STUDIO
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SERVICE

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Donato Masci
CEO & Technical Director

11 / Dec
— 2025

Next-generation hybrid acoustic simulation

Full-spectrum design with wave and geometrical acoustics

Who we are


STUDIO
SOUND
SERVICE
We design places for your sound
Mulinetti – Alberto Parodi @ Genoa (IT)
Read more

STUDIO SOUND SERVICE

Donato Masci

Studio Sound Service – Team

Studio Sound Service is a well-established design and consultancy company that specialises in every aspect of acoustics and sound systems.

Founded in 1983

SSS has built an enviable reputation for the production of world class performance and recording spaces, from personal studios to large scale film, broadcast and corporate facilities.

By combining aesthetic and technical skills with decades for experience SSS strives to make every project successful, both sonically and visually.

Donato Masci
Physicist & Acoustic Designer - CEO

Cecilia Torracchi
Acoustic & Civil Engineer - Partner

Giulia Bondielli
Acoustic & Building Engineer – Partner

Elena Rossi
Acoustic & Building – Architectural Engineer

Niccolò Pizzamano
Architect & Acoustic Designer

Chantal Valdambrini
Communication Manager

ADR, Post & Broadcast. Cinema Mixing studios. Gaming Studios.

- Iyuno (ex SDI Media) Acoustic Designers (more than 15 countries)
- Cinecittà Studios (Postproduction Facility 2020 Renewal) @ Rome
- Dubbing Brothers (Italy, USA)
- 3Cycle postproduction Facility @ Rome
- FOX Dolby Atmos Studios @ Rome (IT), Münich (DE), London (UK)
- Netflix Facility @ Rome
- Disney Facility @ Warsaw (PO), Milan
- inHouse (Oscar winner Sorrentino) @ Roma

Music Studios (400+)

- Cicaleto Recording – Francesco Ponticelli @ Arezzo
- Aemme Recording Studio – Salvatore Addeo @ Lecco
- D:POT Recording Arts @ Prato – Fabrizio Simoncioni
- Mulinetti Studio @ Genova – Alberto Parodi
  Resolution Award 2015 Best Audio Facility
- The Garage @ Civitella v.d.C. (AR)
  Resolution Award 2014 Best Audio Facility
- House of Glass @ Viareggio (LU) – Gianni Bini
  Resolution Award 2013 Best Audio Facility
- SonicFab Studio @ Pioltello (MI)
- Waves Music @ Genova
- Marco Borsatti Studio @ Bologna
- Pop Fiction – Janie Price @ Firenze
- Sugarmusic @ Milano
- Experimental Studios @ Torino

Dolby Atmos Music Studios: 50+ rooms
Dolby Atmos Home Entertainment Studios: 80+ rooms
Dolby Atmos Theatrical Studios: 10+ Theatres

Personal Studios:

- Andrea Bocelli, Asaf Avidan, Biagio Antonacci, Daniele Silvestri, Damian Lazarus, Diego Calvetti, Enrico Cremonesi (Fiorello), Enrico Melozzi, Fabio Rovazzi, Federica Vincenti (Michele Placido), Gabry Ponte, Giorgia Angiuli, Irko (Kanye West sound engineer), Luca Agnelli, Marco Masini, Marco Messina (99 Posse), Merk & Kremont, Nari&Milani, Paolo Sandrini, Petra Magoni, Piero Pelù, Pino Iodice, Renato Zero, Vinai.

- Barys Arena (ice hockey) @ Astana, Kazakhstan
- Chorus Life (arena e cittadella) @ Bergamo
- Stadio Tardini @ Parma

- Hospitals: Nuovo Ruggi @ Salerno, Cesena

- George Lucas Home Theater, Italy
- Cinema Barberini @ Roma

- Chiesa Santa Maria Nuova (Arch. M. Botta) @ Terranuova B. (AR)
- Duomo di Siena new audio system

- Prada Auditorium and Conference Room via Orobia @ Milano
- Presentation room Ferrari HQ @ Maranello (MO)
- Siemens HQ @ Milano
- Heineken HQ @ Milano
- Leonardo Elicotteri @ Milano

- Four Seasons Hotel @ Firenze
- Portrait Milano – Ferragamo @ Milano
- Caffè dell'Oro – Ferragamo @ Firenze
- Hotel Veronesi (Calzedonia) @ Verona

- EVAC Dubai Metro
- EVAC Bahrain and Islamabad airport (THALES)
- EVAC Scuola di Magistratura Castelpulci @ Scandicci Firenze

- Teatro del Popolo @ Castelfiorentino (FI)
- Teatro del Popolo @ Colle di Val d'Elsa
- Teatro del Popolo @ Poggibonsi
- Teatro il Ferruccio @ Empoli
- Teatro Marconi @ Pistoia
- Teatro Nazionale @ Firenze

Business Fields Evolution

40 YEARS

1983

- **Audio equipment sales representative**
- **Technical Assistance**
- **Audio facility**
  Music Studio

1990

- **Audio equipment sales representative**
- **Technical Assistance**
- **Audio facility**
  Music Studios
  Post-production A/V

2000

- **Audio equipment sales representative**
- **Architectural Acoustics**
  Theaters, Concert Halls
- **Audio facility**
  Music Studios
  Post-production A/V

2008

- **Environmental acoustics**
- **Noise control consultancies**
- **Architectural Acoustics**
  Theaters, Concert Halls
  Religious
  Corporate
  - Multimedia Conference Hall

  Sports
  HoReCa
  - Clubs

- **Audio facility**
  Music Studios
  - DJ Studios
  - Private Studios

  Post-production A/V

2010

- **Audio Systems (EVAC)**
- **Building Acoustics**
- **Environmental acoustics**
- **Noise control consultancies**
- **Architectural Acoustics**
  Theaters, Concert Halls
  Religious
  Corporate
  - Multimedia Conference Hall

  Sports
  HoReCa
  - Clubs
  - Hotel, Restaurants, Café

  Residential
  - Home Theaters

  Art & Culture
  - Cinemas

- **Audio facility**
  Music Studios
  - DJ Studios
  - Private Studios
  - Orchestral Halls

  Post-production A/V
  - ADR, Post & Broadcast
  - Cinema Mixing Theaters

2015

- **R&D electroacoustic industrial consultancies**
- **Audio Systems (EVAC)**
- **Building Acoustics**
- **Environmental acoustics**
- **Noise control consultancies**
- **Architectural Acoustics**
  Theaters, Concert Halls
  Religious
  Corporate
  - Multimedia Conference Hall
  - Office
  - Meeting Room

  Sports
  - Arenas

  HoReCa
  - Clubs
  - Hotel, Restaurants, Café

  Residential
  - Home Theaters

  Art & Culture
  - Cinemas
  - Museums & Exhibitions

- **Audio facility**
  Music Studios
  - DJ Studios
  - Private Studios
  - Orchestral Halls

  Post-production A/V
  - ADR, Post & Broadcast
  - Cinema Mixing Theaters
  - Dolby Atmos HE

2020

- **R&D electroacoustic industrial consultancies**
- **Audio Systems (EVAC)**
- **Building Acoustics**
- **Environmental acoustics**
- **Noise control consultancies**
- **Architectural Acoustics**
  Theaters, Concert Halls
  Religious
  Corporate
  - Multimedia Conference Hall
  - Office
  - Meeting Room

  Sports
  - Arenas
  - Stadiums

  HoReCa
  - Clubs
  - Hotel, Restaurants, Café

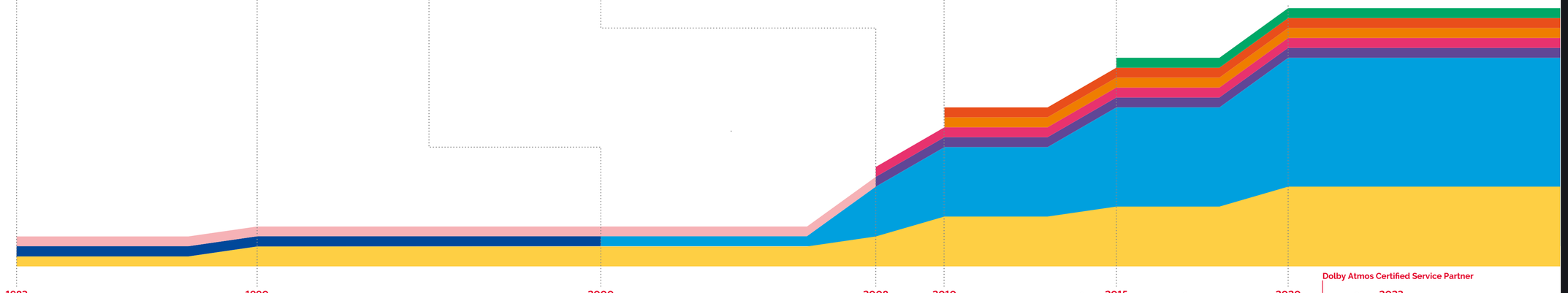
  Residential
  - Home Theaters
  - Luxury Residences

  Art & Culture
  - Cinemas
  - Museums & Exhibitions
  - Educational

  Healthcare

- **Audio facility**
  Music Studios
  - DJ Studios
  - Private Studios
  - Orchestral Halls
  - Dolby Atmos Music

  Post-production A/V
  - ADR, Post & Broadcast
  - Cinema Mixing Theaters
  - Dolby Atmos HE
  - Gaming Studios



2023

Dolby Atmos Certified Service Partner

Fabrizio Giovannozzi
Founder (1983 — 2012)

Donato Masci
CEO from 2010

Cecilia Torrachi
(Partner)

Giulia Bondielli
(Partner)

Elena Rossi

Niccolò Pizzamano

Chantal Valdambrini

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Countries where we operate

Studio Sound Service is the only Italian Dolby CSP.

We can provide design, commissioning and consultancy services worldwide with Dolby's certified quality standards.

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CEDIA associated

CEDIA®

MEMBER 2024 - 2024

Studio Sound Service Srl

Industry-Related Professional

CEDIA Members are smart home professionals providing comfort, control, connection, and entertainment for clients to experience the best moment in life in their homes.

The Association for Smart home Professionals™

CEDIA Member Code of Conduct

Each member of CEDIA shall agree to adhere to the following:

1. Provide to all persons truthful and accurate information with respect to the professional performance of duties.

2. Maintain the highest standards of personal conduct to bring credit to the custom electronic and design industry.

3. Promote and encourage the highest level of ethics within the profession.

4. Responsibly uphold all laws and regulations relating to CEDIA policies and activities.

5.Strive for excellence in all aspects of the industry.

6. Use only legal and ethical means in all ndustry activities.

7.Protect the public against fraud and unfair practices.

8.Use written contracts clearly stating all charges, services, products and other essential information.

9. Demonstrate respect for every professional within the industry by consistently performing at or above the standards acceptable to the industry.

10. Make a commitment to increase professional growth and knowledge by participating in technical and industry business training.

11. Contribute knowledge to professional meetings and journals to raise the professionalism of the industry.

12. Maintain the highest standards of safety

13. When providing services or products, maintain in full force adequate or appropriate insurance.

14. Cooperate with professional colleagues, suppliers and employees to provide the highest quality service.

15. Extend these same professional commitments to all persons supervised or employed.

16. Subscribe to CEDIA's Code of Ethics and abide by the CEDIA Bylaws.

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Room Design:
Treatment Strategy

…Perfect Absorber?

The perfect absorber doesn't exist, but fortunately it's not necessary to achieve perfect silence…

it would be sufficient to reach a value close to the perception threshold!

This is true for professionals, so why it couldn't be true for the consumer world?

Porous Absorber (velocity)

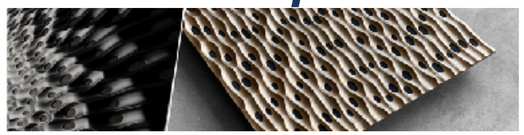
Wools, extruded materials etc.

Membrane Resonator (pressure)

Panel absorber

Helmholtz Resonator (pressure)

Perforated panel



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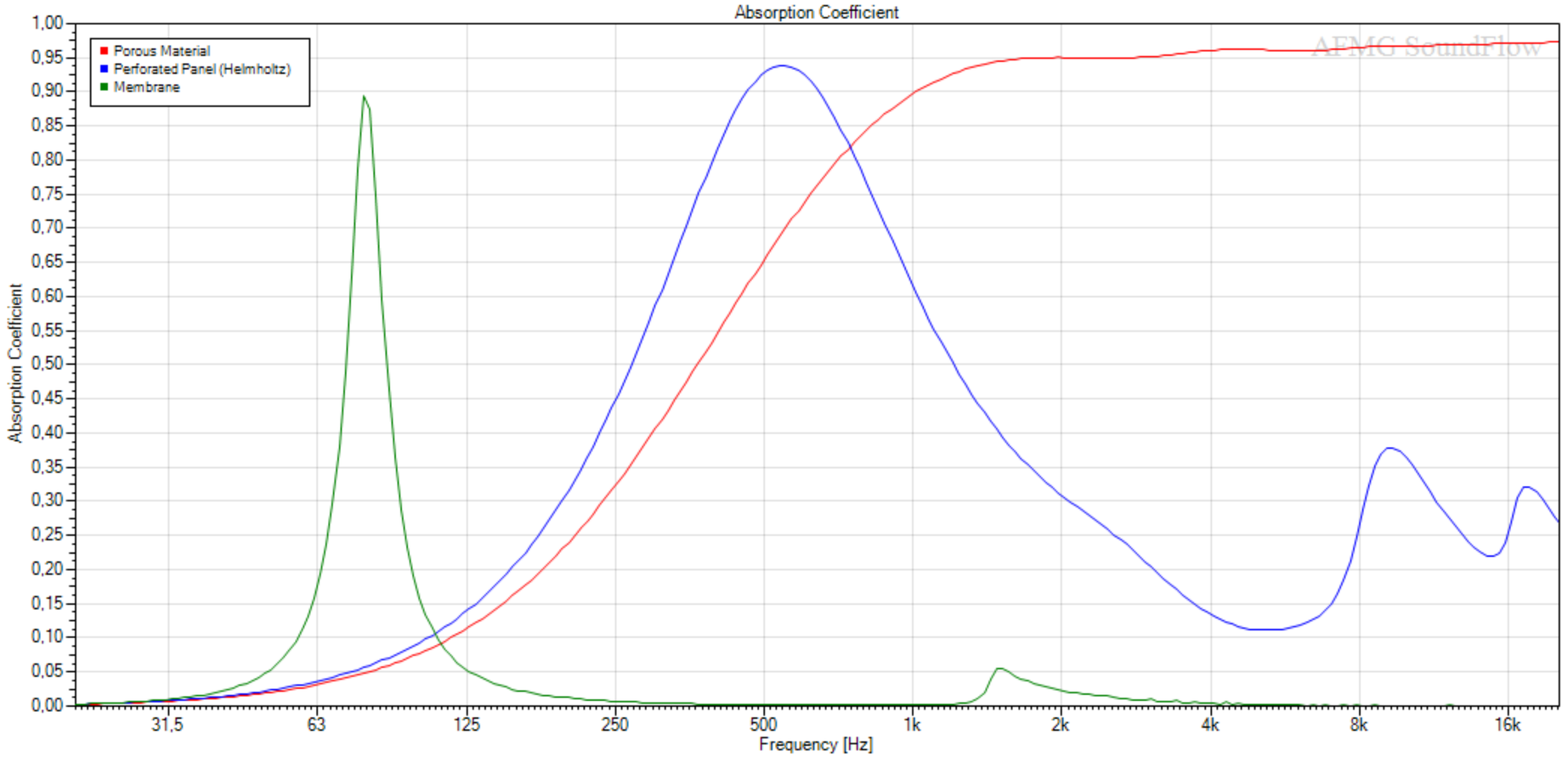
Acoustic Treatment Strategies



- **Below 100-120 Hz: Membrane absorbers**
- **100÷250 Hz: Helmholtz resonators**
- **Above 250 Hz: Porous materials**

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Room Acoustics: Key Challenges and Solutions

1. Dual Nature of Problems:
   - Room modes
   - Loudspeaker boundary interactions
   —> Complex interweaving of both issues

2. Simulation Limitations:
   - Difficulties in accurately modeling combined effects
   —> Need for practical, proven solutions

3. Absorption Strategy:
   - Use of proven, specific absorption designs
   —> Preference for broadband vs single-frequency solutions
   (contradiction with common HiFi industry claims)

4. Loudspeaker Boundary Issues:
   - Most problematic acoustic challenge
   - More prominent in dry acoustic fields
   (critical impact of floor/wall interactions)

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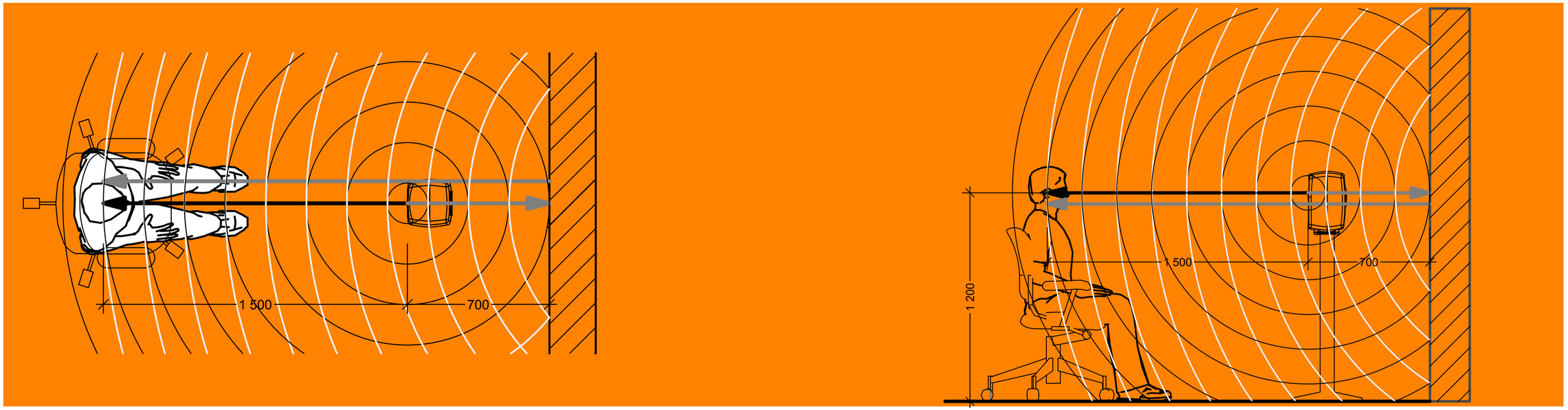
Room Modes vs. Loudspeaker/boundary effects

A dip in the frequency response can be caused by positioning in a resonance mode minimum or by a loudspeaker-boundary effect

Room modes create maximum and minimum pressure zones, but loudspeaker-boundary interactions create very strong phase cancellations.



Non-minimum phase effect

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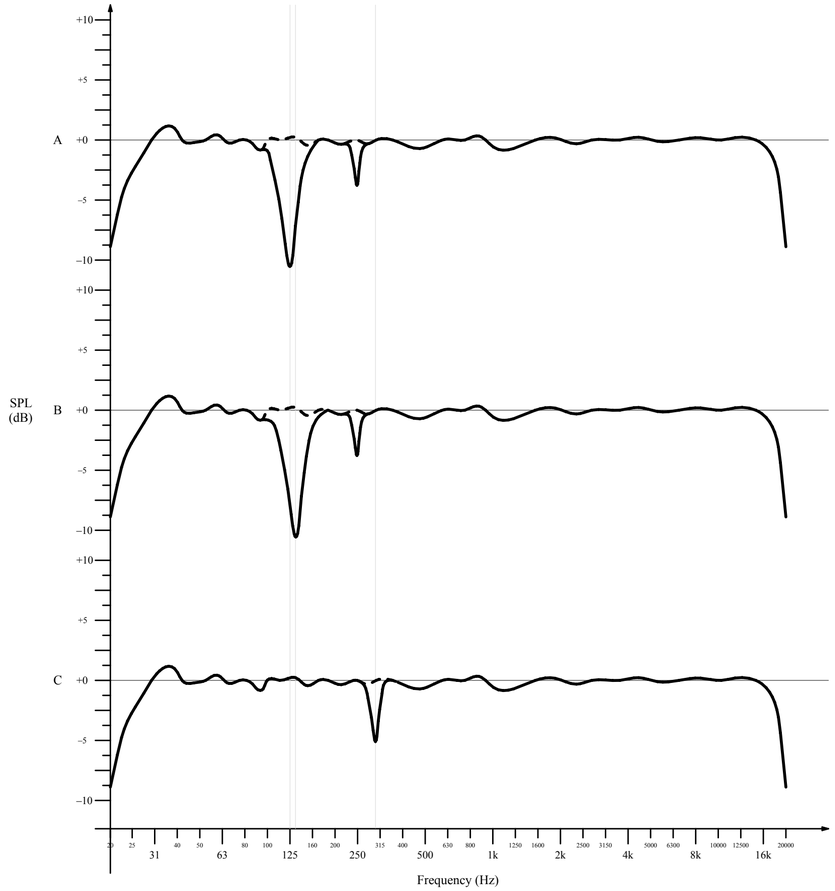
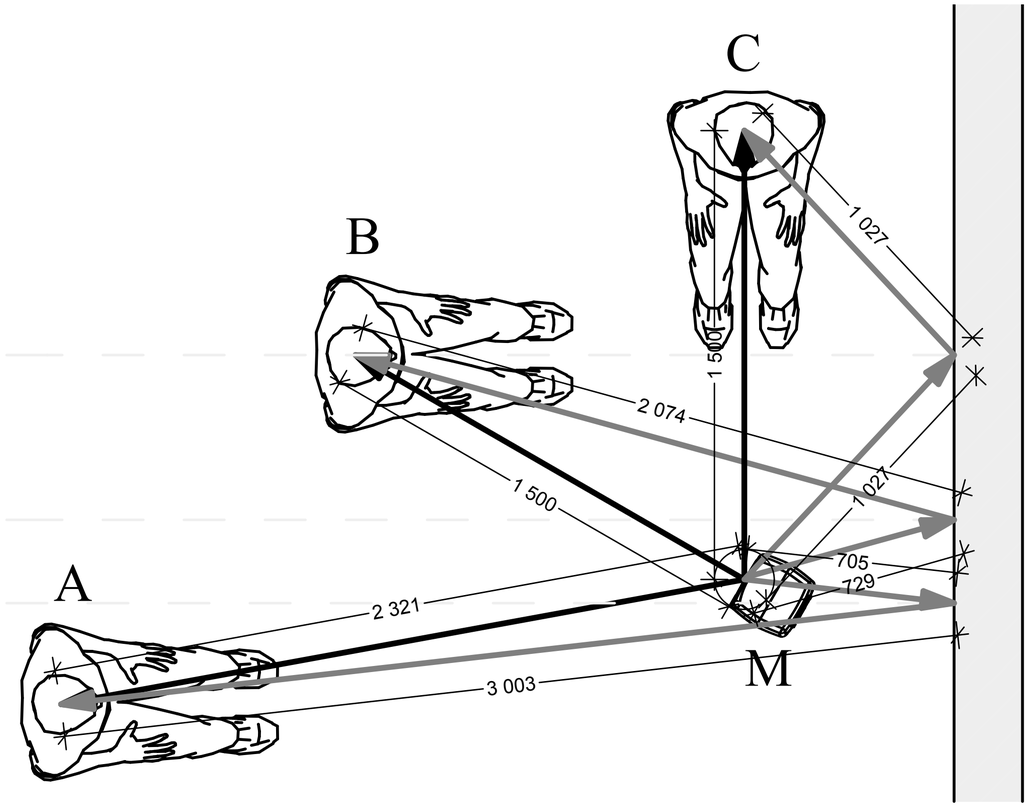
Room Modes vs. Loudspeaker/boundary effects





Non-minimum phase effect

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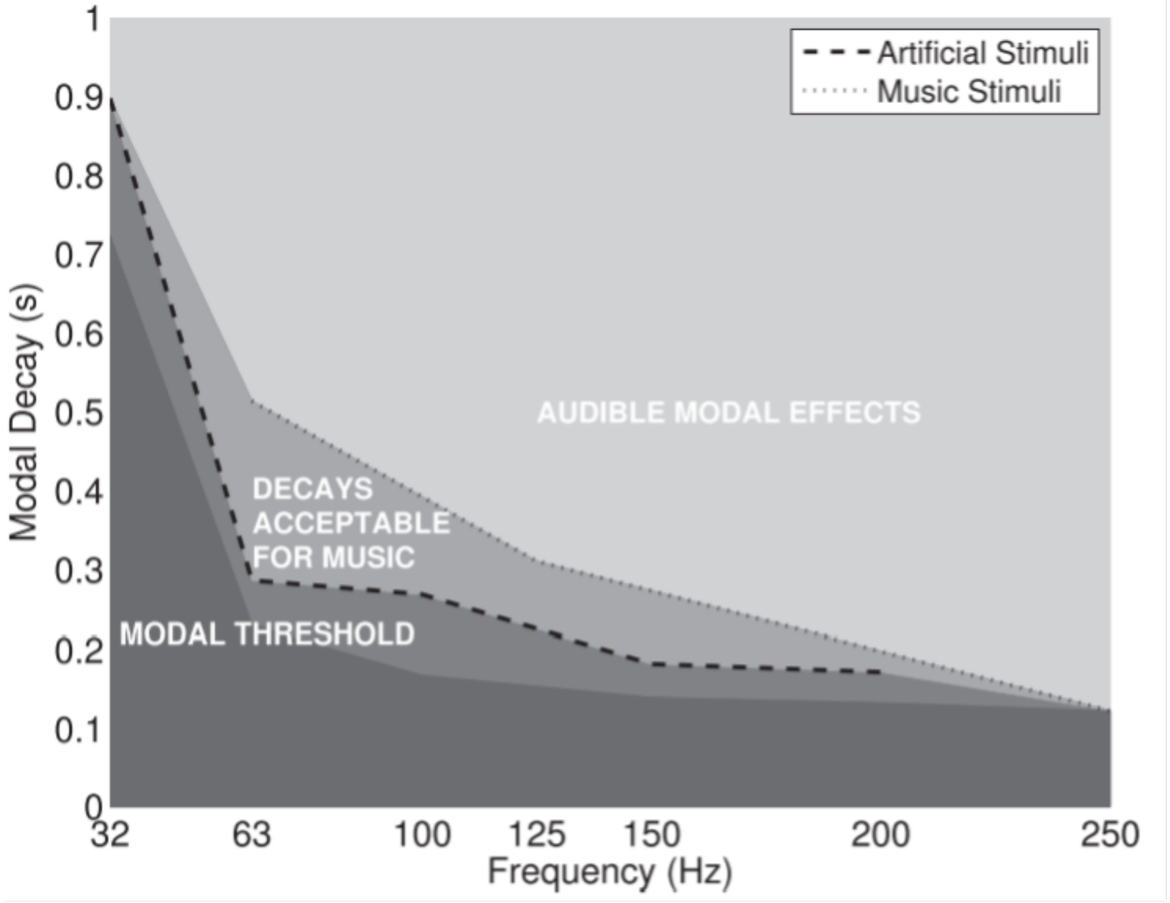
Professional background

Perception limits of LF reverberation



Perception limits of low-frequency reverberation (by Bruno Fazenda)

- The Chart shows the limits of perception of modal decay for various sound sources under controlled laboratory conditions. The absolute limits are in effect the point where further reduction in decay time by acoustic or other means would be futile.
- The critical frequency would seem to be 63Hz and resonant decay above that is noticeable if longer than 0.2s. Above 250Hz modes become reverberation which is more likely to be significant in terms of spatial awareness. Below 63Hz modal decay can increase exponentially to almost 1s at the limit of our hearing.
- It is logical that reverberation control should match as closely as possible the threshold for modes as basically they are the same thing but with different distribution.

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Optimal Reverberation times

They depends on the intended use:

Recording: Dubbing studios (ADR)
1. **have a neutral tonal coloration**
2. **not to exceed the low frequency modal perception threshold**

- **LF reverberation time 0.30÷0.35s**
- **HF flat reverberation time 0.10÷0.15s**

Dolby Atmos Home Entertainment
(Where broadcast and TV contents are mixed and post produced)

- **LF reverberation time 0.35÷0.45s**
- **HF flat reverberation time 0.15÷0.30s**

Dolby Atmos Cinema Mixing Room
(Where movies are mixed)

- **LF reverberation time 0.40÷0.80s**
- **HF flat reverberation time 0.20÷0.40s**

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Case Study

Cinecittà Sala A

Roma

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Case Study

Cinecittà Sala A

Roma

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Case Study

Cinecittà Sala A

Roma

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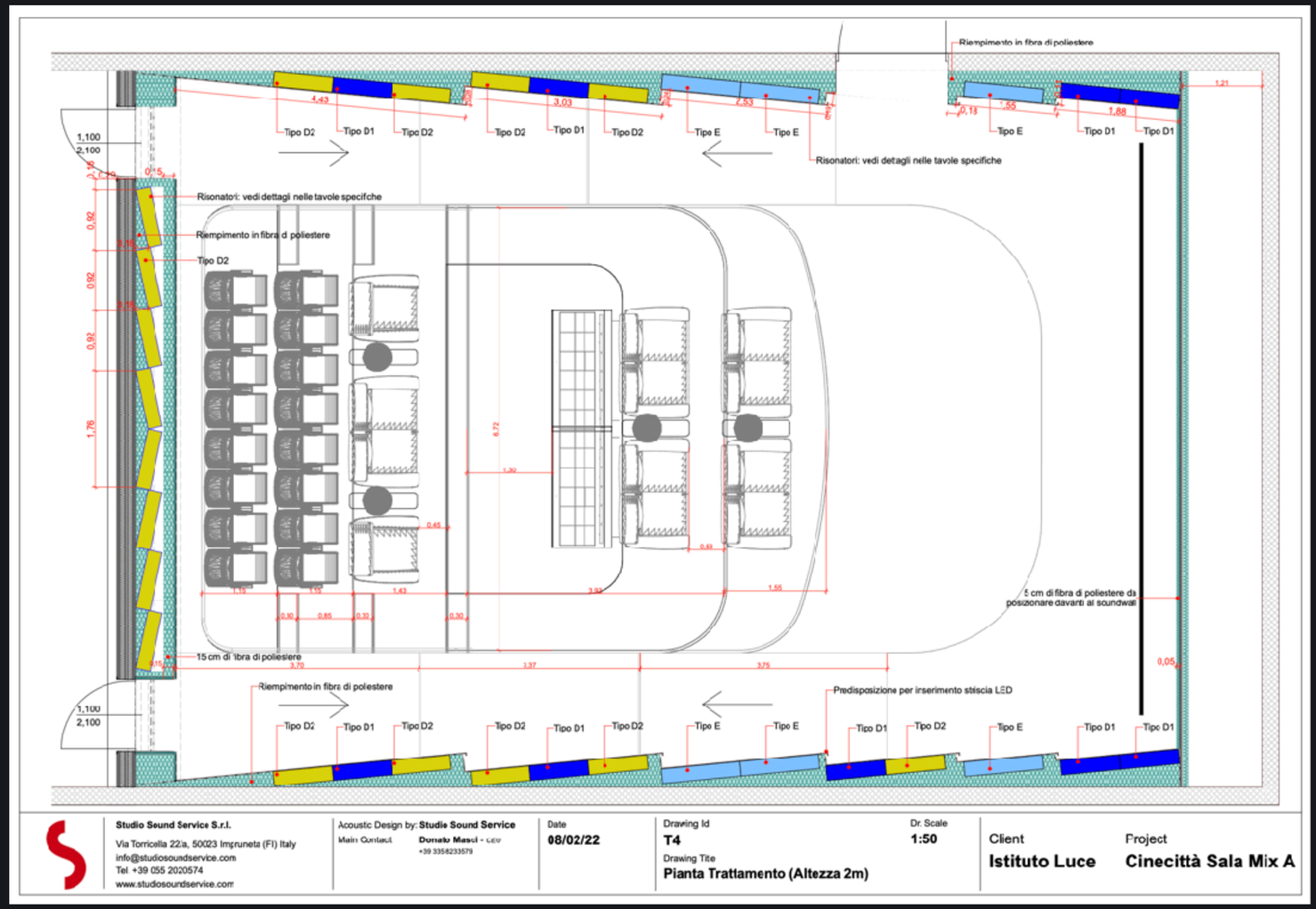
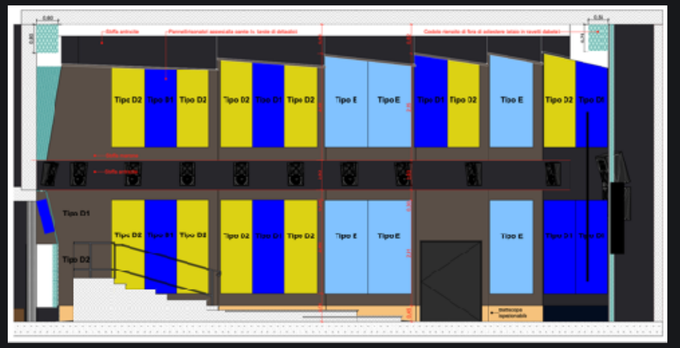
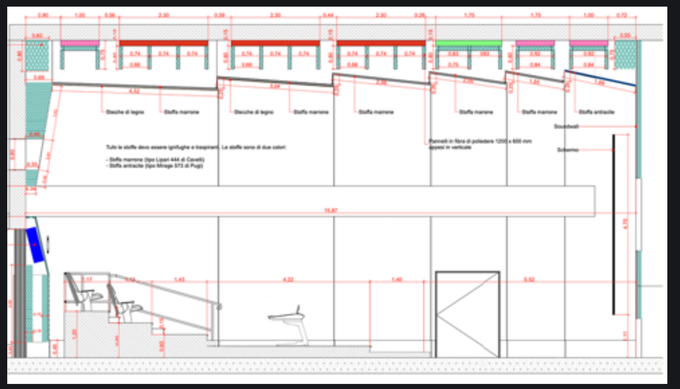
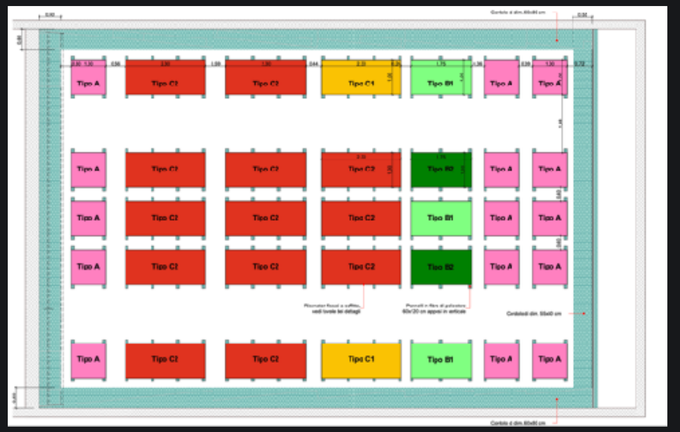
Acoustic Treatment









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Acoustic Treatment

Low Frequency Absorption

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Case Study

Cinecittà Sala Color Blu

Roma

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Cinecittà Sala Color Blu

Roma

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Case Study

Cinecittà Sala HE Millennium Falcon

Roma

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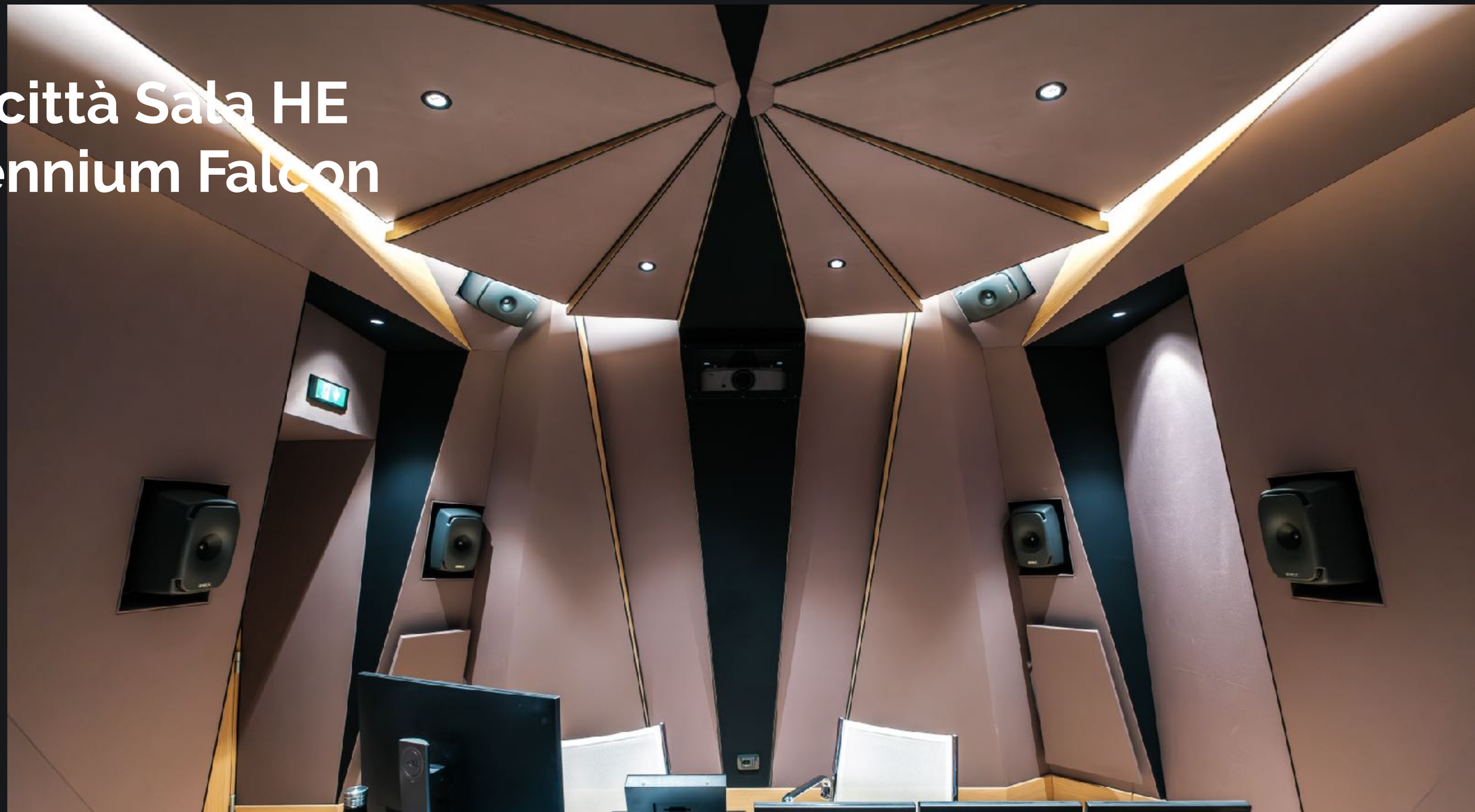
Case Study

Cinecittà Sala HE Millennium Falcon

Roma



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Case Study

Marco Borsatti Studio

Bologna

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Donato Masci

Case Study

Marco Borsatti Studio

Bologna

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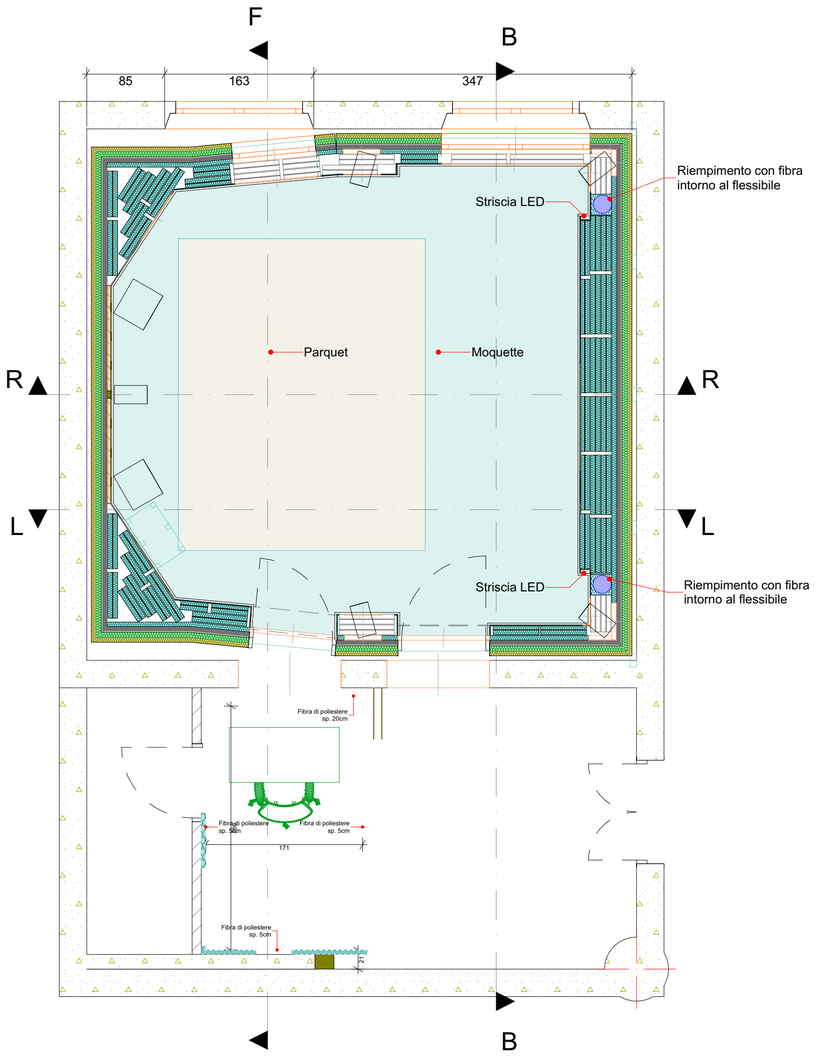
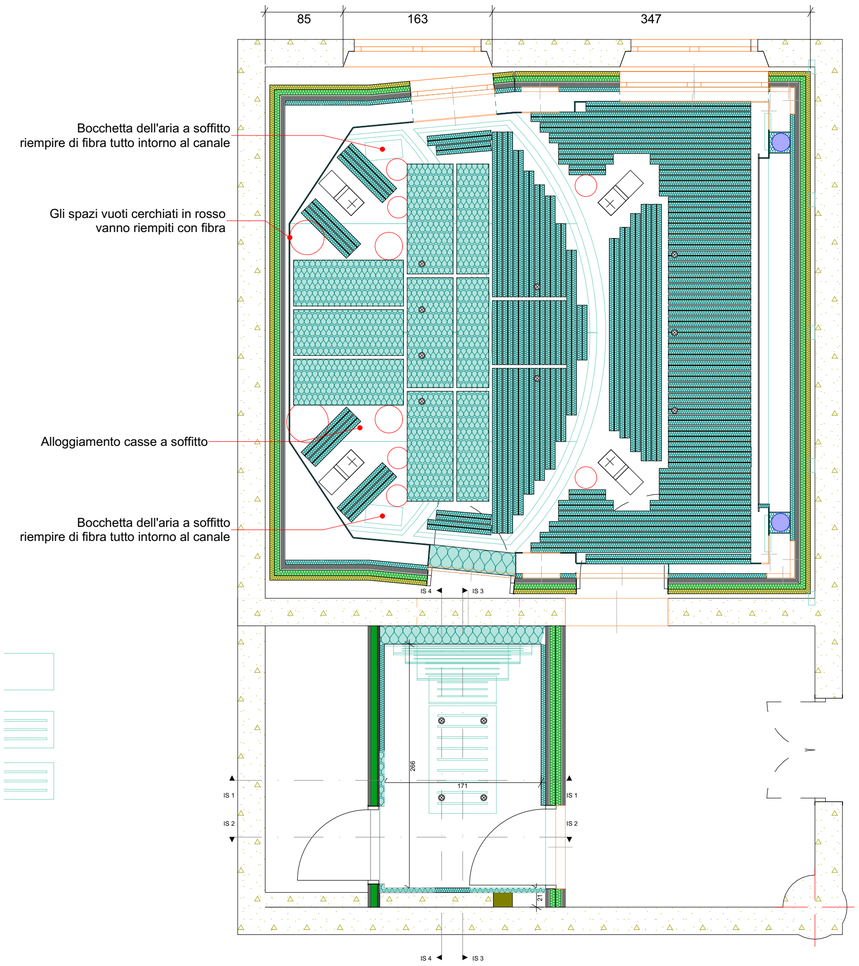
Acoustic Treatment with suspended panels



Treatment Layout 1:50



Treatment Ceiling 1:50

Studio Sound Service S.r.l.

