

# ECHO Project

## 2L-PRISM Array

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2L

Our aim in the ECHO-project is to examine and compare how different microphone arrays captures a musical performance at the same position in a room simultaneously. Given the complexity of the mechanics of 108 microphones in the same space, the placement was a best guesstimate based on our common experience. It was not possible to move the microphones once the session was started. There was also limitations in how to monitor and enable critical listening to multiple arrays at the same time. The sounding result only constitute one part of what is the process of recording music. Normally we would listen and adjust placement of the microphones, then engage with the musicians in their sound making.

A secondary perspective of this experiment is to examine how the placement of the musicians in the room affects our sonic and musical perception. The same music was recorded with the orchestra in a circular layout around the listener and in a more traditional stage layout. The microphone arrays were stationary and representing the listener.

The 2L-cube is really a direct consequence of the speaker configuration in the immersive playback systems. Time of arrival, SPL and on-axis HF texture is directly preserved in this 7.1.4 microphone configuration. Proportions are cubical and the dimensions could vary from 150 cm for a large orchestral array down to 40 cm in an intimate chamber musical context. I always use true omnidirectional microphones in the main array. Depending on the room, the music and the instruments, I alternate between the DPA 4003 and the 4041, the latter with the larger membrane providing a more focused on-axis texture. Refining the microphone array is a constant evolution. We started with a 2L-cube for 5.1.4 then expanded it with side-fills within the cube for 7.1.4. Lately, we tend to stretch the cube into a 2L-prism where the sides are now the surrounds, and the surrounds slide further back to become rears. The typical dimensions are one meter wide, two meters deep and one meter high. Our philosophy is simple; one microphone straight to one speaker. The important aspect is to configure the array so time of arrival is captured and released in natural order.

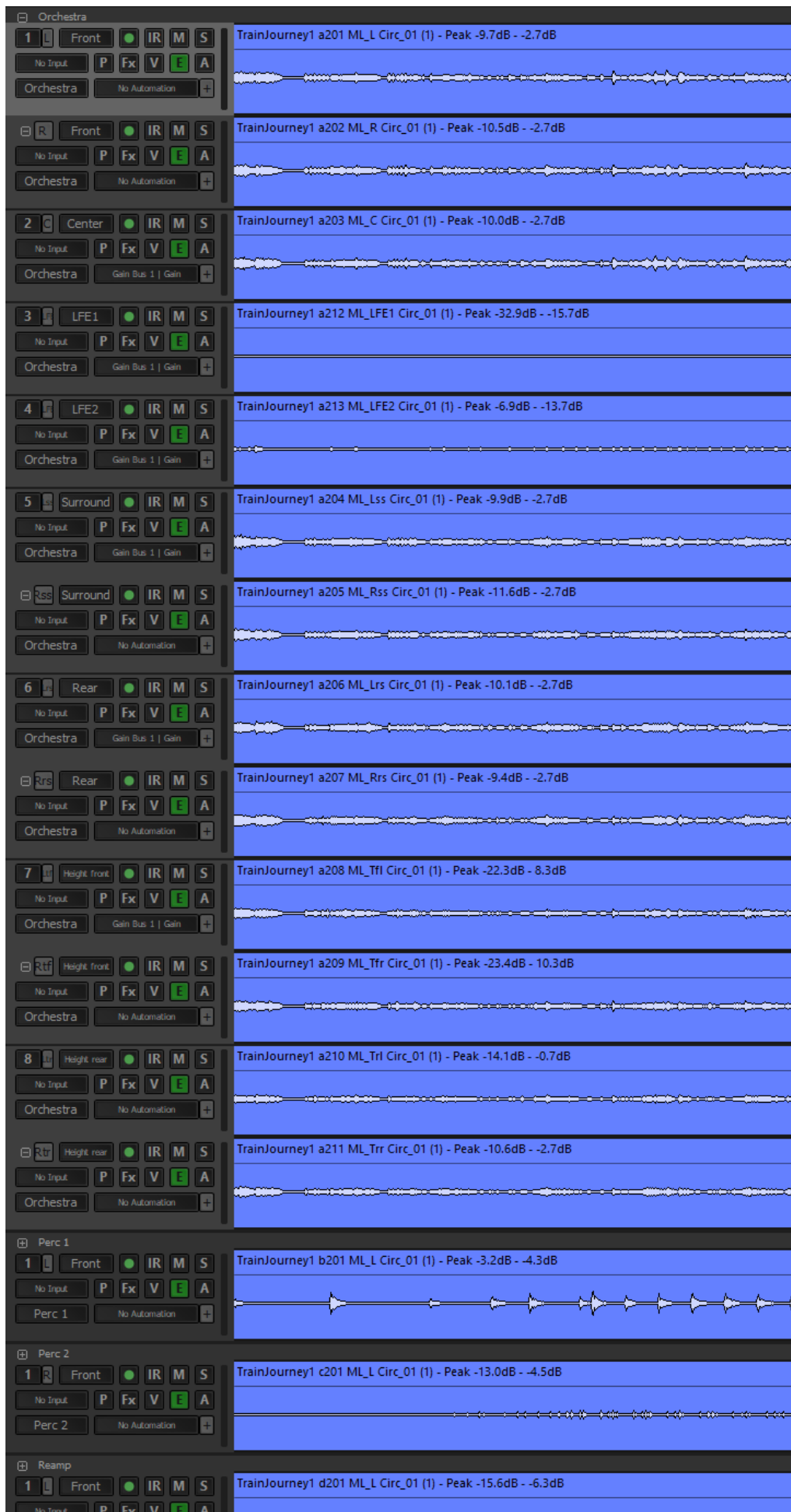
## Array-Only (puristic microphone capture)

