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Donato Masci
Acoustic Designer & Consultant

04 / 02
— 2019

Acoustic Design for Broadcasting next Generation Audio

Dolby Atmos Design, Home Entertainment

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Who we are

Who we are

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

- FOX Dolby Atmos HE Studios @ Rome (IT);
- FOX post-production studios @ Münich (DE);
- FOX post-production studios @ London (UK);
- In House (Dolby® approved – Sorrentino) @ Roma;
- Aemme Recording Studio – Salvatore Addeo @ Lecco
- D:POT Recording Arts @ Prato – Fabrizio Simoncioni;
- Platinum Studio @ San Gimignano – Diego Calvetti;
- 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);*
- Waves Music @ Genova;
- PPG Studios (Andrea Bocelli) @ S. Pietro Belvedere (PI);
- SonicFab Studio @ Pioltello (MI);
- Renato Zero Studio @ Rome;
- Marco Masini Studio @ Florence;
- Damian Lazarus, Monastic Studio @ Vicchio (FI);
- Giorgia Angiuli Studio @ Florence;
- Vinai Studio @ Brescia;
- Barys Arena (ice hockey) @ Astana, Kazakhstan;
- George Lucas Home Theater, Italy;
- Chiesa Santa Maria Nuova (Arch. M. Botta) @ Terranuova B. (AR);
- Prada Auditorium and Conference Room via Orobia @ Milano;
- Presentation room Ferrari HQ @ Maranello (MO);
- Duomo di Siena new audio system;
- Siemens HQ @ Milano;
- EVAC Dubai Metro;
- EVAC Bahrain and Islamabad airport (THALES).

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Audio Facilities

Bagnoli bros. studio

Castelnovo ne' Monti — RE

Vinai

Brescia

SonicFab

Pioltello (MI)

Renato Zero

Roma

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Casi studio

a/v post-production studios

Fox - NatGeo

Hammersmith, London UK

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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Dolby Atmos

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.

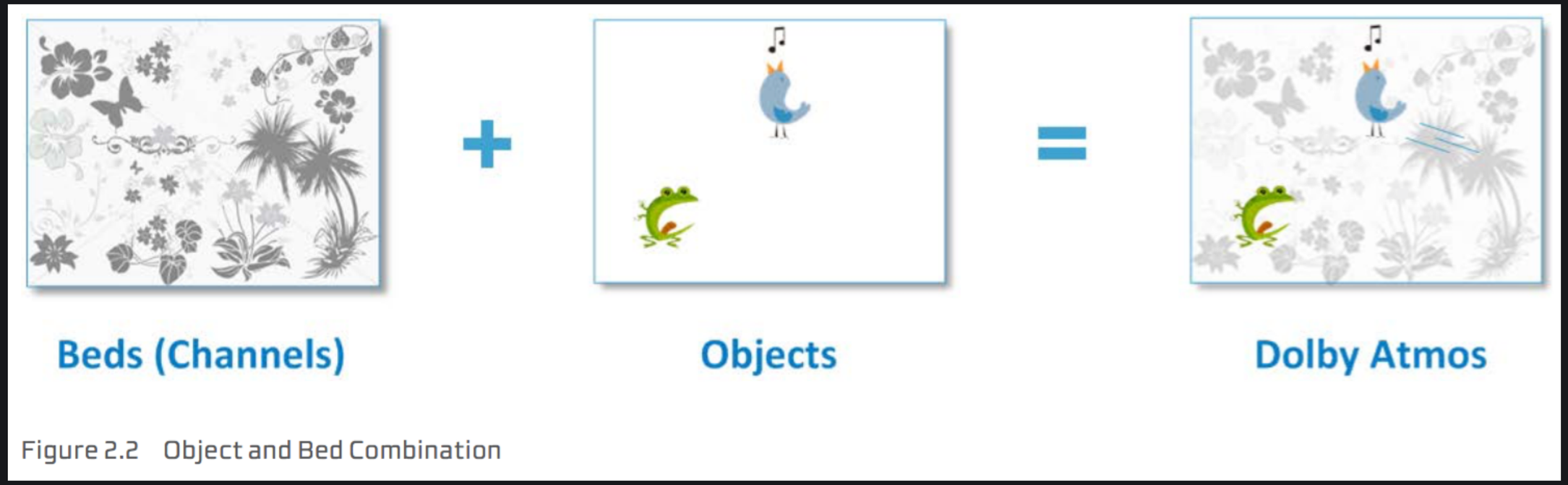
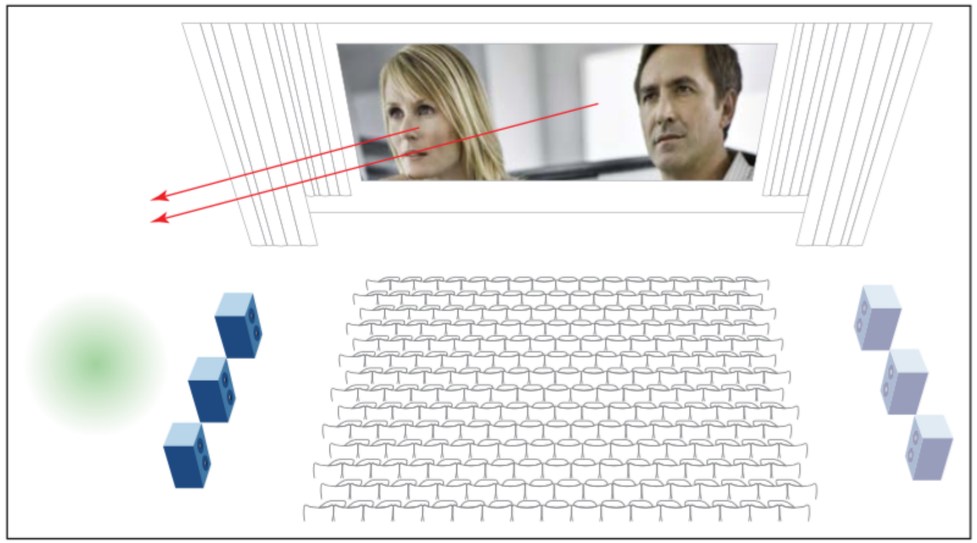


