PI BY SAHARTY

PI UPMIX

Stereo and surround to immersive



USER MANUAL

Version 1.1.0 · macOS & Windows

www.pi-ware.com · support@pi-ware.com

Precision is a constant.

CONTENTS

01 Welcome 3

02 Quick start 5

03 Installation 6

04 Activation & licensing 9

05 Interface tour 11

06 Upmixing stereo to speakers 17

07 Downmix lock and creative mode 21

08 Stem-aware upmixing 24

09 Stem objects and ADM-OSC 26

10 Format conversion and downmix 28

11 Stereo, headphone and Ambisonics outputs 29

12 Room regeneration 31

13 Spatial Match 32

14 Custom speaker layouts 33

15 Presets and A/B comparison 34

16 Rendering files (standalone app) 36

17 Settings & preferences 38

18 Keyboard shortcuts / remote control 40

19 Tips for live/studio use 41

20 Troubleshooting 43

21 Specifications & system requirements 45

22 Support 47

WELCOME

Pi UpMix by Saharty turns stereo (or mono) into surround and immersive sound. It takes a finished stereo mix and spreads it across every speaker in the room, from a simple LCR up to a 16-channel 9.1.6 layout, or renders it to headphones, Lo/Ro, Lt/Rt or Ambisonics. It also works as a format converter: feed it a 5.1 or 7.1.4 bed and it carries every channel to the matching speaker of a bigger or smaller layout.

Its signature feature is **Downmix lock**. With the lock on (the default), the upmix is built so that the standard stereo fold-down of the result gives back your original stereo exactly. There are no phase tricks and no comb filtering: the version most people will hear, the stereo one, stays untouched. On our test material the fold-down null measures about -138 dB on every layout.

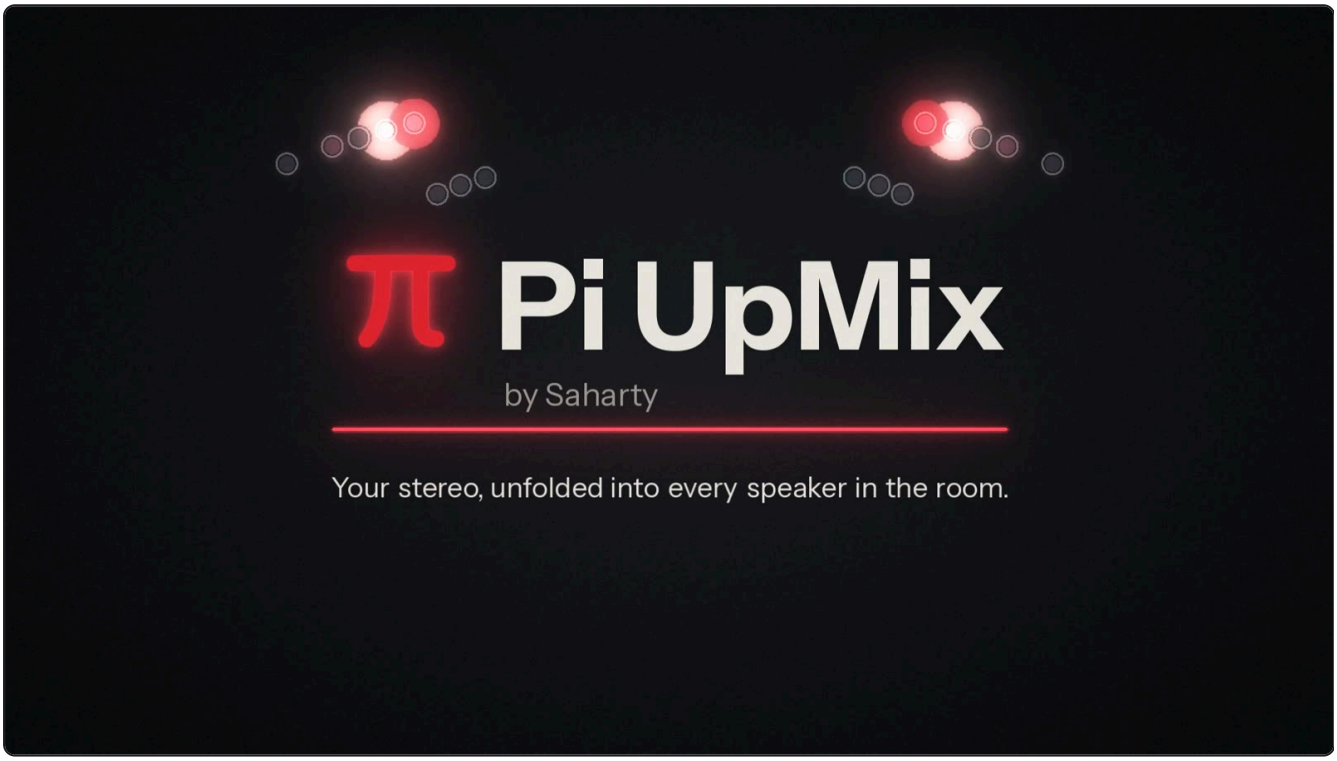


Figure 1. Pi UpMix by Saharty: your stereo, unfolded into every speaker in the room

Pi UpMix is made for:

- **Studio engineers** delivering surround and immersive versions of catalogue releases, live recordings, film and broadcast material from stereo masters.
- **Live and installation engineers** feeding surround and overhead speakers in clubs, theatres and installations from a stereo playback or a console bus, in real time.
- **Anyone without an immersive room**, who can monitor the full layout on headphones with the built-in binaural renderer.

It comes as VST3, Audio Unit (macOS), AAX and a standalone app for macOS and Windows. The standalone app adds an offline file renderer.

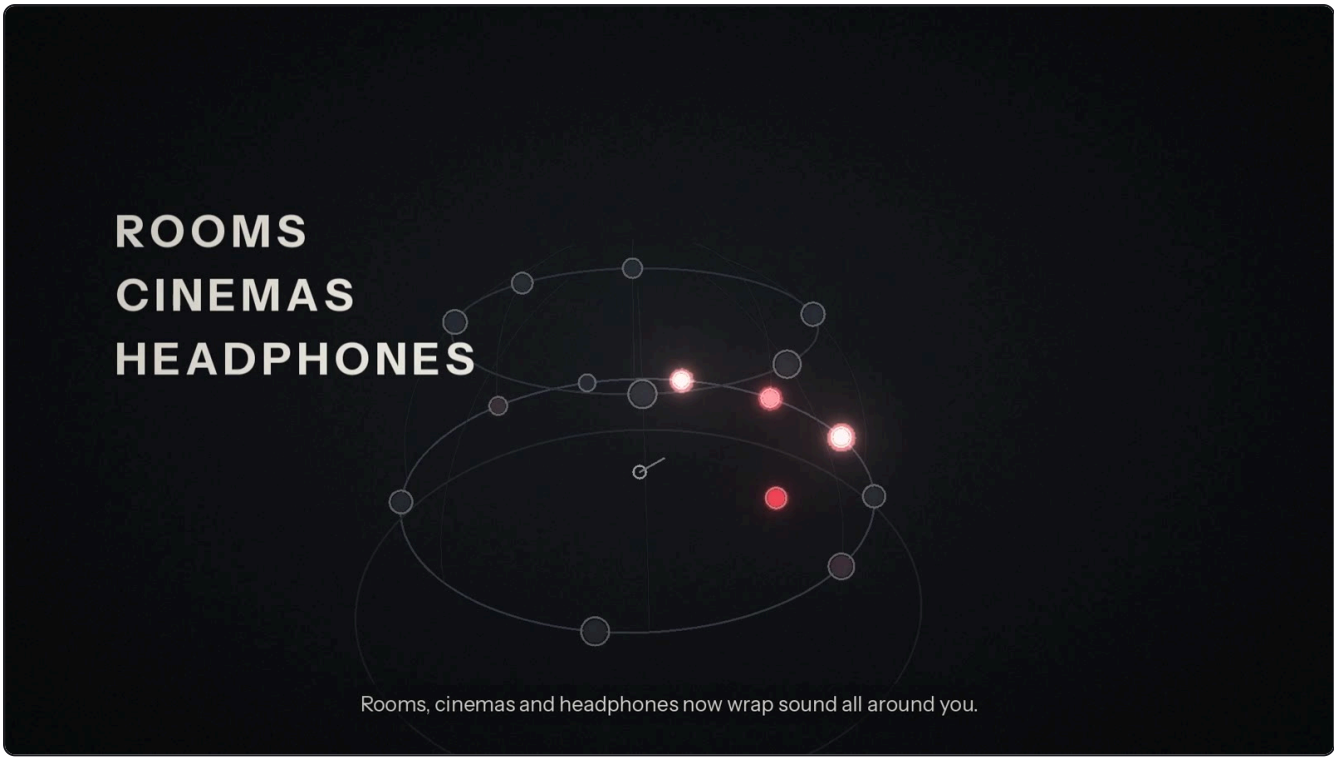


Figure 2. Rooms, cinemas and headphones now wrap sound all around you ▶ **Animated in the online manual**

What's new in version 1.1

- **Stem separation** (Stems tab, off by default). When you turn it on, the mix is split into vocal, drums, bass, instruments and ambience, and each part is placed on its own. It is still exact with Downmix lock.
- **Stem objects output**: the eight stems go to the first eight outputs, and their positions can be sent to an object renderer over ADM-OSC.
- **Room regeneration** (Space tab, creative mode): measures the decay of the room in your source and regenerates a matching room in the surround and height speakers.
- **Fold-down guard**: keeps an exact stereo fold-down even in creative mode with delays, diffusion and room.
- **Spatial Match**: learns how a reference surround or immersive mix uses its speakers and moves your upmix towards it, band by band.
- **Head tracking** for the headphone render, over OSC.
- **Custom speaker layouts**: type in your own speakers (up to 16).
- **Live (5 ms) quality** for live sound and broadcast.

QUICK START

1. Run the installer for your system (macOS .dmg or Windows .exe) and restart your audio software.
2. Open Pi UpMix and click **Activate...** in the header. Enter your licence key and click **Activate**, or click **Start 15-day free trial**.
3. In your DAW, create a track or bus with the target layout (for example 7.1.4, 12 channels) and put your stereo source on its L and R channels, or use a stereo-in / multichannel-out insert where your host offers one.
4. Insert **Pi UpMix by Saharty** on that track.
5. Check the readout under the speaker map: it should say, for example, "Input Stereo, output 7.1.4".
6. Press play. The speaker map lights up as each speaker receives sound.
7. Choose a starting point from the preset menu, for example **Music natural**.
8. Adjust the **Front**, **Surround** and **Height** rows on the **Main** tab to taste.
9. Leave **Downmix lock** on and watch the **Fold-down match** readout: it confirms your stereo is preserved.
10. No speakers? Choose **Monitor headphones** in the monitoring menu to hear the whole layout binaurally on the L and R outputs.

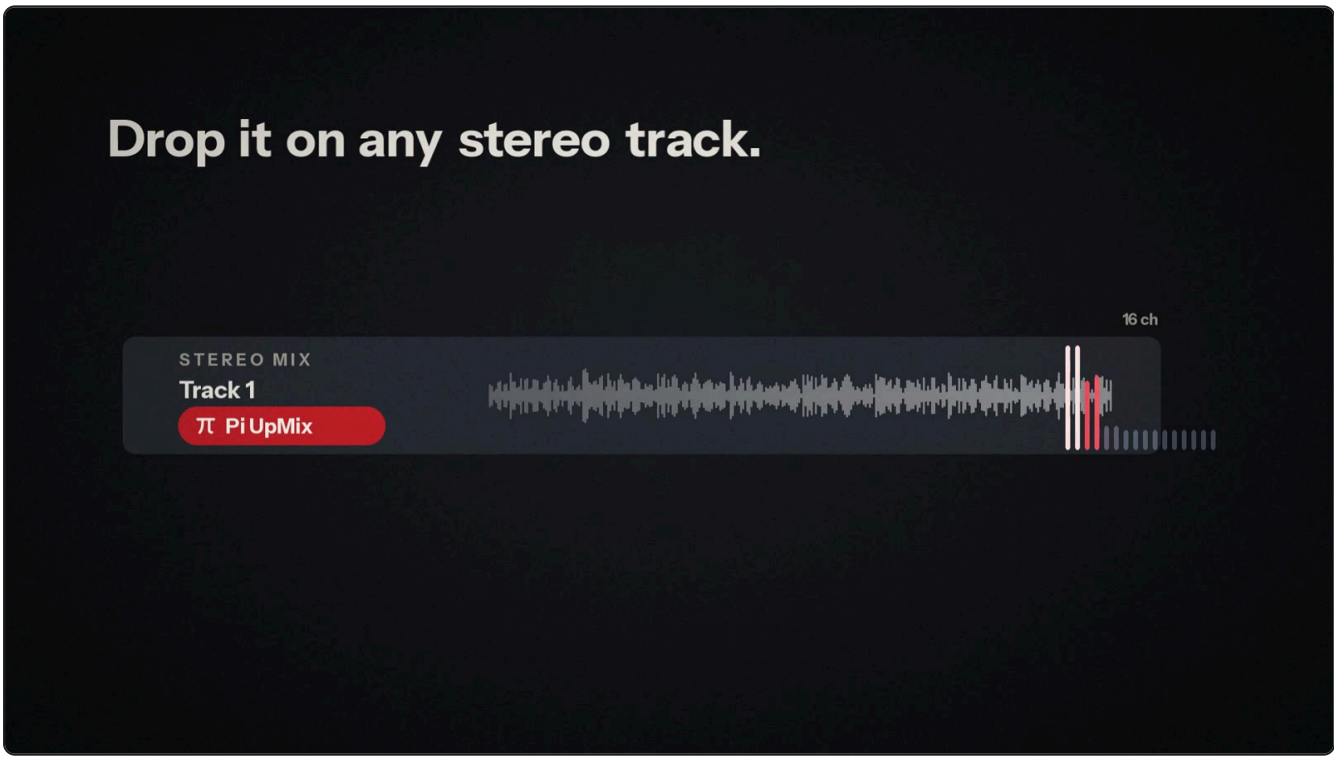


Figure 3. Drop Pi UpMix on any stereo track ▶ Animated in the online manual

INSTALLATION

macOS

1. Open the downloaded .dmg.
2. Double-click **Install Pi UpMix by Saharty.pkg**.
3. Click **Customize** if you want to choose the formats (VST3, Audio Unit, AAX, standalone app). By default all are installed.
4. Finish the installer and restart your audio software. Look for **Pi UpMix by Saharty** from the manufacturer **Saharty**.

The .dmg also contains **Uninstall Pi UpMix.command**, which removes everything.

> **Note:** If macOS says the installer is from an unidentified developer, right-click the installer, choose **Open**, then **Open** again, or allow it in **System Settings > Privacy & Security**.

Windows

1. Run the setup .exe and follow the steps.
2. Restart your audio software.

> **Note:** If Windows SmartScreen shows a warning, choose **More info**, then **Run anyway**.

Where the files go

Format	macOS	Windows
VST3	/Library/Audio/Plug-Ins/VST3	C:\Program Files\Common Files\VST3
Audio Unit	/Library/Audio/Plug-Ins/Components	(not available)
AAX	/Library/Application Support/Avid/Audio/Plug-Ins	C:\Program Files\Common Files\Avid\Audio\Plug-Ins
Standalone app	/Applications	C:\Program Files\Saharty\Pi UpMix

Everything Pi UpMix needs is inside the installer. Nothing else has to be installed.

First launch

- **Plug-in**: insert it on a track. The window opens at its default size; drag the bottom-right corner to resize it (from 780 x 495 up to 1560 x 990, aspect ratio fixed). The size is remembered with the session.

