

## polyphonic surround live granular synthesis system

for those who seek beyond the usual sound

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# 1. Welcome!

## **Granular Synthesis revolutionized Sound Design, Electronic and Experimental Music! crusher-X does advanced polyphonic multichannel granular synthesis on live input in real-time**

crusher-X granular synthesizer effect plug-in for Windows (VST 2+3, AAX) and macOS (AU, VST 2+3, AAX, native Silicon/M1 support)

Its powerful algorithm creates very complex sounds, drones and outstanding surround effects. Since 1999, the crusher-X trademark has been "the" granular effect standard. crusher-X is used by famous sound-designers, composers, musicians and film-makers all over the world.

### **Key features:**

- Real-time live, glitch and static, polyphonic and multichannel granular synthesis engine that creates grains from live input signals or sound files
- Real-time vector modulation of all Grain Modulations: Delay, Length, Birth, Offset, GCO Mix, GCO Pitch, Speed, Sweep, WaveShaper, X-Crush, Bit-Crush, Filter, Diffuse, Volume, Pan and Tilt
- Real-time, spectral, interactive, formant wave selection/trigger filter
- MIDI Polyphonic Expression (MPE) support
- Side chain as an alternative audio input or to modulate, trigger and spawn grain modulation
- Grain Controlled Oscillator (GCO) system - crusher-X has Oscillator and Sample grain print-ins that can be generated and mixed with the live- or side chain input
- Grain Controlled MIDI (GCM) system - crusher-X can generate MIDI Notes and MIDI Controllers along with each grain to keep external sound or light systems in sync with the grain generation
- Grain Life-Time (GLT) System - The life-time of each grainstream can be controlled via UI, LFOs, MIDI and the Live and Side chain Audio Input
- Autotune and Pitch tracking system
- Unique Grain Controlled Feedback (GCF) system for shimmer reverb design
- Up to 12-channel surround outputs (e.g. 5.1, 6.1, 7.1, 8.2, 9.1) incl. 7.1.2 Atmos bed and 7.1.4 Atmos layout
- Microtonal tuning. Tuned Speed, GCO Pitch and Filter-Cut modulations (Grain-Arpeggiator). Comes with hundreds of different tuning scales and MIDI keyboard control
- Up to 199 individual grain streams (generators) that have multi-core CPU support
- Physical modeling sliders and an unique physical modeling X/Y controller
- Unique 3D grain visualization
- Unique "Grain-Drop" vertical live Grain Buffer visualization
- Real-time Grain Window Tilt functionality
- Over 240 preset programs
- Meta real-time parameter control with 13 global and editable adore plug-in parameters
- 12 easy to assign real-time plug-in MACRO parameters, stored in programs.
- Free real-time MIDI control assignments on over 450 UI elements
- Factory sounds and patches created by Richard Devine, Robert Dudzic, Ulrich Müller, Andrew Huang and accSone. Unique ASMR sound bank
- Morphing system with editable morph curve to morph seamless between parameters changes and program changes
- Undo/Redo and randomize functionalities
- Over 4500 LFOs. Each Grain Modulation has their own individual set of LFOs for each Generator
- 2 Global 4 Slot Grain Modulation Matrices (GMMs) with free assignable modulation targets
- LFO phase and frequency spread modulations (you can spread modulations over several grain stream generators)
- LFOs, Live Triggers and Grain creation can be bound to the tempo of the DAW (beats / second)
- Free editable ADSR with individual Attack, Decay and Release spline curves - up to 10min
- Free editable Envelope Followers on Input and Side chain for additional Grain modulations
- Grain lengths up to 60 seconds
- Shadow programs
- Several granulation live-buffer and interactive freeze modes: Can easily switch between live processing to file processing
- Can stop and save the live granulizing buffer at any time
- 8 DCO source generators, with FM control and 8 sample-players. Several player, mark-in, mark-out and looping modes
- Offline rendering
- Automatic triggered grain buffer filling modes

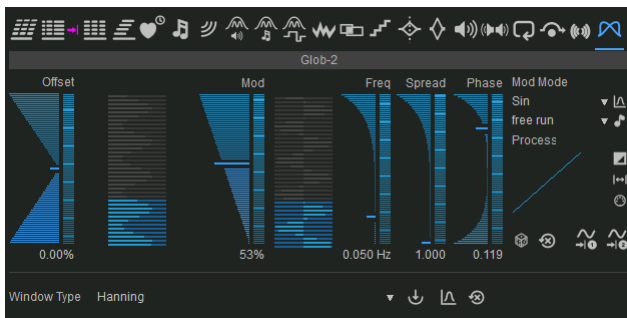
- Auto-Normalization during loading of soundfiles
- Two free editable multi-channel Compressor/Expander/Limiters to stabilize feedback and output level
- Smart latency compensation and overload detection system
- Integrated interactive quick-start tutorial

## 2. What's New in crusher-X 11?

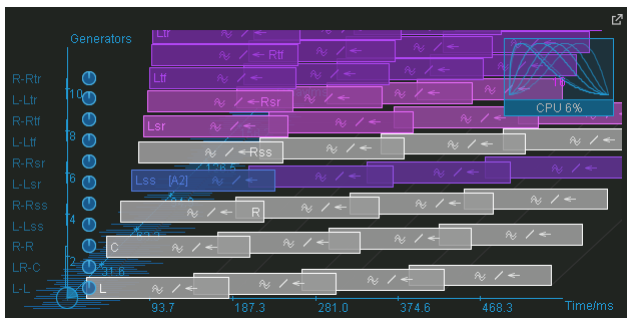


Discover the next level of granular synthesis with **crusher-X 11**, a groundbreaking update that redefines sound design. With revolutionary new features, enhanced sound quality, and a completely reimagined interface, this version is designed to inspire creativity and streamline workflows. Whether you're crafting cinematic textures or exploring uncharted sonic territory, crusher-X 11 provides the tools to push your ideas further.

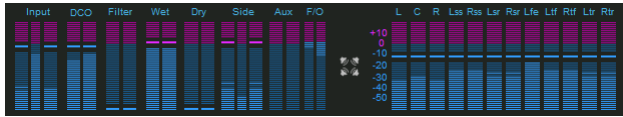
### Hyper Percussive or Sloppy Grain Storms: Grain Window Tilt Modulation



One of the standout features in version 11 is the Grain Window Tilt Modulation, an exclusive innovation by accSone for 2025. This game-changing addition allows you to tilt the grain window, creating hyper-percussive textures or chaotic, storm-like effects that redefine how granular synthesis can sound. It's a powerful new way to shape your audio with precision and creativity.



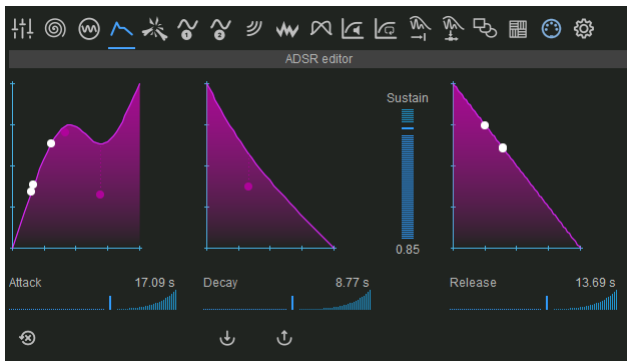
## Expanded Output: 12 Channels for Immersive Soundscapes



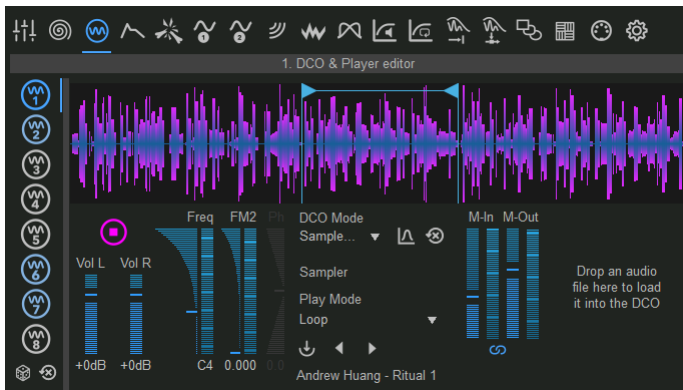
The output capabilities of crusher-X 11 have been significantly expanded, introducing 12 main channels and 2 AUX channels. This enables support for immersive formats such as 7.1.4 Atmos, 7.2.1, 7.4.1, and 5.1 Pro Tools Atmos. A new standalone version also leverages the 12-channel output configuration, while center panning grain modulation brings precise spatial control, perfect for Atmos surround mixes.

## Instrument Versions and Streamlined MIDI Functionality

crusher-X 11 also introduces instrument versions for all major plug-in formats, including VST2, VST3, AAX, and AU. These versions come with tailored user interfaces and patch variations to suit both instrument and effect workflows. MIDI functionality has been simplified, with generators now always active and ADSR processing refined to operate at the sample level for unparalleled precision.



## Now 8 DCOs!



The DCOs feeding the granular engine with raw sound material. crusher-X 11 introduces full UI control over 8 DCOs (Digital Control Oscillators), providing unmatched flexibility. Each DCO has its own dedicated tab, allowing granular control over parameters such as Volume, Sampler, and mutual FM modulation. This makes it easier than ever to sculpt complex, layered sounds and explore creative modulation possibilities. The addition of dice and reset buttons for all DCOs ensures seamless experimentation, letting you quickly return to a random or default state when needed.



## Enhanced User Interface

Version 11 features a redesigned interface with a modernized layout, improved color palette, and enhanced contrast for labels and buttons. This streamlined design ensures better usability and faster workflows, while the addition of a refined top bar offers quick access to essential features like Bypass, Program Selector, Undo, Morphing, and Random/Reset tools.

## Enhanced Sound Quality

The sound quality in version 11 has been again enhanced with updates to the speed processing engine, DCO processing, and grain window interpolation. These improvements ensure smoother, more accurate granular synthesis and better synchronization for Speed and Sweep modulations. Additionally, the new ADSR control introduces spline-controlled attack, decay, and release with durations up to 10 minutes, opening new creative possibilities for shaping dynamic soundscapes.

## Creative Tools for Ultimate Flexibility: MACRO Parameters



Sound design has been made even more dynamic with the addition of 12 MACRO Parameters. This new feature enables you to automate complex sound designs effortlessly, combining multiple parameters into single controls for creative and efficient automation workflows. By simplifying plug-in parameter mapping, the MACRO Editor brings new levels of flexibility to your production process.

Workflow and performance have also been optimized. On Windows, increased multi-threading harnesses the power of high-performance CPUs, while macOS users benefit from an installer that no longer requires a system restart. Navigation has been improved with a better mapping grid scroll behavior and an updated shortcut system, making crusher-X 11 faster and more intuitive than ever.

crusher-X 11 is packed with fixes and refinements including an improved user manual for better accessibility. Morphing has been decoupled from the undo/redo system, allowing seamless transitions between different states, and program resets now automatically adjust generator counts to match output channels.

With its innovative features like the Grain Window Tilt Modulation, immersive 12-channel output, 12 MACRO Parameters with Editor, and a refined user experience, crusher-X 11 is a must-have upgrade for sound designers, composers, and producers.

## Why Upgrade to crusher-X 11?

From its innovative Grain Window Tilt Modulation to its immersive 12-channel output and redesigned interface, crusher-X 11 empowers sound designers, composers, and producers with the tools to create next-level audio experiences.



[Find your crusher-X upgrade offer at the accSone shop](#)

### 3. The accSone innovation journey

The following unique innovations were launched by accSone with crusher-X:

- **Grain Window Tilt Modulation** (introduced 2025). Hyper Percussive or Sloppy Grain Storms
- **Long-term ADSR** (introduced 2025). Up to 10 minutes of freely editable attack, decay and release spline curves for super detailed volume and grain modulation
- **Glitcher-X Mode** (introduced 2023). Glitcher Mode anchors grains to auto-selected incoming life audio events and modulates the grain around these anchor points during the grains life-time
- **Spectral Selector** (introduced 2023). An interactive spectral selector will help you to mask the audio input and auto-trigger the respawn of a grains to the next audio transient
- **Generator LifeTime (G-Life)** (introduced 2021). If the Generator Lifetime has been exceeded they can be revived with a new Respawn button, with MIDI-Note Events, a Level Trigger or with Quantization. Generator Life Time is indicated in the Grain View by a clock symbols. Grains can be modulated by their "age"
- **Grain Controlled MIDI (GCM)** (introduced 2021). If enabled, each grain launch creates MIDI NoteOn and NoteOff events to control outboard MIDI devices in sync with the grain creation
- **Grain Controlled Oscillators (GCOs)** (introduced 2019). Together with the new GCO feature crusher-X combines fixed and floating sound buffer granulation principles by doing Waveform and Sample print-ins on the live audio material
- **Grain Controlled Feedback (GCF)** (introduced 2022). Each Grain can be individually modulated to provide its contribution to the feedback bus
- **Grain Arpeggiator** (introduced 2019). Tuned Grain modulations with MIDI Keyboard control
- **Bit-Crush** modulation (introduced 2019). Independent modulated Bit-crusher for each grain
- Screenless spline and step edit: New plug-in parameter based (cursor-X, cursor-Y, SetDelete) spline and step edit modes for blind / sight impaired musicians
- The **Diffuse** modulation (introduced 2016) is unique in the world of granular synthesis: It feeds the grain into independent reverb processors (one for each generator, from up to 10 parallel independent reverb lines) before the grain window is applied. The "reverb memory" will be passed from one grain in a series to the next. This leads to a very special, non smearing, precise and sharp - though warm - grain diffusion that can't be compared to a simple granulizer feeding a normal reverb processor
- The **X-Crush** modulation (introduced 2014) is unique in the world of granular synthesis: It adds a special asymmetric ring-modulation transformation feed by overlapping each grain with its successive grain. While dynamically interacting with other grain modulations x-crush will offer you a range of sounds from subtle ringing artifacts up to extreme phase shifting and distortion sounds
- The **Sweep** modulation is outstanding (dynamic grain pitching): Normally grains are created out of a standard set of parameters and executed without any modification. But the Sweep Grain Modulation is different: It allows sample accurate pitch shifting modulations due to a linear or editable spline or step function. Sweep creates sounds which range from warm "Water drop"-like sweeps up to wired pitch modulations or melodic ecstasies
- A **WaveShape** algorithm generates strange grain overdrive effects that are ideally used together with guitar input sounds. The WaveShape curve can be edited via a feature rich spline editor
- A **Formant** filter mode, which is processed on the grain level. It supports modulated vowels (a-e-i-o-u) with adjustable Q factors that control the sharpness of each vowel.
- All Grain Modulations can be controlled by a **Pitch Tracker** and **Autotune** system which tracks the pitch of the input channel in real-time, transforming the pitch by a selected scale and modulating an emphasis or compensation towards the grain pitch.
- Innovative Scaling feature allows harmonic grain clouds generation. Beside the usual Western standard scales the package contains thousands of historical, experimental, microtonal and exotic non western intonation scales that can be used to manipulate the pitch of the grains. Play crusher-X with your midi keyboard!
- A stoppable live **grain buffer** which can also host audio files
- The ability to Save the content of the live grain buffer to disk at any time
- Control the grain pitch and volumes with a **midi keyboard**. Scales can be applied to filter out "wrong" keys.
- Audio spikes will not be created by stating or stopping the grain buffer because smooth small fading is automatically applied
- A sizable and separated **Grain view** window shows the grains in detail. Can be controlled via plug-in parameters
- **Multi CPU / Core / Thread** grain generation allows utilization of all available CPU cores of the host system
- The granular engine supports multichannel input processing

- All interface elements can be assigned to controllers through an easy to use midi / plug-in parameter control mapping and learning function
- Several background assistants ensure quick workflows such as grain density editing
- The innovative **physical modeling sliders**, **physical modeling wheels** and our unique **physical modeling X/Y controller** (introduced 2000) allows smooth and intuitive value editing
- A full spline editable **multichannel surround compressor/expander/limiter** with flexible channel linking. Allows sophisticated output level and feedback flow control
- A smart **latency compensation** system to ensure live beat synchronicity by determining the "granular audio gravity" of a crusher-X Program

## 4. Installation

### 4.1. Requirements

Windows:

- VST 2.4 / 64bit and VST 3 / 64bit
- AAX / 64bit
- Windows10 or higher 64bit
- Requires a 64bit VST host to run the plug-in

macOS:

- Audio Unit (AU) / 64bit and VST 2.4, VST 3 / 64bit, AAX / 64bit
- Intel CPU, 1 GB, 2 GHz CPU
- Runs native on Apple Silicon CPUs (recommended)
- Mac OS X / macOS 11.00 or higher
- Requires a 64bit AU, VST or AAX host to run the plug-in

These hosts have been tested for compatibility. If your host is not listed, download the free demo and give it a try with your host:

<a href="#">Ableton Live</a>
<a href="#">Apple Logic Studio</a>
<a href="#">Apple Garageband</a>
<a href="#">Apple Mainstage</a>
<a href="#">Apple auval (Audio Unit Validation)</a>
<a href="#">SAMPLITUDE</a>
<a href="#">Cubase</a>
<a href="#">Wavelab</a>
<a href="#">AudioMulch</a>
<a href="#">FruityLoops (FL Studio)</a>
<a href="#">Renoise</a>
<a href="#">Sonar</a>
<a href="#">MiniHost</a>
<a href="#">Plogue Bidule</a>
<a href="#">Reaper</a>
<a href="#">Bitwig Studio</a>
<a href="#">Audacity</a>
<a href="#">Numerology</a>
<a href="#">Vienna Ensemble PRO</a>
<a href="#">Blue Cat PatchWork</a>
<a href="#">AVID Protools</a>
<a href="#">Reason</a>

For information about VST, please visit the [Steinberg Homepage](#) . And here you can find more information about [Apple Audio Units \(AU\)](#)

### 4.2. Install on macOS

Simply mount the downloaded dmg file and start the installer. After installation find the crusher-X AU, VST and AAX components copied to these folders:

/Library/Audio/Plug-Ins/Components

/Library/Audio/Plug-Ins/VST

/Library/Audio/Plug-Ins/VST3

/Library/Application Support/Avid/Audio/Plug-Ins

If you like you can manually copy the crusher-X user-manual to a favorite location.