Via Torricella 22/a, 50023 Impruneta (FI) Italy
info@studiosoundservice.com
Tel. +39 055 2020574
www.studiosoundservice.com

Acoustic Design: **Studio Sound Service**

Date **08/06/2023**
Revision **Definitive**

Drawing Number **9 /4**

Title **Treatment** Layout

Dr. Scale **1:50**

Client **Marco Borsatti**

Project **Studio Borsatti**

SoundBeat 3 - IRKO (Kanie West)

Pasadena, USA

Fabio Piazzalunga

Florence

SonicFab

Pioltello

Sudestudio

Guagnano – LE

Cicaleto Recording

Arezzo

JAN 2025

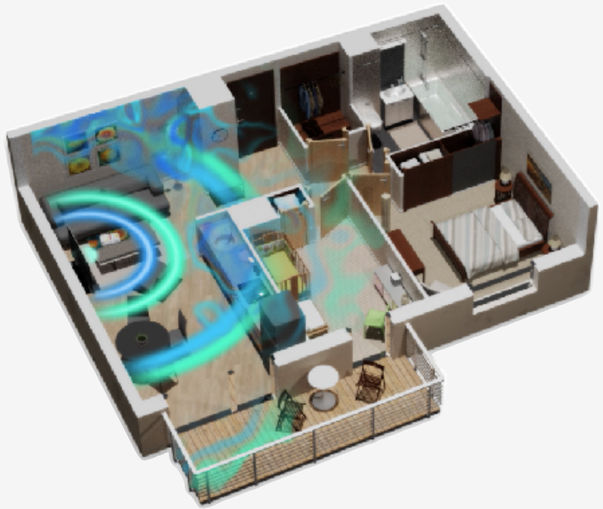
Treble: The next generation simulation platform for room acoustics and electro-acoustics

treble

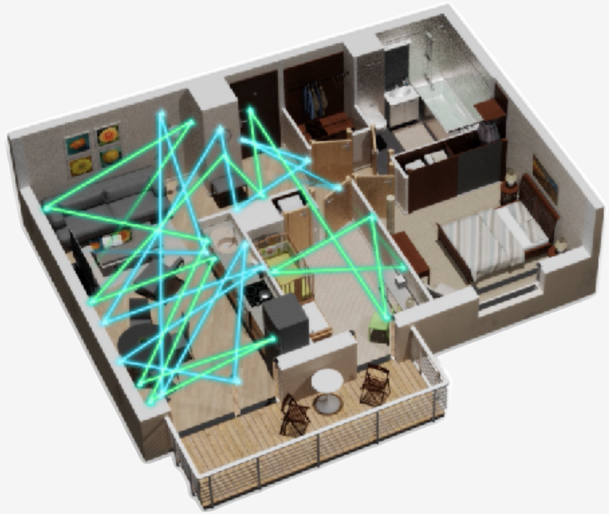
Enabling a better sounding world

A HYBRID APPROACH TO ROOM ACOUSTIC SIMULATIONS

Our core tech: A paradigm shift in acoustic simulation



Efficient wave-based FEM acoustic simulations for low-mid frequencies



Phased geometrical acoustics simulations for high frequencies

Treble has developed a groundbreaking acoustic simulation and spatial audio engine. Seamlessly blend massively accelerated wave-based (FEM) modeling at low-mid frequencies with state-of-the-art phased geometrical acoustics at high frequencies for improved simulation accuracy, which in turn reduces risk, increases design quality and avoids overdesign.

Utilize Treble's proprietary geometry processing technology to enhance the efficiency of your workflows. Access a wide range of advanced features on source modeling, receiver modeling, auralization, visualization and more.

The core tech leverages recent scientific breakthroughs in applied mathematics, high performance computing and acoustics. Treble holds several patents on its proprietary simulation technology.

Our tech is born out of high-level academic research at:

DTU Technical University of Denmark

VIRGINIA TECH

EPFL

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Materials: acoustic impedance

Create new material

MATERIAL NAME

MATERIAL DESCRIPTION (OPTIONAL)

MATERIAL CATEGORY

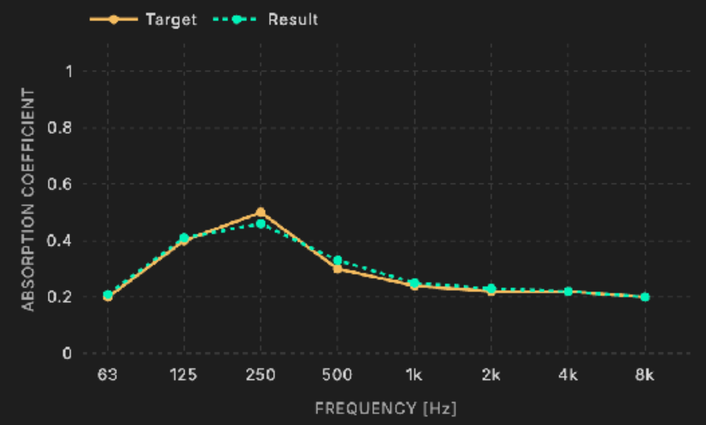
Default scattering 0,3

Material import / input | Porous material builder Beta

Full octave absorption | Surface impedance | Reflection coefficient

Absorption coefficient (Random incidence) Upload file

Fraquency (Hz)	63	125	250	500	1k	2k	4k	8k
Target	0,2	0,4	0,5	0,3	0,24	0,22	0,22	0,20
Result	0.21	0.41	0.46	0.33	0.25	0.23	0.22	0.2



Share with organization

Edit | Create material

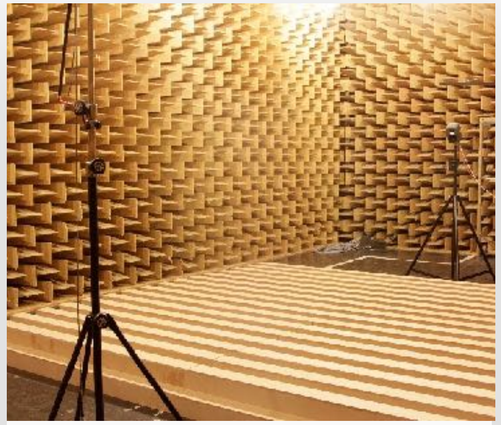
BENCHMARKS & CASE STUDIES

Isolated Acoustic Phenomena

Simulation of single reflection absorption

Treble outperforms conventional GA software in accurately simulating absorbing reflections by directly solving the wave equation and applying impedance material properties, achieving superior accuracy even at low frequencies.

SEE STUDY



Simulation of single reflection diffusion

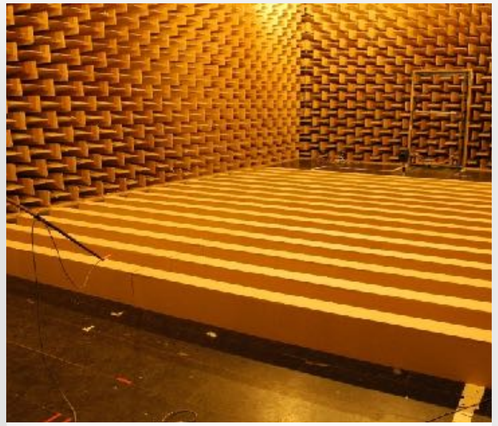
Treble excels in modeling diffuse reflections with superior accuracy compared to conventional GA software, leveraging direct wave equation solutions to capture complex sound scattering effects realistically.

SEE STUDY

Simulation of diffraction

Treble accurately simulates diffraction by directly solving the wave equation, outperforming traditional GA software, particularly in complex scenarios like large barriers or finite diffracting bodies.

SEE RS5 STUDY SEE RS6 STUDY



Simulation of seat dip effect

Treble accurately simulates seat dip effects, common e.g. in performance halls, by solving the wave equation with correct surface impedance data, outperforming GA software in modeling complex diffraction behavior.

SEE STUDY

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LF APPLICATION: ARC DELAY

Subwoofer array design with Treble

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Subwoofer Array Design

Example project > Results > Cluster V, Cluster S, Array

+ New

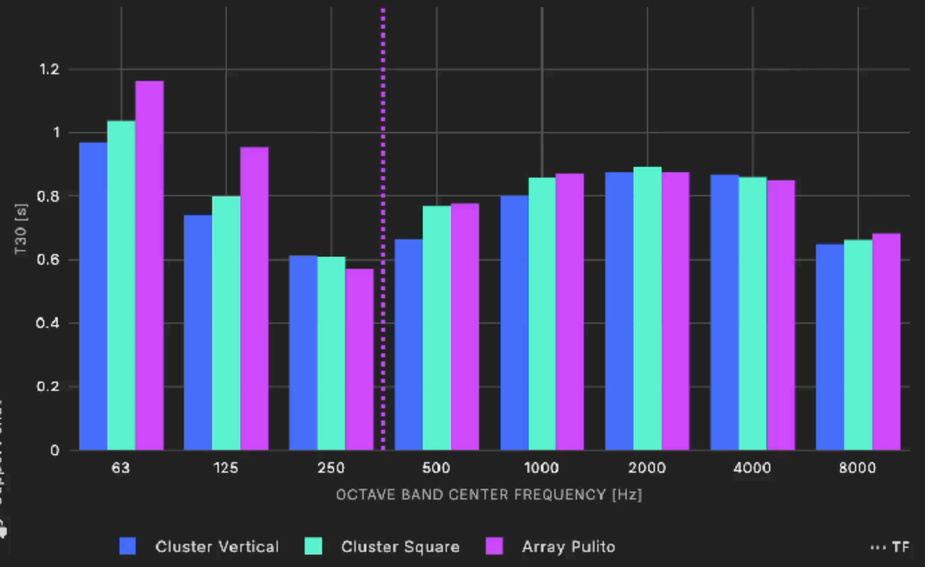
Recent tasks

Result view | Load | Save

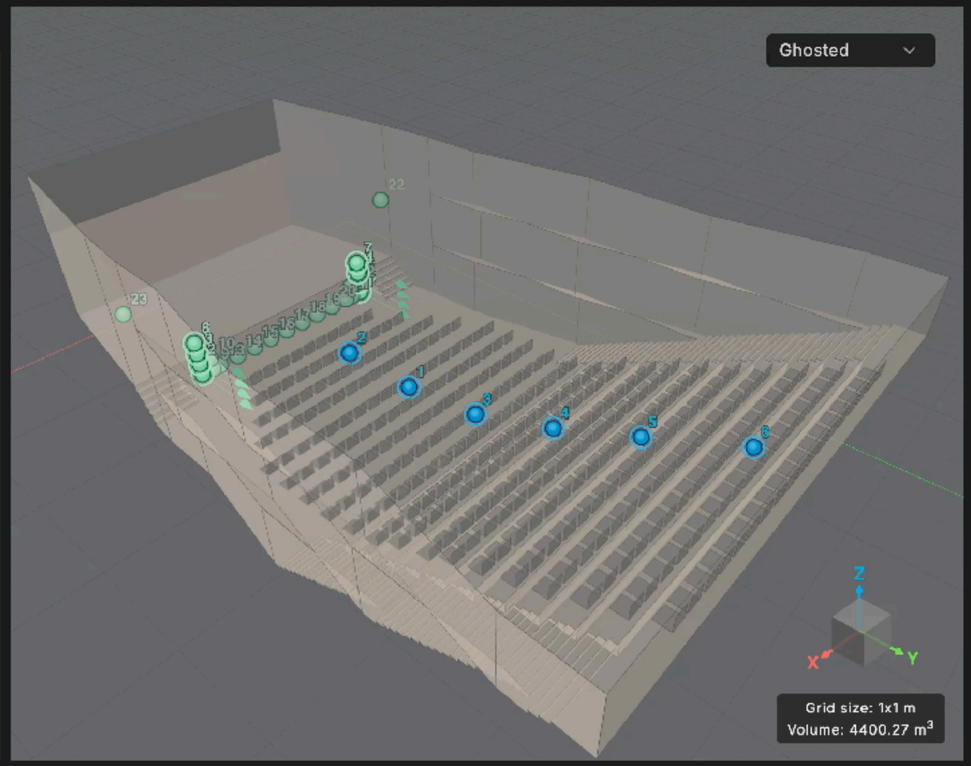
Parameters | Plots

Select parameter

EDT | T20 | T30 | C50 | C80 | D50 | TS | G | SPL | STI | LJ | LF | QOP



Support chat



Materials | Sources / Receivers | Settings

LAYER	MATERIAL	SCATTER
Chair	Upholstered seating	0.5
Walls	Glasswool 100 mm, 2...	0.15
Ceiling	Acoustic ceiling (glas...	0.2
Floor	Wooden flooring	0.15
Wallpanel	Wood panel with air s...	0.15
Stage	Stage floor	0.25

All subwoofers
Lecture hall > Initial design
Cluster Vertical
Source: Cluster Vertical
Receivers: Receiver 1, Receiver 2, Receiv...
Result type: Hybrid
Download

All subwoofers
Lecture hall > Initial design
Cluster Square
Source: Cluster Square
Receivers: Receiver 1, Receiver 2, Receiv...
Result type: Hybrid
Download

All subwoofers
Lecture hall > Initial design
Array Pulito
Source: Array pulito
Receivers: Receiver 1, Receiver 2, Receiv...
Result type: Hybrid
Download

Add simulation

RT estimates

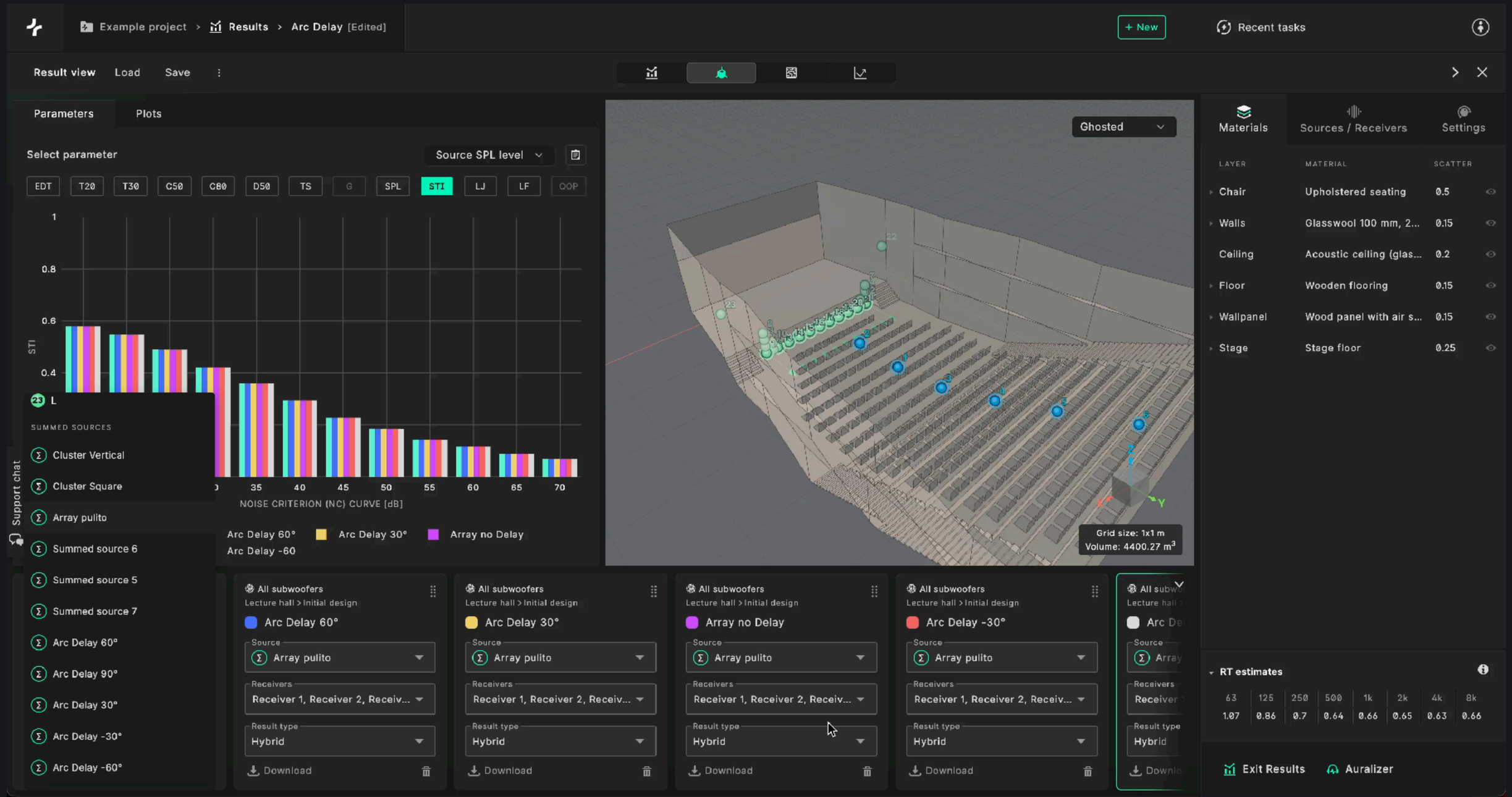
63	125	250	500	1k	2k	4k	8k
1.07	0.86	0.7	0.64	0.66	0.65	0.63	0.66

Exit Results | Auralizer

STUDIO SOUND SERVICE

Donato Masci

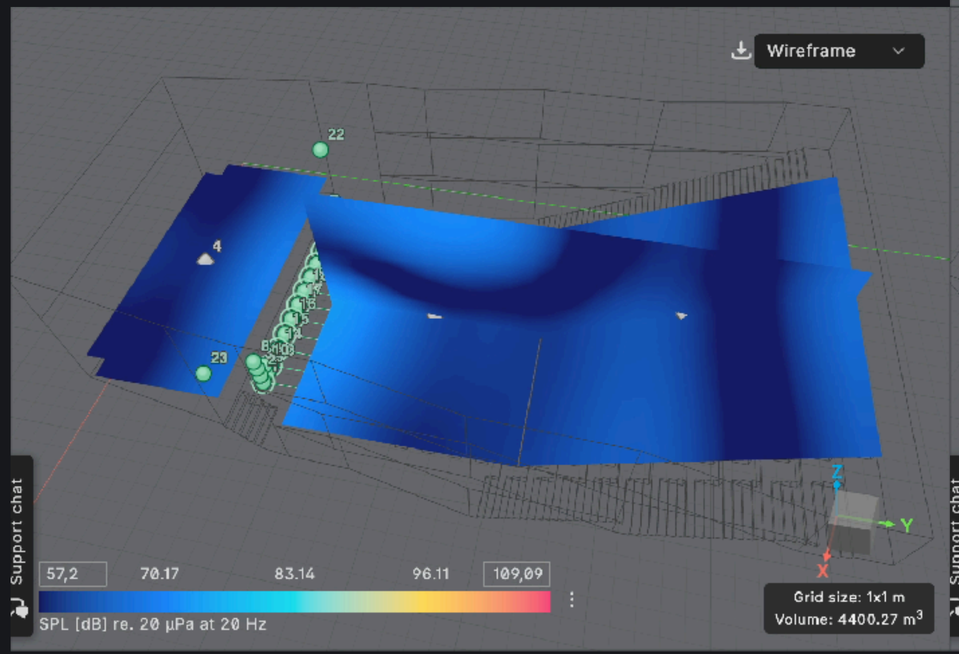
Subwoofer Array Design: Applying the delay



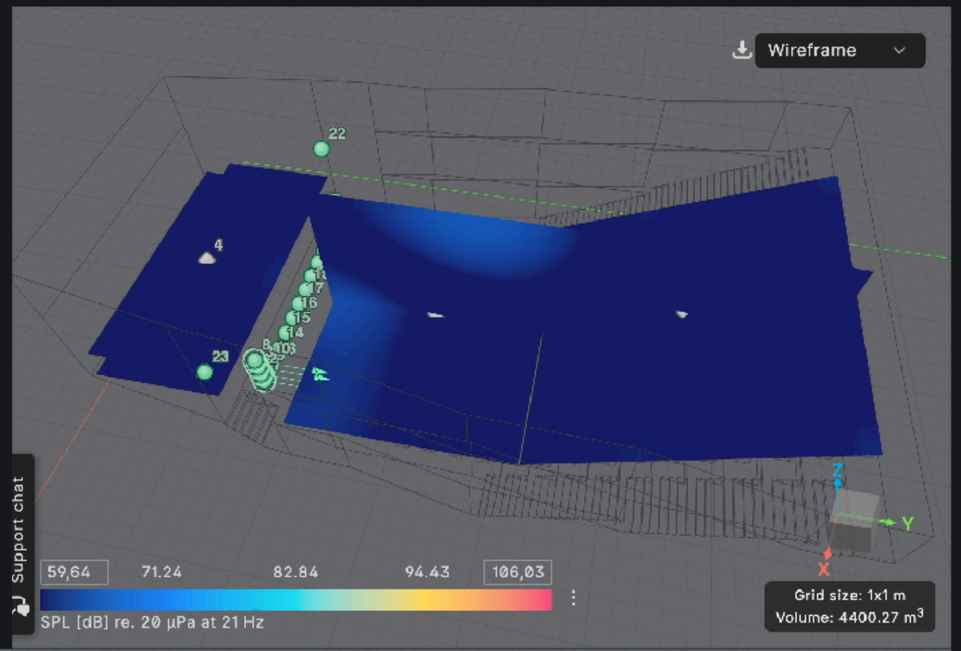
Donato Masci

Subwoofer Array Design: different configurations

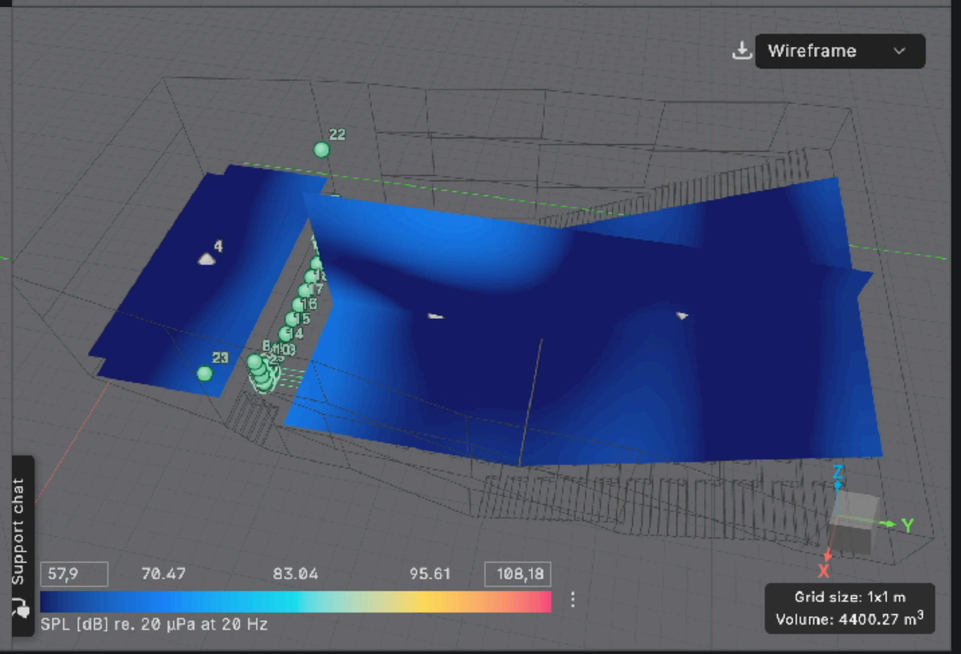
Array

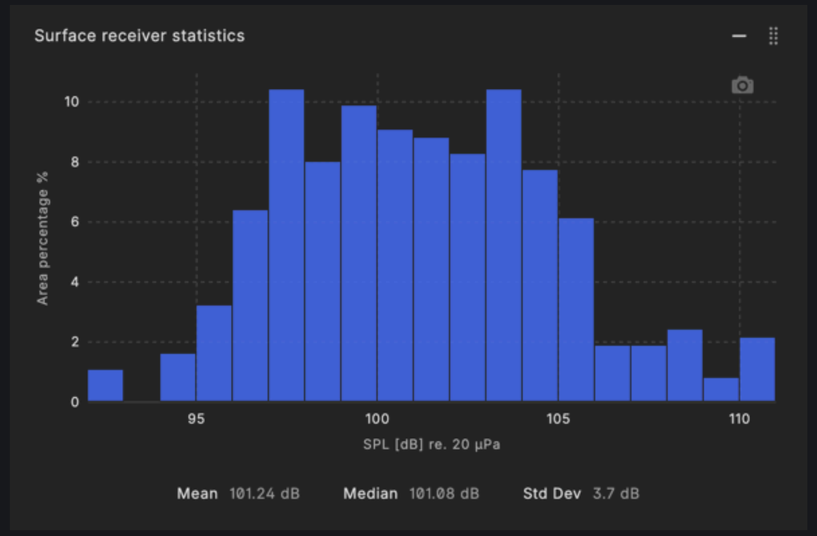


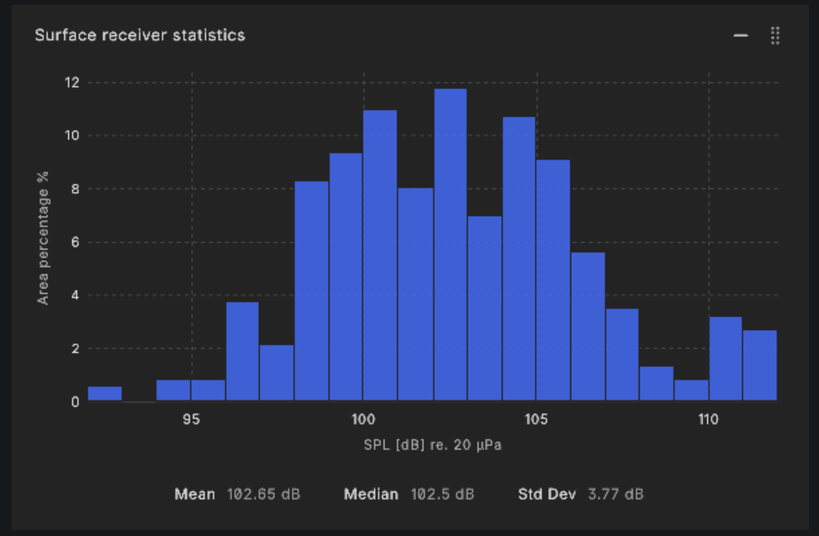
Cluster Vertical

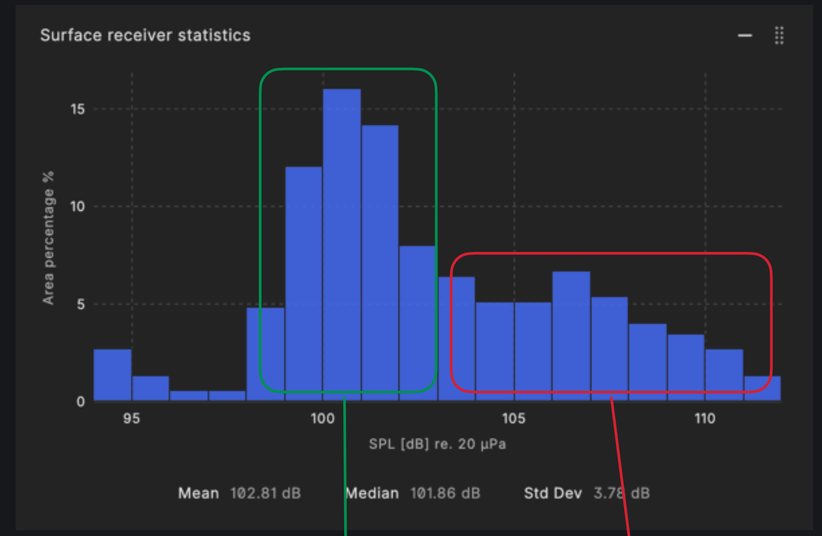


Cluster Square

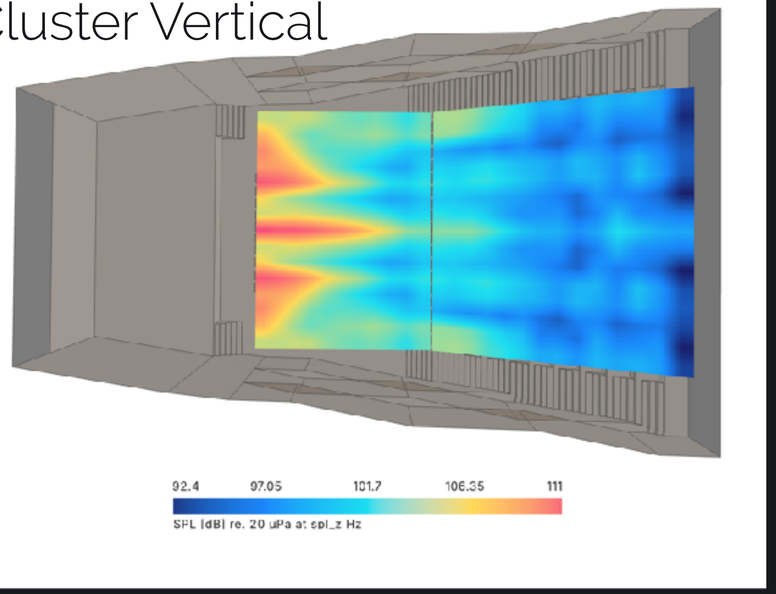




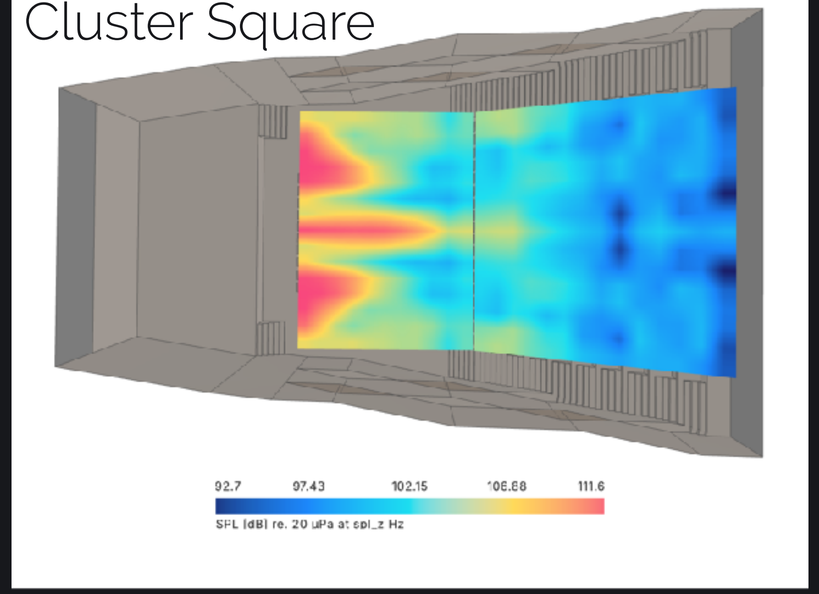




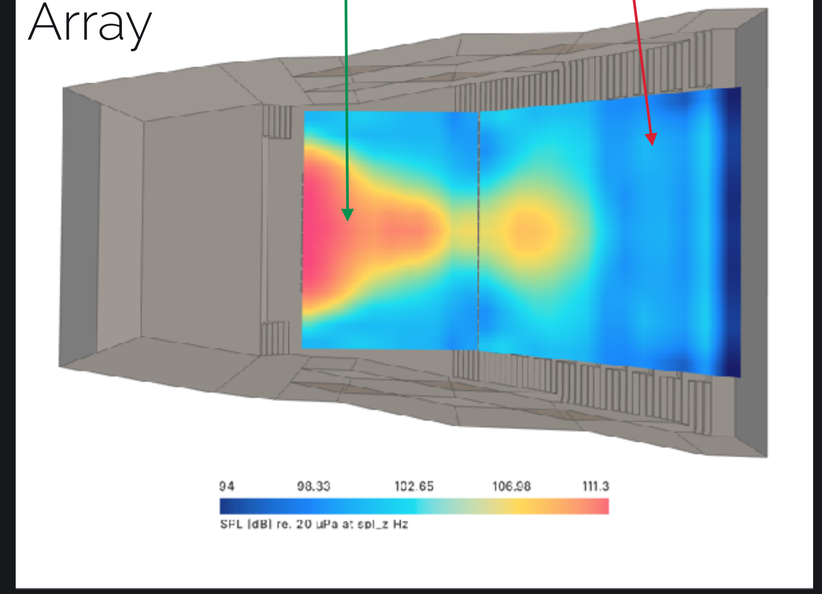
Cluster Vertical



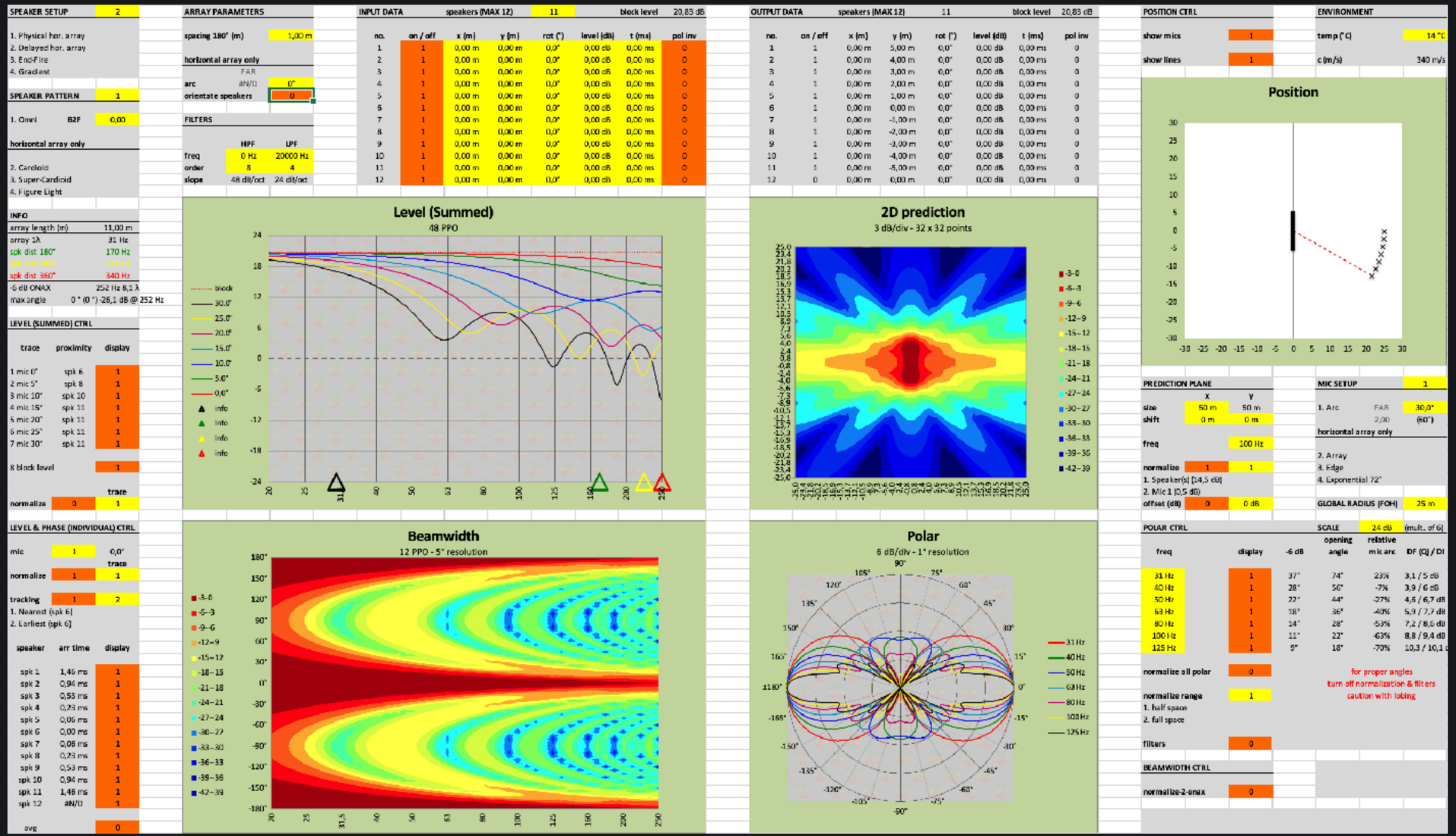
Cluster Square



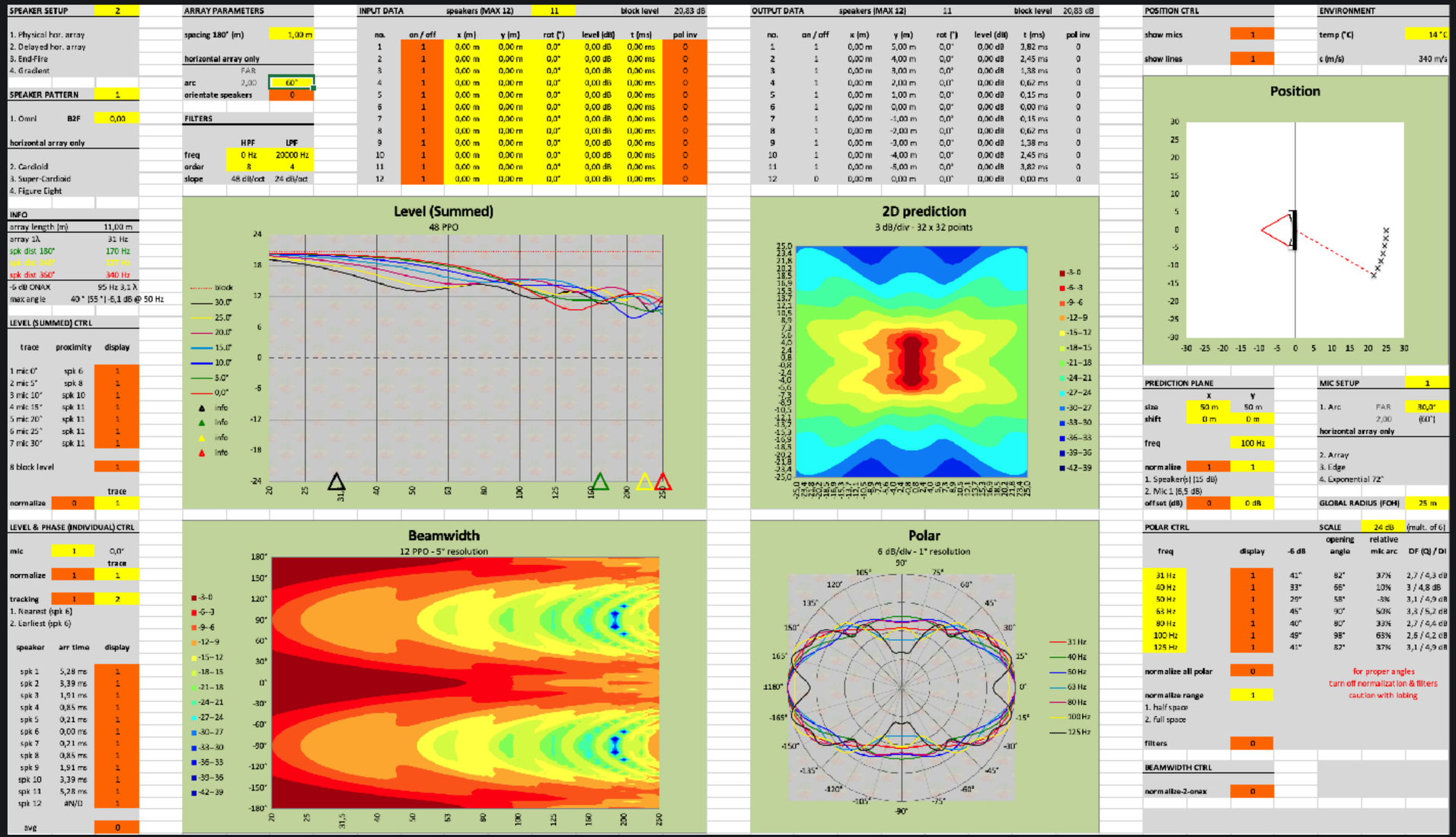
Array

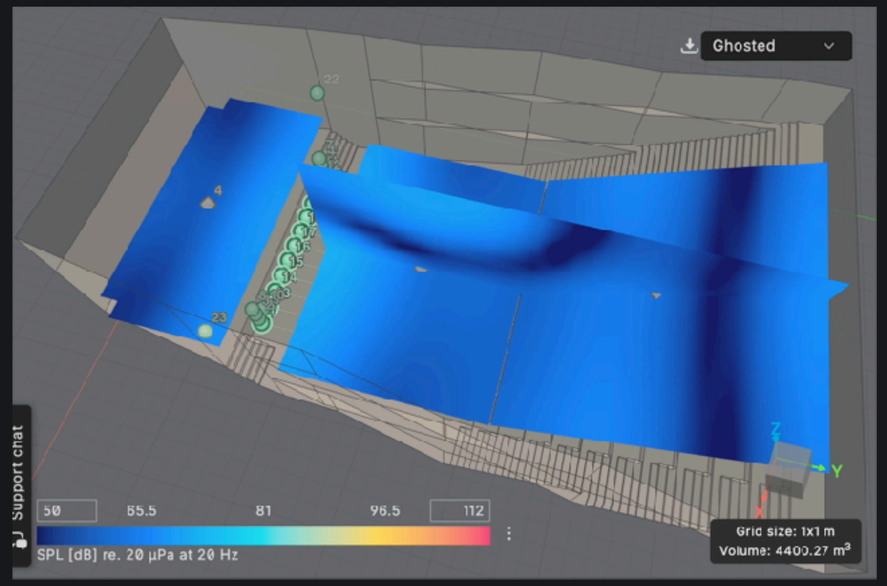


S.A.D. V1.10 BY MERLIJN VAN VEEN

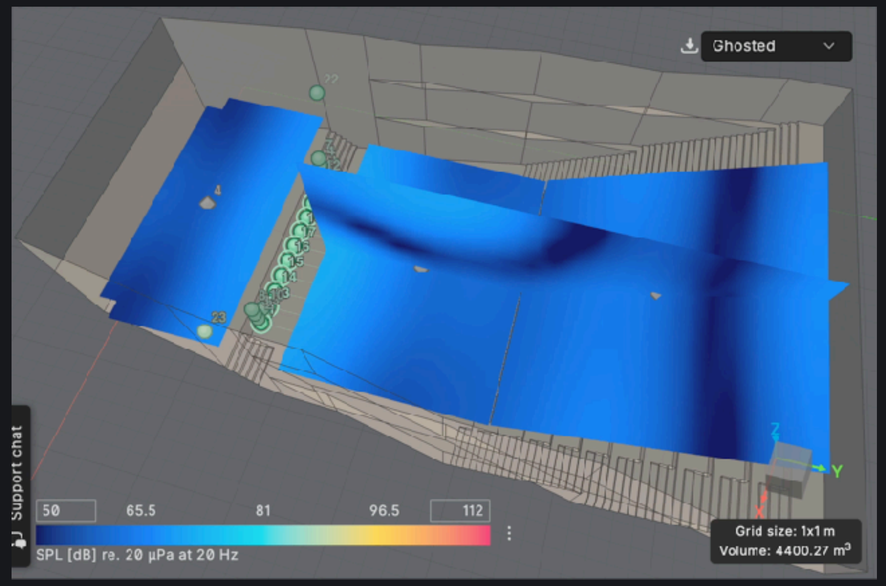


S.A.D. V1.10 BY MERLIJN VAN VEEN

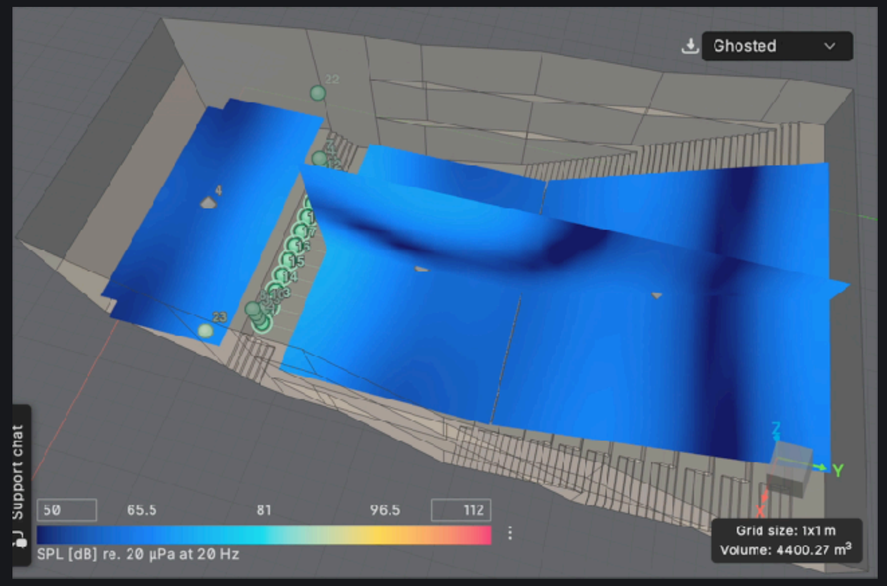



Ghosted
Support chat
50
55.5
81
96.5
112
SPL [dB] re. 20 µPa at 20 Hz
Grid size: 1x1 m
Volume: 4400.27 m³

