

432 EVO is continuously searching for ways to improve the sound of it's award winning music servers.

We have looked deeper into our own DSP recipes, and found several ways to drastically improve the sound quality of the 432 EVO music server. We have decided to publish these improvements as a free software update.

The basics

Let's start with some 432 EVO basics. All 432 EVO music servers render any PCM file to 32 bit into the desired output resolution set by the 432 Hz plugin:

DAC Output resolution from 432 Hz plugin + recipe

32/192



Ultra High

This is set using the Configure Player form:

Configure Player

Name	MAC address	Audio output device
ZILVER		plughw:1,0

DAC Output resolution from 432 Hz plugin + recipe

32/192 Ultra H

Internal precision

1x = OUTPUT RESOLUTI

Base frequency for 432 Hz plugin:

440

Target frequency for plugin:

432

async buffer size:

256K

SQI force 24 bit output

Archimago's intermediate

Plugin calculating in

Disabled

Processing delay

Linear phase normal

Submit

Linear phase with slow roll

You can use up to 5 different built-in players with your Vortex

Linear phase high precision

and type in the device name, then press submit. A MAC will e

Minimum phase normal

The device for your player will depend on the hardware you h

Minimum phase high precis

hw:0,0 and the first USB device is usually hw:1,0. Your device

Time domain

determine what device to use.

Time domain high precision

To remove a player delete its name and press submit.

Archimago's intermediate p

ALSA device list

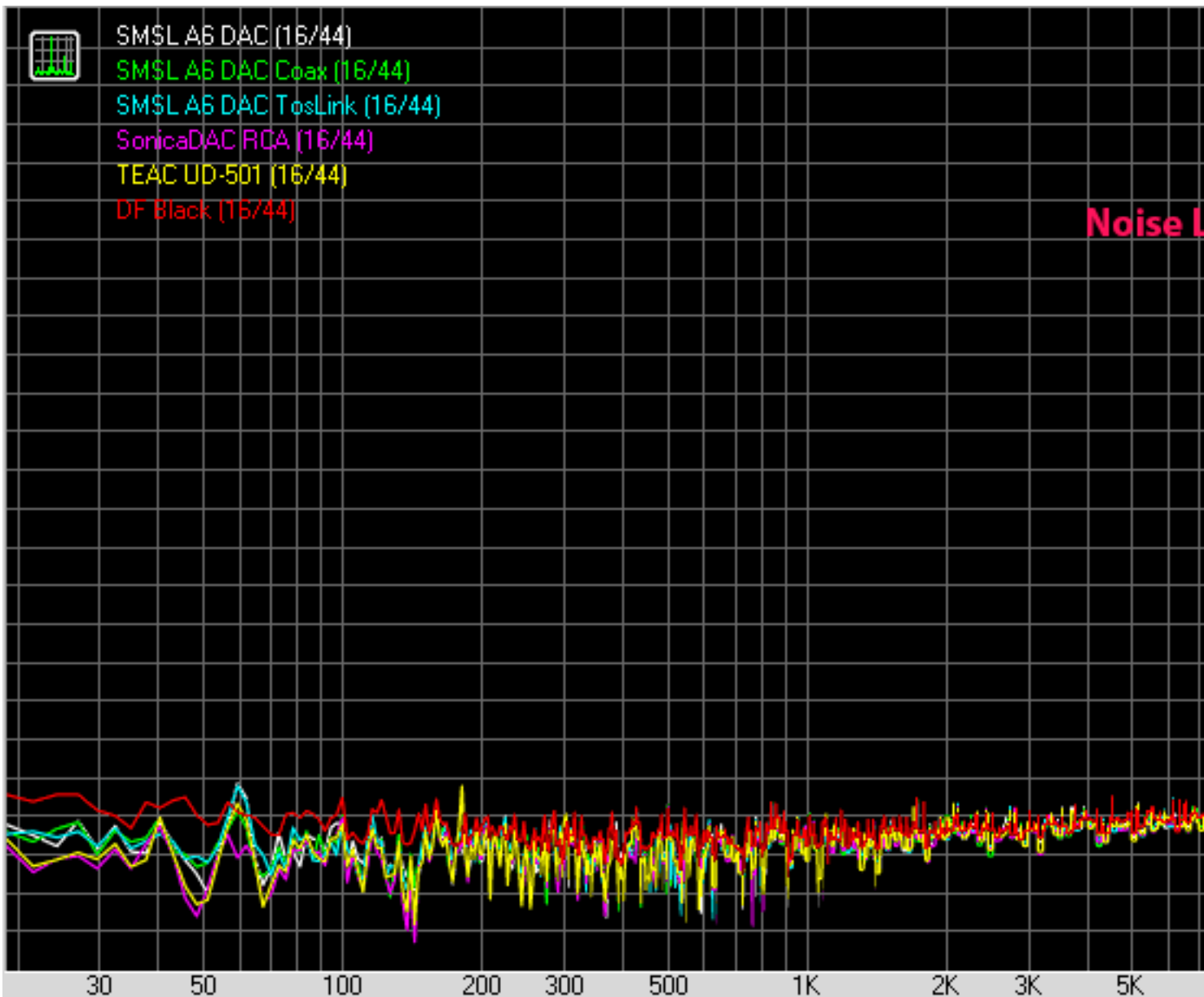
When you press the submit button, the MAC address will be generated and displayed. The device name will be displayed in the table above. The device name will be displayed in the table above. The device name will be displayed in the table above.