Be sure that your DAW / host is running not in Rosetta mode. To change the mode, use Command-I in the Finder with the application selected.

After installation, your DAW / host will find the following plug-ins:

- crusher-X VST component
- crusher-X Instrument VST component
- crusher-X VST3 component
- crusher-X Instrument VST3 component
- crusher-X AU component
- crusher-X Instrument AU component
- crusher-X AAX component
- crusher-X Instrument AAX component

Start your DAW / host. After loading the crusher-X Instrument plug-in in an instrument rack and optional feeding it with some side chain sound, provide MIDI and you'll hear your first crusher-X sound! As an alternative you can use the crusher-X standalone app (crusher-X.app - not avail in the demo version). With your Mac's desktop selected, click **Go > Applications** on the menu bar. Then double click on the crusher-X App to launch crusher-X. It supports real-time stereo input and output and surround recording.

Note: You can't save any plug-in presets or plug-in parameters with the demo version. Please purchase a license if you like what you hear!

### 4.3. Install on Windows

Just unzip the package and move the VST2 plug-in (\*.dll) or/and the VST3 plug-in (\*.vst3) or/and the AAX plug-in folder(\*.aaxplugin) into the VST2, VST3 or AAX plug-in directory of your host or DAW.

For example:

File crusher-X\_.dll -> C:\Program Files\Common Files\VST2

File crusher-X\_.vst3 -> C:\Program Files\Common Files\VST3

Folder crusher-X\_.aaxplugin -> C:\Program Files\Common Files\Avid\Audio\Plug-Ins

Please refer to the documentation of your VST or AAX host for details about using plug-ins.

All plug-ins are in 64bit format. Only 64bit hosts are supported.

Optional you can copy the user manual pdf file to a location of your choice.

If you like to use scala tuning files (not supported in the demo version) you can unzip the scales.zip folder to a location of your choice.

Start your DAW / host. After loading the crusher-X Instrument plug-in in an instrument rack and optional feeding it with some side chain sound, provide MIDI and you'll hear your first crusher-X sound! As an alternative you can use the crusher-X standalone application (crusher-X.exe - not avail in the demo version). It supports real-time multichannel ASIO input and output and surround recording.

Note: You can't save any plug-in bank or plug-in parameter with the demo version. Please purchase a license if you like what you hear!

## 5. Introduction

### 5.1. Granular Synthesis

*"For this purpose the qualification "beautiful" or "ugly" makes no sense for sound, nor for the music that derives from it; the quantity of intelligence carried by the sounds must be the true criterion of the validity of a particular music."*

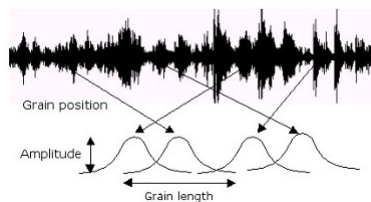
Iannis Xenakis in "Formalized music: Thought and mathematics in composition.", 1963-1992

The crusher-X algorithm is based on the traditional granular synthesis algorithm (Xenakis, Roads, Wilkins), which was invented in the early 1950s. In granular synthesis, short sound fragments (e.g. 50 milliseconds), "the grains," come from a fixed file buffer. The starting time, length and silence between the grains can be modulated. Working with more than one grain at a time is possible, thus you can create complex sound "clouds" from any sound signal.

*"When experimenting with those (length of grains), I have discovered a certain confusion as to what effect one can expect when setting parameters to certain values. Not only it seemed that length and density each had an impact of its own on the character of the granulated sound, but it also appeared that their relational value was highly important."*

Leon Zadorin "Composing with Granular Synthesis"

A "window function" blends in and out the grains at the beginnings and endings of their life-cycles. This function determines the character of the continuum and thus the different perceptions. Xenakis recommended the Gaussian window because of its theoretical considerations.



*"All sound is an integration of grains, of elementary sonic particles, of sonic quanta. Each of these elementary grains has a threefold nature: duration, frequency, and intensity. All sound, even all continuous sonic variation, is conceived as an assemblage of a large number of elementary adequately disposed in time. (...) Hecatombs of pure sounds are necessary for the creation of a complex sound."*

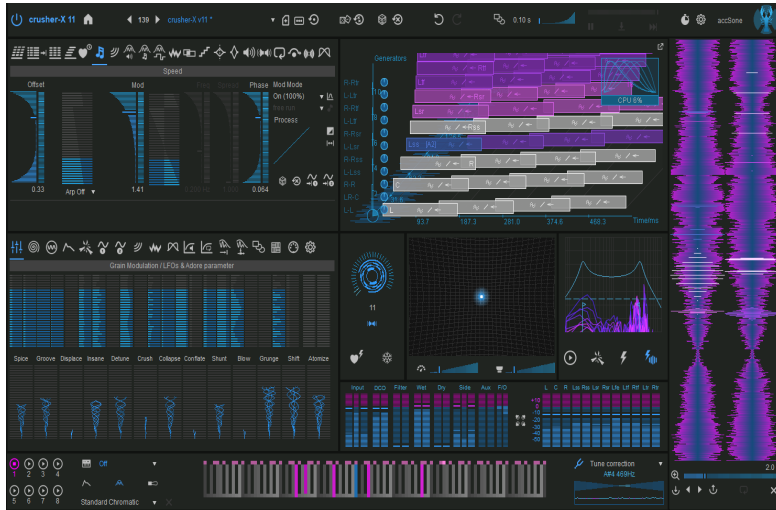
Iannis Xenakis in "Formalized music: Thought and mathematics in composition.", 1963-1992

Instead of the "classic" file-based approach, the crusher-X algorithm provides a floating grain buffer which allows real-time input and output. In this floating buffer, the grains are created by several generators routed to several outputs (surround modes) or combined to become single outputs (mono and stereo modes). You are able to apply many unusual Grain Modulations to the grains such as Reverse-Speed, Filter, Pan, X-Crush, WaveShape, Bit-Crush as you like - all modulated by independent modulation sources and modulation phases, either synchronized or not synchronized to the host. The X-Crush parameter is unique in the world of granular synthesis: It applies a ring modulation between the overlapping areas of the grains that follow each other. A feedback loop from the output towards the input is capable of generating extremely complex and non-linear sounds.

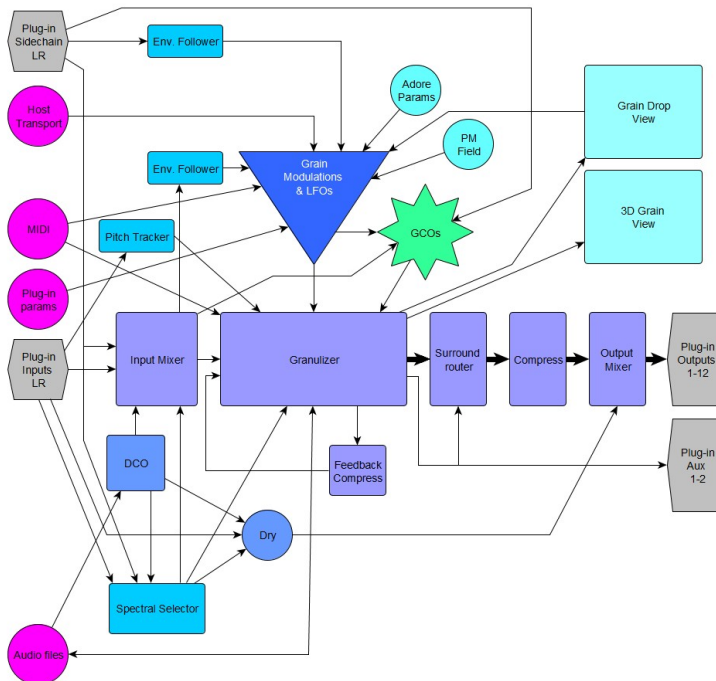
*"A complex sound may be imagined as a multi-colored firework in which each point of light appears and instantaneously disappears against a black sky. But in this firework there would be such a quantity of points of light organized in such a way that their rapid and teeming succession would create forms and spirals, slowly unfolding, or conversely, brief explosions setting the whole sky aflame. A line of light would be created by a sufficiently large multitude of points appearing and disappearing instantaneously."*

Iannis Xenakis in "Formalized music: Thought and mathematics in composition.", 1963-1992

## 5.2. crusher-X signal flow



*crusher-X plug-in*



*Audio and control flow through the crusher-X plug-in*

The plug-in's stereo inputs or the Side chain inputs and the output of the 8 DCOs are routed through the **Mixer** towards the **Granulizer** which generates the **Grains** from up to 199 **Grain Generators** which run in parallel. The **GCOs** (Grain Controlled Oscillators - one for each Generator) provide an audio print-in (driven from a .wav or other audio file) for each grain on top of the input signal. The input channel is also routed towards the **Pitch Tracker** (pre fader) and to the **Envelope Follower** (post fader). The **Feedback** signal is added to the **Granulizer's** input. The plug-in's 12 outputs are fed by the Mixer and Compressor's output which gets its input from the Granulizer. The **Surround router** determines the routing from the **Generators** towards the **Output channels**. The **Dry** signal can be mixed to each **Output channel**.

#### Modulation:

The differing **Grain Modulations** determine the following for the grains: grain generation, its life-cycle, GCO amplitude/pitch and processing. Each **Grain Modulation** has its own set of **LFOs** (one for each generator, up to 199) The **Global Modulation function** is the global modulator for all **Grain Modulations**.

#### Controlling:

Various **Grain** and **GCO** processing modes are determined by the **Granulizer** settings. The **PM Field** is able to be a modulation source of the **Grain Modulations**. The **Grain Modulations** can also be randomized by a **Random** generator. The Grain pitch can be controlled by **MIDI** key events. The filling of the **Grain buffer** is controlled by **Live** and **Glitcher Mode** the **Spectral Selector** and **Quant** settings.

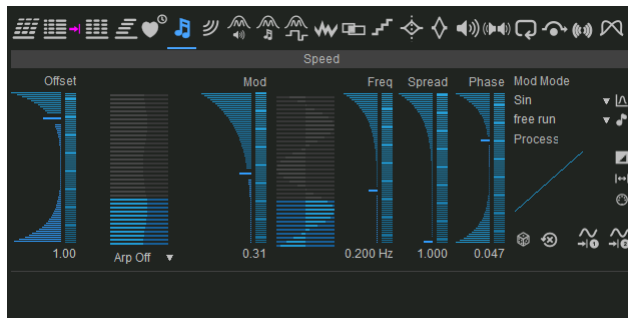
All settings can be stored and restored as a **Program**.

#### Visualization:

The **Granulizer's** status is displayed in the **Grain View**. The Grain Buffer audio data is displayed in the **Grain Buffer view** ("Grain Drop" view). Audio levels are visualized in the **Level view**. Current modulations are visualized in **Grain Modulation, LFO, and Adore parameter** views.

### 5.3. Physical Modeling sliders

The UI of the plug-in gives access to all crusher-X settings. The editor is designed to provide full control over all sound processing features while providing visual feedback of all changes.



*crusher-X sliders with PM-Wheels*

Tip: Most of crusher-X's sliders are also able to be controlled with a physical-modeling "wheel" (**PM-Wheel**) on the right side of each slider. Just "push" the wheel with the mouse (holding the left mouse-button down) and observe how the wheel and the slider moves. The same functions can be accomplished by using the scroll-wheel of a mouse or by a finger on a touch screen.

This unique technique which accSone invented in 2003 allows you to have full control to fine-tune and delicately calibrate changes very quickly and smoothly simply by scrolling slowly or quickly. You can also push the wheel by scrolling the mouse wheel. Simply move the mouse over a slider and turn the wheel. The text value inputs can also be controlled by mouse scrolling or mouse dragging.



## 5.4. Drag'n drop files

Audio files (WAV, MP3 or AIFF files) can be dragged and dropped on the plug-in interface. If an audio file is dropped on the DCO or Tab area the file will be loaded into the DCO and opens the DCO editor. If an audio file dropped elsewhere the file will be loaded to the Grain-Buffer and the Live Mode will be switched off.

crusher-X Program files and crusher-X Sound Package files can be dropped on the UI as well: Drop one or several crusher-X Programs to the UI it will load the program(s) to the program slots and do a morph to the last program. Drop a crusher-X sound package file to the UI will load the complete sound package (see Top Bar)

## 6. The Top Bar



*Top Bar with the Program Management Menu*

crusher-X can be switched into bypass mode by using the **< Power >** button.

The programs can be changed by selecting one from the **Program List** or by pressing the **< >** buttons. Each program holds the entirety of the current status of the plug-in with all its values and settings. Depending on the **Morph time** switching between the programs will change the settings faster or slower.

Tip: Use the program change buttons with higher morph time values to morph from one program to another

A right click on the **Program List** or a Click on the **< ... >** button will open the Program Management Menu. This allows to cut/copy/paste programs inside or to other running crusher-X instances. New as well as the **< + >** button will create full reset, untitled programs. **Import Program** and **Export Program** allows to save and load single crusher-X Programs to or from the hard disk. The full Bank (all Slots) can be imported/exported with **Import Bank** and **Export Bank** (e.g. crusher-X Sound Packages). crusher-X Programs are compatible with previous crusherX-Live!, crusherX-Studio! and crusherX-Mac! versions. When more than one crusher-X Program is selected from the file open dialog all files are imported to the corresponding program slots in sequence. The current filename will be used to change the program name.

Tip: If a filename contains a **" \_ "** character then it is displayed and sorted into a group. The group name is defined by the part of the filename that is before the **" \_ "** character. Same can be achieved on using **Rename** if the entered new name contains a **":"** character e.g. enter "group:programname" or "group:subgroup:programname"

crusher-X program files can be dropped on the UI as well: Drop one or several crusher-X Programs to the UI it will load the program(s) to the program slots and do a morph to the last program. Drop a crusher-X sound package file to the UI will load the complete sound package

All new imported or loaded programs will be stored in a shadow program "under" the current modified program. Choosing **Reload from Shadow** or pressing the **< Reload >** button will reload the underlying shadow's program. If no shadow program was imported before, the factory default program will be reloaded. The shadow programs are stored into the host's project and are also available after a reload of your project. With this feature you can reset your modifications very quickly to a predefined set of programs. This will give you higher freedom for live modifications. While modifying the program by changing a setting a **\*** will be displayed in front of the program name and the color of the name will change.

Tip: For supporting live performances, import several programs and assign the **< Reload >** button to a MIDI-Controller. This enables you to switch back to the initial sound immediately after changing several values

### 6.1. Randomize Grain Modulations

The 4 **< Dice >** and **< Reset >** buttons apply and resets all Grain Modulations in two different ways.

Tip: Use the **< Dice >** button together with **< Undo >** or **< Redo >** and the **Morphing System** to generate interesting modulation floats

## 6.2. Undo/Redo

After changing any value, the entire program (without the program names) of the crusher is streamed into memory; you can undo each change step by pressing the **<Undo>** button. The **<Redo>** button will redo the change.

Tip: Use the **<Undo>** / **<Redo>** buttons with higher morph time values to morph between the changes

## 6.3. Morphing System

One special feature of crusher-X is the morphing system. Each time you change one or more settings (e.g. via loading a program, changing settings in the UI, or using MIDI) the Morphing System will try to find a smooth transition between changes in settings. With the **Time** slider you can determine the time between the changes (from 1ms up to 1 hour). During the Morph process the process can be paused and manually controlled by using the morphing position slider. This slider can be external controlled by a plug-in parameter or a MIDI mapping.

Tip: Click on the value field to enter morph times longer than 60s (up to 3600s are possible!)