- **Standalone app**: open **Pi UpMix by Saharty** from Applications (macOS) or the Start menu (Windows). On macOS the app asks for permission to use audio input, since it processes live sound from your interface. Use the app's audio settings to choose your audio device and the input and output channels.

Using it in your DAW

Host	How to set it up
Pro Tools	Insert it on a multichannel track (for example 7.1.4) whose L and R carry the stereo source, or use a mono or stereo to multichannel version where Pro Tools offers one.
Logic Pro	In a surround project, insert it on a stereo track and choose the stereo to surround format.
Cubase and Nuendo	Route the track or a group to the target layout; the plug-in takes stereo in and multichannel out.
Reaper	Set the track to the needed channel count (12 for 7.1.4). Pi UpMix uses the discrete channel orders below.
Stereo-only hosts	You get the stereo output: headphones (binaural), Lo/Ro or Lt/Rt (Detail tab, **Stereo output**).

Discrete channel orders (Reaper and other hosts that only know a channel count, and the files written by the standalone renderer):

Channels	Layout	Order
3	LCR	L R C
4	Quad	L R Ls Rs
5 / 6	5.0 / 5.1	L R C (LFE) Ls Rs
7 / 8	7.0 / 7.1	L R C (LFE) Lss Rss Lrs Rrs
9 / 10	7.0.2 / 7.1.2	7.x then Ltm Rtm
11 / 12	7.0.4 / 7.1.4	7.x then Ltf Rtf Ltr Rtr
13 / 14	7.0.6 / 7.1.6	7.x then Ltf Rtf Ltm Rtm Ltr Rtr
15 / 16	9.0.6 / 9.1.6	L R C (LFE) Lss Rss Lrs Rrs Lw Rw Ltf Rtf Ltm Rtm Ltr Rtr

Hosts that name their channels (Pro Tools, Logic Pro, Cubase, Nuendo) can use any of the named layouts: LCR, LCRS, quad, 5.0, 5.1, 6.0, 6.1, 7.0, 7.1, 5.0.2, 5.1.2, 5.0.4, 5.1.4, 7.0.2, 7.1.2, 7.0.4, 7.1.4, 7.0.6, 7.1.6, 9.0.4, 9.1.4, 9.0.6 and 9.1.6, or any other speaker set built from these speakers (up to 16 channels, with L and R present). An Ambisonics bus of order 1 to 3 is also accepted as the output.

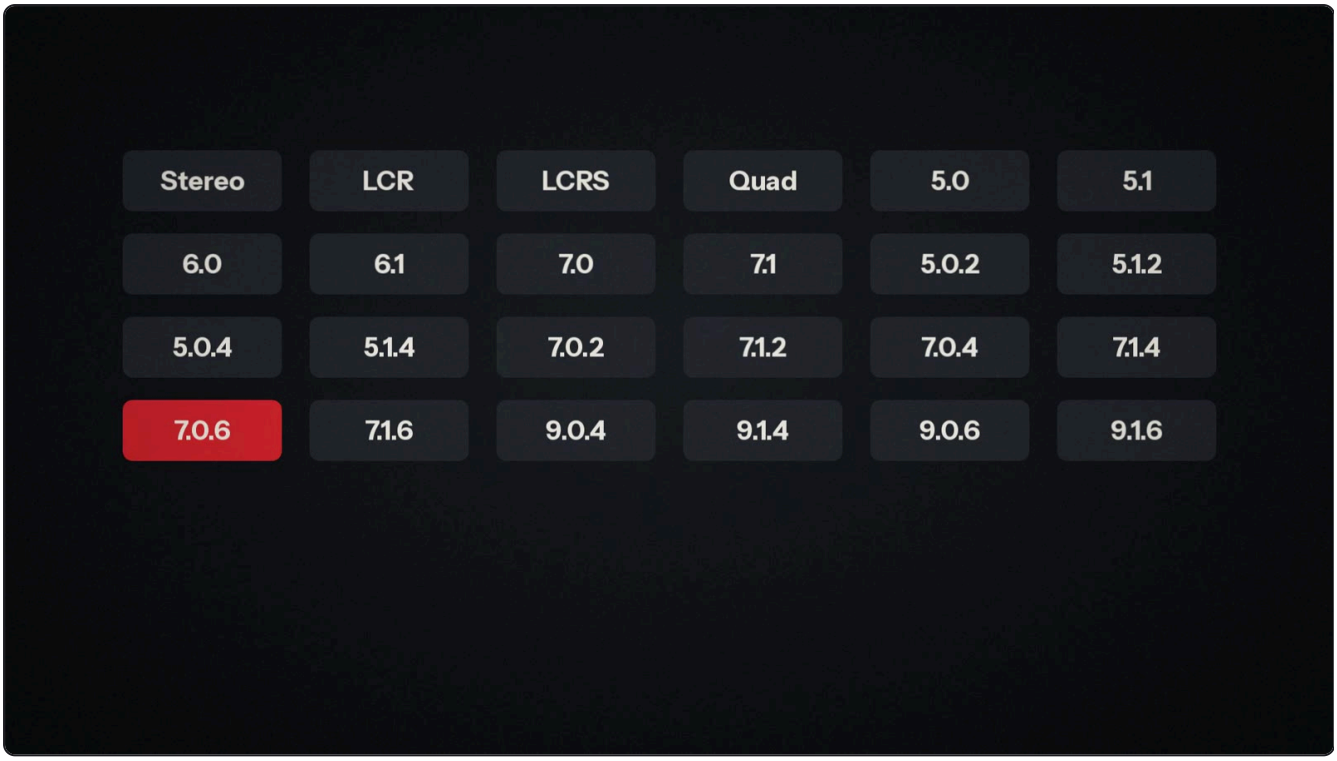


Figure 4. Every layout from LCR to 9.1.6, plus Ambisonics and binaural

ACTIVATION & LICENSING

Pi UpMix is licensed per computer: one licence activates one computer, and you can move it at any time. The VST3, AU, AAX and standalone versions on one computer share the same licence, so you activate only once.

Buying and the free trial

- Buy Pi UpMix at **pi-ware.com**. Your licence key arrives by email after purchase.
- You can try every feature free for **15 days**. No payment details are needed. Start the trial from the licence window (**Start 15-day free trial**).
- You get free updates.

The licence window

Click the licence button in the header to open the licence window. The button's label tells you the state at a glance:

Button label	Meaning
Activate... (highlighted)	Not activated on this computer, or limited.
Trial...	The free trial is running.
Notice...	A notice is counting down (see below).
Licence...	Activated. Every feature is on.

When there is something to tell you, a banner also appears across the top of the window; click it to open the licence window.

The licence window shows the current status, **This computer:** with the computer's name, a **Licence key** field and these actions:

- **Activate**: activates the key you typed (format XXXXX-XXXXX-XXXXX-XXXXX).
- **Start 15-day free trial**: shown while the computer is not activated or on a trial.
- **Deactivate this computer**: frees this computer so the licence can be used elsewhere.
- **Offline activation**: shows the offline steps.
- **Buy a licence**: opens the product's page on pi-ware.com.

How to activate online

1. Click **Activate...** in the header.
2. Paste your licence key in the **Licence key** field.
3. Click **Activate** (or press Return). The status line changes to "Activated ... Every feature is on."

How to activate offline

Use this when the computer running Pi UpMix has no internet connection.

1. Type your licence key in the **Licence key** field first.
2. Click **Offline activation**. A request code appears.
3. Click **Copy code** and take the code to any device with internet access.
4. Paste the code at **pi-ware.com/activate**. You receive a licence file.
5. Bring the file back and click **Load licence file...** to load it (.pilic file).

Moving the licence to a new computer

- **From the old computer**: open the licence window and click **Deactivate this computer**, then activate on the new one.
- **If you no longer have the old computer**: just activate on the new computer. Pi UpMix tells you the licence is active on another computer and asks whether to move it (**Move it here**). The dialog also shows how many moves you have left this year. The old computer gets a 24-hour notice, then switches to limited features.
- You can also deactivate or reset computers from your account at **pi-ware.com/account**.

Checks, notices and limited mode

- Pi UpMix checks the licence whenever it finds an internet connection (at launch, then every hour). It keeps working offline with no time limit.
- Nothing is ever limited without at least **24 hours of notice** on that computer (for example after the licence was moved, the trial ended or the computer was deactivated from your account). During the notice every feature works and the banner shows the countdown.
- In **limited mode** (or when not activated) the audio passes through unprocessed, with a short 50 ms crossfade: the input goes to the matching output channels (L to L, R to R, the other speakers silent), with the same latency as the upmix, so your session stays in sync. The window, controls and presets stay available. In the standalone app the render button shows **Activate to render**.

Licence file location

System	Path
macOS	~/Library/Application Support/Pi by Saharty/Licences/pi-upmix.pilic
Windows	%APPDATA%\Pi by Saharty\Licences\pi-upmix.pilic

INTERFACE TOUR

The window has four areas: the **header** across the top, the **speaker map** on the left, the **tabs** with the controls on the right, and the **meter strip** along the bottom.

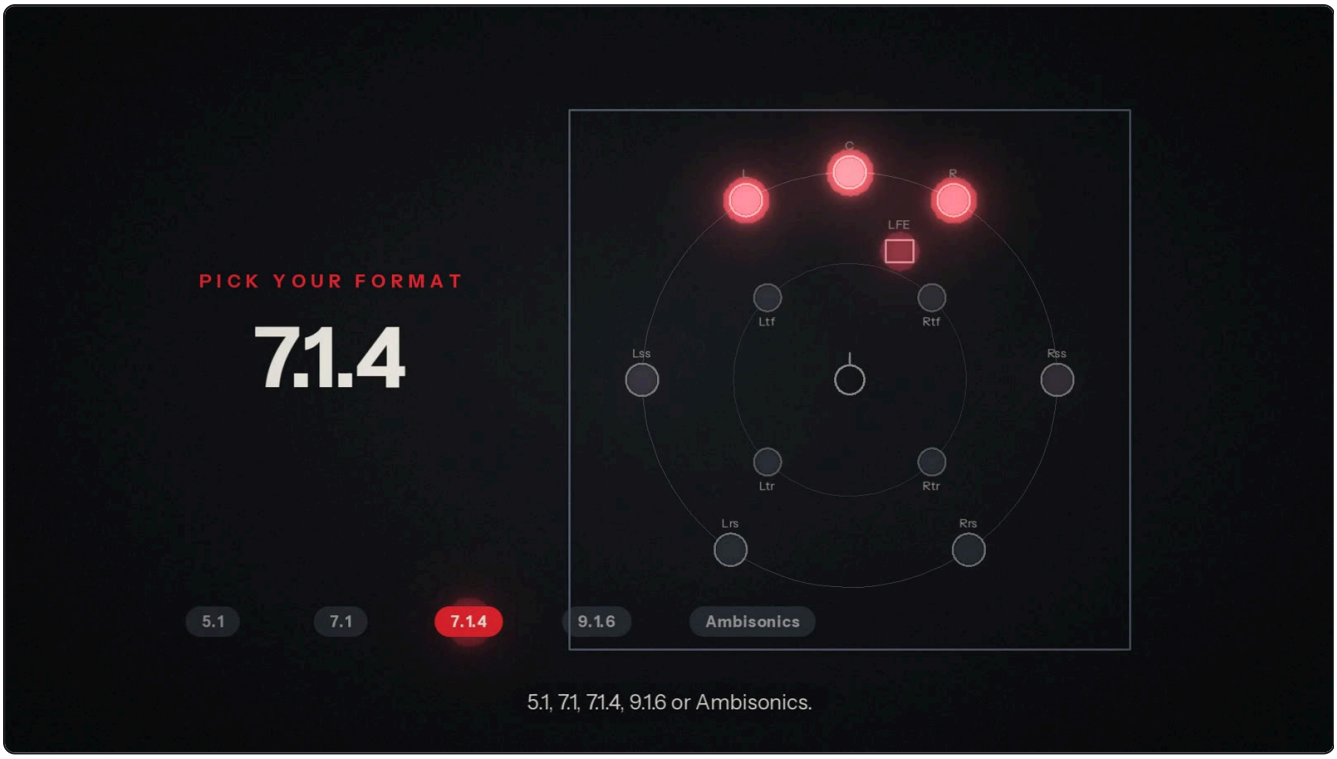


Figure 5. The speaker map for a 7.1.4 layout

Header

Control	What it does	Range/default
Licence…	Opens the licence window. Its label changes with the licence state (**Activate…**, **Trial…**, **Notice…**).	–
< / >	Previous / next preset (factory presets, then your user presets).	–
Preset menu	Lists the **Factory** presets and, once you have saved some, your **User** presets.	Default balanced (downmix safe)
Save	Saves the current settings as a user preset.	–
A / B	Two complete sets of settings for instant comparison.	A
Copy	Copies the current settings to the other slot.	–
Downmix lock	Exact, phase-free upmix whose stereo fold-down returns the source. Off = creative mode.	On
Bypass	Bypasses the processing with the same latency.	Off

Speaker map and monitoring

The speaker map shows every speaker of the current output, seen from above with the front at the top, and lights each one with its live level.

- **Click a speaker** to solo it. Click more speakers to add them to the solo.
- **Right-click a speaker** to mute it.
- **Clear solo** clears every solo and mute.

Below the map:

Item	What it shows / does
Layout readout	The input and output, for example "Input Stereo, output 7.1.4", "output headphones (binaural)", "output 8 stem objects" or "output custom layout (10 speakers)".
Latency readout	The current latency in milliseconds and samples (reported to the host).
Fold-down match	How closely the stereo fold-down of the output matches the source: "exact (below -150 dB)", a value in dB, or "no signal". "(creative mode)" is added when Downmix lock is off.
Monitoring menu	**Monitor speakers** (normal), **Monitor stereo fold-down** or **Monitor headphones**. The two check modes play on the L and R outputs. Available with speaker outputs.
Clear solo	Clears all solos and mutes.
Render file...	Standalone app only: opens the offline file renderer.

> **Note:** Solo, mute and the monitoring menu are checking tools. They are not saved with presets.

Tabs

The controls are on four tabs: **Main**, **Detail**, **Stems** and **Space**. Controls that only work in creative mode are dimmed while **Downmix lock** is on. Stem controls are dimmed until stem separation (or the Stem objects output) is on. Hover over any control to see a tooltip.

Turn a knob by dragging; the value appears with its unit. Typing a value is also possible where your host's generic parameter view allows it (frequencies accept "k", for example "1.2k").