Sound Quality Improved

Thursday, 03 August 2017 15:47 - Last Updated Sunday, 14 January 2018 21:54



Upgrading your DAC can improve the sound quality of your system. The Brooklyn DAC+ is a high-quality DAC that can be connected to your LEEZ 432 EVO Reference Music Server. The DAC is a small, black, rectangular device with a silver front panel. It features a blue LED display showing '11' and a digital readout (DSD) display showing '32bit 192.0k' and 'USB'. The LEEZ server is a larger, black, rectangular device with a silver front panel and the text 'LEEZ 432 EVO REFERENCE MUSIC SERVER' visible. The DAC is plugged into the front of the server.



First solution: Less is more!



DAC Output resolution from 432 Hz plugin + recipe 32/352.8 Ultra High

Internal precision 1x = OUTPUT RESOLUTION

Base frequency for 432 Hz plugin: 440

Target frequency for plugin: 432

async buffer size: 256K

Deblur Disabled

Plugin calculating in Disabled

Processing delay Force 24 bit output

Submit

Force 24 bit output + temporal

The first variant (see the screenshot) does not work as intended. The DAC is stuck at 32 bit and 440 Hz. The second variant (see the screenshot) does not work as intended. The DAC is stuck at 32 bit and 440 Hz.

Second solution: 24 bit with tweaked filters including linear phase, minimum phase and intermediate phase!

DAC Output resolution from 432 Hz plugin + recipe	32/192 ▾	Ultra High
Internal precision	1x = OUTPUT RESOLUTION	
Base frequency for 432 Hz plugin:	440 ▾	
Target frequency for plugin:	432 ▾	
async buffer size:	256K ▾	
<u>SQi</u> force 24 bit output	Archimago's intermediate ph	
Plugin calculating in	Disabled	
Processing delay	Linear phase normal	
	Linear phase with slow rolloff	
	Linear phase high precision	
	Minimum phase normal	
	Minimum phase high precision	
	Time domain	
	Time domain high precision	
	Archimago's intermediate pha	

Submit

In Q4 2017, deblur was renamed to SQi, "Sound Quality improved", and more recipes were added.

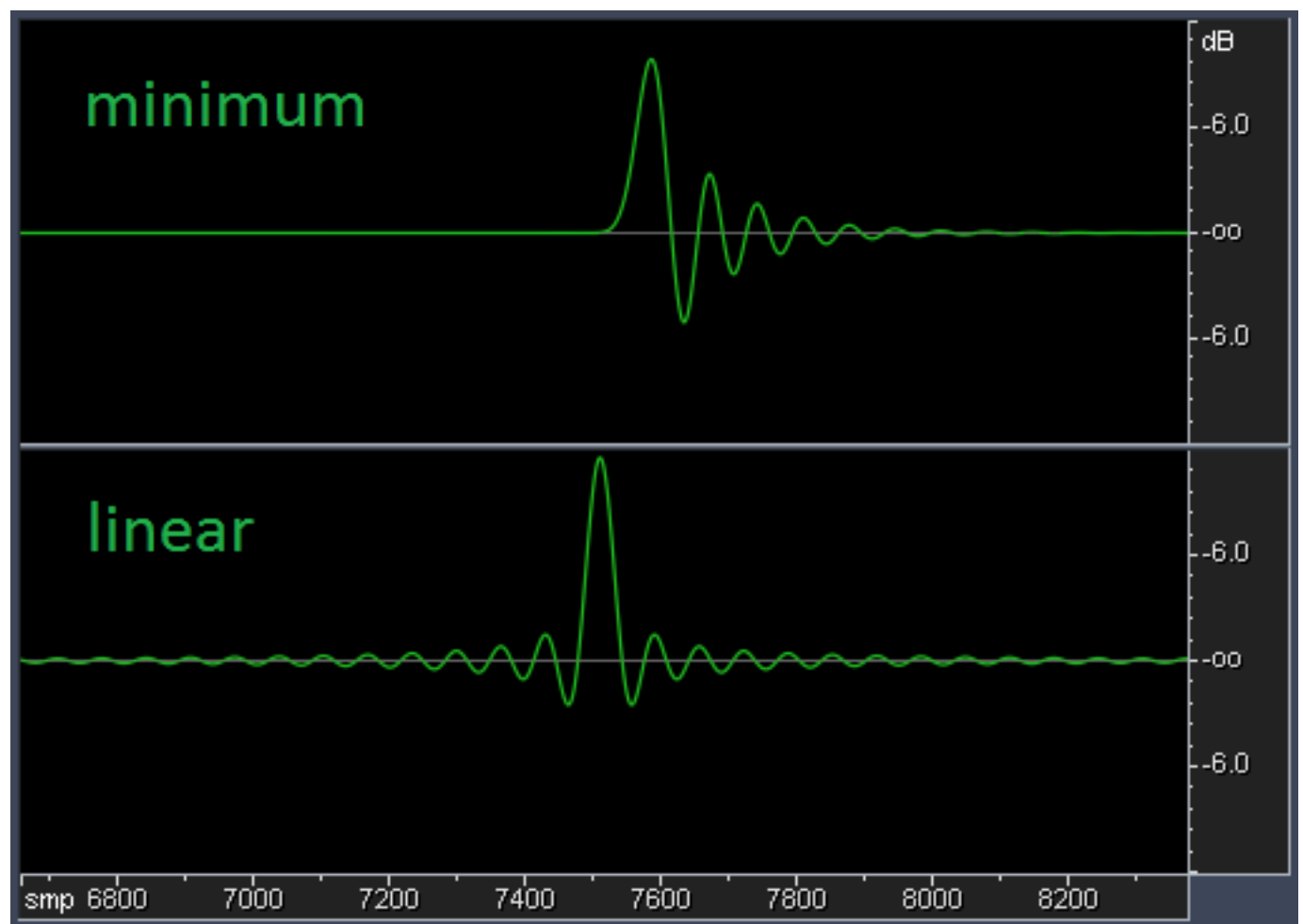
When you set the BASE and TARGET frequencies to 440, it acts as a high-end upsampler with much higher precision than what is available in most DAC's. When you set the TARGET to 432 or any other frequency such as 430.5, it will change the frequency of the A, based on speed shifting instead of pitch shifting, as pitch shifting sounds fake. Except for a very subtle tempo change, 432 EVO's 432 Hz method has no audible artefacts. This is all explained in our FAQ.