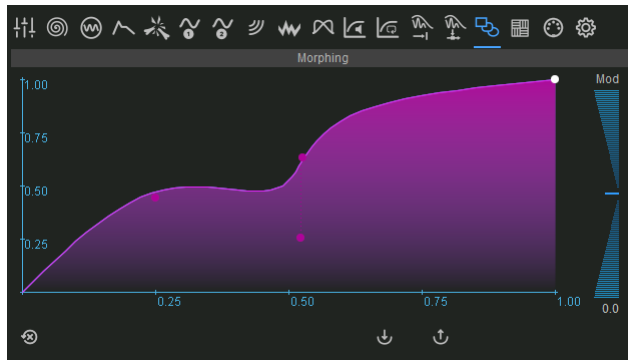
During morphing the following buttons can control the morphing process:

**<Pause>**: Pauses the morphing process until you press the button again.

**<Apply>**: Transfers the actual morphing values to the UI and stops the morphing. Use this button if you like the actual sound and want to save it.

**<Fast Forward>**: Stops the morphing process and sets the destination settings immediately.

The **<Morph>** button opens the Morph Spline Editor Tab and enables to edit the path the morphing system will change the parameters. With that feature one can create an individual "gesture" for the morph transition itself (in contrast to a simple linear transition)



*Morph Editor Tab*

Tip: Using the Morphing System together with Program changes, **<Undo>**, **<Redo>**, **<Reset>** or **<Random>** buttons.

Note: Morphing also occurs if you change the settings with the UI sliders. Use smaller morph times if you like to have faster audible reactions to your changes. Also pitch shifts that are caused by MIDI-Key changes are morphed (though a MIDI key receive will by design not trigger the Morphing System).

## 6.4. Latency compensation system

The **<Clock>** button creates a calculation of a latency compensation for the current or modified program.

Use this if you want to make sure that your audio generated by crusher-X stays in sync with the track that feeds crusher-X (e.g. to stay synchronized on a drum-beat). If a program contains deeper modulations of the Delay, Length, Speed or Sweep Grain Modulations then the smart latency compensation algorithm will calculate a "grain gravity compensation" so that the compensation remains meaningful. Although in these cases a full compensation is not desired nor possible. If the current calculated compensation fits the current program then the button will stay blue, but if the compensation will not fit, it will turn purple (e.g. after a setting or program change). As every new calculation will force the host to re-synchronize its audio processing there will be some audio outages you'll easily be able to notice (depending on the host) depending on if the button is pressed or released. Releasing the button will reset the compensation back to 0 samples - Use this with live input sources to ensure a minimum of processing latency in this case. The current latency compensation is stored as a global setting (not with each program). This enables the following: Initial loading of a compensation on launching the host or a smooth morphing between programs

Note: The functionality of this feature is highly dependent on the ability of the host to receive the reported latency compensation from the plug-in into account:

**Live** does a pretty good job as it cross-blends changes, even during playback.

**Logic** has problems with applying the changes during playback. But if this happens, sometimes clicking the **<Stop>** button in Logic Transport and then clicking the **<Clock>** button in crusher-X helps.

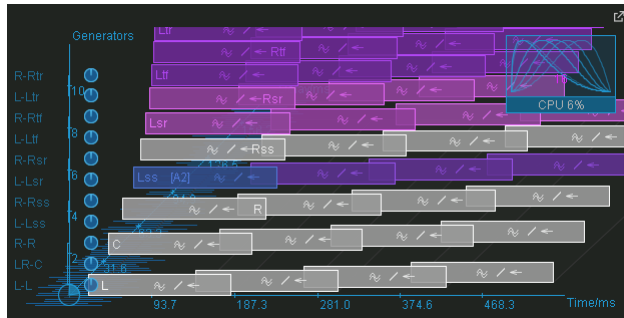
## 6.5. Settings and crusher-X Logo

The **<Settings>** button opens the Settings Tab (See Settings Tab section).

Clicking on the crusher-X Logo will show a dialog with detailed version information.

## 7. Grain Views

### 7.1. The Grain 3D View



*The Grain 3D View*

The **Grain 3D View** depicts all **Grain Modulations** and grain generations. If you press the <^> button the Grain View will open in an additional floating window.

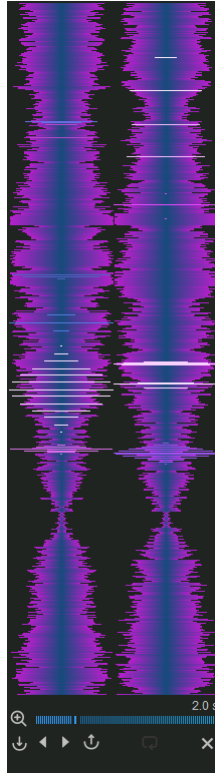
Note: To change the perspective, hold the left mouse button and drag the mouse over the window. To switch the mouse mode to **Zoom**, **Move** or **Rotate**, press the right mouse button. The actual mode is indicated by the mouse cursor. 2 plug-in parameters RotateX and RotateY can be used to automate the 3D view (e.g. for visual performances like requested from the artist Aphex Twin)

At the bottom left, the pie circle does a representation of the grain buffer filling.

At the top right, you will find a representation of the current **Grain Window** setting including a CPU load indicator. The small number gives the actual number of the generated grains at this time.

Grains are represented by the colored rectangles. Those most recently generated (the grains you currently hear) on the left side, followed by 3 older "dead grain" generations.

## 7.2. The Grain Buffer



*The "Grain Drop" View*

The **Grain Buffer View** shows the current audio content of the Grain Buffer. On top of the Waveform the basic **Grain Modulations** are painted with horizontal colored lines. The Grain Buffer can be in **Live** or **Stop Mode** (see next chapter how to control the modes). The same color scheme from the **Grain View** is used to visualize the current Grain processing. Dragging the Mouse with the left mouse button pressed sets the Offset of the **Delay Grain Modulation**. If the Grain Buffer is not in Stop Mode a right click on the Grain Buffer View will Trigger a new Fill of the Grain Buffer.

In Fixed Mode the Loop Button can be used to set the **Delay** and **Speed** Grain Modulations, especially the Delay **Offset**, the Delay **Modulation** and the Delay LFO **Frequency** to automatically adjust in such a way so that a non-pitched and forward playback of the buffer is ensured.

Use the import and export buttons below to load or save the current Grain Buffer content. An audio file can be also loaded by dragging it on the Grain Buffer UI. Once an audio file is loaded, the Grain Buffer switches to Fixed Mode.

Tip: Use the **<Loop>** Button to start your granular experiments on fixed buffers. Simply press **<Undo>** if you want to revert to your previous settings

Note: Don't expect that what you hear is automatically preserved when saving the buffer content as the buffer content is only the source for the processed sound

The **<X>** Button immediately clears the Grain Buffer - use it in case you want to "clean" long lasting grain structures with long grain lengths and/or high feedback. In case a file is loaded into the Grain Buffer the button will also trigger a switch back to the Live mode.

### 7.3. Grain Buffer Live and Stop Mode



*Trigger & Glitcher*

If the **<Play>** button is pressed the grain buffer will be continuously updated (Live Mode). Releasing the button means it will switch over to a fixed buffer mode (Stop Mode)

In Stop Mode one can trigger the buffer to update by either:

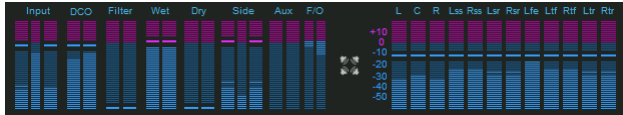
- press the **<Flash>** button
- With the **Quantization** mode **Fill/Glitch** or **Grain+Fill/Glitch** (see Quantization Tab)
- Enabled with the **<Flash Audio>** button, the live signal of the Real-time Input or Side chain Channels can be used to create Auto-Triggers: Use the **Spectral Selector Filter** below to set the desired frequency ranges of the detector (See the Chapter about the Spectral Selector)

Tip: Use a Microphone as an input signal and release the **<Play>** button (Stop Mode). Reset the Delay Modulation and adjust to small, slightly overlapping grain lengths. Enable the **<Flash Audio>** button. Each time you speak into the microphone the grain buffer is triggered. This will generate robot like sounds and the grain generation will stop with your last spoken word / syllable.

Note: Without saving the buffer the content will be lost if you change to a program that switches to **Live** mode and therefore triggers refilling of the buffer. If you want to have a certain buffer sound associated to a program you must save the buffer.

Tip: You can start an intro to your live performance using a preloaded buffer and move seamlessly to the live mode by let the granulizer being triggered by the audio level trigger

## 8. The Mixer



*The Mixer*

The **Mixer** allows to have full control over the volume of all relevant inputs and outputs and allows you to choose the assignments of both the surround output and the Compressor settings.

The **Input** slider adjusts the level of the plug-in's stereo inputs that is mixed together with the **DCO** and **Filtered** Signal to feed the Granulizer.

The **DCO** slider mixes the DCOs sum into the Granulizers input.

The **Filtered** slider mixes the output of the **Spectral Selector** into the Granulizers input.

Note: The **Pitch Tracking** System (pre-fader) and the **Envelope follower** (post-fader) also gets their audio input from the plug-in's input

Note: Grouped sliders are moved together if one slider is moved or one slider is manipulated through a plug-in parameter or MIDI controller. Holding the **Shift key** while moving a slider will change the channel volumes individually

The **Wet** sliders control the stereo output volume of the Granulizer.

The **Dry** slider mixes the stereo input, the DCOs and Filtered signal directly to the outputs.

Note: The **Wet** and **Dry** sliders are also morphed by the Morphing System which allows smooth fading and muting - even with a volume change resulting from using the **Undo/Redo** function or altering other values. This will only happen if the **Global Mixer** setting in the **Settings Tab** is disabled.

The **Out** sliders determine the volume of the stereo output of the plug-in.

Note: The internal structures allow internal overload close to +40dB! It depends on the DAW's ability if the output of the plug-in has to be below 0dB or not to prevent distortion.

Grain Modulations can be bound to Stereo Pairs but depending on the program the output of the granulizer might create very wide stereo left/right audio pannings.

If the generator count exceeds the active channels, the output of the generators are summed up towards the next available channel (generator rotation).

Click on an output channel label to solo individual channels. Click on a soloed label to mute the channel. Click on a muted label to get back to all channels enabled.



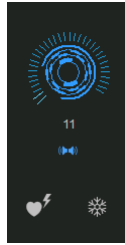
## 8.1. Surround Modes

The surround routing between the Generator outputs and the plug-in outlets can be chosen with the **Surround Mode** selector on the Mixer. Choose the one that fits best to the surround channel layout of your DAW. Find the current output labels also left to generator row in the Grain 3D View.

These modes will not only affect the assignment and labeling of the output channels but will also affect the routing of the generator streams towards the outputs and provides the sum of the **LFE** (Low Frequency Effect) channels and the **Aux** channels.

The Surround Mode can also be defined in the **Settings Tab**.

## 9. The Generators



*Generator*

The **Generator** input box and wheel allows to set the number of generators (up to 199) that will generate the grain stream.

Each generator adds a set of generated grains to be mixed towards the different output channel. Each generator receives its input depending on the setting of the **<L/R>** button: If it's not pressed then each generator will receive a down-mix to mono of the input channels. If the **<L/R>** button is pressed then input of the generator's channel will depend on the generator number (odd/even) and the setting of the **Surround Mode** (see **Mixer**).

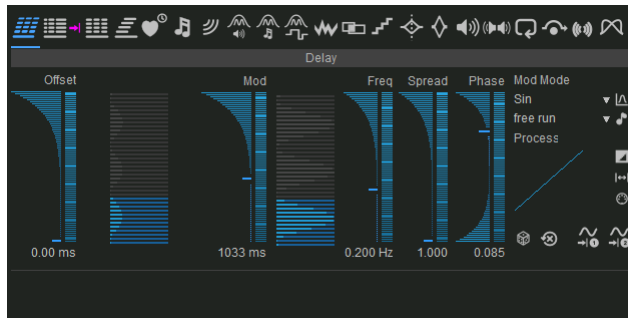
If the G-Life Grain Modulation is "non eternal" and grains becoming "dead", the **<Flash Heart>** button starts to blink and is ready to launch a respawn of the grains.

A very powerful modulation effect can be achieved by pressing the **<Freeze>** button: Depending on the morph time setting, all Grain Modulations will become decelerated and finally pause until the button is released.

Tip: To use this feature in for a live performance, map the **<Freeze>** button to an external MIDI controller device.

## 10. Grain Modulations and LFOs

### 10.1. Grain Modulations and LFOs



*Grain Modulation Delay*

Grain Modulations control the generation and processing of the grains. To adjust the modulation of Grain Modulation simply choose the desired Tab and use the sliders. Grain Modulation define (from the left Tab to the right Tab):

- the way in which a grain is generated - **Delay, Birth, Offset**
- the grain's lifetime - **Length** and **G-Life**
- the grain's pitch - **Speed** and **Sweep**
- the GCO audio in-print - **GCO-Mix, GCO-Pitch** and **GCO-Wave**
- the grain's audio processing - **WaveShape, X-Crush, Bit-Crush, Filter Cut, Filter Q, Volume, Pan, Bypass/Aux, Diffuse** and **Tilt**

Each **Grain Modulation** applies to all **Generators**.

All Grain Modulations share the same structure:

The **Offset** slider sets the general offset of the Grain Modulation

**Mod** defines the modulation depth of the Grain Modulation's LFOs

**Freq** determines the frequency of the Grain Modulation's LFOs

The **Phase** slider defines changes of modulation phasing between the individual **Grain Generators**. Note: Changes between individual generators can only be made by using the **Phase** slider

The **Spread** slider defines changes of the modulation frequency for each **Grain Generator**. The first Generator (the lowest) will be modulated by the selected base frequency. The other Generators are modulated by the base frequency multiplied by the Spread factor and the Number of the generator (e.g. 1,2,3,4)

Note: With the Phase and the Spread functionalities you are able to control the frequency's and phase's relationships between the LFOs for each generator. Think of up to 199 LFOs being controlled by only 2 sliders for each Grain Modulation. One of crusher-X's "unique-sounding secrets" is this concept of "spread LFO" control over a series of granulation streams

The pressed **<->** button will ensure that the modulation stays the same for each Left- and Right Stereo Generator pair even if Spread or Phase is used. This will regulate the stereo depth of the applied modulation and ensures a more balanced modulation output if desired.

**Mod Mode** sets the modulation modes. Several types are available:

- Standard modulation forms such as: Sin, Triangle, Saw, Rect
- **Each Grain** is randomized: Every grain will be created with a random value
- **RandLine Sync**: A random "travel line" floating modulation will be applied to all generators (spread & phase can be applied to sync)
- **RandLine Free**: A random "travel line" floating modulation will be individually applied to each generator
- **Rand S&H Sync**: A random "sample and hold" modulation will be applied to all generators (spread & phase can be applied to sync)
- **Rand S&H Free**: A random "sample and hold" modulation will be individually applied to each generator
- **X PM-Field, Y PM-Field**: Modulate with the PM-Field
- **On (100%)**: No modulation will be applied with an offset of 100% (can be used together with **Phase** to spread an offset over the generators)
- **Off (50%)**: No modulation will be applied with an offset of 50%
- **Spline**: Enables custom spline editing of the modulation
- **Steps**: Enables custom step sequence editing of the modulation
- **ADSR**: Ties the modulator to the ADSR generator. Edit the curve with the ADSR Tab
- **Velocity ADSR**: same like above, but takes the MIDI Velocity into account
- **Channel Pressure (MIDI & MPE)**: ties the Modulator to the Channel Pressure MIDI event. In MPE mode each generator will be steered by each individual MPE channel
- **Polyphonic Aftertouch (MIDI)**: ties the Modulator to the Polyphonic Aftertouch MIDI events.
- **MPE CC74 (MIDI & MPE)**: ties the Modulator to the MPE CC74 controller for each MPE channel individually. Works only in MPE mode
- **Follow Tune (Pitch Tracker Tuned, Base Note)**: Modulates the output of the pitch tracking system by compensating to the selected Scale
- **Follow Pitch (Pitch Tracker, Base Note)**: Modulates the output of the pitch tracking system by following the selected Scale
- **Input Envelope Follower**: Modulates with the output of the envelope follower system. To adjust the Envelope Follower characteristic curve or Attack and Release times select the Input Envelope Follower Tab
- **Side chain Envelope Follower**: Modulates with the output of the envelope follower system for the side chain. It can be setup in the **Side chain Envelope Follower Tab**
- **Follow Generator Lifetime**: Modulates according to the "age" of the grains (see GLT System)

Each modulation is passed through logarithmic or exponential processing. You can adjust the curve of processing by the **Process** graph. This little graph will show you the resulting processes. The mouse can be used to further modify them. In combination with the modulations sources this function is very useful to generate more "human-sounding" modulations. By pressing the **<Invert>** button one can "invert" the processing. Although it is a binary control it will be morphed on larger morph time settings:

Tip: Use the **<Invert>** button together with a morph time set >0. The process graph will display the processing changes. Along with **Phase** this generates a smooth forward/back like effect

All modulations can run independently of the host's beat in the **free run** mode. Choosing a **beat** will sync the modulation to the host's beat.

