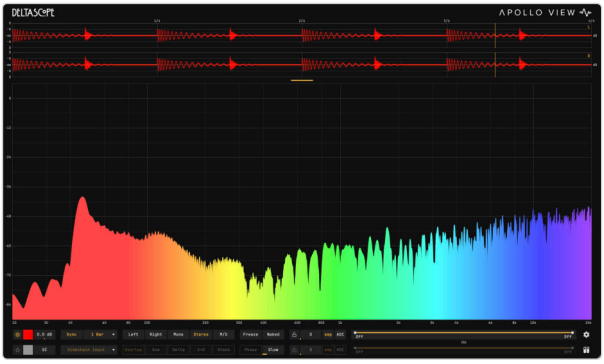
COLOUR BY FREQUENCY

Settings > FFT > Colour by Frequency draws a curve's fill and outline as a run of colour along the axis, the peak-hold line included: red up to 80 Hz, then through orange, green and blue to violet at the top. The region of the spectrum you're looking at then reads by colour as well as by position. The colours belong to frequencies, not to the pane: zoom the axis and 1 kHz stays green. `Main` and `Sidechain` have their own switches, and in Stereo or Mid/Side the two channels take the same colours, one a little darker and one a little lighter, as they do in flat colour. With a switch off, that curve wears its swatch colour whether or not the scope is coloured, and the swatch itself stays live until both displays colour that signal (see Colour by frequency in the scope chapter).

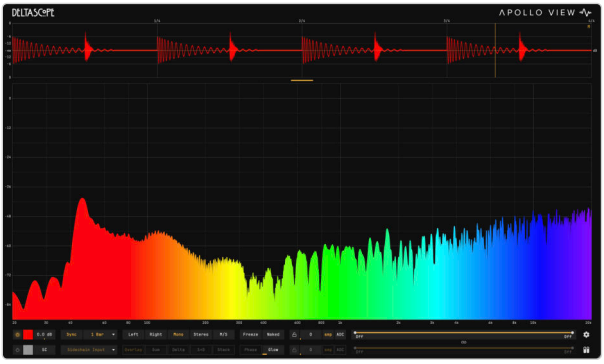


All four switches are independent. Here the scope colours the main signal and leaves the reference flat, while the analyser does the opposite: flat main curve, coloured reference. Both swatches stay flat and live, because neither signal is coloured on both displays.

> **PRO TIP:** In Stereo and Mid/Side the lighter curve (right or side) is drawn in front of the darker one (left or mid). A darker see-through fill over a lighter one blends into it as `Fill` rises, so the lighter curve goes in front and both stay readable at any `Fill` . The side channel is usually quieter than the mid, so in Mid/Side it would otherwise sit hidden behind the mid. Switch the channel mode to `Mono` when one curve for both channels is all you need.



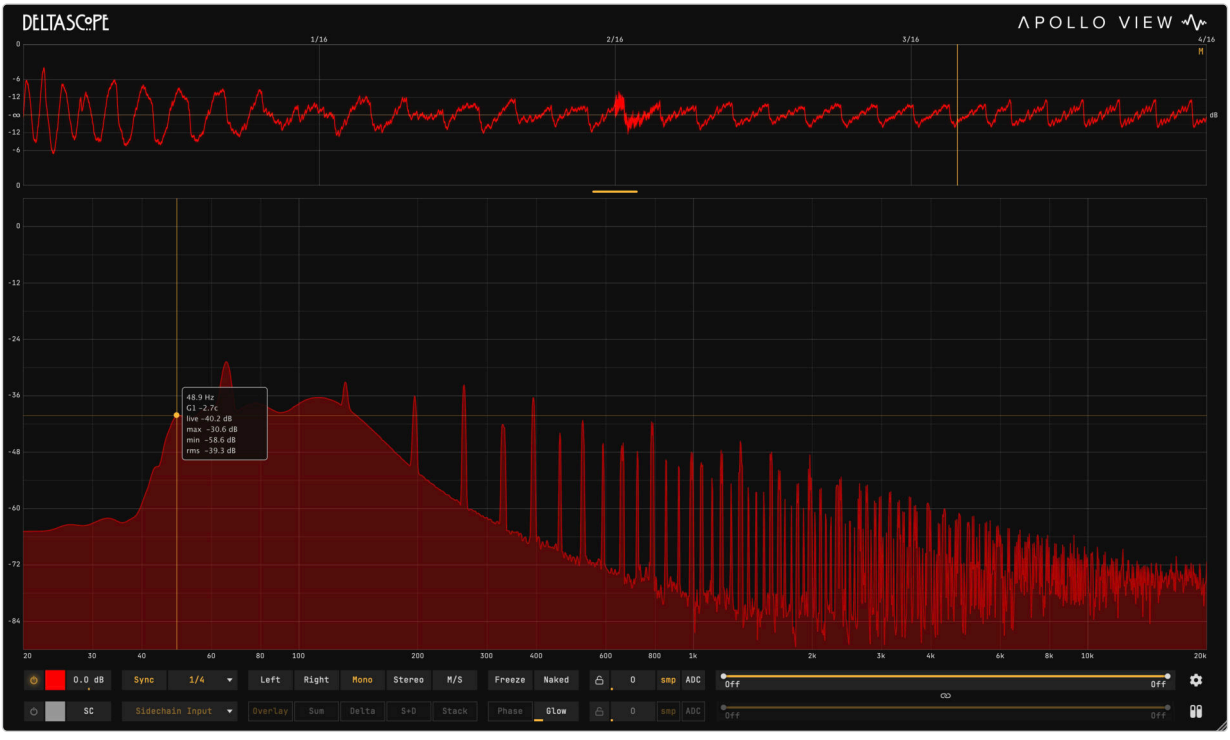
Stereo at 100% `Fill`: the lighter right-channel curve in front, the darker left channel showing where it rises above it.



The same audio in Mono: one curve, full-strength colour.

CROSSHAIR MEASUREMENT

Move the mouse over the spectrum and the crosshair follows with a readout: frequency, the nearest note with cents, and the level of the curve as drawn (live, or held while frozen), plus **max**, **min** and **rms** at that frequency. The max and min are a true hold over roughly the last eight seconds; the rms is a running average with a 2.5-second time constant. The history runs for the whole spectrum even while the crosshair is hidden, so wherever you hover, the answer is already there. Hold **Alt** to snap the crosshair to the nearest prominent peak (the closest one, not the loudest), so a quiet resonance beside a loud fundamental is reachable. The `Crosshair` toggle in Settings > FFT keeps it always on, or shows it only while Alt is held. The crosshair gives you a reading like “B3 +12 cents at −18.4 dB” instead of a guess like “somewhere around 250 Hz”.



Alt-hover snapped to the bass fundamental: 48.9 Hz, a hair under G1, with the live level plus the held max and min and the rms at that frequency.

PEAK HOLD

Transients are too brief to read from a moving curve. A snare hit is over before you can read it, and a resonance that appears once per bar never shows on an average. The peak-hold line is drawn above the live curve and keeps each frequency's highest recent level: it holds for the `Hold` time, then falls at the `Decay` rate. The gap between the held line and the live curve is how far your peaks are above the average. Set `Hold` to its top step (or type "inf") and it never falls: a whole-song maximum trace.

Peak hold on: the filled curve is live; the thin line above it is each frequency's held maximum.

Any FFT display, DeltaScope's included, treats tones and noise differently:

- **Tones**: a tone shows its true level at any `Size`. With `Slope` at 0, a −24 dB sine reads within a decibel of −24 dB whether it is at 50 Hz or 15 kHz; the last fraction of a dB depends on where the tone falls between analysis bins. At the default +3 dB/oct the display is deliberately tilted around a pivot at 1 kHz, so the same tone reads higher at 15 kHz and lower at 50 Hz. Set Slope to 0 whenever you want absolute levels.
- **Noise**: broadband noise moves with FFT size. Doubling `Size` halves each analysis band's width, so each band collects half the noise power: the noise floor drops about 3 dB per doubling while tones keep the same level. Every analyser does this; a noise level only means something together with the bandwidth it was measured in. The same physics means the noise floor steps down gently through Multi FFT's bands while tones cross every band boundary at the same level, within about a decibel.

FFT SETTINGS (SETTINGS > FFT)

Settings, FFT page.

Section	Control	What it does
Analysis	`Size`	FFT length, 2048 to 65536. Bigger means finer frequency detail and slower response. Default 8192.
	`Multi FFT`	Multiresolution analysis: the low end uses progressively longer windows for sub-bass detail while the rest of the spectrum keeps the speed of your chosen Size (see Resolution and Multi FFT). The low end itself responds more slowly while on. Default off.
Range	`Min` / `Max`	Displayed frequency range. Min 1-100 Hz (default 20), Max 6-96 kHz (default 20 kHz). Raise Max above Nyquist and the gold line appears.
Display	`Crosshair`	Always-on crosshair readout; off means hold Alt to show it.
	`Filters » FFT`	Band filters also apply to the spectrum (see Band filters).
Colour by Frequency	`Main`	Draw the main curve (both channels in Stereo or Mid/Side) as a run of colour along the axis, red at the bass through green to violet at the top (see Colour by frequency).

Section	Control	What it does
	`Sidechain`	The same for the sidechain curve, and for the delta curve drawn beside the sum in S+D.
Curve	`Floor` / `Ceiling`	Level range in dB. Floor −120 to −30 (default −90), Ceiling −24 to +30 (default +6).
	`Slope`	dB/octave tilt. Music gets quieter by roughly 3 dB per octave as frequency rises, so at the +3 default a balanced mix reads flat and imbalance reads as slope; 0 is measurement-flat.
	`Fill`	Opacity of the shaded area under the curve.
	`Smooth`	Fractional-octave smoothing of the live curve: at 0 you see every analysis bin, wobble included; raise it and the curve smooths into a tonal-balance read, at the cost of narrow peaks and notches. Default 0.
Ballistics	`Avg`	How quickly the curve follows the music: low for a fast curve that shows every hit, high for a steady average you can compare against. DeltaScope compensates for the FFT length, so changing `Size` changes the response speed much less than it otherwise would; bigger sizes are still a little slower.
Peak Hold	`Peak Hold`	Enable the peak-hold line (see Peak hold).
	`Hold` / `Decay`	Hold time before decay (top step is infinite) and decay rate in dB/s.
	`Smooth`	Extra fractional-octave smoothing of the peak-hold line, across frequency, so it reads as a smooth outline rather than a jagged, spiky line.
Delta	`View`	Difference or Magnitude (see Delta and Hear the Delta). Set it at any time; it takes effect in the Delta comparison mode.
	`Reset`	This page back to its defaults.

SIDECHAIN

The bottom control row belongs to the reference signal. `SC` switches it on.

The sidechain row: power, colour, SC, the source picker, the comparison modes, Phase and Glow, and the sidechain's own alignment cluster.

The row has two switches because they do two different jobs. `SC` turns the reference signal on or off. The SC power button only hides the reference's picture — its trace and its spectrum curve; the reference stays connected, so you can clear the picture for a moment and bring it back with one click. Nothing to re-route.

Until `SC` is on, the rest of the row is greyed: the power button, the five comparison modes, `Phase`, the source picker, the sidechain band filter and its alignment cluster. Only `Glow` stays active, since it needs no reference. Even dimmed, the comparison-mode buttons still show which mode will come back when you switch `SC` on again.

The sidechain row with `SC` off: only `Glow` is active.

CHOOSING THE SOURCE

The source picker, active once `SC` is on, offers two kinds of reference:

- `Sidechain Input`: the plugin's sidechain bus, routed from your DAW like any sidechain compressor's key input.
- **Another DeltaScope instance**: every DeltaScope of the same plugin format in the project appears in the menu by track name (as "Instance n" where the host reports no names). A host that runs each plugin in its own separate process keeps instances from finding each other. Pick one and DeltaScope receives its signal directly. Once the transport has run, the two signals are lined up by host position, so the DAW's own delay compensation and processing order are handled for you. The link can't know the latency of plugins inserted between the two instances; the offset and ADC controls are for that.

> **NOTE:** Instance linking is the quickest way to compare two points in a chain: insert a DeltaScope before the processing and one after, then link the second to the first.

Pro Tools: the key input is mono — a Pro Tools convention that applies to every AAX plugin — and DeltaScope uses that one channel for both lanes. Overlay and Stack work as anywhere else. Sum, Delta and S+D compare each main channel against the same mono key, so on stereo material the delta includes the stereo difference itself. For a true stereo delta, link another DeltaScope instead: Link carries stereo and takes precedence over the key input. Keep the key input for mono references.

The source picker: Sidechain Input, then every other DeltaScope of the same format in the project by track name — here there is one, on the track called Reference. Pick one and its audio is sent directly to this instance: compare any two points in the project, even across tracks the DAW can't sidechain.

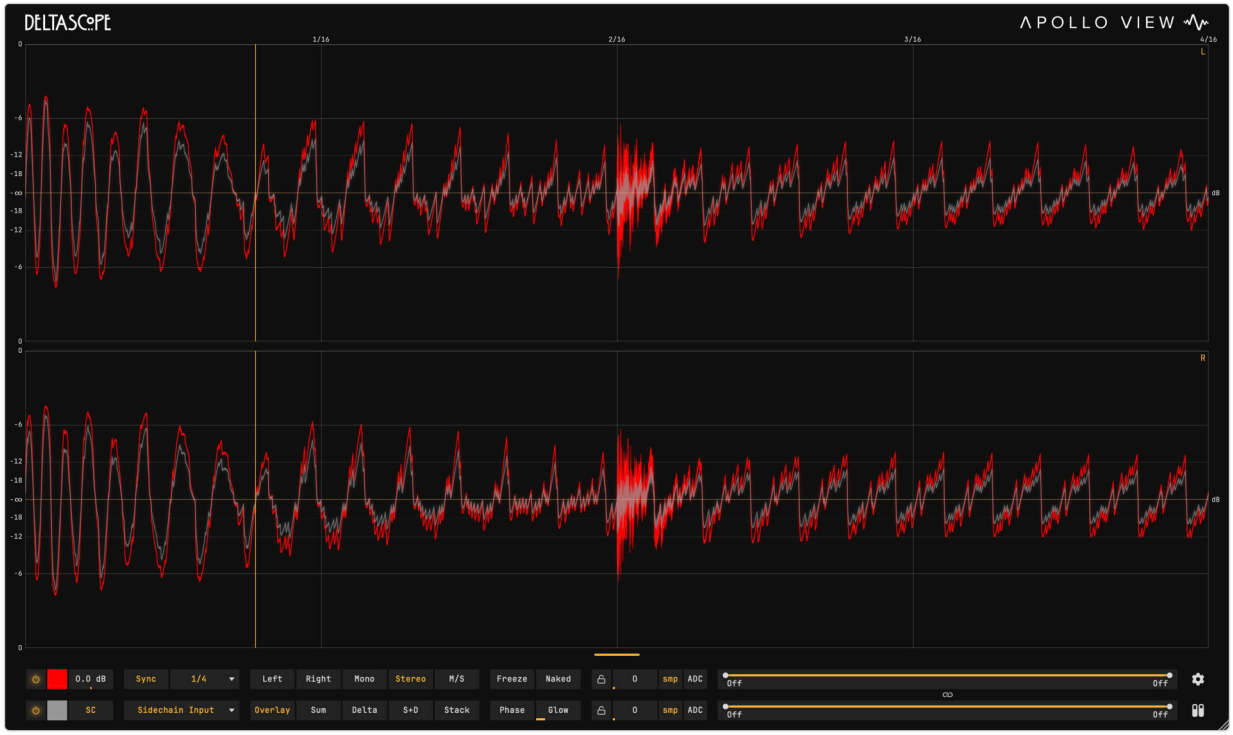
Links are made by track name: reopen the project and every instance reconnects by name. A DAW's automatic track numbering is stripped, so renumbered tracks still match. If renumbering leaves a name matching more than one track, DeltaScope leaves the link unresolved rather than guessing. A host that allows two tracks with literally the same name is different: there the first match is used, so keep names distinct. Delete a source and the link keeps the name, so an undo reconnects it. No routing to set up, and nothing to set up again when you reopen the project.

