



O1A Decoding Plugins

v2.2.1

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1 Introduction

The O1A Decoding Plugins "decode" first order ambisonic (O1A) streams for playback on a range of speaker layouts including [plain stereo](#), [5.1](#), [7.1](#), [7.1.2 \(Dolby Atmos\)](#), [22.2](#), [Auro-3D](#), [IMAX](#) and binaural audio for [headphones](#). The first order ambisonic streams are assumed to use the SN3D/ACN convention, although a [converter](#) plugin is provided to handle streams using classic B-Format.

These plugins are simplified to use first order ambisonics (O1A) rather than modern third order ambisonics (O3A). Please think carefully before using them as they often produce less accurate 3D sound than their O3A equivalents.

The decoders are based on the Blue Ripple Sound's ground-breaking Rapture3D Higher Order Ambisonic decoder, but running at just first order.

1.1 O1A and O3A

First order ambisonics (O1A) uses four channels of sound to capture a 3D sound scene. Third order ambisonics (O3A) uses sixteen channels of sound and captures more detail. We recommend O3A rather than O1A for most purposes and it possible to inject O1A material into O3A mixes using a number of approaches, including direct mixing, or active upmixing with tools like the O3A Harpex Upsampler. Third order equivalents to the decoder plugins here can be found in the O3A Decoding or O3A Core plugin libraries.

However, you may only have first order material and not wish to treat it. In this case, the O1A decoders here may provide marginally better decodes than their O3A equivalents.

Some of the features of these decoders (in particular HRTF processing and tinting) will have a weak effect when compared to the equivalent O3A decoder plugins. The switches for these features are included anyway, primarily to provide approximately matched levels and timbre in cases where the O1A and O3A plugins are to be used together.

1.2 O1A Material, A-Format and B-Format

O1A material can come from a number of sources. There are a number of B-Format microphones available.

The output of such microphones may need to be converted to SN3D/ACN (the format used by these plugins). If it uses "classic" B-Format (often labelled W, X, Y and Z), the audio cannot be fed directly to these plugins; it will need to be converted using the [O1A Injector - FuMa](#) plugin first.

There are also a number of "A-Format" microphones available, such as CoreSound's [Tetramic](#). The output of "A-Format" microphones must be converted to "B-Format" before processing with any of these plugins. In most cases, the microphone's manufacturer will be able to provide you with software to do this. The software should indicate if the output uses classic B-Format (equivalent to FuMa at first order) or SN3D/ACN (also known as AmbiX).

1.3 Compatibility

Note that some of these plugins need quite a few channels (for instance, 7.1.2 needs 10) and so *will not work correctly* in many Digital Audio Workstations, which may even crash if these plugins are used.

1.3.1 AAX

Most of these plugins exist as AAX versions which are compatible with [Pro Tools Ultimate](#) or Pro Tools HD 12.8.2 and 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 ensure plugins are used in the right places. However, where formats are not available in Pro Tools (e.g. 22.2), corresponding plugins are generally not available. To avoid this in some cases, some plugins "misuse" stem formats with matching channel counts. For instance, the eight-channel "cube" format is unavailable directly in Pro Tools, so the "O1A Decoder - Cube" plugin outputs the audio as eight-channel 7.1. Cases like this are described for individual plugins below in the text.

1.3.2 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 VST 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.

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.

1.3.3 Buffering

Some of these 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 Decoding

2.1 Choosing a Decoder

We do not describe how to make an O1A mix here. If you are new to ambisonics, we recommend you start with third order ambisonics (O3A) rather than O1A.

O1A material can be decoded into other formats for actual listening. There are a number of decoders available here and most support a number of decoding methods.

2.1.1 Headphones

If you are listening on headphones, the binaural decoder for [headphones](#) will almost certainly work best, although you could also try the basic [Stereo](#) decoder for a simpler mix which may play more naturally on ordinary stereo speakers.

2.1.2 Stereo Speakers

The basic [Stereo](#) decoder can be a good choice here.

The O3A Core plugin library includes a virtual stereo microphone plugin which can be used with O1A streams and the O3A Decoding library ships with a stereo crosstalk cancellation module.

2.1.3 Surround Speakers

Decoders of this type are available for [5.1](#), [7.1](#), [7.1.2 \(Dolby Atmos\)](#), [7.1.4](#), [Hamasaki 22.2](#), [Auro-3D](#), [IMAX](#) and others.

Three methods are supported: "Basic", "Reconstruction" and "Tinted Reconstruction".

Generally, "Basic" is recommended for downmixing for distribution and for listening on speaker rigs that are not set up accurately, or are in larger venues. It produces a high quality, resilient "all-purpose" mix.

The other methods can produce a better sound, but are optimised for fairly idealised speaker layouts and listener locations.

If you need a custom layout you may wish to consider the "Advanced" edition of Rapture3D.

2.2 Low Frequency Effects (LFE)

When decoders in this library manage an output format with a Low Frequency Effect (LFE) channel, a "LFE Crossover" control is shown. The control is off by default.

