STUDIO
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SERVICE

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Donato Masci
Acoustic designer & Consultant

24 / 05
— 2018

Studio Design for Next Generation Audio

Dolby Atmos Design, Home Entertainment

Who we are

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

Studio Sound Service is an acoustic design firm, located in Florence, Italy. Since 1983 we design rooms for music and audio/video production.

Some Projects:

- Barys Arena (ice hockey) @ Astana, Kazakhstan;
- FOX post-production studios @ Münich (DE);
- FOX post-production studios @ Hammersmith, London (UK);
- D:POT Recording Arts @ Prato – Fabrizio Simoncioni;
- Mulinetti Studio @ Genova – Alberto Parodi (Resolution Award 2015 Best Audio Facility, Nomination);
- The Garage @ Civitella v.d.C. (AR) (Resolution Award 2014 Best Audio Facility, Nomination);
- House of Glass @ Viareggio (LU) – Gianni Bini (Resolution Award 2013 Best Audio Facility, Nomination);
- Damian Lazarus – Monastic Studio @ Vicchio (FI);
- Vinai Studio @ Brescia;
- Renato Zero Studio @ Roma;
- PPG Studios (Andrea Bocelli) @ S. Pietro Belvedere (PI);
- In House (Dolby® approved - Sorrentino) @ Roma;
- George Lucas Home Theater, Italy;
- Chiesa di Santa Maria Nuova (Arch. Mario Botta) @ Terranuova Bracciolini (AR);
- Prada Auditorium and Conference Room via Orobia @ Milano;
- Sala Proiezioni Museo Ferrari @ Maranello (MO).

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Music Facilities

Bagnoli bros. studio

Castelnovo ne' Monti — RE

Renato Zero

Roma

Fox - NatGeo

Hammersmith, London UK

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Casi studio

Cinema mixing Room, Dolby®

inHouse

Roma

Kalimba Studio

Monselice – PD

Platinum Studio Diego Calvetti

San Gimignano - SI

House of Glass
Gianni Bini

Viareggio

Mulinetti Alberto Parodi

Genova

D:POT recording arts
Fabrizio Simoncioni – Litfiba

Prato

Officina Sonora del Bigallo

Bagno a Ripoli - FI

Sudestudio

Guagnano – LE

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A Brief History of Multichannel Audio

(for video...?)

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Evolution: audio tech vs film sound (90')

1890 1960 1970 1980 1990 2000

AM Radio
Electrical Phonographs

Reel to Reel

First stereo
AM/FM/Phono

Dolby Cassettes

44.1/16 Digital CD

Dolby Surround, THX
70mm & IMAX

MP3, AC3, DTS 96/24
DVD-A, SACD

5.1 compressed
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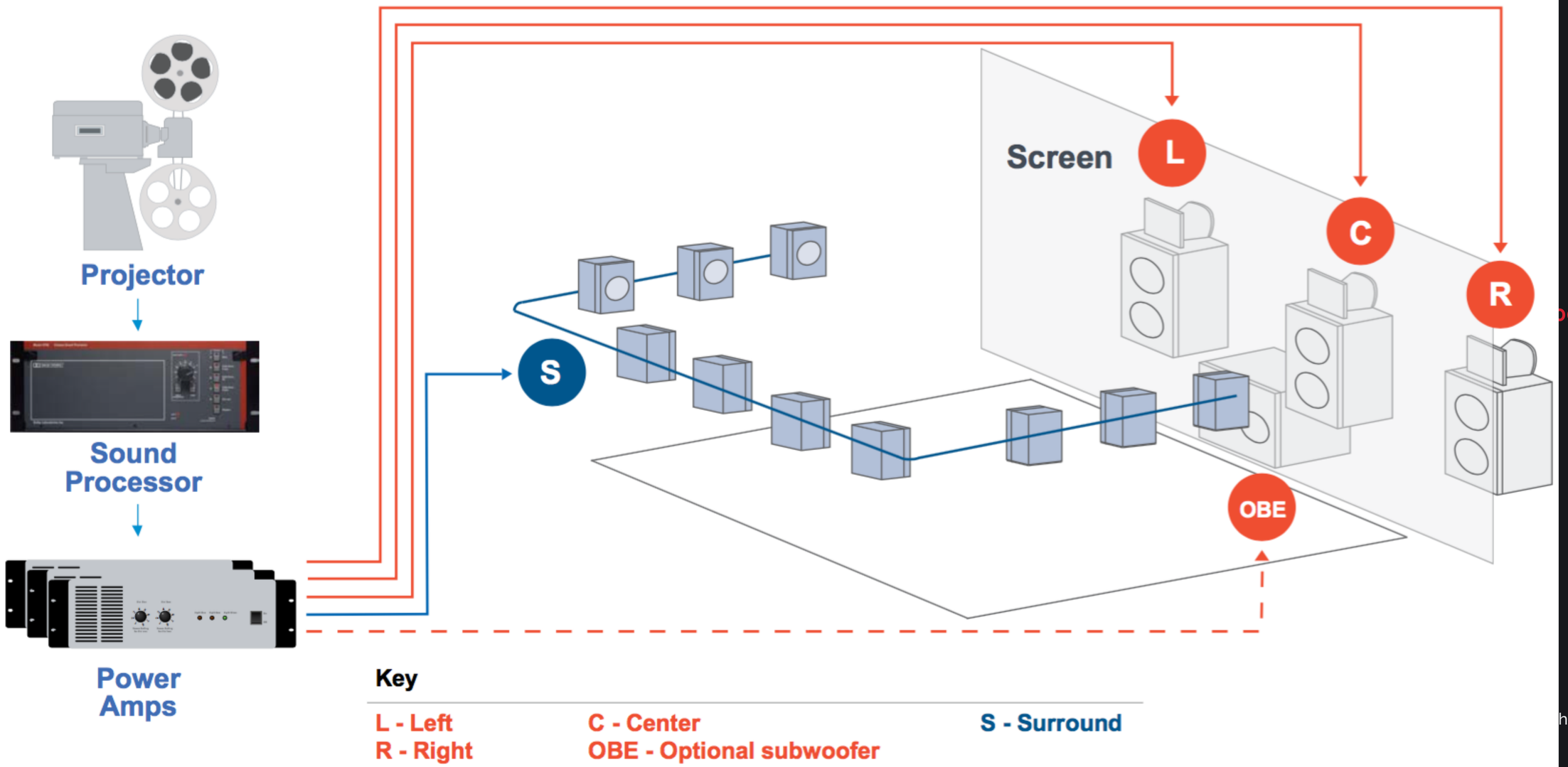

Figure 1.1 Dolby Surround

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- **5.1 discrete digital channels (surround with wider FR) (LFE subwoofer)**
- Screen channels expanded 3->5 (inner left, inner right)
- Dolby Digital Surround EX

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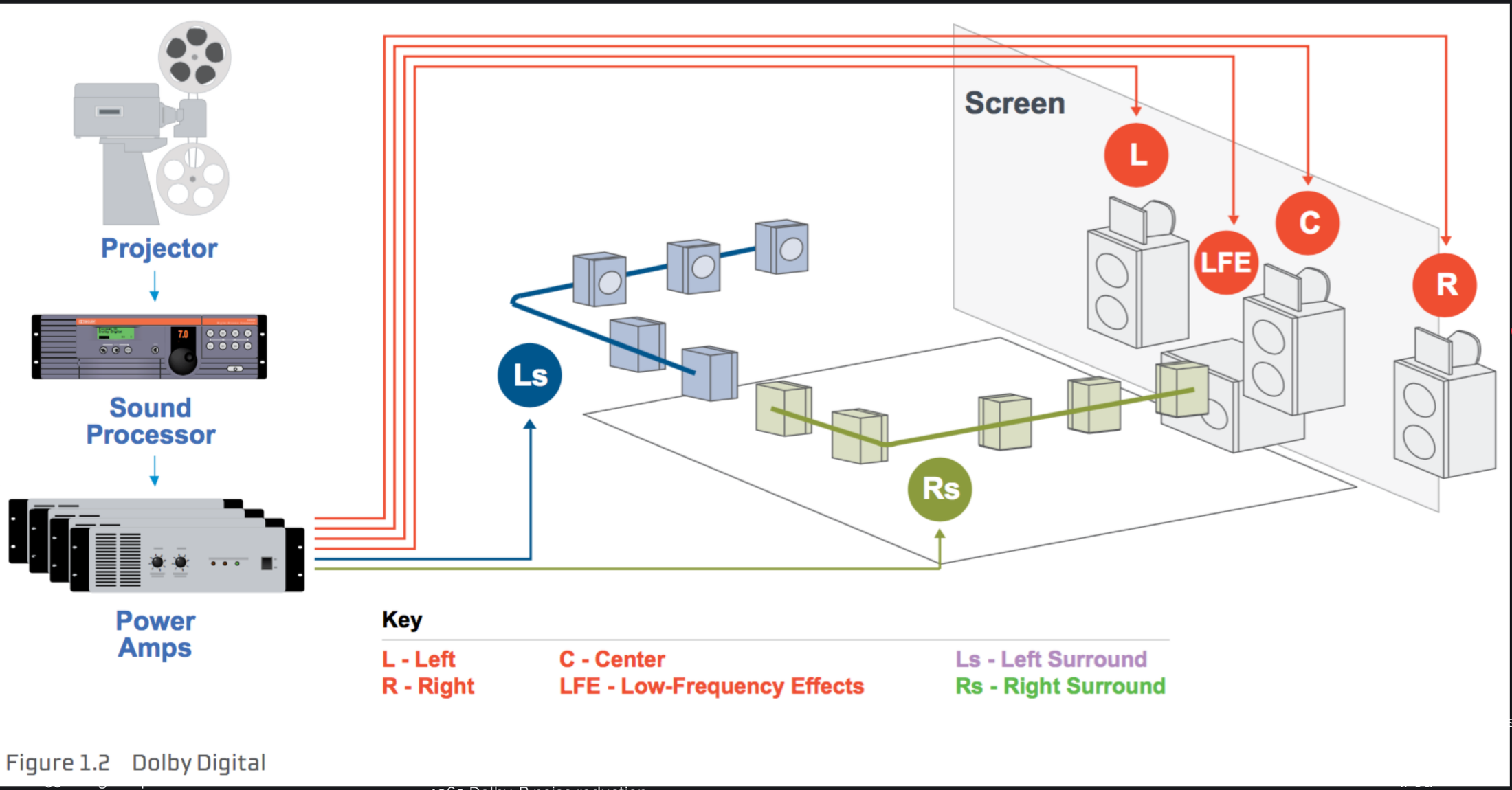

Figure 1.2 Dolby Digital

First magnetic tape recorder

1969 Dolby-B noise reduction

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- The document describes overall system requirements and specifications for digital cinema
- Based on many SMPTE and ISO standards
- it explains the route to create an entire Digital Cinema Package (DCP) from a raw collection of files known as the Digital Cinema Distribution Master (DCDM)
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2010 – Dolby Surround 7.1

- increasing the number of surround channels by splitting the existing Ls, Rs into 4 zones: Lss Lrs, Rss, Rrs.
- more that 120 titles and 4000 screens equipped in less than 3 years since its launch

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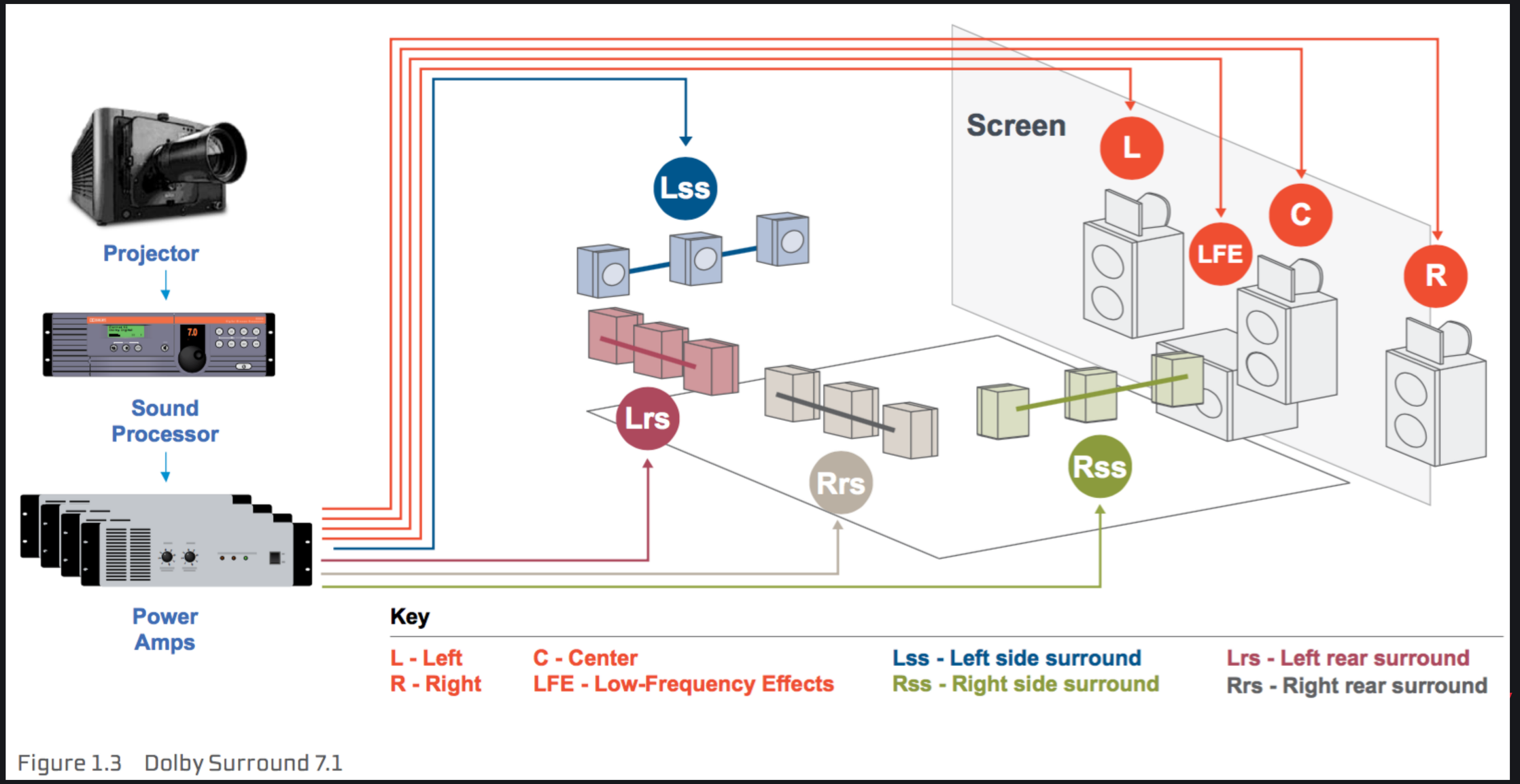

Figure 1.3 Dolby Surround 7.1

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Dolby R&D – Various speaker configuration

- remixed movies into different theatres
- feedbacks
- precise targeting of requirements for the next generation of digital cinema sound
- e.g. inner left and inner right replay channels are rarely used because a dedicated five-screen channel mix must be created to support them...
- technology and standards for dubbing theatres and cinemas are aligned and monitored

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- next generation of sound for cinema
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now – Dolby Atmos Home entertainment

- guidance for equipping a professional mixing/ encoding room for Dolby Atmos home entertainment audio production and quality control

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- **24 bits per sample, 48 kHz or 96 kHz, up to 16 channels, WAV container, uncompressed PCM**

2007 – DCI Specification 1.1

2010 – Dolby Surround 7.1
- increasing the number of surround channels by splitting the existing Ls, Rs into 4 zones: Lss Lrs, Rss, Rrs.
- more that 120 titles and 4000 screens equipped in less than 3 years since its launch

Dolby R&D – Various speaker configuration
- remixed movies into different theatres
- feedbacks
- precise targeting of requirements for the next generation of digital cinema sound
- e.g. inner left and inner right replay channels are rarely used because a dedicated five-screen channel mix must be created to support them...
- technology and standards for dubbing theatres and cinemas are aligned and monitored

2012 – Dolby Atmos
- next generation of sound for cinema
- beds+object

2012 – DCI Specification 1.2

now – Dolby Atmos Home entertainment
- guidance for equipping a professional mixing/ encoding room for Dolby Atmos home entertainment audio production and quality control

3D audio for Broadcast
- Netflix
- Sky
- Fox
- ... many other in 2018

2005 2010 2015 now

Digital Cinema Initiatives, LLC (DCI) released Version 1.0 of its "Digital Cinema System Specification"
- The document describes overall system requirements and specifications for digital cinema
- Based on many SMPTE and ISO standards
- it explains the route to create an entire Digital Cinema Package (DCP) from a raw collection of files known as the Digital Cinema Distribution Master (DCDM)
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- Netflix
- Sky
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- ... many other in 2018

3D audio for Music...?

2005 — 2010 — 2015 — now

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Dolby Atmos

Two critical elements significantly improve the audience experience over 5.1 and 7.1 systems:

A. Sounds originating overhead.

B. Sounds originating from discrete sources throughout the auditorium.

Audio Objects:
groups of sound elements that share the same physical location in the auditorium

A. They can be static or move.

B. Controlled by metadata that details the position of the sound at a given point in time.

C. When objects are monitored or played back in a theatre, they are rendered according to the positional metadata using the speakers that are present, rather than necessarily being output to a physical channel.

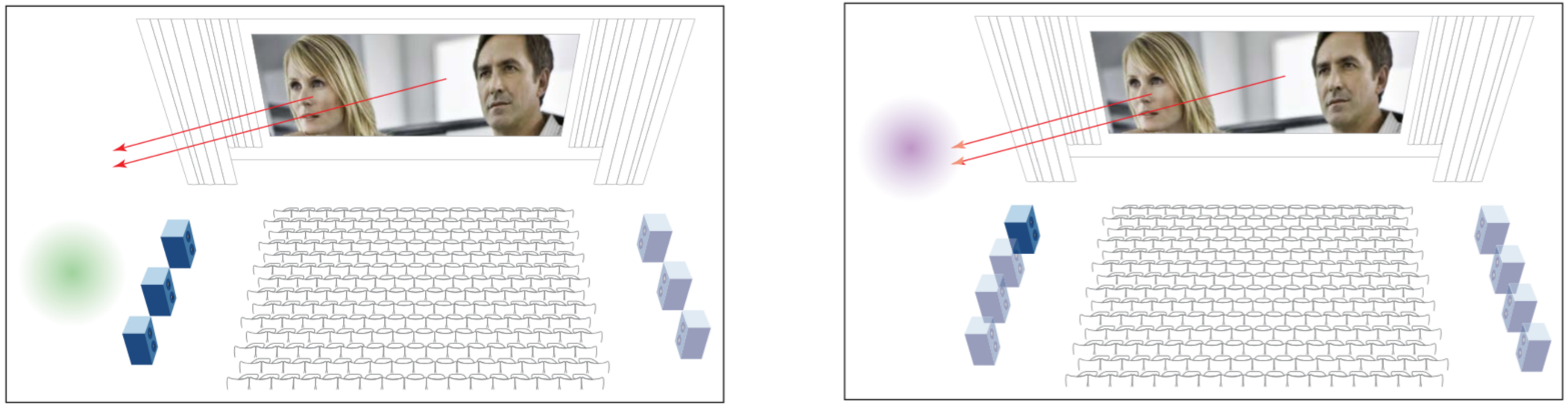

Figure 2.1 Benefits of Increased Surround Resolution for Audio/Visual Coherence

Audio Objects:

groups of sound elements that share the same physical location in the auditorium

A. They can be static or move.

B. Controlled by metadata that details the position of the sound at a given point in time.

C. When objects are monitored or played back in a theatre, they are rendered according to the positional metadata using the speakers that are present, rather than necessarily being output to a physical channel.

Objects + Beds

While the use of audio objects provides desired control for discrete effects, other aspects of a movie soundtrack do work effectively in a channel-based environment.

A. beds are channel-based submixes or stems (5.1, 7.1 or 9.1)

B. e.g. ambient effects or reverberations actually benefit from being fed to arrays of speakers —> channels.

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While the use of audio objects provides desired control for discrete effects, other aspects of a movie soundtrack do work effectively in a channel-based environment.

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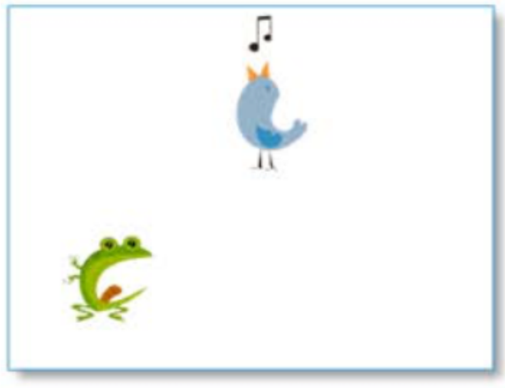
B. e.g. ambient effects or reverberations actually benefit from being fed to arrays of speakers —> channels.

Beds (Channels)



Objects

Dolby Atmos

Figure 2.2 Object and Bed Combination

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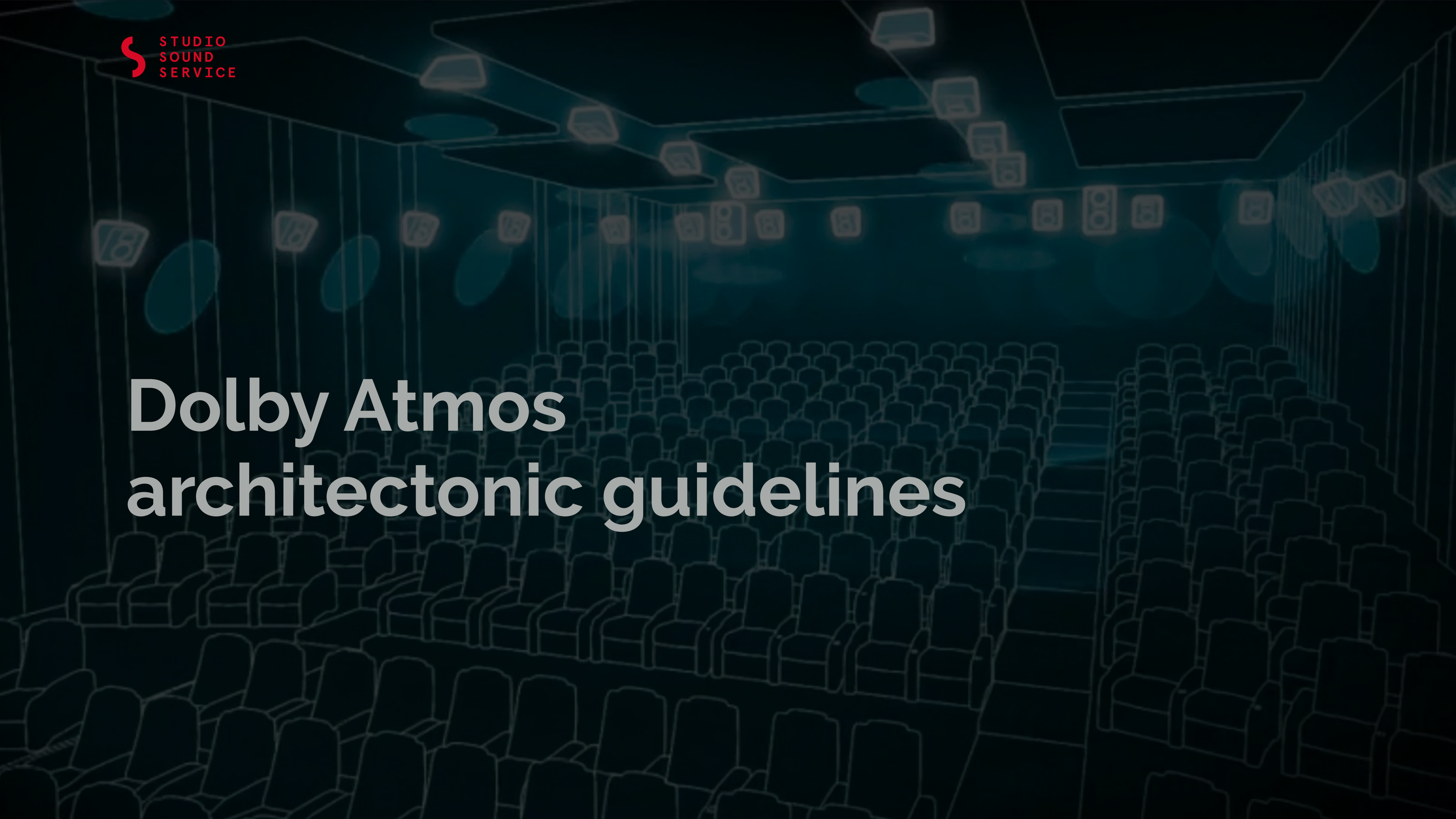
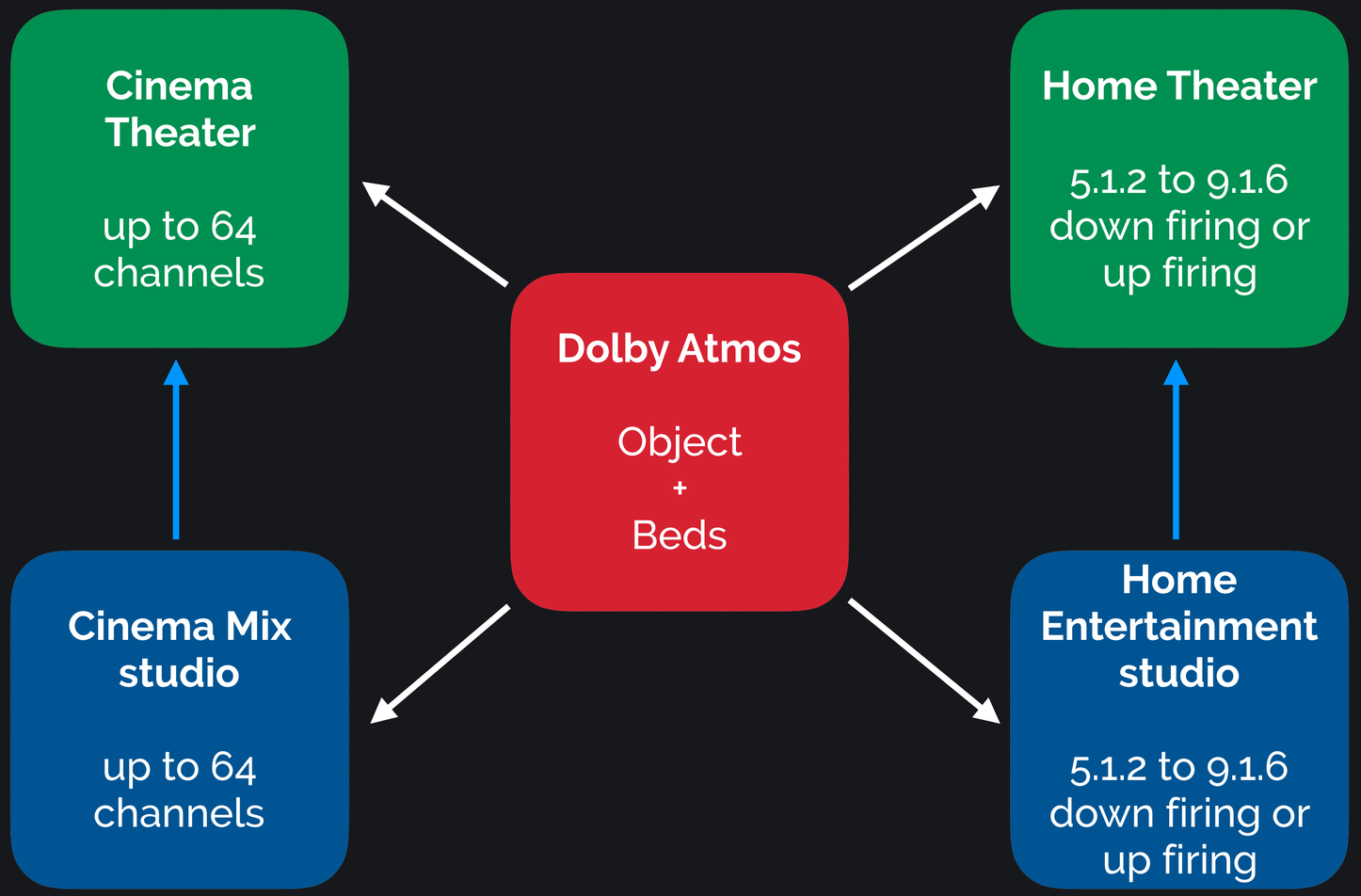


Dolby Atmos architectonic guidelines



A. Different speaker locations can differ in effectiveness depending on the theatre design.

B. Dolby Atmos is adaptable and able to playback accurately in a variety of auditoria *(highly flexible configurations).*

C. The speakers layout remains compatible with previous cinema systems.

D. In contrast to using all 64 output channels available, the Dolby Atmos format can be accurately rendered in the cinema to other speaker configurations such as 7.1, allowing the format to be used in existing theatres with no change to amplifiers or speakers.