Your mix (red) against a commercial reference (grey), overlaid live. No sidechain routing needed: the two instances are linked by track name. The gap between the two curves shows how much louder the reference is than the mix at each frequency; it is widest in the top octaves.

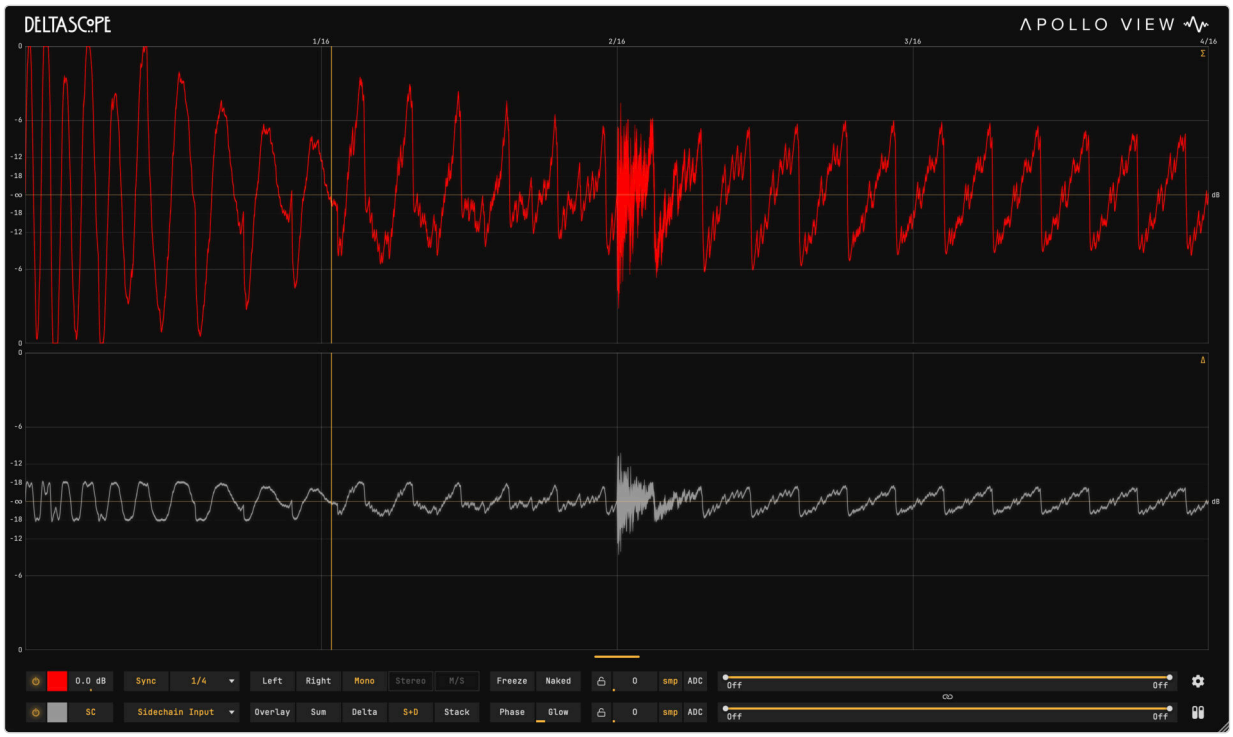
COMPARISON MODES

Mode	Shows
`Overlay`	The reference drawn over the main waveform in its own colour: where the traces separate is what's different.
`Sum`	Main plus reference: the two added together. Watch kick and bass combine, or a dry track with its parallel return, and see where the sum gains or loses level.
`Delta`	The difference, main minus reference. Identical signals draw a flat line.
`S+D`	Sum and Delta in stacked lanes: the two together and the difference between them, on screen at once.
`Stack`	Main and reference in separate stacked lanes. Use it instead of Overlay when the overlapping traces are too dense to read.

NOTE: `S+D` and `Stack` use both display lanes for the comparison, so a Stereo or M/S channel mode switches to Mono, and the `Stereo` and `M/S` buttons are unavailable while either is active (Left, Right and Mono stay as chosen). `Delta` on its own keeps whichever channel mode you've chosen and subtracts lane by lane (see Per-lane delta in Delta and Hear the Delta).



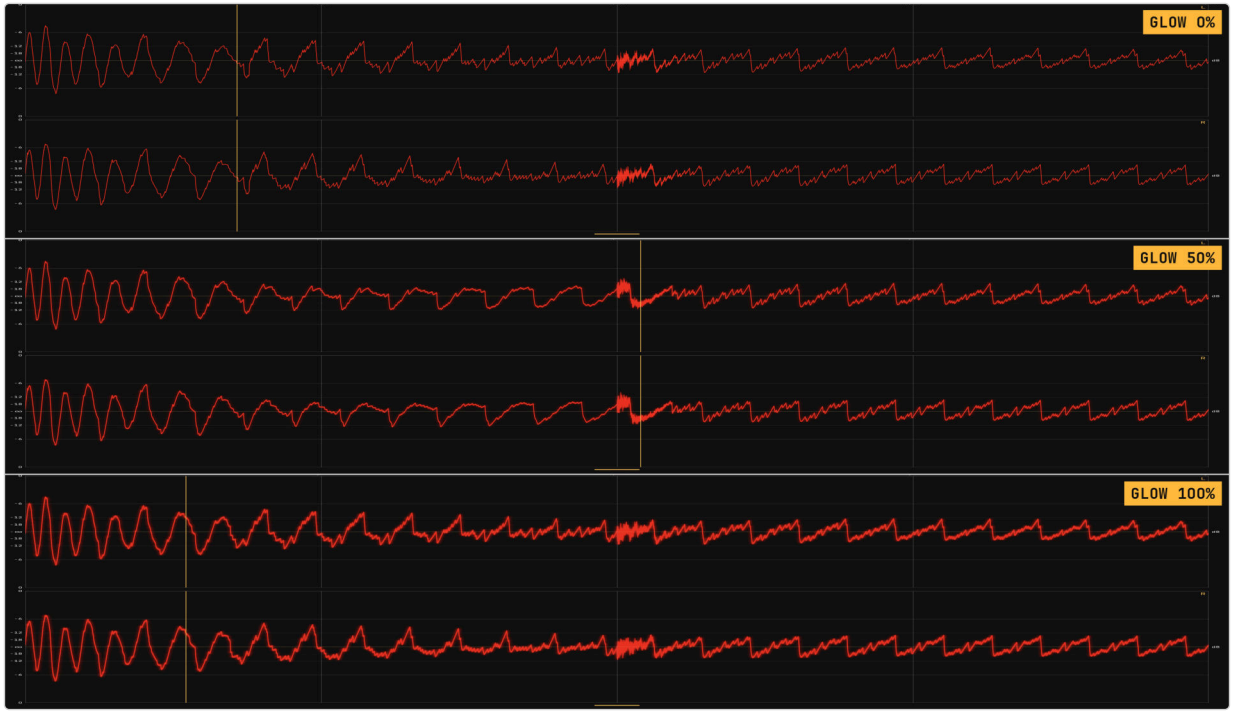
Overlay: processed (red) over dry (grey). Where the traces separate is what the processing is doing.



S+D: the Σ lane above carries the sum, the Δ lane below the delta, both built from the same two lined-up signals.

GLOW

The `Glow` slider adds a phosphor-style bloom to the waveforms. It's not just for looks: on dense material the brightest spots are where the traces overlap most often. Alt-click resets to 0.



The same beat at Glow 0%, 50% and 100%.

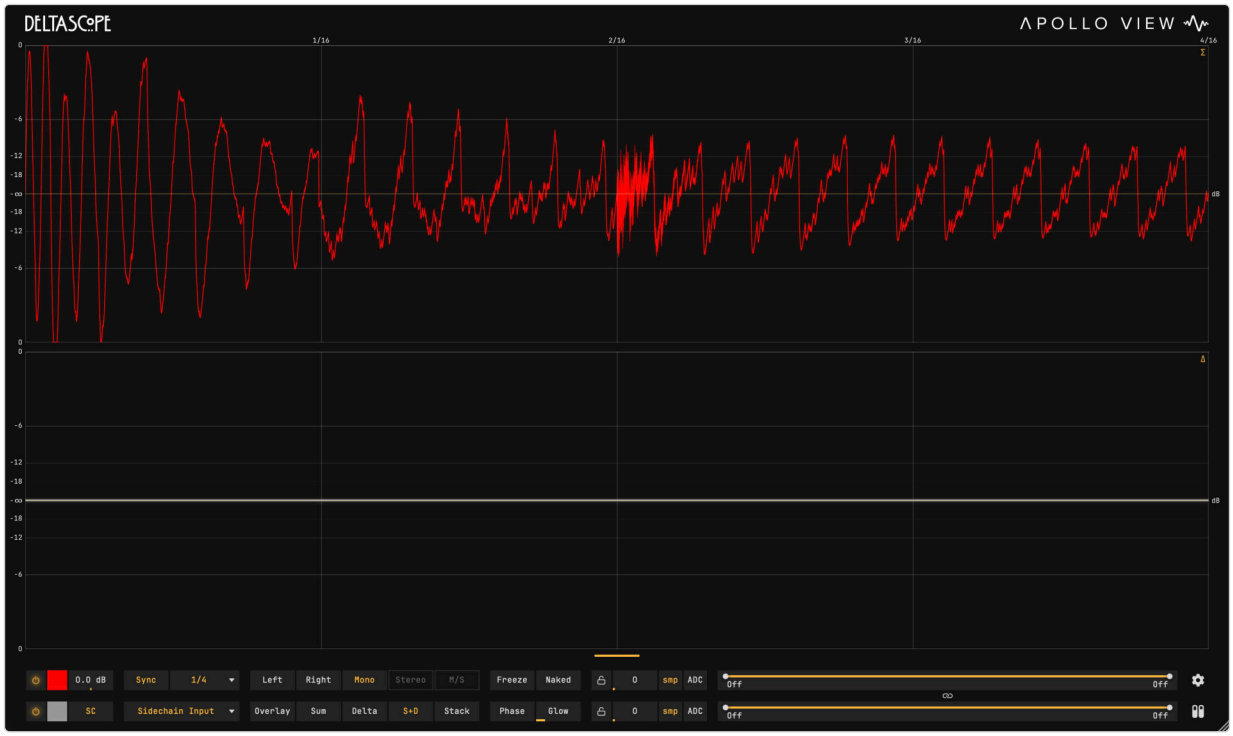
DELTA AND HEAR THE DELTA

DeltaScope subtracts the two aligned signals once, as the audio passes through, and keeps the result as a separate signal.

> **NOTE:** The trace, the spectrum's Difference view, the measurement readouts and the Hear the Delta output all work from that one difference signal. What you see is what you hear, and an exported image of a delta lane shows the same signal that left the plugin's output. Two things change the picture without changing the signal: the display gain, and the band filter. With a band active you see a band-limited delta and hear the full-band one.

THE PERFECT NULL

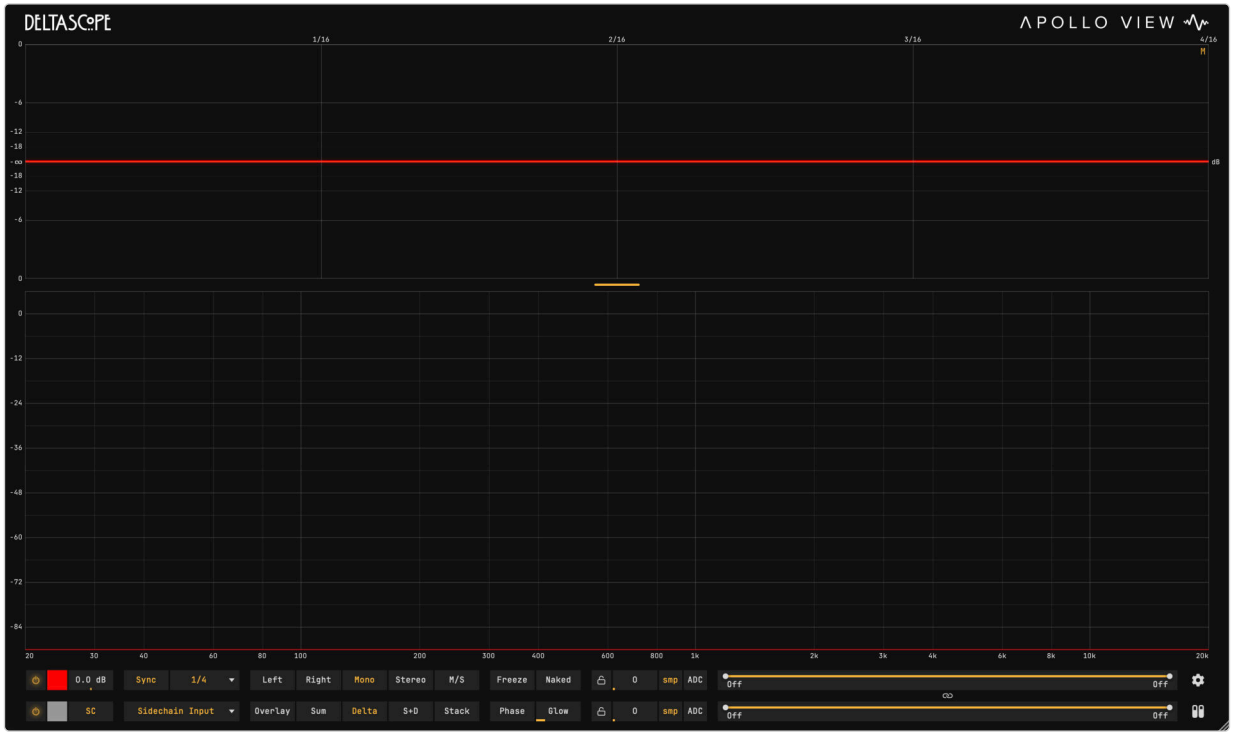
The null test is the classic way to check whether two signals are identical: subtract one from the other and listen to what's left. Traditionally you flip the polarity of one copy, play both together and listen for silence. DeltaScope does the same subtraction live and keeps the result on screen while you play. Route the second signal in, from the sidechain input or another instance picked by track name, click `S+D`, and read the two lanes. The Σ (sum) lane carries the two added together; the Δ (delta) lane is what differs. Identical signals cancel completely and draw a flat line, and the display keeps updating on real programme material while you listen.



