Grainsmith

Desktop Edition (macOS & Windows)

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1. Grainsmith

A granular synthesis instrument and effect. Load any audio, break it into thousands of short grains, and reshape them into pads, drones, textures, rhythms, and sound effects.

Grainsmith comes in two editions:

- **Grainsmith** is the desktop plugin for macOS and Windows, in VST3, AU, AAX, and standalone formats. Two layers, a spectral synth per layer, reverb, delay, compression, and a modulation matrix.
- **Grainsmith Field** is the iPad and iPhone app, built for touch. Four XY performance pads over the same granular engine.

Pick your edition below.

Desktop: quick start

Get sound out of the plugin in about five minutes.

Desktop quick start →

Field: your first sound

From opening the app to a sound you can play.

Field quick start →

What is granular synthesis?

The idea behind the instrument and what you can make with it.

Read the theory →

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2. What is Grainsmith?

Grainsmith is a **granular synthesizer**. You give it an audio sample — a recording of anything, from a single piano note to a field recording of rain — and it slices that sample into hundreds or thousands of short fragments called **grains**. Each grain is between about 1 millisecond and half a second long. By spawning grains rapidly, varying their pitch, position, window shape, and amplitude, and layering the result through a modulation matrix, Grainsmith turns any source sound into a new instrument.

2.1 Two layers, one engine

Grainsmith has two independent **layers**, Layer 1 and Layer 2. Each layer has its own audio buffer, grain engine, window shape, pitch variation, filter, and envelopes. Use the two layers in parallel for thick layered sounds, in opposition for call-and-response patches, or mix a rhythmic layer against a pad for generative backgrounds.

A global synthesis block (sub oscillator, VCA/filter envelopes, glide) sits downstream of both layers, followed by the FX chain — master filter, compressor, tape delay, and multi-mode reverb. The Layer System reference explains exactly what is per-layer and what is global.

2.2 What you can make with it

- **Pads and drones** from a single held note or a vocal "ahh".
- **Rhythmic textures** by syncing grain density to your DAW's clock and routing a euclidean pattern to the grain trigger.
- **Frozen reverbs** by holding the grain position and sweeping density.
- **Pitched instruments** by mapping the grain source to MIDI notes with the root-note glide control.
- **Sound design** for film, games, and live performance.
- **Cinematic risers and impacts** by modulating scan rate and window shape over time.

2.3 Versions

Grainsmith runs as:

- A **standalone desktop app** for macOS and Windows.
- A **plug-in** for any DAW that supports VST3, AudioUnit, or AAX (macOS), or VST3 (Windows).

This manual covers the desktop app and plug-in. The iPad version is a separate product, **Grainsmith Field**, with its own documentation.

2.4 Where to start

If you want sound right now, read the Quick Start. If you want to learn every control before you touch one, start with the GRAIN tab reference. If you want to build something specific end-to-end, try Your First Patch — a ten-minute walkthrough that ends with a working ambient pad preset.

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3. Quick Start

You'll have sound coming out of Grainsmith in about five minutes.

> **First-launch shortcut**
>
> The very first time you launch Grainsmith, the app loads a factory preset called **First Patch** with a sample already attached. Press Play (standalone) or hold a MIDI note (plug-in, Instrument mode) and you'll have sound immediately — no setup required. The walk-through below assumes a clean session with your own sample, but you can also just start tweaking First Patch.

1. **Install Grainsmith** by following the install guide.
2. **Launch the standalone app**, or open Grainsmith as a plug-in in your DAW — load it on an instrument track (or use Grainsmith FX on an audio track).
3. **Drag any audio file** onto the waveform display at the top of the window. WAV, MP3, and FLAC work everywhere; macOS also loads AIFF, M4A, and Ogg. Any sample rate is fine — Grainsmith resamples to the session rate automatically.
4. **Press Play** in the header (standalone), or play a MIDI note from your DAW (plug-in, Instrument play mode).
5. **Turn the Density knob** on the GRAIN tab up to around 30. You should hear a stream of grains pulled from your sample.
6. **Turn the Pitch knob** up an octave (+12 st). The grains shift up while keeping the same grain size and density.
7. **Open the FX tab** and raise the Reverb Mix knob. Welcome to ambient music.

3.1 Next steps

- For a full guided walkthrough: Your First Patch.
- To understand what you just heard conceptually: What is Grainsmith?.
- To learn every control on every panel: start with the GRAIN tab reference and work through the other tabs under **Reference → Tabs** in the sidebar.

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4. Your First Patch — An Ambient Pad

This tutorial walks you through building a slowly-evolving ambient pad from a single audio sample. By the end you'll understand the core controls on the GRAIN, TEXTURE, MOD, and FX tabs, and you'll have a sound you can save as a user preset.

Time: about 10 minutes.

You'll need: any sustained sound recording — a held piano note, a vocal "ahh", a string drone, or a field recording with a pitched character all work well. A sharp drum hit is a poor choice for this particular recipe; short percussive samples produce rhythmic textures instead of pads.

4.1 Step 1 — Load a sample

Drag your audio file onto the waveform display at the top of the Grainsmith window. The waveform appears and Grainsmith automatically resamples the file to your current session sample rate on a background thread.

You should see a stereo waveform drawn across the top of the window and a vertical line marking the current grain spawn position.

4.2 Step 2 — Set the grain core

Open the **GRAIN** tab if it isn't already visible and dial in these starting values in the GRAIN column:

- `Size` — set to around **0.3 s** (300 ms). Large grains are the foundation of pad sounds: they play back enough of the source that each grain has a recognizable tone, but not so much that you just hear the original sample looping.
- `Density` — set to around **20**. Enough grains overlap to create a continuous texture without the CPU load of hundreds per second.
- `Pitch` — leave at **0** for now. We'll add variation with the MOD tab later.
- `Speed` — set to around **0.05**. This is the *playback* speed of the grain reader through the buffer — slow enough that successive grains come from nearly the same point in the sample, which is what makes a pad sound static.
- `Jitter` — set to about **0.15**. A small amount of random position offset prevents the machine-regularity that pure 20 Hz density would otherwise produce.

Press Play (standalone) or hold a MIDI note (plug-in, Instrument mode) and you should already hear a rough pad-like sound.

4.3 Step 3 — Pick a window shape

Switch to the **TEXTURE** tab. In the **Shape** column:

- Set `Window Shape` to **Hanning**.

The window is the amplitude envelope applied to every grain. Hanning (a raised-cosine curve) fades each grain in and out smoothly, which is exactly what you want for pad sounds — the fade-in and fade-out eliminate the clicks you would get from abrupt grain starts, and the soft envelope lets adjacent grains blend rather than compete. Try switching to **Triangle** or **Trapezoid** for comparison: they sound noticeably more percussive.

Leave Tilt, Curve, and Sides at their defaults for now.

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4.4 Step 4 — Add motion with modulation

Pads get boring when nothing moves. Switch to the **MOD** tab and set up one of the five mod lanes:

- `Source` — **LFO**.
- `Dest` — **Position** (grain spawn position).
- `Amount` — about **0.15**. This is a bipolar depth, so the grain position will drift ±15% of the buffer around the currently-set point.
- `LFO Rate` — about **0.1 Hz** (one full cycle every 10 seconds).
- `LFO Shape` — **Sine**.

The position of the grains now slowly drifts through the sample over time. Because your sample is a sustained sound rather than a percussive one, the drift sweeps through slightly different timbres (different overtones, slightly different decay characteristics) and adds the organic evolution that a static pad lacks.

4.5 Step 5 — Send it through reverb

Switch to the **FX** tab. In the Reverb section:

- `Mode` — **Stormy**. Of the three reverb modes, Stormy has the longest tail and the most modulated character, which is the ambient-pad default.
- `Size` — **0.75**. A large virtual space.
- `Damping` — **0.4**. Some high-frequency absorption so the reverb tail doesn't get harsh.
- `Mix` — **0.45**. A generous wet amount — ambient pads live and die by their reverb.

If you want to push into washing-drone territory, raise Mix to 0.7 and enable `Freeze` on the reverb to hold the current tail indefinitely.

4.6 Step 6 — Save it as a preset

In the header bar, click the **Save** button (disk icon next to the preset name). Enter a name — "My First Pad" is traditional — and confirm. The preset file is written to your user presets directory and is now available from the preset browser on any future launch.

4.7 What you just learned

- The four most important grain parameters: **Size**, **Density**, **Speed**, and **Position**. Every pad recipe starts with these.
- How **window shape** changes the *character* of grains beyond their basic parameters — a Hanning window is smooth, a Trapezoid window is punchy, and the choice matters as much as any knob on GRAIN.
- How **modulation** adds movement to an otherwise static patch, and how even a very slow LFO on a single parameter can make a sound feel alive.
- How **reverb mode** is more than a tail length — it's a tonal choice, and the Stormy mode sounds different from Misty even at identical Size and Mix values.

4.8 Where to go next

- Read the full GRAIN tab reference to discover every control you didn't touch (including the MORPH column's assignable Macro knob, which is a tutorial of its own).
- Read the full MOD tab reference — the single lane you set up is one of five, and the rhythmic sources can drive entirely different types of patches.

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- Try the same recipe with a **percussive** sample (a single drum hit, a snippet of speech, a guitar pluck). The same knob positions will produce a completely different sound, which is the whole point of granular synthesis.

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5. What is granular synthesis?

5.1 Opening hook

Imagine you have a vinyl record playing a single piano note. The note holds steady for thirty seconds. Now imagine you pick up the needle, drop it back on the same groove, wait a few milliseconds, and repeat — ten times a second. You'll hear a rapid stutter. The original piano note is in there, but the sound itself is something new: a buzzing, textured drone stitched together from tiny snippets of the original.

That's granular synthesis. The technique takes any recorded sound, slices it into fragments shorter than a human ear can resolve individually, and resynthesizes a new sound out of the overlap.

5.2 The core idea

A **grain** is a short audio fragment — typically between one millisecond and half a second long — taken from a source recording and shaped by a smooth amplitude envelope at both ends so it doesn't click when it starts or stops. By itself a single grain sounds like what it is: a tiny snippet of sound. The interesting part starts when you spawn many grains in rapid succession, each from a slightly different position in the source buffer, and let them overlap. Your ear can't resolve individual grains below about twenty per second, so above that rate the grains fuse into a continuous texture.

Four variables define how that texture sounds. **Grain size** — how long each grain is — controls whether you hear something pad-like (longer grains, more of the original sample audible in each) or percussive (shorter grains, each heard as a pointillistic click or pluck). **Density** — how many grains spawn per second — controls whether the result sounds sparse and rhythmic (low density, grains heard as discrete events) or smooth and continuous (high density, grains overlapping into a wash). **Position** — where in the source audio each grain is sliced from — lets you hold a single moment of the source or scan through it at any speed you like, including backwards. **Pitch** — the per-grain transposition — lets you shift the perceived pitch of the resynthesized sound without changing how fast the position scans, because each grain is short enough that the pitch-shift is effectively instantaneous.

Those four knobs are the heart of every granular patch ever made. Every other granular control — jitter, spread, window shape, trigger patterns, modulation — is a variation or a decoration on top of them.

The technique was first theorized by the physicist Dennis Gabor in 1947, in a paper called *Theory of Communication*. Gabor wasn't a composer; he was working on a mathematical decomposition of signals into elementary time-frequency atoms. Musically, the technique was first put into practice by Iannis Xenakis in the late 1950s — he assembled grain sequences by hand, cutting and splicing magnetic tape, because no computer of the era could do it in real time. Curtis Roads wrote the software implementations that made granular synthesis practical on computers in the 1970s and 1980s, and his book *Microsound* (2001) remains the canonical reference.

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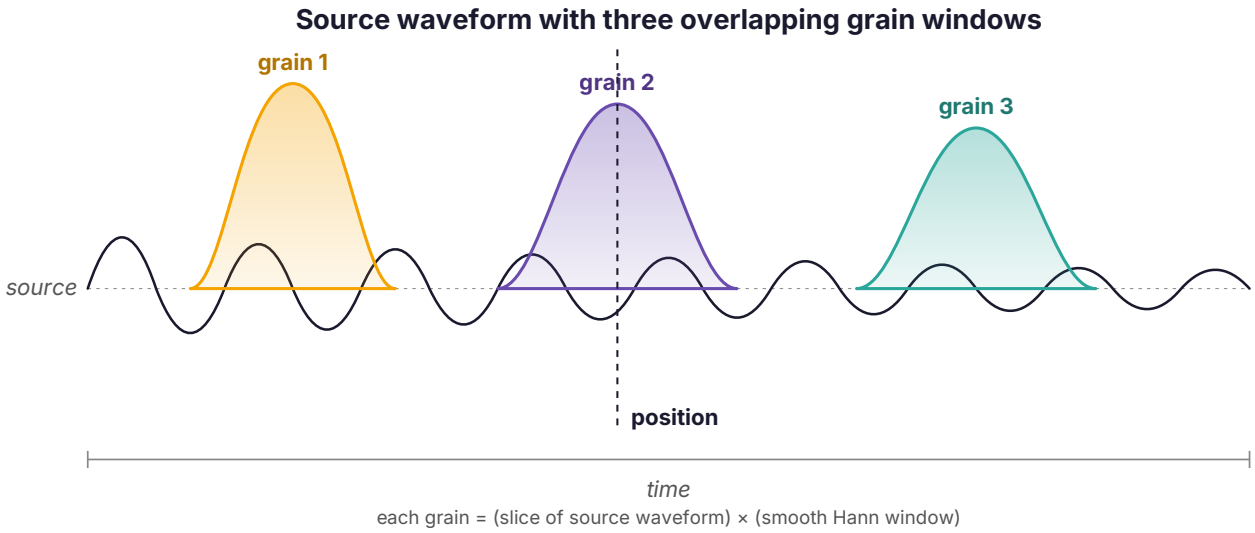

The diagram above shows a source waveform (the piano note) with three grain windows overlaid at different positions. Each grain takes a small slice of the source and multiplies it by a smooth envelope that fades in and out. The grains overlap each other, and the listener's ear blends them into a continuous texture.

5.3 In Grainsmith

Everything above maps to the same handful of core controls, in both the desktop plugin and Grainsmith Field on iPad:

- `Size` sets the grain length, from a few milliseconds (so short you hear each grain as a click or as its own pitch) up past a second (so long it sounds almost like the original sample playing). Most musical pad textures live in the 30–200 ms range.
- `Density` sets how many grains spawn per second. At low values (below about 10 Hz) you hear discrete grain events, useful for rhythmic, pointillistic patches. Above about 20 Hz the grains fuse into a continuous wash; above about 100 Hz the spawn rate itself starts to be heard as pitch.
- `Pitch` transposes each grain up or down at the moment it spawns. Because grains are short, you can pitch-shift them a long way without the time-stretching artifacts you'd hear from pitch-shifting the whole sample in real time.
- The read position on the waveform sets where in the source each grain is sliced from. Hold it still and you get a frozen sound at one moment of the source; sweep it and you scan through the source in time.

