

IRCAM Verb

FLUX:: Immersive

2023-02-06

Table of contents

1	IRCAM Verb	7
2	Quick start guide	10
3	Decay	11
3.1	(1) Decay time	12
3.2	(2) Decay High	12
3.3	(3) Decay Mid	12
3.4	(4) Decay Low	13
3.5	(5) Crossover Freq High	13
3.6	(6) Crossover Freq Low	13
4	Time Structure Display	14
4.1	(7) High density	14
4.2	(8) Early On / Solo	15
4.3	(9) Cluster On / Solo	15
4.4	(10) Reverb On / Solo	15
4.5	(11) Direct signal	15
4.6	(12) Early	15
4.7	(13) Cluster	15
4.8	(14) Reverb	16
4.9	(15) Room size	16
4.10	(16) Reverb Start	16
4.11	(17) Reverb Distr.	16
5	Options	17
5.1	(28) Infinite	18
5.2	(29) Air Roll Freq	18
5.3	(30) Air Absorption	18
5.4	(31) Modal density	18
5.5	(32) Panning	18
5.6	(33) Width	19
5.7	(34) Diffuseness	19
6	Time Structure Settings	20
6.1	(35) Early shape	20

6.2	(36) Early Min	20
6.3	(37) Early Max	21
6.4	(38) Early Distribution	21
6.5	(39) Cluster Min	21
6.6	(40) Cluster Max	21
6.7	(41) Cluster Distribution	21
7	Input Output Section	22
7.1	(42) Input Gain	22
7.2	(43) Input level meter	22
7.3	(44) Output Gain	22
7.4	(45) Output level meter	23
7.5	(46) Dry/Wet	23
7.6	(47) Setup	23
7.7	(48) Setting	23
7.8	(49) Day - Night	23
8	Preset Section	24
8.1	(50) Save	24
8.2	(51) Recall	24
8.3	(52) Copy B	25
8.4	(53) Preset Name	25
8.5	(54) Morphing A B	25
8.6	(55) Automation	25
9	Preset Management	26
9.1	From the Plug-in interface	26
9.1.1	A-B Sections	26
9.1.2	Save	26
9.1.3	Recall	26
9.1.4	AB Slider	26
9.2	From the Preset Management Window	27
9.2.1	Recall A	27
9.2.2	Recall B	27
9.2.3	Copy A and Copy B	27
9.2.4	Update	28
9.2.5	New	28
9.2.6	Duplicate	28
9.2.7	Edit	28
9.2.8	Delete	28
9.2.9	Export	28
9.2.10	Import	28
9.2.11	Ordering arrows	29

10 Credits	30
10.1 Software development	30
10.1.1 Project Manager and Designer:	30
10.1.2 Application Development:	30
10.1.3 FLUX:: DSP Design and Development:	30
10.1.4 Graphic design:	30
10.1.5 FLUX:: Framework development:	30
10.1.6 FLUX:: Framework graphic engine:	30
10.1.7 And	31
10.1.8 FLUX:: Special Thanks to:	31
10.2 FLUX::	31
10.3 Additional libs	31
10.4 Open source libraries	32
10.4.1 RTTrPM SDK (Blacktraxx)	32
10.4.2 ThorVG (replaces crossed-out libraries above) - MIT	32
10.4.3 r8brain free - MIT	33
10.4.4 ooura fft from lmdsp - MIT (or MIT-like)	33
10.4.5 LibJpeg - Custom (BSD-like)	33
10.4.6 libpng - PNG Reference Library License version 2	33
10.4.7 Freetype 2 - FreeType License	33
10.4.8 Zlib - zlib	34
10.4.9 bzip2 - Modified zlib	34
10.4.10 Boost - BSL-1.0	34
10.4.11 mimalloc - MIT	34
10.4.12 ni-media - MIT	34
10.4.13 pfft	34
10.4.14 pybind11	34
10.4.15 rtaudio	34
10.4.16 rtmidi	34
10.4.17 concurrentqueue - Simplified BSD	35
10.4.18 readerwriterqueue - Simplified BSD	35
10.4.19 assimp	36
10.4.20 enet - MIT	37
10.4.21 fmt	37
10.4.22 functions (Erik Rigtorp) - MIT	37
10.4.23 inplace_function - BSL-1.0	37
10.4.24 gtest - " BSD 3-Clause "New" or "Revised" "	37
10.4.25 jsoncpp - MIT	38
10.4.26 libcurl - MIT like	38
10.4.27 magic_enum - MIT	39
10.4.28 nanobench - MIT	39
10.4.29 nlohmann_json - MIT	40
10.4.30 openddl - MIT	40

10.4.31	openvr - " BSD 3-Clause "New" or "Revised"	41
10.4.32	poly2tri - " BSD 3-Clause "New" or "Revised"	41
10.4.33	pugixml - MIT	42
10.4.34	rapidjson - MIT	42
10.4.35	shared_recursive_mutex - MIT	43
10.4.36	sentry-native - MIT	43
10.4.37	sqlite3 - Public Domain	44
10.4.38	sqlite_orm - MIT	44
10.4.39	stb - MIT	45
10.4.40	utfcpp - BSL-1.0	45
10.4.41	unqlite - BSD 2-clause	46
10.4.42	argh (Andrey Mikhaylenko) - LGPLv3	46
10.4.43	chardet (Mark Pilgrim, Daniel Blanchard) - LGPL v2.1	46
10.4.44	charset_normalizer - MIT	46
10.4.45	docopt (Vladimir Keleshev) - MIT	47
10.4.46	dotenv - "BSD 3-Clause"New" or "Revised"	47
11	Specifications	49
11.1	Availability	49
11.2	Processing	49
11.3	Hardware Requirements	49
11.4	Software License Requirements	49
11.5	Compatibility	50
11.5.1	Windows – 10, in 64 bits only.	50
11.5.2	macOS (Intel and ARM)	50
	Appendices	51
A	Release Notes	51
A.1	Build 24.07.0.50393 - All plugins	51
A.1.1	New Features	51
A.1.2	Improvements	51
A.1.3	Bugs	51
A.1.4	Known Issues	51
A.2	Build 24.06.0.50386 - All plugins	52
A.2.1	Improvements	52
A.2.2	Bugs	52
A.2.3	Known Issues	53
A.3	Build 23.07.50310 - All plugins	54
A.3.1	New features	54
A.3.2	Bugs fixes	54
A.3.3	Known issues	55

A.4	Build 23.1.0.50251 - All plugins	55
A.4.1	New features	55
A.4.2	Bugs fixes	56
A.4.3	Known issues	57
A.5	Build 21.12.0.50123 - All plugins except TRAX and StudioSession	57
A.6	Build 21.11.0.50107 (HEar, IRCAM Verb)	58
A.7	FLUX:: Immersive - Plugins (including IRCAM Tools) 21.09	58
A.7.1	Build 21.9.0.50083	58
A.8	FLUX:: Immersive - Plugins (including IRCAM Tools) 20.12	59
A.8.1	Build 20.12.0.49880	59
A.9	Known Issues	60

1 IRCAM Verb

[Product Page](#) | [Shop Page](#)