The null test, live: the Σ lane carries the two signals added together, the Δ lane the difference between them. Here the two are identical, so the sum is the mix doubled and the delta a flat line.

Click `Delta` to give the residual (what's left after the subtraction) the whole display, and open the spectrum's Difference view to check it across the whole range at once. If the null is close

but a small, unsteady residue remains instead of a flat line, the two signals are most likely slightly out of time rather than different. See Alignment.



The same null through the analyser's Difference view: the spectrum of what's left is at the bottom of the level range at every frequency, nothing above it anywhere from 20 Hz to 20 kHz.

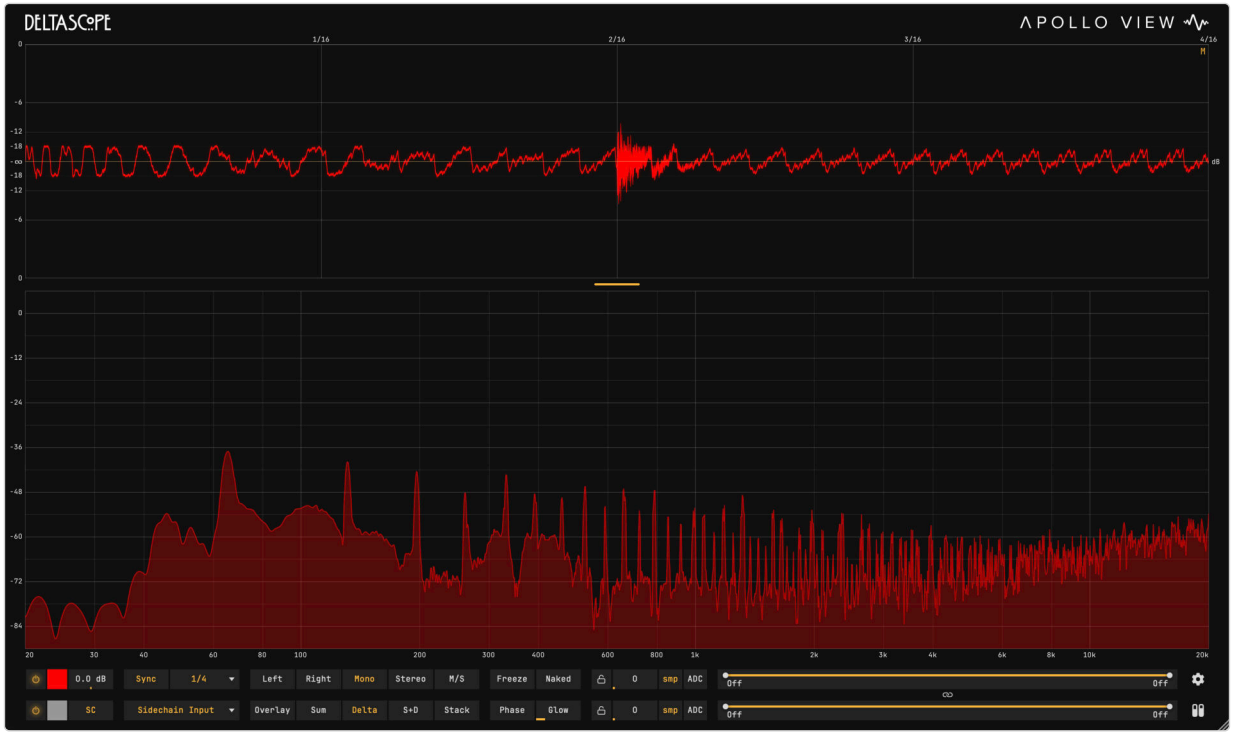
PER-LANE DELTA

Delta respects the channel mode. In Left, Right or Mono there's one delta; in Stereo you get an L-delta and an R-delta; in Mid-Side, a mid-delta and a side-delta, so you can see whether a processor changes your side channel differently from your mid. The spectrum's Delta views draw the same lanes: on `Auto`, a darker shade of the main colour for L/Mid and a lighter one for R/Side.

THE DELTA IN THE SPECTRUM: DIFFERENCE AND MAGNITUDE

In the Delta comparison mode the spectrum can show two different things. Choose with `View` in Settings > FFT. You can set it at any time, whatever the comparison mode; it takes effect once `Delta` is the comparison mode:

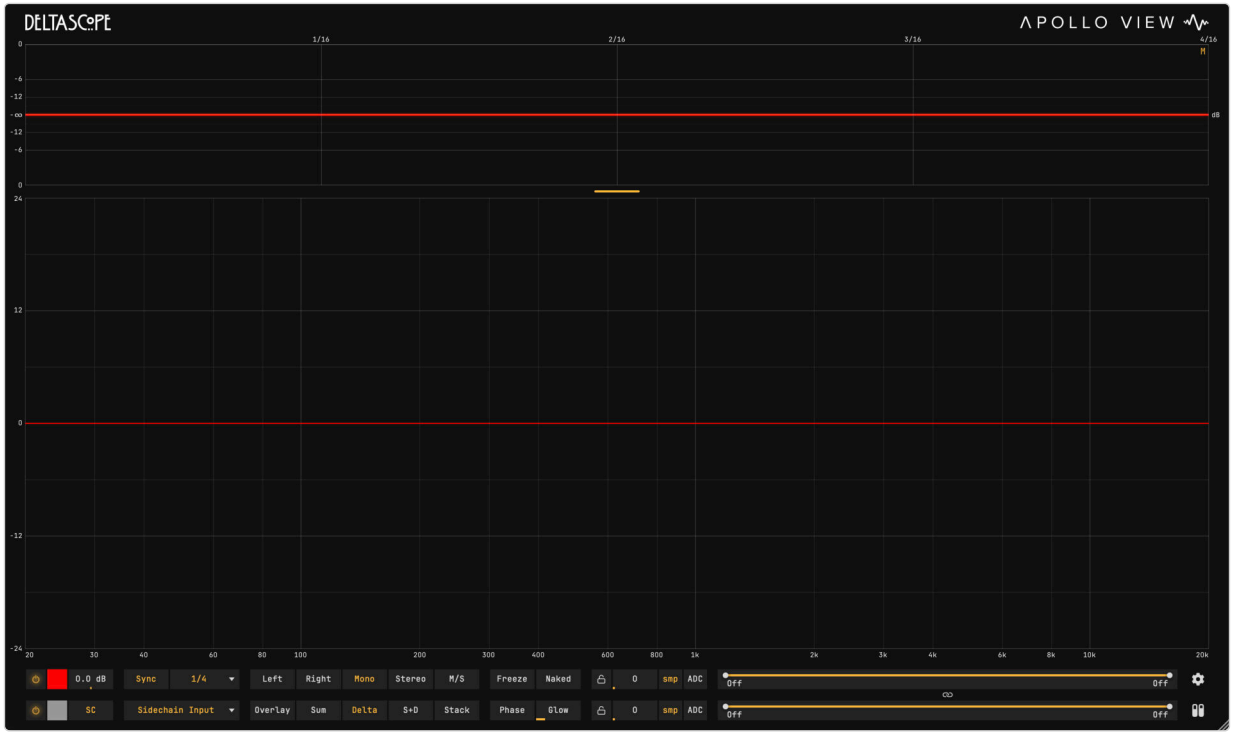
- **Difference**: the spectrum of the delta itself, the same signal the scope draws: it shows how much is changing and at which frequencies.
- **Magnitude**: how much louder or quieter the main signal is than the reference at each frequency, in dB. That's the frequency response of whatever processing is between them: how much it boosts or cuts. It's a ratio, so it reads the same whether the music is loud or quiet.



Difference view: the spectrum of everything the processing is changing.

TRACING A PROCESSOR'S REAL CURVE

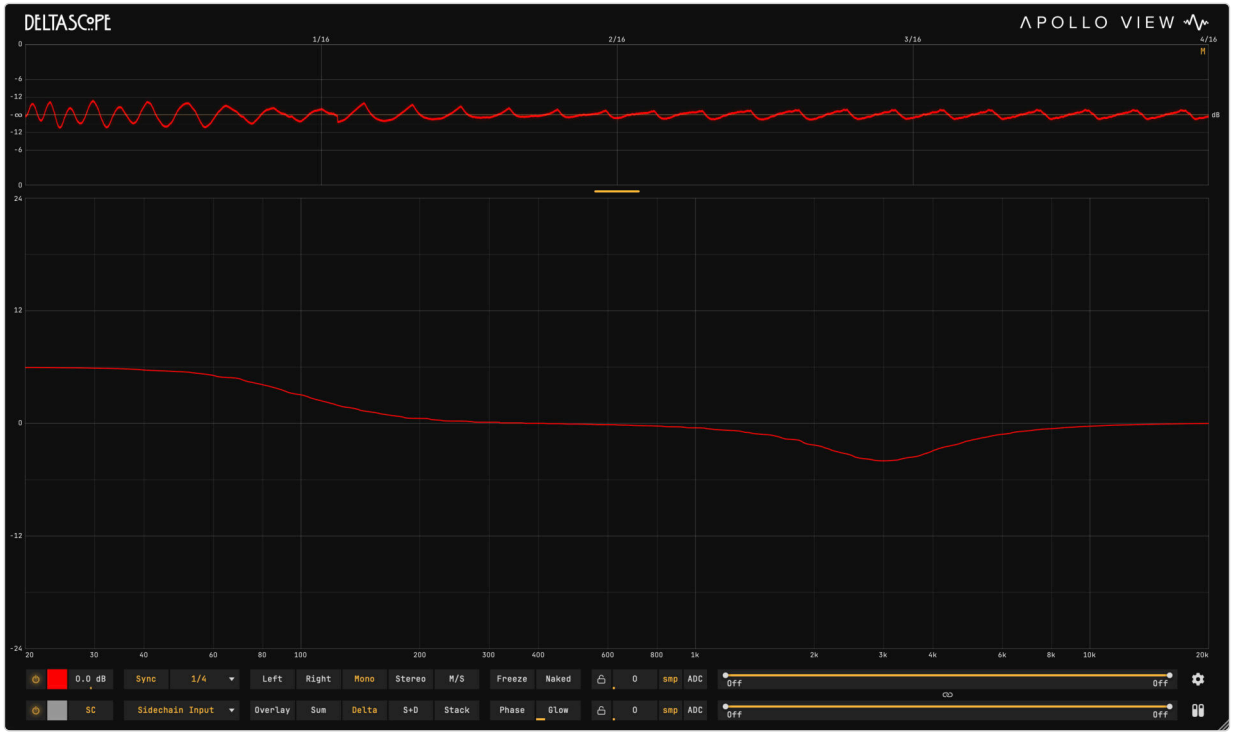
Any processor between the two points where you take your signals can be traced, as long as it behaves like a filter: it changes the level and timing of each frequency, and adds nothing new. Put the processor on a track and insert DeltaScope after it. Then give DeltaScope the signal from before the processor. The simplest way in any DAW is a second DeltaScope inserted ahead of the processor on the same track, picked from the source picker (a pre-FX send also works in DAWs that offer one, such as REAPER). Click `Delta`, then open Settings and set the spectrum's `View` to Magnitude. DeltaScope now draws the frequency response of whatever processing is between the two signals: an EQ's actual curve, a console emulation's tilt, an entire chain, a signal sent out to hardware and back, drawn from your own material as it plays. You never need to open the processor's UI.



The baseline: identical signals draw a flat line at 0 dB. Anything that moves this line is something the processor is doing.

Read it against the fixed ±24 dB axis: 0 dB means untouched, above is boost, below is cut. If the Magnitude line stays flat while the Difference view shows a lot, the processing is changing phase or timing, not tone. That's a real result, not a fault in the measurement. A compressor is different again. It moves the whole line away from 0 dB (below it, unless make-up gain raises it), and the line rises and falls with the music. That's because Magnitude compares the levels of the two signals over the last stretch of audio. One limit: the curve can only be measured where your material has energy. Where the source has no energy at a frequency (for instance, the highest frequencies of a mix with little high-frequency content), there's nothing to compare. The line settles at 0 dB there, which reads as "untouched" whether or not it is. Play something broadband through the chain to trace the whole range.

