



O7A Music Plugins
v2.4.0

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1 Introduction

The O7A Music plugin library provides a small collection of creative tools for use with [seventh order ambisonic \(O7A\) streams](#).

The plugins included are:

- [O7A Bitcrusher](#)
- [O7A Chorus](#)
- [O7A Fold](#)
- [O7A Overdrive](#)
- [O7A Ring Modulator](#)
- [O7A Shells Split](#)

In general we recommend the use of O7A streams primary for research purposes, or in studios with high-end modern hardware. **The CPU load generated by the O7A plugins can be very high and may not be suitable for use on standard studio computer systems.** Third order (O3A) streams are an alternative. These carry enough spatial detail for most practical applications and present a much lighter processing load. Many O3A plugins run roughly four or sixteen times faster than their O7A equivalents.

1.1 Compatibility

O7A streams require audio busses with at least 64 channels, which (at the time of writing) most Digital Audio Workstations (DAWs) cannot handle. Some are limited at 2 channel stereo and many are limited at the 8 channels used for 7.1 surround mixes. **The O7A plugins will not work correctly with these DAWs**, which may even crash. In general, Reaper or Pro Tools Ultimate (version 2023.6 or later) are good options.

1.1.1 AAX

Most of the O7A plugins exist as AAX versions which are compatible with [Pro Tools Ultimate](#) version 2023.6 or later and plugin support (or not) is indicated in this text.

Pro Tools keeps careful track of exactly what stem formats are present on tracks and busses; this is a powerful feature which helps avoid mistakes and helps ensure plugins are used in the right places. However, where formats are not available in Pro Tools, corresponding plugins are generally not available.

1.1.2 VST2

The plugin library works as a "shell" plugin. This means that a number of individual audio plugin effects are provided by a single library file. Some VST2 hosts may have a slightly different way of managing these plugins to ordinary ones. For instance, in [Max/MSP](#) the vst~ plugin uses "subname" messages to specify the individual plugin within the library. At the time of writing, VST2 shell plugins are not supported in Nuendo or Cubase.

Most VST2-compatible DAWs (such as [Reaper](#)) have a plugin "path", which is a list of directories which will be searched for VST2 plugins. You may need to change this path to point at the location of the plugins, or move the plugins there. By default, these plugins are installed into `/Library/Audio/Plug-Ins/VST` on macOS. Various directories may be used on Windows, but `C:\Program Files\Steinberg\VST2` is not uncommon.

1.1.3 Buffering

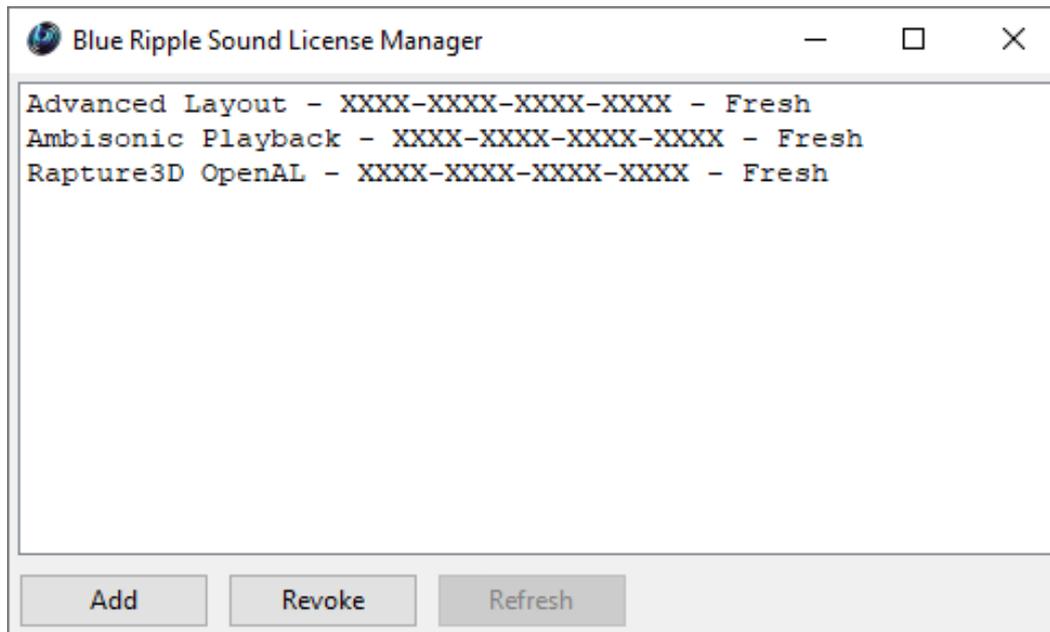
Some of the O7A plugins use internal buffering with a length of 128 samples. For smooth CPU load, you may wish to ensure your DAW buffer size is a multiple of this.

