



O3A View Plugins

v2.4.0

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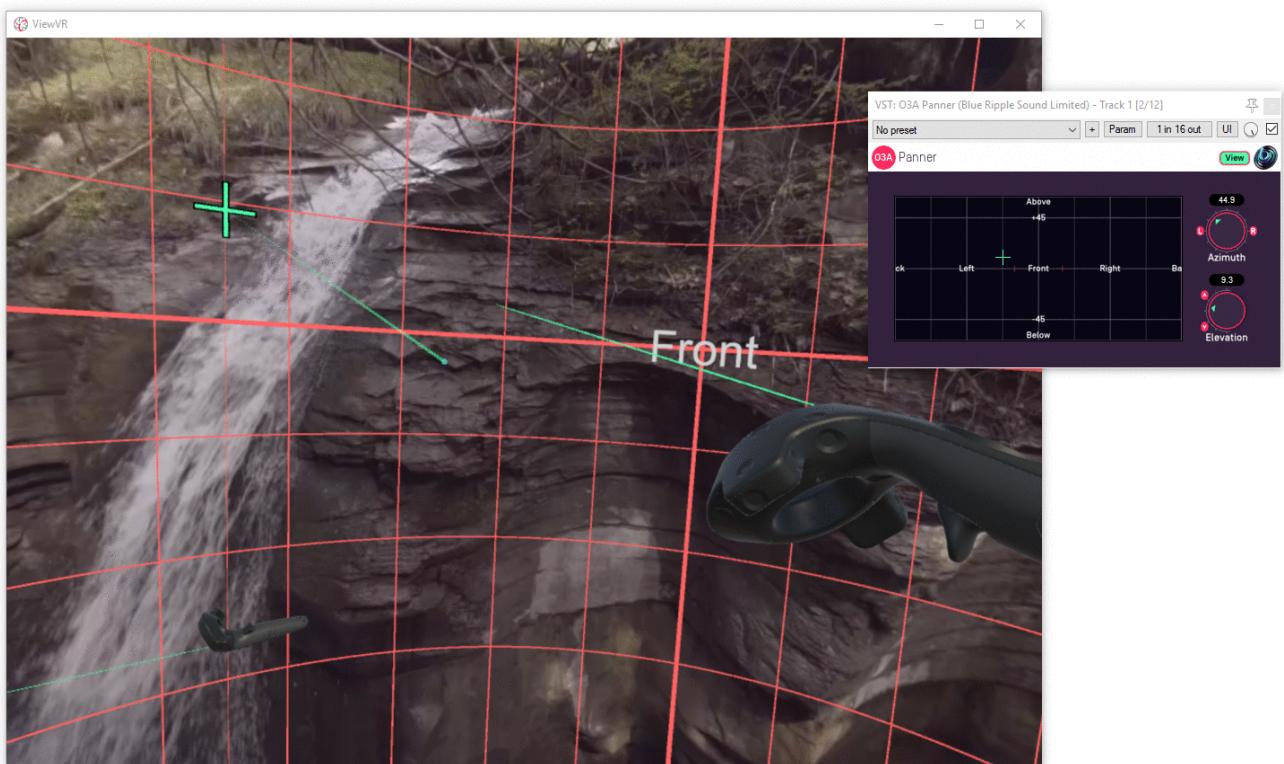
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1 Introduction

The O3A View plugin library provides a number of tools to help mix [third order ambisonic \(O3A\) streams](#) for use in Virtual Reality (VR) and film.

This plugin library comes with a [separate viewing application](#) which allows video to be synchronized with audio, for mixing to picture. This viewing application has two versions, one for use on conventional displays and another for use with a Virtual Reality headset. Various image layouts are supported, including classic film and 360 spherical video, with or without stereographics.

When this separate viewing application is used, some O3A plugins can be controlled from the application. For instance, this allows control of panning automation from within virtual reality. A [number of O3A plugins](#) benefit from this, including some plugins in other Blue Ripple Sound O3A plugin libraries.



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.

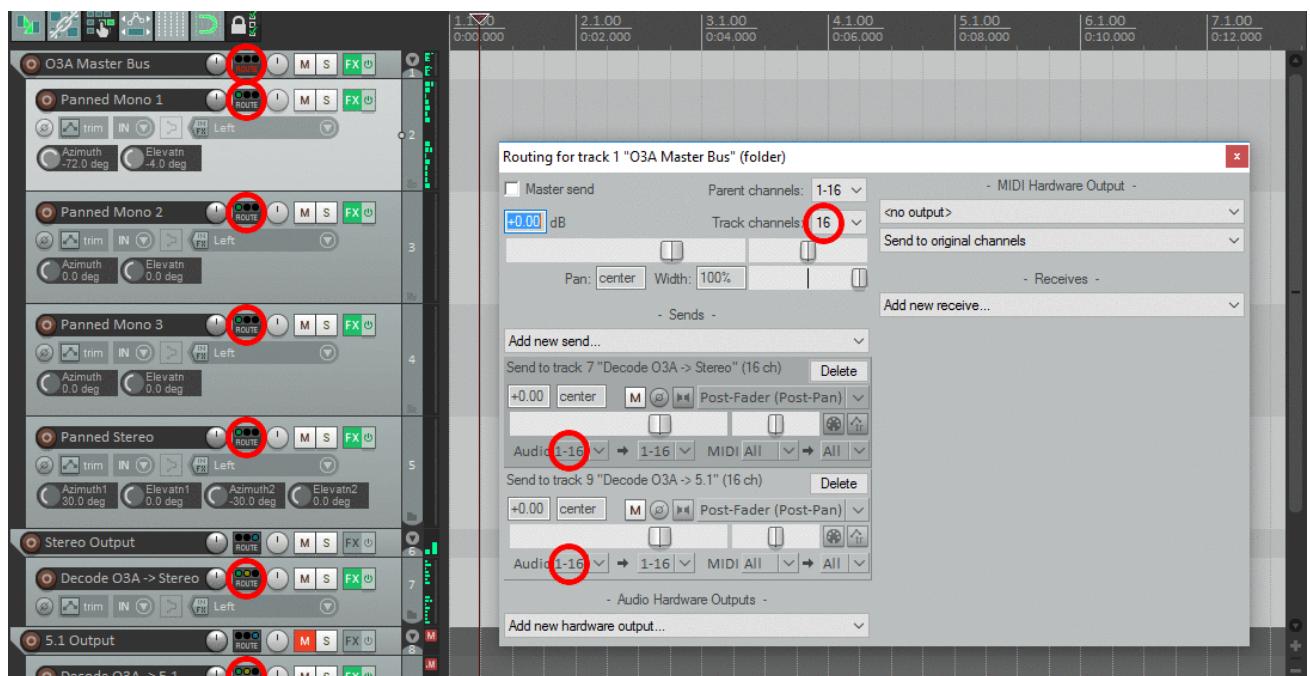
2.2.1 Shell Plugins

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.

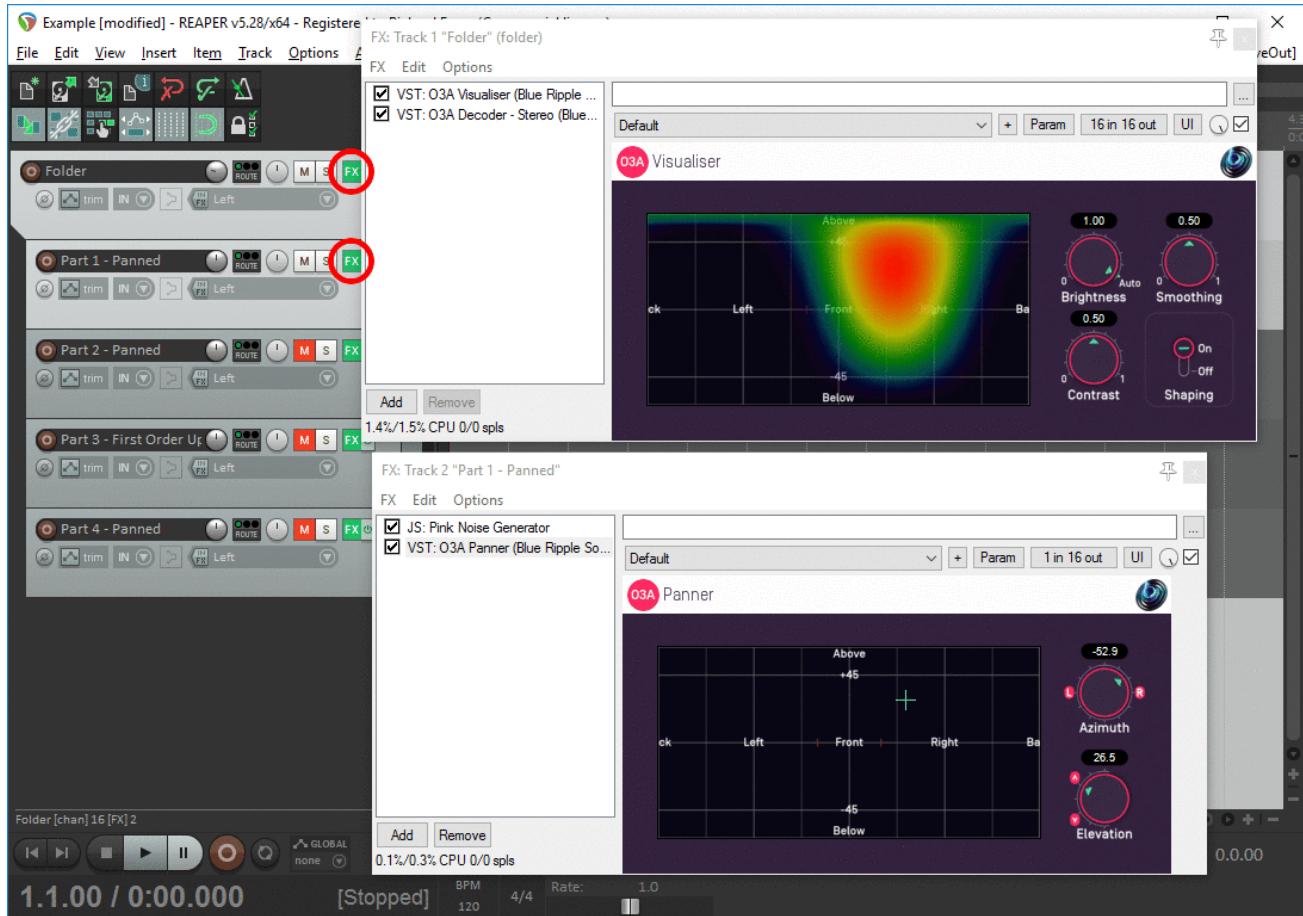
To fix this, go into the Reaper "Options" menu and select "Preferences..." to bring up the preferences screen. Then, under "Plug-ins", find "VST". On the VST tab, please ensure that "Get VST names/types when scanning" is checked and then click "Clear cache/re-scan".

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).

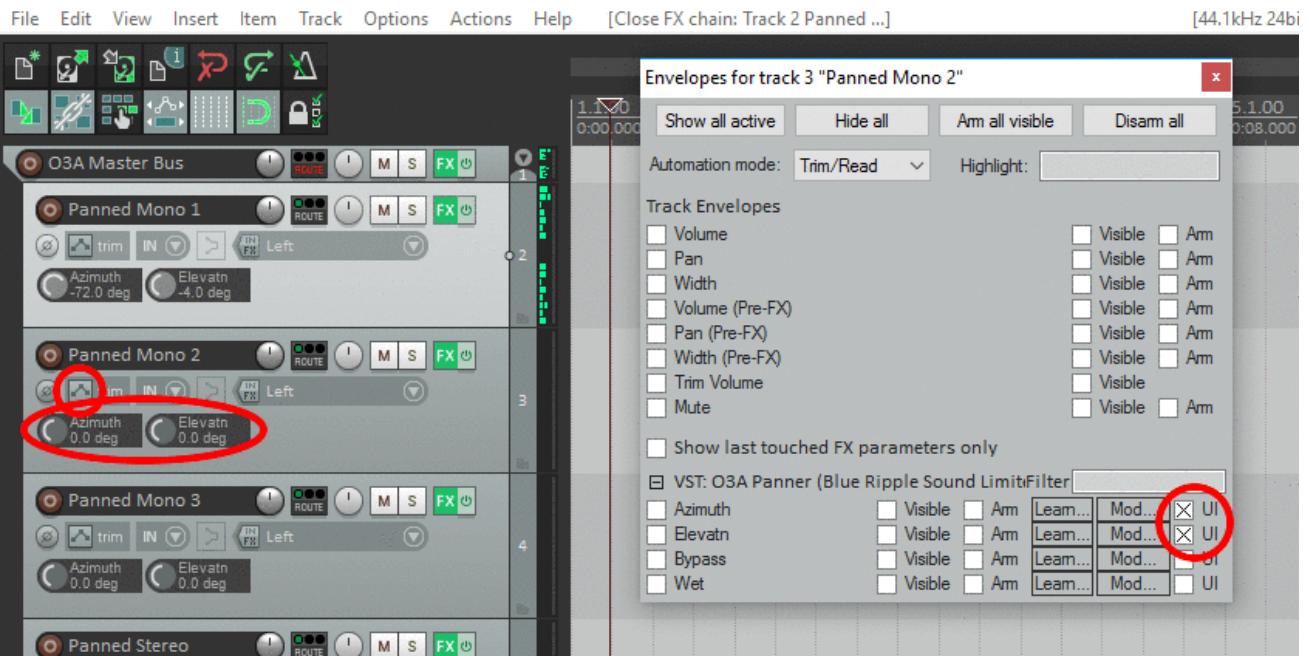
This means that after all the audio from the individual parts has been mixed together it will be visualised in 3D and then converted to stereo for monitoring.

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.