Figure 2.2 Object and Bed Combination



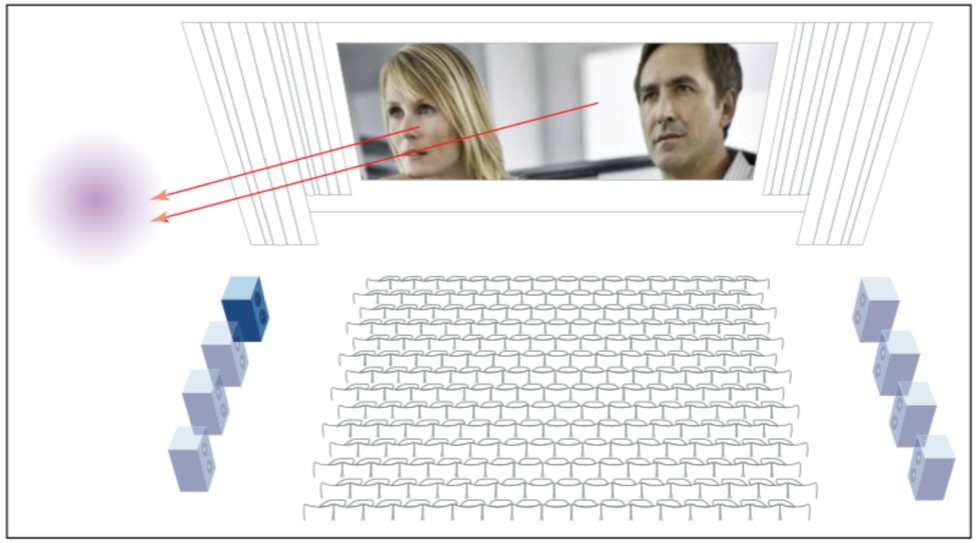


Figure 2.1 Benefits of Increased Surround Resolution for Audio/Visual Coherence

Audio Objects:

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

location (x, y, z), not speaker!

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.

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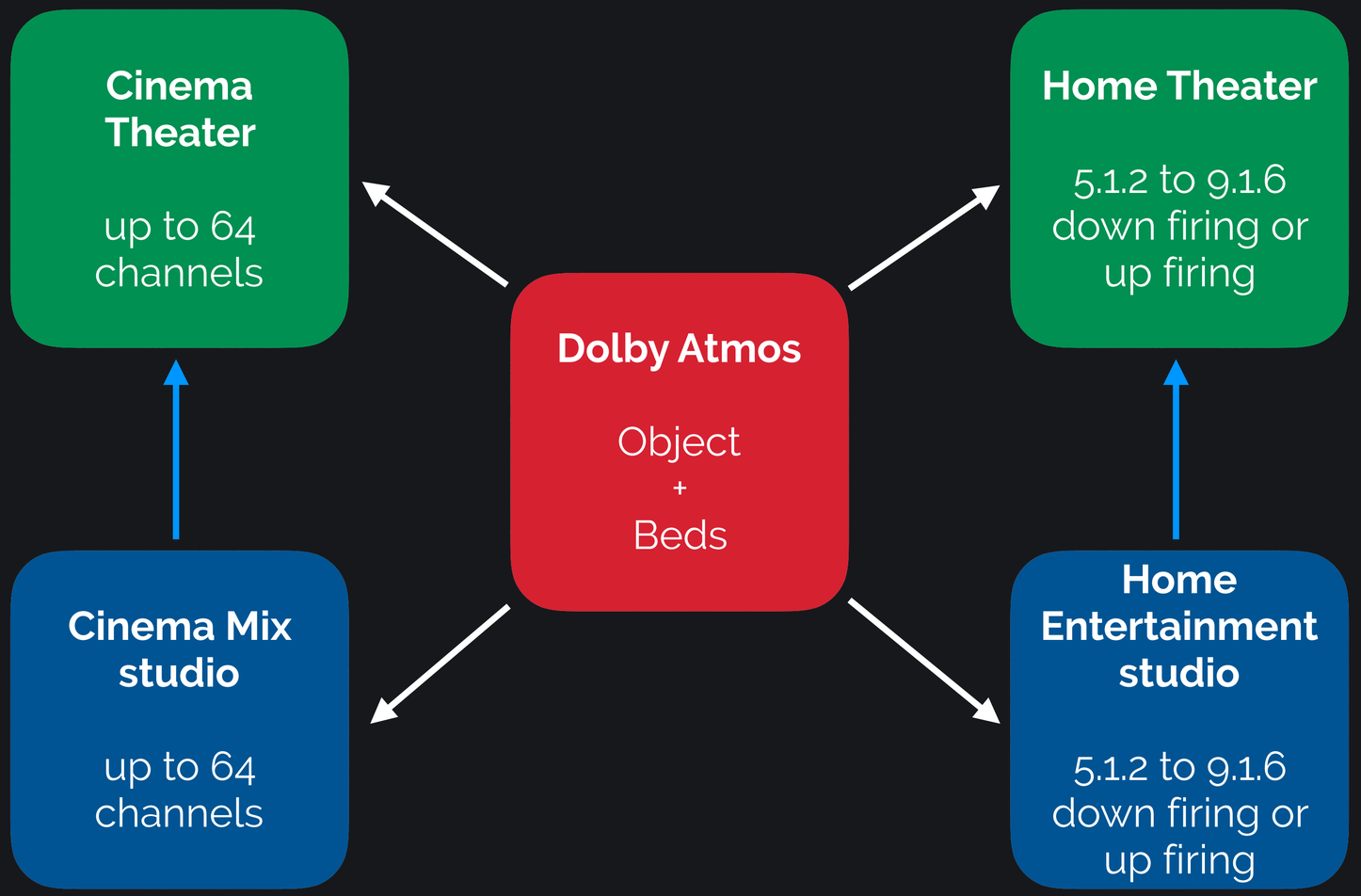
Interaction between Dolby Atmos configs.



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.