1.2 Getting Started

This documentation assumes you are familiar with Reaper or a similar DAW, and with the O7A Core library, which provides a number of essential tools for working with O7A streams. If you are not, you may wish to start with the documentation for the O7A Core.

1.3 The License Manager

The Blue Ripple Sound License Manager application can be used to move license keys around between computers.



The application is generally available in the Start Menu on Windows, and in your installation directory, which is typically:

- C:\Program Files\Blue Ripple Sound\ on Windows, and
- /Applications/Blue Ripple Sound/ on macOS.

License keys can be removed from a computer using the 'Revoke' button and added with 'Add'. If data is not 'Fresh' this probably indicates a network connectivity issue, in which case the 'Refresh' button may be used. Generally, licenses are refreshed automatically.

1.4 Technical Requirements

1.4.1 Operating System

Supported versions of Microsoft Windows are 10 or 11, 64bit Intel.

Supported versions of Apple macOS are 10.14 to 13.5, 64bit Intel or Apple Silicon.

1.4.2 VST Host

The VST plugins require a VST 2 host with shell plugin support.

These plugins do not work with all VST 2 hosts. One reason for this is that the O7A plugins need large numbers of channels on their input or output busses. Check the individual plugins for the channel counts they need, but all of the O7A plugins need at least 64 channels on each track. Also, at the time of writing VST 2 shell plugins are not supported in Nuendo or Cubase.

1.4.3 AAX Host

The AAX plugins require **Pro Tools Ultimate version 2023.6** or later.

Due to channel and stem restrictions, not all plugins are supported in AAX. Please see the plugin descriptions for details.

1.4.4 PC Hardware

Please check your PC meets the following requirements:

- Intel Core i7 CPU or better, or Apple Silicon.
- 400MB of free disk space.

1.4.5 Permissions

You'll need administrator permissions while installing on Windows. The software probably won't install properly using a "restricted" account.

1.4.6 Internet Connection Required

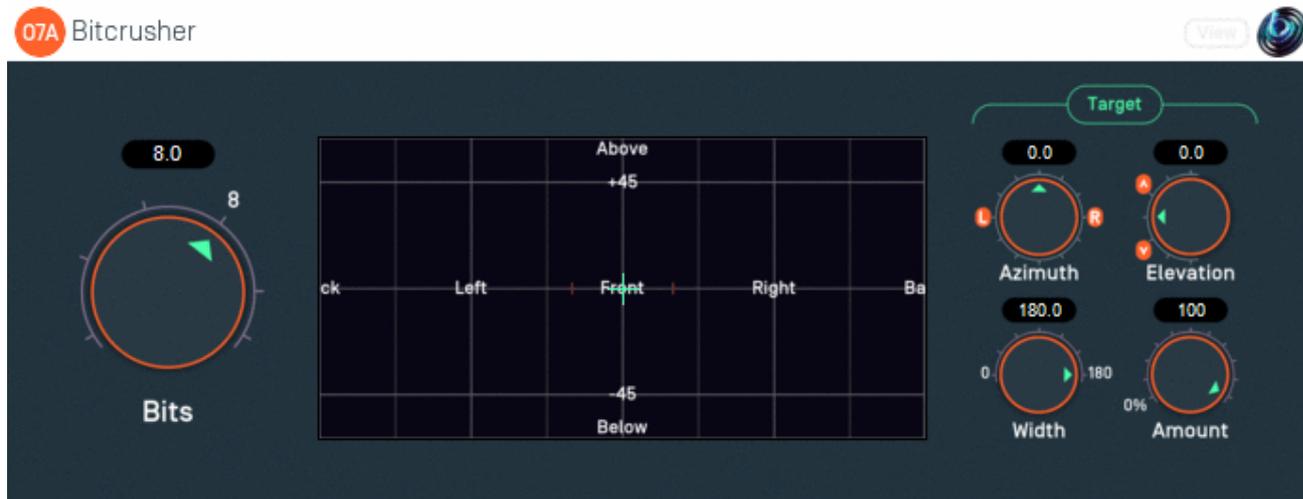
This software requires an Internet Connection for license activation and verification.

Successful license verification isn't required every time you use the software, but it is needed during installation and needs to succeed once every couple of weeks to keep the license fresh.

The license can be "revoked" to remove it from one machine so it can be moved on to another. You should also do this if you're updating your system in case the machine appears to have changed identity.

2 Effects

2.1 O7A Bitcrusher



2.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

2.1.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

2.1.3 Controls

- Bits
- Target Azimuth
- Target Elevation
- Target Width
- Target Amount

2.1.4 Description

This plugin deliberately degrades the audio stream as if it had been passed through an unusual low-resolution digital audio stage. It can be used to add a "digital" character to part or all of a complete audio scene.

The artefacts produced this way are spatially close to sources in the scene, and vary slightly in timbre depending on direction. Dry scenes with small numbers of sources generally produce the most clearly localised artefacts; processing more complex scenes in their entirety can result in spatially indistinct results.