The window shape each grain plays through, and the per-grain pitch and reverse variation layered on top, build on these core controls. Where each control lives is covered in your edition's reference: the tab pages for the desktop plugin, the panel and pad pages for Grainsmith Field.

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The math, for the curious

A grain is a finite-length signal $g(n)$ formed by multiplying a source signal $s(n)$ by an envelope window $w(n)$:

$$g(n) = s(n_0 + n) \cdot w(n), \quad 0 \le n < L$$

where L is the grain length in samples and n_0 is the read position in the source buffer. The window function $w(n)$ is typically a Hann or Tukey window — smooth at both ends so that the product of source-times-window fades in and out without an audible click. The output of the granular synthesizer is the sum of many overlapping grains, each spawned at its own start time t_i:

$$y(n) = \sum_i g_i(n - t_i)$$

Density is the rate λ at which spawn times t_i are scheduled — either uniformly (every $1/\lambda$ seconds) or stochastically (Poisson-distributed around a mean rate of λ). **Pitch shifting** is implemented by reading the source buffer at a different speed inside each grain: a per-grain resampling that doesn't affect the overall playback rate, because each grain is short enough that the resampling is inaudible as a time stretch.

Curtis Roads' *Microsound* (MIT Press, 2001) derives all of this formally, connects it to the Fourier-style time-frequency decomposition Gabor originally proposed, and is the canonical reference for anyone who wants to dig further.

5.4 Further reading

- **Microsound**, Curtis Roads (MIT Press, 2001) — the definitive book on granular synthesis theory and practice.
- **Theory of Communication**, Dennis Gabor (Journal of the Institution of Electrical Engineers, 1946) — the original mathematical paper that introduced the grain concept.
- **Formalized Music**, Iannis Xenakis (Indiana University Press, 1971) — the first composer to put the theory to musical use writes about it in his own words.

5.5 See also

The controls that put this theory to work live in your edition's reference: the GRAIN tab and the first-patch tutorial in the desktop manual, and the panels and pads in Grainsmith Field.

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6. Header Bar

The header bar runs across the top of the Grainsmith window. It holds the preset browser, transport, host-sync toggle, and (in compact layouts) the layer selector and tab navigation.

6.1 Preset browser

At the center of the header bar is the **preset browser**:

- **← / →** — step to the previous or next preset.
- **Name** — click to open a searchable list of factory and user presets.
- **Save** — write the current patch as a user preset (`.gv2p` file).
- **Init** — load the default "init" preset.

User presets are stored in the application support directory and are shared between the standalone app and the plugin formats.

6.2 Transport

- **Play / Stop** — toggles global playback. Behavior depends on the play mode (see below).
- **SYNC** — a toggle that locks grain density, LFO rate, and delay time to the host's tempo. In the standalone app the toggle is disabled; in a DAW it follows the host transport.

6.3 Play mode

Grainsmith has two play modes:

- **Free** — grains spawn continuously as long as a layer is enabled. The Play button drives playback.
- **Instrument** — grains spawn only while MIDI notes are held, and each note sets the root pitch for the layer.

The play-mode toggle is available from the header settings menu and from any MIDI-control panel on the SYNTH tab.

6.4 Layer selector

In compact layouts (AU plugin and iPhone), only one layer's controls are visible at a time. A **Layer 1 / Layer 2** segmented control in the header (or at the top of the GRAIN panel in the full layout) switches the visible layer. The selector is highlighted in the current layer's accent color.

Internally, Grainsmith calls these "voices" (parameter names start with `v1` or `v2`), but the UI uses "Layer" everywhere a user sees them.

6.5 Tab navigation

The **GRAIN**, **TEXTURE**, **SYNTH**, **FX**, and **MOD** tab buttons sit beneath the header bar. Click a tab to switch the main panel view. The MOD tab is always visible, even in layouts that collapse other panels, so the modulation matrix is reachable from anywhere.

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6.6 See also

- Waveform Display
- Layer System

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7. Waveform Display

The waveform display sits beneath the header bar and shows the loaded audio sample together with the current grain activity. In the full (two-row) layout there are **two** waveform displays side by side — one for each layer. In compact layouts the selected layer's display is shown full width.

7.1 What you see

- **Stereo waveform** — the loaded sample drawn as a pair of channels.
- **Position cursor** — a vertical line marking the current grain spawn position in the buffer.
- **Active grain dots** — each currently sounding grain is drawn as a small dot over the waveform. The horizontal position encodes the grain's position in the buffer; the vertical position encodes pan; the brightness encodes amplitude.
- **Trim handles** — a pair of bars at the left and right edges of the audible region. Hover the waveform to reveal them; drag to set the loop in / out points. Double-click a handle to reset that side to the buffer edge. The handles auto-reset when you load a new sample or enter Live recording mode.
- **Freeze button** — captures the current buffer state so you can scroll the position freely without the playhead advancing (useful for holding a specific moment for manipulation).
- **Layer-link toggle** — on Layer 2's waveform display only, a chain icon toggles whether Layer 2 uses its own buffer (independent) or shares Layer 1's buffer.

7.2 Loading a sound

You can load an audio file three ways:

1. **Drag and drop** an audio file onto the waveform display.
2. **Click** anywhere on the waveform display to open a file browser.
3. **Use the Load menu** in the header (in full layout) or the layer's context menu (right-click / long-press).

Supported formats vary by platform. WAV, MP3, and FLAC work everywhere. AIFF, M4A (AAC), and Ogg Vorbis decode on **macOS only** (through Core Audio); the Windows and iPad builds do not handle those formats and you'll need to convert to WAV first. Files at any sample rate are automatically resampled to the current app or host sample rate on a background thread, so loading a 48 kHz file into a 44.1 kHz session plays back at the correct pitch.

Clear Audio

The per-layer context menu (right-click on a waveform display, or long-press on iPad) includes a **Clear Audio** item. Selecting it empties that layer's buffer and resets its trim handles. Useful when you want to disarm a layer without unloading the preset.

7.3 Setting the position

Click and drag on the waveform to scrub the grain spawn position manually. In Free play mode the position advances according to the Speed parameter; drag sets it explicitly. In Instrument play mode, the position advances only while notes are held.

7.4 See also

- Header Bar
- Layer System

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8. Layer System

Grainsmith has two independent **layers**, Layer 1 and Layer 2. Each layer has its own audio buffer, grain engine, window shape, pitch variation, and filter. The two layers share a single global synthesis block (sub oscillator, VCA + filter envelopes, glide), the effects chain (master filter, compressor, delay, reverb), and the modulation matrix.

Internally the code calls these "voices" and parameter names begin with `v1` / `v2`, but the UI and this manual use "Layer 1" / "Layer 2" throughout.

8.1 What each layer owns

Truly per-layer controls — independent between Layer 1 and Layer 2 — live on the GRAIN, TEXTURE, and SYNTH tabs:

- Grain core (size, density, pitch, speed, jitter, spread, pan, level)
- Window shape, window morph, decay
- Pitch variation (probability, mode, direction, range)
- Dynamics randomisation
- Reverse probability
- Scan rate / depth
- Loop points, freeze state
- The per-layer filter (model, cutoff, resonance, drive, env depth)
- The per-layer Spectral Array Oscillator (SYNTH tab)
- Root note (used in Instrument play mode)

On the SYNTH tab, only the two **Spectral Array Oscillator** columns and the `Root 1` / `Root 2` knobs are truly per-layer. The Sub Oscillator, VCA envelope, Filter envelope, and Glide are all **global**: they are mounted in the UI via Layer 1's parameters, and any change applies to both layers. The per-layer parameter slots still exist in the preset format for backward compatibility, but the audio engine runs a single shared instance.

See the SYNTH tab page for details.

8.2 What is shared between layers

The following are global and affect both layers together:

- SYNTH panel: sub oscillator, VCA / filter envelopes, glide
- FX chain: master filter, compressor, delay, reverb
- Master gain, dry/wet
- Modulation matrix (each lane can be targeted at a specific layer)

The Macro knob (the hero Morph control on the GRAIN tab) is **per layer** — Layer 1 and Layer 2 each have their own, along with their own Morph LFO.

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8.3 Buffer modes

A **Link** toggle on Layer 2's waveform display controls whether the two layers share one audio buffer or use independent ones:

- **Independent** (unlinked) — each layer loads its own sample. Dropping a file onto Layer 1's waveform fills Layer 1; dropping onto Layer 2's waveform fills Layer 2.
- **Linked** (shared) — Layer 2 reads from Layer 1's buffer. Loading a new sample into Layer 1 updates both layers. Useful for building dense textures from a single source.

In linked mode, Layer 2 still has its own grain parameters — it's only the underlying audio that is shared.

8.4 Enabling and muting layers

Each layer has a power toggle that disables it entirely (no grains spawn, no CPU spent). Mute and solo buttons provide quick in-session silencing without resetting the layer.

8.5 Switching layers in compact mode

In the full two-row standalone layout, both layers' controls are visible side by side. In the compact AU or iPhone layout, only one layer's controls are visible at a time and the **Layer 1 / Layer 2** segmented control in the header bar switches the view. Changing layers never stops playback — both layers keep running, you are only changing what is visible for editing.

8.6 See also

- Header Bar
- Waveform Display

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9. GRAIN Tab

The GRAIN tab is Grainsmith's default view and the heart of the granular engine. The desktop layout shows **both layers side by side, all the time** — there is no layer-focus toggle. From left to right the tab is:

- **LAYER 1** panel — Layer 1's grain core, per-layer Morph, and per-layer filter, stacked top-to-bottom.
- **LAYER 2** panel — the same controls for Layer 2, independently set.
- **MASTER** panel — pans, faders, the global VU meter, and the Dry/Wet blend.

A pair of waveform displays sits above the panel row, one per layer. See Waveform Display for everything they do.

9.1 Per-layer panels

Layers 1 and 2 carry the same controls; setting them independently is how you build dual-source patches, call-and-response textures, and layered pads. Each panel has three sub-sections — **GRAIN**, **MORPH**, and **FILTER** — stacked from top to bottom.

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GRAIN sub-section

Eight knobs in two rows of four drive the granular engine.

Control	Range	Description
`Size`	0.001–1.5 s	Duration of each grain. Short sizes give choppy, rhythmic textures; longer sizes produce smooth, pad-like tones. Latched at grain spawn.
`Density`	1–512 Hz	Grain spawn rate. Higher values create denser, overlapping clouds; lower values leave sparse, audible gaps.
`Pitch`	−24 to +24 st	Transposes the layer in semitones, applied at grain spawn. The caret (▾) on the knob's readout opens the pitch-mode popup — see Pitch modes below.
`Speed`	−3 to +3 (displayed as %)	Internal playback speed multiplier. Negative values play in reverse; values outside ±1 combine with `Pitch` for extreme time-stretch effects. Displayed as a percentage (100 % = 1.0). Latched at grain spawn.
`Jitter`	0–0.5 s	Random offset added to each grain's start position. Small amounts humanize the stream; larger amounts scatter grains across the buffer.
`Spread`	0–1	Stereo spread of grain pan. 0 is mono, 1 is full L/R separation.
`Level`	−70 to +12 dB	Per-layer grain level. Mirrors the layer fader in the MASTER panel — moving one moves the other.
`Morph`	0–1	Per-layer macro that simultaneously moves every assigned morph target. 0 leaves parameters at their base values; 1 drives them to their configured target values. Targets and depths are configured from the gear button in the MORPH strip.

`Size` and `Density` interact: their product is roughly the overlap. At 100 Hz with 50 ms grains you have ~5 grains at once — a continuous drone. Drop density to 5 Hz and you hear each grain individually. `Jitter` then breaks up machine-gun periodicity.

Pitch modes

The `Pitch` knob can snap to a set of allowed pitches instead of moving continuously. Click the small caret (▾) on the knob's value readout to open the pitch-mode popup. The popup has two dropdowns:

Setting	Options	Default
Mode	Octaves / Oct+5ths / Scale / Free / Chromatic	Chromatic
Scale	Major, Minor, Pent Maj, Pent Min, Dorian, Mixolydian, Harm Minor, Phrygian, Lydian, Locrian, Whole Tone, Chromatic	Major

Each mode limits where the knob can land across its full −24 to +24 semitone range:

- **Octaves** — whole octaves only (0, ±12, ±24).
- **Oct+5ths** — octaves plus perfect fifths.
- **Scale** — the nearest degree of the selected scale.
- **Free** — no snapping; any fractional value.
- **Chromatic** — the nearest whole semitone. This is the default and matches how the knob behaved before pitch modes existed.

The knob snaps **on release**: drag freely and it lands on the nearest allowed pitch when you let go. In **Free** mode the readout shows one decimal (for example `+7.4 st`); every other mode reads in whole semitones. Changing the mode or scale re-snaps the held pitch right away, so you don't have to nudge the knob to hear the change.

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The **Scale** setting is shared with the per-grain pitch variation on the TEXTURE tab — pick a scale in the Pitch popup and the TEXTURE scale dropdown follows, and vice versa. The pitch-mode setting itself is per layer, so Layer 1 and Layer 2 can snap to different pitch sets.

MORPH strip

Below the eight grain knobs sits the per-layer **Morph LFO** strip — an LFO that automates the `Morph` knob above. The two together are how a single layer evolves over time without any MOD lane assignment.

Control	Range	Description
`ON`	toggle	Enables the Morph LFO for this layer. Off = the `Morph` knob is static.
`Wave`	Sine / Triangle / Saw / Square / S&H	LFO shape, picked from the inline wave-selector buttons.
`SYNC`	toggle	When on, the rate snaps to the host tempo at the configured division. When off, `Rate` is in Hz.
`Rate`	0–0.5 Hz (free) / division (synced)	LFO speed. The free range tops out at 0.5 Hz — this is a slow evolution control, not an audio-rate LFO. With `SYNC` on, the rate follows a host-tempo division instead.

A horizontal bar beneath the controls visualises the live LFO output across each assigned target.

The gear button at the top right of the MORPH strip opens the morph settings popup, where you assign which parameters the `Morph` knob drives and at what depth.

FILTER sub-section

The FILTER row is the **per-layer** filter, upstream of the global master filter on the FX tab. Only the tone-shaping controls live here; the filter envelope (ADSR and Env Depth) is on the SYNTH tab.

Control	Range	Description
`Filter Model`	10 models	Dropdown selector: Stilson, Microtracker, Krajeski, MusicDSP, Oberheim, Improved, RKSimulation, Hyperion, DaisyLadder, CytomicSVF. Each model has a distinct saturation and resonance character. Defaults to CytomicSVF.
`Cutoff`	20 Hz – 20 kHz	Filter cutoff frequency.
`Reso`	0–1	Resonance amount at the cutoff. High settings self-oscillate on some models.
`Drive`	0–1	Input drive into the filter stage. Adds saturation and harmonic content, especially at higher resonance.