The seven 4041-S in the bed layer is a matched set from DPA and serves as a reference in the array in terms of both sensitivity and spectral qualities. These are at equal gain thru all stages and is our reference level in gain structure.

The four DPA 4006 used as height microphones in this experiment is not a matched set. Unfortunately, the reference is somewhat compromised as front and rear are different year-models. Sensitivity differs by 13 dB between the four, not limited to pairs. The left rear height also feature an elevated THD (distortion) especially noticeable on the sound of the violins.

To balance the heights with the bed reference, the following gain compensation has been applied:

Left front height: +11 dB  
Right front height: +13 dB  
Left rear height: +2 dB  
Right rear height: 0 dB

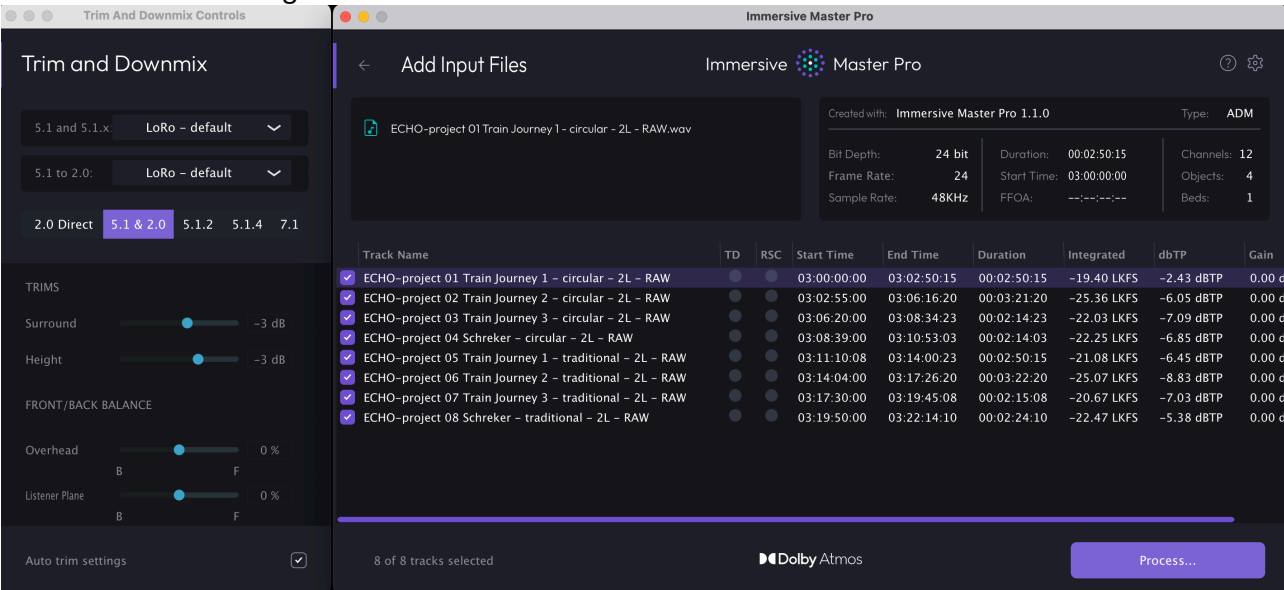


Lfe1 (Perc) and Lfe2 (Double Bass) low-pass filtered at standard 120Hz 24dB/octave.



The layer for the traditional orchestral setup has been gained 1dB more to compensate for the fact that a larger number of musicians are seated further away from the microphones compared to the circular layout.

These are the resulting ADM files labeled «raw»:



# Presentation Mix

Source levels for all microphones in the array is the same as for the RAW.

Level modification from raw to mix:

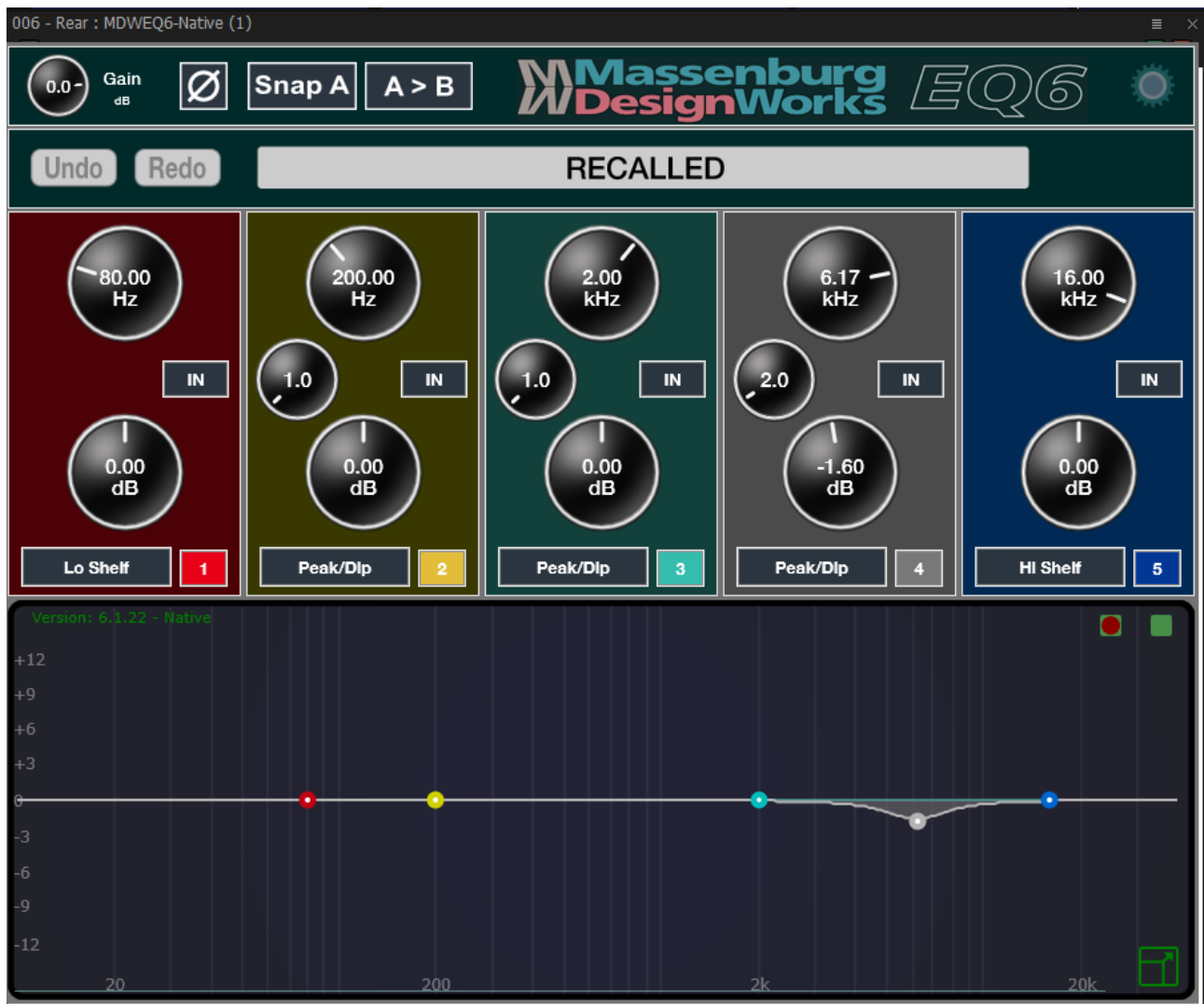
Bed: +1dB

Heights: -1dB

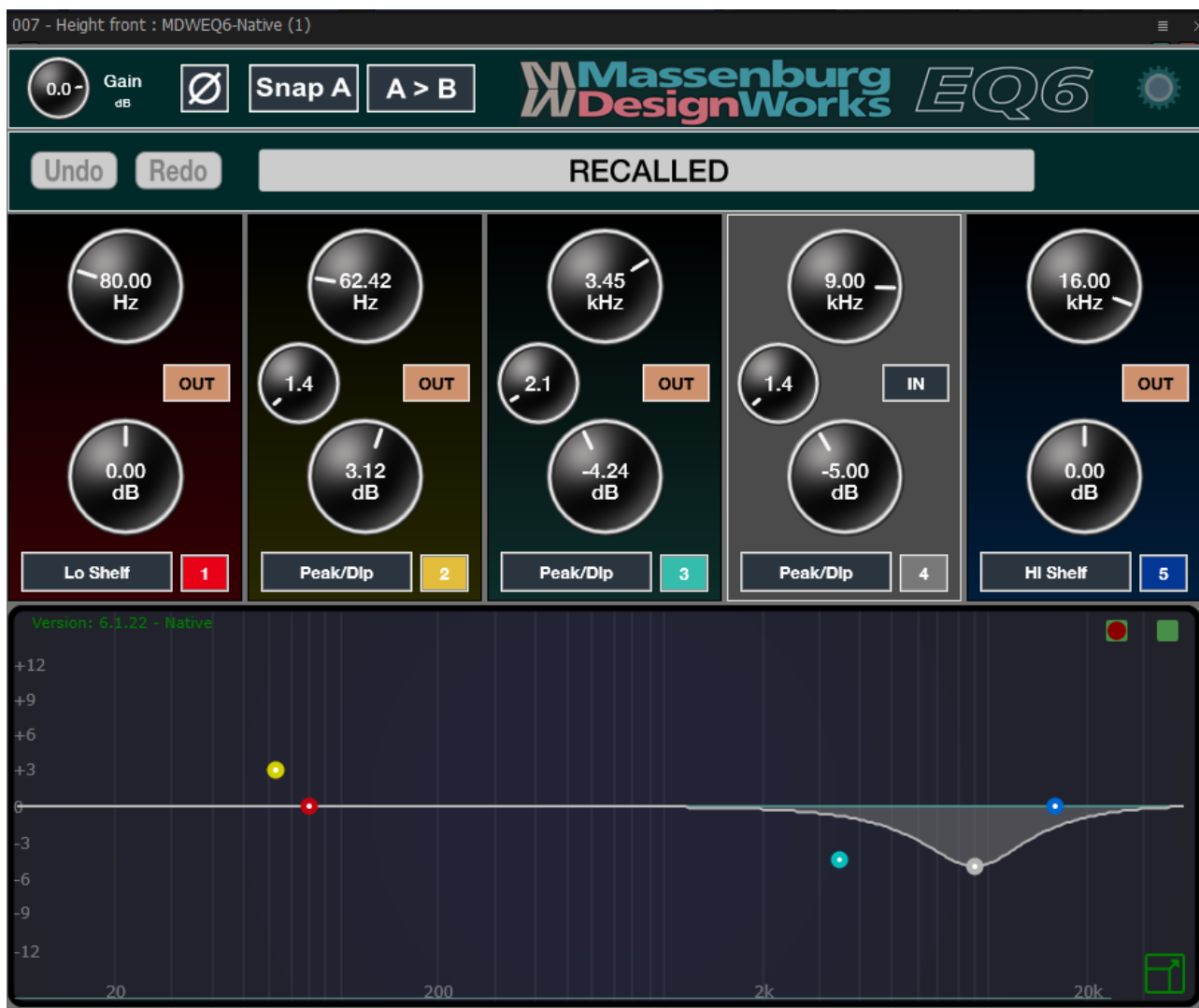
This is to give a slight priority to direct instrumental texture over diffuse room.