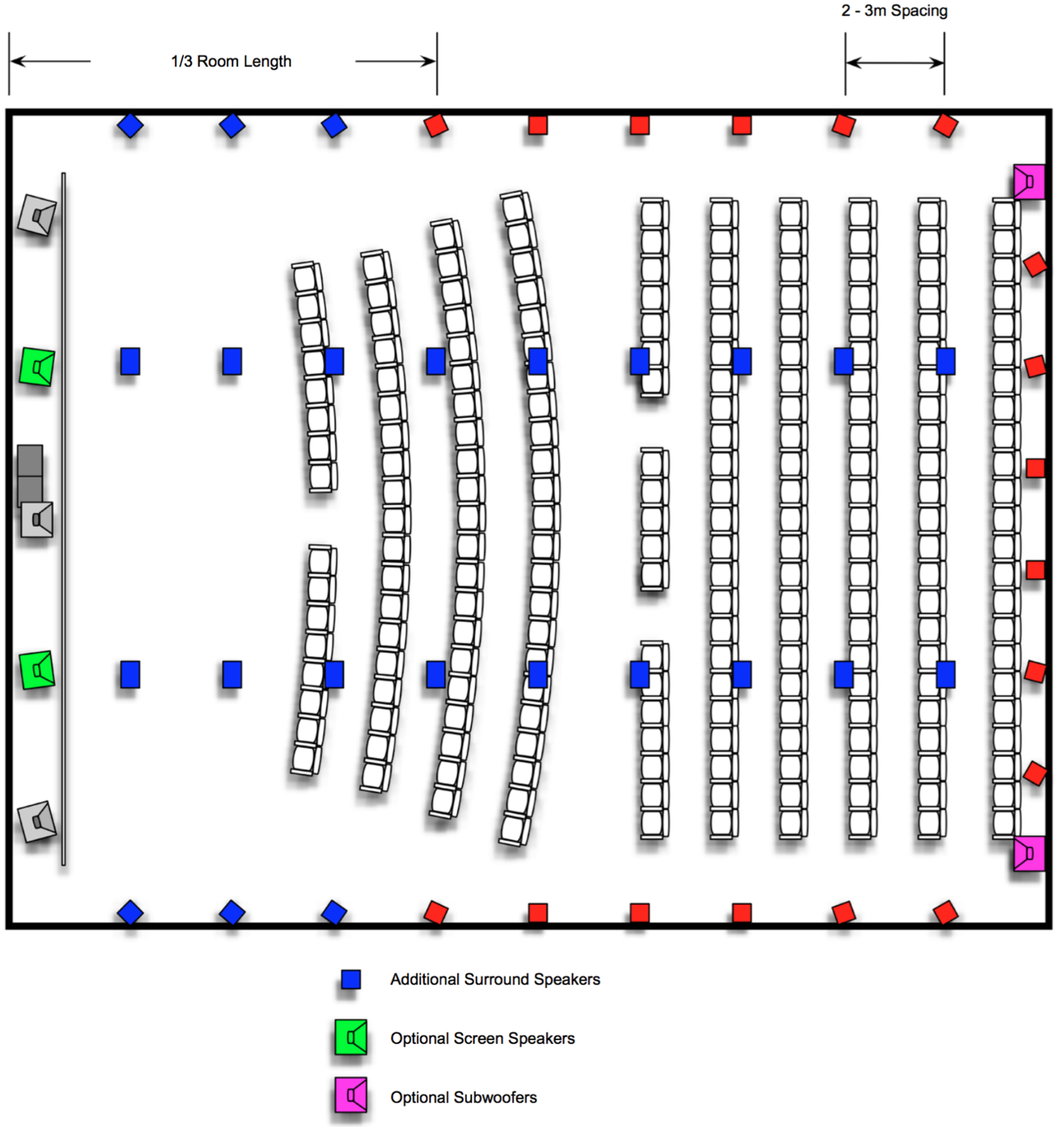


Figure 5.1 Recommended Speaker Locations

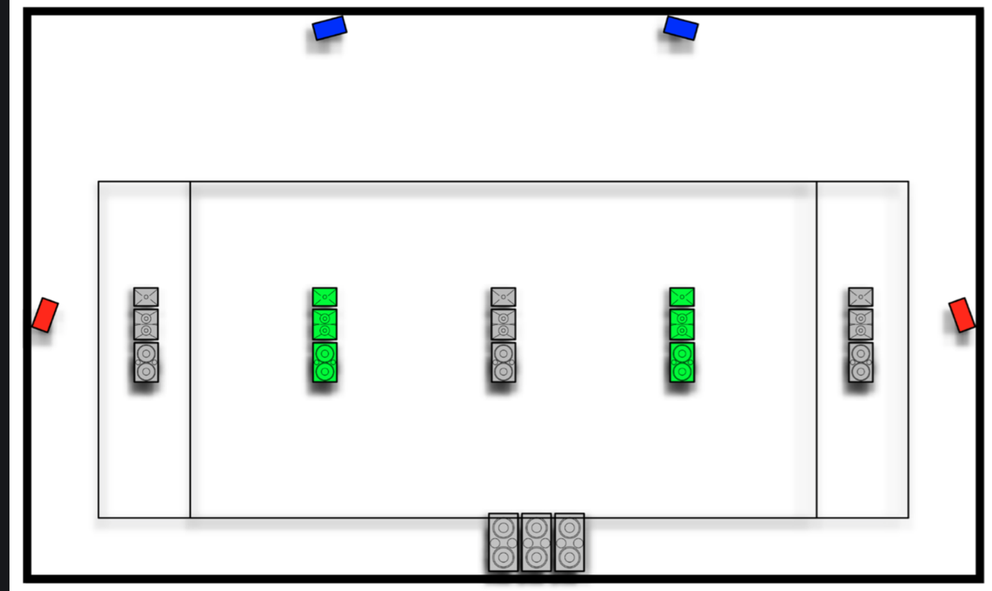


Figure 5.2 Recommended Speaker Locations (Screen, Side Surrounds, and Top Surrounds)

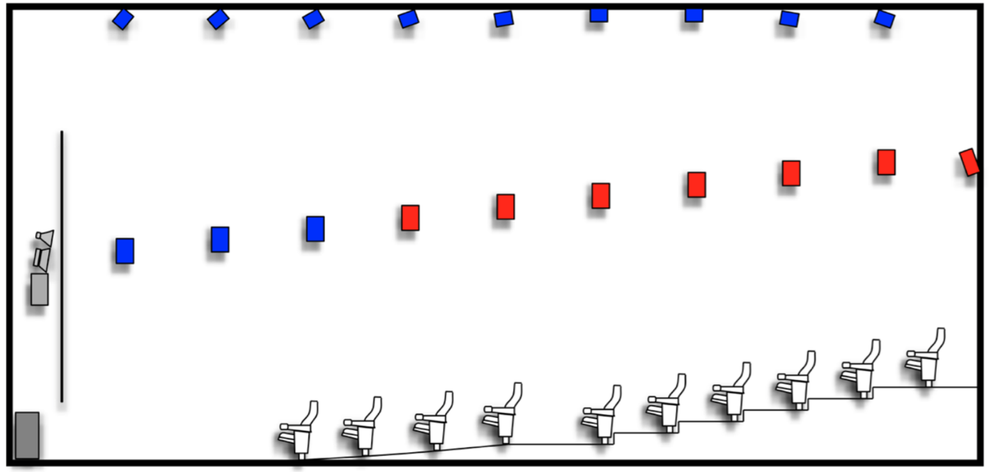


Figure 5.3 Recommended Side Wall and Ceiling Speaker Locations

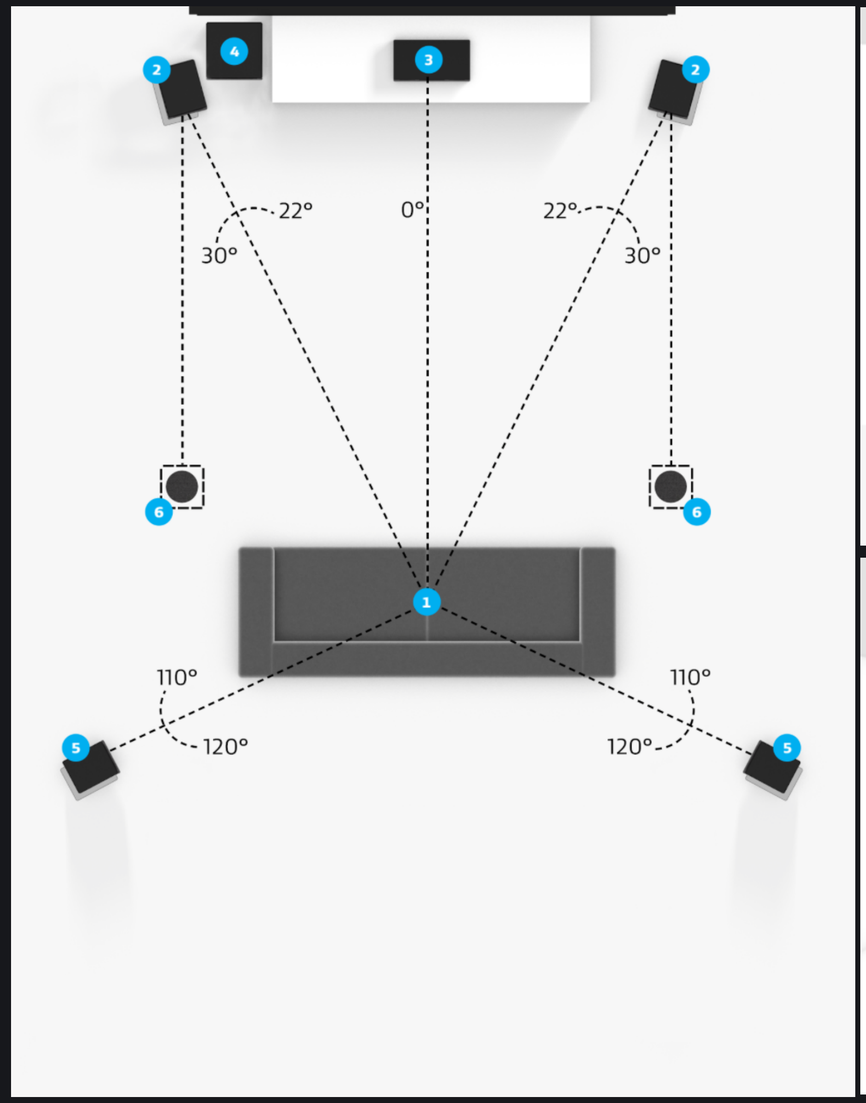
Dolby Atmos Layouts for Home Theater

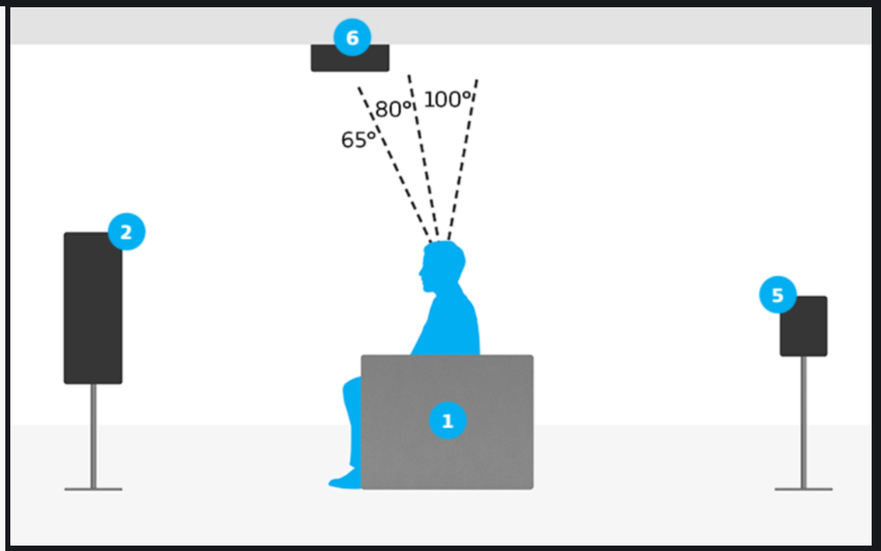
A. You can choose between different setup: 5.1 – 7.1 – 9.1.

B. You can choose between
   1. overhead speakers (down-firing);
   2. up-firing speakers;
   3. …and a combination of down-firing and up-firing.

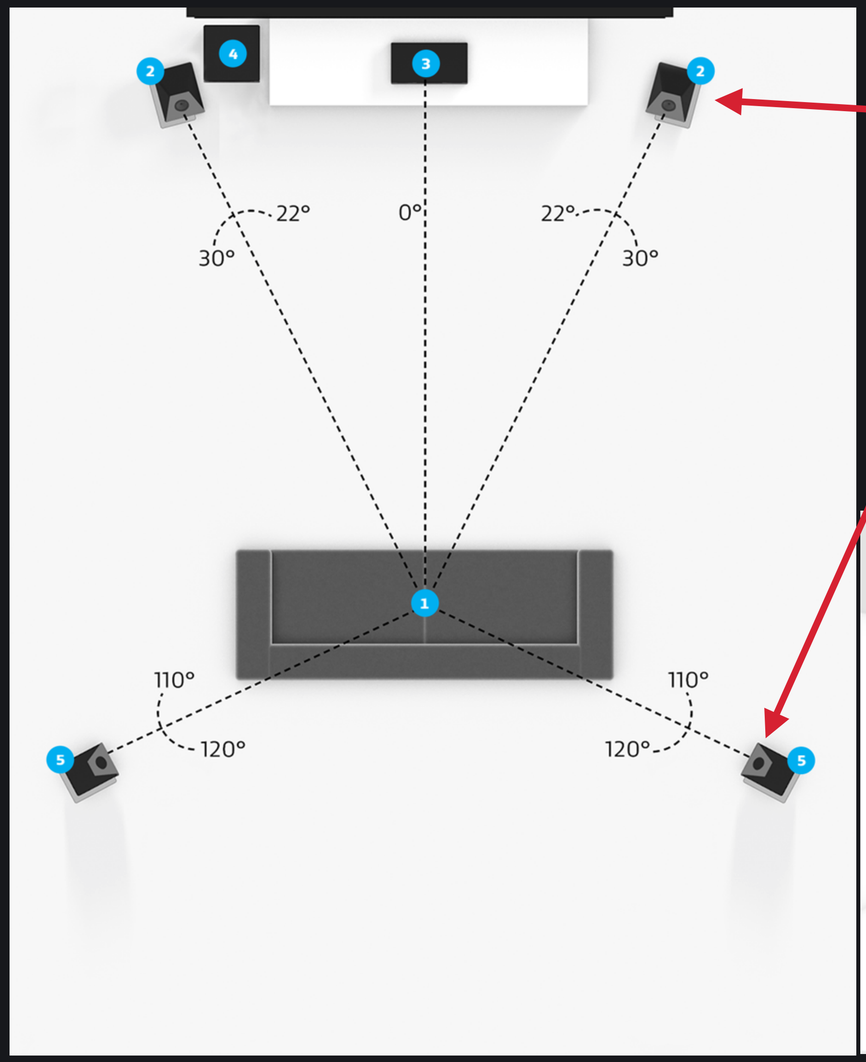
C. You can choose… a soundbar!

Home Theater 5.1.2 down-firing

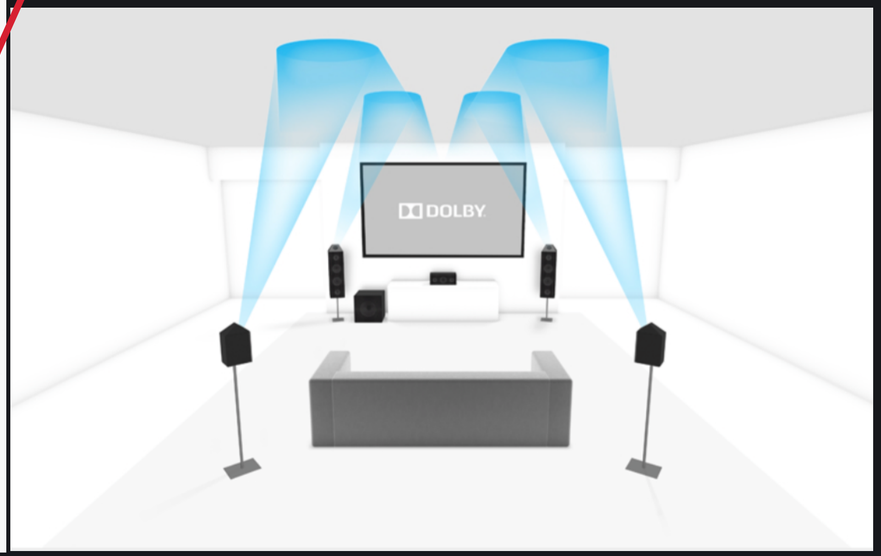




Home Theater 5.1.4 up-firing

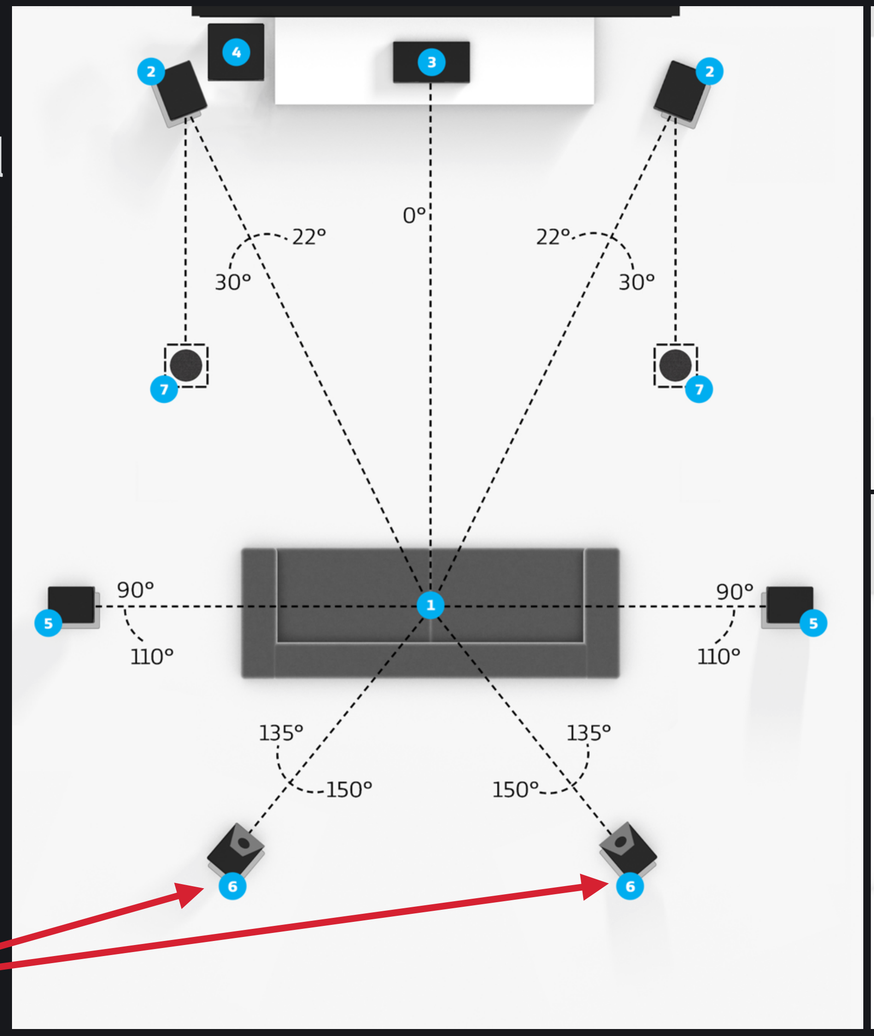


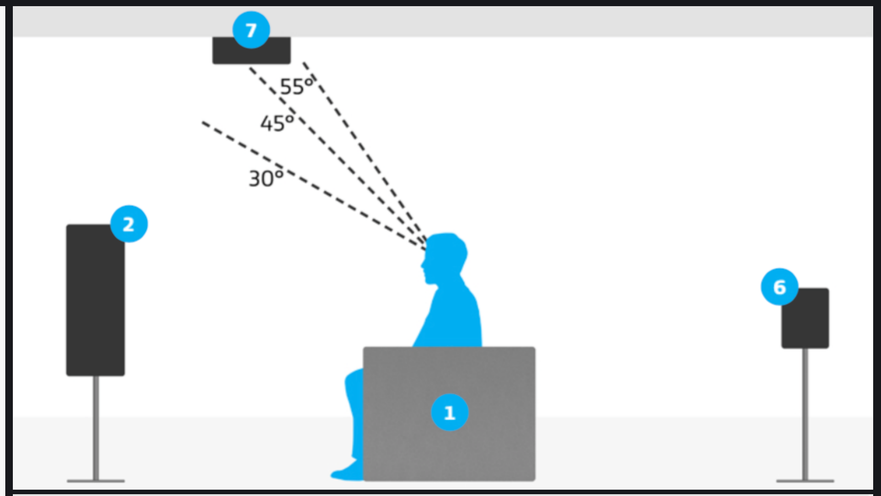
Atmos enabled surround speakers (up-firing)

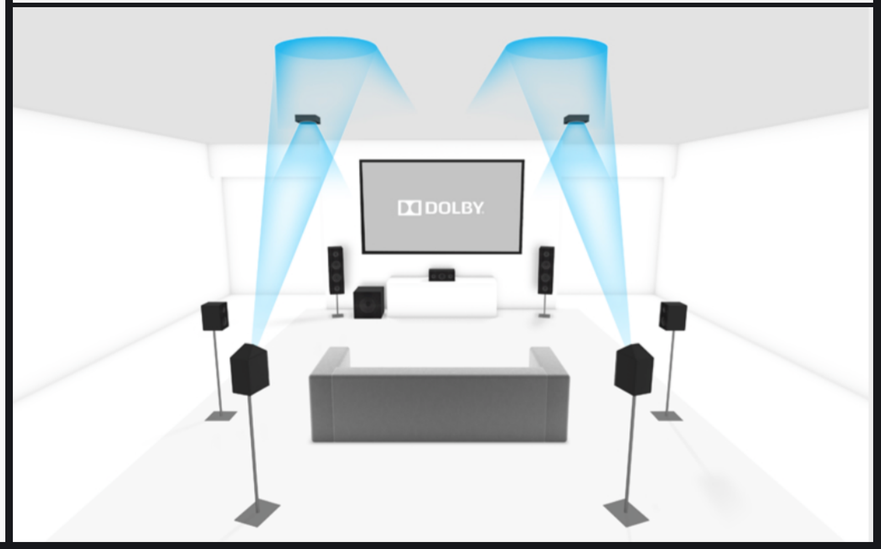


Home Theater
7.1.4
Hybrid overhead

front down-firing
back up-firing

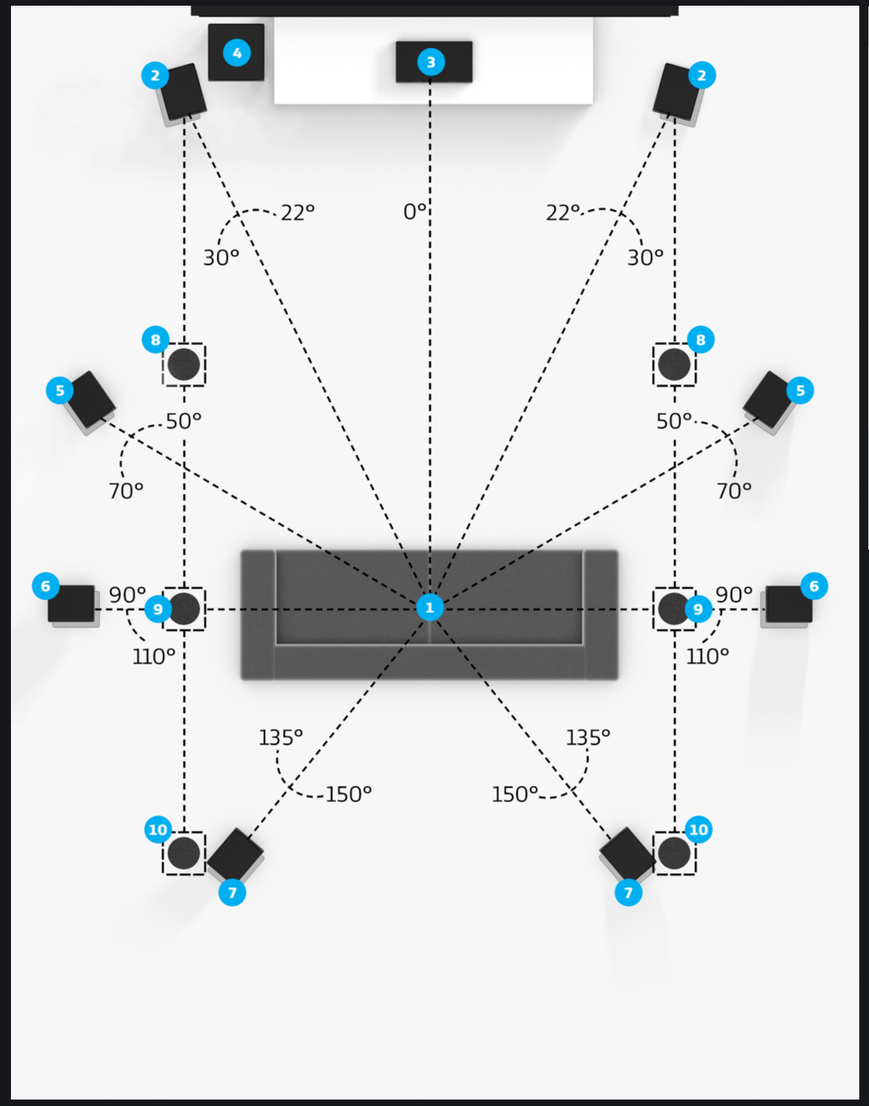


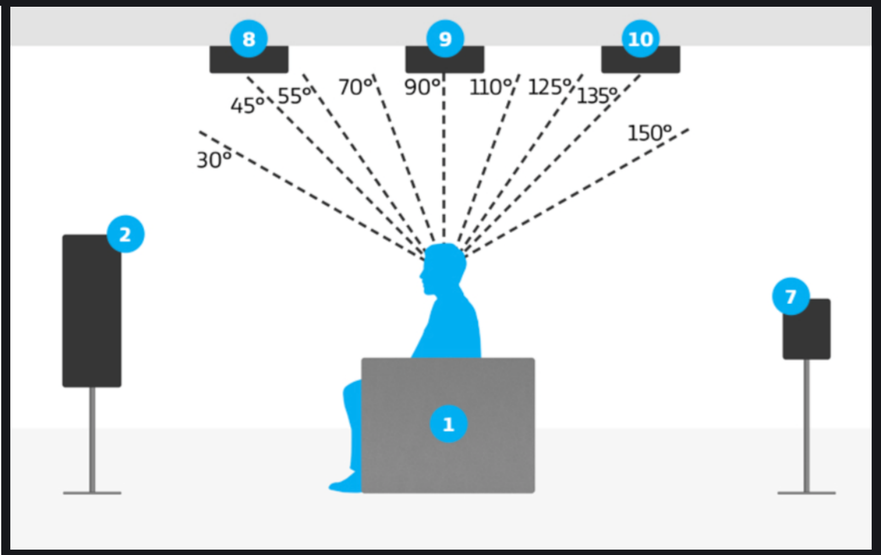




Atmos enabled
surround speakers
(up-firing)

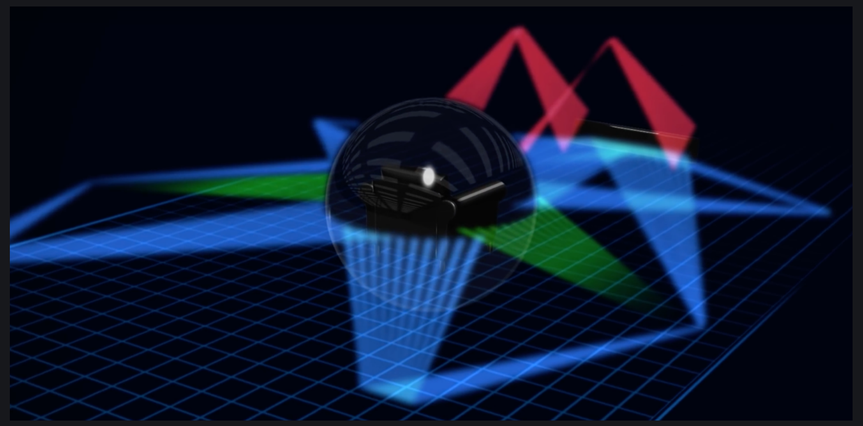
Home Theater 9.1.6 down-firing





Home Theater
Atmos Soundbar

Atmos enabled
surround speakers
arrays
(up-firing)



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Dolby Atmos Mixing Theatre Design

Dolby Atmos mixing theater Requirements

A. Room size > 40 m² (> 8x5m)

B. Height > 3.6 m

C. Adequate loudspeaker power handling

D. CMA (Critical Mix Area – mixing theater)
vs.
CLA (Central Listening Area – cinema)

Dolby Atmos mixing theater Requirements

A. Room size > 40 m² (> 8x5m)

B. Height > 3.6 m

C. Adequate loudspeaker power handling

D. CMA (Critical Mix Area – mixing theater) vs. CLA (Central Listening Area – cinema)

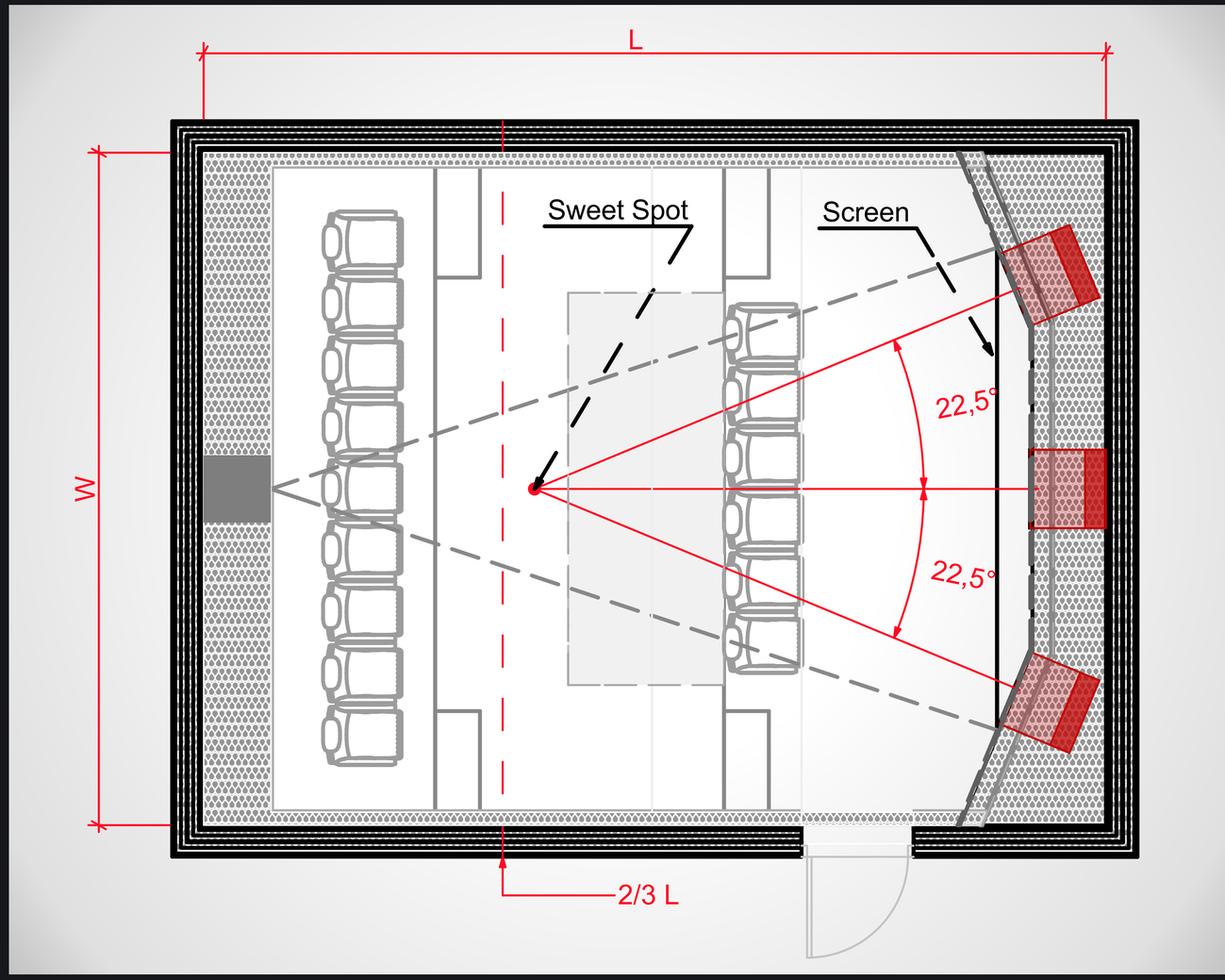
DARDT Excel file from Dolby with specs (Dolby Atmos Room Design Tool)

1. Listening point

- On the horizontal plan chose and fix the listening point – ideally at 2/3 of longest dimension – and where additional chairs are going to be placed: you should now be able to estimate how many step you'll need to place for the audience in order to reduce at minimum reciprocal disturbance.

2. Screen Dimensioning & Front Speaker elevation:

- Since front transducer's tweeters must be hidden behind the screen and that Left and Right channels in Dolby Atmos configuration should form a 45° angle together respect the listening point, the maximum screen width is implicitly fixed.

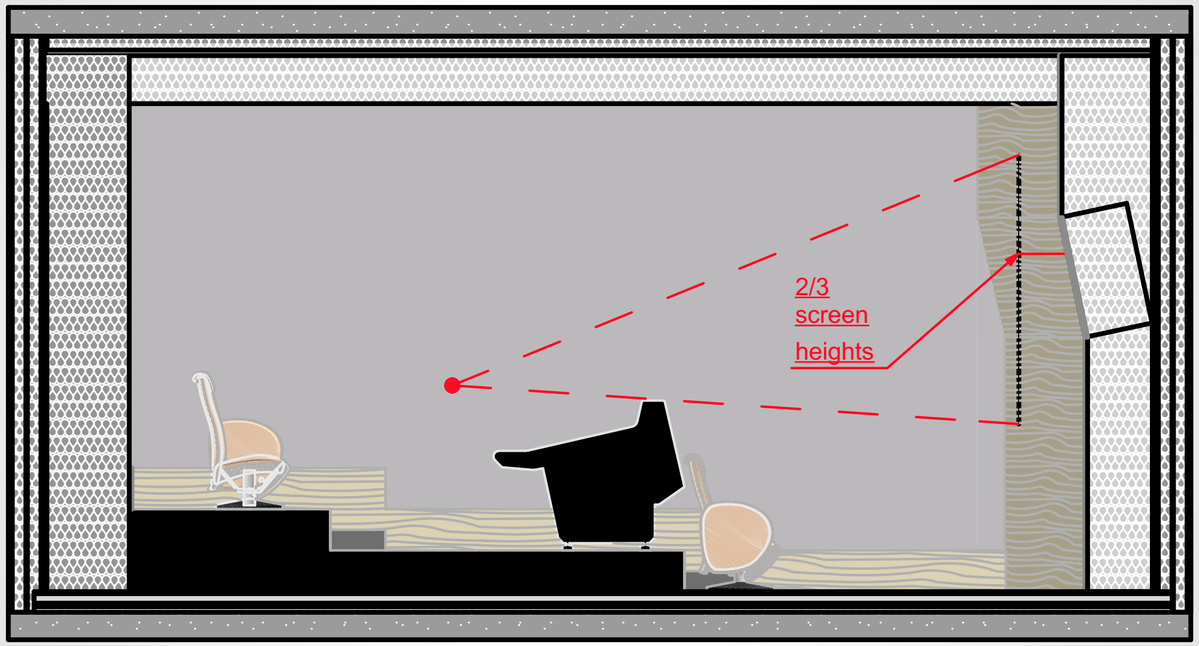


2. Screen Dimensioning & Front Speaker elevation:

- Screen height is then imposed by the image format, which commonly means diving above chosen screen width by 2,35 – approximately a 16:9.

- Considering listener step and desk height, place then the screen at the minimum height so that that the whole screen is clear from the sweet spot height.

- Elevate front wall/behind the screen monitor acoustic axis at 2/3 of screen height.

