



O7A View Plugins
v2.4.0

Copyright 2023 Blue Ripple Sound Limited

Table of Contents

1 Introduction.....	1
1.1 Compatibility.....	1
1.2 Getting Started.....	3
1.3 The License Manager.....	4
1.4 Technical Requirements.....	5
2 The 'View' Applications.....	7
2.1 View and ViewVR.....	7
2.2 Plugin Connection.....	7
3 Using the View Applications.....	8
3.1 Starting Up.....	8
3.2 Connecting.....	8
3.3 Interaction with Plugins.....	8
3.4 Video Files.....	8
3.5 Configuring Video Formats.....	9
3.6 Controlling the View.....	9
3.7 Grids.....	11
3.8 Other Keys.....	11
3.9 Video Codecs in the View Applications.....	12
4 Plugin Support in the View Applications.....	13
4.1 The 'View' Button.....	13
4.2 Warning: A 'Quirk'.....	13
4.3 View/ViewVR Supported Plugins.....	13
5 Panners.....	14
5.1 O7A Panner 16 and 32.....	14
6 Monitoring and Control.....	18
6.1 O7A View Sync.....	18
6.2 O7A Decoder - VR Monitoring.....	24
7 Appendix: O7A Streams.....	27
7.1 What is an O7A Stream?.....	27
7.2 What processing can I apply to an O7A stream?.....	27
7.3 Encoding.....	27
7.4 How does O7A SN3D relate to FuMa and Classic Ambisonics?.....	28

1 Introduction

The O7A View plugin library provides a number of tools to help mix [seventh order ambisonic \(O7A\) 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 O7A plugins can be controlled from the application. For instance, this allows control of panning automation from within virtual reality. A [number of O7A plugins](#) benefit from this, including some plugins in other Blue Ripple Sound O7A plugin libraries.

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

1.1 Compatibility

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

1.1.1 AAX

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

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

1.1.2 VST2

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

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

1.1.3 Buffering

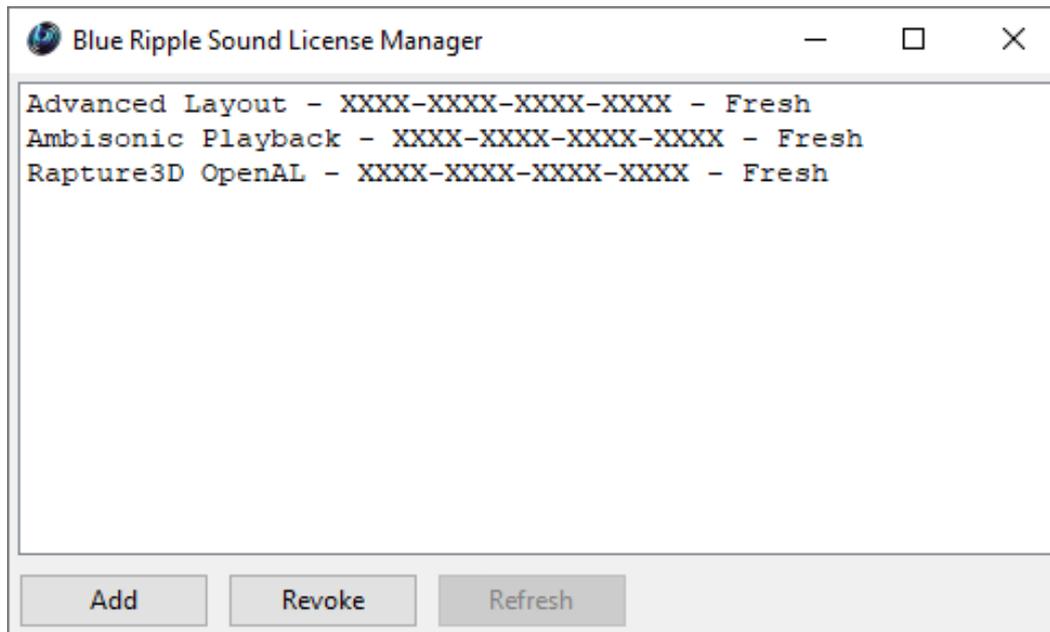
Some of the O7A plugins use internal buffering with a length of 128 samples. For smooth CPU load, you may wish to ensure your DAW buffer size is a multiple of this.