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Dolby Atmos – Recommended Speaker Location – Theatre

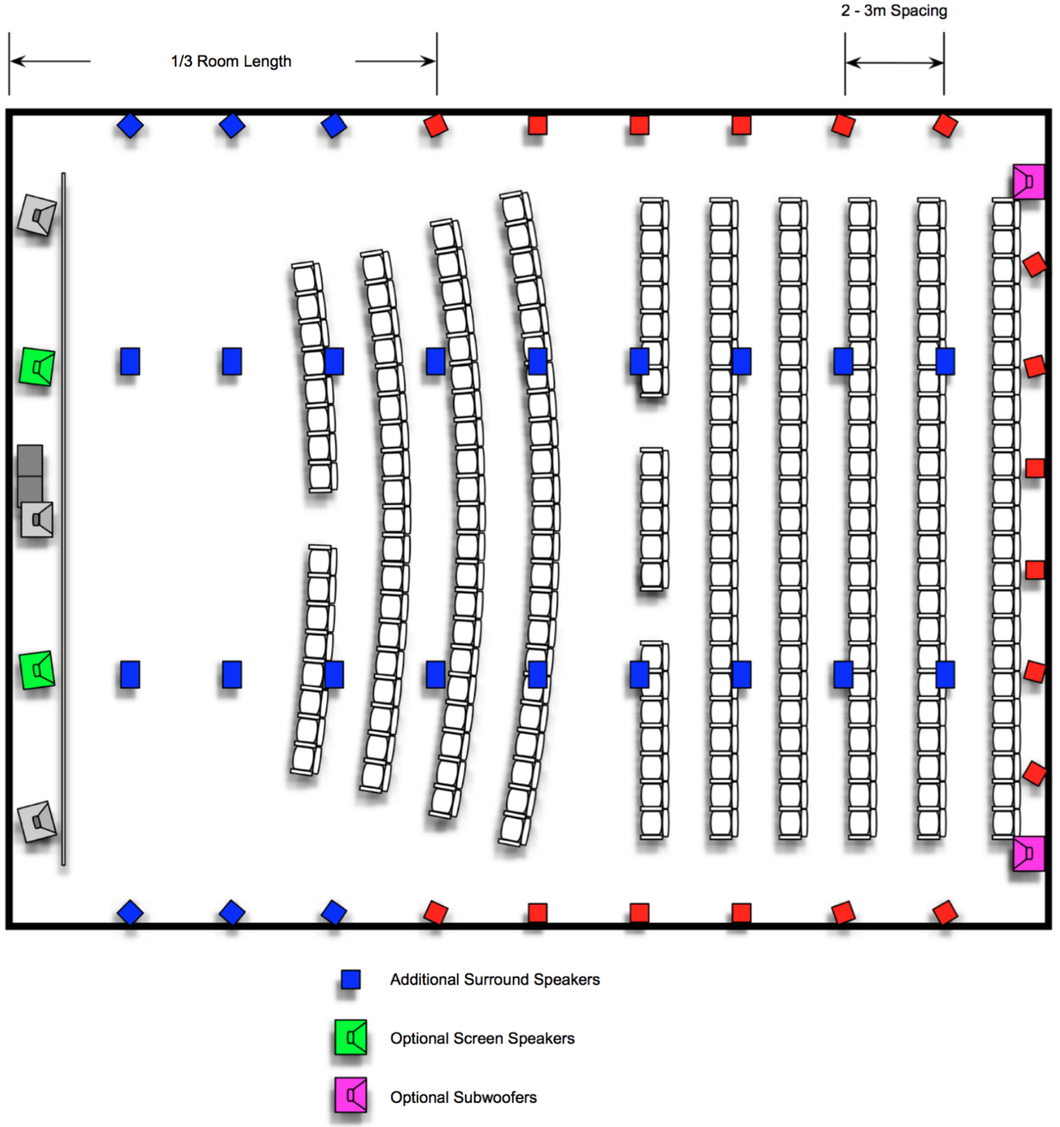

Figure 5.1 Recommended Speaker Locations

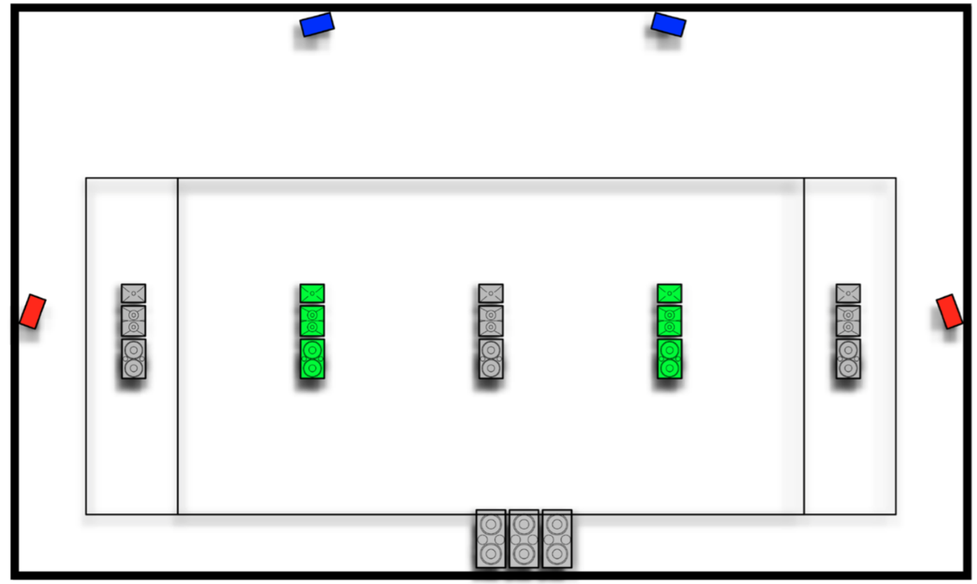

Figure 5.2 Recommended Speaker Locations (Screen, Side Surrounds, and Top Surrounds)