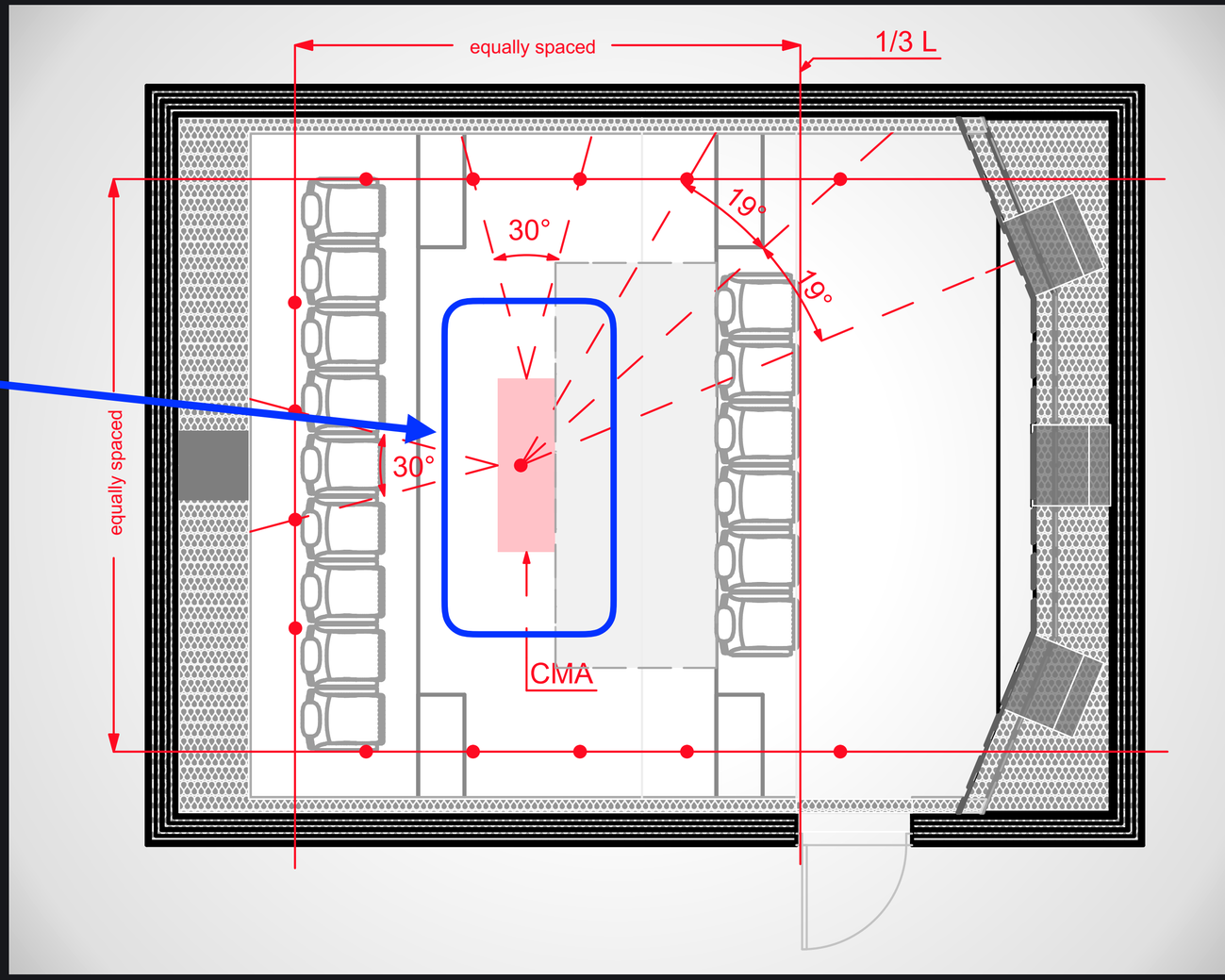


3. Critical Mixing Area:

- Define an rectangular area surrounding the sweet spot where sound quality must be kept optimal:

  Theatrical Studio:
  CMA Area = (W - 2)/2 * 1 [m]

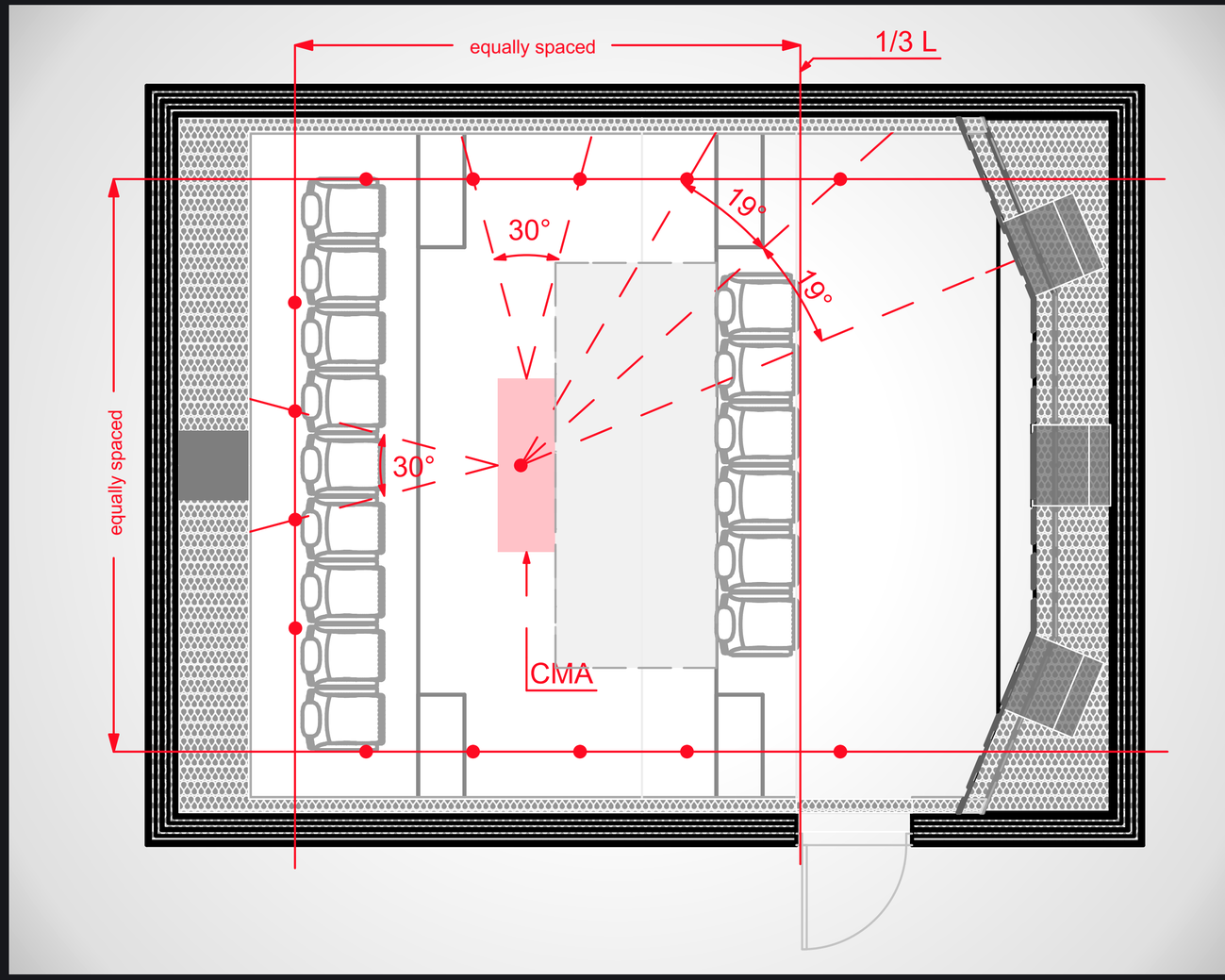
  Smaller studio (broadcast, HE)
  CMA Area = (W – 3)/2 * 0.5 [m]



4. Side/Rear monitor horizontal plan placing

- On the horizontal plan define three straight line where the acoustic axis of side and rear monitors will be placed.
  Mind the fact that since those must be tilted (max 30°) is best to keep some distance from relative closest wall!

- Then, determine mutual distances for the rear and side monitor by drawing two lines 30° separate apart from the center of the of CMA sides: rear monitors are all equally spaced, while side ones could actually be equally spaced from the back till 1/3 of room length and then progressively more spreaded apart.

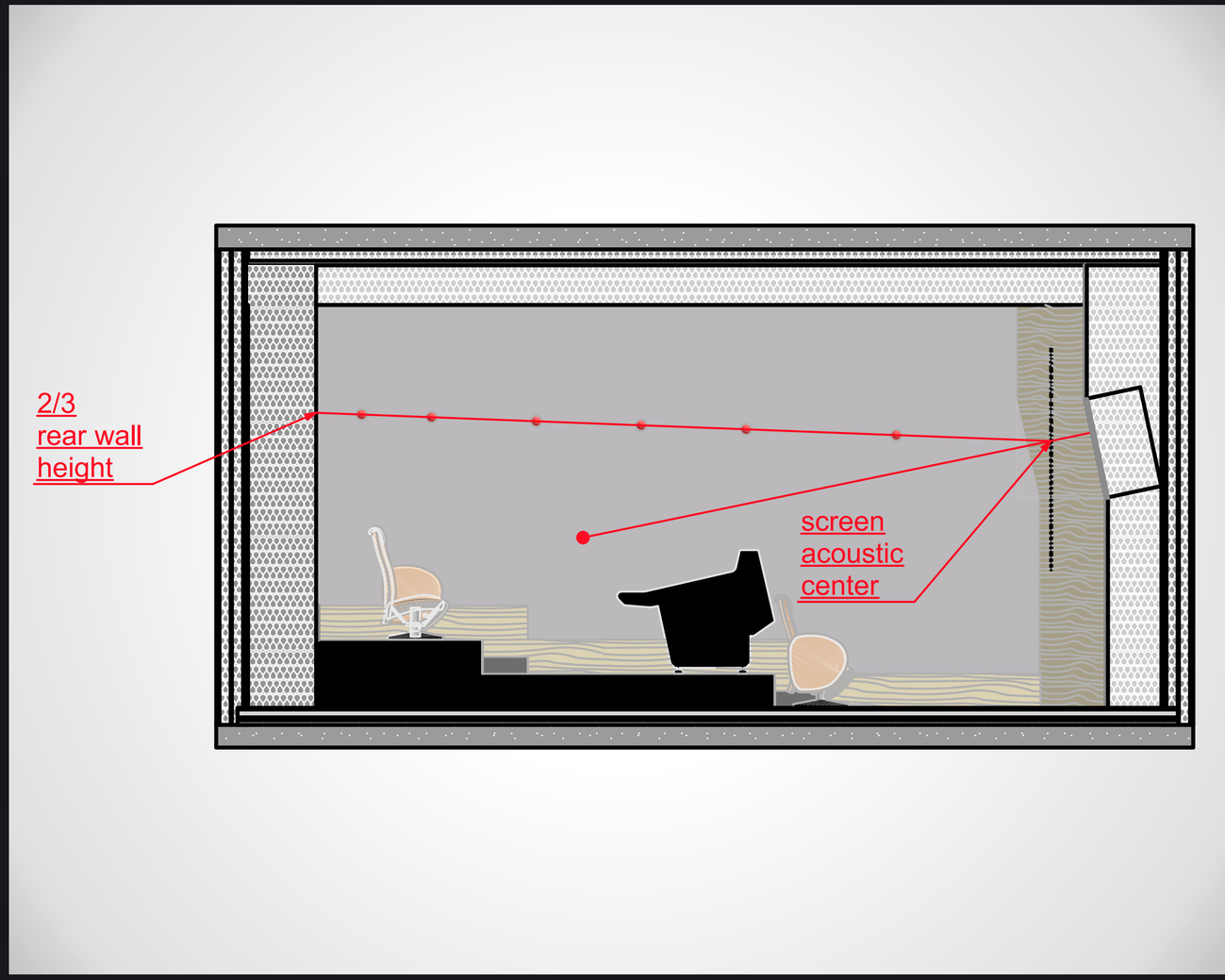


5. Side/Rear monitor elevation and aiming

Considering a vertical and symmetrical section of the room:

- the acoustic center of the screen is determined by the intersection between the screen itself and the line joining front monitors acoustic axis and the sweet spot;

- all side and rear monitors will then be elevated at heights lying on the line joining screen acoustic center to the 2/3 back wall heights.



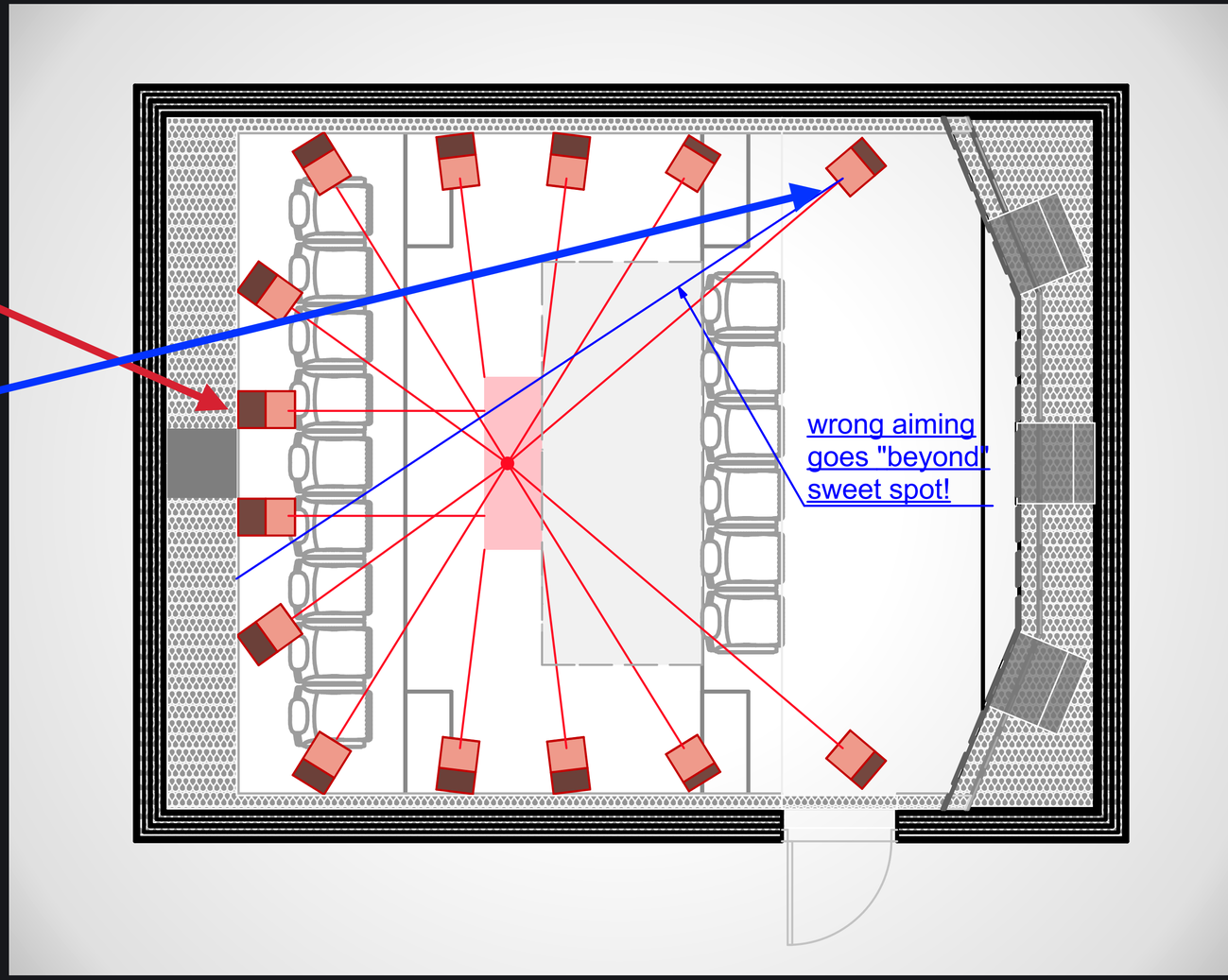
5. Side/Rear monitor elevation and aiming

Aim horizontally side and rear monitors as follows:

- monitor particularly close to the CMA are simply aimed perpendicularly to CMA sides;

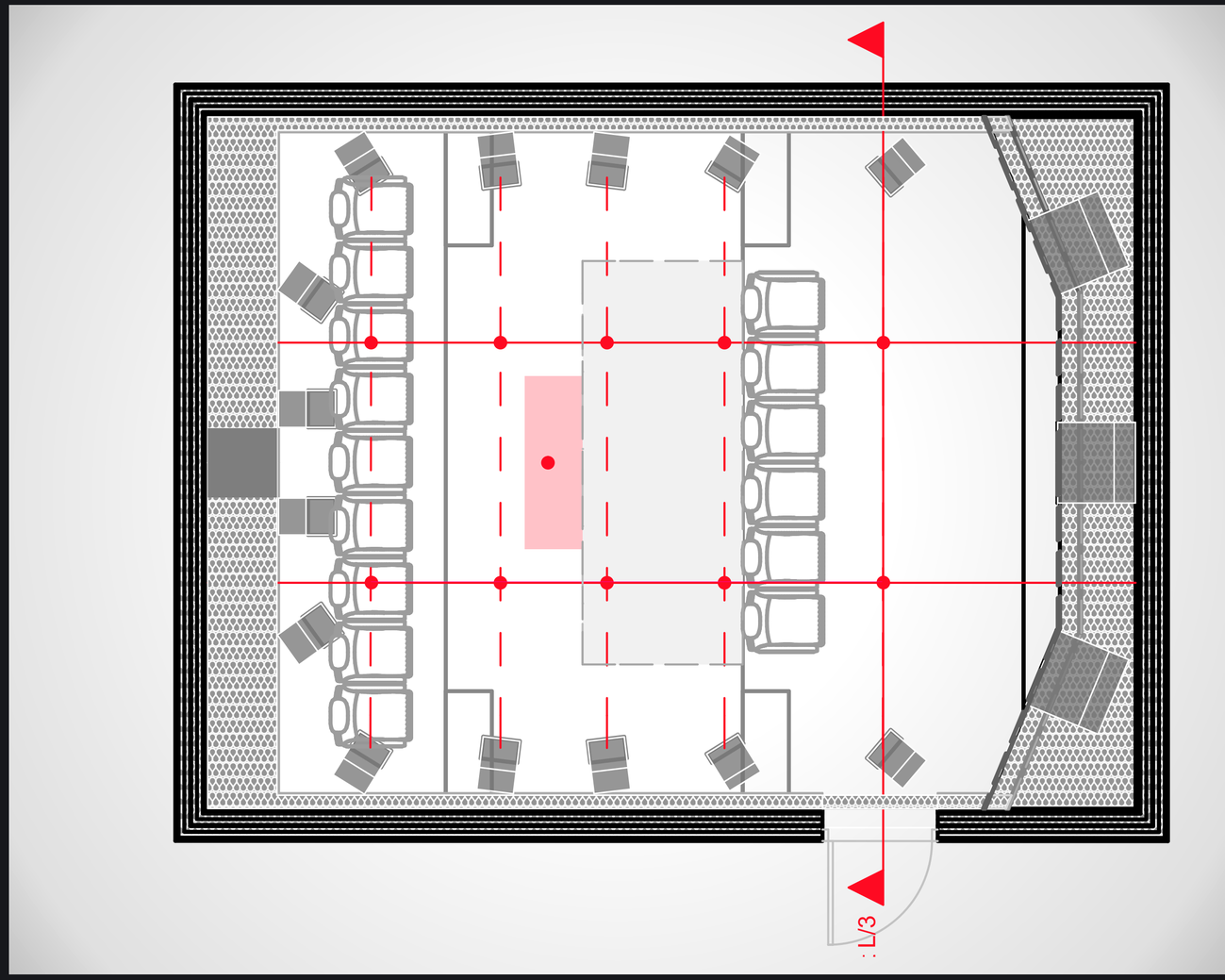
- aim the other monitors to the CMA vertex, checking that their aiming projection line doesn't fall "beyond" the sweet spot: if that happen aim the relative monitor to the sweet spot itself.

Lastly, aim vertically each side/rear monitor to the sweet spot by looking at vertical section passing through the sweet spot itself and the acoustic center of the monitor considered



6. Ceiling monitors placing and aiming

- On the horizontal plan, draw at least two straight line parallel to room longest dimension and bounded in between the two most spreaded apart front monitor: the ceiling speaker will be then placed on those lines at longitudinal distances corresponding to the side monitors horizontal positions.

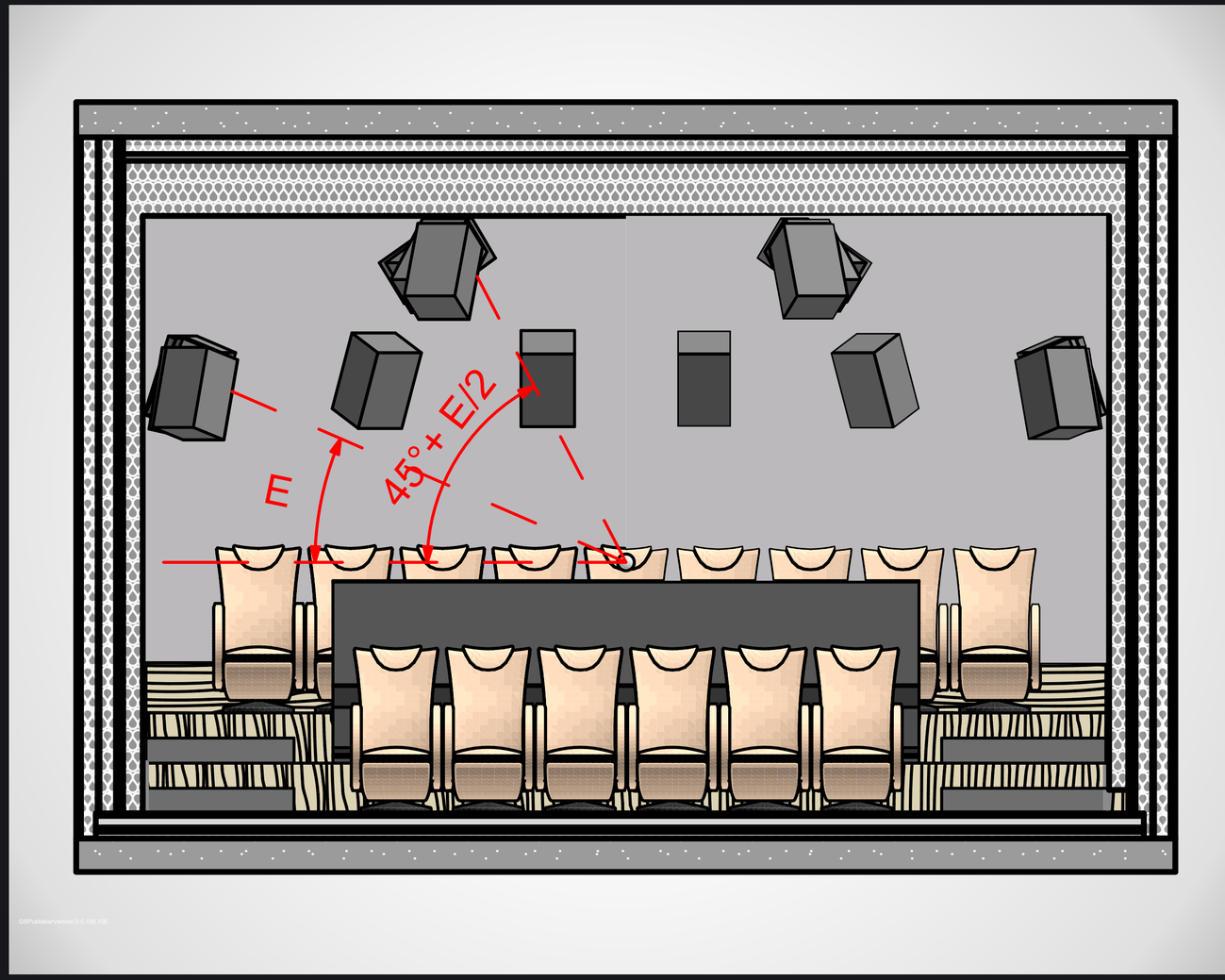


6. Ceiling monitors placing and aiming

- Ceiling monitor elevation is unique and determined by looking at a vertical section view, parallel and oriented to the rear wall and comprehensive of the monitor closer to 1/3 room length.

- Monitors height is then obtained by the intersection of previously defined longitudinal reference lines and the line forming an angle, where E is the angle formed in section view by joining the sweet spot to the side monitor acoustic axis closer to 1/3 of room length.

Note that in case resulting elevation is too high the most straightforward solution is to move closer to the room center the ceiling monitor horizontal reference lines – but still checking that ceiling tilting angles are adequate!



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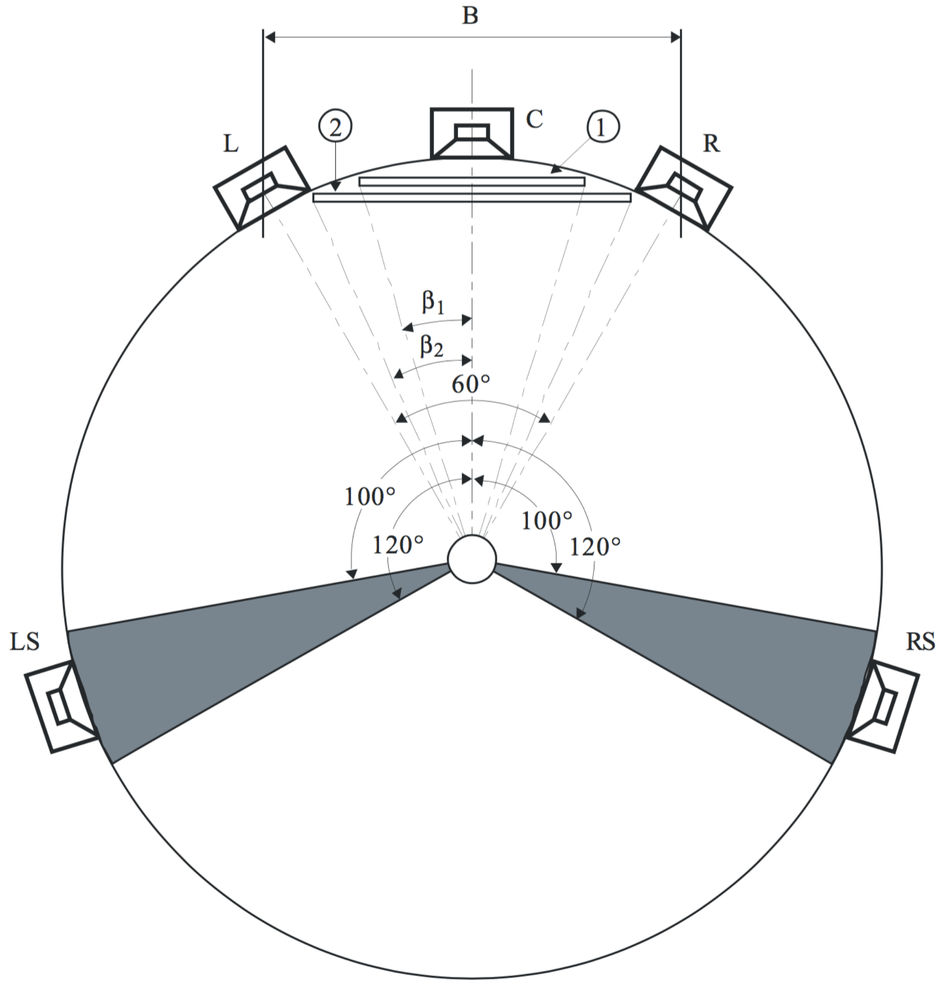
Multichannel Audio Standards

Multichannel Audio Standards

A. ITU-R BS 775-3 “Multichannel stereophonic sound system with and without accompanying picture” (Geneva, 2012)
B. ITU-R BS 1116-1 “Methods for the subjective assessment of small impairments in audio systems including multichannel sound systems” (Geneva, 1994-97).
C. ITU-R BS.2159-7 “Multichannel sound technology in home and broadcasting applications”
D. AESTD1001.1.01-10 “Multichannel surround sound systems and operations”
E. SMPTE RP-173, “Loudspeaker placements for audio monitoring in high definition electronic production,” Rec., SMPTE N 15.04/152-300B, Society of Motion Picture and Television Engineers (1991).
F. EBU Tech 3276-E “Listening conditions for the assessment of sound programme material”(2004).
G. SMPTE ST 202:2010 - SMPTE Standard - Motion-Pictures — Dubbing Theaters, Review Rooms and Indoor Theaters — B-Chain Electroacoustic Response

5.1 – ITU-R BS 775-3

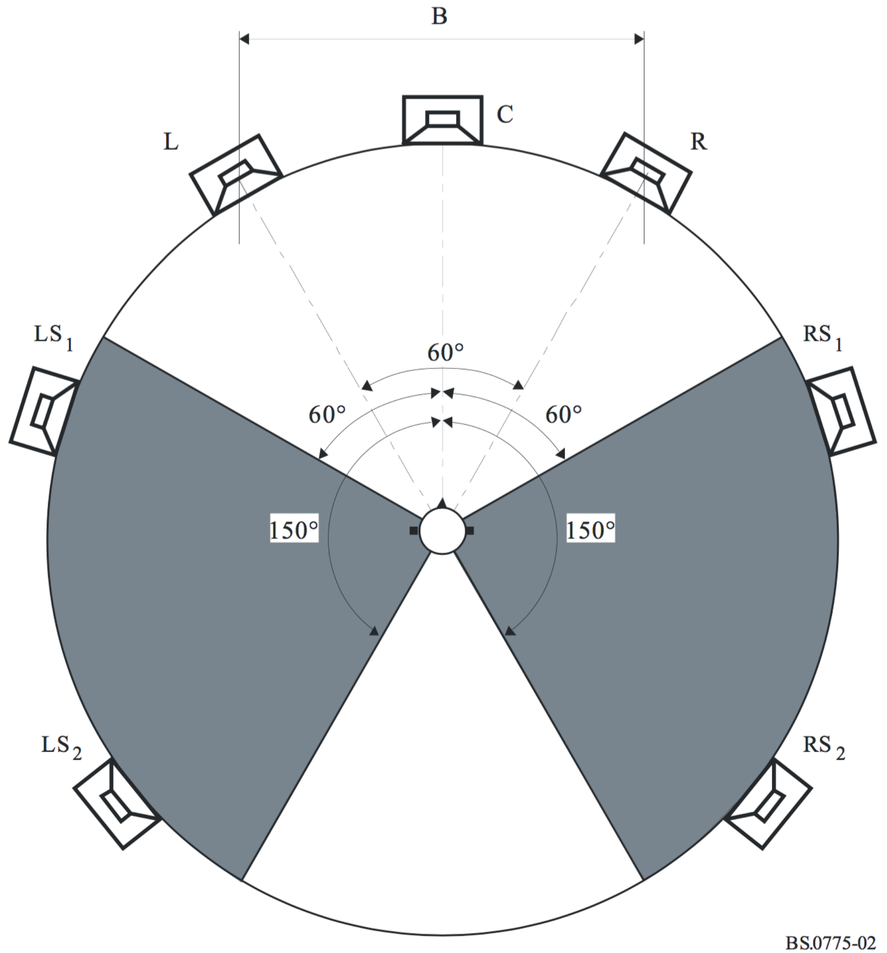
Reference loudspeaker arrangement with loudspeakers L/C/R and LS/RS



7.1 – ITU-R BS 775-3

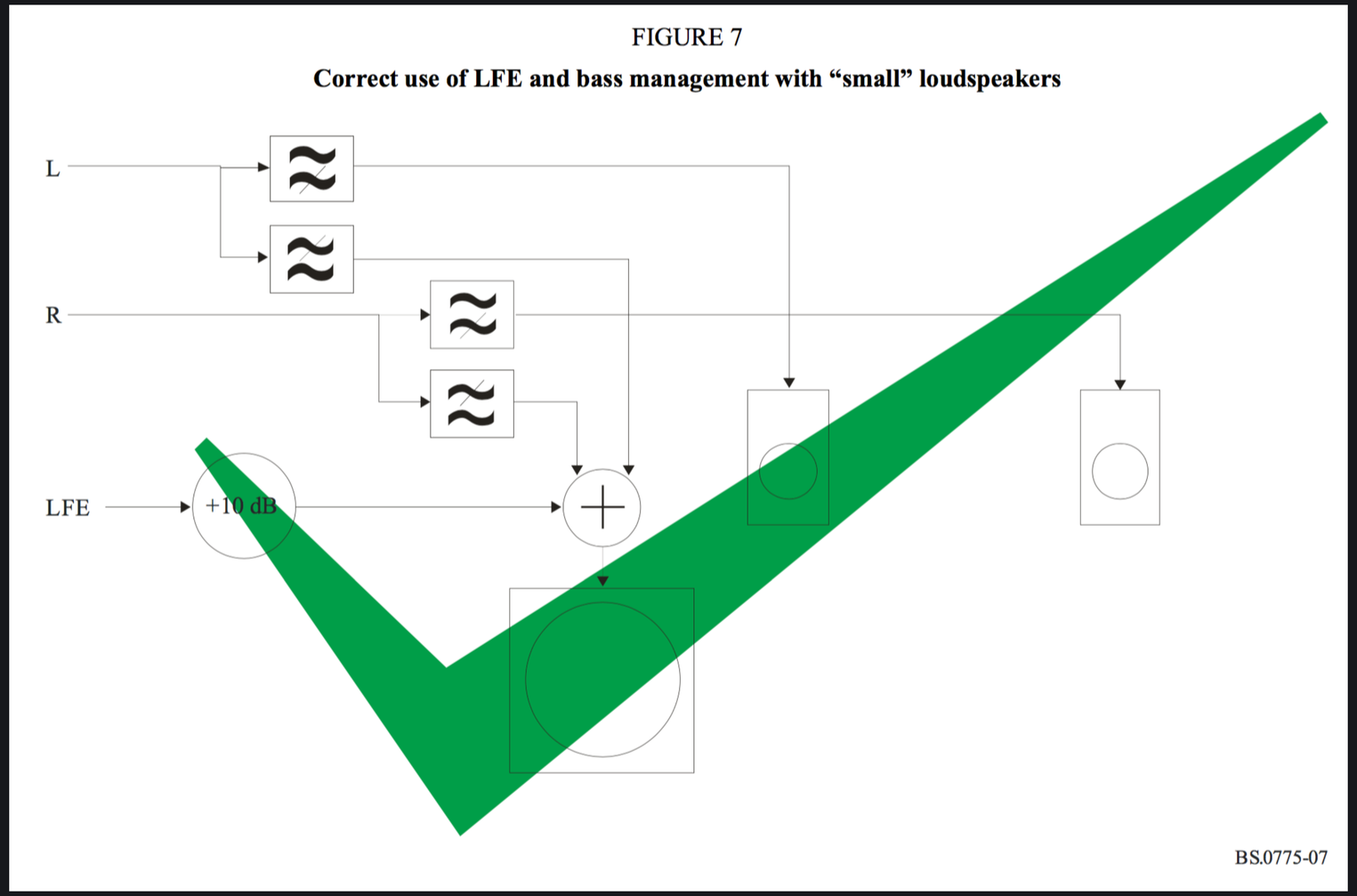
FIGURE 2

Optional 3/4 loudspeaker arrangement (3 front and 4 surround)



ITU-R BS 775-3

Subwoofer:
LFE
+
Bass Management



AESTD1001.1.01-10

Reverberation time

$T_m \approx 0.25\,(V/100)^{1/3}$ [s]

so for 100 m^3 room is 0.25 s

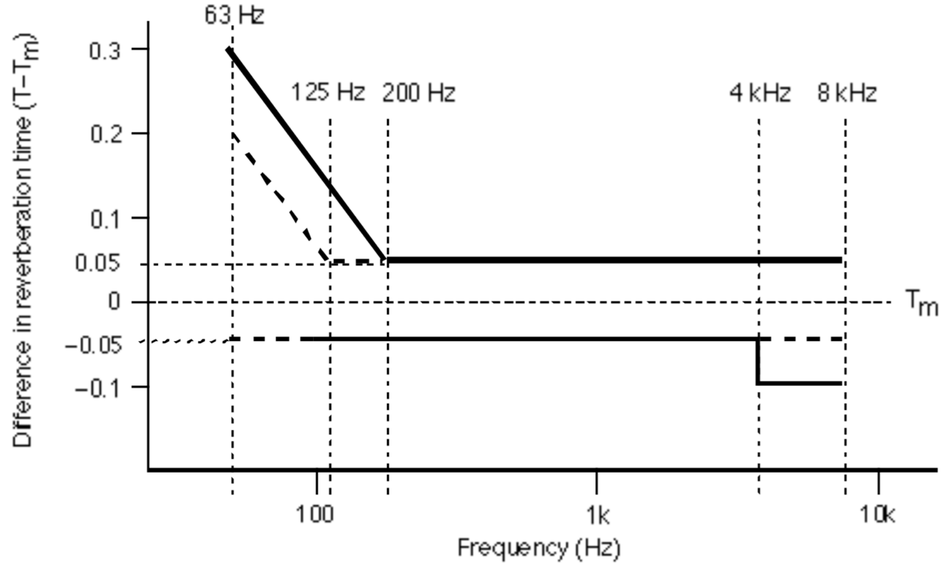


Figure 3. Tolerance mask for reverberation time, relative to arithmetic average value T_m. (Based on international recommendations, but extended to lower frequencies, with smaller tolerances in the range of 63–125/200 Hz.)