When this is switched on, some audio is removed from the main channels and routed to the LFE, effectively performing some early bass management. Note that this is in addition to any bass management that may be happening in the playback venue.

We generally do *not* recommend using this. Depending on what happens to the mix, LFE channels may be removed before final playback. Further, audio in this channel is effectively not spatialised. If bass management is needed, it is generally best handled by the playback system, which should also know the crossovers of the actual speakers involved.

However, there are reasons you may need to generate LFE. These include lack of bandwidth, or downstream Quality teams who expect to see some content in this channel! In both these cases, you may find that a very low crossover frequency (such as 10Hz) is satisfactory.

Note that the transition between "On" and "Off" is not necessarily seamless as this switch disables the crossover module to save CPU load.

Audio is split directly, at its original level, so you may need to apply a further gain to the LFE output during some mastering processes (typically -10dB). The "LFE Gain" control can be used for this purpose.

2.3 Technical Requirements

2.3.1 Operating System

Supported versions of Microsoft Windows are Windows 7, Windows 8 and Windows 10. Supported versions of Apple macOS X are 10.7 or later, Intel only. VST plugins are generally available in 32bit or 64bit forms on both platforms (packaged as a Universal Binary on macOS). The AAX plugins are 64bit only.

2.3.2 VST Host

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

These plugins do not work with all VST 2 hosts. They are multichannel plugins and so will not work on VST hosts that only handle stereo. Some of the plugins need large numbers of channels on each track. Check the individual plugins for the channel counts they need. Also note that not all VST 2 hosts can use shell plugins. In particular, at the time of writing shell plugins are not supported in Nuendo 8.

2.3.3 AAX Host

The AAX plugins require Pro Tools Ultimate, or Pro Tools HD v12.8.2 or later.

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

2.3.4 PC Hardware

Please check your PC meets the following requirements:

- Intel Pentium D CPU or better.
- 200MB of free disk space.
- Internal network card.

2.3.5 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.

2.3.6 Permissions

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

3 Binaural Decoding

3.1 O1A Decoder - Headphones



3.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

3.1.2 Audio

	Channels	Content
Input	4	O1A
Output	2	Binaural Stereo

3.1.3 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it to 3D stereo suitable for use with headphones. The results are similar to a binaural recording and can be used to place sounds behind, around, above and below the listener.

This plugin uses Blue Ripple Sound's ground-breaking "Amber" HRTF technology.

3.1.3.1 Technical Notes

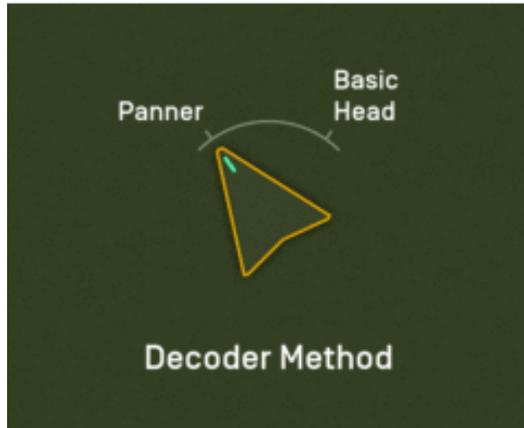
The Blue Ripple Sound Amber HRTF uses data from the IRCAM LISTEN HRTF data set, available at <http://recherche.ircam.fr/equipes/salles/listen/index.html>.

The HRTF data for each head in the data set is cleaned and converted into a suitable parameterised model. The parameter space is explored to find an "average" head model which works on a wide range of heads. This is then used to build a higher order ambisonics (HOA) decoder.

This results in smooth HRTF-based decoders which work on a wide range of heads and do not suffer from the high frequency phasing artefacts common with some other headphone decoders and binaural panners, particularly when sounds are moving. The decoder is able to synthesise ITD (inter-aural time difference) cues at low frequencies and ILD (inter-aural level differences) throughout the frequency range. This plugin uses the first order (O1A) version of the decoder.

4 Loudspeaker Decoding

4.1 O1A Decoder - Stereo



4.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.1.2 Audio

	Channels	Content
Input	4	O1A
Output	2	Stereo

4.1.3 Controls

- Method

4.1.4 Description

This plugin takes a first order ambisonics (O1A) 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 [O1A Decoder - Headphones](#).

4.1.5 Controls

4.1.5.1 Control: Method

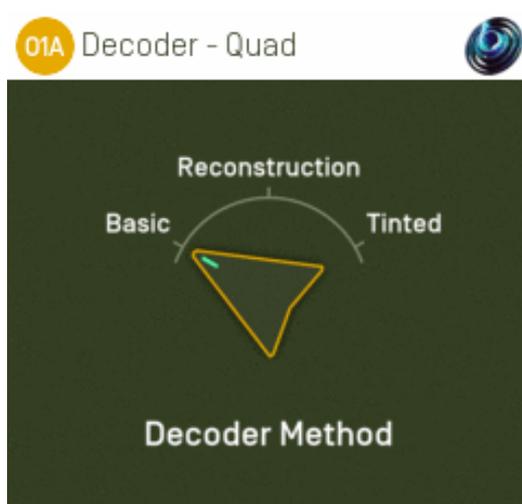
Two decoder methods are supported, "Panner" and "Basic Head".