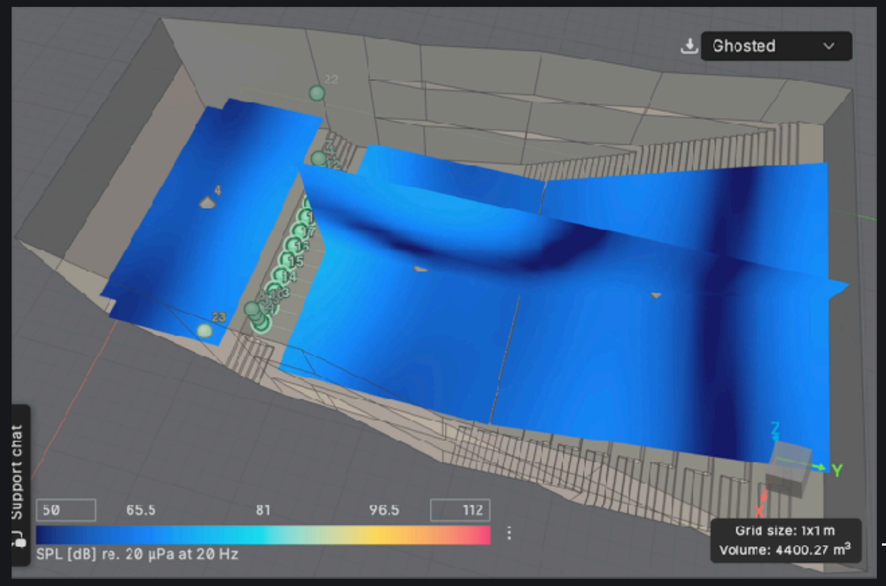
0°


Ghosted
Support chat
50
65.5
81
96.5
112
SPL [dB] re. 20 µPa at 20 Hz
Grid size: 1x1 m
Volume: 4400.27 m³

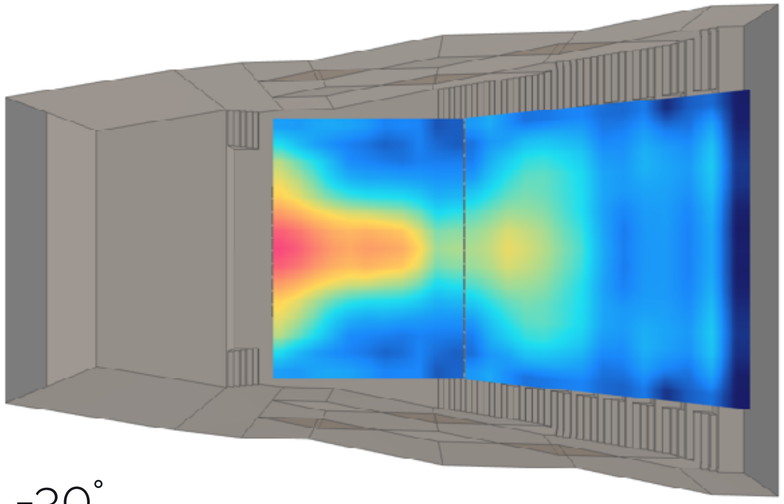
60°


Ghosted
Support chat
50
65.5
81
96.5
112
SPL [dB] re. 20 µPa at 20 Hz
Grid size: 1x1 m
Volume: 4400.27 m³

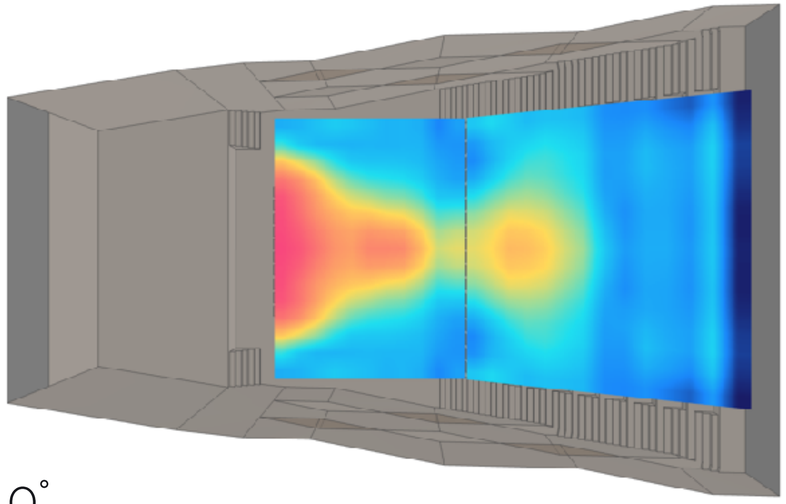
30°


Ghosted
Support chat
50
65.5
81
96.5
112
SPL [dB] re. 20 µPa at 20 Hz
Grid size: 1x1 m
Volume: 4400.27 m³

-60°



-30°



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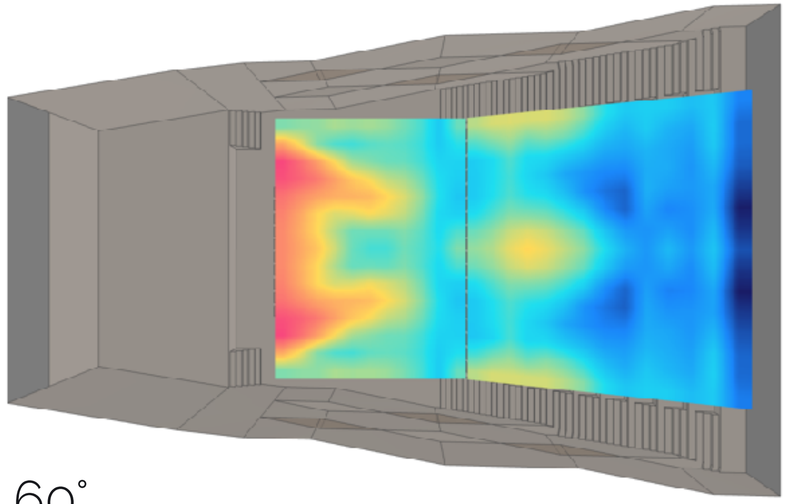

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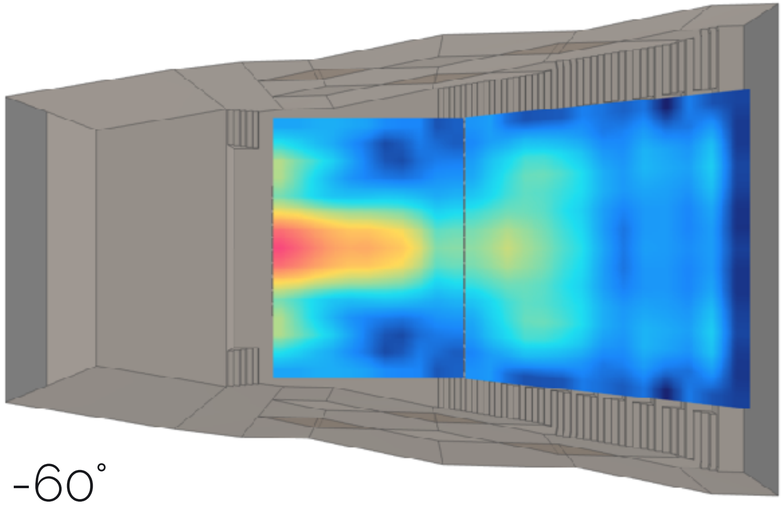

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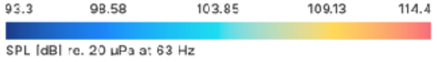

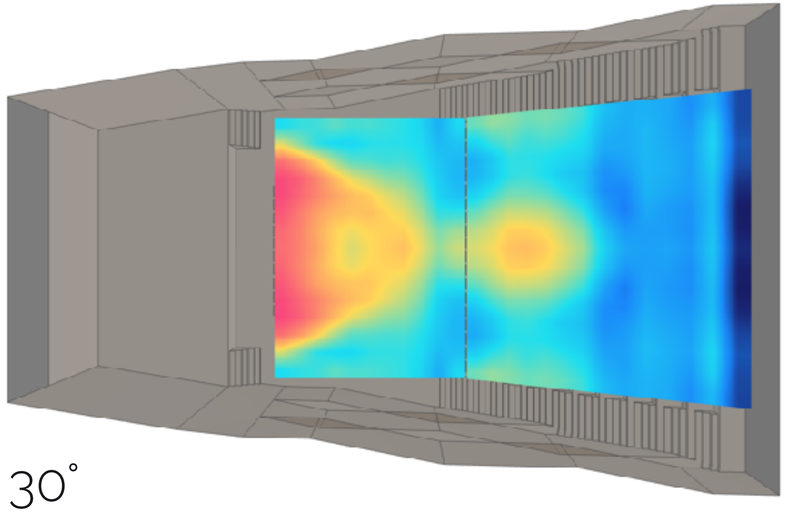

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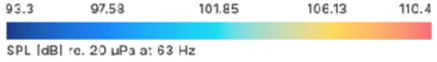

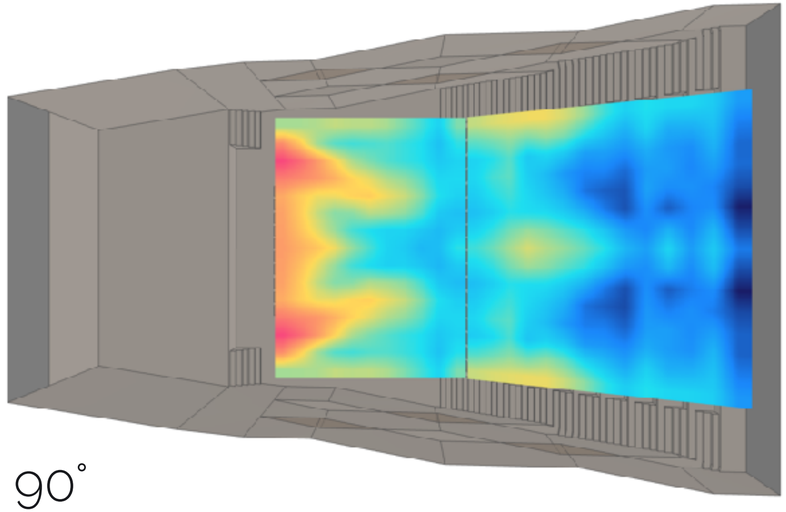

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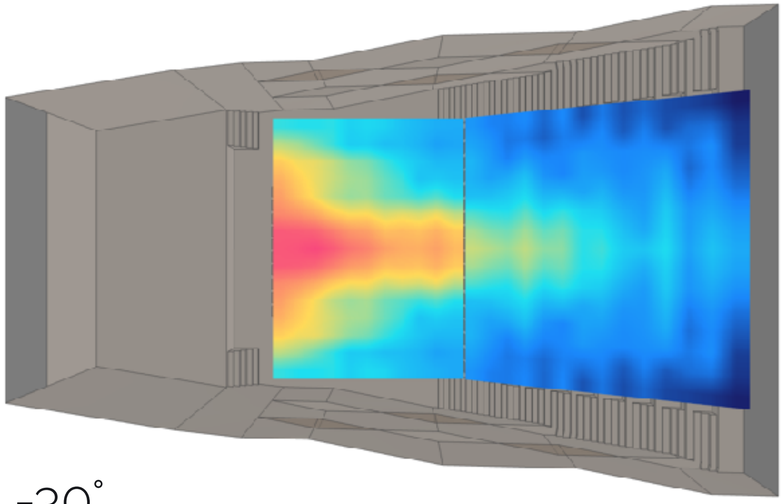

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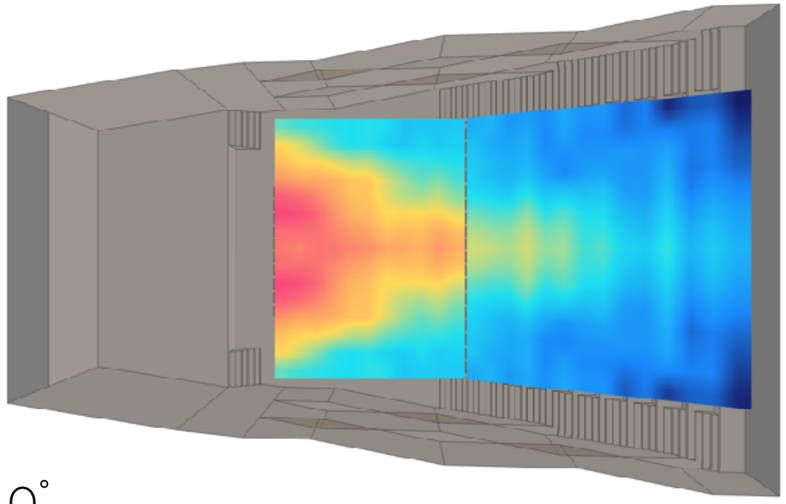

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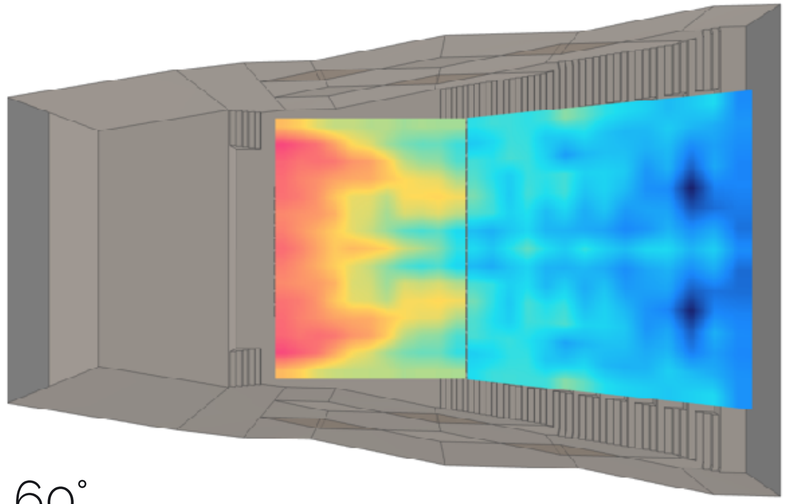

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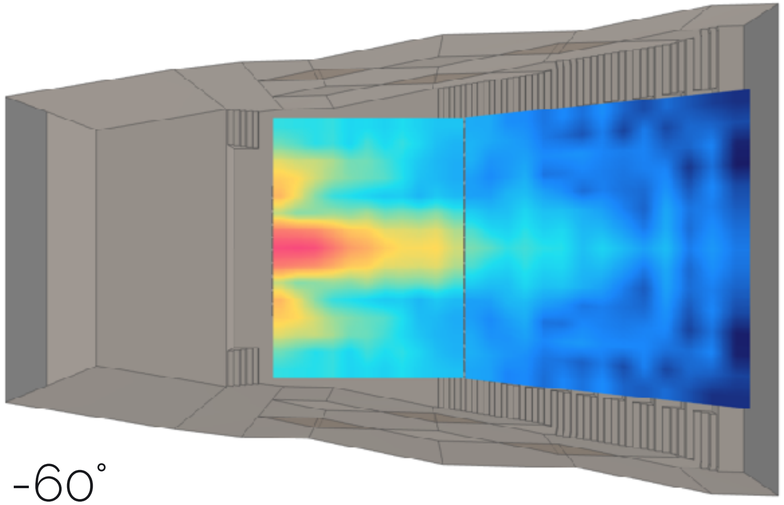

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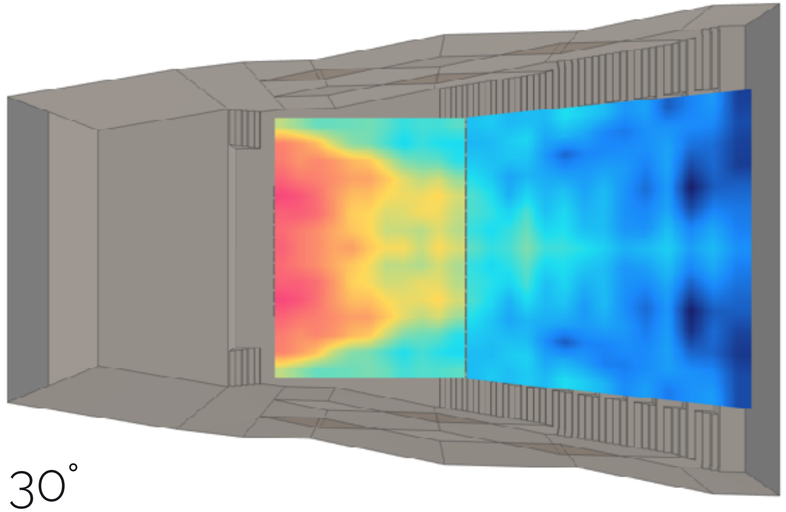

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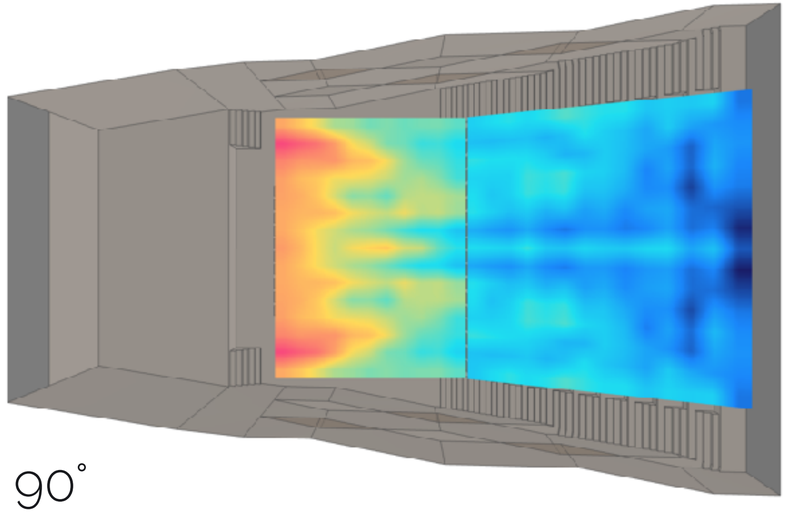

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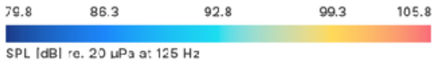
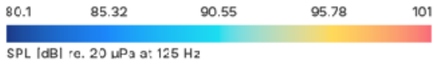
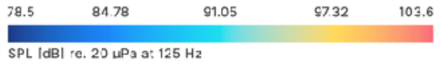
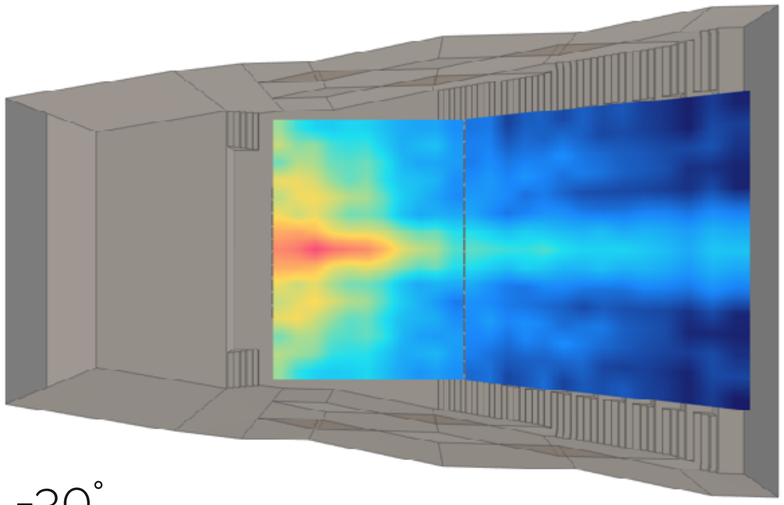
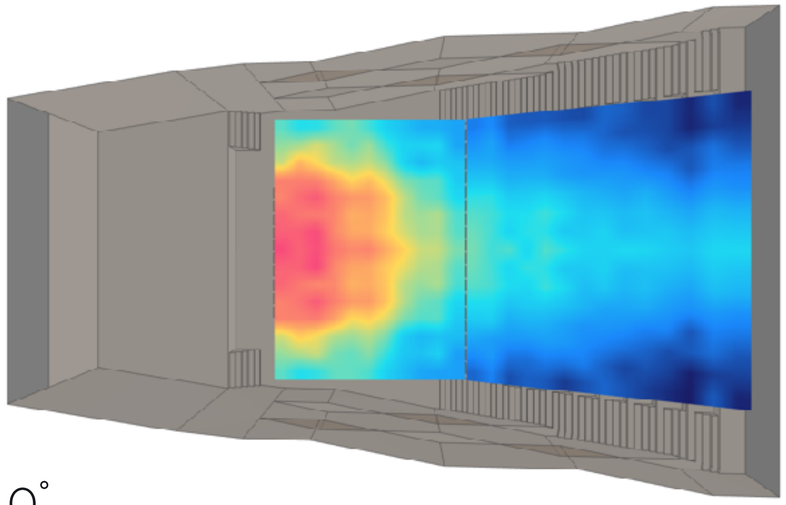








-30°



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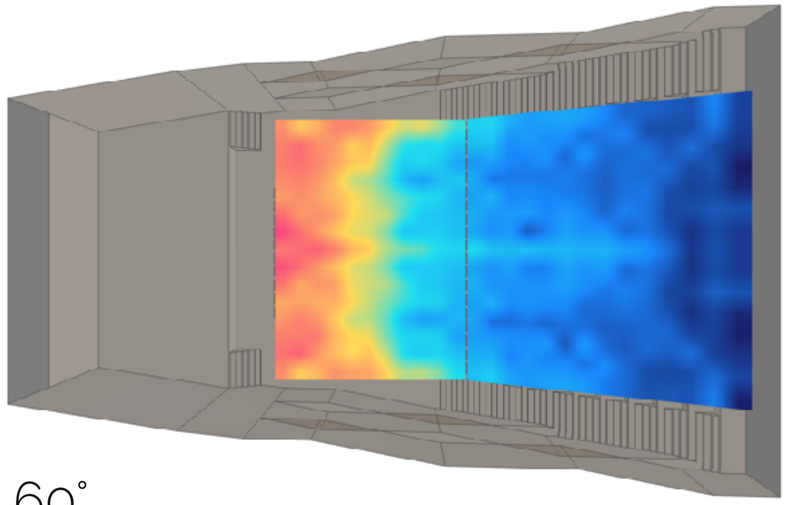

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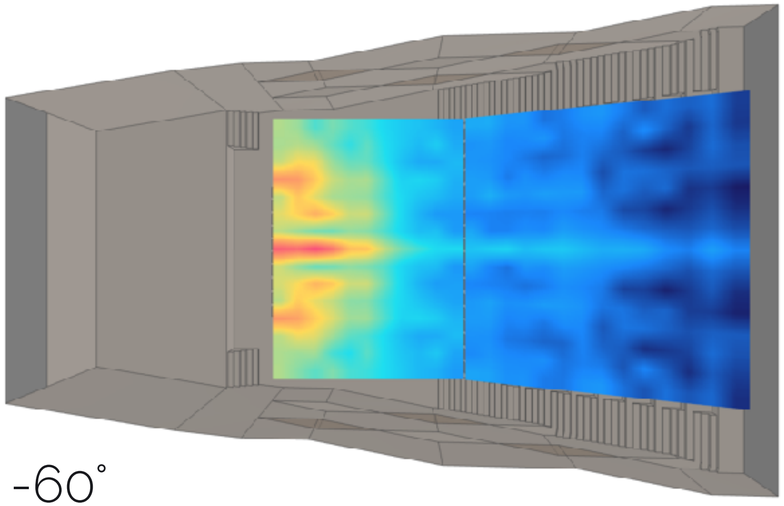

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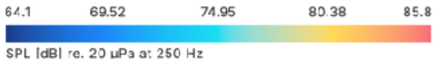

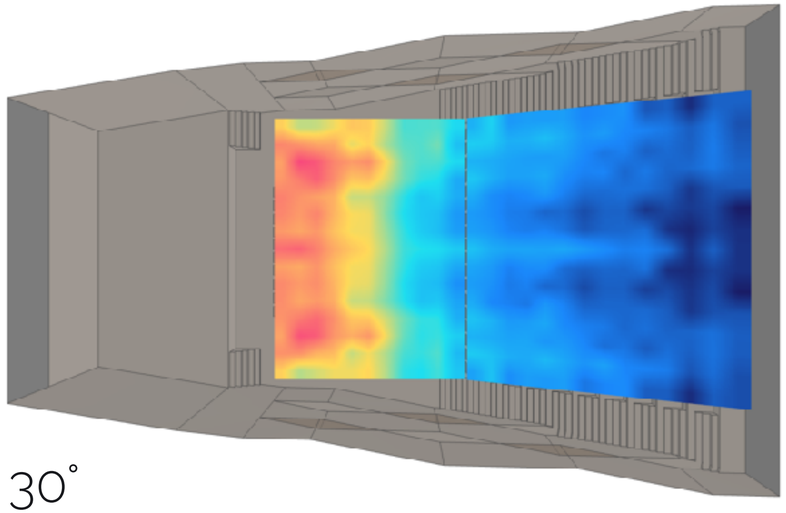

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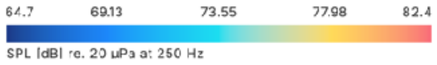
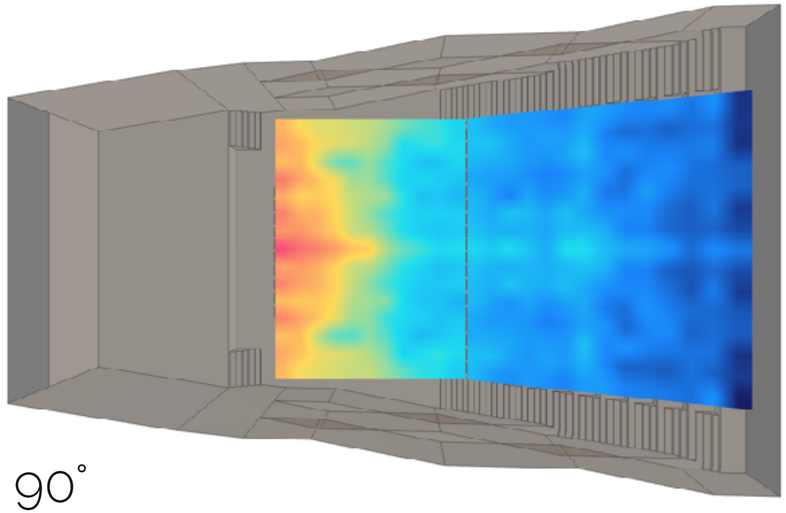
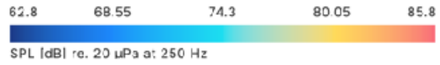
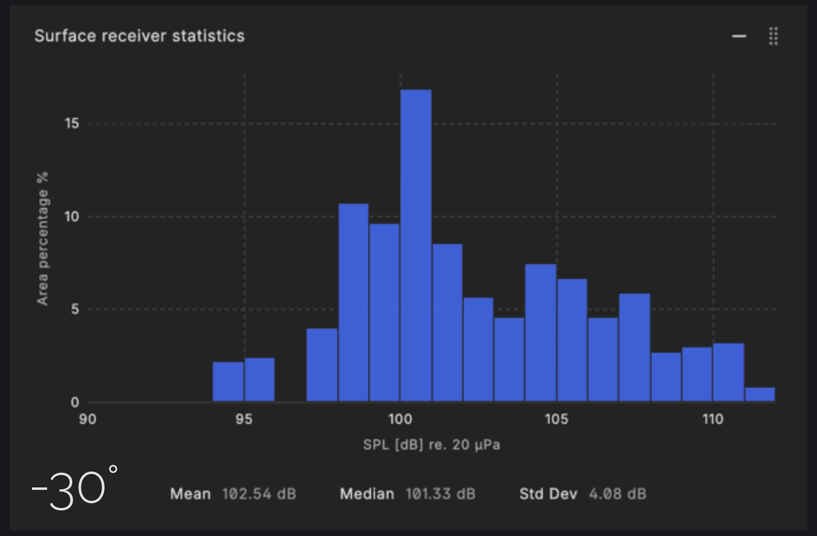


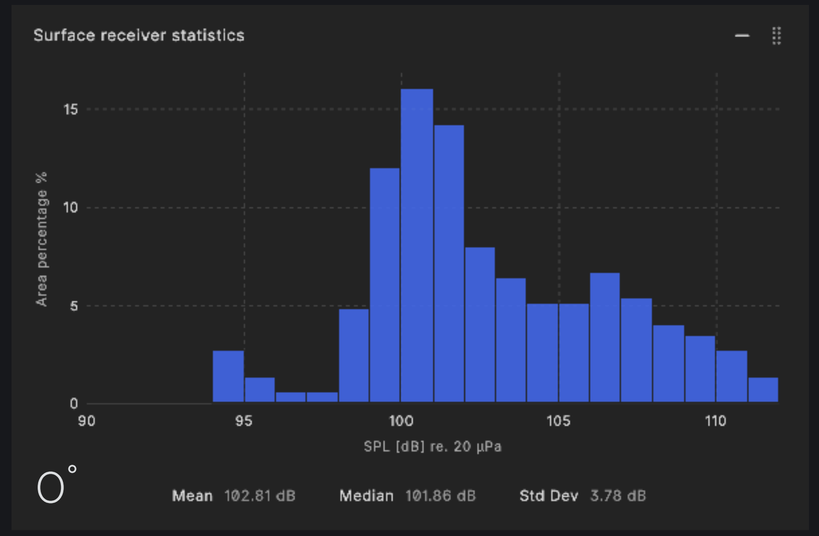


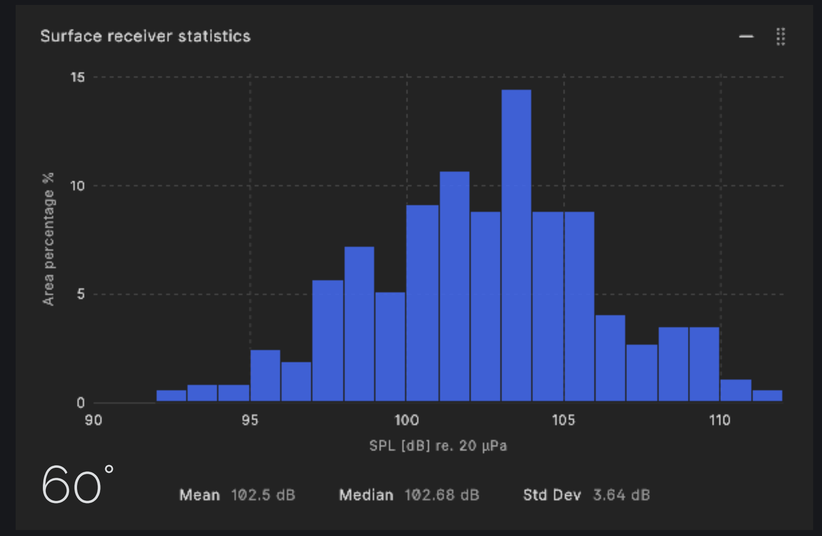
90°

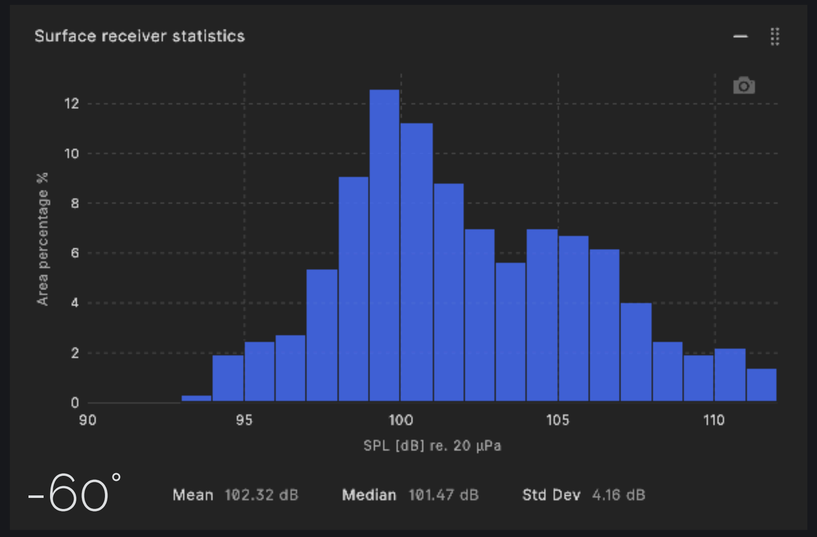


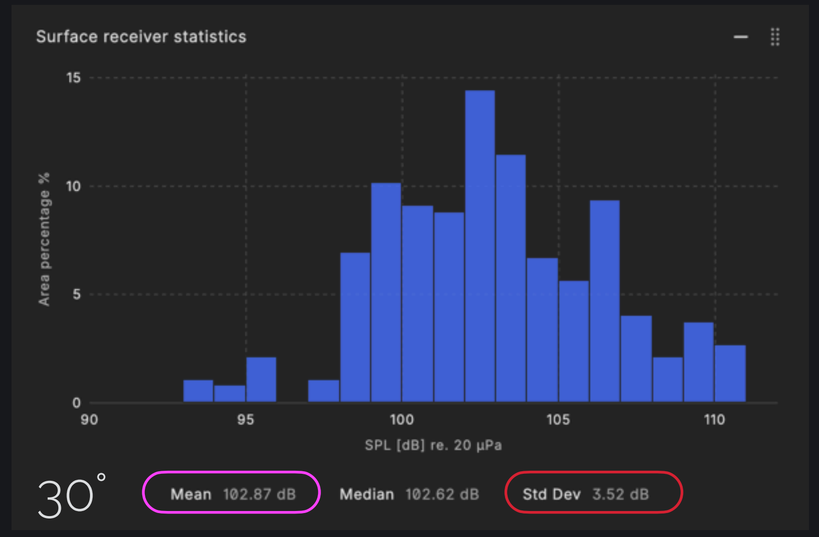
Total SPL

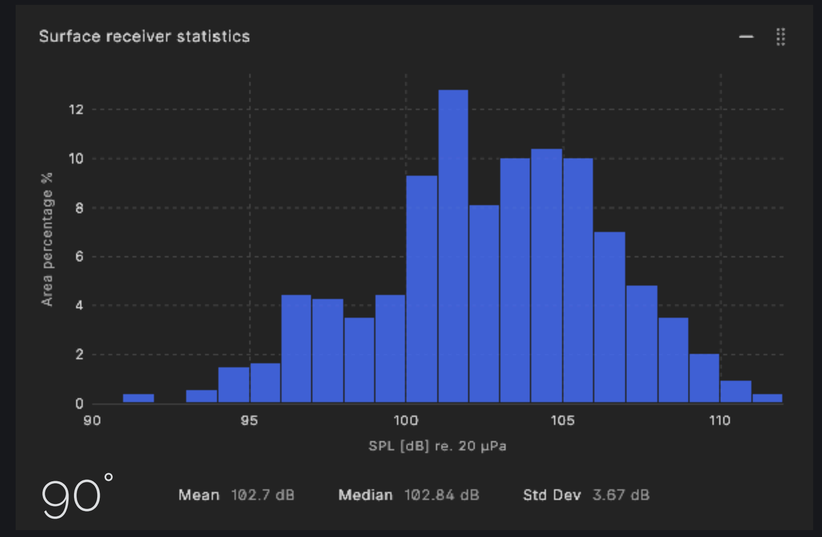

Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
-30°
Mean 102.54 dB
Median 101.33 dB
Std Dev 4.08 dB


Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
0°
Mean 102.81 dB
Median 101.86 dB
Std Dev 3.78 dB


Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
60°
Mean 102.5 dB
Median 102.68 dB
Std Dev 3.64 dB


Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
-60°
Mean 102.32 dB
Median 101.47 dB
Std Dev 4.16 dB


Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
30°
Mean 102.87 dB
Median 102.62 dB
Std Dev 3.52 dB


Surface receiver statistics
Area percentage %
SPL [dB] re. 20 µPa
90°
Mean 102.7 dB
Median 102.84 dB
Std Dev 3.67 dB

Arc delay optimization: beyond polar patterns

TRADITIONAL APPROACH

- Polar patterns show source directivity

TREBLE WAVE SIMULATION

- shows room response to that directivity

- Arc delay example:
- Opening the arc → SPL **Std Dev** decreases ✓
- Beyond critical angle → SPL **Std Dev** increases again ✗
- Visual feedback: lateral wall interactions emerge

Result: optimize coverage angle for *this specific room*, not just theoretical pattern

STUDIO
SOUND
SERVICE

THE CALIBRATION CHALLENGE – SMALL SPACES

Where Control Meets Precision

Small Rooms: The Luxury of Modal Control

THE SMALL ROOM ADVANTAGE

Below Schroeder Frequency (~350Hz):

- Individual modes are audible
- We can count them
- We can measure them
- **We can kill them (one by one!!!)**

OUR WEAPON

- Wave-based simulation (FEM/BEM)
- *(?) Precise impedance control*
- Targeted treatment
- Mathematical certainty

Result: ±5% accuracy

Critical insight:
*"In small rooms, we are **gods**"*

From Empty Box to Validated Model


Conference Paper | PDF Available

A simulation test bench for decay times in room acoustics

October 2018

Conference: COMSOL Conference 2018 · At: Lausanne (Switzerland)

Authors:

Roberto Magalotti
Bowers & Wilkins

Valentina Cardinali
B&C Speakers

- Inverse problem: From MT60 to impedance
- 4 modes = 4 unknown = 4 impedance
- Modal participation factors (ε)
- Process:
  Measure MT60 → Calculate ε → Assign Z
- *Works for 6 surfaces, doesn't scale to 100*
- *Controlled materials*
- *No aging, no surprises*

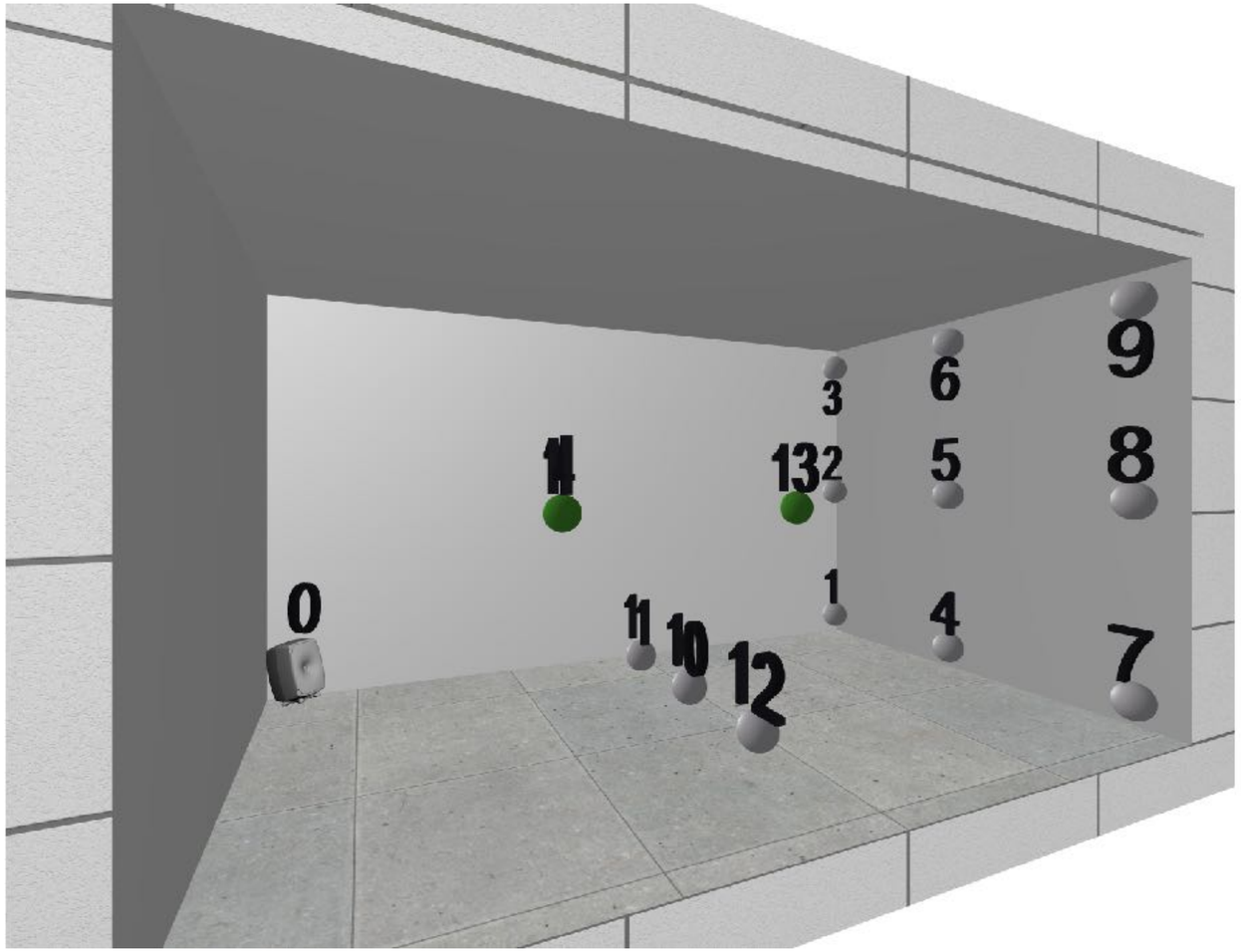
2025 ISE CEDIA Convention

We used the procedure from Roberto Magalotti and Valentina Cardinali's paper: *"A simulation test bench for decay times in room acoustic"*

to indirectly estimate the acoustic impedance of the walls with COMSOL®

and we calculated it using a Mathematica® tool

Measurements in the SSStudio



Points were selected

1. **on the back wall (9 points)**
   - **4 in the corner (1,3,9,7)**
   - **1 in the middle (5)**
   - **4 at the midpoints of the sides (2, 4, 6, 8)**