AESTD1001.1.01-10

Frequency response mask

±3 dB

possible slope for HF

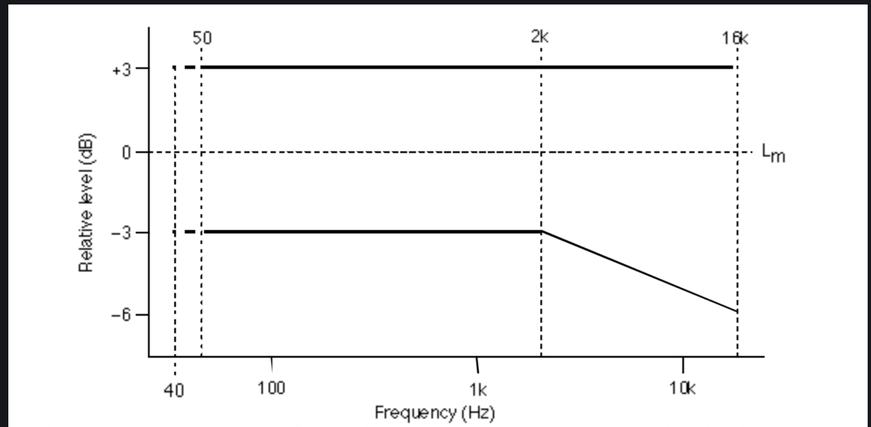


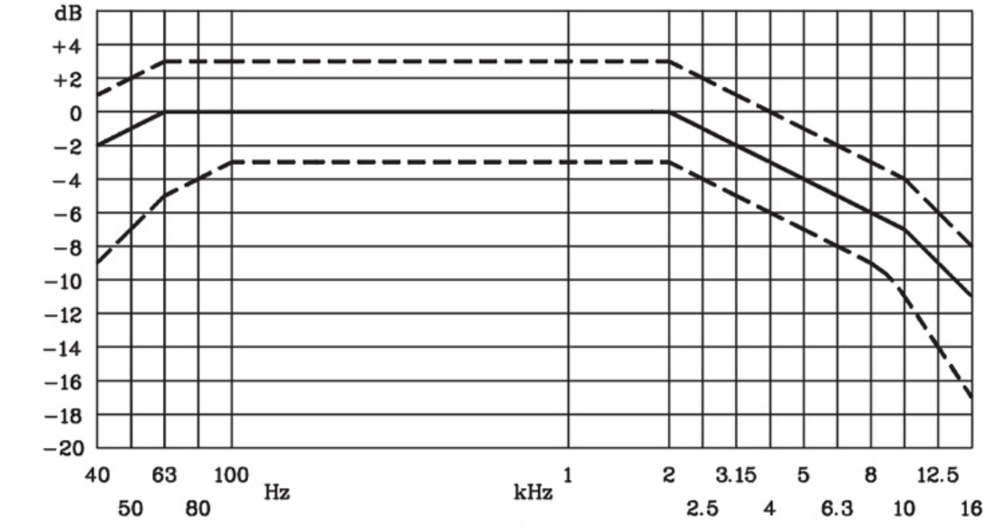
Figure 4. Tolerance limits of operational room response curve, relative level. (Based on international recommendations but extended to lower frequencies.)

SMPTE X Curve

1. The X-curve is not an equalization/target curve. Rather, it is a response that shows up if you measure a loudspeaker with flat response, in a large room with a real-time analyzer and pink noise as specified in the standard. And that such a measurement will tend to show a decline in frequency response starting around 2 kHz at a rate of 3 dB per octave.

2. Since the X-curve is a measurement error, it is not a “target curve” in the sense of trying to modify the sound. That is, the goal is to get at flat response and compensate for the measurement error.

3. The reason behind the measurement error is the inclusion of the reverberations in the room. That is, when the direct (“on-axis”) sound of a flat response speaker is combined with reflections/ reverberations in the room, the high frequencies when measured continuously using Real-Time Analyzer (RTA) and pink noise. There is also an effect stated to be there in low frequencies.



NOTE – Tolerances are based upon 1/3-octave measurements. If 1/1-octave measurements are used, reduce the tolerance by 1 dB.

Figure 18 - SMPTE 202M – 1998 – X-Curve extended to 16 kHz with second break point at 10 kHz

How do standards evolve?

has the public become more critical with the evolution of increasingly complex multi-channel systems?

A. Joining scientific aspects and consumer expectation might result tricky:
still, it is important to consider both!!!
—> the standard as a design prerequisite and a consumption model

B. standards have been consolidated with respect to technology innovation and the gradual change in public audience expectations and competence

C. first implementations of such reproduction standards referred to Cinema application, while nowadays surrogate configurations and pro-ish equipments could actually reach private houses at relatively cheap prices – such perspective is becoming more and more popular, implying that dedicated standards, studios and contents are increasingly required.

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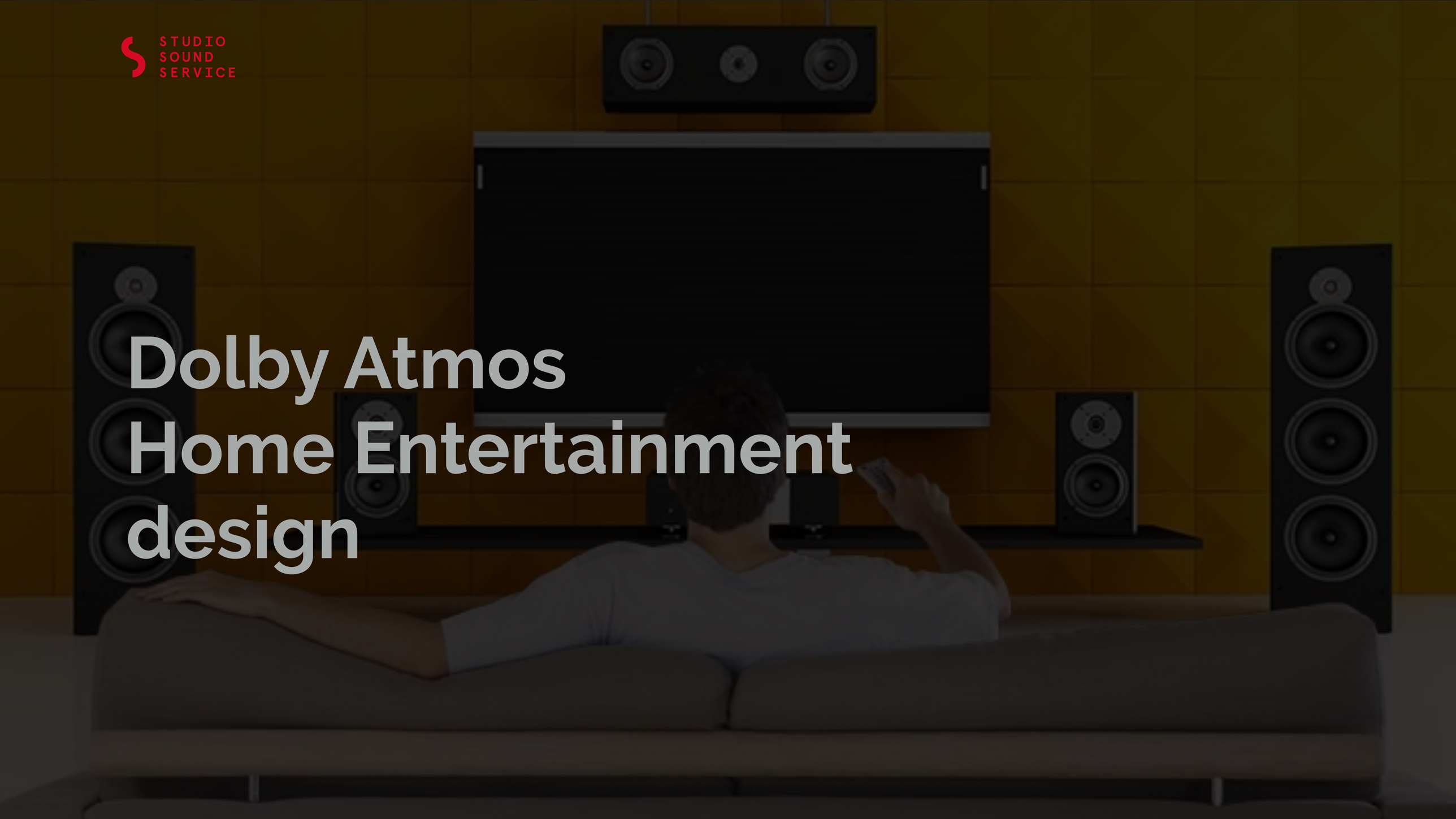
SOUND
SERVICE



Dolby Atmos Home Entertainment design

Dolby Atmos Home Entertainment Requirements

A. Room Volume > 28 m^3
(> 3.6x3.3x2.4 m)
Room > 58 m^3 may be more practical!!!

B. Acoustic treatment like a control room.

C. If you use up-firing speakers, ceiling must be reflective.

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(> 3.6x3.3x2.4 m)
Room > 58 m^3 may be more practical!!!

B. Acoustic treatment like a control room.

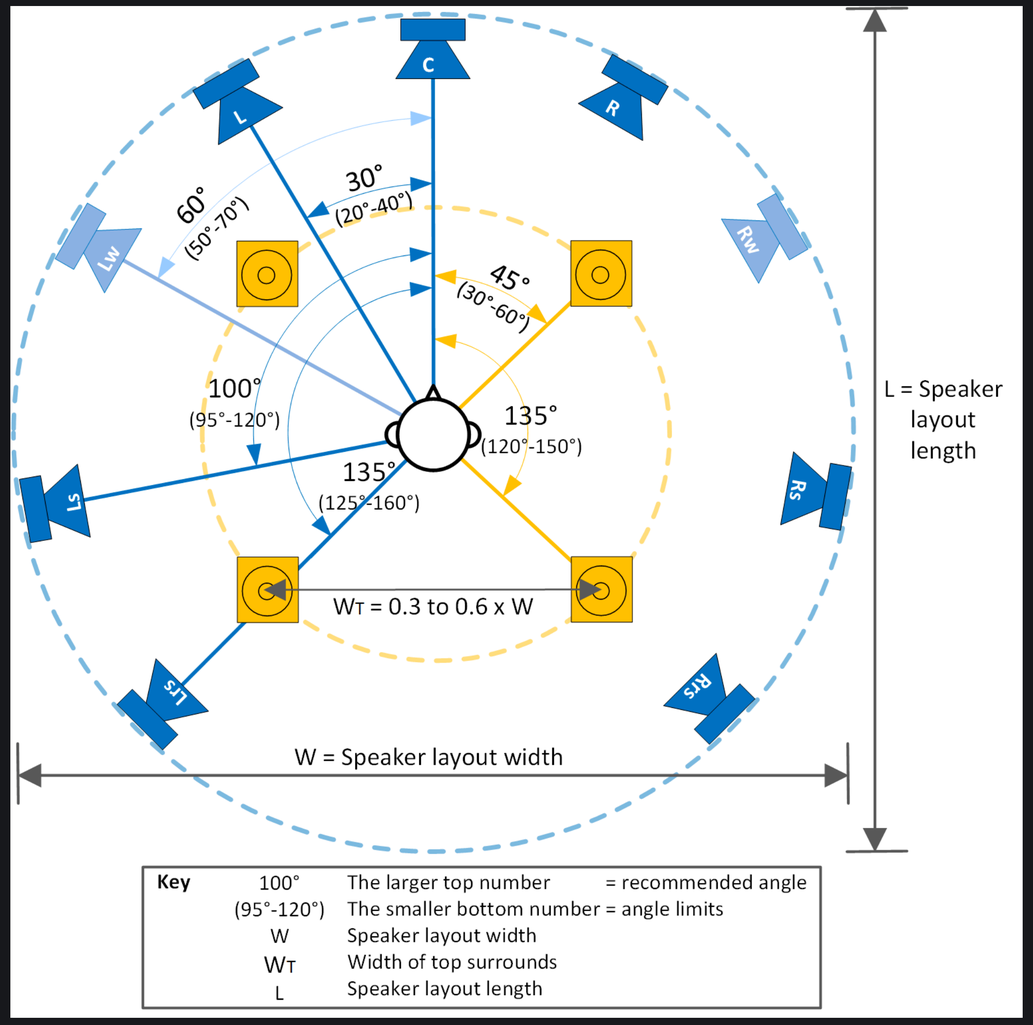
C. If you use up-firing speakers, ceiling must be reflective.

DARDT Excel file from Dolby with specs
(Dolby Atmos Room Design Tool)

Dolby Atmos Home Entertainment Arrangement of Speakers

A. Basing on **ITU-R 775-3**:
- LCR 30+30˚
- Ls 100˚ (95÷120)˚
- Lrs 135˚ (125-160)

B. Speakers equidistant from the listening position, but this is not always possible.
—> delay and level calibration



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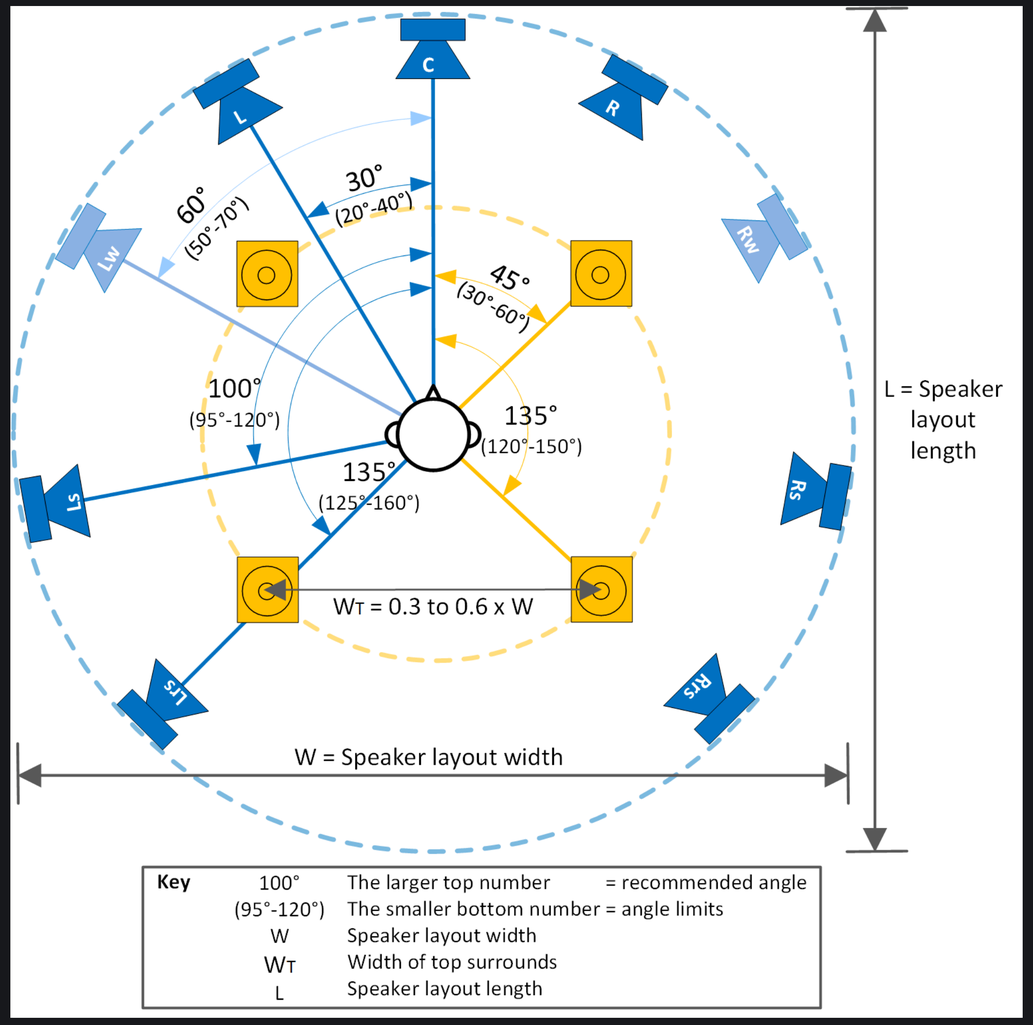
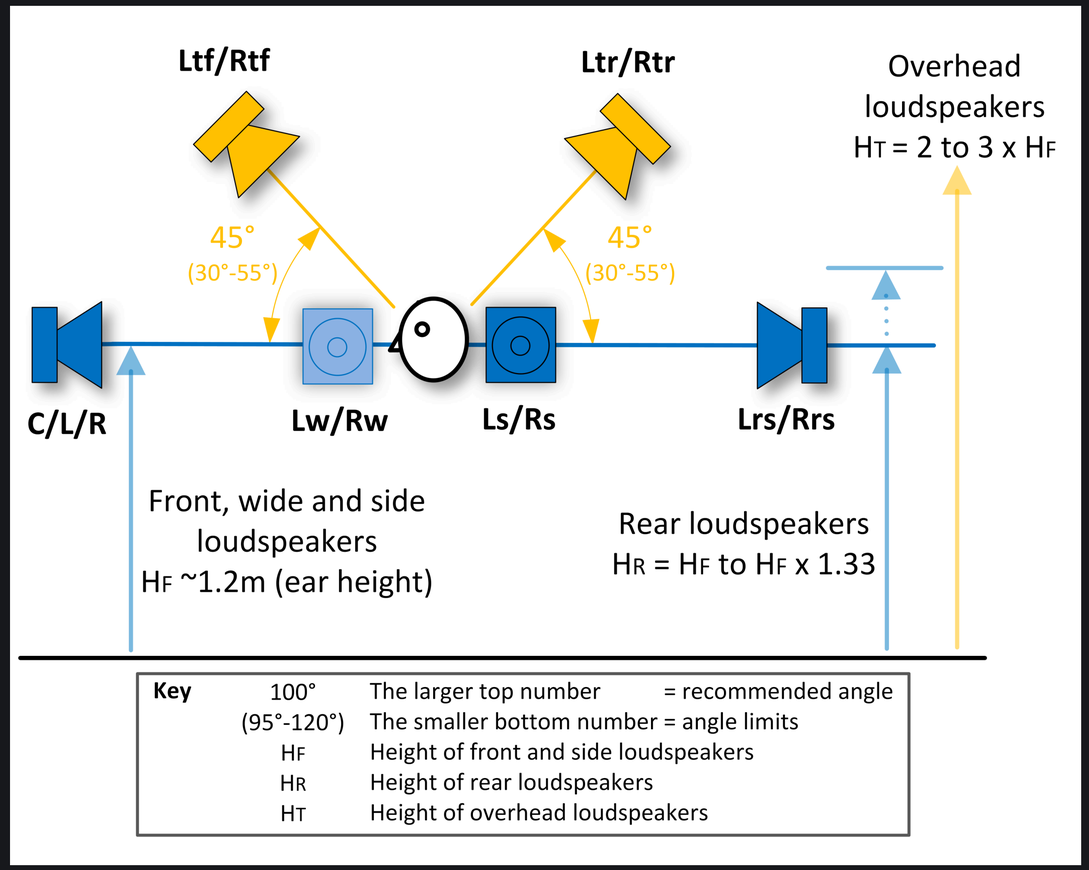


→ ITU standards are closer to the consumer experience so Dolby uses them for HE arrangement

Dolby Atmos Home Entertainment Arrangement of Speakers

A. Speakers height (**ITU-R BS 1116-1**):
- LCR + Ls/Rs —> (H_F) at ear-level (120 cm), *if possible*
- Lrs, Rrs —> (H_R) at (H_F ÷ H_Fx1.33) so (120÷160 cm)

B. Ceiling speakers:
- the overhead side-to-side separation should be 0.3 to 0.6 of the width W of the overall layout.
- the height H_T must be 2 ÷ 3 times the floor speaker height H_F (*i.e. 240-360cm*).
- the angle towards the listening point must be 45° (*adjusted 30÷55*)°.



Dolby Atmos Home Entertainment Calibration

A. Calibration from 79 to 82 dB (C) with a pink noise RMS at -20 dBFS
for Game: 75 dB

B. each speaker must be calibrated to 79 dB(C) and each speaker must be able to play 99 dB(C) at the listening point with a 102 dB(C) option for rooms that need more headroom.

C. LFE +10 dB *ITU-R BR-1384*

D. Calibration and Target Curve:
- **room bigger than 125 m³**
  SMPTE 202: 2010 X-Curve ± *3 dB (100÷16k) Hz*
- **room smaller than 125 m³**
  the X-Curve slope 2kHz may be reduced or the knee-point may be moved up to 4 kHz, 8 kHz or even higher in some cases

STUDIO
SOUND
SERVICE

Case studies

STUDIO SOUND SERVICE

Donato Masci
Case studies

Dolby Certified Cinema Mixing Room
7.1 + ... Atmos Ready

inHouse

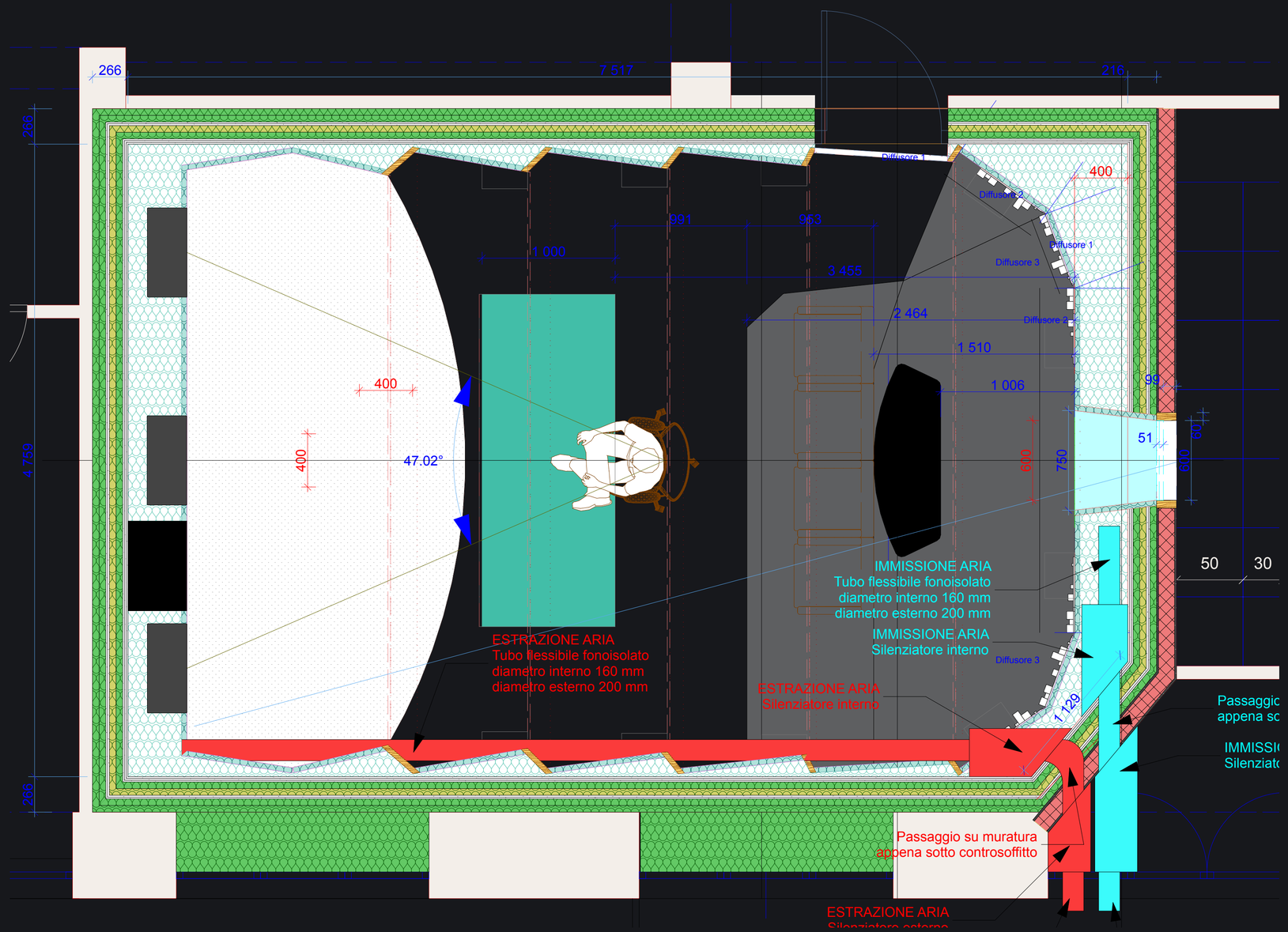
Roma

Audio Mix and Color Correction
in the same room!!!

A mixing room of 40 m² in a common
Rome apartment

Paolo Sorrentino used it for several films:
The Great Beauty (oscar winner)
Youth
The Young Pope (HBO Series)

Mirko Perri is a young Italian Audio Engineer award winner (David Donatello)


266
7 517
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4 759
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991
963
1 000
3 455
2 464
1 510
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Diffusore 1
Diffusore 2
Diffusore 3
Diffusore 1
Diffusore 3
Diffusore 3
400
99
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60
600
750
600
50
30
1 129
ESTRAZIONE ARIA
Tubo flessibile fonoisolato
diametro interno 160 mm
diametro esterno 200 mm
IMMISSIONE ARIA
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IMMISSIONE ARIA
Silenziatore interno
ESTRAZIONE ARIA
Silenziatore interno
Passaggio su muratura
appena sotto controsoffitto
ESTRAZIONE ARIA
Passaggio
appena sc
IMMISSI
Silenziat

STUDIO
SOUND
SERVICE

Genelec + Dolby guidelines

Work in progress!!!

Small room
Dolby Atmos Home Entertainment

- Area ≈ 18 m²
- Volume ≈ 60 m³
- **Reproduction System: 5.1.2**
  with listening position at 1/3 L
  small mixing room, rec/composing

- Front Speakers (L - C - R):
  Genelec 8331 SPL @ listener: 105 dBC
- Surround Speakers (Ls - Rs):
  Genelec 8331 SPL @ listener: 105 dBC
- Ceiling Speakers (Lc - Rc):
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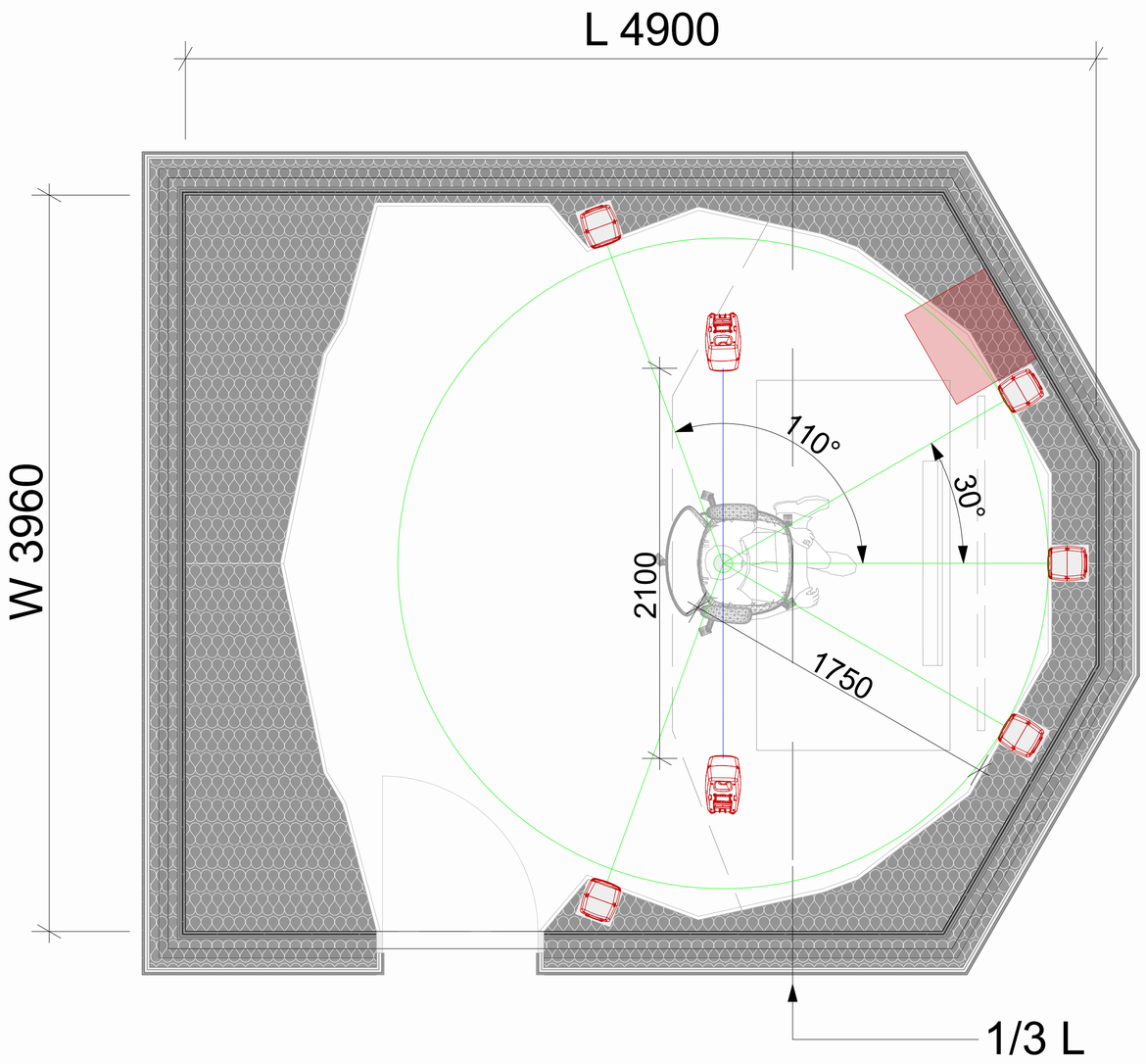
- Subwoofer:
  Genelec 7370A SPL @ listener: 117 dBC



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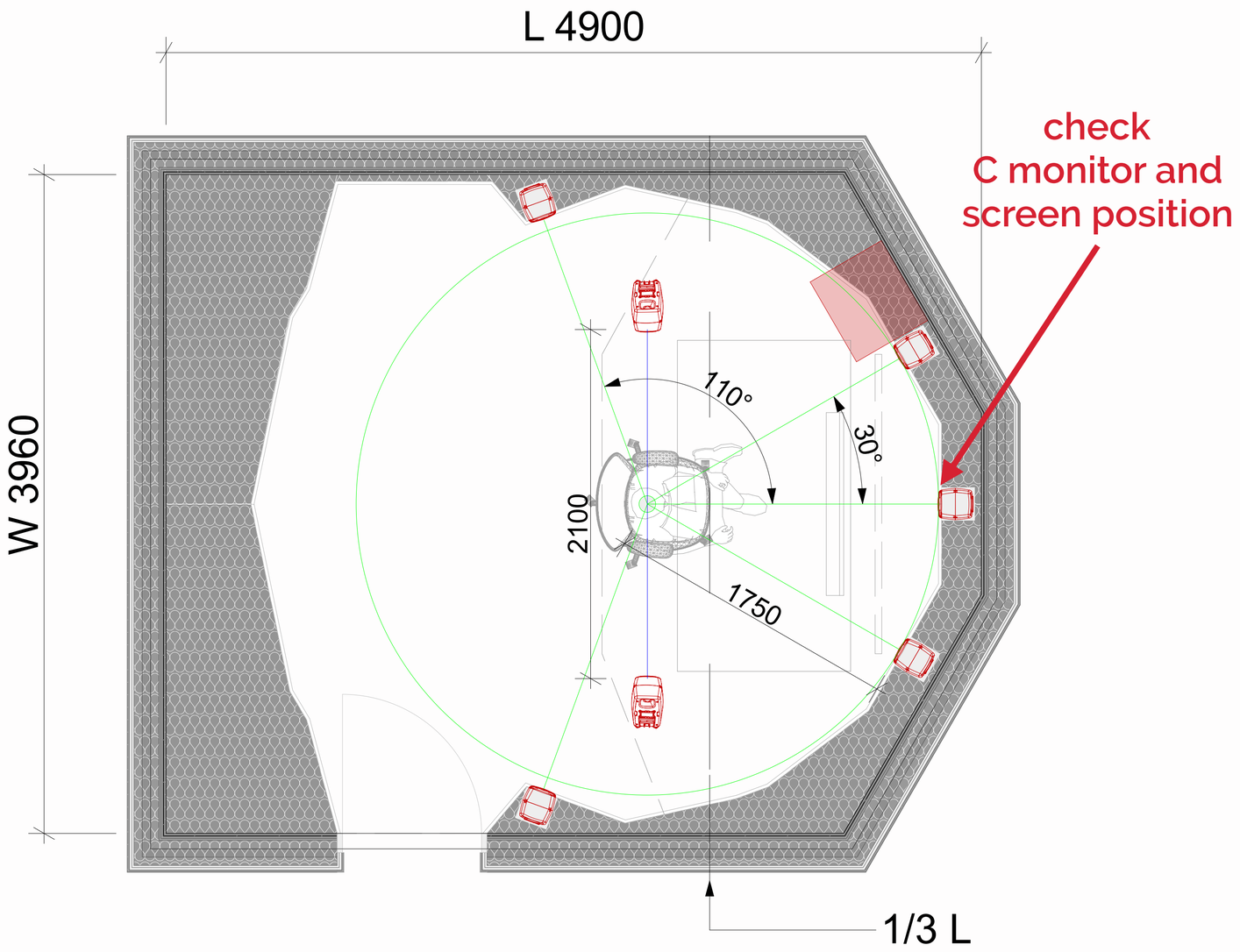

