



O3A Manipulator Plugins

v2.4.0

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Table of Contents

1 Introduction.....	1
1.1 Compatibility.....	1
2 Getting Started.....	2
2.1 Working with O3A.....	2
2.2 Getting Started with Reaper.....	3
2.3 Getting Started with Premiere Pro.....	8
2.4 Getting Started with Pro Tools.....	10
2.5 Getting Started with Pyramix.....	13
2.6 Audio for Virtual Reality 360 Video.....	15
2.7 Spotting A Common Issue.....	17
2.8 The License Manager.....	18
2.9 Visualisation of Manipulations.....	19
2.10 Split and Join.....	20
2.11 Technical Requirements.....	21
3 O3A Manipulators - Soundfield Modification.....	22
3.1 O3A Compressor.....	22
3.2 O3A Diffuser.....	25
3.3 O3A Low/High Pass Filter.....	27
3.4 O3A Move.....	29
3.5 O3A Zoom and O3A Zoom XYZ.....	33
3.6 O3A Directional Emphasis.....	37
3.7 O3A Directional Mask.....	40
3.8 O3A Order Amplifier.....	42
3.9 O3A Portal.....	44
3.10 O3A Reflection.....	47
3.11 O3A Screen Resizer.....	49
3.12 O3A Spatial Mask.....	51
3.13 O3A Spotlight.....	54
3.14 O3A Parametric Equalizer.....	57
3.15 O3A Graphic Equalizer.....	59
3.16 O3A Spatial Equalizer.....	61
4 O3A Manipulators - Panners.....	64
4.1 O3A Panner LS and O3A Panner LS XYZ.....	64
4.2 O3A Panner LS8.....	68
4.3 O3A Line.....	71
5 O3A Manipulators - "A-Format" Support.....	74
5.1 O3A A20->B Converter and O3A B->A20 Converter.....	74
6 O3A Manipulators - Split and Join.....	77
6.1 O3A Spatial Mask Split.....	77
6.2 O3A Spotlight Split.....	79
6.3 O3A Swap.....	81
6.4 O3A Join.....	82
7 O3A Core - Panners.....	83
7.1 O3A Panner.....	83
7.2 O3A Panner - Classic.....	85
7.3 O3A Panner - Hemisphere.....	87
7.4 O3A Panner - Large.....	89
7.5 O3A Panner - Two Channel.....	91

Table of Contents

7 O3A Core - Panners	
7.6 O3A Panner - Eight Channel.....	94
8 O3A Core - Visualisers.....	98
8.1 O3A Visualiser.....	98
8.2 O3A Visualiser - Hemisphere.....	100
8.3 O3A Colourizer.....	102
8.4 O3A Flare.....	104
9 O3A Core - Rotation.....	106
9.1 O3A Look.....	106
9.2 O3A Rotation.....	108
10 O3A Core - Decoders and Converters.....	111
10.1 O3A Decoder - Stereo.....	111
10.2 O3A Decoder - Mono.....	113
10.3 O3A Decoder - 5.1 Basic.....	114
10.4 O3A Decoder - FuMa.....	115
10.5 O3A Injector - FuMa.....	116
10.6 O3A Decoder - O1A and O2A.....	117
10.7 O3A Injector - O1A and O2A.....	119
11 O3A Core - Virtual Microphones.....	121
11.1 O3A Beamer.....	121
11.2 O3A Virtual Microphone.....	123
12 O3A Core - Metering.....	125
12.1 O3A Meter - Signal.....	125
12.2 O3A Meter.....	126
13 O3A Core - Soundfield Modification.....	128
13.1 O3A Gain.....	128
13.2 O3A Spatial Delay.....	129
14 Appendix: O3A Streams.....	133
14.1 What is an O3A Stream?.....	133
14.2 What processing can I apply to an O3A stream?.....	133
14.3 Encoding.....	133
14.4 How does O3A SN3D relate to FuMa and Classic Ambisonics?.....	134
14.5 Why Third Order?.....	134

1 Introduction

The O3A Manipulator Plugins allow changes to the content of [third order ambisonic \(O3A\) streams](#).

A variety of manipulations are included, from simple changes to the level of sound in particular directions, through to directional compression, manipulations to move sounds around in space and equalization that can be "painted" on to the audio scene. The library also includes some specialised panner plugins, tools to split up the scene into sections for separate processing, and some other features.

This documentation also covers the O3A Core.

1.1 Compatibility

O3A streams require audio busses with at least 16 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 O3A plugins *will not work correctly with these DAWs***, which may even crash.

1.1.1 AAX

Most of the O3A plugins exist as AAX versions which are compatible with [Pro Tools Ultimate](#) or Studio 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. To avoid this in some cases, some plugins "misuse" stem formats with matching channel counts. Cases like this are described for individual plugins below in the text.

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 O3A 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.

2 Getting Started

2.1 Working with O3A

When working with stereo, you normally "pan" a mono sound to stereo and "mix" it onto a stereo bus. With O3A, you can work in a similar way but there is an extra intermediate multichannel audio format, and a final "decoding" step. The simplest case is probably as follows:

1. Panning - mono sources are panned to 16 channel O3A. The [O3A Panner](#) plugin can be used for this.
2. Mixing - multiple streams of 16 channel O3A can be mixed together using your DAW's mixing engine. No special plugin is needed here, as long as the DAW can handle 16 channel busses. You end up with a final mix, as an O3A stream.
3. Decoding - during actual playback (and you probably want to listen while you work!) you "decode" the O3A stream for whatever speaker layout you are actually listening with. One of the huge advantages of ambisonic techniques is that the O3A mix is independent of its final playback environment, so you can switch between stereo speakers, headphones, 5.1, 22.2 or whatever. One of the simplest of these decoders is provided by the basic [O3A Decoder - Stereo](#) plugin.

These are just the basics. There are other ways to encode audio into O3A rather than panning, for instance by upmixing, or recording with ambisonic microphones.

You can also manipulate O3A streams. As a simple example, it is possible to [rotate](#) the soundfield almost perfectly, and much more complex transformations are possible, including spatial ones. Manipulator plugins typically have 16 channel O3A as both an input and output. There are some [technical notes on O3A streams](#) at the end of this document.

If you are also working with first order B-Format using the SN3D/ACN convention you can mix this in too, because the first four channels of O3A correspond to the four channels of first order. To reduce an O3A stream to first order, you can simply take these four channels and throw away the rest.

2.2 Getting Started with Reaper

This section gives an introduction to use of the VST2 version of the O3A plugins with [Reaper](#).

We are assuming that you know how to use Reaper already. A number of simple Reaper example projects are included in standard installations, along with simple explanatory text files.

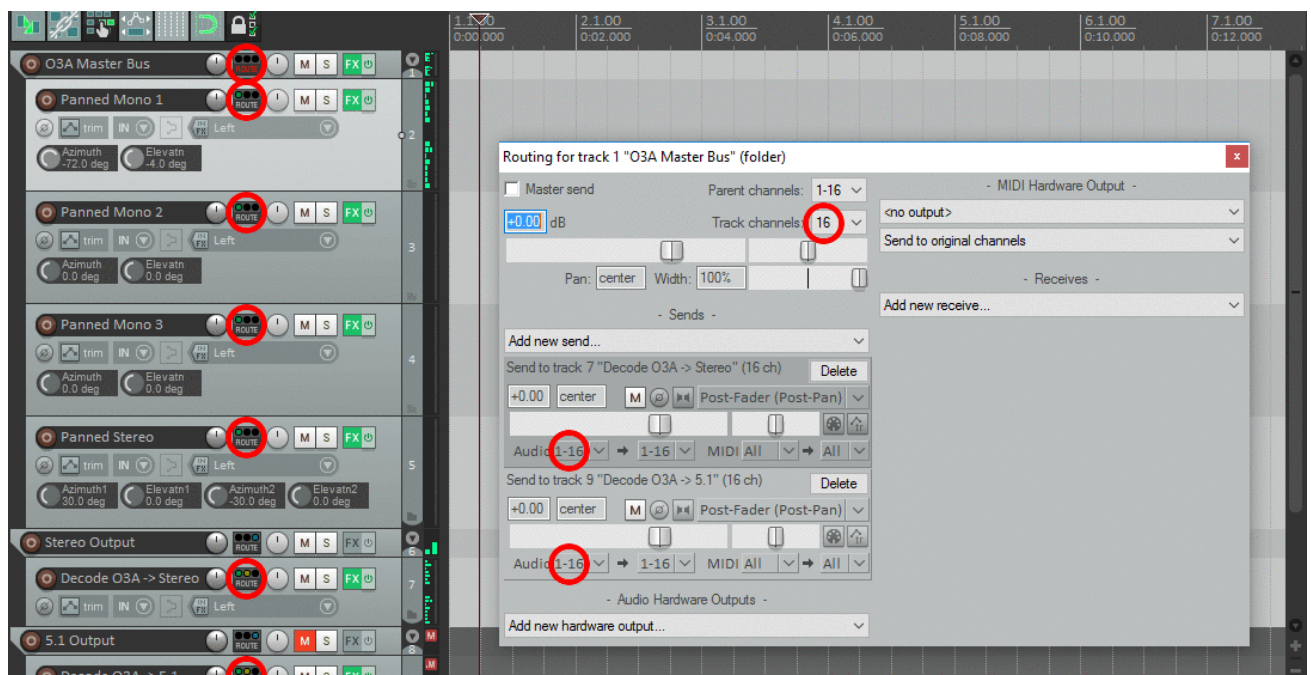
2.2.1 Shell Plugins

The O3A VST plugin libraries are VST2 "shell" plugins which each provide a number of plugin effects. If you find your list of O3A effects is short, with names like "O3ACore", this means that Reaper has not scanned the content of the libraries.

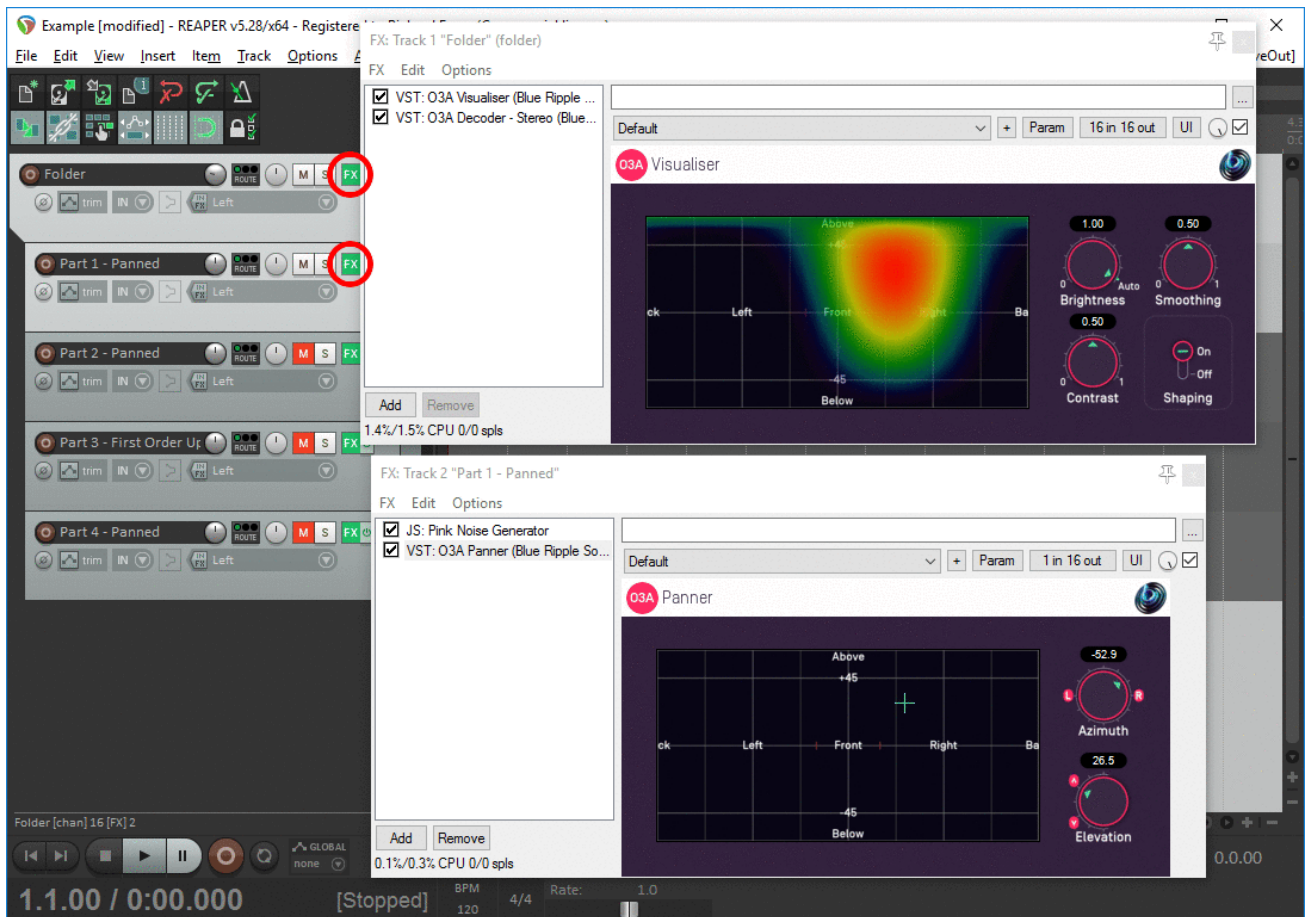
To fix this, go into the Reaper "Options" menu and select "Preferences..." to bring up the preferences screen. Then, under "Plug-ins", find "VST". On the VST tab, please ensure that "Get VST names/types when scanning" is checked and then click "Clear cache/re-scan".

2.2.2 Basics

In Reaper, whenever you create a track or send to be used with [O3A streams](#), make sure it has at least 16 channels. A few plugins need even more (e.g. a decoder for [Hamasaki 22.2](#)).



2.2.3 Layout



On the folder track, add the following plugins *in this order* to the FX chain:

- [O3A Visualiser](#)
- [O3A Decoder - Stereo](#) (or whichever decoder best suits your speaker rig).

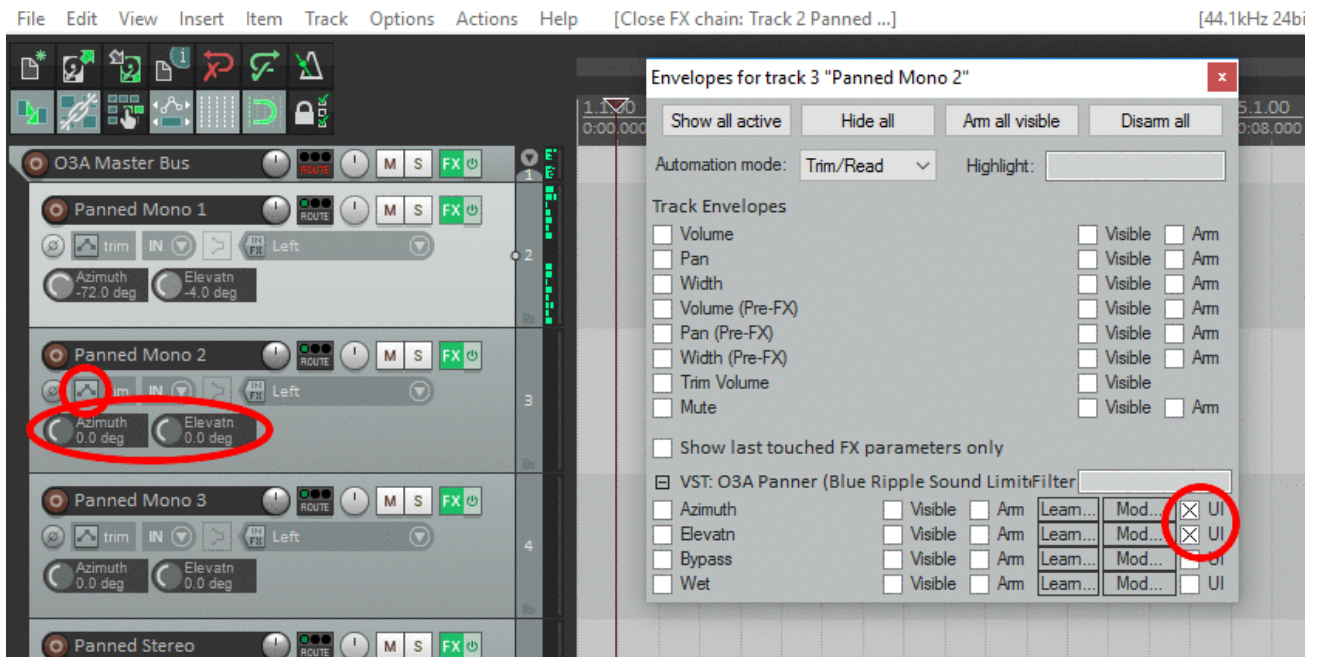
This means that after all the audio from the individual parts has been mixed together it will be visualised in 3D and then converted to stereo for monitoring.

On tracks for mono parts that are to be panned, add the following:

- An [O3A Panner](#) plugin.

Do **NOT** use the built-in Reaper stereo panner with O3A!

It is also possible to add azimuth and elevation controls to Reaper on these channels. To do this, add the panner as above and then use the "Trim" button and cross the "UI" boxes for the azimuth and elevation controls.



Parts that are already first order ambisonic B-Format can typically be injected directly without issue, although processing can help (e.g. the O3A First Order Injector plugin from the O3A Upmixers set, or the O3A Harpex Upsampler). Of course, other O3A material can be injected directly. FuMa material needs to be converted using the [O3A Injector - FuMa](#) plugin.

2.2.4 Processing O3A streams

Other plugins (for instance the [rotation](#) plugin) manipulate the O3A stream. The stream needs to be in O3A format (for instance by panning) before such processing can be used.

Applying processing to the O3A stream can be confusing at first. We suggest you spend a few minutes getting familiar with the [O3A Visualiser](#) plugin and put visualisers before and after your processing. You can then see what is going on, which can be really helpful!



Some plugins have O3A as an input but output something else. In these cases, make sure you only chain together processors in a combination that make sense. For instance, the [O3A Beamer](#) plugin produces mono which you might want to run through a mono distortion plugin before panning it back into O3A using the [O3A Panner](#).

2.2.5 Sends

Effect sends can be used in the normal way. Just be careful about which busses are expecting mono or O3A as input and output and be sure to check your channel counts.

Again, do not use the Reaper panner for the send (leave it set to the centre) or the spatial image will be damaged. For similar reasons, make sure the project's "Pan Law" (in Project Settings) is set to 0dB, or avoid use of Post-Fade sends.

2.2.6 Mastering

2.2.6.1 Keep Your O3A Master Mix

Keep your Reaper project files and inputs if you like, keep your favourite stereo and 5.1 downmixes etc. But whatever you do, *keep a copy of the 16 channel O3A mix*. This may not make a difference to you now, but when someone asks you for a 22.2 (or other) downmix in a few years time, you will not need to fake height information from the 5.1 mix, or go searching for a missing file needed by the original Reaper project. Instead, you will be able to produce the downmix from the ambisonic B-Format (i.e. O3A) master using whatever tools are in vogue then.

If you have taken the simple approach as described above, probably the easiest way to grab the O3A mix is simply to switch off the decoder on your Reaper master track, and then use the "Render..." menu item. You will probably need to set the Channels to "16" by typing the number in

and use the "Stems (selected tracks)" option rather than what Reaper considers the master mix, in which case you will also need to have selected your folder track. If you want to check the output, you can always load it into a new Reaper session and run it through your favourite decoder.

2.2.6.2 Other Mixes

If you want to produce a number of different format outputs from your O3A master (stereo, headphones, 5.1 etc.) you could use a number of projects that use the O3A master file.

Another option is to place a number of decoders on your decoding/folder track and only switch on the one you want for the particular rendering.

However, our preferred option is to send from the O3A master bus to one of a number of separate decoding tracks which can be freely muted or unmuted. This is the approach taken in the example Reaper projects provided.

2.2.7 Troubleshooting

If you find plugin libraries are not picked up during Reaper plugin scanning, this can typically be fixed by backing up any relevant files and settings, removing the relevant libraries from the Reaper path (either by moving the files or changing the path), restarting Reaper, putting them back, and restarting Reaper again.

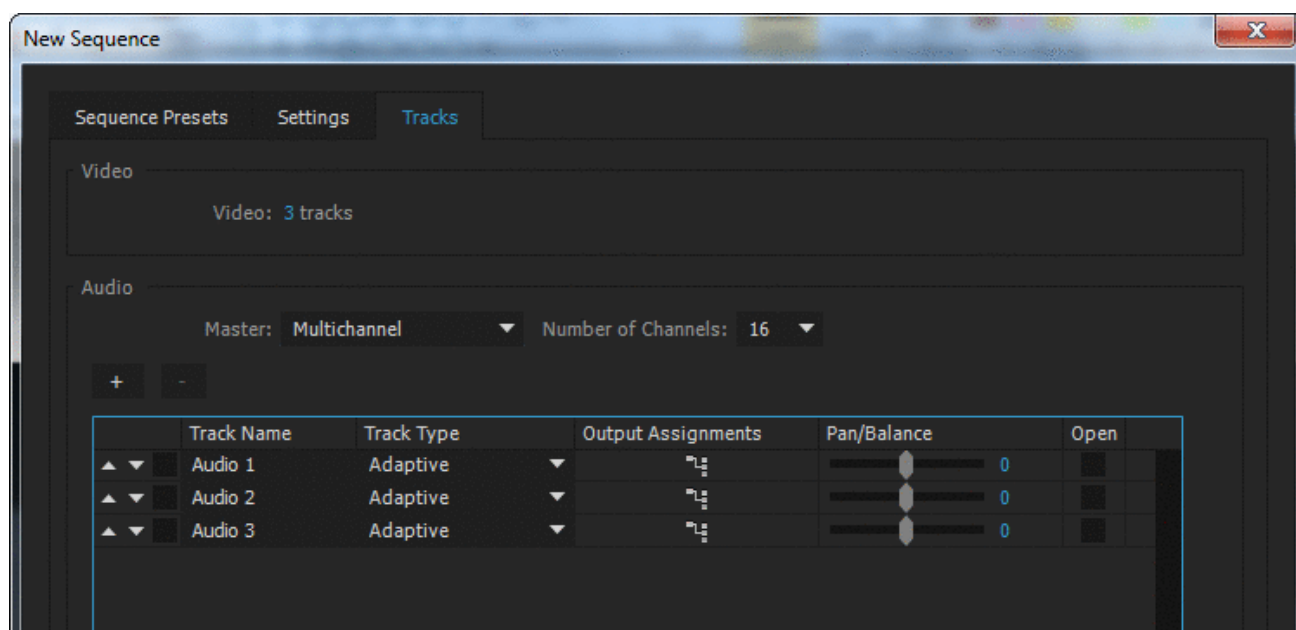
2.3 Getting Started with Premiere Pro

In Adobe Premiere Pro, as with Reaper, it is essential to make sure that your audio tracks have 16 channels (or more if you are using plugins that need them).

2.3.1 Sequence Settings

In particular, when creating a New Sequence, go to the "Tracks" tab and make the following changes:

1. The "Master" Track should be set to "Multichannel".
2. The "Number of Channels" should be set to "16", or as many as you need.
3. Each audio "Track Type" that is going to carry O3A audio (or suchlike) should be set to "Adaptive" or "Adaptive Submix".



Premiere Pro includes some VR Sequence Presets that support ambisonics. However, these only set the number of channels to 4 by default, which is correct for first order ambisonics, but not for third order. 16 channels are needed by these plugins, so please check the "Number of Channels" as above, or plugins may not work and spatialisation quality may be seriously compromised.

2.3.2 Importing Audio

When importing audio with many channels, Premiere Pro may place each channel of the audio onto a different track rather than keeping the spatial mix together. If this happens, find the clip, right click and select "Modify" and then "Audio Channels..." and do the following before trying again:

1. Set the "Clip Channel Format" to "Adaptive".
2. Check the "Active Channels Per Clip" matches the audio (for instance, 4 for first order ambisonics or 16 for third order ambisonics).
3. Set the "Number of Audio Clips" to 1.

You can also make this the default behaviour by going into Premiere Pro's "Preferences...", finding the "Audio" section and setting the "Multichannel Mono Mode" item to "Adaptive".

2.3.3 Compatibility

Our plugins do not work with all versions of Premiere. They do not work with versions prior to v12.1, or versions from v14.4 to the current version.

The "O3A View Sync" plugin from the O3A View library is not fully compatible with the current version of Premiere Pro. Necessary VST2 timing information is currently not available in Premiere, which means that video playback cannot synchronize correctly.

The Premiere list of "Available Plug-Ins" only shows one plugin from each of the plugin libraries, but they all should be available for use.

Plugin presets are not available in Premiere Pro.

2.4 Getting Started with Pro Tools

This section gives an introduction to use of the AAX version of the O3A plugins with [Pro Tools Ultimate](#), which was previously known as Pro Tools HD. Ambisonic support has been available in Pro Tools HD since version 12.8.2. It is also available in Pro Tools Studio, but not Pro Tools Intro or Artist.

These notes assume you are familiar with Pro Tools already. A number of simple Pro Tools example projects are included in standard installations, along with simple explanatory text files.

2.4.1 Stem Formats

When effects are used on tracks, Pro Tools takes account of changes in the stem format in use, which is generally very convenient when working with ambisonics. In particular, effect lists shown will be appropriate to the current stem format you are using.

For instance, if you have a mono track that you wish to pan to O3A, you will find the insert effect list includes the [O3A Panner](#) (under "Sound Field"). Introducing this effect as an insert will change the track stem format from this point to third order ambisonics (O3A) automatically. Mono effects can still be used *before* the panner, but after panning the effect list will include a different set of plugins appropriate for a third order ambisonic stream, such as the [O3A Visualiser](#) and O3A decoders. If you decode to stereo, the stem will change to stereo and so on.

2.4.2 Stem Formats that Pro Tools does not support directly

However, Pro Tools does not have direct support for some of the more unusual stem formats used by some plugins in the Blue Ripple range. Consequently:

- Some of the plugins do *not support* AAX. For instance, plugins requiring the Hamasaki 22.2 stem format are not included in the AAX version of the plugin libraries.
- Some plugins "misuse" other stem formats with matching channel counts. For instance, the [O3A Decoder - FuMa](#) plugin outputs ambisonics using the FuMa convention, but labels its output stem format as ordinary ambisonics using the SN3D convention, which is not really correct. As a result, the Pro Tools effect lists shown will not be correct. Similarly, the [O3A Decoder - IMAX 6.0](#) plugin outputs audio targeting the IMAX 6.0 layout, but labels its output stem format as standard 6.0, which does *not* have exactly the same channel definitions.

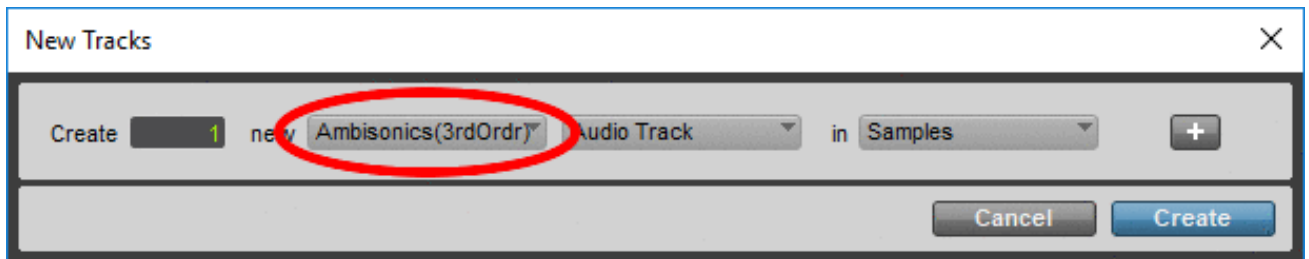
Where you are using standard Pro Tools stem formats only, these issues are not relevant. But, if you are using stem formats that Pro Tools does not support directly, care is needed.

Please see the documentation for each individual plugin for details.

2.4.3 Ambisonic Tracks

Pro Tools stem formats make it very straightforward to organise an ambisonic project. Often, tracks do not need to be created in special way as simply including an O3A panner or other ambisonic encoder will result in the track stem format changing automatically, e.g. from mono.

However, if you wish to create an ambisonic track directly, Pro Tools provides simple options on the track creation screen.



Like these plugins, Pro Tools normally uses the [SN3D/ACN](#) ambisonic format. You can convert from FuMa to SN3D using the [O3A Injector - FuMa](#) plugin.

2.4.4 Organising Projects

A recommended way to organise a project is to route all of your ambisonic material (panned or otherwise) to a single ambisonic "O3A Master" bus, set to third order ambisonics in much the same way as tracks (see above).