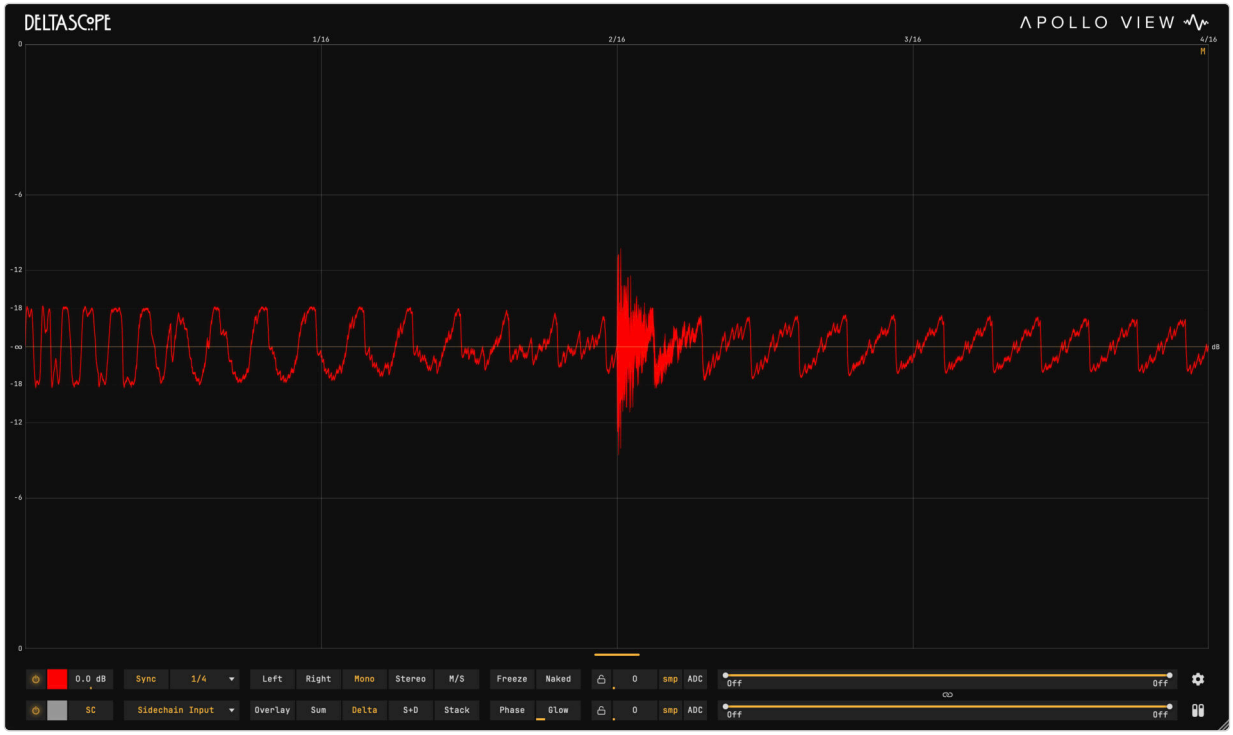
> **TIP:** To see a processor's complete curve rather than only where your music has energy, play broadband noise through it for a few seconds: pink or white noise from your DAW's signal generator (Logic's Test Oscillator, Pro Tools' Signal Generator, or any noise plugin), inserted ahead of the processor. White noise measures every frequency equally well; pink favours the low end. Magnitude is a ratio, so the level doesn't matter, only that every frequency has something to measure. Bypass the noise before you bounce.



A hidden EQ, traced live on programme material: a +6 dB low shelf at 100 Hz and a 4 dB dip at 3 kHz, read straight off the display.

HEAR THE DELTA

A level-matched A/B asks whether a change sounds better; soloing the difference asks what the change is. They answer different questions. A loud delta isn't proof of an audible difference, and a quiet one isn't proof of transparency. With `Hear the Delta` on (Settings > General, on by default), choosing the Delta comparison mode switches the plugin's output to the difference signal. What you hear is the delta lane's signal, before the display gain and any band filter. In Left, Right or Mono you hear that one delta on both outputs. In Stereo you monitor the L and R deltas. In Mid-Side the left output carries the mid-delta and the right output the side-delta, so you're hearing two analysis channels side by side, not a stereo image. Click any other mode and the output is the unchanged track again.



What the saturator is changing. With Hear the Delta on, the delta on screen and the audio at the output are the same signal: harmonics, transient bite, hiss.

For a moment after you link a source, the delta lanes (and the output, with Hear the Delta on) are silent while DeltaScope lines the two signals up. Without this you would see and hear a full-volume copy of the main track, as if nothing had cancelled. The scope shows the same silence you hear, and when the lanes return they are aligned.

> **CAUTION:** With `Hear the Delta` on (the default), choosing the `Delta` comparison mode replaces the plugin's output with the difference signal, and with `Hear the Sum` on, choosing `Sum` replaces it with the two signals added. Every other comparison mode, `S+D` included, leaves the audio untouched. If DeltaScope is on your master bus, what you hear, record or bounce in those modes is the monitored signal, not the mix.

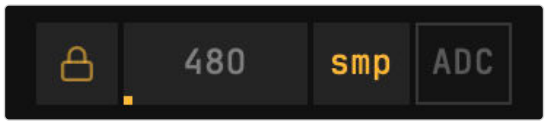
HEAR THE SUM

`Hear the Sum` (Settings > General, off by default) does for the Sum comparison mode what Hear the Delta does for Delta: with it on, choosing `Sum` sends the two signals added together to the plugin's output, aligned the same way the delta is. On its own that's a way to audition a sidechained part through the track it's compared with. Together with Hear the Delta it turns the `Sum` and `Delta` buttons into a polarity switch. Sum is one signal plus the other; Delta is one minus the other, which is the second signal with its polarity flipped. Clicking between them flips that signal against the first, and nothing else changes.

PRO TIP: A quick polarity check. Put DeltaScope on the kick track, sidechain the bass into it, and turn `Hear the Sum` on. Mute the bass track in your DAW: the kick track is now the only place you hear the bass, and DeltaScope decides how. Click `Sum` and you hear kick and bass as they are; click `Delta` and you hear them with the bass's polarity flipped. Go back and forth while the loop plays and keep whichever has the fuller low end; the scope draws the same two signals adding or cancelling as you listen. If Delta wins, flip the polarity on the bass track, or nudge its timing until Sum wins, then unmute the bass and set the mode back to `Overlay`. Keep the sidechain send at the same level as the bass track's output, so the sum you hear is the mix you'd get with both tracks playing.

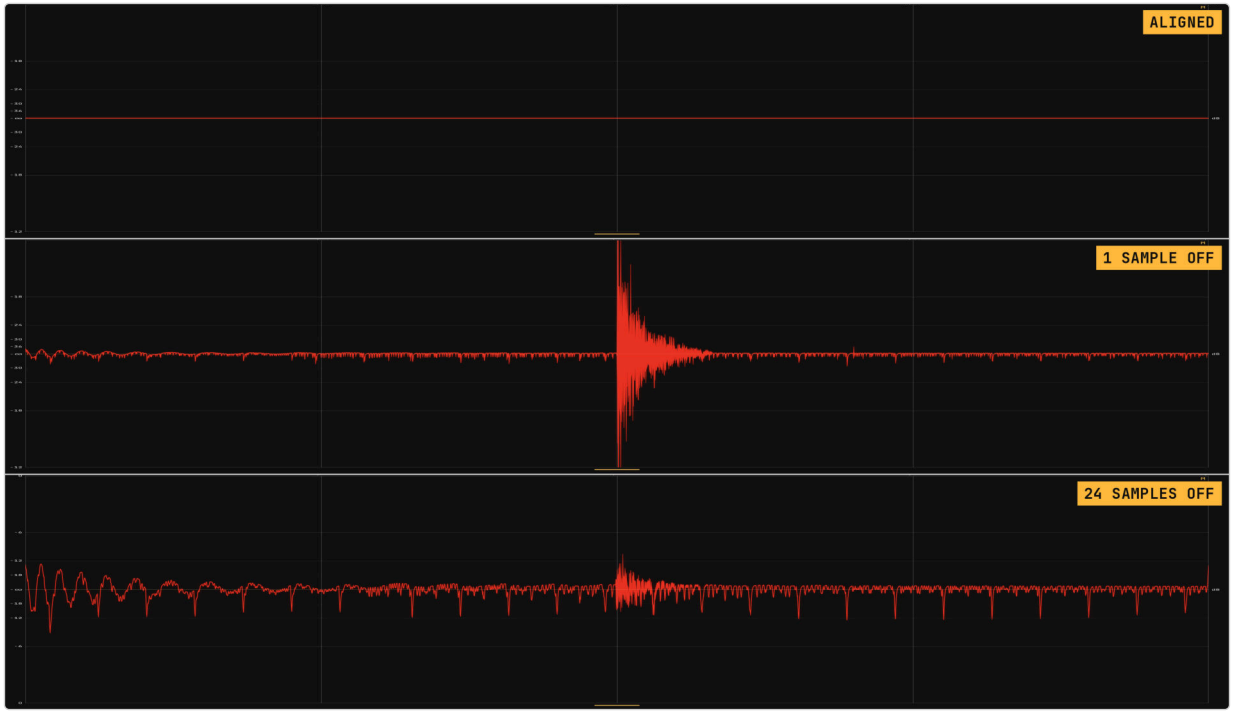
ALIGNMENT: OFFSET AND ADC

A comparison depends on good alignment, and a null test depends on it most. If main and reference are even one sample out of time, the high frequencies stop cancelling and a quiet high-frequency residue appears where there should be silence. A few hundred samples of plugin latency turn the null into a comb filter: the two copies cancel at some frequencies and reinforce at others, leaving an unsteady residue instead of silence. So each signal row has its own alignment cluster:

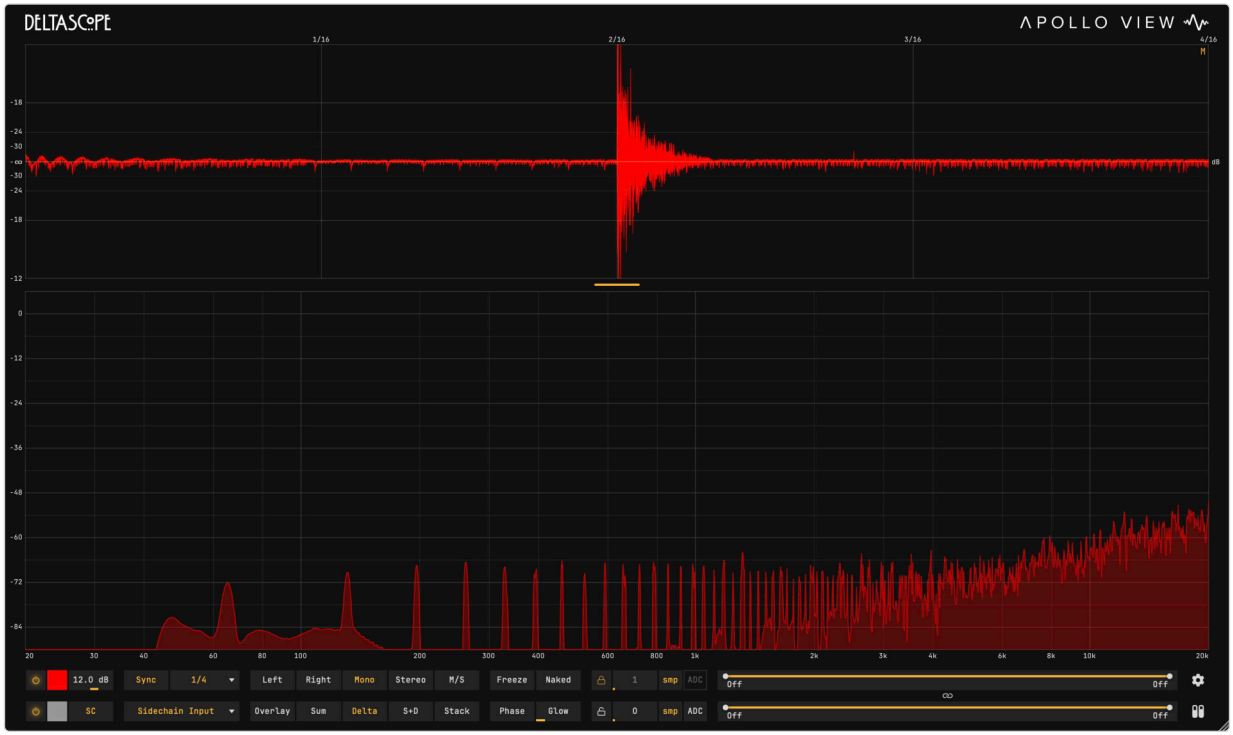


The alignment cluster: padlock, offset, units and ADC, here locked at 480 samples after an ADC pass.

- **Sample offset slider**: tells DeltaScope how late that row's signal arrives, up to one second, in samples or milliseconds (units button). That row is shifted earlier to compensate, in the picture and in the comparison. Click to type an exact value; Alt-click resets to 0.
- **Calculator**: the offset box does the adding for you. Read the latencies your DAW reports for the plugins in the chain and type them as a sum, `256+128+64`; Enter sets the total. It subtracts, multiplies and divides too, with brackets where you need them: `1024-256`, `(64+32)*2`, `2048/4`. In milliseconds it works the same way, `5.8+2.9`.
- **Lock** (padlock): protects the offset from accidental drags, and greys out that row's `ADC` button along with the slider, so a settled offset can't be re-measured by mistake either. It engages on its own ten seconds after you stop adjusting, and the moment you type a value into the slider. If `ADC` is greyed out after a small adjustment, the padlock has engaged: click it to unlock, and the slider and the button are active again.
- `ADC` (auto delay compensation): each signal row has its own. Click it to arm it, then start playback with the play cursor placed right on a clear hit that starts from silence; a kick on the downbeat of bar one, played from bar one, is ideal. DeltaScope counts the samples from the moment the transport starts to the first sound louder than −40 dBFS in that row's signal, sets the row's offset to that count and locks it. If playback starts at bar one with the hit on the downbeat, that count is the chain's latency, plus the few samples the hit takes to reach that level. Start mid-song and it only counts to the next loud hit, so cue the transport to the hit itself first. If nothing loud arrives within five seconds the button disarms on its own: stop, cue the transport to a louder hit that starts from silence, and arm again. It works on the main row, the sidechain row and across linked instances.