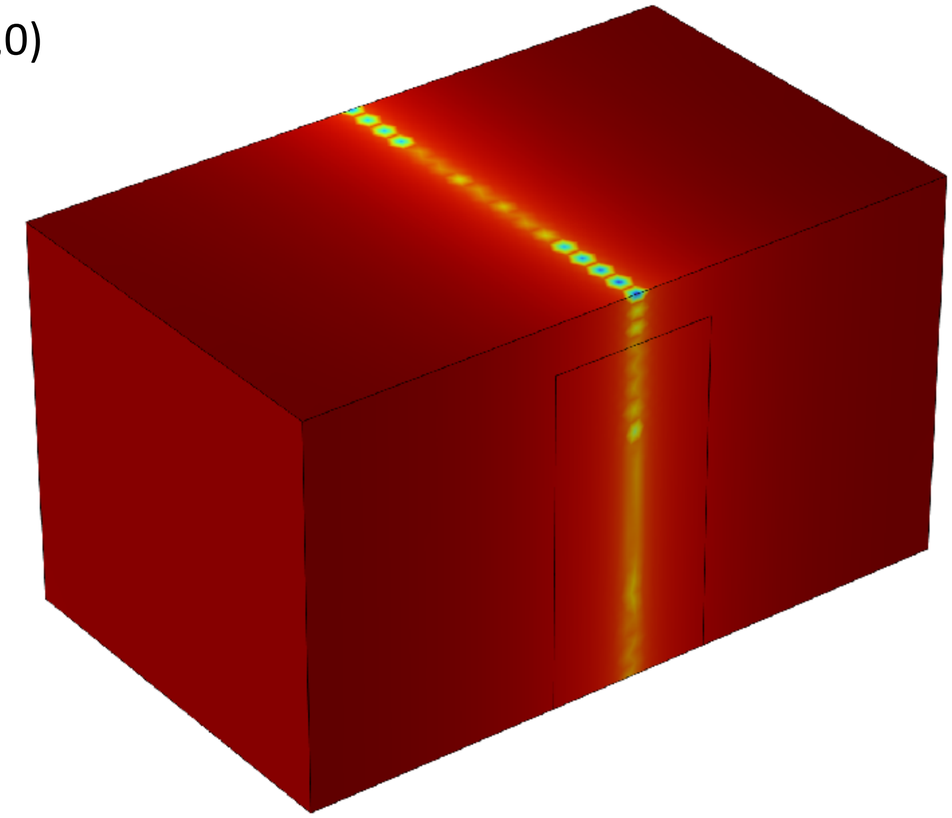
2. **at the middle of the room to distinguish the modal responses**
   - **10**
   - **11 and 12 at 1/4W**

3. **Points at 1/3 of the length as a control position (13, 14)**

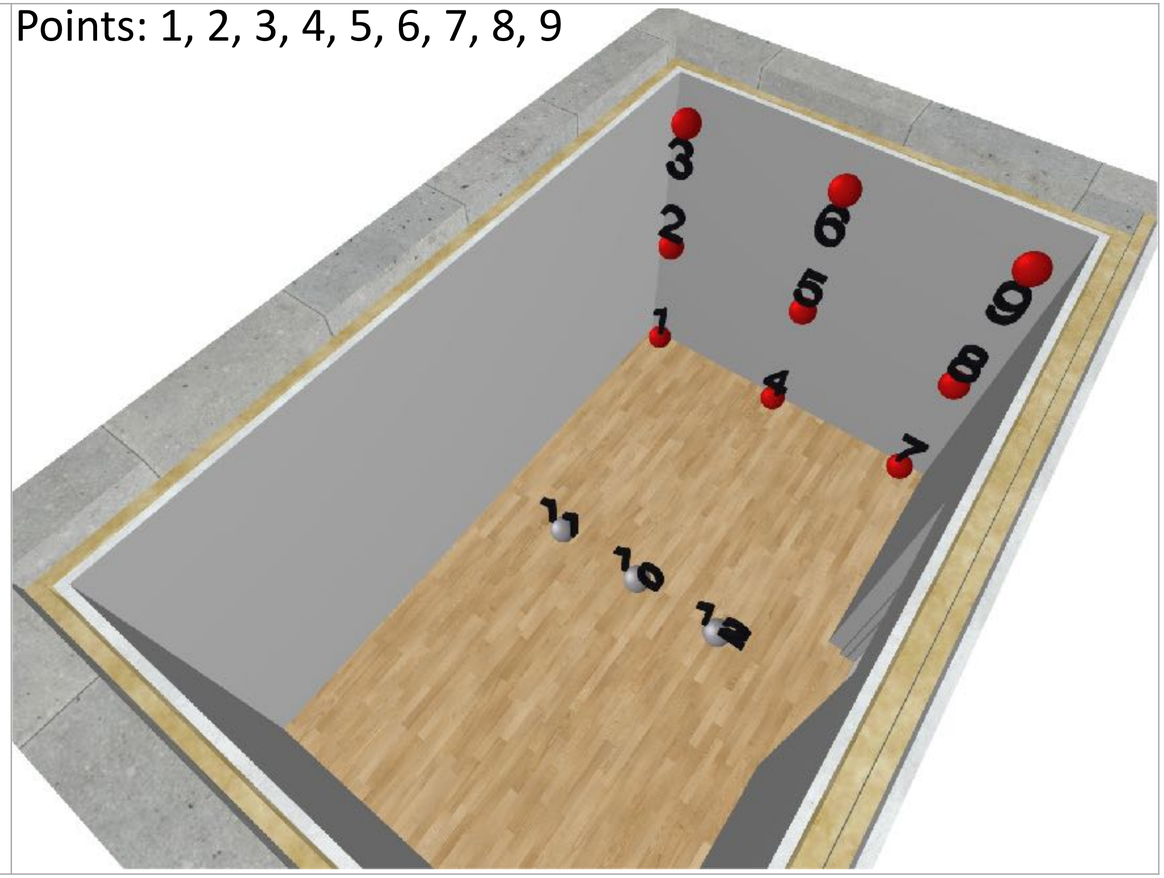
STUDIO SOUND SERVICE

Measurements - Room modes

38
(1,0,0)



Points: 1, 2, 3, 4, 5, 6, 7, 8, 9



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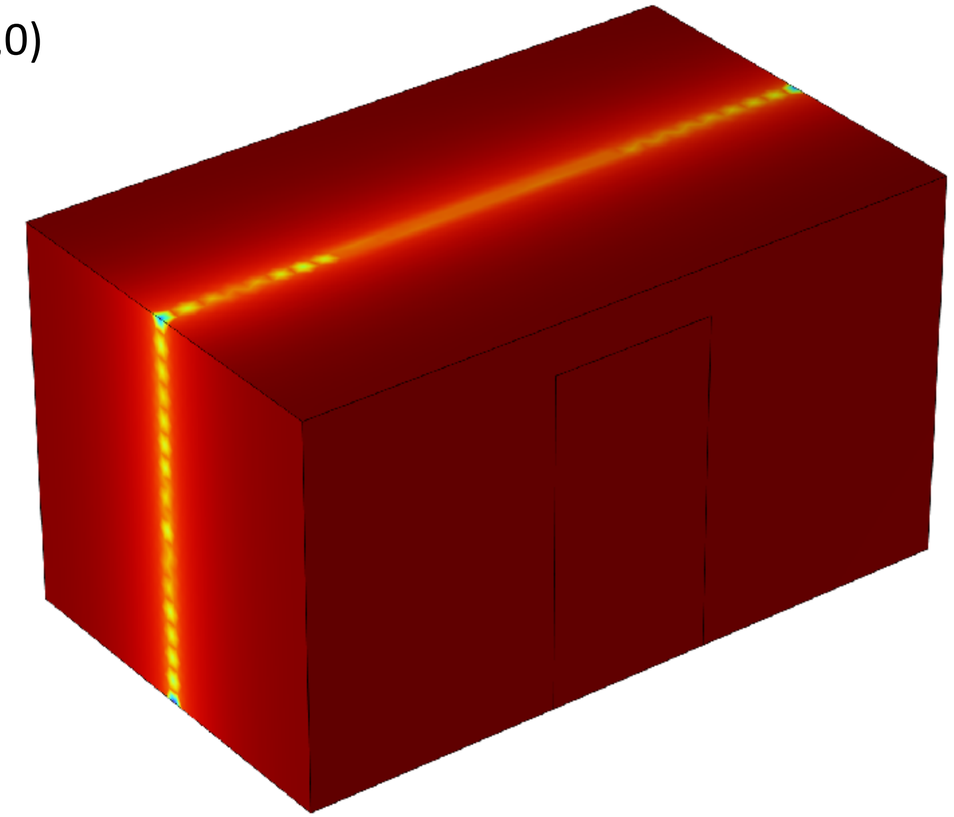
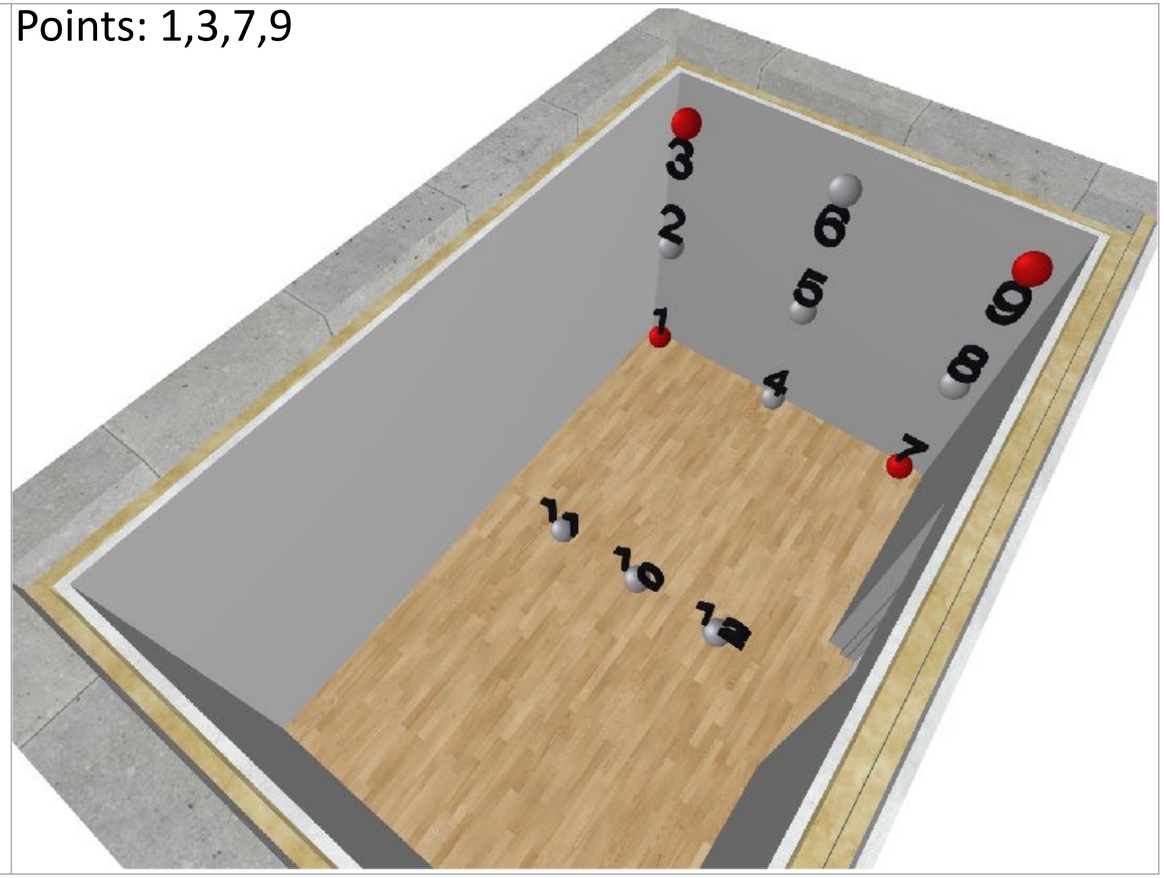
Measurements - Room modes

63
(0,1,0)



Points: 1,3,7,9



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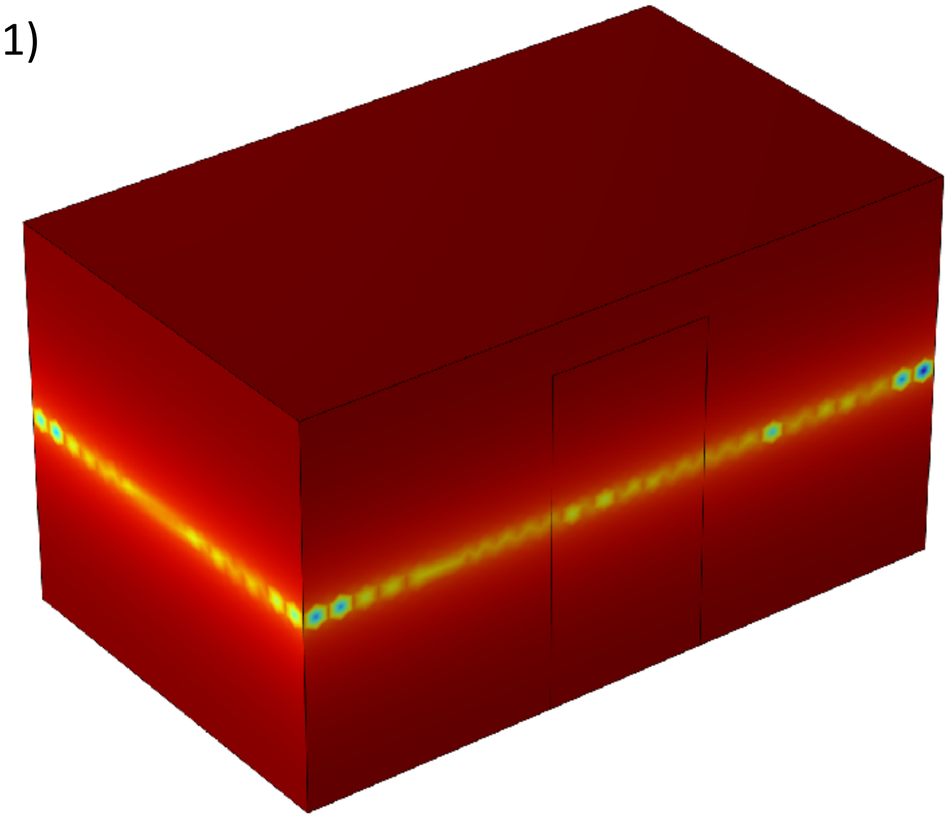
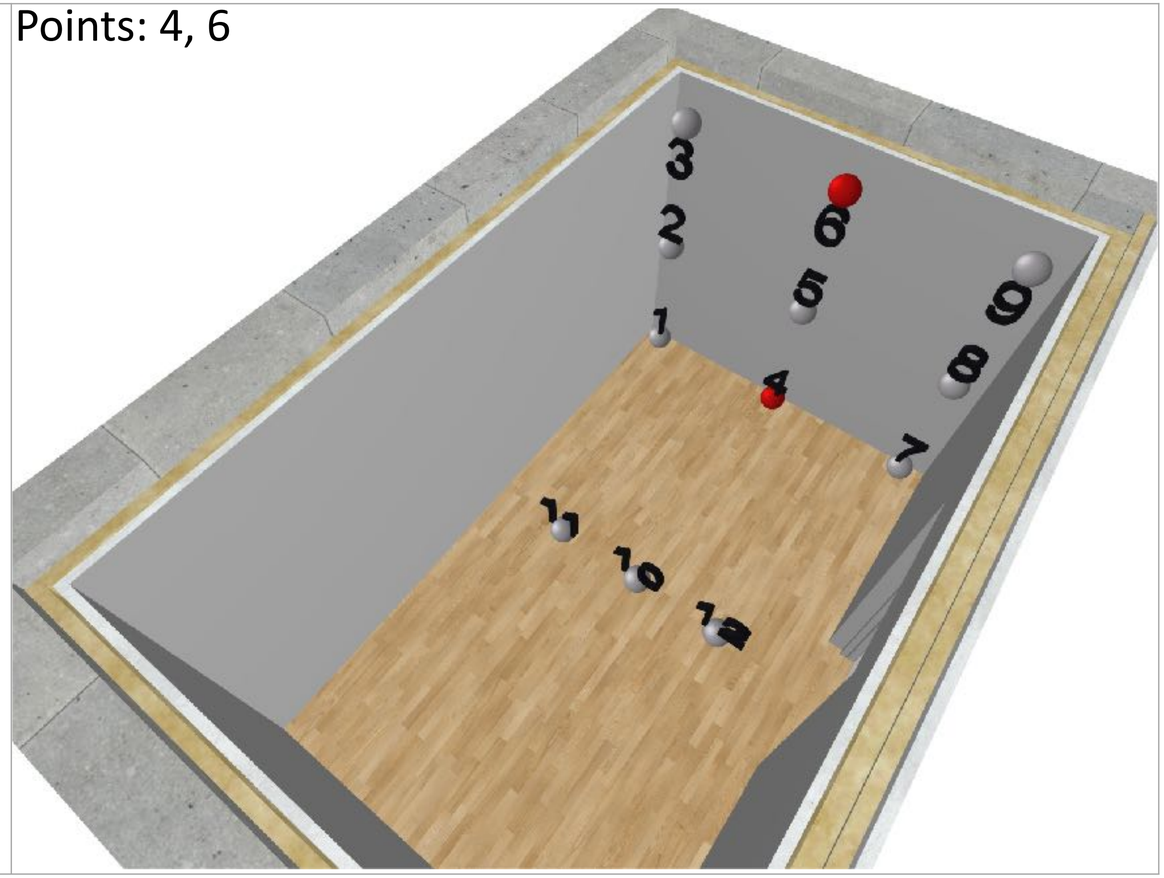
Measurements - Room modes

68
(0,0,1)



Points: 4, 6



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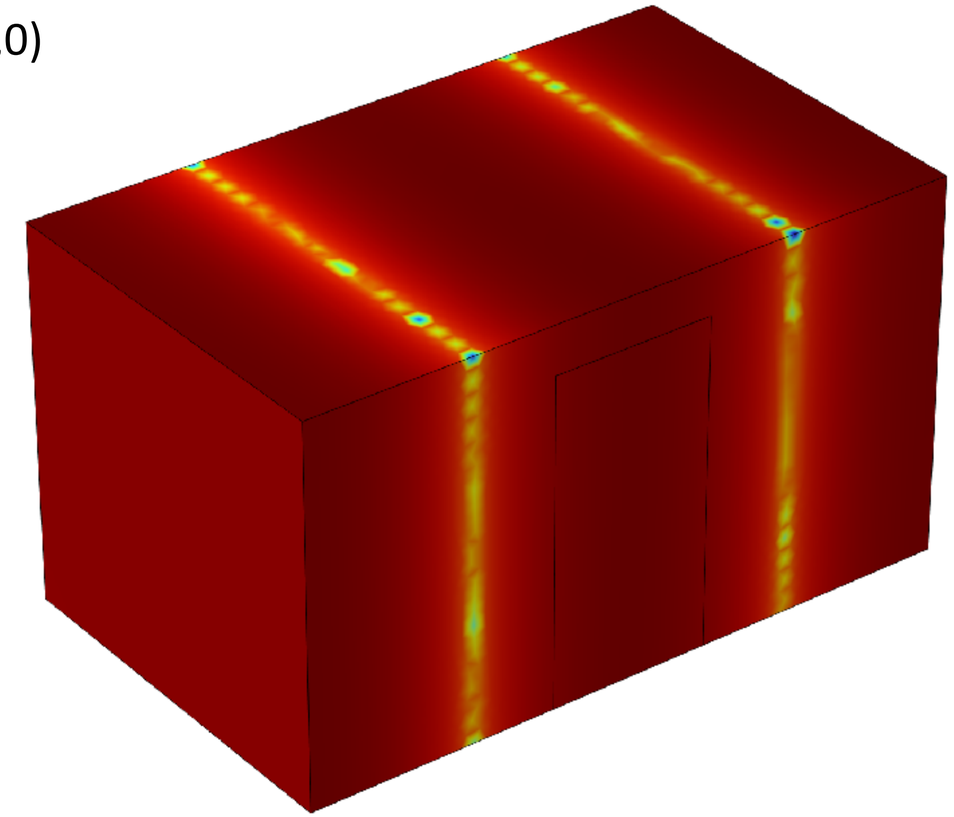
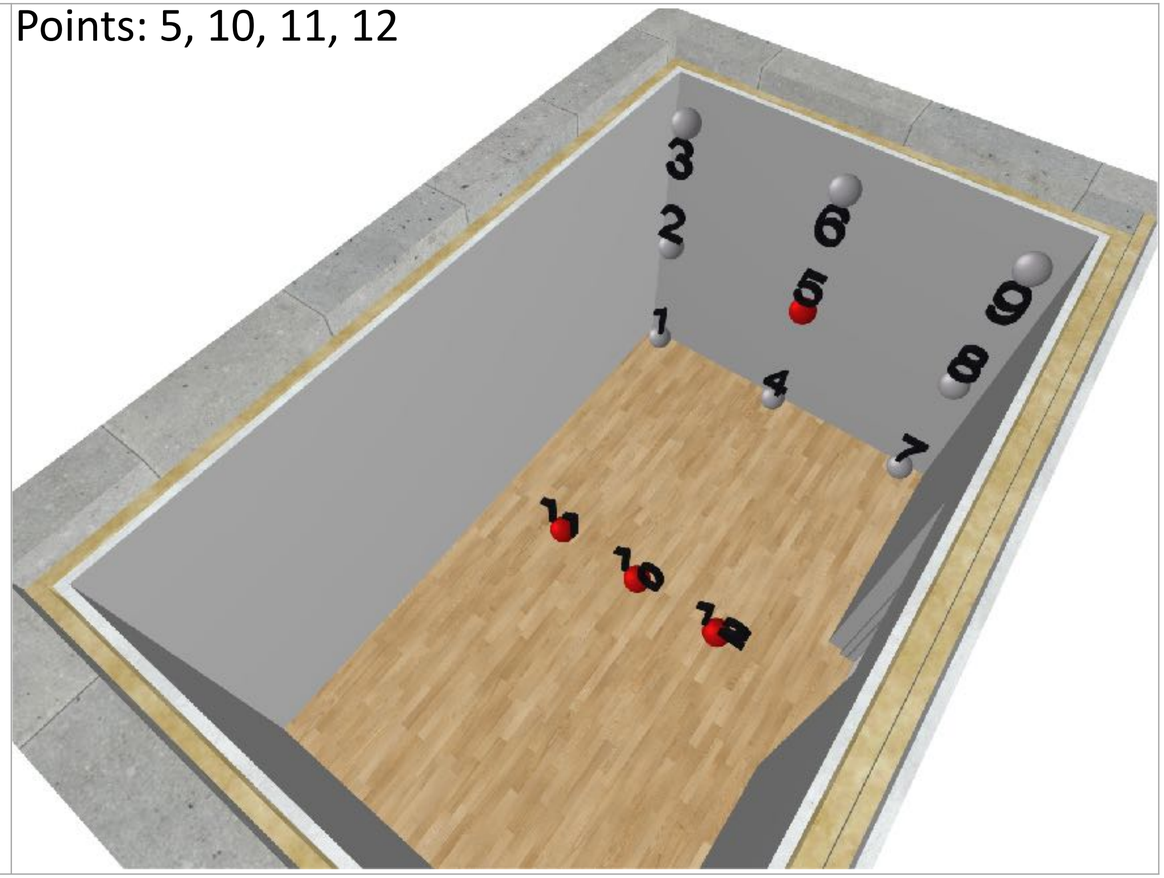
Measurements - Room modes

76
(2,0,0)



Points: 5, 10, 11, 12



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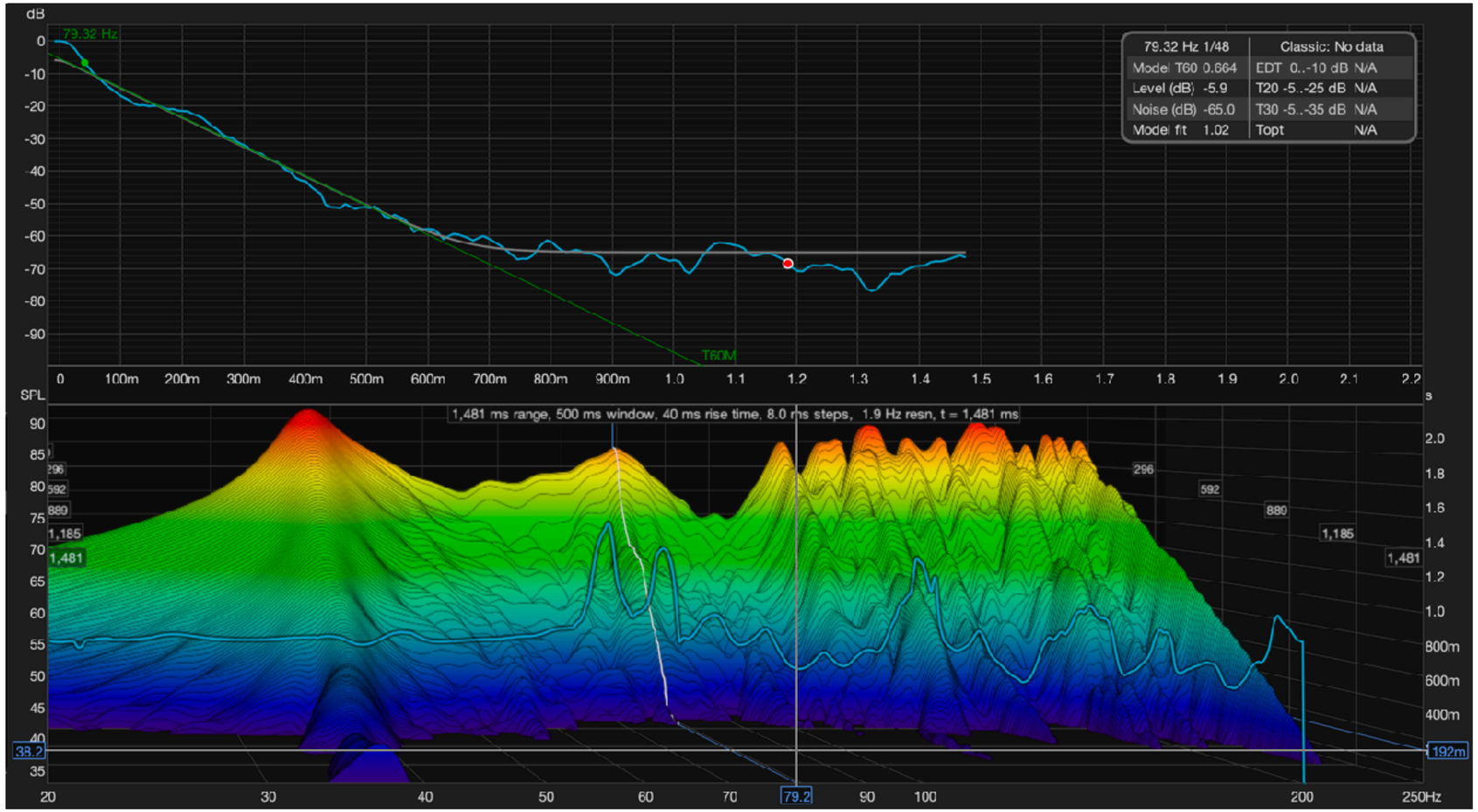
Post-processing - MT60 estimation



We estimated the MT60 for specific modes using measurements in different positions to isolate the modal decay response as much as possible.

For this analysis, we used REW's decay estimation tools.

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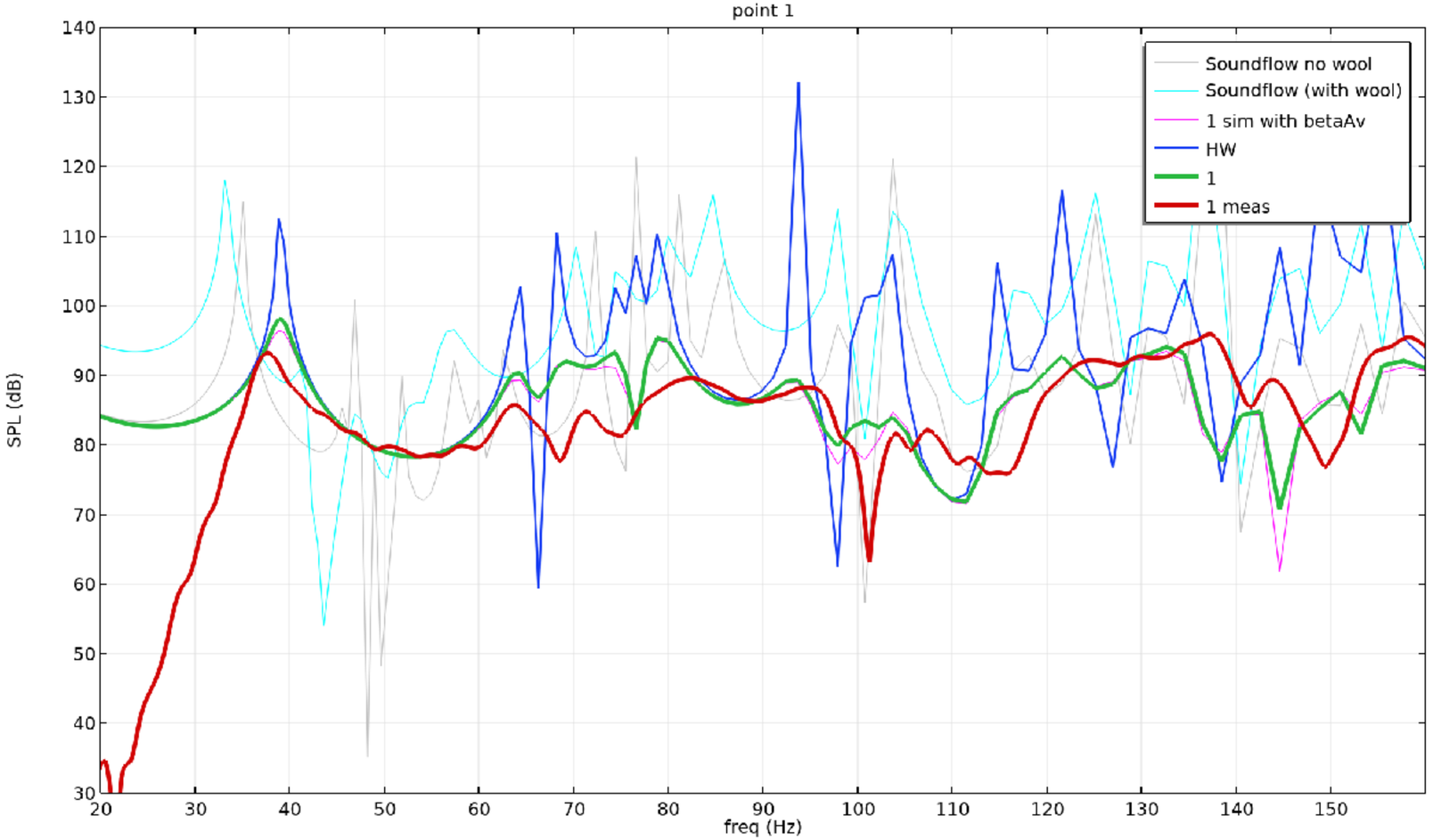
Modeling



We applied the calculated acoustic impedance to the model walls and compared the frequency response results between:

- **simulations using the calculated impedance**
- **rigid walls**
- **measurements**

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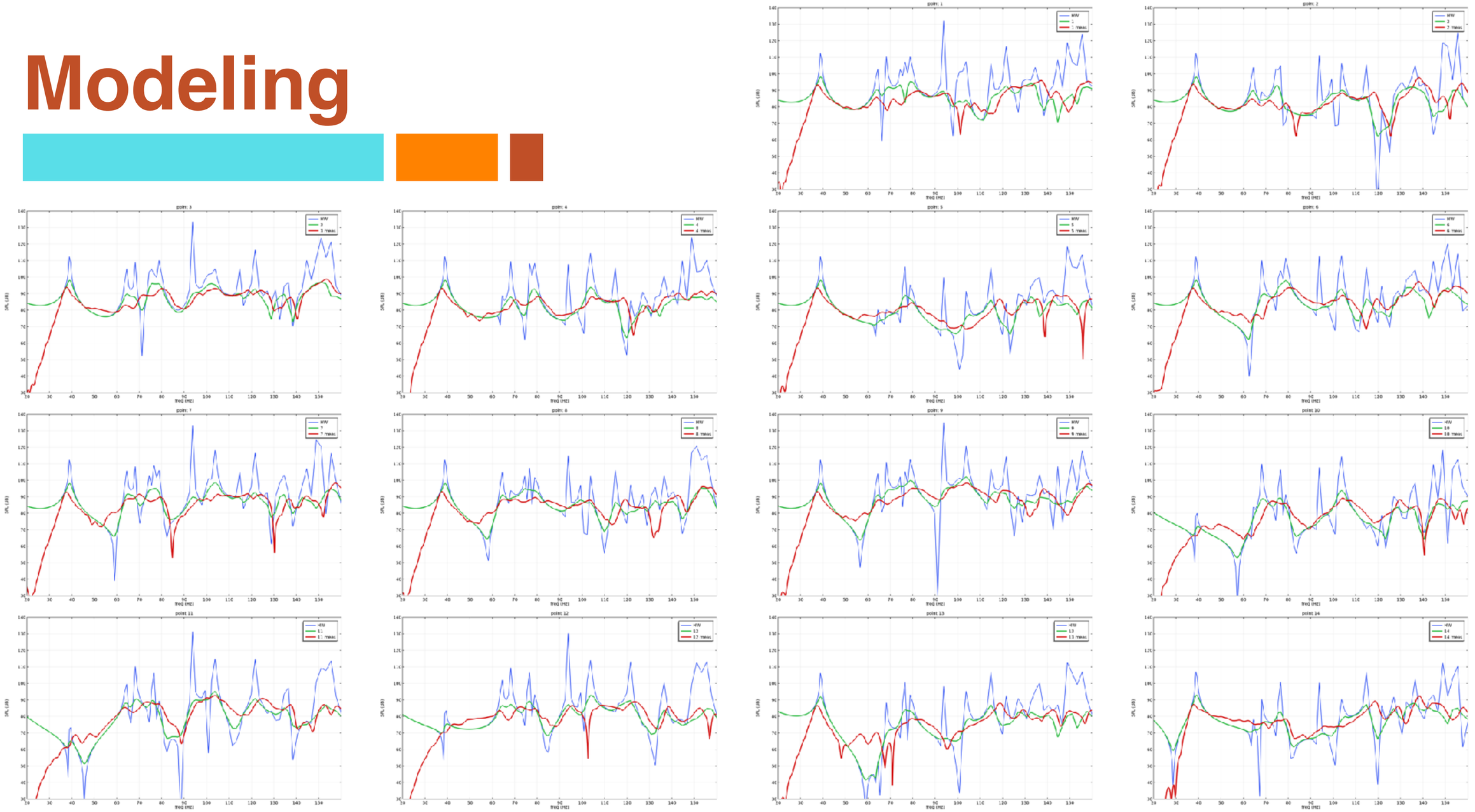
Modeling



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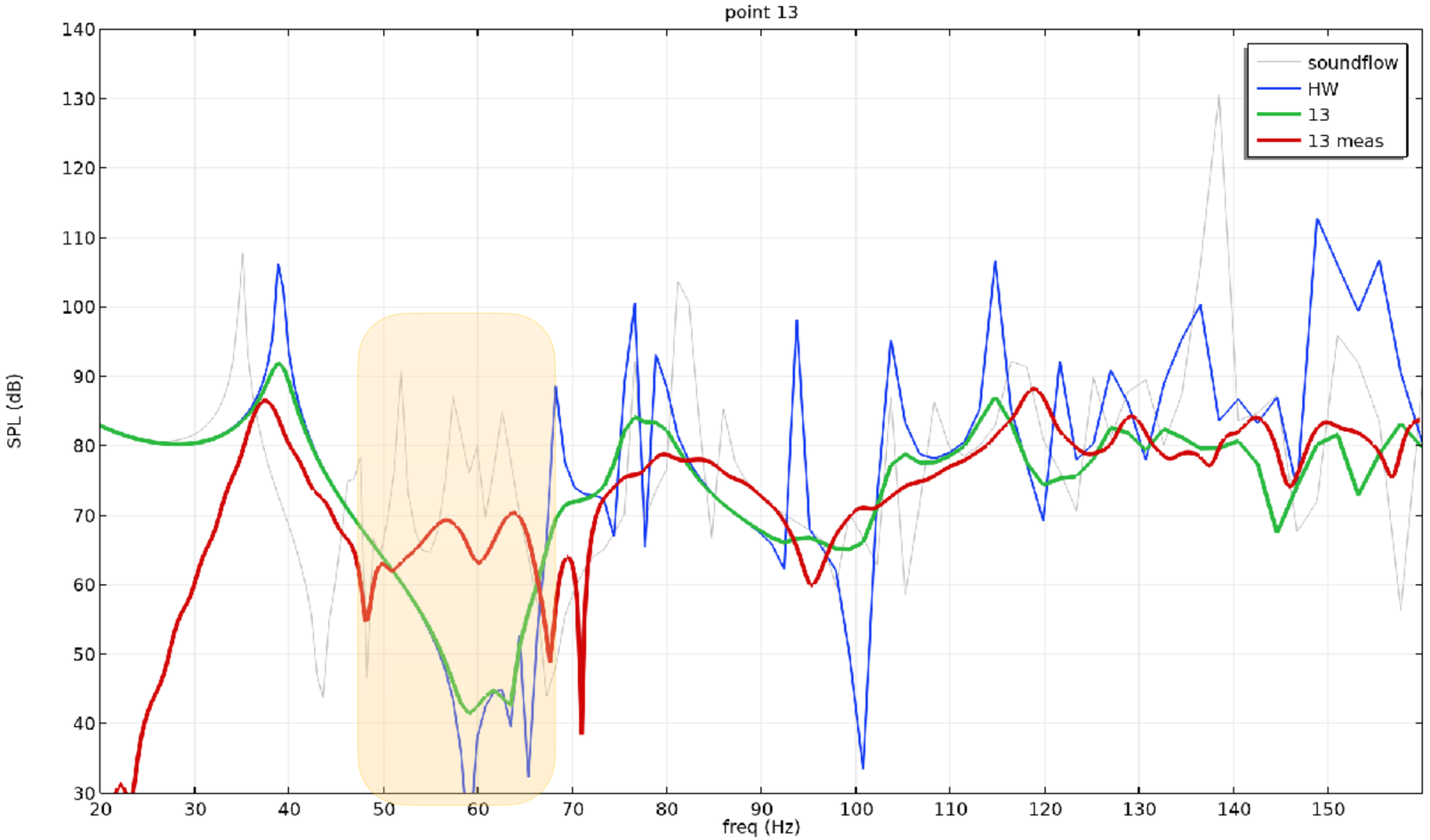
Blue: Hard wall **Green: Simulation** **Red: Measurements**

Modeling - Soundflow tentative



The agreement between simulations and measurements is good, however this is only an estimate with an impedance value in *rayls* and doesn't have a specific frequency behavior.

The part of the spectrum most affected by drywall resonance is certainly impacted by this. For this reason, we decided to evaluate the impedances through simulation using Soundflow.