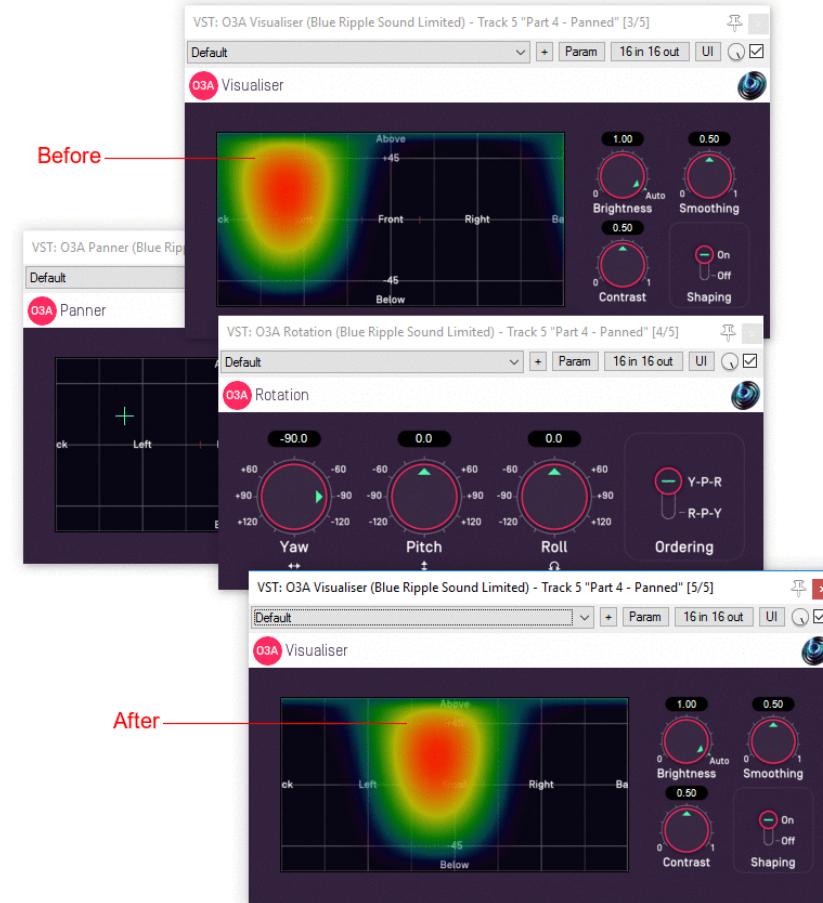


Parts that are already first order ambisonic B-Format can typically be injected directly without issue, although processing can help (e.g. the O3A First Order Injector plugin from the O3A Upmixers set, or the O3A Harpex Upsampler). Of course, other O3A material can be injected directly. FuMa material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

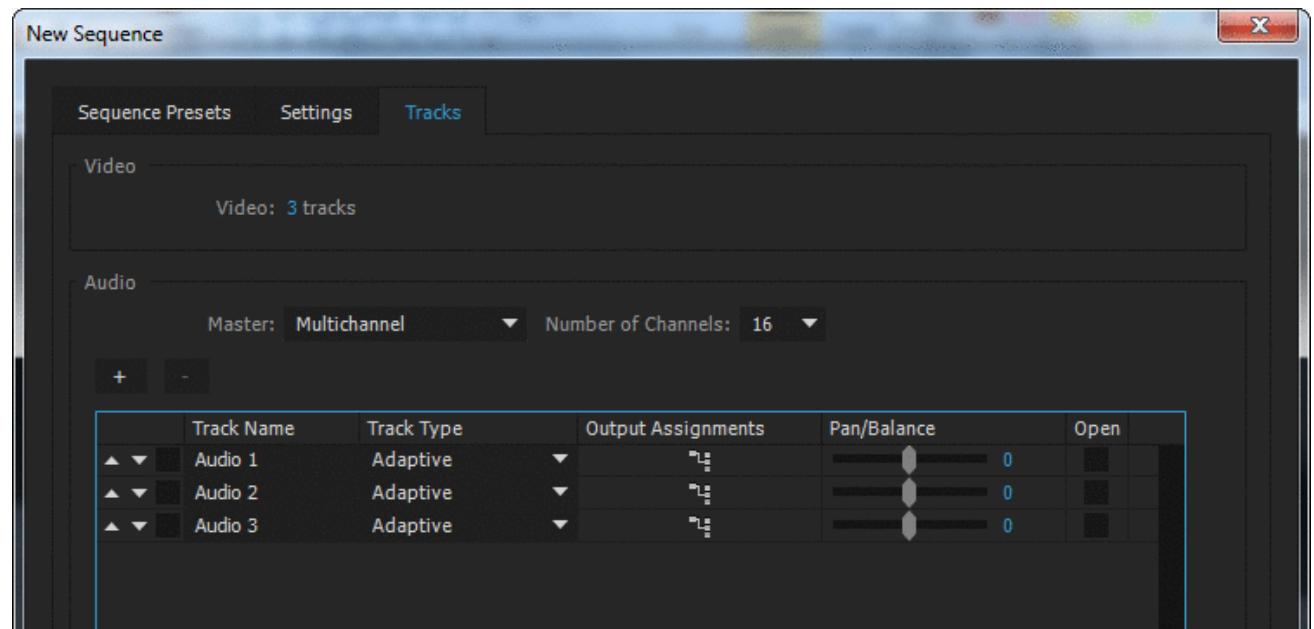
2.3 Getting Started with Premiere Pro

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.

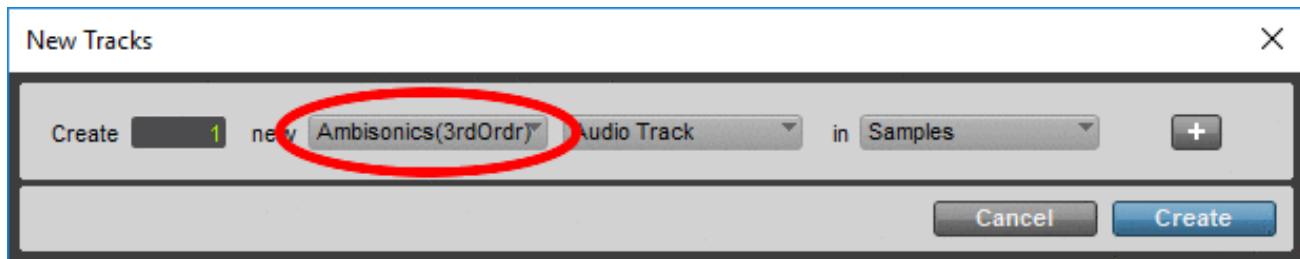
Where you are using standard Pro Tools stem formats only, these issues are not relevant. But, if you are using stem formats that Pro Tools does not support directly, care is needed.

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).



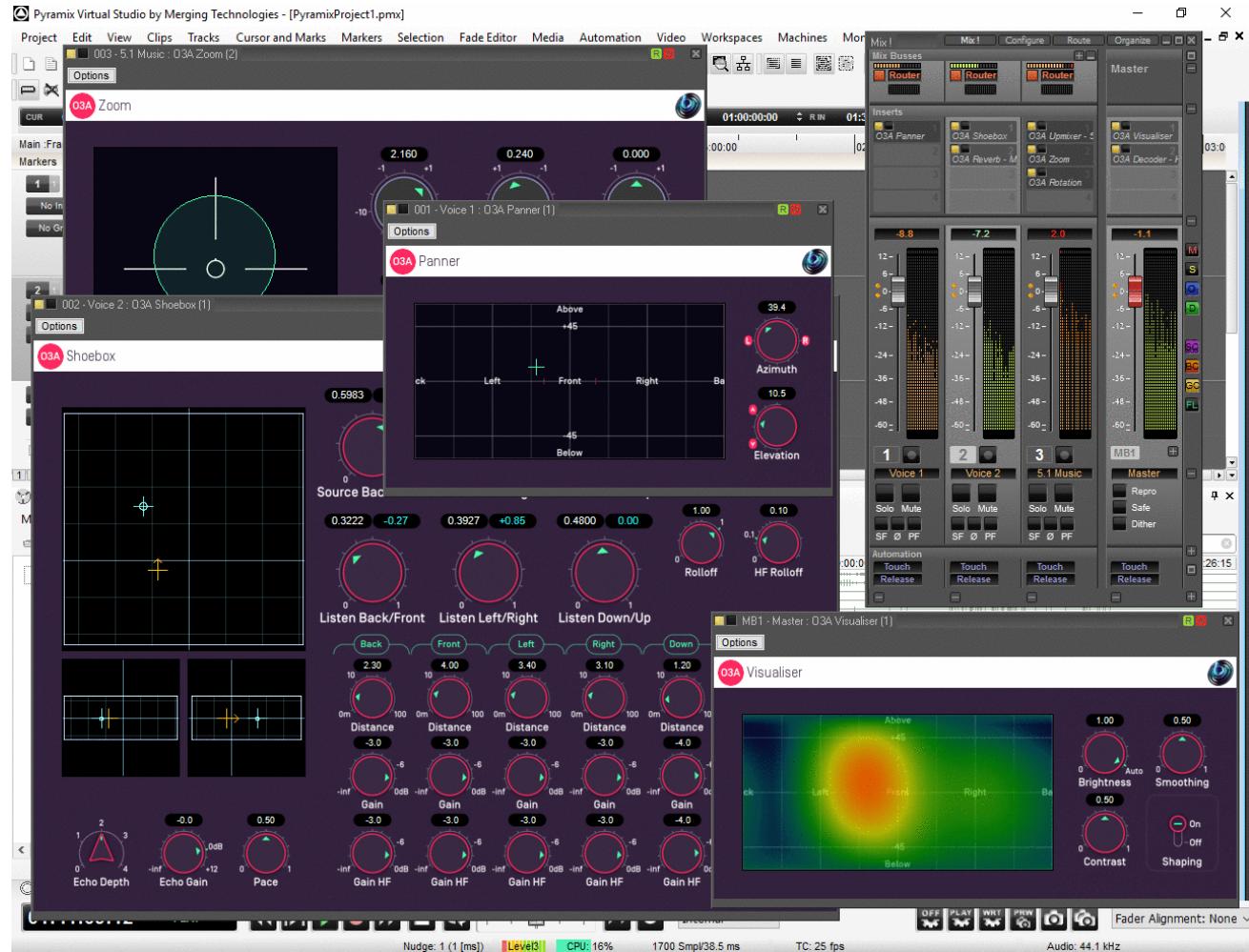
This gives a convenient place to bring the whole O3A mix together and send it to a number of tracks for visualisation (e.g. with [O3A Visualiser](#) or [O3A Flare](#)), metering and decoding for specific output formats.

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.

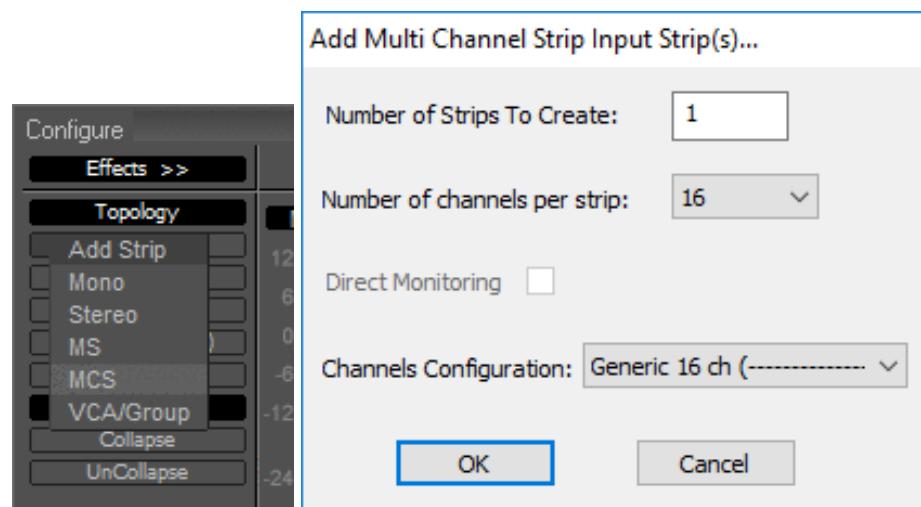
2.5 Getting Started with Pyramix

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.

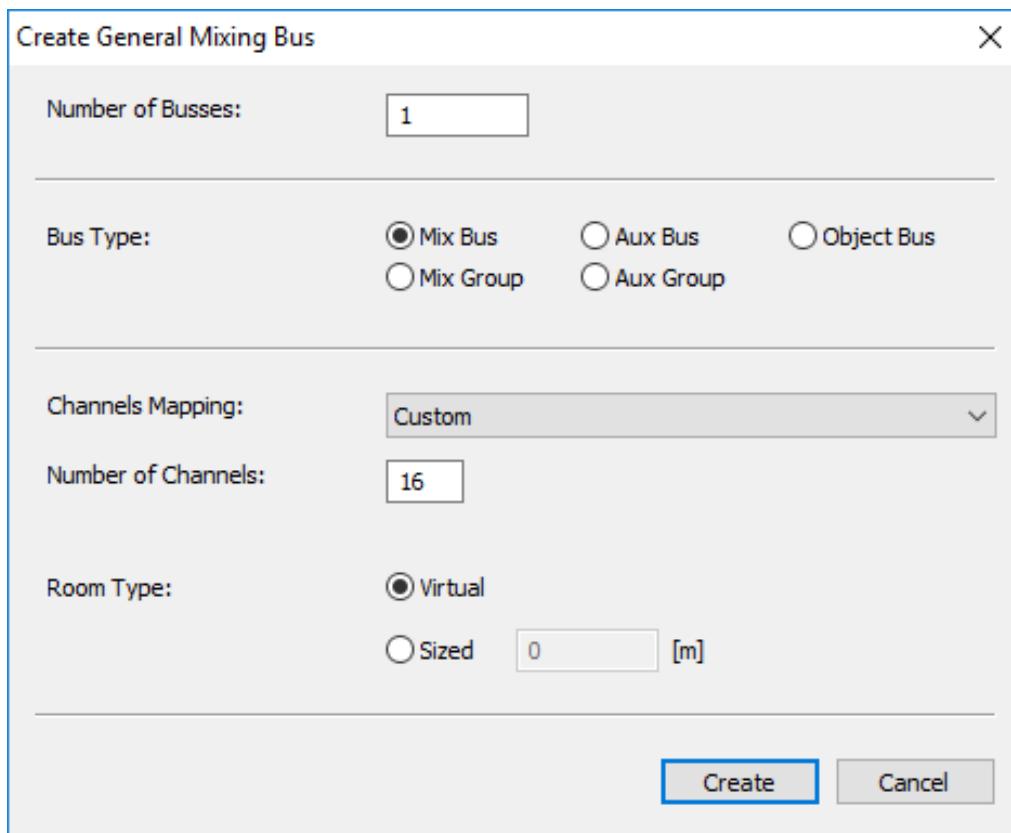


2.5.1 Setup

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.



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](#).