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 O1A Decoder - Headphones from this library. or Rapture3D Advanced.</p> <p>Unlike most other O1A decoders, this decoder presents sounds from different directions at different levels. For instance, sounds to the front are louder than those behind.</p>

4.1.5.2 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.

4.2 O1A Decoder - Quad



4.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.2.2 Audio

	Channels	Content
Input	4	O1A
Output	4	Quad

4.2.3 Controls

- [Method](#)

4.2.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as speaker feeds for four speakers set out at the corners of a square.

4.2.4.1 Channels

The channel ordering used is:

Channel	AAX/VST
1	Front Left
2	Front Right
3	Back Left
4	Back Right

4.2.5 Controls

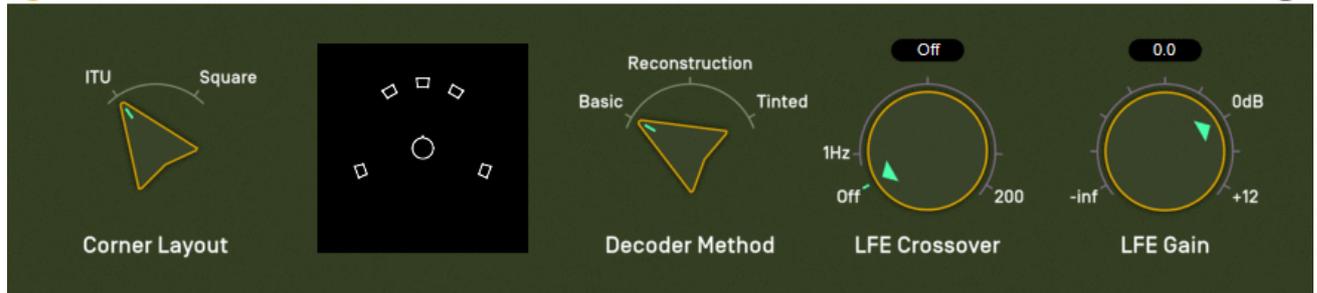
4.2.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.3 O1A Decoder - 5.1

O1A Decoder - 5.1



4.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.3.2 Audio

	Channels	Content
Input	4	O1A
Output	6	5.1 Surround

4.3.3 Controls

- [Corners](#)
- [Method](#)
- [LFE Crossover](#)
- [LFE Gain](#)

4.3.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as a 5.1 surround mix.

4.3.4.1 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

4.3.5 Controls

4.3.5.1 Control: Corners

The corner layout lets you tell the processor where the corner speakers for 5.1 playback are assumed to be:

Corner Layout	Description
ITU	In principle, the speakers of a 5.1 system should be set out using ITU angles. From front centre, this recommends front left and right speakers be at +30 or -30 degrees and side speakers be at +110 or -110 degrees. ITU layouts are common in studios and are a common way to mix 5.1.
Square	In practice, many 5.1 speaker systems are set up with the corner speakers set out in what is roughly a square and some mixes are put together on this basis. If you know that's the case, switch the corner layout to Square.

4.3.5.2 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.3.5.3 Control: LFE Crossover

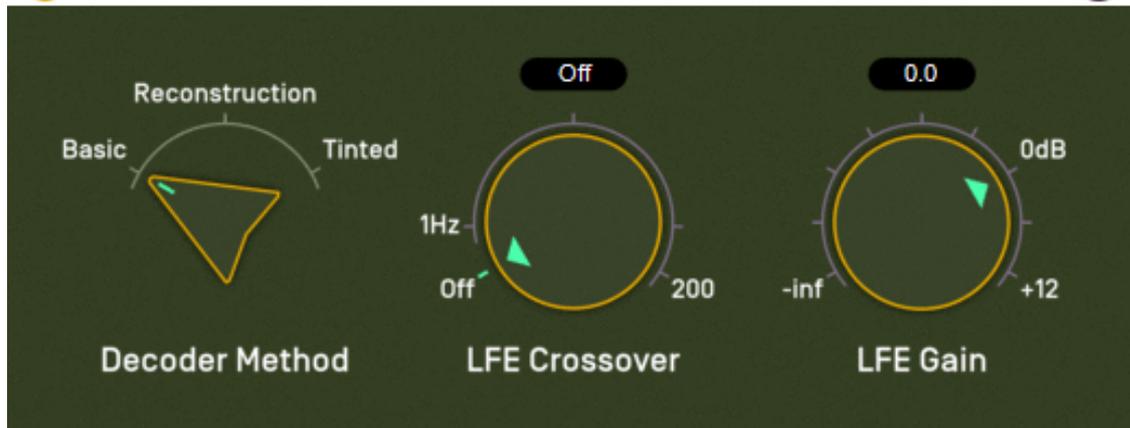
This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.3.5.4 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.4 O1A Decoder - 7.1

O1A Decoder - 7.1



4.4.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.4.2 Audio

	Channels	Content
Input	4	O1A
Output	8	7.1 Surround

4.4.3 Controls

- Method
- LFE Crossover
- LFE Gain

4.4.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as a 7.1 surround mix.