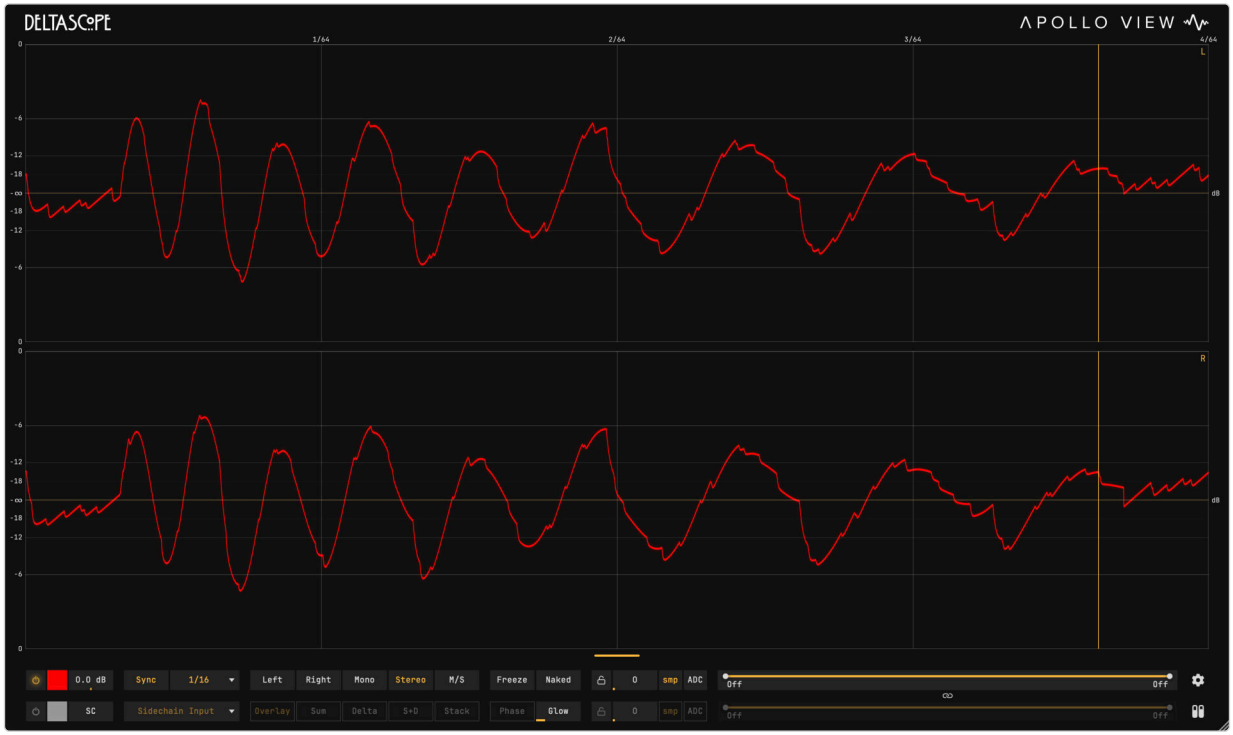
Aligned, one sample off, 24 samples off: the same null with the offset moved. ADC measures the chain's latency for you, but a real transient can trigger its detector a sample or more late. Unlock, adjust the offset a sample at a time, watch the delta flatten to a line, and let the padlock lock again on its own.



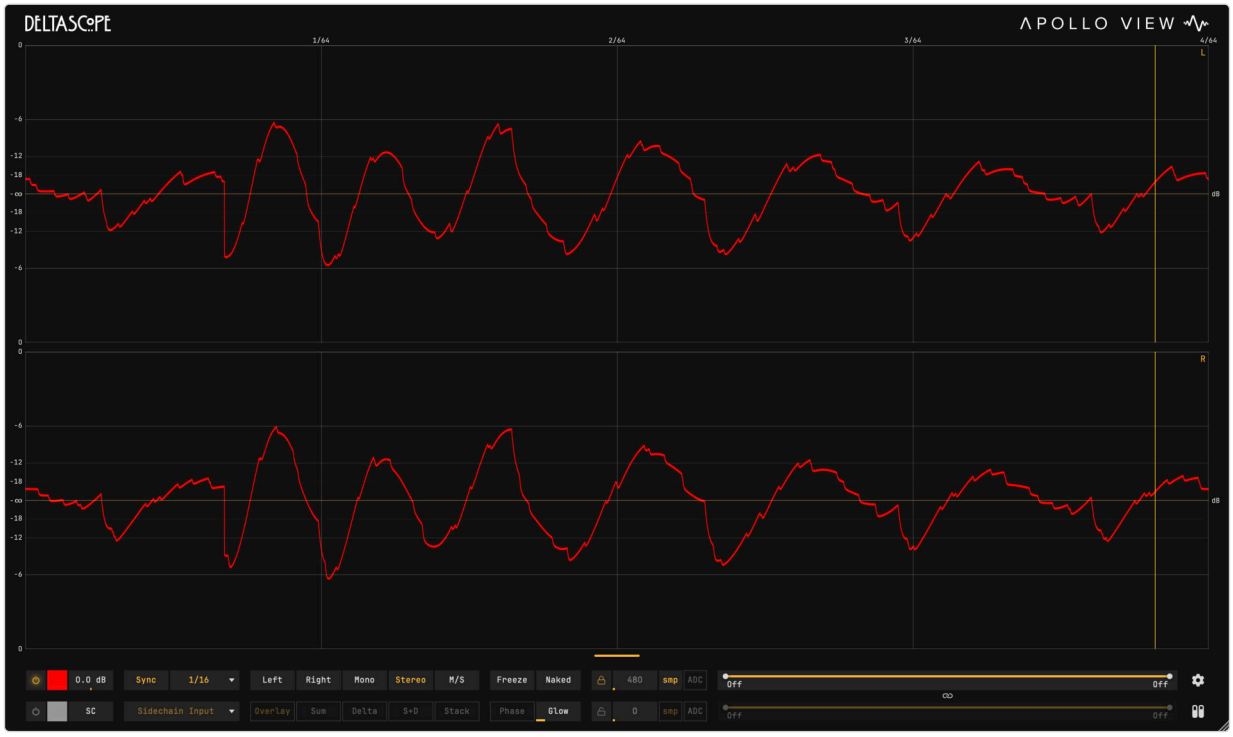
The spectrum of a one-sample error is a clean ramp rising towards the top of the range. The two signals still cancel in the bass, where one sample is a tiny fraction of a cycle, and cancel less and less as the frequency rises. Remember the shape: it's the sign of a single sample of misalignment.

ADC is also useful with no reference at all. Plugins inserted **before** DeltaScope add latency, so in Sync mode (see Timebase) the whole waveform is drawn to the right of the beat grid. Arm

`ADC`, play, and the display realigns: on drums, the downbeat kick moves back to the left edge of the scope, on the grid line.



A chain with latency ahead of DeltaScope draws the downbeat to the right of the grid line: 480 samples of plugin delay, visible.



ADC armed, played, measured: the kick back on the left edge, offset set and locked.

TIP: ADC waits for the first moment the signal rises past a fixed level. A real transient takes time to reach that level, so the moment it finds is a little after the true start: a sample or two on a hard edge, more on a soft attack. ADC measures slightly late by design; it isn't unreliable. Treat it as the first step. Let it give you an approximate value, unlock the padlock, adjust the offset a sample at a time while watching the Δ lane, and stop when the line goes flat. Most DAWs also report each plugin's latency (REAPER shows it per plugin in the FX chain window). Adding up those figures also works: type them into the offset as a sum, such as 256+128+64, and Enter sets the total. That's only as good as the figures, since not every plugin reports its latency correctly.

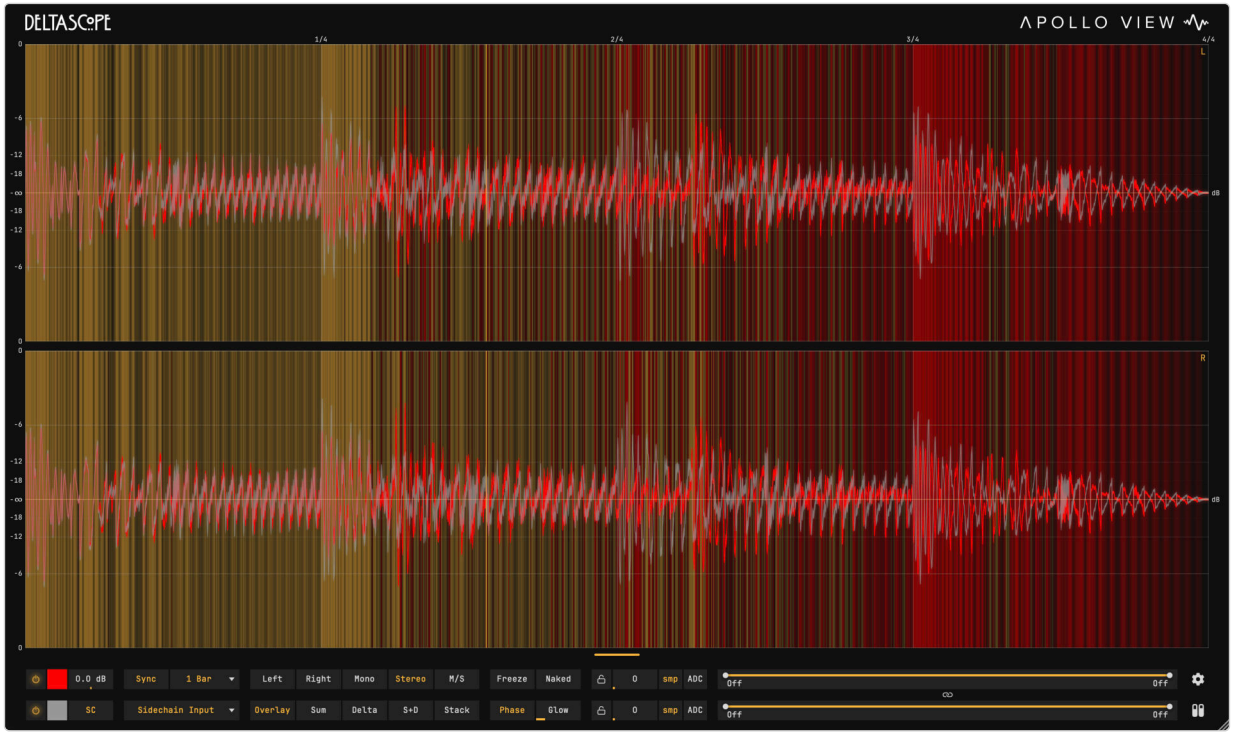
PHASE CORRELATION

This is different from the correlation meter in your DAW. That meter compares left with right, averaged over time. DeltaScope's phase display compares the **main signal with the reference** (kick against bass, processed against dry) and shows the result along the waveform, so you see where in time the two cancel, not only that they sometimes do.

`Phase` overlays the correlation on the scope, as bars or as a heat fill behind the waveforms. It's in the sidechain row because it needs a reference: until a reference (host sidechain or instance link) is connected and `SC` is on, there's nothing to correlate against.

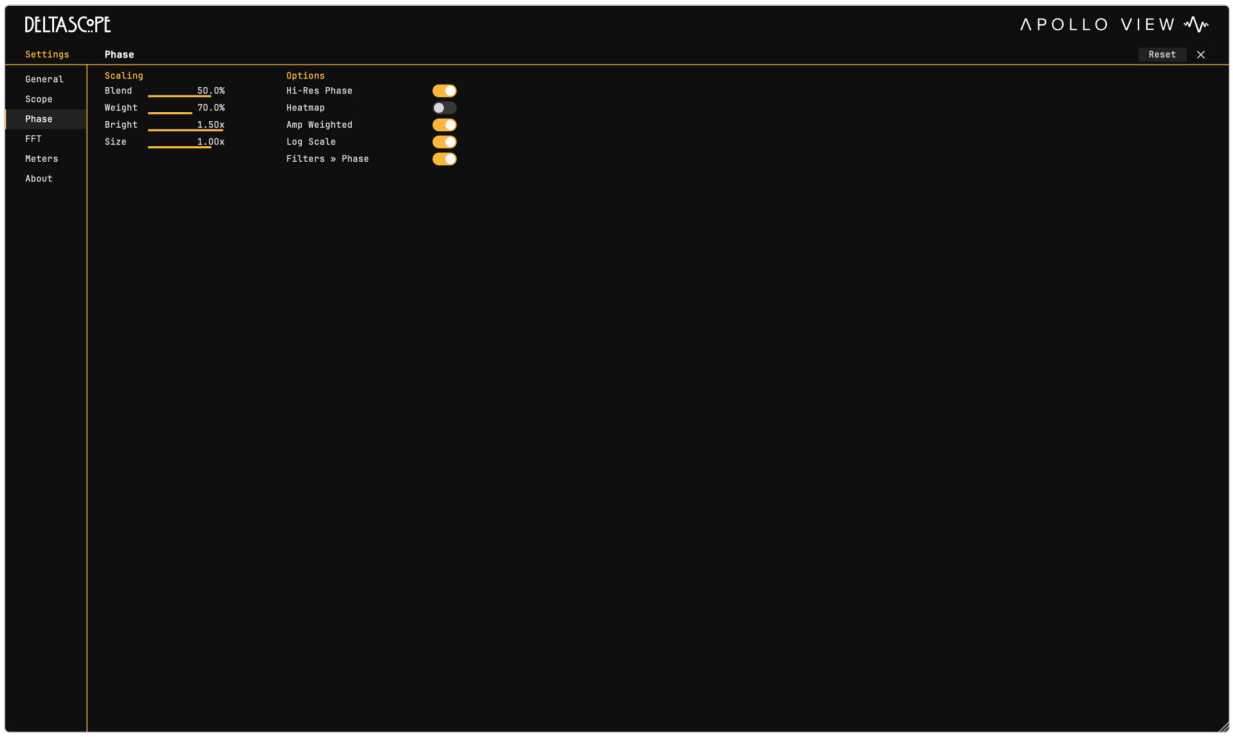
+1 means the two move together (gold: they reinforce when summed); **0** means no consistent relationship; **−1** means they move in opposition, as if one had its polarity flipped (red: they cancel when summed).

Correlation bars, main against reference: gold bars near +1 while the two are in phase, red bars near −1 as they move out of phase later in the musical bar.



The same drift in the Heatmap style: gold where the signals are in phase, red where they fall out of phase.

PHASE SETTINGS (SETTINGS > PHASE)



Settings, Phase page.

Section	Control	What it does
Scaling	`Blend`	What the display measures: 0% is pure correlation, which ignores level (“are these in phase?”); 100% is interference (“will these cancel when summed?”). Default 50%.
	`Weight`	How much more the louder moments count than the quiet ones while `Amp Weighted` is on, 0-200%: 0% treats every moment equally; 100% is normal weighting; 200% is stronger. Default 70%.
	`Bright`	How strongly the bars or heat fill glow. Turn it down when the overlay fights the waveform for attention, up when a quiet passage’s colours are too faint to read. Default 1.5.
	`Size`	How tall the bars stand in the lane: short, they sit under the waveform as a quiet strip; tall, the correlation becomes the main event. Greyed in Heatmap style, which has no bars. Default 1.0.
Options	`Hi-Res Phase`	Twice as many correlation bars across the display, 64 per grid division instead of 32, so shorter moments get their own bars. The trade is a busier overlay.
	`Heatmap`	A continuous colour field instead of bars: trouble shows at a glance across a whole passage, while bars resolve individual moments. `Size` doesn’t apply.
	`Amp Weighted`	Weight the display by amplitude so quiet passages don’t show strong readings that mean nothing.
	`Log Scale`	Draws bar height and heat strength on a dB scale instead of a linear one, so weak correlation stays visible rather than vanishing near zero.
	`Filters » Phase`	Band filters also apply to the correlation analysis (see Band filters, the next chapter).
	`Reset`	This page back to its defaults.