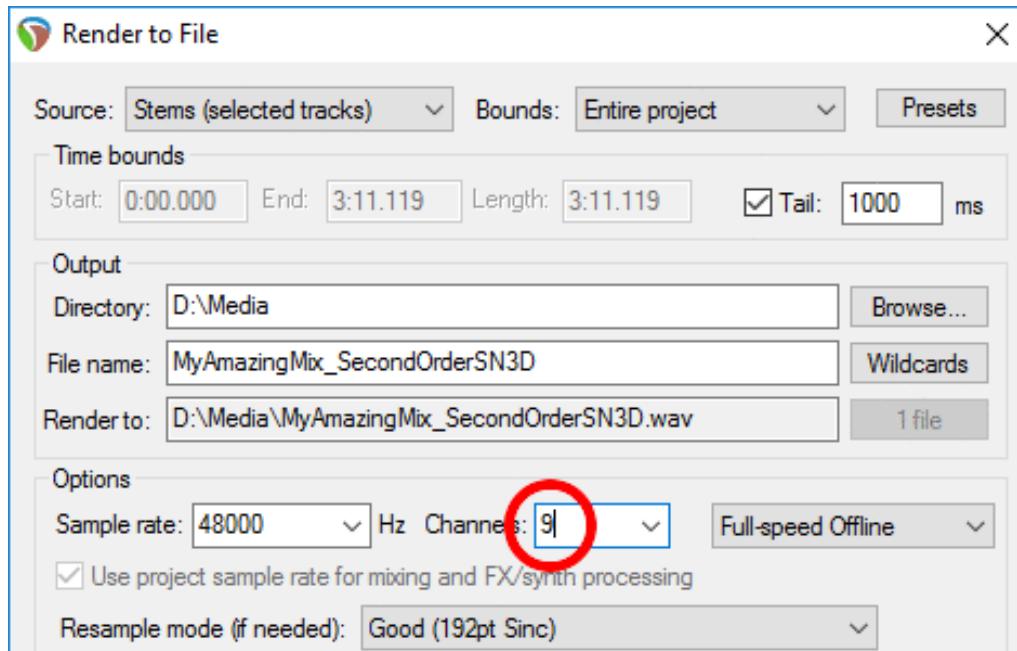
2.6.2 Google Jump Inspector

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

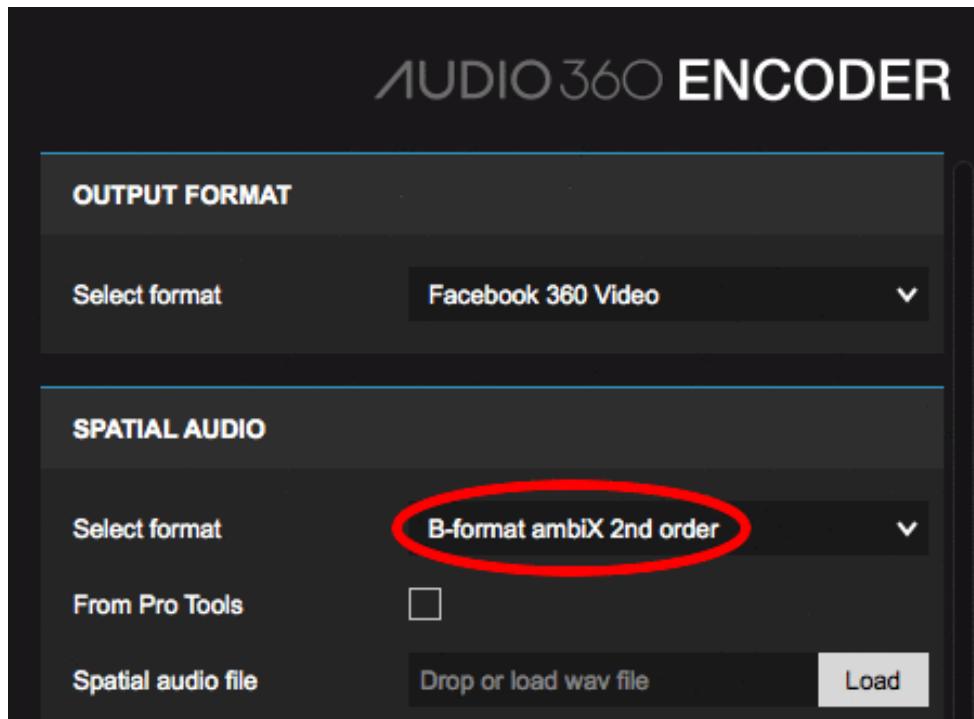
2.6.3 Facebook 360 Video

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 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:

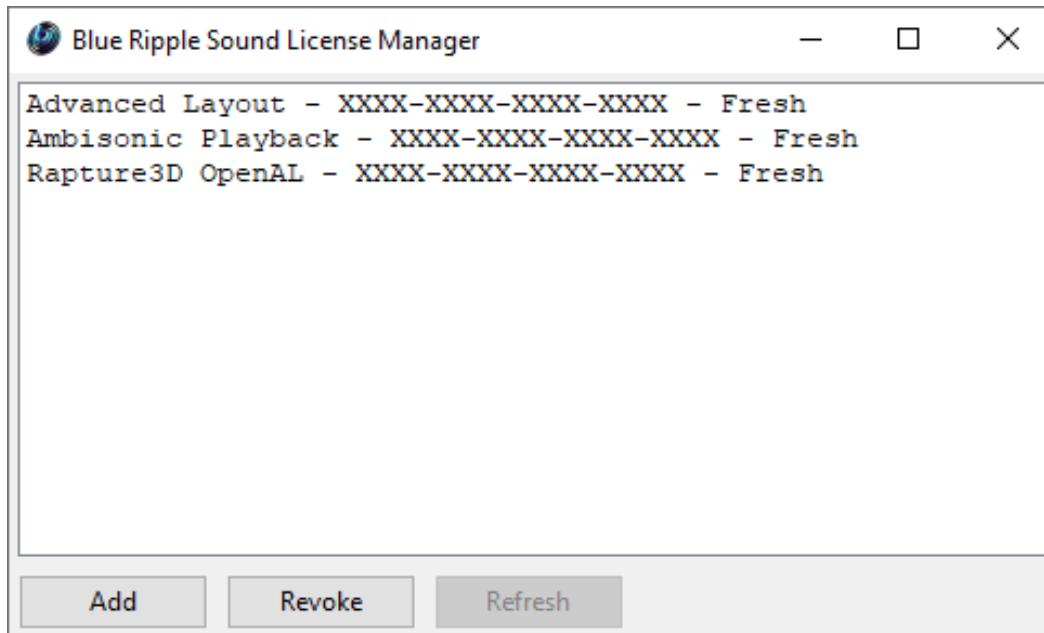


The reason this happens is that O3A needs 16 channels to work properly. If only the first two channels are present, these happen to be the omnidirectional and left-right ambisonic components, like in M/S stereo. These are enough to get an approximate sound level to transmit some basic left/right information, 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 Technical Requirements

2.9.1 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.

2.9.2 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.

2.9.3 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.

2.9.4 PC Hardware

Please check your PC meets the following requirements:

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

2.9.5 Permissions

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

2.9.6 ViewVR Application

For the ViewVR application, Microsoft Windows 10 or 11 64bit is required, along with a supported Virtual Reality headset and a computer meeting its technical requirements. macOS is not currently supported. Note however that it is possible to run the studio plugins on a different computer to the one running the ViewVR application, and to connect the two using a local network.

Currently supported VR headsets are:

- HTC Vive
- Valve Index

Other VR headsets that are compatible with SteamVR may work but are not supported.

2.9.7 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.

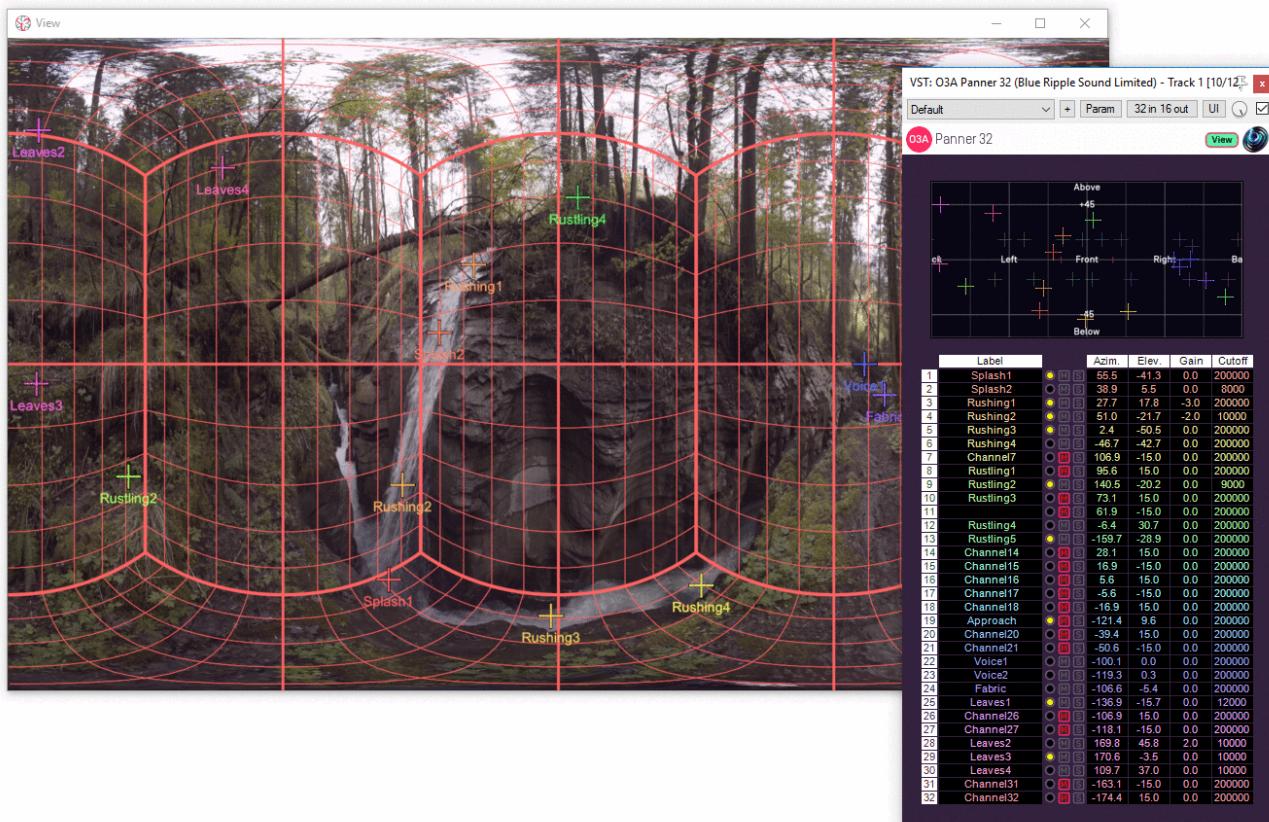
The license can be "revoked" to remove it from one machine so it can be moved on to another. You should also do this if you're updating your system in case the machine appears to have changed identity.

3 The 'View' Applications

3.1 View and ViewVR

Two separate applications can be used with this plugin library. The difference between the two is the use of a Virtual Reality (VR) headset.

- The **View** program uses a conventional 2D rectangular screen window and can run on both Windows and macOS. It does not require any specialised hardware, although it will work better on a powerful machine. Some DAW plugins can be controlled from the program using the mouse.
- The **ViewVR** program requires 'SteamVR', which is a Virtual Reality framework from Valve. ViewVR may show up in Windows as 'View (Steam VR)'. This needs to be installed and running. At the time of writing, it is probably most associated with the HTC Vive and Valve Index, although SteamVR can also work with some other devices such as the Oculus Rift. Some DAW plugins can be controlled using Vive controllers and some require a reasonable amount of space to move around in VR. Currently, this version of the View application is only supported on Windows, with the HTC Vive or Valve Index.



3.2 Plugin Connection

The View applications are controlled by an [O3A View Sync](#) plugin in a DAW such as Reaper.

The connection is made by setting the View application to 'listen' on a particular network port and by then setting the plugin to connect to it. This approach allows the application and plugin to run locally, or on different computers connected by a network.

Timing data is sent from the DAW to the View application so that a video can be watched in sync with the audio. An offset can be applied if necessary.

Audio is not sent from the DAW to ViewVR by the plugin. For in-VR monitoring, some other signal path is required, for instance by sending from the DAW to the headset audio output, or use of a separate headphone cable.

A variety of video formats are supported, depending on the platform. Each frame can be interpreted as rectangular 4:3, 16:9, 2.39:1, or as spherical video (for use in Virtual Reality). Stereographic video is also supported, although the stereo effect will only be visible in the VR version.

The direction of view can be changed in the View application (except in modes in the rectangular version). This is particularly important for 360 video for virtual reality (VR360), where the direction of view is typically read from the VR headset.

The direction of view is transmitted back to the DAW, where it can be used to rotate an O3A stream to compensate for the change in head orientation.

Some O3A plugins have a number of controls that can be linked to the View application. This is done by pressing the 'View' button on the relevant plugins.

This feature uses the mouse in the rectangular version of the View, or VR controllers in the VR version.

In addition, the [O3A Flare](#) visualiser can be linked to the View application, although this requires a fast network connection.

4 Using the View Applications

4.1 Starting Up

Start the View or ViewVR application, which is normally installed in the main Blue Ripple Sound installation directory. The application is not started automatically from the DAW.

After this, the application should indicate that it is waiting for an incoming connection on a particular network port (27103 by default). If you need to change this port, you can do so by pressing the left or right cursor keys on the keyboard, or left or right on a VR controller touch pad or joystick.

The View application will do nothing else until an [O3A View Sync](#) plugin connects to it.

4.2 Connecting

4.2.1 Configuring the Plugin

To connect the [O3A View Sync](#) plugin to the View application, start one and make sure the "Remote Host" is set correctly. If you are working on the same machine and have not changed the View network port, this may already be set correctly and connection should be immediate.

If the port is not specified, the default (27103) is used. This must match the setting on screen in the View application. See the [O3A View Sync](#) plugin for details on how to enter this.

4.2.2 Security and Firewalls

The connection between the plugin and View application works through your computer's network core. This is powerful as it allows them to run on separate machines, but networking is technology that is commonly locked down with software or hardware firewalls for good reasons relating to security.

Please think twice before attempting to connect across an untrusted network, or even run the View 'server' on a machine exposed to an untrusted network. **The network protocol used is intended to be reasonably robust, but we cannot guarantee that it would be resilient against a determined hacker.** In principle, a breach could result in a hacker gaining remote control of your computer.

Firewalls are generally designed to protect against hacking but can also get in the way of use of the software and you may need to create an "exception" or "port forwarding" to allow network traffic to flow correctly.

If you need to configure a firewall, you will need to allow "TCP" flow on the port selected above (usually 27103).

4.3 Interaction with Plugins

The plugin can also manage control links between a small number of *other* O3A plugins and the View application. This is discussed in a [later section](#).

4.4 Video Files

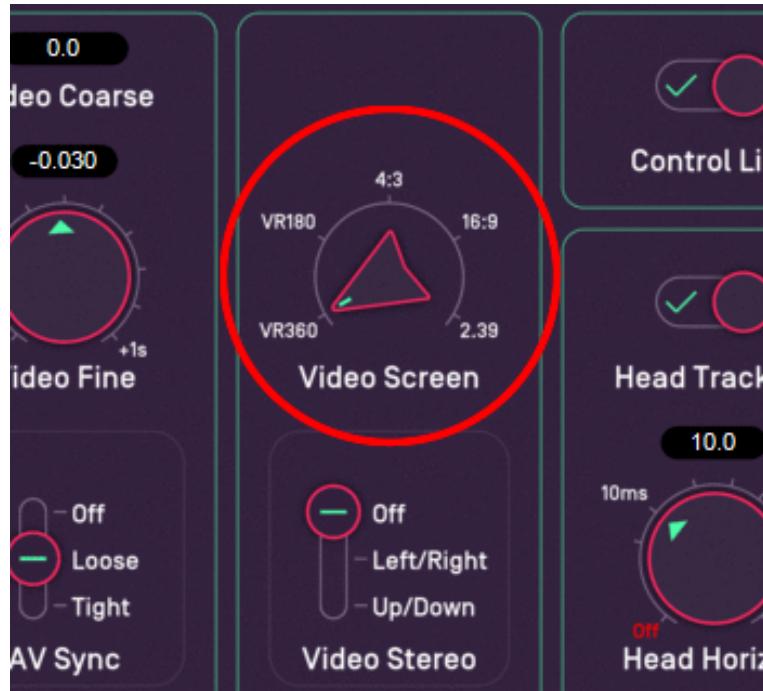
The O3A View Sync plugin can be used to specify a video file, and how it should be presented. See the [plugin documentation](#) for more details.