We now also offer the new A=430.5 target frequency endorsed by another company who also believes in C=256 Hz sounding better, but using a different tuning system so A becomes 430.5 Hz (scientific tuning) instead of 432 Hz (Pythagorean tuning). 432 EVO offers both tuning, and several variants such as A=444 (Horowitz tuning) and A=426.6 (Diatonic Scale Tuning).

The processing power of the 432 EVO allows any DSD input file up to DSD256, any PCM input file including 16/44.1 up to DXD and 24/384, to be output in any PCM output resolution your

DAC supports, in any support BASE,TARGET frequency pair, or with just upsampling (where both are set to 440), while keeping power consumption low and keeping the machine cool.

Linear phase vs minimum phase



To understand the SQi modes, we need to explain minimum phase vs linear phase first.

Our hearing is very sensitive to sounds before the actual transients. The default upsampler before SQi was offered uses linear phase. When a pulse is going through such upsampler, there will be ringing before and after the peak. This ringing will be symmetric, as all frequencies pass through the filter with the same delay. The fact that there's a signal before the actual transient results in subtle loss of dynamic range.

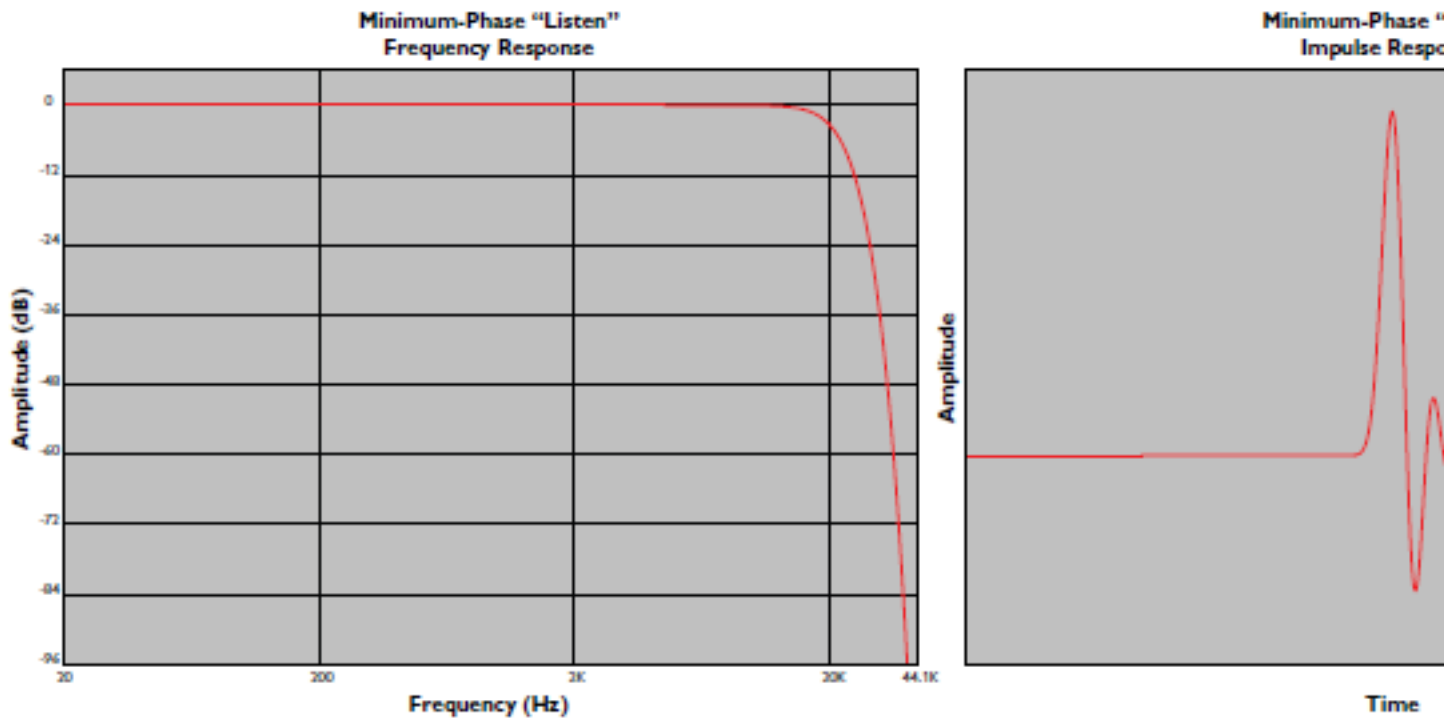
When using minimum phase, there will be no pre-ringing, and all ringing will be after the actual pulse. This post-ringing will be buried in the decay of instruments and reverb of the room. Our hearing is very sensitive to pre-ringing, but not post-ringing.