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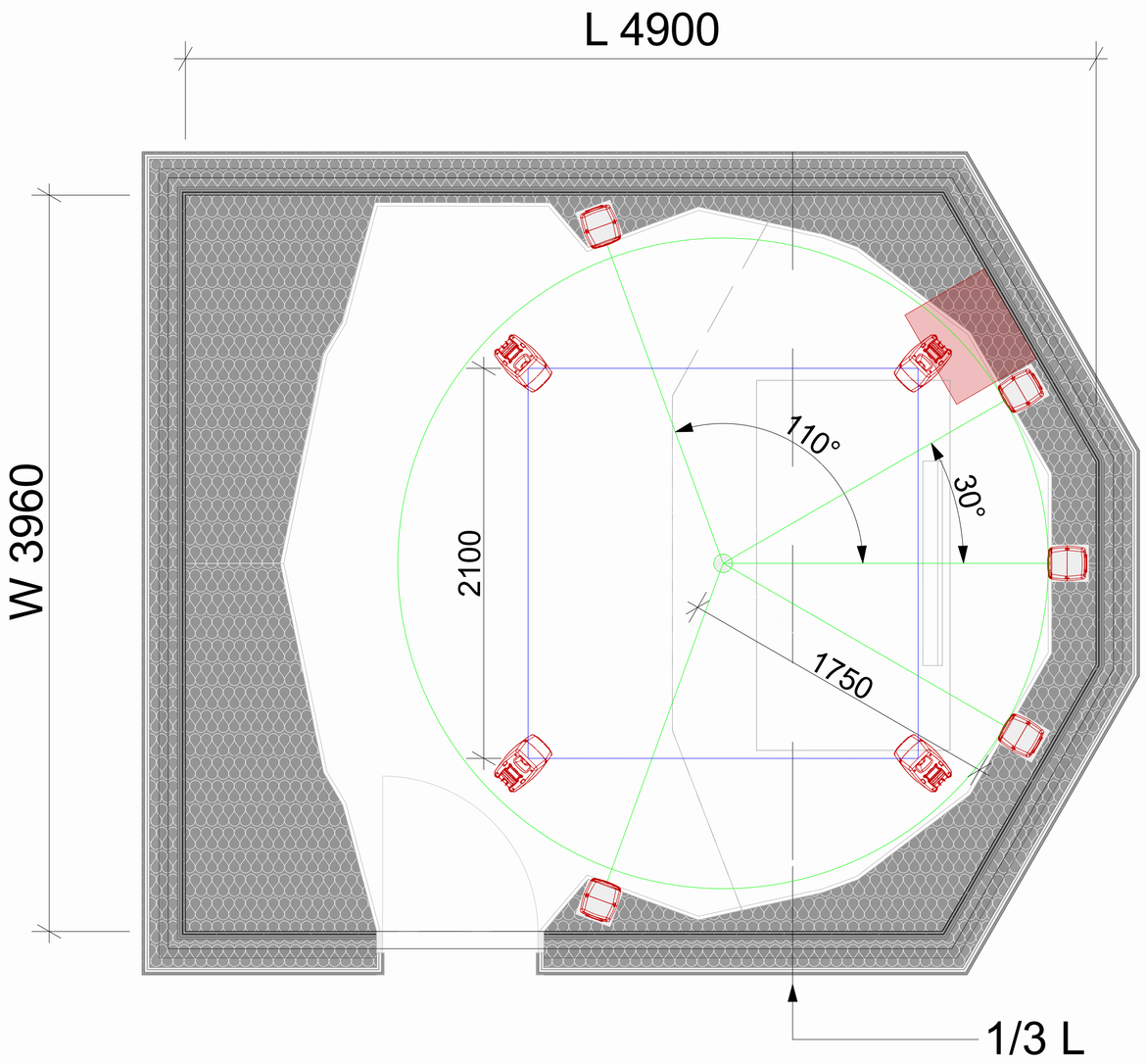

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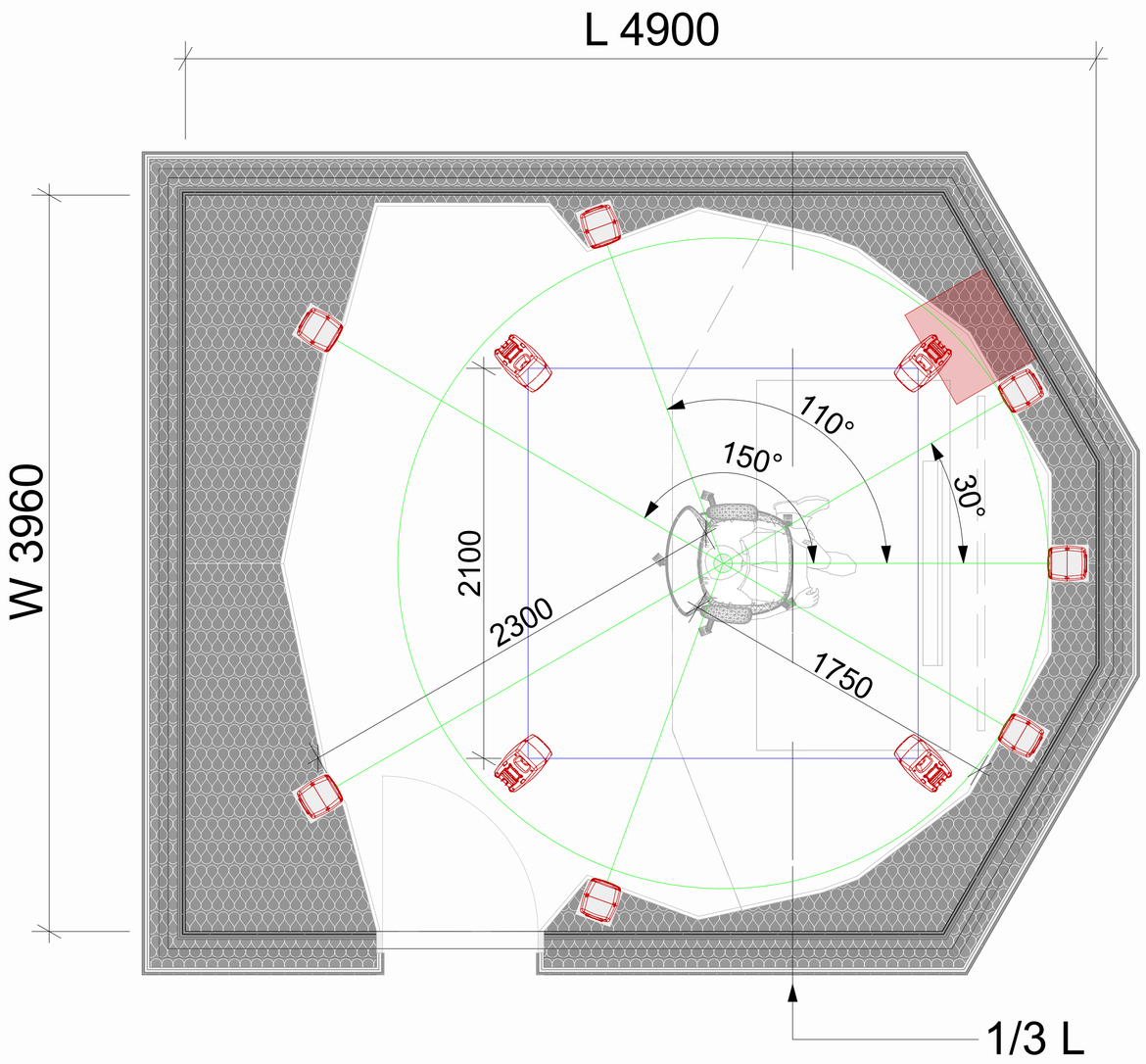

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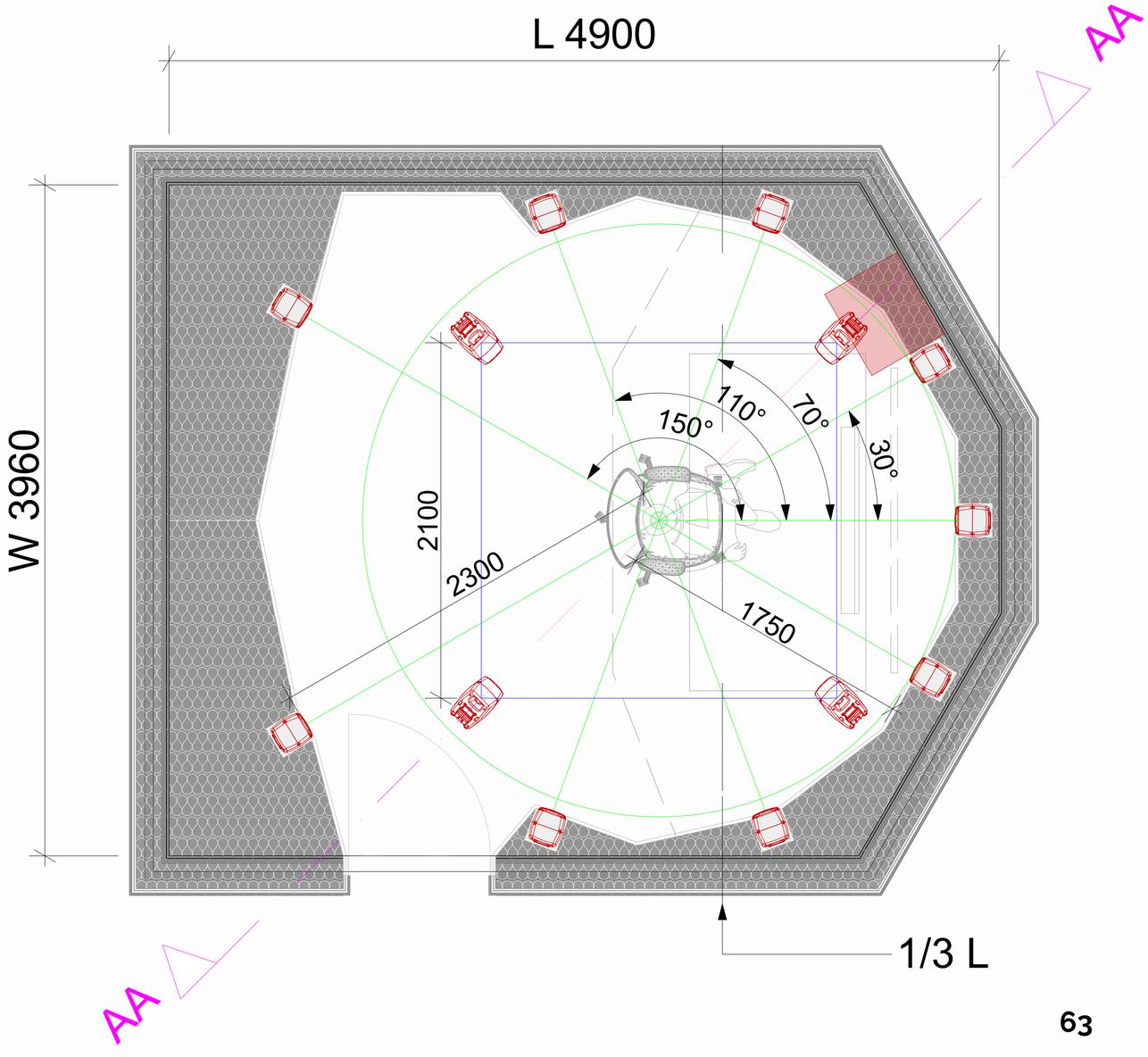

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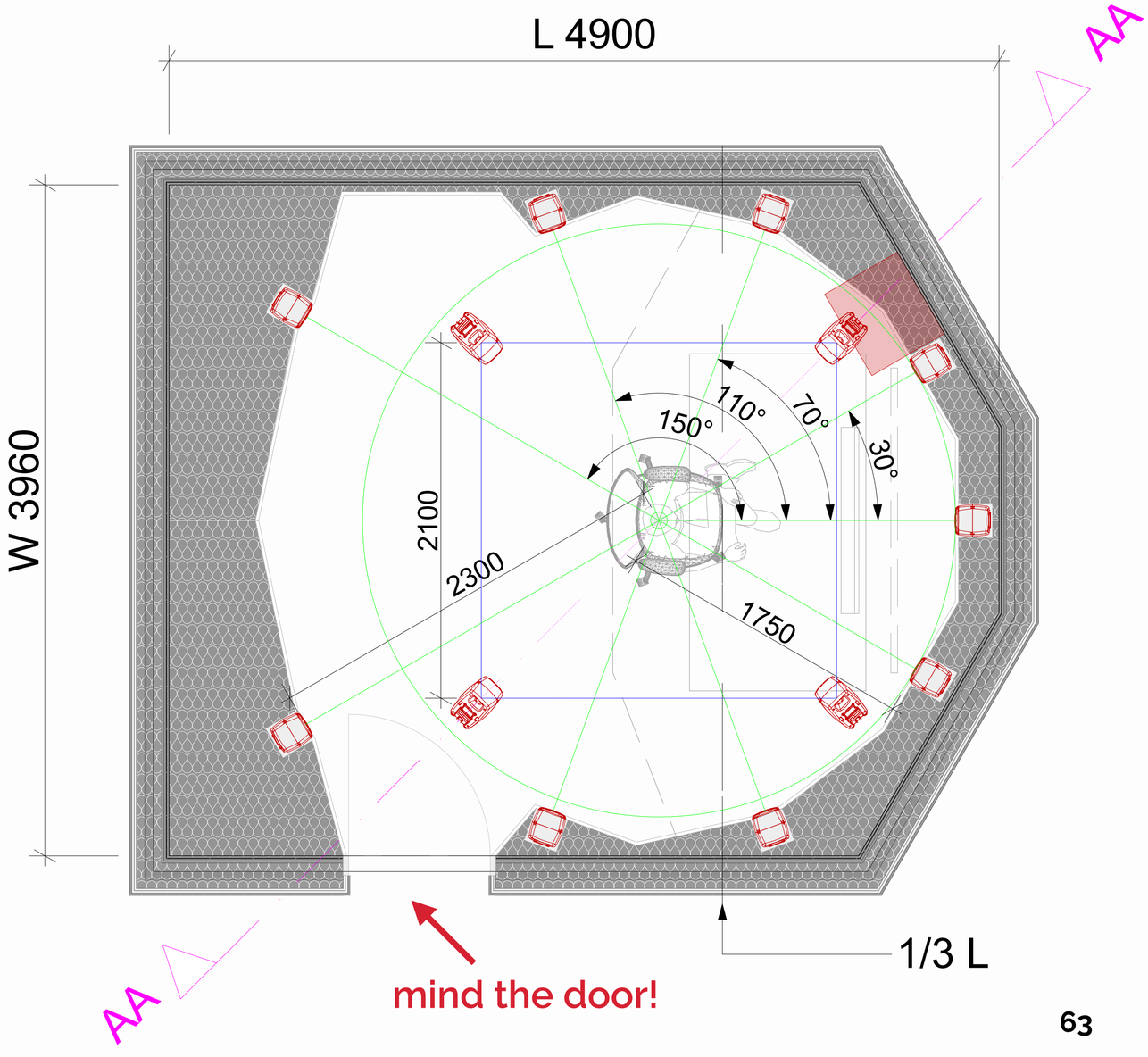

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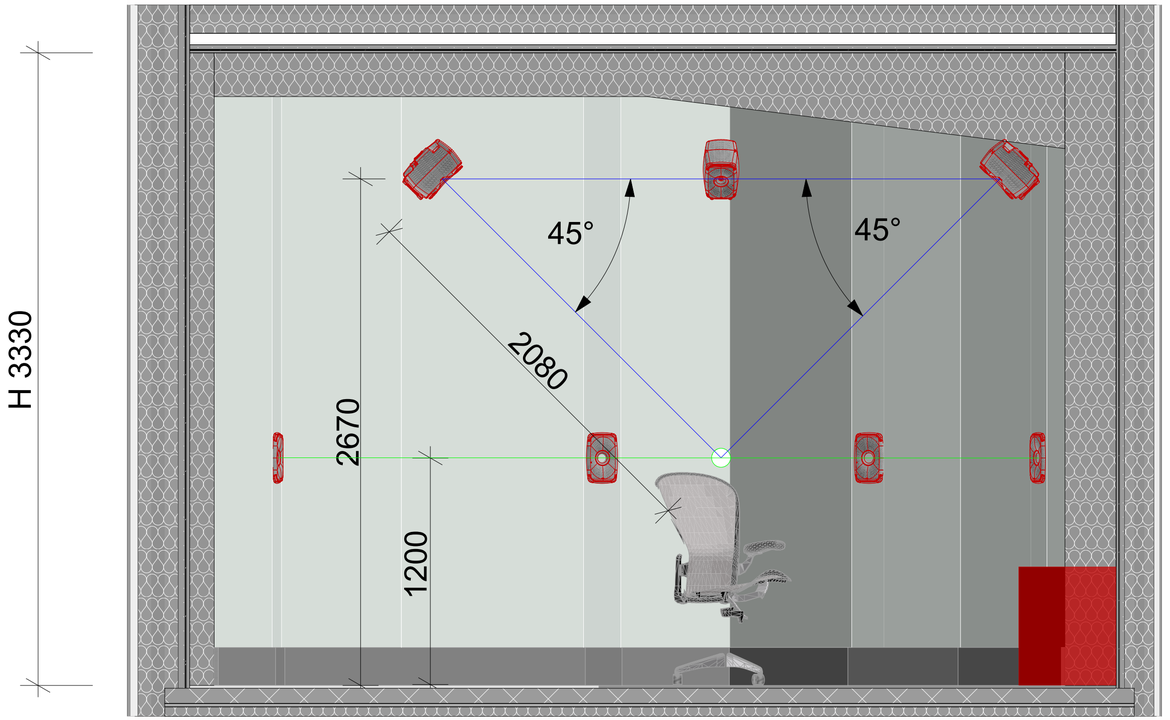

Medium room
Dolby Atmos Home Entertainment

- Area ≈ 29 m²
- Volume ≈ 96 m³
- **Reproduction System: 5.1.4**
  with listening position at 1/3 L
  medium mixing room, rec/composing

- Front Speakers (L - C - R):
  Genelec 8351 SPL @ listener: 111 dBC
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  Genelec 8341 SPL @ listener: 109 dBC
- Ceiling Speakers (Lfc - Rfc - Lrc - Rrc):
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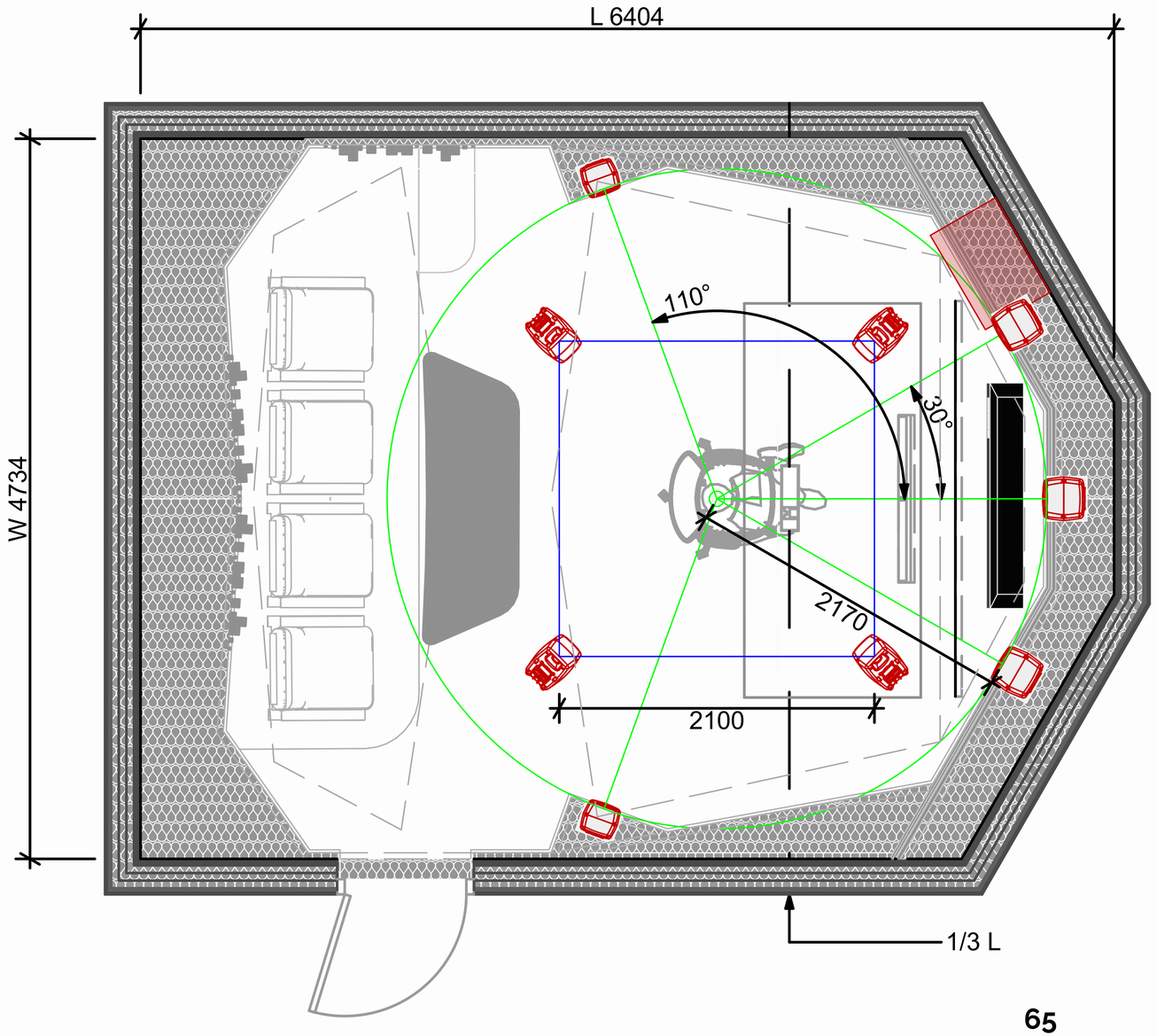

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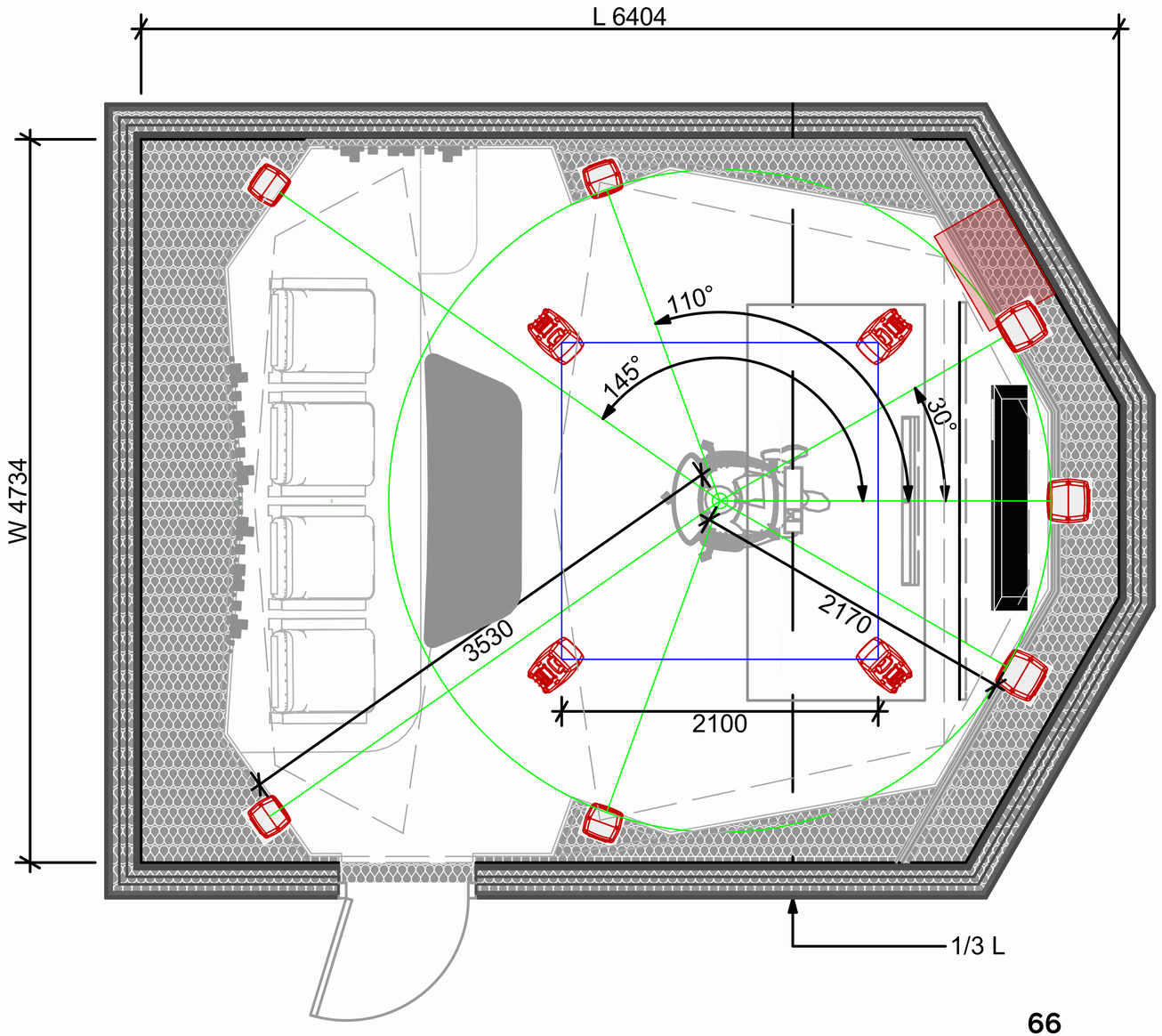

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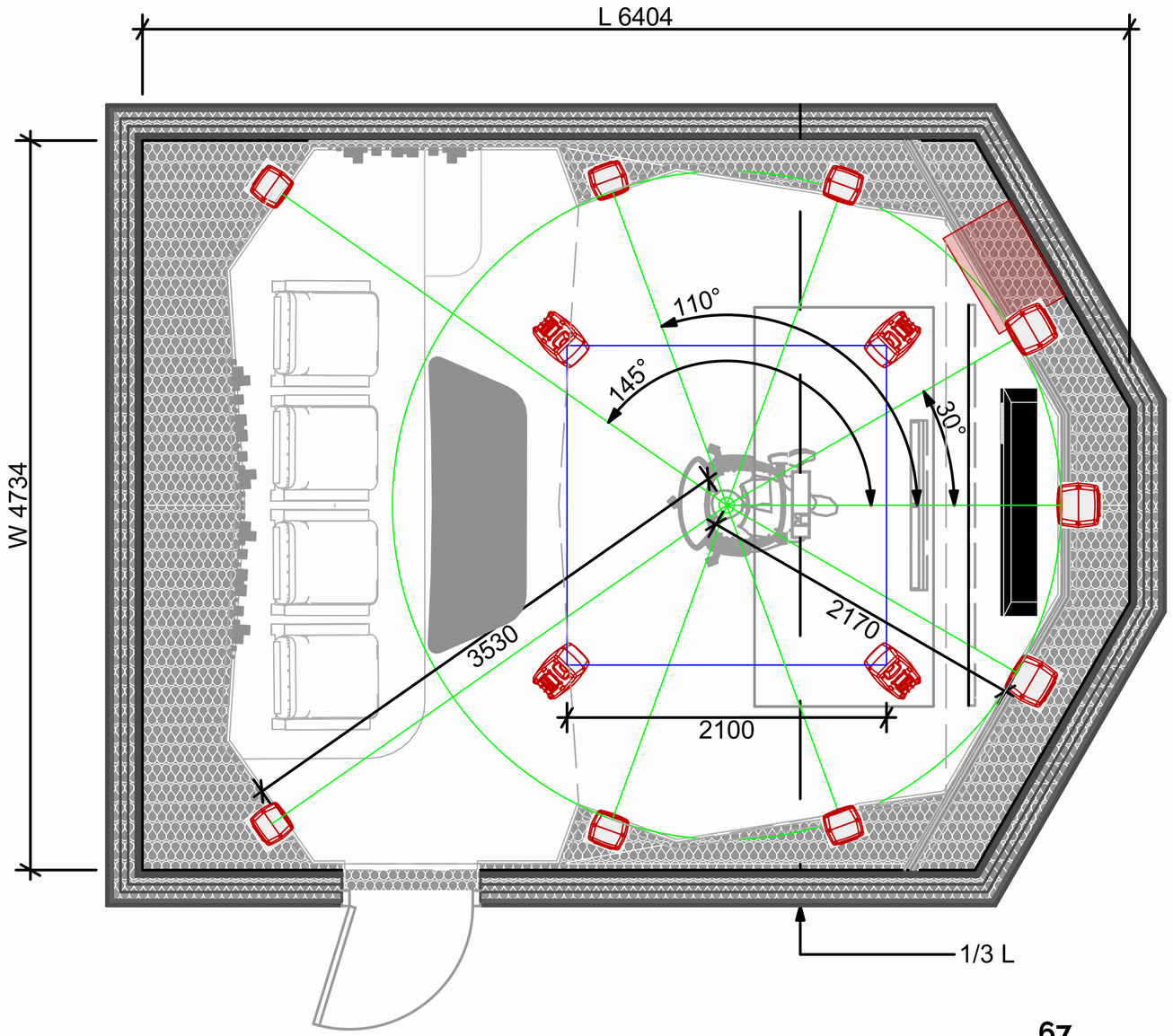

Medium room
Dolby Atmos Home Entertainment

- Area ≈ 29 m²
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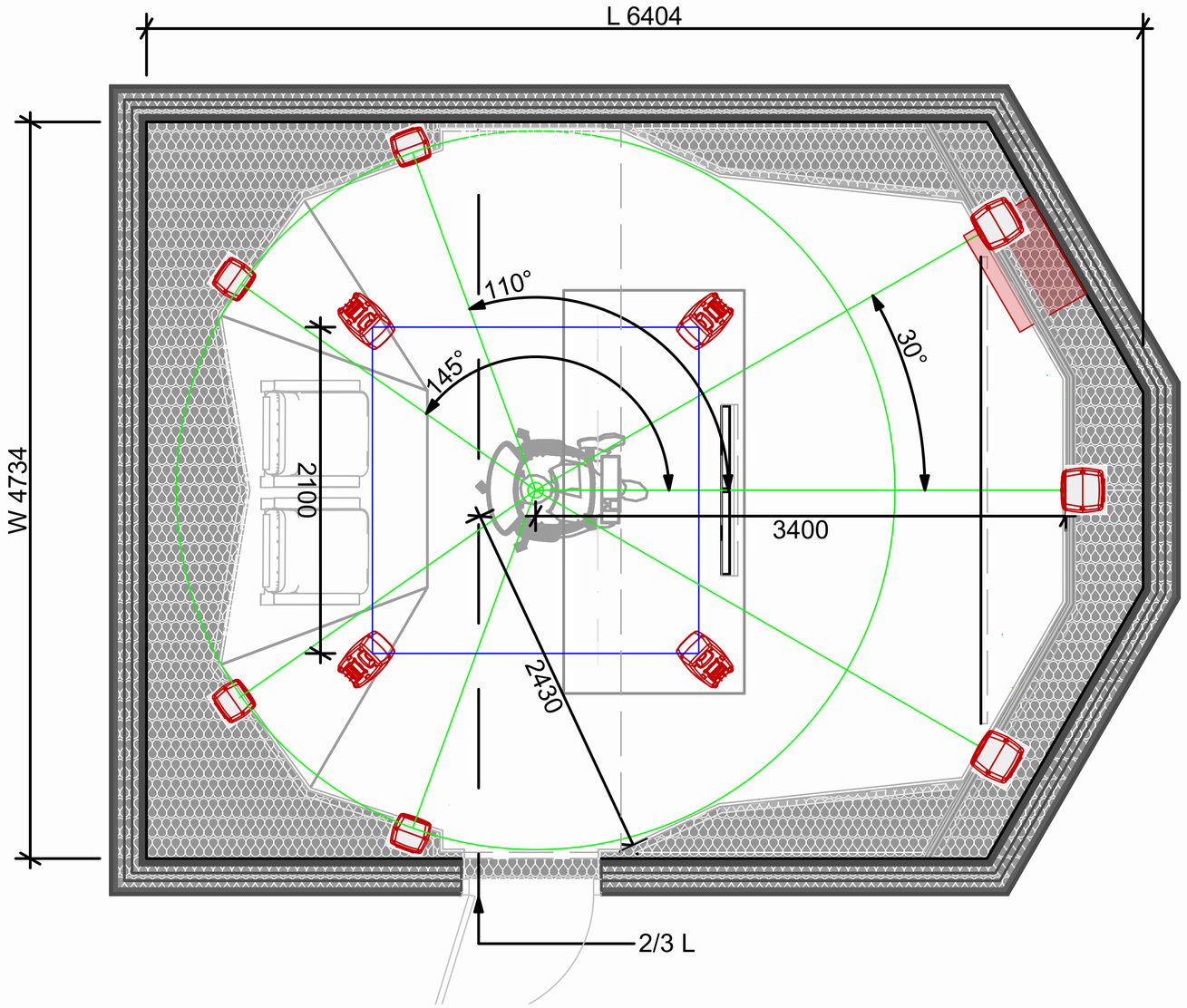