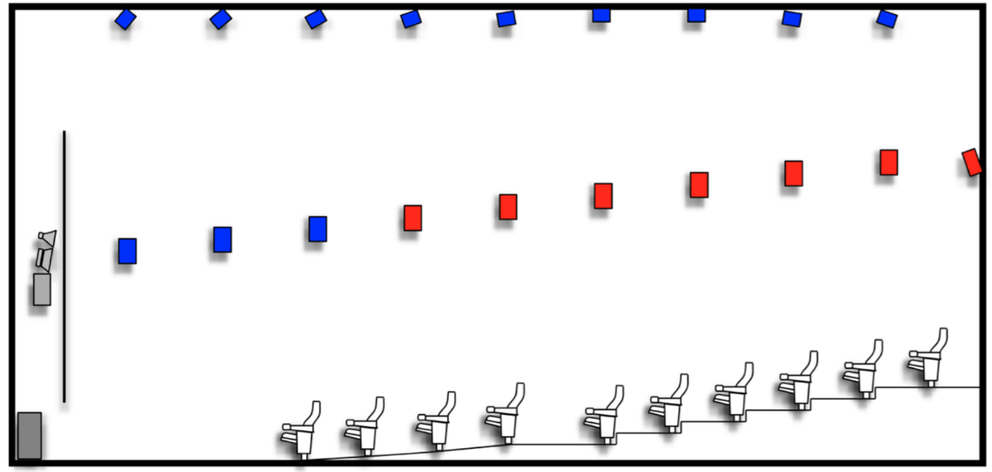

Figure 5.3 Recommended Side Wall and Ceiling Speaker Locations

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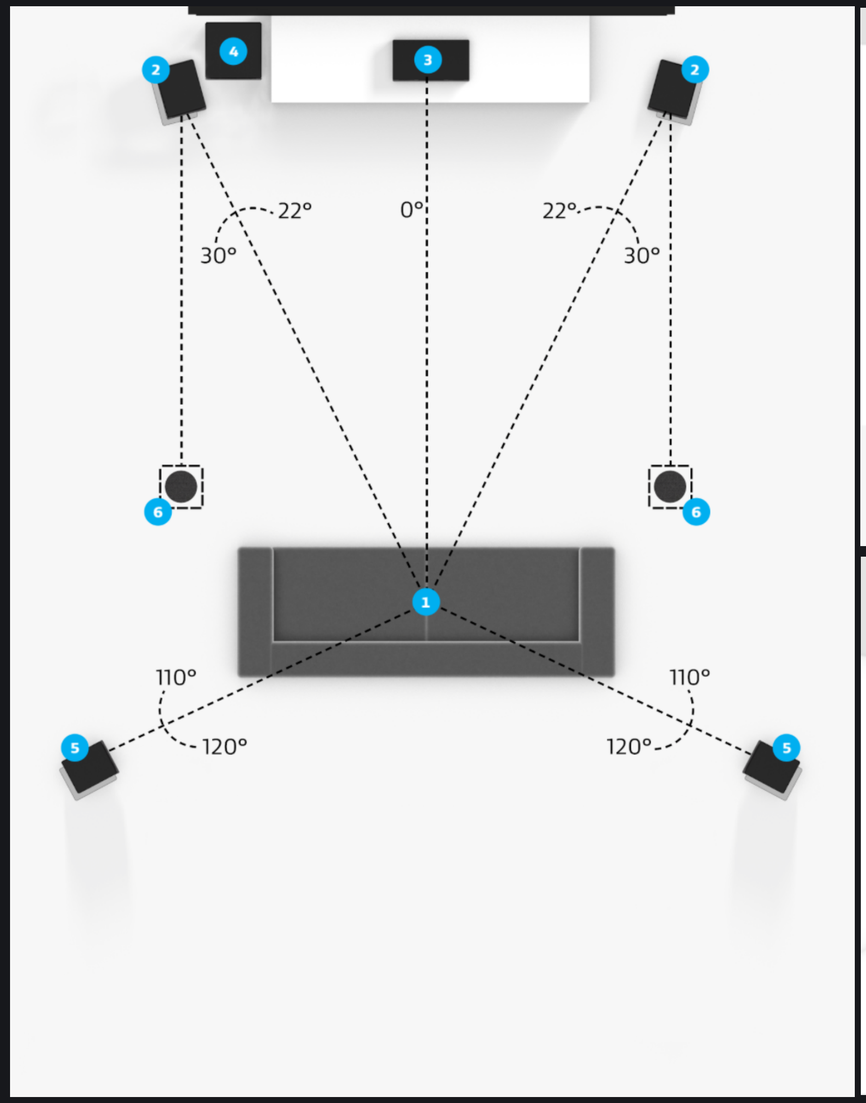
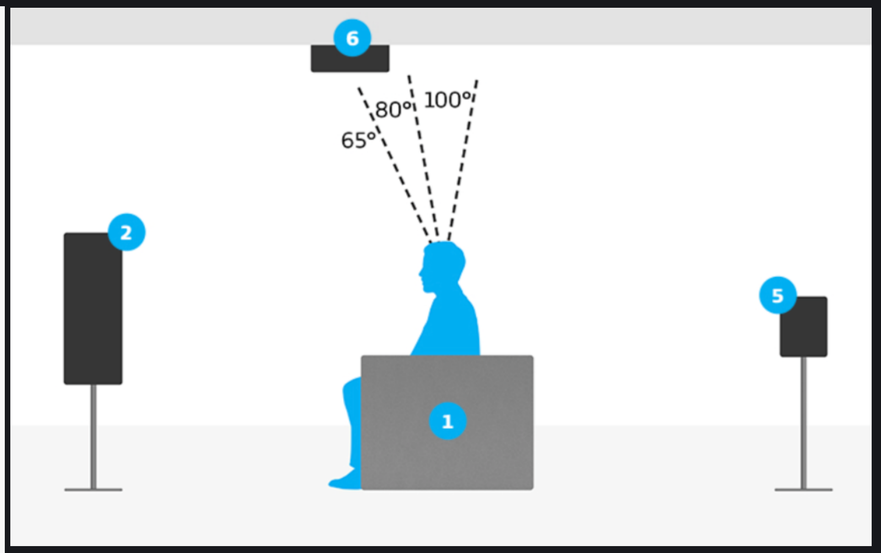
Dolby Atmos – Recommended Speaker Location – Home Theatre