Layer header

Each layer panel's header shows **LAYER 1 GRAIN** / **LAYER 2 GRAIN** and a small activity indicator. The indicator lights when any grain is sounding on that layer — a quick way to verify a layer is producing audio without watching the meters.

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9.2 MASTER panel

The Master panel sits to the right of the two layer panels. It moved here from the FX tab in the 2026-04-07 layout revision so layer balance and wet/dry are always visible on the default view.

Control	Range	Description
`Layer 1 Pan`	−1 to +1	Stereo pan for Layer 1.
`Layer 2 Pan`	−1 to +1	Stereo pan for Layer 2.
`Layer 1 Level`	−70 to +12 dB	Layer 1 vertical fader. Mirrors the `Level` knob in Layer 1's GRAIN row.
`Layer 2 Level`	−70 to +12 dB	Layer 2 vertical fader. Mirrors the `Level` knob in Layer 2's GRAIN row.
Master VU meter	—	Stereo meter on the master output (post layers, post wet/dry).
`Wet/Dry`	0–1	Global wet/dry balance between the granular output and the dry input.

The faders carry small tick marks at common reference levels (−∞, −12, −6, 0, +6) so you can balance two layers by feel.

9.3 Dual waveform display

Above the panel row, the GRAIN tab draws **two waveform displays side by side**, one per layer, each with its own position cursor, active-grain dots, freeze button, and trim handles. Layer 2's display also carries the layer-link toggle for switching between shared and independent buffers. See Waveform Display for the full treatment.

9.4 See also

- Waveform Display
- Layer System
- TEXTURE Tab
- SYNTH Tab — Spectral, Voice Interaction, sub, envelopes & MIDI
- FX Tab

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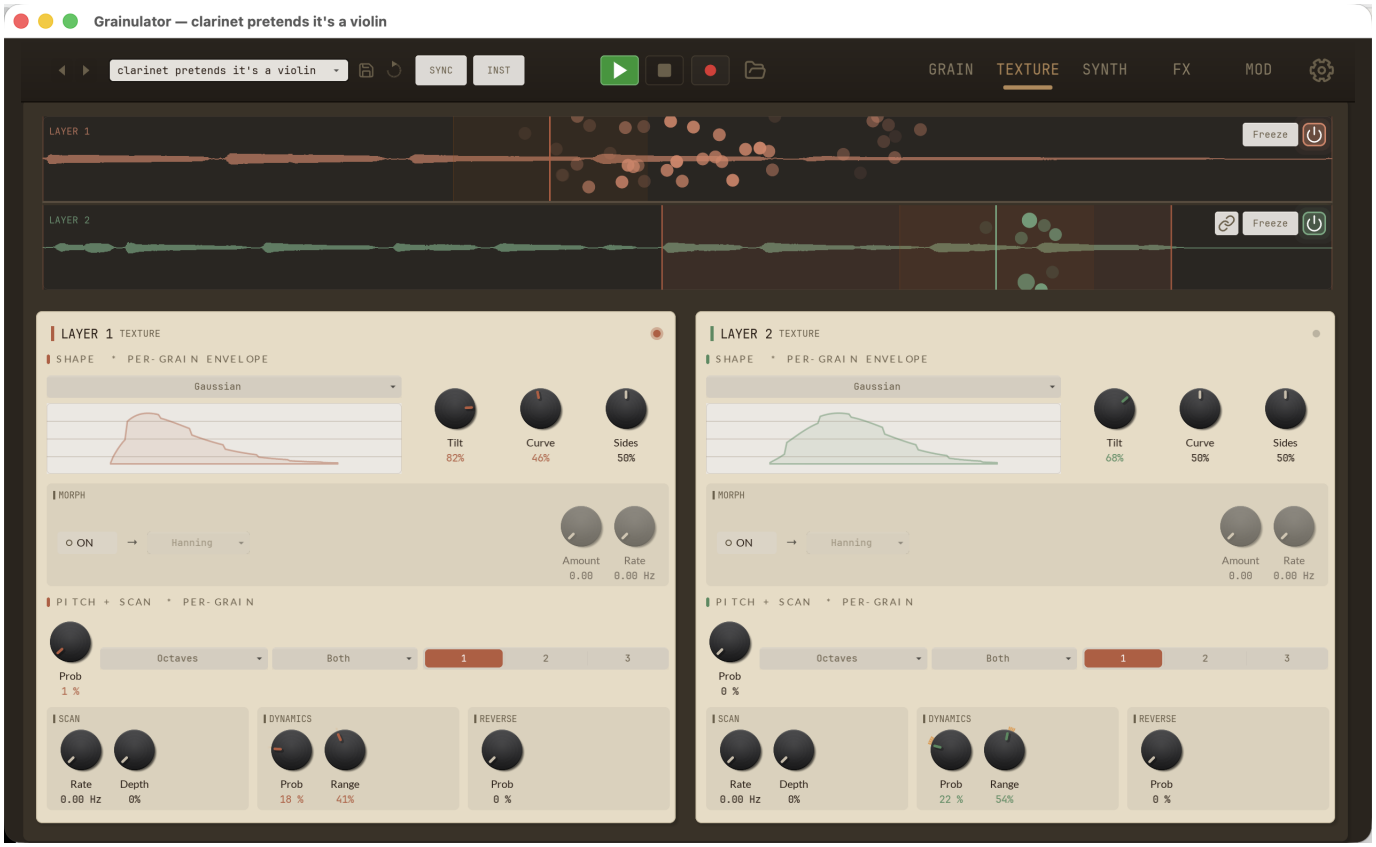
10. TEXTURE Tab



The TEXTURE tab shapes the *character* of each grain once the GRAIN tab has decided how big, how dense, and from where in the buffer it reads. Everything here is per-layer — the dual waveform display sits at the top of the tab (Layer 1 in orange above, Layer 2 in green below) and two side-by-side **LAYER 1 TEXTURE** / **LAYER 2 TEXTURE** panels underneath hold identical sets of controls. The descriptions on this page apply to both layers; values are tracked independently.

Each panel groups its controls into three labelled sections plus a bottom mini-row:

- **Shape · per-grain envelope** — the window applied to every grain
- **Morph** — optional automatic crossfade to a second window shape
- **Pitch + Scan · per-grain** — random pitch variation per grain plus the buffer-scan LFO
- **SCAN / DYNAMICS / REVERSE** mini-row — three small groups along the bottom of the panel

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10.1 Shape — per-grain envelope

Every grain has an amplitude envelope ("window") applied on playback. The window determines whether grains sound smooth and pad-like, punchy and percussive, or plucked and decaying. The live preview to the right of the shape picker updates in real time as you tweak Tilt, Curve, and Sides.

Control	Range	Description
`Shape`	Hanning / Gaussian / Trapezoid / Triangle / Tukey / Pluck / PluckSoft / ExpDecay	Base envelope shape applied to every grain.
`Tilt`	0–100%	Shifts the envelope peak earlier or later within the grain. 50% is symmetric.
`Curve`	0–100%	Bends the attack and release slopes between linear and exponential.
`Sides`	0–100%	Softens or sharpens the edges of the window (trapezoid / Tukey plateau width).

Hanning and Gaussian give the smoothest, most classical granular sound. Trapezoid and Triangle produce punchier, more rhythmic grains. Pluck, PluckSoft, and ExpDecay give each grain a struck-string envelope that is great for pitched percussion and pointillist textures.

The "per-grain envelope" subtitle distinguishes this window from the VCA envelope on the SYNTH tab, which shapes the note as a whole rather than the individual grains inside it.

10.2 Morph

The dashed sub-panel below the Shape controls enables an automatic crossfade from the base Shape into a second target shape, on a per-grain basis. When `On` is engaged the layout shows the target picker plus Amount and Rate knobs; when off, those controls dim out.

Control	Range	Description
`On`	pill toggle	Master enable for the morph. Default **off**.
`Target`	same eight shapes as Shape	Second window shape to morph into.
`Amount`	0–1	Current morph position between the base Shape (0.0) and the Target (1.0). With **Rate** at 0 this is a static crossfade you can sweep manually or modulate.
`Rate`	0–3 Hz	LFO speed that automatically cycles **Amount** between 0 and 1. At 0 Hz the morph is static (use **Amount** by hand).

10.3 Pitch + Scan — per-grain

The left half of this section adds random pitch variation to individual grains at spawn; the right half (Scan Rate + Depth) lives in the **SCAN** mini-group below the dropdowns but is grouped under the same section header because both are per-grain modifications.

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Only grains that "win" the **Prob** dice roll are re-pitched.

Control	Range	Default	Description
`Prob`	0–100%	0%	Chance that a new grain is re-pitched. 0% = always use base pitch, 100% = every grain.
`Mode`	Octaves / Oct+5ths / Scale / Free / Chromatic	Octaves	Which pitches a re-pitched grain is allowed to land on. **Octaves** transposes by whole octaves; **Oct+5ths** adds perfect fifths; **Scale** snaps to the selected scale; **Free** allows any continuous transposition; **Chromatic** rounds to whole semitones.
`Direction`	Both / Up / Down	Both	Constrains variation to move only upward, only downward, or in either direction from the base pitch.
`Range`	1 Oct / 2 Oct / 3 Oct	1 Oct	Maximum transposition distance in octaves. Three-state selector.

In **Scale** mode a scale selector chooses which of 12 scales the re-pitched grains snap to: Major, Minor, Pentatonic Major, Pentatonic Minor, Dorian, Mixolydian, Harmonic Minor, Phrygian, Lydian, Locrian, Whole Tone, and Chromatic.

This scale is the **same setting** the GRAIN-tab Pitch knob uses for its own Scale mode — pick a scale in either place and both follow. See the GRAIN tab Pitch modes for the knob side of it.

Note: **Glide** (pitch smoothing between notes) lives on the SYNTH tab's Envelopes & MIDI column alongside the per-layer root notes.

10.4 SCAN / DYNAMICS / REVERSE mini-row

The bottom of each TEXTURE panel collects three small groups along one horizontal row.

SCAN

A slow position LFO applied to the grain spawn point, sweeping through the buffer over time. Combine with a static Position knob on the GRAIN tab to drift around a focal point, or with Speed 0 to replace static freezing with gentle motion.

Control	Range	Description
`Rate`	0–5 Hz	Speed of the scan LFO. 0 Hz disables scanning.
`Depth`	0–50%	Amount of buffer traversed by the LFO, as a fraction of the whole file. 50% covers half the buffer peak-to-peak.

DYNAMICS

Randomises each grain's amplitude at spawn, adding natural breathiness or aggressive volume jitter depending on the Range setting. The base grain level itself lives on the GRAIN tab (`Level`); this section only adds variation on top of it.

Control	Range	Description
`Prob`	0–100%	Chance that a grain's amplitude is randomised.
`Range`	0–100%	Maximum amplitude deviation. 0% = no change, 100% = grains can be fully attenuated.

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REVERSE

Control	Range	Description
Prob	0–100%	Chance that a grain plays backward. 50% gives an even mix of forward and reversed grains; 100% reverses every grain.

Because only the *grain's* playback direction flips — not the source buffer — Reverse works with any position, speed, or loop setting and can be modulated for rhythmic forward/backward effects.

10.5 See also

- GRAIN Tab
- SYNTH Tab
- Layer System

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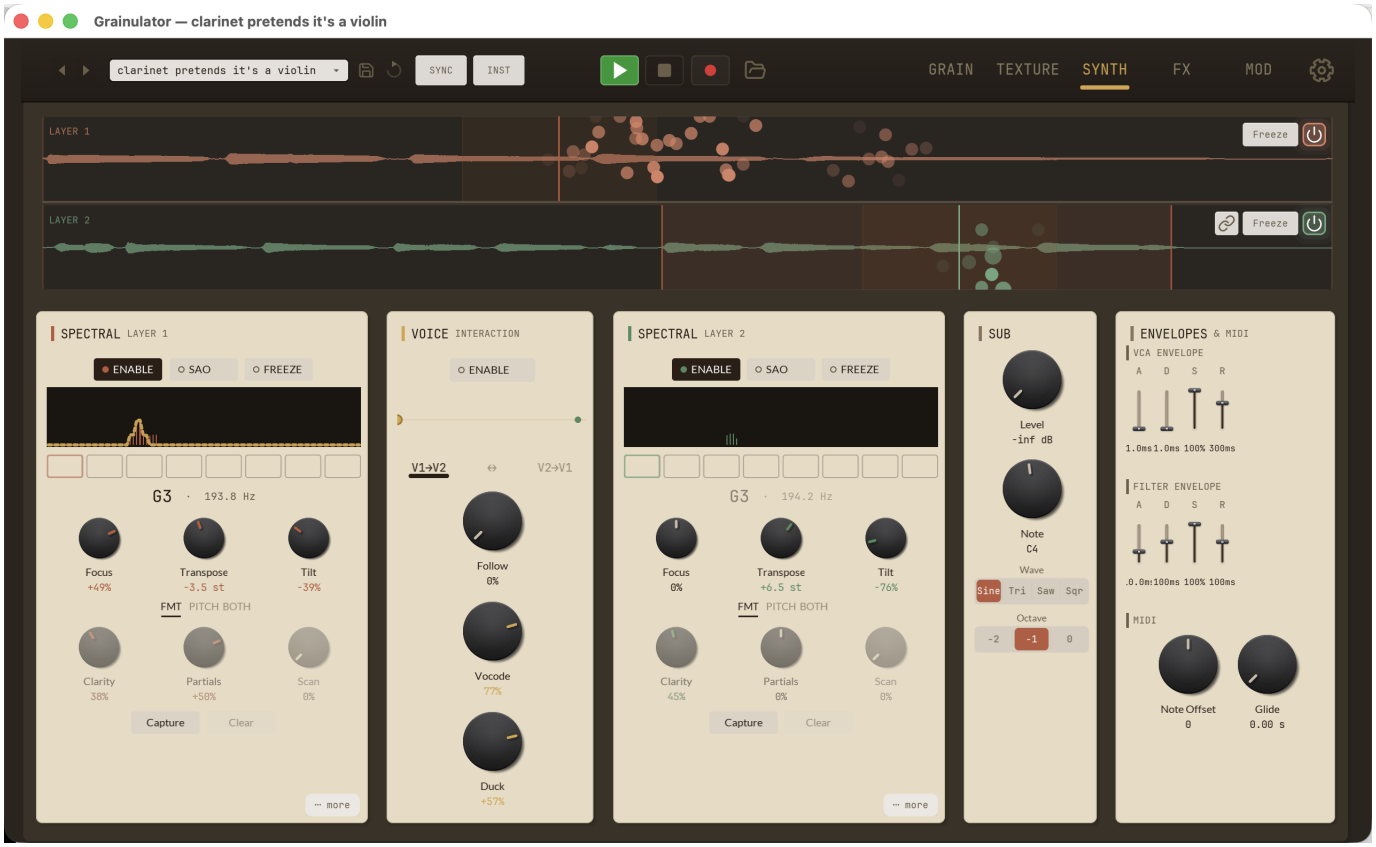
11. SYNTH Tab



The SYNTH tab gathers the traditional-synthesis elements that sit on top of the granular core: the two **Spectral Array Oscillator (SAO)** columns — per-layer phase-vocoder synths — a **Voice Interaction** panel between them for cross-layer routing, a **Sub Oscillator**, and the **Envelopes & MIDI** column that holds the VCA + filter ADSRs alongside the per-layer root notes and glide.