BAND FILTERS

A picture is easier to read when it shows only the range you care about. When you check a null in the bass you don't need to see the cymbals, and what a saturator does to the mids is easier to see when the kick's fundamental is filtered out. So each signal row ends in a two-handle slider: a high-pass and a low-pass, 20 Hz to 20 kHz (the high-pass handle stops at 15 kHz, the low-pass at 30 Hz). The filters are zero-phase, so the filtering never shifts what you see in time. Move both handles to the ends of the range and the band is `Off`.

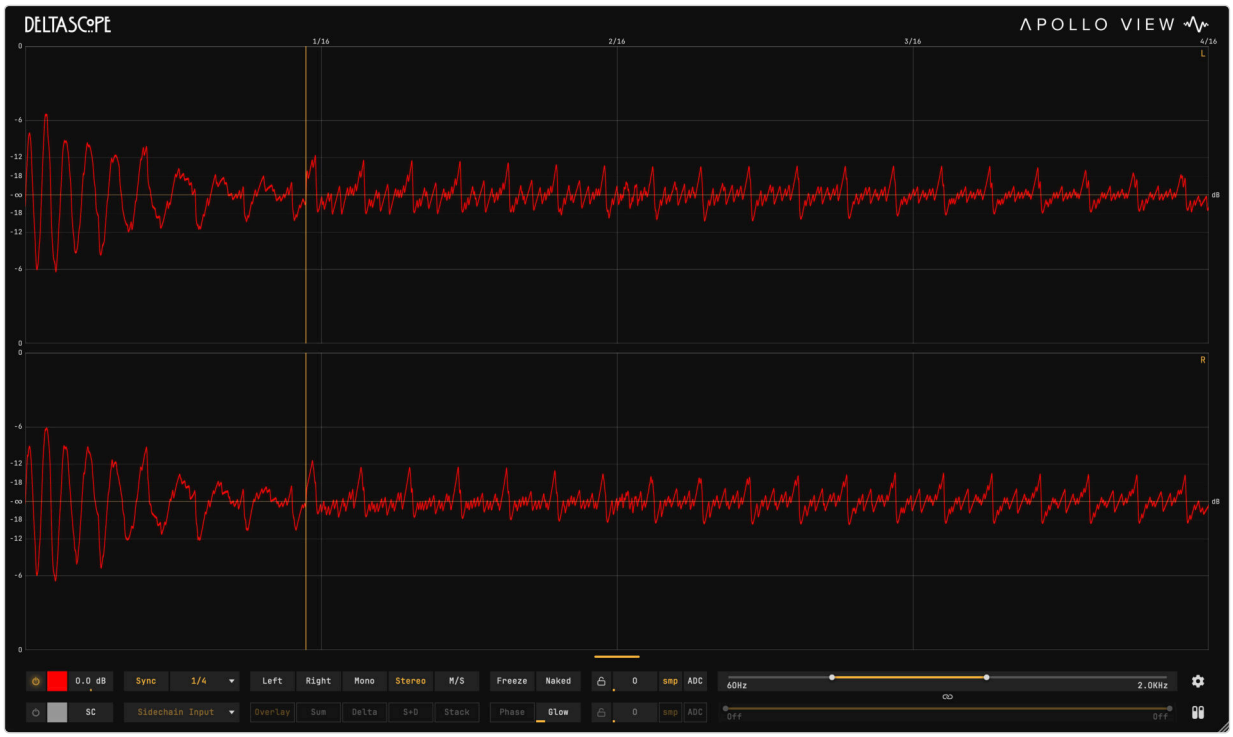
The band filter: high-pass and low-pass handles, with the link button beneath.

An analyser working on captured audio can filter with zero phase shift; a real-time EQ can't do this without adding latency. An ordinary filter shifts the frequencies near its cutoff slightly in time (that shift is "phase shift"), which would move the waveform on screen. DeltaScope's filters run over the captured stretch of audio forwards and then backwards. The two time shifts cancel, so nothing moves. That's why offset readings, nulls and phase checks made through the band stay valid.

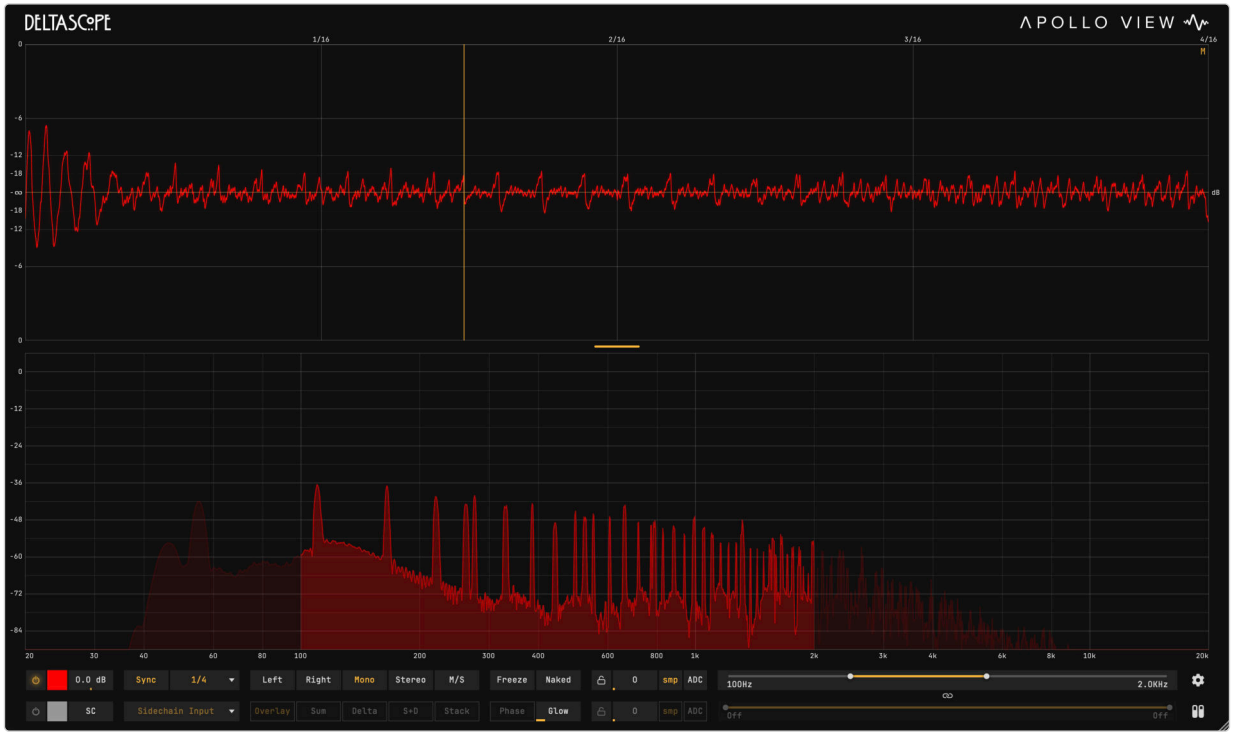
The coloured bar between the two handles is a handle too. Drag it and the whole band slides along, keeping its width: a quick way to sweep a fixed-width band across the spectrum. It's useful with Delta: sweep the band while watching the delta to find the frequency range a processor changes.

> **CAUTION:** The band filters are purely visual. They filter what DeltaScope analyses and draws, never the audio you hear. The signal passing through the plugin stays untouched wherever the handles are.

The link button between the rows ties both filters together, so main and reference always compare the same band. Two switches in Settings apply the band to the spectrum (`Filters » FFT`) and the phase display (`Filters » Phase`); in the spectrum the out-of-band region dims, so you can see which range is being analysed. The Magnitude view is the one exception. It always compares the two full-band signals, because a filtered ratio would no longer be the processor's curve.



Main band 60 Hz to 2 kHz: the scope draws only the range in question; the audio through the plugin is untouched.



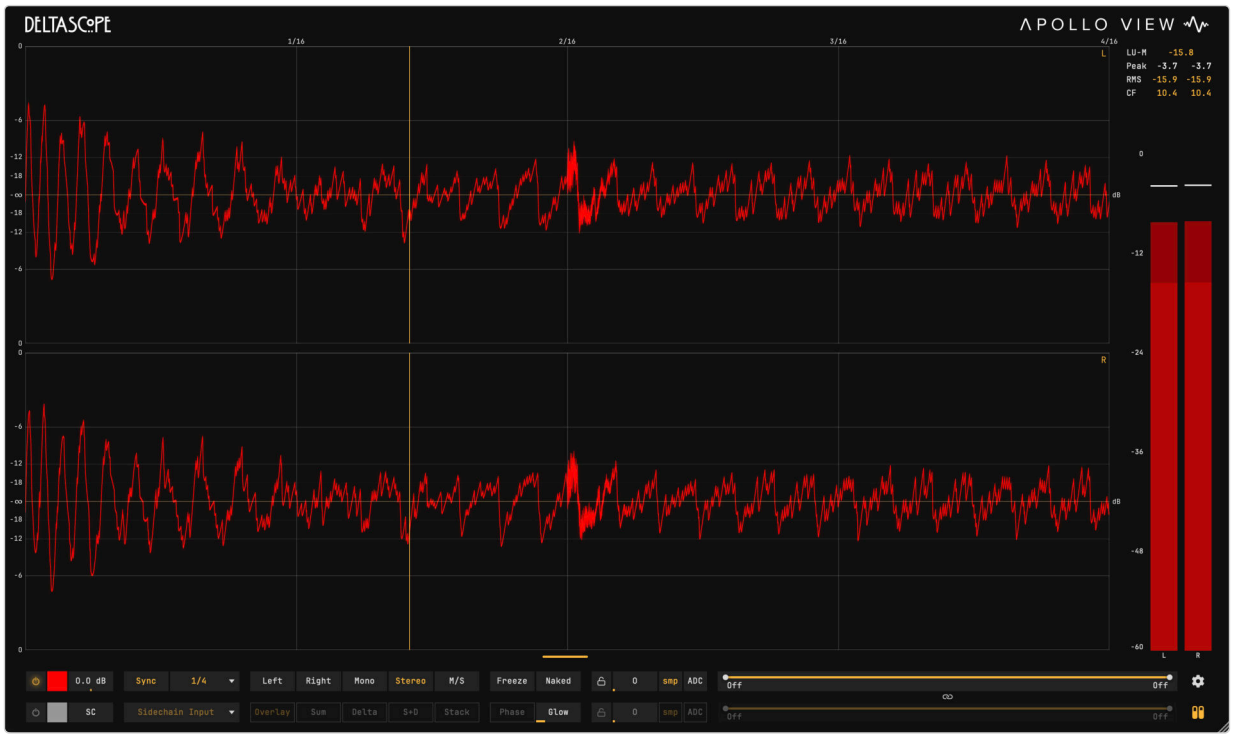
Band at 100 Hz to 2 kHz with Filters » FFT active: the spectrum fill dims outside the band.

Band at 100 Hz to 2 kHz applied to the phase display: correlation is analysed inside the band only.

LEVEL METERS

The meters button (bottom right) docks a meter strip beside the display:

- **Peak bar**: one per channel (L/R, or Mid/Side in M/S mode). Sample peak reads the loudest sample. True peak (4× oversampled, the ITU-R BS.1770 approach) also estimates the peaks that fall between samples. A converter or a lossy encoder can produce those peaks, which is why delivery specs ask for a true-peak figure. Ceiling, floor, release and peak hold are configurable. The held line turns red while it is at or above 0 dBFS.
- **Secondary bar**: per-channel RMS, with its window set in Settings > Meters.
- **Readout**: loudness as streaming services and broadcasters measure it (BS.1770), as a momentary (LU-M), short-term (LU-S) or whole-programme integrated (LU-I) figure, alongside per-channel peak, RMS and crest factor (CF). The peak figure holds its highest value for two seconds before it decays, and turns red while that channel's held peak is at or above 0 dBFS. Double-click the loudness readout to restart an integrated (LU-I) measurement.
- **Crest factor**: the gap between peak and average level, how much dynamic range is left; a smaller number means a more compressed signal. The readout holds its lowest recent value, the most compressed moment, for two seconds before releasing, so a limiter that is compressing too much appears as a low number. The RMS window is also used as the crest-factor window.



Meter strip docked: peak and RMS per channel, programme loudness on top.

In Mid-Side mode the bars and the peak, RMS and crest-factor readings all measure mid and side. The one exception is the loudness figure at the top: it stays the loudness of the whole programme, not of mid or side on their own, because that's what the standard defines and what a streaming service will measure. Switching channel modes never changes your loudness number. Two more readings can look wrong but are correct. Programme loudness

sums both channels, so a centred signal reads about 3 LU above what either channel alone would. And True Peak can legitimately read above 0 dBFS; finding inter-sample peaks is the purpose of the measurement. For reference, a sine's crest factor is about 3 dB and a square's about 0 dB.

METER SETTINGS (SETTINGS > METERS)

Settings, Meters page.

Section	Control	What it does
Peak	`True Peak`	Estimate the peaks that fall between samples (4× oversampled true peak) instead of reading the loudest sample.
	`Release`	How quickly the peak bar falls back after a peak: short and the bar dances with every hit, long and it eases down for an easier read. (The held line above it is `Hold`'s job.) Default 150 ms.
	`Hold`	How long the peak bar's held line stays before dropping. Default 2000 ms.
RMS	`Window`	How much recent audio the RMS and crest-factor figures average over: short follows the music moment to moment, long gives a steadier number that's easier to compare. Default 300 ms.
Readout	`LUFS`	Loudness readout mode: LU-M (momentary), LU-S (short-term) or LU-I (integrated). Double-click the readout to restart LU-I.
Range	`Ceiling` / `Floor`	Meter scale in dB. Default +6 / −60.
	`Reset`	This page back to its defaults.