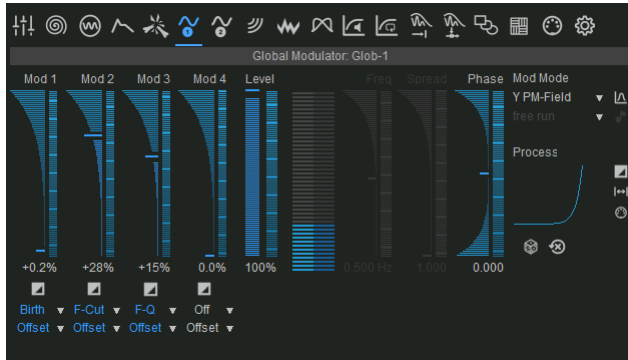
The modulation can be re-triggered by a MIDI Note when the **<MIDI>** button is pressed. Use it to sync the modulation to the keyboard play.

The **<Dice>** and **<Reset>** buttons apply random values or resets the currently selected modulations.

Tip: Use the **<Dice>** button together with **<Undo>** or **<Redo>** and the **Morphing** System to generate interesting modulation floats

The **-> G1** and **-> G2** buttons are shortcuts to move the current Modulation towards a Global Modulation Matrice slot (see below).

## 10.2. Global Modulation Matrices (GMMs)



*Two Global Modulation Matrices (GMMs) to add global modulations*

To show a GMM, choose either the <G1> or the <G2> Tab

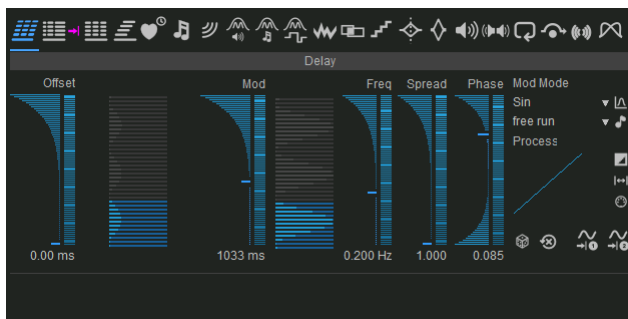
Each GMM has 4 Slots **Mod 1-4** that defines the amount, a target and a type of global modulation. The **Level** slider will steer the overall amount of all 4 modulations.

The <Invert> buttons on each slot "reverses" the modulation of the slot. This allows opposing Grain Modulations (e.g. increasing the length and lowering the speed with the same global modulation source). Any setting including the inversion will be further morphed by the Morphing System

Note: Experienced users may start their sound design workflow at the GMMs first and then add individual modulations later as the GMM slots allow full control for each modulation target and type. This makes it easier to define first the Grain Modulation Targets that should run synchronously to create to more coherent sound gestures.

Tip: Use the Global Modulation Phase slider to change the phase of the modulation. This allows for creating interesting sounds where the Grain Modulations are modulated synchronously but with an offset for each generator.

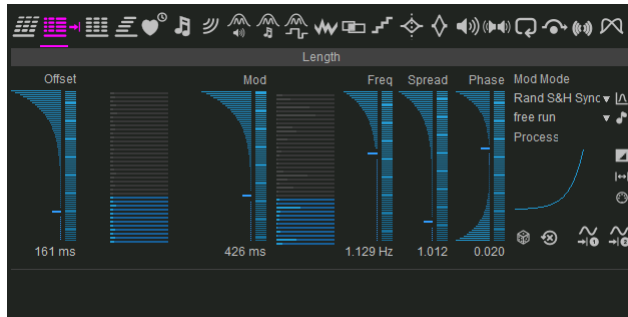
## 10.3. Delay Grain Modulation



*Delay Grain Modulation*

The **Delay** Grain Modulation defines the delay between the audio input into the buffer and the grain(s) output. It can be seen as a delay line where the read-head is moving. It is defined in msec (1/1000 Second).

## 10.4. Length Grain Modulation

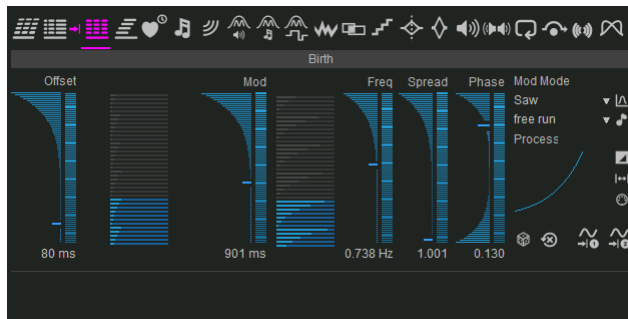


*Length Grain Modulation*

**Length** determines the length of the grain in msec.

Tip: Extremely short (1ms - 20ms) grains sound like "spikes" or "sparks". Longer overlapping grains (100ms - 500ms) are appropriated for pitch shifting effects. Lengths > 10sec can be used for longer lasting sound moves or sound collages.

## 10.5. Birth Grain Modulation



*Birth Grain Modulation*

**Birth** determines the time (in msec) the generator will wait until a new grain is born. If the Birth time is smaller than the Length of the grain the grains will overlap. The generator prevents the birth time from decreasing under 10% of the actual grain length. This prevents it from overloading the system. The actual generated numbers of the grains are shown in the **Grain View**.

Adding the Length and Birth Grain Modulations together will determine the **grain density**. Longer length times and smaller Birth times will lead to higher grain density that will finally end up in an overload. Take a look at the Grain View in the upper right corner to determine the amount of grains running at the same time.

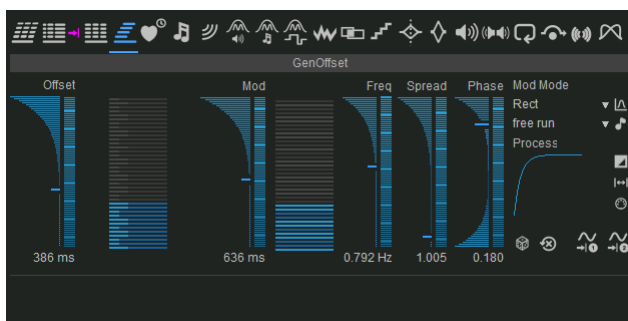
In the **Grain View** the grains are represented by the rectangles in a 3D coordinate system. The **Delay** is shown in the Z axis and **Length** and **Birth** are shown in the X axis. The Y axis shows the different **Generators**. The grain near the Y axis is the one that is currently generated. The 3 other grains in the X direction to the right represents the ones which have already played.

Tip: To get started understanding grain generation principles use the program "**to start with**", feed in some audio from your DAW and experiment with the **Length**, **Birth** and **Delay** Grain Modulations by using the **Offset** sliders. It's best to start with audio material that you're familiar with or that has some good observable structures (like e.g. spoken text or reduced drum loops with some melodic elements)

Pressing the **> button** between the Length and the Birth selectors will enable a proportional following of the Offset on the Birth Grain Modulation if the offset of the Length Grain Modulation is changed manually. That feature ensures easy adjustment of the grain density (you might know that type from other granular synthesizer effects). The link is only unidirectional meaning that you are still able to change the relationship between Length and Birth by editing the Birth Grain Modulation first.

## 10.6. Offset Grain Modulation

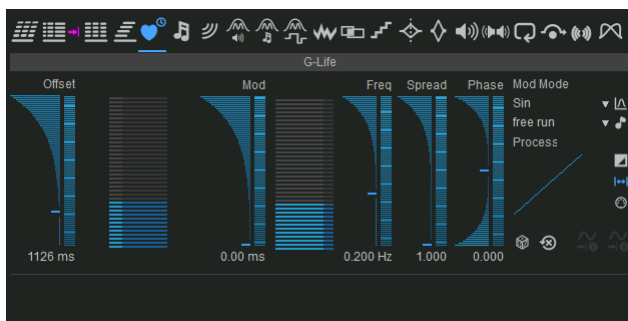
**Offset** determine the time (in msec) each generator waits until a grain - that has given birth - is actually processed (in older versions of crusher-X this was partially the result of a static, global Generator Offset setting). This Modulation needs some Phase or Spread applied to have an outstanding effect: It determines if all the grains from each generator are created at the same time (No Offset) or at a different point in time for each generator.



*Offset Grain Modulation*

Tip: Use a Phased Offset modulation together with longer Birth times to "smear" the grain generation into pauses. This generates smooth but very light "drones". After that you can control the Density of the drones with the Birth Modulation

## 10.7. G-Life Grain Modulation



*The GLT (Grain Life-Time) System*

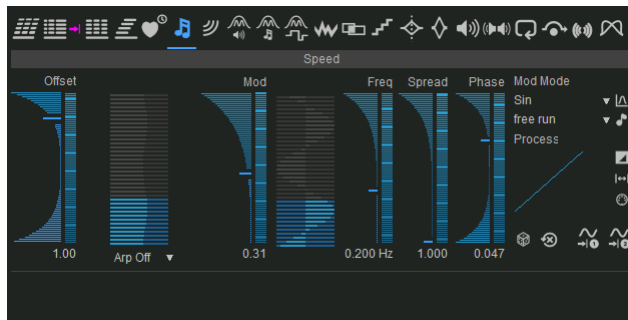
The **GLT** (Grain Life-Time) System is a unique crusher-X feature that gives detailed control over the time each grain generator is alive. The GLT is activated by adding an Offset or a Modulation to G-Life. Once activated a count-down timer for the generator is launched for each generator (Spread and Phase allow to create different life-times for each generator). The timers are visible in the Grain 3D View.

Once the count-down timer has expired the attached generator is deactivated until one of the following events occur:

- A click on the blinking **<Flash Heart>** button on the Generator
- A MIDI-Note On event (or a fixed MIDI-Note On state)
- A trigger of the Audio-Signal (Trigger Level) either with the Input Signal
- Quantization if selected to trigger a Respawn Event (see Quantization Tab)

Tip: Use the GLT System to create percussive grain developments that doesn't sound static. As the lifetime can also control the modulation itself one can create very interesting developments of time limited drones (see Grain Modulations)

## 10.8. Speed Grain Modulation



*Speed Grain Modulation*

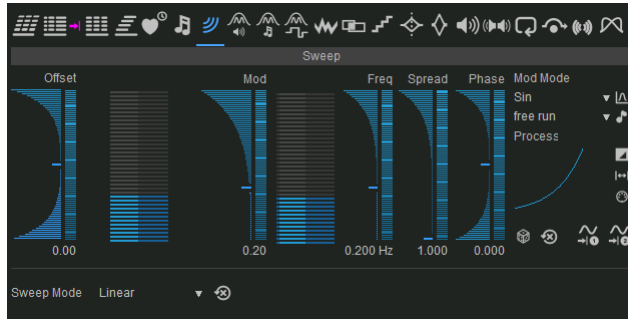
**Speed** refers to the pitch of the grain. It is defined as a multiplication factor and ranges from -5 to 5. 1 indicates no pitch shifting. 2 means a double pitch. Values > 1 scale the pitch up. Values from 1 down to 0 scale the pitch down. Values below 0 represent backwards pitch shifting (-1 without pitch shift, 0 to -1 pitch down, < -1 pitch up).

Note: Speed modulation doesn't affect the GCO pitch, which allows you to independently control the input-signal pitch and GCO pitch of the GCO Ring modulation or FM Modes.

Tip: Use speed modulation on longer grains to create scratch effects



## 10.9. Sweep Grain Modulation



*Sweep Grain Modulation*

**Sweep** determines grains pitch-shift during its life-cycle. (dynamic grain pitching). Positive values increase the speed during a grain's lifetime, negative values decrease the speed. The following modulation types of pitch changes can also be selected: Linear (normal sweep), Spline and Steps.

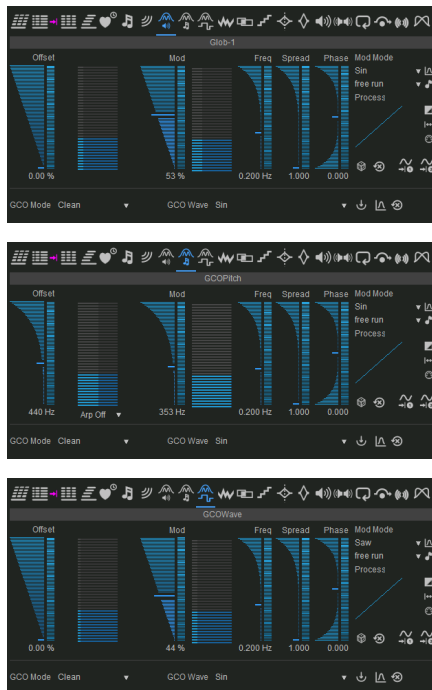
Note: Sweep modulation doesn't affect GCO pitch

Tip: Use a linear sweep to make the sound "wet"! Longer grains will sound like water drops with Sweep amounts different from 0. With the Spline and Step modes you can create very sophisticated "sweep and pitch changes" that are executed during the grain's generation and depends on the length of the grain (which is relative in time to the grain's **Length**). E.g. - You can use Step mode to create a kind of "melody" on longer grains (>1s) which is played back to you for each grain. Modulate the Grain Length to let the grain melodies interfere in time and space. This crusher-X feature alone can provide you hours of joy exploring the land of dynamic grain pitching!

The **Sweep Mode** selects the way how Sweep processing is performed. **Linear** will do a linear increment (+ modulation value) or decrement (-modulation value) of playback speed during the processing of the grains. Spline will automatically open the spline editor for designing a speed curve. **Steps** will open the step editor to enter a step sequence of pitch changes that will be processed during grain processing.

Tip: Using Steps with longer grain lengths will lead to very interesting melodic sequences. The tempo of the sequence is bound to the grain length. Use it in combination with a grain Length modulation!

## 10.10. GCO Grain Modulation



*GCO Grain Modulations*

The **GCO** (Grain Controlled Oscillator) is a unique crusher-X feature that allows you to add audio waveforms and samples on top of the live input signal from the grain buffer. Think of an Oscillator or Sampler that is only alive during a grain's lifetime. The **GCO Mix** modulation determines the balance between the buffer's audio and the GCO. The **GCO Pitch** modulation determines the pitch or tuning of the GCO. If a **GCO Waveform** is selected, the **GCO Wave** modulation applies a wave phase modulation. If an audio file or factory sound is selected, the **GCO Wave** modulation sets the starting point (0%-100%) of the GCO file playback.

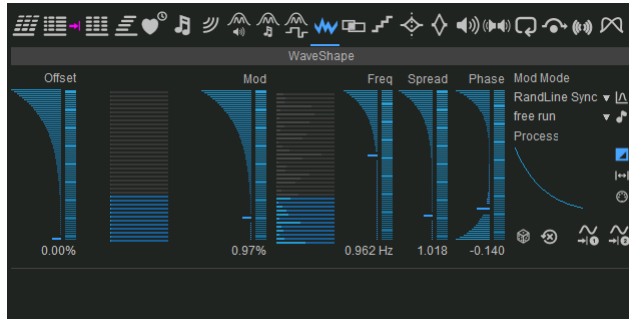
Tip: Use the GCO to "color" your live processed signal. Together with the Arpeggiator Modes you can add a tuned "flavor" to your drone that can be "played" via the MIDI Keyboard

The **GCO Modes** determine the audio source of the GCO (simple waveform or files) and the way the GCO is processing and interacting with the live signal (e.g. Clean/FM/Ring modes)

The **GCO Wave** can be the use of different Waveforms, Splines, Factory sounds. Also an audio file selection is possible. Besides a clean Oscillator print-in, Ring modulation and Frequency Modulation are also available that interfere with the live input buffer audio of the grains. Switching the mode is processed thru the morphing system so that you can blend thru the modes (e.g. by using a MIDI controller)

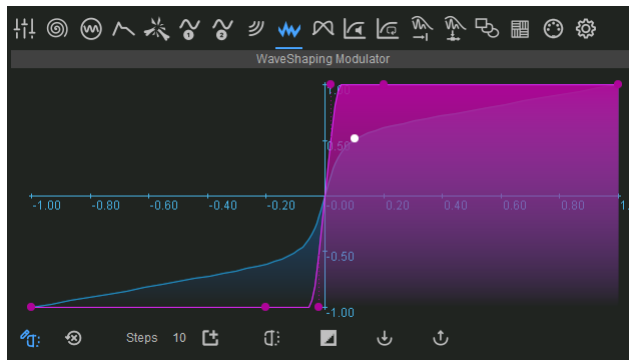
Tip: In FM or Ringmodulation Modes you can "detune" either the GCO with the GCO pitch modulation or the "live input" with the Speed or Sweep modulation to create outstanding sonic interferences

## 10.11. WaveShape Grain Modulation



*WaveShape Grain Modulation*

Each sample of a grain is manipulated by a **WaveShape** amplitude modulator. WaveShaping is a generic way of defining various flavors of an overdrive effect. The characteristics of the overdrive can be controlled by the relationship between the input and output level of each sample. The curve's characteristics can be edited in the WaveShape spline editor Tab:

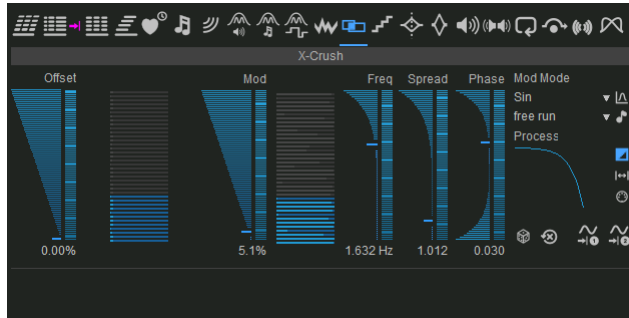


*WaveShape Spline Editor Tab*

The WaveShape Modulator controls the amount of modulation of the edited spline (pink) curve. The result is represented by the blue curve. In **WaveShape Spline Editor** the white arrows representing the current input and output sample is mirrored on the blue line. It depicts the current applied modulation of the first generator. The modulations range from 0% ("linear" - meaning input=output) to 100% (the current edited spline).