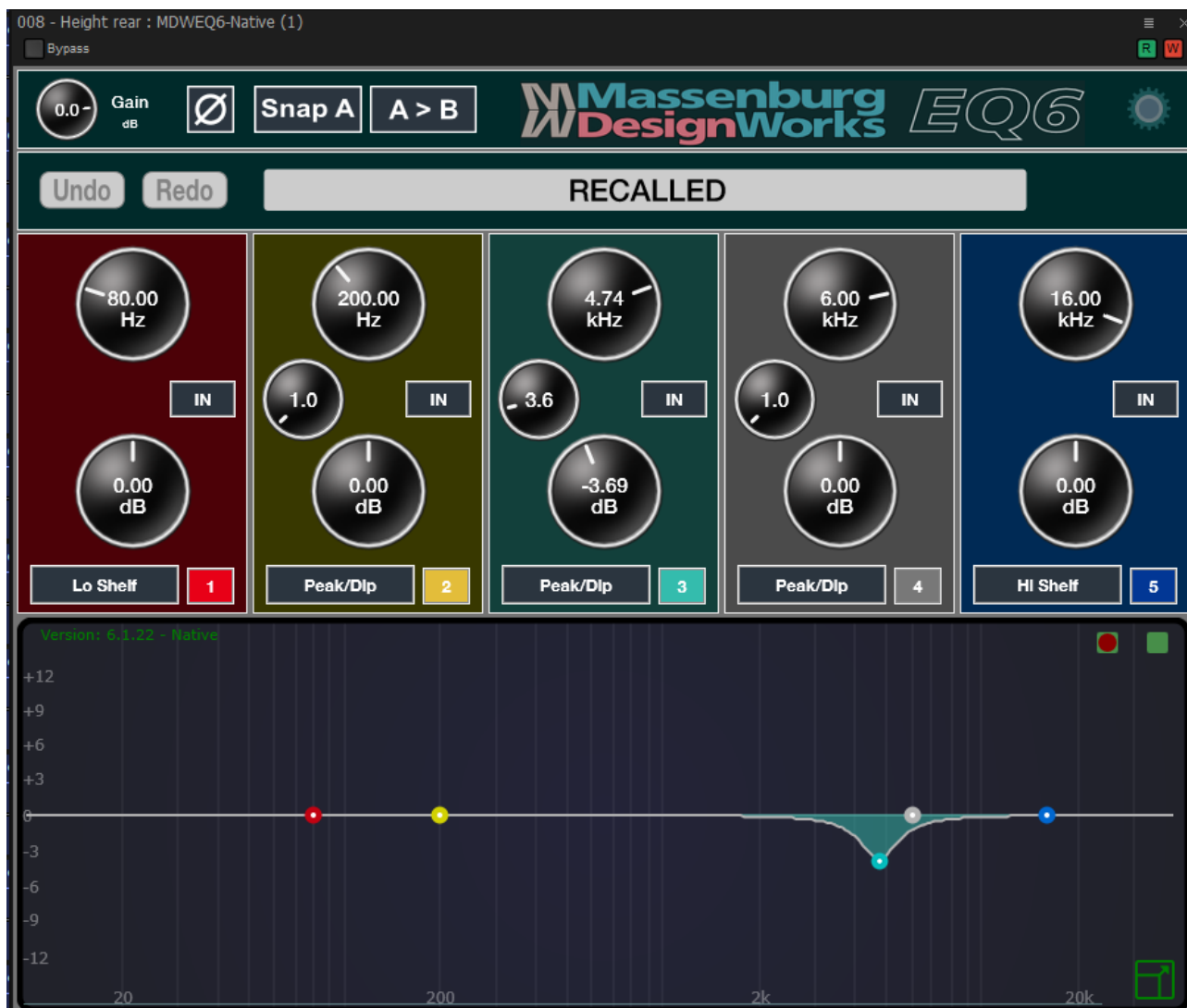
DSP, Rear microphones in bed: The rear pair 4041-S is pointing directly to the string instruments for maximum on-axis response. In a regular recording session I would have shifted the angle upwards to smoothen the texture. To simulate a slight off-axis response of the 4041-S an EQ 6.17kHz 2Q -1.6dB has been applied.