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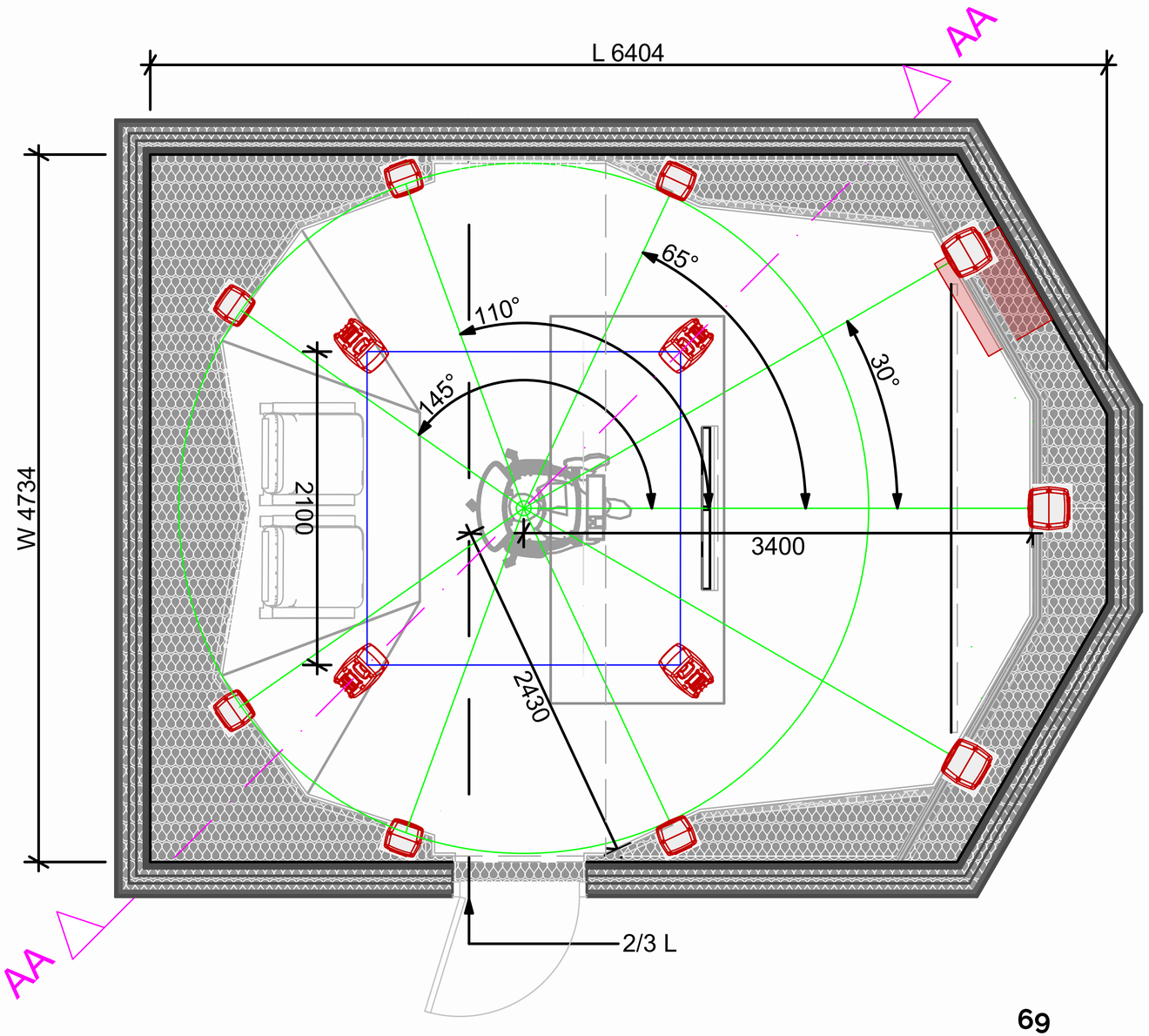

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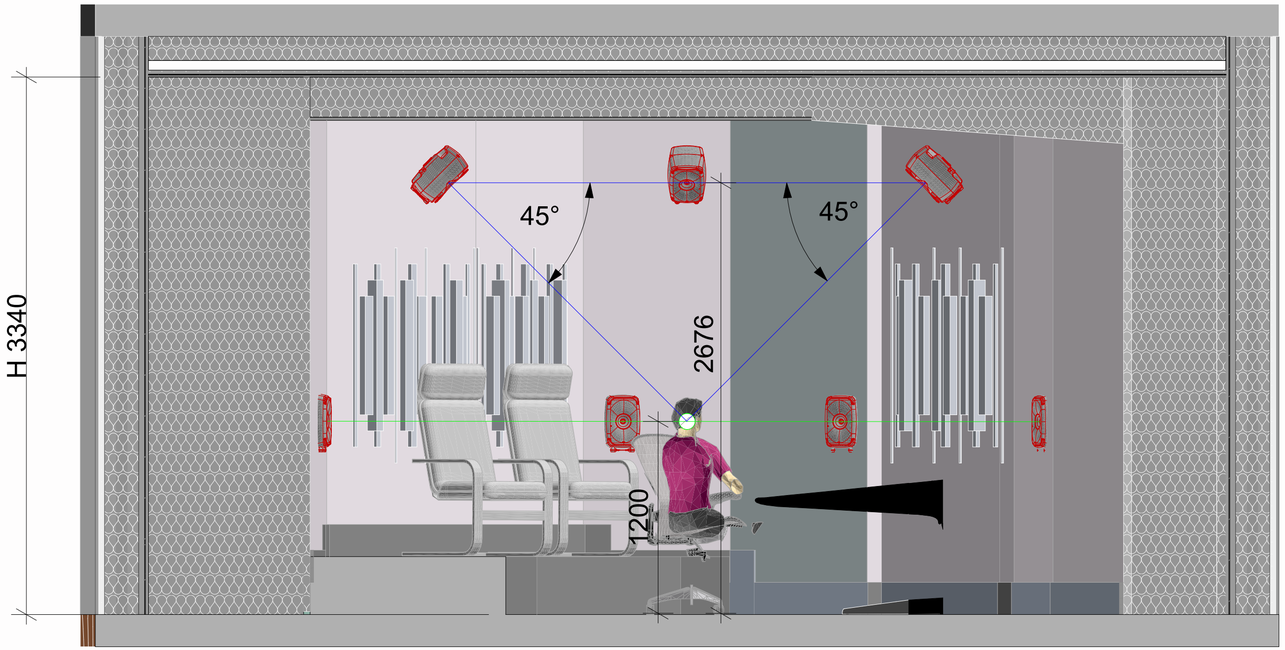

Large room
Dolby Atmos Home Entertainment

- Area ≈ 50 m²
- Volume ≈ 190 m³
- **Reproduction System: 5.1.4**
  with listening position at 1/3 L
  big control room – soundtrack composers

- Front Speakers (L - C - R):
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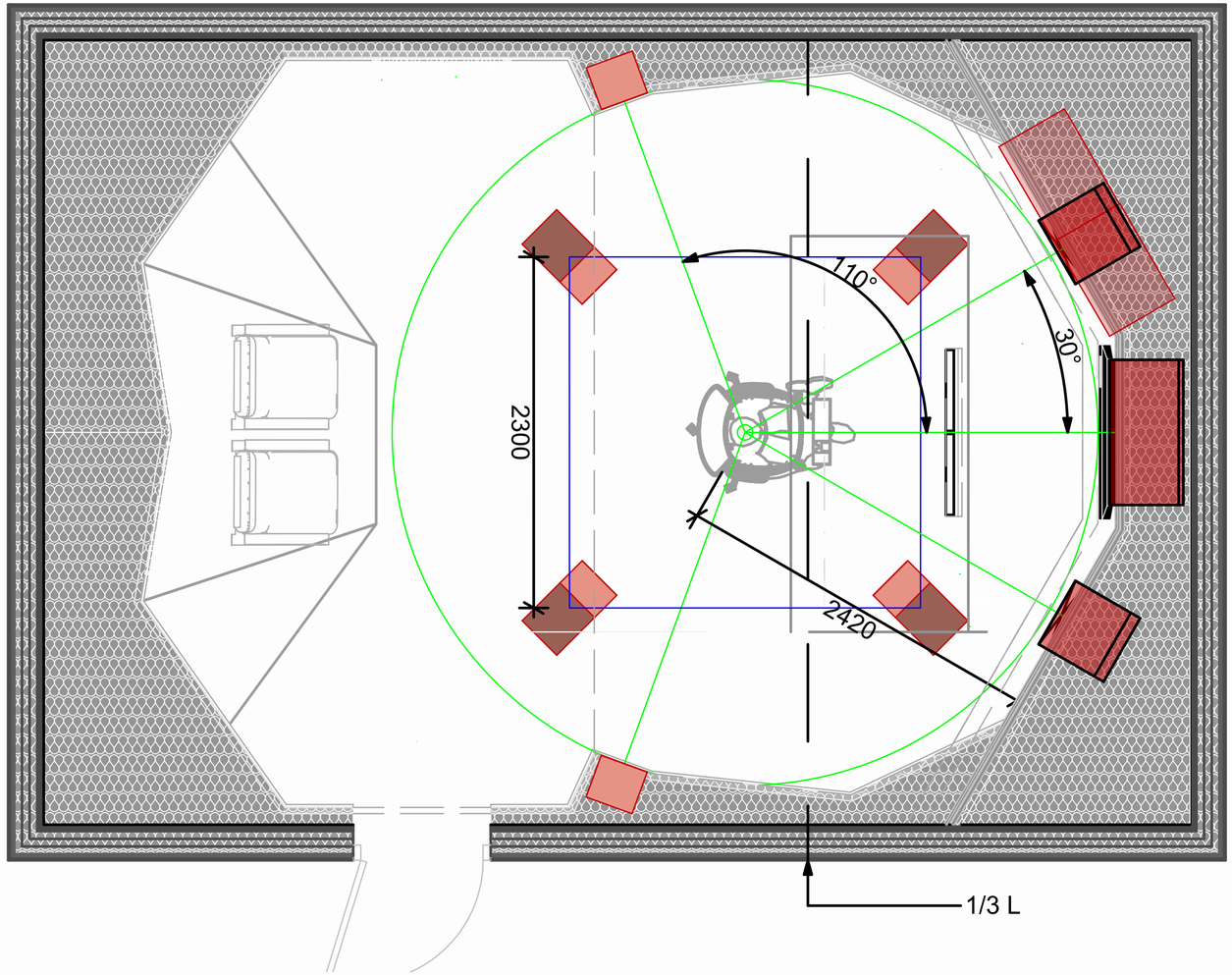

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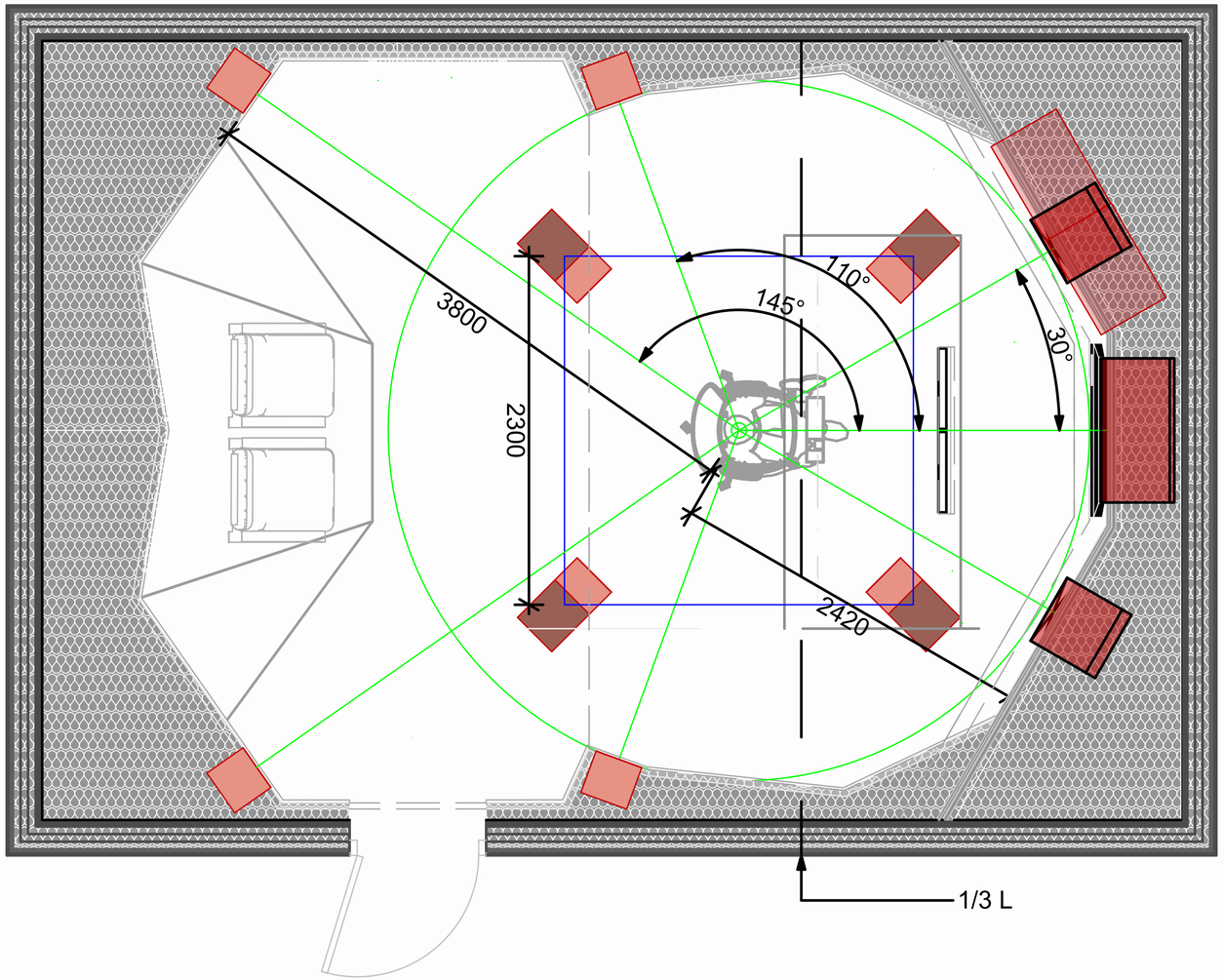

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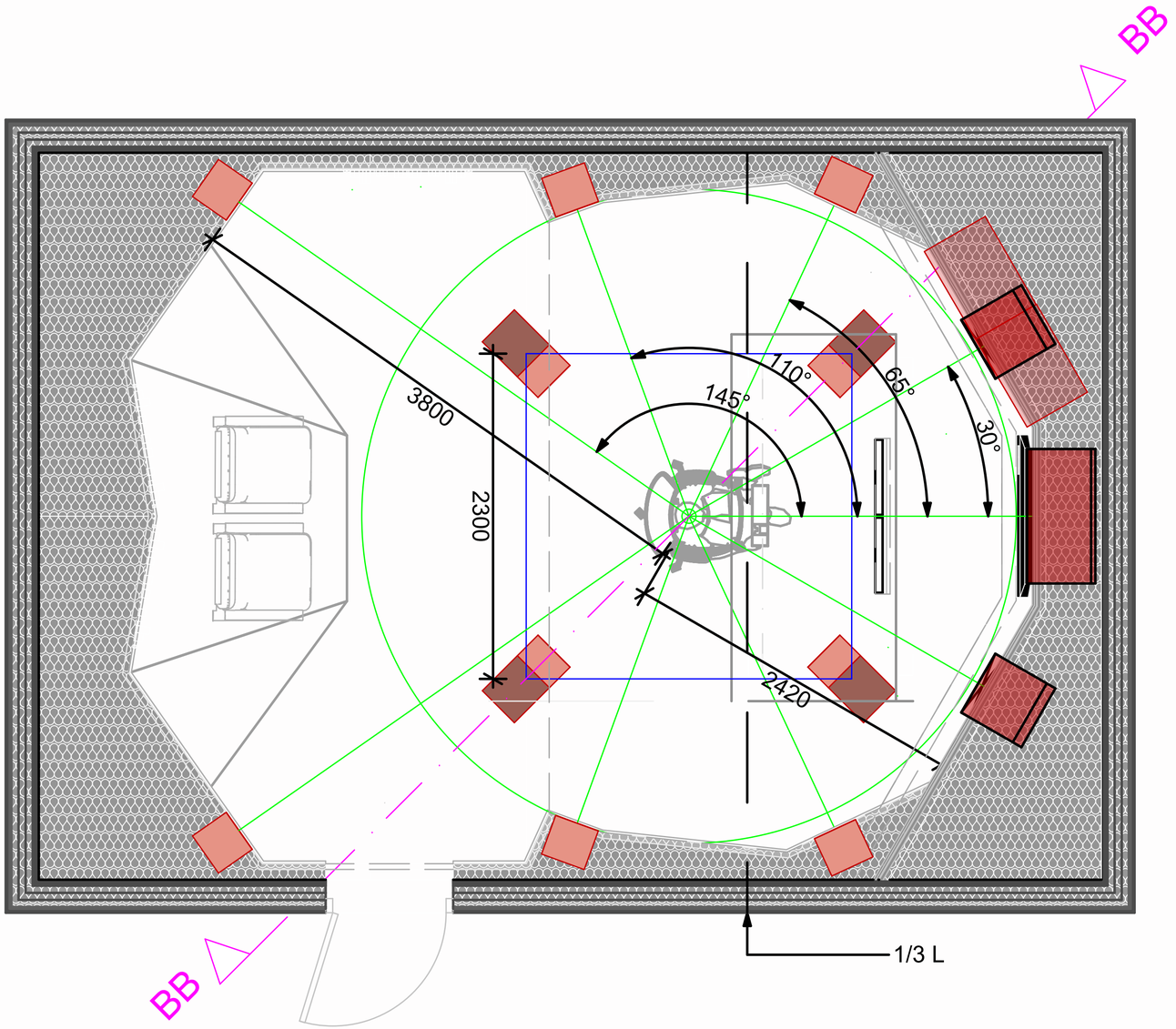

Large room
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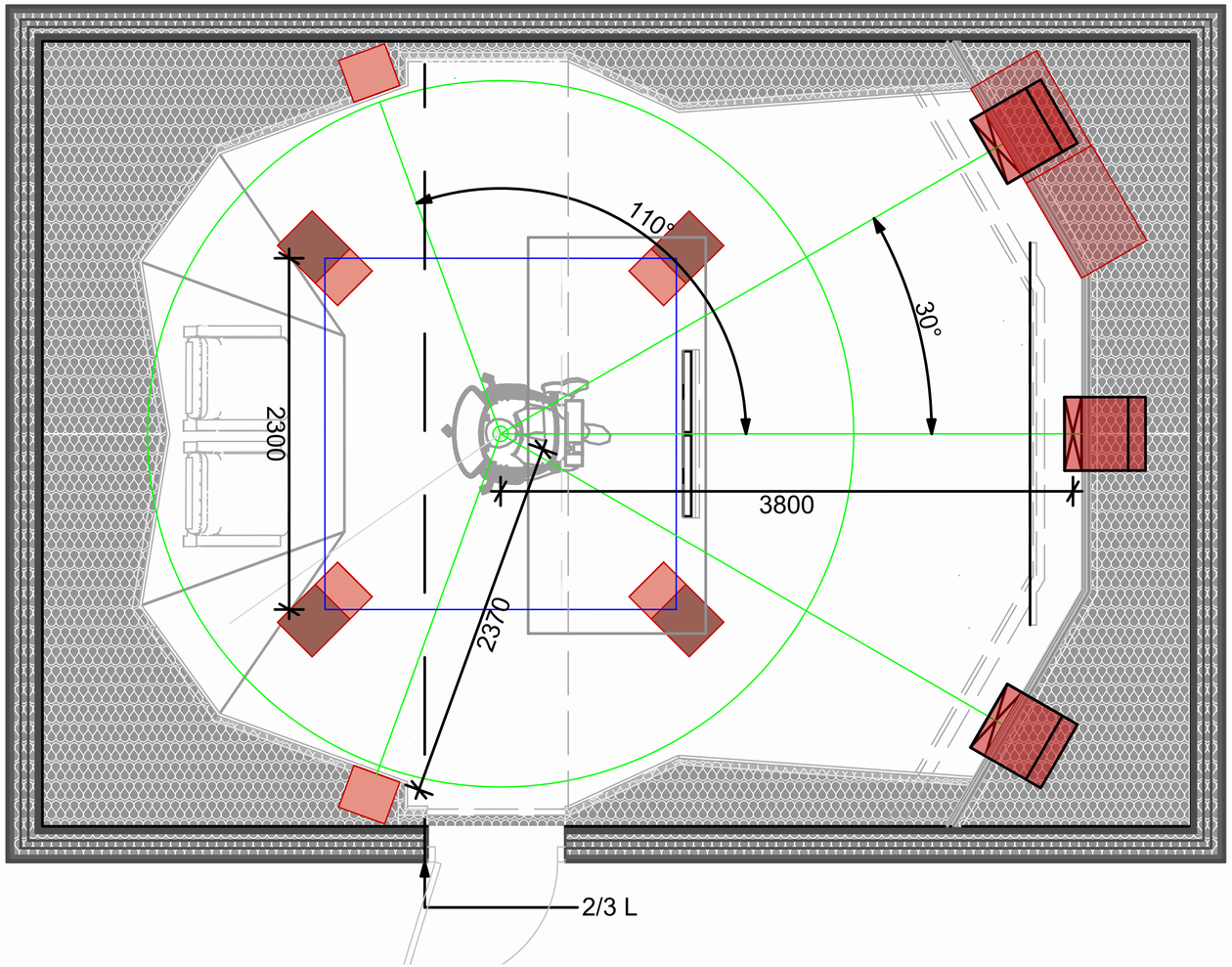

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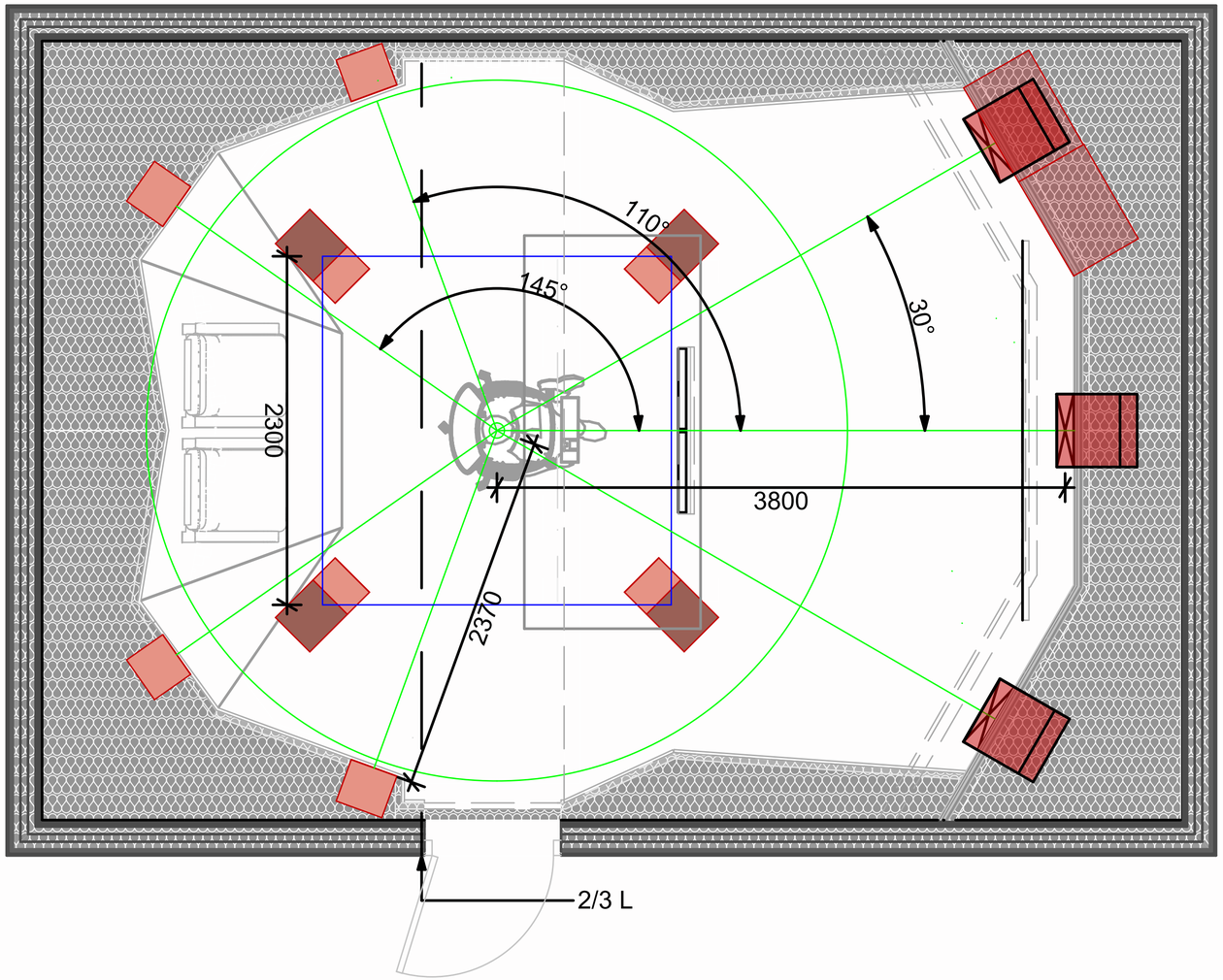

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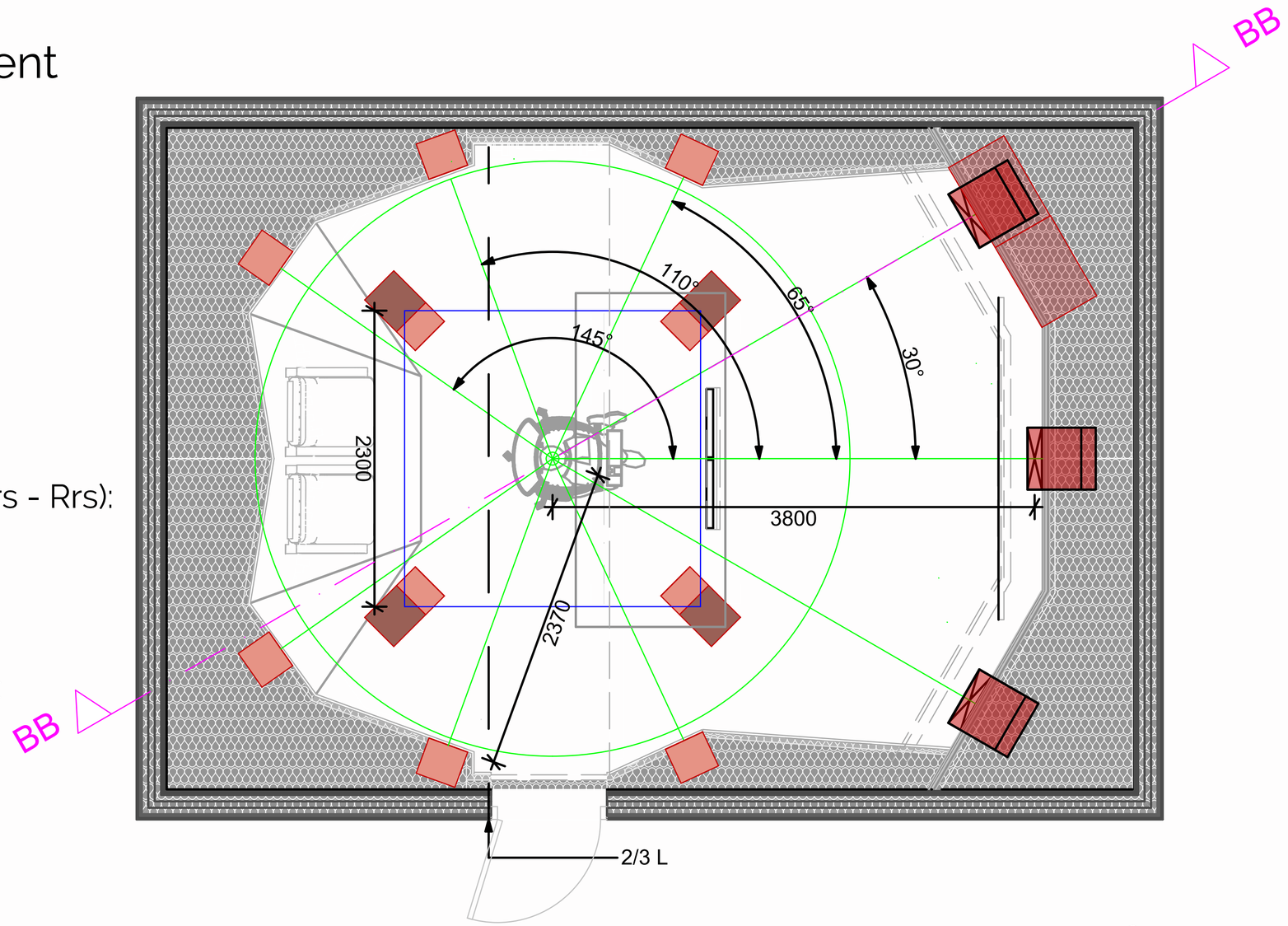
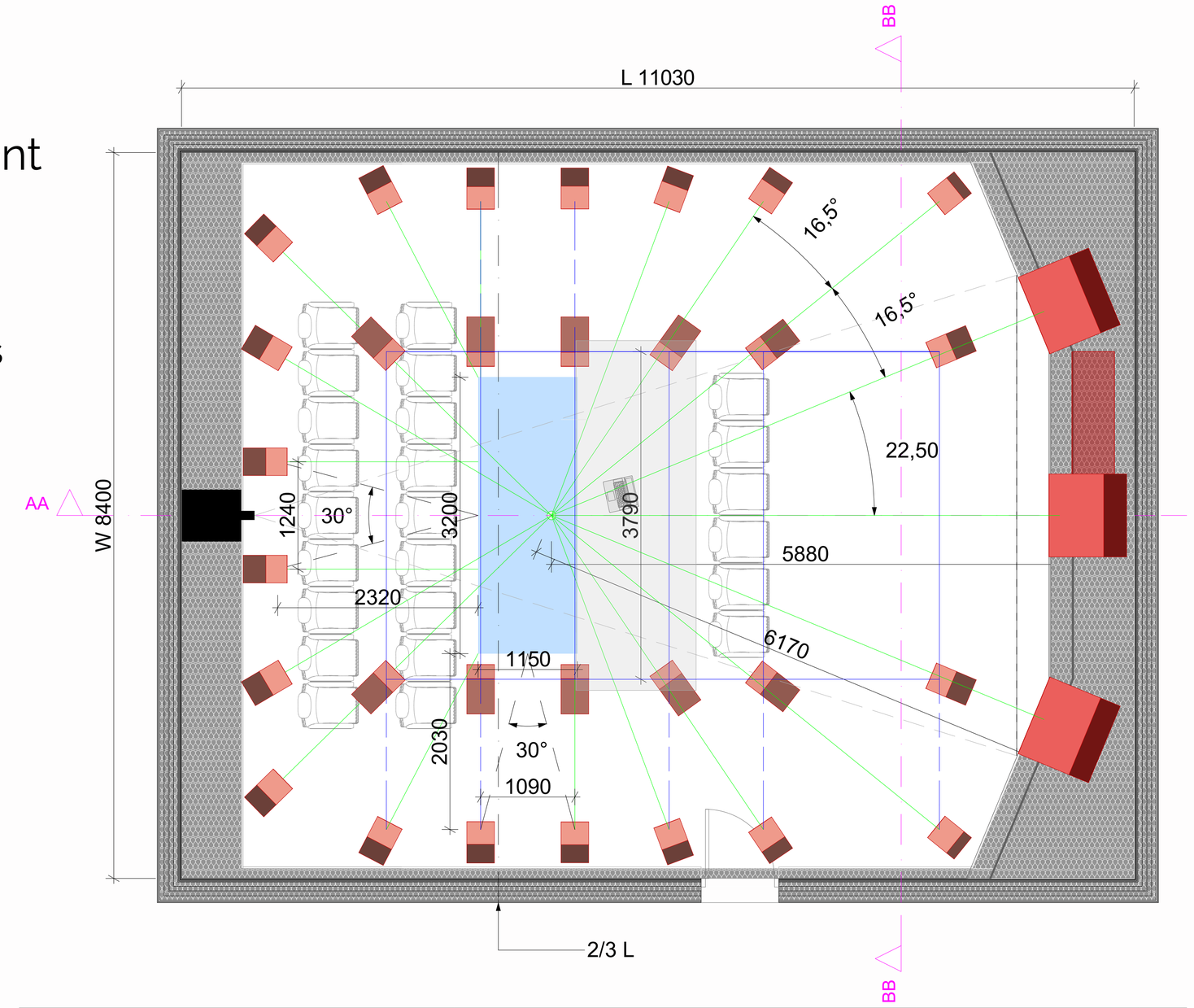