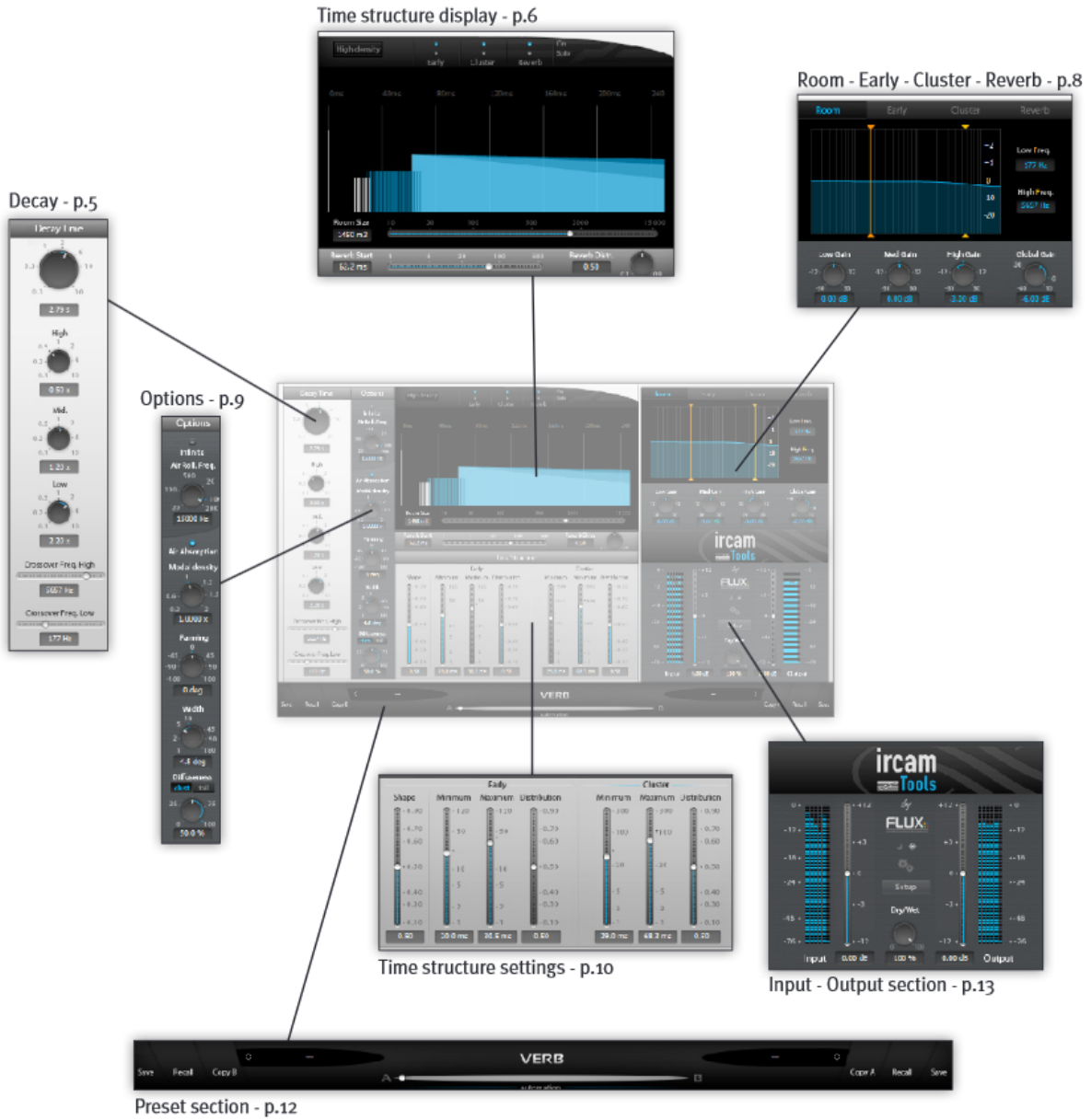
ircam
Tools

by FLUX
sound and picture development

VERB

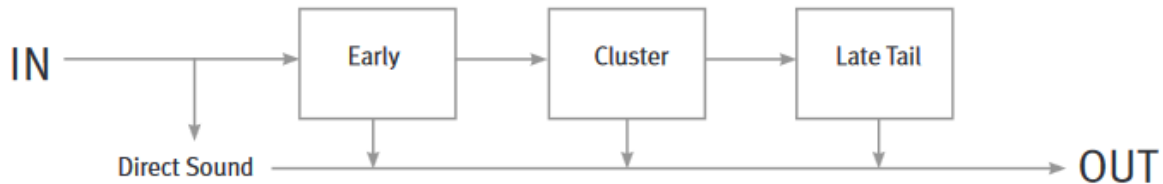
Room Acoustics & Reverberation processor





2 Quick start guide

The Verb is an algorithmic reverberation processor build in a modular way, with an recursive filtering based engine.



This block diagram view explain the basics of this engine, to explain the time structure of the reverberation tail:

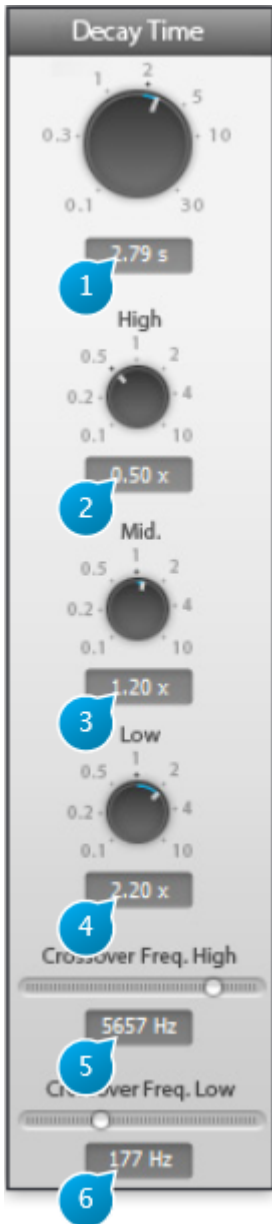
- The direct signal is pushed first. It represents the direct sound, aka. the sound that comes first to the listener.
- Then, follow a first generator of early reflexions, called here EARLY. Theses early reflexions are particularly important as they describe the immediate spatial environment around the sound source: walls, floor, roof. Theses reflexions are depending on the source position : they are panned in the space.
- A second delay generator follows the early stage, called CLUSTER. Theses early reflexions comes a bit later, and have seen their density increased in comparasion to the first early. They can be shown as a transition stage between the early and the late tail generator. In a standard configuration, theses reflexions are seen as a common part of all the space : they are not localized. You can make it directive using the diffuseness parameter.
- A final LATE TAIL stage, synthetize the reverb tail. Most of the time, acoustical description of this tail shows it as an dense and homogeneous material in the reverberated space (you can change that too with the same diffuseness parameter).

Understanding this time structure, and the associated listening feeling is really important for an enhanced approach to any reverberation system.

For a first quick approach, you can:

- set the reverberation time with the main decay time
- set the room basics characteristic with the room size meta-parameter
- set some room filters, to adapt the tail to your current needs.

3 Decay



3.1 (1) Decay time

This is the duration of the reverberation ‘tail’ in seconds, in other words how long it takes for the reverberated sound to vanish away. In more technical terms, this is sometimes referred to as the RT60 factor, which is the time at which the response of the reverberation to an input signal goes below -60dB of attenuation.

Please bear in mind that the master decay and high/mid/low controls are interactive, which means that the same audible result can be attained with different settings. This is intentional, as this allows you to get to the result faster and in a manner suited to your personal habits. Generally speaking, it might be more convenient to adjust the master decay time using the resulting sound as a guideline, then fine tune using high and/or low decay controls and leave the mid decay at the default setting. On the other hand, if you specifically to concentrate on the mids, for example to create a ‘hollow room’ sound, it’s easier to focus on the mid decay control, leaving hi and mid decay untouched.

3.2 (2) Decay High

Adjusts relative decay time of high frequencies specifically. It is expressed as a ratio of the global decay time setting explained above. Default setting is 0.5, meaning the high frequencies decay faster than the main decay time. This behavior is quite typical of natural spaces, where high frequencies are easily absorbed (by furniture, carpet, etc...) before the lowest ones. Roughly speaking, for a given master decay time, increasing this ratio increases the sense of liveliness of the acoustic space, whereas decreasing it deadens it.

The correspondingly affected band frequencies are determined by the Crossover freq. high control setting.

3.3 (3) Decay Mid

Adjusts relative decay time of medium frequencies specifically. Default setting is 1.

The mid range is where the human ear is most sensitive, and roughly corresponds to the frequency spectrum of the human voice. The correspondingly affected band frequencies are comprised in between the Crossover freq. high and low control frequency values .

3.4 (4) Decay Low

Adjusts relative decay time of low frequencies specifically. Default setting is 1.

In most real acoustic spaces, low frequencies reverberate freely in the sense that wall materials barely affect the low-frequency response, except if specifically adapted materials have been employed such as bass-traps and anything that acts as a tuned resonator. Generally room size and shape is what influences the low-frequency reverberation content the most, so one could say the default setting corresponds to a space with no low-frequency specific acoustic treatment.

The correspondingly affected band frequencies are determined by the Crossover freq. low control setting.

3.5 (5) Crossover Freq High

Sets the frequency above which reverberation time is determined by the Decay high setting, expressed in Hertz(Hz).