Unlike the GRAIN tab — where every knob edits one layer at a time — most of the SYNTH panels drive a single shared engine. The Sub Oscillator, VCA envelope, Filter envelope, and Glide are **global**: they are mounted in the UI via Layer 1's parameters and any change applies to both layers. The two **Spectral** columns are genuinely per-layer — Layer 1 and Layer 2 each have an independent Spectral Array Oscillator. Only `Root 1` and `Root 2` are genuinely independent per layer.

11.1 Spectral panel (Spectral Array Oscillator)

Each layer has its own **Spectral Array Oscillator (SAO)** column that sits at the head of the SYNTH tab — Layer 1's panel on the left, Layer 2's on the right, with the Voice Interaction panel between them. The SAO is a phase-vocoder-based synth that treats each layer's post-grain audio as a stream of frequency-domain frames, then captures, re-shapes, and re-tunes them. It is **MIDI-responsive and polyphonic** — held notes drive multiple internal voices through a single SAO instance.

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What it actually does

Under the hood, the post-grain audio for each layer feeds a **2048-point FFT with 75 % overlap** (hop = 512 samples). For every hop:

1. **Analyse** the input into magnitudes + phases.
2. Apply the **Focus** max-hold smoother (positive values only — see Focus below).
3. Track phase history for frozen-spectrum phase progression.
4. If `Freeze` is engaged: blend the captured magnitudes into the live spectrum with re-enhancement controlled by `Clarity`.
5. Apply the **Partials** odd/even gate, keyed off the `Fund` frequency.
6. Apply the **F↔P** morph between formant-only and pitch-only shifting.
7. Apply **Tilt** as a broadband spectral EQ.
8. If this layer is a Voice-Interaction *follower* with `Vocode` > 0: multiply bins by the driver layer's mean-normalised spectral envelope.
9. Publish this layer's magnitudes so the partner can vocode next block.
10. IFFT + overlap-add back into the audio stream.

In **SAO mode**, step 1 is replaced — instead of analysing the live input, the SAO interpolates magnitudes between adjacent slots in the Spectral Array (the bank of captured frames) and advances phase from the captured increments. Everything from step 4 onward still applies to the SAO-rendered frame.

The result: every Spectral knob shapes the frame whether it came from live input or from the captured Array.

Top toggles

A row of three toggles runs along the panel header. They use the spectral-synth pill style with the layer's accent fill when engaged:

Toggle	Behaviour
`ENABLE`	Master power for the Spectral panel. Off bypasses the SAO entirely and consumes no CPU — useful for A/B comparisons against the raw grain output. A short wet/dry crossfade eases the toggle so it doesn't click in playback.
`SAO`	Switches between **Spectral Array Oscillator** mode (free-running off the captured Array, MIDI-driven polyphonic re-pitch) and the simpler **frame-pass** mode (the live grain output is the source). SAO is the right pick for melodic playing; frame-pass is for spectral effects on the grain stream itself.
`FREEZE`	Captures the current post-enhancement spectrum and holds it, then progresses phase from the captured increments so the frozen tone has motion rather than sitting on a single STFT frame. **No effect when SAO is on** — the Array is the source of truth.

8-step pitch grid

Beneath the toggles, an **8-cell pad row** displays the SAO's pitch sequence — each cell represents one slot of the Spectral Array. The active cell (whichever Scan is currently pointing at) is highlighted in the layer's accent colour (coral for Layer 1, green for Layer 2). The current centre pitch (e.g. `A2`, `G#4`) and its frequency are displayed alongside the grid so you can see where the SAO is reading from at a glance.

Captures fill the slots in order and wrap at 8 — the 9th capture overwrites slot 0, the 10th overwrites slot 1, and so on (a ring buffer). Use **Clear** to wipe the Array and reset the next-capture pointer to slot 0.

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Knobs (top row)

Three knobs above the FMT toggle shape the spectral frame's pitch character and harmonic balance:

Control	Range	Description
`Focus`	−1 to +1	Per-bin max-hold magnitude smoother. At 0 the spectrum tracks input instantly. Positive values hold magnitudes with decay, so transients linger across several FFT hops — turning taps into tonal bells, smoothing gaps in sparse material. Negative values are reserved for future use and currently clamp to 0.
`Transpose`	−24 to +24 st	Pitch offset applied to the entire spectral frame, in semitones, independent of MIDI note tracking. Use to detune one layer against the other or to drive the SAO into very high / very low registers.
`Tilt`	−1 to +1	Broadband spectral EQ with a tilted shelf. Negative darkens (rolls off highs); positive brightens (rolls off lows). At ±1 the band-edge shift is roughly ±15 dB, softly normalised so loudness stays roughly constant as you sweep.

FMT / PITCH / BOTH toggle

A `FMT – PITCH – BOTH` segmented toggle sits between the two knob rows. It controls how MIDI notes interact with the spectral frame:

State	Behaviour
`FMT`	Formant-only — incoming notes shift the spectral envelope (the "vowel" character) without moving the fundamental. Useful for keeping a captured drone in tune while morphing its timbre.
`PITCH`	Pitch-only — notes re-pitch the frame without preserving formants. The classic phase-vocoder pitch shift; high notes will sound "chipmunked" on speech-like material.
`BOTH`	Both formant and pitch track the played note. The default — the most "synth-like" behaviour, closest to a sampler that re-pitches everything together.

Knobs (bottom row)

Control	Range	Description
`Clarity`	0–1	A combined "how clean is the captured tone" control that drives both spectral Character (peak-prominence extraction) and PeakLock (zeroing of non-peak bins) along a single axis. Low values preserve the natural envelope (noisy/textural); high values heavy-handedly extract a harmonic skeleton (clean, tuned, drone-like). Only affects captures — sweep at capture time to decide how much residue to keep.
`Partials`	−1 to +1 (bipolar)	Odd/even harmonic emphasis, keyed off `Fund`. Negative attenuates even partials (odd-only, hollow / clarinet-like); positive attenuates odd partials (even-only, softer / fuller); 0 is neutral. A Gaussian soft-sidelobe keeps the gate from acting like a comb filter at low fundamentals, and the gated spectrum is energy-normalised so the knob reads as timbre rather than volume. Most audible on pitched material tuned to `Fund`.
`Scan`	0–1	Position within the Spectral Array. With SAO on, Scan is the primary "pitch/timbre" sweep across the captured slots — automating it with an LFO produces a morphing spectral wavetable. Log-tapered for finer control at the low-slot end. With SAO off, Scan has no audible effect (reserved for a future ghost-blend feature).

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Fund frequency

A small `Fund` readout sits inside the spectrum display, with a tiny edit cap and a manual-override toggle. It sets the fundamental frequency the **Partials** gate keys off (range 20 Hz – 2 kHz, default 110 Hz). Set it to the pitch of your source for crisp odd/even selection. At 48 kHz / 2048 FFT, bin resolution is ≈ 23 Hz, so fundamentals below ~25 Hz won't resolve individual harmonics. Not modulatable — audio-rate changes here cause bin-quantisation zipper.

When the manual-override toggle is off, the SAO auto-tracks the detected fundamental from the input.

Capture / Clear

Two buttons at the bottom of the panel control the Spectral Array:

- `Capture` — snapshots the current post-processed spectrum into the next Array slot. Press while audio is playing through the layer to load fresh material. The capture inherits the current `Clarity` setting, so the cleaner Clarity is at capture time, the more skeletal the slot.
- `Clear` — wipes all 8 slots and resets the next-capture pointer to slot 0.

The captured Array is per-layer and is saved with the preset, so you can build a fixed bank of spectra (pad / speech / bowed string / drum) and recall it from any session.

Modulation routing

All continuous Spectral controls are routable as Mod Matrix destinations. The Voice Interaction panel's knobs (Follow / Vocode / Duck) live under a separate **Voice FX** category — see the MOD tab reference for the full list.

Mod destination	Range mapping	Notes
`Transpose`	±24 st	Bipolar
`Tilt`	±1	Bipolar
`Frz Blend`	0–1	Unipolar
`Clarity`	0–1	Unipolar — drives the combined Character + PeakLock pair
`Focus`	0–1	Positive side only; negative mod is ignored
`Freeze`	gate	Thresholds on 0.5 — useful for a momentary freeze stab
`Formant Mix`	0–1	Unipolar — sweeps F ↔ P from formant-only (1) to pitch-only (0)
`Partials`	±1	Bipolar
`Scan`	0–1	Unipolar — LFO this to auto-scan the Array

Deliberately **not** modulatable: `Fund` (bin zipper at audio rate), the `SAO` toggle (discrete state switch), and `Capture` / `Clear` (one-shot triggers — mod retrigger would erase user state).

Recipes

- **Pad / ambient bed** — feed a slow grain cloud, raise `Focus` to ~0.7, `Clarity` to ~0.6. Enable `Freeze`. The Spectral panel produces a slowly mutating drone over the granular wash.
- **Harmonic stencil from any source** — set `Clarity` to ~0.8, play pitched material through the layer, hit `Capture`. Toggle `SAO` on. The captured slot is now a clean, tuned tone you can play polyphonically.
- **Spectraphon-style wavetable** — capture 4–6 slots from varied source material (pad / speech / bowed instrument / drum hit), toggle `SAO` on, route an LFO at ~0.03 Hz to `Scan`. The SAO morphs between captured spectra like a single-cycle wavetable, but with rich harmonic evolution between slots.

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- **Vocoder-style talkbox** — load speech into Layer 2's grain buffer, switch the Voice Interaction direction to V2 → V1, set `Vocode` to ~0.8. Layer 1's tone takes on Layer 2's formant envelope each STFT hop.
- **Drum tonalisation** — feed a percussive loop, raise `Focus` to ~0.9 (max hold turns transients into ringing tones), set `Partials` to +0.6 and `Fund` to the drum's apparent pitch for a mallet-instrument character.

11.2 Voice Interaction panel

Sits between the two Spectral columns. Three knobs drive categorically different cross-voice effects — **Follow** (time-domain source coupling), **Vocode** (spectral envelope transfer), and **Duck** (amplitude sidechain) — governed by a shared direction switch and a power toggle that bypasses the whole section.

An animated bus indicator above the direction switch visualises current effect amount (line thickness) and routing (flow direction of the travelling dots). In **Both** mode the dots follow whichever layer is louder at the moment.

Direction

One 3-state segmented control governs all three knobs:

State	Behaviour
`V1 → V2`	Layer 1 is driver; Layer 2 is follower. All three knobs affect Layer 2 only.
`V1 ↔ V2` (Both)	Mutual / symmetric. Each layer acts on the other with the same knob amounts.
`V2 → V1`	Layer 2 is driver; Layer 1 is follower.

Knobs

Control	Range	Description
`Follow`	0–1	The follower layer's granular engine reads the driver's **live post-grain audio** instead of its own loaded buffer. At 1 the follower is fully tracking the driver's output; at 0 it plays its own buffer (default). The follower's `Position` knob is reinterpreted as ring-buffer age — 0 = newest, 1 = oldest (~2 s back). Grain size, pitch, and speed still work inside the live source. In Both mode, a one-block latency prevents feedback.
`Vocode`	0–1	True spectral vocoding. The driver's mean-normalised spectral envelope multiplies the follower's bin magnitudes. At 1 the follower adopts the driver's timbral/formant contour while keeping its own harmonic content. Loudness-preserving — the mean normalisation stops the follower from getting quiet when the driver is sparse.
`Duck`	−1 to +1	The driver's amplitude envelope modulates the follower's output gain. Negative = classic sidechain duck (follower dips when driver is loud). Positive = "swell" / shadow (follower amplifies with the driver). 0 is bypass. Attack ≈ 3 ms, release ≈ 150 ms. Read from pre-duck envelopes so mutual ducking in Both mode is feedback-safe.

Power toggle

The power icon in the panel title stripe hard-bypasses the entire section. Use it to A/B the contribution of Voice Interaction without resetting all three knobs.

Mod routing

All three knobs are available as mod destinations under a new **Voice FX** category on the MOD tab. The direction switch and power toggle are not modulatable (they're discrete state), but their param values round-trip cleanly through preset save/load and DAW automation.

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11.3 Sub Oscillator

A global monophonic sub that tracks the played note and thickens the low end. Set `Level` to 0 to disable.

Control	Range	Description
`Level`	0–1	Output level of the sub. 0 silences it.
`Note`	0–127 (MIDI)	Base pitch of the sub when no MIDI note is playing (Free mode), or the reference pitch in Instrument mode. Displayed as a note name.
`Wave`	Sine / Tri / Saw / Sqr	Oscillator waveform. Sine is pure, Triangle is soft, Saw and Square (both band-limited) add harmonics.
`Octave`	−2 / −1 / 0	Octave offset relative to the played note.

11.4 VCA Envelope

A global ADSR that shapes the amplitude of every played note. In **Instrument** play mode the envelope retriggers on each note-on; in **Free** mode it effectively holds at sustain while the global transport is running.

Control	Range	Default	Description
`A` (Attack)	0.001–3 s	1 ms	Time from note-on to peak level.
`D` (Decay)	0.001–5 s	1 ms	Time from peak down to the sustain level.
`S` (Sustain)	0–1	1.0	Level held while the note is active.
`R` (Release)	0.001–5 s	300 ms	Time to fade to silence after note-off.

11.5 Filter Envelope

A second ADSR that modulates the per-layer filter cutoff. The filter itself — model, cutoff, resonance, drive — lives on the GRAIN tab FILTER column, along with the bipolar `Depth` knob that scales how much of this envelope reaches the cutoff.

Control	Range	Default	Description
`A` (Attack)	0.001–3 s	10 ms	Time from note-on to peak envelope level.
`D` (Decay)	0.001–5 s	100 ms	Time from peak to sustain.
`S` (Sustain)	0–1	1.0	Level held while the note is active.
`R` (Release)	0.001–5 s	100 ms	Time to fade after note-off.

With `Depth` at 0 the envelope has no effect. Push it positive to open the filter on note-on and let it close back toward the static cutoff; push it negative to invert the shape.