The effect can be focussed onto a selected target region by use of the targetting controls below.

2.1.5 View Support

When used with O7A View Sync from the O7A View library, this plugin can be connected to the separate View or ViewVR applications.

When this option is available, a 'View' button appears at the top right of the plugin's user interface.



When this is pressed, the plugin is connected to the View or ViewVR application and is displayed there.

View Support	ViewVR Support
The current direction is shown using a cross. Hold the left mouse button to set the azimuth and elevation.	The current direction is shown using a beam and cross. Hold a VR controller trigger to set the azimuth and elevation.

2.1.6 Controls

2.1.6.1 Control: Bits

Decreasing the bits setting results in heavier degradation of the audio stream and values below 8 are often highly audible.

This control determines the number of steps used between -1 and +1 when quantizing the signal. The number can be found by raising 2 to the power of this setting. Note that the quantization is applied to an A-Format transformation of the signal.

If the setting is too low the audio can all be rounded to zero and go silent.

2.1.6.2 Controls: Target Azimuth and Target Elevation

These azimuth and elevation controls determine the direction of the target region.

Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

For instance, the direction for azimuth +90 and elevation +45 can be found by turning 90 degrees to the left and then looking up by 45 degrees.

These controls have no effect when Target Width is set to 180.

2.1.6.3 Control: Target Width

Target Width is an angle, between 0 and 180 degrees, indicating how wide the target region should be. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene.

Angles are measured from the direction given by the azimuth and elevation, to the sound direction. When the angle is less than the width setting, the sound is in the region. In practice, the transition into the target region is a gradual slope rather than a hard edge.

2.1.6.4 Control: Target Amount

This controls the amount of processed audio that appears in the output, as opposed to unprocessed audio. It applies only to audio in the target region, as other audio is unprocessed anyway.

It works as a percentage, so 0% indicates that no processed audio should be in the output, and 100% indicates that all processed audio should be output.

For many purposes this can be thought of as a Dry/Wet control.

2.2 O7A Chorus



2.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

2.2.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

2.2.3 Controls

- Target Azimuth
- Target Elevation
- Target Width
- Target Amount
- Target Filter
- Target Cutoff
- Dry On/Off

- Quality
- Output Filter
- Output Cutoff
- On/Off 1 - 4
- Gain 1 - 4
- Feedback Gain 1 - 4
- Feedback Polarity 1 - 4
- Frequency 1 - 4
- Depth 1 - 4
- Azimuth 1 - 4
- Elevation 1 - 4
- Width 1 - 4

2.2.4 Description

This plugin applies a chorus effect to a target region in a 3D O7A mix.

The centre of the chorused region is selected using azimuth and elevation controls, or the control surface, where the target direction is indicated by crosshairs.

There are labels on the control surface to help you find left, right, above etc. However, if this still does not make any sense, you might want to see our page on the O7A Visualiser which lays out its viewing region in the same way.

2.2.4.1 Delay Lines

The processed output from the chorus includes a direct, dry audio path and up to four delay lines. Each of these delay lines presents the same audio, but with an independent time-varying delay. The idea is that the combination of these various audio paths results in a thicker sound, as if multiple instruments or voices were present. Other effects are possible too.

The output of each delay line can be focussed on a particular spatial region using independent azimuth, elevation and width controls.

Each delay line has a sinusoidal Low Frequency Oscillator (LFO). The delay is shifted in time so the dry path always arrived first. The dry path is essentially not delayed.

Note that the delay lines here are each carrying a complete O7A scene, not just a mono signal as in conventional choruses.

2.2.4.2 Feedback and Flange

Each delay line can use feedback to create more extreme effects. It is commonly used in 'Flange' effects.

Feedback gains close to 0dB add a decay to the ends of sounds and stronger timbral colouration. Be careful not to put the feedback gain too close to 0dB as this can result in uncontrolled high volumes.

2.2.4.3 Target and Output Filters

A 'target' filter on the input determines what frequency range will be affected by the chorus, constraining the target region in the frequency domain as well as the spatial domain. The processed output of the chorus can also be modified by an output filter.

2.2.5 View Support

When used with O7A View Sync from the O7A View library, this plugin can be connected to the separate View or ViewVR applications.

When this option is available, a 'View' button appears at the top right of the plugin's user interface.



When this is pressed, the plugin is connected to the View or ViewVR application and is displayed there.

View Support	ViewVR Support
The current direction is shown using a cross. Hold the left mouse button to set the azimuth and elevation.	The current direction is shown using a beam and cross. Hold a VR controller trigger to set the azimuth and elevation.

2.2.6 Controls

2.2.6.1 Controls: Target Azimuth and Target Elevation

The target azimuth and elevation controls determine the direction of the spatial region to be affected by the chorus.

Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

For instance, the direction for azimuth +90 and elevation +45 can be found by turning 90 degrees to the left and then looking up by 45 degrees.