The video file is loaded by the View application, so it is important that the path to the file is accessible to it. On macOS in particular, this can require some care, and you may need to check your settings, specifically Settings / Privacy & Security / Files and Folders, or Settings / Privacy & Security / Full Disk Access.

When running View on a different computer to the plugins, remember that the video file needs to be on the View computer, and the filename needs to correspond.

4.5 Configuring Video Formats

The plugin has a [Video Screen](#) setting that describes the intended presentation format of the video. **Please always ensure the plugin video screen and stereo settings match the intended presentation format of the video** - or very strange things may happen!



The plugin settings are independent of how the video is actually shown in the View applications. The View application has a second set of perspective controls, see [Controlling the View](#). The plugin controls should always be set to the intended presentation format of the video, regardless of how the View applications will be used to look at it.

The assumption is that VR360 images are intended to be shown all around and that the traditional cinema formats (16:9 and so on) are intended to be shown on the front wall. This means that in some of the views below that show the whole space (not just the front wall), the video is not always visible, or takes up a small amount of screen space. In View, use perspective "3" if you want to see the full raw image.

If your video is a 360 video but you want a rectangular "camera" view onto it in View, set the presentation format to VR360 in the plugin, and use perspective "1" below. We strongly recommend you do not try to use the cinema modes to view a 360 video.

4.6 Controlling the View

Once the video presentation format has been selected in the [plugin](#), a variety of perspectives are used to view the video scene. It is important to note that all perspective options are available regardless of the video presentation format. All combinations of video options and perspective

support viewing, a control link, and consistent grids.

In some modes, the plugin can also receive 2DOF (two degrees of freedom) or 3DOF (three degrees of freedom) orientation information and use it to reorient an O3A stream, so the audio matches the camera. See the [O3A View Sync](#) plugin for details.

4.6.1 Perspectives - View

In the View application (but not ViewVR), three rectangular perspectives are available. These are selected by pressing the number keys 1, 2 or 3.

Key	View	Description
1	Frontal View	<p>In this mode, the view looks forward into the scene. The direction of view can be changed by holding down the right mouse button and dragging, so you can look around. If you do not have a right mouse button, you can hold down the "Alt" key and use the main mouse instead, or use the cursor keys. When no control link is in use, primary mouse can also be used. Pressing the number key "0" resets the view to the front of the scene.</p> <p>The forward direction is sent to the O3A View Sync plugin as 2DOF head-tracking data, so the audio scene can be made to rotate to match the view.</p>
2	Whole Scene	<p>In this mode, the whole scene, including regions that may not be on screen for traditional film, is warped onto the rectangle using an 'equal area' projection, so objects take up the same amount of space in both the actual video scene and the rectangle. This gives a good idea of the actual density of sources and all potential audio panning directions are visible on screen at once.</p> <p>This rectangular projection is used in many O3A tools (such as the main O3A Panner) and is recommended when working with them.</p> <p>When viewing a traditional cinema image (such as 16:9) please note that the screen area only takes up a small frontal part of the whole scene. This perspective allows sounds to be seen and panned on or off screen.</p> <p>No head tracking data is provided to the O3A View Sync plugin in this mode.</p>
3	Video Format	<p>In this mode, the underlying video screen mode set in the plugin defines the view. For the VR360 and VR180 screen modes, the video will take up the entire window, using the equirectangular projection normally used as the raw image format for these videos. Note that this is not quite the same as the equal area projection above, which we recommend when using the O3A tools.</p> <p>For traditional 4:3, 16:9 and 2.39, the video is shown within the window at its correct aspect ratio.</p> <p>Note that, except when the VR360 screen mode is used, not all directions are visible on screen. Consequently, this mode is typically not very useful when a control link is enabled.</p> <p>No head tracking data is provided to the O3A View Sync plugin in this mode.</p>

4.6.2 Perspective - ViewVR

In the Virtual Reality version of the View application (ViewVR) the perspective is always a frontal view which depends on which way the user is looking. To look in another direction, simply turn your head.

In this case, full 3DOF head-tracking orientation data is made available to the plugin and can be used to reorient the soundfield for head tracked playback (see the [O3A View Sync](#) plugin).

4.7 Grids

Grids can be overlayed on the view by pressing the number keys 7, 8 or 9. Grids are available in both View applications and in all perspectives. When changing perspective, the grids warp so they always appear in the same positions relative to the overall scene.

Key	View	2D Grid	Description
7	Off		No grid is shown (the default).
8	Angles		Lines are shown at 10 degree and 45 degree azimuth and elevation intervals. These azimuth and elevations correspond directly to azimuth and elevations used in the plugins.
9	Cube		This shows a simple cubic 'room' around the centre of the space. In traditional cinema modes (16:9 and so on) the image will be seen on part of the front wall of the room.

In the ViewVR application, grids can also be cycled using the VR controller 'Menu' button.

4.8 Other Keys

Key	Description
Escape	Quit application.
Enter / Return	Toggle full-screen mode.

Key	Description
0 (Zero)	In View in Frontal View, reset to front.
4	In View, in windowed modes, set the window aspect ratio to 4:3 by changing the window height.
5	In View, in windowed modes, change window aspect ratio to 16:9 by changing the window height.
6	In View, in windowed modes, change window aspect ratio to 2.39:1 by changing the window height.

4.9 Video Codecs in the View Applications

Regardless of the [perspective](#) and [video format](#) used, video is still read from disk using relatively conventional video codecs.

These streams are read from file using a video library which in turn uses your operating system's built-in media support. On Windows, Media Foundation is used (or DirectSound on Windows 7 and below, although this is not supported). On macOS, the AVFoundation API is used.

This means that the available video codecs (i.e. the formats that are supported) depends on your system. The most common format used is probably MP4 with H.264 video encoding. The audio encoding is not important since the View application mutes any audio in the video file; it is assumed that all audio is generated from the DAW.

Additional third party codecs can be installed on both Windows and macOS.

5 Plugin Support in the View Applications

5.1 The 'View' Button

Some of the O3A plugins can be linked to the View application. When this is an option, a 'View' button appears on the plugin and pressing this button will allow remote automation of some parameters of the plugin from the View application.



If the following conditions are met, the 'View' button should appear:

1. The plugin must support remote automation (see the individual plugins for details).
2. There must be a [O3A View Sync](#) plugin running and connected to a View application.
3. That sync plugin must have its 'Control Link' button enabled.
4. That sync plugin must be the *only* plugin with the 'Control Link' button enabled.
5. All O3A plugins involved *must* be running the same software version.

5.2 Warning: A 'Quirk'

On very rare occasions, even when the conditions above are met, the 'View' button may not appear at first. This can happen if the user interface for the affected plugin is set up before the sync plugin has started up for the first time (typically when first starting a Reaper session). To work around this, just close the user interface for the affected plugin and reopen it.

But, this is rare. If the link button does not appear it is much more likely to be because one of the conditions above is not met.

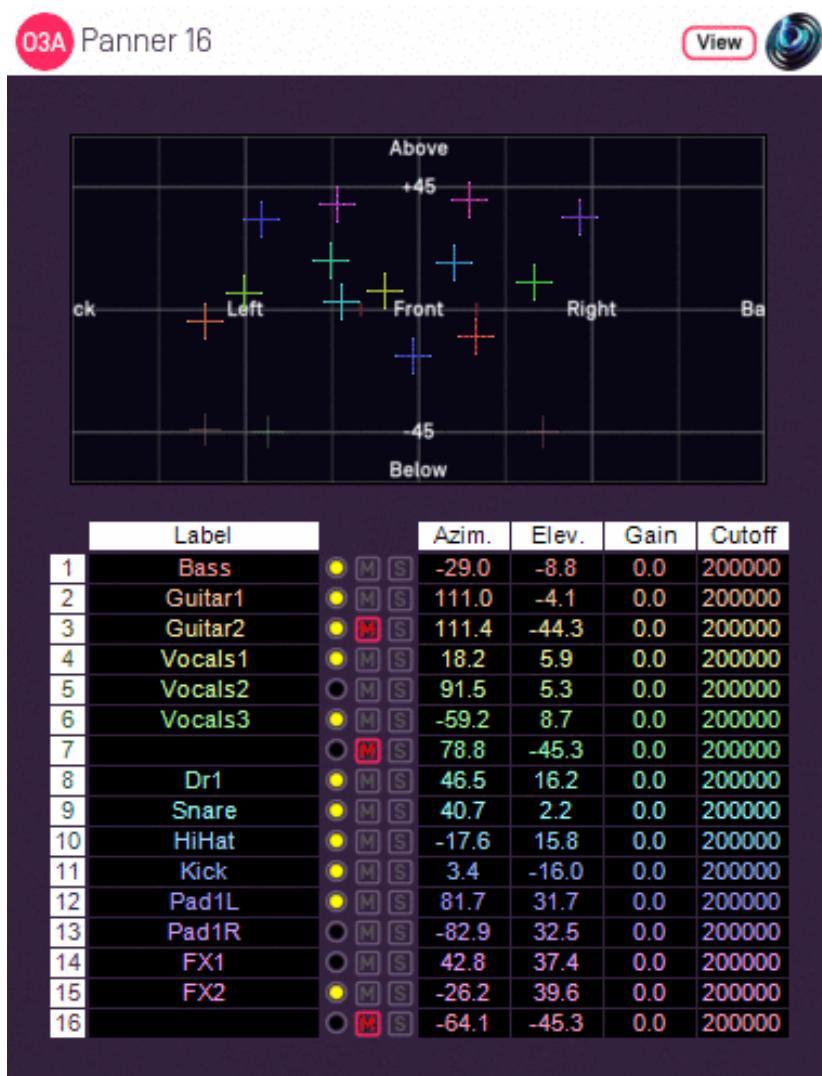
5.3 View/ViewVR Supported Plugins

Plugins with support in the View or ViewVR applications via this library are:

Library	Plugins
O3A Core	O3A Panner , O3A Panner - Classic , O3A Panner - Hemisphere , O3A Panner - Large , O3A Panner - Two Channel , O3A Panner - Eight Channel , O3A Flare , O3A Look , O3A Rotation , O3A Beamer , O3A Spatial Delay
O3A Manipulators	O3A Move , O3A Zoom , O3A Zoom XYZ , O3A Directional Emphasis , O3A Directional Mask , O3A Portal , O3A Reflection , O3A Spotlight , O3A Panner LS , O3A Panner LS XYZ , O3A Panner LS8 , O3A Line , O3A Spotlight Split
O3A Music	O3A Bitcrusher , O3A Chorus , O3A Overdrive , O3A Ring Modulator , O3A Shells , O3A Shells Split
O3A Reverb	O3A Shoebox
O3A Upmixers	O3A Upmixer - Stereo
O3A View	O3A Panner 16 , O3A Panner 32

6 O3A View - Panners

6.1 O3A Panner 16 and 32



6.1.1 Host Support

6.1.1.1 O3A Panner 16

Host Type	Support
AAX	Yes, input mapped to third order ambisonics
VST2	Yes

6.1.1.2 O3A Panner 32

Host Type	Support
AAX	No
VST2	Yes

6.1.2 Audio

6.1.2.1 O3A Panner 16

	Channels	Content
Input	16	16 channels of mono (mapped to third order ambisonics for AAX)
Output	16	O3A

6.1.2.2 O3A Panner 32

	Channels	Content
Input	32	32 channels of mono
Output	16	O3A

6.1.3 Controls

- Azimuth 1 - 16 or 1 - 32
- Elevation 1 - 16 or 1 - 32
- Gain 1 - 16 or 1 - 32
- Cutoff 1 - 16 or 1 - 32
- Mute 1 - 16 or 1 - 32
- Solo 1 - 16 or 1 - 32

6.1.4 Description

These O3A panners takes 16 or 32 mono sound sources and place them in particular directions in a 3D O3A mix.

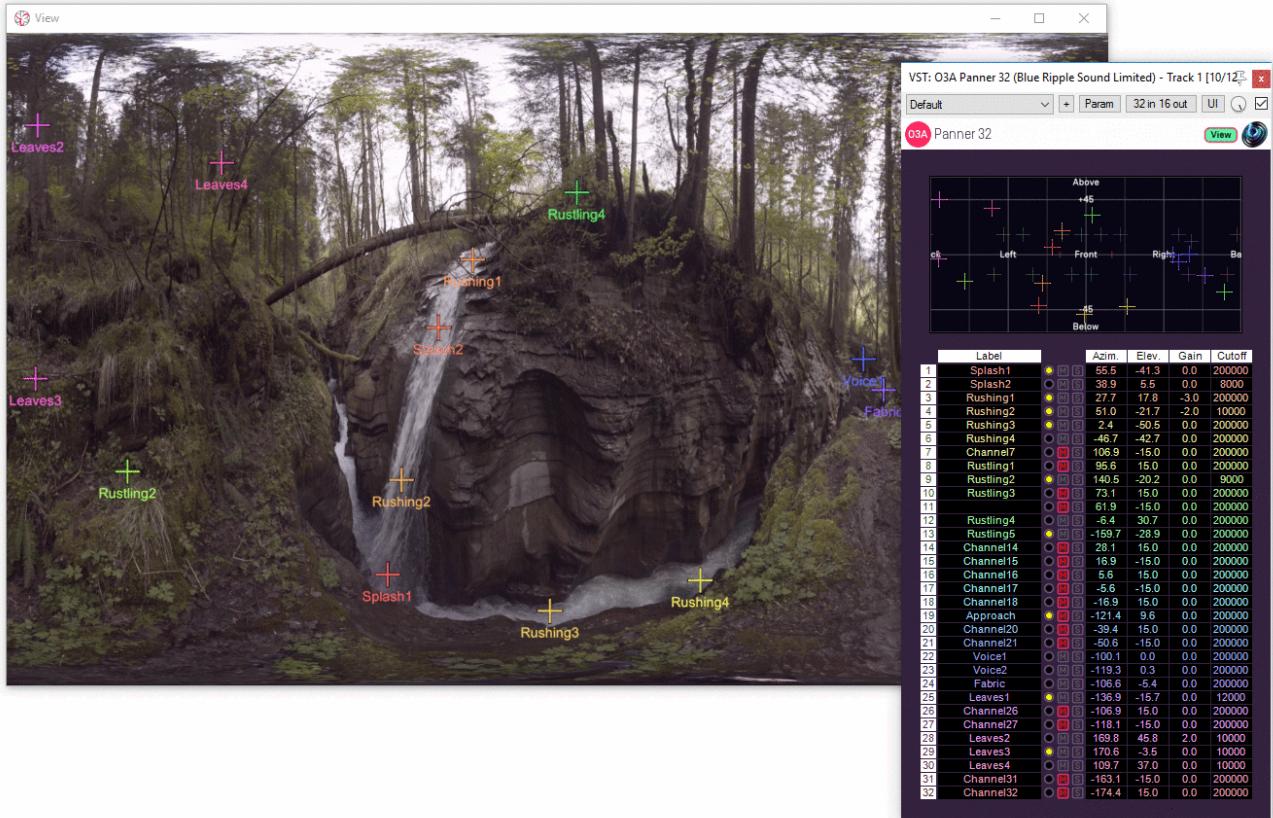
There are azimuth and elevation dials for each of the sources. These work the same way as the controls in the standard [single-channel panner](#).