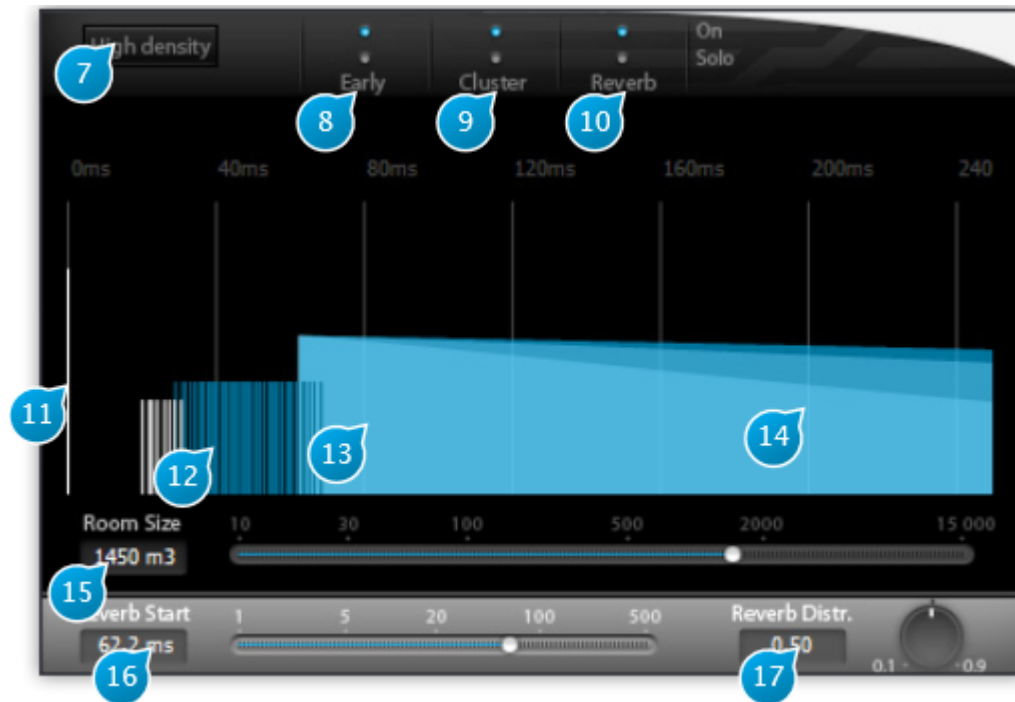
Default value: 5657 Hz

3.6 (6) Crossover Freq Low

Sets the frequency below which reverberation time is determined by the Decay low setting, expressed in Hertz(Hz).

Default value: 177 Hz

4 Time Structure Display



4.1 (7) High density

Toggles between standard and high density reverberation engine.

High density gives better quality at the expense of a little more CPU consumption, by increasing the size of the feedback network used to compute the reverberation.

Please note that this affects not only the sound quality of the reverberation, but can also change its character and tonal qualities somewhat, especially at certain settings, so, as always, you should let your ears be the judge as to which is best for a particular situation.

4.2 (8) Early On / Solo

These buttons are part of a mini-mixer console for the reverberation engine where each channel is fed by one of the reverberation sections.

Here these standard mute and solos controls belong to the early reflection section channel.

They allow you to isolate it or temporarily suppress a section of the reverberation so you can exactly evaluate the influence that this specific section has on the overall reverberation sound, for example when fine-tuning is required.

4.3 (9) Cluster On / Solo

Same as above, acting on the cluster section of the reverberation engine.

4.4 (10) Reverb On / Solo

Same as above, acting on the reverberation tail section of the reverberation engine.

4.5 (11) Direct signal

The grey bar at the start of the reverberation pictogram represents the direct sound send at the input of the plug-in. In the time structure of the reverberation, it is the first element that is heard.

4.6 (12) Early

Overall representation of the early reflections distribution.

Vertical bars roughly indicate at what time locations (horizontally) and levels (bar height) these early reflections occur.

4.7 (13) Cluster

See 12.

4.8 (14) Reverb

Shows a graphical representation of the reverberation tail part of the engine. The decay curves of the high, mid and low bands, which are controlled by the decay time settings, are superimposed in different colors and can rapidly be assessed and checked.

Also see 12.

4.9 (15) Room size

This parameter is a meta parameter that allow you to quickly perform an homogeneous set of parameters for the early reflexions part (early + cluster). Theses part are particularly important to achieve the “room” feeling of the desired space.

It adjust the time structure of the whole reverberation (early-min, early-max, cluster-min, cluster-max, reverb-start). This is a key control for quick settings, before a detailed fine tune with each parameters.

4.10 (16) Reverb Start

The time at which the latest part (diffuse part) of the reverberation section starts to be heard, in milliseconds. This is the delay between the dry signal and the beginning of the late reverberated signal. Please note that this setting does not affect the time characteristics of the early and cluster sections. It is however not possible to move the reverberation start time before the first early reflections.

4.11 (17) Reverb Distr.

Reverberation tail distribution controls the way in which reverberation tail ‘spikes’ are scattered in time.

5 Options



5.1 (28) Infinite

When activated, the signal is recirculated indefinitely inside the reverberation engine.

Best suited for special effects such as “deep-freezing” the signal, or if you’re looking to create something a little less conventional than a fade-out for the end of your track.

5.2 (29) Air Roll Freq

Roll-off frequency for the air absorption simulation via a low-pass filter. Signal content above this frequency vanishes faster.

5.3 (30) Air Absorption

Simulates the frequency-dependent absorption of air, where high frequencies roll-off quicker than low-frequencies with respect to distance. You’ve most probably noticed this real-world phenomenon when you’re far away from a concert venue and only able to hear the bass, and gradually start to hear the whole mix as you get closer.

5.4 (31) Modal density

Scales the modal density with respect to the current setting, which is internal to the plug-in engine, and depends on other parameters such as reverberation time, etc.

The modal density governs the frequency “smoothness” of the verb engine. Increasing this setting reduces the graininess of the reverberation. Adjust to taste, depending on the source material and desired result.

5.5 (32) Panning

Virtual source panning direction offset relative to input channels, in degrees.

In mono-to-stereo mode, this acts as a standard pan control, adjusting L/R direction of the source.

In a stereo-to-stereo channel configuration, this controls allows one to gradually remap the input

channels to each virtual source. In N-to-N surround configuration, the input channels are gradually remapped to their closest neighbors, in a circular, carousel fashion.

5.6 (33) Width

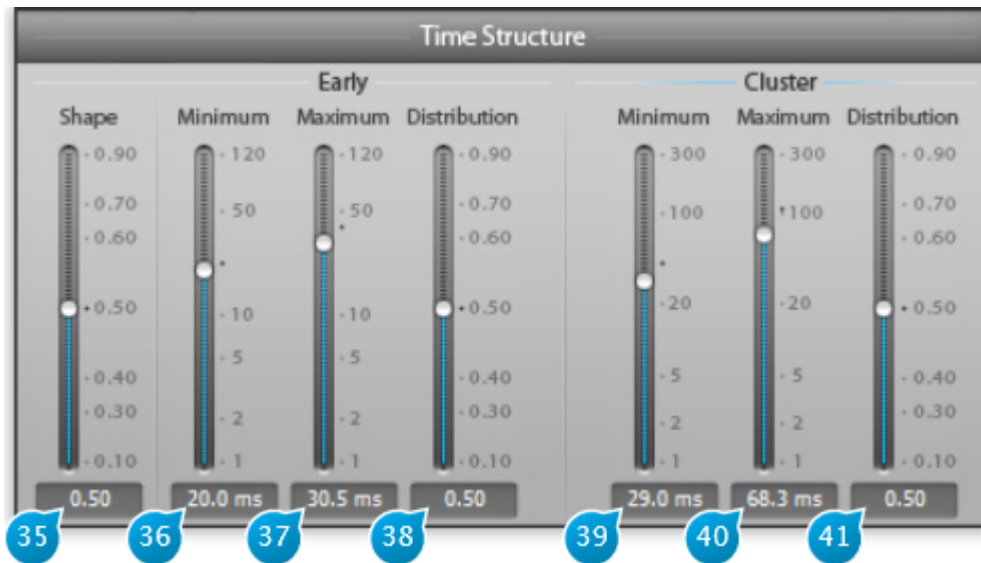
Panning width of the input channel - virtual source remapping described above.

5.7 (34) Diffuseness

Determines the spatial width of the reverberated signal part, one could also say it changes the directional information of the reverberation, or the ability of the listener to locate the spatial origin of the this signal. In a real-life space, this would corresponding to how non-symmetric, irregular and complicated the shape of the room would be.

When engaged, separate cluster and tail reverberation push-buttons determine which section is affected by the diffuseness parameter. A zero setting equates to maximum localization while a 100-percent setting gives full diffuseness and no localization.

6 Time Structure Settings



6.1 (35) Early shape

Governs the amplitude rise or fall of early reflections. The default setting of 0.5 corresponds to early reflections all having the same level. This mimics an acoustical space where reflective surfaces are all located at roughly the same distance to the listener.

Below 0.5 early reflections decay with time, above 0.5 they rise with time. Early reflections of decreasing level would be typical of a space where most of the reflective surfaces are grouped at a range closest to the listener.