A special case: minimum phase with one cycle post-ringing

The above impulse response plots have long pre- and/or post-ringing tails. This is necessary, as the steeper the filter, the longer the ringing. A special variant exists, where one allows aliasing in the upsampler to create a very shallow filter. This filter [was already described in 2009 by Ayre](#). While 432 EVO does not use the exact filter Ayre has implemented, it has a very similar transient response as what both Ayre and MQA are implementing:

The Best of Both Worlds

While the "Apodizing" filter proposed by Craven solves many of the problems with digital filters, care conducted at Ayre showed that the multiple cycles of post-ringing still created an artificial brightness and confusion to the sound. We therefore sought to combine the best aspects of Craven's minimum-phase proposal with a slower roll-off that reduced the overall amount of ringing.

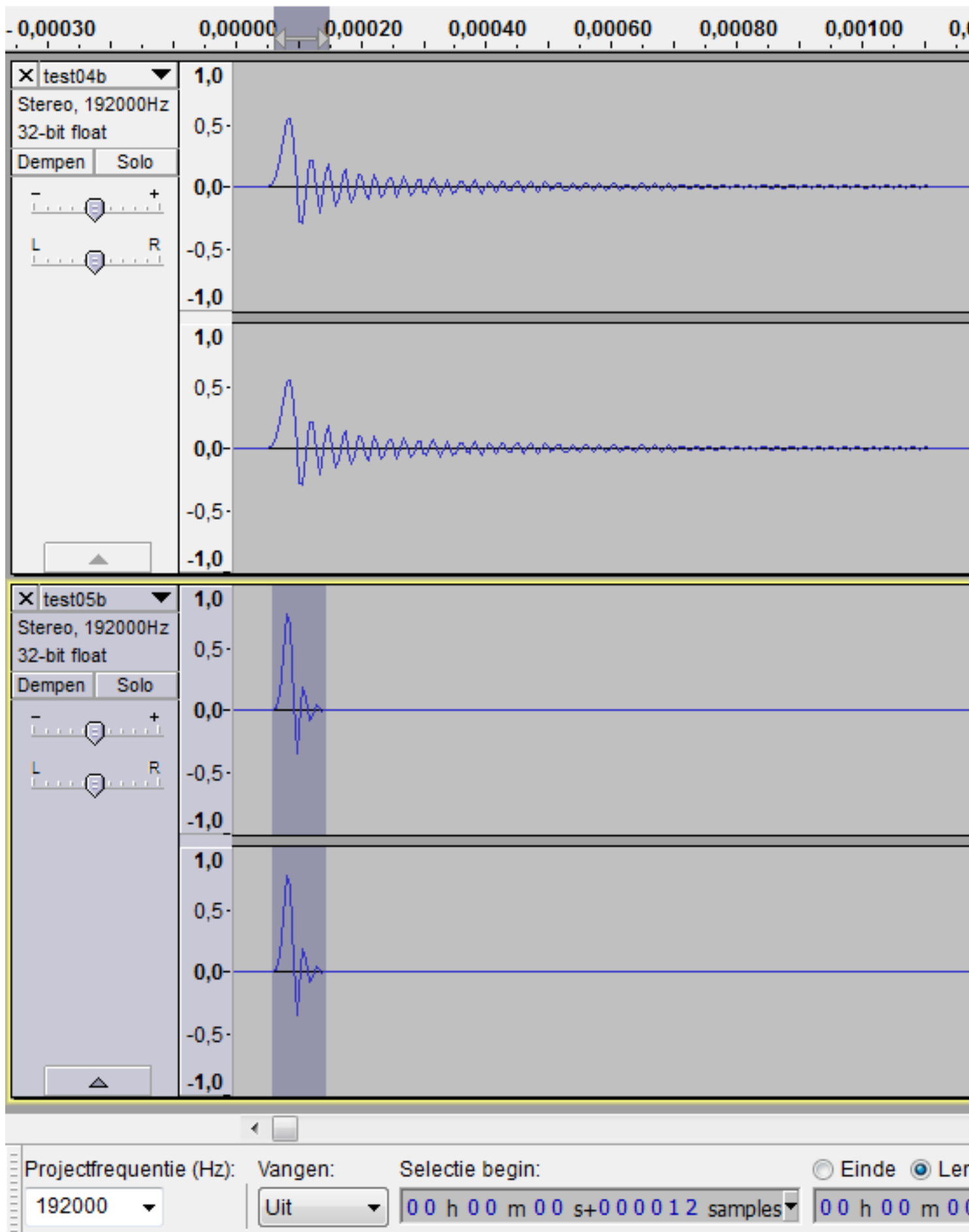


"Slow Roll-Off" Digital Filter, -6 dB at 22,050 Hz, No Pre-Ringing, ~1 Cycle of Post-Ringing

Imaging (a) Ayre's "Listen" and "Impulse" responses are fair use

Sound Quality Improved

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~~FWIW, I don't think the "v" recipe is the best, but it's a good starting point. I think the "v" recipe is the best, but it's a good starting point. I think the "v" recipe is the best, but it's a good starting point.~~