4.4.4.1 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 Side	LFE
5	Right Surround Side	Back Left
6	Left Surround Rear	Back Right
7	Right Surround Rear	Side Left
8	LFE	Side Right

4.4.5 Controls

4.4.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.4.5.2 Control: LFE Crossover

This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.4.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.5 O1A Decoder - 7.1.2 (Dolby Atmos)

O1A Decoder - 7.1.2 (Dolby Atmos)



4.5.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

4.5.2 Audio

	Channels	Content
Input	4	O1A
Output	10	7.1.2 (Dolby Atmos)

4.5.3 Controls

- Method
- LFE Crossover
- LFE Gain

4.5.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as 7.1.2.

7.1.2 is a standard mix format for beds in Dolby Atmos. It adds two ceiling channels to standard 7.1.

4.5.4.1 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 Side	LFE
5	Right Surround Side	Left Surround Rear
6	Left Surround Rear	Right Surround Rear
7	Right Surround Rear	Left Surround Side
8	LFE	Right Surround Side
9	Left Top Surround	Left Top Surround
10	Right Top Surround	Right Top Surround

Please note that the channel ordering used by Dolby's Atmos RMU may differ.

4.5.5 Controls

4.5.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.5.5.2 Control: LFE Crossover

This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.5.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.6 O1A Decoder - 7.1.4

O1A Decoder - 7.1.4



4.6.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

4.6.2 Audio

	Channels	Content
Input	4	O1A
Output	12	7.1.4 Surround

4.6.3 Controls

- Method
- LFE Crossover
- LFE Gain

4.6.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it to 7.1.4.

Please note that although 7.1.4 is not an uncommon speaker layout for Dolby Atmos playback, the actual mastering and delivery format used is often [7.1.2](#).

4.6.4.1 Channels

The channel ordering used is:

Channel	VST
1	Front Left
2	Front Right
3	Front Centre
4	LFE
5	Left Surround Rear
6	Right Surround Rear
7	Left Surround Side
8	Right Surround Side
9	Left Top Front
10	Right Top Front
11	Left Top Rear
12	Right Top Rear

4.6.5 Controls

4.6.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.6.5.2 Control: LFE Crossover

This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.6.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.7 O1A Decoder - Auro-3D 9.1, 10.1, 11.1 and 13.1

O1A Decoder - Auro-3D 9.1



4.7.1 Host Support

4.7.1.1 O1A Decoder - Auro-3D 9.1

Host Type	Support
AAX	Yes, output mapped to 7.1.2 (Dolby Atmos) stem
VST2	Yes

4.7.1.2 O1A Decoder - Auro-3D 10.1

Host Type	Support
AAX	No
VST2	Yes

4.7.1.3 O1A Decoder - Auro-3D 11.1

Host Type	Support
AAX	No
VST2	Yes

4.7.1.4 O1A Decoder - Auro-3D 13.1

Host Type	Support
AAX	No
VST2	Yes

4.7.2 Audio

4.7.2.1 O1A Decoder - Auro-3D 9.1

	Channels	Content
Input	4	O1A
Output	10	Auro-3D 9.1 (mapped to 7.1.2 for AAX)

4.7.2.2 O1A Decoder - Auro-3D 10.1

	Channels	Content
Input	4	O1A
Output	11	Auro-3D 10.1

4.7.2.3 O1A Decoder - Auro-3D 11.1

	Channels	Content
Input	4	O1A
Output	12	Auro-3D 11.1

4.7.2.4 O1A Decoder - Auro-3D 13.1

	Channels	Content
Input	4	O1A
Output	14	Auro-3D 13.1

4.7.3 Controls

- [Method](#)
- [LFE Crossover](#)
- [LFE Gain](#)

4.7.4 Description

Four decoder plugins are provided, which produce Auro-3D surround mixes from O1A streams. The plugins correspond to each of the Auro-3D 9.1, Auro-3D 10.1, Auro-3D 11.1 and Auro-3D 13.1 speaker layouts.

These plugins do *not* perform bitstream encoding to allow transmission of Auro-3D over backwards-compatible formats. The output is in a form suitable to be fed directly to speaker channels, or to such an encoder.

4.7.4.1 Channels

The channel orderings used for the Auro-3D formats are:

Auro-3D 9.1	Auro-3D 10.1	Auro-3D 11.1	Auro-3D 13.1	Channel Name
1	1	1	1	Front Left
2	2	2	2	Front Right
3	3	3	3	Front Centre
4	4	4	4	LFE
5	5	5	5	Surround Left
6	6	6	6	Surround Right
-	-	-	7	Back Left
-	-	-	8	Back Right
7	7	7	9	Height Front Left
8	8	8	10	Height Front Right
9	9	9	11	Height Surround Left
10	10	10	12	Height Surround Right
-	-	11	13	Height Front Centre
-	11	12	14	Top Ceiling

Please note that when Auro-3D 9.1 is mapped to 7.1.2 (Dolby Atmos) for AAX, no attempt is made to map to channels where they correspond. The channels simply appear in the order above.