These controls have no effect when Target Width is set to 180.

2.2.6.2 Control: Target Width

Target Width is an angle, between 0 and 180 degrees, indicating how wide the region to be chorused should be. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene.

Angles are measured from the target direction to the sound direction. When the angle is less than the width setting, the sound is in the chorused region. In practice, the transition into the target region is a gradual slope rather than a hard transition.

2.2.6.3 Control: Target Amount

This controls the amount of processed audio that appears in the output, as opposed to unprocessed audio. It applies only to audio in the target region, as other audio is unprocessed anyway.

It works as a percentage, so 0% indicates that no processed audio should be in the output, and 100% indicates that all processed audio should be output.

For many purposes this can be thought of as a Dry/Wet control.

2.2.6.4 Controls: Target Cutoff and Target Filter

An filter determines what frequencies are processed by the plugin. Others pass through the plugin largely unaffected.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

2.2.6.5 Control: Dry On/Off

The processed chorus output normally includes the unmodified input ("dry") signal that is provided to it. This switch can be used to silence it. This has various uses, for instance when configuring the chorus, or using it as a "send" effect, or for less subtle effects.

Note that this switch modifies the processed output, and so applies only in the target region (and frequencies). Audio that is not in this region will be passed through unprocessed anyway.

2.2.6.6 Control: Quality

The plugin uses upsampling. The quality setting determines the degree and quality of upsampling used.

Higher quality settings create substantially more CPU load, but reduce frequency aliasing effects. Low Quality disables upsampling.

2.2.6.7 Controls: Output Cutoff and Output Filter

An output filter is applied to the target signal path. It does not affect audio that is not in the target region.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

2.2.6.8 Controls: On/Off 1 - 4

These four controls switch the output of each individual delay line on or off.

2.2.6.9 Controls: Gain 1 - 4

These four controls control the level of output of each individual delay line. A gain of 0dB will produce an output at the same level as the dry signal.

2.2.6.10 Controls: Feedback Gain 1 - 4

These four controls control the level of feedback in each delay line. Setting this to -inf turns feedback off.

Using feedback tends to strengthen flange-type settings and can give the effect more of a "tail" which decays after the original sound has finished.

Be careful with this control; setting it close to 0dB can result in high volume output.

2.2.6.11 Controls: Feedback Polarity 1 - 4

These four controls can be used to switch the polarity of the feedback gains. This does not affect the output gains.

Negative values tend to produce more pronounced effects, and can help control build up of low frequencies.

2.2.6.12 Controls: Frequency 1 - 4

These four controls set the frequency (in Hertz) of the sinusoidal Low Frequency Oscillator (LFO) used by each delay line.

2.2.6.13 Controls: Depth 1 - 4

These four controls set the depth (in milliseconds) used when calculating the delay of the sinusoidal Low Frequency Oscillator (LFO) used by each delay line. The resulting delay time oscillates between zero and this value.

2.2.6.14 Controls: Azimuth 1 - 4, Elevation 1 - 4 and Width 1 - 4

These four sets of controls determine the spatial region which is affected by a each delay line. The controls work essentially in the same way as the overall target controls (Target Azimuth etc.), but only one delay line is affected by each.

These can be used to increase the spatial complexity of the resulting audio scene. If the delay line should affect the whole scene, set the width to 180.

2.2.7 Presets

Presets are available for this plugin:

- Gentle
- Thin
- Thick
- Fast
- Flange
- Multiflange
- Edginess
- Modulation
- Spin
- Swirl

2.3 O7A Fold



2.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

2.3.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

2.3.3 Description

This plugin folds sounds from the lower hemisphere into the upper hemisphere.

This can be particularly useful for musical material where a decoder is to be used that has upper speakers but not lower speakers. Without this plugin, lower material will generally end up coming from the lowest available speakers rather than being spread over the upper hemisphere.

Lower sounds are effectively reflected in the horizontal plane. For instance, a sound that was previously at the lower front right will end up at the upper front right.

2.4 O7A Overdrive



2.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

2.4.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

2.4.3 Controls

- Drive
- Mode
- Target Azimuth
- Target Elevation
- Target Width
- Target Amount
- Target Filter
- Target Cutoff
- Quality
- Rider
- Output Gain
- Output Filter
- Output Cutoff

2.4.4 Description

This plugin applies simulated overdrive or other distortion to an O7A scene, or a target region in it. This has a variety of uses, for instance to give a scene some additional warmth or "edginess", or to shred part or all of it.

If the **Target Width** control is set to 180 then the distortion is applied everywhere in the scene. Otherwise, the **Target Azimuth and Elevation** controls can be used to direct distortion into a particular region. A filter is also available which can be used to target the overdrive specifically at low or high frequencies.

The level of distortion is controlled by the **Drive** control and the type by the **Mode**. A gain rider is used, which can help keep the level of distortion introduced independent of the level of the input signal.