1.2 Getting Started

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

1.3 The License Manager

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



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

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

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

1.4 Technical Requirements

1.4.1 Operating System

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

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

1.4.2 VST Host

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

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

1.4.3 AAX Host

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

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

1.4.4 PC Hardware

Please check your PC meets the following requirements:

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

1.4.5 Permissions

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

1.4.6 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.

1.4.7 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.

2 The 'View' Applications

2.1 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.

2.2 Plugin Connection

The View applications are controlled by an [O7A 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 O7A stream to compensate for the change in head orientation.

[Some O7A 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 O7A Flare visualiser can be linked to the View application, although this requires a fast network connection.

3 Using the View Applications

3.1 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 [O7A View Sync](#) plugin connects to it.

3.2 Connecting

3.2.1 Configuring the Plugin

To connect the [O7A 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 [O7A View Sync](#) plugin for details on how to enter this.

3.2.2 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).

3.3 Interaction with Plugins

The plugin can also manage control links between a small number of *other* O7A plugins and the View application. This is discussed in a [later section](#).

3.4 Video Files

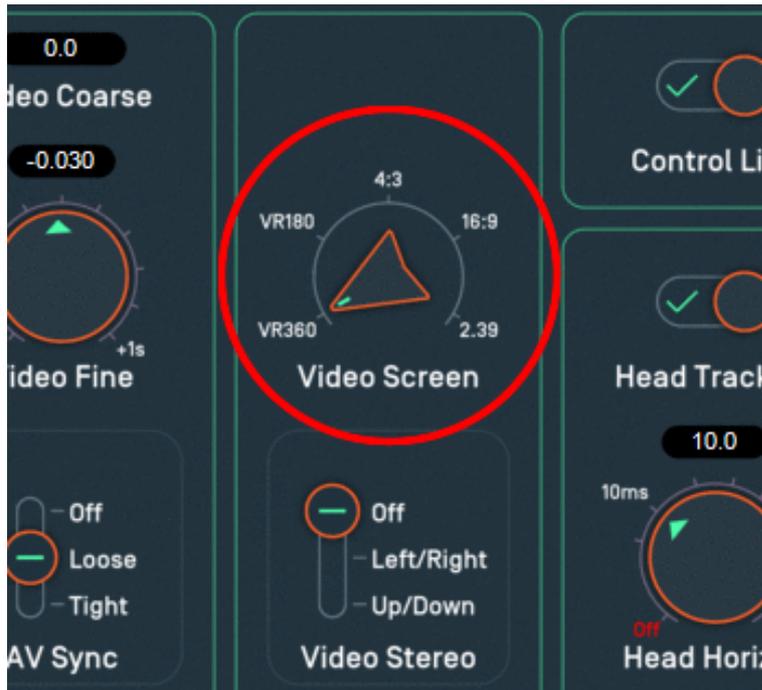
The O7A View Sync plugin can be used to specify a video file, and how it should be presented. See the [plugin documentation](#) for more details.

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.

3.5 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.

3.6 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 O7A stream, so the audio matches the camera. See the [O7A View Sync](#) plugin for details.

3.6.1 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 O7A 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 O7A tools (such as the main O7A 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 O7A 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 O7A 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 O7A View Sync plugin in this mode.</p>

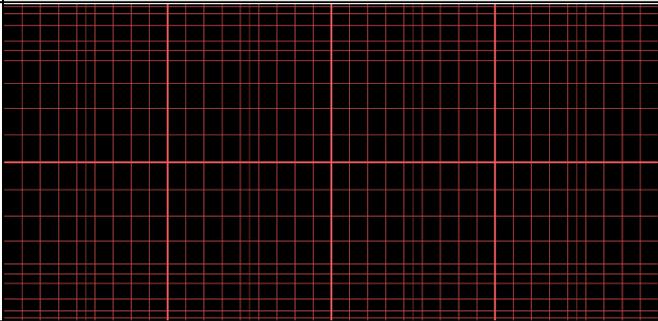
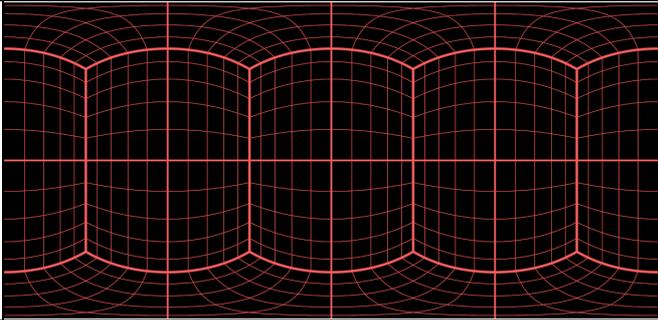
3.6.2 Perspective - ViewVR

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 [O7A View Sync](#) plugin).