4.7.5 Controls

4.7.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.7.5.2 Control: LFE Crossover

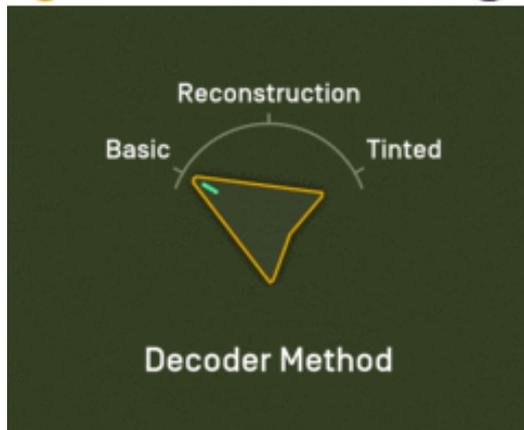
This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.7.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.8 O1A Decoder - IMAX 5.0, 6.0 and 12.0

O1A Decoder - IMAX 5.0



4.8.1 Host Support

4.8.1.1 O1A Decoder - IMAX 5.0

Host Type	Support
AAX	Yes, output mapped to standard 5.0 stem
VST2	Yes

4.8.1.2 O1A Decoder - IMAX 6.0

Host Type	Support
AAX	Yes, output mapped to standard 6.0 stem
VST2	Yes

4.8.1.3 O1A Decoder - IMAX 12.0

Host Type	Support
AAX	No
VST2	Yes

4.8.2 Audio

4.8.2.1 O1A Decoder - IMAX 5.0

	Channels	Content
Input	4	O1A
Output	5	IMAX 5.0 (mapped to standard 5.0 for AAX)

4.8.2.2 O1A Decoder - IMAX 6.0

	Channels	Content
Input	4	O1A
Output	6	IMAX 6.0 (mapped to standard 6.0 for AAX)

4.8.2.3 O1A Decoder - IMAX 12.0

	Channels	Content
Input	4	O1A
Output	12	IMAX 12.0

4.8.3 Controls

- [Method](#)

4.8.4 Description

These plugins take a first order ambisonics (O1A) mix and decode it as IMAX surround mixes.

4.8.4.1 IMAX 5.0 Channels

The channel ordering used for IMAX 5.0 is as follows:

Channel	AAX	VST
1	Front Left	Front Left
2	Front Centre	Front Right
3	Front Right	Front Centre
4	Rear Left (mapped to Left Surround)	Rear Left
5	Rear Right (mapped to Right Surround)	Rear Right

For AAX, note that this is mapped to standard 5.0.

4.8.4.2 IMAX 6.0 Channels

Channel	AAX	VST
1	Front Left	Front Left
2	Front Centre	Front Right
3	Front Right	Front Centre
4	Rear Left (mapped to Left Surround)	Front Centre Overhead
5	Front Centre Overhead (mapped to Centre Surround)	Rear Left
6	Rear Right (mapped to Right Surround)	Rear Right

For AAX, note that this is mapped to standard 6.0, with the IMAX Front Centre Overhead channel mapped to the Centre Surround in standard 6.0 (i.e. at the back).

4.8.4.3 IMAX 12.0 Channels

Channel	VST
1	Front Left
2	Front Right
3	Front Centre
4	Front Centre Overhead
5	Rear Left
6	Rear Right
7	Side Left
8	Side Right
9	Overhead Front Left
10	Overhead Front Right
11	Overhead Rear Left
12	Overhead Rear Right

IMAX systems use speakers with wider bandwidth than typical cinema systems. No Low Frequency Effect (LFE) channel is used in the mix formats. Also note that the last two channels in IMAX 5.0 and 6.0 correspond to rear speakers, not side or surround speakers.

4.8.5 Controls

4.8.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.9 O1A Decoder - 22.2

O1A Decoder - 22.2



4.9.1 Host Support

Host Type	Support
AAX	No
VST2	Yes

4.9.2 Audio

	Channels	Content
Input	4	O1A
Output	24	Hamasaki 22.2

4.9.3 Controls

- Method
- LFE Crossover
- LFE Gain

4.9.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as a 24 channel Hamasaki 22.2 surround mix.

4.9.4.1 Channels

The channel ordering used is:

Channel	VST
1	Front Left
2	Front Right
3	Front Centre
4	LFE Left
5	Back Left
6	Back Right
7	Front Left/Centre
8	Front Right/Centre
9	Back Centre
10	LFE Right
11	Side Left
12	Side Right
13	Top Front Left
14	Top Front Right
15	Top Front Centre
16	Top Centre
17	Top Back Left
18	Top Back Right
19	Top Side Left
20	Top Side Right
21	Top Back Centre
22	Bottom Front Centre
23	Bottom Front Left
24	Bottom Front Right

4.9.5 Controls

4.9.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.9.5.2 Control: LFE Crossover

This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.9.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

Please note that a further -6dB is applied in addition to this setting to compensate for the presence of two LFEs in the 22.2 configuration.