11.6 MIDI control

Grainsmith has two play modes, selected in the header settings popup:

- **Free** — the global transport runs grains continuously; MIDI notes are ignored for pitch.
- **Instrument** — note-on / note-off gate the VCA and filter envelopes, and incoming notes transpose the grain pitch relative to the layer's root note.

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The root-note and glide controls live in the **Envelopes & MIDI** column alongside the ADSR sliders:

Control	Range	Default	Description
`Root 1`	0–127 (MIDI)	60 (C3)	Root note for **Layer 1**. When you play this MIDI note in Instrument mode, Layer 1 plays its source at unshifted pitch.
`Root 2`	0–127 (MIDI)	60 (C3)	Root note for **Layer 2**, independently settable.
`Glide`	0–2 s	0 s	Portamento time between consecutive MIDI notes. Applied to both layers.

Both root-note knobs render their value as a note name (`C3`, `F#4`, …) rather than a raw number, matching the `Note` knob on the Sub panel.

On every MIDI note-on in Instrument mode the engine calculates `note − root` for each layer and applies that offset on top of the `Pitch` knob from the GRAIN tab — so Layer 1 and Layer 2 can transpose against the same incoming note by setting different root values.

`Glide` smooths pitch transitions between notes at the per-layer level; 0 disables portamento, 2 s gives a long, slow slide. It applies equally to both layers.

11.7 See also

- GRAIN Tab — the per-layer filter (model, cutoff, resonance, drive, envelope depth) lives there
- MOD Tab — route LFOs, envelopes, and step sequencers to sub, envelope, and FX parameters
- Layer System

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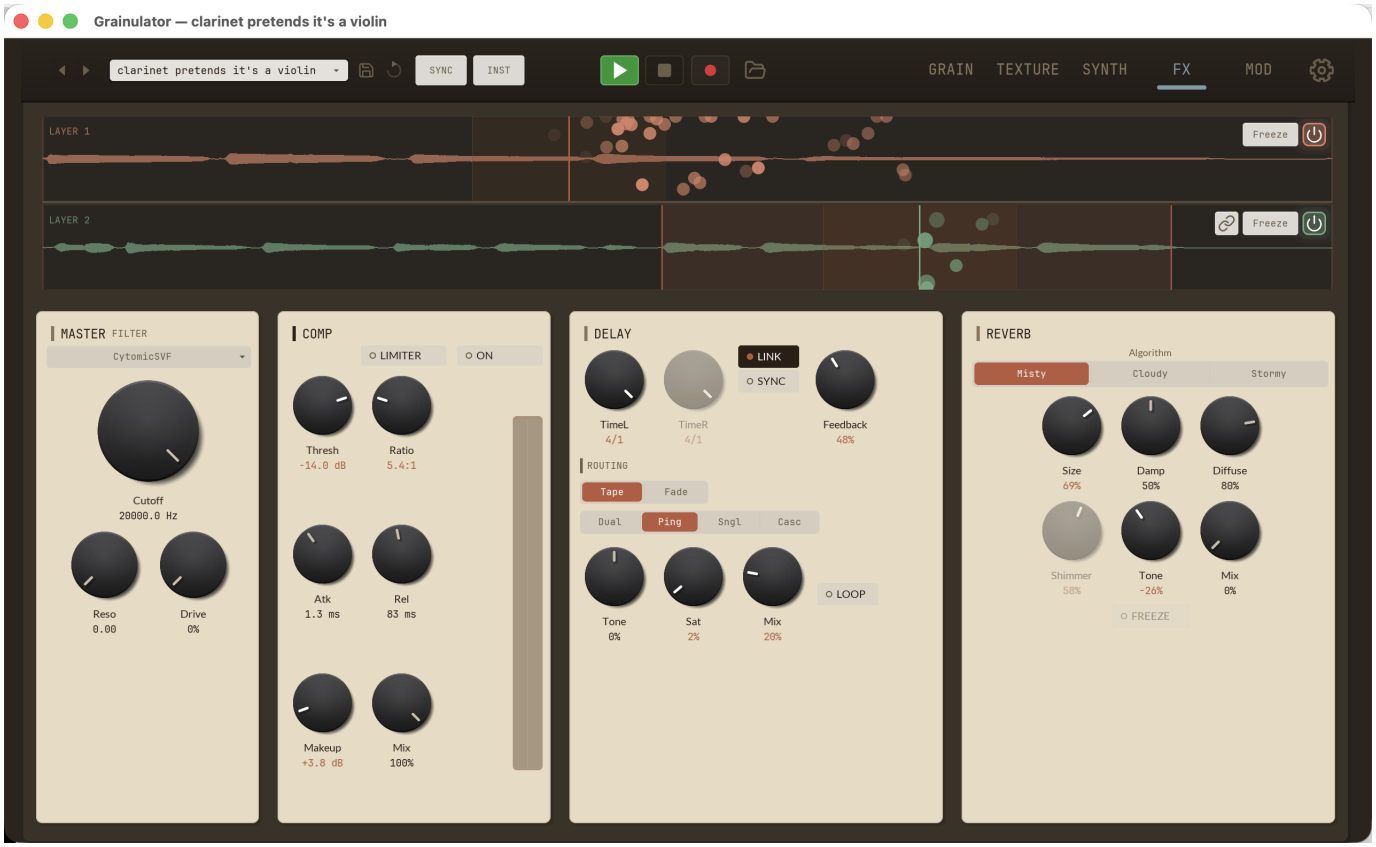
12. FX Tab



The FX tab holds Grainsmith's post-mix effects chain. Everything on this tab is **global** — both layers are already summed by the time the signal arrives, so there is no per-layer FX. Signal flows strictly left to right: **Master Filter → Compressor → Delay → Reverb**.

The master mixing controls — Layer 1 / Layer 2 faders, pans, and Wet/Dry — used to live on FX but were relocated to the GRAIN tab MASTER column in the 2026-04-07 layout update.

12.1 Master Filter

A single post-mix filter stage applied before the compressor. The filter bypasses itself automatically when `Cutoff` is wide open (20 kHz) and `Drive` is 0, so a fully-open setting costs nothing.

Control	Range	Description
`Model`	10 models	Filter topology: Stilson, Microtracker, Krajeski, MusicDSP, Oberheim, Improved, RKSimulation, Hyperion, DaisyLadder, CytomicSVF. Defaults to CytomicSVF. Same bank as the per-layer filter on the GRAIN tab.
`Cutoff`	20 Hz – 20 kHz	Global filter frequency (log-scaled). Displayed in Hz / kHz.
`Reso`	0–100%	Resonance at cutoff. Displayed as a percentage. High values add a singing, whistling character to the full mix.
`Drive`	0–100%	Saturation applied alongside the filter. Adds warmth and gentle compression even with cutoff wide open.

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12.2 Compressor

A feed-forward log-domain compressor (Giannoulis / Massberg / Reiss 2012) with stereo-linked peak detection, a fixed 6 dB soft knee, and an optional soft-knee limiter. The character is clean and transparent — this is a glue/bus compressor, not a coloration effect. A live gain reduction meter next to the knob grid shows how hard the detector is working. Each knob displays its value in standard engineering units (dB, ms, X:1) — the underlying parameter is normalised 0–1 for automation, but the UI shows the mapped musical value.

Control	Range	Description
`ON`	on/off	Master bypass for the compressor stage. Click-free. Default **on**.
`Thresh`	−60 to 0 dB	Level above which gain reduction starts. Default ≈ −3 dB (very light touch).
`Ratio`	1.0:1 to 20.0:1	Amount of reduction above the threshold. Default ≈ 4.0:1.
`Atk`	0.1 – 100 ms (log)	How quickly the envelope follower reacts to peaks. Short attacks catch transients; long attacks let them through for punch.
`Rel`	10 ms – 1 s (log)	How quickly gain recovers after a peak. Switches from ms to s past 1000 ms.
`Makeup`	0 to +40 dB	Output gain added after compression to compensate for reduction.
`Mix`	0–100% (dry→wet)	Parallel-compression blend. At 100% the signal is fully compressed; lower values blend in the uncompressed signal for NY-style parallel compression. Default **100%** (fully wet).
`LIM`	on/off	Post-compressor soft-knee limiter. Transparent below ±0.9 (linear passthrough), then a smooth `tanh`-shaped rolloff asymptotic at ±1.0 (0 dBFS). No hard clipping, no square-wave fold, no aliased harmonic breakup when the pre-limiter signal is well above 0 dBFS. Default **on** as a safety net.

The compressor only sees the wet signal; the dry path on the GRAIN tab's Dry/Wet mix skips it, so the unprocessed input is never compressed.

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12.3 Delay

A stereo tape-style delay with independent L/R times, four routing modes, and two time-change behaviors. Feedback can be pushed above unity for self-oscillating runaways, and the infinite-loop toggle turns the delay into a captured loop.

Control	Range	Description
`TimeL` / `TimeR`	5 – 2730 ms	Delay time per channel (log-scaled).
`Link`	on/off	When on, TimeR follows TimeL. Turn off to set stereo offsets manually. Default **on**.
`Feedback`	0–125%	Amount fed back into the delay line. Values above 100% are self-oscillating — use with care.
`Mod Mode`	Tape, Fade	How the delay reacts when its time parameter is changed. **Tape** re-pitches the tail as the read head moves (classic tape warp). **Fade** crossfades between old and new positions without pitch shift.
`Mode`	Dual, PingPong, Single, Cascade	Routing of the two internal delay lines. **Dual:** independent L/R. **PingPong:** L→R→L bouncing. **Single:** mono delay duplicated to both channels. **Cascade:** the two lines are chained in series for longer or more rhythmic echoes.
`Tone`	−100% to +100%	Bipolar tone control on the delayed signal. Negative darkens (low-pass), positive brightens (high-pass).
`Sat`	0–100%	Saturation drive inside the feedback loop. Adds warmth and iterative grit as feedback regenerates.
`Sync`	on/off	When on, delay times snap to host tempo. Uses `Clock Div` and `Sync Offset`.
`Clock Div`	1/4 – 4/1	Tempo division when `Sync` is on. Available values: 1/4, 1/3, 1/2, 2/3, 3/4, 1/1, 3/2, 2/1, 3/1, 4/1. Default **1/1**.
`Sync Offset`	−5 to +5	Integer offset from the selected clock division (steps in the divisor table) for swing and pushed/pulled feel.
`Loop`	on/off	Infinite-loop mode — the current delay buffer is captured and plays back indefinitely regardless of feedback.
`Mix`	0–100%	Delay wet/dry blend for the delay stage itself (independent of the global Dry/Wet on GRAIN).

The two mode parameters are not duplicates. `Mode` is the **routing** between the two internal delay lines (Dual / PingPong / Single / Cascade). `Mod Mode` is the **time-change behavior**: Tape pitches the tail when you turn the time knob, Fade crossfades without pitch shift.

12.4 Reverb

The reverb panel has an **algorithm selector** that switches between three distinct reverb engines. The surrounding knobs (`Size`, `Damp`, `Width`, `Shimmer`, `Tone`, `Mix`, `Freeze`) are shared across all three algorithms — the UI layout never changes — but the underlying interpretation depends on which engine is active.

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Algorithm selector

The three engines are named for their character, not their internal algorithm. Default is **Stormy**.

Algorithm	Engine	Character	Best for
`Misty`	Signalsmith Basics	Clean, modern, diffuse. No shimmer, no freeze behavior.	Transparent ambience, pads, realistic-sounding spaces where the reverb should get out of the way.
`Cloudy`	Mutable Rings (Griesinger)	Smooth, classic plate/hall tone with gentle modulation. No shimmer, no freeze behavior.	Warm vintage-style reverb on grain clouds and sustained textures.
`Stormy`	Oliverb (extended Griesinger/Dattorro)	Rich, heavily-modulated, with pitch-shift shimmer in the feedback loop and infinite freeze.	Shimmer pads, ambient tails, evolving textures, long drones. This is the default and the most Grainsmith-like.

Common controls

Control	Range	Description
`Size`	0–100%	Room size / decay length. All three engines scale decay time from this.
`Damp`	0–100%	High-frequency damping in the feedback loop. Higher values make tails darker over time.
`Width`	0–100%	Stereo width / diffusion. Maps to diffuser AP coefficients inside each engine.
`Shimmer`	0–100%	Pitch-shift amount in the reverb feedback loop. Only audible on **Stormy** — mapped to approximately ±12 semitones around a center-off point. Ignored by Misty and Cloudy.
`Tone`	−100% to +100%	Bipolar post-reverb tone shelf. Negative darkens, positive brightens. Common to all engines.
`Mix`	0–100%	Reverb wet/dry blend for the reverb stage. Default **0%** — reverb is off until you turn it up.
`Freeze`	on/off	Captures the current reverb state and sustains it indefinitely. Only has effect on **Stormy**: input gain, damping, and high-pass are disabled so the tail holds forever. Misty and Cloudy ignore this toggle.

Notes on per-algorithm behavior

- **Stormy** is where the personality lives: nine random modulation LFOs scattered through the topology, a dual-tap pitch shifter per feedback branch, a HP filter to keep long tails clean, and an infinite freeze. Modulation rate and depth scale automatically with `Size`.
- **Cloudy** is the previous default — the Mutable Rings Griesinger reverb. Smooth and musical, without shimmer or freeze.
- **Misty** is the cleanest of the three; best when you want the reverb to feel like a natural space rather than an effect.
- Switching algorithms briefly clears the newly-selected engine's buffers, so you will hear the tail cut on switch.
- `Shimmer` and `Freeze` remain visible in all modes on purpose — they simply do nothing in Misty and Cloudy.