Home Theater 5.1.2 down-firing





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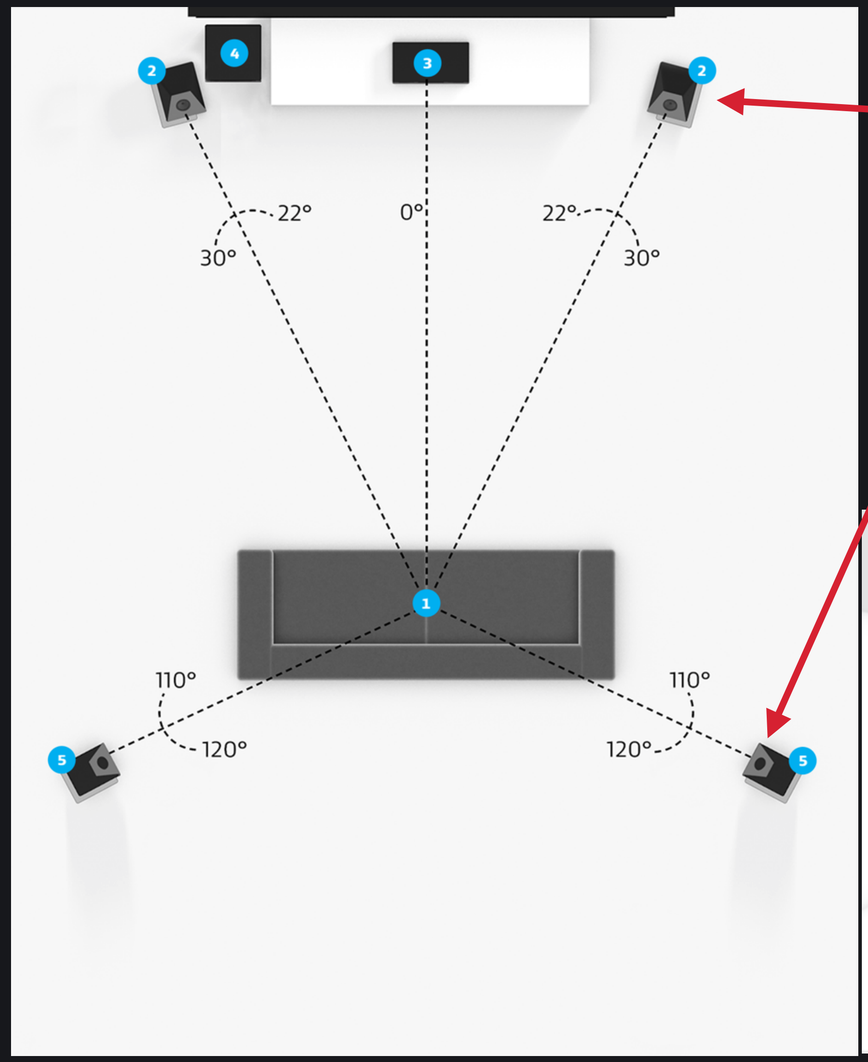
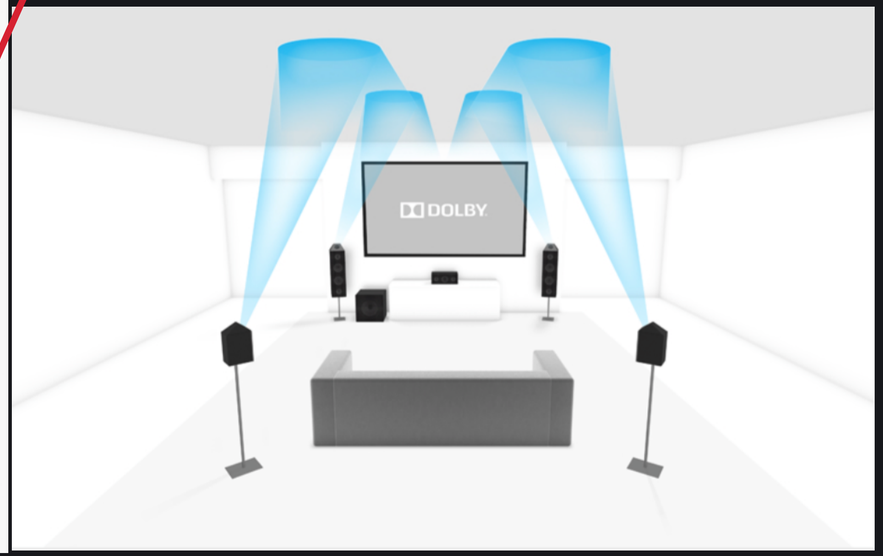
Dolby Atmos – Recommended Speaker Location – Home Theatre

Home Theater 5.1.4 up-firing



Atmos enabled surround speakers (up-firing)