4.10 O1A Decoder - 3D7.1

O1A Decoder - 3D7.1



4.10.1 Host Support

Host Type	Support
AAX	Yes, output mapped to 7.1 stem
VST2	Yes

4.10.2 Audio

	Channels	Content
Input	4	O1A
Output	8	3D7.1 Surround (mapped to standard 7.1)

4.10.3 Controls

- [Method](#)
- [LFE Crossover](#)
- [LFE Gain](#)

4.10.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as a 3D7.1 surround mix.

3D7.1 is a modified version of the 7.1 speaker layout invented by Simon N. Goodwin. It is based on the equipment used for 7.1 but places the speakers in different locations, some being raised or lowered.

If you intend to use this decoder then you should move your speakers to these new locations. Alternatively there is a normal [O1A decoder for 7.1](#).

4.10.4.1 Channel Ordering for AAX

For AAX, the channel ordering and assumed speaker locations for the 3D7.1 surround mix are as follow.

Channel	7.1 Speaker Position	3D7.1 Speaker Position	Azimuth	Elevation	Used in 5.1
1	Front Left	Front Left High	+51	+24	Yes
2	Front Centre	Front Centre	0	0	Yes
3	Front Right	Front Right High	-51	+24	Yes
4	Left Surround Side	Rear Left Low	+129	-24	Yes
5	Right Surround Side	Rear Right Low	-129	-24	Yes
6	Left Surround Rear	Rear Centre High	+180	+55	No
7	Right Surround Rear	Front Centre Low	0	-55	No
8	LFE	LFE	-	-	Yes

4.10.4.2 VST

For VST, the channel ordering and assumed speaker locations for the 3D7.1 surround mix are as follow.

Channel	7.1 Speaker Position	3D7.1 Speaker Position	Azimuth	Elevation	Used in 5.1
1	Front Left	Front Left High	+51	+24	Yes
2	Front Right	Front Right High	-51	+24	Yes
3	Front Centre	Front Centre	0	0	Yes
4	LFE	LFE	-	-	Yes
5	Rear Left	Rear Centre High	+180	+55	No
6	Rear Right	Front Centre Low	0	-55	No
7	Side Left	Rear Left Low	+129	-24	Yes
8	Side Right	Rear Right Low	-129	-24	Yes

In the tables above, azimuth is measured anticlockwise (left) from the front and elevation upwards from the horizontal.

4.10.5 Controls

4.10.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

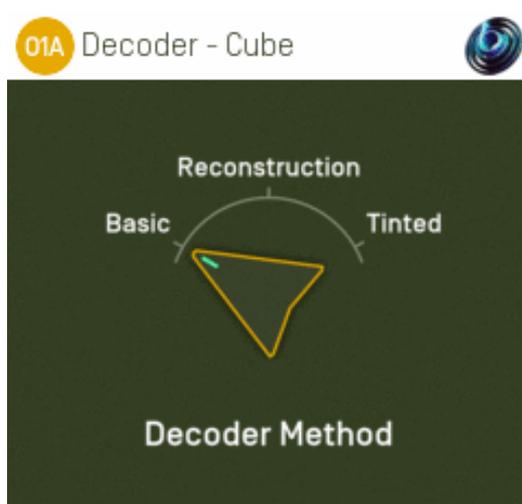
4.10.5.2 Control: LFE Crossover

This determines if any audio is sent to the LFE channel. It may be set to "Off" and this is recommended. If enabled, audio is extracted from the main mix into the LFE channel using the indicated crossover frequency (between 1 and 200Hz). You may wish to read our [notes on this](#) for more detail.

4.10.5.3 Control: LFE Gain

If the LFE gain is active, this gain is applied to it. Some export formats may need this set to -10dB to take into account a +10dB gain applied during playback.

4.11 O1A Decoder - Cube



4.11.1 Host Support

Host Type	Support
AAX	Yes, output mapped to 7.1 stem
VST2	Yes

4.11.2 Audio

	Channels	Content
Input	4	O1A
Output	8	Speaker feeds for cube (mapped to 7.1 for AAX)

4.11.3 Controls

- [Method](#)

4.11.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as speaker feeds for eight speakers set out at the corners of an cube.

4.11.4.1 Channels

The channel ordering used is:

Channel	AAX/VST
1	Lower Front Left
2	Lower Front Right
3	Lower Back Right
4	Lower Back Left
5	Upper Front Left
6	Upper Front Right
7	Upper Back Right
8	Upper Back Left

Note that these are mapped directly onto a 7.1 output in the AAX version of the plugin.