The overdrive is applied to sounds in the scene without moving them significantly. If overdrive is to be combined with reverb, applying the overdrive before the reverb typically gives more spatially believable results.

An output filter is also available, which affects the processed output for the target region (and frequencies) only.

2.4.5 View Support

When used with O7A View Sync from the O7A View library, this plugin can be connected to the separate View or ViewVR applications.

When this option is available, a 'View' button appears at the top right of the plugin's user interface.



When this is pressed, the plugin is connected to the View or ViewVR application and is displayed there.

View Support	ViewVR Support
The current direction is shown using a cross.	The current direction is shown using a beam and cross.
Hold the left mouse button to set the azimuth and elevation.	Hold a VR controller trigger to set the azimuth and elevation.

2.4.6 Controls

2.4.6.1 Control: Drive

The drive control determines the intensity of the overdrive to be applied to the target region.

Values are from 0 to 10, where a value of 0 means the signal passes through unaffected.

2.4.6.2 Control: Mode

The overdrive is performed by applying a nonlinearity to the input audio, and four are available. The choices are:

hTan	This gives a classic overdrive sound that can be introduced gently by increasing the drive. Implemented using the hypertangent.
Sine	This also gives a classic sound, but implemented with a different mathematical method. Implemented using a limited sine function.
Clip	Here the audio is hard-clipped when it hits a threshold, giving a harsher "digital" distortion. Sound is typically unaffected until the drive is high enough for hard clipping to start.
Cut	This mode cuts away parts of the waveform that are close to zero. Increasing the drive cuts away more of the waveform, damaging it in a way that often produces a quite gritty sound. Setting the drive high can remove everything, resulting in periods of silence.

2.4.6.3 Controls: Target Azimuth and Target Elevation

These azimuth and elevation controls determine the direction of the target region.

Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

For instance, the direction for azimuth +90 and elevation +45 can be found by turning 90 degrees to the left and then looking up by 45 degrees.

These controls have no effect when Target Width is set to 180.

2.4.6.4 Control: Target Width

Target Width is an angle, between 0 and 180 degrees, indicating how wide the target region should be. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene.

Angles are measured from the direction given by the azimuth and elevation, to the sound direction. When the angle is less than the width setting, the sound is in the region. In practice, the transition into the target region is a gradual slope rather than a hard edge.

2.4.6.5 Control: Target Amount

This controls the amount of processed audio that appears in the output, as opposed to unprocessed audio. It applies only to audio in the target region, as other audio is unprocessed anyway.

It works as a percentage, so 0% indicates that no processed audio should be in the output, and 100% indicates that all processed audio should be output.

For many purposes this can be thought of as a Dry/Wet control.

2.4.6.6 Controls: Target Cutoff and Target Filter

An filter determines what frequencies are processed by the plugin. Others pass through the plugin largely unaffected.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

2.4.6.7 Control: Quality

The plugin uses upsampling. The quality setting determines the degree and quality of upsampling used.

Higher quality settings create substantially more CPU load, but reduce frequency aliasing effects. Low Quality disables upsampling.

Many applications of overdrive do not need oversampling, and you can save CPU load by leaving this set to Low in these cases.

2.4.6.8 Control: Rider

A gain rider is used, which can help to keep the level of distortion independent of the level of the input signal. Shorter rider times typically result in more consistent distortion.

2.4.6.9 Control: Output Gain

The output level of the target signal path can be modified. Audio that is not in the target region is not affected.

The gain is between -30dB and +30dB or silent.

2.4.6.10 Controls: Output Cutoff and Output Filter

An output filter is applied to the target signal path. It does not affect audio that is not in the target region.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

2.4.7 Presets

Presets are available for this plugin:

- Warm
- Edge
- Hard Edge
- Hard Drive
- Destruction
- Crump
- Fizz
- Threat
- Gravel
- Splinters

2.5 O7A Ring Modulator



2.5.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

2.5.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

2.5.3 Controls

- Frequency
- Target Azimuth
- Target Elevation
- Target Width
- Target Amount
- Target Filter
- Target Cutoff
- Quality
- Output Gain
- Output Filter
- Output Cutoff

2.5.4 Description

This plugin applies ring modulation to a target region of an O7A scene.

If the [Target Width](#) control is set to 180 then the overdrive is applied everywhere in the scene. Otherwise, the [Target Azimuth](#) and [Elevation](#) controls can be used to direct the effect into a particular region. A filter allows a certain frequency range to be targeted for processing.

Ring modulation has the effect of moving frequencies in the original mix (known as the Modulator signal) to different frequencies, where the move depends on a sine wave (known as the Carrier signal). If a modulator is originally at frequency f , and a carrier at c , then resulting signals will be at $c+f$ and $c-f$.

2.5.5 View Support

When used with O7A View Sync from the O7A View library, this plugin can be connected to the separate View or ViewVR applications.

When this option is available, a 'View' button appears at the top right of the plugin's user interface.