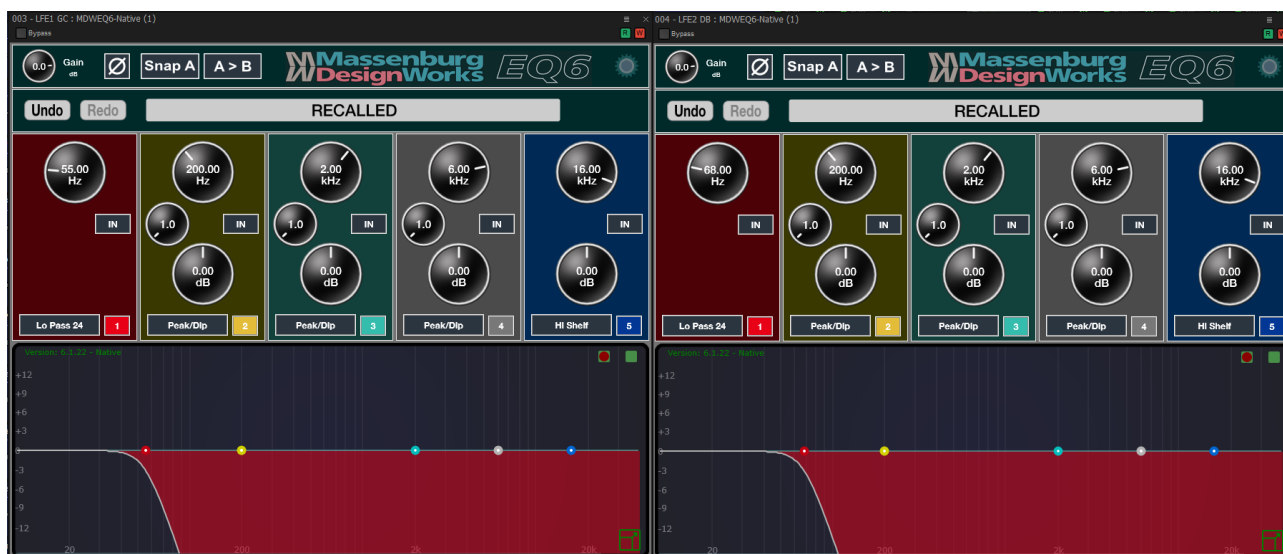
DSP, height front microphones: These microphones had both the black diffuse field grid and the APE50 that made for a somewhat brittle spectral character. This EQ emulates «undo» and seek to reset to what a DPA 4006 with regular grid and without the APE could have sounded like. EQ 9kHz 1.4Q -5dB