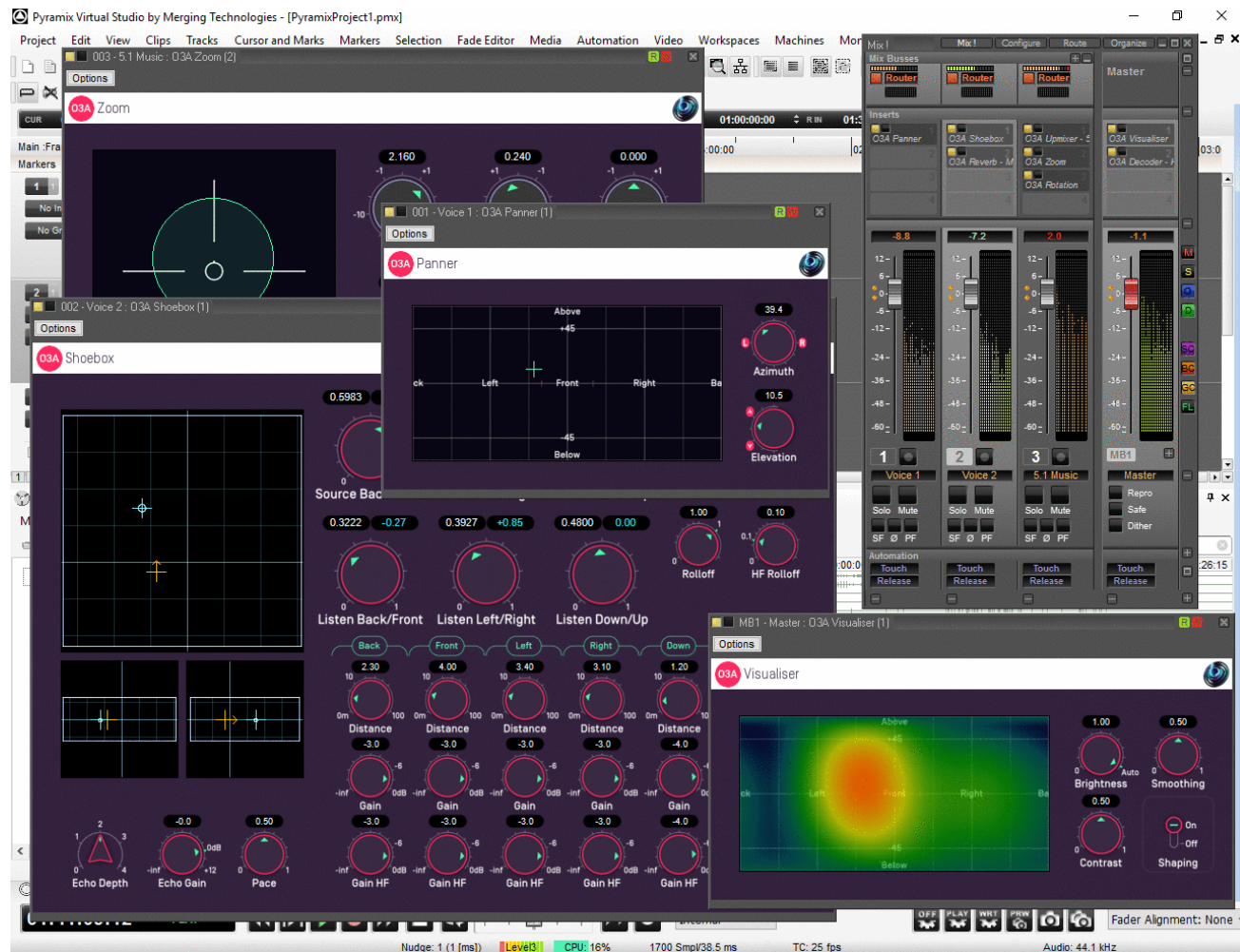
This gives a convenient place to bring the whole O3A mix together and send it to a number of tracks for visualisation (e.g. with [O3A Visualiser](#) or [O3A Flare](#)), metering and decoding for specific output formats.

For instance, you might create a "Stereo Decoding" track including the [O3A Decoder - Stereo](#) plugin, so the final stem format is stereo, ready for monitoring. You might also set up a "5.1 Decoding" track in parallel and mute the one you are not using - and so on for other final output formats.

Effect sends can be used in the normal way and Pro Tools will help you match up the stem formats in use.

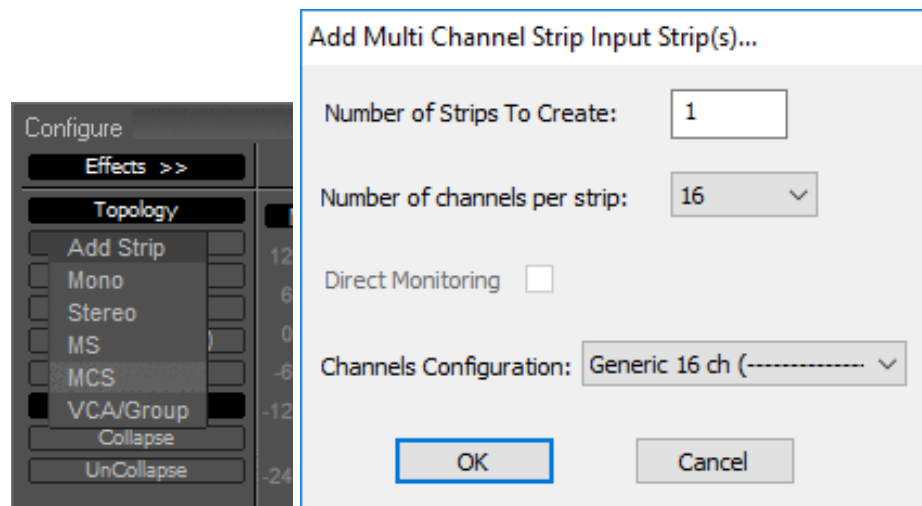
2.5 Getting Started with Pyramix

This section gives an introduction to use of the VST2 version of the O3A plugins with [Pyramix](#). We are assuming you know your way around Pyramix already and have configured it to find the VST plugins. Note that modern Pyramix requires the 64bit version of the plugins.



2.5.1 Setup

O3A streams are most easily handled using Multi Channel Strips (MCS). When creating these, set the channel count to 16 (or even more, e.g. for Hamasaki 22.2).



Custom 16 channel mix busses can also be used.

Create General Mixing Bus

Number of Busses:

Bus Type: Mix Bus Aux Bus Object Bus
 Mix Group Aux Group

Channels Mapping:

Number of Channels:

Room Type: Virtual Sized [m]

Create Cancel

2.5.2 Mixing

Set mix busses to "Router" rather than "Pan" to ensure that the O3A plugins are determining the panning used.

In Pyramix, plugin user interface dials are set to the VST "linear" style, so drag up and down rather than around to change them.

Beyond this, plugins can be used much as you would expect!

2.6 Audio for Virtual Reality 360 Video

The [O3A streams](#) used by these plugins capture a spatial audio scene that can be used for Virtual Reality (VR) playback. Typically, the audio is delivered to the VR device in a raw ambisonic format and is rotated using head tracker data before live decoding. This has the effect of modifying the audio scene to take into account where the user is looking. Because raw ambisonic audio is delivered to the device, final mixes should not generally be decoded in the studio, except for monitoring.

O3A streams contain third order SN3D/ACN (AmbiX), which uses 16 channels. This, or a subset of the channels, is directly compatible with many VR systems.

2.6.1 YouTube 360-Degree Videos

YouTube 360-degree videos can use first order SN3D. To reduce your mix to first order, just take the first four channels of your 16 channel mix, or use [O3A Decoder - O1A](#).

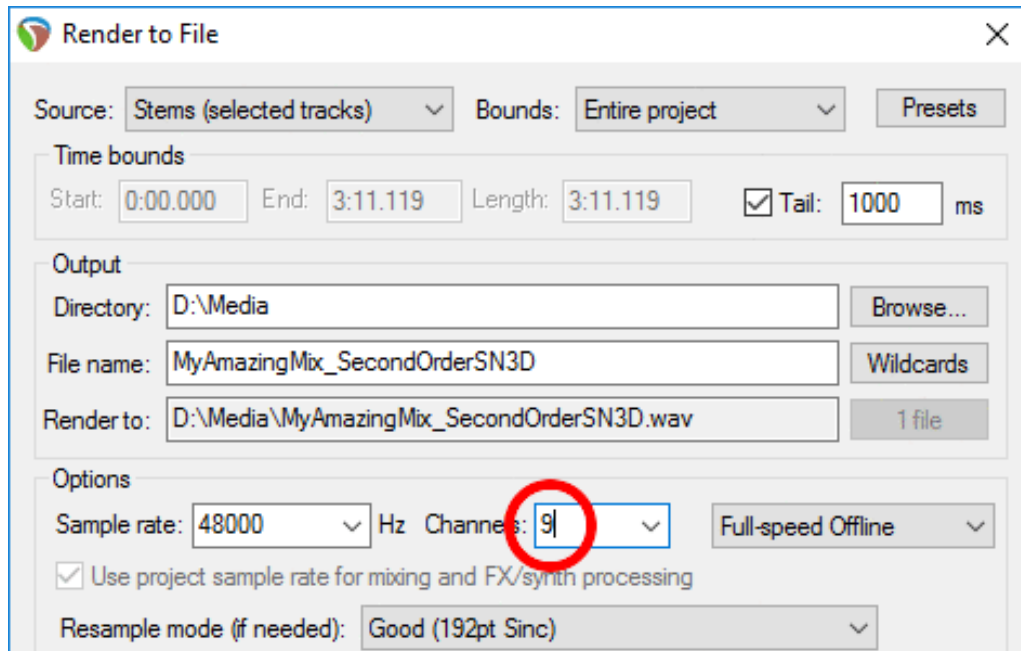
2.6.2 Google Jump Inspector

Google Jump Inspector can use the third order SN3D audio produced by these plugins directly.

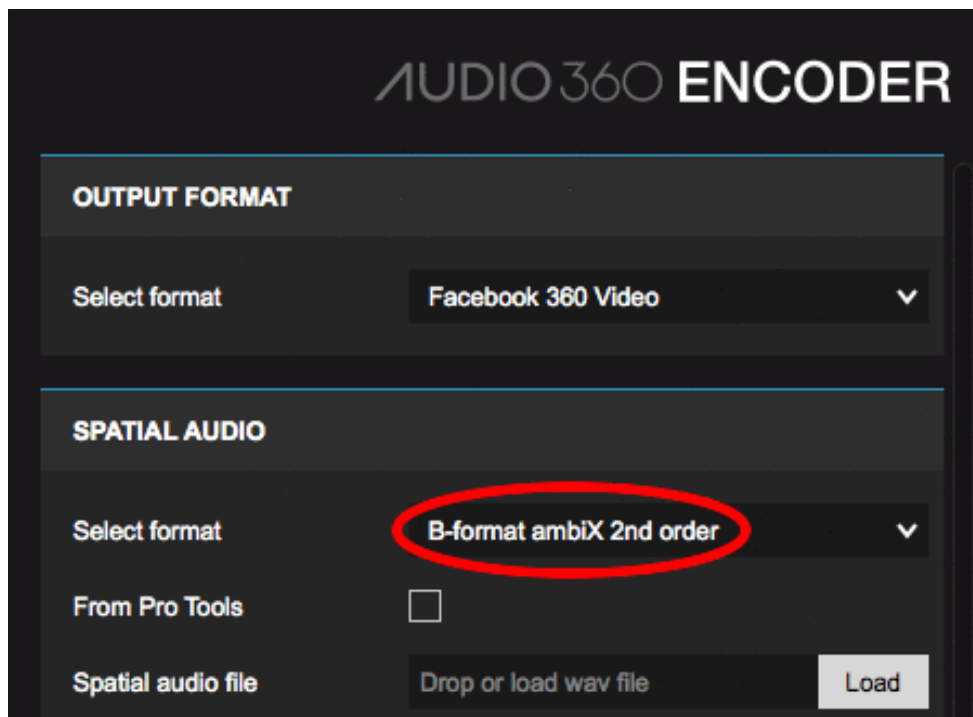
2.6.3 Facebook 360 Video

Facebook 360 videos can use second order SN3D audio, which uses nine channels.

The easiest way to reduce an O3A mix to just nine channels in Reaper is often to set the render channel count to nine by *typing* the number 9 into the Channels box.



Once you have a nine channel second order file, this can be encoded using the Facebook FB360 Encoder (v1.3.0 or later). Select format "B-format ambiX 2nd order".



2.6.4 Rapture3D Universal

The Blue Ripple Sound Rapture3D Universal game/VR engine can render the third order SN3D audio used by these plugins directly.

2.6.5 Quad Binaural

Quad binaural is an alternative system that does *not* use raw ambisonic audio. Instead, four binaural stereo images are used, corresponding to different head orientations (front, left, back and right). These are mixed together live depending on where the user is looking. This system only supports one axis of rotation, unlike ambisonics which supports all three.

Quad binaural is generally delivered as four stereo files. To produce these, we recommend use of the the O3A Decoder - Quad Binaural plugin from the O3A Decoding pack. This will typically give better final results than rotating the O3A stream and using a more conventional binaural decoder to generate the Quad Binaural.

2.7 Spotting A Common Issue

In many DAWs it is easy to forget to set your track or send channel counts to 16 at some point and end up trying to handle O3A as stereo audio. We certainly do this regularly!

This is such a common problem that it is worth taking a moment to look at what then happens, so you can spot the issue more quickly:

- Sound positioning becomes vague.
- Sound movement is only to the left and right, with nothing definite in other directions.
- The O3A Visualiser typically shows a vague left or right image, or just one colour. The left-hand case typically looks something like this:

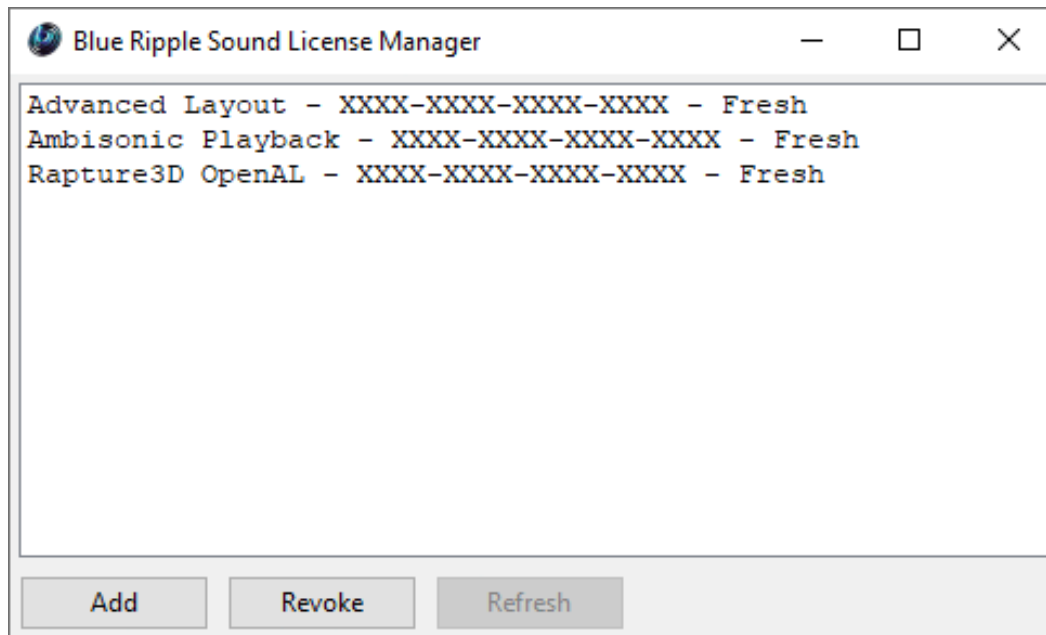


The reason this happens is that O3A needs 16 channels to work properly. If only the first two channels are present, these happen to be the omnidirectional and left-right ambisonic components, like in M/S stereo. These are enough to get an approximate sound level to transmit some basic left/right information, but definitely not the full detail of the soundfield!

So, keep your eyes and ears open and remember that O3A needs 16 channels.

2.8 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.

2.9 Visualisation of Manipulations

Many of the manipulator plugins in this library are applied to an entire O3A mix, or part of it. This can sometimes be confusing. To help understand what is going on, we recommend use of visualisation plugins like [O3A Flare](#) and the [O3A Visualiser](#).

2.10 Split and Join

2.10.1 How to use Split and Join

Two of the plugins in this library, [O3A Spatial Mask Split](#) and [O3A Spotlight Split](#), separate the contents of an O3A mix into two separate O3A mixes depending on sound direction. The two O3A mixes can be recombined using [O3A Join](#).

The output of the Split plugins contains 32 channels. The first 16 are the same as the O3A output of [O3A Spatial Mask](#) (with wet and thru gains set to 0dB and -inf dB) and [O3A Spotlight](#) respectively. The extra channels (17-32) contain a second O3A scene containing everything else, so the whole original scene can be reconstructed by combining the two together. [O3A Join](#) can be used to do this, or you can simply mix everything back together yourself.

These plugins are typically used on a track with 32 channels. For instance, consider the following plugin chain:

- O3A Spotlight Split, splitting the scene into just the front stage (channels 1-16) and everything else (channels 17-32).
- O3A Reflection, swapping sounds on the left and right. This is applied to channels 1-16 *only*.
- O3A Join, recombining everything into one scene.

As the reflection plugin is only applied to the first 16 channels on a 32 channel track, this has the effect of reflecting only sound that was selected into channels 1-16 by the Spotlight plugin. The other channels (17-32) containing the rest of the mix pass through unmodified. The O3A Join plugin recombines the modified mix in channels 1-16 and the unmodified mix in channels 17-32 to put the scene back together as a single 16 channel O3A mix.

Overall, this plugin chain has the effect of swapping sounds on the left and right, but only for sounds in the front stage. Sounds not in the front stage remain where they were. Many other effects can be applied to just a part of a scene in a similar way.

Split and Join plugins need to be placed on tracks and busses with at least 32 channels. Consequently, Split and Join are not available in the AAX version of the plugins. However, similar results can be obtained using pairs of the O3A Spatial Mask or O3A Spotlight plugins and their "flip" features. Scenes can be recombined using normal mixing.

2.10.2 Warning: Phase

As the two separated O3A mixes may be processed differently, it is possible that they may be delayed, or otherwise have their phase modified. If phases do not match when the mixes are joined back together you may encounter significant phasing, filtering or spatial errors.

To avoid this, ensure the separate signal paths have any necessary delay compensation (some DAWs will do this for you automatically) and ensure any filters used are linear phase, or are phase-matched across the two mixes. In practice, you can just try your signal chain and listen for problems. But please listen carefully!

2.11 Technical Requirements

2.11.1 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.

2.11.2 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 O3A 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 O3A plugins need at least 16 channels on each track, and some need more. Also, at the time of writing VST 2 shell plugins are not supported in Nuendo or Cubase.

2.11.3 AAX Host

The AAX plugins require Pro Tools Ultimate or Studio.

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

2.11.4 PC Hardware

Please check your PC meets the following requirements:

- Intel Core i5 CPU or better, or Apple Silicon.
- 200MB of free disk space.

2.11.5 Permissions

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

2.11.6 Internet Connection Required

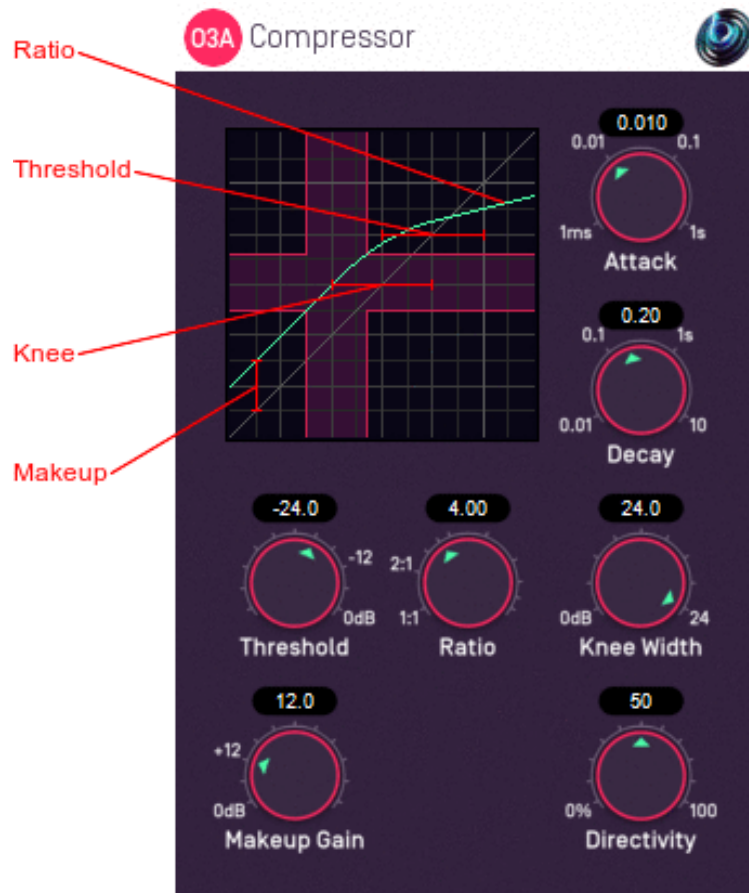
This software requires an Internet Connection for license activation and verification.

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.

3 O3A Manipulators - Soundfield Modification

3.1 O3A Compressor



3.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.1.3 Controls

- Threshold
- Ratio
- Knee Width
- Makeup Gain
- Attack
- Decay
- Directivity

3.1.4 Description

This plugin applies compression to an O3A stream. This has the effect of decreasing the dynamic range of the stream without substantially disrupting spatial placement.

The main difference between this and conventional compressors is its spatial processing. A **directivity** control allows the compression to be applied consistently over the entire sound scene, or independently in different directions; or somewhere in between.

3.1.4.1 The Graph

The graph at the top left of the panel shows the compressor response curve, plotting the input level along the horizontal axis and the output level along the vertical axis. Grid lines are shown at 6 decibel intervals.

The current ranges of input and output levels are also shown in real-time, in blue. These ignore the current attack and decay settings.

3.1.5 Controls

3.1.5.1 Control: Threshold

Assuming the knee width control is set to zero, the threshold is the level (in decibels) above which compression applies. Quieter signals are not affected.

When the knee is not set to zero, the transition through the threshold is not abrupt, but is instead smoothed out. The threshold then determines the centre of the transition interval.

The threshold can be seen in the graph provided as the point around which the slope of the response curve changes.

3.1.5.2 Control: Ratio

The ratio determines how much compression is applied to the signal when its level is above the threshold (and close to it when a soft knee is in use).

The ratio determines the inverse slope of the output level versus the input level, once above the threshold (and knee), when plotted in decibels. It can be seen in the graph provided as the slope of the response curve on the right hand side.

3.1.5.3 Control: Knee Width

When the knee width is set to zero, signals quieter than the threshold are not compressed and signals above the threshold are. This can be a fairly abrupt transition in some circumstances and is known as a "hard knee".

Setting the knee width to a non-zero values changes this behaviour, arranging for the output level to change smoothly over an interval. This is known as a "soft knee".

The knee width is measured in decibels and its centre is determined by the threshold. It can be seen in the graph provided as the interval over which the response curve transitions from one slope to another.

3.1.5.4 Control: Makeup Gain

This "makeup" gain amplifies the output of the compressor. It can be seen in the graph provided as an upwards shift in the response curve. It is typically used to make up for the reduction in level that results from compression.

3.1.5.5 Controls: Attack and Decay

The attack determines how quickly the effect responds to an increase in sound level by decreasing its gain and the decay determines how quickly the effect relaxes again when the sound level drops.

The values are defined as the time it takes the gain to move by 10 decibels.

3.1.5.6 Control: Directivity

Previous controls will be familiar to those who have worked with conventional compressors before. However, the O3A Compressor affects an entire sound scene.

A directivity value of zero means that sounds in all directions are compressed using the same gain. For instance, if a mix consists of a drum track and strings in different directions, a loud event in the drum track may result in the compressor kicking in, bringing down the entire mix level (including the strings). This can be thought of as equivalent to "Stereo Linking" in a conventional stereo compressor.

Increasing the directivity means that sounds in different directions are compressed more independently. In the example above, this means that the loud event in the drum track would affect the strings less.

3.2 O3A Diffuser



3.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.2.3 Controls

- Diffusion
- Spread

3.2.4 Description

This plugin takes a 3D O3A mix and "smudges" it slightly in time and space. This can be quite a subtle effect similar to that of an all-pass filter, but has a quite wide variety of uses.

For instance, you can use it to add some spatial detail to an omnidirectional O3A mix, which provides a useful way to place a mono sound into space without giving it a definite direction. To do this, ensure that the mono sound is in the first channel of the input to this plugin and that the other inputs are silent.

You can also use this plugin to smudge a panned source that otherwise might be too sharp spatially, or to "soften" the transients in a complete 3D O3A mix.

3.2.5 Controls

3.2.5.1 Control: Diffusion

The diffusion value controls how much the mix is smudged in time. This softens transients slightly.

The effect is analogous to that produced by the feedback gain control in an all-pass filter, but the smudging varies slightly in different spatial directions, so omnidirectional sounds become diffuse.

3.2.5.2 Control: Spread

The spread value controls how much the mix is smudged in space.

Some spatial spreading occurs with a zero value, but when the value increases the spread increases. For non-zero spreads, the diffusion value also increases the amount of spread.

3.3 O3A Low/High Pass Filter



3.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.3.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.3.3 Controls

- Slope
- Cutoff

3.3.4 Description

This plugin applies a simple low-pass or high-pass Butterworth filter to all sound in a 3D O3A soundfield.

3.3.5 Controls

3.3.5.1 Control: Slope

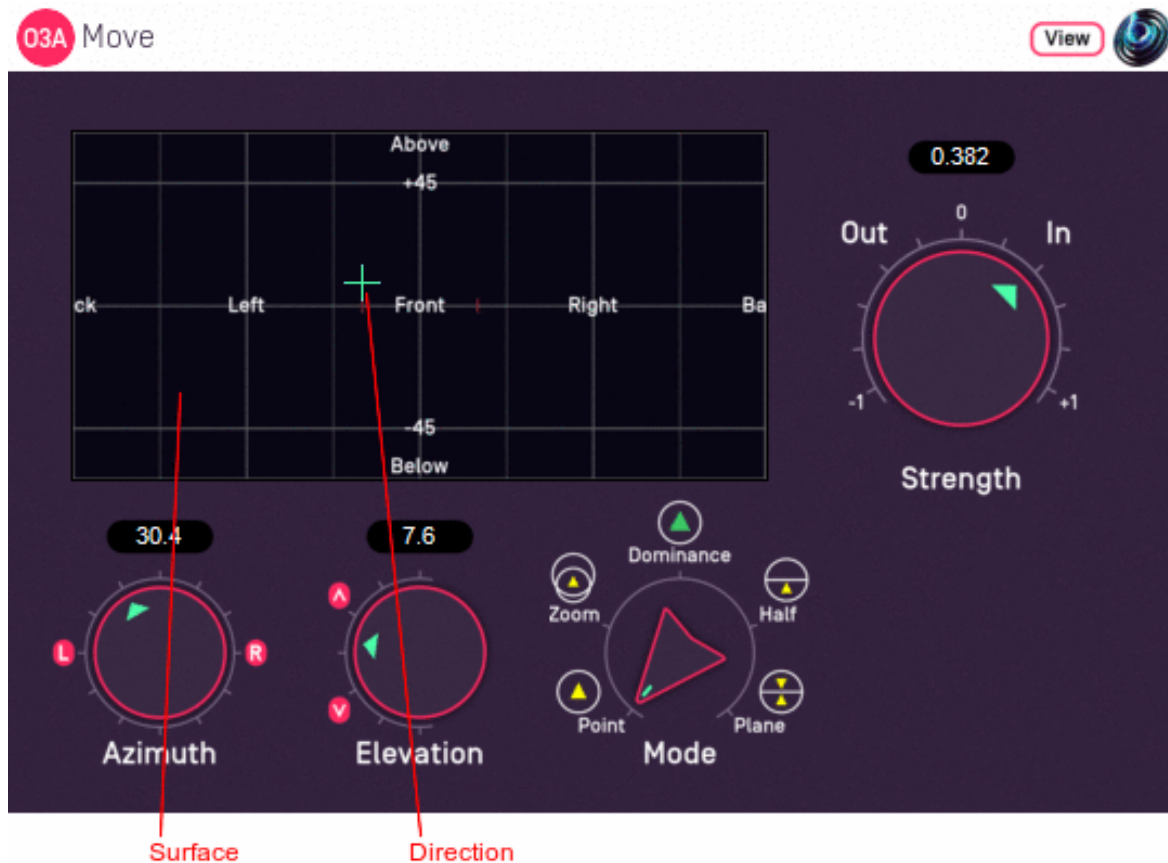
The slope control switches between different filter configurations. Low-pass and high-pass filters with different rolloff slopes are available in -6dB/octave steps down to -48dB/octave. The control can also be set "Off" in which case audio is passed through without filtering.

Changing this control switches the internal filter configuration and will not generally result in smooth transitions (i.e. you may hear clicks or pops).

3.3.5.2 Control: Cutoff

The cutoff control changes the filter's -3dB cutoff frequency. The control has a range from 1Hz to 200kHz. The cutoff frequency actually used is limited just below the Nyquist frequency.

3.4 O3A Move



3.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.4.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.4.3 Controls

- Azimuth
- Elevation
- Mode
- Strength

3.4.4 Description

This plugin modifies a 3D O3A mix by moving sounds from some directions to others.

Sounds can be moved towards or away from a particular reference direction, which is set using the azimuth and elevation controls, or the control surface, which can also be used to visualise the current direction. The current direction (indicated by the crosshairs) can also be changed by clicking

on the surface with the mouse.

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 [O3A Visualiser](#) which lays out its viewing region in the same way.