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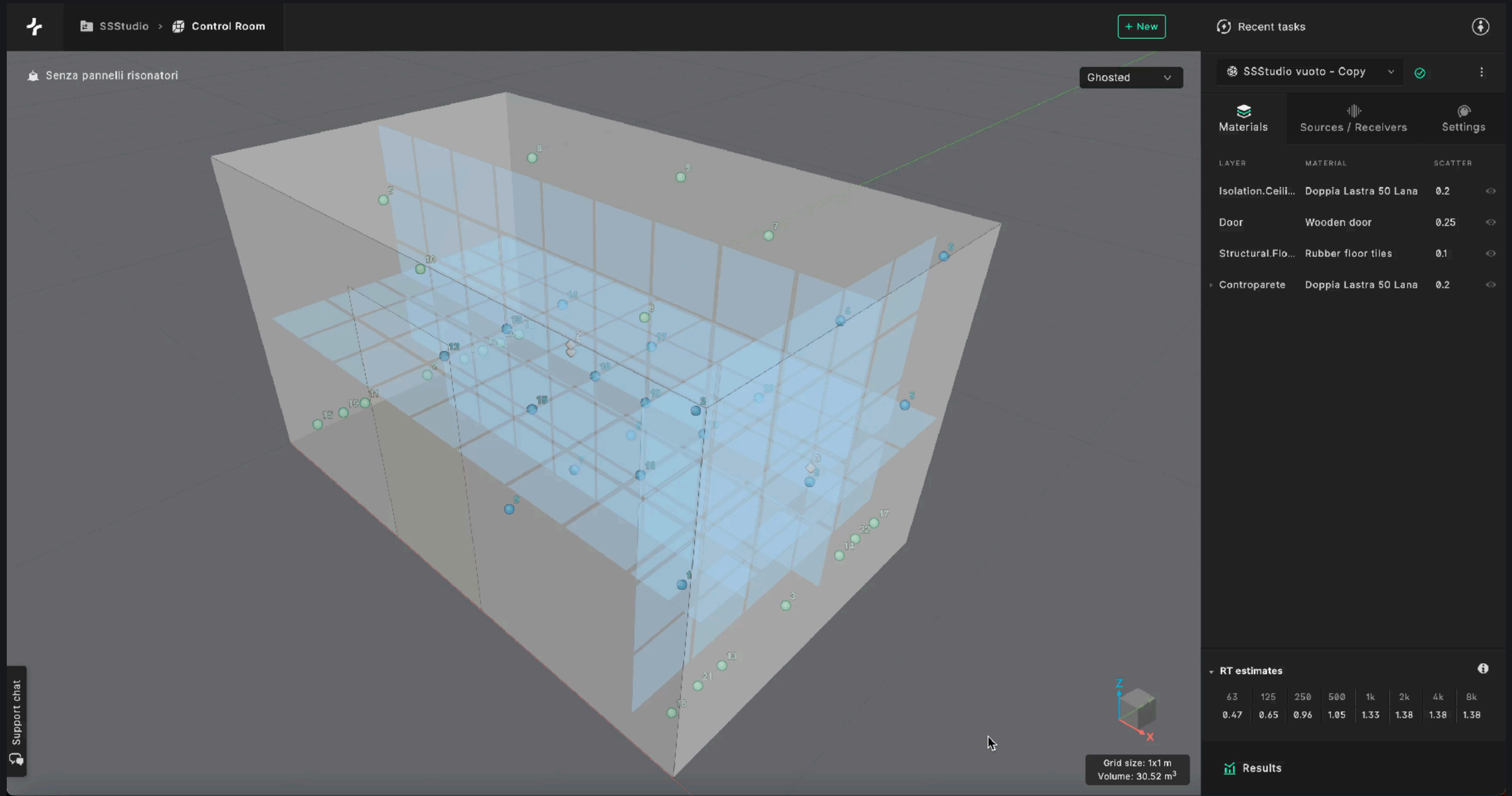
Donato Masci

Treble modeling with materials: acoustic impedance



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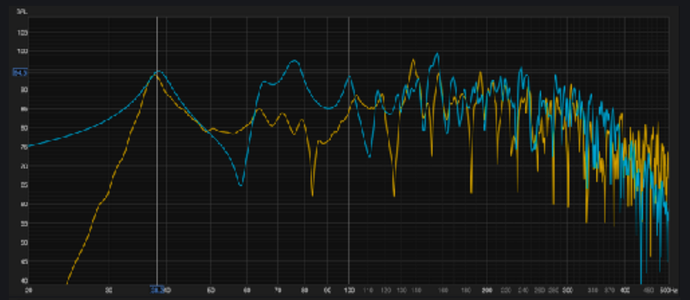
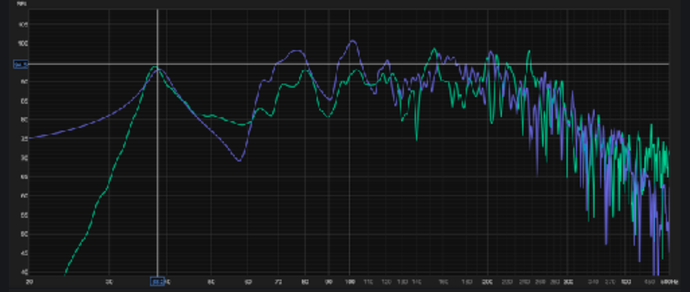
Donato Masci

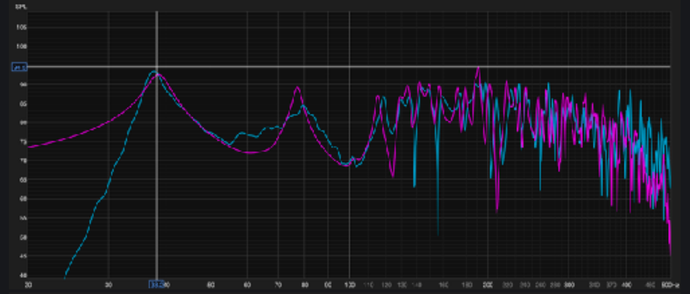
FR: Treble simulations vs measurements



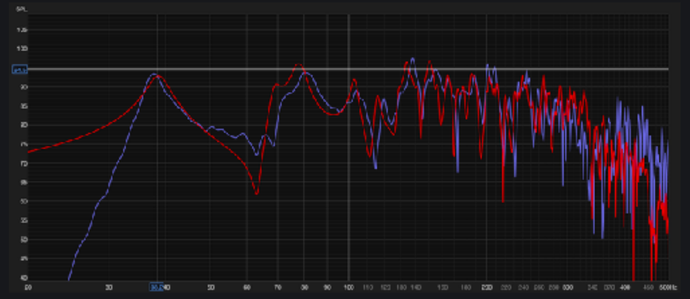
2



3

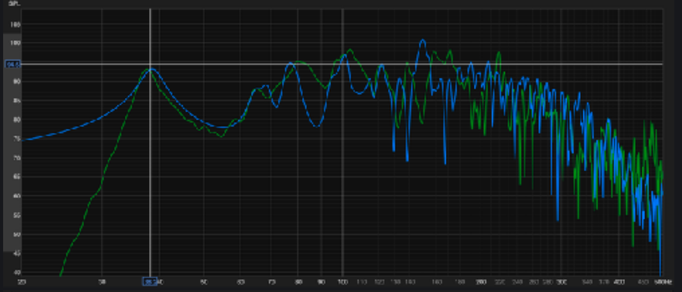


5

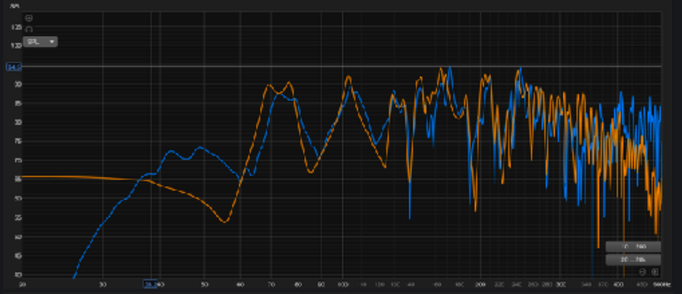


6

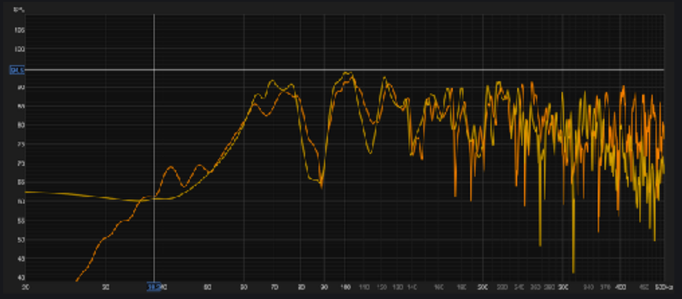
8



9



10



11

12

13

14

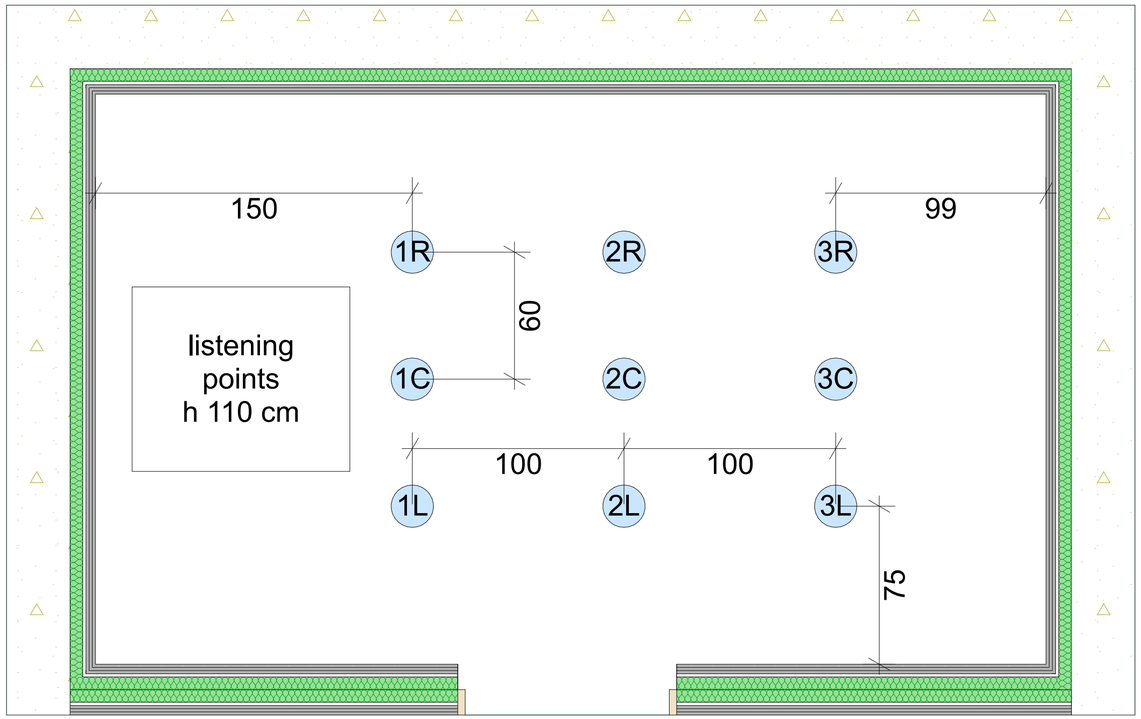
Simulations and Treatment

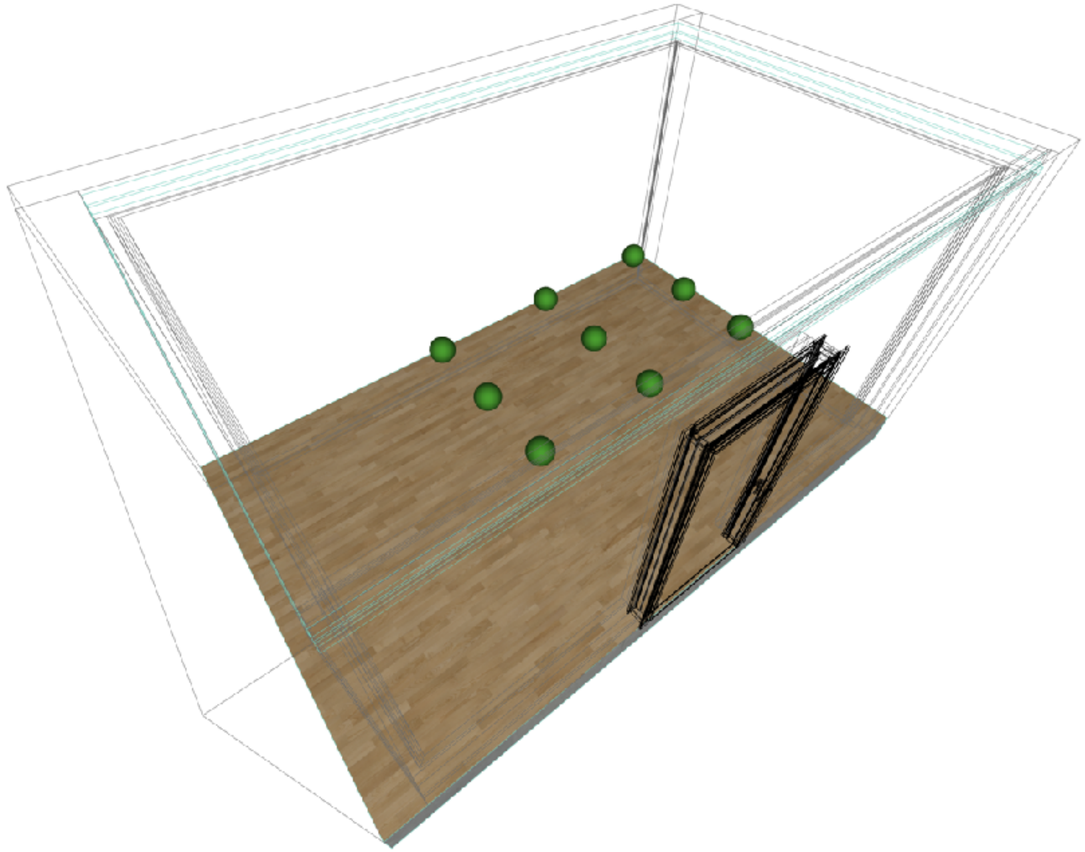
Once the model was tuned as best as possible, we were able to add more things to the room:

A. Subwoofer positions
- **1/3 W (Dolby)**
- **1/2 W**
- **a) Cedia**
- **b) and b_h) Cedia**
- **c) Cedia**
- **e) Cedia**
- **f) Cedia**
- **Array with 3 Sub on front**

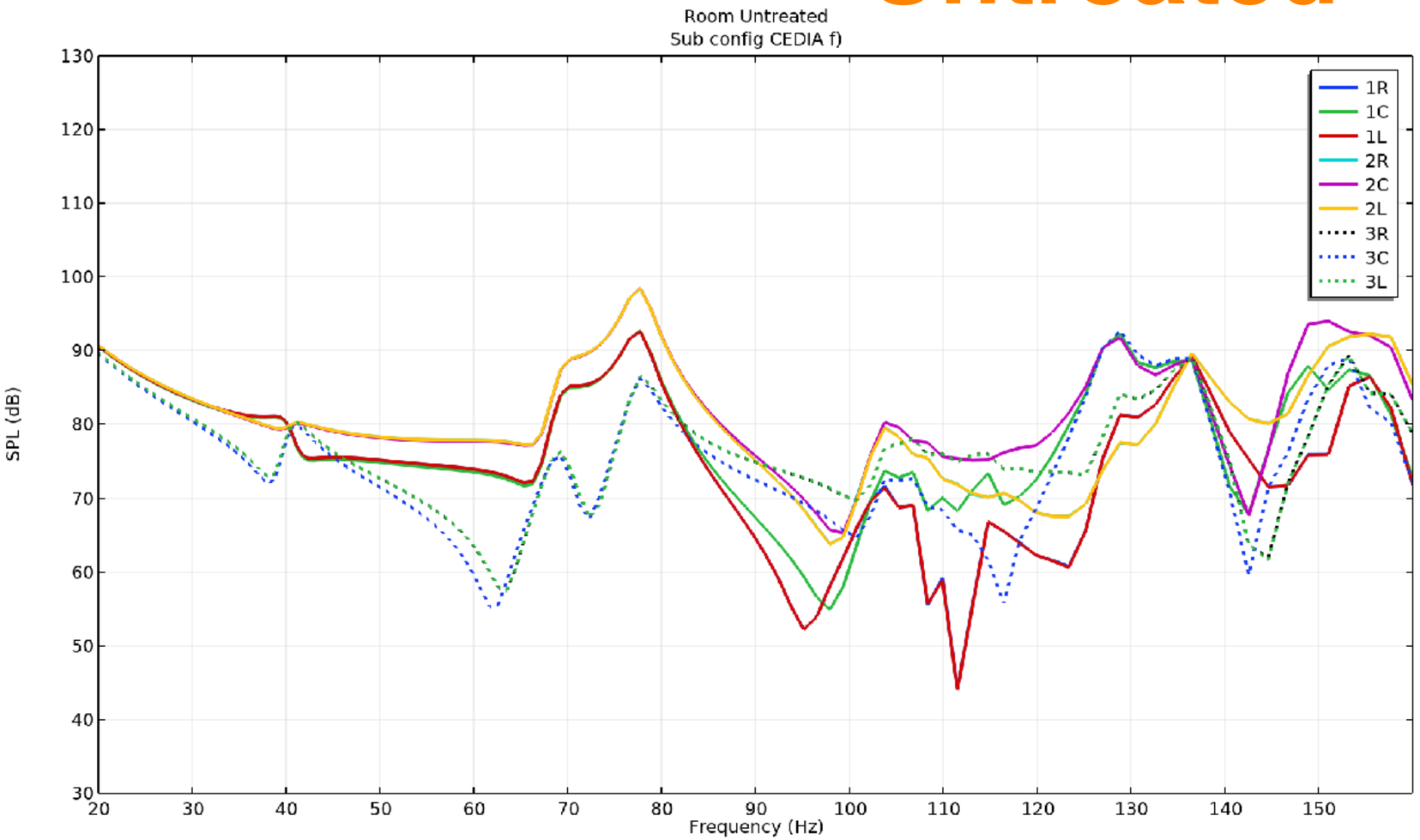
B. Acoustic Treatment
- **Resonator panels 1**
  (alpha constant)
- **Resonator panels 2**
  (alpha frequency dependent)

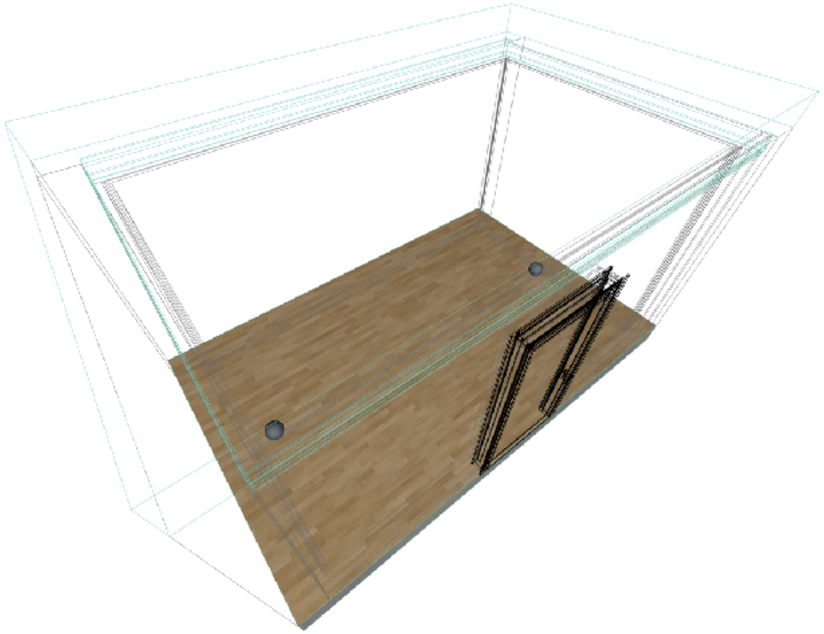
Simulations - Matrix of Positions

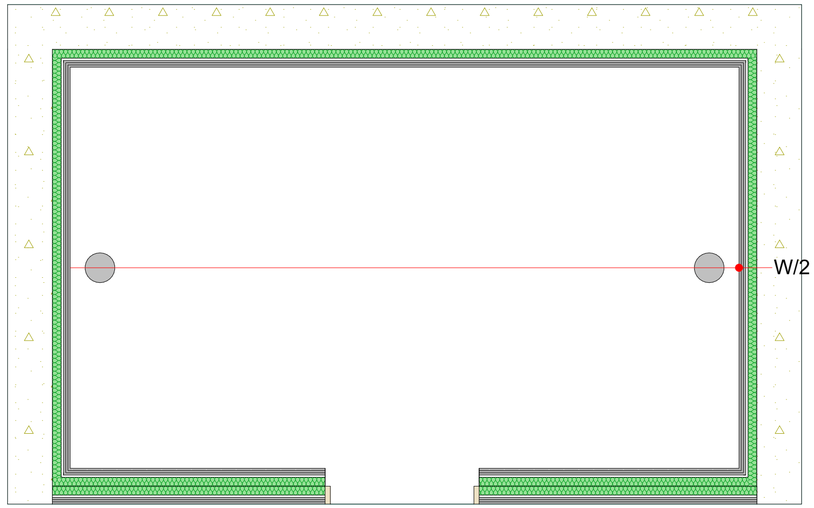




Simulations - Cedia f) Untreated







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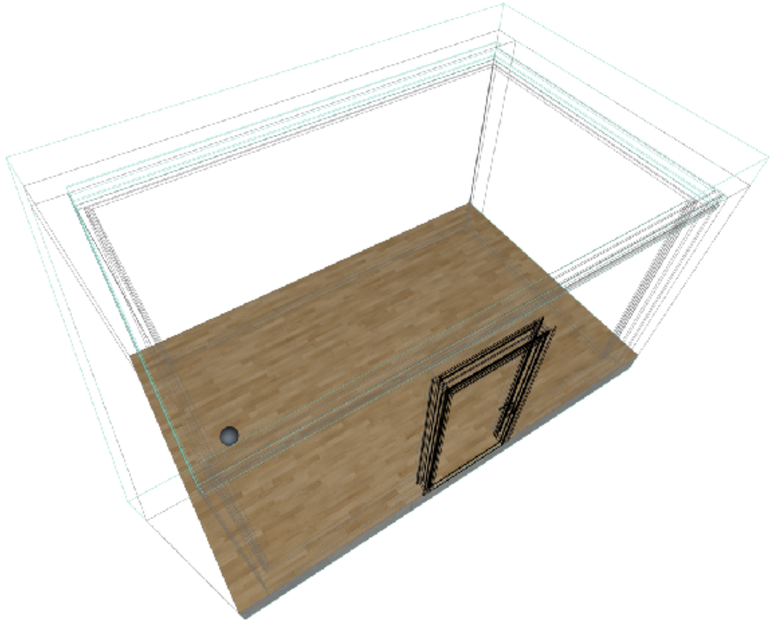
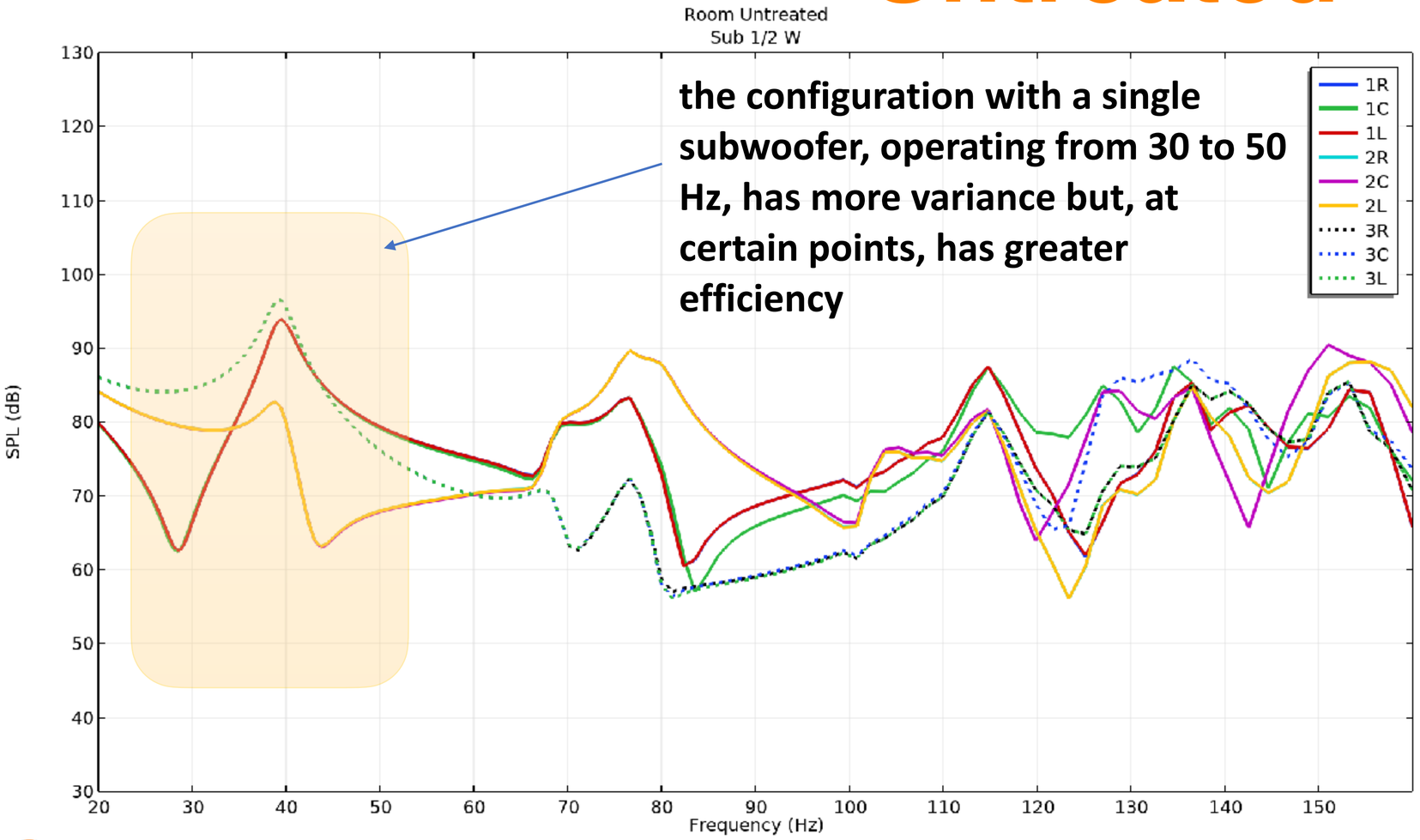
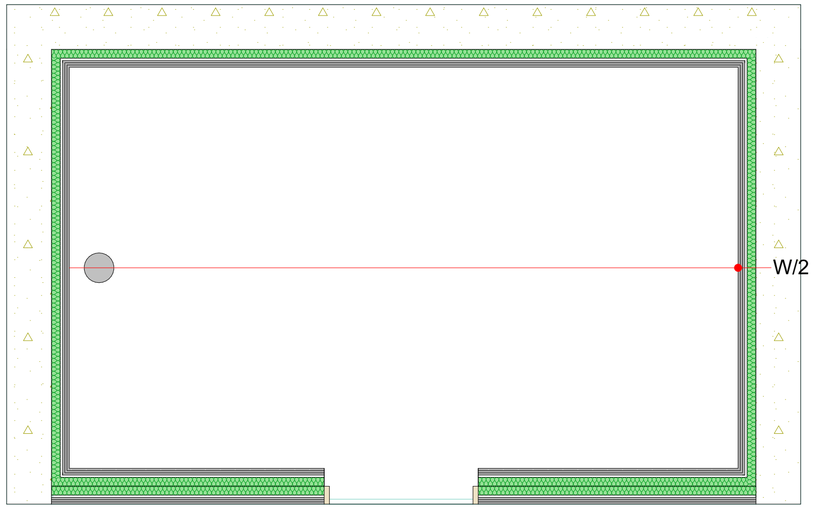
Simulations - 1/2

Untreated





the configuration with a single subwoofer, operating from 30 to 50 Hz, has more variance but, at certain points, has greater efficiency



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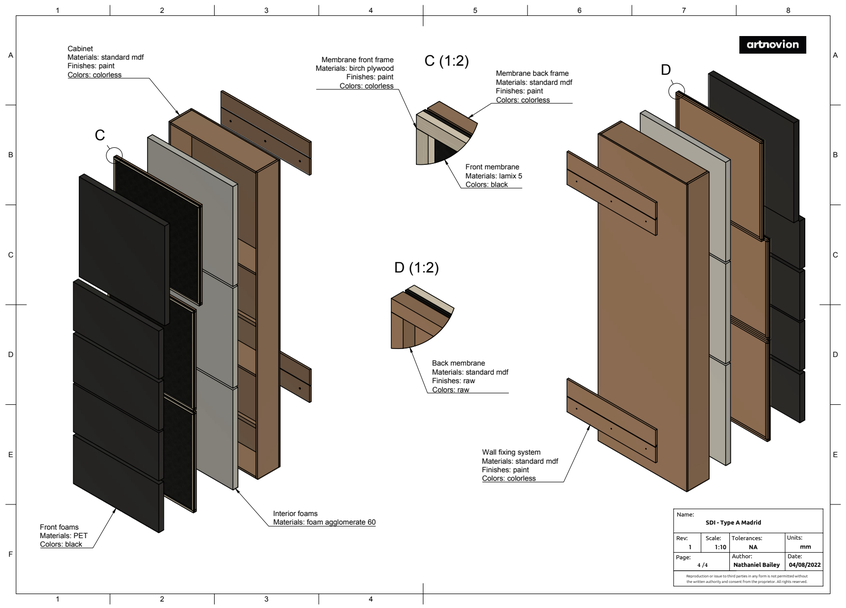
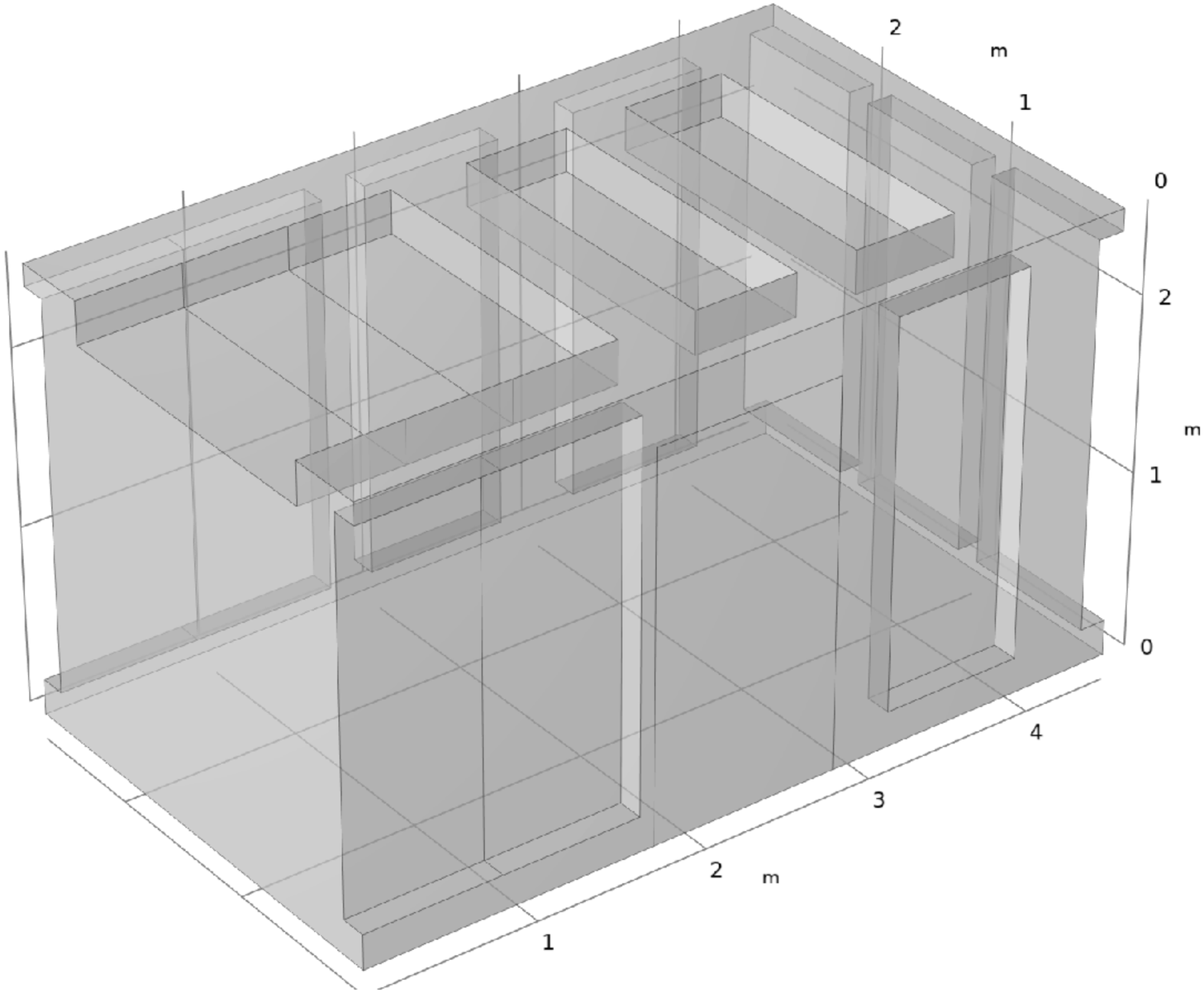
Treatment 1





approximated constant impedance and absorption coefficient

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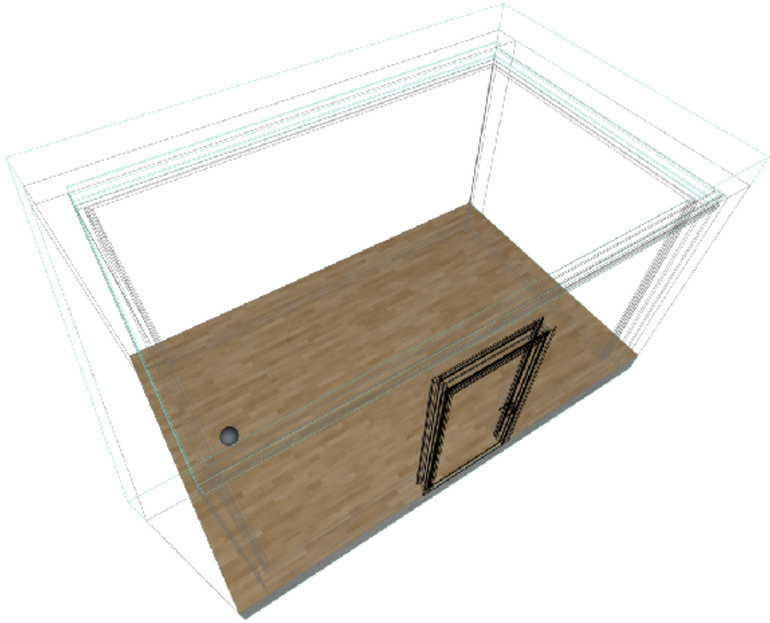
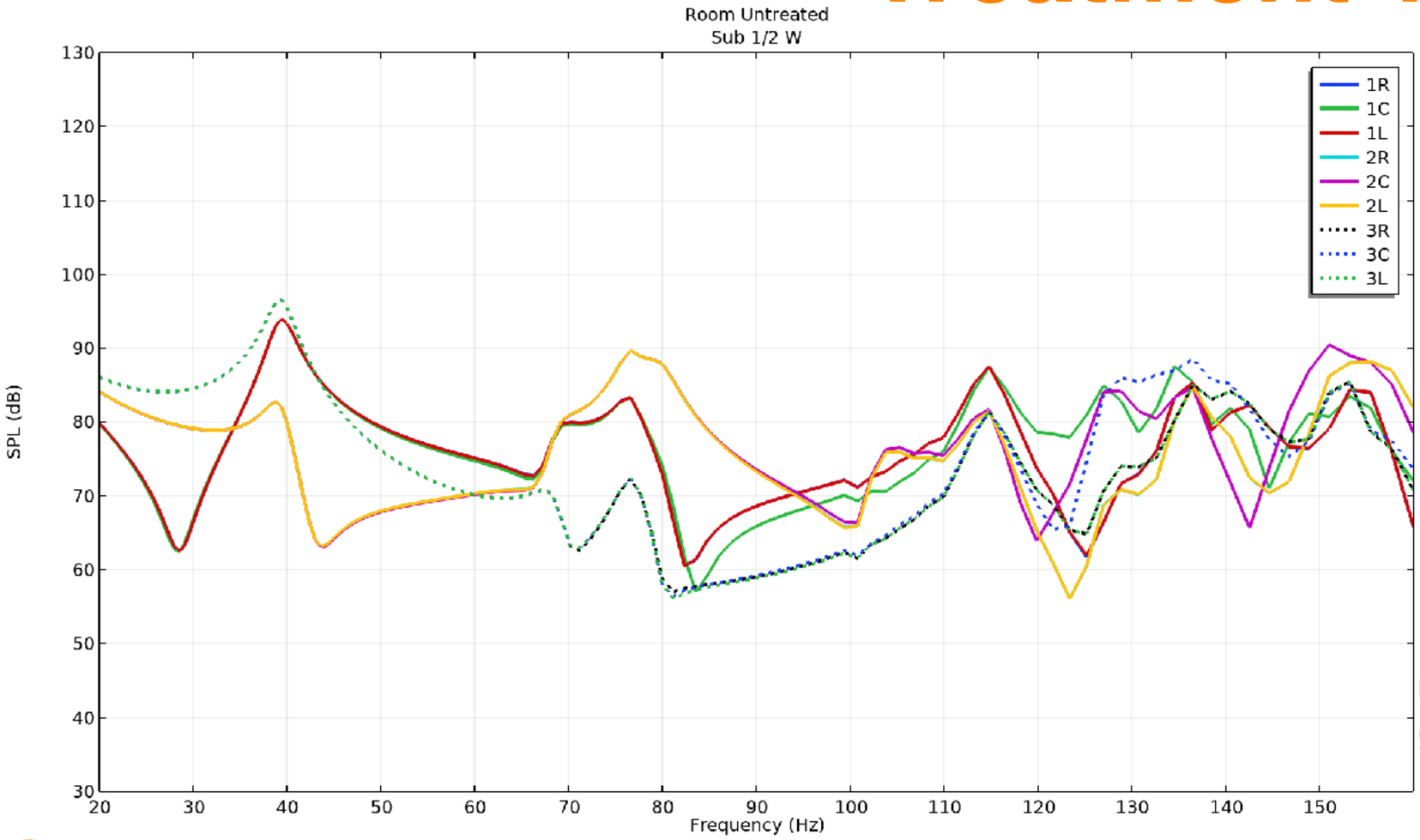
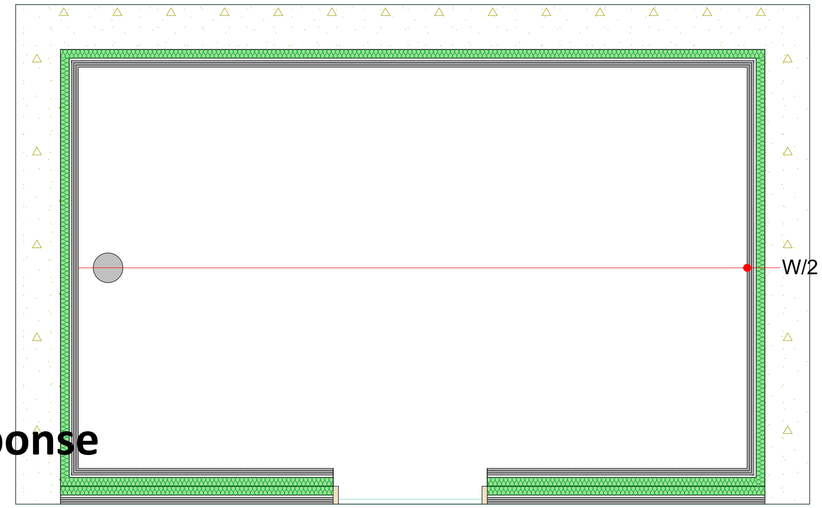
Simulations - 1/2

Treatment 1







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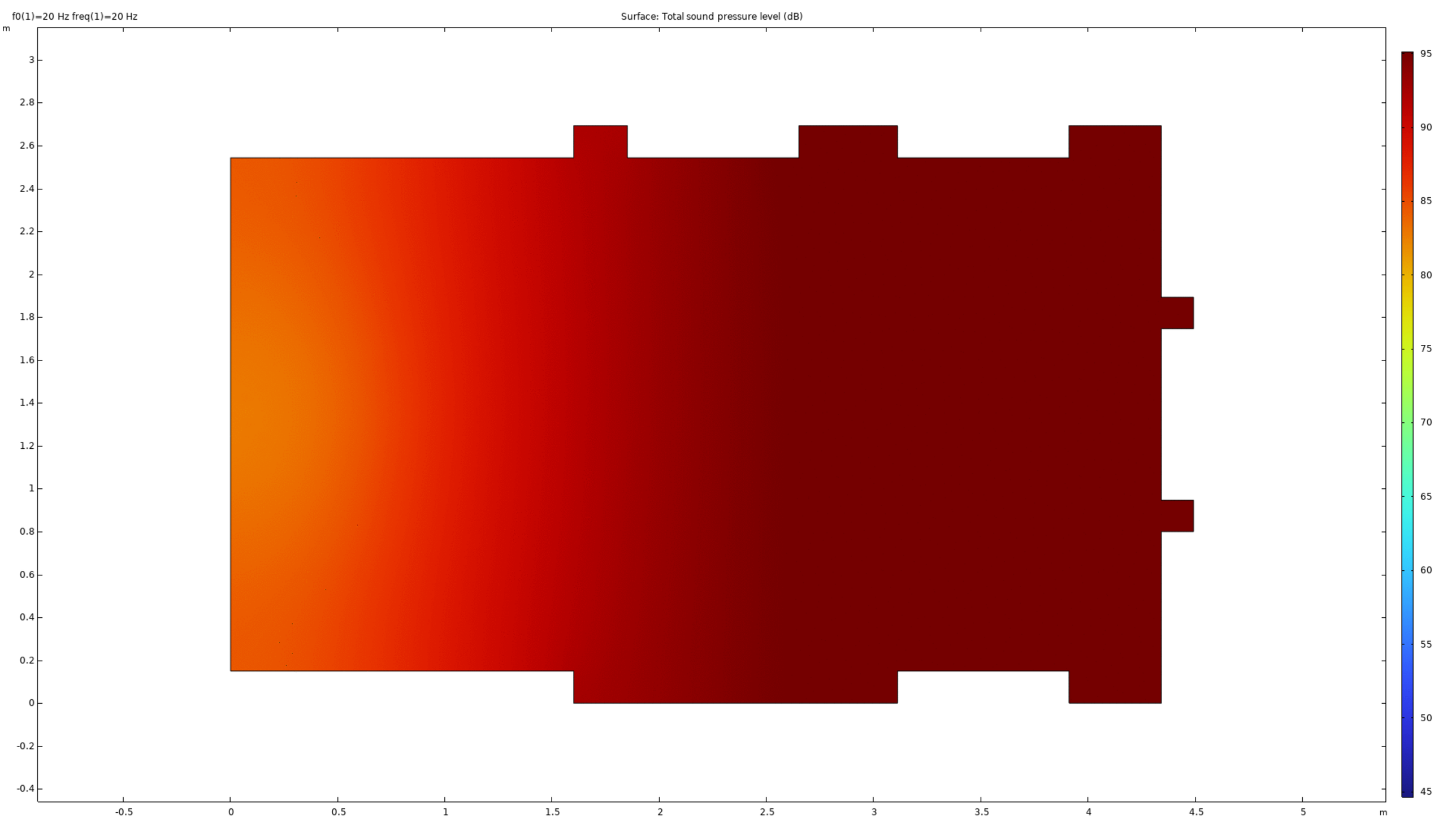
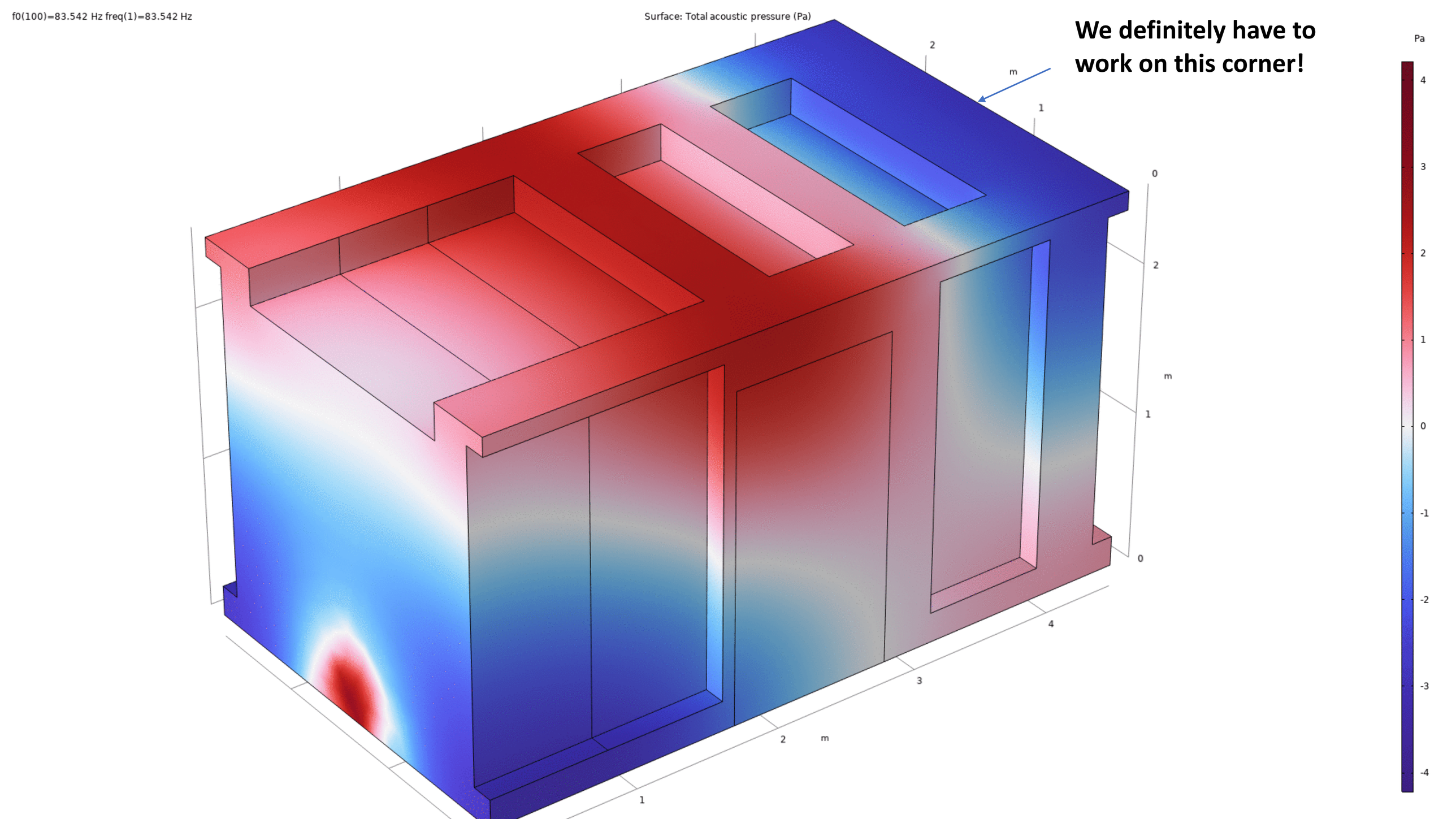
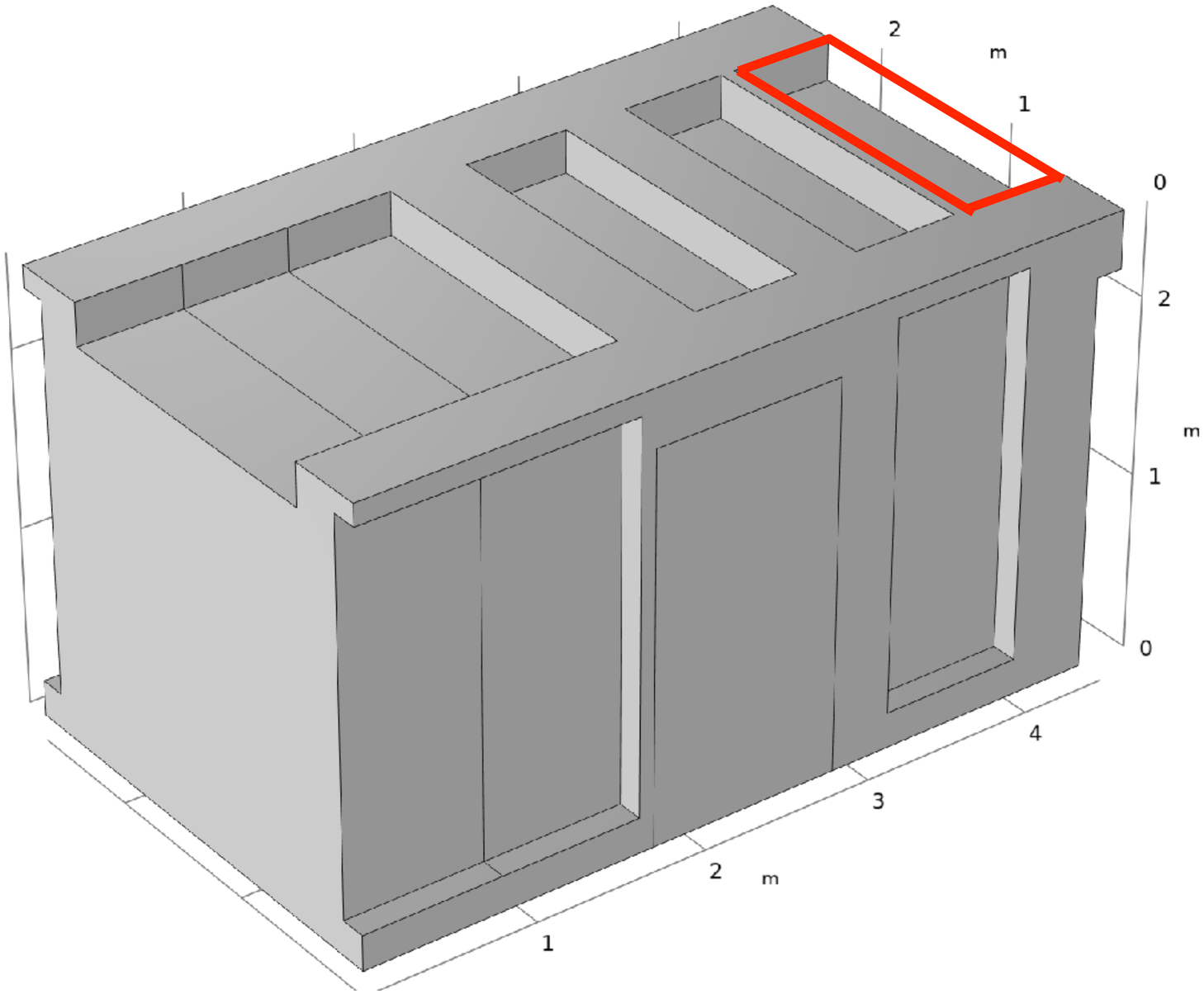

f0(1)=20 Hz freq(1)=20 Hz
Surface: Total sound pressure level (dB)
m
3
2.8
2.6
2.4
2.2
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.5
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
m
95
90
85
80
75
70
65
60
55
50
45


f0(100)=83.542 Hz freq(1)=83.542 Hz
Surface: Total acoustic pressure (Pa)
We definitely have to work on this corner!
Pa
4
3
2
1
0
-1
-2
-3
-4
m
0
1
2
m
0
1
2
3
4
m