Main tab

Row	Control	What it does	Range/default
Front	**Center**	How much of the centered image moves to the center speaker.	0–100 %, 75 %
Front	**Center width**	How wide a pan range is treated as center.	0–100 %, 50 %
Front	**Wides**	Sends hard-panned front sound to the wide speakers (9.x layouts).	0–100 %, 35 %

Row	Control	What it does	Range/default
Front	**Height lift**	Lifts part of the front image into the top front speakers.	0–100 %, 0 %
Surround	**Amount**	How much ambience goes to the surround speakers.	0–100 %, 60 %
Surround	**Side to rear**	Places the surround ambience between the side and rear speakers.	0–100 %, 35 %
Surround	**Delay** (creative)	Delays the surround speakers so the front image stays forward.	0–40 ms, 10 ms
Surround	**Diffusion** (creative)	Decorrelates the surround speakers for a wider, enveloping sound.	0–100 %, 30 %
Height	**Amount**	How much ambience goes to the height speakers.	0–100 %, 30 %
Height	**Front to rear**	Places the height ambience between the top front and top rear speakers.	0–100 %, 40 %
Height	**Delay** (creative)	Delays the height speakers.	0–30 ms, 6 ms
Height	**Diffusion** (creative)	Decorrelates the height speakers.	0–100 %, 40 %
LFE and output	**LFE**	Feeds low frequencies to the LFE channel. The main speakers keep their bass.	On/Off, On
LFE and output	**LFE level**	Level of the LFE feed.	-30 to +10 dB, -10 dB
LFE and output	**LFE cutoff**	Upper frequency of the LFE feed.	40–200 Hz, 80 Hz
LFE and output	**Output**	Output gain for every channel.	-24 to +12 dB, 0 dB

Detail tab

Row	Control	What it does	Range/default
Analysis	**Sensitivity**	Higher values treat more of the signal as ambience.	0–100 %, 60 %
Analysis	**Response**	How fast the analysis follows the music.	10–300 ms, 60 ms
Analysis	**Transient guard**	Keeps attacks in the front speakers.	0–100 %, 50 %
Low cuts	**Center**	Bass below this stays in left and right instead of the center.	20–500 Hz, 80 Hz
Low cuts	**Surround**	Bass below this stays in the front speakers.	20 Hz–1 kHz, 100 Hz
Low cuts	**Height**	Frequencies below this stay out of the height speakers.	20 Hz–4 kHz, 250 Hz
Input	**Source**	**Stereo pair (L/R)** upmixes L and R. **All input channels** also carries every other input channel to the matching output speaker.	Stereo pair (L/R)

Row	Control	What it does	Range/default
Input	**Input mode**	Treat the input as **Stereo**, **Mono (L+R)**, **Left only** or **Right only**.	Stereo
Input	**Width** (creative)	Narrows or widens the stereo input before the upmix.	0–200 %, 100 %
Input	**Mono spread** (creative)	Spreads a mono source into the room.	0–100 %, 50 %
Trims (creative)	**Front**, **Center**, **Surround**, **Height**, **Wide**	Level trim for each speaker group.	-12 to +12 dB, 0 dB
Output	**Stereo output**	With a stereo output: **Headphones (binaural)**, **Lo/Ro fold-down** or **Lt/Rt matrix**.	Headphones (binaural)
Output	**Virtual layout**	Speaker layout rendered for the stereo and Ambisonics outputs: **5.1**, **7.1**, **7.1.4** or **9.1.6**.	7.1.4
Output	**Quality**	Frequency resolution: **Low latency**, **Standard**, **High quality**, **Live (5 ms)**. Higher quality adds latency, which is reported to the host.	Standard

Stems tab

Row	Control	What it does	Range/default
Stem separation	**Separation**	**Off (normal upmix)** or **On** (split into vocal, drums, bass, instruments and ambience).	Off (normal upmix)
Stem separation	**Output**	**Speakers** or **Stem objects** (the 8 stems on the first 8 outputs).	Speakers
Stem separation	**Bass split**	Below this the bass stem stays in the front speakers.	40–300 Hz, 120 Hz
Vocal	**To center**	How much of the lead vocal moves into the center speaker.	0–100 %, 100 %
Vocal	**Width**	How wide a pan range counts as the lead vocal.	0–100 %, 40 %
Vocal	**Lift**	Raises part of the vocal into the top front speakers.	0–100 %, 0 %
Drums	**Position**	Angle of the drums on each side (30° is the front speakers, 90° the sides).	0–150°, 30°
Drums	**Height**	Raises the drums towards the height speakers.	0–100 %, 0 %
Drums	**Spread**	Spreads the drums over neighbouring speakers.	0–100 %, 20 %
Instruments	**Position**	Angle of guitars, keys and other instruments on each side.	0–150°, 60°
Instruments	**Height**	Raises the instruments towards the height speakers.	0–100 %, 15 %

Row	Control	What it does	Range/default
Instruments	**Spread**	Spreads the instruments over neighbouring speakers.	0–100 %, 50 %
Stem levels (creative)	**Vocal**, **Drums**, **Bass**, **Instruments**, **Ambience**	Level of each stem.	-24 to +12 dB, 0 dB

Space tab

Row	Control	What it does	Range/default
Room (creative)	**Amount**	Regenerates a room that matches the source in the surround and height speakers.	0–100 %, 0 %
Room (creative)	**Decay**	Room decay time. At zero it shows "Match source" and follows the decay measured in the source.	Match source – 8 s, Match source
Room (creative)	**Damping**	How quickly the high frequencies of the room fade.	0–100 %, 50 %
Room (creative)	**Size**	Size of the regenerated room.	50–200 %, 100 %
Room	**Source decay**	Readout: the decay time measured from the source.	–
Match	**Fold-down guard** (creative)	Keeps the stereo fold-down exact in creative mode by correcting L and R.	0–100 %, 0 %
Match	**Spatial match**	Moves the upmix towards the way the learned reference mix uses its speakers.	0–100 %, 0 %
Match	**Learn...**	Chooses a surround or immersive reference file to learn.	–
Match	**Reference status**	Readout, for example "No reference learned yet" or "Learned Mix.wav".	–
Head tracking	**Tracking**	Turns the headphone render with your head.	On/Off, Off
Head tracking	**OSC port**	UDP port the head tracker sends to.	1024–65535, 8000
Head tracking	**Recenter**	Uses the current head direction as the front.	–
Head tracking	**Tracker**	Readout: "Receiving, yaw ..." or "No tracker data".	–
Speakers	**Custom layout**	Renders to your own speaker positions.	Off
Speakers	**Edit...**	Opens the custom speaker editor.	–
Speakers	**Layout**	Readout: number of speakers and whether the layout is active.	–
Objects	**ADM-OSC**	Sends the stem object positions to an object renderer.	Off

Row	Control	What it does	Range/default
Objects	**Renderer address**	IP address of the renderer.	127.0.0.1
Objects	**Port**	UDP port of the renderer.	9000

Meter strip

Along the bottom you find the **Input** meters (L and R), the **Correlation** readout of the input (+1 is mono, 0 is wide, negative values mean out-of-phase content), and one output meter per channel, labelled with the speaker names of the current layout (for example L, R, C, LFE, Lss …). With the Stem objects output the meters are labelled Vocal, Drums L, Drums R, Bass, Other L, Other R, Ambience L and Ambience R.

UPMIXING STEREO TO SPEAKERS

This is the core workflow: a stereo source into a multichannel speaker layout.

How it works

Pi UpMix analyses the stereo signal frequency by frequency. It separates the **direct** sound (anything panned somewhere between the speakers: vocals, instruments, dialogue) from the **ambience** (the room, the reverb, the wide and diffuse parts). The direct sound stays in the front, with the centered part anchored in the center speaker; the ambience goes to the surrounds and heights; the lowest frequencies can feed the LFE.

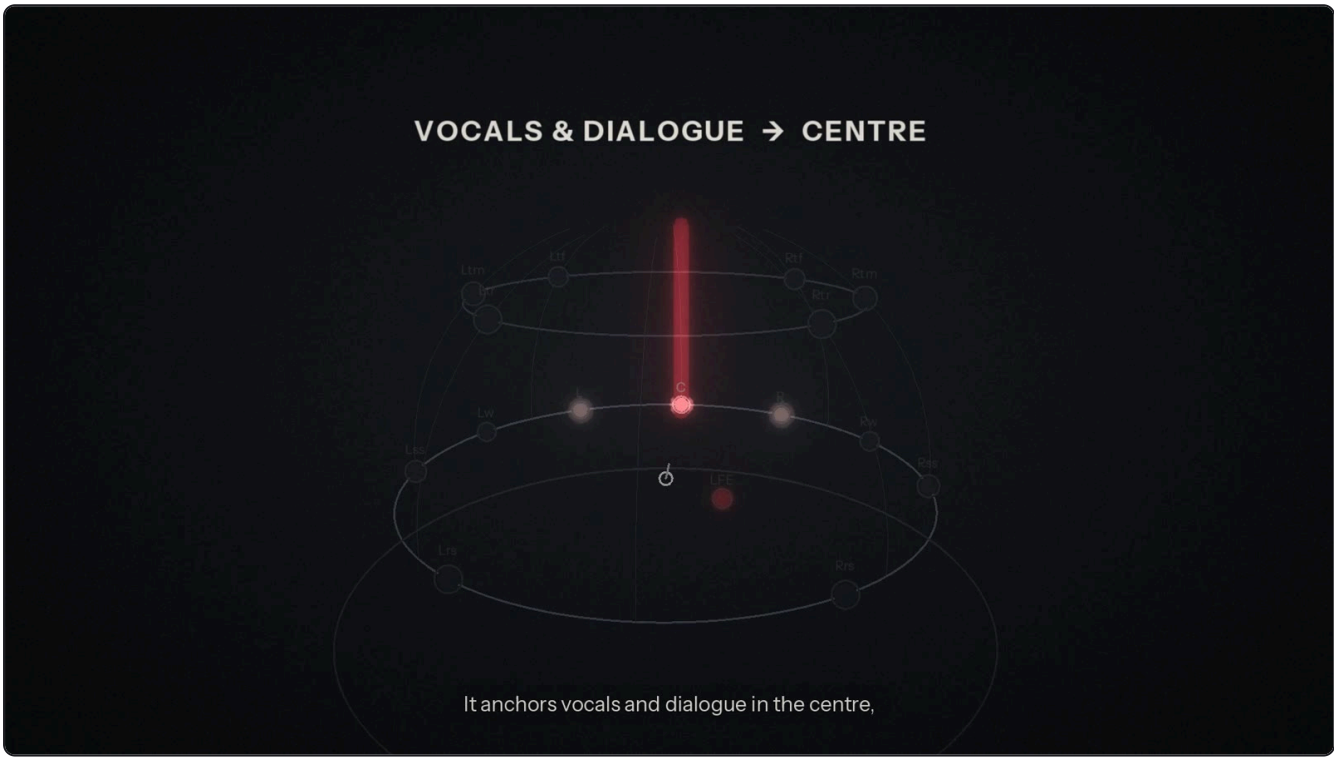


Figure 6. Vocals and dialogue are anchored in the center speaker

How to set up a basic upmix

1. Insert Pi UpMix on a track with your target layout (see Installation).
2. Load **Default balanced (downmix safe)** or **Music natural** from the preset menu.
3. On the **Main** tab, set the **Front** row: - Raise **Center** to anchor vocals and dialogue more firmly in the center speaker; lower it for a more phantom, stereo-like front. - Reduce **Center width** if instruments panned slightly off-center are being pulled into the center. - On 9.x layouts, use **Wides** to send hard-panned sound to the wide speakers. - Use **Height lift** to raise part of the front image into the top front speakers.
4. Set the **Surround** row: **Amount** for how much ambience reaches the surrounds, **Side to rear** to move it from the side towards the rear speakers.
5. Set the **Height** row: **Amount** for the heights, **Front to rear** to balance between top front and top rear speakers.

6. Check the result with the speaker map and the solo function (click a speaker to hear it alone).



Figure 7. Wides take the hard-panned front sound on 9.x layouts

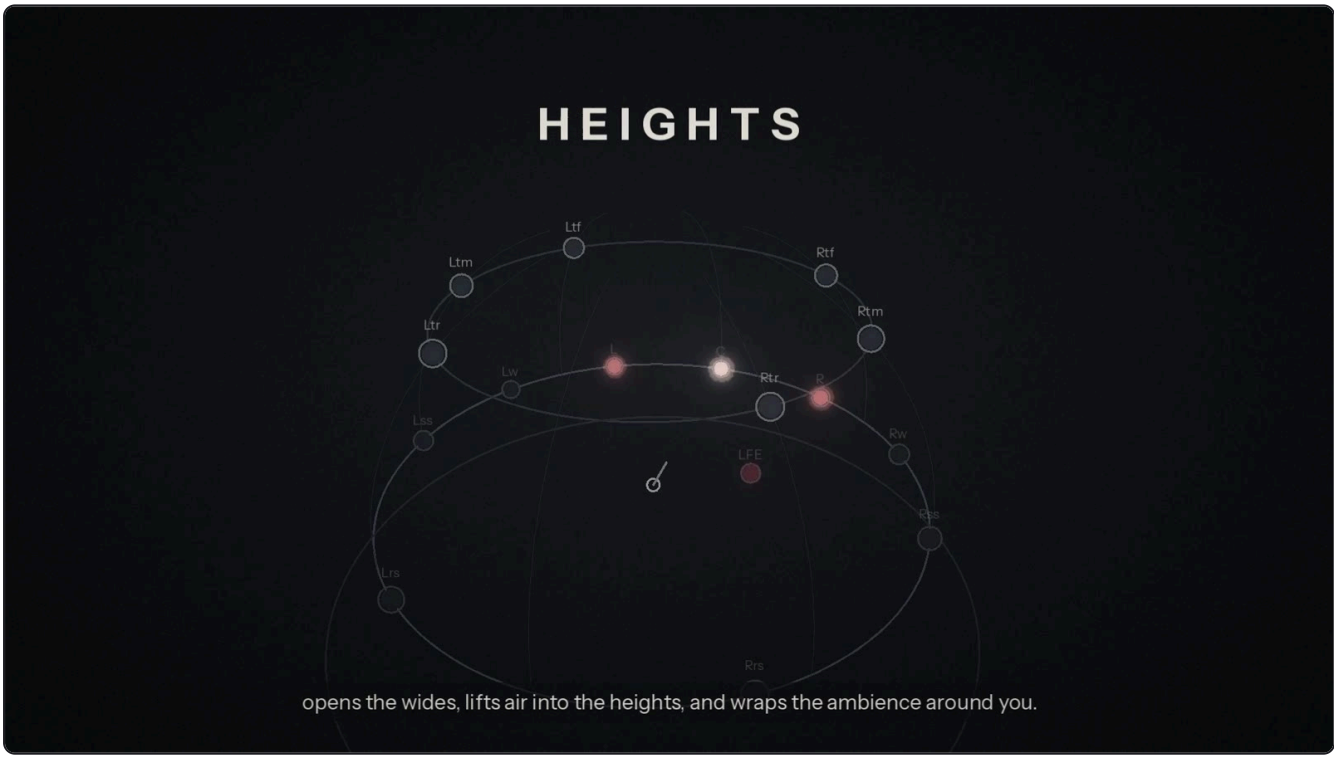


Figure 8. Heights lift the image into the top speakers

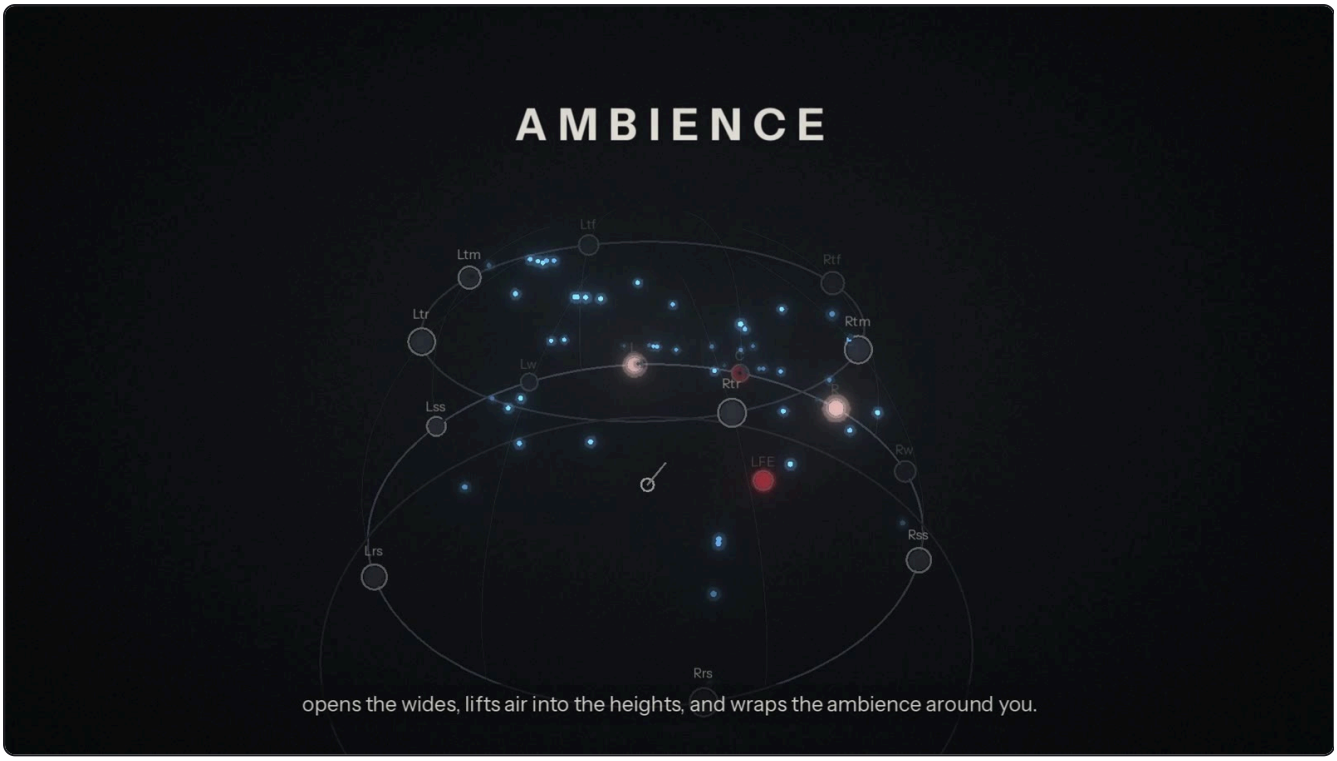


Figure 9. Ambience wraps around you in the surround and height speakers

How to fine-tune the analysis

On the **Detail** tab, the **Analysis** row controls how the direct sound and ambience are told apart:

- **Sensitivity**: higher values treat more of the signal as ambience, so more goes to the surrounds and heights. Lower values keep more in front.
- **Response**: how fast the analysis follows the music. Short times (tens of milliseconds) react quickly to changes; long times (100 ms and more) give a calmer, steadier image, which suits classical and acoustic recordings.
- **Transient guard**: keeps attacks (drum hits, plucks, consonants) in the front speakers, so they do not smear into the surrounds.

The **Low cuts** row keeps bass where it belongs: below **Center** the bass stays in L and R, below **Surround** it stays in the front speakers, and below **Height** it stays out of the height speakers.

How to use the LFE

1. Make sure **LFE** is on (Main tab, LFE and output row). The LFE channel only exists in .1 layouts.
2. Set **LFE cutoff** (the upper frequency of the LFE feed) and **LFE level**.

The LFE is an extra feed: the main speakers keep their bass. With a bass-managed system you may want LFE off, or a low level.

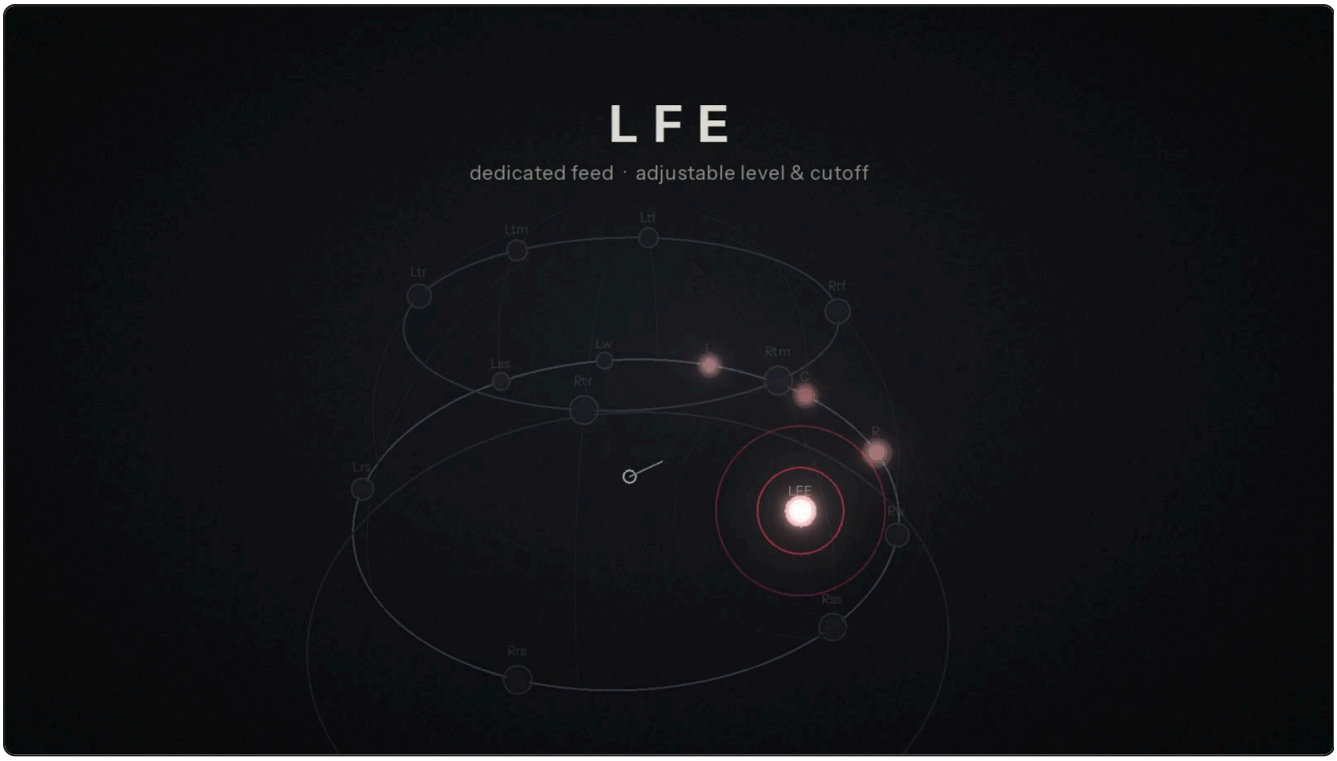


Figure 10. A dedicated LFE feed with adjustable level and cutoff ▶ **Animated in the online manual**

How to upmix a mono source

1. On the **Detail** tab, set **Input mode** to **Mono (L+R)**, or **Left only** / **Right only** to use one side.
2. Turn **Downmix lock** off and use **Mono spread** (Input row) to spread the mono source into the room.
3. Or simply load the **Mono to surround** factory preset.

A mono input bus (one channel) is also accepted and is treated as a center source.

DOWNMIX LOCK AND CREATIVE MODE

Downmix lock

With **Downmix lock** on, every speaker feed is a phase-free combination of the input, chosen so that the standard stereo fold-down returns the input exactly:

L' = L + 0.707 x (C + every left-side speaker), and the same on the right. A centre surround speaker folds at 0.5 into both sides, and the LFE is left out.

The **Fold-down match** readout under the speaker map shows the result live. With the lock on it reads about -100 dB or lower, and often "exact (below -150 dB)". In other words: when your immersive mix is folded down to stereo by a player, a renderer or a broadcast chain, your original stereo master comes back.

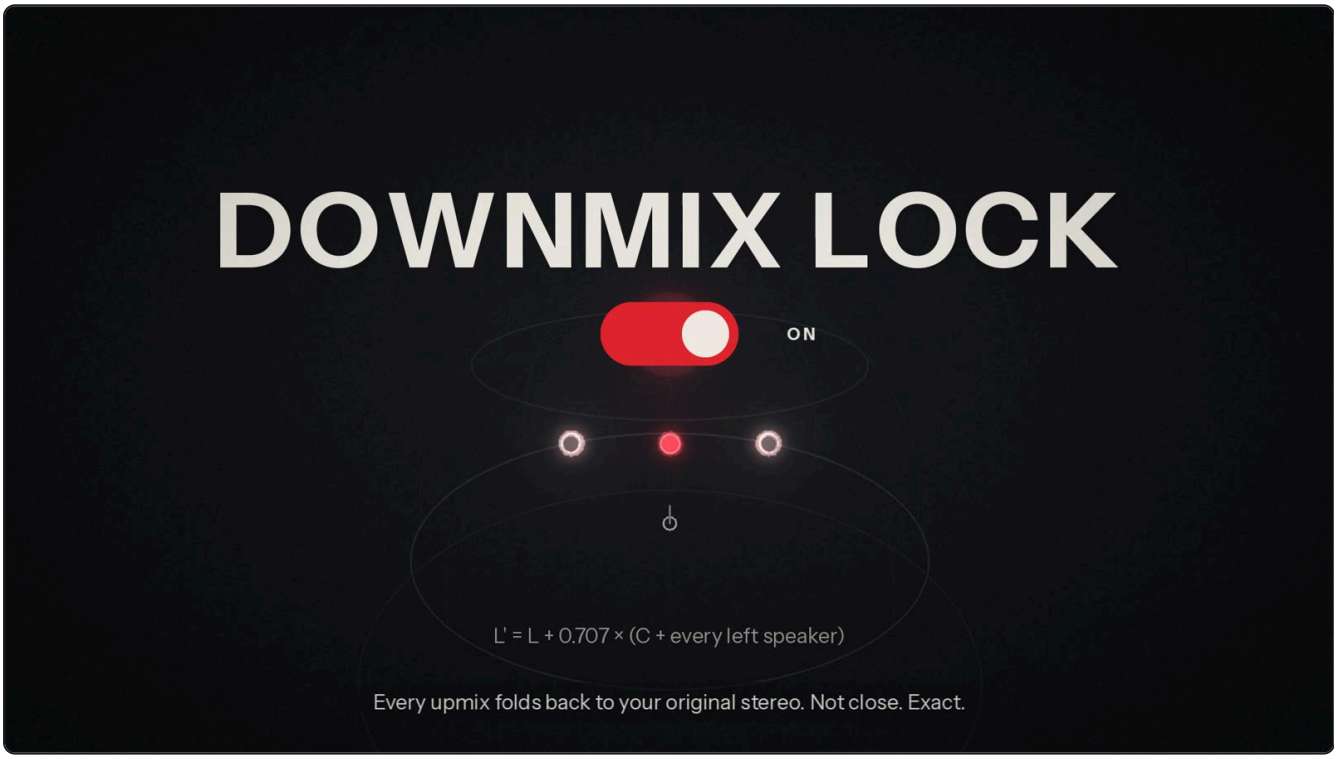


Figure 11. Downmix lock: every upmix folds back to the original stereo ▶ **Animated in the online manual**

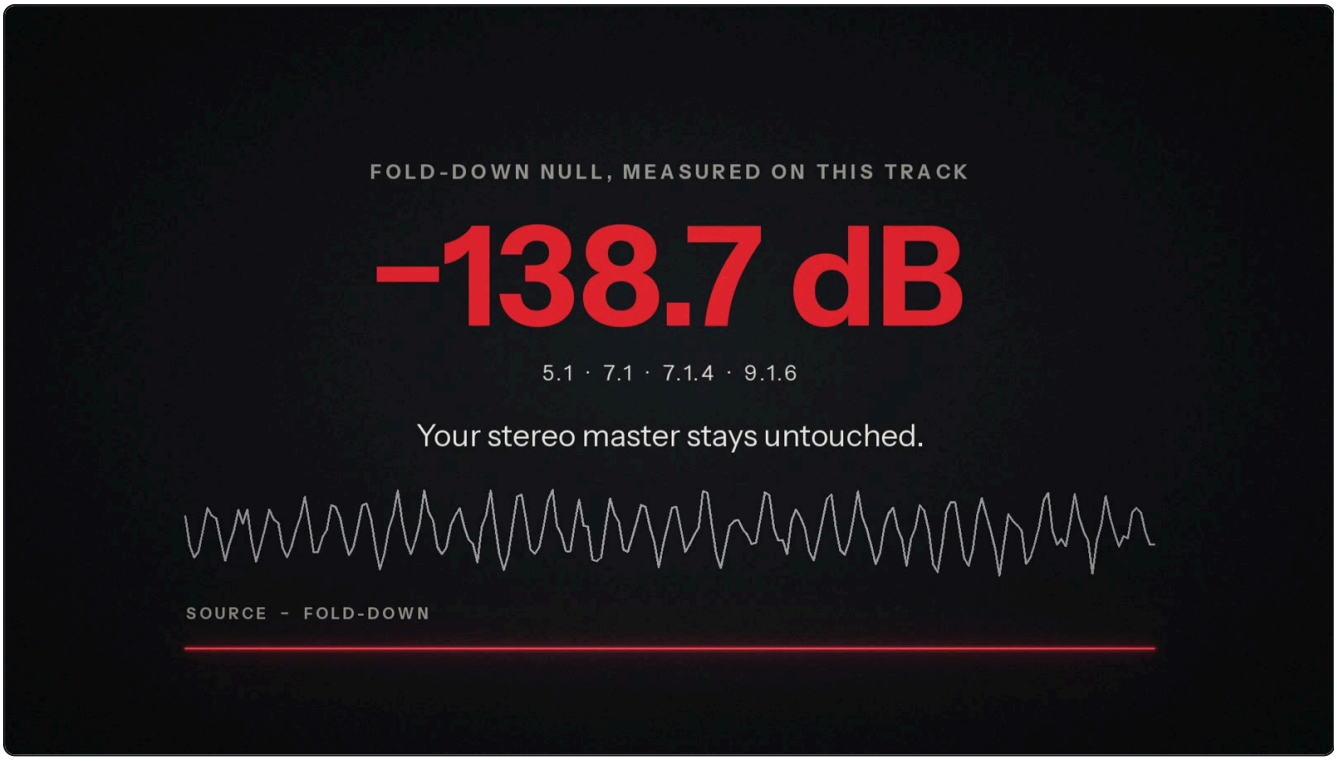


Figure 12. Fold-down null measured on a test track

Creative mode

Turn **Downmix lock** off to enter creative mode. Pi UpMix keeps the overall energy constant, and these controls become available (they are dimmed while the lock is on):

- Surround and height **Delay** and **Diffusion** (Main tab)
- Input **Width** and **Mono spread** (Detail tab)
- **Trims** for front, center, surround, height and wide speakers (Detail tab)
- **Stem levels** (Stems tab)
- **Room** regeneration and **Fold-down guard** (Space tab)

Delay pushes the surround or height speakers slightly later so the front image stays forward (precedence). **Diffusion** decorrelates the speakers for a wider, more enveloping sound.