For instance, this effect can be used to move the whole soundfield smoothly towards a single point and then expand it back out into full 3D. In addition to moving the soundfield towards a point, other movement modes can be used. The available modes are:

- Point - moves sounds towards or away from a point.
- Zoom - performs a change of perspective.
- Dominance - an O3A equivalent to "classic" dominance.
- Half - moves sounds in half of the scene towards a plane.
- Plane - moves all sounds towards or away from a plane.

3.4.4.1 "Point" Mode

In "Point" mode positive strength values move sounds smoothly towards the selected direction. Negative values move sounds away.

3.4.4.2 "Zoom" Mode

In "Zoom" mode, positive strength values move sounds smoothly towards the selected direction, as with "Point" mode. However, significant levels changes are also made, to help give the overall impression that the entire sound scene is being moved forwards (positive strength) or backwards (negative strength).

In this mode, strength values between -0.5 and +0.5 indicate that the scene remains around the listener, so for many uses it is best to stay in that range. Beyond that, the scene begins to disappear into the distance.

This plugin does not change the time alignment of sounds.

If you are particularly interested in this mode as a way to change the scene perspective, you may also want to try the [O3A Zoom](#) plugin which is based around the same algorithm but has additional controls.

3.4.4.3 "Dominance" Mode

"Dominance" mode is similar to the "Point" and "Zoom" modes in that positive strength values move sounds towards the selected direction and negative values move them away. Like "Zoom", dominance changes the level of sounds significantly, but in a different way.

From a technical perspective, this mode is based on "classic" first order dominance and in fact, if only first order components are considered, it is the same. It is included primarily for those who are familiar with dominance from work with first order ambisonics and wish to use an equivalent at higher orders.

3.4.4.4 "Half" Mode

In "Half" mode, sounds on one side of a plane through the centre of the room are moved towards the plane, so half the sounds in the scene are moved to form a gap. The plane is shown using dots on the control surface and is controlled using the azimuth and elevation controls; the reference direction is the "normal" of the plane, i.e. it is at right angles to it.

Sounds that are moved are in the half of the scene *opposite* the reference direction for positive strength settings, or in the same half for negative strength settings. In both cases, movement is towards the plane.

In practice, this mode is normally used with the elevation set to +90, so the plane is the horizontal plane. Positive strength values can then be used to pull sounds in the lower hemisphere up towards the horizontal plane without disrupting the upper hemisphere significantly.

3.4.4.5 "Plane" Mode

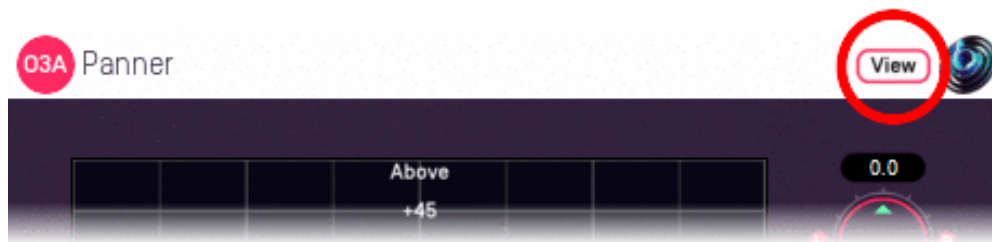
In "Plane" mode, sounds are moved towards or away from a plane through the centre of the room. The plane is shown using dots on the control surface and is controlled using the azimuth and elevation controls; the reference direction is the "normal" of the plane, i.e. it is at right angles to it.

In practice, this mode is normally used with the elevation set to +90, so the plane is the horizontal plane. Positive strength values can then be used to pull upper and lower sounds towards the horizontal plane.

3.4.5 View Support

When used with O3A View Sync from the O3A 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.

3.4.6 Controls

3.4.6.1 Controls: Azimuth and Elevation

These controls move the reference direction used in the movement.

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.

3.4.6.2 Control: Mode

The mode dial selects one of five movement modes. See above for details of the each mode.

3.4.6.3 Control: Strength

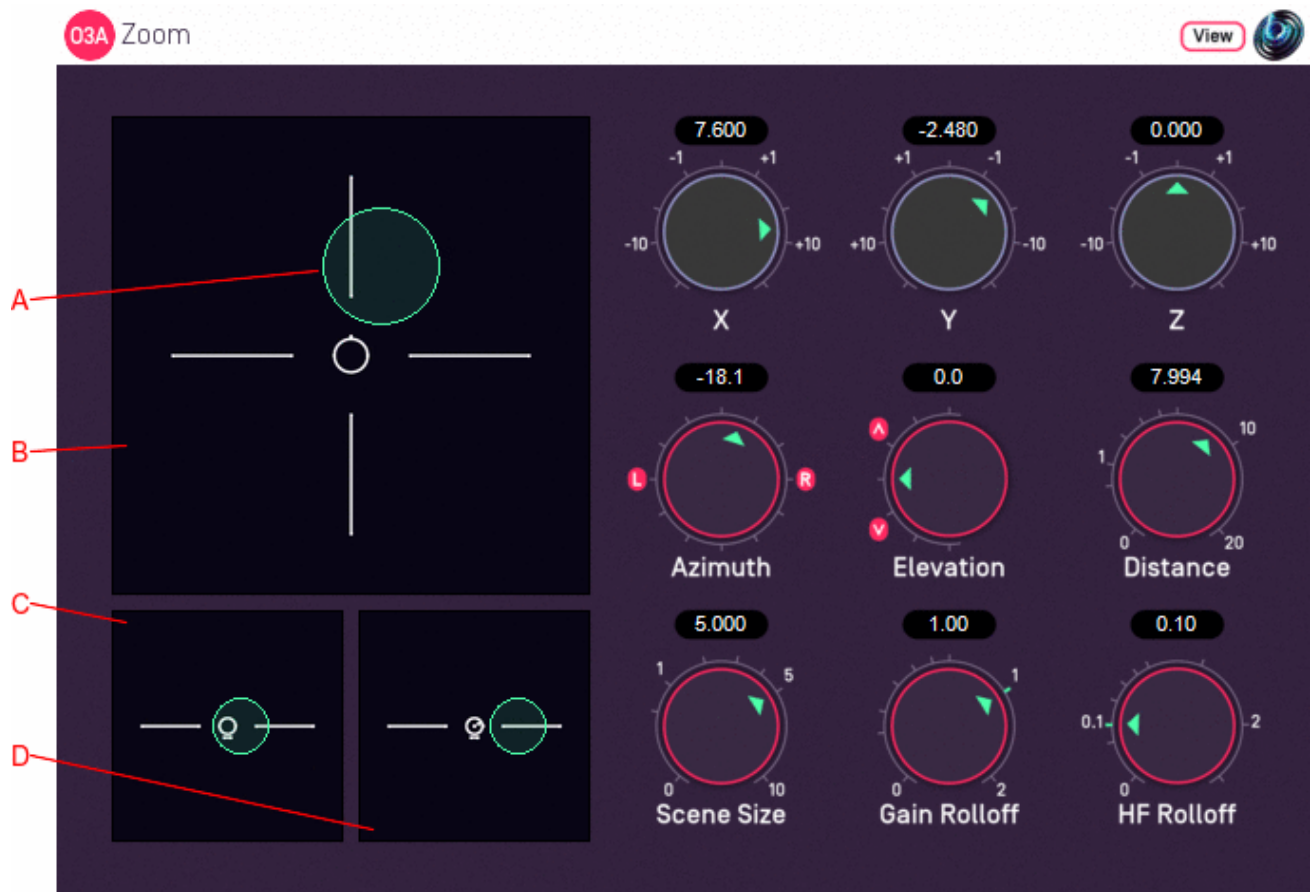
This controls how much movement is applied. A value of 0 indicates that no change is made to the soundfield. A value of +1 or -1 indicates a full strength movement. See above for more details of each movement mode.

3.4.7 Presets

Presets are available for this plugin:

- Pull Towards Front
- Completely To Front
- Remove Height
- Raise Lower Sounds
- Move Front Closer

3.5 O3A Zoom and O3A Zoom XYZ



3.5.1 Host Support

3.5.1.1 O3A Zoom

Host Type	Support
AAX	Yes
VST2	Yes

3.5.1.2 O3A Zoom XYZ

Host Type	Support
AAX	Yes
VST2	Yes

3.5.2 Audio

3.5.2.1 O3A Zoom

	Channels	Content
Input	16	O3A
Output	16	O3A

3.5.2.2 O3A Zoom XYZ

	Channels	Content
Input	16	O3A
Output	16	O3A

3.5.3 Controls

- X
- Y
- Z
- Azimuth
- Elevation
- Distance
- Scene Size
- Gain Rolloff
- HF Rolloff

3.5.4 Description

This manipulator has similar controls to the [O3A Panner LS](#) plugin, but it does *not* pan mono sounds. Instead, its input is an entire O3A sound scene. It uses a change of perspective manipulation to give the impression that the listener or the entire O3A sound scene has moved. For instance, this can be used to move the listener towards a front stage, or move a 3D rainstorm recording in from the distance until we are in the middle of it. You may wish to combine its use with a rotation plugin to give more movement options.

The underlying algorithm used is very similar to the "Zoom" mode of the [O3A Move](#) plugin.

Two versions of the plugin exist. The only difference is the way that the controls are exposed to automation. The reason for this is that the X, Y and Z controls and the Azimuth, Elevation and Distance controls do essentially the same thing (move the sound) and so to avoid confusion, the plugins only expose one set of controls to automation. O3A Zoom exposes Azimuth, Elevation and Distance to automation, whereas O3A Zoom XYZ exposes X, Y and Z. This restriction only applies to automation; all controls are available in the user interface.

There are three control surfaces which can be used to move the scene "A" around. The main surface "B" is a view from above, with the front at the top of the screen. Below it is a view "C" from behind and another "D" from the right.

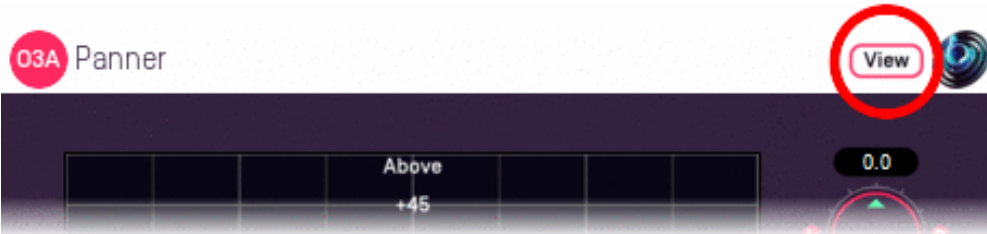
This plugin also has scene size controls and a distance model. The size is visible on the control surfaces. Units are nominally metres, but it is possible to give a sense of larger or smaller distances by changing the scene size and rolloffs.

This plugin does not change the time alignment of sounds.

3.5.5 View Support

When used with O3A View Sync from the O3A 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 3D location is shown as a small scaled sphere, within a scaled cube, which should be in reach of the VR controllers. The unscaled location (potentially out of reach) where the audio is actually located is also shown.
Hold the left mouse button to set the azimuth and elevation.	Hold a VR controller trigger to move the scaled sphere to the controller. The unscaled sphere will move to match.

3.5.6 Controls

3.5.6.1 Controls: X, Y and Z

The coordinates determine where the centre of the scene is in space. Units are nominally metres.

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

These coordinates are not available as automation parameters in O3A Zoom. Instead, they are translated to and from Azimuth, Elevation and Distance, which may be used instead. If you need to automate these controls you should probably use O3A Zoom XYZ instead.

When X, Y and Z are all zero, the scene passes through the plugin unmodified.

3.5.6.2 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction of the scene relative to the centre.

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.

Azimuth, Elevation and Distance are not available as automation parameters in O3A Zoom XYZ. Instead, they are translated to and from X, Y and Z, which may be used instead. If you need to automate these controls you should probably use O3A Zoom instead.

3.5.6.3 Control: Distance

This control indicates how far away the centre of the scene is. Units are nominally metres. When the distance is zero, the scene passes through the plugin unmodified.

Azimuth, Elevation and Distance are not available as automation parameters in O3A Zoom XYZ. Instead, they are translated to and from X, Y and Z, which may be used instead. If you need to automate these controls you should probably use O3A Zoom instead.

3.5.6.4 Control: Scene Size

The scene size is the radius of the "bubble" containing the scene that is being moved. Units are nominally metres. Changing this allows better control of whether the listener is inside or outside the scene.

3.5.6.5 Control: Gain Rolloff

This rolloff determines the rule that is used to reduce the scene's level as it moves away. It is only applied when the listener is outside the scene. 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.

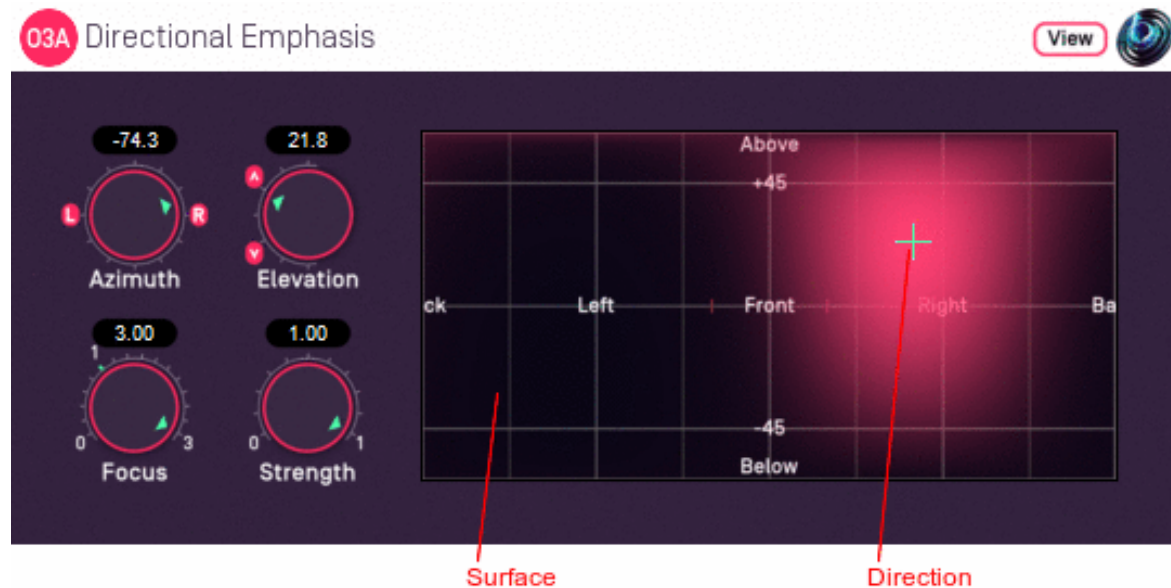
Mathematically, the gain applied is determined by the inverse square law, but raised to a power given by this control.

3.5.6.6 Control: HF Rolloff

This controls a simple low-pass filter that reduces high frequency content as the source moves away. It is only applied when the listener is outside the scene. 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.

3.6 O3A Directional Emphasis



3.6.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.6.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.6.3 Controls

- Azimuth
- Elevation
- Focus
- Strength

3.6.4 Description

This plugin modifies levels in a 3D O3A mix to emphasise sound in a particular direction. It is similar to the [O3A Directional Mask](#) plugin.

The emphasis direction can be set using the azimuth and elevation controls, or the control surface, where the direction is indicated by the 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 [O3A Visualiser](#) which lays out its viewing region in the same way.

The algorithm used is a "passive" one and should not colour the frequency content of the sound significantly.

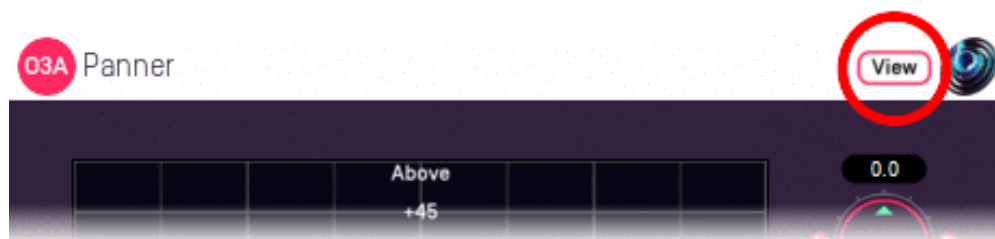
This plugin takes a fairly simple approach, providing control in one direction and just two further control parameters. For more sophisticated manipulations you may want to use the [O3A Spatial Mask](#) plugin.

This plugin has behaviour which is consistent with Rapture3D directional emphasis.

3.6.5 View Support

When used with O3A View Sync from the O3A 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.

3.6.6 Controls

3.6.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to emphasised.

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.

3.6.6.2 Control: Focus

Focus determines the shape of the emphasis, with higher values using a more focussed (narrow) region.

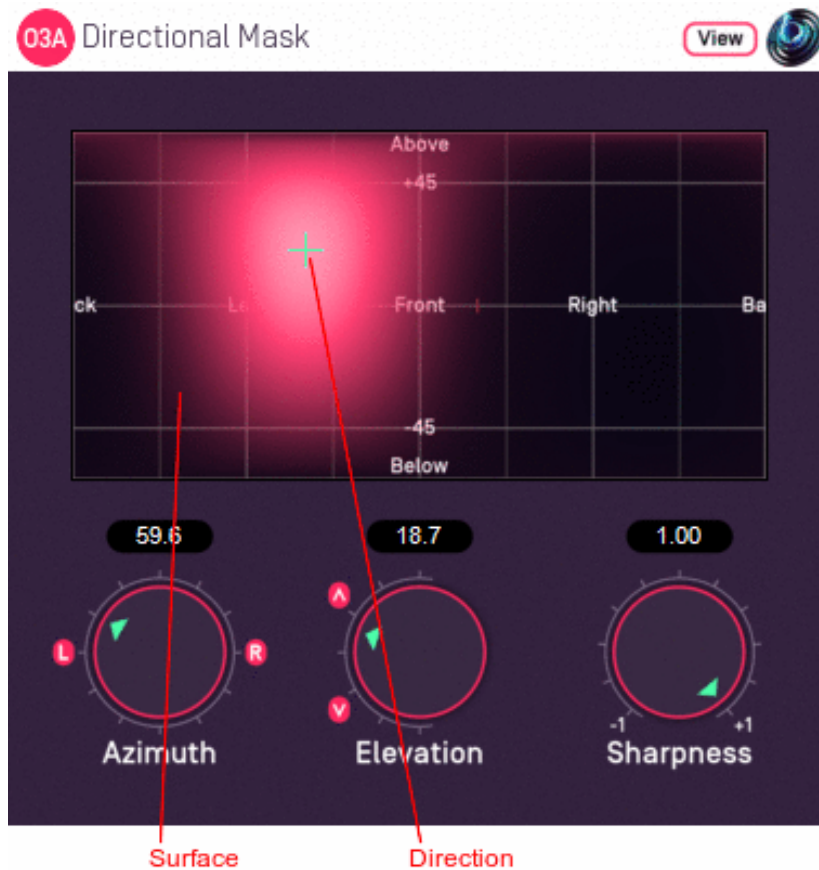
A value of zero means that no modification is made to the stream. The focus value can go up to three, for the most focussed emphasis.

3.6.6.3 Control: Strength

Strength determines how aggressively sounds not in the focussed region are reduced in level.

Strength values are between zero and one, where a value of zero means that no modification is made to the stream and a value of one provides the strongest emphasis.

3.7 O3A Directional Mask



3.7.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.7.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.7.3 Controls

- Azimuth
- Elevation
- Sharpness

3.7.4 Description

This plugin modifies levels in a 3D O3A mix to emphasise or de-emphasise sound in a particular direction. It is similar to the [O3A Directional Emphasis](#) plugin.

The emphasis (or de-emphasis) direction can be set using the azimuth and elevation controls, or the control surface, where the direction is indicated by the crosshairs.

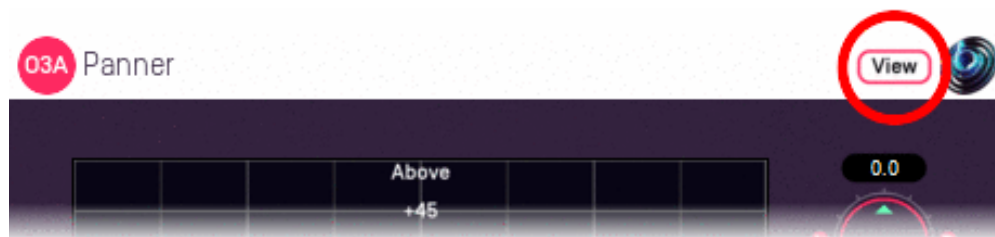
The algorithm used is a "passive" one and should not colour the frequency content of the sound significantly.

This plugin takes a fairly simple approach, providing control in one direction and just one further control parameter. For more sophisticated manipulations you may want to use the [O3A Spatial Mask](#) plugin.

3.7.5 View Support

When used with O3A View Sync from the O3A 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.

3.7.6 Controls

3.7.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to modified.

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.

3.7.6.2 Control: Sharpness

This controls the sharpness and strength of the emphasis or de-emphasis.

A value of zero means that no modification is made to the stream.

Positive values leave sound in the chosen direction as it is but reduce sound elsewhere, so that the direction is emphasised. Values near +1 provide the sharpest emphasis.

Negative values reduce the sound in the chosen direction, so it is de-emphasised.

3.8 O3A Order Amplifier



3.8.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.8.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.8.3 Controls

- [Order 0 - 3 Gains](#)

3.8.4 Description

3.8.4.1 *You probably should not use this plugin!*

This plugin applies a simple amplifier to all channels of the O3A stream. Different gains are applied for the channels introduced at each order. If you do not know what this implies, here is not the place to find out.

We wondered if we should include this plugin at all in the library, because there are rather unnatural things that can be done with it which might sound good on a particular speaker layout and decoder, but horrid on others.

This plugin is not really intended for use as an artistic effect - it is here because you might have a good reason to want to mess with the order levels, probably to do with the source material you are processing. If this is the case, you probably know the gains you want already and this plugin becomes a useful tool, which is why we did include it in the end.

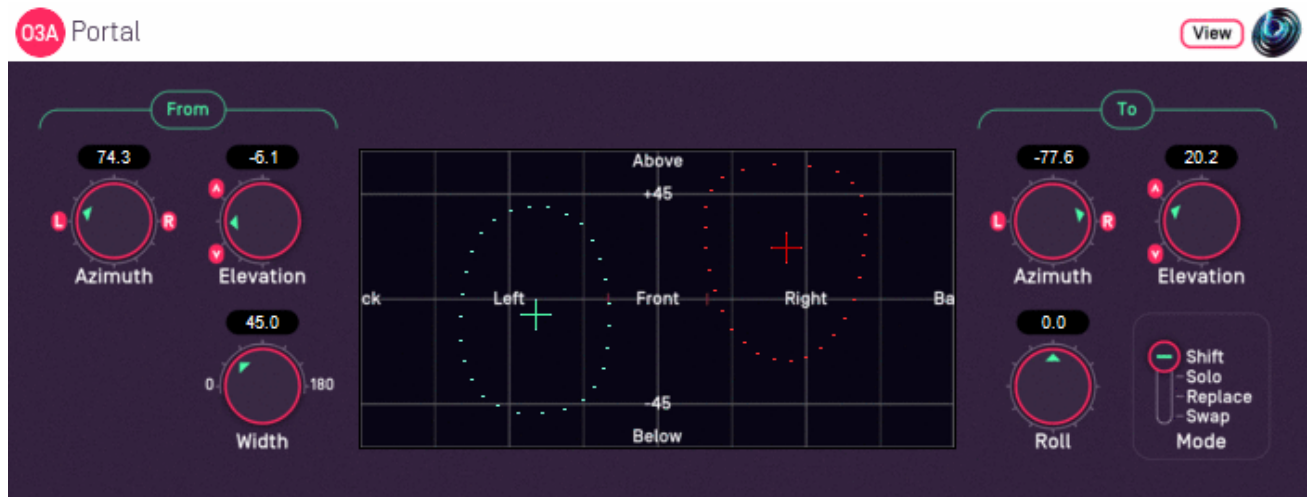
3.8.5 Controls

3.8.5.1 Controls: Order 0 - 3 Gains

This plugin represents gains directly as scalar coefficients, not as decibel values.

The order zero gain is applied to the first channel. The order one gain is applied to channels 2 to 4. The order two gain is applied to channels 5 to 9. The order three gain is applied to channels 10 to 16.

3.9 O3A Portal



3.9.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.9.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.9.3 Controls

- From Azimuth
- From Elevation
- To Azimuth
- To Elevation
- Width
- Roll
- Mode

3.9.4 Description

This plugin shifts a region in an O3A audio scene to another direction in the audio scene. The "from" and "to" directions for this shift are set independently. The angular width of the region to be shifted can be set, and the region can be rotated (rolled) during the shift.

The "from" and "to" directions can be set using the azimuth and elevation controls, or the control surface, where the directions are indicated by the crosshairs. The "from" direction is indicated using green/blue and the "to" direction using red. They can be changed by clicking with the mouse, using the left mouse button for the "from" direction and the right mouse button for "to". If you do not have a right mouse button, or are using a touch screen, you can hold down the 'Alt' key and press the main button instead. You can also move both directions together using the 'Shift' key.

The algorithm used is a "passive" one and should not colour the frequency content of the sound significantly.

3.9.5 View Support

When used with O3A View Sync from the O3A 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 'from' and 'to' directions are shown using green/blue and red crosses, similarly to the plugin display.	The current 'from' and 'to' directions are shown using green/blue and red beams and crosses, similarly to the plugin display.
Point at one and hold the left mouse button to select it. Then, drag to set its azimuth and elevation.	Each VR controller moves a direction and the controllers show short green/blue and red beams to indicate which is which. Hold a VR controller trigger to set an azimuth and elevation.

3.9.6 Controls

3.9.6.1 Controls: From Azimuth and From Elevation

These azimuth and elevation controls determine the direction from which audio should be shifted.

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.

3.9.6.2 Controls: To Azimuth and To Elevation

These azimuth and elevation controls determine the direction to which audio should be shifted.

3.9.6.3 Control: Width

Width is an angle, between 0 and 180 degrees, indicating how large a region of audio should be shifted. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene. Behaviour is similar to that of the [O3A Spotlight](#) plugin.

Angles are measured from the plugin "from" direction to the sound direction. When the angle is less than the width setting, the sound is in the region to be shifted. In practice, the transition out of the shifted region is a gradual slope rather than a hard transition.

3.9.6.4 Control: Roll

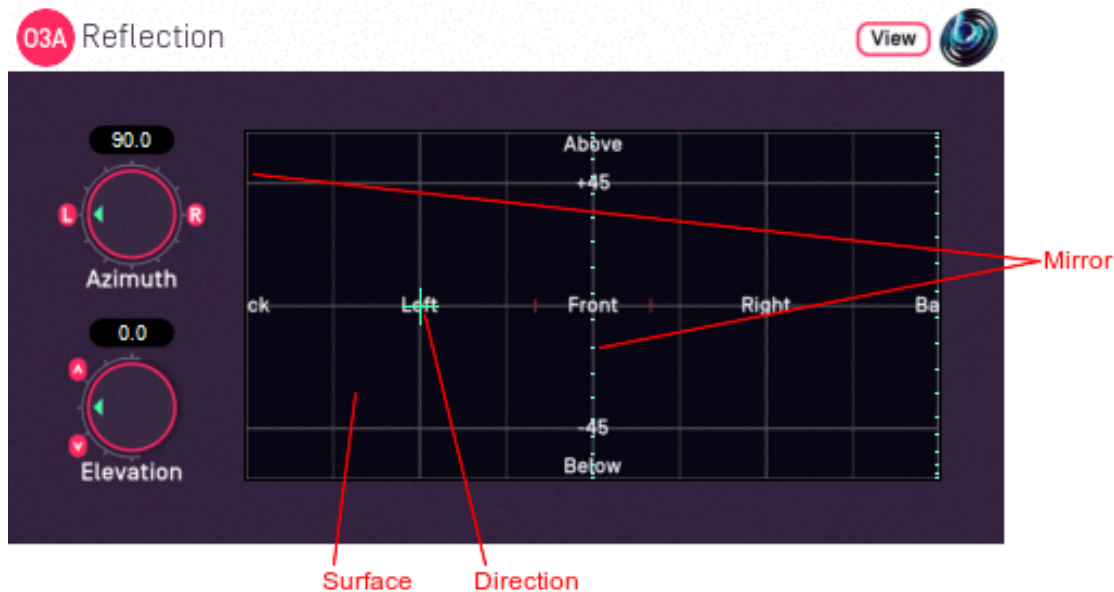
If roll is set to zero, the shifted audio will be oriented so "up" is where it was before shifting. However, this can be changed using this control. The shifted audio can be rotated (rolled) around its central direction using any angle from -180 to +180 degrees, where positive angles are clockwise on the canvas.

3.9.6.5 Control: Mode

Four slightly different modes of operation are supported:

Shift	In this mode, the audio is shifted by removing it from its old direction and adding it back to the new one. This provides a simple way to shift a sound from one place to another, but can leave a gap where the sound was shifted from. This is the default mode.
Solo	In this mode, the audio is shifted by removing it from its old direction and adding it back to the new one. However, all other audio is removed. This is typically used as a way of testing that the correct audio has been selected for shifting.
Replace	In this mode, the audio is shifted by removing it from its old direction and replacing the audio at the new direction. This leaves a gap where the sound was shifted from and reduces sound energy where sounds are overwritten. This mode can be useful when the mix contains unwanted sounds.
Swap	In this mode, the audio is shifted by removing it from its old direction and swapping it for the audio at the new direction. This does not create a gap in the scene. Audio swapped back is reflected to help maintain audio content when regions overlap.