There is a control surface which can be used to visualise the current directions for the sources, indicated by coloured crosshairs. These can be moved around 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.

Each channel has a gain control and a -6dB/octave low pass filter which can be used to simulate distance and occlusion effects. A signal indicator lights up when a channel is active and has an input signal.

Text can be entered into channel labels to help you keep track of which channel is which. With this many channels, this is well worth doing! These labels are also shown when using this plugin's [View support](#).



6.1.4.1 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 the source.

6.1.4.2 Pro Tools Note

For compatibility with AAX, the 16 channel version of this plugin misuses the third order ambisonic AAX stem format to create an input with 16 channels. As a result, it will show up in plugin lists on third order ambisonic busses, which is not strictly correct as its input is not really ambisonic. You will probably want to create one or more third order ambisonic busses to use this plugin. Obviously, it should not be used to process real third order ambisonic streams!

The 32 channel version of this plugin is not compatible with Pro Tools.

6.1.4.3 Use

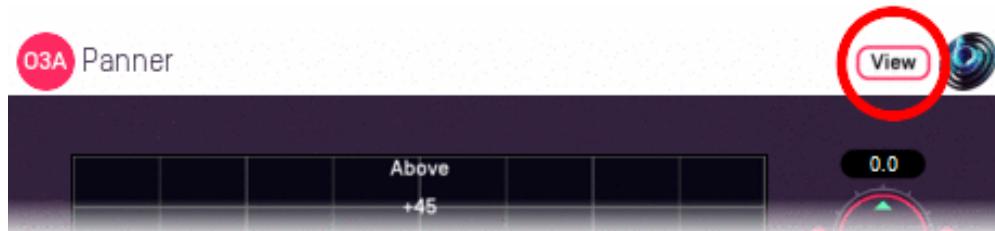
This plugin has a large number of control parameters and the display does not include individual dials for them all; values need to be entered as numbers. Panning can be controlled using the control surface, but this can become quite cluttered. If you want a plugin similar to this one with a similar layout but with a more manageable number of channels, you may wish to consider [O3A Panner - Eight Channel](#).

However, this plugin comes into its own when it is used with [O3A View](#)'s separate View applications. Here, channels are overlaid onto a much larger panning surface, potentially with video, and potentially in VR.

6.1.5 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 panner directions are shown using colour-coded crosses and labels, 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.	The current panner directions are shown using colour-coded beams, crosses and labels, similarly to the plugin display. 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.

6.1.6 Controls

6.1.6.1 Controls: Azimuth 1 - 16 or 1 - 32 and Elevation 1 - 16 or 1 - 32

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.

6.1.6.2 Controls: Gain 1 - 16 or 1 - 32

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

6.1.6.3 Controls: Cutoff 1 - 16 or 1 - 32

Each panned source has its own low pass filter. The filter is a relatively subtle -6dB/octave filter with -3dB at the cutoff frequency provided. This is intended primary for use in simulation of distance or acoustic occlusion.

6.1.6.4 Controls: Mute 1 - 16 or 1 - 32 and Solo 1 - 16 or 1 - 32

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

7 O3A View - Monitoring and Control

7.1 O3A View Sync



7.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

7.1.3 Controls

- [Remote Host](#)
- [Remote File](#)
- [Video Coarse](#)
- [Video Fine](#)
- [A/V Sync](#)
- [Video Screen](#)
- [Video Stereo](#)
- [Control Link](#)
- [Head Tracking](#)
- [Head Horizon](#)

7.1.4 Description

This plugin manages a link between a DAW session and a separate [View](#) application running on an ordinary display or Virtual Reality (VR) headset, locally or remotely. This link can be used to:

- Connect to a View application.
- Start video playback in the View application and synchronize DAW audio and View video.
- Receive head tracking orientation back from the View application and compensate for head orientation by rotating the O3A audio stream.
- Link some controls from [some plugins](#) to the View application so they can be controlled there.

The only audio processing that this plugin performs is rotation of the audio stream when head tracking is in use. Otherwise, it passes the audio through unmodified.

7.1.4.1 Connecting to a View Application

The plugin connects to a View application running on a local or remote host. It does not matter whether the plugin or application is started first as the plugin will make repeated attempts to connect, but for a successful connection both the plugin and View must be using the same port number (27103 by default). The connection uses TCP and networking needs to be possible on this port (in particular, [firewalls](#) may need configuration).

The remote host is configured by entering text into the [Remote Host](#) text box. The status of the connection is described in the main status box in the middle of the user interface.

7.1.4.2 Video Files

Entering a filename into the [Remote File](#) text box will cause the View application to look for a video file on its file system. If the connection is remote, please note that the View application will be looking at the file system on the *remote* machine.

If the connection is local (so the [Remote Host](#) text box says "localhost") a "Browse" button is available.

The View application reads the video directly; it is not streamed from the DAW plugin. Consequently, the View application needs permission to access the file, which may need changes to be made in macOS Settings. Also, if the View application is running on a remote machine, the filename needs to be correct for that machine, not the one running the plugin. The status of the video will be shown in the main status box in the middle of the user interface.

The video format present in the file should be configured using the [Video Screen](#) and [Video Stereo](#) options.

7.1.4.3 Video Synchronization

Once open, the video can be synchronized with the audio in the DAW. This allows audio to be edited "to picture" for both classic film and 360 video for Virtual Reality.

Basic time synchronization is made between the time within the DAW's project timeline and the video time. For instance, if the DAW project is ten seconds in from the start of the project, video from ten seconds in will be shown.

However, you may not want to place the audio for the video at the start of the DAW project. To allow this, the [Video Coarse](#) control allows the video and audio to be offset by a large interval.

There may also be synchronization issues between audio and video, for instance because of a latent audio stack. To compensate for this, the [Video Fine](#) control can be used to make small shifts to the offset. In fact, the coarse and fine controls are just added together before they are used; two controls are provided for convenience.

A/V sync can get out of line, particularly on a busy computer system. The [A/V Sync](#) control helps control how this is handled. If you find your A/V Sync is inconsistent or playback sometimes "judders" then you may want to try changing this setting.

7.1.4.4 Head Tracking

The View applications can send orientation data back to the plugin. The VR version of the View application (ViewVR) can use the head tracker built into the VR headset. In the View application, in Frontal View mode, 2DOF orientation data matching the camera can be controlled using the mouse. See our notes on "[Controlling the View](#)".

When head tracking is turned on, the 3D audio stream being passed through the plugin is rotated in a way that compensates for the head orientation. For instance, if the head is turned to the left, the audio scene is rotated to the right so sounds that were to the left are now in front.

Head tracking data can take a while to arrive and its impact will not be heard until after the audio has passed through the system audio stack. Consequently, it can be latent. To attempt to compensate for this, a [Head Horizon](#) forward predictor is available. This attempts to guess where the head *will* be, based on the data available. However, best results are typically achieved when latency is very low (a few milliseconds) so it may be worth configuring your DAW with this in mind.

The current 'forward' and 'up' head direction vectors are shown in the display, in ambisonic coordinates (so X is forwards, Y is to the left and Z is up).

7.1.4.5 Control Link

If the [Control Link](#) switch is enabled on this sync plugin (and on no other within the DAW) then this plugin will be used to manage communication between the View application and other O3A plugins in the same process.

7.1.4.6 More Than One Sync Plugin

More than one sync plugin may be used in a project.

Using head tracking on more than one plugin at a time can make sense in some contexts. For instance, you can send from a O3A master track to multiple binaural decoder tracks, each with independent head tracking for different VR headsets.

However, only one O3A sync plugin may have its [Control Link](#) switch enabled at once. If more than one is enabled, control links will not work.

7.1.4.7 Connections Between Plugins

When Control Link is used to communicate between the O3A View Sync plugin and other plugins, the plugins involved must be in the same Windows or macOS process. Some DAWs allow plugins to be hosted in separate processes. If you use this facility, take care to ensure the same hosting is used for the plugins you want to link.

7.1.4.8 Is The Plugin Ignoring Me?

The plugin needs to be running for things to happen. If it is switched off or bypassed, it will not work properly.

Also, to save CPU usage, some DAWs switch off plugins dynamically when they do not see them doing anything, and they will not see the network communication this plugin uses. You can discourage such DAWs from switching this plugin off by making sure you have some audio running through it.

7.1.5 Controls

7.1.5.1 Control: Remote Host

The Remote Host text tells the plugin where to find a View application to connect to. This can be written as:

- The text "localhost", meaning the machine the plugin is running on.
- A network hostname. If you are on a local network, this may be a simple machine label (e.g. "server7"). Otherwise, it may be a machine hostname similar to those seen within web URLs (e.g. "nosuch.blueripplesound.com").
- An IP address, which typically takes the form of four numbers separated by periods such as "192.168.1.4".
- Any of the above, but followed by a colon and number. This is used when you want to specify which port to connect to on the remote machine. For instance, "server7:27104" means that the plugin should connect to machine `server7`, but use port 27104 rather than the usual port (27103).

If the port is not specified, the default (27103) is used. To connect, this must match the setting shown on screen in the View application connected to.

7.1.5.2 Control: Remote File

If a filename is entered into the Remote Field field then the a connected View application will attempt to find a video file at this location.

Please note that the video file needs to be accessible to the View application rather than the plugin, which is unlikely to be running in the same directory and need not even be on the same computer.

On macOS, you may need to change Settings to allow View to access video files, depending on their location.

7.1.5.3 Controls: Video Coarse and Video Fine

The coarse and fine video controls are added together and then used as an offset to the clock used to control the video stream. Negative values delay the video and positive values advance it.

Two controls are provided for ease of use; the fine control is normally reserved for fine A/V sync tuning.

7.1.5.4 Control: A/V Sync

This control determines how the View application will react when it realises that audio and video it is not fully in sync. This setting is offered because correcting synchronization issues too often can cause video to skip and make things worse rather than better. The options are:

Setting	Description
Off	Synchronization is only used in the event of jumps in the audio file. No local synchronization is applied.
Loose	Some synchronization is applied and the video should rarely drift visibly out of line.
Tight	Tight synchronization is applied. This may cause issues for some video modes.

Also see the section on [video codecs](#).

7.1.5.5 Controls: Video Screen and Video Stereo

These controls must be set to correspond to the intended presentation of the video frames in the file. When stereographic video is in use, the frames are subdivided into halves for each eye. Then, the image may be interpreted in different ways, for instance for a 16:9 rectangular screen, or as a 360 video to be shown as a VR experience.

These settings should be set accurately regardless of the perspective used in the View application.

The screen options are:

Setting	Description
VR360	The video is assumed to contain a full spherical VR video, mapped onto the rectangular video frame. The frame is assumed to map elevation to pixels linearly. The top of the frame is assumed to correspond to the top of the sphere and the middle of the frame to the front of the sphere.
VR180	The video is assumed to contain a frontal hemispherical VR video, mapped onto the rectangular video frame. The frame is assumed to map elevation to pixels linearly. The top of the frame is assumed to correspond to the top of the sphere and the middle of the frame to the front of the sphere.
4:3	The video is assumed to be intended for use on a 4:3 rectangular video screen.
16:9	The video is assumed to be intended for use on a 16:9 rectangular video screen.
2.39	The video is assumed to be intended for use on a 2.39:1 rectangular video screen.

The stereo (stereographic) options are:

Setting	Description
Off	The video is not stereographic.
Left-Right	Each video frame is divided horizontally into left and right images corresponding to the left and right eyes.
Up-Down	Each video frame is divided vertically into upper and lower images corresponding to the left and right eyes.

Depending on the type and mode of the View application the video can be presented in different ways, see [above](#).

At the time of writing, only the ViewVR application will render stereographic images as such.

7.1.5.6 Control: Control Link

If this switch is enabled on this sync plugin and no other in the DAW then plugin will be used to manage communication between the View application and other plugins.

7.1.5.7 Control: Head Tracking

This switch enables or disables use of head tracking data, if it is available.

7.1.5.8 Control: Head Horizon

This dial determines how far into the future the head tracking module will attempt to predict head orientation. Longer predictions are less stable. This module can be turned off. It can be used to help compensate for slow head tracking or latent audio.

7.2 O3A Decoder - VR Monitoring



7.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

7.2.2 Audio

	Channels	Content
Input	16	O3A
Output	2	Binaural Stereo

7.2.3 Controls

- Decoder
- Normalise
- Focus
- Strength
- Limiter

7.2.4 Description

This plugin takes a third order ambisonics (O3A) mix and decodes it to binaural stereo. It allows monitoring of VR mixes with a range of binaural decoders that might be used during later playback, assuming the mix is passed on as an ambisonic mix.

If you also need head-tracking, this can be achieved by placing an [O3A View Sync](#) plugin with head-tracking enabled immediately *before* this decoder. The [O3A Look](#) plugin is a simple alternative.

In addition to the decoder itself, a frontal directional emphasis module and a limiter module are available.

7.2.4.1 Level Normalisation

If the [Normalise](#) switch is not enabled, the plugins output audio using the decoders' standard levels, which are not quite the same. This can be useful when performing level checks during mastering.

Enabling the [Normalise](#) switch brings the decoder levels more closely into line with each, so timbre can be compared without changing your monitoring level. Behaviour is then also consistent with the [O3A Meter](#), [O3A Meter - Karma](#) and so on.

7.2.4.2 Directional Emphasis Module

This module further modifies levels to emphasise frontal audio. It uses essentially the same algorithm as Rapture3D Universal (running at third order) or the O3A Directional Emphasis plugin from the O3A Manipulators plugin library. It provides [focus](#) and [strength](#) controls and is always applied forwards.

7.2.4.3 Limiter Module

This module is an optional brickwall limiter module. This will automatically reduce the final level of loud audio to avoid clipping. A light indicates when the signal level is reduced.

7.2.5 Controls

7.2.5.1 Control: Decoder

A number of decoder methods are supported. In all cases, these are HRTF-based decoders that are intended to synthesize psychoacoustic binaural cues on headphones.

Method	Description
Amber	This decoder uses Blue Ripple Sound's ground-breaking "Amber" HRTF technology. It is used in the "O3A Decoder - Headphones plugin" in the O3A Decoding pack and is the default headphone decoder in Rapture3D Universal. It is well-suited to a wide range of heads.
Red, Orange, Yellow, Green and Blue	These are older Blue Ripple Sound HRTF decoders supported by Rapture3D. They are sometimes preferred to Amber.
Mid/Side	This decoder uses a full-width, first order Mid/Side decode (equivalent to two side-facing cardioids). This is used by a number of players when loudspeakers are present rather than headphones. This actually only uses audio from the first two channels of the O3A mix.
YouTube Binaural	This decoder uses an algorithm equivalent to YouTube's 360 video binaural headphone decoder as of April 2017. This is a first order decoder and therefore only uses spatial information from the first four channels of the O3A mix.
Facebook 360	This decoder is equivalent to the binaural headphone decoder used in Facebook 360 as of May 2018. This is based on coefficients published by Facebook on GitHub. This is a second order decoder and therefore only uses spatial information from the first nine channels of the O3A mix.
Purple	This decoder uses Blue Ripple Sound's current HRTF processing, with HRTF data from a KU100 dummy head. It is supported by Rapture3D.