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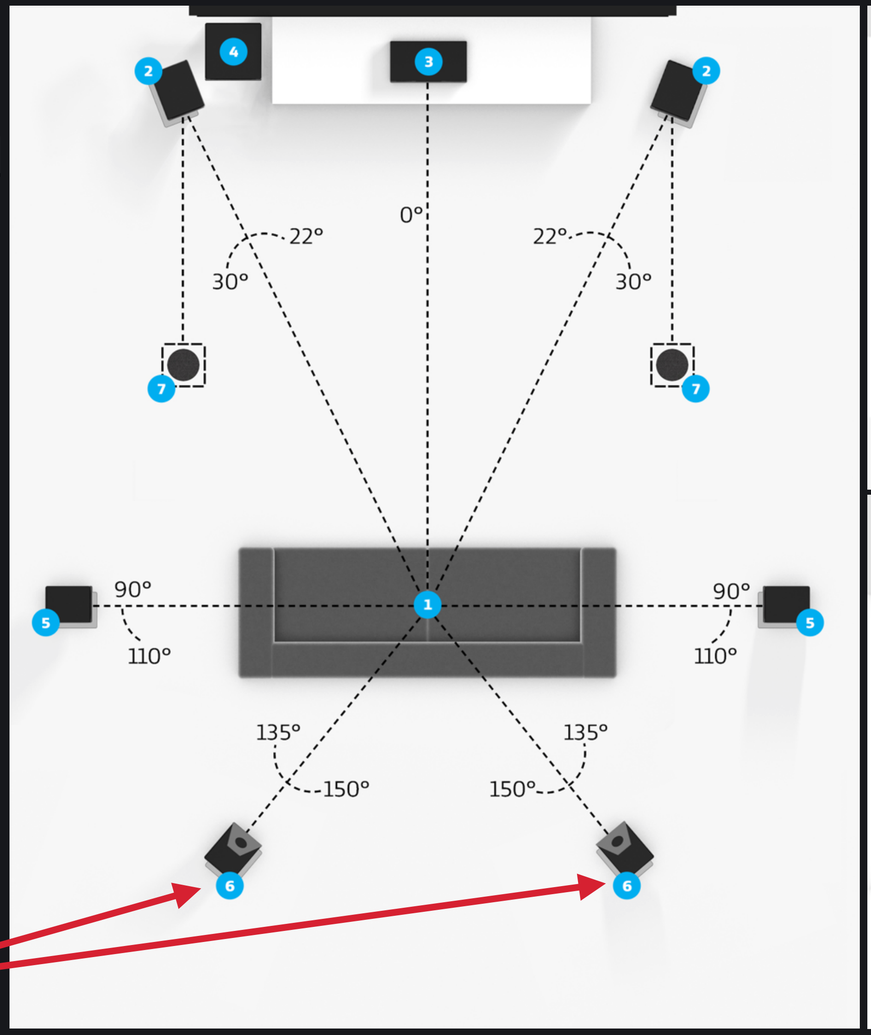
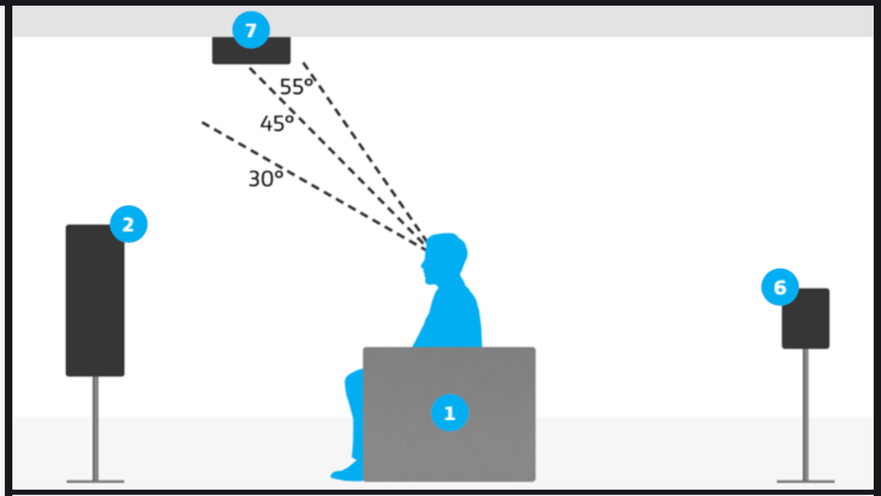
Dolby Atmos – Recommended Speaker Location – Home Theatre

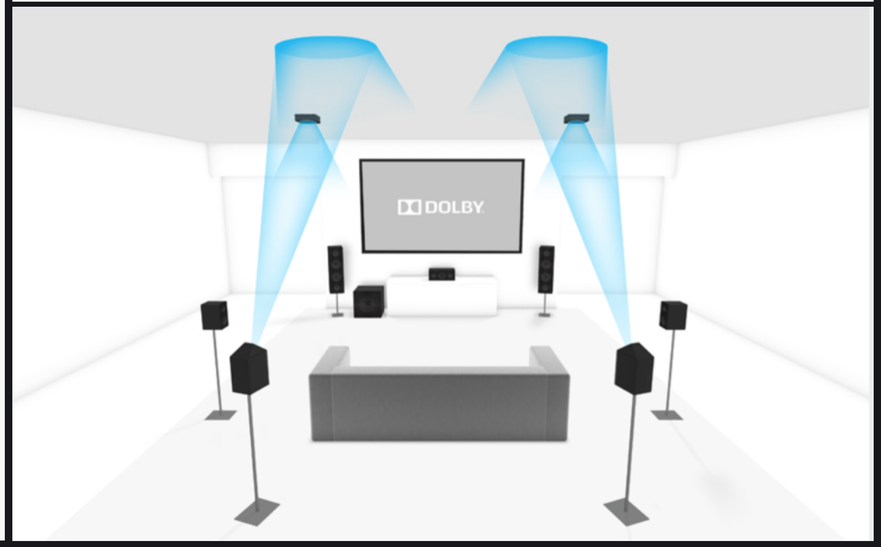
Home Theater
7.1.4
Hybrid overhead

front down-firing
back up-firing

Atmos enabled
surround speakers
(up-firing)