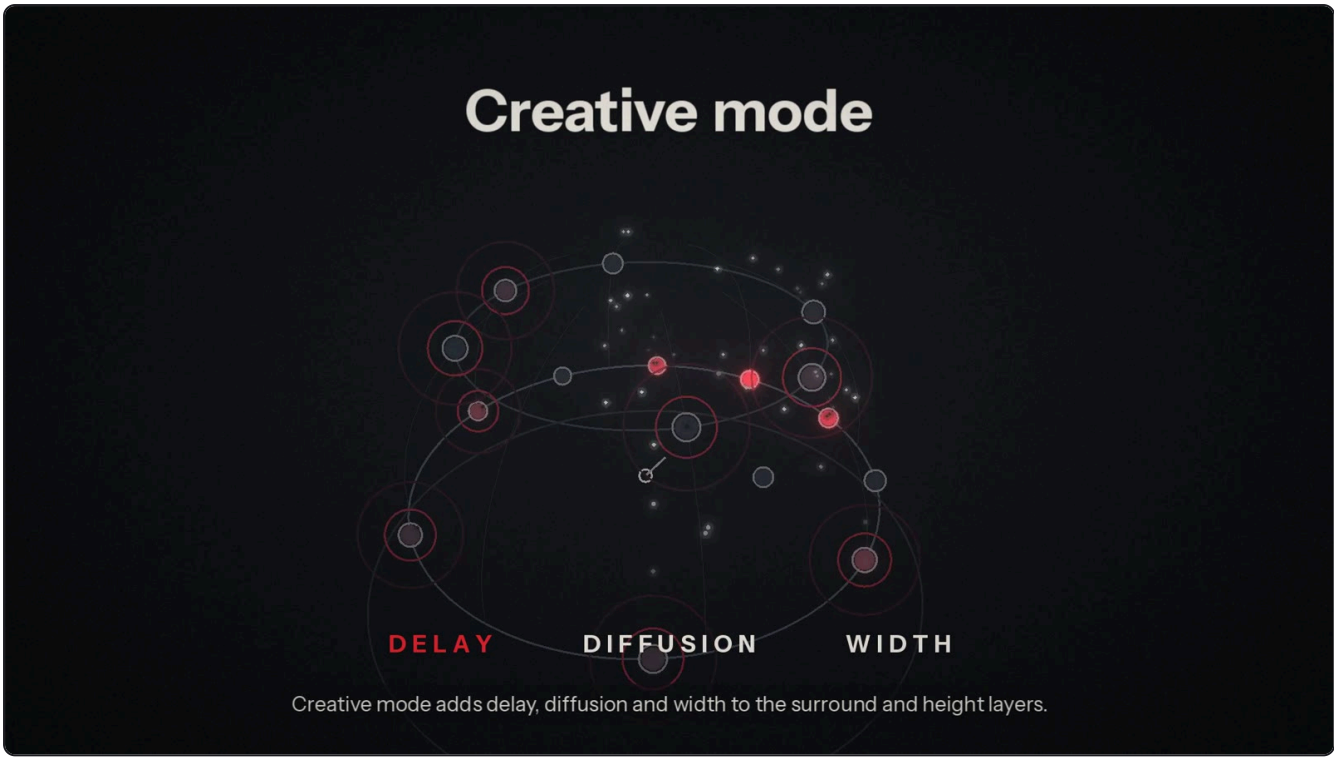


Figure 13. Creative mode adds delay, diffusion and width

How to keep the fold-down exact in creative mode

1. Turn **Downmix lock** off and set your delays, diffusion and room.
2. On the **Space** tab, raise **Fold-down guard**. At 100 % the stereo fold-down stays exact, because L and R are corrected for what the creative processing added.
3. Watch the **Fold-down match** readout ("(creative mode)" is added to it).

> **Tip:** Use creative mode for live rooms, installations and deliberate effects. When the stereo fold-down must stay pristine (catalogue releases, broadcast), keep the lock on, or use **Fold-down guard** at 100 %.

STEM-AWARE UPMIXING

New in version 1.1. Pi UpMix is a normal upmixer until you set **Separation** to **On**, choose the **Stem objects** output, or load one of the **Stems** presets. Until then the separation does not run and its controls are dimmed.

When it is on, the mix is split into five parts using fast signal processing: **vocal**, **drums**, **bass**, **instruments** and **ambience**. Each part is placed on its own:

- The lead vocal goes to the center, with optional lift into the top front speakers.
- Drum hits stay in front instead of leaking into the center or the surrounds.
- The bass stays solid in the front speakers below the **Bass split** frequency.
- Instruments can be pushed to the sides or up.
- The ambience feeds the surrounds and heights.

Stem-aware upmixing is still exact with **Downmix lock** (fold-down null about -138 dB).

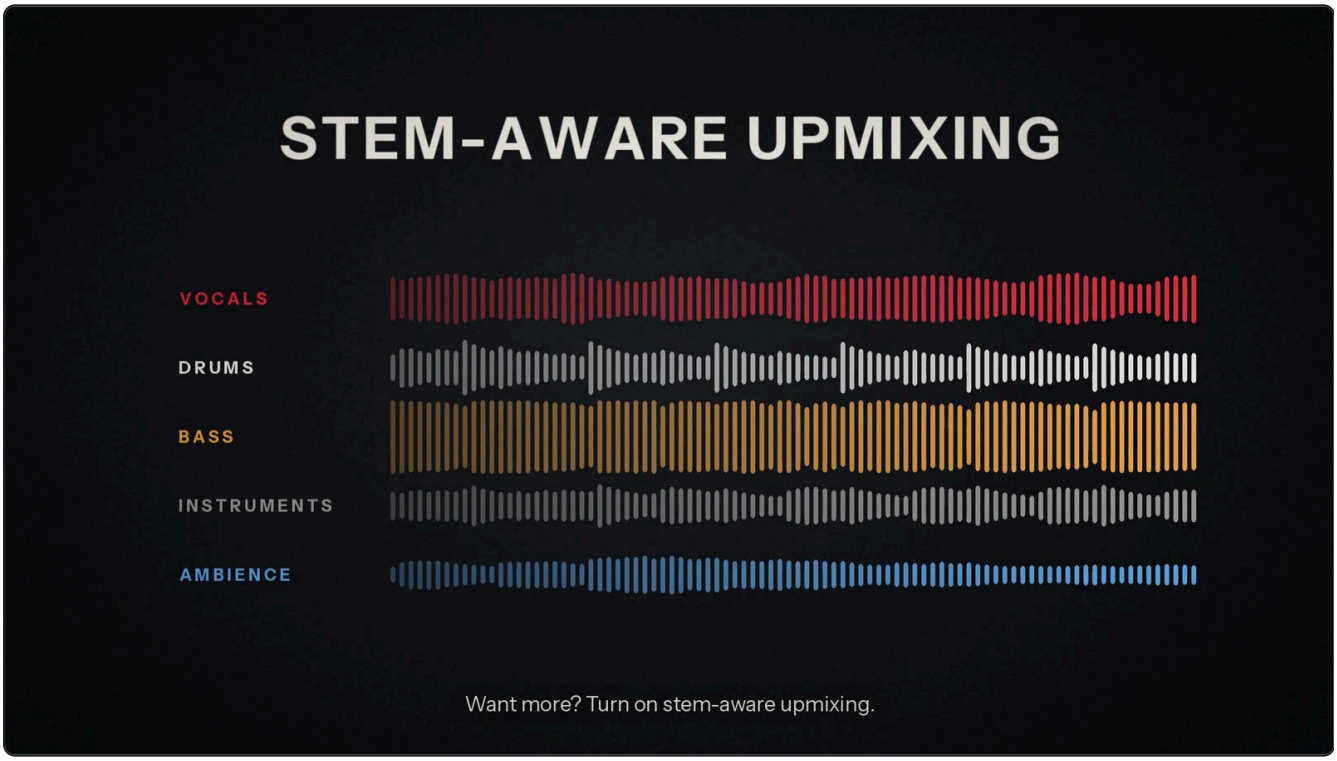


Figure 14. Stem-aware upmixing: vocals, drums, bass, instruments and ambience

How to place the stems

1. On the **Stems** tab, set **Separation** to **On** (or load **Stems: natural (downmix safe)**).
2. **Vocal** row: **To center** sets how much of the lead vocal moves into the center speaker; **Width** sets how wide a pan range counts as the lead vocal; **Lift** raises part of it into the top front speakers.
3. **Drums** row: **Position** is the angle on each side (30° = the front L/R speakers, 90° = the sides, up to 150°). **Height** raises them towards the heights; **Spread** spreads them over neighbouring speakers.
4. **Instruments** row: the same three controls for guitars, keys and other instruments.

5. **Bass split**: below this frequency the bass stem stays in the front speakers.
6. In creative mode (lock off), balance the parts with the **Stem levels** row.

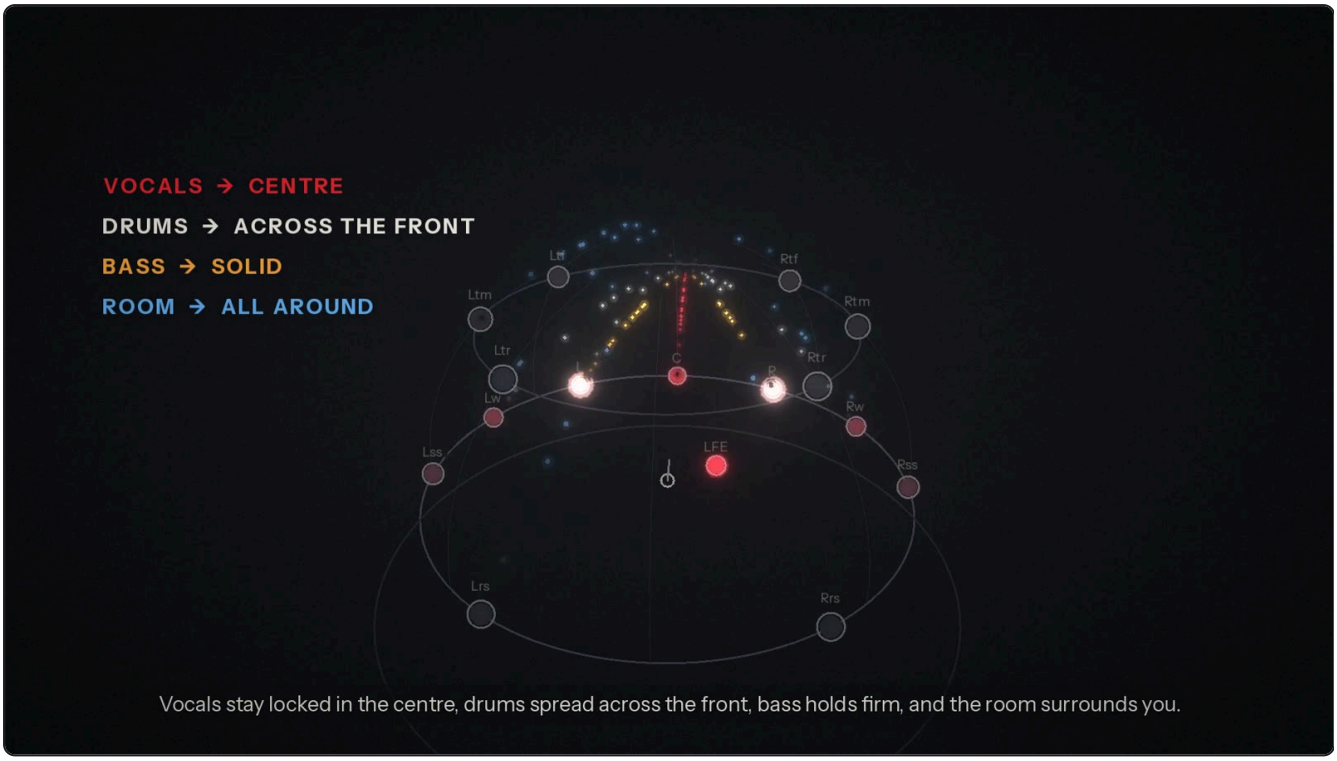


Figure 15. Vocals locked in the centre, drums across the front, bass solid, room all around ▶ **Animated in the online manual**

> **Tip:** Start with **Stems: wide stage** for a bigger, more spacious band image, or **Stems: creative room** to add a regenerated room as well.

STEM OBJECTS AND ADM-OSC

For object-based workflows, Pi UpMix can output the stems as eight separate objects instead of speaker feeds.

How to output stem objects

1. Give the track at least 8 output channels.
2. On the **Stems** tab, set **Output** to **Stem objects**.
3. The first eight outputs now carry: **Vocal**, **Drums L**, **Drums R**, **Bass**, **Other L** (instruments left), **Other R**, **Ambience L**, **Ambience R**. The layout readout says "output 8 stem objects" and the meters show these names.

If the track has fewer than 8 channels, Pi UpMix keeps the normal speaker output.

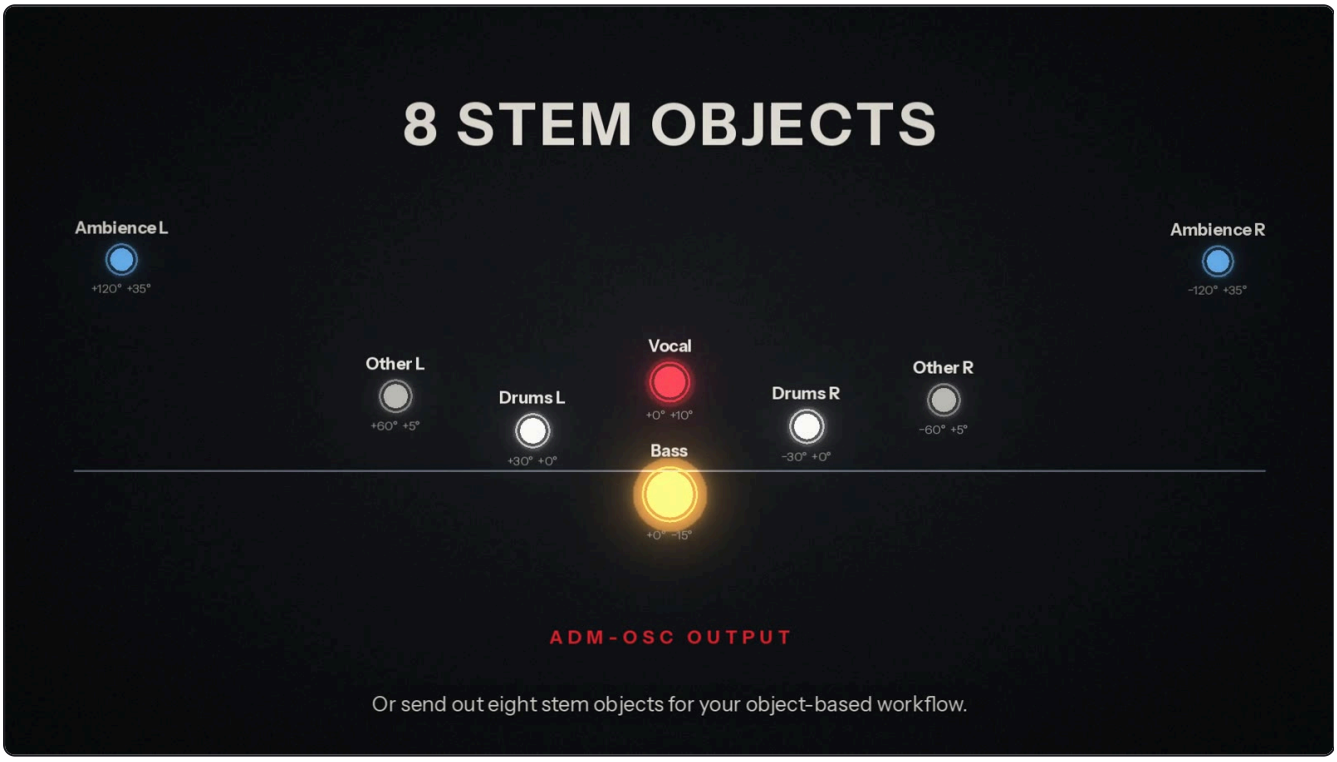


Figure 16. Eight stem objects for object-based workflows

How to send object positions to a renderer

1. Go to the **Space** tab, **Objects** row.
2. Enter the **Renderer address** (IP address; 127.0.0.1 for the same computer) and **Port** (default 9000). Press Return or click elsewhere to apply.
3. Click **ADM-OSC** so it reads **On**.