7.2.5.2 Control: Normalise

If the Normalise switch is enabled, the decoder output levels are normalised to be consistent with other O3A decoder plugins and O3A metering. Otherwise, raw decoder output levels are used.

7.2.5.3 Control: Focus

Focus determines the shape of the frontal directional 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.

7.2.5.4 Control: Strength

Strength determines how aggressively sounds not in the focussed region are reduced in level by the directional emphasis module.

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.

7.2.5.5 Control: Limiter

The limiter control toggle enables or disables the limiter module.

7.2.6 Technical Notes

The Amber and Orange HRTFs use data from the IRCAM LISTEN HRTF data set, available at <http://recherche.ircam.fr/equipes/salles/listen/index.html>. The data has been processed by Rapture3D.

The Red and Yellow HRTFs use data from the MIT KEMAR data set by Bill Gardner and Keith Martin, available at <https://sound.media.mit.edu/KEMAR.html>. The data has been processed by Rapture3D.

The Green and Blue HRTFs use data from the CIAIR HRTF data set by Takanori Nishino, Shoji Kajita, Kazuya Takeda and Fumitada Itakura, which was available at <http://www.sp.m.is.nagoya-u.ac.jp/HRTF/database.html>. The data has been processed by Rapture3D.

The YouTube HRTF is derived fairly directly from the "symmetric" version of the SADIE binaural measurements published by Google (April 2017), available at <https://github.com/google/spatial-media/tree/master/spatial-audio>.

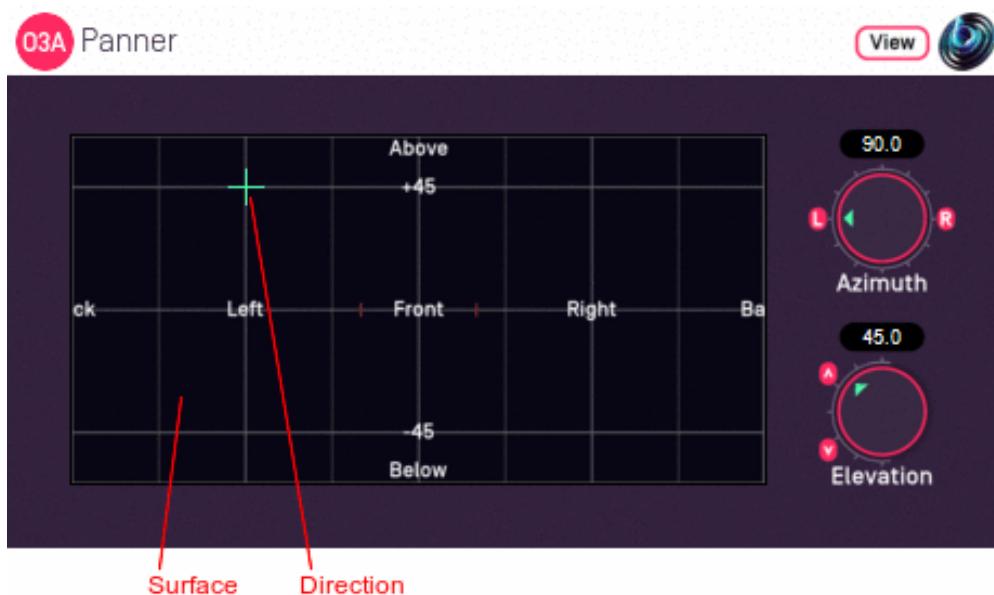
The Facebook 360 HRTF is based on coefficients used in the Facebook 360 audio renderer published by Facebook as an open source project on GitHub under the "MIT" license. This can be found at <https://github.com/facebookincubator/Audio360>.

The Purple HRTF uses data from the SADIE II data set, prepared at the University of York. This is available at <https://www.york.ac.uk/sadie-project/index.html>. The data has been processed by Rapture3D.

Thanks to all parties!

8 O3A Core - Panners

8.1 O3A Panner



8.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.1.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

8.1.3 Controls

- Azimuth
- Elevation

8.1.4 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.

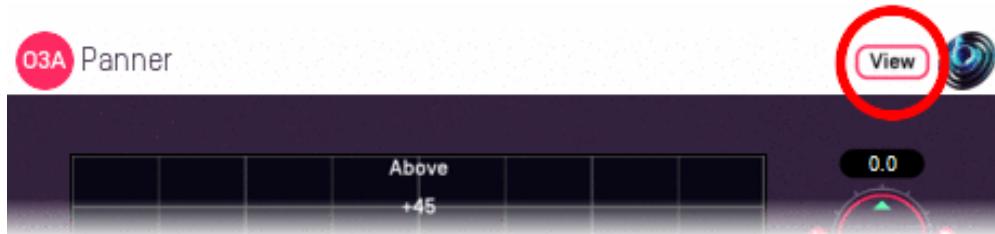
As well as azimuth and elevation dials, there is a control surface which can be used to visualise the current direction (indicated by the crosshairs). This direction can also be changed by clicking with the mouse.

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.

8.1.5 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.

8.1.6 Controls

8.1.6.1 Controls: Azimuth and Elevation

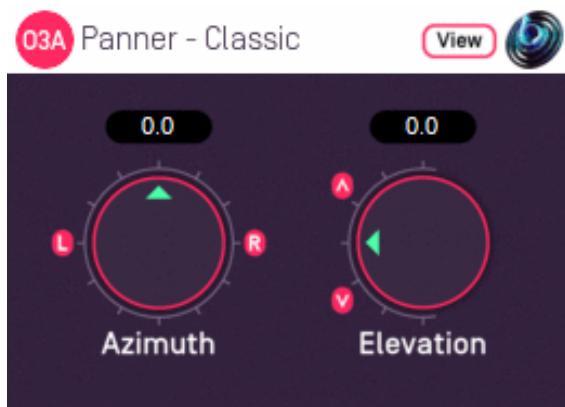
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

8.2 O3A Panner - Classic



8.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.2.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

8.2.3 Controls

- Azimuth
- Elevation

8.2.4 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](#).

8.2.5 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.

8.2.6 Controls

8.2.6.1 Controls: Azimuth and Elevation

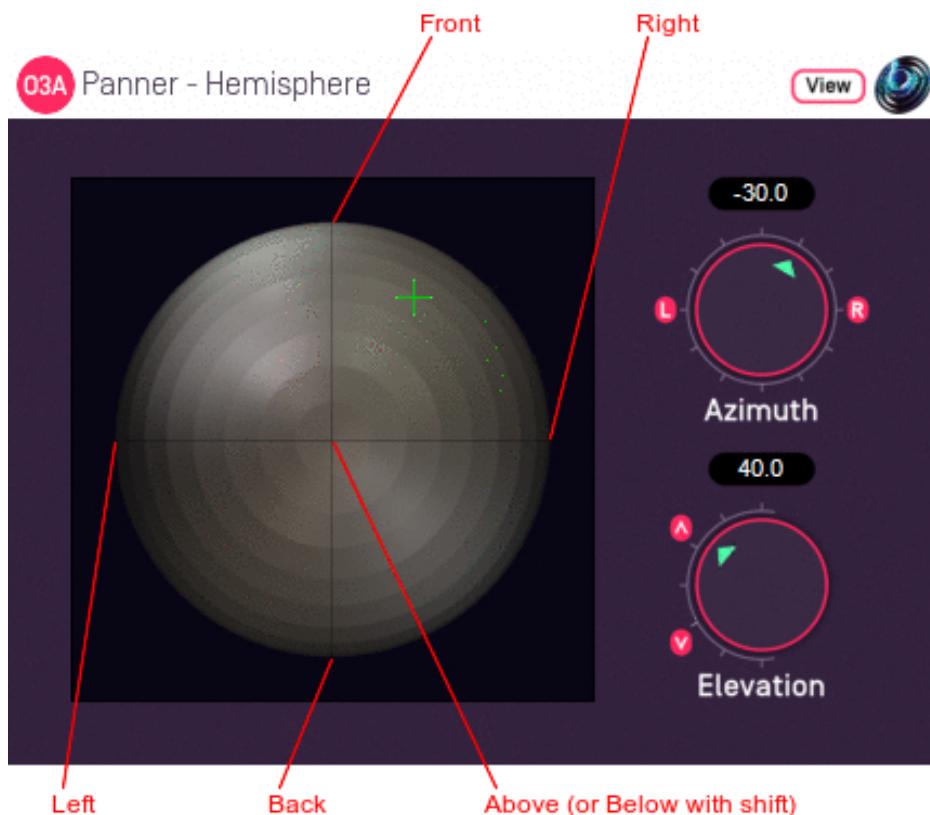
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

8.3 O3A Panner - Hemisphere



8.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.3.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

8.3.3 Controls

- Azimuth
- Elevation

8.3.4 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

8.3.5 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.

8.3.6 Controls

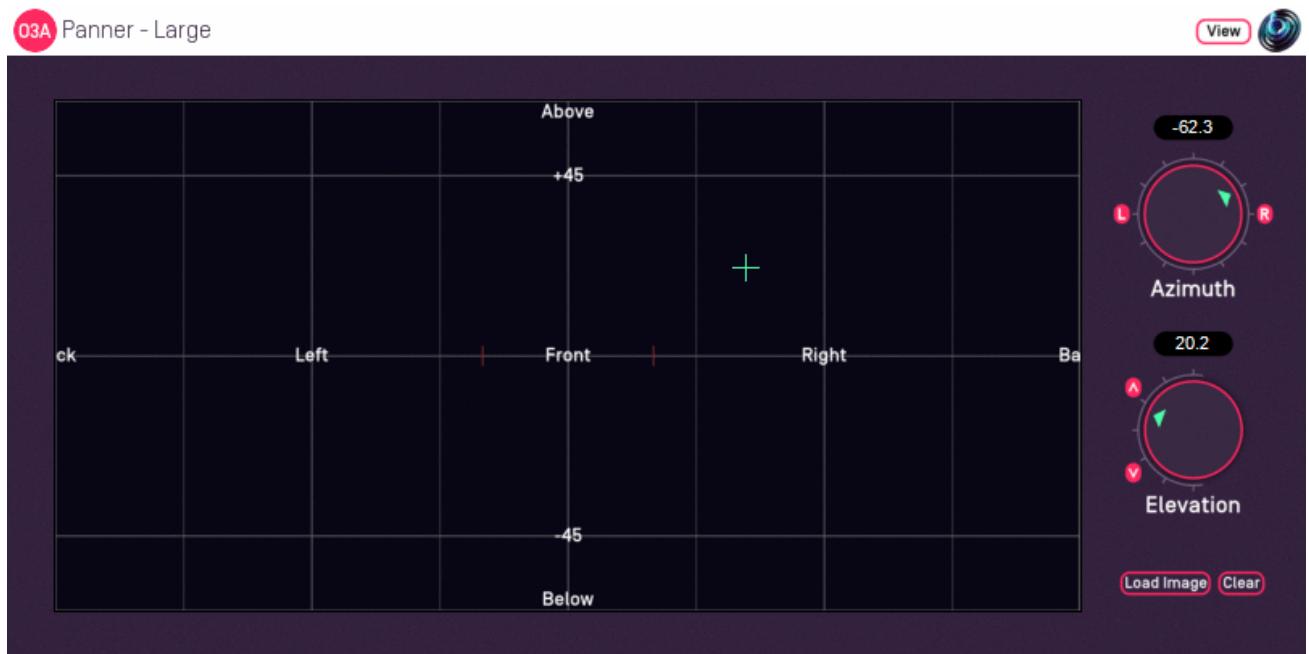
8.3.6.1 Controls: Azimuth and Elevation

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.

8.4 O3A Panner - Large



8.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.4.2 Audio

	Channels	Content
Input	1	Mono
Output	16	O3A

8.4.3 Controls

- [Azimuth](#)
- [Elevation](#)

8.4.4 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.

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
<p>The current direction is shown using a cross.</p> <p>Hold the left mouse button to set the azimuth and elevation.</p>	<p>The current direction is shown using a beam and cross.</p> <p>Hold a VR controller trigger to set the azimuth and elevation.</p>

8.4.6 Controls

8.4.6.1 Controls: Azimuth and Elevation

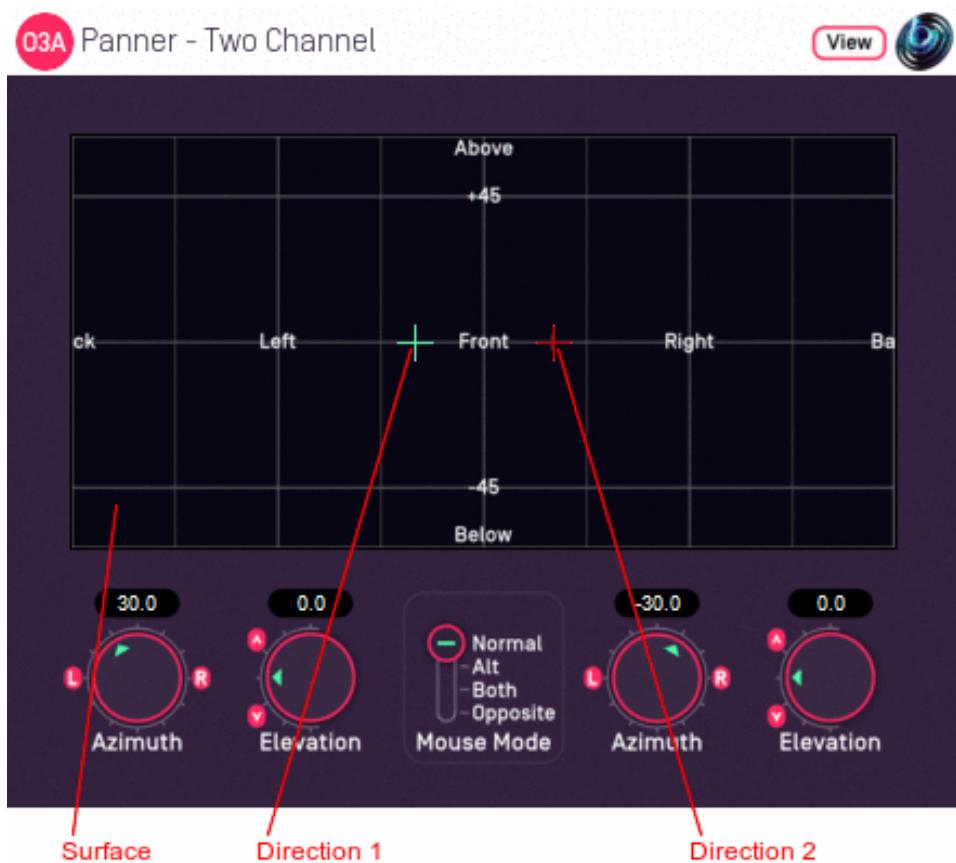
Azimuth and Elevation control the direction in which the input is placed in the 3D audio scene.

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.

8.5 O3A Panner - Two Channel



8.5.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

8.5.2 Audio

	Channels	Content
Input	2	Stereo
Output	16	O3A

8.5.3 Controls

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

8.5.4 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.

8.5.5 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>

8.5.6 Controls

8.5.6.1 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).