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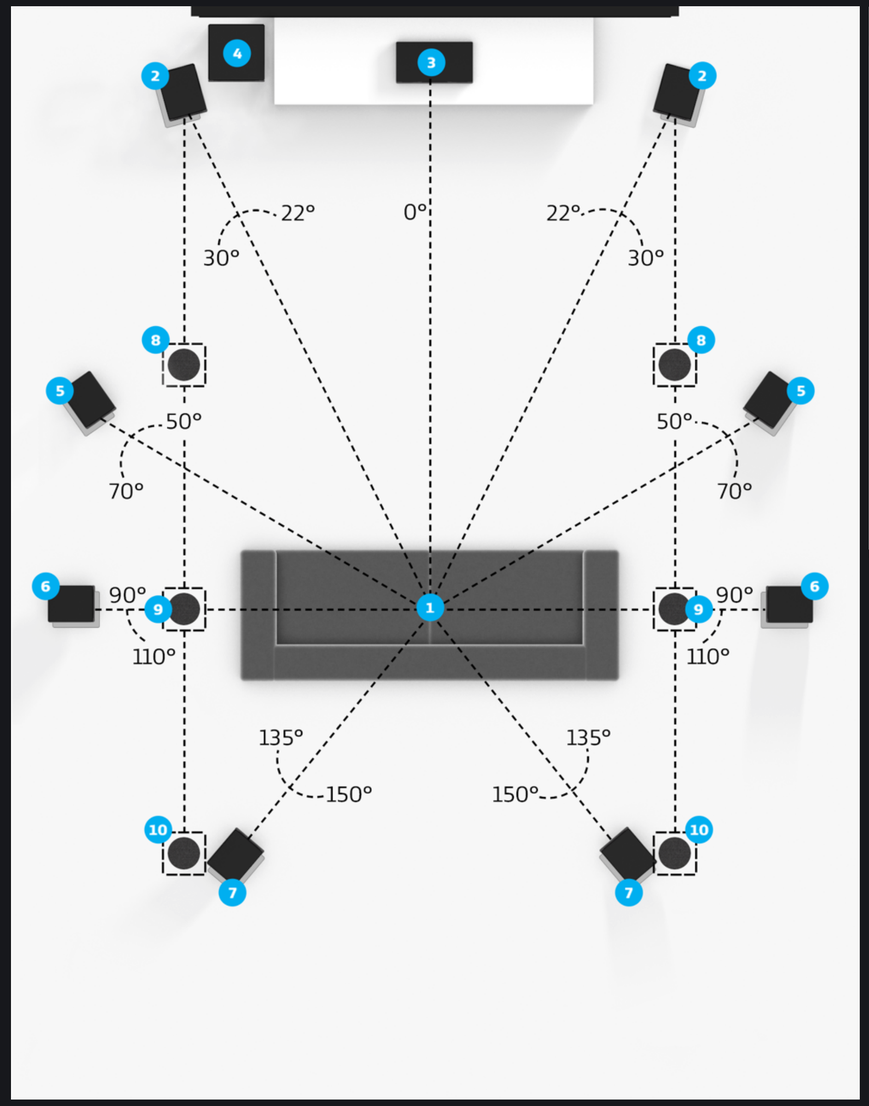
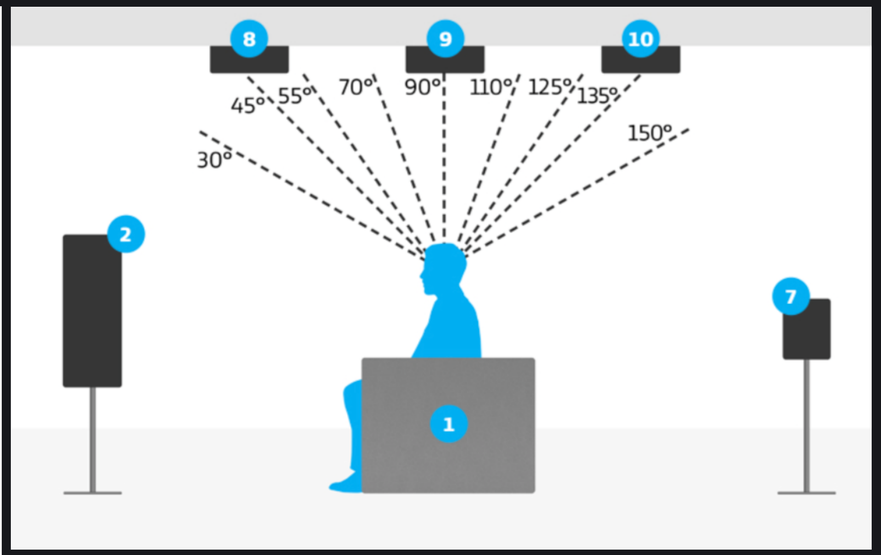
Dolby Atmos – Recommended Speaker Location – Home Theatre

Home Theater 9.1.6 down-firing





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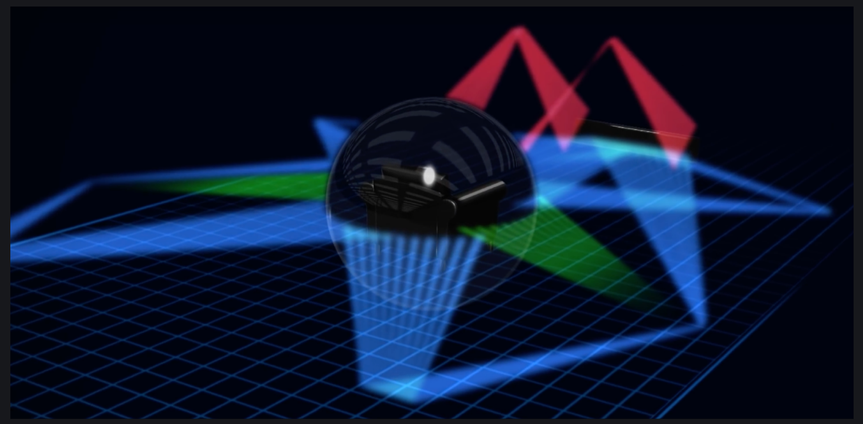
Dolby Atmos – Recommended Speaker Location – Home Theatre

Home Theater
Atmos Soundbar

Atmos enabled
surround speakers
arrays
(up-firing)