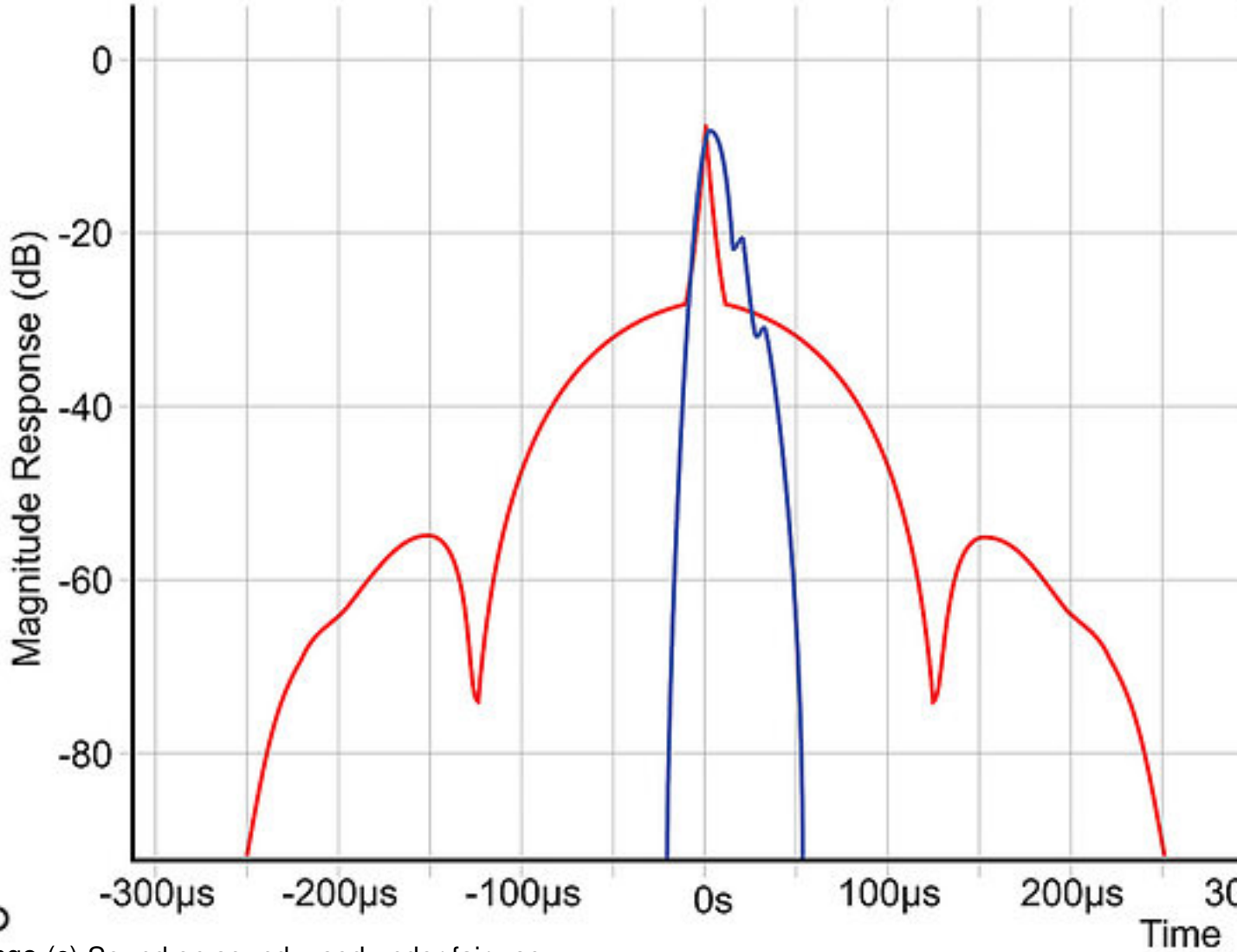


Image (c) Sound on sound, used under fair use.

All the modes explained

SQI Disabled

This is the default mode since 2013, where we render in 32 bit and leave the 32 bits as-is to the DAC, which typically throws away 8 bits.

When using very high, this is based on the "v" recipe of the SoX resampler.

When using ultra high, this is based on sox's libsamplerate emulation for libsamplerate's "best sinc", which is very efficient code.

DAC Output resolution from 432 Hz plugin + recipe	32/192	Ultra Hig
Internal precision	1x = OUTPUT RES	Ultra Hig
Base frequency for 432 Hz plugin:	440	Very Hig

We prefer Very High instead of Very High as the SoX "v" recipe can sometimes sound a little

SQi Linear phase normal

This uses the same resampler as SQi disabled, but with 24 bit output instead of 32 bit. So this uses the first pillar on which SQi is based: less is more.

SQi Linear phase with slow rolloff