3.7 Grids

Grids can be overlaid 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.

3.8 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.

3.9 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.

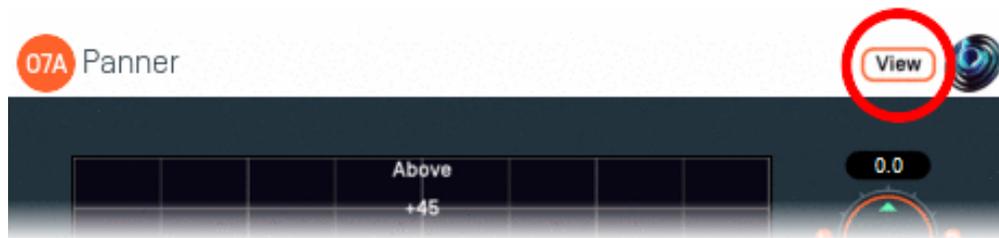
This means that the available video codecs (i.e. the formats that are supported) depends on your system. The most common format used is probably MP4 with H.264 video encoding. The audio encoding is not important since the View application mutes any audio in the video file; it is assumed that all audio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

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

4 Plugin Support in the View Applications

4.1 The 'View' Button

Some of the O7A 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 [O7A 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 O7A plugins involved *must* be running the same software version.

4.2 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.

4.3 View/ViewVR Supported Plugins

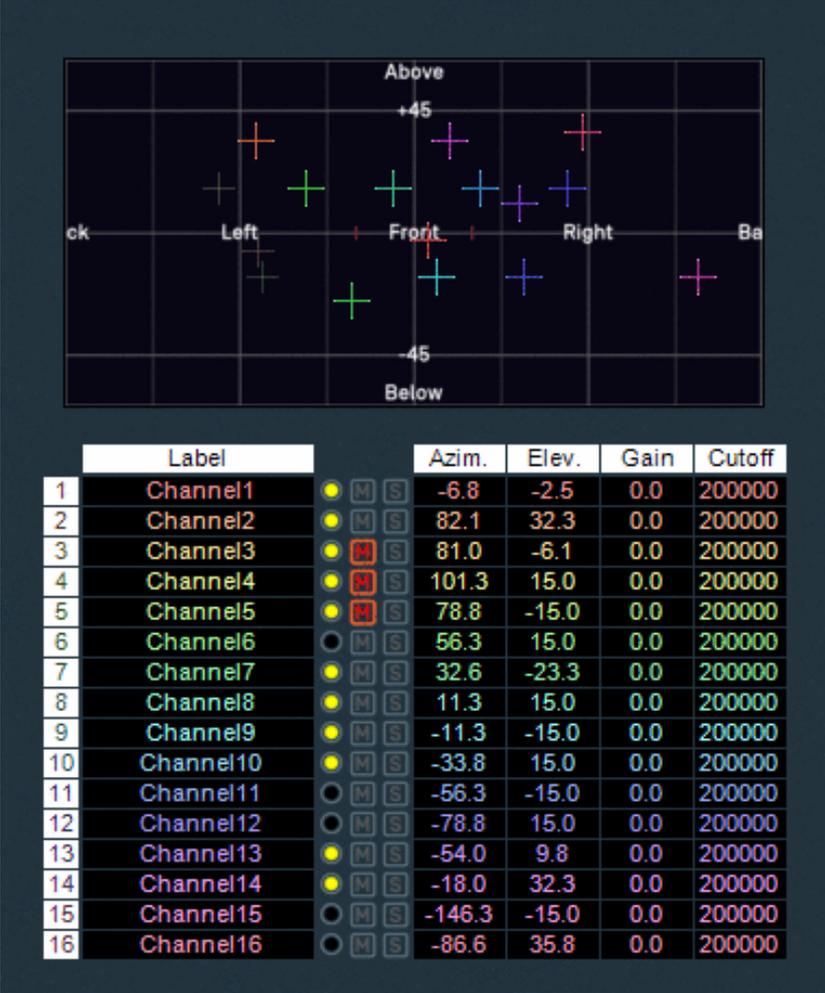
Plugins with support in the View or ViewVR applications via this library are:

Library	Plugins
O7A Core	O7A Panner, O7A Panner - Classic, O7A Panner - Hemisphere, O7A Panner - Large, O7A Panner - Two Channel, O7A Panner - Eight Channel, O7A Flare, O7A Look, O7A Rotation, O7A Beamer, O7A Spatial Delay
O7A Manipulators	O7A Move, O7A Zoom, O7A Zoom XYZ, O7A Directional Emphasis, O7A Directional Mask, O7A Portal, O7A Reflection, O7A Spotlight, O7A Panner LS, O7A Panner LS XYZ, O7A Panner LS8, O7A Line, O7A Spotlight Split
O7A Music	O7A Bitcrusher, O7A Chorus, O7A Overdrive, O7A Ring Modulator, O7A Shells Split
O7A Reverb	O7A Shoebox
O7A Upmixers	O7A Upmixer - Stereo
O7A View	O7A Panner 16 , O7A Panner 32

5 Panners

5.1 O7A Panner 16 and 32

O7A Panner 16 View 



	Label			Azim.	Elev.	Gain	Cutoff
1	Channel1	●	M S	-6.8	-2.5	0.0	200000
2	Channel2	●	M S	82.1	32.3	0.0	200000
3	Channel3	●	M S	81.0	-6.1	0.0	200000
4	Channel4	●	M S	101.3	15.0	0.0	200000
5	Channel5	●	M S	78.8	-15.0	0.0	200000
6	Channel6	○	M S	56.3	15.0	0.0	200000
7	Channel7	●	M S	32.6	-23.3	0.0	200000
8	Channel8	●	M S	11.3	15.0	0.0	200000
9	Channel9	●	M S	-11.3	-15.0	0.0	200000
10	Channel10	●	M S	-33.8	15.0	0.0	200000
11	Channel11	○	M S	-56.3	-15.0	0.0	200000
12	Channel12	○	M S	-78.8	15.0	0.0	200000
13	Channel13	●	M S	-54.0	9.8	0.0	200000
14	Channel14	●	M S	-18.0	32.3	0.0	200000
15	Channel15	○	M S	-146.3	-15.0	0.0	200000
16	Channel16	○	M S	-86.6	35.8	0.0	200000

5.1.1 Host Support

5.1.1.1 O7A Panner 16

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

5.1.1.2 O7A Panner 32

Host Type	Support
AAX	No
VST2	Yes

5.1.2 Audio

5.1.2.1 O7A Panner 16

	Channels	Content
Input	16	16 channels of mono (mapped to third order ambisonics for AAX)
Output	64	O7A

5.1.2.2 O7A Panner 32

	Channels	Content
Input	32	32 channels of mono
Output	64	O7A

5.1.3 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

5.1.4 Description

These O7A panners takes 16 or 32 mono sound sources and place them in particular directions in a 3D O7A 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 O7A 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](#).

5.1.4.1 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.

5.1.4.2 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.

5.1.4.3 Use

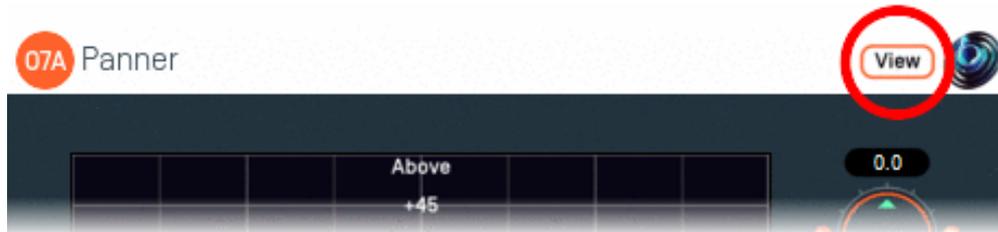
This plugin has a large number of control parameters and the display does not include individual dials for them all; values need to be entered as numbers. Panning can be controlled using the control surface, but this can become quite cluttered. If you want a plugin similar to this one with a similar layout but with a more manageable number of channels, you may wish to consider O7A Panner - Eight Channel.

However, this plugin comes into its own is when it used with [O7A View's](#) separate View applications. Here, channels be overlaid onto a much larger panning surface, potentially with video, and potentially in VR.

5.1.5 View Support

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

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



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

View Support	ViewVR Support
The current 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.

5.1.6 Controls

5.1.6.1 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.