12.5 See also

- GRAIN Tab — master mixing (layer faders, pans, Wet/Dry) and the per-layer filter
- SYNTH Tab — sub oscillator and the VCA / filter envelopes upstream of the FX chain

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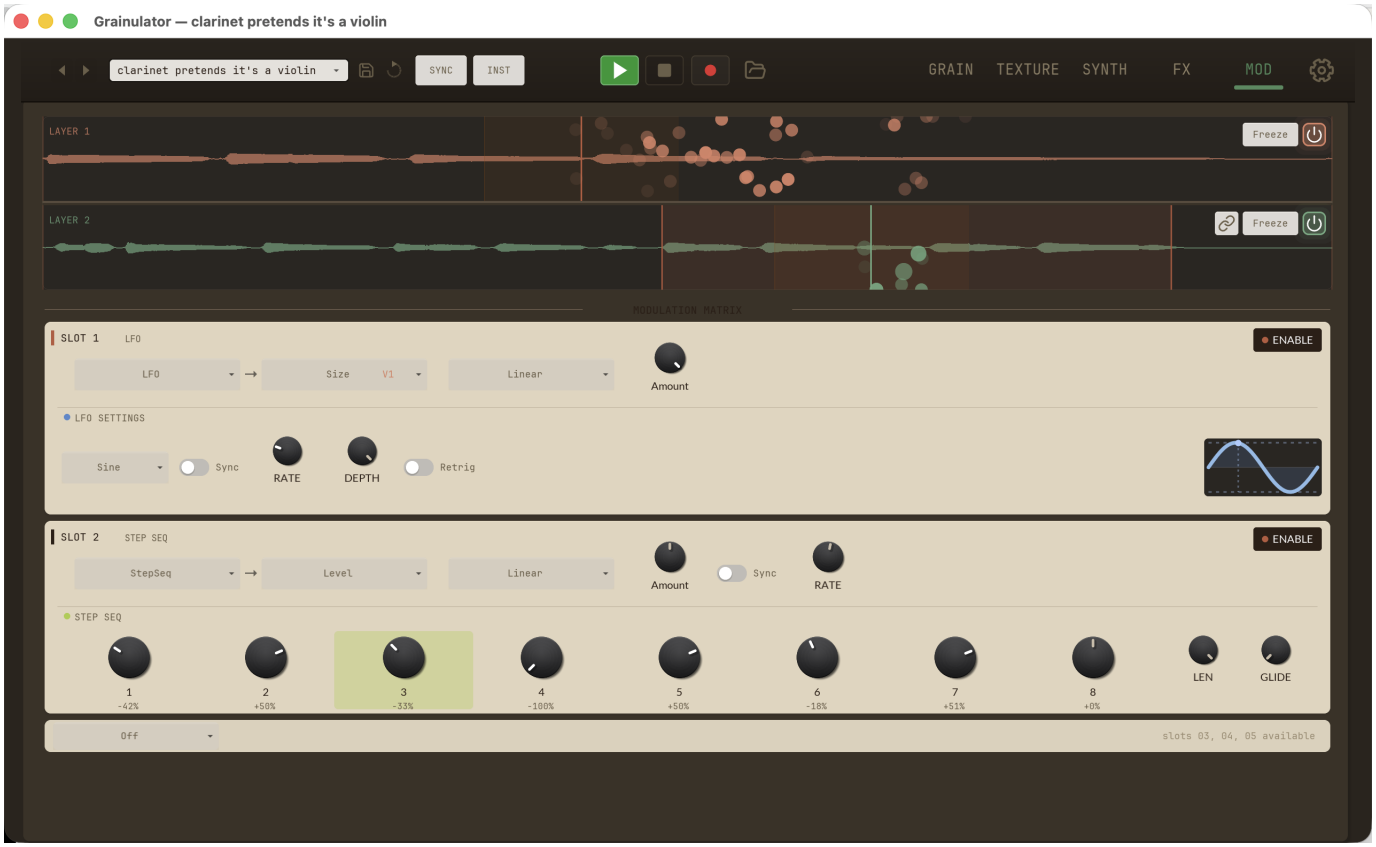
13. MOD Tab



The MOD tab is Grainsmith's modulation matrix — five independent **lanes** that each pick a **source**, a **destination**, and a set of per-lane shaping controls. Because the MOD tab is always visible (including in the compact AU layout, where SYNTH / FX / MOD live in a tab strip at the top), every modulation assignment is reachable from any other view without losing your place on the GRAIN, TEXTURE, or FX tabs.

The UI labels each lane `SLOT 1`, `SLOT 2` … through `SLOT 5`; this manual uses "lane" interchangeably with "slot" — they are the same thing.

Each lane carries its own LFO, ADSR envelope, Euclidean generator and 8-step sequencer, so you don't have to reserve a global resource to get movement on a single parameter. Sources cover LFOs, envelopes and two rhythmic generators — a clock-divided **Euclidean LFO** and a tempo-synced **step sequencer**. Destinations reach **45 active targets** covering the grain core, window, filter, spectral block, master filter, global effects, cross-voice interaction, and the compressor. A small number of entries (the Resonator block and the legacy Spectral Cross-Mod slot) still appear in the destination dropdown so older presets round-trip cleanly — see Destinations below.

Mod lanes always respect the layer model. Each lane has a `Target` that picks which layer(s) it applies to, and the UI uses the **Layer 1 / Layer 2** naming throughout even though the underlying parameters are stored as `Voice 1` / `Voice 2`.

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13.1 Overview

Every lane exposes the same set of core controls:

Control	Description
`Source`	What drives the modulation. Per-lane LFO, envelope, Euclidean LFO, or step sequencer.
`Dest`	Which parameter is modulated. One of 45 targets grouped by category.
`Amount`	Bipolar scale from −1 to +1. Negative values invert the source.
`Curve`	Response shaping applied to the source before it hits the destination.
`Target`	Which layer(s) the modulation applies to: both, Layer 1 only, or Layer 2 only.
`Enable`	Lane on/off without having to reset `Source` or `Dest`.

The `Curve` menu offers nine shapes — `Linear`, `Exponential`, `Logarithmic`, `S-Curve`, `Stepped`, `RandomSmooth`, `Threshold`, `Inverted` and `Bipolar`. `Threshold` is particularly handy with the `Spectral Freeze` destination: it converts any bipolar source into a clean gate (1 above zero, 0 below).

13.2 Sources

The `Source` dropdown on each lane lists every available modulation source. The previous Macro / Velocity / Pressure entries are retained in the underlying parameter enum for preset compatibility but are hidden from the UI and produce zero output at runtime — the four live sources are described below.

Per-lane LFO

Classic free-running or tempo-synced LFO. Each lane has its own, so you never run out.

Control	Range	Description
`LFO Shape`	enum	`Sine`, `Triangle`, `Saw`, `Square`, `Random`, `S&H`.
`LFO Rate`	0.01–50 Hz	Free-running rate when the lane's `Sync` toggle is off.
`LFO Depth`	0–1	Output scale applied before `Amount`.
`LFO Retrig`	toggle	When on, the LFO resets to phase 0 on every MIDI note-on (Instrument mode). When off, the LFO runs free.

When the lane's shared `Sync` toggle is on the LFO is driven by the rhythmic clock described below and `LFO Rate` is ignored.

Per-lane envelope

A full ADSR envelope, one per lane. In Instrument mode it is triggered by MIDI note-on and released on note-off; in Free mode it triggers alongside the global play transport.

Control	Range	Description
`Env A`	0.001–10 s	Attack time from 0 to peak.
`Env D`	0.001–10 s	Decay time from peak to sustain.
`Env S`	0–1	Sustain level held while the note is active.
`Env R`	0.001–10 s	Release time after note-off.

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Rhythmic sources (added 2026-04-05)

Two phase-driven generators share a single clock with the LFO. The clock can free-run at a Hz rate, or lock to host tempo at a musical division (1/32 through 1/1, straight / dotted / triplet), so all three time-based source types line up with the rest of your project.

Euclidean LFO distributes `Euc Hits` evenly across `Euc Steps` using Bjorklund's algorithm, rotates the pattern by `Euc Rot`, and renders each hit according to `Euc Shape`: at 0 each hit is a gate (square pulse), at 1 it's a ramp that decays linearly to zero over the step, and 0.5 sits between the two.

Step Sequencer plays back an 8-step pattern of bipolar slider values at the lane's clock rate. `Seq Len` truncates the sequence to anywhere from 1 to 8 active steps, and `Glide` slews between adjacent steps over a fraction of the step duration (0 = instant, 1 = full step slew). When the lane's `Dest` is `Pitch` the sliders snap to integer semitones and the hybrid pitch path emits a full ±12 semitone range, bypassing the usual `Curve` and `Amount`.

Every rhythmic source shares the same 18 per-lane parameters:

Control	Range	Description
`Sync`	toggle	Lock this lane's clock to host tempo. Off = use `Free Rate`.
`SyncDiv`	0–15	Division index (1/32 → 1/1, including dotted and triplet variants). Used when `Sync` is on.
`Free Rate`	0.01–50 Hz	Free-running clock rate. Used when `Sync` is off.
`Euc Hits`	0–16	Number of active hits in the Euclidean pattern.
`Euc Steps`	1–16	Pattern length for the Euclidean LFO.
`Euc Rot`	0–15	Pattern rotation. Shifts which step the pattern starts on.
`Euc Shape`	0–1	Hit rendering: 0 = gate, 0.5 = pulse, 1 = ramp.
`Step 0` … `Step 7`	−1…+1	Eight bipolar step values for the sequencer. On pitch destinations they snap to integer semitones.
`Seq Len`	1–8	Active step count. Steps beyond the length are skipped and dimmed in the UI.
`Glide`	0–1	Fraction of step duration spent slewing between step values.
`Reserved`	—	Reserved for future use; has no effect.

One clock "cycle" is one full pass through the source's period — the Euclidean pattern's step count, or the step sequencer's length. A lane synced to 1/4 at 120 BPM therefore produces one full pass every two beats.

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13.3 Destinations

Each lane's `Dest` dropdown lists 45 modulation targets grouped by category. Per-layer destinations are routed through `Target`; global destinations (master filter, effects, Voice FX, compressor) ignore `Target`.

Group	Destinations
Grain	`Position`, `Speed`, `Pitch`, `Size`, `Density`
Window	`Tilt`, `Curve`, `Morph Amt`, `Morph Rate`
Filter	`Cutoff`, `Resonance`
Resonator (legacy)	`Chord`, `Brightness`, `Damping`, `Scatter`, `Mix`, `Note`
Amplitude	`Level`, `Pan`, `Spread`
Master	`M.Cutoff`, `M.Reso`
Effects	`Delay Mix`, `Reverb Mix`, `Reverb Size`, `Rev Freeze`
Spectral	`Transpose`, `Tilt`, `Frz Blend`, `Clarity`, `Focus`, `Freeze`, `Formant Mix`, `Partials`, `Peak Lock`, `Cross-Mod`, `Scan`
Voice FX	`Follow`, `Vocode`, `Duck`
Compressor	`Comp Thresh`, `Comp Ratio`, `Comp Attack`, `Comp Release`, `Comp Makeup`, `Comp Mix`

The **Voice FX** destinations drive the Voice Interaction panel on the SYNTH tab — see that section for what each target does.

> **Legacy destinations**
>
> The six **Resonator** destinations and the **Cross-Mod** entry under Spectral still appear in the destination dropdown so older presets and mod-lane routings load without errors, but the resonator module and per-voice cross-mod path are no longer in the audio engine — routing a lane to one of these targets produces no audible change.

13.4 Layer targeting

Each lane's `Target` picks which layer(s) the lane applies to:

Value	Behaviour
`Both`	Apply to both layers.
`Voice 1`	Apply only to Layer 1.
`Voice 2`	Apply only to Layer 2.

The underlying enum labels still read `Voice 1` / `Voice 2`, but the layer they address is Layer 1 / Layer 2 as named everywhere else in the UI. Global destinations (master filter, delay, reverb, compressor) ignore this setting.

13.5 See also

- Layer System
- GRAIN Tab
- TEXTURE Tab

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14. Parameter Reference

Grainsmith's parameters are documented on the per-tab pages under **Reference → Tabs**. This page is a quick lookup for "which tab is parameter X on?". For ranges, defaults, and descriptive prose, follow the link to the tab page.

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14.1 Quick lookup

Area	Parameters	Tab
Grain core	Position, Speed, Pitch, Size, Density, Jitter, Spread, Pan	GRAIN
Per-layer filter	Model, Cutoff, Resonance, Drive, Env Depth	GRAIN
Master mixer	Layer 1/2 Level, Layer 1/2 Pan, Wet/Dry	GRAIN
Morph (per-layer hero knob)	Macro, Morph LFO Rate, assignable targets	GRAIN
Grain window	Window Shape, Tilt, Curve, Sides, Decay, Window B, Morph, Rate	TEXTURE
Pitch knob mode (per-layer, ▾ popup)	Mode (Octaves/Oct+5ths/Scale/Free/Chromatic), Scale (12 scales)	GRAIN
Pitch variation (per-grain)	Prob, Mode (5), Direction, Range, Scale	TEXTURE
Dynamics	Prob, Range	TEXTURE
Reverse	Reverse probability	TEXTURE
Scan	Rate, Depth	TEXTURE
Spectral Array Oscillator (per-layer)	Enable, SAO, Freeze, Focus, Transpose, Tilt, FMT mode, Clarity, Partials, Scan, Capture, Clear	SYNTH
Voice Interaction	Enable, Direction, Follow, Vocode, Duck	SYNTH
Sub oscillator	Level, Waveform, Octave, Note	SYNTH
VCA envelope	Attack, Decay, Sustain, Release	SYNTH
Filter envelope	Attack, Decay, Sustain, Release	SYNTH
MIDI (in Envelopes & MIDI column)	Root 1, Root 2, Glide	SYNTH
Master filter	Model, Cutoff, Resonance, Drive	FX
Compressor	Enable, Threshold, Ratio, Attack, Release, Makeup, Mix, Limiter	FX
Delay	Time L/R, Link, Feedback, Mode, ModMode, Tone, Sat Drive, Sync, Clock Div, Sync Offset, Infinite, Mix	FX
Reverb	Mode (Misty/Cloudy/Stormy), Size, Damping, Width, Modulation, Tone, Mix, Freeze	FX
Mod matrix — per lane	Source, Dest, Amount, Curve, Target, Enable	MOD
Mod matrix — per lane LFO	Rate, Shape, Depth, Retrigger	MOD
Mod matrix — per lane envelope	A, D, S, R	MOD
Rhythmic sources	Sync, Div, Free Rate, Euclid Hits/Steps/Rotation/Shape, 8 Step values, Step Length, Step Glide	MOD

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14.2 Layer scope at a glance

Most parameters exist per layer (Layer 1 and Layer 2 can hold different values). The exceptions — parameters that are global regardless of the layer you are editing — are:

- All FX chain parameters (master filter, compressor, delay, reverb)
- Master mix (Layer 1/2 level and pan, Wet/Dry)
- The modulation matrix (though each lane can be targeted at a specific layer via its Target setting)
- **SYNTH tab**: Sub Oscillator, VCA envelope, Filter envelope, and Glide are all global even though the UI mounts them under Layer 1. Root Note and the Spectral Array Oscillator controls are genuinely per-layer. The Voice Interaction controls are global (they describe the routing *between* layers, not per-layer state). See Layer System for the full story.

14.3 See also

- Interface — Header Bar
- Interface — Waveform Display
- Layer System

> **Note**
>
> The authoritative ranges, defaults, and units for every parameter live on the per-tab pages linked above. A consolidated auto-generated parameter table is on the post-launch roadmap.

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15. Install

Grainsmith ships as a standalone app plus VST3, AudioUnit, and AAX plug-ins for macOS, and a standalone app plus VST3 plug-ins for Windows. The macOS build is a universal binary (Apple Silicon and Intel); the Windows build is 64-bit.

Each format comes in two variants: **Grainsmith** (a MIDI-controlled instrument) and **Grainsmith FX** (a plain insert effect). See Instrument vs. effect for which to use.