Tip: By using the **Phase** sliders you can assign different modulations to different generators. This will generate a mix of distorted and clean grains.

## 10.12. X-Crush Grain Modulation



*X-Crush Grain Modulation*

**X-Crush** is a very special grain modulation that was invented by accSone in 2014 and is unique in the world of granular synthesis: It adds a special asymmetric ring-modulation transformation feed by overlapping each grain with its successive grain.

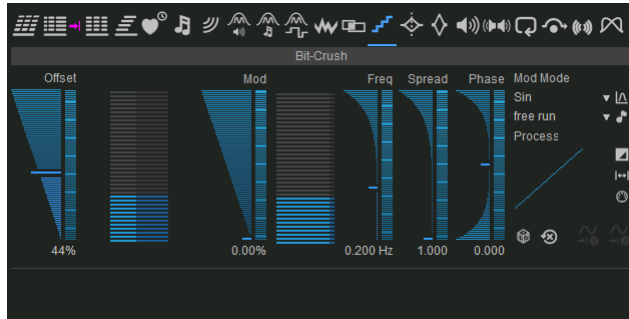
Grain overlapping happens if the grains are longer (defined by Length Grain Modulation) than the birthing time (defined by the Birth Grain Modulation). X-Crush is only applied inside each generator, not across several generators (so to speak, only in X-direction, not in Y-direction – to see this you can take a look at the **Grain View**).

If the X-Crush Grain Modulation is 0% a normal summary of the grain's output is performed on each generator stream. But once the X-Crush Grain Modulation becomes >0% (due to offset setting or modulation), the overlapping area is processed by a special asymmetric ring-modulator algorithm. It processes the final part of the previous grain and also the beginning of the current grain. Because grains are normally windowed the effect is faded in and out by each grain's window.

Note: You won't be able to hear the X-Crush Grain Modulation's effects if the grains are shorter than their birthing time.

The X-Crush effect varies a lot depending on the settings of other Grain Modulations: For example, by using static Length/Birth times without any Depth modulation X-Crush will sound like nonlinear, fixed distortion. However, by adding Depth/Length/Birth modulations it will dramatically change the effect towards ringing or other types of artifacts. Try to add some X-Crush modulations on top, possibly with a phase between the generators, to change the window type...

## 10.13. Bit-Crush Grain Modulation

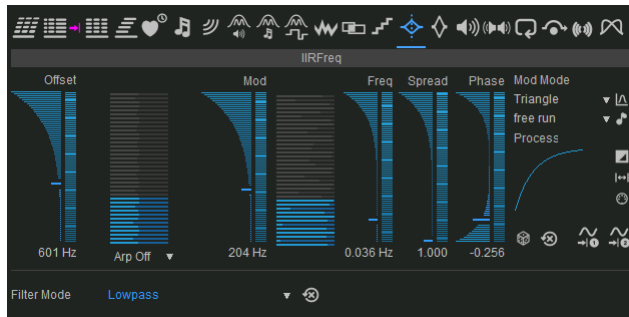


*Bit-Crush Modulation*

**Bit-Crush** is a grain modulator that individually processes a Bit-Crusher lo-fi effect on each grain that depends on the amount of modulation on the current grain. It produces distortion by the reducing the sample resolution and creating additional quantization noise. It ranges from 12Bit (1% Modulation ) to 1Bit (100%).

Tip: Utilize the Phase and Spread functionalities of the Bit-Crush Modulation to create Bit-Crush interferences between grains. This leads to warm, ever changing and colorful Bit-Crush sounds.

## 10.14. Filter Cut and Q Grain Modulation



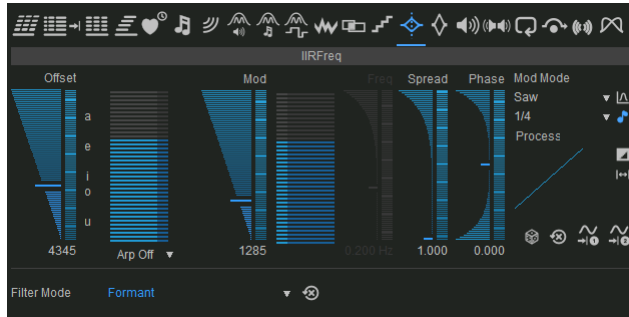
*Filter Grain Modulation*

Each Grain has its own IIR-Filter that can be set up by its **Filter Cut** Frequency and its Bandwidth **Q** Modulation. The **Filter Mode** can be set below. The **Filter Mode** selection sets the filter type that is applied during generation of the grains (see the **Filter Cut** and **Filter Q** Modulations). To disable the filter select **Bypass**.

Note: If the **Filter Cut** or **Q** modulation is changed and the **Filter Mode** is set to **Bypass** the Filter Mode is automatically set to Lowpass

Note: Changes of the Filter Mode will be morphed through the Morphing System.

### 10.14.1. Formant Filter mode

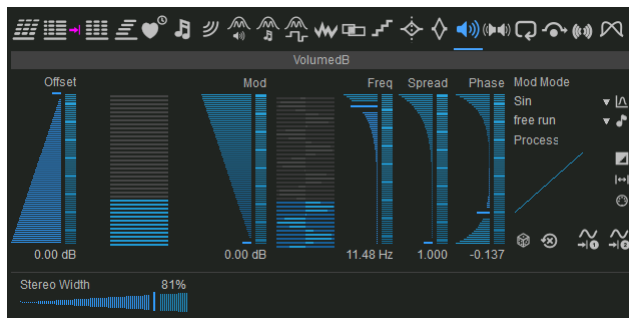


*Formant Filter Grain Modulation*

If the **Filter Mode** is set to **Formant** the **Filter Cut** modulation changes to a formant selection modulation.

Tip: Set the starting vowel with the offset and modulate the Grain Modulation with a S&H modulation. Provide a noise or saw oscillator input sound. The crusher will start talking!

### 10.15. Volume Grain Modulation



*Volume Grain Modulation*

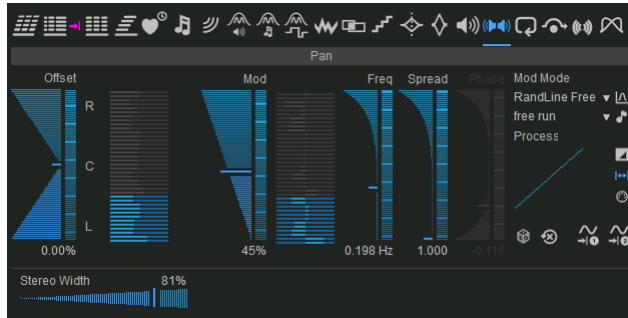
Each grain can be modulated in its **Volume**

Tip: Using the **Spread** or **Phase** sliders of the **Pan** Modulation creates fluent panorama shifts - Volume Grain Modulation is the key to fantastic surround sound scenes. Try it in an Atmos setup and you will blow away!

The **Volume** Modulations effect the multichannel output levels depending on the **Surround Mode** setting in the **Mixer**.

The current Pan of a Grain is depict by a fading channel labels on the 1st grain column in the Grain 3D View.

## 10.16. Pan Grain Modulation



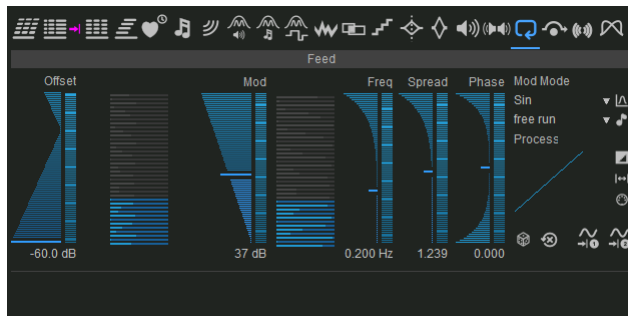
*Pan Grain Modulation*

As each Generator can be routed either to a Left, Right or Center plug-in Output (via the <Surround Mode> button in the **Mixer**), the **Pan** Grain Modulation will affect the panning of the channels.

The current Pan of a Grain is depicted by a fading channel labels on the 1st grain column in the Grain 3D View.

The **Stereo Width** slider shrinks the stereo width down to Mono (slider on the left). This can be useful to reduce the stereo width in case deep Volume or Pan Grain modulations are applied.

## 10.17. Feedback Grain Modulation



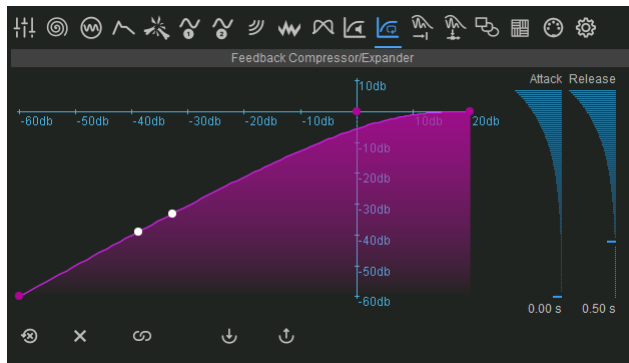
*Feedback Grain Modulation and Feedback Compressor*

The **Grain Controlled Feedback (GCF)** system (invented by accSone 2022) controls the contribution of each Grain to the feedback bus. This is actually a multi-dimensional, modulated feedback matrix that could create hyper-shimmer reverbs and non static, floating feedback drones.

The **Feedback Compressor Tab** opens the feedback compressor/limiter/expander that processes in the feedback loop.

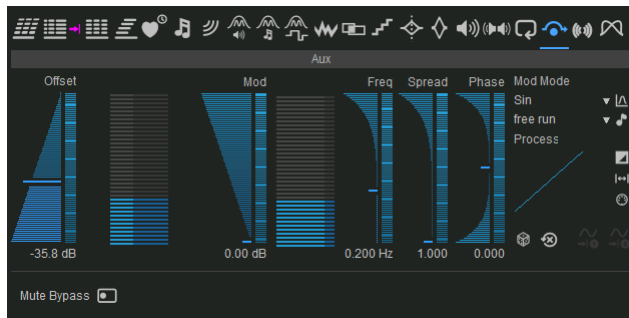
Tip: Become our own reverb designer! The Shimmer-HyperShimmerReverb program can provide you a nice starting point for endless signature reverb design sessions. Consider to use it in combination with **Surround Modes**

Tip: Use the feedback together with the **Delay**, **Speed**, **Filter** and **Sweep** Modulations to create "Dub Delay" like effects.



*Feedback Compressor Tab*

## 10.18. Bypass / Aux Grain Modulation



*Bypass / Aux Modulation*

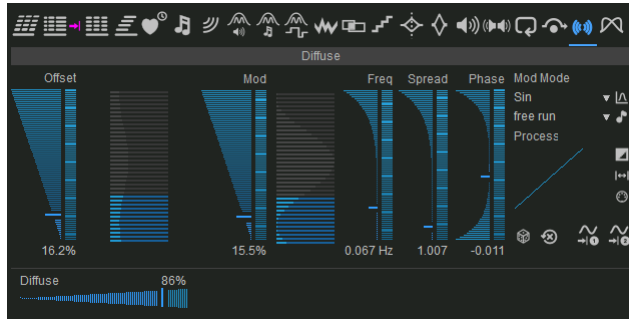
With the **Bypass/Aux** Grain Modulation each Grain can be individually modulated to bypass the previous Effect Grain Modulations and/or bleed the pure Grain signal to an additional Aux bus of the VST3 plug-in. For VST2 or AU plug-ins you can use additional **Surround Modes** that provides the Aux Channels at different channels on the main output bus.

The **<Mute Bypass>** button will mute the Bypass Grain Modulation so that only the Aux bus is fed by the Bypass/Aux Grain Modulator

Tip: With the Aux bus one can further process "dry" Grains with own external effects and feed them into an extra mix. Use the **<Mute Bypass>** button to disable the Bypass Grain Modulation to isolate the Aux functionality if needed



## 10.19. Diffuse Grain Modulation



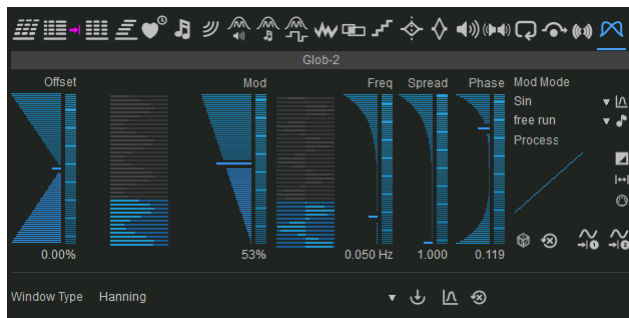
*Diffuse Modulation*

The **Diffuse** Modulation (invented by accSone in 2016) is unique in the world of granular synthesis: It mixes a reverb output for each grain generator before the grain window is applied. The "reverb memory" will be taken from one grain to another in the grain series that diffuses the grain content but not from the grain output! This leads to a very special, non smearing, precise and sharp - though warm - grain diffusion that can't be compared to a simple granulizer feeding a normal reverb processor.

Tip: Use the Diffuse Modulation on longer Birth times to get this specific effect of a sharply defined but internally diffused sound impression.

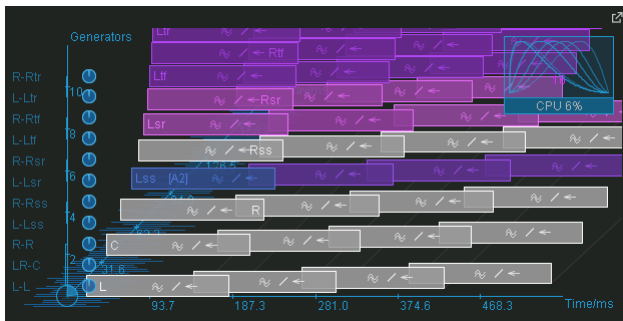
The **Diffuse** Slider selects the size of the Diffuse Room for Diffuse grain processing.

## 10.20. Tilt Grain Modulation



*Tilt Grain Modulation*

The **Window Tilt** Grain Modulation (invented by accSone 2025) allows to modulate the shape of each Grain Windows in real-time. This applies also for Audio File Windows. This Grain Modulation is unique in the world of granular syntheses as it allows to modulate the Grain windows for each grain differently. Negative Values will create "Drop like" sounds on shorter grains. The Grain Window form of the first generators are also displayed in the Grain 3D View.



*Tilted Grain Windows in Grain 3D view*

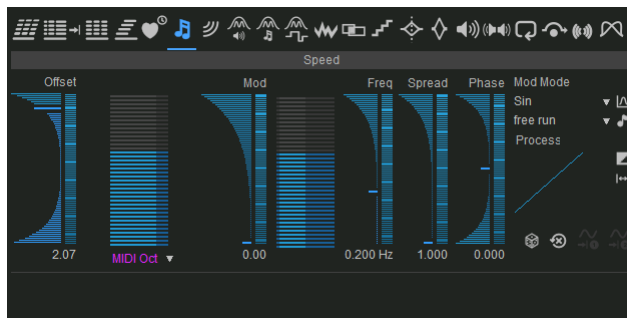
Tip: Use Mod, Spread or Phase on the Tilt Grain Modulation to let each Grain being processed with different Grain Windows.

**Window Type** selects the Grain Window. It is used to prevent noisy switching sounds between grains, as each grain is windowed by an envelope. This envelope type can be selected from the **Window Type** list. The Window could be also free designed by using **Spline** editing, using factory sounds or loading a Mono WAV, MP3 or AIFF file.

Switching/Nasty sounds can be achieved by selecting a **SharpRect**, **Dirac 1** or **Dirac 2** window type. Choosing **Spline** from the list brings up the **Spline Editor**. In this editor the window envelope can be edited manually.

Tip: Window types with several X-axis crossings will generating ring-modulation artifacts (e.g. together with the live input or the DCO). This is of coarse the case if a Factory Sound or an Audio File is used. The pitch of these artifacts depends on the **Length** of grains. In that case you can use a simple DCO waveform (e.g. like Sin) and change the DCO frequency to produce very strange ring-modulation grain effect.