5.1.6.2 Controls: Gain 1 - 16 or 1 - 32

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

5.1.6.3 Controls: Cutoff 1 - 16 or 1 - 32

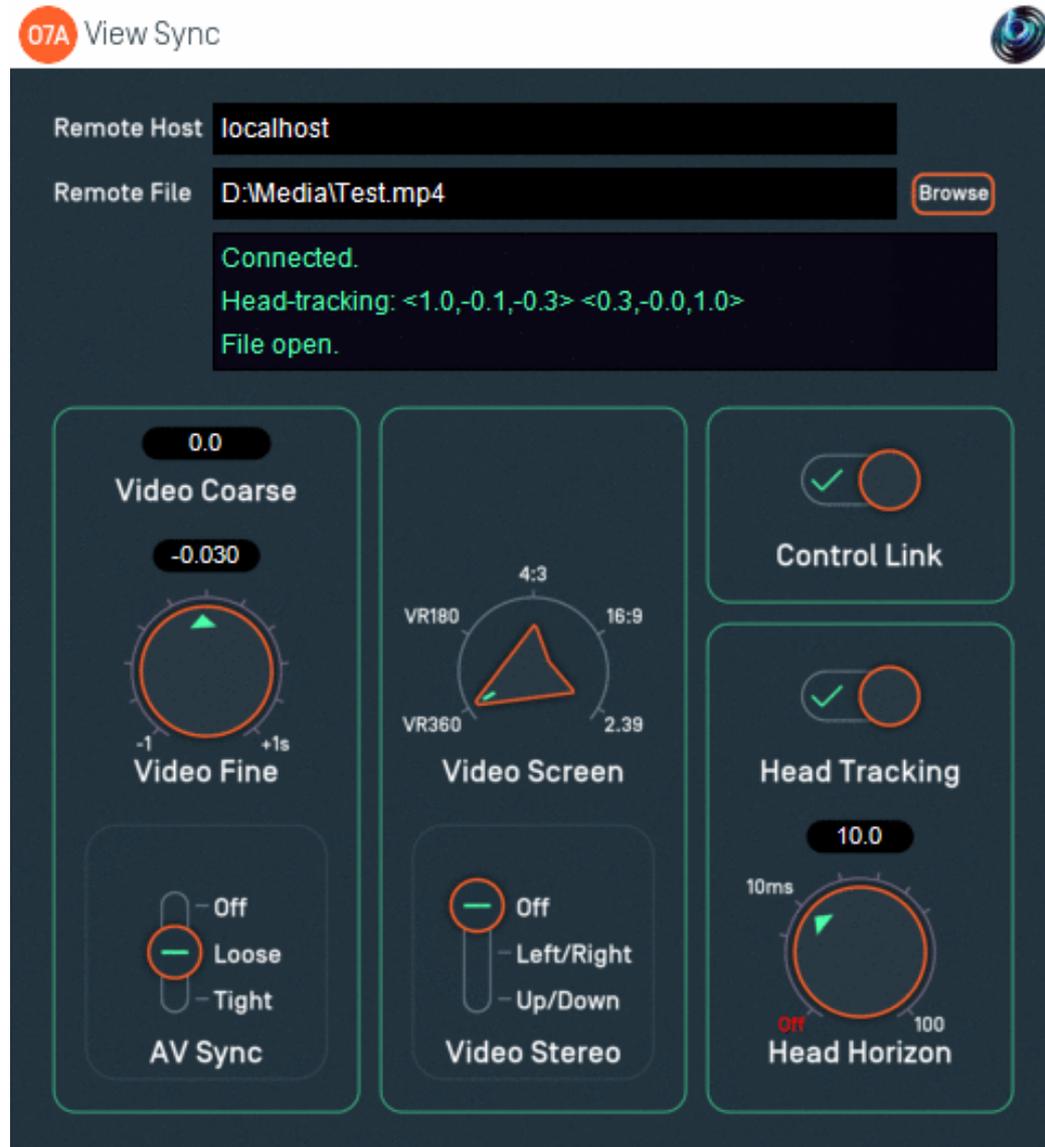
Each panned source has its own low pass filter. The filter is a relatively subtle -6dB/octave filter with -3dB at the cutoff frequency provided. This is intended primary for use in simulation of distance or acoustic occlusion.

5.1.6.4 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.

6 Monitoring and Control

6.1 O7A View Sync



6.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

6.1.2 Audio

	Channels	Content
Input	64	O7A
Output	64	O7A

6.1.3 Controls

- Remote Host
- Remote File
- Video Coarse
- Video Fine
- A/V Sync
- Video Screen
- Video Stereo
- Control Link
- Head Tracking
- Head Horizon

6.1.4 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 O7A 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.

6.1.4.1 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.

6.1.4.2 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.

6.1.4.3 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.