3.10 O3A Reflection



3.10.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.10.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.10.3 Controls

- Azimuth
- Elevation

3.10.4 Description

This plugin reflects the entire O3A soundfield in a "mirror" plane through the centre of the room. For instance, it can swap sounds on the left with those on the right.

Azimuth and elevation controls are provided to control the direction in which the mirror plane is placed. For instance, setting the azimuth to +90 and the elevation to +0 points sets the direction to the left. This mirror will transfer sounds on the right over to the left and vice versa. Similarly, setting the direction to the front transfers sounds at the front to the back and vice versa. Technically, this direction is the "normal" to the plane.

The direction can be set using the azimuth and elevation controls, or the control surface. The mirror plane is indicated on the surface by a dotted line and the direction by crosshairs, which can be changed by clicking with the mouse.

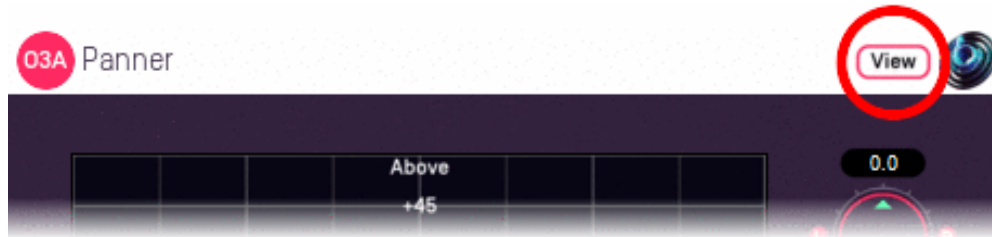
There are labels on the control surface to help you find left, right, above etc. However, if this still does not make any sense, you might want to see our page on the [O3A Visualiser](#) which lays out its

viewing region in the same way.

3.10.5 View Support

When used with O3A View Sync from the O3A 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.

3.10.6 Controls

3.10.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction towards the mirror plane.

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.

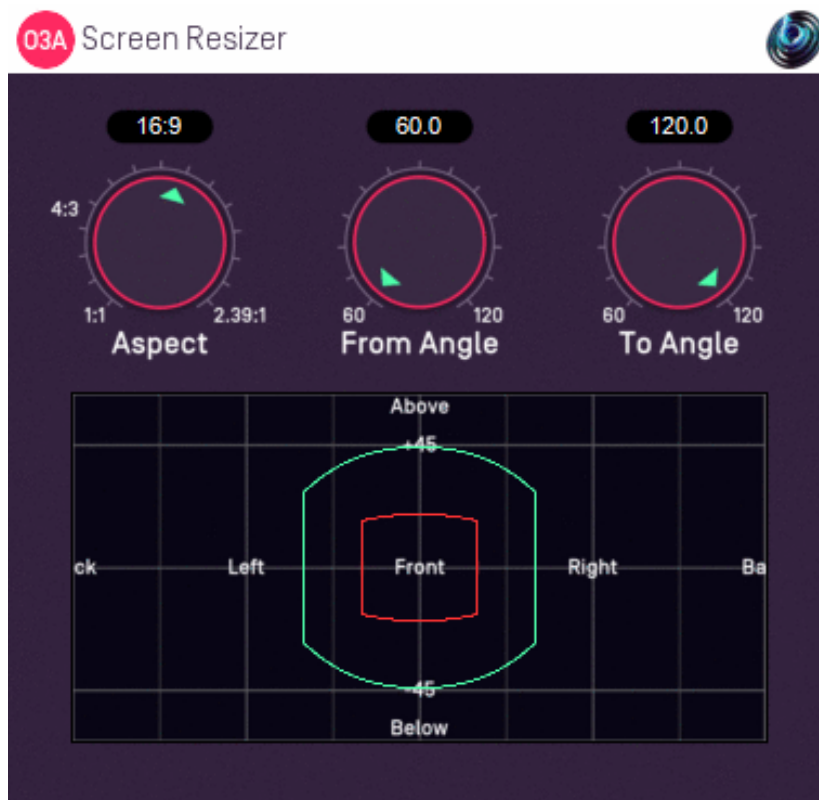
For instance, the direction for azimuth +90 and elevation +45 can be found by turning 90 degrees to the left and then looking up by 45 degrees.

3.10.7 Presets

Presets are available for this plugin:

- Left - Right
- Front - Back
- Up - Down

3.11 O3A Screen Resizer



3.11.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.11.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.11.3 Controls

- [Aspect](#)
- [From Angle](#)
- [To Angle](#)

3.11.4 Description

This plugin modifies a 3D O3A mix by moving sounds from some directions to others. It is designed for use with 3D mixes which match a film image. The plugin moves sounds to compensate for a change in the screen size on which the film is to be presented, moving on-screen sounds to keep them in the same position relative to the image.

This plugin produces a very specific movement. Other movements are available in the [O3A Move](#) plugin.

The screen is assumed to be in front of the audience. Sounds outside the screen but in front of the audience are stretched or expanded to make up the remaining space around the new screen.

The original screen size is shown in a display in red and the new screen size in green/blue. The screen is assumed to be flat; if it seems surprising that the upper and lower edge of the screen as shown on the display are curved, consider the elevation of the top centre and top left points on the screen (the top left point is further away).

3.11.5 Controls

3.11.5.1 Control: Aspect

This is the aspect ratio of the screen (for instance, 4:3, 16:9 or 2.39:1). This is the ratio of the width to the height of the image.

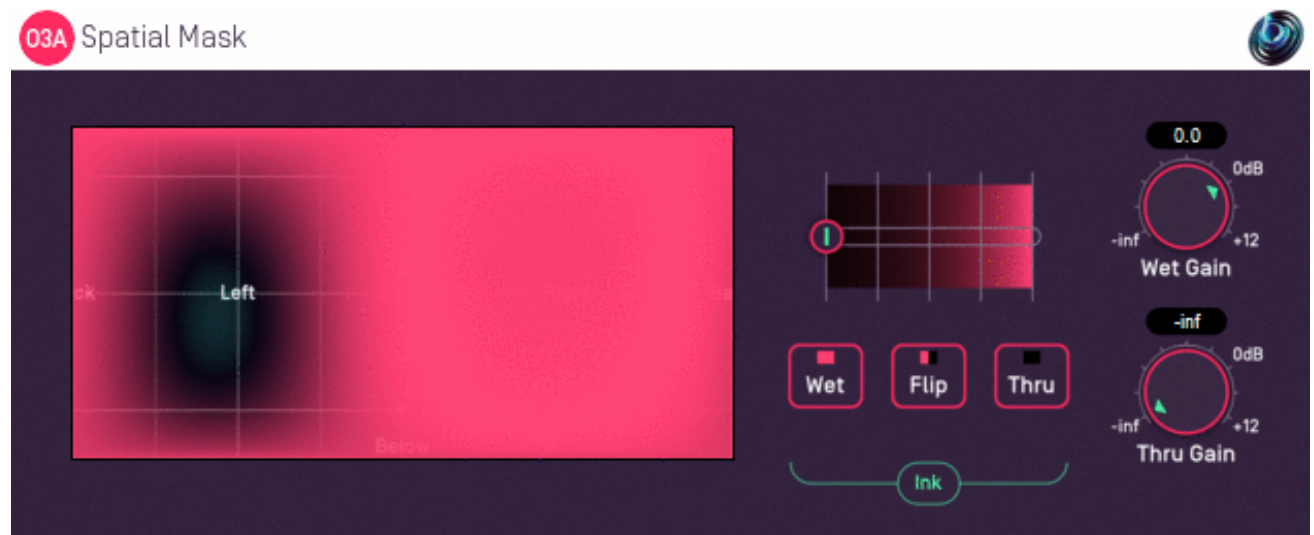
3.11.5.2 Control: From Angle

This is the original angular width of the screen, measured in degrees. This is visible in the display as the width of the red image.

3.11.5.3 Control: To Angle

This is the new angular width of the screen, measured in degrees. This is visible in the display as the width of the green/blue image.

3.12 O3A Spatial Mask



3.12.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.12.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.12.3 Controls

- Ink Control
- Thru Button
- Wet Button
- Flip Button
- Wet Gain
- Thru Gain
- ACN00 - ACN15 Elements

3.12.4 Description

This plugin modifies a 3D O3A mix by changing the level of sound in different directions. For instance, you can use this to lower the level of a cough from an audience. A canvas is shown on the left which can be "painted" on to control the directions that will be changed. The canvas is set out in the same way as in the [O3A Visualiser](#).

Sounds in different directions are separated out into two spatial channels, the "Thru" channel and the "Wet" channel. These names may seem wrong, but they should make more sense if you are familiar with the [O3A Spatial Equalizer](#) plugin.

An ink control determines how the canvas is changed when it is clicked/drawn on. Dark ink means that sound in a particular direction should be sent to the "Thru" channel and light ink means to the "Wet". Ink in between indicates that an intermediate amount is sent to each of the two different

channels. A gain is applied to each of the Thru and Wet channels, controlled by the dials, and then the results are brought back together.

This means that sound directions painted dark are affected by the Thru gain and sound directions painted light are affected by the Wet gain. Colours in between are a mix.

The algorithm used is a "passive" one and should not colour the frequency content of the sound significantly.

3.12.4.1 That was all a bit confusing...

An earlier version of the plugin did not have the Thru and Wet dials and these are normally the source of confusion. If you just leave them so Thru is set to "-inf" and Wet to "0.0", then the panel on the left can be used simply to paint the sounds you want to keep. Light to keep, dark for silent, or somewhere in between.

You might like to set up two [O3A Visualiser](#) plugins, one before and one after this effect. If you set up the Thru and Wet gains in this way, you will see that sounds disappear from the visualisation of the output when they are painted dark and are unchanged when they are light.

The dials then come in useful if e.g. you want to fade between the shape you have drawn and an unmodified stream. For instance, you can paint the canvas in a way which roughly isolates a singer. (You can use the "flip" button to check that you are flipping between the singer on their own and "everything else".) Once you have done this, you can bring the Thru gain up to "0.0" so everything else is unmodified and use the Wet gain control to control the singer's level.

If you just want to emphasise or isolate a particular direction, you also might want to try the much simpler [O3A Directional Emphasis](#) or [O3A Directional Mask](#) plugins. On the other hand, if you want more control, you may want to try the [O3A Spatial Equalizer](#).

3.12.4.2 Automation

Most of this plugin *can* be automated. Pressing the buttons or drawing on the canvas are converted into changes in the [internal ACN elements](#), so you can record these changes and play them back to reproduce canvas paint changes.

To put this another way, the ink control, brush and thru/wet/flip buttons are not accessible via automation, but the changes they make to the canvas are.

3.12.5 Controls

3.12.5.1 Control: Ink Control

The first horizontal slider selects the colour of the "ink" that will be used when the panel is painted on. The grey tick marks are 6dB points.

3.12.5.2 Control: Thru Button

This instantly paints the entire canvas dark ("Thru"). This means that all sound directions are then affected by the [Thru Gain](#) dial only.

3.12.5.3 Control: Wet Button

This instantly paints the entire canvas light ("Wet"). This means that all sound directions are then affected by the [Wet Gain](#) dial only.

3.12.5.4 Control: Flip Button

This instantly converts the parts of the canvas that were light to dark and the parts that were dark to light and so on. This has the effect of converting all sound direction contributions that were Thru to Wet and vice versa.

3.12.5.5 Control: Wet Gain

This sets the gain applied to sound directions that are painted as "Wet" (light).

By default this is set to "0.0" (unit gain). This means that light ink on the canvas indicates that sounds should be let through the plugin unmodified.

3.12.5.6 Control: Thru Gain

This sets the gain applied to sound directions that are painted as "Thru" (dark).

By default this is set to "-inf" (silent). This means that dark ink on the canvas indicates that sounds should be made silent, but you can bring up and modify the level of those sounds with this dial if you want.

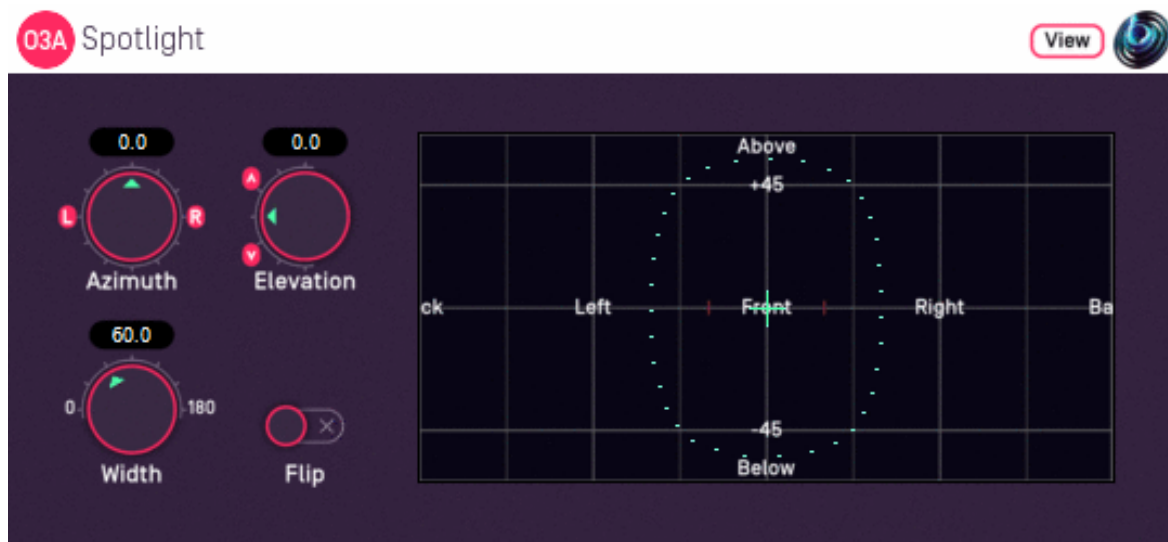
3.12.5.7 Controls: ACN00 - ACN15 Elements

These controls are not shown on screen as numbers but are available for automation. They capture an internal representation of what is on the canvas and they can be used to automate the canvas. If you are recording them, make sure you record them all together!

We recommend that you do not attempt to interpret these numbers. However, it may be worth knowing that fading them together (linearly) will result in a natural (linear) fade of the canvas image.

Technically, these elements contain a spherical harmonic decomposition of the gain function, defined as a function mapping the surface of the unit sphere to values broadly between 0 and 1, where the spherical harmonics are encoded using the SN3D convention.

3.13 O3A Spotlight



3.13.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.13.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.13.3 Controls

- Azimuth
- Elevation
- Width
- Flip

3.13.4 Description

This plugin can be imagined as a spotlight being applied to a direction in an O3A audio scene. Lit parts of the scene are kept and unlit parts are removed. The width of the spotlight beam can be controlled.

This plugin has features in common with the [O3A Directional Emphasis](#) and [O3A Directional Mask](#) plugins, but aims for a cleaner transition between its lit and unlit regions. Typically, this makes it more suitable for isolating sounds in a particular region.

The spotlight direction can be set using the azimuth and elevation controls, or the control surface, where the direction is indicated by the crosshairs.

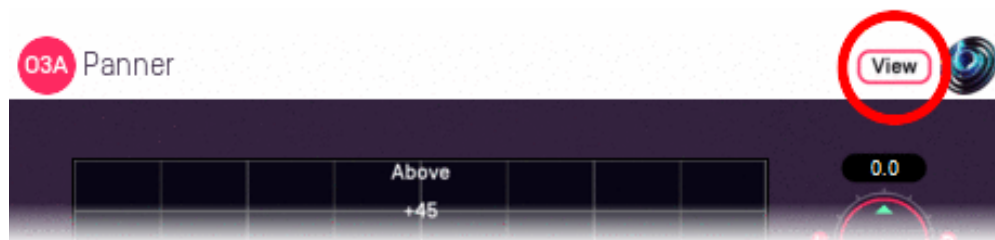
There are labels on the control surface to help you find left, right, above etc. However, if this still does not make any sense, you might want to see our page on the [O3A Visualiser](#) which lays out its viewing region in the same way.

The algorithm used is a "passive" one and should not colour the frequency content of the sound significantly.

3.13.5 View Support

When used with O3A View Sync from the O3A 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.

3.13.6 Controls

3.13.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to be isolated.

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.

3.13.6.2 Control: Width

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

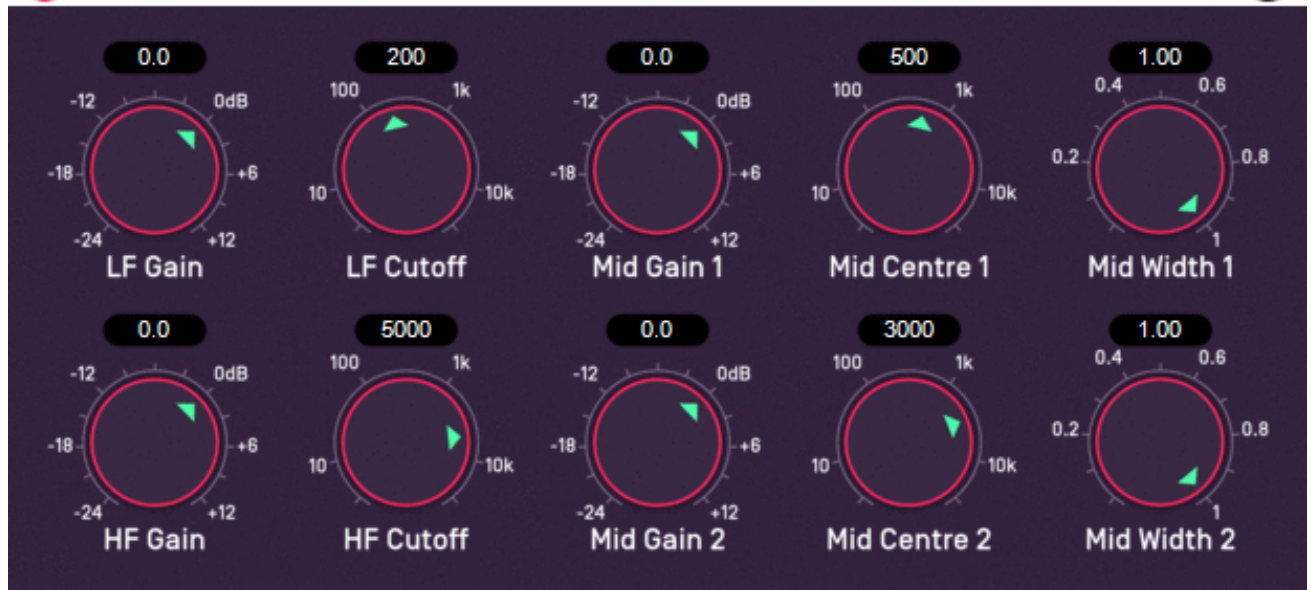
Angles are measured from the spotlight direction to the sound direction. When the angle is less than the width setting, the sound is in the lit region and should be kept. Other sounds are in the unlit region and should be attenuated. In practice, the transition from the lit to unlit region is a gradual slope rather than a hard transition.

3.13.6.3 Control: Flip

Enabling this switch flips the meaning of the lit and unlit regions.

3.14 O3A Parametric Equalizer

O3A Parametric Equalizer



3.14.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.14.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.14.3 Controls

- LF Gain
- LF Cutoff
- Mid Gain 1
- Mid Centre 1
- Mid Width 1
- Mid Gain 2
- Mid Centre 2
- Mid Width 2
- HF Gain
- HF Cutoff

3.14.4 Description

This plugin is a fairly conventional parametric equalizer that is applied equally to all sound in the O3A 3D soundfield. It is not particularly special except that it can be applied easily to all the O3A channels at once.

You can do this yourself with any linear equalizer by applying it equally to all O3A channels. But be careful to apply it to *all* the channels. And *identically* to them all.

You may also be interested in the [O3A Graphic Equalizer](#) and [O3A Spatial Equalizer](#).

3.14.5 Controls

3.14.5.1 Controls: LF Cutoff and LF Gain

These two parameters control a low frequency shelf filter which can be used to boost or cut audio below a particular cutoff frequency.

3.14.5.2 Controls: Mid Centre 1, Mid Gain 1 and Mid Width 1

These three parameters control a parametric filter that can be used to boost or cut audio around a particular frequency. The centre frequency can be moved and the width changed.

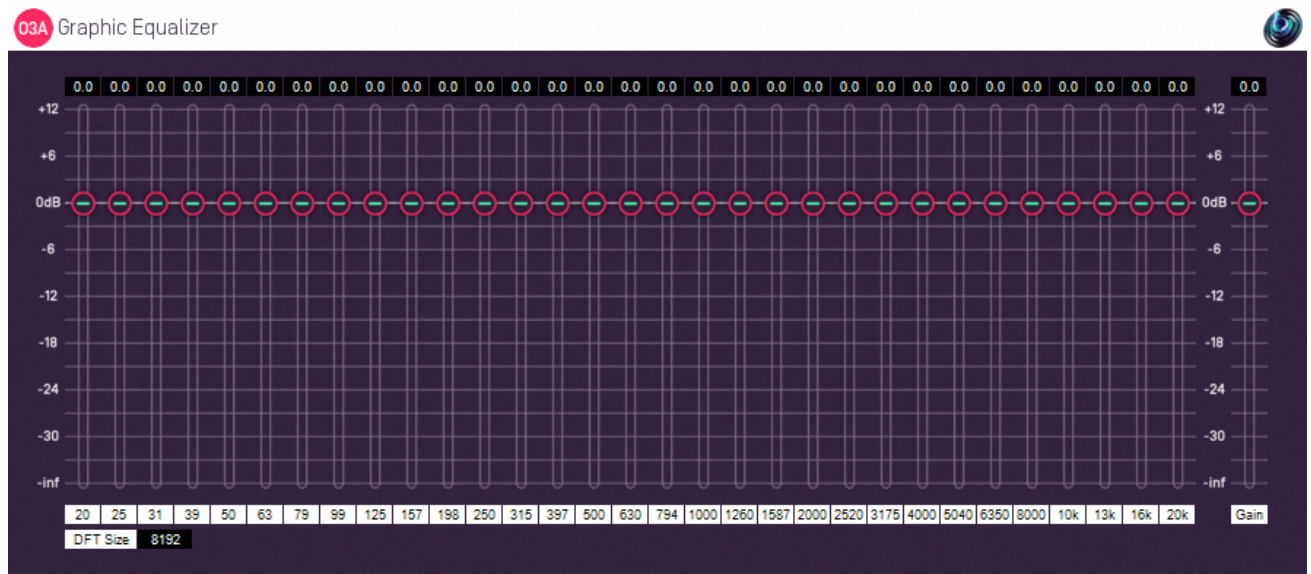
3.14.5.3 Controls: Mid Centre 2, Mid Gain 2 and Mid Width 2

These control a second parametric filter.

3.14.5.4 Controls: HF Cutoff and HF Gain

These two parameters control a high frequency shelf filter which can be used to boost or cut audio above a particular cutoff frequency.

3.15 O3A Graphic Equalizer



3.15.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.15.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.15.3 Controls

- 20Hz - 20kHz Band Gains
- Gain
- DFT Size

3.15.4 Description

This plugin is a 31-band third-of-octave graphic equalizer. It is applied equally to all sound in the O3A 3D soundfield.

The algorithm is implemented in the frequency domain. It has a significant latency, which hopefully your DAW will compensate for. It is linear-phase.

You may also be interested in the simpler [O3A Parametric Equalizer](#) and the more complex [O3A Spatial Equalizer](#).

3.15.5 Controls

3.15.5.1 Controls: 20Hz - 20kHz Band Gains

These controls affect the frequency content of the soundfield at the frequency selected.

If the [DFT size](#) is low, some of the frequency bands are ganged together.

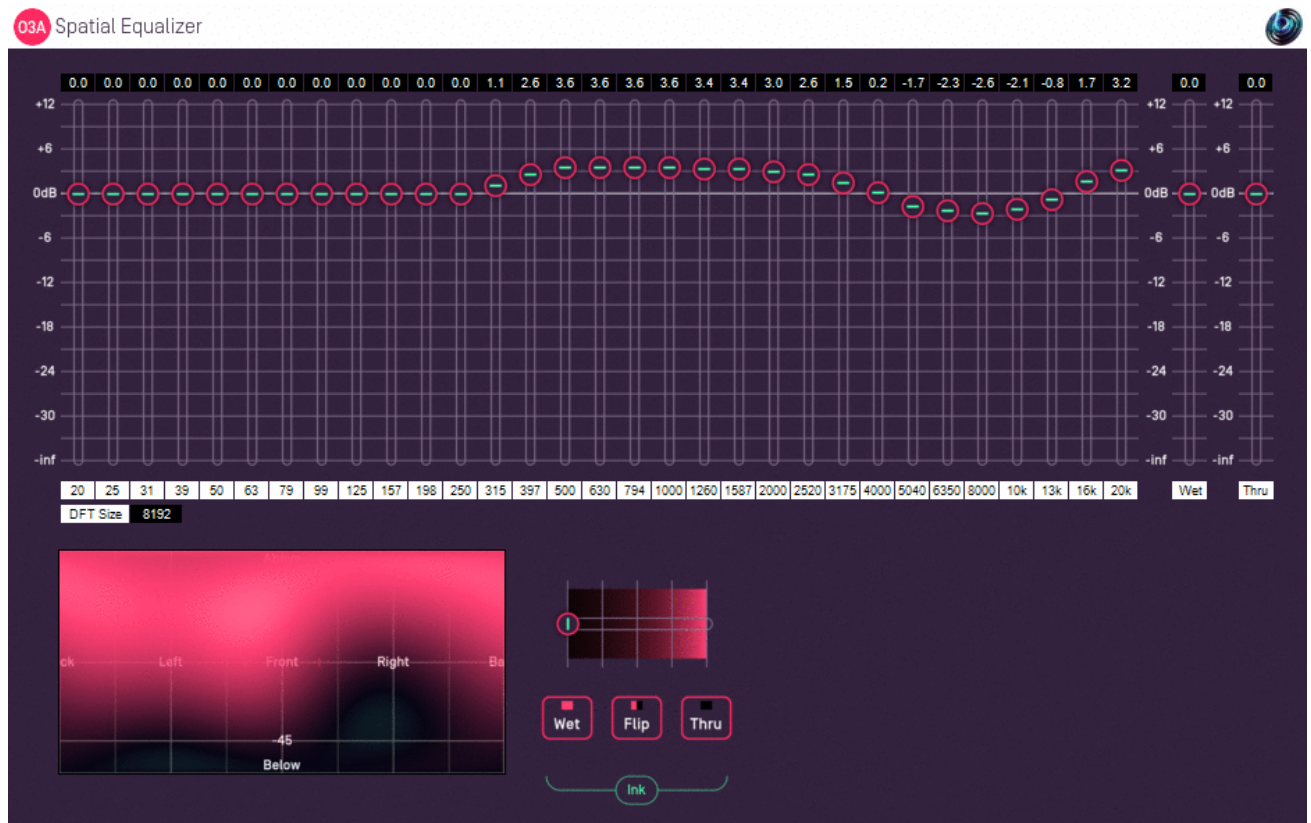
3.15.5.2 Control: Gain

This is an overall gain control.

3.15.5.3 Control: DFT Size

The DFT size is used in the internal processing of this plugin. The size can be 512, 1024, 2048, 4096, 8192, 16384, 32768 or 65536. Lower sizes give lower latency and use less CPU power, but provide a less sharp equalizer. In this case, the plugin may gang low frequency bands together.

3.16 O3A Spatial Equalizer



3.16.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.16.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

3.16.3 Controls

- 20Hz - 20kHz Band Gains
- Ink Control
- Thru Button
- Wet Button
- Flip Button
- Wet Gain
- Thru Gain
- DFT Size
- ACN00 - ACN15 Elements

3.16.4 Description

This plugin modifies a 3D O3A mix by changing sound in different directions. A canvas is shown at the bottom in the middle which can be "painted" on to control the directions that will be changed. The canvas is set out in the same way as in the [O3A Visualiser](#) and [O3A Spatial Mask](#) plugins.

This plugin combines features of the [O3A Spatial Mask](#) and [O3A Graphic Equalizer](#) plugins. It allows you to make precise changes to the frequency content of an O3A mix in particular directions, for instance to enhance a particular singer without modifying the whole mix.

The graphic equalizer is of the 31-band third-of-octave type. Parts of this plugin are implemented in the frequency domain and it has a significant latency, which hopefully your DAW will compensate for. The equalizer is linear-phase.

Sounds in different directions are separated out into two spatial channels, the "Thru" channel and the "Wet" channel. By default, the "Thru" channel is passed through unmodified and the "Wet" channel is modified by the graphic equalizer.

An ink control determines how the canvas is changed when it is clicked/drawn on. Dark ink means that sound in a particular direction should be sent to the "Thru" channel and light ink means to the "Wet". Ink in between indicates that an intermediate amount is sent to each of the two different channels. The Thru channel is modified by the Thru gain and delayed to have the same latency as the Wet channel. The Wet channel is modified by the Wet gain and also the graphic equalizer provided. The two channels are then combined.

This means that sound directions painted dark are affected by the Thru gain only and sound directions painted light are affected by the Wet gain *and the equalizer*. Colours in between are a mix.

3.16.4.1 That was all a bit confusing...

Yes. You might want to play with the [O3A Spatial Mask](#) and [O3A Graphic Equalizer](#) plugins to help get your head around what is going on here, before taking this plugin on. It's worth it though; this plugin makes a lot of good things possible.