DSP, height rear microphones: These microphones had the APE50 that made for a somewhat brittle spectral character. This EQ emulates «undo» and seek to reset to what a DPA 4006 without the APE could have sounded like. EQ 4.74kHz 3.6Q -3.69dB. This EQ also limits the impact of the elevated THD of the faulty left rear height microphone.



DSP, Lfe1 (Perc) has been low-pass filtered at 55 Hz 24dB/octave. Lfe2 (Double Bass) has been low-pass filtered at 65 Hz 24dB/octave.



DSP, Lfe1 and Lfe2: 14ms delay to align with Center channel in bed

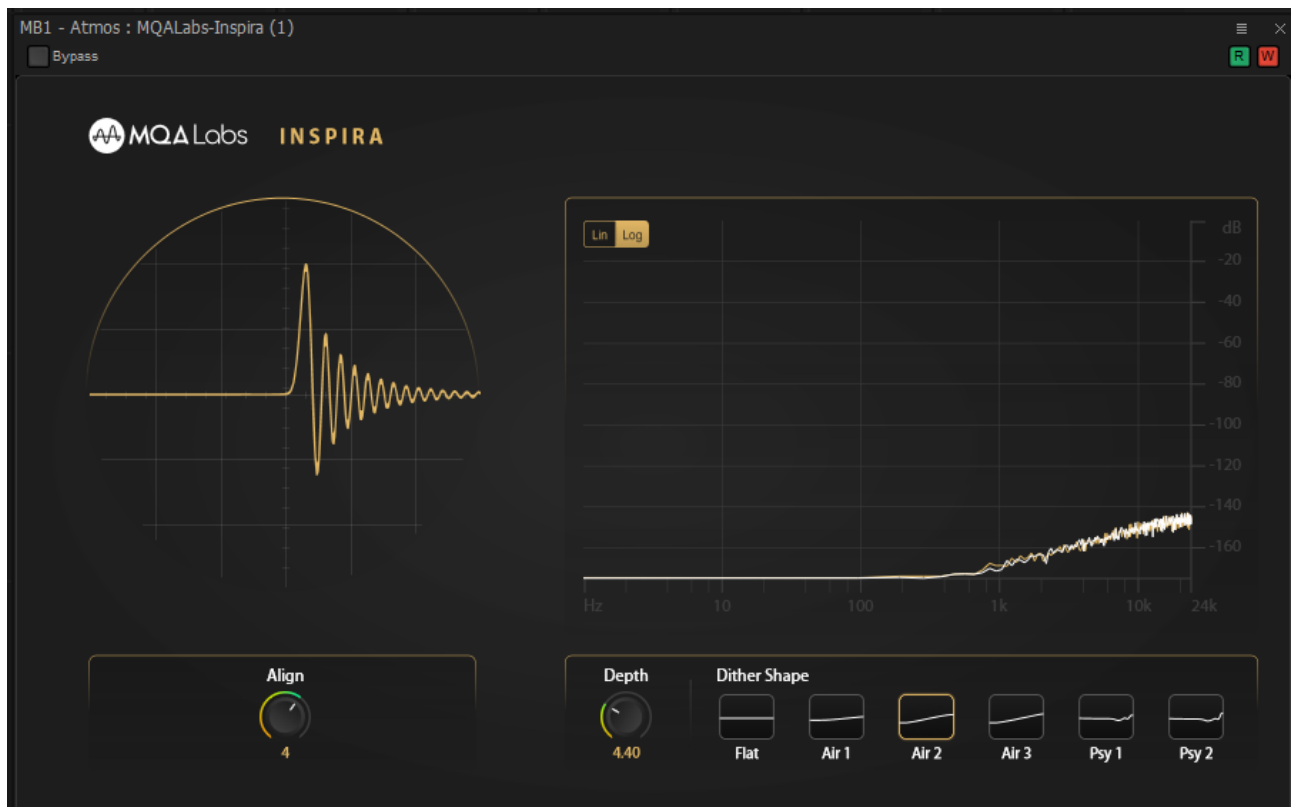


A Stratus-3D reverb is fed equally from all source layers and comes back into the mix attenuated by 18dB. Early reflections are reduced in the reverb algorithm as what I seek is a tail while preserving clarity.



On the Master Bus there is MQA deblur and Noise Shaped Dither to 20-bit.





For the RAW all metadata is set to Default Dolby trim values and Near BIN. For the MIX the trim is set to manual and instruct a 9dB attenuation of the heights when folding down from immersive to surround and to stereo. Heights are set to Mid BIN.

[illegible]

These are the resulting ADM files labeled «mix»:

Trim And Downmix Controls

Trim and Downmix

5.1 and 5.1.x

Direct render

5.1 to 2.0:

LoRo - default

2.0 Direct

5.1 & 2.0

5.1.2

5.1.4

7.1

TRIMS

Surround

-3 dB

Height

-9 dB

FRONT/BACK BALANCE

Overhead

B

F

0 %

Listener Plane

B

F

0 %

Auto trim settings

Immersive Master Pro

Add Input Files

ECHO-project 01 Train Journey 1 - circular - 2L - MIX.wav