Similar to **linear phase normal**, but with a less steep filter. Our preferred linear phase filter.

SQi Linear phase high precision

Similar to linear phase normal, with steep filter, and forced internal 28 bit precision. An alternative to linear phase normal.

SQi Minimum phase

Our standard minimum phase filter, without aliasing and no pre-ringing.

SQi Minimum phase high precision

Our standard minimum phase filter, without aliasing and no pre-ringing and forced internal 28 bit precision.

SQi Time domain

Minimum phase filter, with excellent time domain impulse response, but at the cost of aliasing and ringing. This will make certain instruments more tight, but may lose some depth and decay, as the post-ringing is shortened. Can be fun with electronic music and EDM. Makes the bass kick more.

SQi Time domain high precision

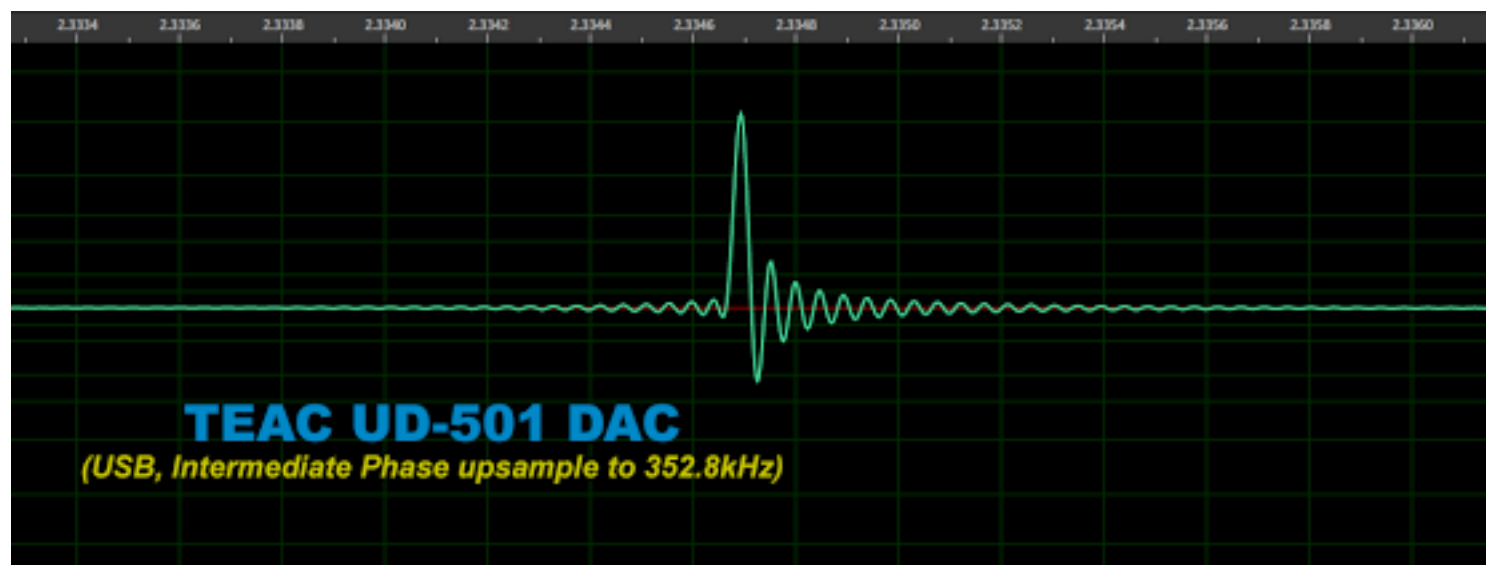
Same as Time Domain but with forced 28 bit internal precision.