While the Stem objects output is active, Pi UpMix sends each object's position ten times a second using the ADM-OSC messages `/adm/obj/n/aed` (azimuth, elevation, distance 1.0) and `/adm/obj/n/w` (width), where n

is 1 to 8 in the order above. The positions follow your Stems tab settings:

Object	Azimuth	Elevation	Width
1 Vocal	0°	30° x **Lift**	0.1
2 / 3 Drums L / R	+ / - drums **Position**	60° x drums **Height**	drums **Spread**
4 Bass	0°	0°	0.2
5 / 6 Other L / R	+ / - instruments **Position**	60° x instruments **Height**	instruments **Spread**
7 / 8 Ambience L / R	+ / - (90° + 60° x surround **Side to rear**)	45° x height **Amount**	0.6

Positive azimuth is to the left. Map the eight output channels to the renderer's objects 1 to 8.

FORMAT CONVERSION AND DOWNMIX

Pi UpMix can also convert between multichannel formats.

How to convert a multichannel bed

1. Set the track's input to the source format (for example 5.1) and the output to the target (for example 7.1.4). In Pro Tools, the AAX version supports this when input and output are the same multichannel format and the source sits on the matching channels; otherwise use a host that offers different input and output formats.
2. On the **Detail** tab, set **Source** to **All input channels**.
3. L and R are upmixed as usual, and every other input channel (C, LFE, surrounds, heights ...) is carried to the matching output speaker.

This works both ways: 5.1 to 7.1.4, or 7.1.4 to 5.1. It is also exact with **Downmix lock**.



Figure 17. Format conversion, for example 5.1 to 9.1.6

STEREO, HEADPHONE AND AMBISONICS OUTPUTS

Stereo outputs

When the output is stereo (2 channels), the **Stereo output** menu on the **Detail** tab chooses what you get:

- **Headphones (binaural)**: a binaural render of the full virtual layout, for listening on headphones.
- **Lo/Ro fold-down**: a standard left-only/right-only fold-down.
- **Lt/Rt matrix**: a matrix-encoded stereo.

Virtual layout chooses the speaker layout that is rendered: **5.1**, **7.1**, **7.1.4** (default) or **9.1.6**.

Headphone monitoring of a speaker output

You do not need a stereo track to check your work on headphones. With any speaker output, choose **Monitor headphones** in the monitoring menu under the speaker map. The binaural render plays on the L and R outputs. **Monitor stereo fold-down** lets you hear exactly what a stereo fold-down of your upmix will sound like. Switch back to **Monitor speakers** before you print.

How to use head tracking

1. On the **Space** tab, **Head tracking** row, set the **OSC port** (default 8000) and press Return.
2. Configure your head tracker (or its app) to send OSC to this computer on that port. Pi UpMix understands: - yaw, pitch and roll in degrees in one message whose address ends in `/ypr`, `/rotation` or `/head`; - a quaternion (w, x, y, z) in a message whose address contains `quaternion`; - separate messages ending in `/yaw`, `/pitch` and `/roll`.
3. Turn **Tracking** on. The **Tracker** readout shows "Receiving, yaw ..." while data arrives.
4. Face the front and click **Recenter**.

Head tracking turns the headphone render with your head, so the speakers stay in place in the room as you move.

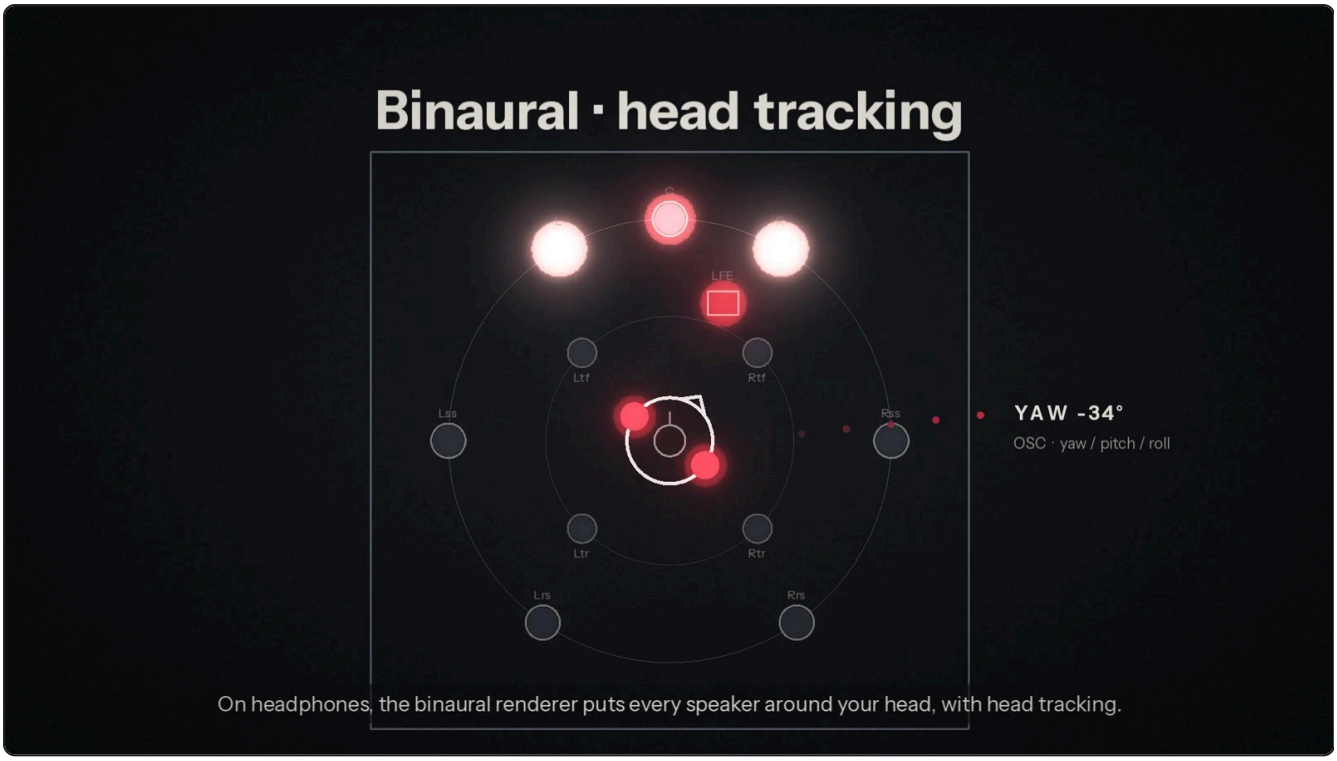


Figure 18. Binaural rendering with head tracking ▶ **Animated in the online manual**

Ambisonics output

If the track's output is an Ambisonics bus (1st, 2nd or 3rd order), Pi UpMix renders the virtual layout to Ambisonics in the AmbiX convention (ACN channel order, SN3D normalisation). The **Virtual layout** menu chooses which layout is encoded.

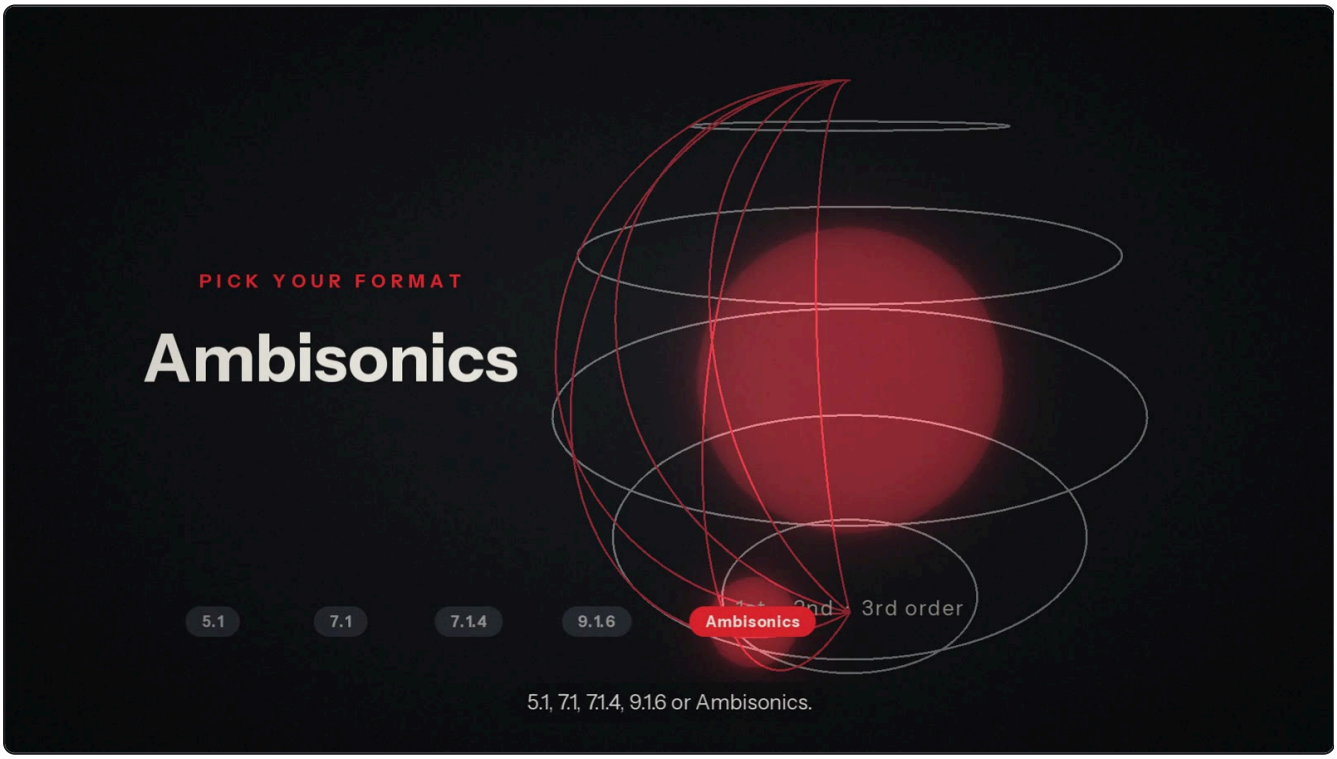


Figure 19. Ambisonics output, 1st to 3rd order

ROOM REGENERATION

New in version 1.1, in creative mode. Pi UpMix measures the decay of the room in your source and regenerates a matching room in the surround and height speakers.

How to add a regenerated room

1. Turn **Downmix lock** off.
2. Go to the **Space** tab, **Room** row. Play the source for a while: **Source decay** shows the decay time measured from the source.
3. Raise **Amount**.
4. Leave **Decay** at **Match source** to follow the measured decay, or turn it up to set a fixed decay time (up to 8 s).
5. Shape the room with **Damping** (how quickly the high frequencies fade) and **Size** (50–200 %).
6. If the stereo fold-down must stay exact, raise **Fold-down guard**.

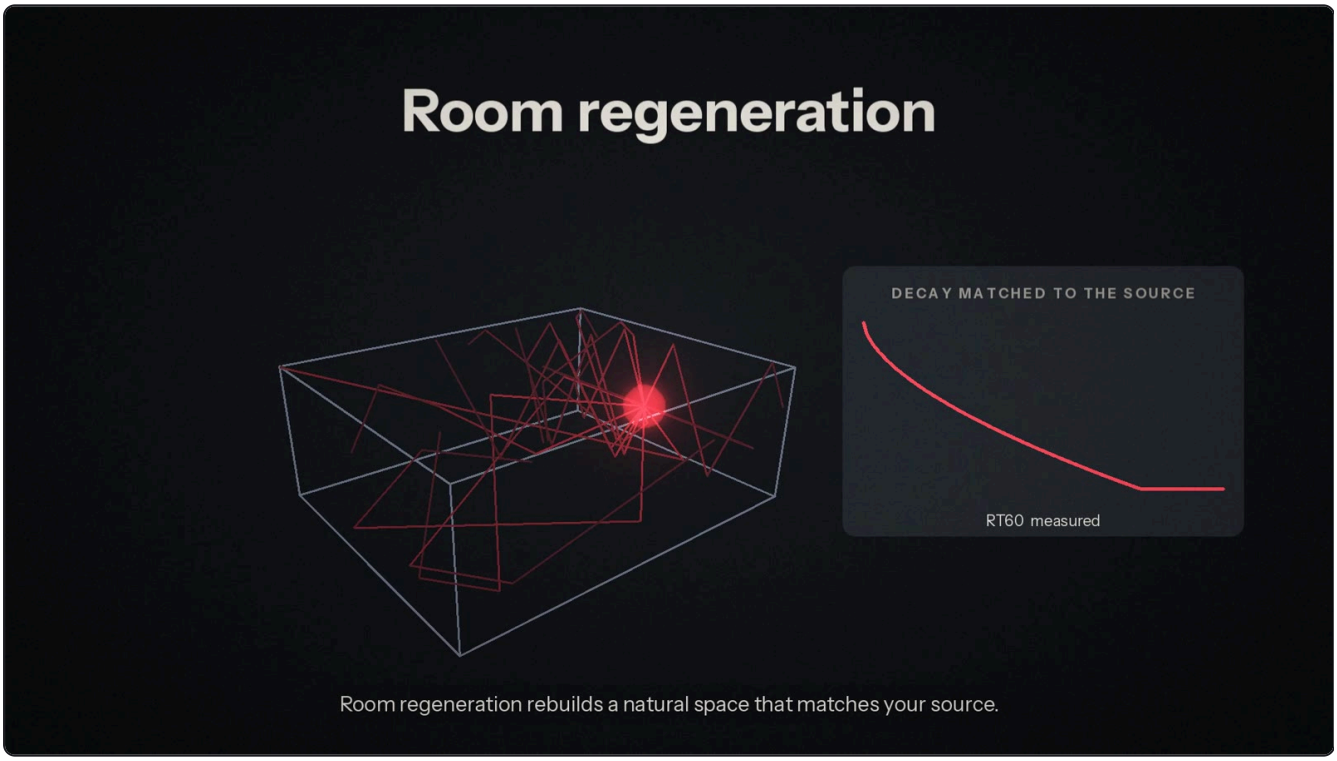


Figure 20. Room regeneration rebuilds a natural space that matches your source ▶ **Animated in the online manual**

SPATIAL MATCH

New in version 1.1. Spatial Match learns how a reference surround or immersive mix uses its speakers and moves your upmix towards it, band by band. It works with **Downmix lock** on and stays exact.

How to match a reference mix

1. Go to the **Space** tab, **Match** row, and click **Learn...**.
2. Choose a multichannel reference file (WAV, AIFF, FLAC or CAF with 3 to 16 channels). Pi UpMix reads it in the background.
3. **Reference status** shows "Learned " when it is done.
4. Raise **Spatial match** to move your upmix towards the reference.