## 10.21. Arpeggiator Modes



*Arpeggiator Modes*



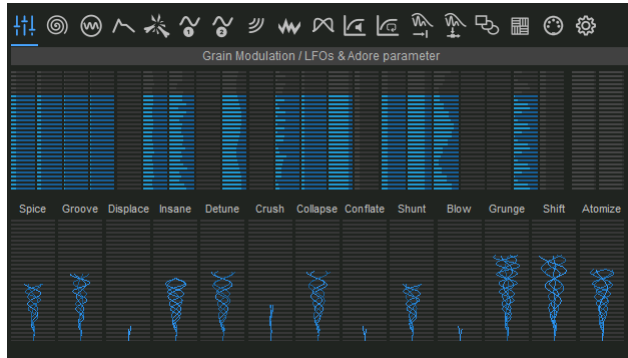
*Arpeggiator visualization*

For the **Speed, GCO pitch and Filter Cut** Modulations an Arpeggiator Mode selector is available. Once the Arpeggiator is enabled it translates the incoming Modulations (Which is a sum of the Offset, Mod and Glob Mods) into dedicated Keystrokes on the MIDI Keyboard - which you can see as pink dots above the Keys when they're selected. Depending on the selected Scale (also Microtonal Scales) the Arpeggiator generates the pitch information and uses this instead of the origin modulation source to modulate the pitch. This powerful feature enables a tuned, Arpeggiator like modulation and allows you to give "color" to the Grain generation in the dedicated scale. The Modulations Mod Mode determines the Arpeggiators type and direction. The Frequency determines the Speed of the Arpeggiator effect. And the Modulation Depth the Range of the Arpeggiator effect. The following Modes can be selected:

- **Arpeggiator Off:** No Arpeggiator Modulation will be applied
- **Free Scaled Arpeggiator:** The full selected Scale is used - no Keyboard MIDI events are needed
- **MIDI Key Filtered Scaled Arpeggiator:** Applies a filter to the pressed MIDI Keys and the selected Scale (MIDI Keys are latched)
- **MIDI Key Octaved Filtered Scaled Arpeggiator:** Applies a filter to the pressed MIDI Keys and all of their Octaves and the selected Scale (MIDI Keys are latched)

Tip: Use the Arpeggiator modes on Speed or GCO pitch to "color" the grain's Modulations in the selected Scale and change this harmonic layer by pressing different Chords on an attached MIDI Keyboard. If you don't want to interfere with the global MIDI harmonic layer use the MIDI Mode "No Pitch"

## 10.22. Grain Modulation Overview and Adore parameter Tab



*Grain Modulation Overview & Adore parameters*

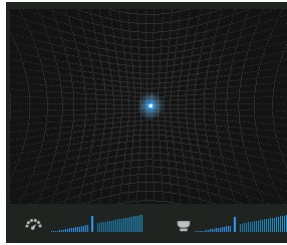
In the top row you can observe all the active **Grain Modulations** at the same time. The active **Generators** are colored. Clicking on specific graphs will highlight the corresponding Grain Modulations tabs.

For curiosity's sake, the amount of currently used LFOs are displayed in the Settings Tab. Each Grain Modulation owns a set of up to 199 (for each Generator) LFOs.

At the bottom there are 13 so called **Adore parameters**. These are mapped to corresponding plug-in parameters and can be understood as meta parameters to control several Grain Modulations and other crusher-X settings at once. Each Adore parameter is mapped to several Grain Modulations via a specified mapping (Refer to chapter "Remote control or automate crusher-X"). Adore parameter modifications are treated as normal Grain Modulation modifications, so therefore can be morphed or undo/redo. However, due to its nature of being a meta parameter that is only applied once, positions of the Adore parameters are not stored with the program.

Tip: You can modify or add more mappings for each Adore parameter by opening the **Mapping Tab**

## 11. The PM-Field



*Physical Model X/Y-Field*

Every **Grain Modulation** and **Global** Modulation can be steered by the X or Y coordinates of the PM-Field. This unique X/Y PM-Controller was invented by accSone in 2001.

It enables you to control complex modulations manually. If one of the **PM-Field** Modes is chosen and **Mod** is not 0, the light on the **PM-Field** turns on.

Move and "throw" the light with the mouse. <Shift> + Click will center the light.

The **PM-Field** is not a normal X/Y controller: It is a physical model of a ball in a cave or a bowl. The left slider controls the speed of the ball and the right slider will turn the field into a bowl enabling an auto-centering system.

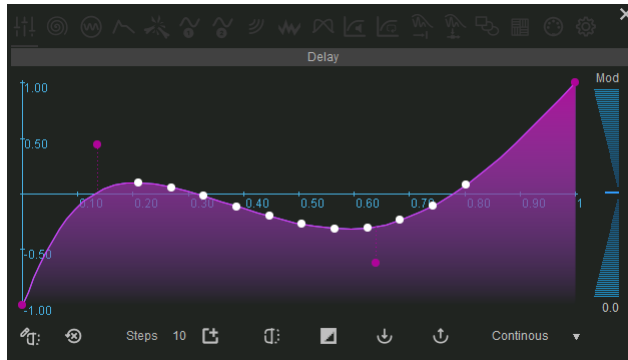
Fast movements of the mouse results in fast movements of the light. You can use the MouseWheel or the Magic Mouse (Mac version) to increase and decrease the ball's speed.

If the PM-Field is assigned to a Grain Modulation the Tool-Tip (mouse hover over the field) shows the current assignments to the X and Y axis (if Mod and Mod Mode of the Grain Modulation is set).

Tip: You can use MIDI-events or plug-in parameters to control the light.

## 12. Spline and Step Editors

### 12.1. Spline Editor



*Spline editor*

The **Spline editor** is used for editing a spline curve, e.g. for **Grain Modulation** Spline Modes, **Window Type** Modes or to edit **Sweep** or **WaveShape** curves. It will open automatically if a Spline.. **Mod Mode** is selected in a Grain Modulation.

You can add, move or edit **Knee / Spline** Points by using the following mouse and the keyboard modifiers:

- Left Mouse Button: Insert Spline Point
- Left Mouse Button + <Shift> Key: Insert Knee Point
- Click on "the point handle" and drag it out of the window's view: Delete
- Drag First or Last Point + Ctrl Key: Set same Y value
- Click on "the point handle" + Ctrl Key: Set only Y value
- Click on "the point handle" + Alt Key: Match X,Y to Grid
- Right Mouse Button: Zoom -> Scroll -> Normal Mode
- DblClick: Reset View Mouse Wheel: Zoom

The button row allows you to modify or generate the following curves:

- **<Symetric>**: The curve will be symmetric on the X/Y axis. Unsymmetrical editing is not allowed
- **<Reset>**: The curve is reset to the default Steps: You can enter the amount of creation steps
- **<Create>**: Choose different spline generators
- **<Mirror>**: Mirrors the curve at the Y axis
- **<Invert>**: Inverts the curve at the X axis
- **<Import>**: Imports a spline definition from a \*.spi file
- **<Export>**: Saves the current spline in a \*.spi file

Note: Spline editing is fully integrated into crusher-X's **Undo/Redo** system.

In some Modes a **X-shift** slider is visible. It allows to "modulate" the current spline curve. The blue curve displays the resulting spline that is currently applied.

Tip: You can control the spline modulation slider through MIDI events or plug-in parameter changes, and by right-clicking you can use the Learn Function on the slider

If the **Scan Mode** selector is visible the "scan" of the curve can be controlled by several modes:

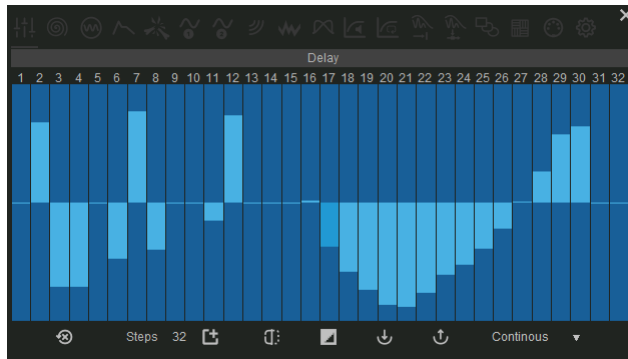
- **Continous**: The modulation is steered by either the frequency or the host beat (in regard to the Grain

Modulation settings)

- **Random:** Random selection of a curve segment steered by either the frequency or the host beat
- **X Up PM-Field:** X-Axis position of PM-Field ball
- **X Dn PM-Field:** X-Axis position of PM-Field ball (reverse)
- **Y Up PM-Field:** Y-Axis position of PM-Field ball
- **Y Dn PM-Field:** Y-Axis position of PM-Field ball (reverse)
- **Grain launch:** The next Spline point will be selected on each launch of a grain (use this for generative music approaches)
- **G-Life:** The "age" of the grains will determine the "scan"

Tip: Use the PM-Field Scan Modes to steer a speed modulation so that a small "melody" or "gesture" can be controlled just with the move of the ball (or with MIDI controllers)

## 12.2. Step Editor



*Step editor*

The **Step editor** is used to edit steps for **Grain Modulation** Step Modes or **Sweep** settings. It will open automatically if a Steps... **Mod Mode** is selected in a Grain Modulation.

Set the step value by dragging the bars with the mouse. Hold the <Shift> key to apply discrete value steps.

Select the desired amount of steps with the **Steps** edit box. Steps can run in free run mode or - depending on the Grain Modulation **Mode** setting - bound to the host beat.

The button row allows you to modify or generate the curve:

- **<Reset>:** All steps are cleared
- **<Create>:** Choose between different step generators
- **<Mirror>:** Mirror the curve at the Y axis
- **<Invert>:** Invert the curve at the X axis
- **Load:** Load a steps definition from a \*.stp file
- **<Import>:** Imports the steps definition from a \*.stp file
- **<Export>:** Saves the steps definition in a \*.stp file

Note: The steps editing is fully integrated into the crusher-X's **Undo/Redo** system.

Tip: Use several step modulations with slightly different step counts to create repetitive but dancing modulations.

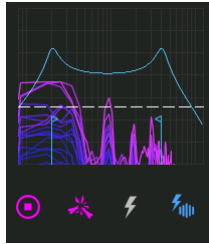
If the **Scan Mode** selector is visible the "scan" of the curve can be controlled by several modes (see Spline editor above)

Steps can be also edited "screenless", see section "Screenless control of crusher-X, e.g. for blind / sight impaired musicians".



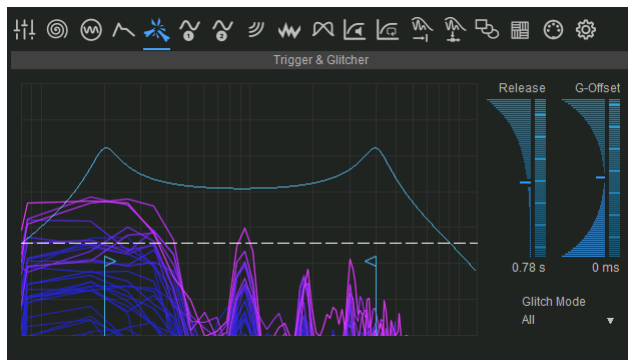
## 13. The Glitcher-X Mode

If the **<Bones>** button is pressed the Glitcher-X Mode is enabled (works only together with Live Mode).



*Glitcher-X Mode enabled*

You probably know the "Eisbach Wave" in Munich? If you come to Munich on your next Germany trip, make sure you drop by and discover this beautiful energized and special place! There are those city surfers waiting in a line to jump on the wave and perform their rides looking for a moment of fame! This is basically what happens when you turn crusher-X into Glitcher Mode: Imagine a grain sitting at the river bank of the audio stream, relaxed but ready to ride the ultimate wave! As soon as the desired wave drops by the grain jumps on the flow and starts performing their moves and modulations until its lifetime is over and it drops off. A spectral formant transient selector filter detects the best moment to jump on the audio stream and the grain adheres on that position. As controlled by the regular Grain Modulations the grain will modulate around its known position. This position is depicted with a dotted white line in the Grain Buffer View.



*Glitcher Settings Tab*

Each Glitch Trigger can be potential happen for each generator (so there will be several grains available to ride the incoming audio wave) and one can choose how the current Glitch Trigger will be populated to the different generators with the **Glitcher Mode** selector in the **Glitcher Settings Tab**:

- **All**: Each Glitch will be applied to all Generators at the same time
- **Random**: Only one random chosen Generator will get the next Glitch
- **RandStereo**: Same as Random but L/R pairs will be selected together
- **Rot**: The next Glitch will be applied to the next higher Generator
- **Rot Stereo**: Same as Rot but L/R pairs will be selected
- **Rot2**: The next Glitch will be applied to the next two higher Generators
- **Rot3**: The next Glitch will be applied to the next three higher Generators

Depending on the numbers of active Generators the selection of the Glitcher Mode creates different Glitch generator patterns.

Besides with the Spectral selector you can also trigger a new Glitch by either:

- Pressing the **<Flash>** button

- With the **Quantization** mode **Fill/Glitch** or **Grain+Fill/Glitch** (see Quantization Tab)

Note: The **Life-time** of the Grain will determine the length of each ride and after the drop (death) of the grain a next Glitch trigger will respawn it again.

Tip: Use Glitcher-X Mode together with a microphone and your instrument. You will control the river stream and crusher-X will surf on it! You could even create a glitch manually with assigning the Glitch button to a foot controller - curtain up!

### 13.1. The Spectral Selector

Fast detection of interesting sound events in live streams is quite tricky. A spectral transition response approach combined with a fast real-time state machine is a the new crusher way to discriminate between silence, tonal, vocal or spectral interesting parts of an incoming audio stream in real-time. To control this job crusher-X introduces a unique trigger control that allows to select the desired spectral trigger range and its sensitivity with simple mouse moves. The trigger is auto sensitives that means it works on all audio levels, detecting a relative change, not an absolute level. This new trigger system is wired up with the Grain buffer Fill, Respawn and Glitch position launches. And as you already controlling this unique formant filter, you can add the outcome of its spectral manipulation as an additional input signal to granulize. Become ready for sophisticated granular filtered sweeps and advanced and color rich drones. The filter sweeps are morphed by the Morphing System.

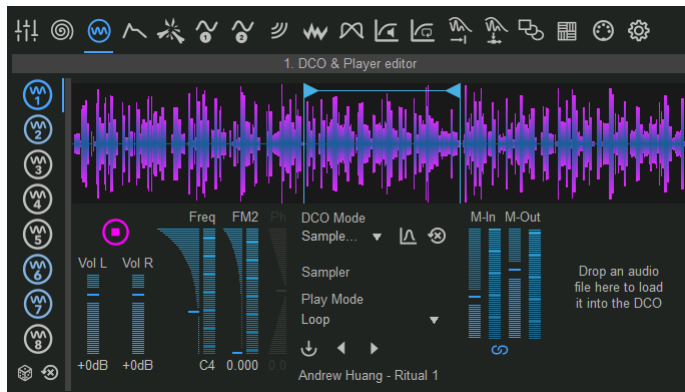
Move the Selector Arrows left/right to control the low and high center frequency so that the desired formant response is selected. Move the Selector Arrows up or down to discriminate the formants or frequency range sharper or weaker. The response function of the filter is shown with the blue humps graph and with resulting spectrum underneath. The dotted horizontal line depicts the current trigger level and when it turns to white it represents a fired trigger. The **Release** slider determines the time until the next trigger will happens. In Glitcher-X Mode The **G-Offset** Slider determines the Delay offset (positive or negative) on the trigger event when the event is attached to a generator.



*Spectral Selector Formant Trigger*

Tip: Move the G-Offset up to auto-select the "body" of an audio event after it was triggered (e.g. skip the transient at the beginning)

## 14. The DCOs



*DCOs Tab*

The 8 available **DCOs** can be used as a source to generate complex granulizer input sounds and are added to the plug-in input signal. Unlike "normal" synthesizers the DCOs just creating raw input continuously to the grain processing engine and are not initial controlled by MIDI or a Keyboard. The ADSR and pitch will be processed by granulizer engine itself in the later signal stage. By default (on initially loading a factory patch) crusher-X Instrument plug-ins enable DCOs (to create an initial sound). The crusher-X effect plug-ins disable the DCOs initially to provide a clean input processing. Of coarse the DCOs can be enabled or disabled for any own patch independent of the plug-in type.

There are 8 independent DCOs avail that can be selected on the left Tabs.

All DCOs are mixed to the DCO Sum with the Vol L/Vol R sliders. Shift-drag the Vol L or Vol R slider to set them individually (e.g. to create panning).

Turn a DCO on by pressing the **<Play/Stop>** button and increasing the **DCO Level**.

Set the Waveform of the DCO by changing the **DCO Mode** to the desired Waveform. Alternatively an audio file can be selected as a waveform.

The FM slider allows to FM control the current DCO by the next one (e.g. DCO1 is FM controlled by DCO2, DCO2 by DCO3 ... DCO8 by DCO1). This chain allows super complex and crazy FM sounds.

If a DCO is active the according DCO Tab is a bit highlighted.

Tip: Use a Saw or Noise generator together with the **Formant** filter to generate human like sounds

Press the **<Dice>** button on the DCO Tab to create unusual FM sounds. Reset all DCOs with the **<Reset>** button on the DCO Tab.

The **Freq** slider determines the frequency of the DCO.

Tip: Use the **<Dice>** button together with longer **Morph** times to generate strange FM sequences. Use the **Dry** sliders in the **Mixer** to hear the original DCO sounds.

Use the **<Import>** button to select a sound file to be played by the DCO.