Treatment 2

- added a new resonator to the rear ceiling section
- the absorption coefficient and impedance have been better analyzed across frequencies



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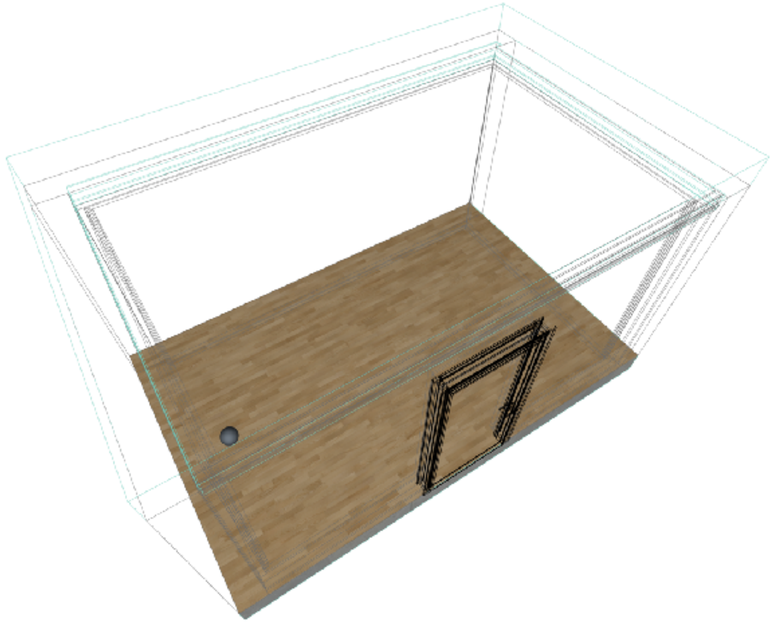
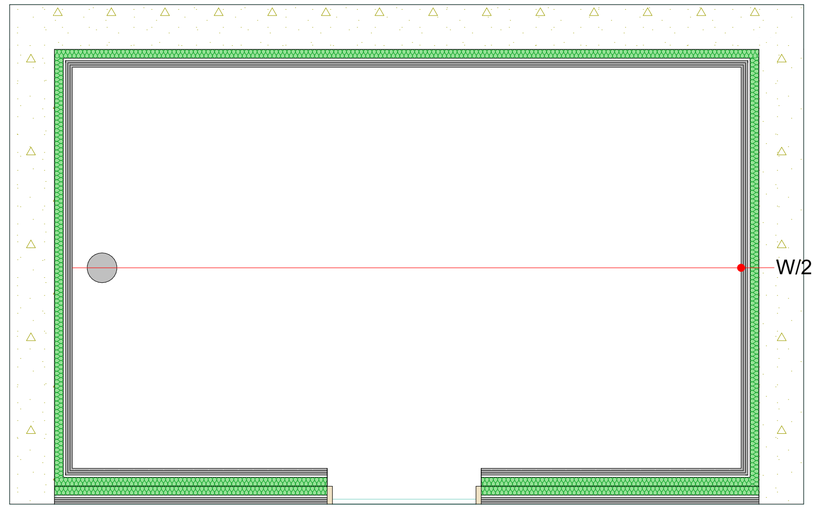
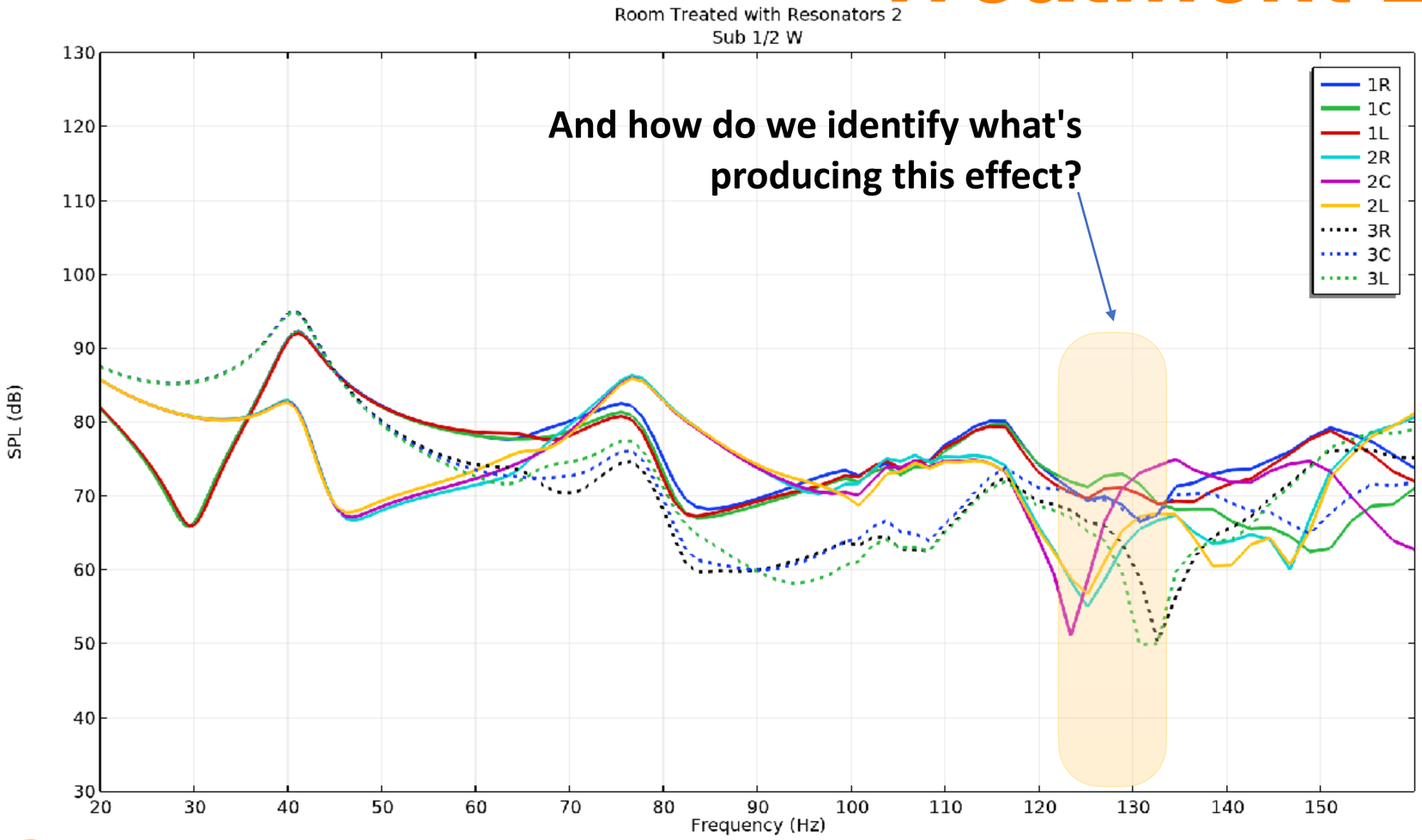
Simulations - 1/2

Treatment 2







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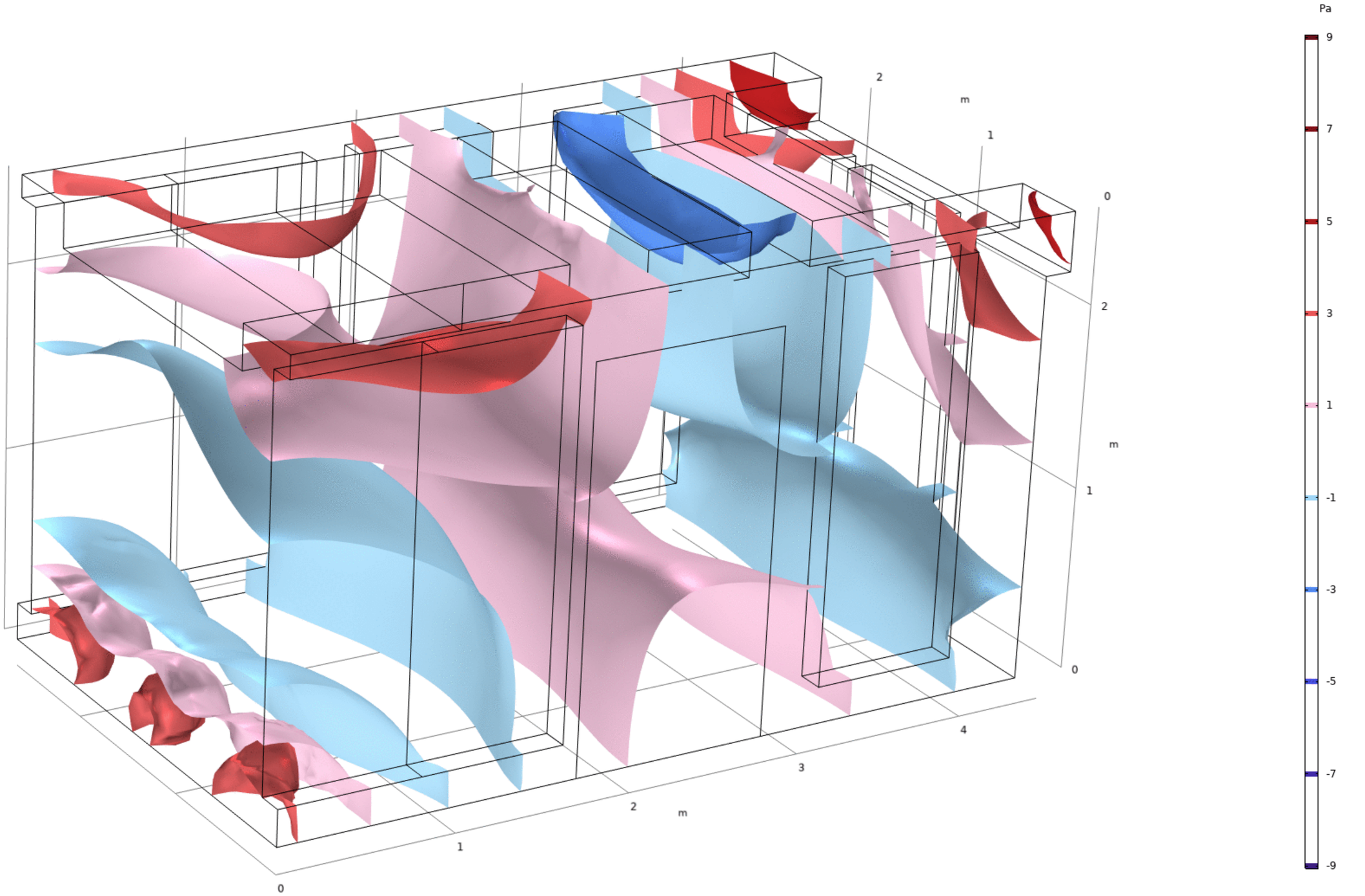
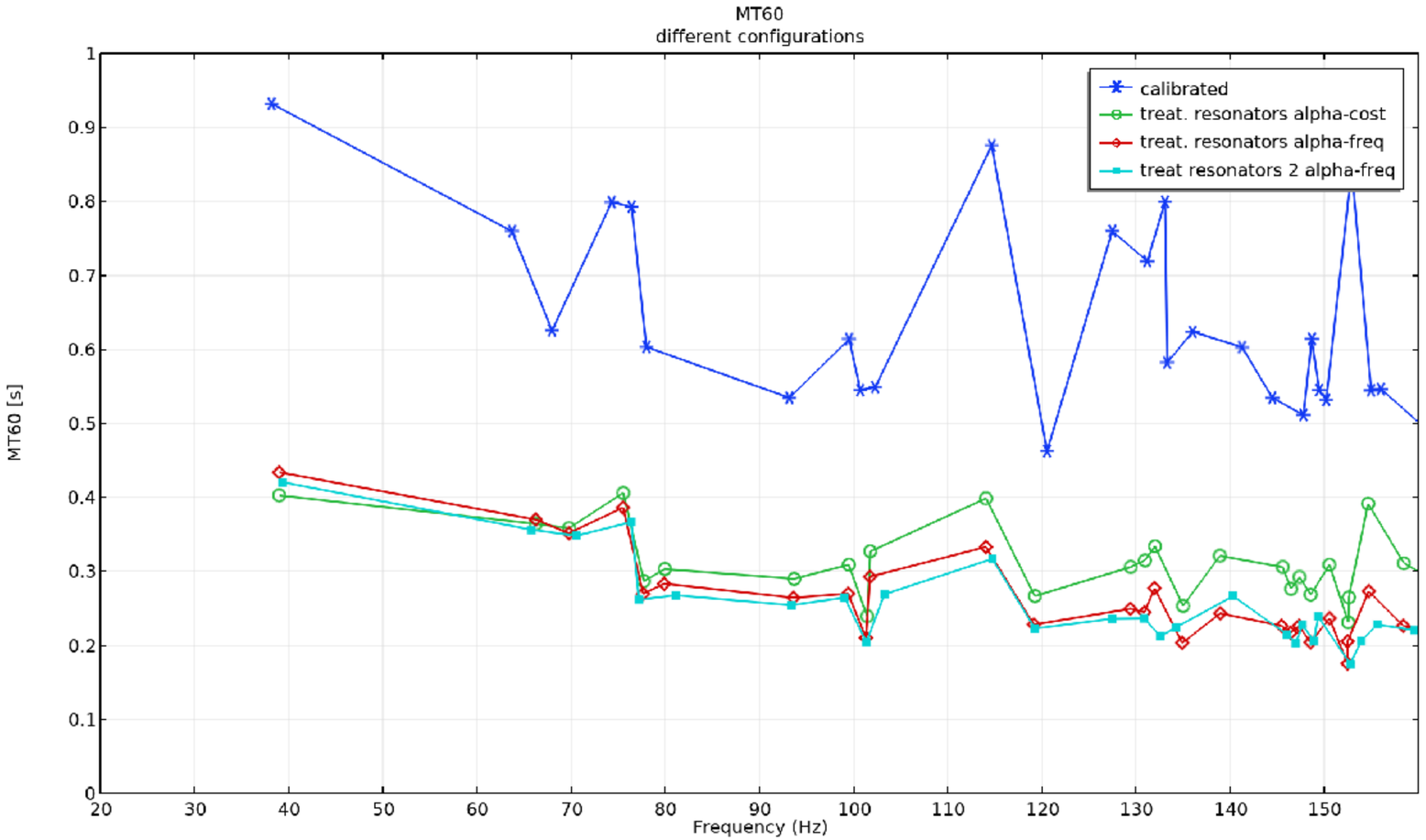
f0(128)=125.17 Hz freq(1)=125.17 Hz

Isosurface: Total acoustic pressure (Pa)



Simulations and Treatment - MT60



We performed a slight fine-tuning to match the resimulated MT60s with the measured ones

(actually, to simplify, we ultimately used an average β value derived from the calibration)

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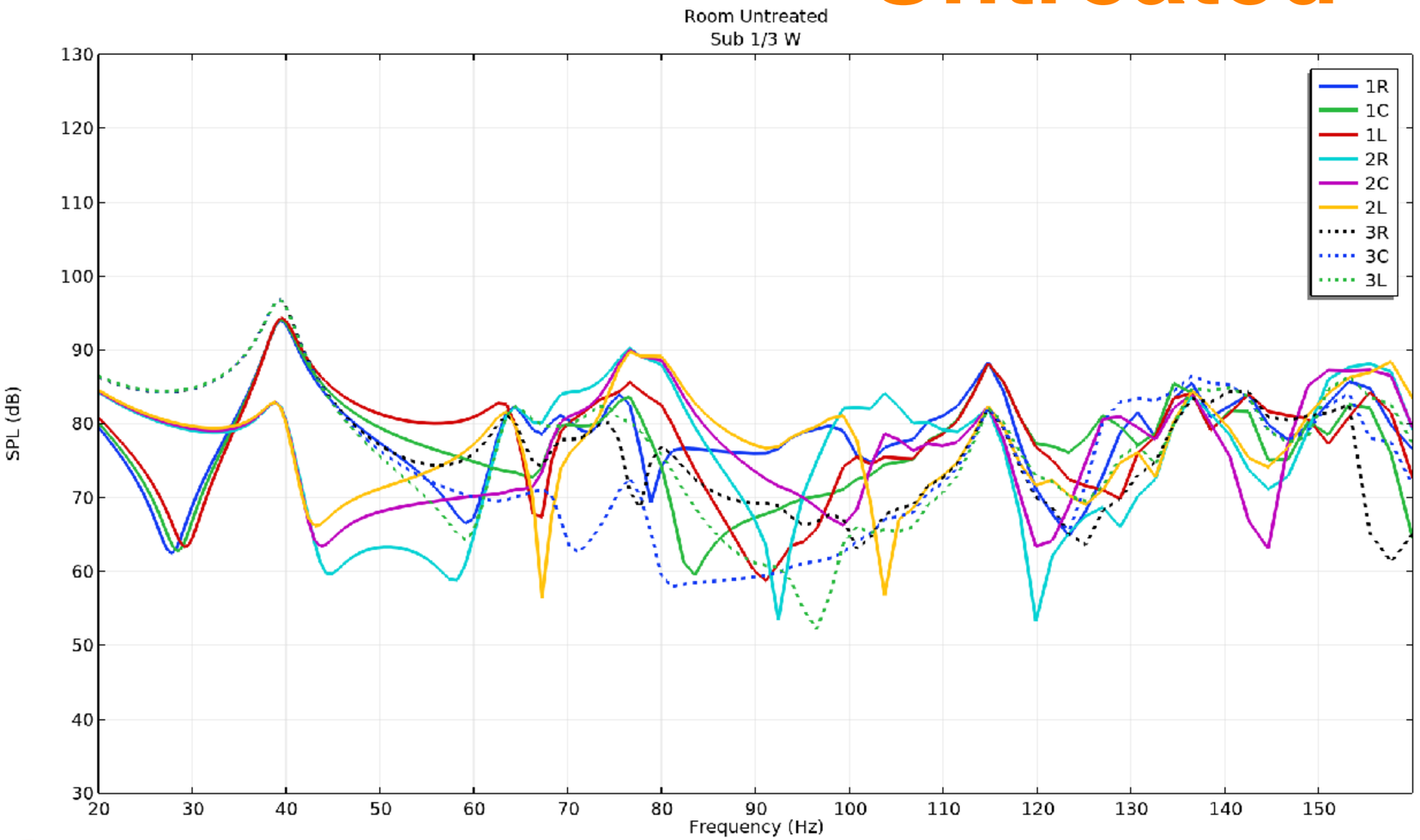
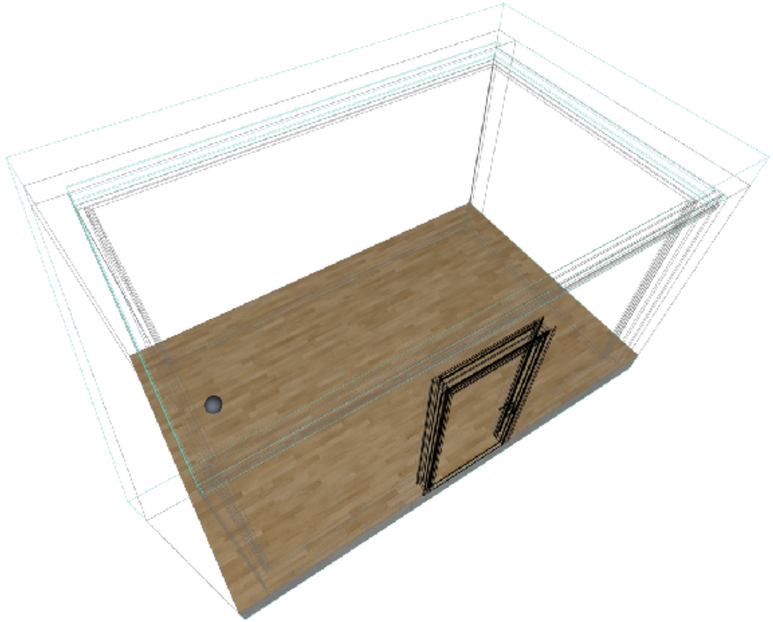
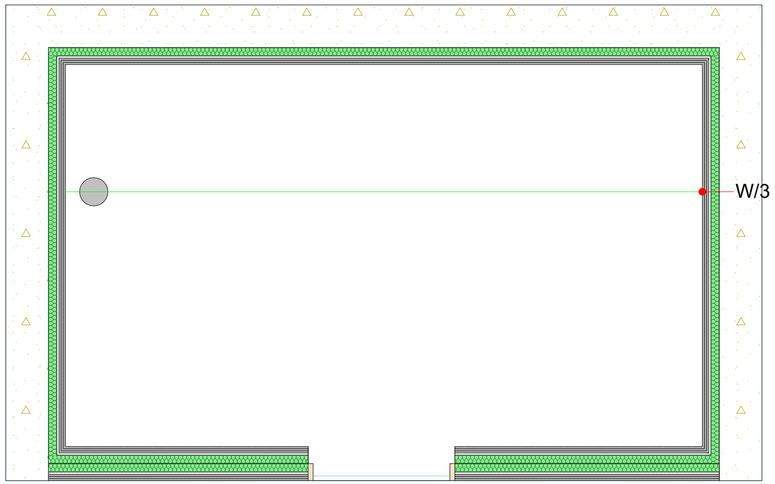
Simulations - Dolby 1/3 Untreated







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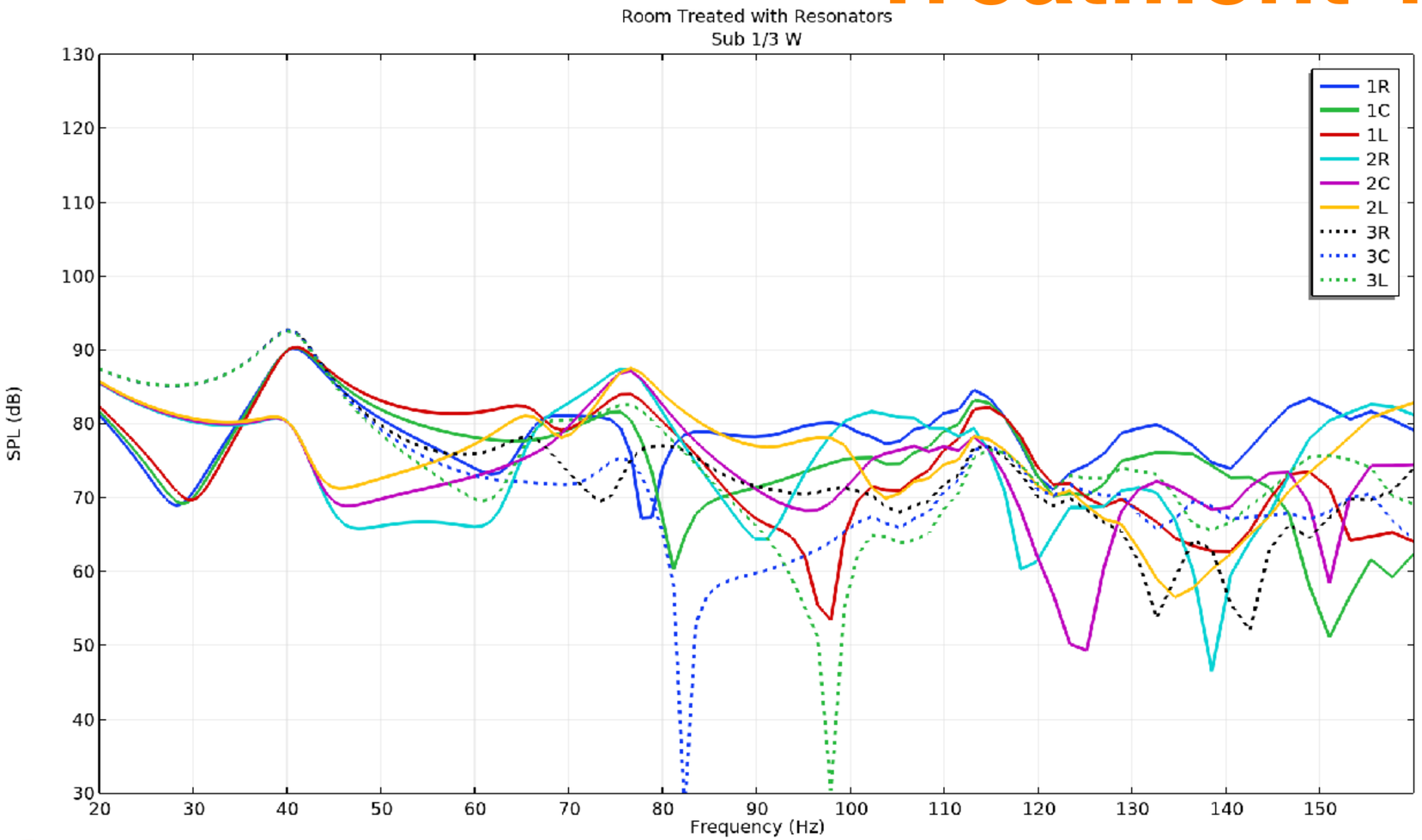
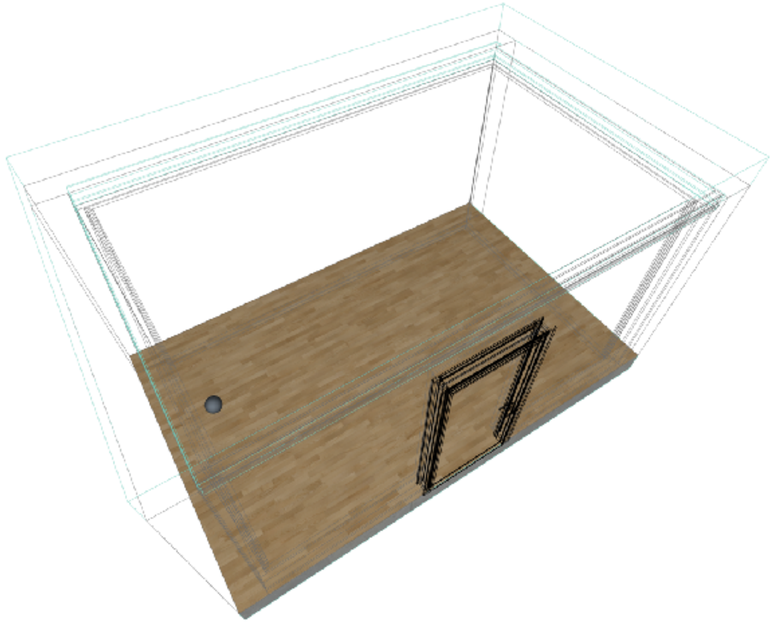
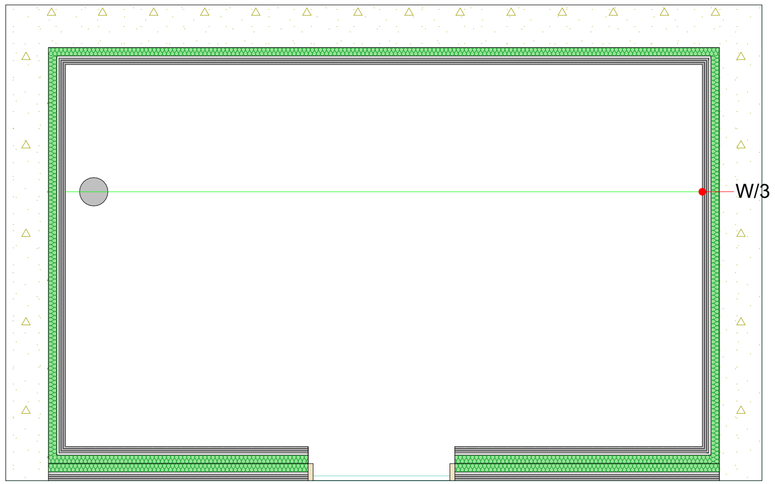
Simulations - Dolby 1/3 Treatment 1







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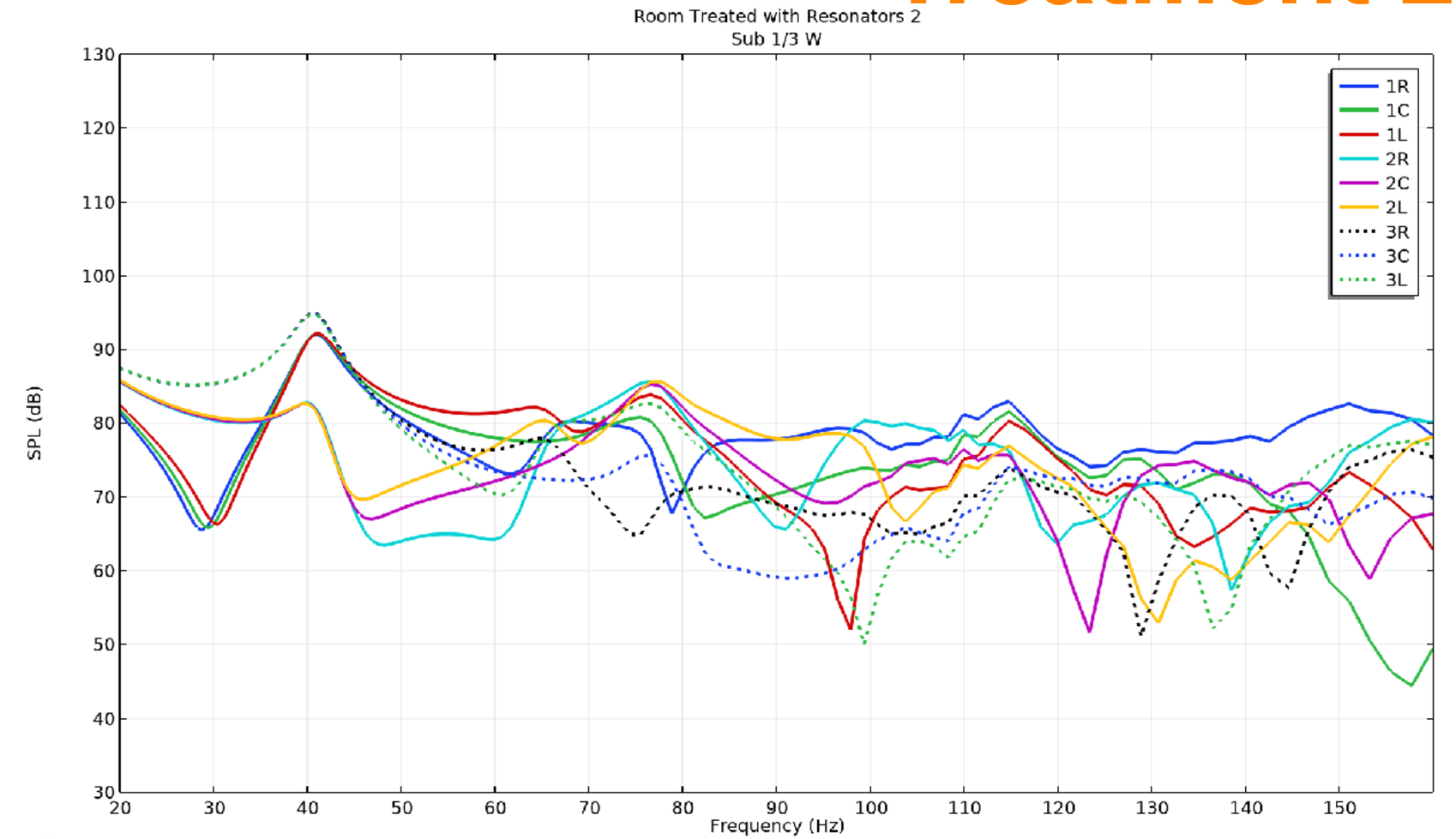
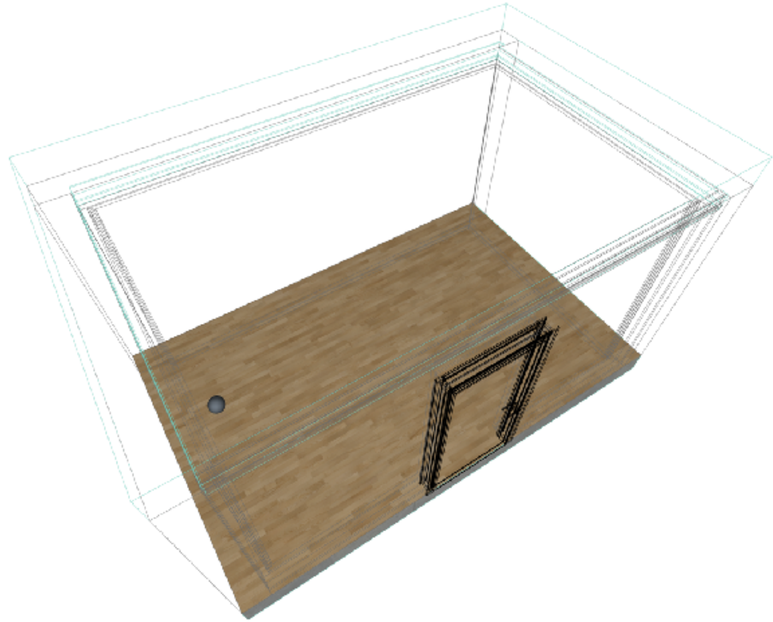
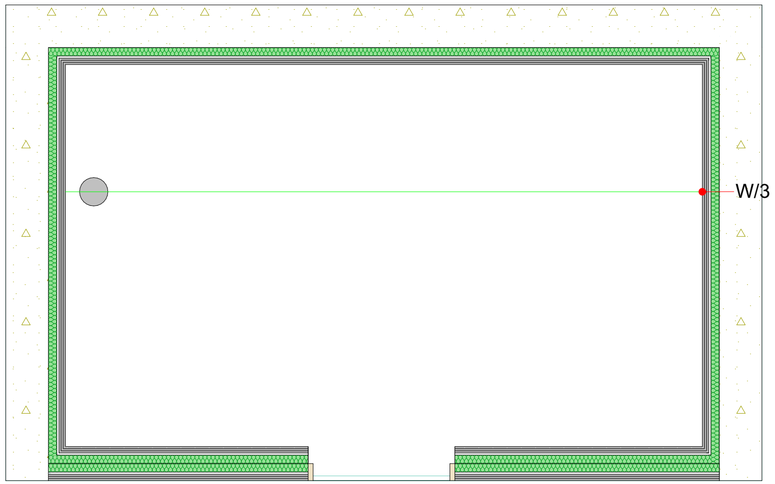
Simulations - Dolby 1/3 Treatment 2







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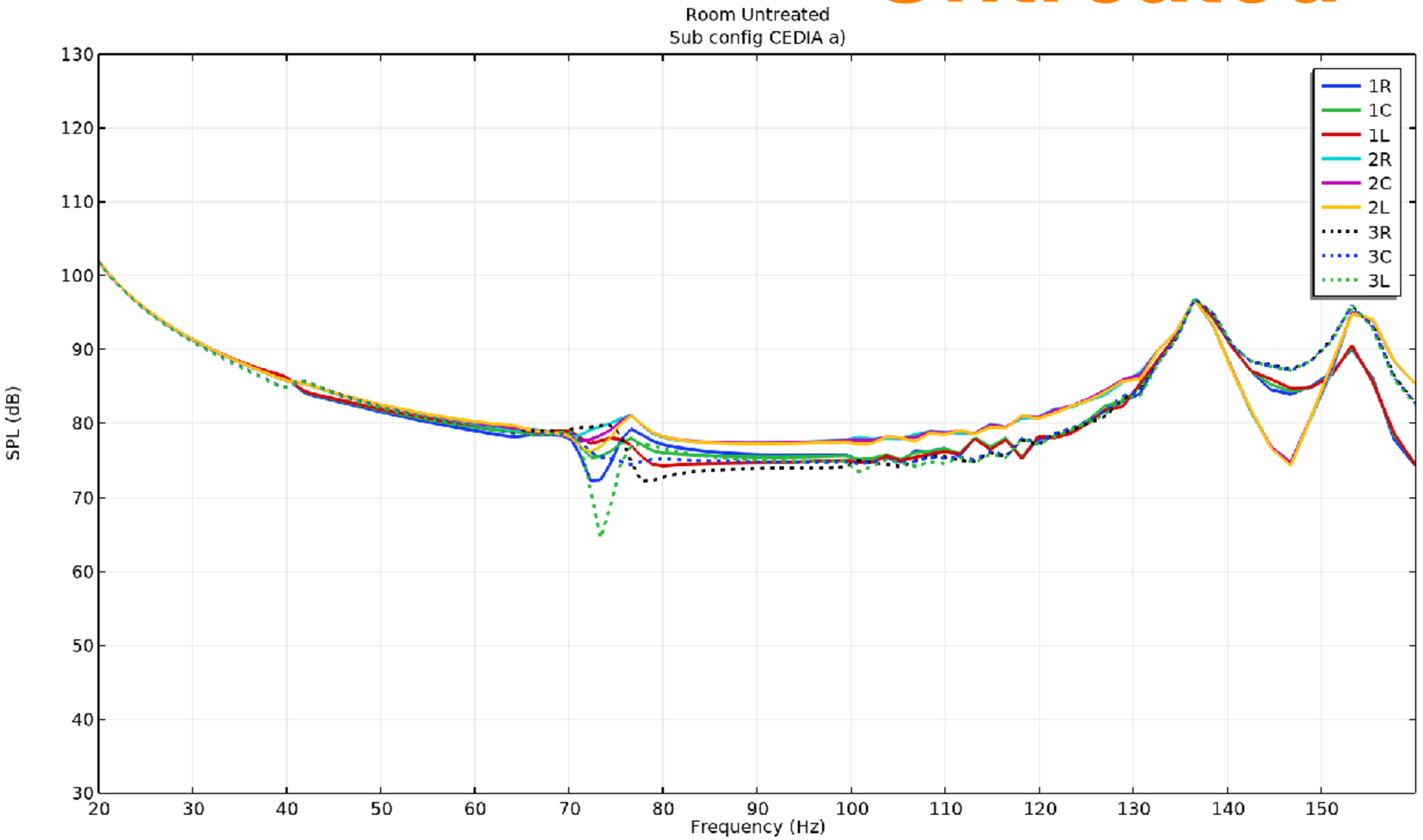
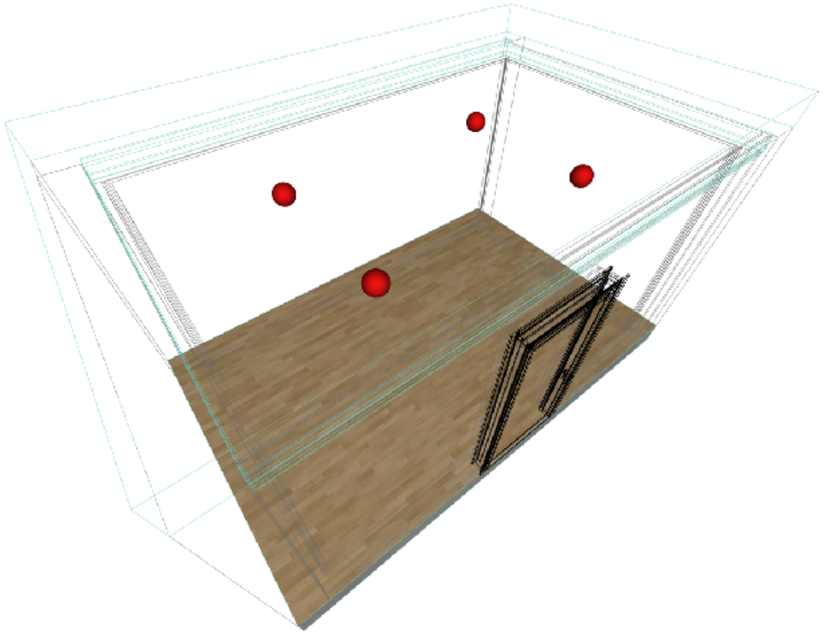
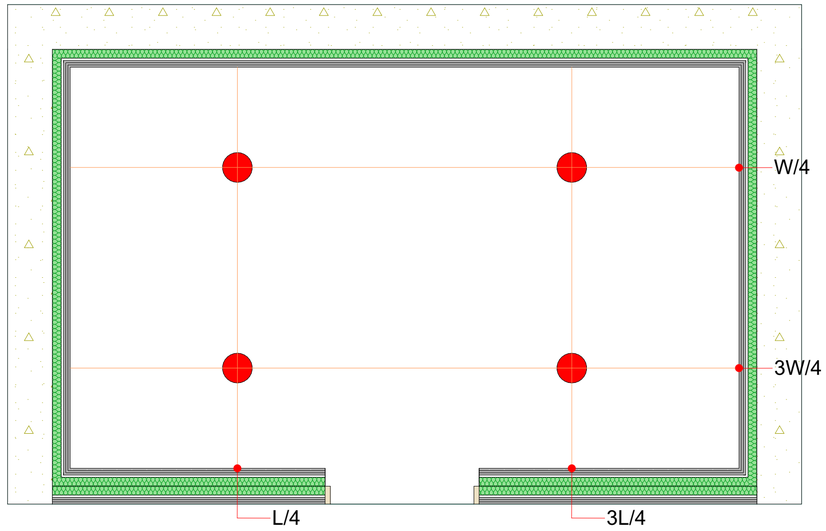
Simulations - Cedia a) Untreated