SQi Archimago Intermediate Phase

This filter is none of the above, and tries to be the best of everything. This filter has partial pre-ringing.

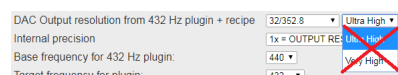
[technical discussion here](#)

[Full](#)



This filter has 28 bits of internal precision, and always forces the "v" = "Very high" recipe of the SoX resampler.

All the Archimago based filters ignore the setting for recipe, and override them manually:



SQi Archimago imp + evo stage 1

This is 432 EVO's version of the filter, tweaked to have more soundstage. Based on sox "v" = "Very high" recipe.

SQi Archimago imp + evo stage 2

This is 432 EVO's version of the filter, tweaked to have more soundstage. Based on libsamplerate emulation (aka recipe = Ultra High).

And what about internal precision?

DAC Output resolution from 432 Hz plugin + recipe: 32/192 Very Hi

Internal precision

Base frequency for 432 Hz plugin:

Target frequency for plugin:

async buffer size:

SQi force 24 bit output

1x = OUTPUT RESOLUTION

2x

4x

8x

Linear phase normal

To use SQi , we do not recommend to use internal precision set to 2x or higher. Set it to 1x!

So suppose you have a 24/96 dac and you would set DAC output resolution to 32/96 and internal precision to 4x, it would tell the player to upsample to 32/384 (combined with 432 Hz processing if "From:" was set to 440 and "To:" set to 432), and at the end of the processing chain, it would downsample it back to 32/96. This way the 432 Hz plugin would have more precision, but this theory is no longer supported for 24/192 and higher DAC's.

Internal precision actually renders to a virtual soundcard with 2x, 4x or 8x the resolution of the actual wanted DAC resolution, and at the end it downsamples it back to the set DAC resolution using a very high quality sox recipe. This was invented to have more precision for older DAC's

limited to 16/48, 24/96 ... and is no longer recommended when using SQi.

So the optimal value when using Sqi is 1x for internal precision:

Internal precision	1x = OUTPUT RESOLUTION
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When changing the filters, just press the submit button on the Configure Player form, and the player will restart the current song. When using Roon, the zone will reappear immediately, but you may press the play button in the Roon app to continue playing. When reloading the player config, Roon will pause the player.

In Munich we demonstrated the 432 EVO in 440 mode, with SQi active:



432 Hz processing and MQA?

MQA is not compatible with any vendor selling DSP solutions including room correction, crossfade, digital equi, bass management. With MQA you get the right to listen to an approximation of the studiomaster, but you'll never get the actual PCM data that the master engineer was working on. As the process is lossy, the original PCM that was used in the studio is never transferred via an MQA distribution file. The [Chaos Computer Club](#) has a good presentation on these issues. MQA will never allow us access to the first + second unfold to run our 432 Hz processing on top of that. Brian Lucey is a Grammy award winning engineer, who has also found MQA t

[o sound different from his own masterings.](#)

Furthermore he found his masterings to be encoded into MQA without permission. So MQA's policies are questionable to say the least.

But there is a way around.