6.1.4.4 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).

6.1.4.5 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 O7A plugins in the same process.

6.1.4.6 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 O7A master track to multiple binaural decoder tracks, each with independent head tracking for different VR headsets.

However, only one O7A sync plugin may have its **Control Link** switch enabled at once. If more than one is enabled, control links will not work.

6.1.4.7 Connections Between Plugins

When Control Link is used to communicate between the O7A 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.

O3A and O7A control links work independently of each other. If you have O3A plugins in your project, they will not connect to the O7A View Sync plugin, and vice versa. O3A View Sync and O7A View Sync can be used simultaneously, although they will need to connect to different View instances.

6.1.4.8 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.

6.1.5 Controls

6.1.5.1 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.

6.1.5.2 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.

6.1.5.3 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.

6.1.5.4 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](#).

6.1.5.5 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.

6.1.5.6 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.

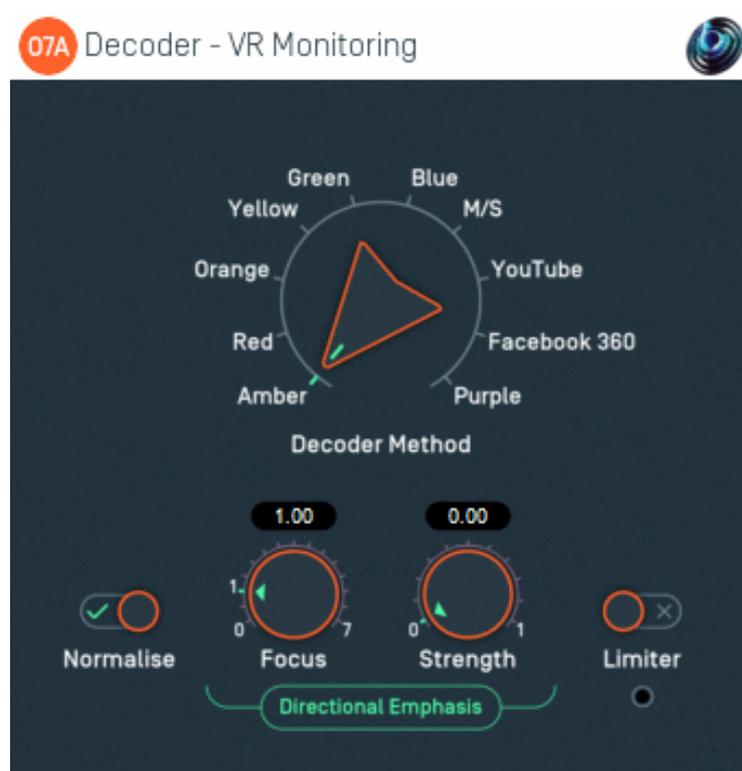
6.1.5.7 Control: Head Tracking

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

6.1.5.8 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.

6.2 O7A Decoder - VR Monitoring



6.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

6.2.2 Audio

	Channels	Content
Input	64	O7A
Output	2	Binaural Stereo

6.2.3 Controls

- Decoder
- Normalise
- Focus
- Strength
- Limiter

6.2.4 Description

This plugin takes a seventh order ambisonics (O7A) 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 [O7A View Sync](#) plugin with head-tracking enabled immediately *before* this decoder. The O7A Look plugin is a simple alternative.

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

6.2.4.1 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 O7A Meter, O7A Meter - Karma and so on.

6.2.4.2 Directional Emphasis Module

This module further modifies levels to emphasise frontal audio. It uses essentially the same algorithm as Rapture3D Universal (running at seventh order) or the O7A Directional Emphasis plugin from the O7A Manipulators plugin library. It provides **focus** and **strength** controls and is always applied forwards.

6.2.4.3 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.

6.2.5 Controls

6.2.5.1 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 "O7A Decoder - Headphones plugin" in the O7A 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 O7A 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 O7A 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 O7A 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.

6.2.5.2 Control: Normalise

If the Normalise switch is enabled, the decoder output levels are normalised to be consistent with other O7A decoder plugins and O7A metering. Otherwise, raw decoder output levels are used.

6.2.5.3 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.

6.2.5.4 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.

6.2.5.5 Control: Limiter

The limiter control toggle enables or disables the limiter module.

6.2.6 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!

7 Appendix: O7A Streams

7.1 What is an O7A Stream?

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

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

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

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

7.2 What processing can I apply to an O7A stream?

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

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

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

7.3 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.

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

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

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