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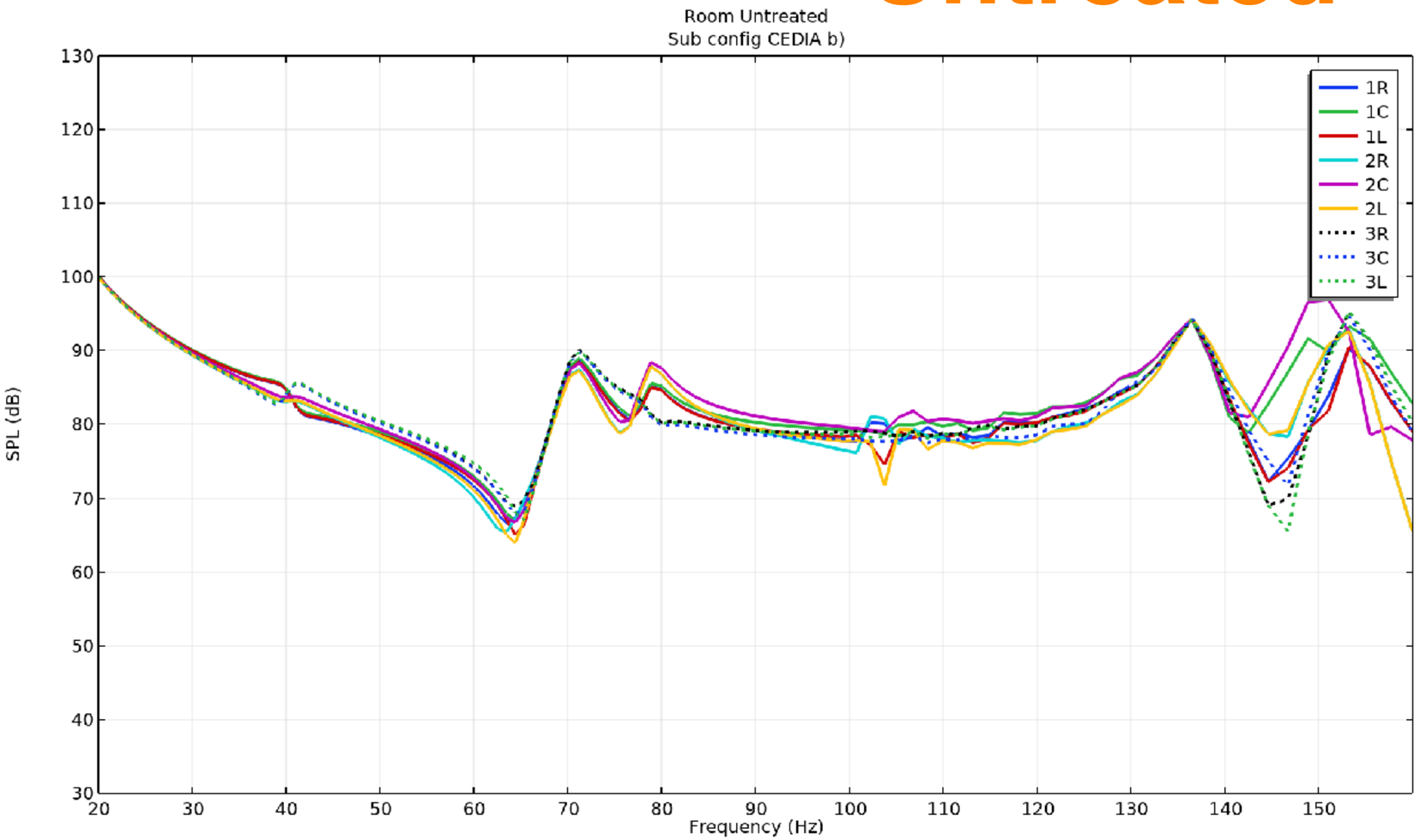
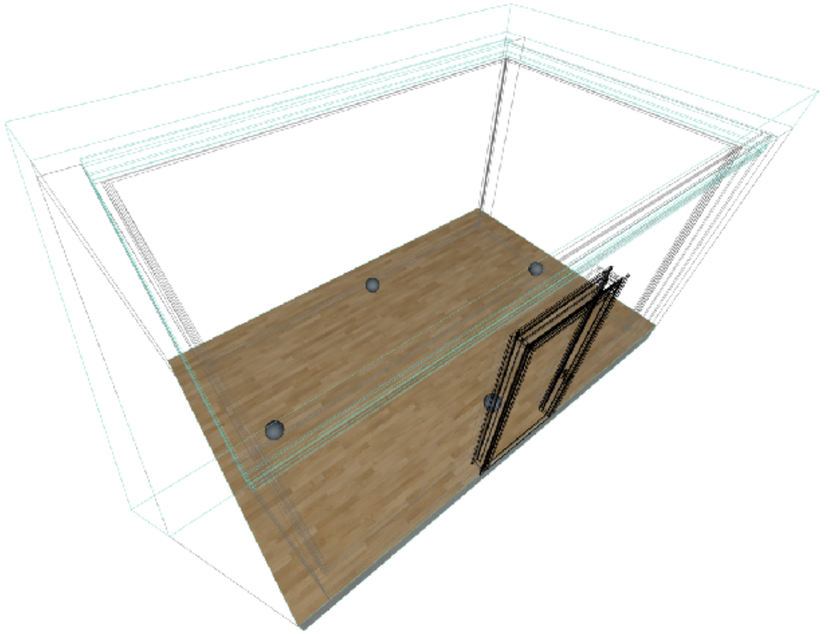
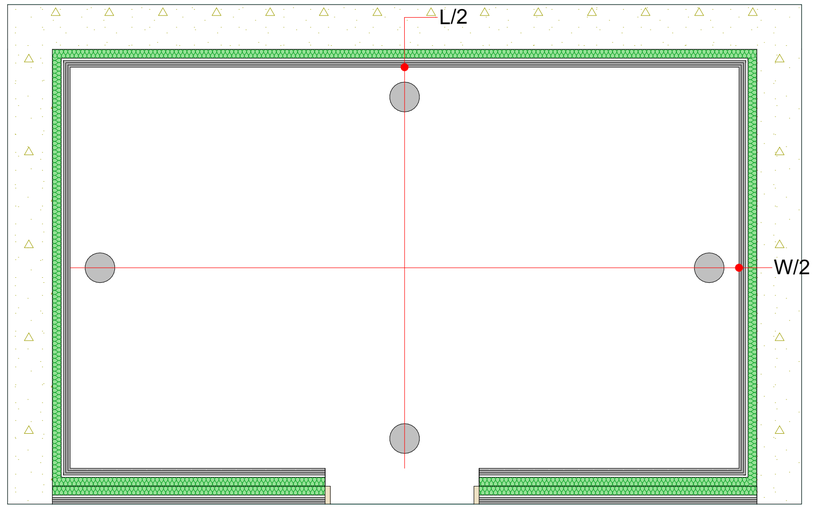
Simulations - Cedia b) Untreated







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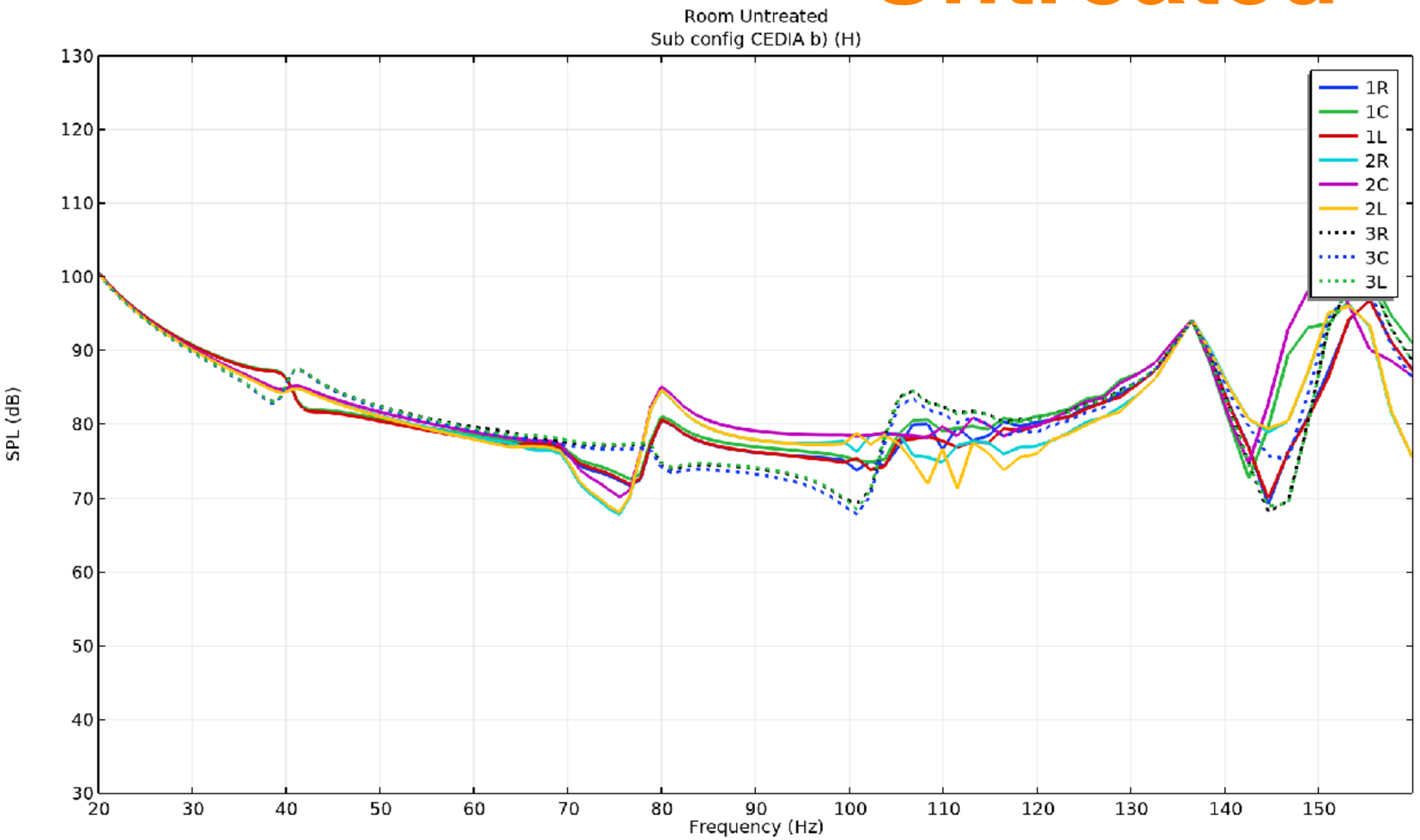
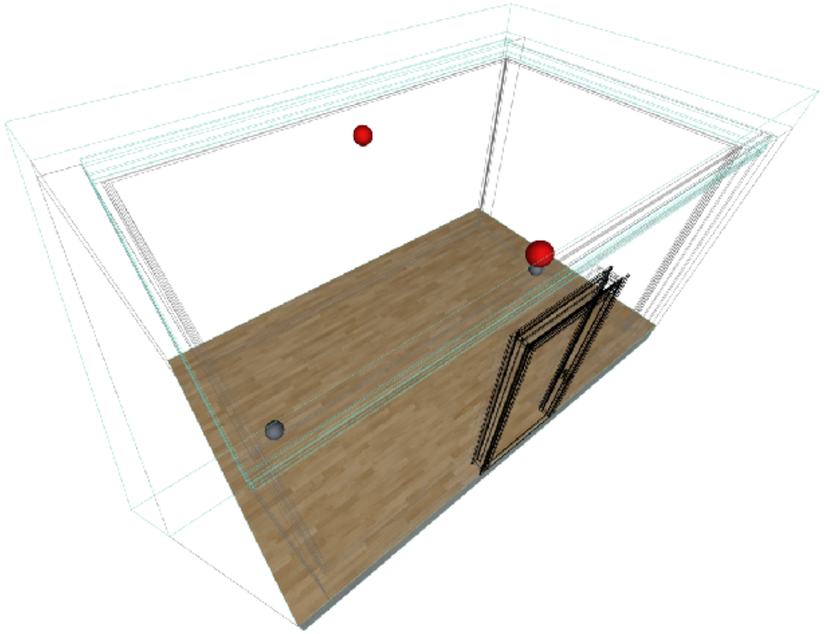
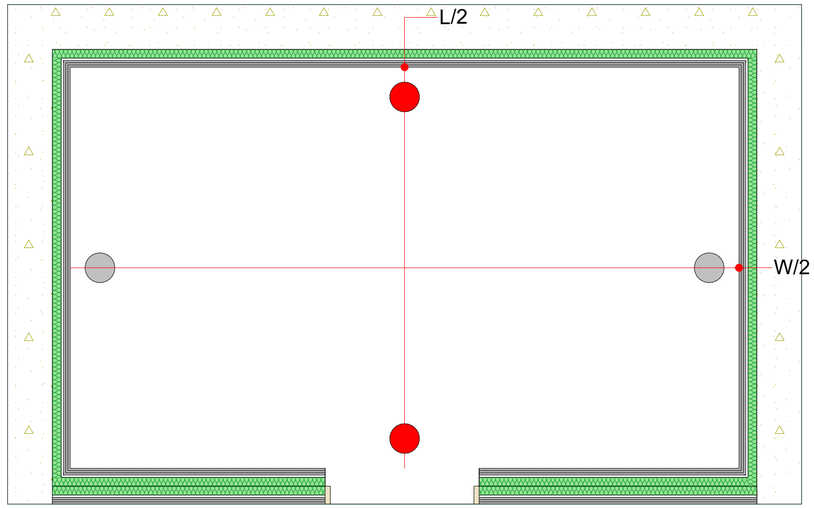
Simulations - Cedia b_h) Untreated







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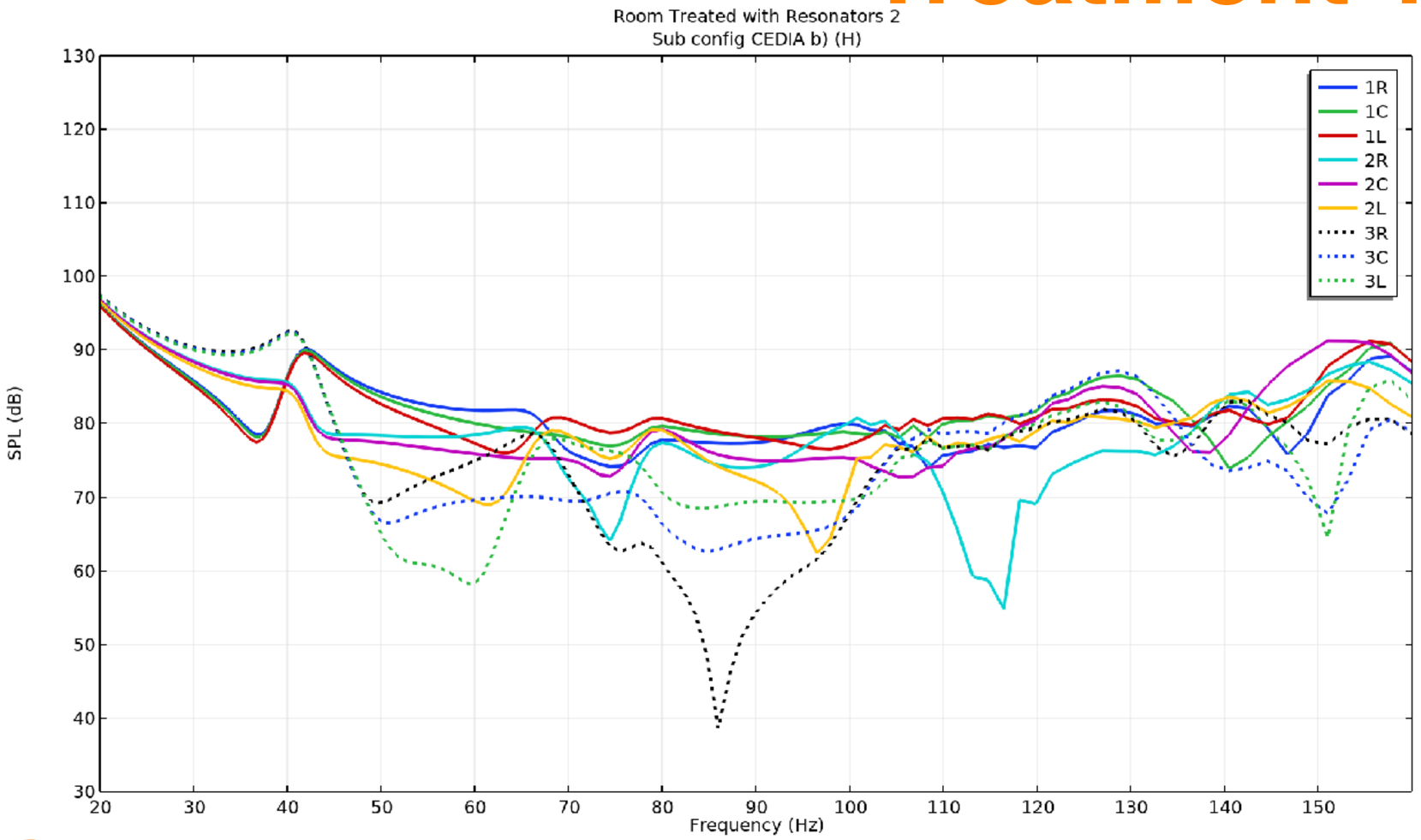
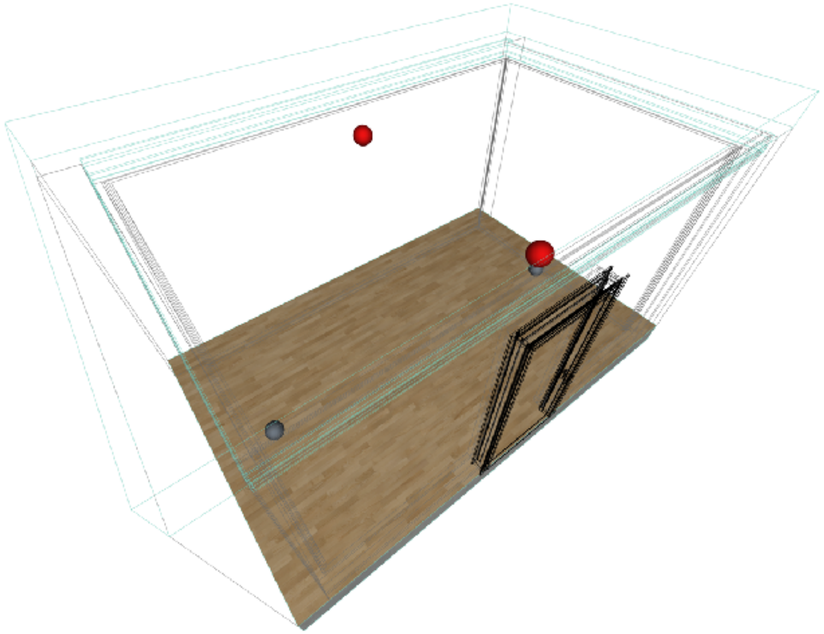
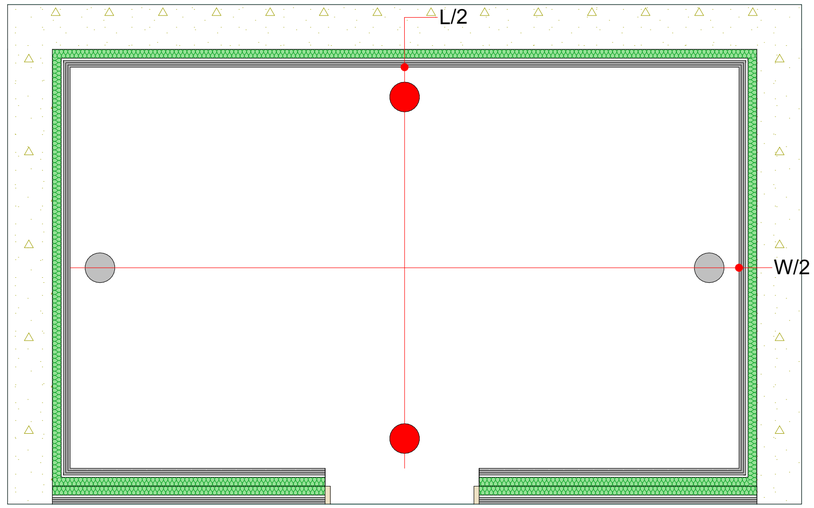
Simulations - Cedia b_h) Treatment 1







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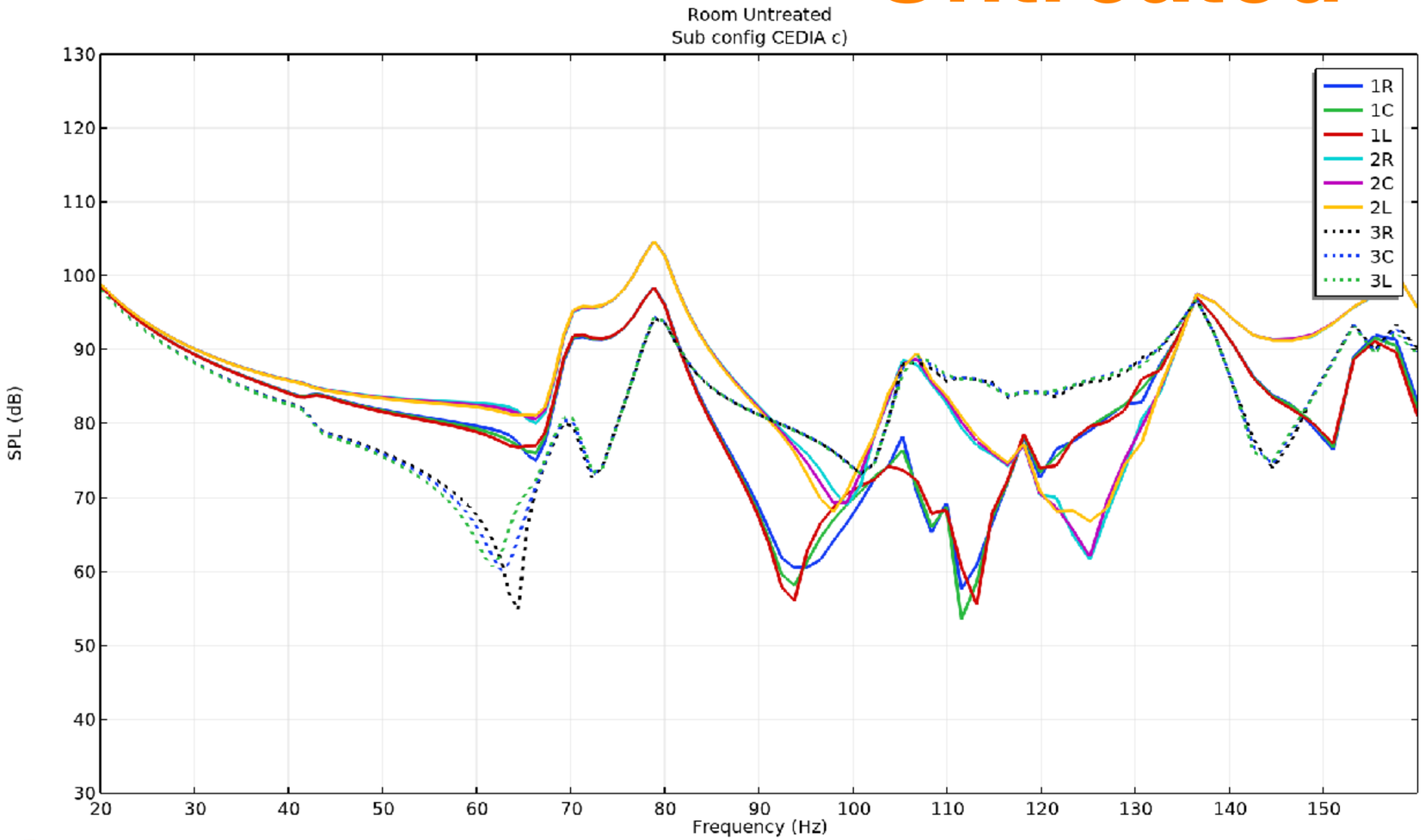
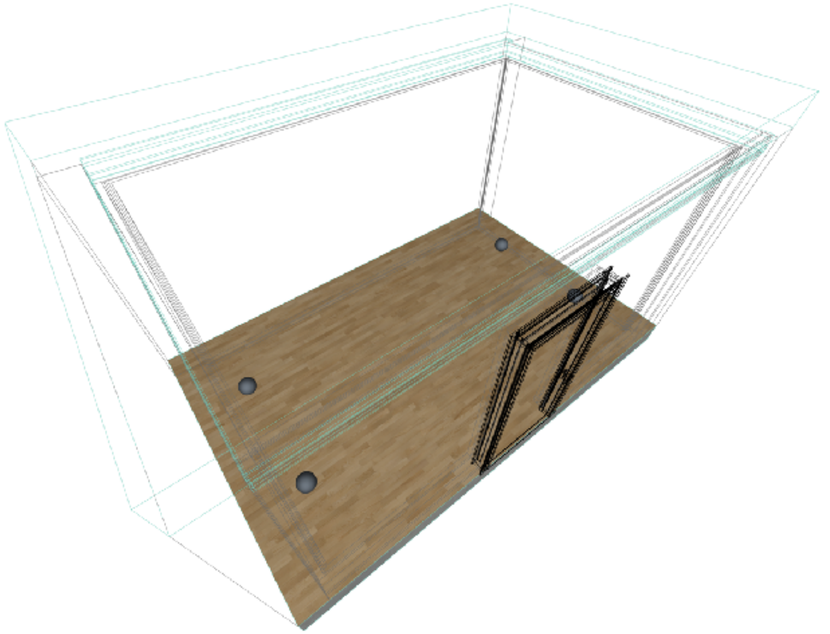
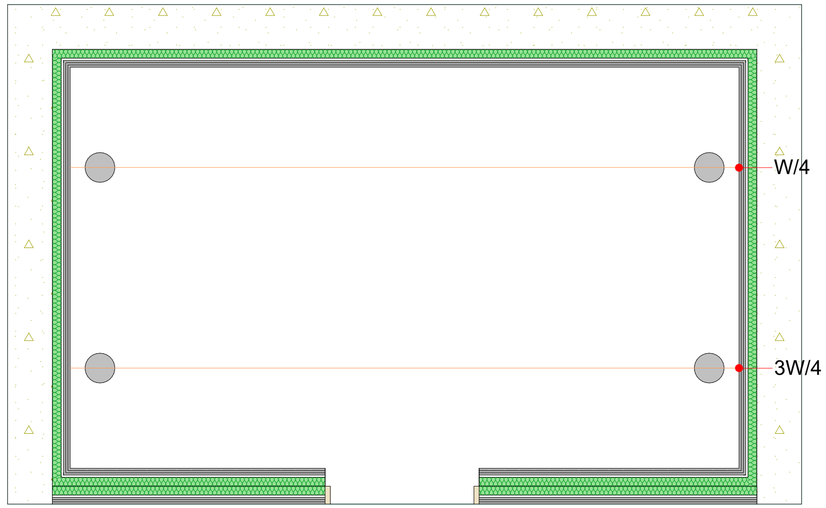
Simulations - Cedia c) Untreated







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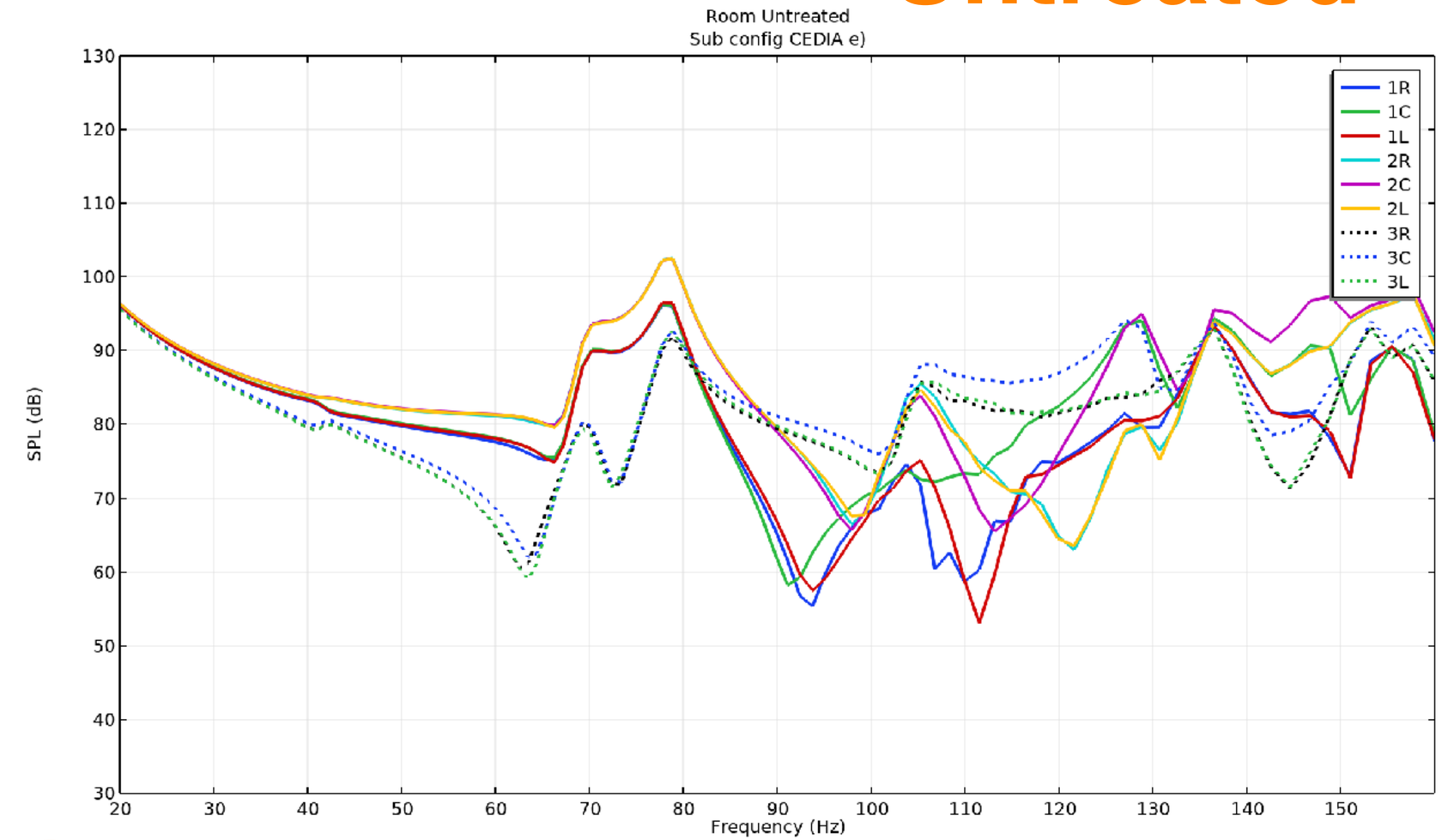
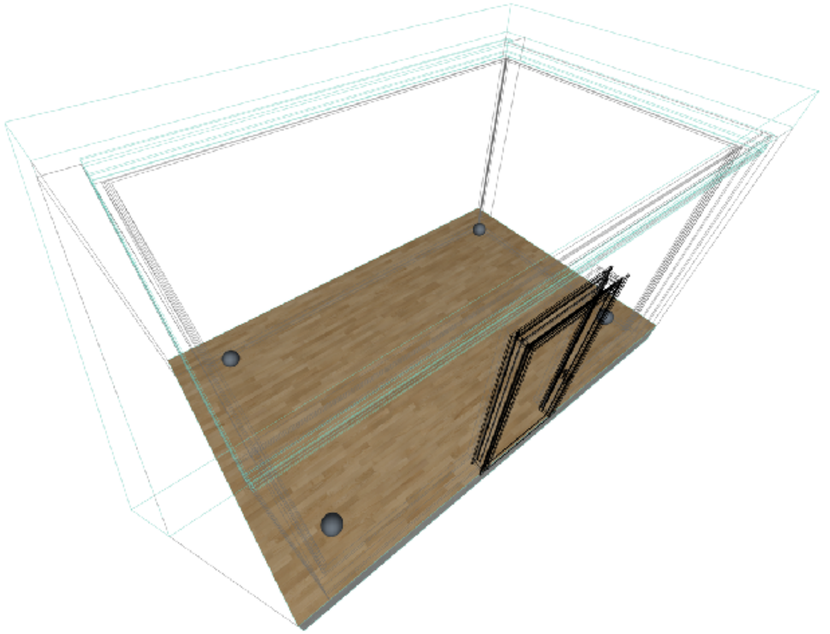
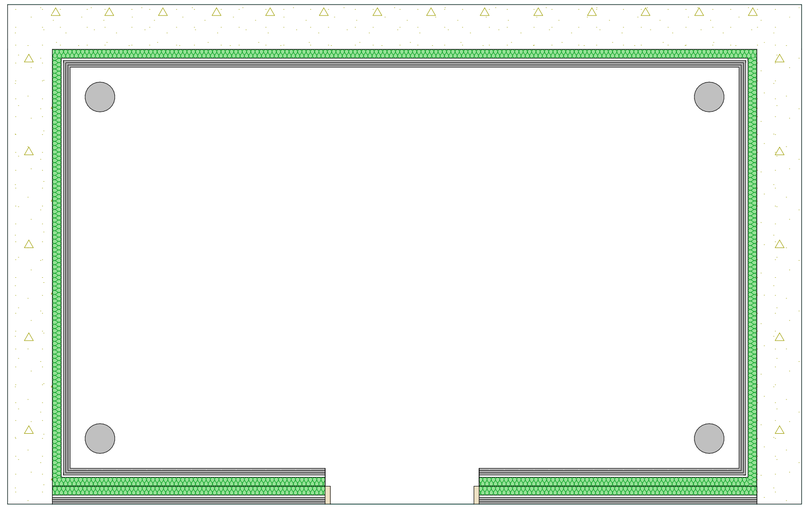
Simulations - Cedia e) Untreated







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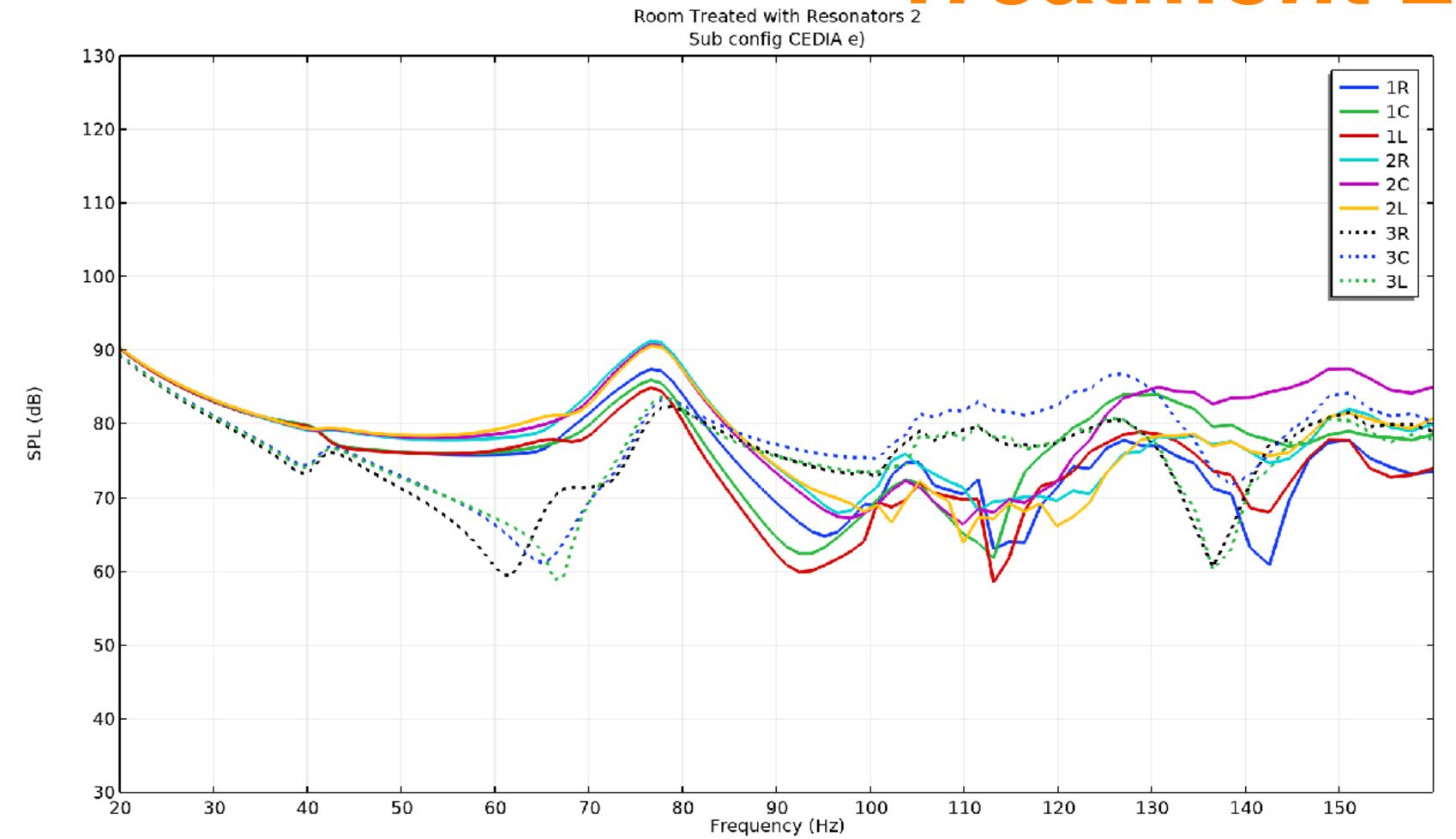
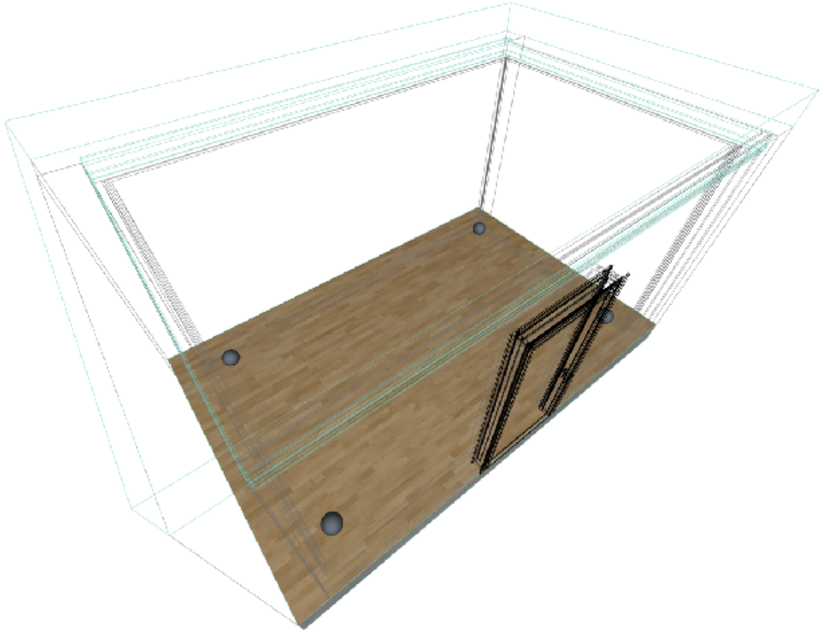
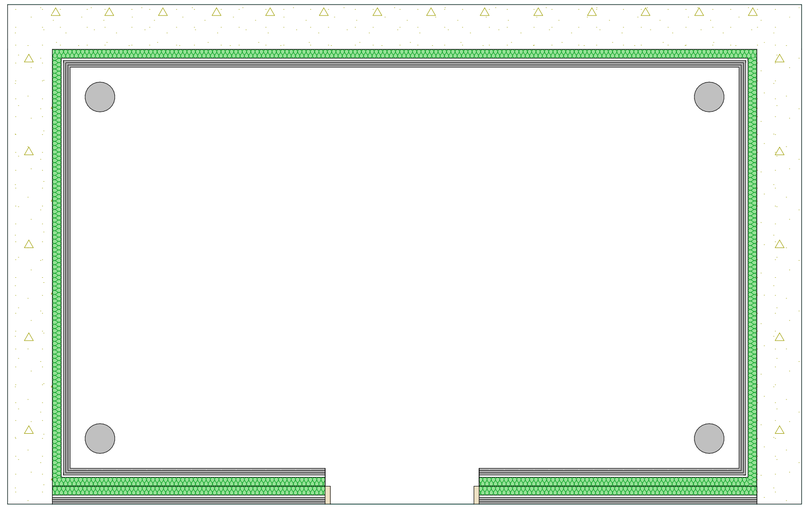
Simulations - Cedia e) Treatment 2







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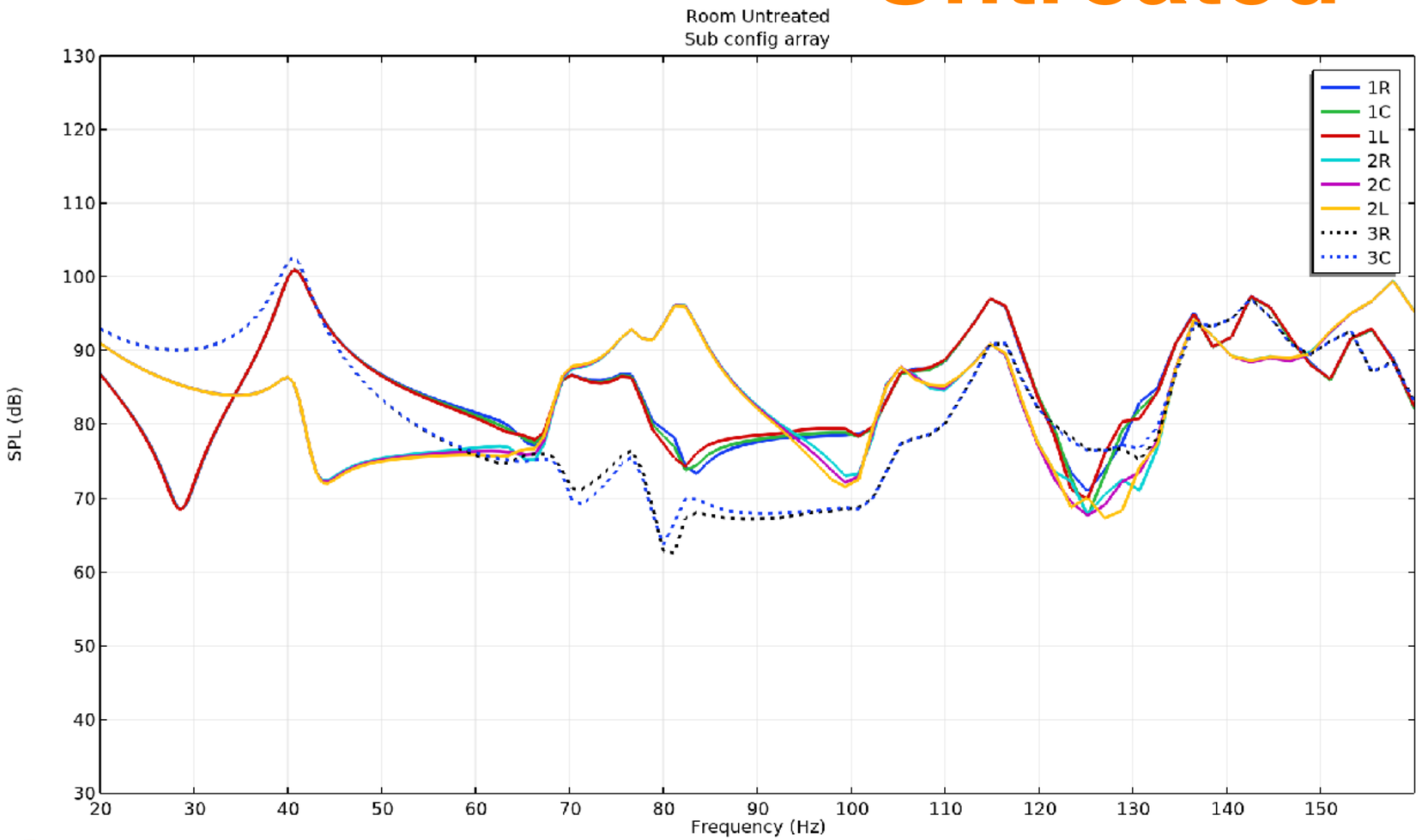
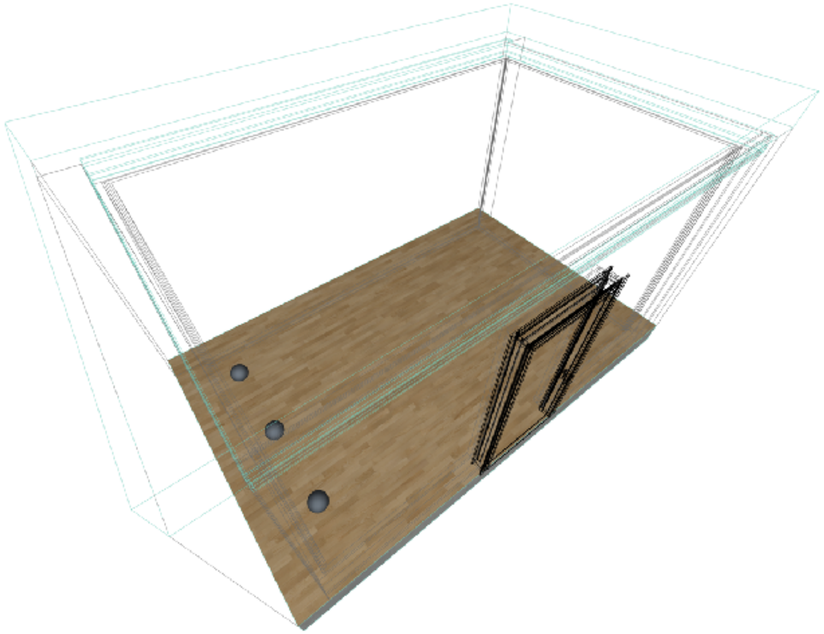
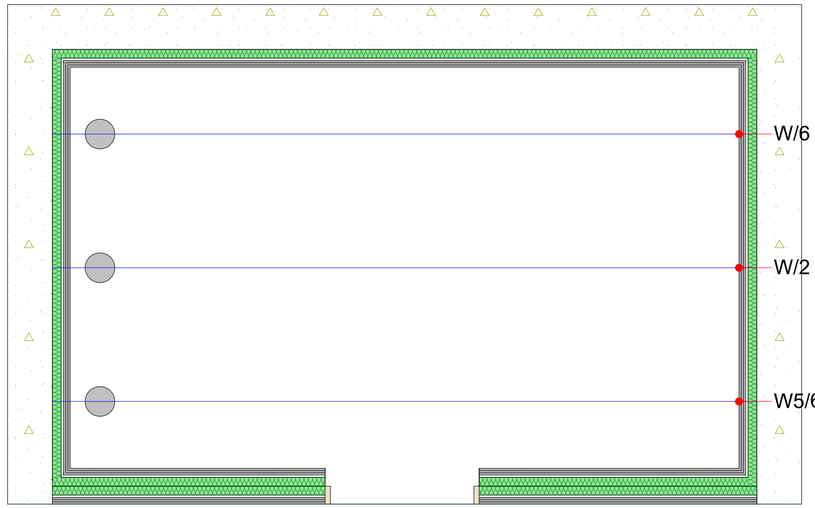
Simulations - Array Untreated