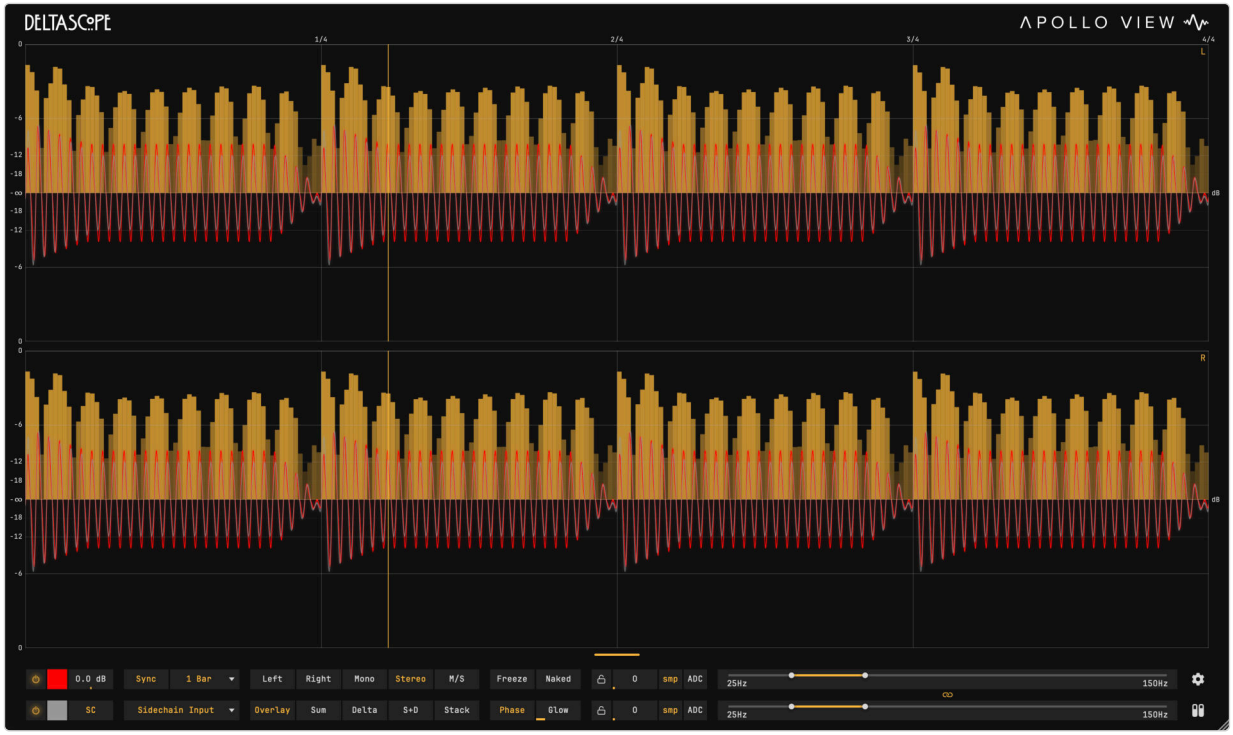
USE CASES

FIX KICK AND BASS PHASE

Kick and bass share the low end, and when they are out of phase the sum loses level in the overlap. EQ can boost the cancelled region, but it can't undo the cancellation.

1. Put DeltaScope on the bass bus and use the kick as the reference (sidechain or instance link).
2. Use the band filters to isolate the overlap region (roughly 25 to 150 Hz) so the analysis covers only that range.
3. Enable `Phase`. Correlation dropping toward −1 on the kick hits means the two are cancelling; `Overlay` mode shows the same thing in the waveforms.
4. Fix it on the bass with a polarity flip or a small time shift, until the correlation reads positive through the kick hits on the notes you care about. Then listen.

The cancellation, located. With the band at 25 to 150 Hz, the phase display compares bass against kick: red for the whole musical bar means the two are cancelling in the band where they overlap. A stereo correlation meter can't show this; it compares left with right, not your kick with your bass.



After the fix: same bar, same instruments, gold. Kick and bass now add together on every hit instead of cancelling each other.

Fixing it at the source is what our Align plugin is for.

SEE WHAT YOUR PROCESSING ACTUALLY DOES

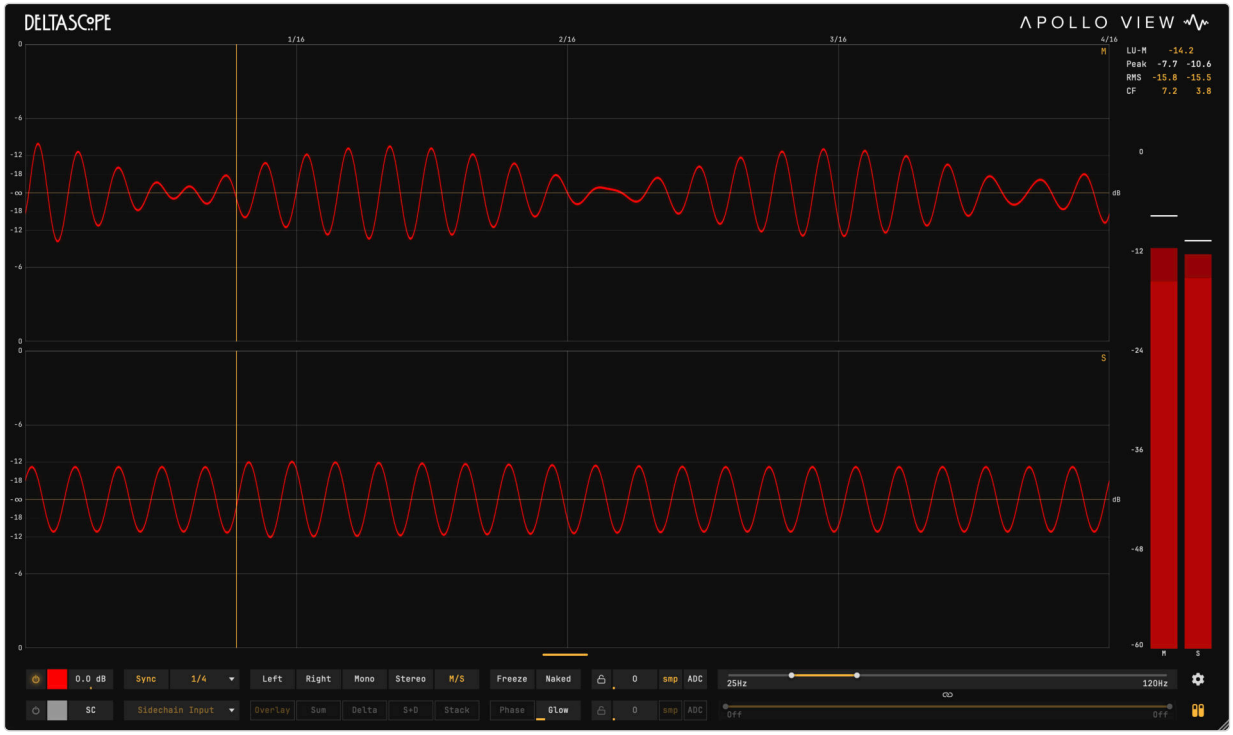
Insert one DeltaScope before your processing and one after, link the second to the first by track name (or sidechain the clean signal into it), and choose `Delta` mode. The scope draws what the processing is changing, and `View` set to Magnitude in Settings > FFT makes the spectrum show the processor's frequency response on your real material. Use it to check a Pultec-style EQ move, see what a compressor reshapes, or check a whole chain. Use ADC and a small manual offset adjustment (see Alignment), or the latency figures your DAW reports, to align the two signals to within a single sample. The full walk-through is Tracing a processor's real curve, in Delta and Hear the Delta.

LISTEN TO THE DIFFERENCE

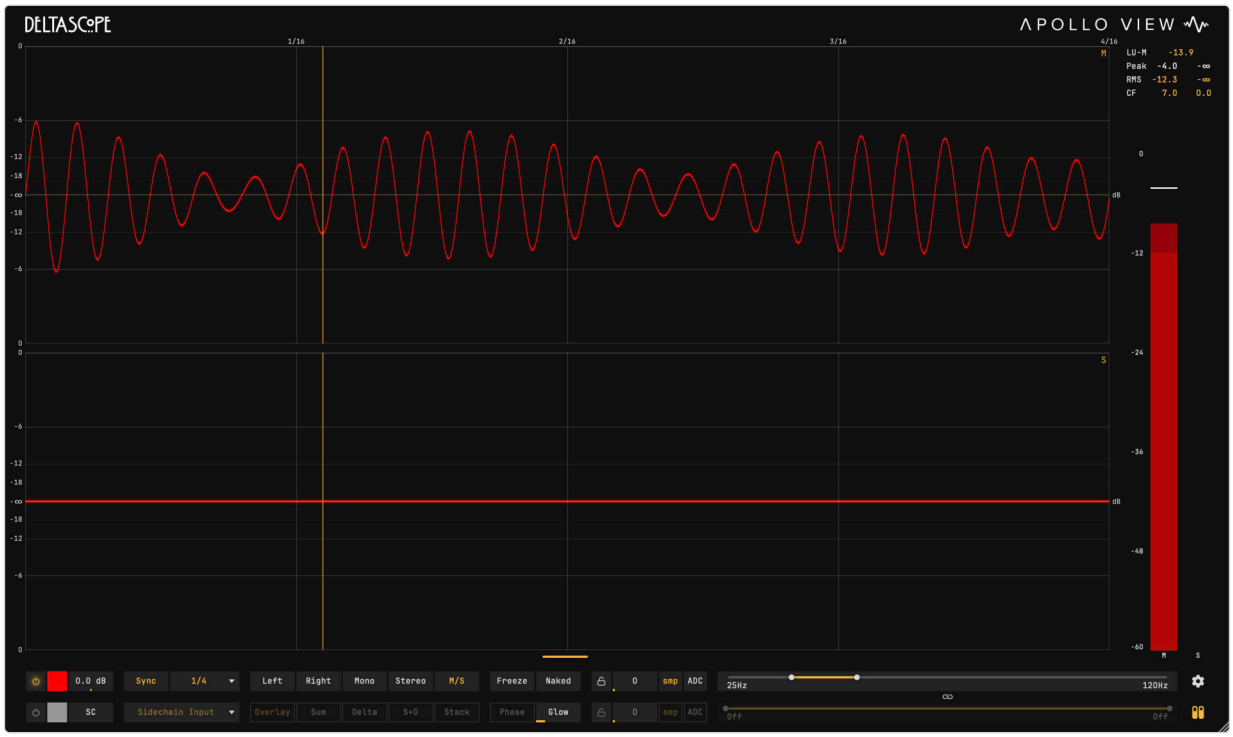
Use the same setup, but listen instead of looking. With Hear the Delta on (the default), DeltaScope's output **is** the difference signal for as long as `Delta` mode is selected. What you hear is everything the processing is adding or taking away, isolated: a limiter reducing transients, or what a plugin described as transparent actually changes. Remember that a delta you can hear on its own isn't the same as a change you'd hear in the mix.

CHECK WHAT SURVIVES MONO

`M/S` mode: anything that appears only in the Side lane disappears when the mix is summed to mono. Band-limit to the low end and look at the Side lane:



Band-limited to the sub and viewed in Mid-Side: the Side lane is carrying real low-frequency energy, and that part of the bass disappears the moment the mix is summed to mono. The meters read the full band, not the band you've isolated.

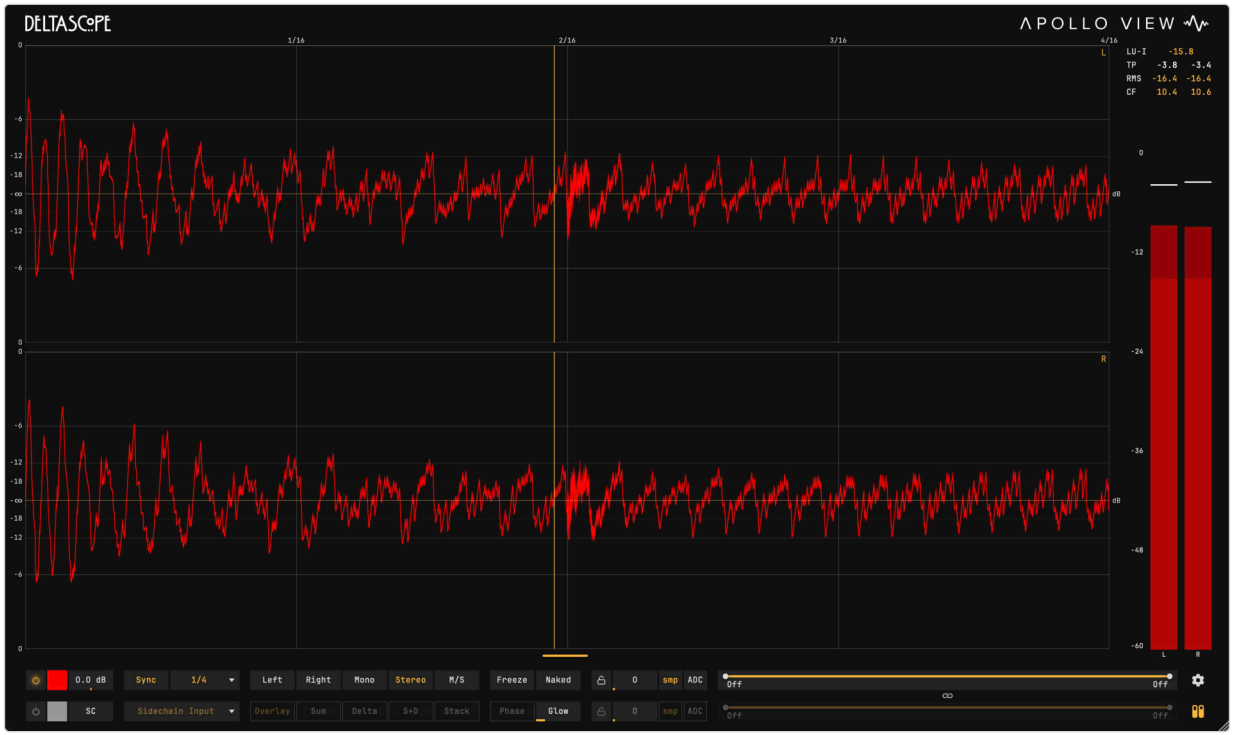


The same groove with a mono sub: the Side lane goes flat, and the low end survives mono.

For the correlation view of the same question, route the elements you're worried about into main and reference (kick against bass, double against lead) and watch where `Phase` turns red. Sweep the band filters to find which frequency range is cancelling.

DELIVER TO SPEC

1. Open the meter strip with the meters button and enable `True Peak` in Settings > Meters.
2. Set the readout to LU-I and double-click it to start a fresh integrated measurement.
3. In Settings > Meters, set `Hold` to its maximum (10 s) so the peak bar's held line stays long enough to read.
4. Play the track from start to end, watching the peak bar's held line through the loudest passages. At the end, the LU-I readout is your integrated loudness.
5. The highest value the held line reaches is your true-peak maximum; the gap between it and the spec's ceiling is your margin. The meters don't remember the highest peak of the whole programme, which is why you watch the held line as the track plays.
6. Compare both with the delivery spec you're mixing for. Most streaming services normalise to around −14 LUFS integrated and ask for a true-peak ceiling of −1 dBTP; broadcast specs are stricter. Those are the two numbers most specs ask for.