The Thru and Wet gain sliders are useful, but can make things more confusing. If you set them both to "0.0" (the default) then dark means the sounds pass through unaffected and light means the equalizer is applied fully.

3.16.4.2 Automation

Most of this plugin *can* be automated. Pressing the buttons or drawing on the canvas are converted into changes in the [internal ACN elements](#), so you can record these changes and play them back to reproduce canvas paint changes.

To put this another way, the ink control, brush and thru/wet/flip buttons are not accessible via automation, but the changes they make to the canvas are.

3.16.5 Controls

3.16.5.1 Controls: 20Hz - 20kHz Band Gains

These controls affect the frequency content of the soundfield at the frequency selected, in the sound directions affected by the "Thru" channel (light ink on the canvas).

If the [DFT size](#) is low, some of the frequency bands are ganged together.

3.16.5.2 Control: Ink Control

The first horizontal slider selects the colour of the "ink" that will be used when the panel is painted on. The grey tick marks are 6dB points.

3.16.5.3 Control: Thru Button

This instantly paints the entire canvas dark ("Thru"). This means that all sound directions are then affected by the [Thru gain](#) slider (and *not* the Wet gain or graphic equalizer).

3.16.5.4 Control: Wet Button

This instantly paints the entire canvas light ("Wet"). This means that all sound directions are then affected by the [Wet gain](#) slider and the graphic equalizer (and not the Thru gain slider).

3.16.5.5 Control: Flip Button

This instantly converts the parts of the canvas that were light to dark and the parts that were dark to light and so on. This has the effect of converting all sound direction contributions that were Thru to Wet and vice versa.

3.16.5.6 Control: Wet Gain

This sets the gain applied to sound directions that are painted as "Wet" (light).

By default this is set to "0.0" (unit gain). This means that light ink on the canvas indicates that sounds should not be changed in level. On the other hand, they *will* be affected by the graphic equalizer which is the main feature of this plugin.

3.16.5.7 Control: Thru Gain

This sets the gain applied to sound directions that are painted as "Thru" (dark).

By default this is set to "0.0" (unit gain). This means that dark ink on the canvas indicates that sounds should be let through the plugin unmodified.

3.16.5.8 Control: DFT Size

The DFT size is used in the internal processing of this plugin. The size can be 512, 1024, 2048, 4096, 8192, 16384, 32768 or 65536. Lower sizes give lower latency and use less CPU power, but provide a less sharp equalizer. In this case, the plugin may gang low frequency bands together.

3.16.5.9 Controls: ACN00 - ACN15 Elements

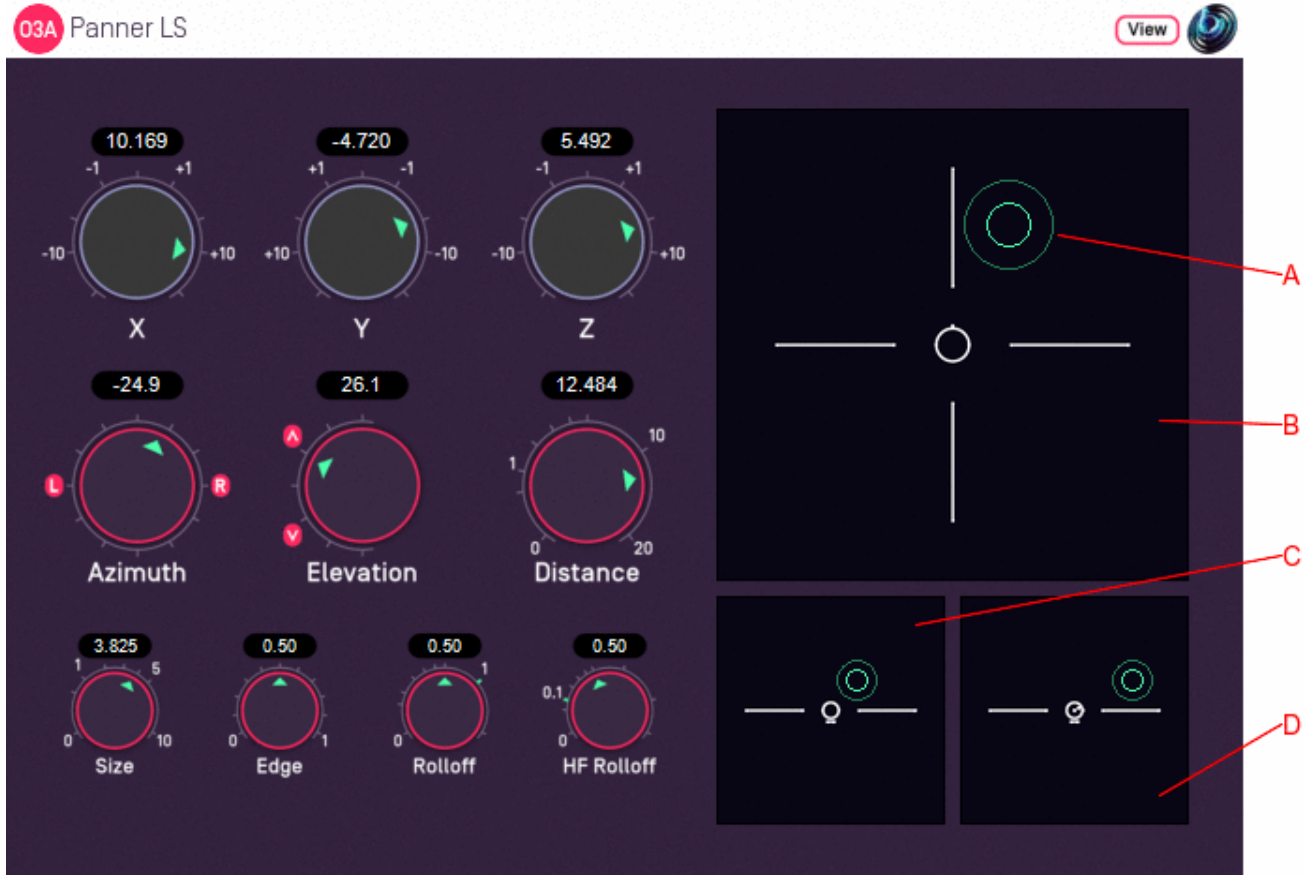
These controls are not shown on screen as numbers but are available for automation. They capture an internal representation of what is on the canvas and they can be used to automate the canvas. If you are recording them, make sure you record them all together!

We recommend that you do not attempt to interpret these numbers. However, it may be worth knowing that fading them together (linearly) will result in a natural (linear) fade of the canvas image.

Technically, these elements contain a spherical harmonic decomposition of the gain function, defined as a function mapping the surface of the unit sphere to values broadly between 0 and 1, where the spherical harmonics are encoded using the SN3D convention.

4 O3A Manipulators - Panners

4.1 O3A Panner LS and O3A Panner LS XYZ



4.1.1 Host Support

4.1.1.1 O3A Panner LS

Host Type	Support
AAX	Yes
VST2	Yes

4.1.1.2 O3A Panner LS XYZ

Host Type	Support
AAX	Yes
VST2	Yes

4.1.2 Audio

4.1.2.1 O3A Panner LS

	Channels	Content
Input	1	Mono
Output	16	O3A

4.1.2.2 O3A Panner LS XYZ

	Channels	Content
Input	1	Mono
Output	16	O3A

4.1.3 Controls

- X
- Y
- Z
- Azimuth
- Elevation
- Distance
- Source Size
- Edge
- Gain Rolloff
- HF Rolloff

4.1.4 Description

This O3A panner takes a mono sound and places it in a particular place in a 3D O3A mix.

This panner is designed to help you move a sound around in 3D space. It still has azimuth and elevation controls like the standard [O3A Panner](#), but also X, Y and Z controls that can be used instead.

There are three control surfaces which can be used to move the sound "A" around. The main surface "B" is a view from above, with the front at the top of the screen. Below it is a view "C" from behind and another "D" from the right.

This panner also has source size controls and a distance model. The size is visible on the control surfaces. Units are nominally metres, but it is possible to give a sense of larger or smaller distances by changing the source size and rollofs.

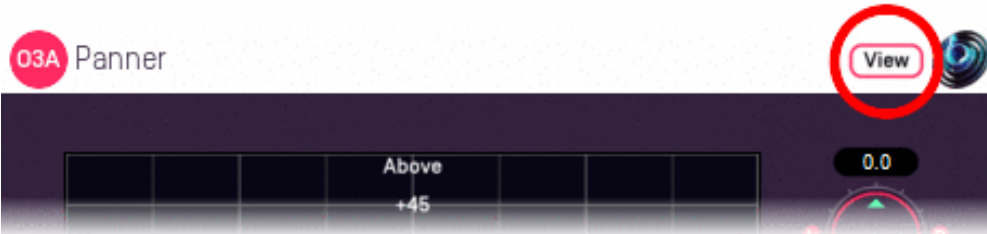
If you have access to the O3A Reverb library, you also may wish to consider the O3A Shoebox plugin. This has a similar control interface but adds an acoustic simulation of a rectangular room.

Two versions of the plugin exist. The only difference is the way that the controls are exposed to automation. The reason for this is that the X, Y and Z controls and the Azimuth, Elevation and Distance controls do essentially the same thing (move the sound) and so to avoid confusion, the plugins only expose one set of controls to automation. O3A Panner LS exposes Azimuth, Elevation and Distance to automation, whereas O3A Panner LS XYZ exposes X, Y and Z. This restriction only applies to automation; all controls are available in the user interface.

4.1.5 View Support

When used with O3A View Sync from the O3A 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 3D location is shown as a small scaled sphere, within a scaled cube, which should be in reach of the VR controllers. The unscaled location (potentially out of reach) where the audio is actually located is also shown.
Hold the left mouse button to set the azimuth and elevation.	Hold a VR controller trigger to move the scaled sphere to the controller. The unscaled sphere will move to match.

4.1.6 Controls

4.1.6.1 Controls: X, Y and Z

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

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

These coordinates are not available as automation parameters in O3A Zoom. Instead, they are translated to and from Azimuth, Elevation and Distance, which may be used instead. If you need to automate these controls you should probably use O3A Panner LS XYZ instead.

4.1.6.2 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction of the source relative to the centre.

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.

Azimuth, Elevation and Distance are not available as automation parameters in O3A Panner LS XYZ. Instead, they are translated to and from X, Y and Z, which may be used instead. If you need to automate these controls you should probably use O3A Panner LS instead.

4.1.6.3 Control: Distance

This control indicates how far away the source is from the centre. Units are nominally metres.

Azimuth, Elevation and Distance are not available as automation parameters in O3A Panner LS XYZ. Instead, they are translated to and from X, Y and Z, which may be used instead. If you need to automate these controls you should probably use O3A Panner LS instead.

4.1.6.4 Control: Source Size

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 [O3A 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 [O3A Diffuser](#) plugin.

4.1.6.5 Control: Edge

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.

4.1.6.6 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.

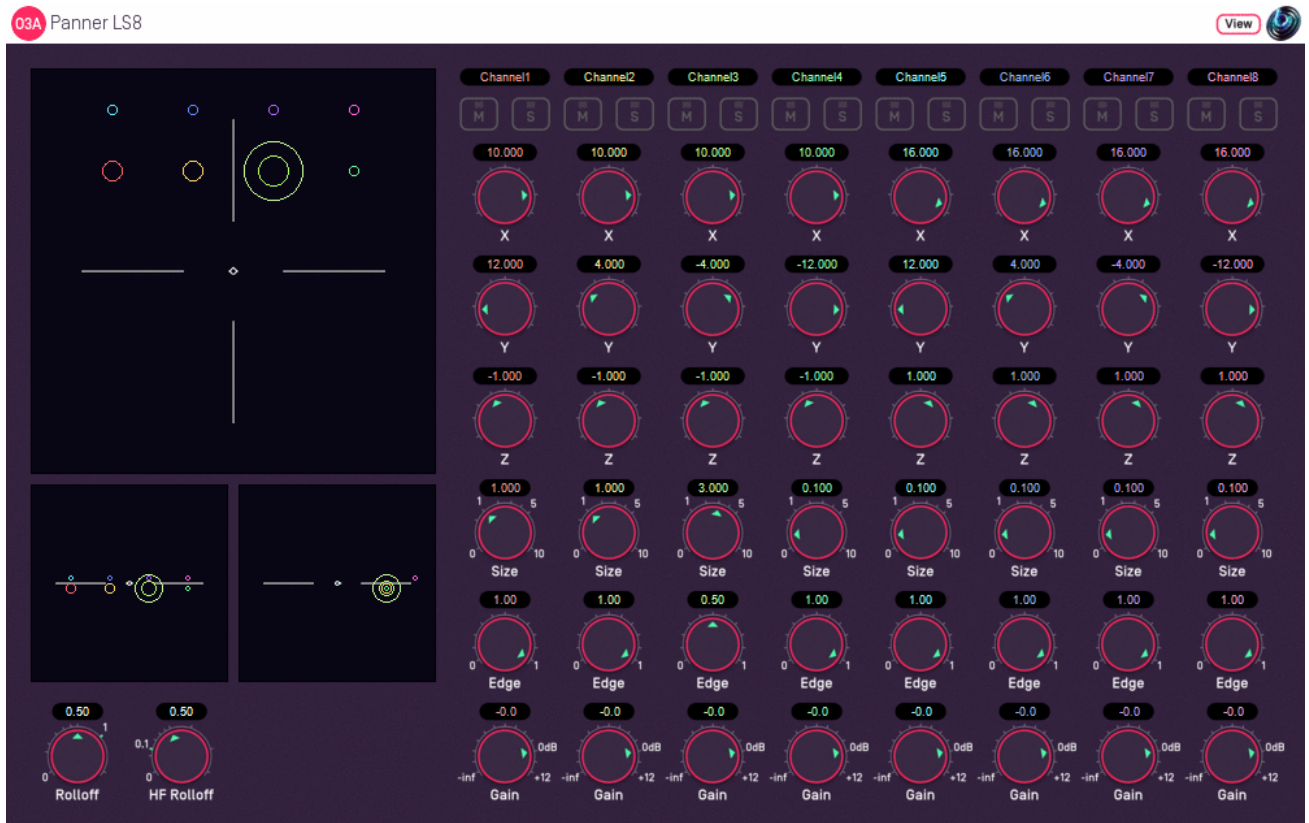
Mathematically, the gain applied is determined by the inverse square law, but raised to a power given by this control.

4.1.6.7 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.

4.2 O3A Panner LS8



4.2.1 Host Support

Host Type	Support
AAX	Yes, input mapped to 7.1
VST2	Yes

4.2.2 Audio

	Channels	Content
Input	8	Eight channels of mono (mapped to 7.1 for AAX)
Output	16	O3A

4.2.3 Controls

- Gain Rolloff
- HF Rolloff
- 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

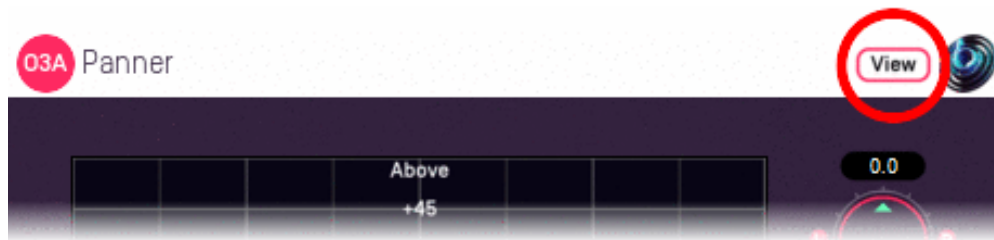
4.2.4 Description

This is a multichannel variant of the [O3A Panner LS](#). Eight channel strips are provided, each with an additional gain control and mute/solo buttons.

4.2.5 View Support

When used with O3A View Sync from the O3A 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 source directions are shown using colour-coded crosses and labels, similar to the display used by O3A Panner - Eight Channel.	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.
Point at one and hold the left mouse button to select it. Then, drag to set its direction.	Grab one of the scaled locations with a VR controller and drag to move it. The unscaled sphere will move to match.

4.2.6 Controls

4.2.6.1 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.

4.2.6.2 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.

4.2.6.3 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

4.2.6.4 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 [O3A 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 [O3A Diffuser](#) plugin.

4.2.6.5 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.

4.2.6.6 Controls: Gain 1 - 8

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

4.2.6.7 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.

4.2.7 Presets

Presets are available for this plugin:

- Cube
- Octagon
- Square
- Stage

4.3 O3A Line



4.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.3.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

4.3.3 Controls

- Width
- Azimuth
- Elevation
- Roll

4.3.4 Description

This plugin takes a mono stream and converts it to third order ambisonics (O3A), spreading the sound out in a line.

The centre and "left" directions of the line can be set using the control surface, where the directions are indicated by crosshairs. The "right" direction is shown but cannot be controlled directly this way.

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 [O3A Visualiser](#) which lays out its viewing region in the same way.

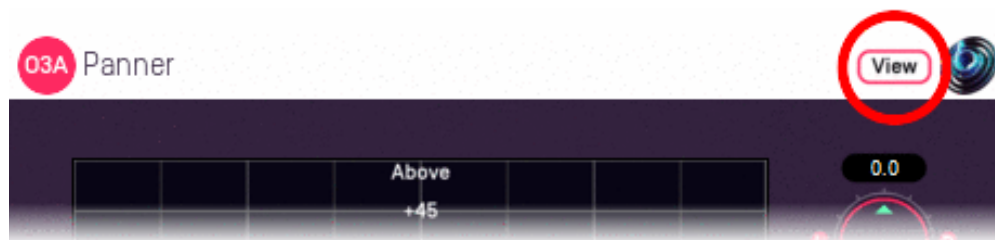
In acoustics terms, this plugin emulates a one-dimensional emitter where all points are the same distance from the centre of the coordinate system. In 3D space, strictly this is an arc rather than a line. The arc appears as a line in perspective views.

This plugin emulates a quite unusual acoustic soundfield. If you find it sounds unnatural you may wish to apply other processing to make it less regular, for instance the [O3A Diffuser](#).

4.3.5 View Support

When used with O3A View Sync from the O3A 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 centre and left side directions are shown using green/blue and red crosses, similarly to the plugin display. A dotted line connects the left and right extent of the stereo image.</p> <p>Point at the centre or left side cross and hold the left mouse button to select it. Then, drag to set its azimuth and elevation.</p>	<p>The current centre and left side directions are shown using green/blue and red beams and crosses, similarly to the plugin display. A dotted line connects the left and right extent of the stereo image.</p> <p>Each VR controller moves one of the centre and left side directions and the controllers show short green/blue and red beams to indicate which is which. Hold a VR controller trigger to set an azimuth and elevation.</p>

4.3.6 Controls

4.3.6.1 Control: Width

The width controls the length of the line, from 0 degrees to 360 degrees. At 0 degrees, this plugin has much the same behaviour as the standard [O3A Panner](#). At 360 degrees, the line forms a complete circle around the listener.

4.3.6.2 Controls: Azimuth and Elevation

Azimuth and Elevation control the centre of the line. Effectively, this allows the line to be moved around.

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.

4.3.6.3 Control: Roll

The line is centred around the point given by the azimuth and elevation controls and with a length given by the width control. The roll control sets the *angle* of the line and can be used to rotate it around the centre point.

This control has an angle between -180 and +180 degrees. Increasing the value rotates the line clockwise.

5 O3A Manipulators - "A-Format" Support

5.1 O3A A20->B Converter and O3A B->A20 Converter



5.1.1 Host Support

5.1.1.1 O3A B->A20 Converter

Host Type	Support
AAX	No
VST2	Yes

5.1.1.2 O3A A20->B Converter

Host Type	Support
AAX	No
VST2	Yes

5.1.2 Audio

5.1.2.1 O3A B->A20 Converter

	Channels	Content
Input	16	O3A (B-Format)
Output	20	A20 (A-Format)

5.1.2.2 O3A A20->B Converter

	Channels	Content
Input	20	A20 (A-Format)
Output	16	O3A (B-Format)

5.1.3 Description

These plugins translate from 16 channel O3A B-Format to a 20 channel "A-Format" and back again.

5.1.4 What do we mean by A-Format Here?

When working with third order ambisonics (O3A) streams, it is often not obvious what the 16 channels of audio within the streams actually 'mean'. It is also often difficult to apply conventional processing directly to the streams without disrupting the 3D.

The terms "A-Format" and "B-Format" strictly relate to microphone techniques, where A-Format is the direct output of a number of directional microphone capsules (typically four cardioids) and B-Format is the full ambisonic stream. For our purposes here, by B-Format we mean the full O3A stream and by A-Format we mean a breakdown of the stream into a collection of channels corresponding to individual directions (although with a sharper response than cardioid). These two plugins translate between these two formats.

We convert to A-Format because some processing is more naturally applied there. This approach was pioneered by Joseph Anderson.

For our A-Format breakdown we use 20 fairly evenly distributed directions set out so some are above and below. You can think of the channels of the A-Format as being similar to narrow microphone responses in these directions.

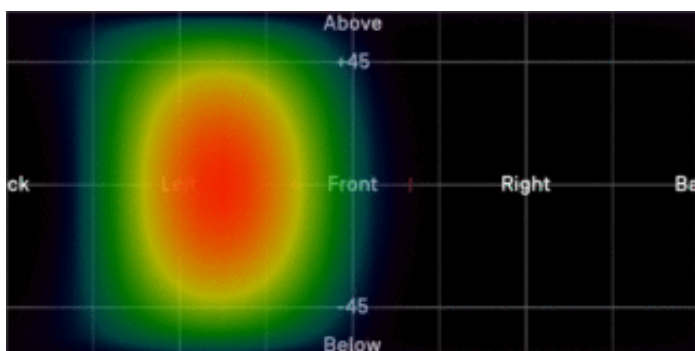
This 20 channel A-Format is *not* compatible with the 4 channel A-Format produced by first order ambisonic microphones. It is similar to, but not the same as, Spatial PCM.

5.1.5 How can we use A-Format?

You can convert freely between normal O3A B-Format and this special 20 channel A-Format.

Once you have your audio in A-Format, you can modify the individual channels of the A-Format and only affect audio in a particular direction (subject to some overlap). For instance, you might want to apply a distortion effect to an O3A mix. Applying distortion to B-Format directly will produce very strange spatial results, but applying it to A-Format will probably give you what you were expecting!

The numbering of the directions is shown as a figure in the plugin display (shown above). If this figure does not make any sense yet, it might help to see this output from the [O3A Visualiser](#) where only channel 10 of the A-Format has been kept (i.e. the others are silent). This channel is to the left, slightly towards the front.



When converting from B-Format to A-Format, this shape can be thought of as an imaginary microphone response pattern. There are 20 such responses, overlapping each other. When converting from A-Format to B-Format, this shape can be thought of as the location at which the A-Format channel audio will be placed. The shape is nearly, but not quite, circular around its main direction. (There are some mathematical reasons why it is not actually circular which relate to some somewhat mind-bending topics. Contact us if you are really interested!)

Some other things you might like to know:

1. If you convert from B-Format to this A-Format and then straight back again, your signal will be essentially as it started. Try it - if it does not work, check you have set your channel count to 20!
2. The opposite is not true. If you start with this A-Format, convert to B-Format and then back again, you will lose a little detail. As we have packed 20 independent channels into 16 channels and then attempted to unpack again to 20 channels, perhaps this is not so surprising.
3. The directions in this A-Format can be seen as the corners of a dodecahedron or the faces of an icosahedron.

5.1.6 Directions

Using the ambisonic convention (X is forward, Y is left and Z is up) the directions, as unit vectors, are:

Number	X	Y	Z
1	0	0.357	0.934
2	0	-0.357	0.934
3	-0.577	0.577	0.577
4	0.577	0.577	0.577
5	0.577	-0.577	0.577
6	-0.577	-0.577	0.577
7	-0.934	0	0.357
8	0.934	0	0.357
9	-0.357	0.934	0
10	0.357	0.934	0
11	0.357	-0.934	0
12	-0.357	-0.934	0
13	-0.934	0	-0.357
14	0.934	0	-0.357
15	-0.577	0.577	-0.577
16	0.577	0.577	-0.577
17	0.577	-0.577	-0.577
18	-0.577	-0.577	-0.577
19	0	0.357	-0.934
20	0	-0.357	-0.934

5.1.7 Working with A-Format in Reaper

If you are working in Reaper, current versions do not make it particularly easy to set up processing of the A-format channels, 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 20 mono compressor 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.

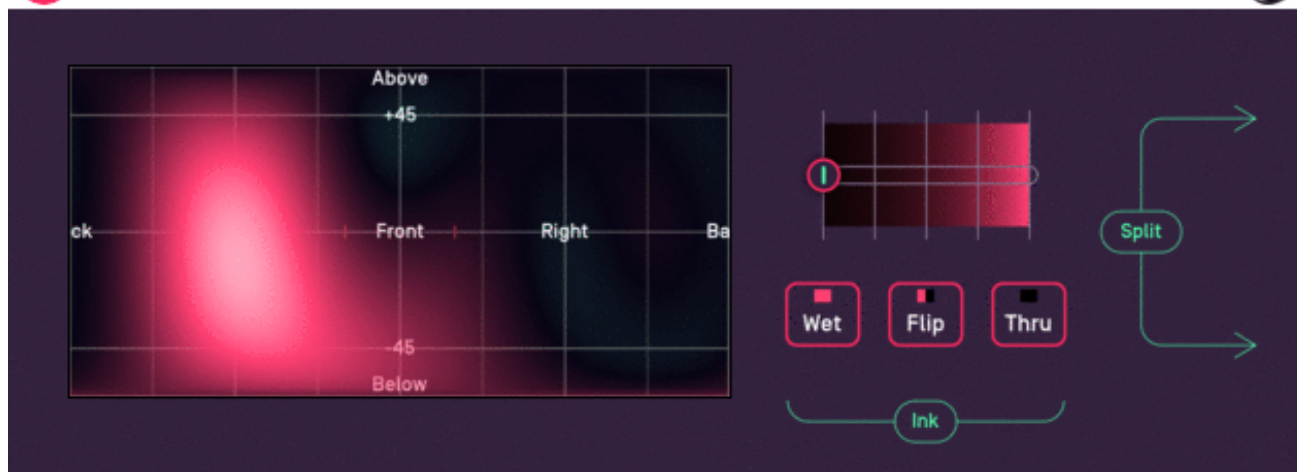
5.1.8 And finally - a "Gotcha":

If you are working in Reaper with O3A, you have probably set all your tracks to contain 16 channels. When working with A-Format in this way you need to set this to 20 or the last four A-Format channels will go missing!

6 O3A Manipulators - Split and Join

6.1 O3A Spatial Mask Split

O3A Spatial Mask Split



6.1.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

6.1.2 Audio

	Channels	Content
Input	16	O3A
Output	32	Two split O3A mixes

6.1.3 Controls

- Ink Control
- Thru Button
- Wet Button
- Flip Button
- ACN00 - ACN15 Elements

6.1.4 Description

This plugin separates the content of an O3A stream into two that can be joined together later. The separation is controlled by painting regions.

This plugin is a variant of the [O3A Spatial Mask](#) plugin. Whereas that plugin produces 16 channels of output containing a single O3A scene, this plugin produces 32 channels of output, containing two O3A scenes.

The first 16 channels of output contain the masked scene as before, but the second 16 channels contain the rest of the original scene. These two sets of channels can be added back together to reconstruct the original input mix with the [O3A Join](#) plugin.

This can be useful when you want to apply processing just to the masked region, leaving the rest of the original scene intact. In Reaper, placing a normal 16 channel O3A manipulator on a 32 channel track applies the manipulator to the masked region (the first 16 channels) only and everything else passes through unaffected. This can all then be joined back together.

6.1.5 Controls

6.1.5.1 Control: Ink Control

The first horizontal slider selects the colour of the "ink" that will be used when the panel is painted on. The grey tick marks are 6dB points.

6.1.5.2 Control: Thru Button

This instantly paints the entire canvas dark ("Thru"). This means that all sound directions are then passed to the *second* O3A mix.

6.1.5.3 Control: Wet Button

This instantly paints the entire canvas light ("Wet"). This means that all sound directions are then passed to the *first* O3A mix.

6.1.5.4 Control: Flip Button

This instantly converts the parts of the canvas that were light to dark and the parts that were dark to light and so on. This has the effect of switching which O3A output sounds are sent to.