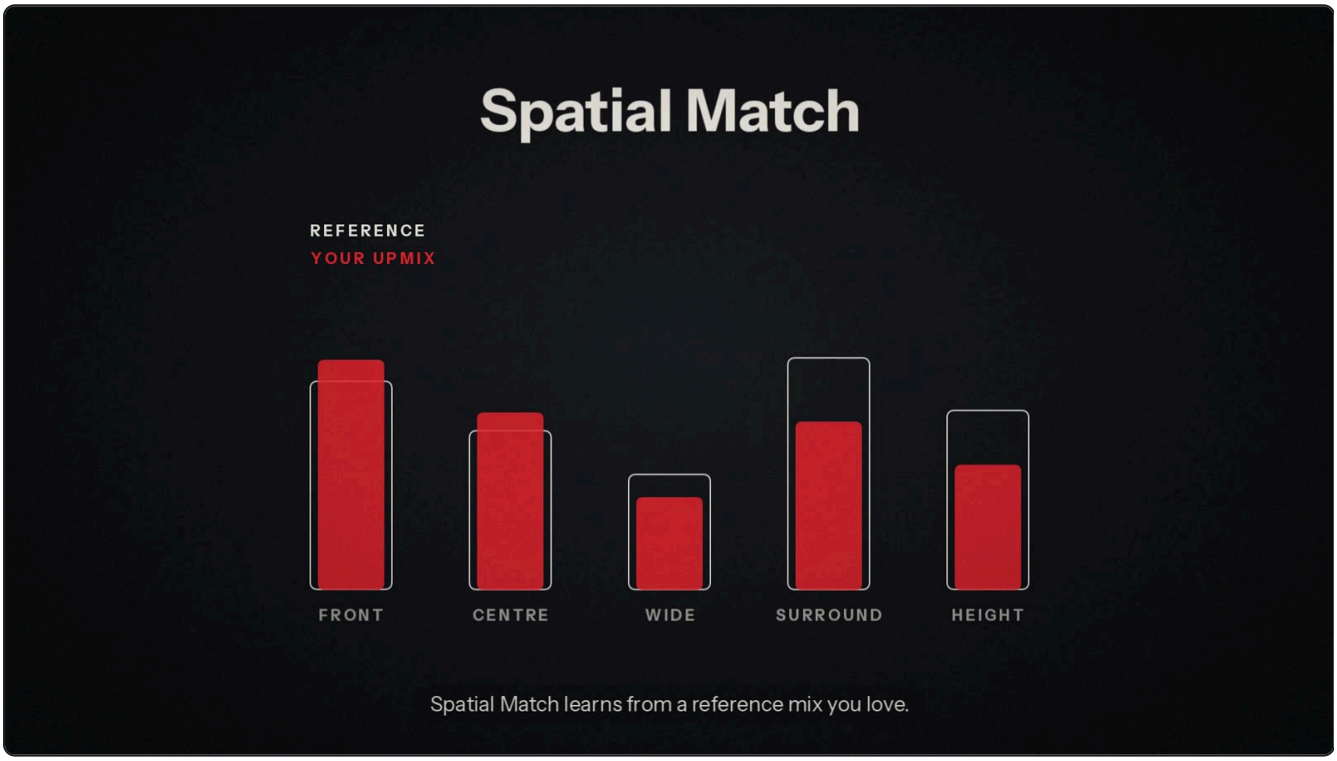


Figure 21. Spatial Match learns how a reference mix uses its speakers

> **Note:** The learned reference is saved with your session, not in presets. The **Spatial match** amount is saved in presets.

CUSTOM SPEAKER LAYOUTS

New in version 1.1. If your room does not match a standard layout, type in your own speakers.

How to create a custom layout

1. Go to the **Space** tab, **Speakers** row, and click **Edit...**.
2. Type one speaker per line, in output channel order: **name**, **azimuth** and **elevation** in degrees. Add the word **lfe** for a subwoofer. For example:

```
L 30 0 R -30 0 C 0 0 SUB 0 0 lfe LS 110 0 RS -110 0 TFL 45 45 TFR -45 45
```

- Azimuth is positive to the left (-180 to 180); elevation is -90 to 90.
- Use between 2 and 16 speakers.
- Spaces, tabs, commas or semicolons separate the values; anything after `#` is a comment. 3. Click **Apply**. The editor shows "Applied: N speakers", or an error explaining which line is wrong. 4. Click **Close**, then turn **Custom layout On**. 5. Give the track the same number of channels as speakers. The **Layout** readout says "N speakers, active" when it is in use, or "give the track N channels" when the channel count does not match yet.

The custom layout is saved with your session.

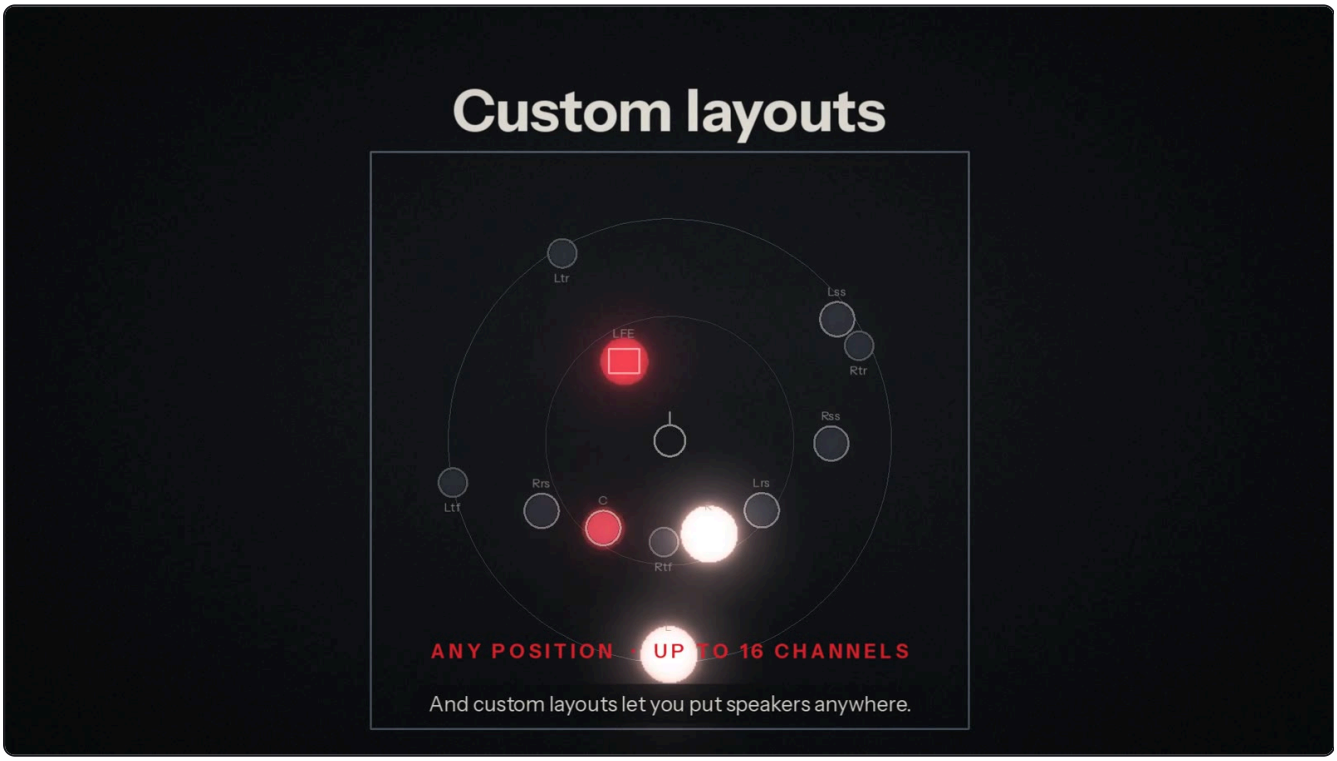


Figure 22. Custom layouts put speakers anywhere, up to 16 channels

PRESETS AND A/B COMPARISON

Factory presets

Preset	Character
Default balanced (downmix safe)	All controls at default; a balanced starting point.
Music natural	Gentle center, moderate surround and height.
Music wide and immersive	Creative mode: wider input, more surround and height, delays and diffusion.
Film and broadcast dialog	Strong center for dialogue, firmer transient guard.
Live concert hall	Creative mode: lots of surround and height with long delays and diffusion.
Ambience only, gentle	No center or wides; light ambience, LFE off.
Center focus vocal	Full center, narrow center width.
Immersive height lift	Height lift and more height ambience.
Mono to surround	Creative mode for mono sources, with mono spread.
Classical hall	Light center, rich surround and height, slow response.
Transparent minimal	Very light upmix, LFE off.
Electronic club	Creative mode: wide, strong LFE, firm transient guard.
Stems: natural (downmix safe)	Stem separation on, natural placement.
Stems: wide stage	Stem separation on, drums and instruments spread wide and up.
Stems: creative room	Creative mode with stems and a regenerated room.

Loading a factory preset first resets all settings to their defaults and then applies the preset. The factory presets also appear in your host's program list.

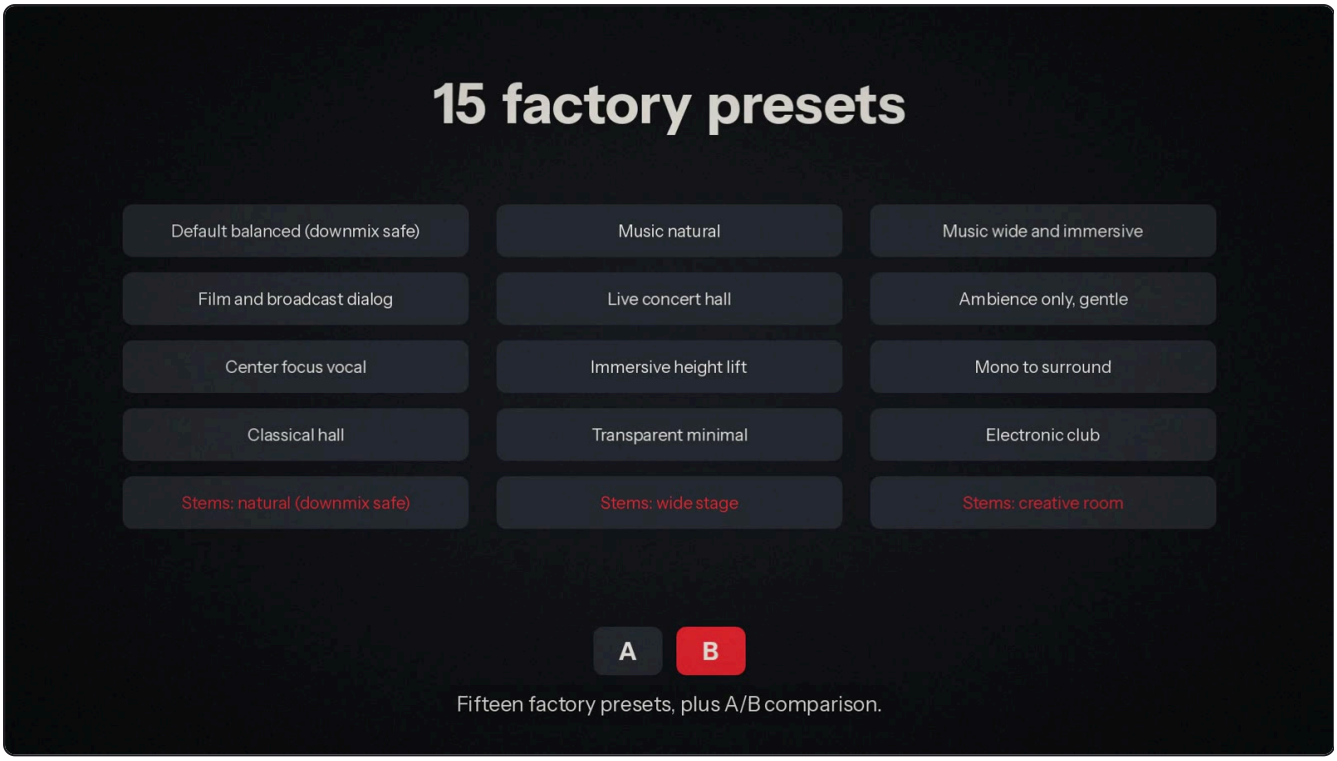


Figure 23. Factory presets and A/B comparison

How to save and load your own presets

1. Click **Save**. A name field appears in place of the preset menu.
2. Type a name and press Return (Escape, or clicking elsewhere, cancels).
3. Your preset appears in the **User** section of the preset menu and in the **<** / **>** order after the factory presets.

User presets are saved as .piupmix files in **Documents/Saharty/Pi UpMix/Presets**. You can copy them to another computer.

> **Note:** Presets do not store **Quality**, **Bypass**, the stem **Output** choice or **Tracking**, so loading a preset never changes your latency or routing.

How to compare two settings

1. Set up a sound in slot **A**.
2. Click **Copy** to copy it to slot B, then click **B**.
3. Change settings in B.
4. Switch between **A** and **B** to compare instantly.

RENDERING FILES (STANDALONE APP)

The standalone app includes an offline renderer that upmixes whole files with the current settings at high quality.

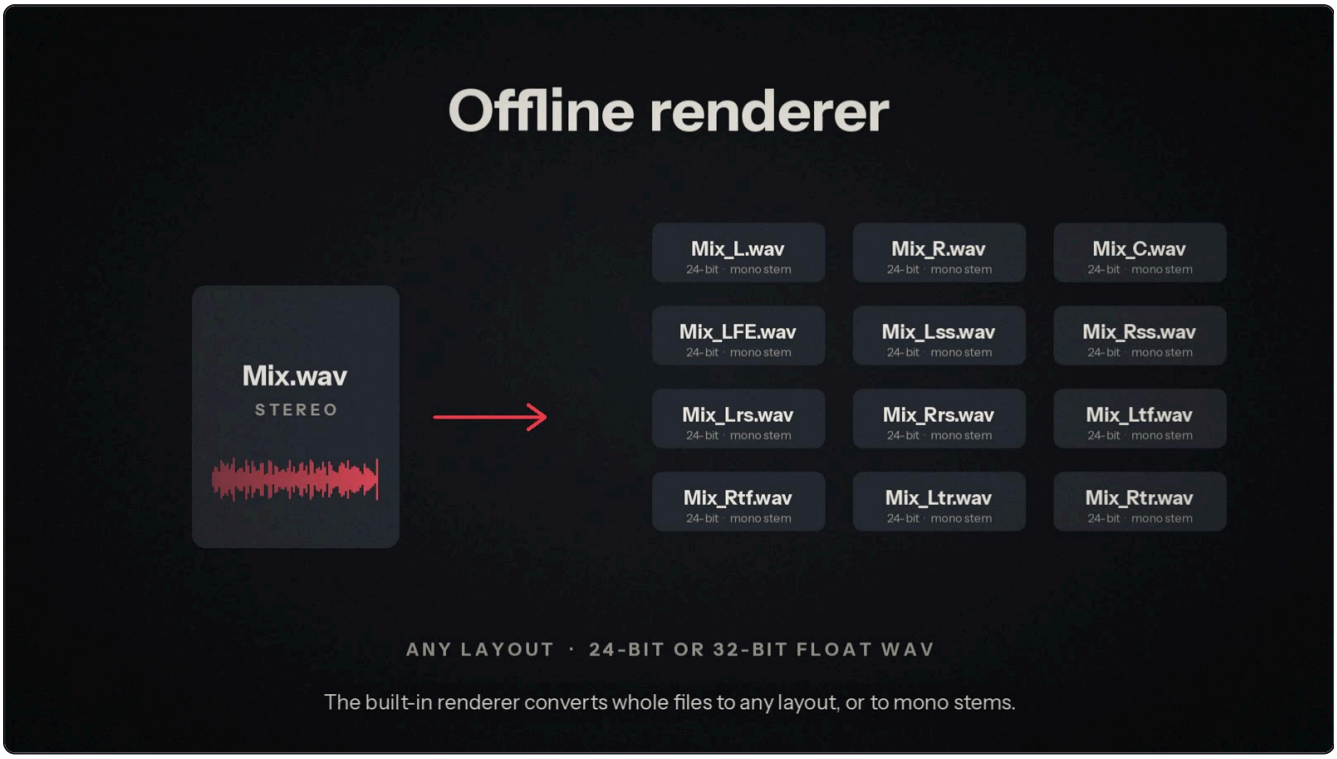


Figure 24. The built-in renderer converts whole files to any layout, or to mono stems ▶ Animated in the online manual

How to render a file

1. Set up your sound in the standalone app (presets, tabs, Spatial Match ...).
2. Click **Render file...** (shown as **Activate to render** until Pi UpMix is activated or the trial is running).
3. Choose the **Output**: any speaker layout from LCR to 9.1.6 (default 7.1.4), **Headphones (binaural stereo)**, **Lo/Ro stereo**, **Lt/Rt stereo**, **Stem objects (8 channels)** or **Ambisonics order 1–3 (AmbiX)**.
4. Choose the **File format**: **32-bit float WAV** (default) or **24-bit WAV**.
5. Turn on **Mono stems** if you want one mono file per channel instead of one multichannel file.
6. Click **Choose file and render...** and choose a stereo or mono audio file (WAV, AIFF, FLAC, MP3 or OGG; on macOS also M4A and CAF).
7. Watch the progress bar. When it says "Done: ...", click **Show in folder**.