When this is pressed, the plugin is connected to the View or ViewVR application and is displayed there.

View Support	ViewVR Support
The current direction is shown using a cross. Hold the left mouse button to set the azimuth and elevation.	The current direction is shown using a beam and cross. Hold a VR controller trigger to set the azimuth and elevation.

2.5.6 Controls

2.5.6.1 Control: Frequency

The main Carrier frequency, in Hertz. This defaults to 1000Hz.

2.5.6.2 Controls: Target Azimuth and Target Elevation

These azimuth and elevation controls determine the direction of the target region.

Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

For instance, the direction for azimuth +90 and elevation +45 can be found by turning 90 degrees to the left and then looking up by 45 degrees.

These controls have no effect when Target Width is set to 180.

2.5.6.3 Control: Target Width

Target Width is an angle, between 0 and 180 degrees, indicating how wide the target region should be. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene.

Angles are measured from the direction given by the azimuth and elevation, to the sound direction. When the angle is less than the width setting, the sound is in the region. In practice, the transition into the target region is a gradual slope rather than a hard edge.

2.5.6.4 Control: Target Amount

This controls the amount of processed audio that appears in the output, as opposed to unprocessed audio. It applies only to audio in the target region, as other audio is unprocessed anyway.

It works as a percentage, so 0% indicates that no processed audio should be in the output, and 100% indicates that all processed audio should be output.

For many purposes this can be thought of as a Dry/Wet control.

2.5.6.5 Controls: Target Cutoff and Target Filter

An filter determines what frequencies are processed by the plugin. Others pass through the plugin largely unaffected.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

2.5.6.6 Control: Quality

The plugin uses upsampling. The quality setting determines the degree and quality of upsampling used.

Higher quality settings create substantially more CPU load, but reduce frequency aliasing effects. Low Quality disables upsampling.

2.5.6.7 Control: Output Gain

The output level of the target signal path can be modified. Audio that is not in the target region is not affected.

The gain is between -30dB and +30dB or silent.

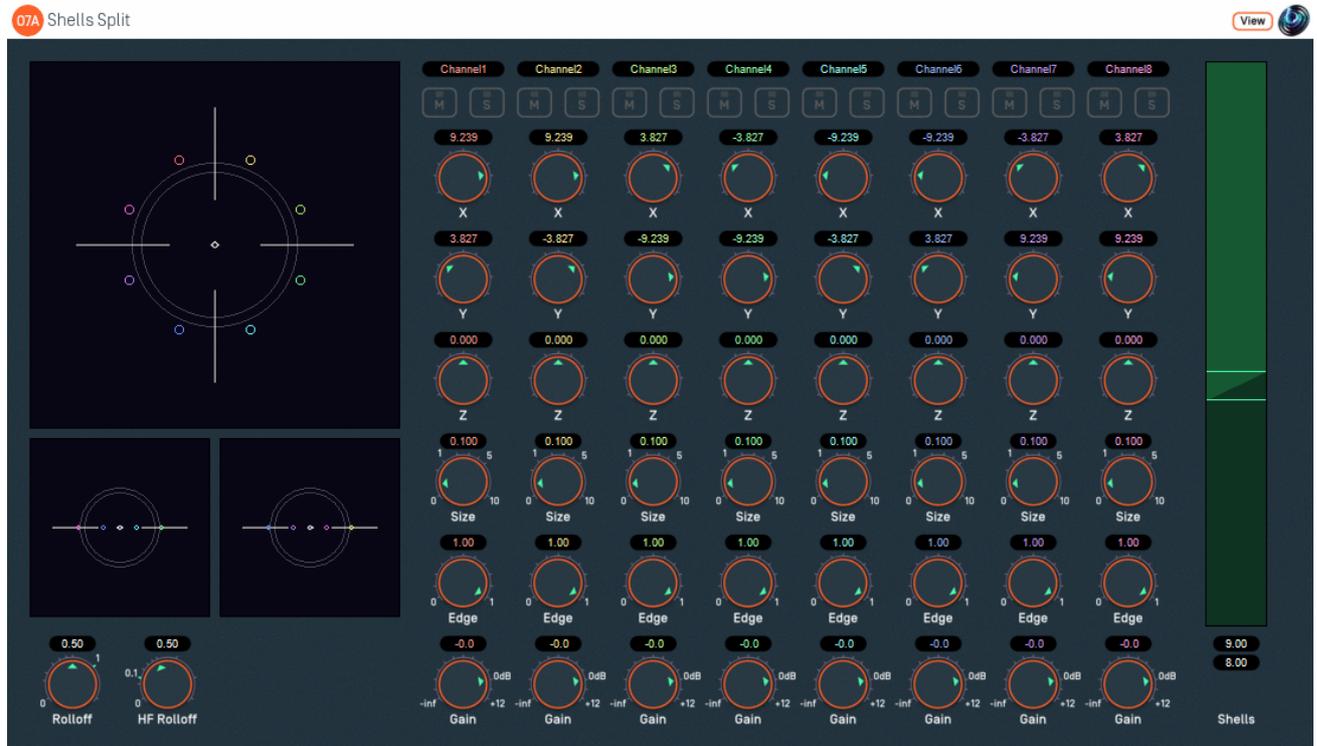
2.5.6.8 Controls: Output Cutoff and Output Filter

An output filter is applied to the target signal path. It does not affect audio that is not in the target region.