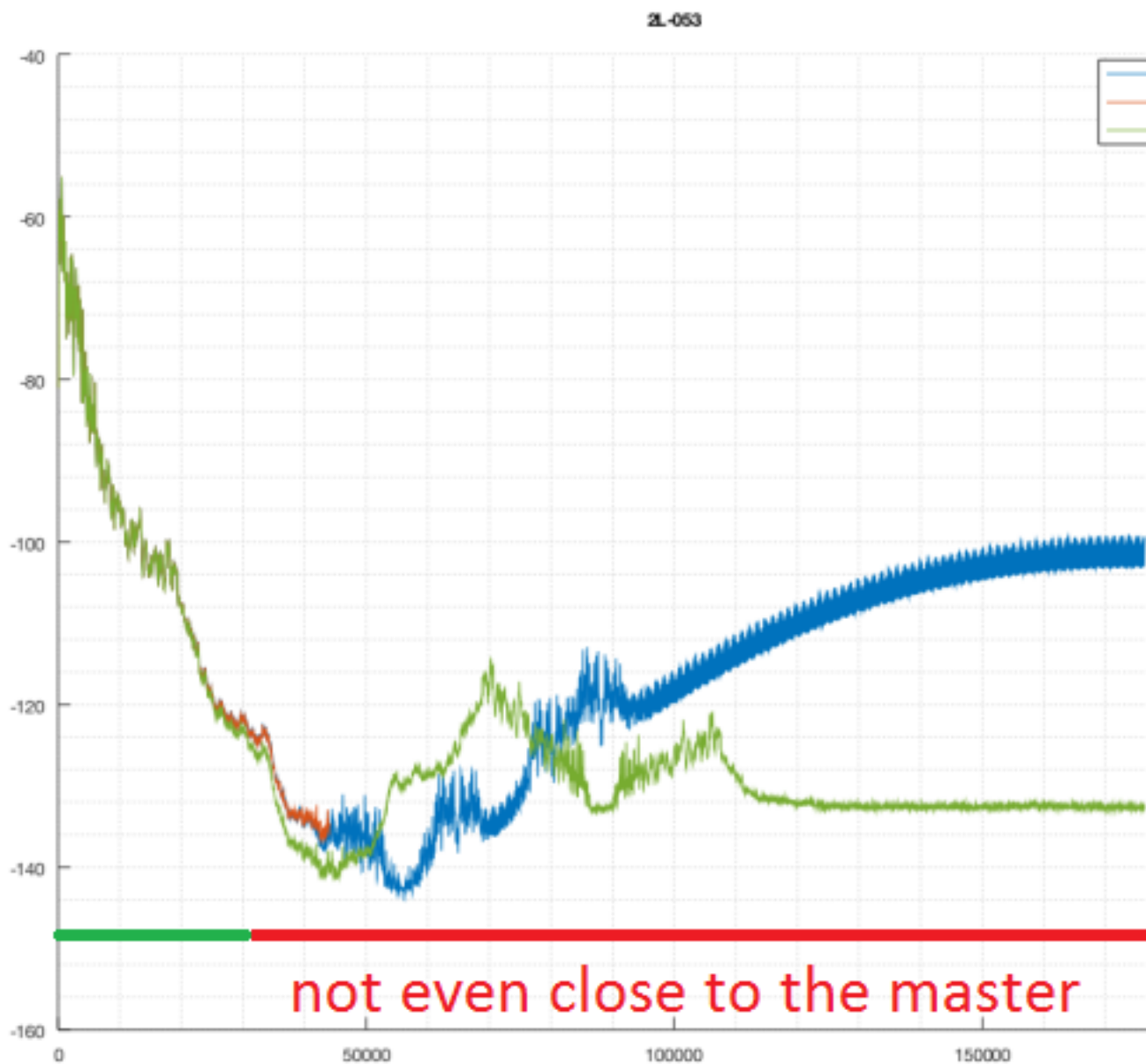
First the sound of the true master file which was used to encode the MQA files can be recovered using the sox minimum phase recipes, which we offer as a free DSP upgrade (part of SQi). We did a lot of testing with befriended hifi professionals and send them our upsampled MQA files using sox minimum phase, and the originals from which they were encoded. They could not hear the difference:

<http://www.digitalaudioreview.net/2017/07/kih-46-mqas-missing-link/>

Only our most expensive system could reveal very small differences, which will not trigger with most of our customers.

Furthermore, the time domain filter we present reaches a very similar impulse response as MQA's renderer, which is basically an upsampler / ditherer. Remember that MQA's first unfold recovers some ultrasonics up to 48 Khz by embedding these as a lossy version in the 8 lowest bits of a 24/44.1 or 24/48 distribution file. The second unfold does not create new data, but upsamples the first unfold while allowing aliasing.

Here is 2L.no's 2L-053 demo track in the original studiomaster (blue plot) vs the first unfold (red plot) and second unfold (green plot):



2L-053





[The effects of MQA on the sound quality of music](#) and [The effects of MQA on the sound quality of music](#) are still different between Bitperfect output? MQA passthrough?

DAC Output resolution from 432 Hz plugin + recipe		Disable Plugin ▾	Ultra Hig
Internal precision		Disable Plugin	SOLUTIO
Base frequency for 432 Hz plugin:		16/44.1	
Target frequency for plugin:		32/88.2	
async buffer size:		32/176.4	
<u>SQi</u> force 24 bit output		32/352.8	mediate pl
Plugin calculating in		32/706.6	: 352.8 k
Processing delay		16/48	
<input type="button" value="Submit"/>			

Some customers prefer bitperfect playback. 432 EVO can be used as a bitperfect source. In case of the all new 432 EVO MASTER, the performance is so high it can compete with any other digital source no matter the price point, and this source won best of show awards in Munich 2017.

To use the 432 EVO as a bitperfect source, just set the DAC Output resolution to "Disable Plugin". This will start a bitperfect player.

This will also pass MQA files to an external DAC which can do the full decode. Don't forget to set the volume to 100%, as volume control implies the output is no longer bitperfect.

432 EVO gives you a lot of choices and does not enforce one way of playback. You can play with many parameters on the Configure Player page to tune the sound to your own taste.

SQi Release = 14 jan 2018

We have released SQi with 10 digital filters instead of the default 2 on 14 jan 2018. Happy updating.