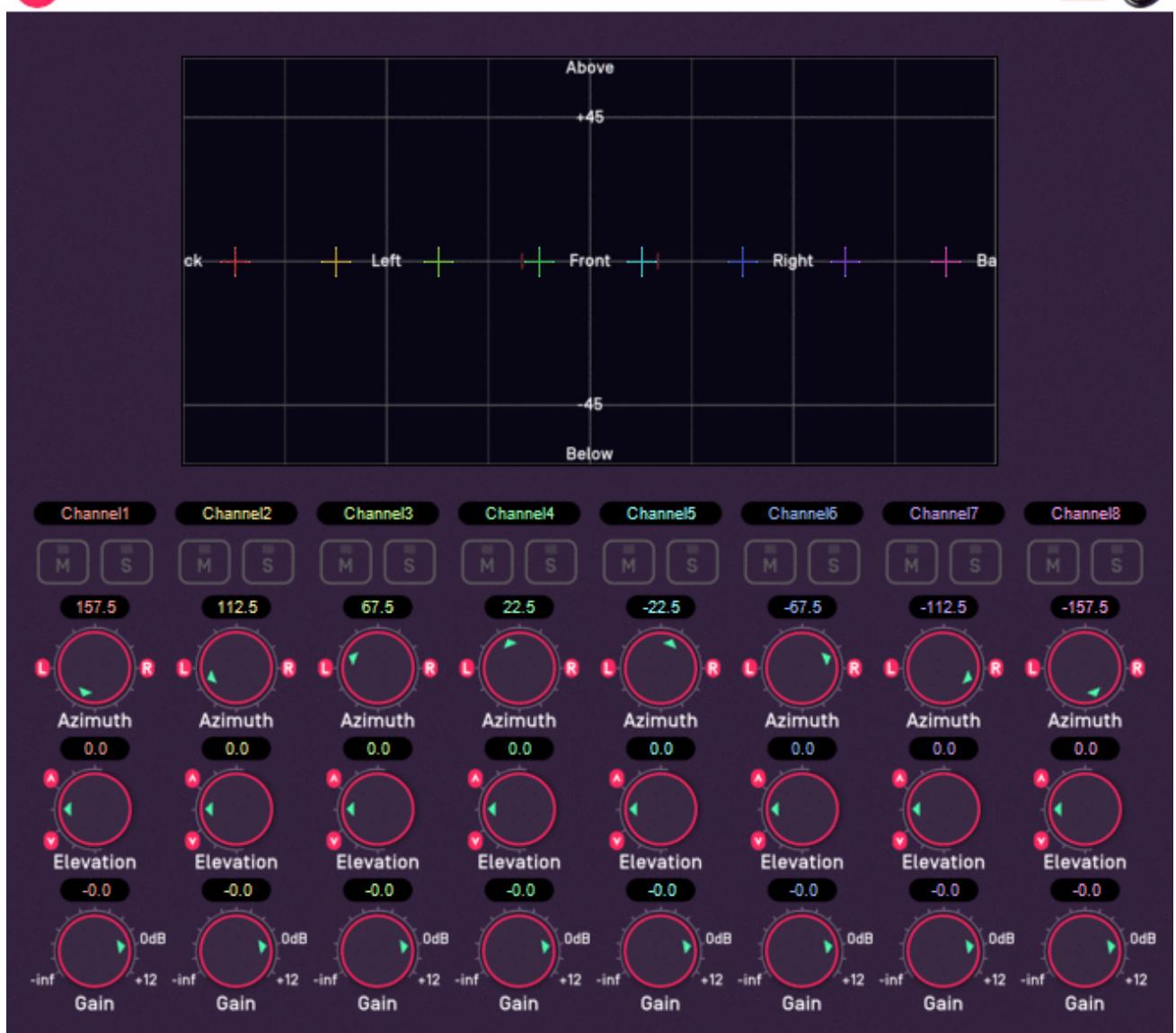
8.5.6.2 Control: Mouse Mode

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.

8.6 O3A Panner - Eight Channel

O3A Panner - Eight Channel

[View](#)



8.6.1 Host Support

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

8.6.2 Audio

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

8.6.3 Controls

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

- Mute 1 - 8
- Solo 1 - 8

8.6.4 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](#).

8.6.4.1 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.

8.6.4.2 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.

8.6.5 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>

8.6.6 Controls

8.6.6.1 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.

8.6.6.2 Controls: Gain 1 - 8

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

8.6.6.3 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.

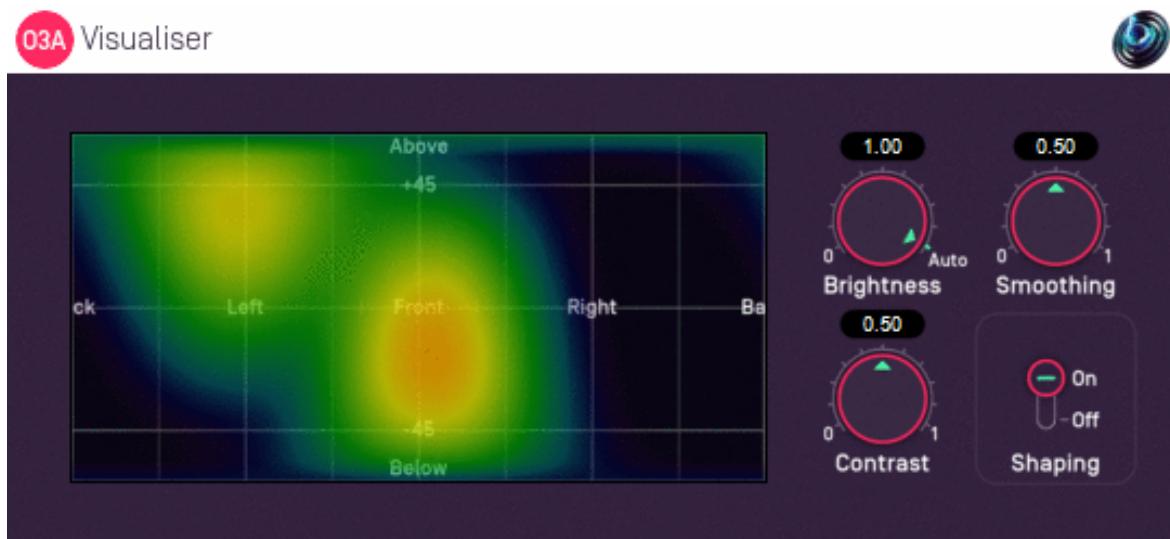
8.6.7 Presets

Presets are available for this plugin:

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

9 O3A Core - Visualisers

9.1 O3A Visualiser



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

- Brightness
- Contrast
- Smoothing
- Shaping

9.1.4 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](#).

9.1.5 Controls

9.1.5.1 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.

9.1.5.2 Control: Contrast

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

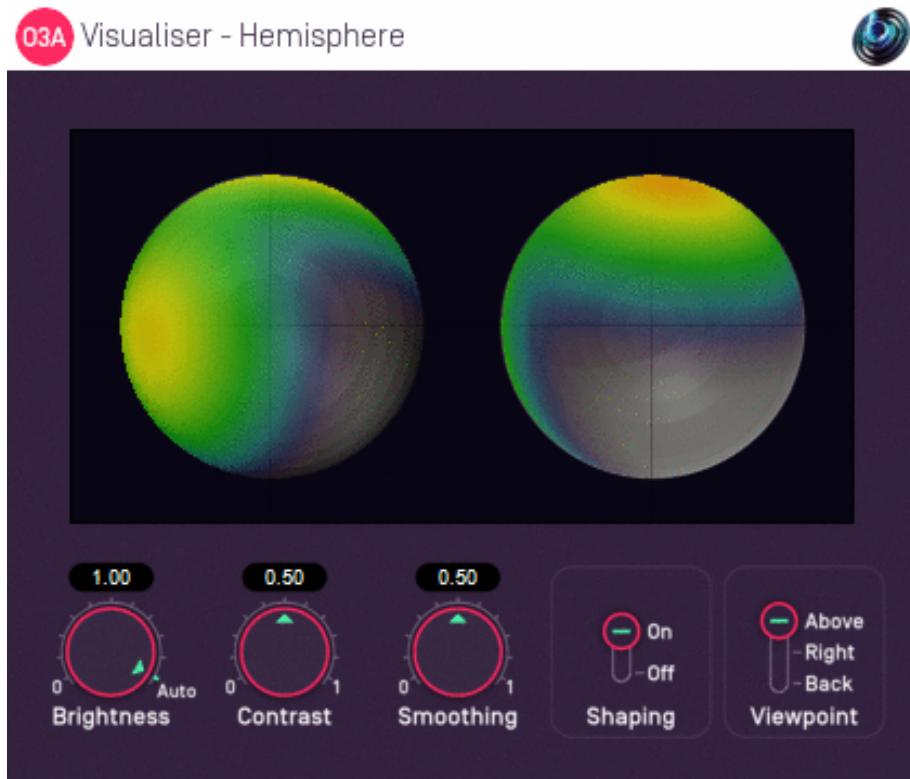
9.1.5.3 Control: Smoothing

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

9.1.5.4 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.

9.2 O3A Visualiser - Hemisphere



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

- Brightness
- Contrast
- Smoothing
- Shaping
- Viewpoint

9.2.4 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](#).

9.2.5 Controls

9.2.5.1 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.

9.2.5.2 Control: Contrast

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

9.2.5.3 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.

9.2.5.4 Control: Shaping

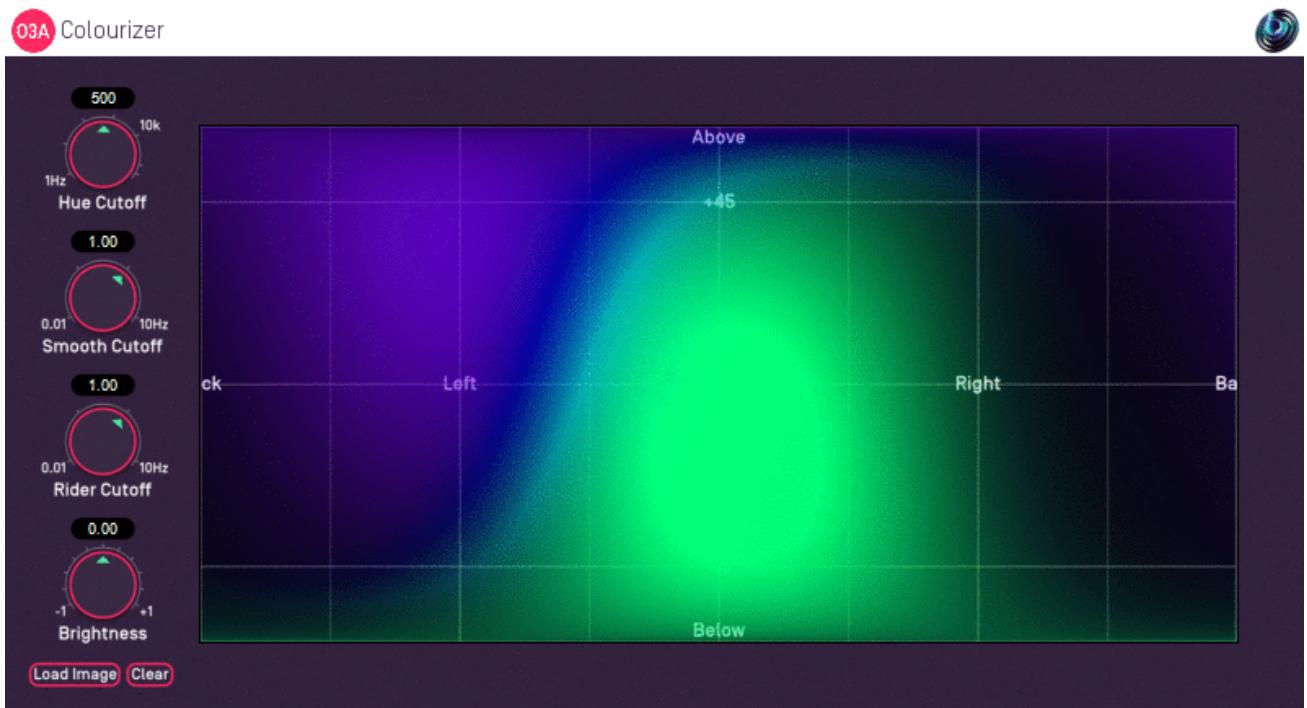
Shaping should normally be left on as it produces a more straightforward view. If this is turned off, the image will typically be sharper, but ripples will be visible in directions away from original sound directions.

9.2.5.5 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.

9.3 O3A Colourizer



9.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

9.3.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

9.3.3 Controls

- Hue Cutoff
- Smooth Cutoff
- Rider Cutoff
- Brightness

9.3.4 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.

9.3.4.1 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.

9.3.5 Controls

9.3.5.1 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.

9.3.5.2 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.

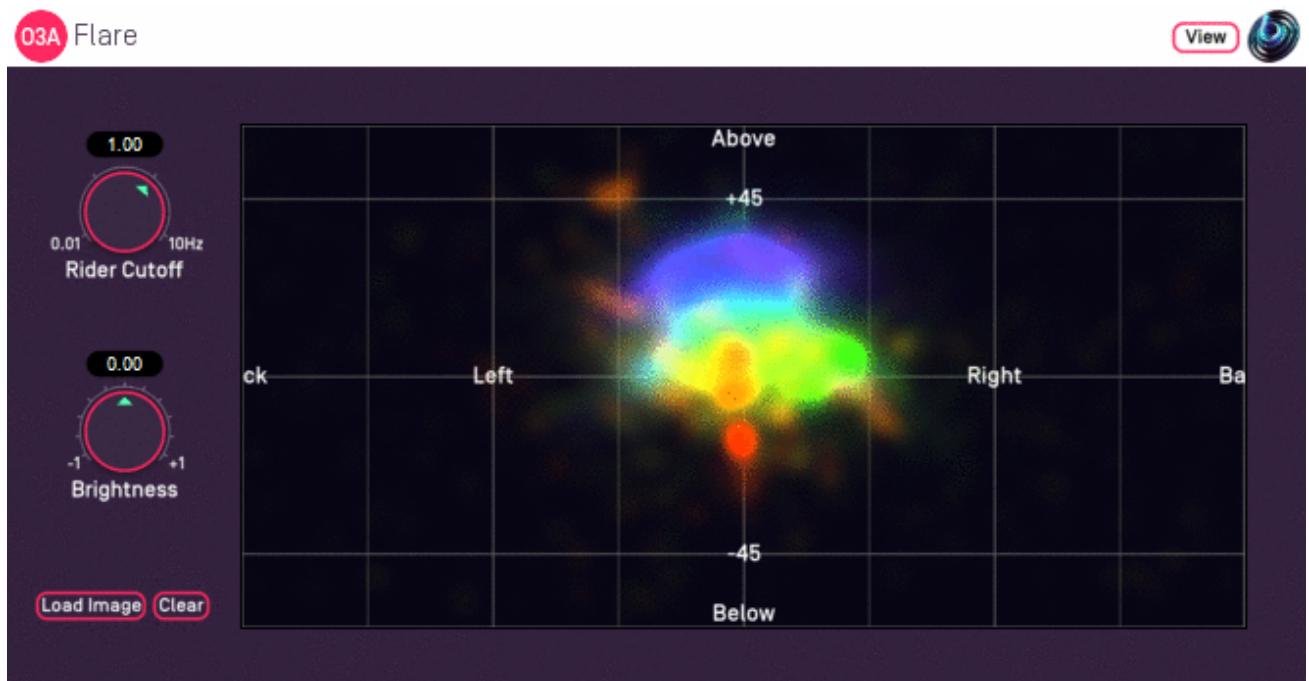
9.3.5.3 Control: Rider Cutoff

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.