The filter can be configured as a low-pass or high-pass filter, or disabled. The filter cutoff controls the filter's -6dB point.

3 Panner

3.1 O7A Shells Split



3.1.1 Host Support

Host Type	Support
AAX	No
VST2	Extreme channel count excludes most hosts

3.1.2 Audio

	Channels	Content
Input	8	Eight channels of mono
Output	128	Far + Close

3.1.3 Controls

- Gain Rolloff
- HF Rolloff
- Crossover Far End
- Crossover Far Start
- X 1 - 8
- Y 1 - 8
- Z 1 - 8
- Source Size 1 - 8
- Edge 1 - 8
- Gain 1 - 8
- Mute 1 - 8
- Solo 1 - 8

3.1.4 Description

This plugin has an extreme channel count and will not work in most hosts.

This plugin allows eight channels of sound to be placed into a 3D mix that is split into two O7A scenes, one containing 'far' sounds and another containing 'close' sounds. These can be mixed together to provide a single complete scene.

The 'far' and 'close' output of this plugin can be recombined by direct mixing, or by use of the O7A Join plugin from the O7A Manipulators pack. This will give a scene containing all elements, as if a more conventional panner had been used. This is typically useful for reverb sends where all elements of the scene are to have reverb applied, or when exporting the mix without shell support.

The 128 channels of output are as follow:

Channels	Description
1-64	The 'far' scene, represented using O7A, including sounds that are far away.
65-128	The 'close' scene, represented using O7A, including sounds that are close.

3.1.5 Uses

Rapture3D Universal can render these scenes using two separate beds to effect a degree of parallax when the listener's position changes. To achieve this, both scenes are played together, but the bed playing the close scene has an 'extent' set on it, so the angle that sounds are rendered at changes when the listener moves. You may be familiar with this type of effect from the O7A Zoom plugin.

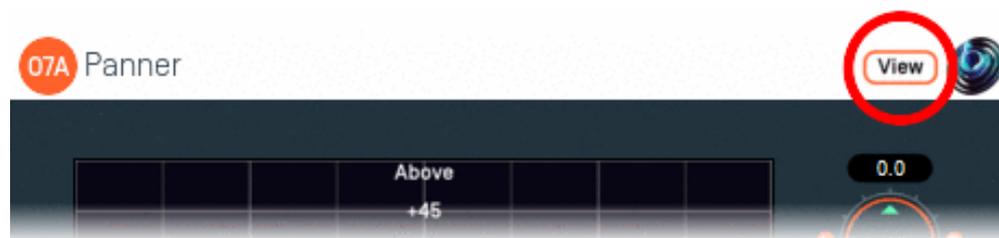
This plugin also has applications in more normal workflows where only a single O7A mix will be produced in the end. For instance, it is possible to apply different reverberation to the close and far scenes, before bringing everything back together by direct mixing, or use of the O7A Join plugin.

The main benefit of this plugin lies in its separation of the scene into close and far elements; if this is not needed then the O7A Panner LS8 from the O7A Manipulators has otherwise similar functionality.

3.1.6 View Support

When used with O7A View Sync from the O7A View library, this plugin can be connected to the separate View or ViewVR applications.

When this option is available, a 'View' button appears at the top right of the plugin's user interface.



When this is pressed, the plugin is connected to the View or ViewVR application and is displayed there.

View Support	ViewVR Support
<p>The current source directions are shown using colour-coded crosses and labels, similar to the display used by O7A Panner - Eight Channel.</p> <p>Point at one and hold the left mouse button to select it. Then, drag to set its direction.</p>	<p>The current 3D locations are shown as small scaled spheres, within a scaled cube, which should be in reach of the VR controllers. The unscaled locations, where the audio is actually presented from, are also shown.</p> <p>Grab one of the scaled locations with a VR controller and drag to move it. The unscaled sphere will move to match.</p>

3.1.7 Controls

3.1.7.1 Control: Gain Rolloff

This rolloff determines the rule that is used to reduce the source's level as the source moves away. A value of 1 is closest to how this occurs in reality. Reducing the value reduces the effect of the level drop and increasing the value exaggerates it. A value of 0 means that the level stays constant.

Mathematically, the gain applied is determined by the inverse square law, but raised to a power given by this control.

3.1.7.2 Control: HF Rolloff

This controls a simple low-pass filter that reduces high frequency content as the source moves away. This happens in reality due to air absorption. A value of 0.1 is close to reality at typical pressure, temperature and humidity, and changing this value reduces or increases the effect. A value of 0 means that no filtering occurs.