6.2 (36) Early Min

Early reflections minimum time, i.e. the time at which the early reflections start to appear, in milliseconds. This is the analogous of the ubiquitous “pre-delay” setting found on most reverberation processors. It represent the time between the direct sound and the first early reflection.

6.3 (37) Early Max

Early reflections maximum time, i.e. the time at which these cease to appear.

6.4 (38) Early Distribution

Early reflections distribution. Determines the way early reflections are scattered in time, inside the Early Min. / Early Max. interval. The default setting of 0.5 corresponds to regularly spaced reflections, above these are more grouped towards the Early Max. value, and vice-versa.

6.5 (39) Cluster Min

Cluster minimum time. See Early Min.

:::{.callout-note} Please keep in mind the cluster is fed with the input of the early reflections processor section, as is shown accordingly on the display. :::

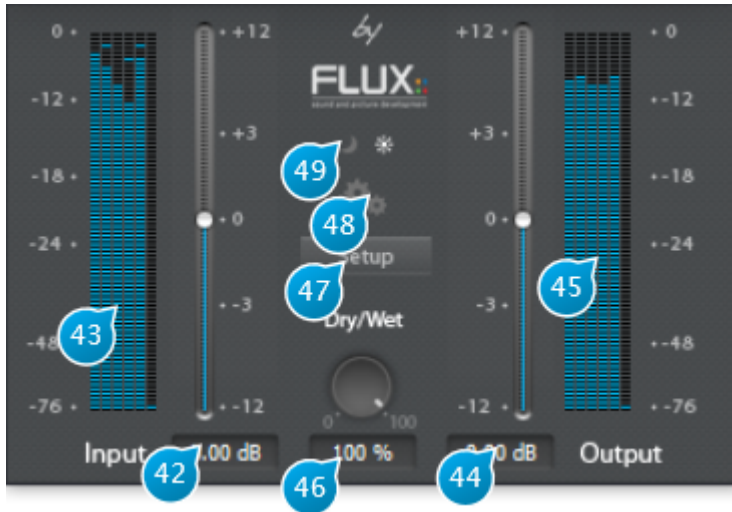
6.6 (40) Cluster Max

Cluster maximum time. See Early Max.

6.7 (41) Cluster Distribution

Cluster distribution. See Early Distribution.

7 Input Output Section



7.1 (42) Input Gain

Adjusts the level of the signal fed to the plug-in, in dB increments.

7.2 (43) Input level meter

Shows the current level of the input signal after applying input gain, in dB FS (deciBel Full Scale).

7.3 (44) Output Gain

Used to trim the output signal and possibly avoid any overloading of the signal in the rest of the signal-chain.

7.4 (45) Output level meter

Shows the current level of the input signal after applying output gain, in dB FS(decibel Full Scale).

7.5 (46) Dry/Wet

When used as insert effect, one can dial the right amount of “wet”, reverberated signal with respect to the “dry”, untreated input signal.

The default 100-percent wet setting is mostly intended for the typical and preferred use in a send-effect configuration.

7.6 (47) Setup

Toggles the display of the routing matrix, where the user can adjust the routing between input channels and virtual sources.

7.7 (48) Setting

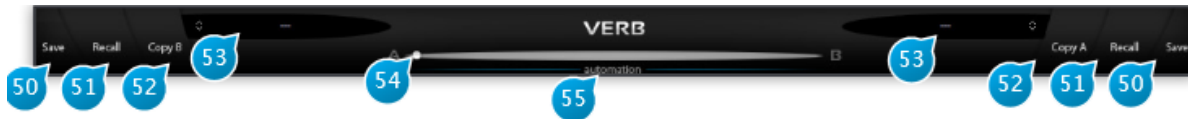
Gives access to a sub-menu where you can either select the I/O configuration, namely the input channel count followed by the output channel count, for hosts that support dynamic I/O configuration or display the credits page.

The exact I/O combinations available depend on your actual audio hardware and host configuration.

7.8 (49) Day - Night

Toggles between two interface schemes, which, as the name implies, are best suited to high or low light environments respectively. In a dimly-lit studio environment, switching to the nighttime scheme with its darker color palette and lower contrast will minimize eye-fatigue when doing long sessions.

8 Preset Section



8.1 (50) Save

Saves a snapshot of the current settings for future use.

Short description and assorted comments can be provided, which comes in especially handy when sharing presets with other users, when the preset is part of a large preset bank, or to identify the author and source.

Entering a descriptive keyword is a good practice to be able to quickly sort your presets, according to character, the type of space they simulate (e.g. hall, room, etc.), and the intended usage (e.g. voice, percussion, guitar, etc.)

A preset can be locked to prevent any further editing.

To re-save your preset under a new name, open the preset manager by clicking the corresponding (A/B) preset slot, then select New, enter a name for your preset, and finally press Save.

8.2 (51) Recall

Recall the settings from the currently selected preset, overwriting any current settings of the plug-in. The sub-menu which appears allows to recall at your choice:

- all parameters
- all parameters but setup: intended for when your particular speaker configuration is different from that of the preset's author (typically stereo)
- all parameters but setup and dry/wet mix: useful in a mix setting when comparing and choosing presets

8.3 (52) Copy B

Copy current settings to the second parameter slot (B). To try out a variation of the current settings without erasing the reference, press this button, switch to B and adjust your parameters of choice, then switch or morph between A and B.

When copying a preset to a slot, the morphing slider will automatically fly to the corresponding slot.

8.4 (53) Preset Name

Displays the current preset name, if any. Clicking the associated button (up&down arrows) brings up the preset manager.

8.5 (54) Morphing A B

Gradually morphes parameters from A to B slots.

The parameter set associated with the current morphing slider position can be saved as a preset. In addition, when the morphing slider is in an intermediary position, any edit made to a parameter switches the slider back to slot A or B, whichever is closest to the current position.

8.6 (55) Automation

Enabling the Automation control switch makes the morphing slider exposed and available for automation read.

When engaged, keep in mind only the morphing slider value is used for automation, and other parameter values are ignored. This behavior is intended and necessary to prevent any parameter conflicts that would otherwise occur.

As a consequence of this, you need to make sure the Automation switch is engaged when mapping the morphing slider mapped to a control surface hardware knob or slider. On the opposite, when not engaged, the plug-in will listen for any parameter automation, except the morphing slider.

9 Preset Management

9.1 From the Plug-in interface

9.1.1 A-B Sections

A plug-in features two preset sections : A & B. Clicking on the slot of a specific section reaches the shared preset bank.

From the preset management window you can select the preset you want to recall in the specific preset section.

9.1.2 Save

Save replaces the selected preset by a new one under the same name featuring the current settings. If you want to keep an existing preset without your new modifications, just select an empty place into the preset list, enter a new name for this modified preset featuring the current settings and press Save.

9.1.3 Recall

Once a preset is selected from the preset list it must be explicitly loaded into the section A or the section B by using the recall button. A preset is effective only after it has been recalled. Double-clicking on the preset name from the list, reloads the preset into the selected slot.

9.1.4 AB Slider

This horizontal slider has no unity nor specific value display. It allows to morph current settings between two loaded presets. A double-click on one side of the slider area toggles between full A and full B settings. The results of an in between setting can be save as a new preset.

9.2 From the Preset Management Window

The Preset Management Window features three preset banks: * The Factory bank gathers presets that can't be edited by users. * The User bank is dedicated to the users presets. * The Global bank features presets for A, B and morphing sections. A single global preset includes A and B section content and the morphing slider position.

A Preset can directly be recalled into the preset section selected by the morphing slider position, by double-clicking on its name on the list. The preset lists can be filtered. This filter is applied to any preset information such as name, description, author, comments or key words.



9.2.1 Recall A

recalls the selected preset into the corresponding section.

9.2.2 Recall B

recalls the selected preset into the corresponding section.

9.2.3 Copy A and Copy B

buttons allow to easily create a variation around a preset.

9.2.4 Update

allows to save the current settings for the selected preset.

9.2.5 New

creates a new preset in the list.

9.2.6 Duplicate

creates a new preset in the list from the selected one.

9.2.7 Edit

gives access to the specific windows which allows to change preset name, description, key words.....

9.2.8 Delete

suppresses the selected preset.

9.2.9 Export

creates a file reflecting the content of the preset bank.

9.2.10 Import

adds existing presets into the preset bank.

9.2.11 Ordering arrows

orders the presets into the list.