Created with: Pyramix Virtual Studio 14.0.0

Type: ADM

Bit Depth: 24 bit

Duration: 00:02:50:15

Channels: 12

Frame Rate: 24

Start Time: 03:00:00:00

Objects: 4

Sample Rate: 48KHz

FFOA: --:--:--:--

Beds: 1

Track Name	TD	RSC	Start Time	End Time	Duration	Integrated	dBTP	Gain
<input checked="" type="checkbox"/> ECHO-project 01 Train Journey 1 - circular - 2L - MIX			03:00:00:00	03:02:50:15	00:02:50:15	-19.35 LKFS	-1.73 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 02 Train Journey 2 - circular - 2L - MIX			03:02:55:00	03:06:16:20	00:03:21:20	-25.43 LKFS	-5.16 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 03 Train Journey 3 - circular - 2L - MIX			03:06:20:00	03:08:34:23	00:02:14:23	-22.23 LKFS	-7.74 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 04 Schreker - circular - 2L - MIX			03:08:39:00	03:10:53:03	00:02:14:03	-22.36 LKFS	-6.95 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 05 Train Journey 1 - traditional - 2L - MIX			03:11:10:08	03:14:00:23	00:02:50:15	-21.15 LKFS	-6.61 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 06 Train Journey 2 - traditional - 2L - MIX			03:14:04:00	03:17:26:20	00:03:22:20	-25.13 LKFS	-10.19 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 07 Train Journey 3 - traditional - 2L - MIX			03:17:30:00	03:19:45:08	00:02:15:08	-20.90 LKFS	-5.88 dBTP	0.00 d
<input checked="" type="checkbox"/> ECHO-project 08 Schreker - traditional - 2L - MIX			03:19:50:00	03:22:14:10	00:02:24:10	-22.73 LKFS	-6.65 dBTP	0.00 d

8 of 8 tracks selected

Dolby Atmos

Process...