Theatrical room
Dolby Atmos Home Entertainment

- Area ≈ 92 m²
- Volume ≈ 496 m³
- **Reproduction System: Dolby Atmos**
  with listening position at 2/3 L
  cinema mixing theatre

- Front Speakers (L - C - R):
  Genelec 1236 (alternatively 1234)
  SPL @ listener: 121 (116) dBC
- Side Surround Speakers:
  Genelec 1032x SPL @ listener: 95 dBC
- Rear Surround Speakers:
  Genelec 1032x SPL @ listener: 95 dBC
- Ceiling Speakers:
  Genelec 1032x SPL @ listener: 95 dBC
- Subwoofer:
  Genelec 2x7380A SPL @ listener: 122 dBC



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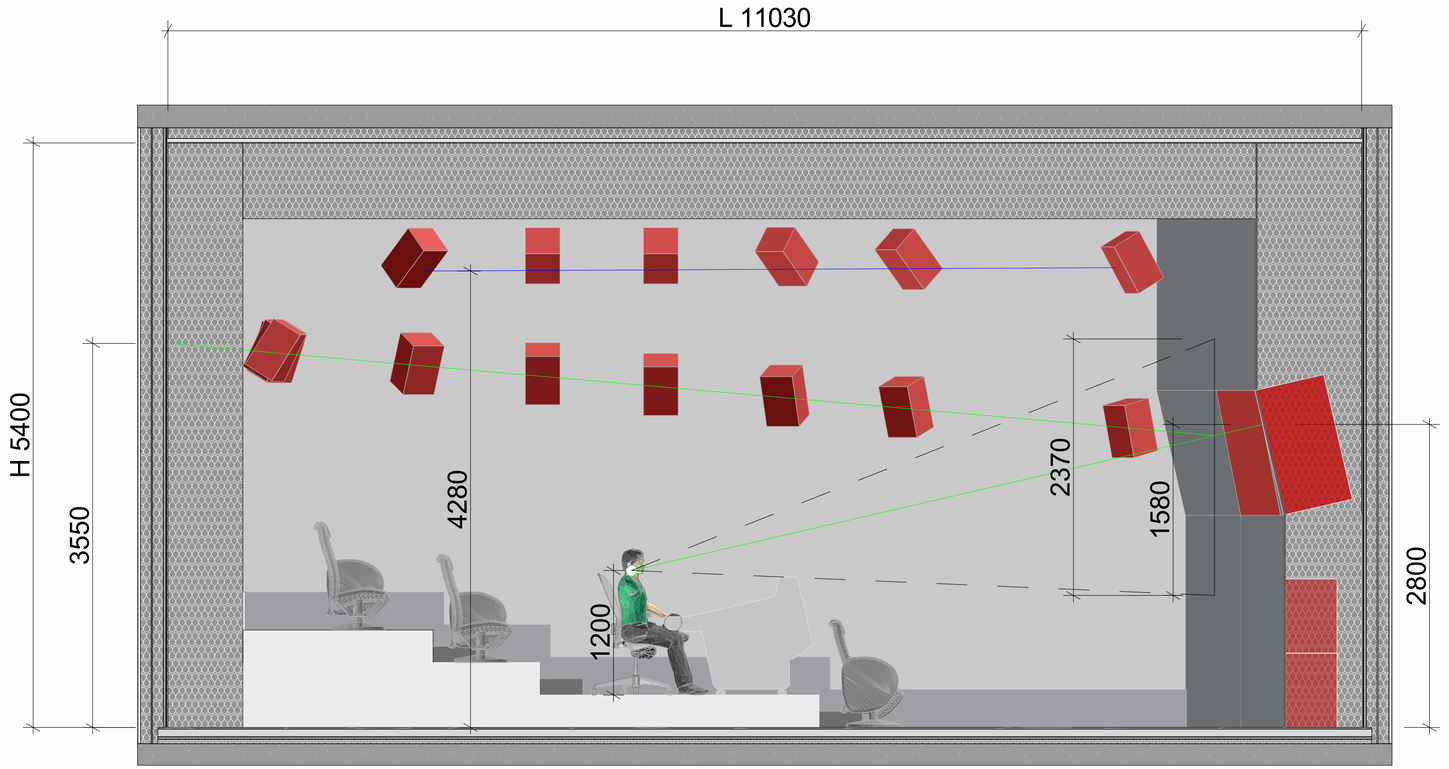

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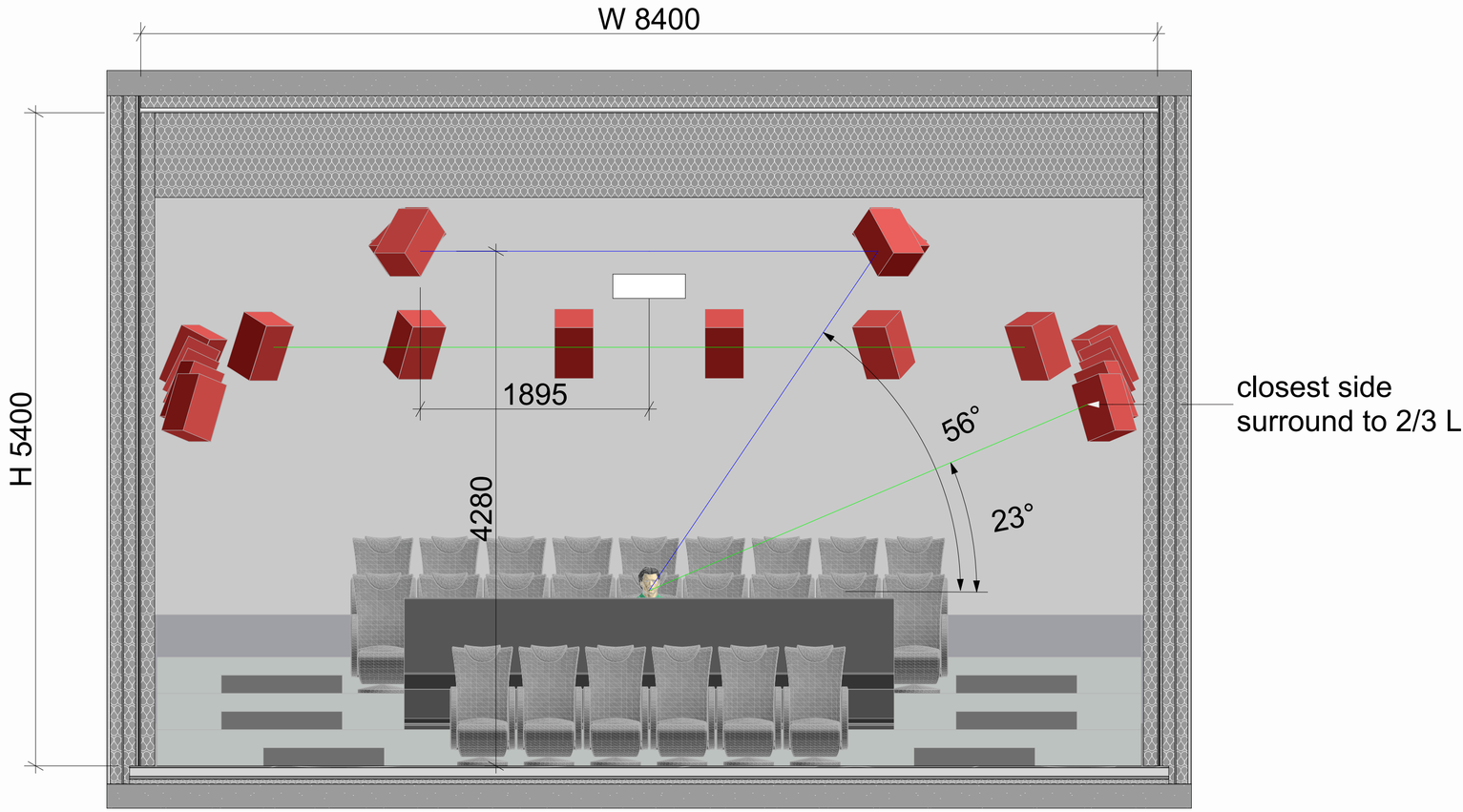

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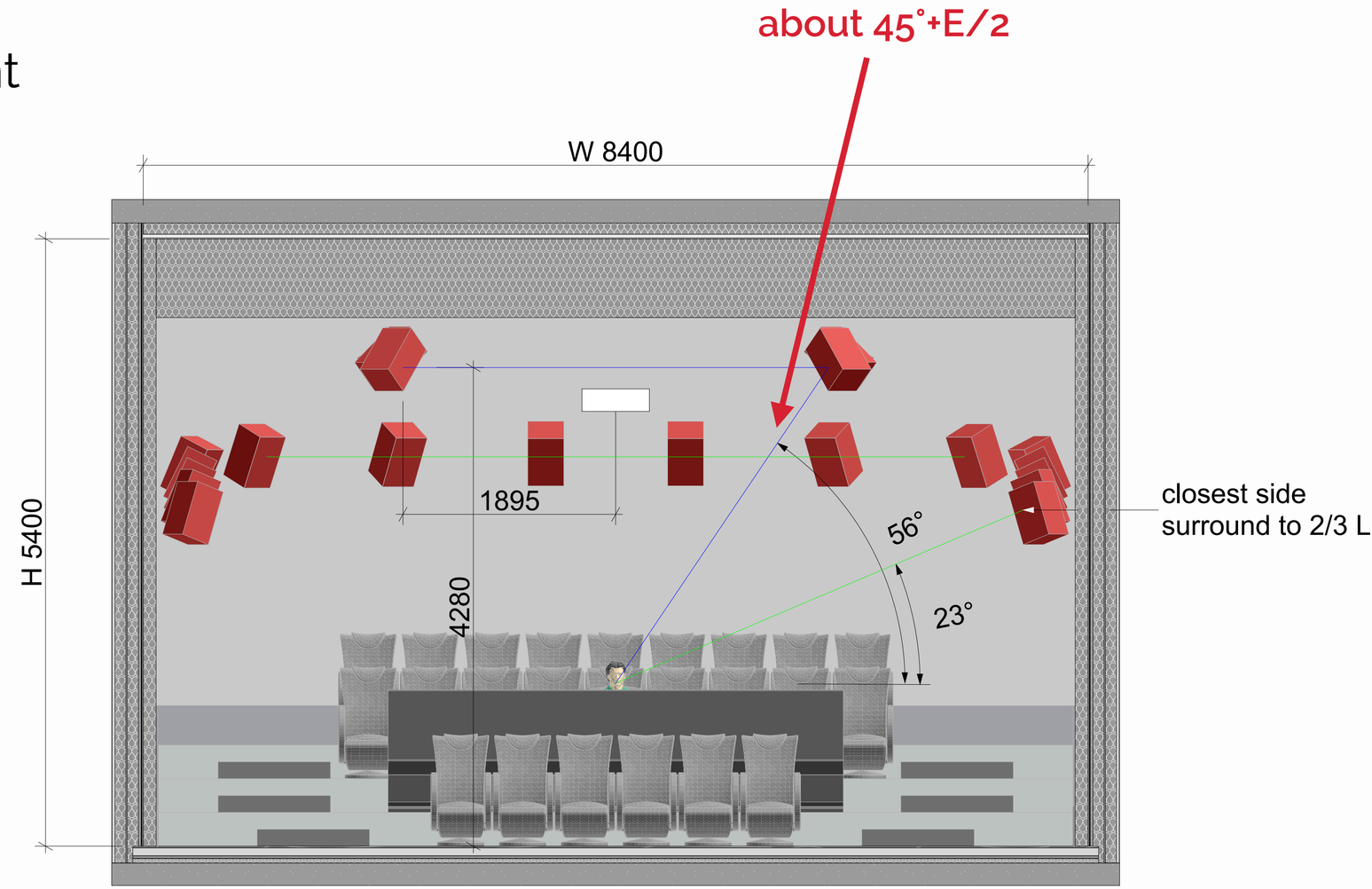

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FOX UK

2015
Fox Networks UK

2 Control room
1 Vocal Booth
1 Sala Post AVID

STUDIO
SOUND
SERVICE

Nat Geo

2015
Fox Networks UK

National Geographic control room
branded

STUDIO
SOUND
SERVICE

Vocal

2015
Fox Networks UK

…con il Vocal-Booth sulla destra

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SERVICE

FOX

2015
Fox Networks UK

Fox Branded
ha il Vocal-Booth a sinistra

STUDIO
SOUND
SERVICE

CHALLENGE

2015
Fox Networks UK

A challenge:
little space and proximity

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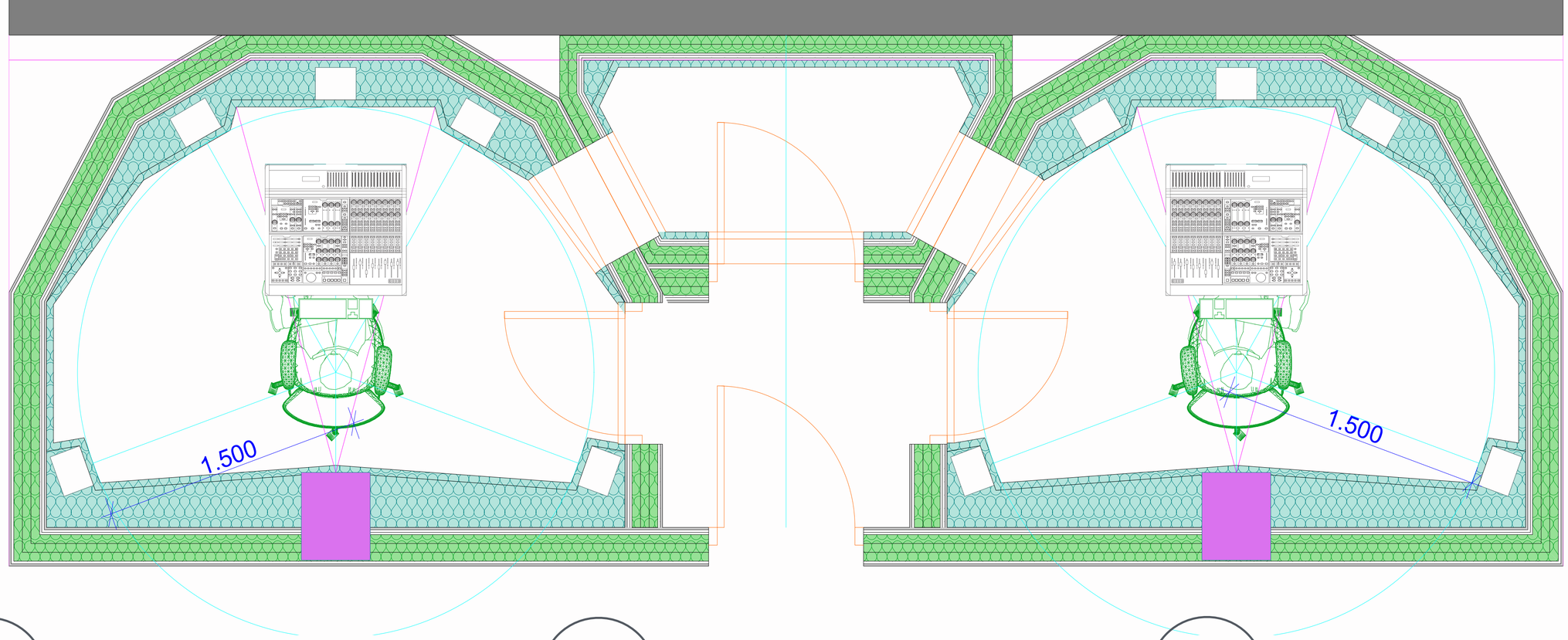
SOUND
SERVICE



1

The binoculars revolution

The room shape we invented (to best occupy all the space) was similar to binoculars, with two perfectly symmetrical rooms that share the Vocal Booth.

2

The basic geometry

the geometry is optimized in order to keep the rooms with the necessary listening systems in the smallest possible space and to offer the best sound experience.

3

The entrance room

The Entrance Room increases privacy for processing and further separates the audio rooms from the open office.

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FOX Münich

2016
Fox Networks DE

1 Control Room
1 Vocal-Booth
2 Post Avid rooms

STUDIO
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SERVICE

Vocal

2016
Fox Networks DE

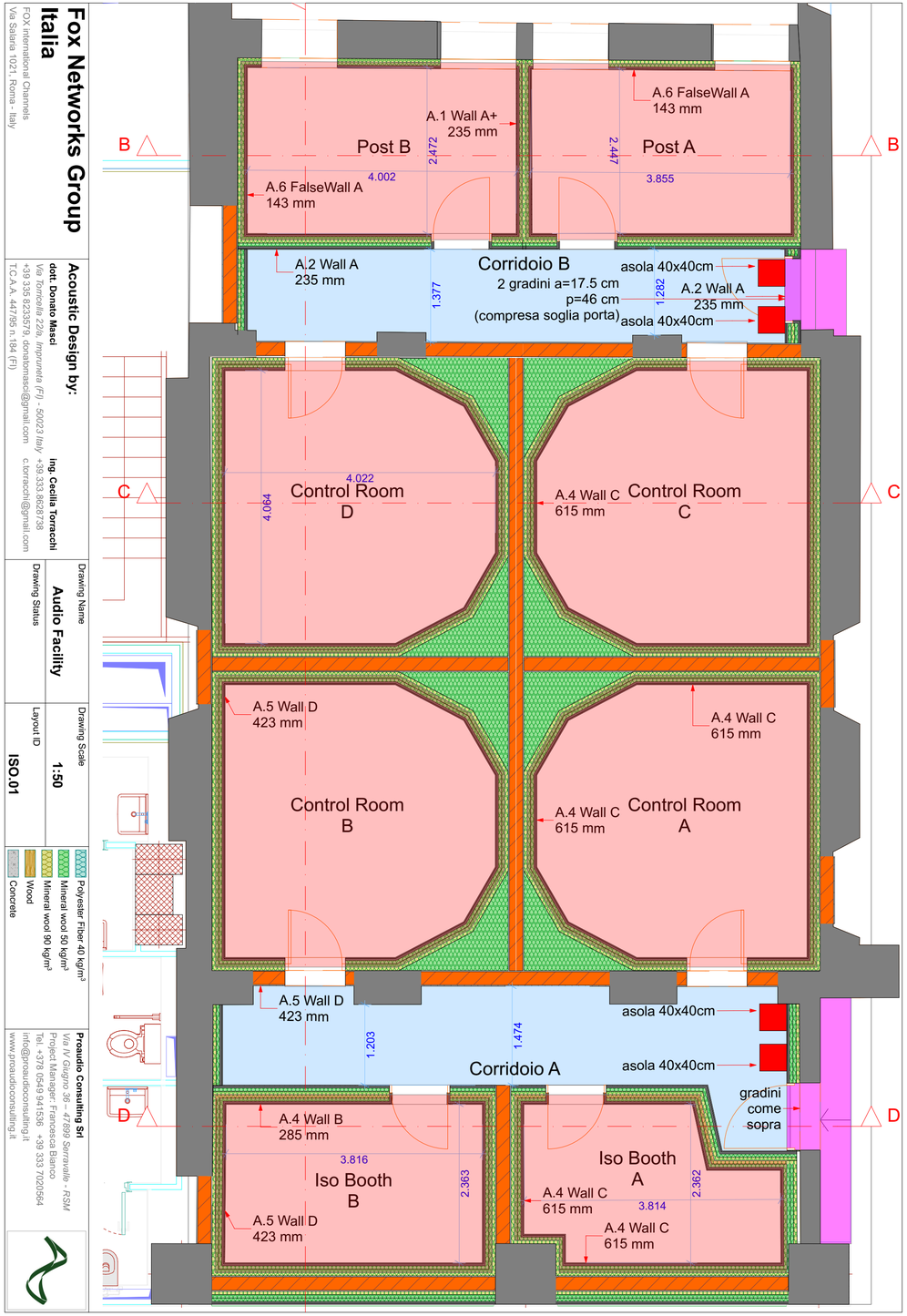
Vocal booth
deep sea fabric prints

STUDIO
SOUND
SERVICE

FOX Roma

2018
Fox Networks IT

4 Control Room
2 Vocal (ISO) - Booth
2 sale Post Avid



Layout

Critical issues

Historic building in the center of Rome.
Four rooms very close to each other, important acoustic insulation.
Set the geometries between the possible spaces.

Division of spaces

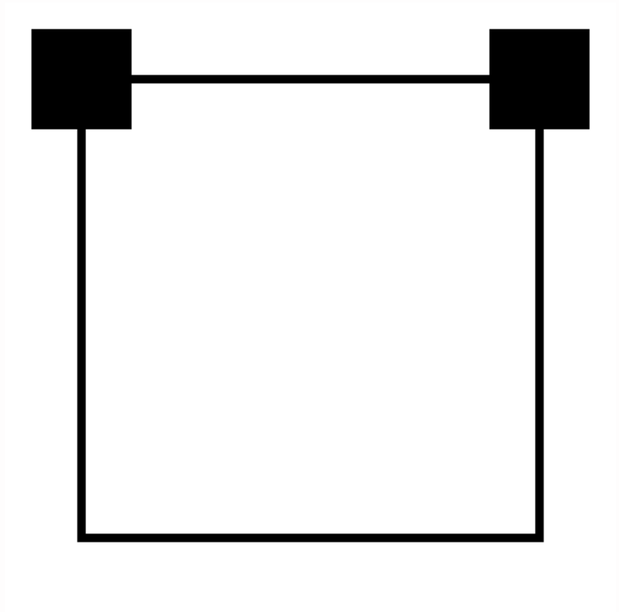
Keep the shape of the Fox room but insert it in a very complex context for divisions, columns etc. creation of two areas with independent access corridors (sound lock).

Functional choices

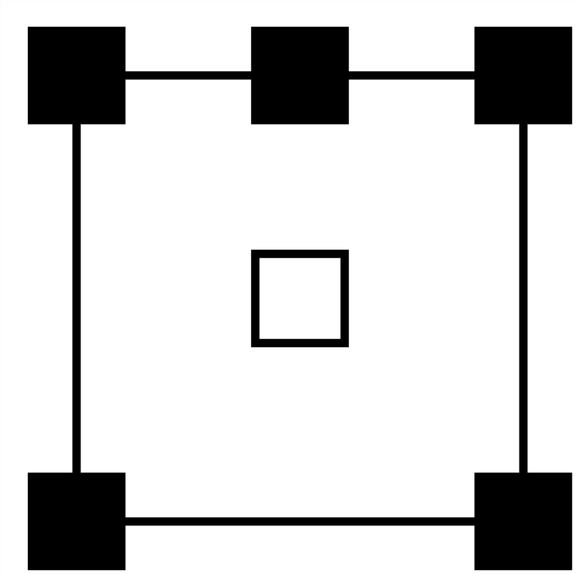
Use of a hybrid insulation system, masonry + plasterboard.
Dolby Atmos listening system.

Multifunctionality.

from stereo (2.0) to Dolby Atmos Home Entertainment (9.1.4)



Stereo



5.1 (Dolby Surround)

Dolby Atmos (9.1.4 to …?)

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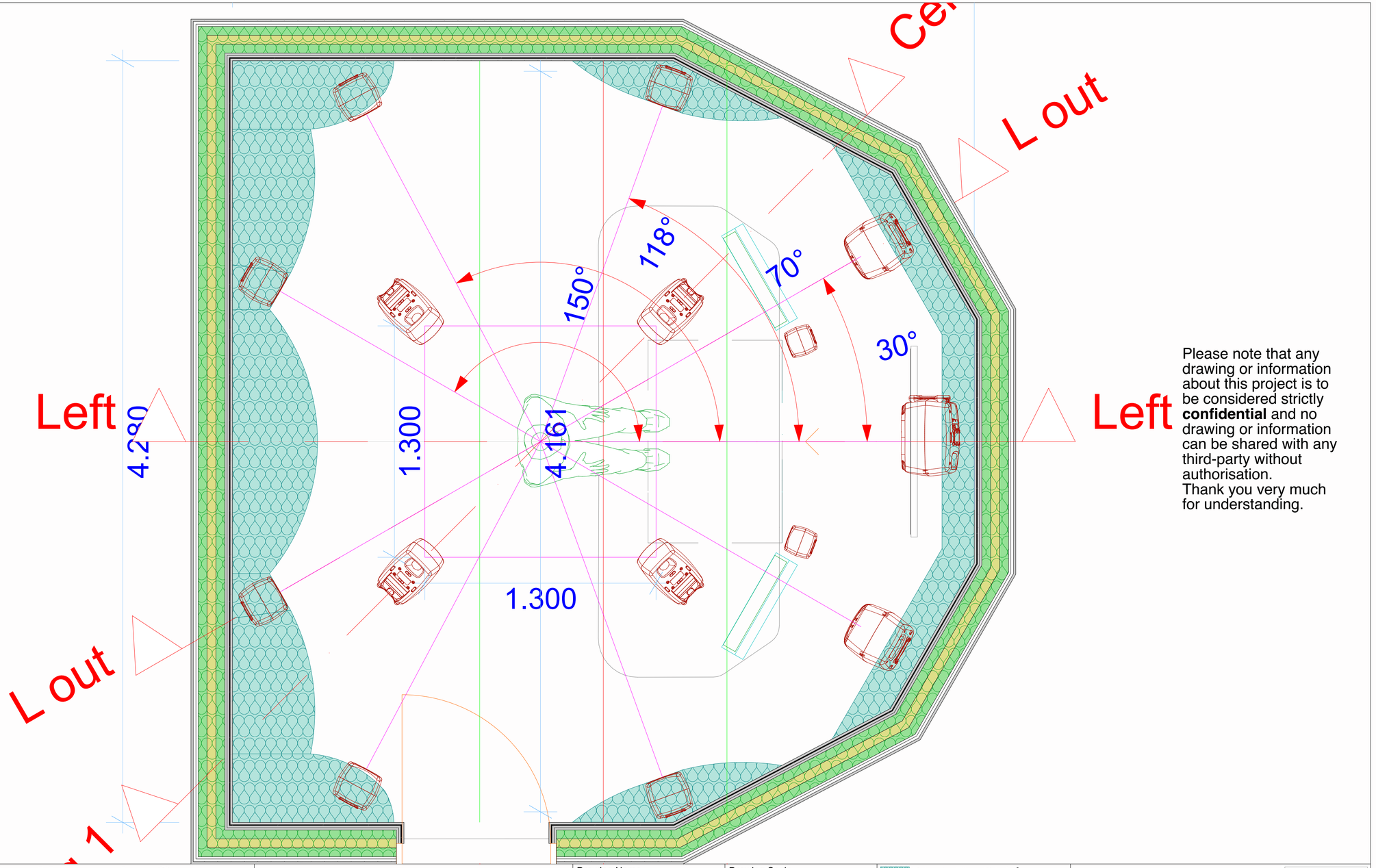

Please note that any drawing or information about this project is to be considered strictly **confidential** and no drawing or information can be shared with any third-party without authorisation.
Thank you very much for understanding.

9.1.4

2018
Fox Networks IT

9.1.4 Dolby Atmos
Home Entertainment

Fox Networks Group Italia
FOX international Channels
Via Salaria 1021, Roma - Italy

Acoustic Design by:

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T.C.A.A. 447/95 n.184 (FI)

ing. Cecilia Torracchi
+39.333.8628738
c.torracchi@gmail.com

Drawing Name: Floor	Drawing Scale: 1:20
Drawing Status	Layout ID: Tav.00

- Polyester Fiber 40 kg/m³
- Mineral wool 50 kg/m³
- Mineral wool 90 kg/m³
- Wood
- Concrete

Proaudio Consulting Srl
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Project Manager: Francesca Bianco
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info@proaudioconsulting.it
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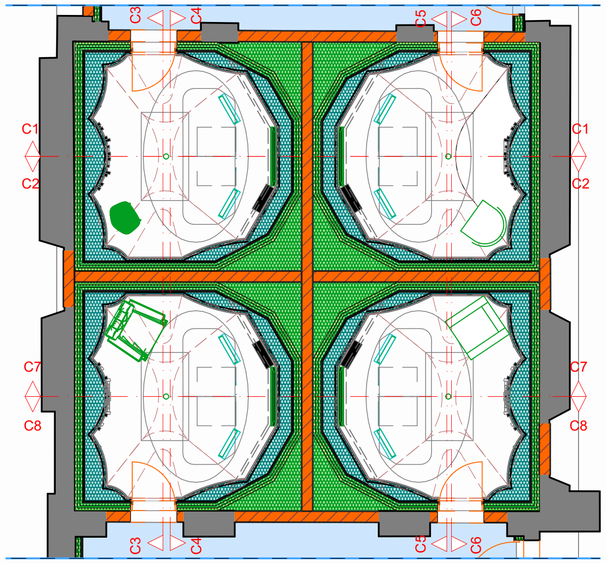
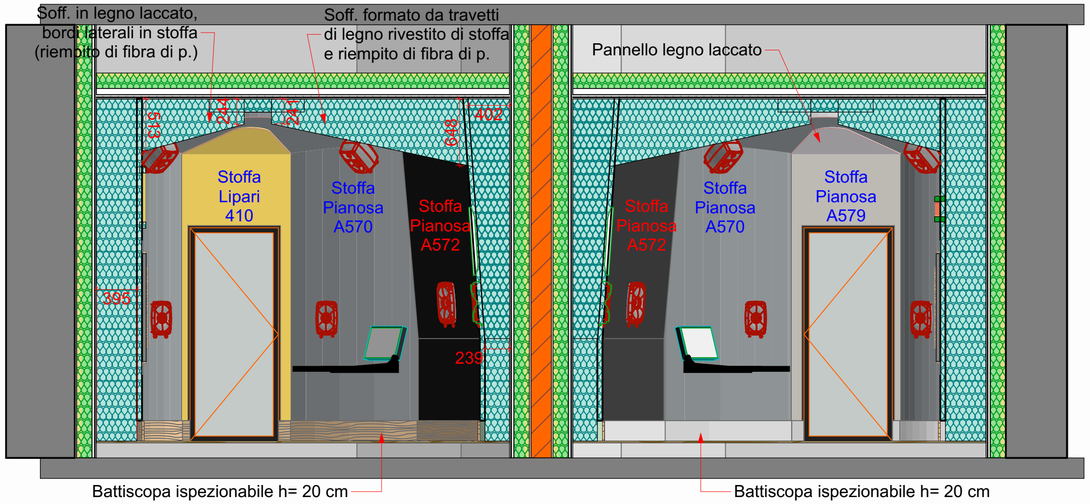
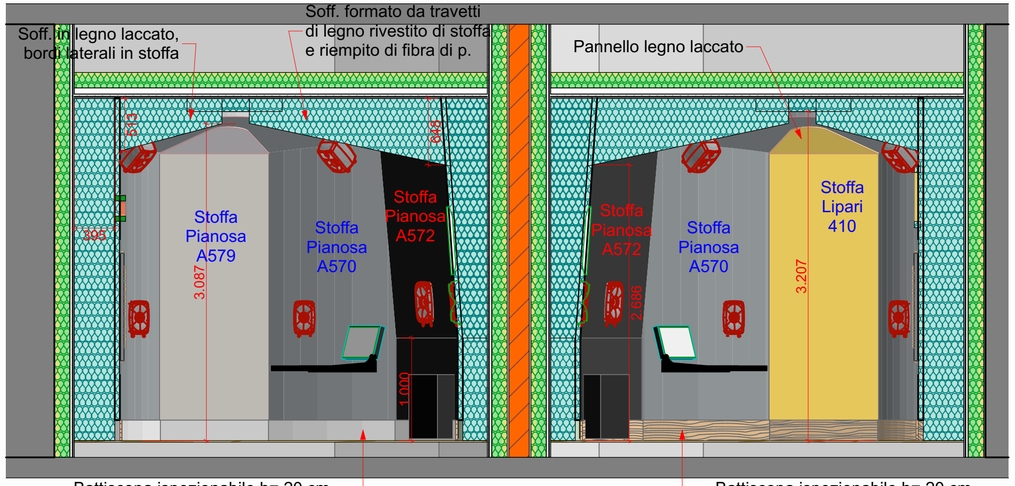


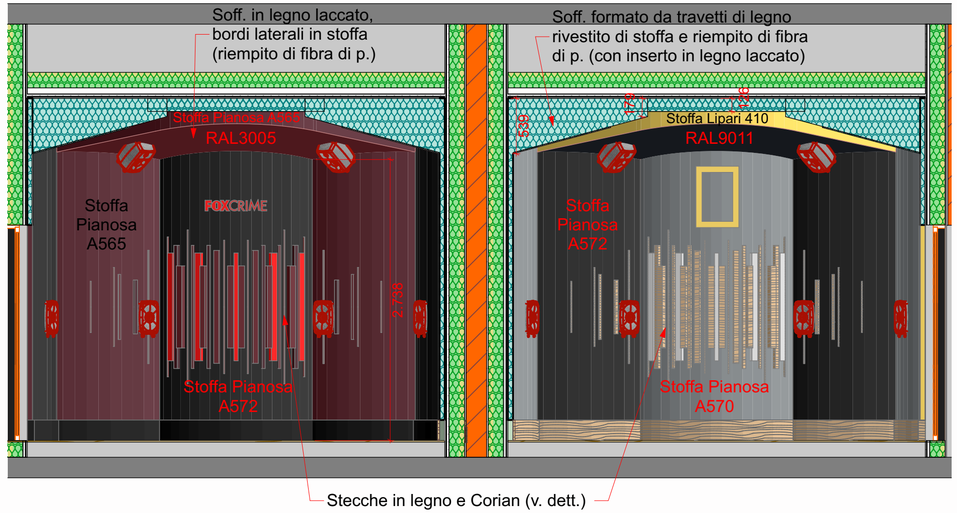
1 Control Rooms (Sezioni) 1:100



C1 Sezione 1:50



C2 Sezione 1:50



C3 Sezione 1:50

9.1.4

2018
Fox Networks IT

9.1.4 Dolby Atmos
Home Entertainment

Fox Networks Group Italia
FOX international Channels
Via Salaria 1021, Roma - Italy