The screenshot shows a dialog box titled "Please Provide Preset Informations". It contains four text input fields with the following values: "Name" is "My Old Compressor", "Description" is "4 ratio", "Comment" is "Bass", and "Keyword" is "Electric bass, Kick". At the bottom of the dialog, there is a "Locked" checkbox which is checked, and two buttons labeled "Ok" and "Cancel".

The preset protection if engaged, allows only its original modification author to uncheck and edit. So you can protect your presets in a multi-user configuration. Protected presets can only be modified using the session of their creator. If used in another user session they can only be imported or deleted.

10 Credits

10.1 Software development

10.1.1 Project Manager and Designer:

Gaël Martinet

10.1.2 Application Development:

Gaël Martinet, Alexis Gentil, Bastien Prevosto, Anthony Belard, Maxence Grandidier, Siegfried Hand and Antoine Lorence.

10.1.3 FLUX:: DSP Design and Development:

Gaël Martinet, Maxence Grandidier and Lorcan Mc Donagh

10.1.4 Graphic design:

Nicolas Philippot

10.1.5 FLUX:: Framework development:

Gaël Martinet, Florie-Anne Lafaye, Alexis Gentil, Lorcan Mc Donagh, Bastien Prevosto, Anthony Belard, Siegfried Hand and Antoine Lorence

Additional contributions: Vincent Carlier, Jean-Loup Pecquais, Nicolas Erard, Jean Cruypenynck, Pablo Arias, Samuel Tracol

10.1.6 FLUX:: Framework graphic engine:

Emmanuel Julien (GS lib) and Gaël Martinet

10.1.7 And

thanks to all fantastic testers...

10.1.8 FLUX:: Special Thanks to:

Alain, Yves, Bruno and Claude for helping to shape our minds over the years.

10.2 FLUX::

www.flux.audio Copyright 2024, Harman Professional, Inc. ALL RIGHTS RESERVED.

10.3 Additional libs

- GS lib Emmanuel Julien, Gael Martinet (Copyright 2013 Emmanuel Julien)
- ThorVG, Copyright (c) 2020 - 2023 notice for the ThorVG Project (see AUTHORS)
- r8brain free - Copyright (c) 2013-2023 Aleksey Vaneev
- LibJpeg - Copyright (c) 1991-2016, Thomas G. Lane, Guido Vollbeding
- libpng :
 - Copyright (c) 1995-2023 The PNG Reference Library Authors.
 - Copyright (c) 2018-2023 Cosmin Truta.
 - Copyright (c) 2000-2002, 2004, 2006-2018 Glenn Randers-Pehrson.
 - Copyright (c) 1996-1997 Andreas Dilger.
 - Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.
- Freetype 2 - Copyright (c) 2006-2023 by David Turner, Robert Wilhelm, and Werner Lemberg.
- Zlib - Copyright (c) 1995-2022 Jean-loup Gailly and Mark Adler
- bzip2 - Copyright (c) 1996-2010 Julian Seward jseward@bzip.org
- Boost - BSL-1.0
- ni-media - Copyright (c) 2022 Native Instruments
- pfft:
 - Copyright (c) 2004 the University Corporation for Atmospheric Research (“UCAR”)
 - Copyright (c) 2013 Julien Pommier (pommier@modartt.com)
 - Copyright (c) 2019 Hayati Ayguen (h_ayguen@web.de)
 - Copyright (c) 2020 Dario Mambro (dario.mambro@gmail.com)
- pybind11 - Copyright (c) 2016 Wenzel Jakob wenzel.jakob@epfl.ch
- rtaudio - Copyright (c) 2001-2021 Gary P. Scavone

- rtmidi - Copyright (c) 2003-2021 Gary P. Scavone
- concurrentqueue - Copyright (c) 2013-2016, Cameron Desrochers.
- readerwriterqueue - Copyright (c) 2013-2021, Cameron Desrochers.
- assimp - Copyright (c) 2006-2021, assimp team
- enet - Copyright (c) 2002-2020 Lee Salzman
- fmt - Copyright (c) 2012 - present, Victor Zverovich and {fmt} contributors
- functions (Erik Rigtorp) - Copyright (c) 2015 Erik Rigtorp erik@rigtorp.se
- inplace_function - BSL-1.0
- gtest - Copyright 2008, Google Inc.
- jsoncpp - Copyright (c) 2007-2010 Baptiste Lepilleur and The JsonCpp Authors
- libcurl - Copyright (c) 1996 - 2023, Daniel Stenberg, daniel@haxx.se, and many contributors
- magic_enum - Copyright (c) 2019 - 2023 Daniil Goncharov
- nanobench - Copyright (c) 2019-2023 Martin Leitner-Ankerl
- nlohmann_json - Copyright (c) 2013-2022 Niels Lohmann
- openddl - Copyright (c) 1999-2022 Eric Lengyel
- openvr - Copyright (c) 2015, Valve Corporation
- poly2tri - Copyright (c) 2009-2018, Poly2Tri Contributors
- pugixml - Copyright (c) 2006-2022 Arseny Kapoulkine
- rapidjson - Copyright (c) 2015 THL A29 Limited, a Tencent company, and Milo Yip.
- shared_recursive_mutex - Copyright (c) 2019 konanM
- sentry-native - Copyright (c) 2019 Sentry (<https://sentry.io>) and individual contributors.
- sqlite3 - Public Domain License
- sqlite_orm - Copyright (c) 2012-2023 Eugene Zakharov and others
- stb - Copyright (c) 2017 Sean Barrett
- utfcpp - Copyright 2006 Nemanja Trifunovic
- unqlite - Copyright (c) 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 Symisc Systems, S.U.A.R.L [M.I.A.G + Mrad Chems Eddine chm@symisc.net].

10.4 Open source libraries

10.4.1 RTTrPM SDK (Blacktraxx)

Copyright (c) 2019 CAST Group of Companies Inc

10.4.2 ThorVG (replaces crossed-out libraries above) - MIT

<https://github.com/thorvg/thorvg/blob/main/LICENSE> Copyright (c) 2020 - 2024 notice for the ThorVG Project (see AUTHORS) Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”),

to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software. THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE."

10.4.3 r8brain free - MIT

<https://github.com/avaneev/r8brain-free-src/blob/master/LICENSE>

10.4.4 ooura fft from lmdsp - MIT (or MIT-like)

<https://www.kurims.kyoto-u.ac.jp/~ooura/fft.html> Copyright Takuya OOURA, 1996-2001

10.4.5 LibJpeg - Custom (BSD-like)

<https://jpegclub.org/reference/> Copyright (C) 1991-2016, Thomas G. Lane, Guido Vollbeding

10.4.6 libpng - PNG Reference Library License version 2

<https://sourceforge.net/p/libpng/code/ci/master/tree/LICENSE> Copyright (c) 1995-2023 The PNG Reference Library Authors. Copyright (c) 2018-2023 Cosmin Truta. - Copyright (c) 2000-2002, 2004, 2006-2018 Glenn Randers-Pehrson. Copyright (c) 1996-1997 Andreas Dilger. Copyright (c) 1995-1996 Guy Eric Schalnat, Group 42, Inc.

10.4.7 Freetype 2 - FreeType License

<https://github.com/freetype/freetype/blob/master/LICENSE.TXT> Copyright (C) 2006-2023 by David Turner, Robert Wilhelm, and Werner Lemberg

10.4.8 Zlib - zlib

https://zlib.net/zlib_license.html Copyright (C) 1995-2022 Jean-loup Gailly and Mark Adler

10.4.9 bzip2 - Modified zlib

Copyright (C) 1996-2010 Julian Seward jseward@bzip.org

10.4.10 Boost - BSL-1.0

https://github.com/boostorg/boost/blob/master/LICENSE_1_0.txt

10.4.11 mimalloc - MIT

<https://github.com/microsoft/mimalloc/blob/master/LICENSE>

10.4.12 ni-media - MIT

<https://github.com/NativeInstruments/ni-media/blob/master/LICENSE>

10.4.13 pfft

<https://github.com/marton78/pfft/blob/master/LICENSE.txt>

10.4.14 pybind11

<https://github.com/pybind/pybind11/blob/master/LICENSE>

10.4.15 rtaudio

<https://github.com/thestk/rtaudio/blob/master/LICENSE>

10.4.16 rtmidi

<https://github.com/thestk/rtmidi/blob/master/LICENSE>

10.4.17 concurrentqueue - Simplified BSD

<https://github.com/cameron314/concurrentqueue/blob/master/LICENSE.md> copyright (c) 2013-2016, Cameron Desrochers. All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.”

10.4.18 readerwriterqueue - Simplified BSD

<https://github.com/cameron314/readerwriterqueue/blob/master/LICENSE.md> Copyright (c) 2013-2021, Cameron Desrochers

All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.”