The value used with this control is the number of additional decibels lost at 10kHz for each metre of distance, on top of the main gain rolloff.

3.1.7.3 Controls: Crossover Far End and Crossover Far Start

These controls determine the distance range over which sounds transition from the 'far' O7A mix to the 'close' O7A mix.

3.1.7.4 Controls: X 1 - 8, Y 1 - 8 and Z 1 - 8

The coordinates determine where each sound is in space. Units are nominally metres.

Axis	Positive	Negative
X	Front	Back
Y	Left	Right
Z	Up	Down

3.1.7.5 Controls: Source Size 1 - 8

Source size can be used to give a source a volume. When the source is close, this changes the spatial response of the source (you will see it looks bigger in the O7A Visualiser). This effect continues when the listener travels inside the source.

When the listener is inside the source, there is a substantial omnidirectional component to the soundfield generated here. You may wish to make this more diffuse, for instance by using the O7A Diffuser plugin.

3.1.7.6 Controls: Edge 1 - 8

The edge setting further determines the shape of a source with size. Increasing the edge setting introduces tapering from the edge of the source, effectively moving more of it towards its centre. This changes the spatial response of the source, particularly when it is close.

3.1.7.7 Controls: Gain 1 - 8

Each sound source has its own gain control, with a range from -60dB to +12dB.

3.1.7.8 Controls: Mute 1 - 8 and Solo 1 - 8

Each sound source has its own mute and solo switch. These have the usual meanings and solo overrides mute.

3.1.8 Presets

Presets are available for this plugin:

- Cube
- Octagon
- Square
- Stage

4 Appendix: O7A Streams

4.1 What is an O7A Stream?

A seventh order ambisonic (O7A) stream is made up of 64 individual channels of audio which together represent a 3D soundfield. Into this "audio scene" can be placed individual sound sources, reverberation and complex spatial textures.

These 64 channels can be quite confusing to understand conceptually. For instance, they do not relate to particular speaker directions, or to individual sound sources in the soundfield. You do *not* need to understand them to use them! But, it doesn't hurt to know the basics.

Each channel adds spatial detail to a sound scene. With just the first channel, you have a basically omnidirectional (mono) sound image. The second channel adds some basic detail left/right, the third up/down and the fourth front/back; these four channels make up first order ambisonics. The first and second channels together provide essentially the spatial detail available with the Mid/Side (M/S) stereo recording technique, which captures a sound image with left/right width. But with the further two channels the detail is available in all directions, not just left/right.

That covers the first 4 channels. The other 60 add further detail to make the image sharper. If you are interested in what exactly is in these channels (which is not so easy to describe) you may want to read up on Higher Order Ambisonics (HOA) and the mathematics of the Spherical Wave Equation and Spherical Harmonics. But you should *not* need to read up to *use* the techniques described here. If you want to make sense of what is going on spatially in an O7A stream, we find that it is normally best to use an O7A Visualiser or O7A Flare plugin.

4.2 What processing can I apply to an O7A stream?

As well as processing designed specifically for O7A streams, it is possible to mix streams together in the expected way. It is also possible to run conventional mono DSP algorithms on them directly by applying the algorithm to all 64 channels individually, subject to some rules. Failing to follow these rules is likely to shred the spatial imaging, so be careful! Specifically:

- If you process an O7A stream with a conventional mono DSP algorithm you *must apply the same processing to all 64 channels identically*.
- Only *linear* processing can be used (e.g. not distortion or compression). Also, be aware that time-variant processing can cause issues.

If you are working in Reaper, current versions do not make it particularly easy to set up this sort of processing, but it is possible if you are prepared to use some advanced features and do some rather tedious set-up. For instance, you can save an "FX Chain" in which a number of equalization plugins are "routed" correctly and in which controls are linked by "parameter modulation" so that one set of controls operates the others. Once the FX Chain is saved, you can load it into other projects.

4.3 Encoding

There are a number of ways in which the channels can be defined in HOA. To a large extent it does not matter which is chosen, as long as *everything uses the same convention*. This is critical and horrible things will happen to the spatial image if this is not the case. However, if you follow the convention, or convert explicitly where you need to, you will be able to pass audio around between different software packages.

These plugins use the "SN3D" ambisonic convention. As is usually the case, we order the channels using "ACN" ordering.

This encoding is used in the "AmbiX" file format and YouTube. It is supported directly by Rapture3D Universal.

4.4 How does O7A SN3D relate to FuMa and Classic Ambisonics?

The ambisonic format used (SN3D) is not directly compatible with classic 1970s four channel "WXYZ" B-Format, or the extension (FuMa) which was used by versions of these plugins prior to version 2.0.

However, conversion is straightforward. The O7A Core pack includes plugins to do this: O7A Decoder - FuMa and O7A Injector - FuMa.