Acoustic Design by:
dott. Donato Masci
Via Torricella 22/a, Impruneta (FI) - 50023 Italy - +39 335 8233579
T.C.A.A. 447/95 n.184 (FI)

ing. Cecilia Torracchi
+39.333.8628738
T.C.A.A. Reg. Toscana

Drawing Name
Control Rooms (Sezioni), Sezione

Drawing Scale
1:100, 1:50

Layout ID
Tr.07

- Polyester Fiber 40 kg/m³
- Mineral wool 50 kg/m³
- Mineral wool 90 kg/m³
- Wood
- Concrete

Proaudio Consulting Srl
Via IV Giugno 36 – 47899 Serravalle - RSM
Project Manager: Francesca Bianco
Tel. +378 0549 941536 +39 333 7020564
info@proaudioconsulting.it
www.proaudioconsulting.it

STUDIO
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The ones

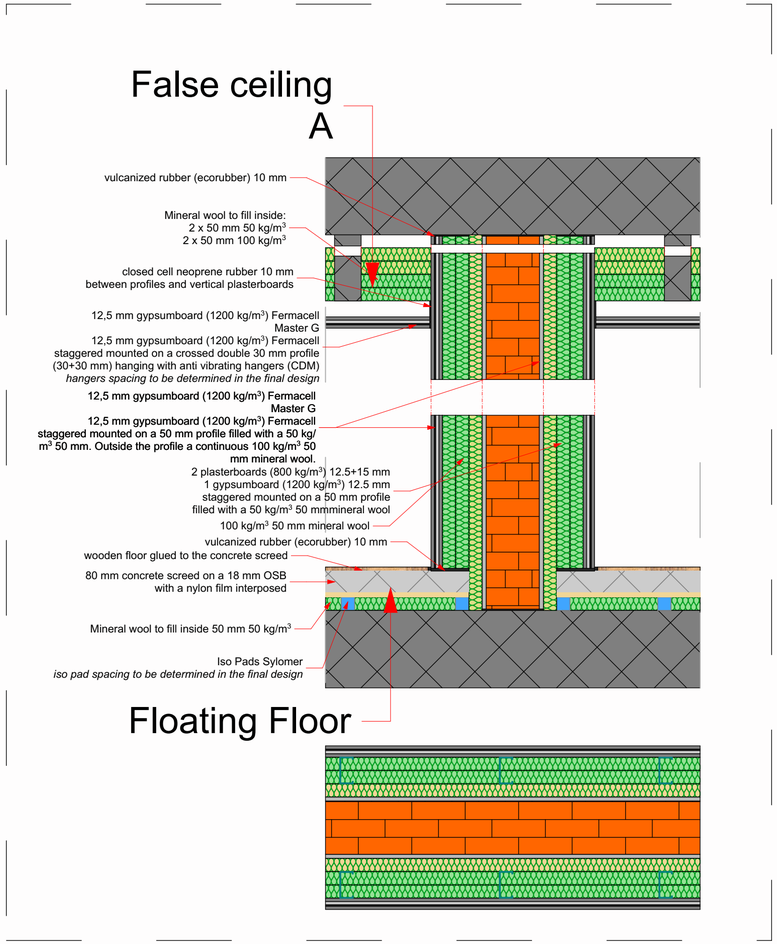
LCR 8351
Surround 8341
Ceiling 8341
Subwoofer 7370

Audio

GENELEC®

2018
Fox Networks IT

Genelec Audio System



5 Wall Type C 1:20

Sound Insulation Prediction (v8.0.3)

Program copyright Marshall Day Acoustics 2014

INSUL

Studio Sound Service - Key No. 2055

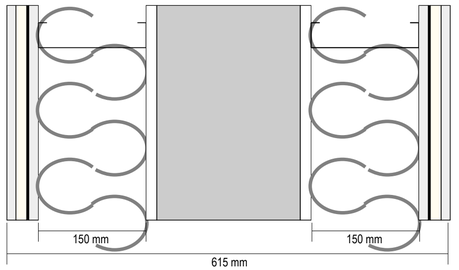
Margin of error is generally within Rw +/- 3 dB

Job Name:

Job No.: Page No.: Notes:

Date: 31 ott 17 Initials:Donato Masci

File Name: 3 lastre + 3 lane + lecablocco 20 + 3 lane + 3 lastre.ixl



Rw 79 dB
C -1 dB
C_{tr} -3 dB
D_{nTw} 81 dB [V:50m3] [A:11m2]

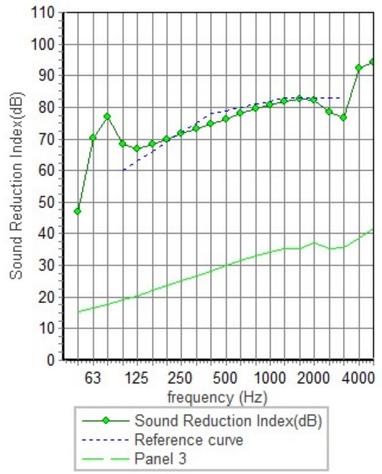
System description

Panel 1 : 1 x 12.5 mm Fermacell 12.5 (?:1150 kg/m3,E:3.8GPa,?:0.01)
+ 1 x 2.5 mm Rubber (?:920 kg/m3,E:0.03GPa,?:0.20)
+ 1 x 15.0 mm mm Plasterboard (?:710 kg/m3,E:2GPa,?:0.01)
+ 1 x 12.5 mm Fermacell 12.5 (?:1150 kg/m3,E:3.8GPa,?:0.01)

Cavity: Steel stud (0.55mm): Stud spacing 600 mm , Infill Rockwool (60kg/m3) Thickness 150 mm (?:60 kg/m3, Rf:24000 Pa.s/m2)
Panel 2 + 1 x 15.0 mm Intonaco (?:1600 kg/m3,E:8GPa,?:0.01)
+ 1 x 15.0 mm Intonaco (?:1600 kg/m3,E:8GPa,?:0.01)
+ 1 x 200.0 mm Leca murblock typ 5 (?:1200 kg/m3,E:3.8GPa,?:0.04)

Cavity: Steel stud (0.55mm): Stud spacing 600 mm , Infill Rockwool (60kg/m3) Thickness 150 mm (?:60 kg/m3, Rf:24000 Pa.s/m2)
Panel 3 + 1 x 12.5 mm Fermacell 12.5 (?:1150 kg/m3,E:3.8GPa,?:0.01)
+ 1 x 15.0 mm mm Plasterboard (?:710 kg/m3,E:2GPa,?:0.01)
+ 1 x 2.5 mm Rubber (?:920 kg/m3,E:0.03GPa,?:0.20)
+ 1 x 12.5 mm Fermacell 12.5 (?:1150 kg/m3,E:3.8GPa,?:0.01)
Mass-air-mass resonant frequency =24 Hz , 27 Hz
Panel Size 2.7x4 m; Mass 389.4 kg/m2

frequency (Hz)	R(dB)	R(dB)
50	47	
63	70	52
80	77	
100	68	
125	67	68
160	68	
200	70	
250	72	71
315	73	
400	75	
500	76	76
630	78	
800	79	
1000	81	81
1250	82	
1600	83	
2000	82	81
2500	78	
3150	77	
4000	93	81
5000	94	



STUDIO SOUND SERVICE

ISO

2018
Fox Networks IT

wall-plasterboard partition
RW=79 dB and surprisingly
47 dB @ 50 Hz

Fox Networks Group Italia FOX international Channels Via Salaria 1021, Roma - Italy	**Acoustic Design by:** **dott. Donato Masci** *Via Torricella 22/a, Impruneta (FI) - 50023 Italy* +39 335 8233579, donatomasci@gmail.com T.C.A.A. 447/95 n.184 (FI) **ing. Cecilia Torracchi** +39.333.8628738 c.torracchi@gmail.com	Drawing Name **Wall Type C, 3 lastre + 3 lane + lecablocco 20 + 3 lane + 3 lastre** Drawing Status	Drawing Scale **1:20, 1:1,23** Layout ID **A. 4**	Polyester Fiber 40 kg/m³ Mineral wool 50 kg/m³ Mineral wool 90 kg/m³ Wood Concrete	**Proaudio Consulting Srl** *Via IV Giugno 36 – 47899 Serravalle - RSM* Project Manager: Francesca Bianco Tel. +378 0549 941536 +39 333 7020564 info@proaudioconsulting.it www.proaudioconsulting.it

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Bel design italiano.

1945 - 1965: Bel Design italiano

Since 1948, as noted by François Burkhardt (2011 International Golden Compass Award):
«The intellectuals lost the battle with the elections of 1948, and with them the possibility of a change in land laws and a reorganization of the community, the architects shifted their attention to the object itself, which then became a bearer of meaning and orientation.»

It is from this year that Made in Italy begins to know its success internationally.

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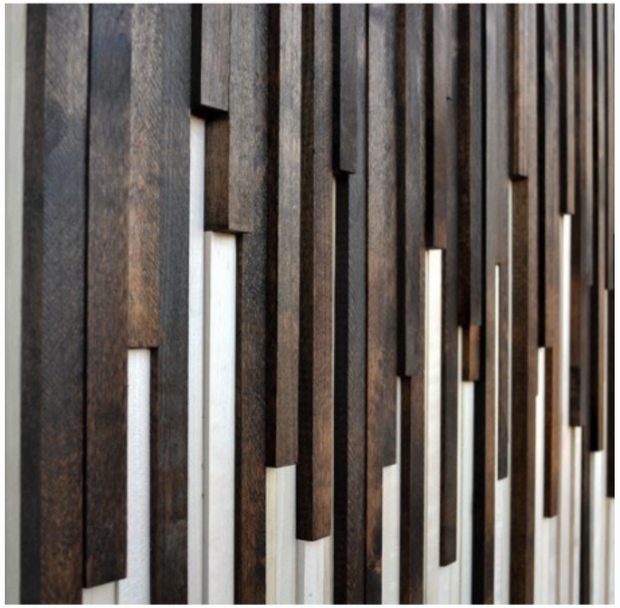
Combining with the style of the facility.



Collaboration with the FOX design team for the complete integration of our ideas in the context of offices.

Moadboard
Chromatic research, color palette
Lighting research
Branding
Complements
Finishes

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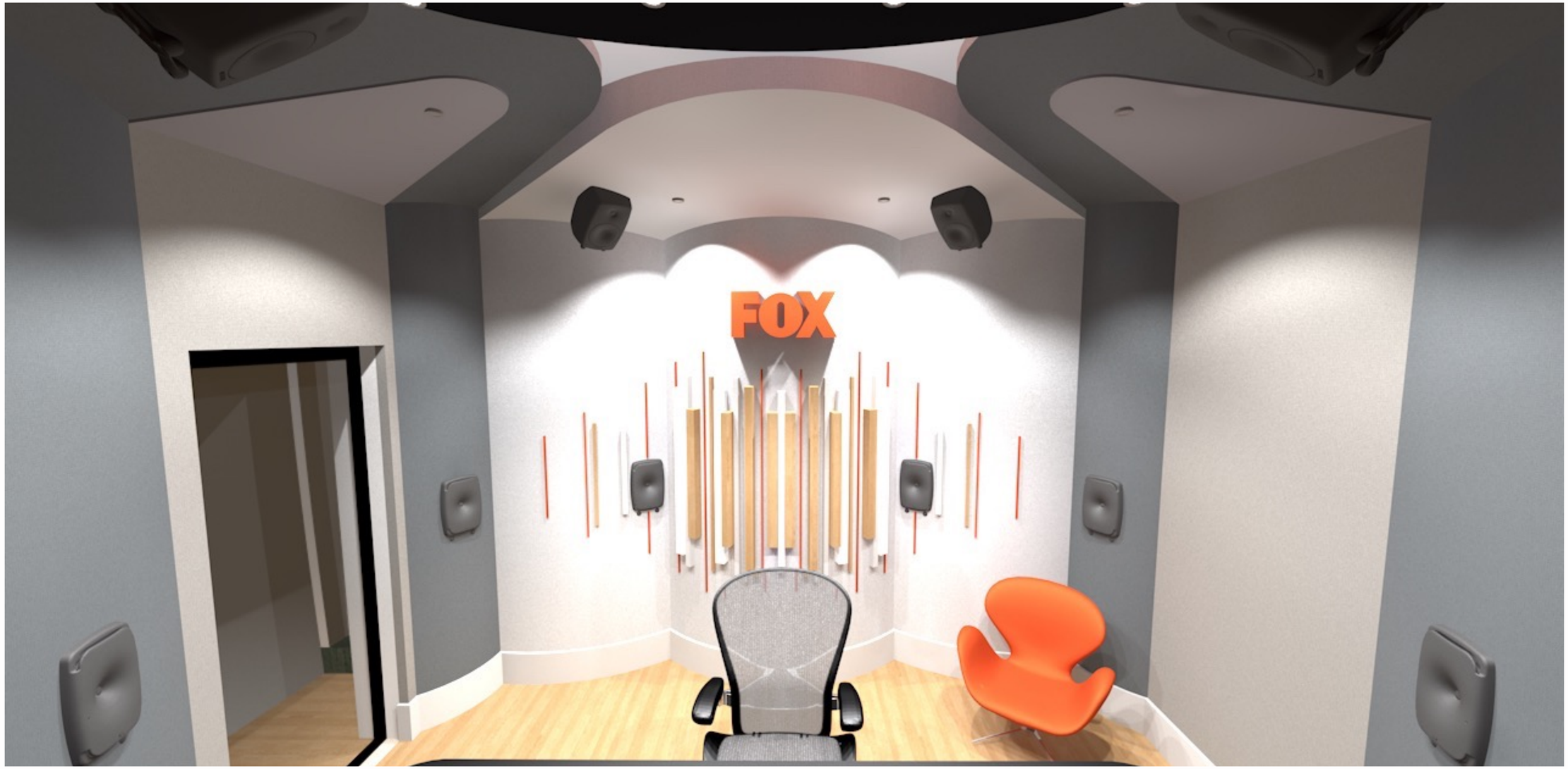


Fox Core

Fox Core

Fox Core

STUDIO
SOUND
SERVICE

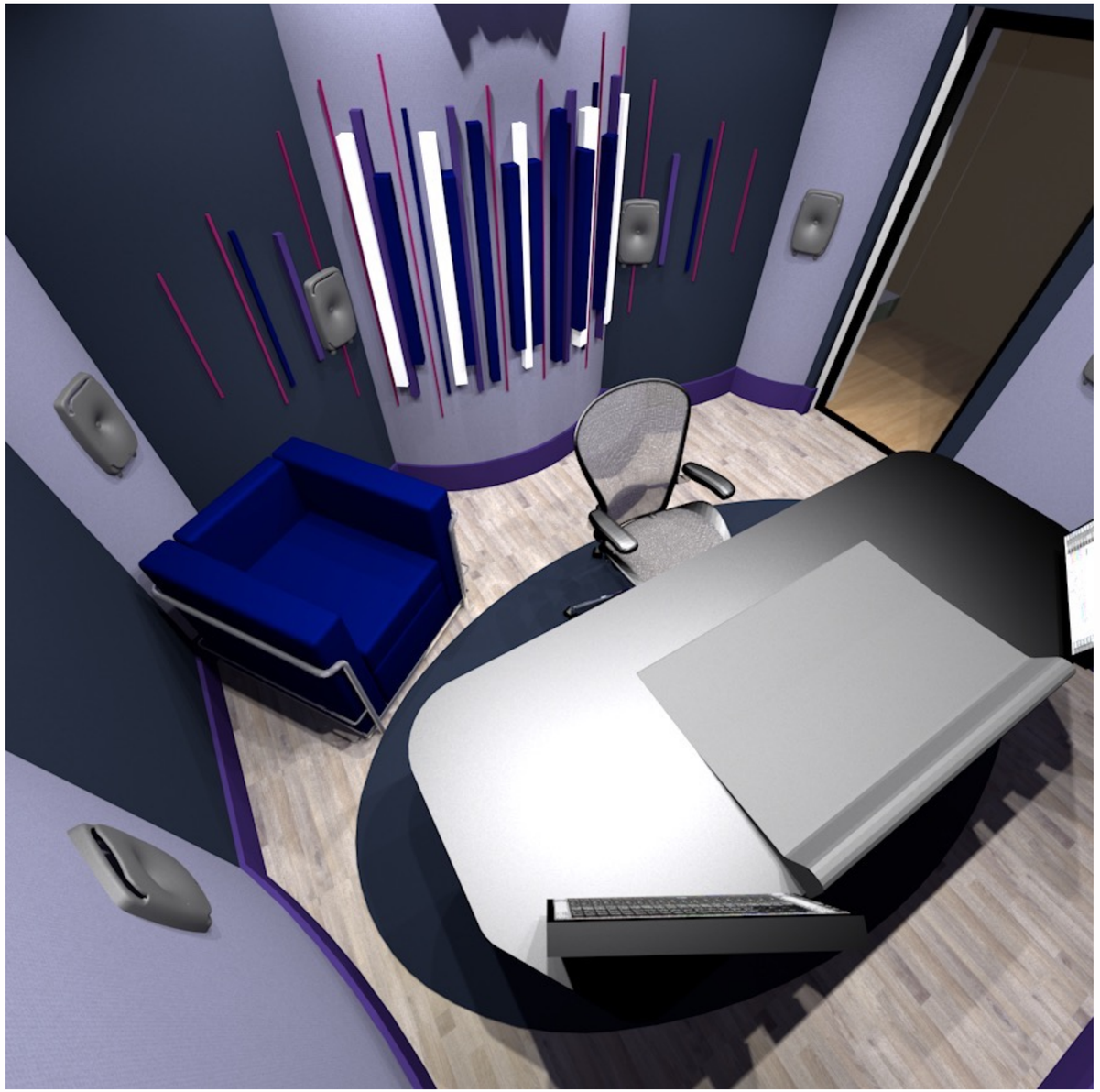
Fox Crime

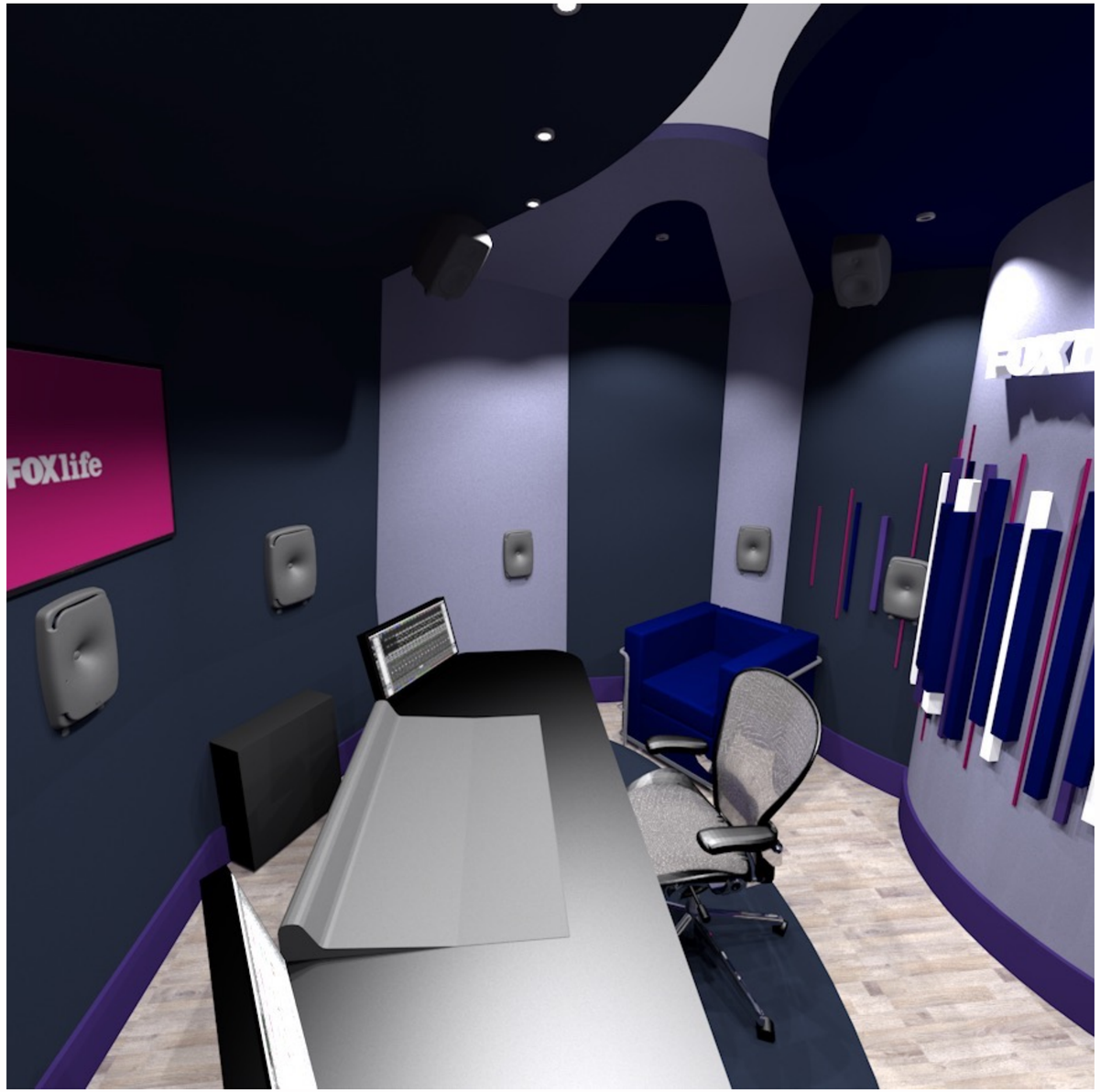
Fox Crime

Fox Crime

STUDIO
SOUND
SERVICE

Fox Life





Fox Life

Fox Life

STUDIO
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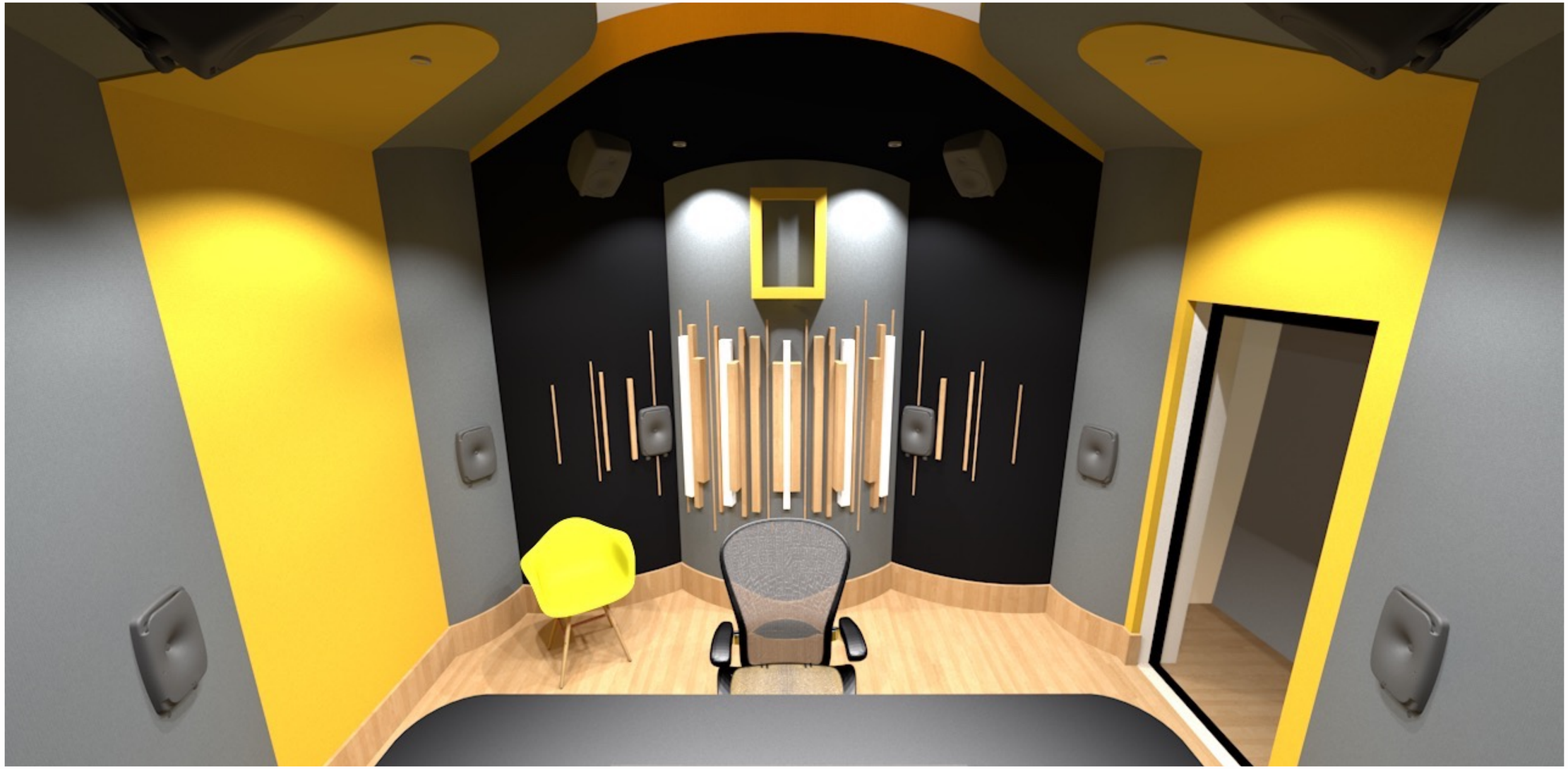
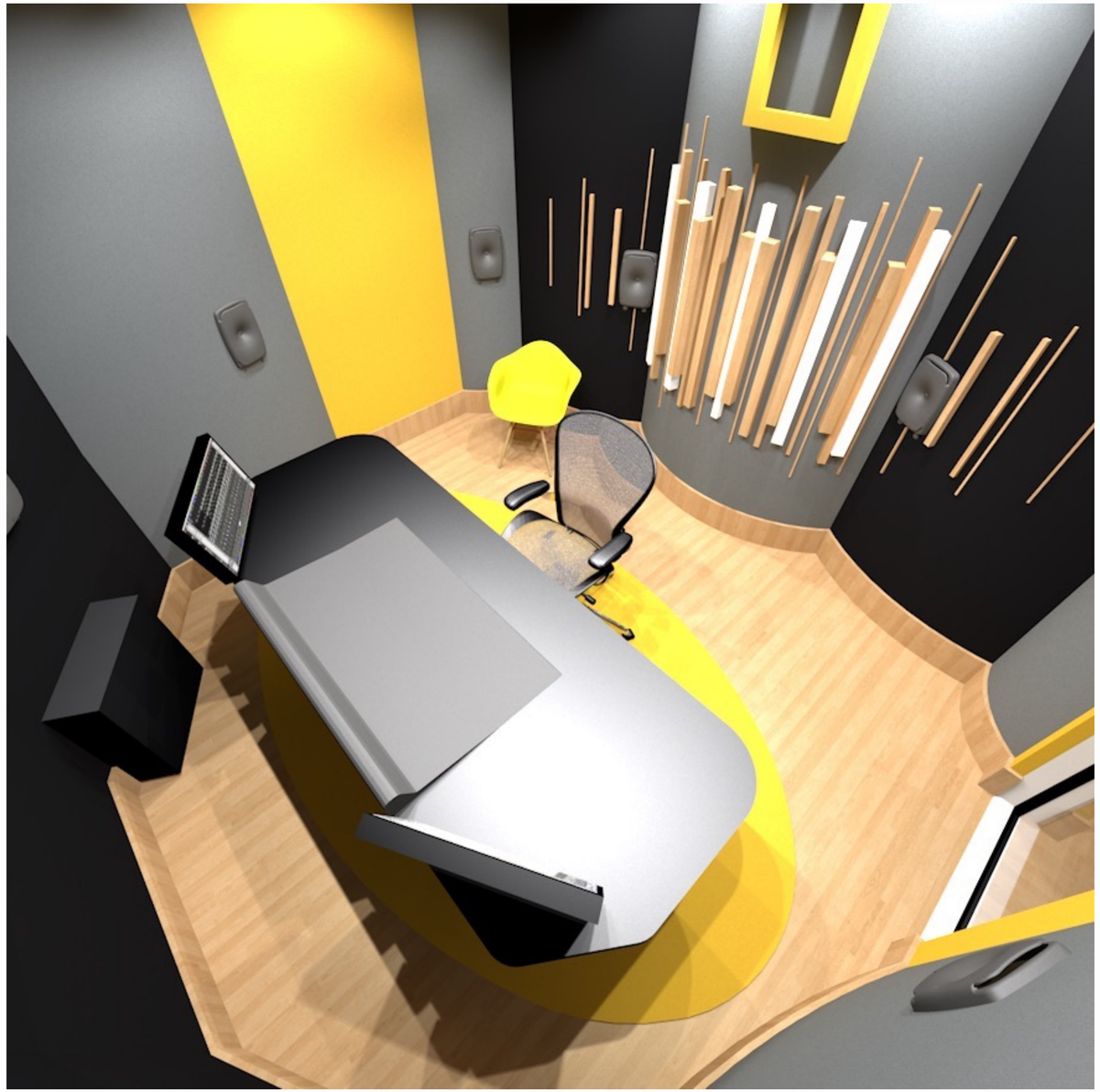


Nat Geo



Nat Geo

Nat Geo

STUDIO
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SERVICE

Iso-Booth 1

Iso-Booth 1

Iso-Booth 1

STUDIO
SOUND
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Conclusions

Problems found in practice about Dolby Home Entertainment design:

basic rules of acoustics might apply to every kind of control room, but issues arise depending on the required integration between audio and video

A. **Door position:**
if the surrounds have to be at about 120÷150 cm height, the door position is a problem (this was not a problem for cinema mixing room because the surrounds are generally higher).

B. **TV LCD vs. Projection screen:**
how to integrate front speakers with the screens?
upper or lower?
side within the image or outside of it?

C. **1/3 or 2/3 of the room length?**
these points came from the room acoustics (better room modes distribution), but the choice depends also on room functionality:

—> 1/3 music studios (also soundtrack composers)
—> 2/3 only mixing (cinema & broadcast)

Conclusions:

A. Standard have been consolidated with respect to technology innovation and the relative change in public audience expectations and competence.

B. Multichannel and immersive audio:

- too many speakers for home!!! soundbar and up-firing speakers are a good solution for the consumer, calibration needed (!)

- up-firing vs down-firing:
  up-firing —> sustained ambiance feeling
  down-firing —> precise origin of sound

  —> *different up-firing and down-firing studios to mix and master the contents?*

Open Questions:

A. What consumer shall expect from industry in coming years?

B. Is the immersive/multichannel audio only for Cinema and TV?

C. Is the Music Industry able/interested to follow?

… if not, will the audio production be different between music and general motion picture application?

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Thank you!

PDF Presentation Download

studiosoundservice.com/en/education

Contacts

info@studiosoundservice.com

studiosoundservice.com

Bibliography

- D. Masci, A. V. Mäkivirta,
"Small multichannel control rooms for broadcast",
Resolution sup. "Small room acoustics" 2015/04;
- D. Masci,
"Myths and facts about studio acoustics - part I,
Auto-Calibration", Resolution, 2014/03;
- D. Masci,
"Myths and facts about studio acoustics - part II,
Monitors in a room", Resolution, 2014/04;
- D. Masci,
"Myths and facts about studio acoustics - part III",
Resolution, 2014/05
- Floyd Toole - Sound Reproduction - Loudspeakers and Rooms;
- SMPTE ST 202:2010 - SMPTE Standard - Motion-Pictures — Dubbing Theaters, Review Rooms and Indoor Theaters — B-Chain Electroacoustic Response
- ITU-R BS 775-3 "Multichannel stereophonic sound system with and without accompanying picture" (Geneva, 2012)
- ITU-R BS 1116-1 "Methods for the subjective assessment of small impairments in audio systems including multichannel sound systems" (Geneva, 1994-97)
- ITU-R BS.2159-7 "Multichannel sound technology in home and broadcasting applications"
- AESTD1001.1.01-10 "Multichannel surround sound systems and operations"
- SMPTE RP-173, "Loudspeaker placements for audio monitoring in high definition electronic production," Rec., SMPTE N 15.04/152-300B, Society of Motion Picture and Television Engineers (1991)
- EBU Tech 3276-E "Listening conditions for the assessment of sound programme material"(2004)
- Dolby Atmos® Home Entertainment Professional Monitoring Guidelines Version 0.8
(White Paper)
- DARDT (Dolby Atmos® Room Design Tool)
- Dolby Atmos® Cinema Technical Guidelines
(White Paper)
- Dolby Atmos® Next-Generation Audio for Cinema
(White Paper)
- Dolby Atmos® Specification
(issue 3)
- Dolby Atmos® Home Theater Installation Guidelines
- Dolby® CP750 Digital Cinema Processor Manual
(issue 5)
- Dolby Atmos® Cinema Processor CP850 Manual
(issue 2)