15.1 Download

Grab the latest Grainsmith installer from the Plastic Factory site. The macOS installer is `Grainsmith-<version>.pkg` (inside a `.dmg`); the Windows installer is `Grainsmith-<version>-Setup.exe`.

15.2 macOS install

Open the downloaded `.dmg` and double-click the `Grainsmith.pkg` inside. The installer drops each component in place:

- **Standalone app:** `/Applications/Grainsmith.app`
- **AudioUnit:** `/Library/Audio/Plug-Ins/Components/Grainsmith.component` (and `GrainsmithFX.component`)
- **VST3:** `/Library/Audio/Plug-Ins/VST3/Grainsmith.vst3` (and `GrainsmithFX.vst3`)
- **AAX:** `/Library/Application Support/Avid/Audio/Plug-Ins/Grainsmith.aaxplugin` (and `GrainsmithFX.aaxplugin`)

You can deselect any component you don't need in the installer's customize screen.

> **First-launch Gatekeeper prompt**
>
> Grainsmith is signed and notarized by Plastic Factory, so Gatekeeper should let it run without fuss. If macOS still blocks the app on first launch, right-click `Grainsmith.app` in Finder and choose **Open**, then confirm the dialog. You only need to do this once.

The build is a universal binary, so there's no separate download for Apple Silicon and Intel Macs. Grainsmith requires macOS 10.15 Catalina or later.

15.3 Windows install

Run the downloaded `Grainsmith-<version>-Setup.exe` and follow the prompts. The default install locations are:

- **Standalone app:** `C:\Program Files\Plastic Factory\Grainsmith\Grainsmith.exe`
- **VST3:** `C:\Program Files\Common Files\VST3\Grainsmith.vst3` (and `GrainsmithFX.vst3`)

> **SmartScreen on first run**
>
> Because Grainsmith is a new installer, Microsoft SmartScreen may show a blue warning the first time you run it. Click **More info**, then **Run anyway** to continue. Subsequent launches are silent.

The Windows build is 64-bit only. AAX and AudioUnit are not available on Windows.

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15.4 License activation

The first time you launch Grainsmith after install, a **license screen** appears. Enter the license key from your purchase email and click **Activate**. Activation runs against Plastic Factory's licensing service and only needs to be done once per machine — subsequent launches go straight to the main UI.

If activation fails:

- Confirm the machine is online — activation requires a one-time internet round-trip.
- Re-check the license key for typos. Keys are case-sensitive.
- If you've already activated on the maximum number of machines, free a seat in your account before trying again.

The license works across both the standalone app and the plug-in formats — there's no separate plug-in activation.

15.5 Verifying the install

Launch the standalone app. The current version shows in the header next to the Plastic Factory logo; if it matches the version you downloaded, you're set. In a DAW, open the plug-in manager, rescan, and load Grainsmith on a track.

> **Tip**
>
> If you see both **Grainsmith** and **Grainsmith FX** in your DAW's plug-in list, that's expected. Grainsmith is a MIDI-controlled instrument; Grainsmith FX is a plain insert effect for audio tracks. Install whichever fits your workflow — or both.

15.6 Uninstalling

macOS. Drag `Grainsmith.app` from `/Applications` to the Trash, then remove the plug-in bundles:

```
rm -rf /Library/Audio/Plug-Ins/Components/Grainsmith.component
rm -rf /Library/Audio/Plug-Ins/Components/GrainsmithFX.component
rm -rf /Library/Audio/Plug-Ins/VST3/Grainsmith.vst3
rm -rf /Library/Audio/Plug-Ins/VST3/GrainsmithFX.vst3
```

Removing the AAX bundles (if installed) means deleting `Grainsmith.aaxplugin` and `GrainsmithFX.aaxplugin` from `/Library/Application Support/Avid/Audio/Plug-Ins/`.

Windows. Open **Settings → Apps → Installed apps**, find Grainsmith, and click **Uninstall**. If the entry is missing, delete `C:\Program Files\Plastic Factory\Grainsmith\` and the `Grainsmith.vst3` / `GrainsmithFX.vst3` bundles from `C:\Program Files\Common Files\VST3\` by hand.

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16. Audio setup

Grainsmith runs either as a standalone app with its own audio engine, or as a plug-in inside your DAW. This page covers both paths and the host-compatibility matrix.

16.1 Audio interface selection (standalone only)

Open the standalone app's audio preferences (Preferences on macOS, Settings on Windows). You can pick:

- **Driver** — Core Audio on macOS, ASIO or Windows Audio on Windows. ASIO is recommended on Windows for usable latency.
- **Input device** — used by a layer's Live mode (recording incoming audio into the buffer). Leave it on your interface's input, or ignore it if you only play files.
- **Output device** — where the grains play back. Select your audio interface here, not the built-in speakers, if you want low latency.
- **Channel count** — Grainsmith is stereo in and stereo out.

16.2 Sample rate and buffer size

The standalone app defaults to **44.1 kHz**. You can change the sample rate from the same audio preferences. As a plug-in, Grainsmith always follows the host sample rate, so there's nothing to configure.

Buffer size trades latency for CPU headroom:

- **128 or 256 samples** — good for live playing and MIDI performance.
- **512 samples or higher** — good for mixing, bouncing, and dense patches with heavy grain density.

If you hear crackles or dropouts, raise the buffer size first. If latency feels sluggish, lower it.

> **Sample-rate auto-resampling**
>
> When you load an audio file, Grainsmith resamples it to the current session sample rate on a background thread. A 48 kHz file dropped into a 44.1 kHz session plays back at the correct pitch — no manual conversion required. The resample happens once at load time, so there's no ongoing CPU cost.

16.3 DAW host compatibility

Grainsmith is tested against these hosts:

- **Logic Pro** — AudioUnit. Insert on an instrument or audio track via the channel-strip plug-in slot.
- **Ableton Live** — VST3 or AudioUnit. Drag from the Plug-ins browser onto a track.
- **Reaper** — VST3 or AudioUnit. Use the FX button on any track.
- **Studio One** — VST3 or AudioUnit. Drag from the Instruments or Effects browser.
- **FL Studio** — VST3. Add from the Channel Rack or the Mixer's plug-in slots.
- **Bitwig Studio** — VST3. Drag from the browser onto a track.
- **Cubase / Nuendo** — VST3. Add from the Instruments or Inserts rack.
- **Pro Tools** — AAX. Insert on an audio or instrument track from the AAX plug-in menu.

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If your host doesn't see Grainsmith after install, force a plug-in rescan — most DAWs only look for new plug-ins at startup or when you press a **Rescan** button. See the troubleshooting page if the plug-in still doesn't show up.

If Grainsmith shows up in the wrong list (for example filed under Effects only, with no way to send it MIDI), see Host Compatibility Notes for host-specific detail, especially if you're on Reason, Cubase, or Pro Tools.

16.4 Instrument vs. effect

Grainsmith is a MIDI-controlled instrument: load it on an instrument track and send MIDI notes to trigger pitched playback. **Grainsmith FX** is a plain insert effect that processes whatever audio is on the track, with no MIDI required. Both share the same granular engine and UI; the difference is the input (MIDI notes vs. track audio) and the default dry/wet balance.

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17. Hardware controllers

Grainsmith can be played from hardware. Four devices are recognised by name and arrive with a built-in binding set; anything else that sends MIDI can be mapped by hand in a few seconds.

Everything here lives in one place: the **Controllers** pill at the bottom right of the plugin window. Click it to open the controllers panel.

17.1 Supported devices

Device	How it connects	What you get
OXI E16	USB MIDI	A full built-in map across its 51 encoders
Faderfox UC4	USB MIDI	A built-in map
monome arc	serialosc	Encoder and ring support, arc 2 and arc 4
Any other MIDI controller	USB or DIN MIDI	Generic MIDI: nothing preset, map what you want with MIDI learn

A controller does not need to be in that list to be useful. The generic MIDI path handles any device that sends control changes, and MIDI learn is the same two clicks whichever device you are on.

OXI E16

The E16's built-in map covers all 51 encoders. It expects the device in its 7-bit absolute CC mode, on **MIDI channel 5**, sending **CC 0 to 50**.

Pushing an encoder resets the parameter it controls. The device sends the same CC number on channel 6 when you push, and Grainsmith treats that as a reset rather than as a second binding, so pushes do not show up as separate rows in the panel.

monome arc

The arc connects through **serialosc**, not MIDI, so it does not appear in your host's MIDI device list. Both arc 2 and arc 4 are recognised. Make sure serialosc is installed and running before you open Grainsmith, otherwise the arc will not appear in the device roster.

17.2 The controllers panel

The panel has two panes. The **left** is the roster of devices Grainsmith can see right now. The **right** is the binding list for whichever device you have selected.

Each row reads left to right:

```
Param | Ch | CC | Lrn | Rst
```

- **Param** is the Grainsmith parameter the row controls.
- **Ch** and **CC** are the MIDI channel and control-change number. Edit either by dragging vertically on the number or by scrolling over it. Rows that are not driven by a CC show a dash and cannot be dragged.
- **Lrn** starts MIDI learn for that row: click it, then move the control you want on the hardware.
- **Rst** puts that row back to the device's built-in default. It is greyed out on rows that have nothing to reset.

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Mapped parameters are listed first. Below a thin dividing rule sit the parameters that are not mapped to anything, dimmed. Clearing a binding does not remove the row, it moves it down into that unmapped section, so the list never changes length and nothing disappears while you are working.

Seeing what you have changed

Rows using the device's built-in default are shown in dim text. Rows you have learned or edited yourself are shown in brighter text with a coloured bar down the left edge. So a glance at the list tells you how far your setup has drifted from the factory map, without having to remember what you touched.

17.3 Profiles

A profile is a saved set of bindings for one device. The built-in map is called **Default** and cannot be overwritten, so you always have something to get back to.

You can save the current bindings as a new profile, rename a profile, or delete one. Profiles are per device: a profile saved for the E16 does not appear when the UC4 is selected.

Use them for different jobs on the same hardware, for example one profile that puts the grain controls under your fingers and another built around the FX tab.

17.4 MIDI learn, step by step

1. Open the **Controllers** panel.
2. Select your device in the left pane.
3. Find the parameter you want in the right pane. Unmapped parameters are in the dimmed section at the bottom.
4. Click **Lrn** on that row.
5. Move the knob, fader, or encoder you want to use.

The row picks up the channel and CC it just saw. Repeat for as many parameters as you want, then save the result as a profile if you want to keep it separate from the default map.

17.5 Troubleshooting

The device is not in the roster. For MIDI devices, check it is connected and visible to your host, then reopen the panel. For a monome arc, check serialosc is running: the arc does not use MIDI and will not appear if serialosc is not up.

A knob moves the wrong parameter. You are likely on a profile you edited earlier. Select **Default** to get the built-in map back, or use **Rst** on the individual row.

A control does nothing. Check the row is actually mapped: unmapped parameters sit in the dimmed section below the divider. If it is mapped and still silent, confirm the hardware is sending on the channel the row shows.

An encoder feels reversed or too coarse. Per-row scaling options (absolute versus relative, 7-bit versus 14-bit, linear versus logarithmic) are not in this release. For now, set the behaviour on the hardware itself where the device allows it.

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18. Host compatibility notes

If you loaded Grainsmith in your DAW and it's not where you expected (missing from the instrument list, or sitting in the effects list but not receiving MIDI notes), this page covers why, and what to do about it. Reason 13 is the most common case, but the same mechanics apply in a few other hosts too.

> **Update to 1.1.1 or later**
>
> Builds before 1.1.1 tag the main Grainsmith VST3 plugin as a plain effect. Some hosts that split their browser into separate Instrument and Effect lists, Reason among them, filed it under Effects only and wouldn't route MIDI notes to it there. 1.1.1 fixes this. Grab the current installer from plasticfactory.com, reinstall, and let your host rescan (quit and relaunch, or use its plug-in rescan command) before checking again.

18.1 What changed in 1.1.1

Before 1.1.1, both Grainsmith plugins (the main MIDI-controlled version and the plain **Grainsmith FX** variant) declared the same VST3 subcategory: a plain effect. That was correct for Grainsmith FX, which never takes MIDI. It was wrong for the main plugin, which does.

As of 1.1.1, the main Grainsmith VST3 plugin declares itself as `Fx|Instrument`, Steinberg's own category for a plugin that's an effect but can also be loaded and driven like an instrument. That tells a host it's safe to offer Grainsmith in an instrument context and route notes to it, without changing anything about the plugin itself: it's the same identity, same audio inputs and outputs, same file format. Projects you saved with an older Grainsmith open exactly as before. This only changes where a host lists the plugin and whether it offers to send it MIDI by default.

Grainsmith FX didn't change and doesn't need to. It's a separate plugin (its own file, installed alongside Grainsmith) built for tracks where you just want to process audio with no MIDI involved, and it still shows up as a plain effect everywhere.

18.2 Host by host

Reason 13

Confirmed working as of 1.1.1: a Reason 13 user on macOS updated and had Grainsmith show up correctly with MIDI reaching it. Reason's own documentation doesn't spell out exactly which plugin metadata drives its Instruments-vs-Effects palette split, so treat this as a confirmed real-world result rather than a documented mechanism. It's confirmed all the same.

If you're still on an older build, or something still isn't working after updating: Reason lets you force MIDI into any effect-slot plugin manually. Right-click the device, choose **Create Track for [device]**, then right-click the new track and choose **New Note Lane**. This works regardless of Grainsmith's version and is a good fallback if you ever hit a similar issue with the FX build (which is a plain effect by design and won't move to the Instruments palette).

Cubase / Nuendo

`Fx|Instrument` makes Grainsmith loadable two ways in Cubase and Nuendo: as a normal insert effect on an audio track, or dropped directly onto an instrument track/rack.

Steinberg's own documentation is explicit that loading a plugin as an instrument (the second path) does not enable its audio input bus. That's how Cubase handles instrument slots for any plugin, not a Grainsmith bug. So:

- **Insert on an audio or FX track** if you want to granulate live audio input. This path keeps the audio input active.
- **Use the instrument slot** if you're fine with MIDI-triggered, sample-only playback and don't need live audio in.

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Pro Tools (AAX)

Pro Tools lists Grainsmith under **Instruments**, not AudioSuite or the Inserts effects menu. This is deliberate: the AAX build is categorized as an instrument specifically so it lands next to other MIDI-controlled plugins in Pro Tools, matching how Logic files it.

We haven't tested whether Pro Tools disables audio input for instrument-track plugins the way Cubase does. Until that's confirmed, if you need to granulate live audio input in Pro Tools, insert Grainsmith on an audio track the way you would any effect plugin, rather than relying on the Instruments menu placement.

Logic Pro

Unaffected by any of the above. Logic has always filed Grainsmith correctly. Apple's AudioUnit format has its own built-in category for a MIDI-controlled effect (a "music effect"), and Grainsmith has declared itself that way from the start. This isn't part of the VST3 change; it's a separate plug-in format with its own mechanism that already worked.