Deliver to spec: `True Peak` on (TP), LU-I integrated readout, RMS secondary bar.

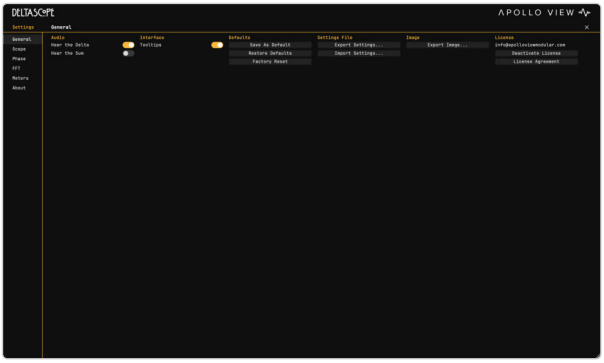
MAKE VIDEO CONTENT

Naked mode hides every control and label, leaving waveform, spectrum or both, edge to edge: clean output for music videos, tutorials and livestreams. The hidden 16:9 lock (see Freeze and Naked mode) fits the window to a video frame.

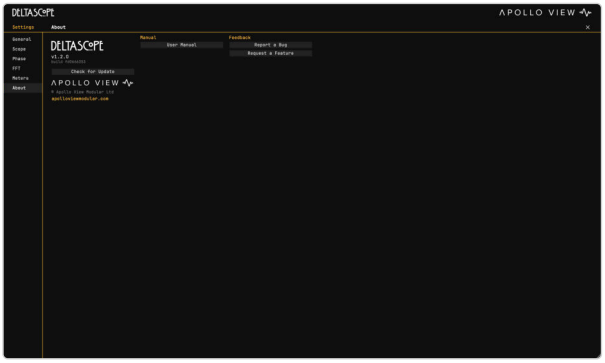
SETTINGS

The cog opens Settings over the display. The title bar stays, so the tooltip strip keeps describing whatever you point at. The pages are listed down the left — `General`, `Scope`, `Phase`, `FFT`, `Meters` and `About` — and clicking a name opens that page. Each page lays its settings out in columns to fit the window at whatever size it is; only a window smaller than the default has to scroll. A page with a `Reset` shows it at the top right, and it returns that page, and only that page, to its defaults. Close Settings with the × at the top right or with Escape. Every change applies as you make it. Phase, FFT and Meters have their own chapters.

- **General**: everything that is about the plugin as a whole. `Hear the Delta` is the delta monitor switch: with it on, choosing the Delta comparison mode sends the difference signal to the plugin's output (see Delta and Hear the Delta). `Hear the Sum` does the same for the Sum comparison mode, off by default; with both on, Sum and Delta are a polarity check (see Hear the Sum). `Tooltips` turns the control descriptions in the title bar on and off. `Save As Default` stores the current settings as the default for new instances. It's dimmed until a setting has changed since the last save or restore. If all you want is to save what you already have, change any setting and change it back. Some settings belong to one project or moment rather than to your general setup: Freeze, the sample offsets with their padlocks, and the instance link. These are not saved in the default, on purpose, so a new instance always opens with its offsets at zero and unlocked. `Restore Defaults` loads the saved default into this instance, keeping its window size; it's dimmed until a saved default exists and something has changed since. `Factory Reset` deletes the saved default and returns this instance to factory settings, window size aside.
  `Export Settings...` writes the current settings to a file and `Import Settings...` loads one, so you can move your setup between machines or share it. Import checks the whole file and rejects a damaged one rather than half-applying it. `Export Image...` renders the current display (waveform lanes and spectrum) as a high-resolution PNG, laid out exactly as on screen and without the controls; a save dialog asks where. The image is drawn from the audio itself, not captured from the screen, so freeze first if you want a precise moment. If nothing has played yet there's nothing to export. When you export, Settings closes first: the display itself renders the image, and Settings sits on top of it. The License section shows the email the plugin is licensed to. `Deactivate License` removes the stored key from this machine (see Licensing), and `License Agreement` opens the licence on our website. Without a licence the section reads Demo mode and the button becomes `Activate License...`, which brings back the activation screen.
- **Scope**: `Clip Overlay` and `Clip Border`, `Cursor` and `Rolling` (the cursor has no meaning while the trace rolls, so it's dimmed then), and `Colour by Frequency` for the main and the sidechain traces (see Colour by frequency). This page has a `Reset`.
- **About**: the version and, under it, a build stamp that distinguishes two builds of the same version; support will ask for both, and a bug report fills them in for you.
  `Check for Update` beneath them opens our website, where the newest version is. The gold address opens our website too. `User Manual` opens this manual in your browser, always the newest version. `Report a Bug` and `Request a Feature` open pre-filled support emails (the bug report fills in your plugin version, build stamp, OS, DAW, sample rate and buffer size for you).



Settings, General page.



Settings, About page: version and build stamp with `Check for Update` under them, the manual and the feedback emails.

WHAT IS REMEMBERED

Nearly everything you set is saved with the DAW project, per instance: window size and the pane split, timebase, channel mode, colours, gain and Glow, the comparison mode and source, both band filters, both offsets with their units and padlocks, every Settings page, the meter strip and `Phase`. Reopen the project and it all comes back, links reconnected by track name. A few things are for the session only, on purpose, and start fresh every time: Freeze, the two power buttons, Naked mode, zoom and pan, an armed `ADC`, a measurement selection and the 16:9 lock. A project never opens frozen, blank, zoomed or with its controls hidden.

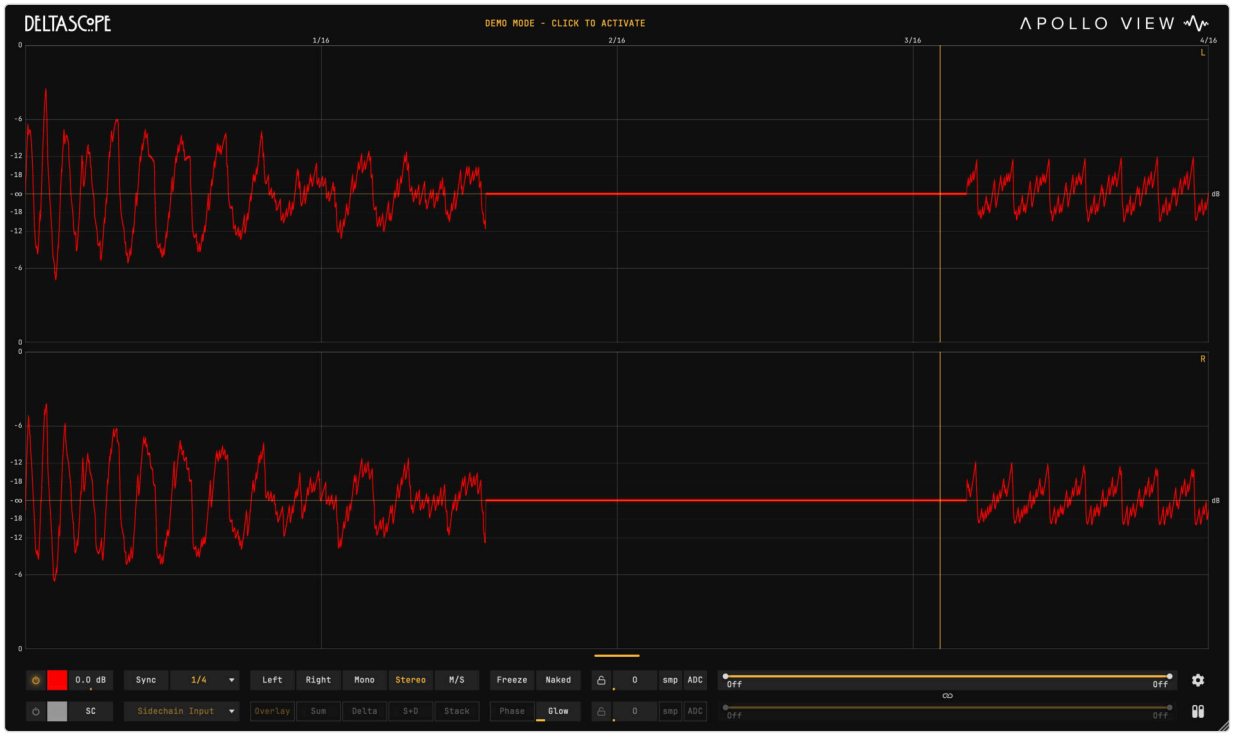
FILES

DeltaScope keeps two files outside your DAW projects, both in `~/Library/Application Support/ApolloView/` on macOS and `%APPDATA%\ApolloView\` on Windows: the licence (`DeltaScope.license`) and your saved defaults (`DeltaScope/defaults.json`). Back up the defaults file when you move to a new machine. The licence doesn't need backing up: just activate again on the new machine. Deleting the licence file returns the plugin to the activation screen; deleting the defaults returns new instances to factory settings. Or skip the file copying: `Export Settings...` and `Import Settings...` in the panel's Settings File section carry your settings across as one file.

DEMO MODE

Without a licence, DeltaScope runs as a full demo: every feature works. The waveform goes flat and the audio mutes for about five seconds in every twenty-five, at a moment that changes from one mute to the next, with a gold `DEMO MODE - CLICK TO ACTIVATE` banner in the title bar. Clicking the banner reopens the activation screen.

The mute fades in and out without clicks, and every demo DeltaScope in the project mutes at the same moment, so a project with several of them goes quiet once each time rather than several times.



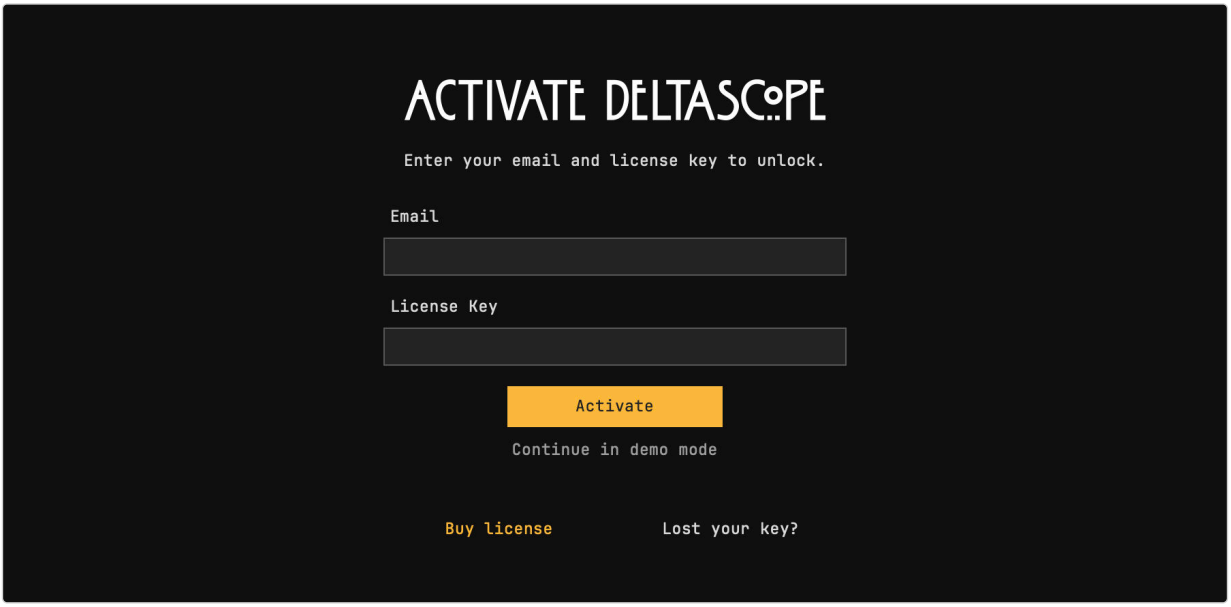
Demo mode: gold banner in the title bar. The flat gap in the waveform is the periodic demo mute.

LICENSING

1. Buy a licence at shop.apolloviewmodular.com/plugins/deltascope (the activation screen's `Buy license` link goes to the same place, and `Lost your key?` is the way to recover a lost key).
2. Open DeltaScope, enter your email and key, click `Activate`.

Activation is local. The key is checked on this machine, and once you have it no internet connection is needed; getting the key is the only online step. `Deactivate License` in Settings > General removes the stored key from this machine. To move to another machine, activate there with the same email and key.

If the activation screen reports that it activated but the licence could not be saved, the key was accepted and this session runs licensed, but the plugin couldn't write its licence file. Check the permissions on the ApolloView folder — both platforms' paths are listed under Files, in the Settings chapter of this manual — or you'll be asked to activate again at the next launch.



The activation screen, with demo entry below.

Licensing is designed so that a failed check never locks you out. If a licence check can't complete, the plugin keeps working, and if the licence file can't be read while the plugin is running, DeltaScope retries rather than treating it as missing. The plugin never contacts our servers on its own. `Check for Update` opens our website in your browser, and a bug report drafts an email in your own mail client. Nothing is sent until you press send.

IN SHORT

- **Frame it**: Sync locks the time window to the beat. Free-run spans a length of time, or a set number of cycles of a chosen frequency or note. MIDI locks to the note you play. Two cycles are easier to read than one. The divider pill sets the split between scope and spectrum, or gives the whole display to one of them.
- **Analyse it**: the spectrum (with Multi FFT for the low end) shows where the energy is, the meters show your levels, and Freeze, zoom and measurement let you study what you find. Band filters isolate the range you care about.
- **Get a second signal in**: sidechain, or link another DeltaScope by track name. Align them (ADC measures the latency; a small manual offset finishes the alignment) and the two are compared sample for sample. Correlation shows where they cancel.
- **The delta**: subtract the original from the processed signal and only the change is left. Identical signals draw a flat line; once the two are aligned, anything else is what your processor is doing: in time on the waveform, in frequency on the spectrum's Difference view, and as a response curve in Magnitude view.
- **Hear it**: Hear the Delta makes the difference signal the plugin's output, but only while Delta mode is selected; Hear the Sum does the same for Sum mode. They're the only times a licensed DeltaScope changes your audio.

LICENCE AND WARRANTY

DeltaScope is licensed, not sold. Use of the software is governed by the End User License Agreement shown by `License Agreement` on the General page of Settings and shown by the macOS installer.

Apollo View Modular Ltd supplies this software “as is” and, to the maximum extent permitted by law, accepts no responsibility for harm to persons, apparatus or data caused through the operation of this product. This does not affect your statutory rights.

Please contact support@apolloviewmodular.com with any questions, bug reports or requests.

https://www.apolloviewmodular.com