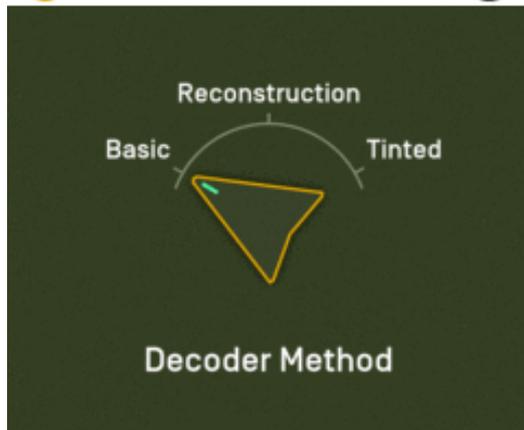
4.11.5 Controls

4.11.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.12 O1A Decoder - Hexagon



4.12.1 Host Support

Host Type	Support
AAX	Yes, output mapped to standard 6.0 stem
VST2	Yes

4.12.2 Audio

	Channels	Content
Input	4	O1A
Output	6	Speaker feeds for hexagon (mapped to 6.0 for AAX)

4.12.3 Controls

- [Method](#)

4.12.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as speaker feeds for six speakers set out at the corners of an hexagon.

4.12.4.1 Channels

The channel ordering for the speaker feeds assumes that the speakers are set out clockwise around the room, starting at the front and slightly to the left, so the first two channels are roughly where normal "Front Left" and "Front Right" speakers would be.

The channel ordering and speaker azimuths are:

Channel	AAX/VST	Azimuth
1	Front Left	+30
2	Front Right	-30
3	Side Right	-90
4	Back Right	-150
5	Back Left	+150
6	Side Left	+90

In the table above, azimuth is measured anticlockwise (left) from the front. Note that these are mapped directly onto a 6.0 output in the AAX version of the plugin.

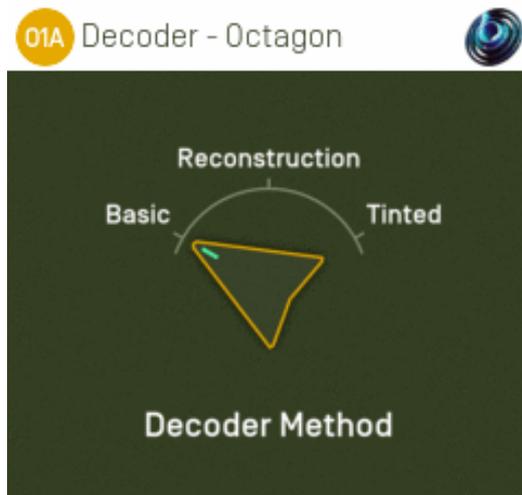
4.12.5 Controls

4.12.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

4.13 O1A Decoder - Octagon



4.13.1 Host Support

Host Type	Support
AAX	Yes, output mapped to 7.1 stem
VST2	Yes

4.13.2 Audio

	Channels	Content
Input	4	O1A
Output	8	Speaker feeds for octagon (mapped to 7.1 for AAX)

4.13.3 Controls

- [Method](#)

4.13.4 Description

This plugin takes a first order ambisonics (O1A) mix and decodes it as speaker feeds for eight speakers set out at the corners of an octagon.

4.13.4.1 Channels

The channel ordering for the speaker feeds assumes that the speakers are set out clockwise around the room, starting at the front and slightly to the left, so the first two channels are roughly where normal "Front Left" and "Front Right" speakers would be.

The channel ordering and speaker azimuths are:

Channel	AAX/VST	Azimuth
1	Left at Front	+22.5
2	Right at Front	-22.5
3	Front at Right	-67.5
4	Back at Right	-112.5
5	Right at Back	-157.5
6	Left at Back	+157.5
7	Back at Left	+112.5
8	Front at Left	+67.5

In the table above, azimuth is measured anticlockwise (left) from the front. Note that these are mapped directly onto a 7.1 output in the AAX version of the plugin.

4.13.5 Controls

4.13.5.1 Control: Method

Three methods are supported, "Basic", "Reconstruction" and "Tinted Reconstruction". Generally, "Basic" is recommended except where the speaker rig to be used for playback is known and has been set up accurately.

Method	Description
Basic	This method produces a resilient decoding which should play well on a range of speaker systems including large venues.
Reconstruction	This method controls the soundfield at the centre of the listening space to produce a clearer spatial image. It relies on the speaker layout being set up accurately.
Tinted Reconstruction	This variant of the Reconstruction method performs HRTF-based tinting on the audio stream to strengthen the spatial image. Again, it relies on the speaker layout being set up accurately.

5 Other Decoders and Converters

5.1 O1A Decoder - Mono

 O1A Decoder - Mono



5.1.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

5.1.2 Audio

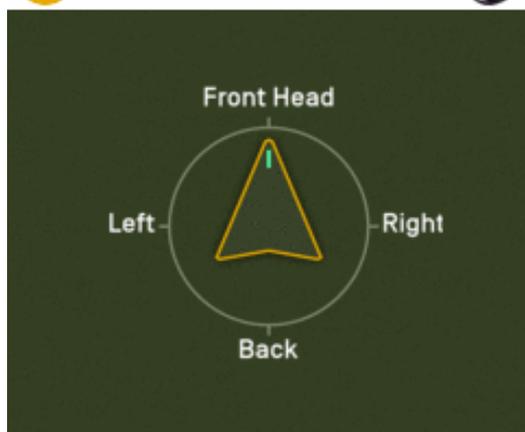
	Channels	Content
Input	4	O1A
Output	1	Mono

5.1.3 Description

This plugin takes a first order ambisonics (O1A) 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.