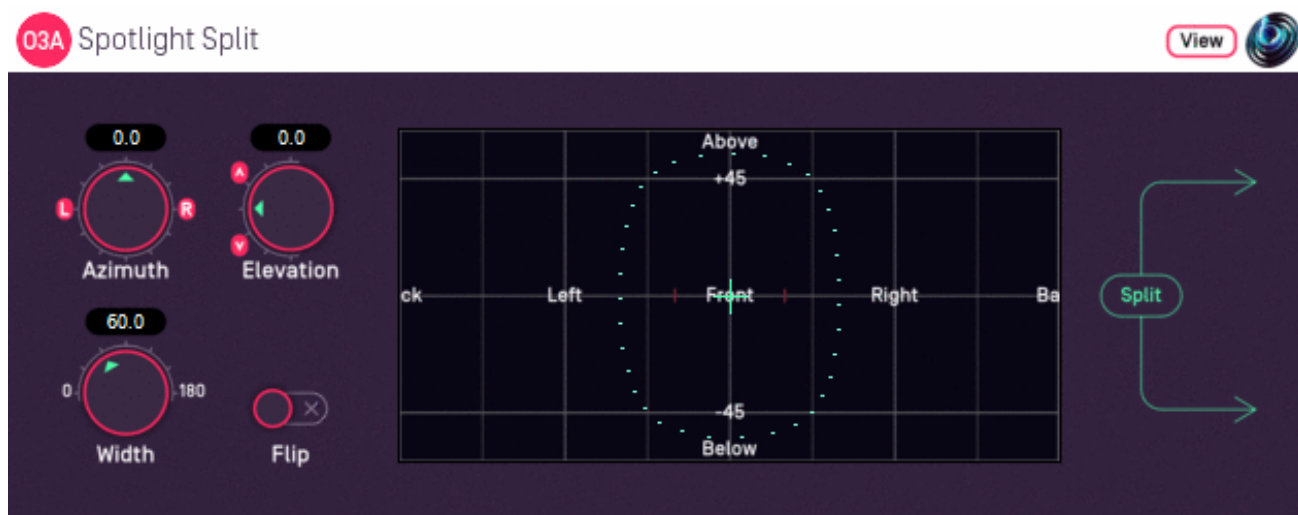
6.1.5.5 Controls: ACN00 - ACN15 Elements

These controls are not shown on screen as numbers but are available for automation. They capture an internal representation of what is on the canvas and they can be used to automate the canvas. If you are recording them, make sure you record them all together!

We recommend that you do not attempt to interpret these numbers. However, it may be worth knowing that fading them together (linearly) will result in a natural (linear) fade of the canvas image.

Technically, these elements contain a spherical harmonic decomposition of the gain function, defined as a function mapping the surface of the unit sphere to values broadly between 0 and 1, where the spherical harmonics are encoded using the SN3D convention.

6.2 O3A Spotlight Split



6.2.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

6.2.2 Audio

	Channels	Content
Input	16	O3A
Output	32	Two split O3A mixes

6.2.3 Controls

- Azimuth
- Elevation
- Width
- Flip

6.2.4 Description

This plugin is a variant of the [O3A Spotlight](#) plugin. Whereas that plugin produces 16 channels of output containing a single O3A scene, this plugin produces 32 channels of output, containing two O3A scenes.

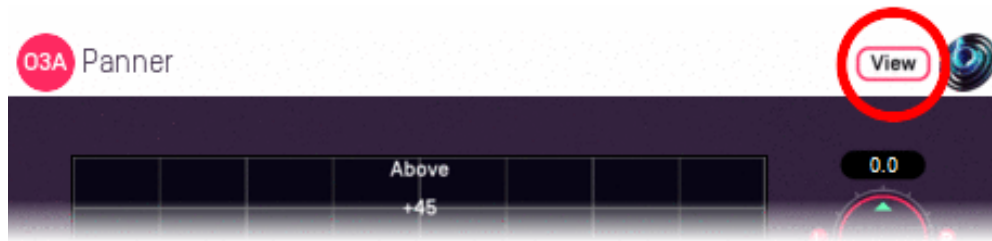
The first 16 channels of the output contain the spotlight scene as before, but the others contain the rest of the original scene. These two sets of channels can be mixed back together to reconstruct the original input mix with the [O3A Join](#) plugin.

This can be useful when you want to apply processing just to the spotlight region, leaving the rest of the original scene intact. In Reaper, placing a normal 16 channel O3A manipulator on a 32 channel track applies the manipulator to the lit region (the first 16 channels) only and the unlit region passes through unaffected. These can then be joined back together.

6.2.5 View Support

When used with O3A View Sync from the O3A 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.

6.2.6 Controls

6.2.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to be kept in the first audio scene (the rest is passed to the second).

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.

6.2.6.2 Control: Width

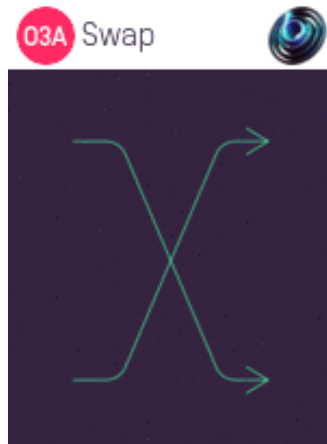
Width is an angle, between 0 and 180 degrees, indicating how wide the beam of the spotlight should be. An angle of 0 indicates a narrow beam and an angle of 180 encompasses the whole scene.

Angles are measured from the spotlight direction to the sound direction. When the angle is less than the width setting, the sound is in the lit region and should be kept. Other sounds are in the unlit region and should be attenuated. In practice, the transition from the lit to unlit region is a gradual slope rather than a hard transition.

6.2.6.3 Control: Flip

Enabling this switch flips the meaning of the lit and unlit regions.

6.3 O3A Swap



6.3.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

6.3.2 Audio

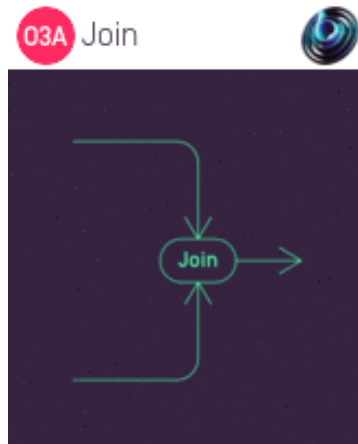
	Channels	Content
Input	32	Two split O3A mixes
Output	32	Two split O3A mixes

6.3.3 Description

The [O3A Spatial Mask Split](#) and [O3A Spotlight Split](#) plugins separate the contents of an O3A mix into two separate O3A mixes, each using 16 channels. This audio can be reassembled into one mix using [O3A Join](#) or by just mixing the audio back together.

This plugin swaps the two O3A mixes over.

6.4 O3A Join



6.4.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

6.4.2 Audio

	Channels	Content
Input	32	Two split O3A mixes
Output	16	O3A

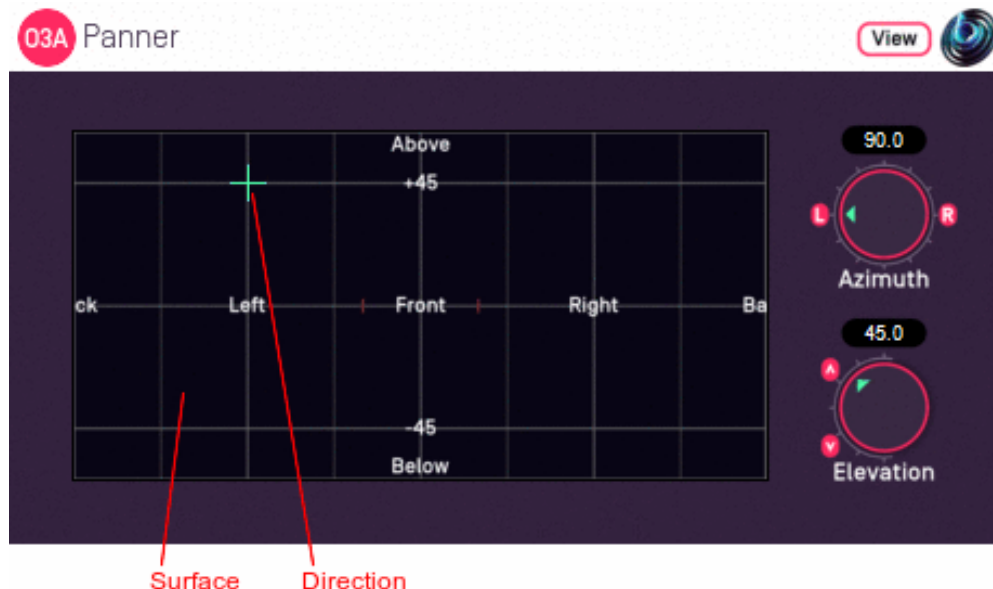
6.4.3 Description

The [O3A Spatial Mask Split](#) and [O3A Spotlight Split](#) plugins separate the contents of an O3A mix into two separate O3A mixes, each using 16 channels. In total, this gives 32 channels of audio. This is typically done so that two spatial regions of an initial mix can be processed separately.

This plugin joins these two O3A mixes back together, by simply mixing the audio from the two scenes back into one.

7 O3A Core - Panners

7.1 O3A Panner



7.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.1.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

7.1.3 Controls

- Azimuth
- Elevation

7.1.4 Description

This O3A panner takes a mono sound and places it in a particular direction in a 3D O3A mix.

There are various versions of this panner plugin, but this is our favourite. This version uses more screen real estate than the "classic" version but is typically easier to use, particularly if you are just starting out with this way of doing things.

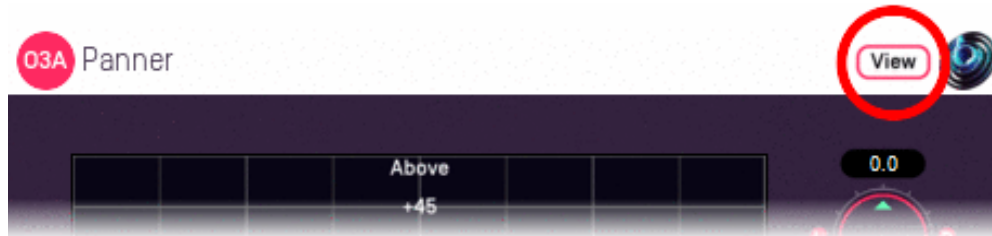
As well as azimuth and elevation dials, there is a control surface which can be used to visualise the current direction (indicated by the crosshairs). This direction can also be changed by clicking with the mouse.

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 [O3A Visualiser](#) which lays out its viewing region in the same way.

7.1.5 View Support

When used with O3A View Sync from the O3A 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.

7.1.6 Controls

7.1.6.1 Controls: Azimuth and Elevation

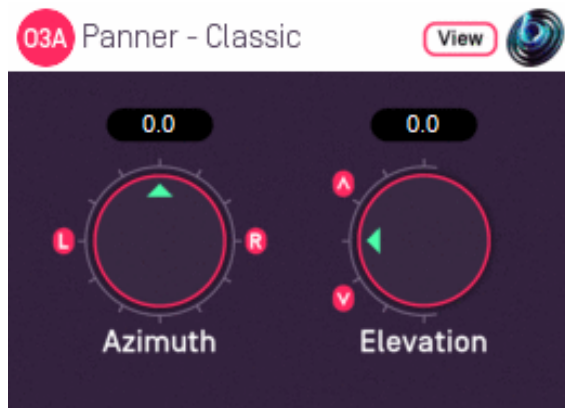
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

It may help to experiment with the control surface to get used to this way of doing things.

7.2 O3A Panner - Classic



7.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.2.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

7.2.3 Controls

- Azimuth
- Elevation

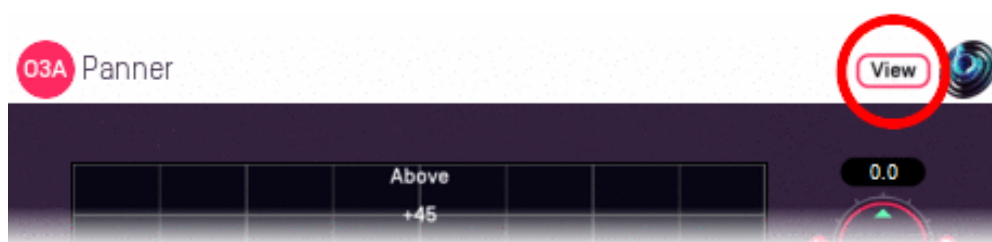
7.2.4 Description

There are various versions of this panner plugin and this is the most "raw" version. Only the "classic" azimuth/elevation controls are provided, largely to save screen real estate. These are great if you are used to them; if you are not, you might want to try the [standard version](#).

7.2.5 View Support

When used with O3A View Sync from the O3A 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.

7.2.6 Controls

7.2.6.1 Controls: Azimuth and Elevation

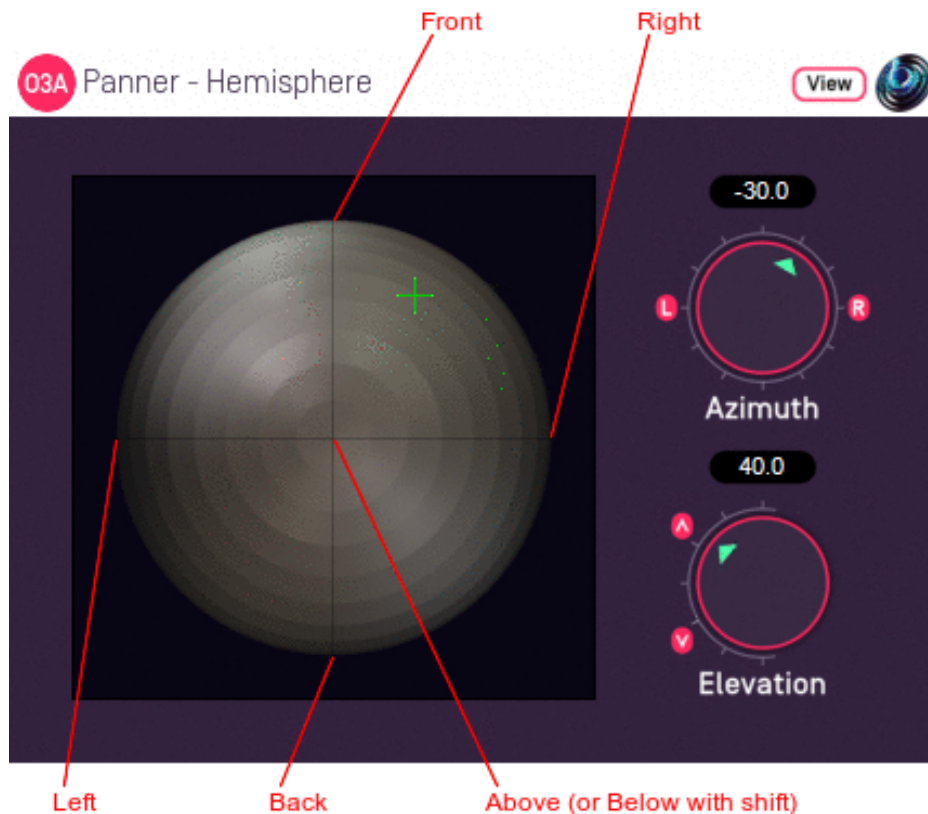
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

It may help to experiment with the [standard version](#) to get used to this way of doing things.

7.3 O3A Panner - Hemisphere



7.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.3.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

7.3.3 Controls

- Azimuth
- Elevation

7.3.4 Description

There are various versions of this panner plugin. This version provides a control surface that maps directly onto the upper hemisphere of possible sound directions. You can click on the control surface to move the sound and holding some keys down changes how the sound is moved:

- Use the "shift" key to select the lower hemisphere (so sounds are below rather than above).
- Use the "alt" key to lock the elevation (so sounds move in a horizontal circle).

A [hemisphere visualiser](#) is available for use with this plugin. However, we generally recommend the [standard panner](#), which has a control surface using the same rectangular layout as the standard

7.3.5 View Support

When used with O3A View Sync from the O3A 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.

7.3.6 Controls

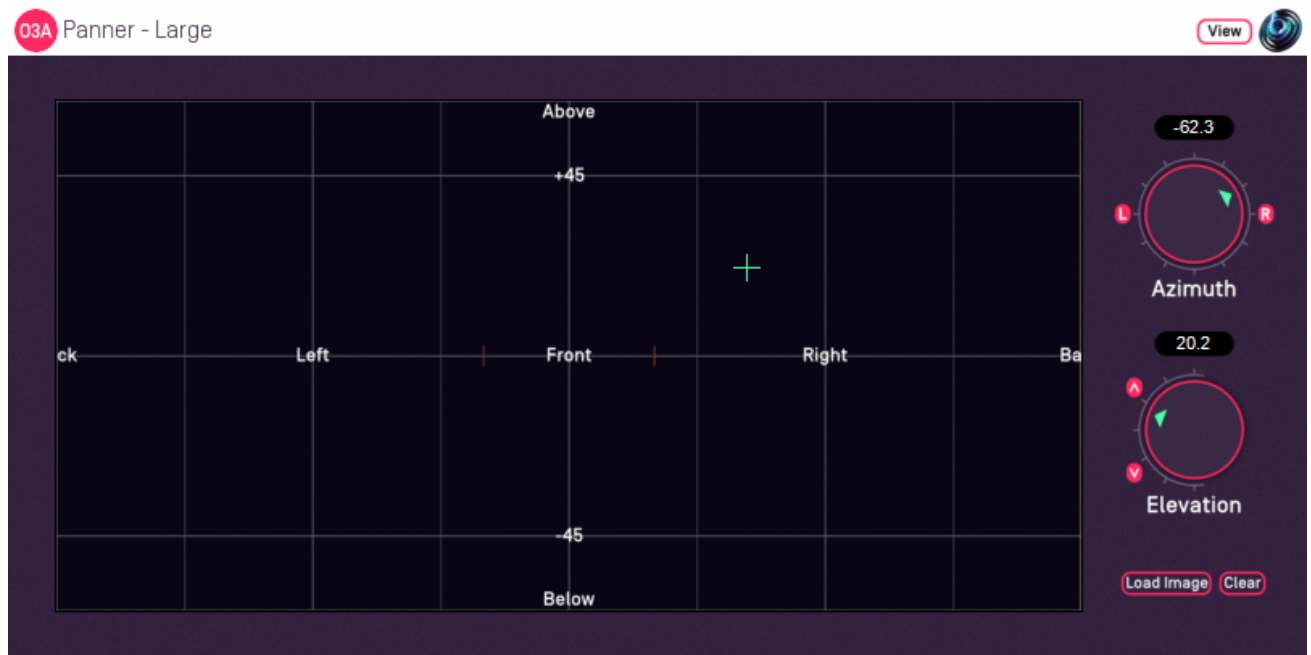
7.3.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

7.4 O3A Panner - Large



7.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.4.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

7.4.3 Controls

- Azimuth
- Elevation

7.4.4 Description

This O3A panner takes a mono sound and places it in a particular direction in a 3D O3A mix.

This plugin is an extra large version of our [standard panner plugin](#). It can be useful on high resolution screens. It also supports background images.

7.4.4.1 Background Images

Press the "Load Image" button to load an image to replace the default grid background. JPG and PNG images are supported. Because of the way the plugin works, we recommend use of dark backgrounds.

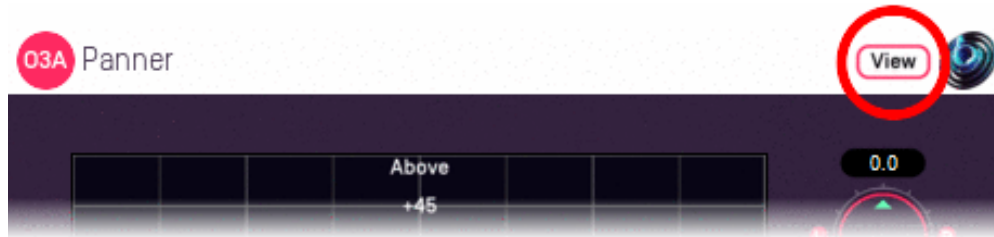
The target image size is 636x316. Other sizes are resized to fit.

The "Clear" button can be used to clear the image so the default grid background is shown again.

7.4.5 View Support

When used with O3A View Sync from the O3A 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.

7.4.6 Controls

7.4.6.1 Controls: Azimuth and Elevation

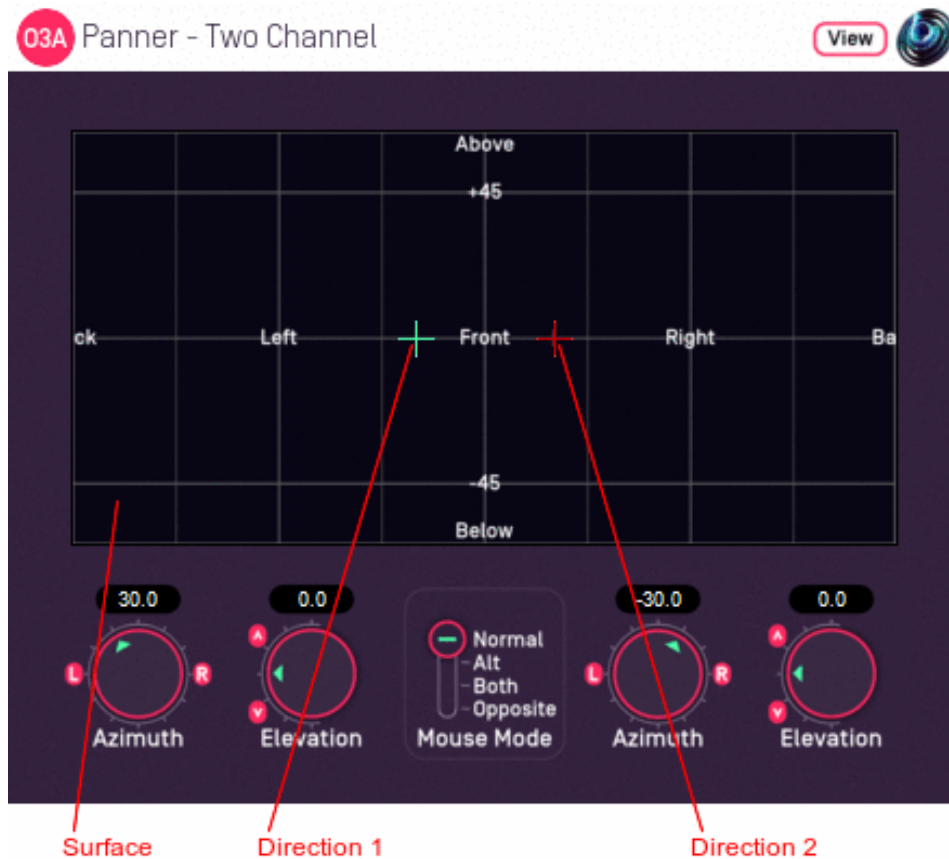
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

It may help to experiment with the control surface to get used to this way of doing things.

7.5 O3A Panner - Two Channel



7.5.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.5.2 Audio

	Channels	Content
Input	2	Stereo
Output	16	O3A

7.5.3 Controls

- Azimuth 1
- Elevation 1
- Azimuth 2
- Elevation 2
- Mouse Mode

7.5.4 Description

This O3A panner takes two mono sound sources and places them in particular directions in a 3D O3A mix.

It can also be used as a simple way to upmix stereo to O3A. However, we do not particularly

recommend you do this except for fairly narrow angles because a large "hole" can appear between the two sources. For a more thorough handling of material that was originally panned to stereo you wish to look at the O3A Upmixer - Stereo plugin.

There are azimuth and elevation dials for each of the two sources. Each works the same way as the controls in the [mono version](#). There is a control surface which can be used to visualise the current directions for the two sources, indicated by the green/blue and red crosshairs. These can be changed by clicking with the mouse, using the left mouse button for the first source and the right mouse button for the second. If you do not have a right mouse button, or are using a touch screen, you can hold down the 'Alt' key and press the main button instead. You can also move both sources around together using the 'Shift' key.

If pressing keys on the keyboard is inconvenient, there is a mouse mode slider on screen which can be used instead.

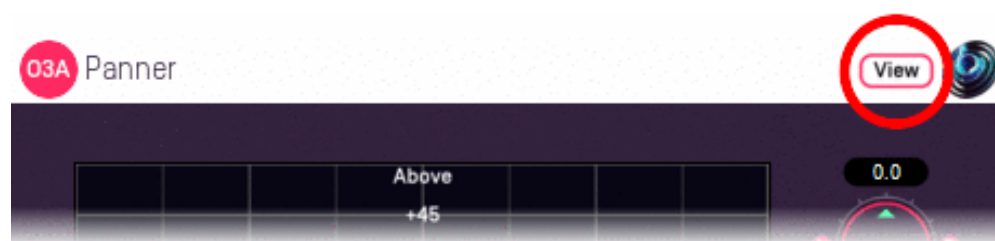
Mouse Mode	Key(s) Held	Function
Norm		Normal operation. Left click to move the first source, right click to move the second source.
Alt	Alt	Flips the source moved when the control surface is clicked, so a left click moves the second source rather than the first (and vice versa). Typically used to select the second source on a mouse with only one button.
Both	Shift	Changes the control surface so that movements of the mouse shift both sources.
Opp	Alt & Shift	Changes the control surface so that movements of the mouse shift both sources, but the sources move in opposite directions.

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 [O3A Visualiser](#) which lays out its viewing region in the same way.

7.5.5 View Support

When used with O3A View Sync from the O3A 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 panner directions are shown using green/blue and red crosses, similarly to the plugin display.</p> <p>Point at one and hold the left mouse button to select it. Then, drag to set its azimuth and elevation.</p>	<p>The current panner directions are shown using green/blue and red beams and crosses, similarly to the plugin display.</p> <p>Each VR controller moves one panner direction and the controllers show short green/blue and red beams to indicate which is which. Hold a VR controller trigger to set an azimuth and elevation.</p>

7.5.6 Controls

7.5.6.1 Controls: Azimuth 1 and 2 and Elevation 1 and 2

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.

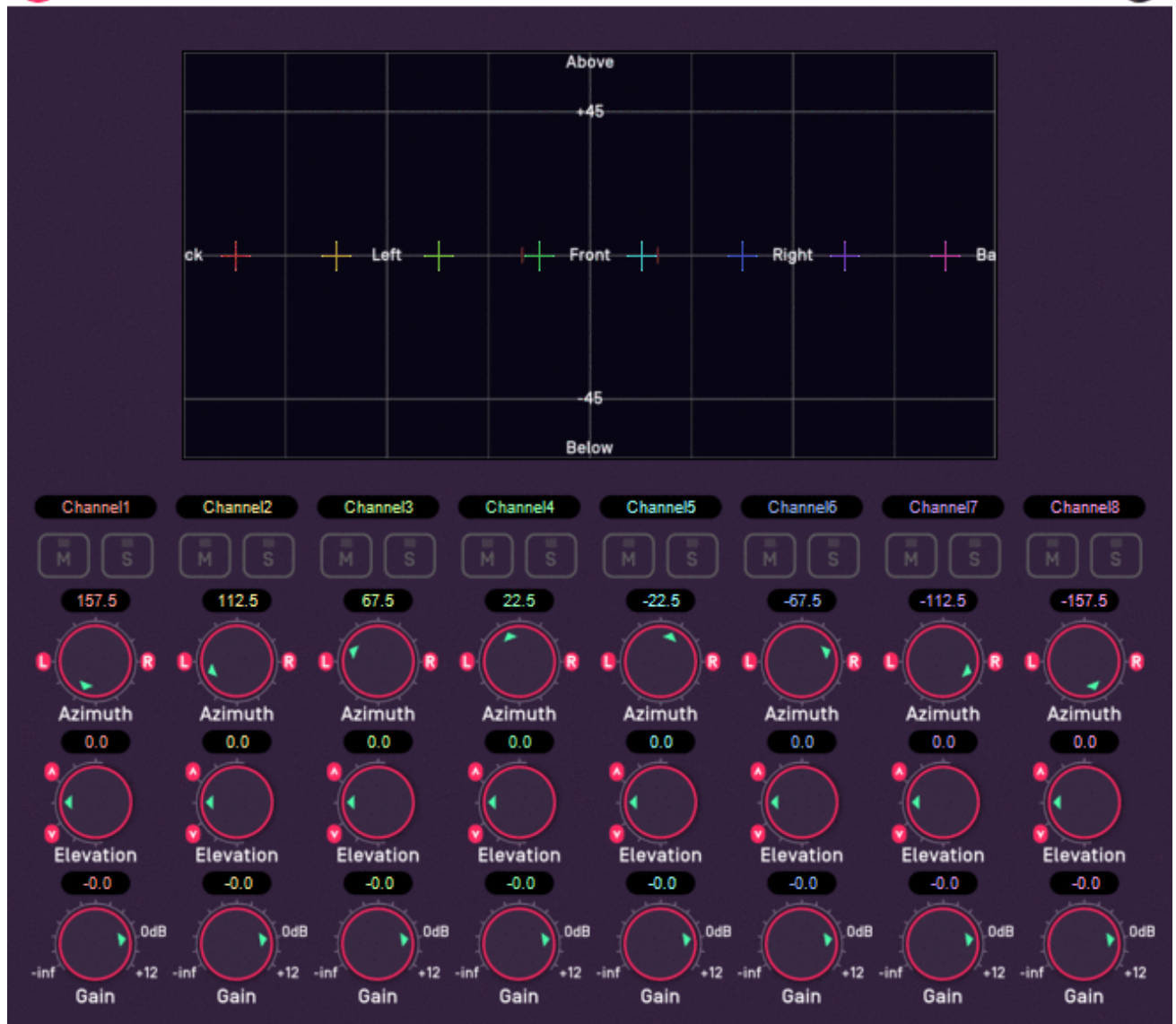
Azimuth 1 and Elevation 1 control the location used to pan the first source (which is shown in green/blue on the control surface). Azimuth 2 and Elevation 2 control the location used to pan the first source (which is shown in red).

7.5.6.2 Control: Mouse Mode

The mouse mode slider in the middle at the bottom of the screen determines the mouse mode used when the control surface is clicked. They are an alternative to use of the Alt and Shift keys. See the [table above](#) for details on how these options affect operation.