10.4.19 assimp

<https://github.com/assimp/assimp/blob/master/LICENSE> Copyright (c) 2006-2021, assimp team All rights reserved.

Redistribution and use of this software in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of the assimp team, nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission of the assimp team.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.”

10.4.20 enet - MIT

<https://github.com/lsalzman/enet/blob/master/LICENSE>

10.4.21 fmt

<https://github.com/fmtlib/fmt/blob/master/LICENSE.rst> Copyright notice Copyright (c) 2012 - present, Victor Zverovich and {fmt} contributors

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.22 functions (Erik Rigtorp) - MIT

<https://github.com/rigtorp/Function/blob/master/LICENSE>

10.4.23 inplace_function - BSL-1.0

10.4.24 gtest - ” BSD 3-Clause “New” or “Revised” ”

<https://github.com/google/googletest/blob/main/LICENSE>

10.4.25 jsoncpp - MIT

<https://github.com/open-source-parsers/jsoncpp/blob/master/LICENSE> Copyright (c) 2007-2010 Baptiste Lepilleur and The JsonCpp Authors

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.26 libcurl - MIT like

<https://curl.se/docs/copyright.html> Copyright (c) 1996 - 2024, Daniel Stenberg, daniel@haxx.se, and many contributors, see the THANKS file.

All rights reserved.

Permission to use, copy, modify, and distribute this software for any purpose with or without fee is hereby granted, provided that the above copyright notice and this permission notice appear in all copies.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT OF THIRD PARTY RIGHTS. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.

Except as contained in this notice, the name of a copyright holder shall not be used in advertising or otherwise to promote the sale, use or other dealings in this Software without prior written authorization of the copyright holder.”

10.4.27 magic_enum - MIT

https://github.com/Neargye/magic_enum/blob/master/LICENSE Copyright (c) 2019 - 2024 Daniil Goncharov

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.28 nanobench - MIT

<https://github.com/martinus/nanobench/blob/master/LICENSE>) Copyright (c) 2019-2023 Martin Leitner-Ankerl

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.29 nlohmann_json - MIT

<https://github.com/nlohmann/json/blob/develop/LICENSE.MIT> Copyright (c) 2013-2022 Niels Lohmann

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.30 openddl - MIT

<https://github.com/EricLengyel/OpenDDL/blob/main/LICENSE> Copyright (c) 1999-2022 Eric Lengyel

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.31 openvr - " BSD 3-Clause "New" or "Revised" "

<https://github.com/ValveSoftware/openvr/blob/master/LICENSE> Copyright (c) 2015, Valve Corporation All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

1. Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
2. Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
3. Neither the name of the copyright holder nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS "AS IS" AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT HOLDER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES - LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE."

10.4.32 poly2tri - " BSD 3-Clause "New" or "Revised" "

<https://github.com/jhasse/poly2tri/blob/master/LICENSE> Copyright (c) 2009-2018, Poly2Tri Contributors All rights reserved.

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.
- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.

- Neither the name of Poly2Tri nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.”

10.4.33 pugixml - MIT

<https://github.com/zeux/pugixml/blob/master/LICENSE.md> Copyright (c) 2006-2024 Arseny Kapoulkine

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.34 rapidjson - MIT

<https://github.com/Tencent/rapidjson/blob/master/license.txt> - “Terms of the MIT License:

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software. THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.35 shared_recursive_mutex - MIT

https://github.com/KonanM/shared_recursive_mutex/blob/master/LICENSE Copyright (c) 2019 konanM

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.36 sentry-native - MIT

<https://github.com/getsentry/sentry-native/blob/master/LICENSE> Copyright (c) 2019 Sentry (<https://sentry.io>) and individual contributors. All rights reserved.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.37 sqlite3 - Public Domain

<https://www.sqlite.org/copyright.html>

10.4.38 sqlite_orm - MIT

https://github.com/fnc12/sqlite_orm/blob/master/COMM-LICENSE Copyright (c) 2012-2023 Eugene Zakharov and others

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.39 stb - MIT

<https://github.com/nothings/stb/blob/master/LICENSE> Copyright (c) 2017 Sean Barrett Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions: The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software. THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.40 utfcpp - BSL-1.0

<https://github.com/nemtrif/utfcpp/blob/master/LICENSE> “Boost Software License - Version 1.0 - August 17th, 2003

Permission is hereby granted, free of charge, to any person or organization obtaining a copy of the software and accompanying documentation covered by this license (the “Software”) to use, reproduce, display, distribute, execute, and transmit the Software, and to prepare derivative works of the Software, and to permit third-parties to whom the Software is furnished to do so, all subject to the following:

The copyright notices in the Software and this entire statement, including the above license grant, this restriction and the following disclaimer, must be included in all copies of the Software, in whole or in part, and all derivative works of the Software, unless such copies or derivative works are solely in the form of machine-executable object code generated by a source language processor.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, TITLE AND NON-INFRINGEMENT. IN NO EVENT SHALL THE COPYRIGHT HOLDERS OR ANYONE DISTRIBUTING THE SOFTWARE BE LIABLE FOR ANY DAMAGES OR OTHER LIABILITY, WHETHER IN CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.41 unqlite - BSD 2-clause

<https://github.com/symisc/unqlite/blob/master/LICENSE> ” * Copyright (C) 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019 Symisc Systems, S.U.A.R.L [M.I.A.G Mrad Chems Eddine chm@symisc.net]. * All rights reserved. Redistribution and use in source and binary forms, with or without * modification, are permitted provided that the following conditions * are met: * 1. Redistributions of source code must retain the above copyright * notice, this list of conditions and the following disclaimer. * 2. Redistributions in binary form must reproduce the above copyright * notice, this list of conditions and the following disclaimer in the * documentation and/or other materials provided with the distribution. THIS SOFTWARE IS PROVIDED BY SYMISC SYSTEMS “AS IS” AND ANY EXPRESS * OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED * WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, OR * NON-INFRINGEMENT, ARE DISCLAIMED. IN NO EVENT SHALL SYMISC SYSTEMS * BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR * CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF * SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS - OR * BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, * WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE * OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN * IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.” 3rd Party Open Source Python Modules - - - -

10.4.42 argh (Andrey Mikhaylenko) - LGPLv3

<https://pypi.org/project/argh/>

10.4.43 chardet (Mark Pilgrim, Daniel Blanchard) - LGPL v2.1

<https://github.com/chardet/chardet/blob/main/LICENSE>

10.4.44 charset_normalizer - MIT

https://github.com/Ousret/charset_normalizer/blob/master/LICENSE Copyright (c) 2019 TAHRI Ahmed R.

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.45 docopt (Vladimir Keleshev) - MIT

<https://github.com/docopt/docopt/blob/master/LICENSE-MIT> Copyright (c) 2012 Vladimir Keleshev, vladimir@keleshev.com

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the “Software”), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED “AS IS”, WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.”

10.4.46 dotenv - “BSD 3-Clause” “New” or “Revised”

<https://github.com/theskumar/python-dotenv/blob/main/LICENSE> Copyright (c) 2014, Saurabh Kumar (python-dotenv), 2013, Ted Tieken (django-dotenv-rw), 2013, Jacob Kaplan-Moss (django-dotenv)

Redistribution and use in source and binary forms, with or without modification, are permitted provided that the following conditions are met:

- Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimer.

- Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimer in the documentation and/or other materials provided with the distribution.
- Neither the name of django-dotenv nor the names of its contributors may be used to endorse or promote products derived from this software without specific prior written permission.

THIS SOFTWARE IS PROVIDED BY THE COPYRIGHT HOLDERS AND CONTRIBUTORS “AS IS” AND ANY EXPRESS OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE DISCLAIMED. IN NO EVENT SHALL THE COPYRIGHT OWNER OR CONTRIBUTORS BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, SPECIAL, EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT NOT LIMITED TO, PROCUREMENT OF SUBSTITUTE GOODS OR SERVICES ; LOSS OF USE, DATA, OR PROFITS ; OR BUSINESS INTERRUPTION) HOWEVER CAUSED AND ON ANY THEORY OF LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY, OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.”

11 Specifications

11.1 Availability

IRCAM Verb is available in:

AU / VST / VST3 / AAX Native/ *AAX AudioSuite*

** AAX Native & AAX AudioSuite in Pro Tools 11 and later*

11.2 Processing

IRCAM Verb provides :

- Up to 16 channels Input/Output in VST/VST3/AU/AAX.
- 64-bits internal floating point processing.
- Sampling rate up to 384 kHz.