5.2 O1A Decoder - Quad Binaural



5.2.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

5.2.2 Audio

	Channels	Content
Input	4	O1A
Output	2	Binaural Stereo (one head of four)

5.2.3 Controls

- [Head](#)

5.2.4 Description

This plugin takes a first order ambisonic (O1A) mix and decodes it to synthetic "Quad Binaural".

Quad Binaural is a format used in some Virtual Reality (VR) applications. It uses four binaural stereo recordings for pairs of ears at ninety degree angles (so eight audio channels in total). The stereo recordings are mixed together during playback in a way that can give the impression of a horizontal scene rotation, typically in response to head-tracking.

We do not particularly recommend the Quad Binaural format for VR applications. If your VR audio engine supports ambisonics properly then better rotational results can be achieved using ambisonic formats directly (for example, in Rapture3D Universal).

The decoder plugin assumes that at any one time during playback, two of the four binaural stereo recordings will be mixed together to produce the final binaural output, using sine and cosine gains (i.e. an equal-power crossfade). This can cause various artefacts which the binaural processing used in this plugin attempts to compensate for. Because of this, when only one head is being used, the results are typically *not* as good as when using the standard headphone decoder directly.

We recommend use of the standard binaural headphone decoder ([O1A Decoder - Headphones](#)) instead of this plugin when Quad Binaural is not in use.

5.2.5 Controls

5.2.5.1 Control: Head

This control identifies which of the four binaural stereo recordings should be synthesized. They are:

Head	Scene Rotation
Front	0 degrees
Right	90 degrees
Back	180 degrees
Left	270 degrees

For instance, the "Right" head corresponds to the case where the head is looking 90 degrees to the right. The scene is thus rotated 90 degrees to the left, so a sound that was previously at the front will be heard on the left.

5.2.5.2 Technical Notes

This plugin is based on the Blue Ripple Sound Amber HRTF (see the [O1A Decoder - Headphones](#) plugin). However, it has been simplified and modified to improve results with Quad Binaural rotation.

The plugin compensates assuming a sine and cosine equal-power crossfade during rotation. Results with linear crossfades are not expected to be as good.

5.3 O1A Decoder - UHJ Stereo



Decoder - UHJ Stereo



5.3.1 Host Support

Host Type	Support
AAX	Yes
VST2	Yes

5.3.2 Audio

	Channels	Content
Input	4	O1A
Output	2	UHJ Stereo

5.3.3 Description

This plugin takes a first order ambisonics (O1A) mix and converts it into UHJ stereo. This form of stereo uses phase to encode a small amount of ambisonic surround sound information, which can be recovered later, for instance in special A/V receivers.

UHJ stereo was introduced in 1985 for use with first order ambisonics. It contains no height information, only takes audio from three of the sixteen channels that make up O1A and those channels cannot be recovered entirely. However, it does allow an impressive amount of spatial detail to be "hidden" in the stream while still being good to listen to in stereo.

UHJ stereo is sometimes used for artistic reasons, as stereo formed this way has particular sound qualities. For instance, UHJ produces a "phasey" stereo image when sounds are behind, which can be desirable.

For simple stereo decoding you might also wish to try the basic [O1A Decoder - Stereo](#) plugin.

This plugin uses a gain boost of +4.315dB relative to the common UHJ decoding equations, for consistency with other Blue Ripple Sound studio decoders.

5.4 O1A Injector - FuMa

O1A Injector - FuMa



FuMa 1 [Classic] -> O1A [SN3D, AmbiX]

5.4.1 Host Support

Host Type	Support
AAX	Yes, input mapped to a standard ambisonic (SN3D) stem
VST2	Yes

5.4.2 Audio

	Channels	Content
Input	4	Classic First Order B-Format (FuMa) Audio (mapped to O1A stem for AAX)
Output	4	O1A

5.4.3 Description

This plugin takes a mix using the classic "WXYZ" B-Format ambisonic convention and converts it to first order ambisonics (SN3D/ACN) as used by the current version of these plugins. At first order, classic B-Format is the same as FuMa B-Format.

The classic B-Format convention is used by some B-Format microphones and other software. FuMa was used by old versions of these plugins (prior to version 2.0).

This plugin allows classic B-Format to be converted into a form suitable for decoding by the O1A decoder plugins in this library. So, if your microphone or microphone software is labelled as producing classic B-Format or FuMa, or if your mix is in these formats, you should insert it before any of the decoder plugins in this library.

In Pro Tools Ultimate, 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 O1A (i.e. SN3D/ACN), so we are "misusing" the format here.