7.6 O3A Panner - Eight Channel

O3A Panner - Eight Channel



7.6.1 Host Support

Host Type	Support
AAX	Yes, input mapped to 7.1
VST2	Yes

7.6.2 Audio

	Channels	Content
Input	8	Eight channels of mono (mapped to 7.1 for AAX)
Output	16	O3A

7.6.3 Controls

- Azimuth 1 - 8
- Elevation 1 - 8
- Gain 1 - 8

- Mute 1 - 8
- Solo 1 - 8

7.6.4 Description

This O3A panner takes eight mono sound sources and places them in particular directions in a 3D O3A mix.

There are azimuth and elevation dials for each of the sources. These work the same way as the controls in the standard [single channel panner](#). Each source also has mute and solo buttons and a gain control.

There is a control surface which can be used to visualise the current directions for the sources, indicated by coloured crosshairs. These can be changed by dragging with the mouse.

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 [O3A Visualiser](#) which lays out its viewing region in the same way.

Text can be entered into channel labels above the mute/solo buttons to help you keep track of which channel is which. these labels are shown when used with this plugin's [View support](#).

7.6.4.1 Reaper Note

If you are using this panner with Reaper, it is fairly easy to set up the individual mono source inputs as subtracks of the track on which the panner is set.

On the routing panel for each subtrack, set the "Parent Channels" to send to the relevant pair of inputs in this plugin and then pan hard left or right depending on whether this should be an odd or even input. Set this panner plugin as the first effect on the parent track and check the routing using the solo button for each source.

7.6.4.2 Pro Tools Note

The AAX version of this plugin expects input as 7.1 audio, with the eight panning channels mapped from the 7.1 channels in the following order:

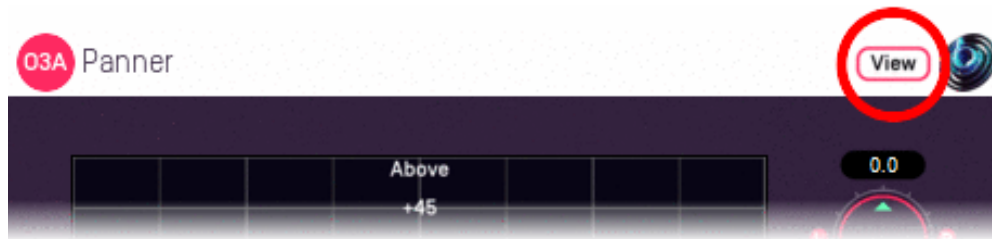
Index	Label
1	L
2	C
3	R
4	Lss
5	Rss
6	Lsr
7	Rsr
8	LFE

A simple way to use this plugin is to place it as the first plugin on a 7.1 track. Mono signals can then be sent from other tracks by addressing the individual channels of the track's 7.1 input bus. For instance, if the input bus is labelled "Panner8" then to send to the first panner channel, mono audio should be sent to "Panner8.L". To send to the second panner channel, "Panner8.C" and so on, through to "Panner8.LFE" for the eighth channel. Routing can be checked using the plugin's solo buttons in the usual way.

7.6.5 View Support

When used with O3A View Sync from the O3A 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 panner directions are shown using colour-coded crosses and labels, similarly to the plugin display.</p> <p>Point at one and hold the left mouse button to select it. Then, drag to set its azimuth and elevation.</p>	<p>The current panner directions are shown using colour-coded beams, crosses and labels, similarly to the plugin display.</p> <p>Point at one with a VR controller and the controller will indicate the label of the source pointed at. Then, hold the VR controller trigger to select it and move the controller to set its azimuth and elevation.</p>

7.6.6 Controls

7.6.6.1 Controls: Azimuth 1 - 8 and Elevation 1 - 8

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.

It may help to experiment with the control surface to get used to this way of doing things.

Azimuth and Elevation can also be changed by dragging the relevant source on the control surface.

7.6.6.2 Controls: Gain 1 - 8

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

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

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

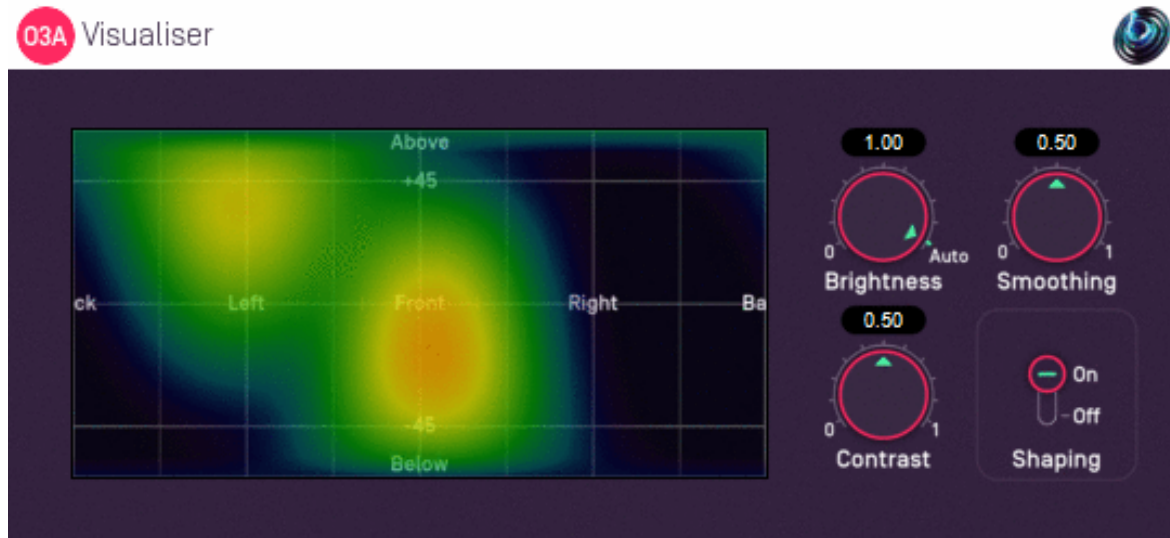
7.6.7 Presets

Presets are available for this plugin:

- 5.0
- 7.0
- Triangle
- Square
- Pentagon
- Hexagon
- Octagon
- Front Stage
- Bi-Triangle
- Octahedon
- Cube

8 O3A Core - Visualisers

8.1 O3A Visualiser



8.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

8.1.3 Controls

- Brightness
- Contrast
- Smoothing
- Shaping

8.1.4 Description

This plugin produces a view of an O3A stream which can help make sense of what is happening in it. Audio is passed through unmodified, so the plugin can be inserted in the middle of an O3A effects chain.

The stream is shown using a rectangular screen region. This rectangular region shows an equal-area cylindrical projection of the directional components of the O3A soundfield interpreted over a sphere.

Or, to put it another way, it lights up in different places depending on where a sound comes from. Some of those places are labelled in the image. The view is like a map of the world, where sounds above are at the "north pole" and are shown across the top of the view and sounds below are at the

"south pole" at the bottom. Sounds rotating around at head height move around the equator, so they move along the view halfway down, wrapping around between the left and right edges as they pass behind.

A good way to try this out is to chain the [O3A Panner](#) immediately before this plugin as this uses the same directional approach. Then set up a decoder after this suitable for use with your speakers or headphones. Then you can play around with different sound directions and hear *and see* the results.

To reduce CPU load, this visualiser stops most processing when it is not on screen.

This plugin does not have O3A View support. You might wish to consider [O3A Flare](#).

8.1.5 Controls

8.1.5.1 Control: Brightness

This controls the brightness of the image. If the screen is black when sounds are playing, you may wish to turn this up. If it is all red, turn it down.

Alternatively, you can set the dial to "Auto", in which case the plugin will try to ride the brightness control to keep the visualisation useful.

8.1.5.2 Control: Contrast

This controls the contrast of the image. Higher values produce a sharper image but map a smaller dynamic range onto the screen.

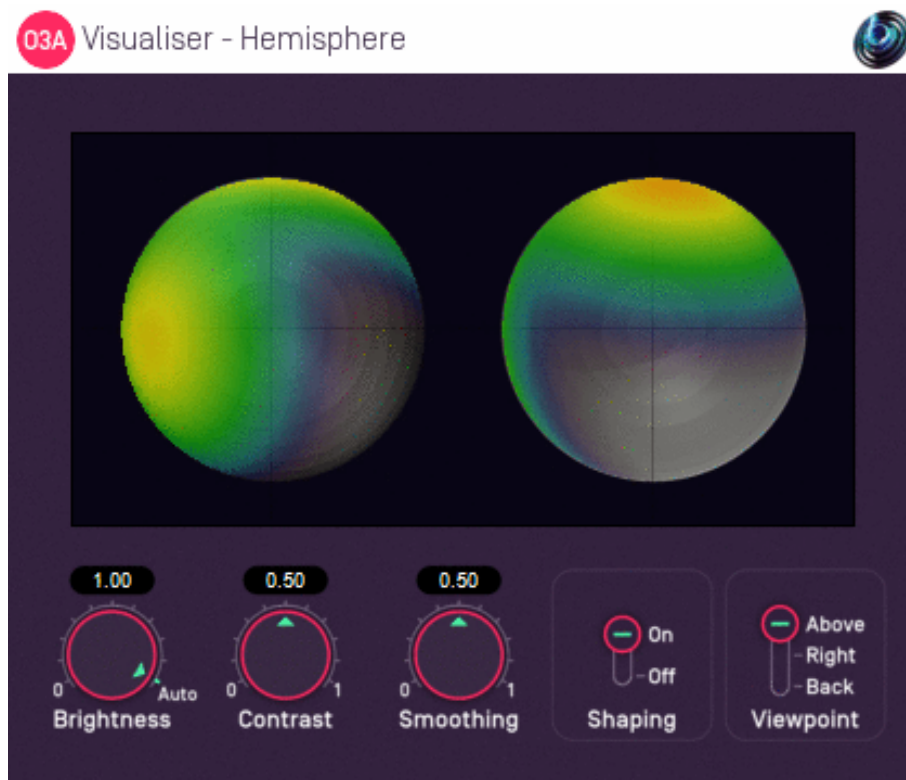
8.1.5.3 Control: Smoothing

The image generated is smoothed over time. Use more smoothing for a more stable, slower moving image. Use less for a more responsive one.

8.1.5.4 Control: Shaping

Shaping should normally be left on as it produces a more straightforward view. If this is turned off, the image will typically be sharper, but ripples will be visible in directions away from original sound directions.

8.2 O3A Visualiser - Hemisphere



8.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

8.2.3 Controls

- Brightness
- Contrast
- Smoothing
- Shaping
- Viewpoint

8.2.4 Description

This plugin produces a view of an O3A stream which can help make sense of what is happening in it. Audio is passed through unmodified, so the plugin can be inserted in the middle of an O3A effects chain.

The stream is shown using a two circular regions each showing a projection of a half of the directional components of the O3A soundfield interpreted over a sphere.

By default, the left sphere shows the upper hemisphere of the soundfield and the right sphere shows the lower hemisphere, as if both were viewed from above. The image is orientated so that sounds at the front appear at the top of both images. However, the [viewpoint](#) can be changed.

A good way to try this out is to chain the [O3A Panner - Hemisphere](#) plugin immediately before this one as that panner uses the same directional approach (as long as the [viewpoint](#) is set to "Above"). Then set up a decoder after this suitable for use with your speakers or headphones. Then you can play around with different sound directions and hear and see the results.

We do not particularly recommend this visualisation. Generally, we suggest you use the standard [O3A Visualiser](#) instead.

This plugin does not have O3A View support. You might wish to consider [O3A Flare](#).

8.2.5 Controls

8.2.5.1 Control: Brightness

This controls the brightness of the image. If the screen shows nothing when sounds are playing, you may wish to turn this up. If it is all red, turn it down.

Alternatively, you can set the dial to "Auto", in which case the plugin will try to ride the brightness control to keep the visualisation useful.

8.2.5.2 Control: Contrast

This controls the contrast of the image. Higher values produce a sharper image but map a smaller dynamic range onto the screen.

8.2.5.3 Control: Smoothing

The image generated is smoothed over time. Use more smoothing for a more stable, slower moving image. Use less for a more responsive one.

8.2.5.4 Control: Shaping

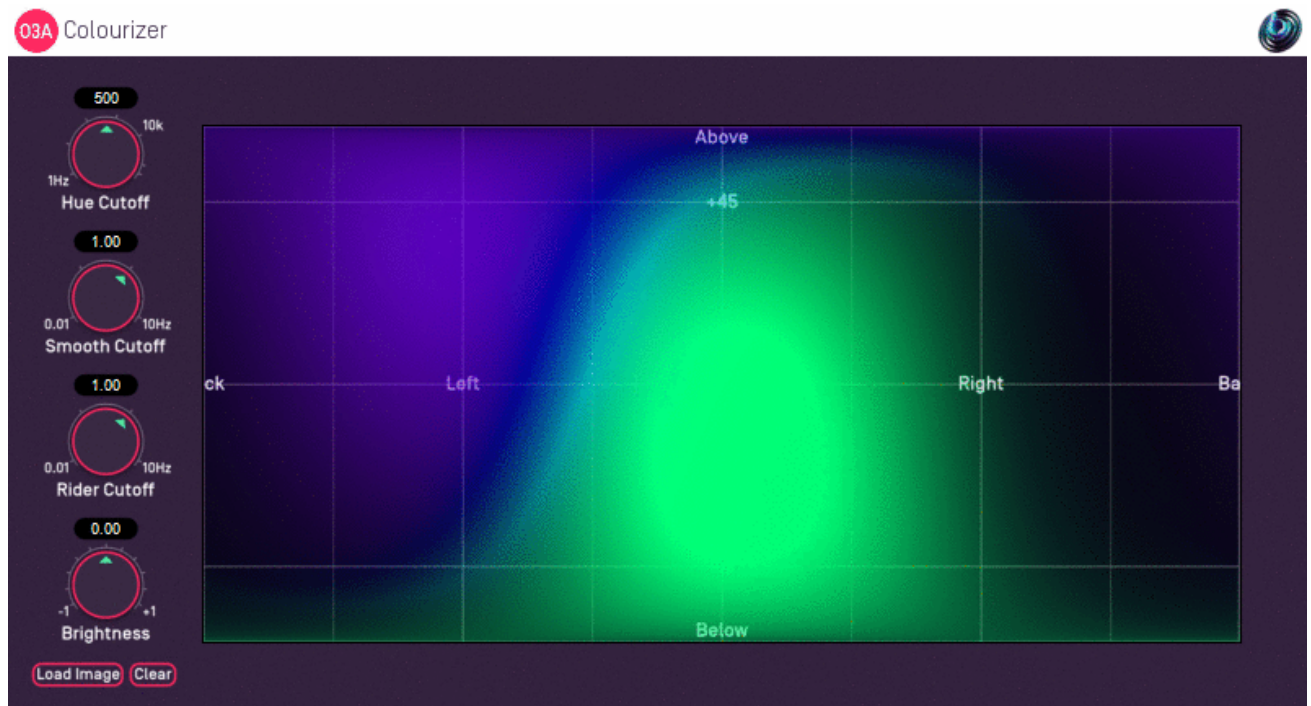
Shaping should normally be left on as it produces a more straightforward view. If this is turned off, the image will typically be sharper, but ripples will be visible in directions away from original sound directions.

8.2.5.5 Control: Viewpoint

By default, the visualisation shows the upper hemisphere on the left and the lower hemisphere on the right, both viewed as the viewpoint was from **above**.

Alternatively, the viewpoint can be changed to view from the **right** or from **behind**. In both cases sounds above appear at the top of the image.

8.3 O3A Colourizer



8.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.3.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

8.3.3 Controls

- Hue Cutoff
- Smooth Cutoff
- Rider Cutoff
- Brightness

8.3.4 Description

This plugin is a variant of the [O3A Visualiser](#) plugin. Like that plugin, it produces a view of an O3A stream which can help understand what is happening in it. Audio is passed through unmodified, so the plugin can be inserted in the middle of an O3A effects chain.

Two significant differences between this and the [O3A Visualiser](#) are the size of the plugin and how colours are mapped. With this plugin, colours are chosen using a hue that depends on the frequency content of the sound. Sounds that are predominantly low-frequency are coloured red and sounds that are predominantly high-frequency are coloured magenta. Sounds between are coloured with other hues accordingly.

8.3.4.1 Background Images

Press the "Load Image" button to load an image to replace the default grid background. JPG and PNG images are supported. Because of the way the plugin works, we recommend use of dark backgrounds.

The target image size is 636x316. Other sizes are resized to fit.

The "Clear" button can be used to clear the image so the default grid background is shown again.

8.3.5 Controls

8.3.5.1 Control: Hue Cutoff

The plugin selects hues by splitting the sound into low and high frequencies. To do this, it uses a low-pass filter with a cutoff frequency given by this control. Generally, it is best to set this where you want the greatest sensitivity to frequency content.

8.3.5.2 Control: Smooth Cutoff

The local image level is smoothed over time using a low-pass filter with a cutoff frequency given by this control. Lower values will give a more stable, slower moving image. Higher values will give a more responsive one.

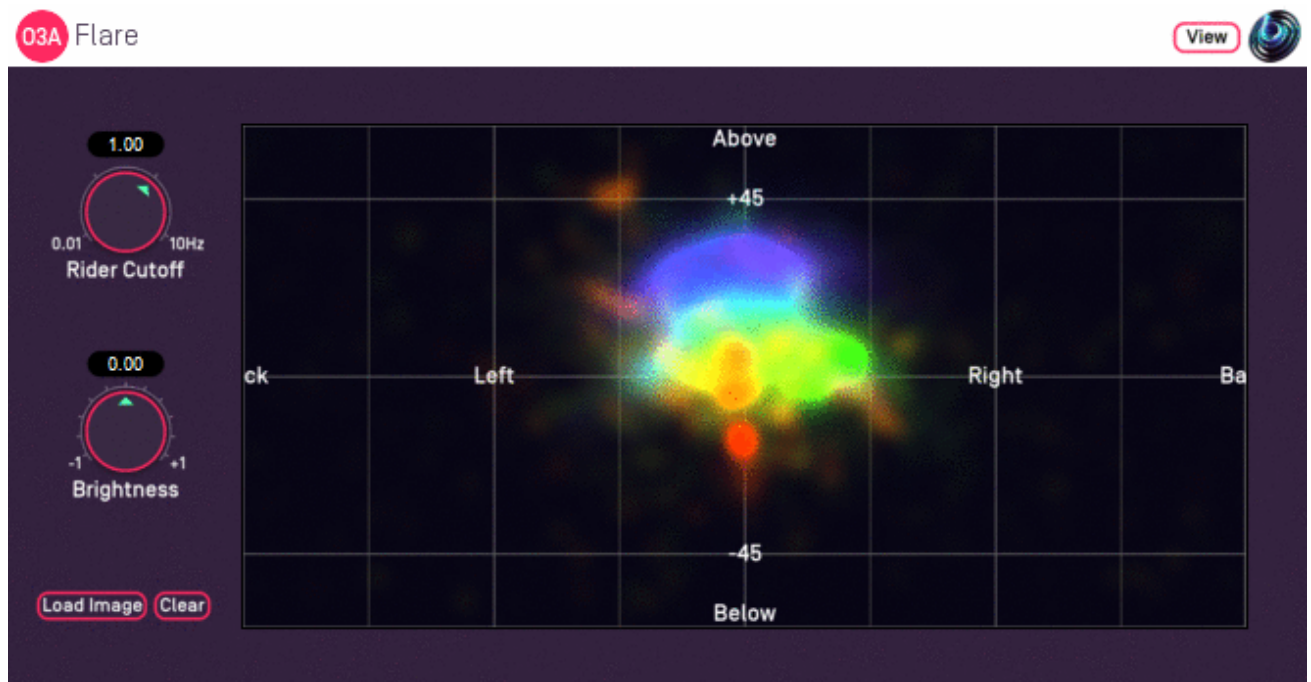
8.3.5.3 Control: Rider Cutoff

A "gain rider" tracks the overall signal level using another low-pass filter. Lower values respond more slowly to changes in the overall level of the signal. Higher values respond more quickly.

8.3.5.4 Control: Brightness

This modifies the overall brightness of the image.

8.4 O3A Flare



8.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.4.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

8.4.3 Controls

- Rider Cutoff
- Brightness

8.4.4 Description

This plugin is a variant of the [O3A Visualiser](#) plugin. Like that plugin, it produces a view of an O3A stream which can help understand what is happening in it. Audio is passed through unmodified, so the plugin can be inserted in the middle of an O3A effects chain.

Although this plugin uses the same layout, it uses substantially different processing to the [O3A Visualiser](#) and [O3A Colourizer](#) plugins. This plugin uses simple first order estimates of the predominant sound direction in a range of frequency bands. These directions are painted using colour coding, ranging from red for low frequencies up to magenta for high frequencies (up to about 20kHz). Plot accuracy is better for simpler scenes; multiple sources with similar frequency content will often result in smudged or misaligned images.

To reduce CPU load, this visualiser stops most processing when it is not on screen.

8.4.4.1 Background Images

Press the "Load Image" button to load an image to replace the default grid background. JPG and PNG images are supported. Because of the way the plugin works, we recommend use of dark backgrounds.

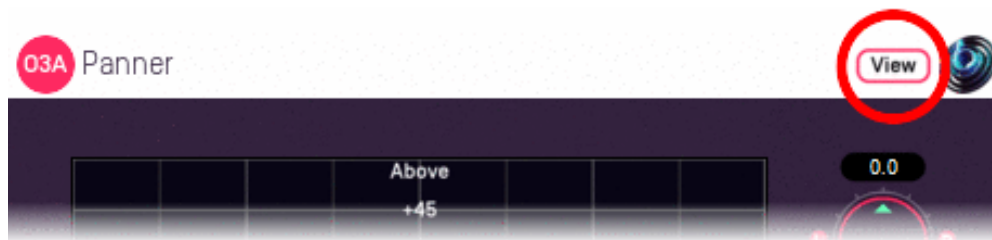
The target image size is 636x316. Other sizes are resized to fit.

The "Clear" button can be used to clear the image so the default grid background is shown again.

8.4.5 View Support

When used with O3A View Sync from the O3A 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 flare visualisation is supported by View.	The flare visualisation is supported by ViewVR.

Warning: requires a fast network connection and powerful CPU.

8.4.6 Controls

8.4.6.1 Control: Rider Cutoff

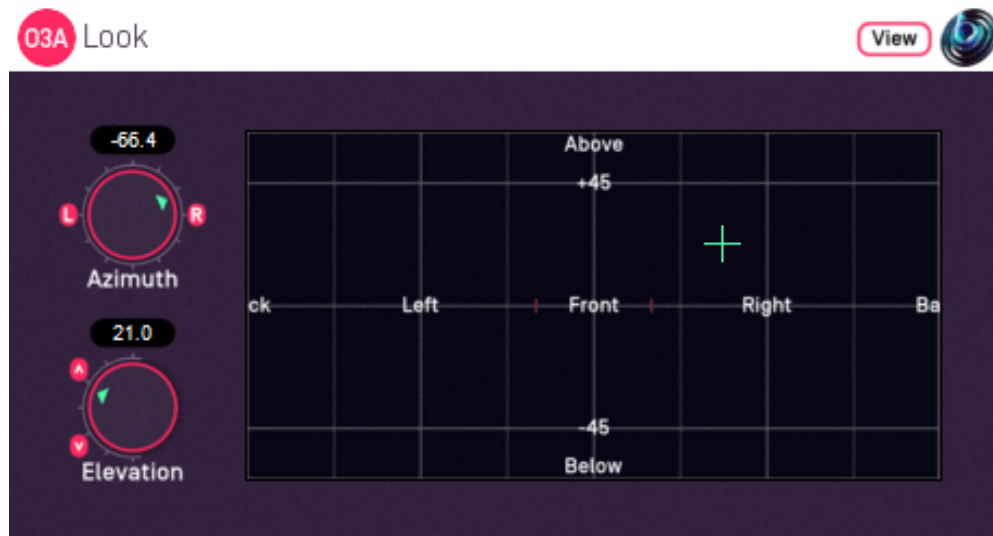
A "gain rider" tracks the overall level using another low-pass filter. Lower values respond more slowly to changes in the overall level of the signal. Higher values respond more quickly.

8.4.6.2 Control: Brightness

This modifies the overall brightness of the image.

9 O3A Core - Rotation

9.1 O3A Look



9.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

9.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

9.1.3 Controls

- Azimuth
- Elevation

9.1.4 Description

This plugin changes where "front" is in the 3D audio scene, as if the listener had turned their head to look (and listen) in another direction.

The "look" direction is chosen using the dials or control surface, in the normal way (for instance, see the [O3A Panner](#)). Sounds that were in this direction will be to the front after processing.

This is essentially an simplified (and inverted) version of the [O3A Rotation](#) plugin. The "roll" and "ordering" controls are not provided. Instead, we just assume that the listener turns their head and pitches it backwards or forwards. Rolling to the sides is not supported (use the rotation plugin if you need this).

9.1.5 View Support

When used with O3A View Sync from the O3A 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.

9.1.6 Controls

9.1.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction that is brought to the front by this plugin.

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.

9.2 O3A Rotation



9.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

9.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

9.2.3 Controls

- Yaw
- Pitch
- Roll
- Ordering

9.2.4 Description

This plugin rotates the entire O3A soundfield around the centre of the room.

Any rotation around the centre is possible and is built up using yaw, pitch and roll rotations. You can think of the rotations as being applied in order.

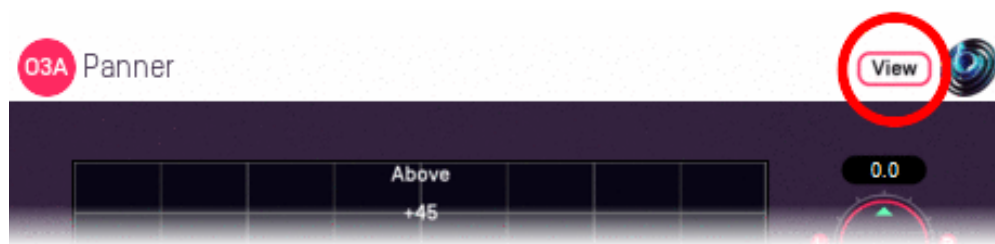
We *strongly recommend* that you use the [O3A Visualiser](#) when working with this plugin, particularly if you are going to use more than one of the dials at once. Otherwise, this plugin can be very confusing! It is easy to control in Virtual Reality using the ViewVR application however.

If you are using this plugin to simulate changes to the listener's orientation, you might also want to consider the [O3A Look](#) plugin, which is simpler to use but does not include a Roll control.

9.2.5 View Support

When used with O3A View Sync from the O3A 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 post-rotation 'front' of the scene is shown using a cross.</p> <p>Hold the left mouse button to set all four rotation controls, moving the 'front' of the scene to the indicated direction. Only 2DOF is supported and the rotation will be set so 'up' is upwards.</p>	<p>The scene orientation is shown using a floating cube with matching marker beams on the cube and VR controllers.</p> <p>Rotate a VR controller into the chosen orientation and hold the trigger to set the four rotation controls. Full 3DOF is supported.</p>

9.2.6 Controls

9.2.6.1 Controls: Pitch, Roll and Yaw

These controls use angles between -180 and +180 degrees which can each be thought of as controlling individual rotations around three fixed axes. The overall rotation is a combination of the three.

Rotation	Axis	Description of Positive Movement
Yaw	Z	The soundfield is "rotated" left around the middle of the room. For instance, a sound that starts at the front moves left, a sound that starts at the left moves backwards and a sound directly above does not move.
Pitch	Y	The soundfield is "tumbled" backwards. For instance, a sound that starts at the front moves upwards, a sound that starts at the left does not move and a sound directly above moves backwards.
Roll	X	The soundfield is "tilted" clockwise. For instance, a sound that starts at the front does not move, a sound that starts at the left moves upwards and a sound directly above moves right.

This plugin can be used to simulate changes in the listener's orientation. If you are doing this, you will probably want to change the sign of the angles involved. For instance, turning the listener's head to the right means that the listener hears sound move to the left.

9.2.6.2 Control: Ordering

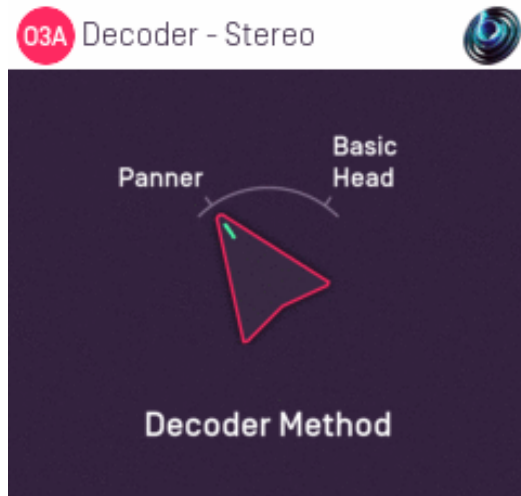
The ordering control determines the order in which the yaw, pitch and roll rotations are applied to make up a single rotation. The default is Y-P-R (i.e. yaw, pitch and then roll) but this can be switched to R-P-Y (i.e. roll, pitch and then yaw).

When simulating changes in the listener's orientation, we generally recommend the Y-P-R ordering. Then, the three dials can be thought of as turning the listener's head horizontally, then pitching it

forwards or backwards and finally rolling it from side to side.

10 O3A Core - Decoders and Converters

10.1 O3A Decoder - Stereo



10.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

10.1.2 Audio

	Channels	Content
Input	16	O3A
Output	2	Stereo

10.1.3 Controls

- [Method](#)

10.1.4 Description

This plugin takes a third order ambisonics (O3A) mix and decodes (renders) it as a simple, robust stereo mix.