The result is written next to the source file:

- One file: `<name> (Pi UpMix <output>).wav`, in the channel order shown in the table under Installation.
- Mono stems: a folder `<name> (Pi UpMix <output>) stems` containing files such as `Song.L.wav`, `Song.C.wav`.

The output is aligned with the source (the processing latency is removed). A file that would exceed 4 GB is written as mono stems automatically. **Cancel** stops the render and keeps the partly written files.

SETTINGS & PREFERENCES

Quality and latency

The **Quality** menu (Detail tab) sets the frequency resolution of the analysis. Higher resolution separates sounds more finely but adds latency. The latency is always reported to the host, so your session stays in sync, and it is shown under the speaker map.

Quality	Latency at 44.1/48 kHz	Use it for
Live (5 ms)	256 samples (about 5.3 ms at 48 kHz)	Live sound and broadcast.
Low latency	1024 samples (about 21 ms at 48 kHz)	Tracking and real-time monitoring.
Standard	2048 samples (about 43 ms at 48 kHz)	Everyday mixing (default).
High quality	4096 samples (about 85 ms at 48 kHz)	Final mixes and deliverables.

At 88.2/96 kHz and 176.4/192 kHz the sample counts double and quadruple, so the latency in milliseconds stays about the same. Changing **Quality** briefly reconfigures the processing; it is not automatable. The offline renderer always uses high quality.

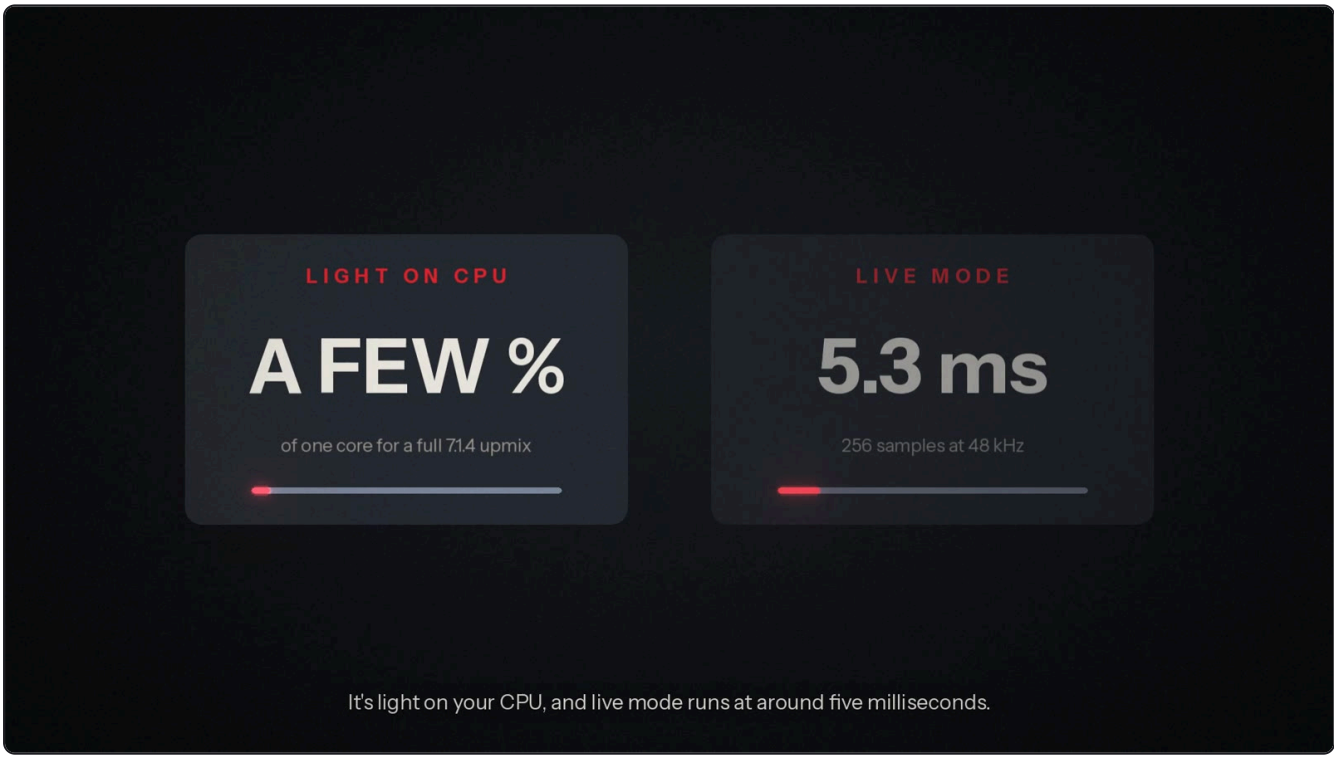


Figure 25. Live mode runs at about five milliseconds

What is saved

- **With the session** (host project): every parameter, the current preset name, the window size, the custom layout and its on/off state, the head-tracking port, the ADM-OSC settings and the learned Spatial Match

reference.

- **In presets**: all sound parameters (not Quality, Bypass, stem Output or Tracking).
- **Not saved**: solo, mute, the monitoring menu, and the A/B slots.

Automation

All parameters can be automated from your host except **Quality** and the stem **Output** choice, which change the processing structure.

Window size

Drag the window corner to resize it between 780 x 495 and 1560 x 990. The layout scales as a whole and keeps its proportions.

KEYBOARD SHORTCUTS / REMOTE CONTROL

Keyboard

Key	Where	Action
Return	Preset name field	Save the preset.
Escape	Preset name field	Cancel saving.
Return	Licence key field	Activate.
Return	OSC port, renderer address and port fields	Apply the value.

OSC input: head tracking

Address (ending / containing)	Arguments	Meaning
ends in `/ypr`, `/rotation` or `/head`	yaw, pitch, roll (degrees)	Head orientation.
contains `quaternion`	w, x, y, z	Head orientation as a quaternion.
ends in `/yaw`, `/pitch`, `/roll`	one value (degrees)	One axis at a time.

Port: **OSC port** on the Space tab (default 8000, UDP). Yaw is positive to the left, pitch positive up, roll positive to the right. Use **Recenter** to set the front.

OSC output: ADM-OSC object positions

Address	Arguments	Sent
`/adm/obj/n/aed`	azimuth, elevation, distance (1.0)	10 times a second per object (n = 1–8)
`/adm/obj/n/w`	width	10 times a second per object

Destination: **Renderer address** and **Port** on the Space tab (default 127.0.0.1:9000). Sent only while **ADM-OSC** is on and the Stem objects output is active.

Pi UpMix does not use MIDI or timecode.

TIPS FOR LIVE/STUDIO USE

Studio

- **Keep Downmix lock on for deliverables.** Your stereo master survives any fold-down. Use the **Fold-down match** readout as your proof.
- **Use High quality for the final print.** Standard is fine while you work; switch to **High quality** before you bounce, or render with the standalone app, which always uses high quality.
- **Check the fold-down and headphones without rerouting.** The monitoring menu's **Monitor stereo fold-down** and **Monitor headphones** play on L and R, so you can check on the same speakers or headphones. Remember to return to **Monitor speakers**.
- **Dialogue and vocals**: raise **Center** and **Transient guard**, and use **Center low cut** so the center speaker does not get muddy. The **Film and broadcast dialog** preset is a good start.
- **Acoustic and classical**: a slower **Response** (100 ms and more) and a lower **Transient guard** give a calmer, more natural hall.
- **Busy pop and rock mixes** that smear into the surrounds benefit from stem separation: drums stay in front, the vocal stays centred.
- **Match a house style** with Spatial Match: learn one of your own finished immersive mixes and apply it to new upmixes for consistent results across an album.

Live

- **Use Live (5 ms) quality** to keep the processing delay small enough to stay with the stage sound.
- **Creative mode works well in rooms**: surround **Delay** keeps the image anchored to the stage (precedence), and **Diffusion** helps the surrounds sound enveloping rather than like extra loudspeakers. Try **Live concert hall** or **Electronic club**.
- **Bypass keeps the latency**, so toggling it never shifts your timing.
- **Use custom layouts** for venues and installations whose speakers are not in standard positions.
- **Give it its own computer or bus**: in the standalone app you can feed Pi UpMix from a console bus through your audio interface and send the outputs straight to the surround and overhead speakers.



Figure 26. VST3, AU, AAX and standalone for macOS and Windows

TROUBLESHOOTING

Symptom	Cause	Fix
Pi UpMix does not appear in the host.	The host has not rescanned, or the format you need was not installed.	Restart the host and rescan plug-ins. Run the installer again and check the format under **Customize** (macOS).
Only L and R play; the other speakers are silent.	Pi UpMix is not activated, or the licence is limited.	Click **Activate...** and activate your key or start the free trial.
Only L and R play although activated.	The track is stereo, so Pi UpMix is producing a stereo (headphones, Lo/Ro or Lt/Rt) output.	Give the track or bus a multichannel layout (for example 7.1.4).
The upmix sounds strange on speakers.	The monitoring menu is set to **Monitor headphones** or **Monitor stereo fold-down**.	Set it back to **Monitor speakers**.
Some speakers are silent.	A speaker is muted or another is soloed on the speaker map.	Click **Clear solo**.
The speakers are in the wrong places (Reaper, discrete channels).	Your outputs are routed in a different order.	Route the channels in the order of the discrete channel table under Installation.
Delay, Diffusion, Trims or Room do nothing and look dimmed.	These are creative-mode controls and **Downmix lock** is on.	Turn **Downmix lock** off.
The Stems tab controls are dimmed.	Stem separation is off.	Set **Separation** to **On**, or choose the **Stem objects** output.
Stem objects has no effect.	The track has fewer than 8 output channels, or a custom layout is active.	Give the track at least 8 channels and turn **Custom layout** off.
Fold-down match shows a high value.	Downmix lock is off (creative mode).	Turn the lock on, or raise **Fold-down guard** to 100 %.
Fold-down match: no signal.	No audio is playing.	Start playback.
The custom layout is not used.	The track's channel count does not match the number of speakers.	Give the track as many channels as the **Layout** readout asks for.
"Use between 2 and 16 speakers." or another error in the speaker editor.	A line is incomplete or out of range.	Each line needs a name, an azimuth (-180 to 180) and an elevation (-90 to 90).
"Choose a surround or immersive mix (3 to 16 channels)".	The Spatial Match reference is stereo or has too many channels.	Choose a multichannel reference with 3 to 16 channels.
Tracker shows "No tracker data".	The tracker sends to a different port or address, the port is used by another app, or a firewall blocks UDP.	Check the port on both sides, try another port, and allow the app in your firewall.

Symptom	Cause	Fix
The object renderer does not move the objects.	**ADM-OSC** is off, the address or port is wrong, or the output is not Stem objects.	Turn **ADM-OSC** on, check the address and port, and set **Output** to **Stem objects**.
The session is out of sync after changing Quality.	Some hosts only pick up a new latency when playback restarts.	Stop and restart playback.
Render file... reads **Activate to render**.	Not activated.	Activate, or start the free trial.
"This file could not be read." when rendering.	The file format is not supported on this system.	Convert the file to WAV, AIFF or FLAC.
"Writing failed. Check the free disk space."	The disk is full or not writable.	Free some space or move the source file to a writable folder.
macOS warns that the installer is from an unidentified developer.	Gatekeeper blocks the installer.	Right-click the installer, choose **Open**, then **Open** again, or allow it in **System Settings > Privacy & Security**.
Windows SmartScreen blocks the installer.	SmartScreen does not know the file yet.	Choose **More info**, then **Run anyway**.
"This licence is active on another computer".	The licence is still active on another computer.	Choose **Move it here**, or deactivate the other computer first.

SPECIFICATIONS & SYSTEM REQUIREMENTS

Specifications

Item	Details
Product	Pi UpMix by Saharty, version 1.1.0
Formats	AAX, VST3, AU (macOS), standalone app
Input	Mono or stereo; any multichannel speaker set for format conversion (up to 16 channels)
Speaker outputs	LCR, LCRS, quad, 5.0, 5.1, 6.0, 6.1, 7.0, 7.1, 5.0.2, 5.1.2, 5.0.4, 5.1.4, 7.0.2, 7.1.2, 7.0.4, 7.1.4, 7.0.6, 7.1.6, 9.0.4, 9.1.4, 9.0.6, 9.1.6, any speaker set made of those speakers, or a custom layout (2–16 speakers)
Stereo outputs	Headphones (binaural, virtual 5.1 / 7.1 / 7.1.4 / 9.1.6, optional head tracking), Lo/Ro, Lt/Rt
Ambisonics	1st to 3rd order, AmbiX (ACN, SN3D)
Object output	8 stem objects with ADM-OSC positions
Sections	Front, surround, height, LFE and output; analysis, low cuts, input, trims; stems; room, match, head tracking, custom speakers, objects
Downmix	Downmix lock with live fold-down match (measured null about -138 dB)
Quality / latency	Live (256 samples), Low latency (1024), Standard (2048), High quality (4096) at 44.1/48 kHz; reported to the host
Presets	15 factory presets, user presets (.piupmix), A/B comparison
File renderer	Standalone app: 32-bit float or 24-bit WAV, one multichannel file or mono stems

System requirements

	macOS minimum	macOS recommended
OS	macOS 11 Big Sur	Latest macOS
Processor	Apple silicon or Intel (Universal)	Apple M1 or better
Memory	8 GB	16 GB (stem separation)
Disk	100 MB	100 MB
Host	AAX, VST3 or AU host	Pro Tools Ultimate or any immersive-capable DAW
Monitoring	Headphones (binaural)	Speakers up to 7.1.4

	Windows minimum	Windows recommended
OS	Windows 10 64-bit	Windows 11 64-bit
Processor	Intel / AMD, 64-bit, 4 cores	Intel Core i7 / AMD Ryzen 7
Memory	8 GB	16 GB (stem separation)
Disk	100 MB	100 MB
Host	AAX or VST3 host	Pro Tools Ultimate or any immersive-capable DAW
Monitoring	Headphones (binaural)	Speakers up to 7.1.4

Linux is not supported. Layouts larger than 7.1.4 depend on your host's support for those formats; contact support if you need help with them.

SUPPORT

We are here to help.

- **Email**: support@pi-ware.com
- **Website**: www.pi-ware.com (downloads, your licences and computers at pi-ware.com/account)
- **Tutorials**: youtube.com/@pibysaharty

When you write to us, please include your operating system, your host and its version, the Pi UpMix version (1.1.0), your track's input and output layout, and a short description of what you did and what happened.



Figure 27. Try Pi UpMix free for 15 days at pi-ware.com

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www.pi-ware.com · support@pi-ware.com
Video tutorials: youtube.com/@pibysaharty
Online manual with animations: https://www.pi-ware.com/manuals/pi-upmix/

Precision is a constant.

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