Use the **<Import>** button to select a sound file. **<Ctrl>+Click** launches the file open dialog directly. The same can be achieved by drag'n drop audio files to the UI or DCO areas of the plug-in interface (if dropped

elsewhere it will load the file into the Grain buffer). The DCO Tab will automatically opened if the file is dropped and the Granulizer will switch to Live Mode.

You can load also some prerecorded Factory Sounds with the **<Import>** button.

The **<Spline>** button will open a spline editor to create individual waveform curves. Close the spline editor to get back to the DCO Tab.

**Mark In** and **Mark Out** can be dragged by moving the flags or can be modified by the sliders to select a part of the file.

Select a **Play Mode** to define how the file play back should behave:

- **Loop:** Loops continuously between Mark In and Mark Out
- **Loop backwards:** Loops continuously backwards between Mark Out and Mark In
- **Loop forth and back:** Loops continuously forth and backwards
- **One shot:** Playback one time from Mark In to Mark Out, then stop
- **One shot backwards:** Playback one time backwards from Mark Out to Mark In, then stop
- **One shot forth and back:** Playback one time forward from Mark In to Mark Out, then backwards and then stop

The **<Play/Stop>** button will enable or stops the DCO.

The **<Reset>** button will reset the selected DCO.

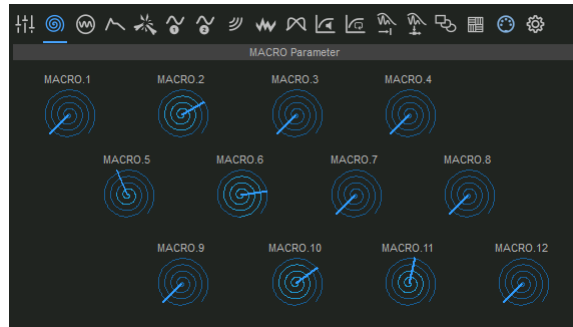
The **<Link>** button will link Mark In and Mark Out together.

All File playback controls can be linked to MIDI messages via MACRO assignments.

Tip: Press the Marker Link button, use a Loop mode and then move the Mark In or Mark Out button to "scan" thru a file.

## 15. Additional Tabs

### 15.1. MACRO Tab

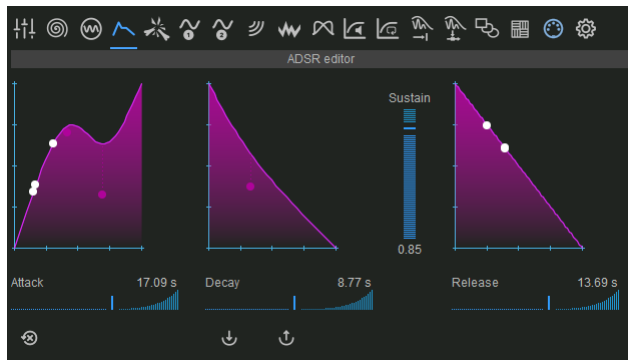


*MACRO Tab*

There are 12 **MACRO** "spiral" knobs available that are mapped to 12 MACRO plug-in parameters. Use these to automate or control one or several mapped UI elements as described in the **Mapping Tab** chapter below. Hovering over the knobs will show the assigned mappings.

Note: MACRO mappings are stored with the Programs, so each MACRO map may change while changing the Program. Use the **Adore** mappings if you want to control UI elements globally - see **Mapping Tab** chapter below.

### 15.2. ADSR Tab

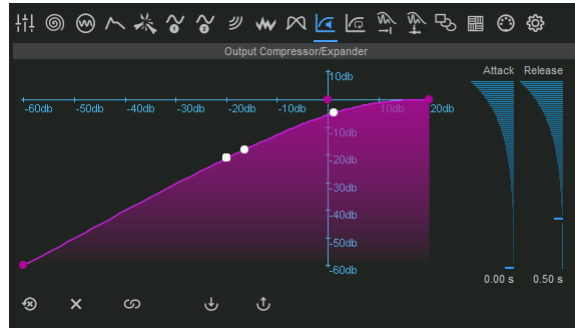


*ADSR Tab*

If the **<ADSR>** button (besides on the Keyboard) is pressed the ADSR is applied for each Generator at the Grain level. Very long Attack, Decay and Release times up to minutes can be set. The splines allows to fully edit the course of the envelope modulation. MIDI Velocity will be calculated in.

The **ADSR** can also be used as a Grain Modulation source with the **Mode Mod** selector of each Grain Modulation

### 15.3. Output Compressor/Expander/Limiter Tab



*Output Compressor/Expander/Limiter Tab*

The **Output Compressor/Expander/Limiter** processes all plug-in outputs to ensure a proper dynamic of the Generator outputs.

The X-Axis represents the input level (in dB) and the Y-Axis the target output level (in dB). Depending on the spline curve form you can achieve either compressor, limiter or expander-like behaviours (or any combinations) Adjust the **Attack** and **Release** timing of the level analyzer with the corresponding controls on the right.

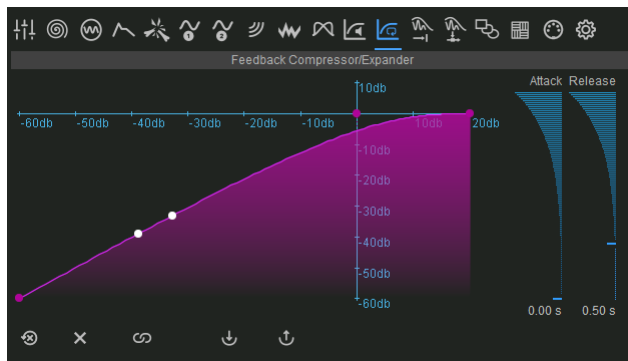
If the **<Channel Link>** button is pressed all channels are synced together. Release the button to let the system process each channel individually.

The **<Global Compressor>** button in the **Global Settings Editor** determines whether the Compressor settings (incl. the spline curve) are stored global (on each plug-in instance) (pressed) or on each program (released).

Tip: As the relationship between input and output levels can be completely freely defined by the spline curve, you can do very special (incl. inverse) channel level behaviors that are able to be programmed in the **following Feedback** scenarios: Pumping and swelling drones. Play also with longer Attack and Release times!

The Compressor/Expander activities can be also monitored in the **Mixer** (F/O meter). It indicates the current compression (down) or expansion (up) factor in dB. A click on the meters also opens the dedicated editor.

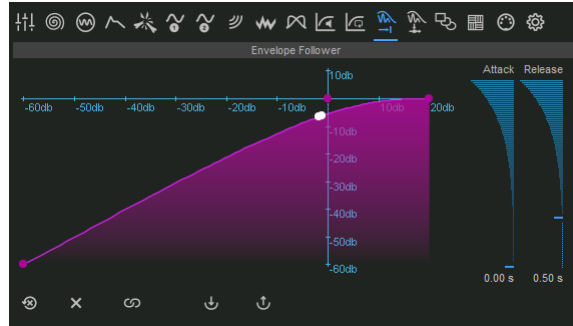
### 15.4. Feedback Compressor/Expander/Limiter Tab



*Feedback Compressor/Expander/Limiter Tab*

The **Feedback Compressor/Expander/Limiter Tab** opens the feedback compressor/limiter/expander that processes in the feedback loop described in the **Feedback Grain Modulation** chapter.

## 15.5. Input Envelope Follower Tab



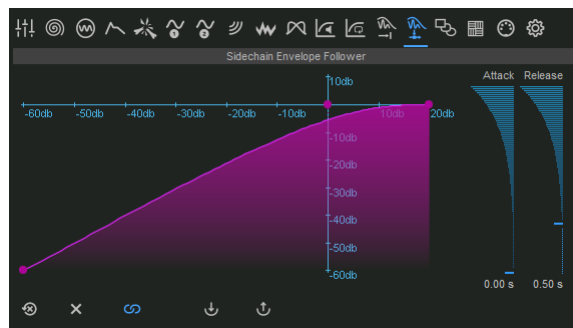
*Input Envelope Follower spline*

For each **Grain Modulation** a Envelope Follower Mode can be selected with the **Mode Mod** selector. Modify the Attack and Release times and the spline of the curve. Link the stereo input channels with the **<Link>** button

Tip: Set up curves with "up" and "downs" to achieve non-linear modulations based on the input signal volume

The current state of the Input and Side chain Envelope Followers can be monitored by the Envelope meters in between the Input and Side Level meters. A click on the meters also opens the dedicated editor.

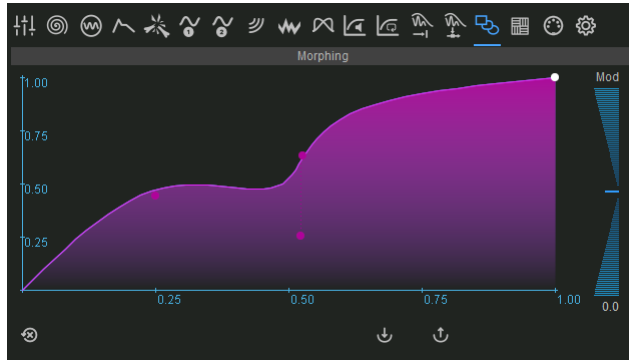
## 15.6. Side chain Envelope Follower Tab



*Side chain Envelope Follower spline*

Also each **Grain Modulation** can use the Side chain Envelope Follower Modulation Mode. The editor behaves the same as described in the Input Envelope Follower Tab chapter above.

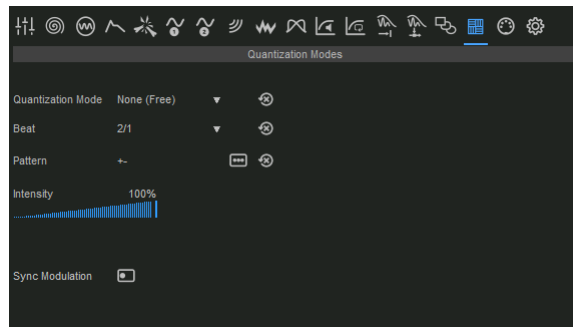
## 15.7. Morph Spline Tab



*Morph Spline Tab*

See description of the Morph Feature in the **The Top bar** Chapter

## 15.8. QuantizationTab



*Quantization Tab*

The whole grain generation process can be synchronized to the bar positions of the host sequencer.

The **Mode** selects the action that is triggered once a quantization point is reached by the host:

- **None** (No quantization)
- **Grain** (Grains are generated but will wait for a quantization point to become alive)
- **Fill/Glitch** (Filling of the grain buffer - in Live Mode, or a Glitch - in Glitcher Mode, will be triggered)
- **Grain + Fill/Glitch** the above two modes combined
- **Respawn** (A Respawn event is fired once a quantization point is reached)

The **Beat** selects the "speed" of the quantization in bars.

With the **Intensity** slider you can control what percent of the grains are quantized. 100% means all grains will be affected, 0% means no quantization at all.

You can choose or enter a bar **Pattern** for the quantization. Choose one from the list or type in your own rhythm. Use <+> (step on) and <-> (step off) keys.

Tip: You can generate your own "grain beats" by entering complex sequences in the **Pattern** text box

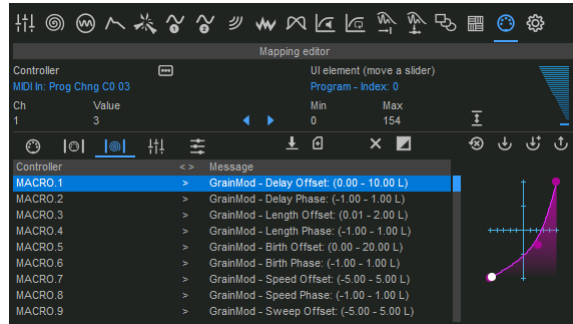


The **<Sync Modulations>** mode sets all Modulations in sync with the scrubber position on the DAW timeline. This doesn't affect no-oscillation modes such as PMField, OFF, MIDI or Pitch Tracking modes.

Note: if the host DAW is in stop or pause mode, the oscillator modulation will also be stopped and become paused in a reproducible state depending on the position of the timeline scrubber. Use this feature if you would like to create reproducible LFO modulations depending on the scrubber's position. If you are processing live audio, e.g. in combination with a host that runs in a looping mode, it is recommended to release the sync mode.

## 15.9. Mapping Tab

### 15.9.1. Remote control and automation



*Mapping Tab*

A Mapping defines the connections between a MIDI, Adore, MACRO or plug-in parameter inputs and one or several UI elements. This can be used for either controlling remotely or automating crusher-X settings. There are several lists of mappings that can be selected in with the List Tab (from left to right):

- MIDI global: Mappings of MIDI Controllers stored globally
- MIDI program: Mappings of MIDI Controllers stored with a Program
- MACRO program: Mappings of MACRO controls and the MACRO plug-in parameters stored with a Program
- ADORE global: Mappings of ADORE controls and the ADORE plug-in parameters stored globally
- Plug-in Parameter global: Mapping of several other available plug-in parameters stored globally - predefined

If the **Mapping Tab** is dimly lit, this indicates that certain Controllers are stored with the current program.

Tip: If you want to map e.g. the crusher-X Program Index selector to a MIDI Controller:

1. Setup MIDI track in your DAW to receive MIDI and route to the track with Crusher-X
2. If needed setup "Controller" type in your DAW to Control Change
3. Switch to the MIDI global Tab
4. Send a controller message so that it is displayed below "Controller" in the Mapping Tab
5. Add the "setting to the list" so that it is mapped to "Program – index..."

### 15.9.2. The Learn Controller context menu

To learn or release a controller on an UI Element select one of the Context Menu (right click) entries:

The **Set to MACRO Param** Menu entries will assign the UI element directly to a MACRO.

**Learn global Controller** and **Learn Controller stored in Program** menu entries prepare the UI element to learn a MIDI controller. The next received MIDI Controller will be added to the mapping lists accordingly.

The following options are available to set initial controller ranges (not all UI elements offer all options). After assignment it is possible to edit the range of the entries in the **MACRO Mapping Tab**:

- **Full ranged:** The full range of the UI element is spanned by the learned controller.
- **Current value as max:** The maximum of the controller range is defined by the current UI element value. On negative values the minimum range will be set accordingly.
- **Around current value:** The controller range will be defined such that the controller will span a reasonable range around the current slider value.
- **Set to current value:** The controller is learned such that the current UI element position is recalled once the controller is received (independent from the controllers value)

**Release all Controllers:** Releases all attached Controllers and deletes the related entries in the lists.

**Show Mapping editor:** Opens the **<Mapping Tab>** to edit the Controller assignments.

Tip: Use **Set to current value** on the Program selector UI element to learn a certain Hardware Controller button to select and load a specific Program.

### 15.9.3. Mapping editor details

The relationship between mapping in and out can be defined with the mapping x/y table. Spline and Knee points are available to define the relationships of the input and output mapping values (for details see the Hint that is displayed when hovering over the control).

Note: More than one UI element can be attached to the same Controller - that allows you to create **MACRO Controller** with different mappings to several UI elements. If the Controller is learned for the current program this allows to organize programs to react differently to the same Hardware MIDI Control Number

Each time crusher-X receives MIDI or detects a plug-in parameter change it will be displayed in the left **Learn control**. Each time you touch an UI element the changed value will appear in the **Learn Message**. For example, this happens during slider movements, button pressing or entering values. The slider on the right of the panel will be mapped temporarily to the UI element. Depending on the value type you are able to assign a control range via minimal and maximum values. Only values in this range will be mapped to a controller. You can "teach" crusher-X a range by pressing the **<Learn range>** button and edit the UI element or the mapped slider.

On can edit the list by using the buttons **<Change>**, **<Add>**, **<Delete>** or **<Invert>**.

Upon selection of a list entry the list entry is then copied to the Learn controller and Learn message panel. Now modifying is possible in these panels (including learning controller or/and messages). To store the changes in the list, press the **<Change>** button.

Alternatively you can choose a default controller by pressing the **<...>** button. Depending on the type of controller one or several properties of this controller can be adjusted by simply entering them with the channel or value fields.

Note: regarding MIDI NoteOn/NoteOff: You can easily select the range by pressing one key and while holding down this key while also pressing another key on the keyboard. Releasing the first key will end up in setting a note range.

For each mapping the direction of the mapping can be selected:

**<Receive>** pressed: The UI element reacts when the target controller is received

**<Send>** pressed: Upon manipulating a UI element in the editor the target controller will be sent out (MIDI-Out, plug-in parameter change).

The **<Reset>** button will reset all lists to the factory default. Ctrl + **<Reset>** will clear the selected list.

The **<Save>** button stores all list entries to a file.

The **<Load>** button will clear the selected list (Macro, Macro-P or Param) and load only the selected list from a file.

The **<Import>** button will not clear the selected list but adds items from the file to the selected list.