11.3 Hardware Requirements

A graphic card fully supporting OpenGL 2.0 is required.

- macOS : OpenGL 2.0 required – Mac Pro 1.1 & Mac Pro 2.1 are not supported.
- Windows : If your computer has an ATi or NVidia graphics card, please assure the latest graphic drivers from the ATi or NVidia website are installed.

11.4 Software License Requirements

In order to use the software an iLok.com user account is required (the iLok USB Smart Key is not required).

11.5 Compatibility

All major native formats are supported

11.5.1 Windows – 10, in 64 bits only.

- VST (2.4)
- VST3 (3.1)
- AAX Native*
- AAX AudioSuite*

11.5.2 macOS (Intel and ARM)

All versions from Sierra (10.12) to latest. (Compatible with previous versions but not supported)

- VST (2.4)
- VST3 (3.1)
- AU
- AAX Native*
- AAX AudioSuite*

* *AAX Native & AAX AudioSuite in Pro Tools 11 and later*

A Release Notes

A.1 Build 24.07.0.50393 - All plugins

A.1.1 New Features

- VST3 automation state on UI

A.1.2 Improvements

- EVO EQ - Dark mode update

A.1.3 Bugs

- All plugins - VST3 - GUI freeze when reloading a session in Studio One
- All plugins - VST3 - Wrong parameters frequencies when reloading session at 44.1KHz
- All plugins - crash when loading a StudioOne session
- All plugins AAX - Crash protocols when using the protocols plugin preset manager on Windows
- EVO Channel/Touch and BS Pro - Presets have to be loaded twice to apply the filter values from the Touch section properly
- Elixir - Latency not properly compensated after changing stage parameters value in VST and AudioUnit
- Elixir - VST - May crash or bypass the audio when reloading a previous session in Nuendo
- Evo Channel - GUI issues on Geek panel
- Evo Channel/Evo EQ - Bad init on the lowpass filter cut off frequency
- HEar - Failed to load HRTF message in Logic until audio playback
- Verb and VerbSession - VST3 - Freeze during Steinberg TestHost on Windows

A.1.4 Known Issues

Important

- All plugins - AU - Crash in Logic 10.5 on MacOS Mojave

- All plugins - AU - Sidechain not available
- All plugins - VST versions - GUI issue in Izotope Ozone and Davinci Resolve
- Elixir - VST3 - Elixir is not available as 32 channels (24 max) in Reaper
- HEar - AU - Crashes Ableton
- HEar - Do not work properly with Ambisonic streams
- Trax - Ran out of CPU error and playback issue in Protools
- Verb - AAX - Moving any temporal parameter mute audio and generate noisy artefacts
- Verb - HOA 3rd order not working properly

Host Specific

- All plugins - VST2 - GUI cropped in TwistedWave
- All plugins - VST3 - Do not process the audio in TwistedWave
- EVO EQ - AAX-DSP - Not listed in DSP plugins list
- EVO Series - AAX DSP - No metering
- Evo Channel/Evo EQ - AudioUnit - LPF cut off frequency badly initialized when samplerate is 2FS or more
- StereoTool - AAX DSP - No metering

A.2 Build 24.06.0.50386 - All plugins

A.2.1 Improvements

- All plugins - Preset manager filter options updated
- All plugins - Preset recall button improved
- All plugins - Preset save button improved

A.2.2 Bugs

- AAX - Preset manager - Default preset is not applied to parameters at plugin instantiation
- All plugins - AAX bad GUI recall with user scale x2 and display scale x2
- All plugins - AU - auval real time safety checks
- All plugins - All parameters are reset when reloading a session when using presets
- All plugins - GUI issue on Windows
- All plugins - GUI issue with Retina in FLStudio
- All plugins - Mouse wheel not working anymore on knobs
- All plugins - Parameters are reset when deactivating/reactivating the plugin in Protools
- All plugins - Parameters are reset when loading a session if a preset is used
- All plugins - Preset manager font issues
- All plugins - VST3 - Keys not working in Pyramix

- All plugins - VST3 - Meters not working in Adobe premiere Pro, Adobe audition, Isotope RX10 and Waves Studio Rack
- All plugins - VST3 - preset name back reset to default when loading a session
- All plugins - VST3 - Can't edit values using keyboard on Windows
- All plugins - mouse wheel + shift key increase controls value when scroll down
- All plugins - AAX - Crash protocols when using the protocols plugin preset manager on Windows
- All plugins - VST3 - crash plugin scan when OSC enabled in prefs
- EVO Channel - Dark mode display issue when closing/opening the plugin
- EVO Channel - custom preset does not load some parameters
- EVO In - Phase shift amount automation line display issue in Logic
- EVO Series - Display issues on some parameters values
- EVO Series - Missing controls text
- EVO Series - Save button from preset manager not working
- EVO Series - save/recall/copy A & B preset buttons from main window not working
- EVO Series - wrong RMS reference value initialisation
- Elixir 1-Stage - GUI broken
- EvoEq - very low noise generated when offline rendering (32bit FP)
- HEar - AudioUnit - Crashes validation in Logic
- Preset Manager - Refresh missing - Preset name still displayed as current preset after being deleted.
- Solera - VST3 on Windows - DExp tab selected as default
- StereoTool - Correlation phase meter is wrong when quality setting set at 60fps
- StudioSession Plugins - May fail to scan in logic
- StudioSession Plugins - loads without the limitations
- Trax - VST3 - Learn feature not working
- VST3 - Some plugins are blacklisted in Cubase 13 on Windows
- VST3 - Conformity report
- VST3 - Display quality (15/30/60Hz) always reverts to initialized value
- VST3 - Verb & VerbSession - Crash in VST3 test host unit test
- VST3 - presets slots values are not correctly recalled when a session is saved after using morphing
- Verb - AAX - Matrix not reloaded on atmos 9.1.4 tracks
- Verb - Does not load the saved multichannel layout
- Verb - Multichannel layout not automatically set in Logic
- Verb - When in High Density, the dry signal is output
- Verb Session - AAX - GUI issue in HiDPI on Windows

A.2.3 Known Issues

Important

- All plugins - AU - Crash in Logic 10.5 on MacOS Mojave
- All plugins - VST2 - GUI cropped in TwistedWave
- All plugins - VST3 - Do not process the audio in TwistedWave
- All plugins VST versions- GUI issue in Izotope Ozone and Davinci Resolve
- Elixir - Latency not properly compensated after changing stage parameters value in VST and AudioUnit
- Elixir - Reaper - VST3 - Elixir is not available as 32 channels (24 max)
- Evo Channel/Evo EQ - All formats -Bad init on the lowpass filter cut off frequency
- HEar - AU - Crashes Ableton
- HEar - Do not work properly with Ambisonic streams
- HEar - Failed to load HRTF message in Logic until audio playback
- Trax - Ran out of CPU error and playback issue in Protools
- Verb - AAX - Moving any temporal parameter mute audio and generate noisy artefacts
- Verb - HOA 3rd order not working properly

A.3 Build 23.07.50310 - All plugins

A.3.1 New features

- Support Pro Tools new track formats

A.3.2 Bugs fixes

- All plugins - Nuendo - VST3 - crash when stereo plugins are instantiated on multichannel tracks (StereoTools, ...)
- All plugins - Pace protected plugins fail to scan on Da Vinci Resolve mac
- All plugins - Popups wrong metrics when changing screen
- All plugins - Presets not imported
- All plugins - VST3 - Nuendo - WIN (UHD360) - Wrong window size init
- All plugins - VST3 - WIN (UHD630) - REAPER - GUI refresh issue when in single window mode
- All plugins - GUI issue with AMD graphics on windows - flickering issue
- All plugins - AU - Plugins parameters are reset when bouncing in Reaper
- All plugins - VST2 - no multichannel with the plugins 23.X in Reaper
- All plugins - VST - Resizing the GUI does not update the floating window size in Nuendo on Windows with UHD630 graphics
- Bittersweet - VST3 - crashes on Pyramix on instantiation
- StereoTool / EVO Channel - VST3 - No goniometer / analyzer in Wavelab
- Elixir - Not available as 32 channels in Reaper
- EVO series - AAX - Dark Mode wrong GUI init