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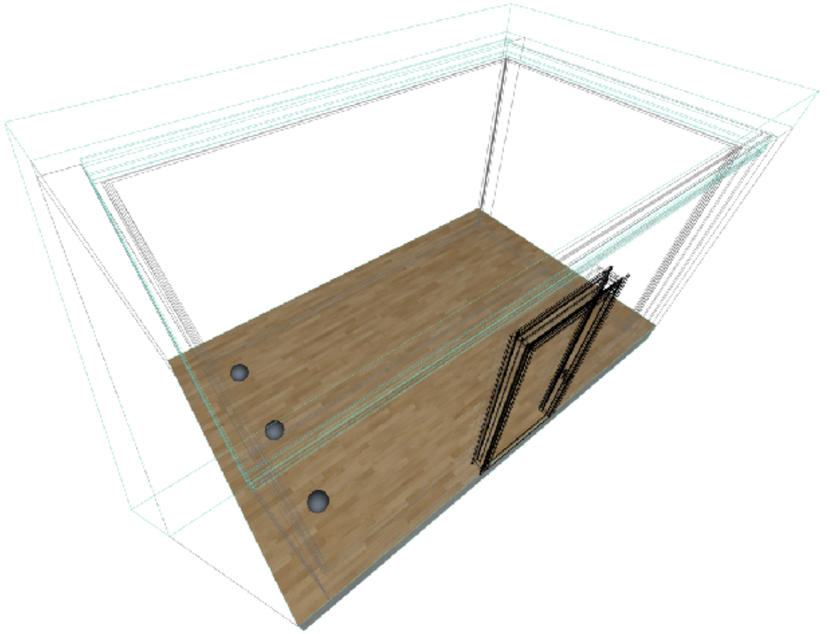
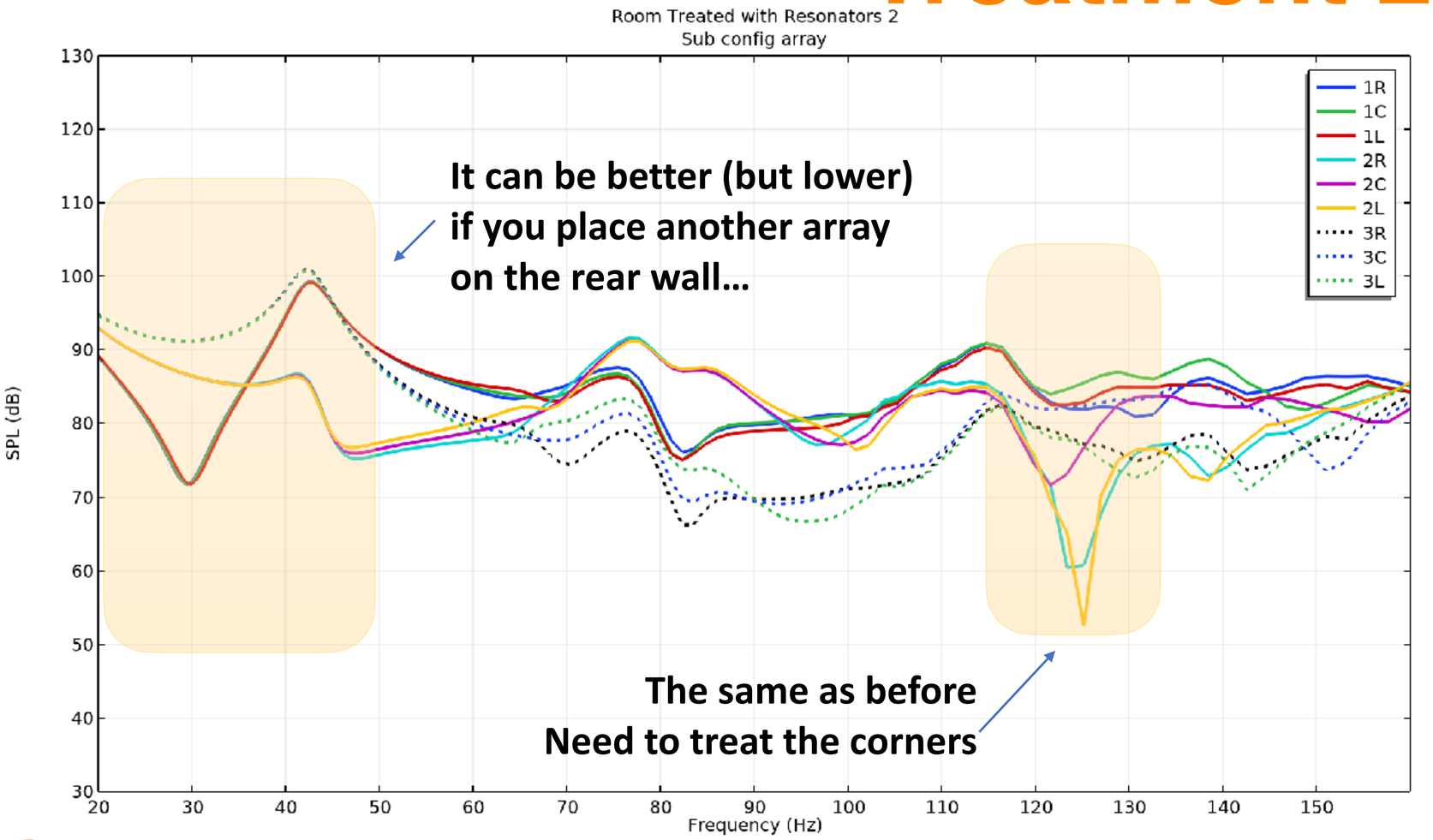
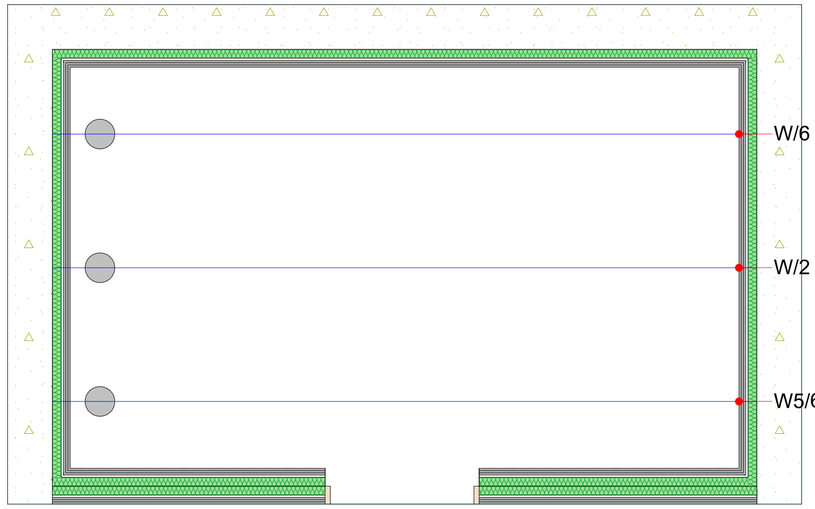
Simulations - Array Treatment 2







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Roma

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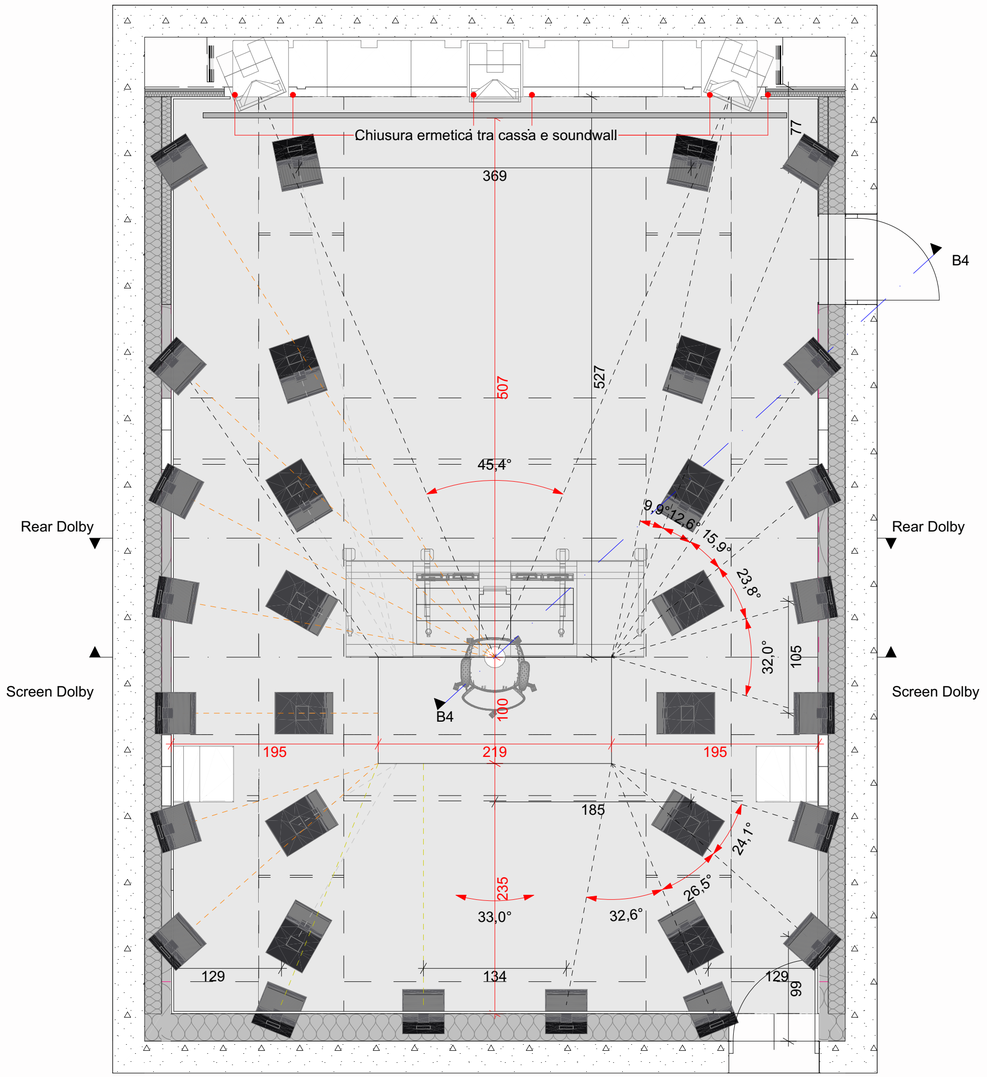
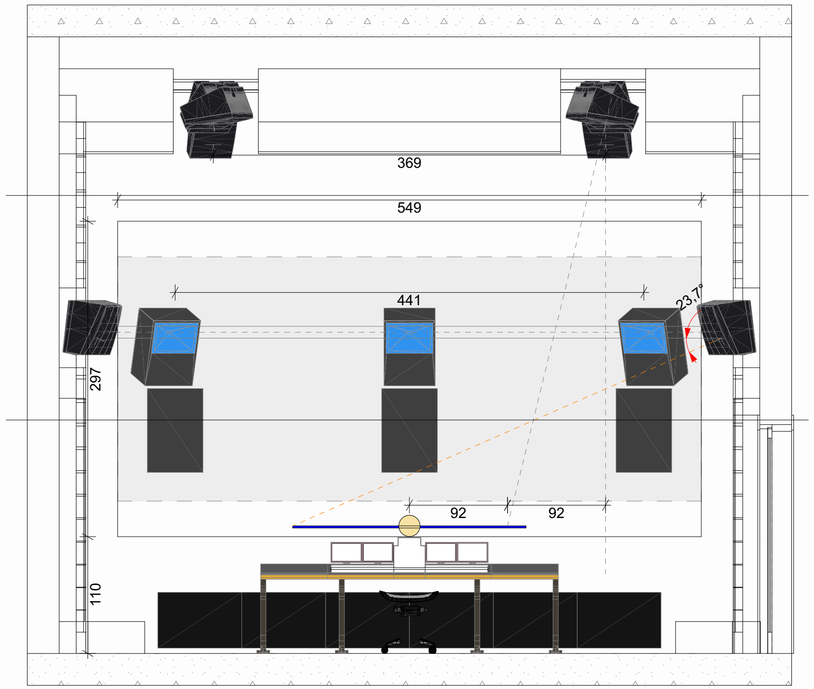
Cinecittà Sala E

Roma



Layout 1:50



Screen elevation 1:50

Studio Sound Service S.r.l.

Via Torricella 22/a, 50023 Impruneta (FI) Italy
info@studiosoundservice.com
Tel. +39 055 2020574
www.studiosoundservice.com

Acoustic Design: **Studio Sound Service**

Date
11/12/2023
Revision
Definitive

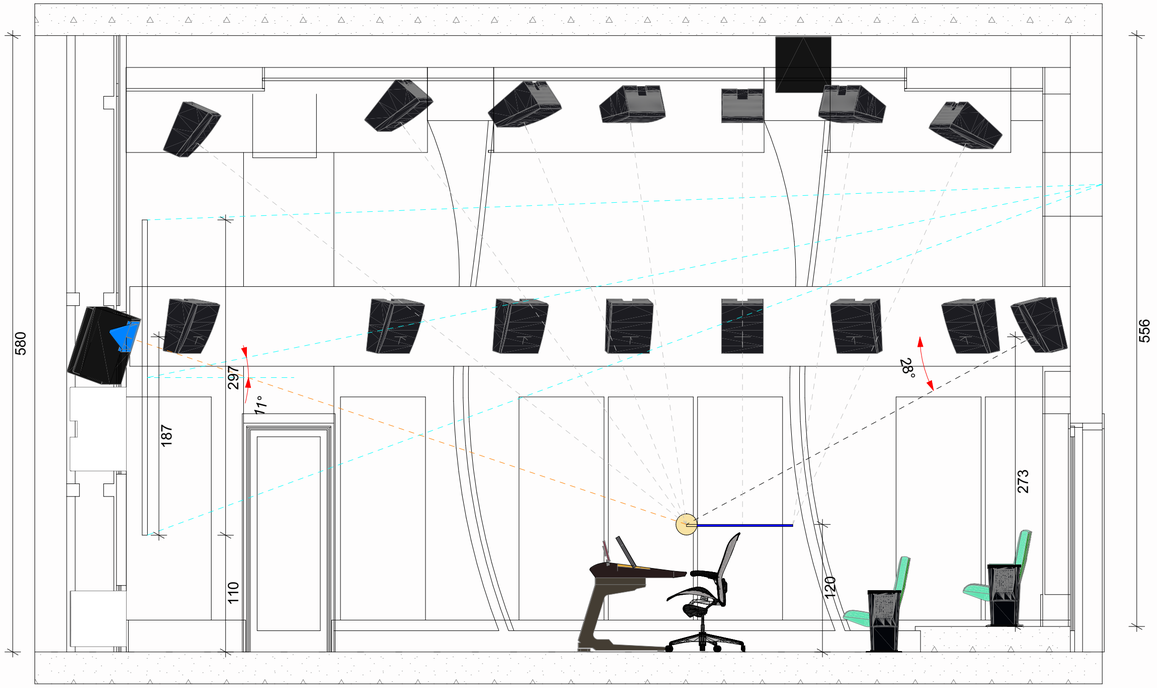
Drawing Number
19 / 21

Title
Dolby
Layout and sections

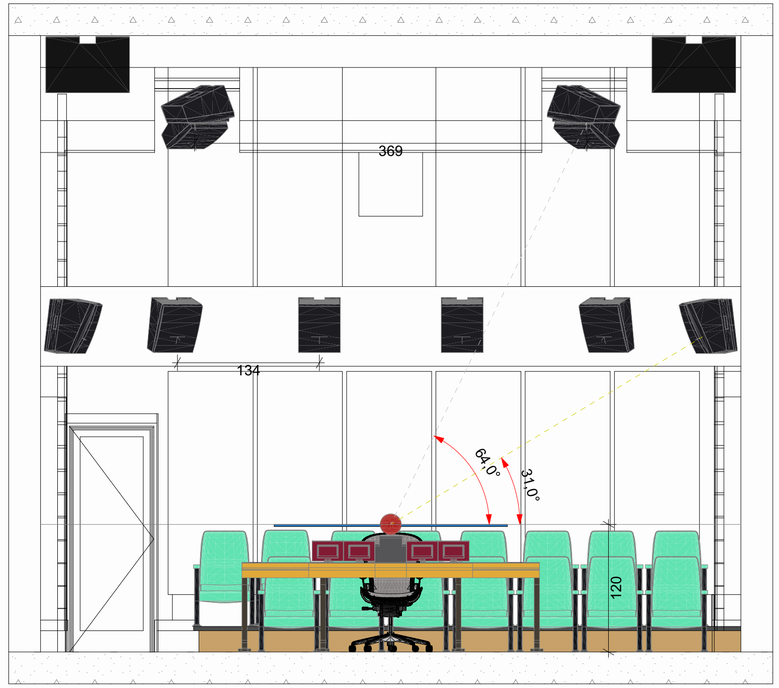
Dr. Scale
1:50

Client
Cinecittà

Project
Sala E



Side elevation 1:50



Rear elevation 1:50

Studio Sound Service S.r.l.

Via Torricella 22/a, 50023 Impruneta (FI) Italy
info@studiosoundservice.com
Tel. +39 055 2020574
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Acoustic Design: **Studio Sound Service**

Date
11/12/2023
Revision
Definitive

Drawing Number
20 / 21

Title
Dolby
Sections

Dr. Scale
1:50

Client
Cinecittà

Project
Sala E

DARDT Status

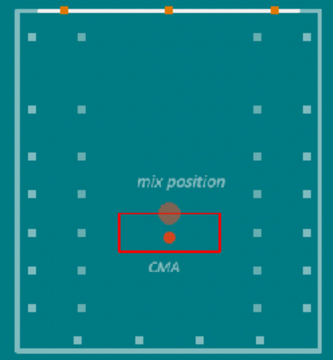
The tool does not ensure full approval of the selected equipment and displayed speaker positions. The design and equipment needs to be approved in conjunction with loudspeaker configuration plans by Dolby Atmos design approvers.

Room Data	(Metric)	Length (m)	Width (m)	Length of raked staging (m)	Room Height at Screen (m)	Room Height at Booth (m)	
Show Label Guide		8,9	6,5	6,7	5,8	5,6	
Application		Speakers per Side Wall (7 recommended)		Speakers Booth Wall (6 recommended)	Surround Subwoofers	3/5 Screen Speakers	Amping Screen Speakers
Dolby Atmos Feature Studio		7		4	2	3	bi-amped

Screen Width (m)	Screen Ratio	Screen Bottom to Floor (m)
5,6	Flat	1,1
Speaker-Screen-Spacing	Linear Spacing Distance	ISS Rear (m)
1,3	1,0	1,3

Auditorium Configuration Options

Amplifier Channels Side	7	Screen subwoofers, LFE clustered	✓
Amplifier Channels Top	7	Screen subwoofers, LFE floor mounted	✓
Top Speakers *Checkbox for equidistant spacing*	7	Surround subwoofers behind screen	
Rear Surround Pairing		Surround subwoofers mounted in joint of floor/wall or wall/ceiling	✓



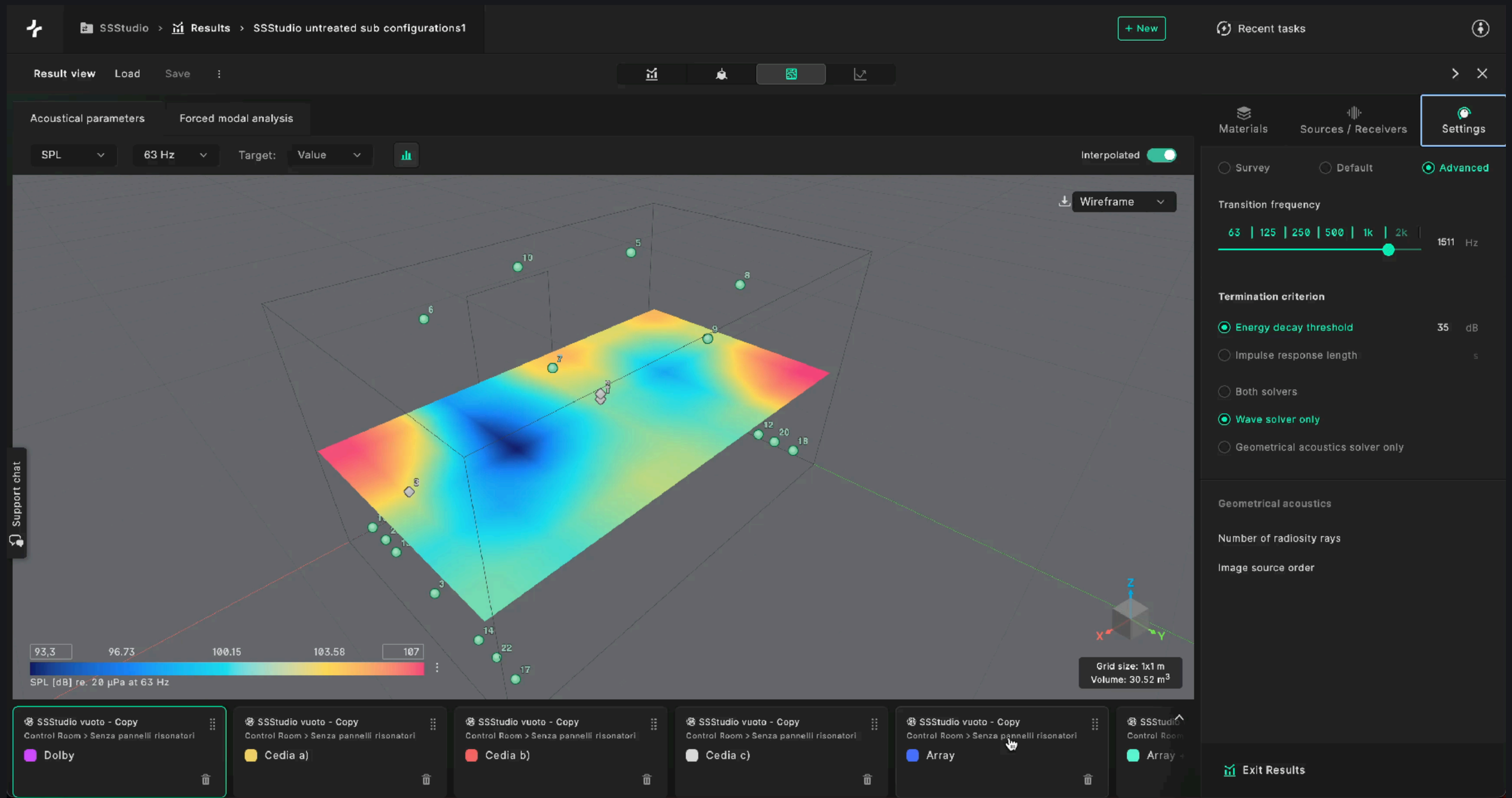
Full linear spacing selected

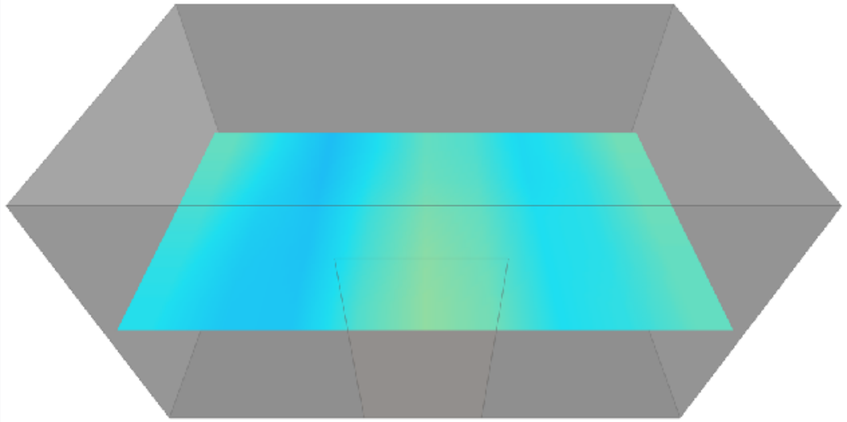
Location	Speaker Channel	Loudspeaker Throw Distance Coordinates referenced from Mix Position				Speaker *Click here for screen speaker target SPL's*				Active Speaker	Required Power Rating for Speaker selected				Amplifier					Notes	Cables	
		X (m)	Y (m)	Z (m)	3D distance from mix pos (m)	Speaker Model *Checkbox only for active loudspeakers*	Speaker Watts (Cont.)	dB SPL 1W@1m	Ω	Maximum Peak SPL (dB)	Watts required 102dB	Watts required for target SPL	Watts re-quired per speaker 115dB	Headroom above target SPL (dB)	Amplifier Model	stereo/ bridged	Ω	Watts available *Single Channel driven*	Amp headroom over target (dB)		Length (m)	ø (mm2)
Screen Left	L (LF)	2,3	5,3	1,8	6,2	Meyer Bluehorn System ✓				132,1				5,3					0		25,0	
	L (HF)																		0		25,0	
Screen Center	C (LF)		5,3	1,8	5,7	Meyer Bluehorn System				132,1				5,9					0		25,0	
	C (HF)																		0		25,0	
Screen Right	R (LF)	2,3	5,3	1,8	6,2	Meyer Bluehorn System				132,1				5,3					0		25,0	
	R (HF)																		0		25,0	
LFE	LFE		5,3	-0,9	5,3	Meyer X-400C ✓				123,0	6 unit			5,0					0		25,0	
Surr. Subw.	SUB 1	3,0	-1,1	4,6	5,6	Meyer X-400C ✓				128,6	1 unit			4,6				W	0		15,0	
	SUB 2	3,0	-1,1	4,6	5,6	Meyer X-400C				128,6	1 unit			4,6				W	0		15,0	
Side Surround	LSS 1	3,0	4,6	1,8	5,8	Meyer HMS-10 ✓				126,6				3,4					0		20,0	
	LSS 2	3,0	2,7	1,8	4,4	Meyer HMS-10 ✓				126,6				5,7					0		20,0	
	LSS 3	3,0	1,5	1,8	3,8	Meyer HMS-10 ✓				126,6				7,0					0		15,0	
	LSS 4	3,0	0,5	1,8	3,5	Meyer HMS-10 ✓				126,6				7,6					0		15,0	
	LSS 5	3,0	-0,5	1,8	3,5	Meyer HMS-10 ✓				126,6				7,6					0		15,0	
	LSS 6	3,0	-1,5	1,8	3,8	Meyer HMS-10 ✓				126,6				7,0					0		15,0	
	LSS 7	3,0	-2,5	1,8	4,3	Meyer HMS-10 ✓				126,6				5,9					0		15,0	
	LSS 8					✓													0			
	LSS 9					✓													0			
	LSS 10					✓													0			
	LSS 11					✓													0			
	LSS 12					✓													0			
	RSS 1	3,0	4,6	1,8	5,8	Meyer HMS-10 ✓				126,6				3,4					0		20,0	
	RSS 2	3,0	2,7	1,8	4,4	Meyer HMS-10 ✓				126,6				5,7					0		20,0	
	RSS 3	3,0	1,5	1,8	3,8	Meyer HMS-10 ✓				126,6				7,0					0		15,0	
	RSS 4	3,0	0,5	1,8	3,5	Meyer HMS-10 ✓				126,6				7,6					0		15,0	
	RSS 5	3,0	-0,5	1,8	3,5	Meyer HMS-10 ✓				126,6				7,6					0		15,0	
	RSS 6	3,0	-1,5	1,8	3,8	Meyer HMS-10 ✓				126,6				7,0					0		15,0	
	RSS 7	3,0	-2,5	1,8	4,3	Meyer HMS-10 ✓				126,6				5,9					0		15,0	
	RSS 8					✓													0			

STUDIO SOUND SERVICE

Donato Masci

Subwoofer Array Design: Applying the delay





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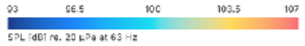
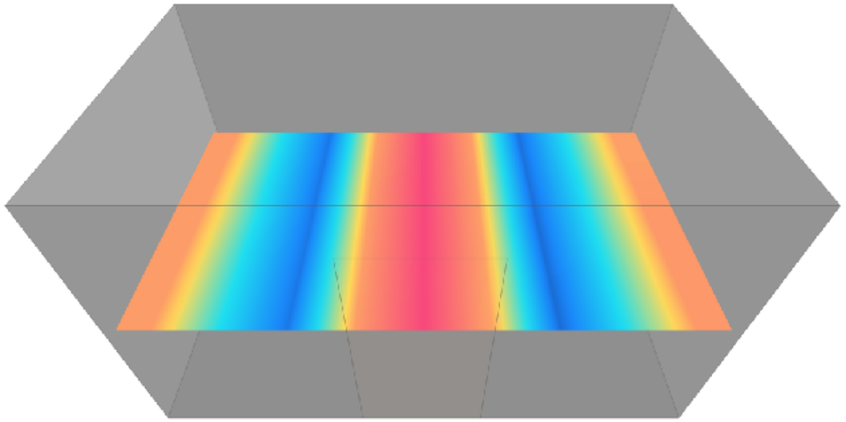
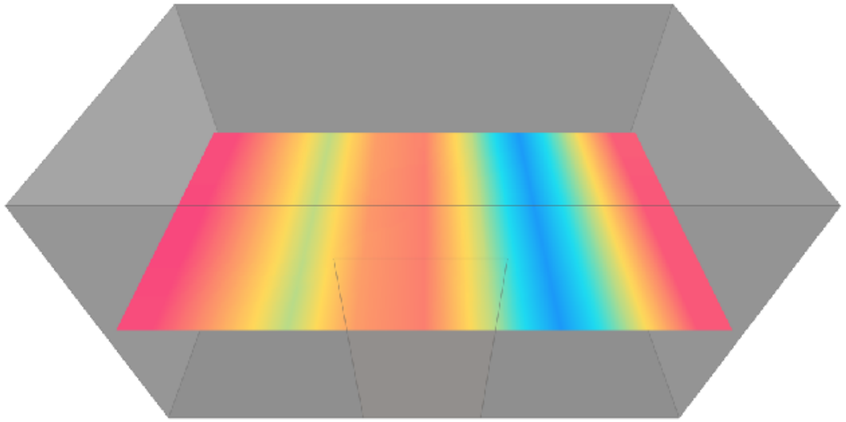




Cedia c)



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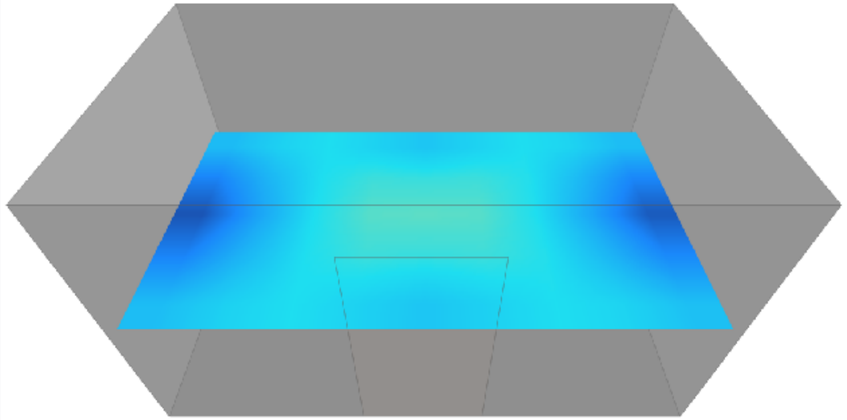

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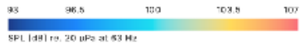
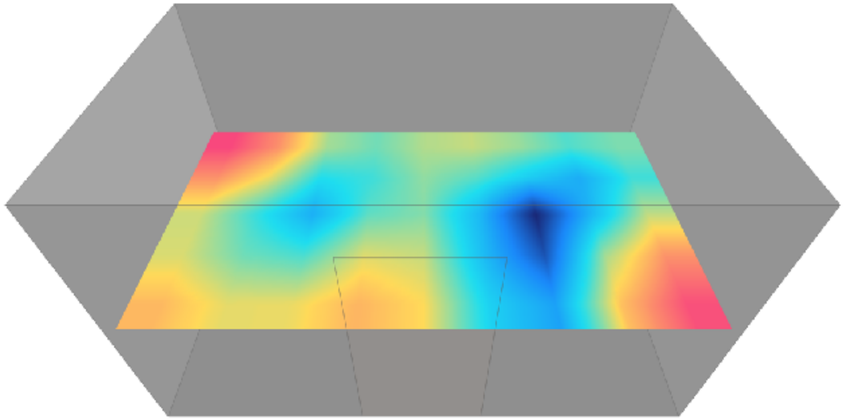
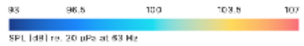
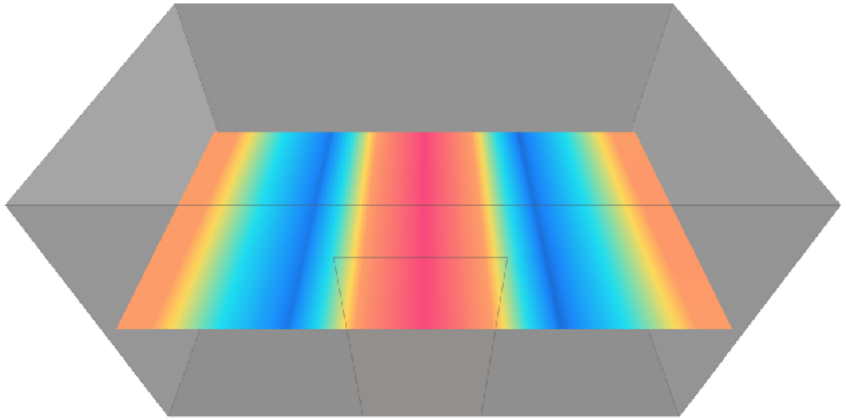




Dolby





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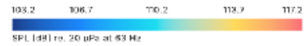
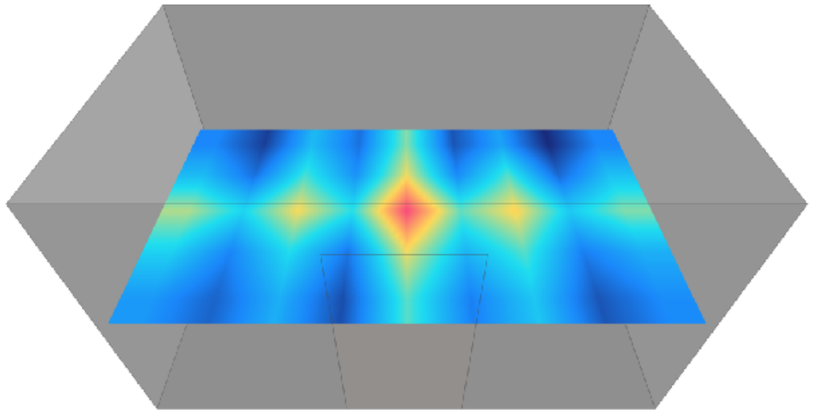
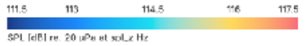
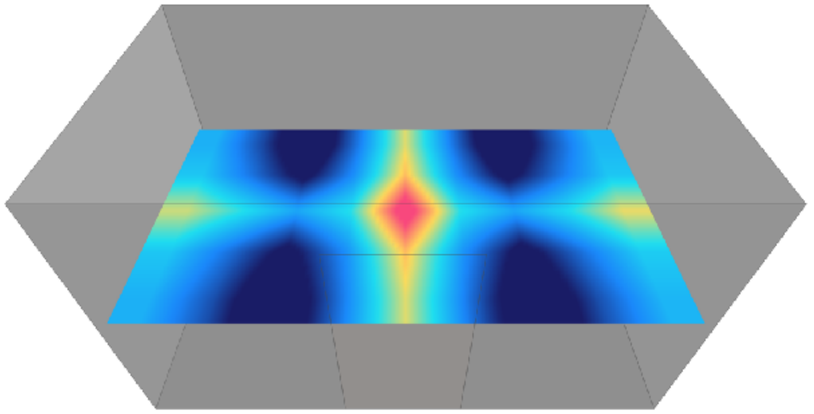




Cedia a)





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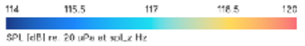

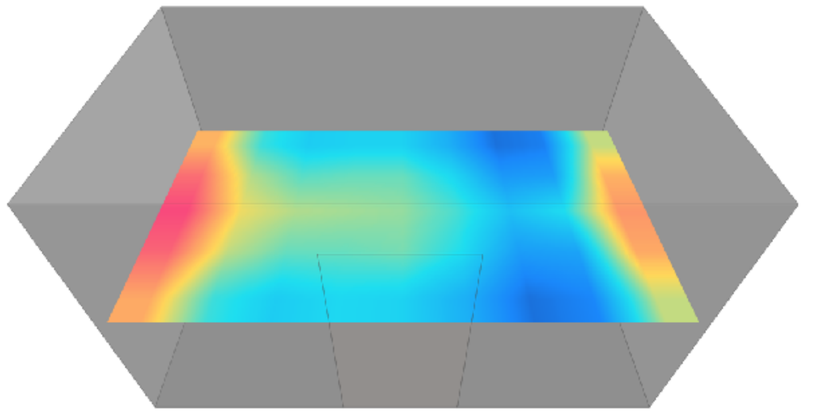

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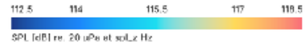

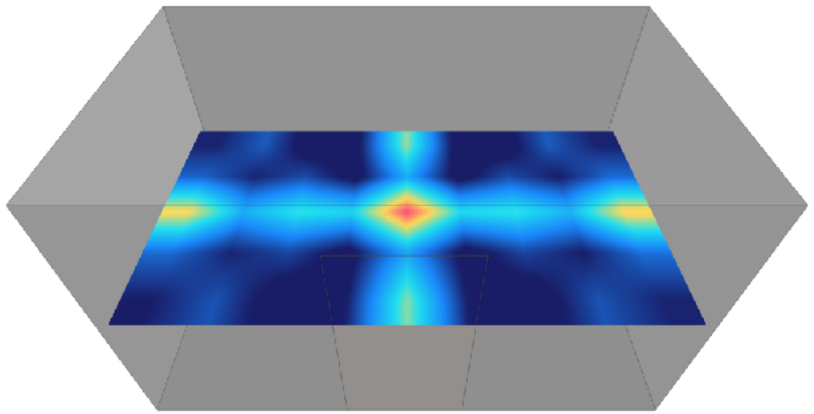

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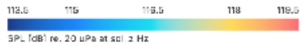

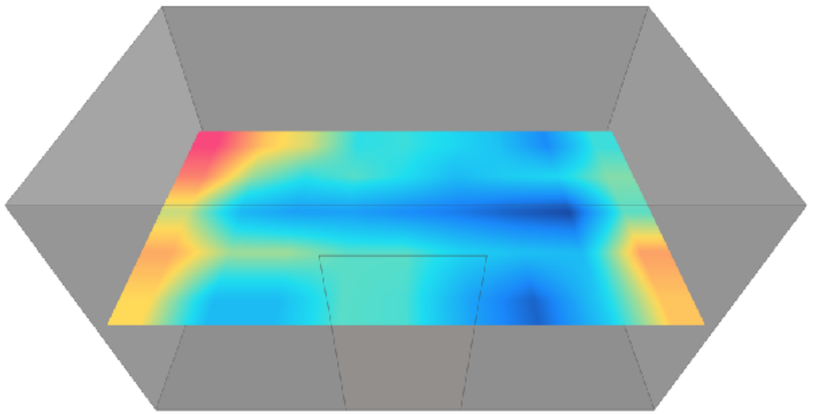

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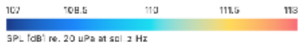

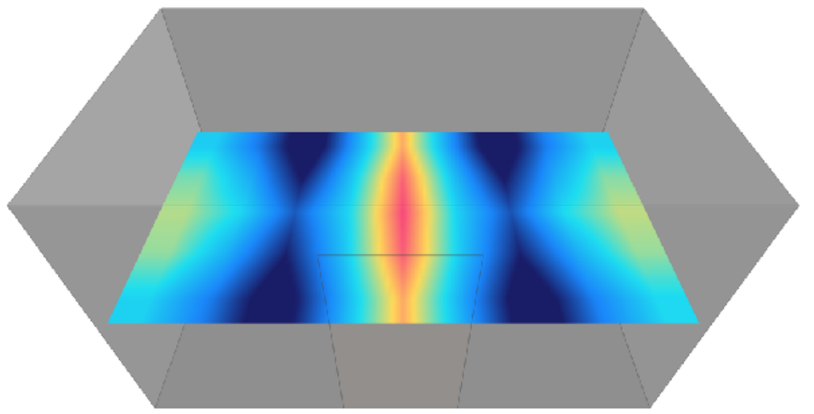

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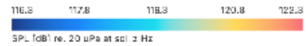

Conclusions

- There are some subwoofer configurations that linearize the FR and make it more uniform in space, but they don't make the room resonate at all, therefore they are definitely less efficient

- If the BM crossover is low (<80Hz), the perception of source location doesn't change much – be careful because the LFE goes up to 120 Hz and its location is perceivable!
  Therefore, content plays a fundamental role in placement decisions

- Even if the FR is linear, it doesn't mean you have good listening conditions. The reverberation time and its frequency behavior make the difference

- There are additional aspects regarding the attack and release of low frequencies that play a fundamental role in both active and traditional acoustic treatment

- Debunking the single-frequency myth: There's never just one frequency to treat. When you address the most obvious one, others become apparent. It's always about broadband treatment

- To achieve excellent results, one must be knowledgeable about both the active part and traditional acoustics in a room

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Small rooms: a few dozen Hz, 95% of the work

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