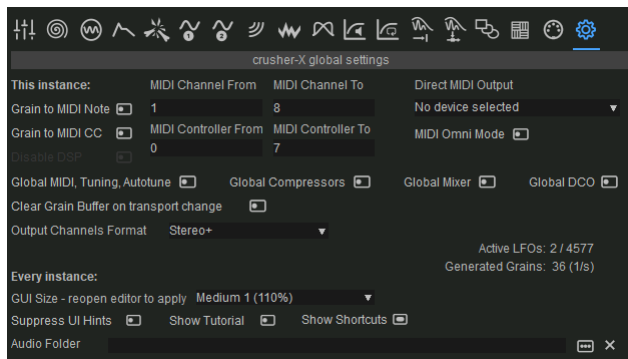
Tip: Organize your mappings by grouping them into different files. This allows to setup different mappings by using **<Import>**.

If the **<MIDI Omni Mode>** button in the Global Settings Editor is enabled, the learned MIDI Channels are ignored.

Tip: If you want to map e.g. the crusher-X Program Index selector to a MIDI Controller:

1. Setup MIDI track in your DAW to receive MIDI and route to the track with Crusher-X
2. If needed setup "Controller" type in your DAW to Control Change
3. Switch to the MIDI global Tab
4. Send a controller message so that it is displayed below "Controller" in the Mapping Tab
5. Add the "setting to the list" so that it is mapped to "Program – index..."

## 15.10. Settings Tab



*Settings Tab*

These settings are stored globally within the plug-in's storage of the plug-in host. To reset, simply reload the plug-in in your host or press the **<Shift>** key while opening the plug-in editor.

The **<Grain to MIDI Note>** button will enable the generation of MIDI-Notes according to each grain speed.

The **<Grain to MIDI CC>** button will enable the generation of MIDI controller streams according to the generator's grain flow.

To send the MIDI events directly to a MIDI Output device choose the desired device in the **Direct MIDI Output** selector. As most DAWs have a not very sophisticated handling of plug-in MIDI out events this functionality can be used as a shortcut.

In case crusher-X is only be used as a MIDI generator the **<Disable DSP>** switches off the audio processing so that CPU resources are reduced.

The **<MIDI Omni Mode>** button switches the Macro Map into Omni Mode - that means MIDI Channels for CC and Note messages are ignored.

The **<Global MIDI, Tuning, Autotune>** button determines whether the MIDI settings are stored either globally (on each plug-in instance) (pressed) or on each program (released).

The **<Global Compressor>** button determines whether the Compressor settings (incl. the spline curve) are stored either globally (on each plug-in instance) (pressed) or on each program (released).

The **<Global Mixer>** button determines whether the Mixer settings (the levels) are stored either globally (on each plug-in instance) (pressed) or on each program (released).

The **<Global DCO>** button determines whether the DCO settings are stored either globally (on each plug-in instance) (pressed) or on each program (released).

If the **<Clears Grain Buffer on transport change>** button is enabled the grain buffer is cleared when the Host / DAW transport is changed (e.g. from stop to play or play to stop). Use this option if you want to do a clean recording of very long grain structures (e.g. with long grain lengths and/or high feedback)

Settings that are stored for every crusher-X instance:

**<GUI Size>** selects a scale of the UI. Use higher scales for higher resolution monitors. Auto will calculate a decent scale according to the main monitor resolution. Reopen the UI to applies the setting. Opening the GUI while holding the **<Shift>** key will resets to Auto.

Note: The UI is scaled in a "smart" way so that the details of the controls like sliders or editors are increased when utilizing larger scale factors

**<Audio Folder>** selects a path that is parsed recursive for audio files to create shortcuts for any audio file selections (e.g. DCO, GCO, Grainbuffer). Press the **<x>** button to remove the path.

The **<Suppress UI Hints>** button could be used to disable the UI Hint display

The **<Show Tutorial>** button re-enables the quick-start tutorial

### 15.10.1. Grain to MIDI

**Grain to MIDI:** Once enabled in the Global Settings Editor, crusher-X will create MIDI Note or controller events from the current grains and generator. The MIDI Controller Values represents the current Envelope of the Volume Grain Modulation and Grain Window. For example, you can route these MIDI events via your host to other MIDI controllable devices such as DMX Light controllers, mixers, instruments etc. This supports advanced multimedia installations in which a MIDI controlled environment follows the current grain flow. When this function is enabled the currently generated control value is displayed in the **Grain View** left to the Y-Axis. The generated MIDI Note event will be displayed on each grain.

## 16. MIDI, MPE, Scales and the Keyboard



*Keyboard*

### 16.1. DCO shortcuts

On the left side there are 8 shortcuts to the DCOs that also visualize and control the playback of each DCO. After loading a Factory Program the DCOs and ADSR will be automatically enabled in the instrument version of the plug-in and disabled in the effect version of the plug-in. Own designed programs are not affected by this automatic.

### 16.2. Keyboard

The virtual MIDI Keyboard can be played by simply clicking it with your mouse. Hold down the <Shift> key to generate multiple keyboard Note On events. The Keyboard is enabled if MIDI Mode is not in the mode "No Pitch", an Arpeggiator mode is selected in the Grain Modulations or Free or AR Velocity Mode is enabled. Each time a MIDI-Key signal is received it will be mapped to the Virtual-KeyBoard.

#### MIDI Modes

There are several MIDI-Modes that determine how the granular engine will be modified by the MIDI keyboard events:

- **Off:** No grain pitch change is generated. Arpeggiator Modes are fed by MIDI events
- **Poly:** Each generator will run continuously and the speed of each generator has an individual offset that maps to the keyboard events defined by the current tuning map. Generators are pitched in stereo pairs (except for Center Channels in Surround modes).
- **Unisono:** Each generator runs continuously and the speed of all generators have the same keyboard event offset
- **MPE (MIDI Polyphonic Expression):** Like Poly Mode but each generator will react to a different MPE MIDI channel. Depending on the amount of MPE channels needed the number of generators will be created automatically. Generators are pitched in stereo pairs (except for Center Channels in Surround modes). Use this mode together with an MPE capable MIDI controller. Together with the Grain Modulations MPE modes this allows very sensitive performances

#### <ADSR> button

- On: The Generator Volumes are controlled by the ADSR - opens also the ADSR Tab
- Off: No ADSR is applied, the Grains are not muted and sound continuously

#### <GCO> button

If the <GCO> button is pressed MIDI-key and MIDI-Pitchwheel data are also send to the GCOs and determine their pitch according to the selected MIDI-mode (see above). If the button is released the GCOs aren't connected to the MIDI System and their pitch stays independent.

#### <Sustain> button

- On: Sustain Mode: No release of generator voices when MIDI Keys are released. Can be controlled by a MIDI Sustain Pedal

Note: The voices of the "synth" are the grain generators. That means you can determine the maximum of used voices which can be used by setting the Generator count. In MPE mode the amount of needed generators are set automatically.

The tuning assignments to the generators are saved by saving a program. This means that the tuned sound is restored upon loading the program (not available in the demo version).

Tip: Release the GCO button in combination with the Ringmodulation GCO-Mode to achieve an intense interference between the GCO waveform and the processed live signal.

## Global or local MIDI Settings

In the **Settings Tab** one can choose whether the MIDI settings are stored global (on each plug-in instance) or on each program.

## Setting the Base-Key

While holding down the Ctrl-Key on your computer's keyboard you can set the Base-Key. On the Base-Key there will be no changes in the speed offsets.

## Scale

A couple of scales can be selected that filter out keys that are not part of the scale. The filtered keys are painted gray. The Base of the scale is set by the **Base-Key**. The selected Scale is also used to determine **Autotune** pitch corrections.

## 16.3. Scala tunings

In addition you can load a Scala file (\*.scl) or AnaMark tuning files (\*.tun) by using the combo box "Insert File..." entry. While clicking on the **<Delete>** button you can remove the selected files from the list. The whole list is saved on the current preset. (The file loading support is not available in the demo version).

Scala was created by Manuel Op de Coul in the Netherlands. crusher-X comes with thousands of predefined tunings. And you can edit your own tuning by simple adding or editing a Scala file (it's a simple text file). Please visit their Homepage to learn more about Scala and update your tuning archive: <http://www.huygens-fokker.org/scala/> ).

Additionally you can load AnaMark tuning files (\*.tun). Please refer to <http://www.mark-henning.de/eternity/tuningspecs.html> to learn more about AnaMark tunings originally designed by Mark Henning.

Tip: Scala tunings are also used by **Autotune** pitch correction. With this feature you can create very sophisticated Autotune pitch corrections that go beyond any standard tuning. Create your own Tuning by creating your own Scala file and loading it.

## Scala Archive:

Find a list of all available Scala files in scalesdir.txt inside the scales.zip package

## 16.4. Pitch Tracker and Autotune

The Pitchtracker on the right allows the analysis of the audio of the input channel (pre-fader)). The frequency being analyzed will be displayed. If the pitch is exactly matched within +/- 10% it will be displayed in red. If it is not possible to detect a pitch (e.g. on noisy input) the previously detected frequency will be displayed in grey. The graph shows the history of pitches detected. The results of this analysis can be used to steer the Speed of the grains. This result depends on the selected autotune mode. In any case the resulting analysis can be used as a modulation source by each **Grain Modulation**.

There are several **Autotune** Modes available:

- **Off**: No pitch correction is applied, though it is possible to select the analysis result as a source of modulation in each **Grain Modulation**.
- **Tune correction** (based on selected scale): Based on the selected Scale a correction of pitch is applied

to the Speed of each grain automatically.

- **Force to Base Key:** A very special mode: **The pitch correction is done in a way that a target pitch determined by the Base Key is always achieved.**
- **Generate MIDI Notes:** No pitch correction is applied but MIDI Note events are generated from the resulting analysis. The MIDI events will steer the Speed of the grain processing like is described in the **MIDI Modes** section.

Tip: Combine the Autotune system with additional MIDI events or Speed modulations to create chorus effects or tuned Accords. Add small Sweep modulations to create "living crowd" chorus or "Darth Vader" effects. Also lower tuned Force to Base Key effects are very impressive.

## 17. Tutorial - MPE with crusher-X

Steer the live grains with your fingertip? Let a drone take off by moving your fingers to the top of the keyboard? Let the grain drone drift left or right by sliding your fingers? This is what you can do with MPE (MIDI Polyphonic Expression) function and the MPE feature set of crusher-X!

### Step 1: Connect your MPE keyboard

Connect an MPE-ready keyboard to your host. "MPE-ready" means that the host should not suppress the MIDI channel's information when it passes the MIDI data to the plug-in. Under Windows you can also use the "MPE-ready" standalone VST host that comes with the crusher-X Windows installation package. Make sure that your keyboard is set to MPE mode.

### Step 2: Create a new Reset Program

Insert the crusher-X-Instrument in an instrument track of your DAW. Add a "Reset" program in the Top bar. You will hear a simple 440Hz tone that is generated from the DCO if you disable the ADSR button. The "Reset" program let the grains overlap themselves by 50% that results in a continuous grain generation without any major sound modification. Load a factory audio into the 1st DCO by using the Import button in the DCO Tab

### Step 3: Set crusher-X to MPE MIDI mode

Set the MIDI Mode to MPE. In this mode each generator will become bound to one of the MPE MIDI channels. The amount of generators needed will be created automatically upon receiving the first MPE MIDI event. (For everything except for Center Channels in Surround mode, the Generators will pitch everything in stereo pairs by default.) If no MIDI key is pressed all generators are muted.

Now you can play the MPE Keyboard. Each touch of the keyboard will be routed to the dedicated set of generators and the generators are correctly pitched according to the selected scale. The same happens upon receiving MPE Pitch data. You can hold the keys and swipe them to the left or right to create individual sweeps of the dedicated grain generator.

*Note: If every generator starts enabling themselves by a single key-press, your Keyboard or Host is not set to MPE Mode!*

### Step 4: Control Grain Modulations with MPE Expressions

Now let's control the Grain Density of each generator by your finger's pressure: Select Birth in the Grain Modulations, increase the modulation depth (e.g. to 200ms) and select Mode "Channel Pressure (MIDI & MPE)". Birth Grain Modulations will now be controlled by the amount of pressure you choose for each finger.

And let's control the amount of distortion with the Y-position of your finger: Select WaveShape in the Grain Modulations, increase the modulation depth (e.g. to 100%) and select Mode "MPE CC74 (MIDI & MPE)". The Y-Position of your finger will now control the WaveShape Grain Modulation.

### STEP 5: Create your own MPE programs

Provide some input sound to become granulized within crusher-X. Modulate other Grain Modulations with the Channel Pressure or MPE CC74 Modes like Filter or Sweep. In the case that you have a surround setup, try to modulate the grain volume e.g. with MPE CC74 to let the grains make sounds from different directions depending of the Y-Position of your finger!

Enjoy!



## 18. crusher-X full version

The full version of crusher-X provides the following:

- Standalone App with ASIO and MIDI merger (Windows && macOS)
- Import/export/save/create crusher-X programs and banks
- Up to 199 Generators
- Full 12-channel surround sound
- Micro-Tuning file support
- Save/load all programs, banks and the Grain Buffer
- Read, write and automate plug-in parameters
- MIDI mappings including import and export
- External control of the Adore and MACRO controls via plug-in parameters
- Save/load splines, steps, WaveShape and ADSR curves and envelopes
- Latest bugfixes and updates are provided free of charge
- A lifetime right to get affordable upgrades and crossgrades
- Fast and full technical support

[Find your crusher-X offer at the accSone shop](https://accsone.com/shop)



<https://accsone.com/shop>

## 19. crusher-X Soundpacks

Wanna get more out of your crusher-X? Here are some suggestions for you:

### 19.1. crushed Guitars

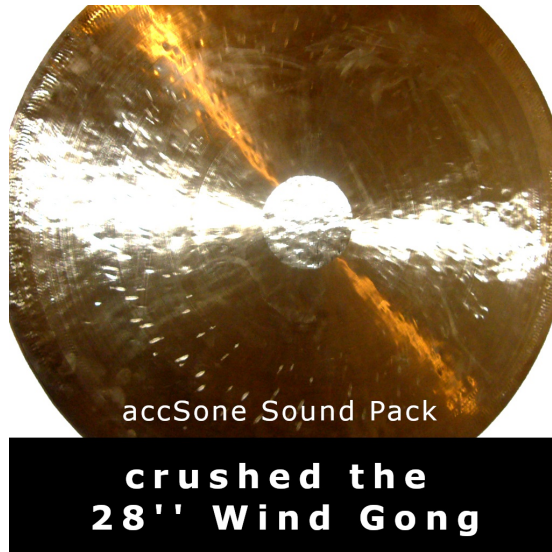


120 crusher-X programs. Granulize your licks!

120 excellently designed sounds and effects programs for crusher-X. This package is the ideal starting point for guitarists and sound designers to get deeper in the unlimited world of granular synthesis. The source material for these awesome crusher-X effects could be from any kind of electric guitars. But human voices can be extremely modified and granulized too. The effects range from smooth doubler effects down to very strange crushed and granulized sounds.

A must-have for advanced sound orientated designers and guitarists!

## 19.2. crushed with the 28" Wind Gong



Push the grains to the next level: Dedicated to the real sound experimentalists!

120 awesomely designed surround sounds and effect programs for crusher-X. Based on more than 40 high quality sound recordings of a 28" Wuhan Wind Gong this sound packages pushes you to the next level of grain experience! And yes, it is dedicated to all of you who have interest in strange, unconventional, and extreme surround sounds. The effects range from never-ending tuned gong phrase environments over barking explosions to extreme percussion eruptions which whip around the listener's head. A must-have for advanced sound-orientated designers and percussionists!

### 19.3. Going Down The Grain



Going Down The Grain - DJ/Dance/Trance/Techno/MPE - Granulize your Tracks!

148 exquisite effects programs for crusher-X designed for DJs, Dance, Trance, Techno and MPE performers. Each program is available as either an interactive or MPE (MIDI Polyphonic Expression) version. From crusher-X 7 version and up, the MPE programs can be live performed directly from your MPE keyboard.

Give your track the grain!

[Find all crusher-X soundpacks at the accSone shop](https://accsone.com/shop)



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## 20. Appendix

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Thanks to Jan, Sven, Nina and Anke for supporting these strange projects over the last decades. Thanks to Ulrich Müller for continuous motivation to start and continue the development. Thanks to TobyBear for tuning file support. Scala was created by Manuel Op de Coul in the Netherlands. Scale Archive is exceptionally licensed for distribution, Thank you! Thanks to Mark Henning for AnaMark tuning file support. Thanks to Rolf Kasten, Felix Petrescu and Simon Stockhausen for creating and sharing tons of high quality video tutorials and audio samples. Thanks to David Hindmarch for inspiring us on screenless editing and accessibility for blind users. Thanks Richard Devine, Robert Dudzic, Ulrich Müller and Andrew Huang for supporting crusher-X with delicious factory sounds and presets! Thanks to Apex Twin for their great feature requests to take Crusher-X to the next level of MIDI control! Thanks to Adam Ostrenga for copy edit and proofreading. Thanks to Anatoly Bugaichuk, Robert Dudzic, David Hindmarch, Rolf Kasten, Ulrich Müller, Felix Petrescu, Seb Prelar, Patrick Schimanski, Simon Stockhausen and Hans-Martin Buff for their beta test feedback and contributions. Thanks to the whole accSone developing team and all the people who send us comments and suggestions!

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## 22. Contact

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We're always looking forward to hear from you!

Peace!

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