Please note that **this is not a binaural decoder**. You may wish to consider [O3A Decoder - Headphones](#).

As another alternative to this plugin, you can use the [O3A Virtual Microphone](#) plugin to produce a stereo mix using a simple virtual stereo microphone.

10.1.5 Controls

10.1.5.1 Control: Method

Two decoder methods are supported, "Panner" and "Basic Head".

Method	Description
Panner	<p>This method produces a simple stereo mix, largely as if the sounds within the mix had been panned conventionally. This can work well on speakers or headphones.</p> <p>Sounds from the front and back are folded down on the stereo image using different angle conventions. Specifically, sounds panned from -30 to +30 degrees at the front will pass across the stereo image, as will sounds panned from -110 to +110 degrees at the back. Sounds above or below are fed to both speakers.</p>
Basic Head	<p>This method produces a stereo mix using a very crude model of a human head. When listened to on headphones, this imitates typical left and right ear levels that would occur naturally, albeit not in a frequency-dependent way. This can work well on speakers or headphones.</p> <p>This is not a binaural decoder. Although the data for this method is based on the Amber HRTF, it has been simplified so that the output is not frequency-dependent, for better results on loudspeakers. This reduces the strength of 3D cues on headphones.</p> <p>For full binaural decoding, we recommend O3A Decoder - Headphones from the O3A Decoding library, O3A Decoder - VR Monitoring from the O3A View plugin library, or Rapture3D Advanced.</p> <p>Unlike most other O3A decoders, this decoder presents sounds from different directions at different levels. For instance, sounds to the front are louder than those behind.</p>

10.1.5.2 Technical Notes

The Blue Ripple Sound Amber HRTF uses data from the IRCAM LISTEN HRTF data set, available at <http://recherche.ircam.fr/equipes/salles/listen/index.html>. It has been processed and simplified heavily.

10.2 O3A Decoder - Mono

O3A Decoder - Mono



10.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

10.2.2 Audio

	Channels	Content
Input	16	O3A
Output	1	Mono

10.2.3 Description

This plugin takes a third order ambisonics (O3A) mix and reduces it to mono by discarding everything but its omnidirectional component.

This type of mix is particularly suitable for level analysis, including loudness monitoring.

If you wish to extract a mono response from the soundfield in a particular direction, you might also want to try the [O3A Virtual Microphone](#) or [O3A Beamer](#) plugins.

10.3 O3A Decoder - 5.1 Basic

O3A Decoder - 5.1 Basic



10.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

10.3.2 Audio

	Channels	Content
Input	16	O3A
Output	6	5.1 Surround

10.3.3 Description

This plugin takes a third order ambisonics (O3A) mix and decodes it as a 5.1 surround mix.

A resilient decoding is used, suitable for small or large venues. ITU speaker angles are assumed.

A version of this plugin with more controls is available in the O3A Decoding plugin library.

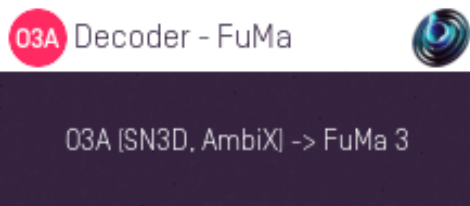
10.3.3.1 Channels

The channel ordering used is:

Channel	AAX	VST
1	Front Left	Front Left
2	Front Centre	Front Right
3	Front Right	Front Centre
4	Left Surround	LFE
5	Right Surround	Side Left
6	LFE	Side Right

The low frequency effect channel is *not* used.

10.4 O3A Decoder - FuMa



10.4.1 Host Support

Host Type	Support
AAX	Yes, output mapped to standard SN3D ambisonics
VST2	Yes

10.4.2 Audio

	Channels	Content
Input	16	O3A
Output	16	FuMa Ambisonic Audio (mapped to standard SN3D ambisonics for AAX)

10.4.3 Description

This plugin takes a third order ambisonic mix prepared with these plugins (O3A) and converts it to a third order mix using the FuMa ambisonic convention. The FuMa convention was used in early versions of these plugins (prior to version 2.0) and is an extension of classic First Order Ambisonics.

We have labelled this plugin as a decoder hopefully to make it clear that its output is an external format and no longer compatible with the [convention](#) that the rest of these plugins use.

You can convert back using the [O3A Injector - FuMa](#) plugin.

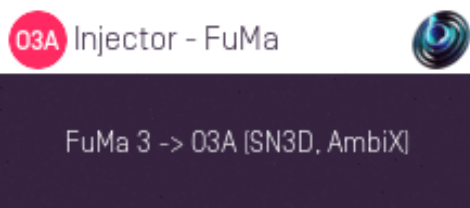
In Pro Tools, as the FuMa format is not supported directly as a stem format, this plugin outputs audio using the ordinary ambisonic stem format. Normally this should be encoded as O3A (i.e. SN3D/ACN), so we are "misusing" the format here.

10.4.3.1 Orders

This plugin produces third order FuMa output. If you only want first or second order output, just take the first four or nine output channels and ignore the rest.

Alternatively, the [O3A Decoder - O1A](#) or [O2A](#) plugins can be "misused" to reduce the order of the FuMa material as this is a rare case where a plugin will work correctly for both SN3D and FuMa.

10.5 O3A Injector - FuMa



10.5.1 Host Support

Host Type	Support
AAX	Yes, input mapped to standard SN3D ambisonics
VST2	Yes

10.5.2 Audio

	Channels	Content
Input	16	FuMa Ambisonic Audio (mapped to standard SN3D ambisonics for AAX)
Output	16	O3A

10.5.3 Description

This plugin takes a mix in the FuMa ambisonic convention and converts it to [third order ambisonics](#) (O3A) as used by the current version of these plugins. FuMa was used by old versions of these plugins (prior to version 2.0) and is an extension of classic First Order Ambisonics.

You can convert back with the [O3A Decoder - FuMa](#) plugin.

In Pro Tools, as the FuMa format is not supported directly as a stem format, this plugin expects audio using the ordinary ambisonic stem format. Normally this should be encoded as O3A (i.e. SN3D/ACN), so we are "misusing" the format here.

10.5.3.1 Orders

This plugin expects third order FuMa input. If you only have first or second order, feed this to the first four or nine input channels and feed silence to the rest.

Alternatively, the [O3A Injector - O1A or O2A plugins](#) can be "misused" to increase the order of the FuMa material as this is a rare case where a plugin will work correctly for both SN3D and FuMa.

10.6 O3A Decoder - O1A and O2A

 O3A Decoder - O1A



O3A [SN3D, AmbiX] -> O1A [SN3D, AmbiX]

10.6.1 Host Support

10.6.1.1 O3A Decoder - O1A

Host Type	Support
AAX	Yes
VST2	Yes

10.6.1.2 O3A Decoder - O2A

Host Type	Support
AAX	Yes
VST2	Yes

10.6.2 Audio

10.6.2.1 O3A Decoder - O1A

	Channels	Content
Input	16	O3A
Output	4	O1A

10.6.2.2 O3A Decoder - O2A

	Channels	Content
Input	16	O3A
Output	9	O2A

10.6.3 Description

These simple plugins take a third order (O3A) ambisonic mix and convert it to a lower resolution first order (O1A) or second order (O2A) mix. In all cases, the SN3D convention is used.

These plugins are extremely simple and just reduce the channel count in use by discarding the later channels, which has the effect of reducing the spatial detail of the mix.

Note that some DAWs (such as Reaper) pass through channels that are not written to. These plugins will appear to have no effect in these DAWs!

These plugins can also be "misused" to reduce the order of N3D/ACN or FuMa material. This is a rare case where the same plugin will work correctly for all three ambisonic formats.

10.7 O3A Injector - O1A and O2A

O3A Injector - O1A



O1A [SN3D, AmbiX] -> O3A [SN3D, AmbiX]
Warning: output has limited spatial detail.

10.7.1 Host Support

10.7.1.1 O3A Injector - O1A

Host Type	Support
AAX	Yes
VST2	Yes

10.7.1.2 O3A Injector - O2A

Host Type	Support
AAX	Yes
VST2	Yes

10.7.2 Audio

10.7.2.1 O3A Injector - O1A

	Channels	Content
Input	4	O1A
Output	16	O3A

10.7.2.2 O3A Injector - O2A

	Channels	Content
Input	9	O2A
Output	16	O3A

10.7.3 Description

These simple plugins take a lower resolution first order (O1A) or second order (O2A) mix and convert it to a third order (O3A) ambisonic mix. In all cases, the SN3D convention is used.

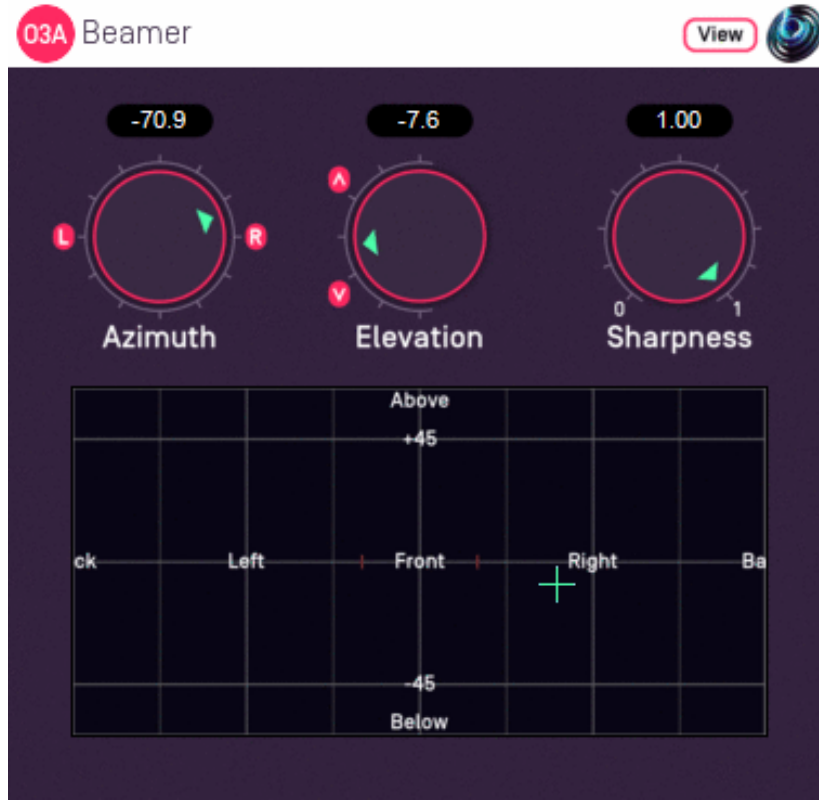
These plugins are extremely simple and just increase the channel count in use, filling new channels with silence. Although this increases the order of the mix, it does not increase its spatial detail. Further, the resulting mix may have unnatural features acoustically.

More sophisticated means to convert first order (O1A) to third order include the O3A Injector - First Order plugin from the O3A Upmixers pack and the O3A Harpex Upsampler.

These plugins can also be "misused" to increase the order of N3D/ACN or FuMa material. This is a rare case where the same plugin will work correctly for all three ambisonic formats.

11 O3A Core - Virtual Microphones

11.1 O3A Beamer



11.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

11.1.2 Audio

	Channels	Content
Input	16	O3A
Output	1	Mono

11.1.3 Controls

- Azimuth
- Elevation
- Sharpness

11.1.4 Description

The O3A Beamer extracts sound in a particular "beam" direction from a 3D O3A mix. You can think of this as a narrow directional microphone response, pointed in a particular direction in the soundfield.

The beam direction can be set using the azimuth and elevation controls, or the control surface, where the direction is indicated by the 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 [O3A Visualiser](#) which lays out its viewing region in the same way.

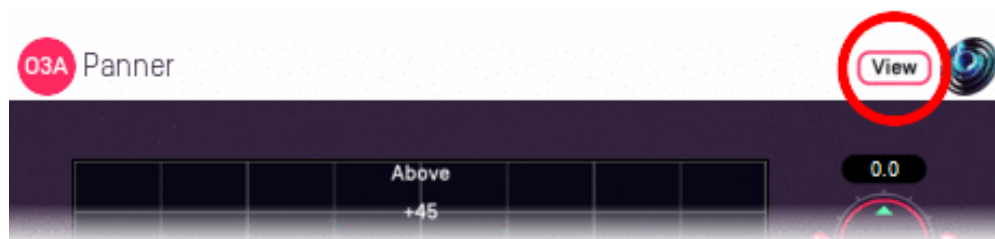
The algorithm used is a "passive" one and should not colour frequency content significantly.

If you are interested in producing simple virtual microphone responses from an O3A mix, you may also wish to read about the [O3A Virtual Microphone](#).

11.1.5 View Support

When used with O3A View Sync from the O3A 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.

11.1.6 Controls

11.1.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to extracted.

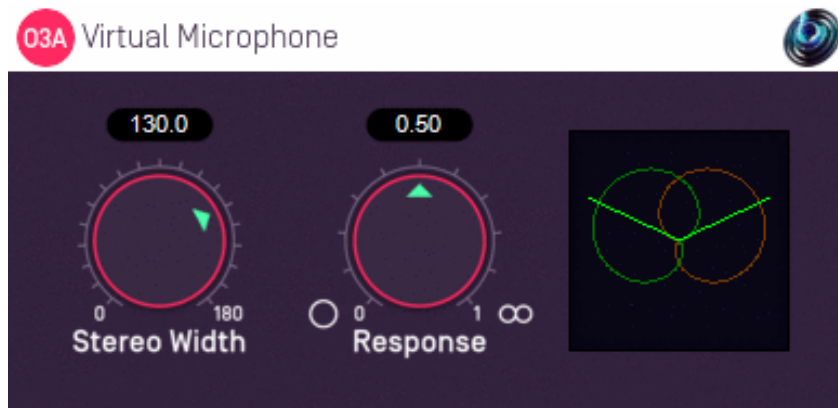
Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

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.

11.1.6.2 Control: Sharpness

The sharpness control determines how directional the beam response is. A value of zero reduces the response to an omnidirectional one like that of the [mono decoder](#). A value of one is the usual case and gives the sharpest response.

11.2 O3A Virtual Microphone



11.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

11.2.2 Audio

	Channels	Content
Input	16	O3A
Output	2	Stereo

11.2.3 Controls

- [Stereo Width](#)
- [Response](#)

11.2.4 Description

The O3A Virtual Microphone extracts a stereo image from a 3D O3A mix using a front-facing "virtual" stereo microphone placed at the centre of the soundfield. The angle between the two capsules of this virtual microphone can be varied, along with their directional response. Available directional responses include omni, cardioid and figure-of-eight. This makes it possible to synthesise the results of various conventional coincident stereo recording techniques such as Blumlein X-Y and M/S.

This plugin does not allow you to point the front of the virtual microphone in other directions. If the front is not where you want, remember that you can rotate the soundfield using [O3A Rotation](#) or [O3A Look](#).

This plugin actually only needs first order ambisonic information (and even then, the height channel is not used).

Be careful using this as a stereo decoder, because the overall output level can be highly dependent on source locations, as with the "real" recording techniques. You might wish to consider [O3A Decoder - Stereo](#).

If you are interested in extracting sounds in particular directions from an O3A mix, you may also be interested in the sharper response of the [O3A Beamer](#) plugin.

11.2.5 Controls

11.2.5.1 Control: Stereo Width

This is the angle between the two virtual microphones, between 0 and 180 degrees. For instance, 90 degrees should be used for Blumlein X-Y.

11.2.5.2 Control: Response

The response control determines the directional response of the two microphone capsules. Some useful values are:

Response Value	Name
0.00	Omnidirectional
0.25	Subcardioid
0.50	Cardioid
0.75	Hypercardioid
1.00	Figure-of-Eight

For instance, 1.00 (figure-of-eight) should be used for Blumlein X-Y.

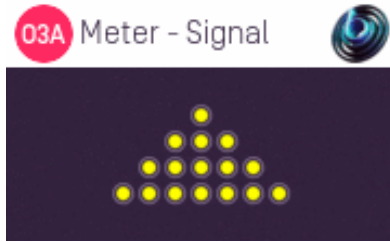
11.2.6 Presets

Presets are available for this plugin:

- Cardioids 130
- Cardioids 90
- Blumlein X/Y

12 O3A Core - Metering

12.1 O3A Meter - Signal



12.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

12.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

12.1.3 Description

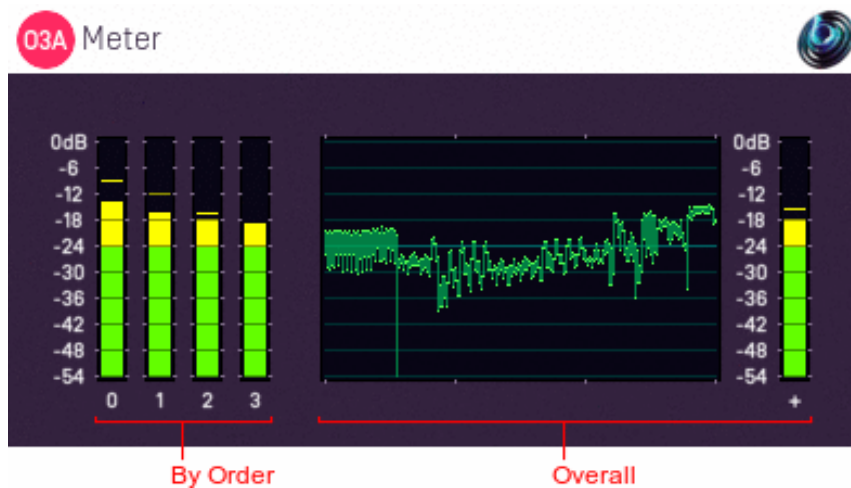
This extremely simple plugin measures the signal peak in each of the 16 channels of an [O3A stream](#) to indicate if a signal is present. It is intended for basic diagnostics (e.g. "are all my channels getting through?") and not for serious signal analysis. Audio is passed through unchanged.

12.1.3.1 Meters

Lights are shown for each of the 16 channels in O3A. They are shown in rows corresponding to the ambisonic orders. Lights switch on with a yellow colour in the presence of very low signal levels (-100dB and above) and switch to red at high levels (0dB and above). These signal levels are simple peak levels, *not* "True Peak".

Note that first order ambisonic B-Format only uses the first four channels of O3A, in which case only the first four lights (top two rows) will be on. Sounds exactly on the horizontal plane switch on alternating lights on each row and a few special directions do other strange things. However, normal 3D streams should switch on all 16 lights; if they do not there is probably something wrong! A common error is to forget to set a track's channel count or send to at least 16, and this plugin will usually make that obvious.

12.2 O3A Meter



12.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

12.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

12.2.3 Description

This plugin measures the sound level in an O3A stream. A breakdown by ambisonic order is provided, along with a history graph and the current overall level. Audio is passed through unchanged.

12.2.3.1 Meters

From left to right, the following displays are shown:

1. Bar meter showing the current and recent peak level in order 0 (ACN channel 0 only).
2. Bar meter showing the current and recent peak level in order 1 (ACN channels 1 to 3).
3. Bar meter showing the current and recent peak level in order 2 (ACN channels 4 to 8).
4. Bar meter showing the current and recent peak level in order 3 (ACN channels 9 to 15).
5. History min/max graph of overall level (all 16 channels).
6. Bar meter showing the overall current and peak level (all 16 channels).

Each bar meter shows the current RMS level in green, averaged using a 400ms rectangular window and translated to a decibel scale, along with a recent peak calculation using a 2s memory. The history graph shows the last three minutes of the overall level, displaying the range from minimum to maximum for each second.

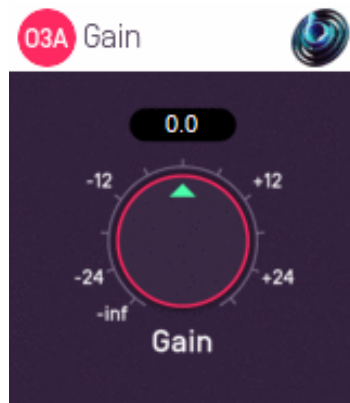
The meters are all normalised so that a 0dBFS peak sine wave panned in any direction will produce a -3.01dB output. There is no sensitivity to frequency or direction. If you are interested in measuring loudness, you may wish to consider the O3A Meter - Karma plugin from the O3A Decoding

Decoding library, which will produce comparable numbers when set to use LUFS units, subject to directional and loudness weighting.

For material that has been assembled by simple panning, the bar meters should be roughly in line with each other.

13 O3A Core - Soundfield Modification

13.1 O3A Gain



13.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

13.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

13.1.3 Controls

- Gain

13.1.4 Description

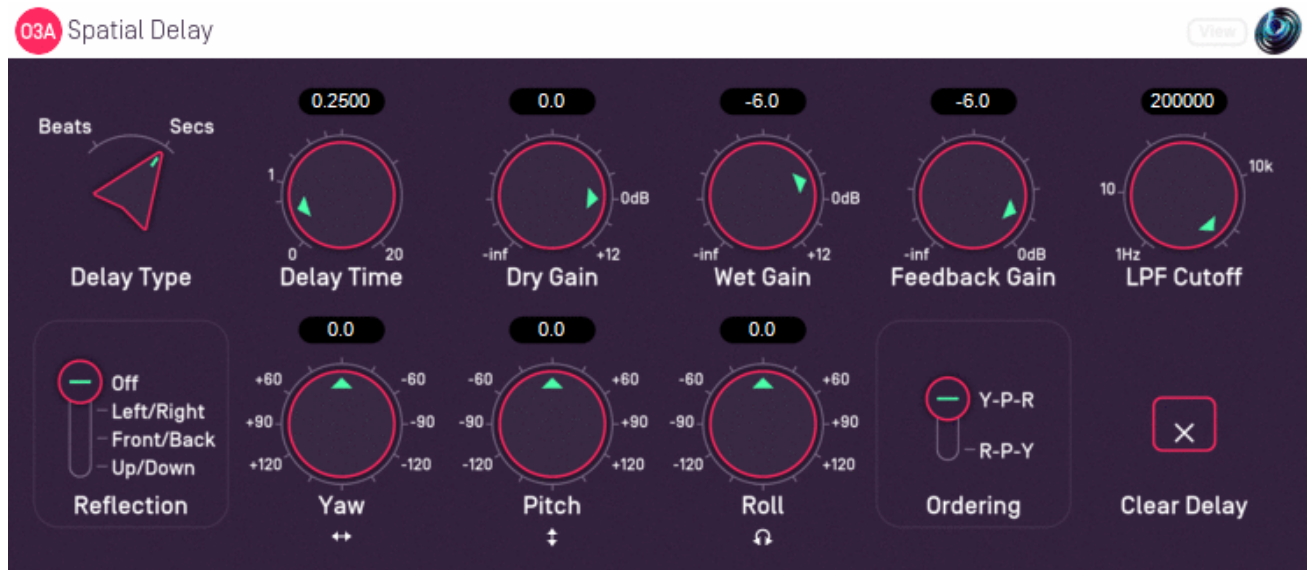
This trivial plugin applies a gain to the O3A stream. All channels of the stream are affected equally.

13.1.5 Controls

13.1.5.1 Control: Gain

The gain to apply, in decibels, between -30dB and +30dB.

13.2 O3A Spatial Delay



13.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

13.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

13.2.3 Controls

- Delay Type
- Delay Time
- Dry Gain
- Wet Gain
- Feedback Gain
- LPF Cutoff
- Reflection
- Yaw
- Pitch
- Roll
- Ordering
- Clear Delay

13.2.4 Description

This plugin delays a third order ambisonic (O3A) stream, applying a scene reflection, rotation and low pass filter to the delayed sound. It also supports feedback, so the output of the plugin can be fed back to its input to create repeating sound effects.

The rotation module of this plugin operates in the same way as the [O3A Rotation](#) plugin and can be controlled by an external View application. The reflection, rotation and low pass filter appear *within*

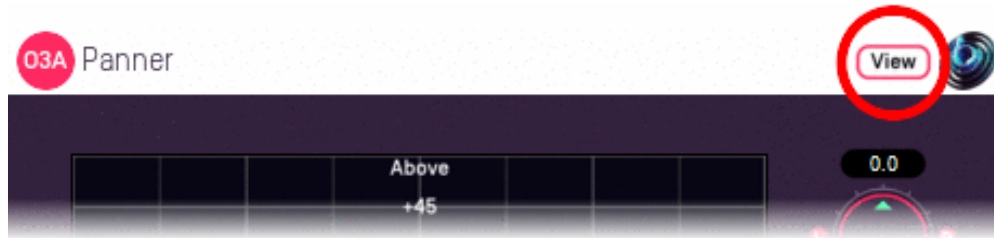
the feedback loop. The wet gain does not, applying only to the final output.

The "Clear Delay" button on the bottom right can be used to clear the audio in the delay line.

13.2.5 View Support

When used with O3A View Sync from the O3A 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 post-rotation 'front' of the scene is shown using a cross. Hold the left mouse button to set all four rotation controls, moving the 'front' of the scene to the indicated direction. Only 2DOF is supported and the rotation will be set so 'up' is upwards.	The scene orientation is shown using a floating cube with matching marker beams on the cube and VR controllers. Rotate a VR controller into the chosen orientation and hold the trigger to set the four rotation controls. Full 3DOF is supported.

13.2.6 Controls

13.2.6.1 Controls: Delay Time and Delay Type

The delay type determines whether the delay time is specified in beats or in seconds. When beats are used, the delay length is a multiple of the beat length in your DAW's current tempo, so if your tempo is in crotchets, then setting the delay to 2.0 results in a delay time equivalent to a minim.

Delay times are rounded to the nearest sample and the minimum delay is one sample. The maximum setting is 20 seconds or 20 beats.

Changes to the delay time are implemented using fades between different delay settings. This means that the delay cannot be used to simulate Doppler shift, but that changes are less likely to be disruptive to musical material. Continuous changes to the delay time may result in artefacts.

Please note that high delay time settings use a significant amount of memory (RAM). This memory is not released until the plugin instance is unloaded.

13.2.6.2 Controls: Dry Gain and Wet Gain

These control how much unmodified "dry" input and delayed "wet" material is included in the output.

13.2.6.3 Control: Feedback Gain

The feedback gain determines how much of the delayed output is sent back into the delay line. The wet gain is not applied here, but rotation and the low pass filter are.

When the feedback gain is set at or close to 0dB, the delay output level is liable to increase over time. Please be careful not to damage anything because of this. The delay line can be cleared using the [Clear Delay](#) button, but being conservative with the feedback gain setting is normally recommended.

13.2.6.4 Control: LPF Cutoff

This controls the cutoff frequency of a simple -6dB/octave low-pass filter applied to the delay output. This can be used to make the sound more distant as echoes repeat. Feedback can result in the filter being applied more than once to the same material.

13.2.6.5 Control: Reflection

This can be used to apply a fixed spatial reflection to the O3A material before a spatial rotation is applied. The spatial reflections available are:

- None
- Left/Right
- Front/Back
- Up/Down

Note that, by combination with the rotation, it is possible to construct any other angle of reflection.

13.2.6.6 Controls: Pitch, Roll and Yaw

A scene rotation is applied to the delayed O3A scene, in a similar way to the rotation used by the [O3A Rotation](#) plugin. Feedback can result in the rotation being applied more than once to the same material.

These controls use angles between -180 and +180 degrees which can each be thought of as controlling individual rotations around three fixed axes. The overall rotation is a combination of the three.

Rotation	Axis	Description of Positive Movement
Yaw	Z	The soundfield is "rotated" left around the middle of the room. For instance, a sound that starts at the front moves left, a sound that starts at the left moves backwards and a sound directly above does not move.
Pitch	Y	The soundfield is "tumbled" backwards. For instance, a sound that starts at the front moves upwards, a sound that starts at the left does not move and a sound directly above moves backwards.
Roll	X	The soundfield is "tilted" clockwise. For instance, a sound that starts at the front does not move, a sound that starts at the left moves upwards and a sound directly above moves right.

13.2.6.7 Control: Ordering

The ordering control determines the order in which the yaw, pitch and roll rotations are applied to make up a single rotation. The default is Y-P-R (i.e. yaw, pitch and then roll) but this can be switched to R-P-Y (i.e. roll, pitch and then yaw).

13.2.6.8 Control: Clear Delay

The "Clear Delay" button can be found at the bottom right of the plugin. While pressed, this button clears the delay line and silences everything but the dry signal.

14 Appendix: O3A Streams

14.1 What is an O3A Stream?

A third order ambisonic (O3A) stream is made up of 16 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 16 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 12 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 O3A stream, we find that it is normally best to use an [O3A Visualiser](#) or [O3A Flare](#) plugin.

14.2 What processing can I apply to an O3A stream?

As well as processing designed specifically for O3A 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 16 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 O3A stream with a conventional mono DSP algorithm you *must apply the same processing to all 16 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.

14.3 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.

14.4 How does O3A 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 O3A Core pack includes plugins to do this: [O3A Decoder - FuMa](#) and [O3A Injector - FuMa](#).

14.5 Why Third Order?

These plugins are based on Higher Order Ambisonic (HOA) techniques, which in principle can run at any "order" of spatial detail. We could have made all these plugins work at different orders; once you have got as far as making the maths and DSP work at third order (16 channels) it is not hard to extend to (for instance) fifth order (36 channels). We decided to use third order as it provides a good balance between spatial detail, current practice and CPU load. And sticking to just one type of B-Format avoids all sorts of "wiring" headaches!

That said, if you have a serious need for even higher order algorithms, please get in touch.