Ableton Live

Live loads Grainsmith as VST3 or AudioUnit. On macOS via AudioUnit, it gets the same built-in music-effect handling as Logic. Via VST3, we don't have a confirmed report either way for how Live buckets `Fx|Instrument` plugins specifically. No functionality should be lost (this is a menu-placement change, not a rewiring of the plugin), but if you can't find Grainsmith where you expect in Live's browser, check both the Instruments and Audio Effects categories.

Other hosts

Reaper, Bitwig, and Studio One aren't documented as treating VST3 category metadata strictly for MIDI routing. Reaper in particular has a reputation for letting you route MIDI to any effect plugin regardless of its declared category. Nothing about the 1.1.1 change should make Grainsmith harder to find or use in these hosts.

FL Studio is the one to watch: there's a historical report (FL Studio 20.6–20.9.2, several years old) of `Fx|Instrument`-tagged VST3 plugins showing up under FL's Generators/Synth list only, not also under Effects. We haven't confirmed whether this still happens in current FL Studio. If you use FL and can't find Grainsmith in the effects browser after updating, check the Generators list instead.

18.3 Why Grainsmith needs effect-style plugin infrastructure at all

Grainsmith isn't just a MIDI-triggered sample player. It granulates whatever audio is already on the track, live, in addition to a loaded sample. That's why both Grainsmith and Grainsmith FX declare a full stereo audio input and output, the same as any insert effect: the live-input path needs somewhere for track audio to come in.

MIDI control sits on top of that. Grainsmith adds MIDI note input to trigger and pitch grains, but the underlying plugin is built as an effect because that's what running on live audio requires. That's also why 1.1.1 uses `Fx|Instrument` rather than a plain instrument category: the VST3 spec defines a plain "Instrument" tag as generator-only (a sound source, not an insert), which is exactly the wrong signal to send hosts, since it would suggest Grainsmith has no meaningful audio input at all. `Fx|Instrument` is the category built for a plugin that's genuinely both.

18.4 See also

Grainsmith Field (the iPad and iPhone app) is a different plugin format, AUv3, and is deliberately a plain effect (`aumf`, an Audio Unit "music effect") in every host it supports. It shows up in your host's effects list, not the instrument list, on purpose. See Field's install page if you're looking for Field rather than desktop Grainsmith.

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19. Troubleshooting

Common problems and their fixes. If none of these solve your issue, email `support@plasticfactory.com` with your OS version, DAW, and a short description of what you're seeing.

I get no sound

Run through this checklist in order:

1. **The layer is on.** Each layer has a power toggle. Make sure Layer 1 is enabled (and Layer 2 if you're using it), and that the global Play transport is running in the standalone app.
2. **The output device is correct.** In the standalone app, open the audio preferences and confirm you're routed to your audio interface, not a disconnected output.
3. **Density and dry/wet are non-zero.** If **Density** is all the way down, no grains spawn. If **Wet/Dry** is fully dry, you only hear the input (or silence, if there's no input). Start both around the 12 o'clock position.
4. **MIDI is arriving (instrument only).** Grainsmith is a MIDI-controlled instrument. Without incoming notes it stays silent in Instrument play mode. Arm the track, play a note, and watch the keyboard indicator. If you want audio without MIDI, use the **Grainsmith FX** build instead.

The app crashes on launch

The most common cause on macOS is a stale quarantine flag on the bundle. Clear it from Terminal:

```
xattr -dr com.apple.quarantine /Applications/Grainsmith.app
```

If that doesn't help, check that your macOS version is supported. Grainsmith requires macOS 10.15 Catalina or later. The Windows build's C runtime is statically linked, so there's no separate redistributable to install.

If the crash is reproducible, grab the crash log (macOS: **Console.app → Crash Reports**; Windows: **Event Viewer → Windows Logs → Application**) and send it to support.

My audio file won't load

Grainsmith loads **WAV, MP3, and FLAC** on every platform. On **macOS** it also loads **AIFF, M4A (AAC), and Ogg Vorbis** through Core Audio. The Windows build handles WAV, MP3, and FLAC only — convert anything else to WAV first.

Sample rate is handled automatically: files are resampled to the current session rate on a background thread, so a 96 kHz WAV in a 44.1 kHz session still plays at the right pitch. That conversion happens once at load time.

Very long files (over about five minutes) take a moment to decode and resample. The waveform display stays blank while the load is in flight, then pops in when it's ready. If a file never finishes loading, it's probably corrupt — try opening it in another audio app to confirm.

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CPU usage is too high

Granular synthesis is expensive by nature, and dense patches on both layers can push a laptop hard. Try these in order:

1. **Drop grain density.** Density is the biggest CPU lever. Halving density roughly halves the grain count and therefore the CPU cost.
2. **Bypass unused FX.** The compressor and reverb each add overhead. The reverb's **Stormy** algorithm is the most expensive of the three — switch to Misty or Cloudy for lighter ambience.
3. **Disable a layer's Spectral Array Oscillator.** Each layer's SAO runs an independent phase vocoder; turn one off if you're not using it.
4. **Disable the second layer.** If you're only using Layer 1, switch Layer 2 off so it stops spawning grains.
5. **Raise the buffer size** in your host or the standalone audio preferences. Larger buffers give the engine more headroom per block.

The plug-in is missing or times out in my DAW

First, force a rescan. Logic Pro caches AU validation results aggressively — delete `~/Library/Caches/AudioUnitCache/` and relaunch Logic to force a clean revalidation. In Ableton Live, go to **Options → Preferences → Plug-ins** and click **Rescan**. Most other hosts have a Rescan button in their plug-in manager.

On macOS, check that Gatekeeper hasn't quarantined the bundle itself. The same `xattr` command from above also works on plug-in bundles:

```
xattr -dr com.apple.quarantine /Library/Audio/Plug-Ins/Components/Grainsmith.component
xattr -dr com.apple.quarantine /Library/Audio/Plug-Ins/VST3/Grainsmith.vst3
```

If a DAW reports the plug-in "timed out during validation", it usually means the host killed the scan before Grainsmith finished initializing its sample cache. Rescan once more — the second attempt almost always succeeds because the cache is already warm.

Grainsmith shows up under Effects only and won't take MIDI

This is a version and host issue, not a missing install. See Host Compatibility Notes. Short version: update to 1.1.1 or later and rescan, then check the host-specific notes for Reason, Cubase, and Pro Tools.

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20. What's New

User-visible changes per Grainsmith desktop release. The current shipping version is **1.1.1**.

Grainsmith shipped its first releases under the name **Grainulator**; the app was renamed to Grainsmith in 1.0.9. The plug-in's internal identifier was kept unchanged through the rename, so DAW projects saved with the older build keep loading the plug-in.

20.1 v1.1.1 — Reason support and clearer activation errors

- The main Grainsmith VST3 is now tagged as an instrument-capable effect (`Fx|Instrument`). Hosts that keep separate instrument and effect lists, Reason 13 in particular, now show Grainsmith in their instrument section and route MIDI notes to it. Grainsmith FX stays a plain effect on purpose, and existing projects are unaffected. Details and per-host notes: Host compatibility.
- License activation failures now tell you what actually went wrong. If the app can't reach the license server, you see the underlying network error (for example a firewall block or no connection), a note that your key was not used, and what to try next. Every activation error includes the support address, and long messages wrap instead of clipping.

20.2 v1.1.0 — Multi-head playheads

- Up to three independent playheads per layer. The new HEADS popover sets head count, per-head Size and Spread on an XY pad, per-head Speed, Pitch, and Level, and includes musical configuration presets.
- Heads are draggable directly on the waveform: double-click to gather them, Option-drag to move them as a group.
- 24 new parameters, all automatable and MIDI-learnable.
- Fixes: Live-mode loop-edge behavior and a Save As crash. Presets move to v33; presets saved by older versions load unchanged.

20.3 v1.0.18 — Controller sync fixes

- Quantized (synced) controls now stay in step across the on-screen needle, the LED ring, and MIDI-learned hardware. Fixes drift between what the knob showed and what a controller reported.

20.4 v1.0.17 — Pitch modes

- The GRAIN-tab **Pitch** knob now snaps to a chosen pitch set. Click the small caret (**▾**) on the Pitch knob to pick a mode: **Octaves**, **Oct+5ths**, **Scale**, **Free**, or **Chromatic**. In Scale mode you also pick one of **12 scales** (Major, Minor, Pentatonic Major, Pentatonic Minor, Dorian, Mixolydian, Harmonic Minor, Phrygian, Lydian, Locrian, Whole Tone, Chromatic).
- The knob snaps on release, so you can drag freely and land on an allowed pitch when you let go. In **Free** mode the readout shows decimals; the other modes round to whole semitones. New patches default to **Chromatic** (whole-semitone snapping), matching earlier behavior.
- The per-grain **pitch variation** on the TEXTURE tab gained the same five modes (previously Octaves / Oct+5ths / Scale only) and shares the scale selection with the Pitch knob — pick a scale in either place and both follow.

20.5 v1.0.16 — Controller support

- Faderfox UC4 hardware controller support, plus fixes to Live mode carried over from the 1.0.15 review.

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20.6 v1.0.15 — Live mode length and feedback

- Live mode (record incoming audio into a layer's buffer, then granulate it) gained loop-length and feedback controls and a de-click pass on the record and play seams.

20.7 v1.0.13 / v1.0.12 — Feel and fixes

- Spectral panel refinements, a per-layer level Trim, and a batch of interaction fixes. Fixed sample paste from the clipboard.

20.8 v1.0.9 — Renamed to Grainsmith

- The app's display name changed from Grainulator to **Grainsmith**. In a DAW the plug-in now shows as "Grainsmith" (and "Grainsmith FX" for the effect build). Installed file names were left unchanged so existing projects keep loading the plug-in.

20.9 v1.0.8 — Maintenance

- Fixed a crash on launch affecting Intel Macs, caused by a factory preset failing to load. Apple Silicon Macs were unaffected.

20.10 v1.0 — Initial release

The first public release (as Grainulator). A dual-layer granular synth with a spectral block, modulation matrix, and a shared post-mix effects chain.

What's in the box

Grain engine — per layer. Two independent granular voices with size, density, pitch, speed, jitter, spread, pan, and level. Each layer has its own audio buffer, loop points, freeze state, scan controls, and reverse probability. The desktop layout shows both layers side by side; the compact AU and iPad layouts use a layer switcher.

Window shaping (TEXTURE tab) — per layer. Eight window shapes per layer (Hanning, Gaussian, Trapezoid, Triangle, Tukey, Pluck, PluckSoft, ExpDecay) with Tilt, Curve, and Sides, plus a second target shape and a Morph knob with rate that crossfades between the two. Pitch variation, dynamics randomisation, reverse probability, and scan rate/depth all live here.

Spectral Array Oscillator (SAO) — per layer. A phase-vocoder synth per layer with Focus, Transpose, Tilt, FMT/Pitch/Both mode, Clarity, Partials, Scan, and Capture/Clear controls. MIDI-responsive and polyphonic.

Voice Interaction. A panel between the two Spectral columns with three cross-voice effects — **Follow** (time-domain source coupling), **Vocode** (spectral envelope transfer), and **Duck** (bipolar amplitude sidechain) — governed by a direction switch and a power toggle.

Global synthesis block (SYNTH tab). Sub Oscillator (Sine / Tri / Saw / Sqr with selectable octave and base note), VCA ADSR, Filter ADSR with bipolar depth, and per-layer root note plus shared glide.

Per-layer filter (GRAIN tab). Ten filter models (Stilson, Microtracker, Krajeski, MusicDSP, Oberheim, Improved, RKSimulation, Hyperion, DaisyLadder, CytomicSVF) with cutoff, resonance, drive, and an envelope-depth knob driven by the Filter ADSR on the SYNTH tab.

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Global effects chain (FX tab). Signal flow is **Master Filter → Compressor → Delay → Reverb**, all running on the summed two-layer signal:

- **Master Filter.** Same ten filter models as the per-layer filter.
- **Compressor.** Feed-forward log-domain with stereo-linked detection, 6 dB soft knee, parallel-mix blend, and an optional `tanh` soft-knee limiter.
- **Tape Delay.** Stereo with independent L/R times, four routing modes (Dual / PingPong / Single / Cascade), two time-change behaviours (Tape / Fade), saturation in the feedback path, tempo sync with swing offset, and infinite-loop capture.
- **Multi-mode Reverb.** Three selectable algorithms — **Misty** (Signalsmith Basics), **Cloudy** (Mutable Rings / Griesinger), and **Stormy** (Oliverb / extended Griesinger-Dattorro) — sharing one surface. Stormy is the default and includes shimmer and infinite freeze.

Modulation matrix (MOD tab). Five lanes, each with a source picker (LFO, Envelope, Euclidean LFO, Step Sequencer), a destination from 45 active targets, an amount and curve, and a layer target. Rhythmic sources share a clock that can free-run or lock to host tempo at a musical division.

MIDI control. Two play modes (Free and Instrument). Per-layer root note plus a shared glide knob in the Envelopes & MIDI column.

Platforms

- **macOS** standalone, AudioUnit (v2 / v3), VST3, AAX. Universal binary (Intel + Apple Silicon).
- **Windows** standalone and VST3.
- **iPadOS** — a separate product, **Grainsmith Field**. See its own documentation.

Audio file formats

- **Everywhere:** WAV, MP3, FLAC.
- **macOS only (via Core Audio):** AIFF, M4A (AAC), Ogg Vorbis.

The Windows build does not decode AIFF / M4A / Ogg — convert those to WAV before loading.

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21. Credits

Grainsmith is made by **Andy Smith** under the **Plastic Factory** label.

21.1 Open-source components

Grainsmith builds on several open-source projects:

- **iPlug2** — the cross-format plug-in framework. VST3, AudioUnit, AAX, and standalone targets all share a single C++ codebase through iPlug2.
- **Visage** — the GPU-backed graphics and UI library used for the controls, panels, and visualizations in the editor.
- **Mutable Instruments Rings** — the Griesinger-style reverb behind the **Cloudy** algorithm is adapted from Émilie Gillet's Rings Eurorack DSP.
- **Signalsmith Audio** — the **Misty** reverb algorithm is built on the Signalsmith Basics DSP library.
- **Oliverb** — the **Stormy** reverb (extended Griesinger / Dattorro with modulation and shimmer) is adapted from the Oliverb project.

21.2 Documentation

This documentation is built with:

- **MkDocs Material** — the site generator, theme, and search.
- **mkdocs-with-pdf** and **WeasyPrint** — the PDF renderer that produces the Desktop Edition PDF.

21.3 Thanks

To the beta testers who caught real bugs and asked for features that turned out better than the ones on the original roadmap. The rhythmic mod sources, the compressor's parallel mix, and the multi-mode reverb all came out of user requests.

If you find a bug or have a feature idea, email support@plasticfactory.com.

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