- EVO series - remove unused and duplicated presets
- EVO Channel - VST3 - spectrum smoothing slider crashes Studio one
- EVO Channel / EVO Eq - VST3 - Analyzer not working in Ableton Live
- EVO Channel / EVO Eq - scale eq control always reload on auto mode
- EVO Eq - weird release on meter
- EVO In - GUI refresh issue when toggling night/day mode
- EVO Touch - Zero Crossing Threshold label missing in the geek panel
- EVO Touch - frequency band selector does not always recall the good settings on session reload
- EVO Touch/ EVO Channel - Frequency range slider is hard to handle
- Pure Serie - VST3 - Attack value max 80ms
- Pure Comp - Crash when loading “Bass guitar” preset
- Pure Limiter - VST3 - advanced mode does not turn on advanced settings
- StereoTool - VST3 - vector scope not working in Ableton Live on Windows
- StereoTool - Not working in Final Cut Pro
- TRAX - Crash using oversampling with sessions set at 2FS or higher
- TRAX Tr - not usable in Protools anymore (build 50123)

A.3.3 Known issues

- All plugins - VST - GUI issue in Izotope Ozone and RX
- All plugins - AAX - Preset manager - Default preset is not applied to parameters at plugin instantiation
- Elixir - Latency not properly compensated after changing stage parameters value in VST and AudioUnit
- TRAX tr - Learn function returning wrong values
- VerbV3 - HOA 3rd order not working properly

A.4 Build 23.1.0.50251 - All plugins

A.4.1 New features

- New plugins Evo Compressor, Evo Touch and Evo EQ.
- VST3 support
- ARM support for AAX, AU and VST3
- Plugins are now resizable
- Elixir now supports 32 channels
- Alchemist, BitterSweet, Epure, Pure Compressor, Pure DCompressor, Pure Expander, Pure DExpander, PureLimiter, Solera, Syrah now support 16 channels

A.4.2 Bugs fixes

- All plugins - Preset Manager - Update user preset do not work
- All plugins - Preset manager - Crash or freeze when saving a preset
- All plugins - UI may be black on Intel UHD 630 graphical cards
- All plugins - AU/VST3 - Preset manager - Default preset is not applied to parameters at plugin instantiation
- All plugins - AAX - Crash with OSC when changing fx slot in Pro Tools
- All plugins - AU - Logic Pro - Automation of boolean/integer parameters broken
- All plugins - AU - Plugins crash in Da Vinci Resolve
- All plugins - DaVinci Resolve - VST - UI is truncated
- All plugins - Streamlabs - Plugins do not work
- All plugins - Licensing issue in DaVinci Resolve and GarageBand
- Alchemist - The range parameter works only for the 1st band
- BitterSweet - Not possible to tweak the Output gain after unlinking it
- BitterSweet - Output gain not reloaded properly when the link is disabled
- BSPro - some modes are not accessible due to GUI issue
- Epure - macOS - Bad graphic scale initialization at 2&4FS
- Evo Channel - Meter reference is not saved
- Syrah - Crash when selecting preset “Static fast compression”
- TRAX Tr - When the link is activated, the Formant slider does not have the expected audio effect
- TRAX Tr - ProTools - Issue in AudioStudio when the modulation is enabled
- VerbSession/VerbSession Studio Session and BSPro StudioSession - Pyramix - VST crash when instantiated
- Verb/Verb Studio Session - Crash when reloading session having 2 instances

A.4.3 Known issues

- All plugins - VST - GUI issue in Izotope Ozone and RX
- All plugins - AAX - Preset manager - Default preset is not applied to parameters at plugin instantiation
- Elixir - Latency not properly compensated after changing stage parameters value in VST and AudioUnit
- TRAX tr - Learn function returning wrong values
- VerbV3 - HOA 3rd order not working properly

A.5 Build 21.12.0.50123 - All plugins except TRAX and StudioSession

Bug fixes

- All plugins AudioUnit - GUI issue with Hdpi displays on macOS Monterey
- All plugins VST - Plugin scan freeze in Wavelab 11 on Mac M1 machines
- All plugins VST - Crash in Adobe Audition on macOS
- All plugins VST macOS - Fix crashes with Ableton live
- Elixir - Automation is not read for toggle parameters.
- Elixir - Crash when clicking on the settings button on Session version
- Elixir - Several fixes on the UI
- Elixir - Windows AAX - Refresh issue with two instances in ProTools
- HEar - Bypass is working in AAX
- HEar AAX - Crash when doing offline bounce on macOS
- HEar AAX - Crash when editing the matrix on macOS
- HEar AAX - Stereo - Change on Matrix are not applied until we change the preset
- HEar AudioUnit - Ableton crashes when inserting a second instance

A.6 Build 21.11.0.50107 (HEar, IRCAM Verb)

NOTE: CURRENTLY NOT COMPLIANT WITH ABLETON LIVE MACOS

Improvement

- HEar - 5.1.4 & 5.0.4 now available

Bug fixes

- HEar - Fix meters refresh issue
- HEar - No verb on some presets
- HEar - Protools crashes when doing offline bounce on macOS

A.7 FLUX:: Immersive - Plugins (including IRCAM Tools) 21.09

This release includes updates for all FLUX::Immersive plugin processing products with the exception of EVO Channel, Epure, IRCAM Trax, Studio Session.

NOTE: CURRENTLY NOT COMPLIANT WITH ABLETON LIVE MACOS

Major optimizations

- Apple computers Big Sur (new M1 chips) AU validation
- Important updates to the Ircam Verb + Session
- Overall better handling of multichannel track setups such for Atmos. (Ircam Hear, Verb and more)
- Automatic detection of track format / channel order for DAWs when possible.

A.7.1 Build 21.9.0.50083

Bug fixes

- Apple computers Big Sur (new M1 chips) AU validation failing
- Empty GUI when close/reopen plugin - Windows 10 - UHD630 graphics
- AudioUnit in Reaper - do not process audio when offline bounce
- Default preset not loaded correctly on instantiation of Verb + Verb Session
- Evo.Channel on Retina - Input and Output Sliders badly scaled
- Incompatible AudioUnit issue in Apple Final Cut Pro
- Plugins: Recall Preset Flags (e.g. “All but setup”) recall always everything
- Preset Manager - UI issue with small plugins when a preset has been created
- Ircam Verb Session reload in VST with audio interruption

- VST Plugins Session not correctly reloaded if it integrate an IO configuration change
- Verb session - Dry/wet not applied in offline render
- Verb v3 Atmos crash on AAX
- Verb: AU validation failed on Apple M1
- Verb: LFE not disabled by default on ProTools
- Verb: Recall Preset may be not correct with double click inside the preset manager
- Verb: disabled channel is not re-injected according to dry/wet parameter (100 % wet means muted)
- Verb: init issue with Nuendo
- AAX - Some plugins - Crash on Mac / No GUI on Windows
- Overall reliability / stability fixes.
- Plugin size not correct
- Potential plugins crash when opening UI

A.8 FLUX:: Immersive - Plugins (including IRCAM Tools) 20.12

This major release includes updates for all **FLUX::Immersive** products with the exception of IRCAM Spat V3 legacy product. Please refer to Spat V3 - Spat Revolution crossgrade options.

Major optimizations

- HiDPI / Retina support + display enhancements and fixes
- Page Table unification for **Avid Control**, S1, S3, S4, S6 and S6L.
- OSC Control for plugins.
- **IRCAM Verb** support for Dolby Atmos, Multichannel support up to 16 channels
- **IRCAM Hear** - Multichannel stability improvement, Now up to 10 channels. (Dolby Atmos 7.1.2)
- **IRCAM Tools** - Audio I/O Matrix and Multichannel enhancement
- Most plugins support of 8 channel.
- 16 channel support for **Bittersweet Pro, Evo In and Evo Channel**

A.8.1 Build 20.12.0.49880

Bug fixes

Core:

- BPro - Latency report issue (AAX)
- IRCAM TRAX Tr - Latency report issue
- IRCAM Verb - Wrong initialization value for Reverb density
- IRCAM Verb -Dry signal still goes out in disabled channels when wet is 100%

- All Pure Dynamics PI + Alchemist - Wrong Thresholds initialization values
- AAX “monolithic” are broken like Hear, TRAX etc...
- Almost all AAX plugins don’t reload parameters from 47856 version session.
- Pure Limiter - Diff feature bypassed the input gain.
- Pure Limiter - Inverted sidechain filters.
- Any plugin except Evo Channel - Research Presets resets when click on a preset.
- Evo channel - Wrong values when reloading touch section.

UI:

- Current preset name disappear on re-opening GUI or session

A.9 Known Issues

- Wavelab “Sample rate not supported” when a plugin is inserted on a clip, track or output section.
- TRAX Tr - Learn frequencies display wrong values (AAX only).
- Hear - Internal config labels change when modify LFE input config from routing matrix.
- When using OSC on a plugin in Pro Tools, a chrash will occur if you change/move FX insert slots