9.3.5.4 Control: Brightness

This modifies the overall brightness of the image.

9.4 O3A Flare



9.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

9.4.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

9.4.3 Controls

- Rider Cutoff
- Brightness

9.4.4 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.

9.4.4.1 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.

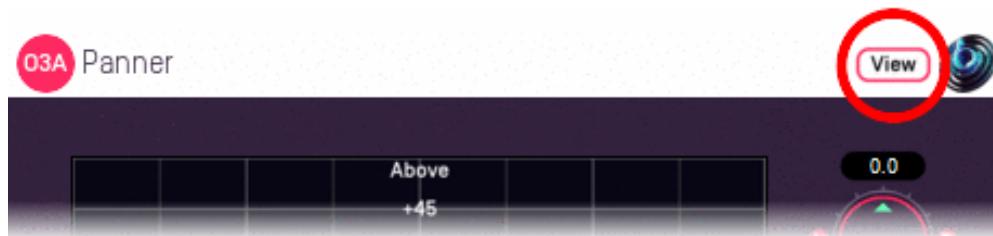
The target image size is 636x316. Other sizes are resized to fit.

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

9.4.5 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.

9.4.6 Controls

9.4.6.1 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.

9.4.6.2 Control: Brightness

This modifies the overall brightness of the image.

10 O3A Core - Rotation

10.1 O3A Look



10.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

10.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

10.1.3 Controls

- Azimuth
- Elevation

10.1.4 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).

10.1.5 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.

10.1.6 Controls

10.1.6.1 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.

10.2 O3A Rotation



10.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

10.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

10.2.3 Controls

- [Yaw](#)
- [Pitch](#)
- [Roll](#)
- [Ordering](#)

10.2.4 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.

10.2.5 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>

10.2.6 Controls

10.2.6.1 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.

10.2.6.2 Control: Ordering

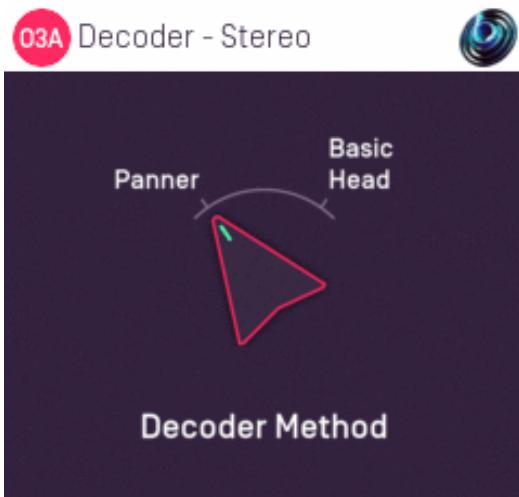
The ordering control determines the order in which the yaw, pitch and roll rotations are applied to make up a single rotation. The default is Y-P-R (i.e. yaw, pitch and then roll) but this can be switched to R-P-Y (i.e. roll, pitch and then yaw).

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.

11 O3A Core - Decoders and Converters

11.1 O3A Decoder - Stereo



11.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

11.1.2 Audio

	Channels	Content
Input	16	O3A
Output	2	Stereo

11.1.3 Controls

- Method

11.1.4 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.

11.1.5 Controls

11.1.5.1 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>

11.1.5.2 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.

11.2 O3A Decoder - Mono



11.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

11.2.2 Audio

	Channels	Content
Input	16	O3A
Output	1	Mono

11.2.3 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.

11.3 O3A Decoder - 5.1 Basic



11.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

11.3.2 Audio

	Channels	Content
Input	16	O3A
Output	6	5.1 Surround

11.3.3 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.

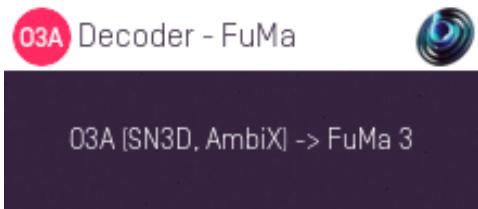
11.3.3.1 Channels

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.

11.4 O3A Decoder - FuMa



11.4.1 Host Support

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

11.4.2 Audio

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

11.4.3 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.

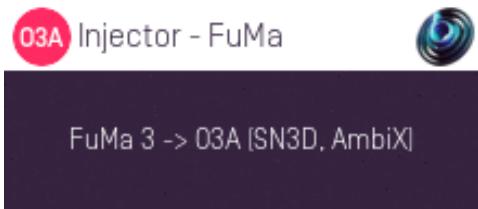
In Pro Tools, as the FuMa format is not supported directly as a stem format, this plugin outputs audio using the ordinary ambisonic stem format. Normally this should be encoded as O3A (i.e. SN3D/ACN), so we are "misusing" the format here.

11.4.3.1 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.

11.5 O3A Injector - FuMa



11.5.1 Host Support

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

11.5.2 Audio

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

11.5.3 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.

11.5.3.1 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.

11.6 O3A Decoder - O1A and O2A

03A Decoder - O1A



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

11.6.1 Host Support

11.6.1.1 O3A Decoder - O1A

Host Type	Support
AAX	Yes
VST2	Yes

11.6.1.2 O3A Decoder - O2A

Host Type	Support
AAX	Yes
VST2	Yes

11.6.2 Audio

11.6.2.1 O3A Decoder - O1A

	Channels	Content
Input	16	O3A
Output	4	O1A

11.6.2.2 O3A Decoder - O2A

	Channels	Content
Input	16	O3A
Output	9	O2A

11.6.3 Description

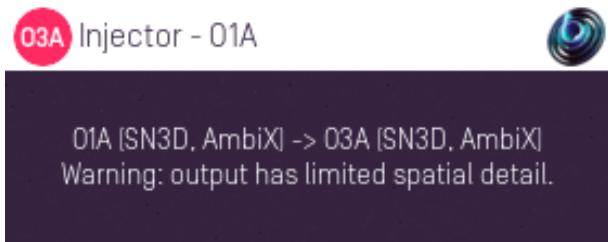
These simple plugins take a third order (O3A) ambisonic mix and convert it to a lower resolution first order (O1A) or second order (O2A) mix. In all cases, the SN3D convention is used.

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.

11.7 O3A Injector - O1A and O2A



11.7.1 Host Support

11.7.1.1 O3A Injector - O1A

Host Type	Support
AAX	Yes
VST2	Yes

11.7.1.2 O3A Injector - O2A

Host Type	Support
AAX	Yes
VST2	Yes

11.7.2 Audio

11.7.2.1 O3A Injector - O1A

	Channels	Content
Input	4	O1A
Output	16	O3A

11.7.2.2 O3A Injector - O2A

	Channels	Content
Input	9	O2A
Output	16	O3A

11.7.3 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.

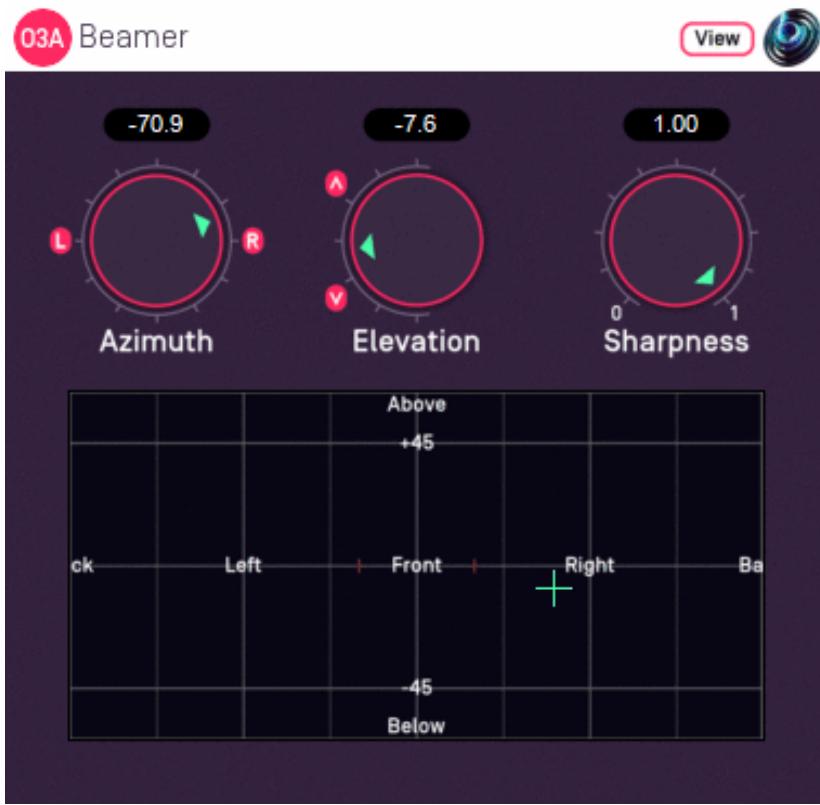
These plugins are extremely simple and just increase the channel count in use, filling new channels with silence. Although this increases the order of the mix, it does not increase its spatial detail. Further, the resulting mix may have unnatural features acoustically.

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.

12 O3A Core - Virtual Microphones

12.1 O3A Beamer



12.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

12.1.2 Audio

	Channels	Content
Input	16	O3A
Output	1	Mono

12.1.3 Controls

- Azimuth
- Elevation
- Sharpness

12.1.4 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](#).

12.1.5 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.

12.1.6 Controls

12.1.6.1 Controls: Azimuth and Elevation

Azimuth and Elevation control the direction to extracted.

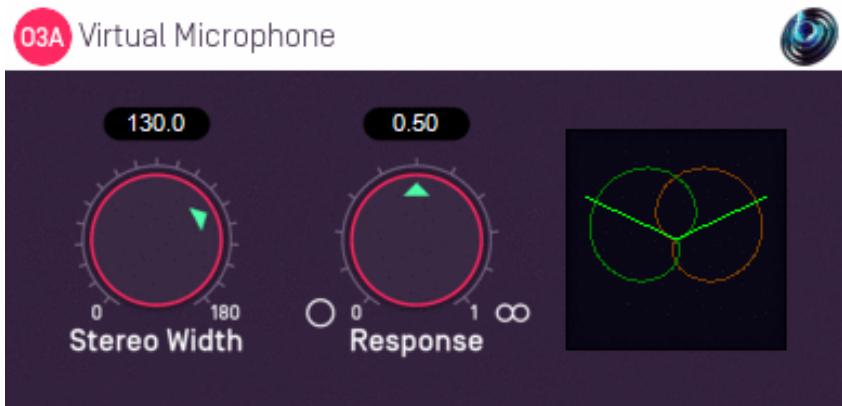
Azimuth is the horizontal angle, between -180 to +180 degrees, measured anticlockwise (left) from the front. Elevation is a vertical angle between -90 and +90 degrees, measured with positive upwards and 0 on the horizontal.

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.

12.1.6.2 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.

12.2 O3A Virtual Microphone



12.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

12.2.2 Audio

	Channels	Content
Input	16	O3A
Output	2	Stereo

12.2.3 Controls

- Stereo Width
- Response

12.2.4 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.

12.2.5 Controls

12.2.5.1 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.

12.2.5.2 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.

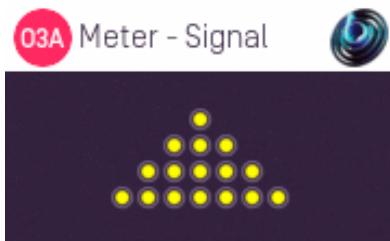
12.2.6 Presets

Presets are available for this plugin:

- Cardioids 130
- Cardioids 90
- Blumlein X/Y

13 O3A Core - Metering

13.1 O3A Meter - Signal



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 Description

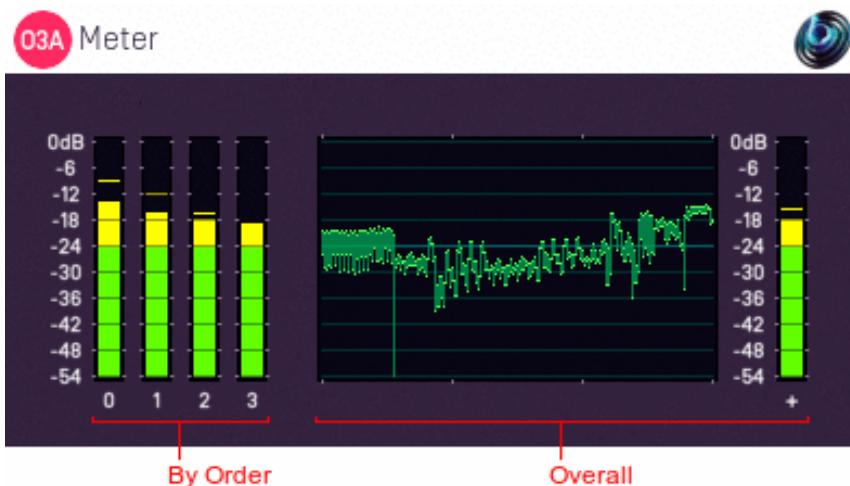
This extremely simple plugin measures the signal peak in each of the 16 channels of an [O3A stream](#) to indicate if a signal is present. It is intended for basic diagnostics (e.g. "are all my channels getting through?") and not for serious signal analysis. Audio is passed through unchanged.

13.1.3.1 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.

13.2 O3A Meter



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 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.

13.2.3.1 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.

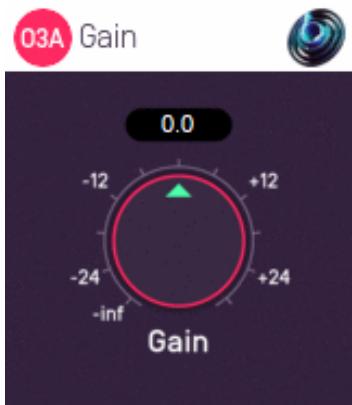
The meters are all normalised so that a 0dBFS peak sine wave panned in any direction will produce a -3.01dB output. There is no sensitivity to frequency or direction. If you are interested in measuring loudness, you may wish to consider the O3A Meter - Karma plugin from the O3A Decoding

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.

14 O3A Core - Soundfield Modification

14.1 O3A Gain



14.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

14.1.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

14.1.3 Controls

- Gain

14.1.4 Description

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

14.1.5 Controls

14.1.5.1 Control: Gain

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

14.2 O3A Spatial Delay



14.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

14.2.2 Audio

	Channels	Content
Input	16	O3A
Output	16	O3A

14.2.3 Controls

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

14.2.4 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.

14.2.5 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>

14.2.6 Controls

14.2.6.1 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.

14.2.6.2 Controls: Dry Gain and Wet Gain

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

14.2.6.3 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.

14.2.6.4 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.

14.2.6.5 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.

14.2.6.6 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.

14.2.6.7 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).

14.2.6.8 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.

15 Appendix: O3A Streams

15.1 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.

15.2 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.

15.3 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.

15.4 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](#).

15.5 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.