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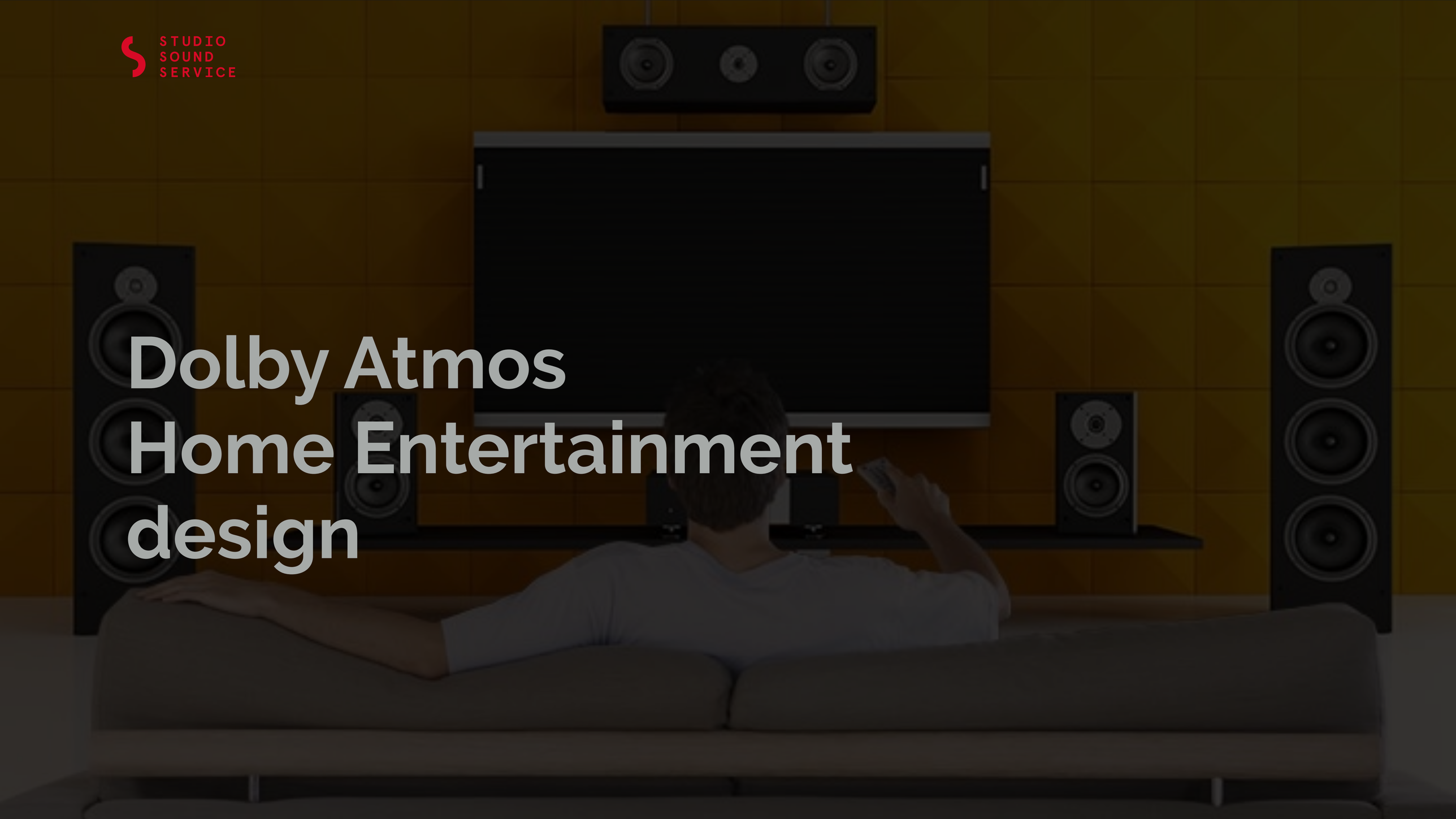


Dolby Atmos Home Entertainment design

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.

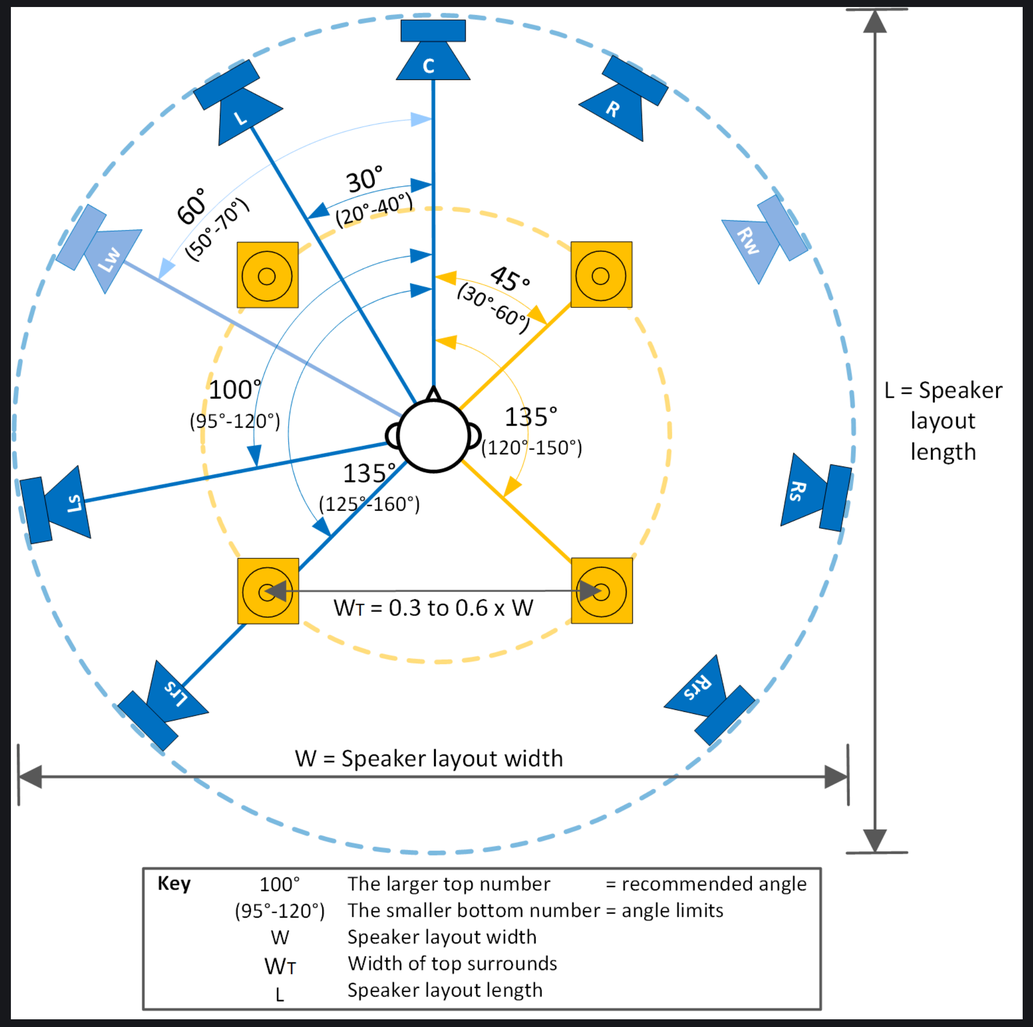
C. If you use up-firing speakers, ceiling must be reflective.

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

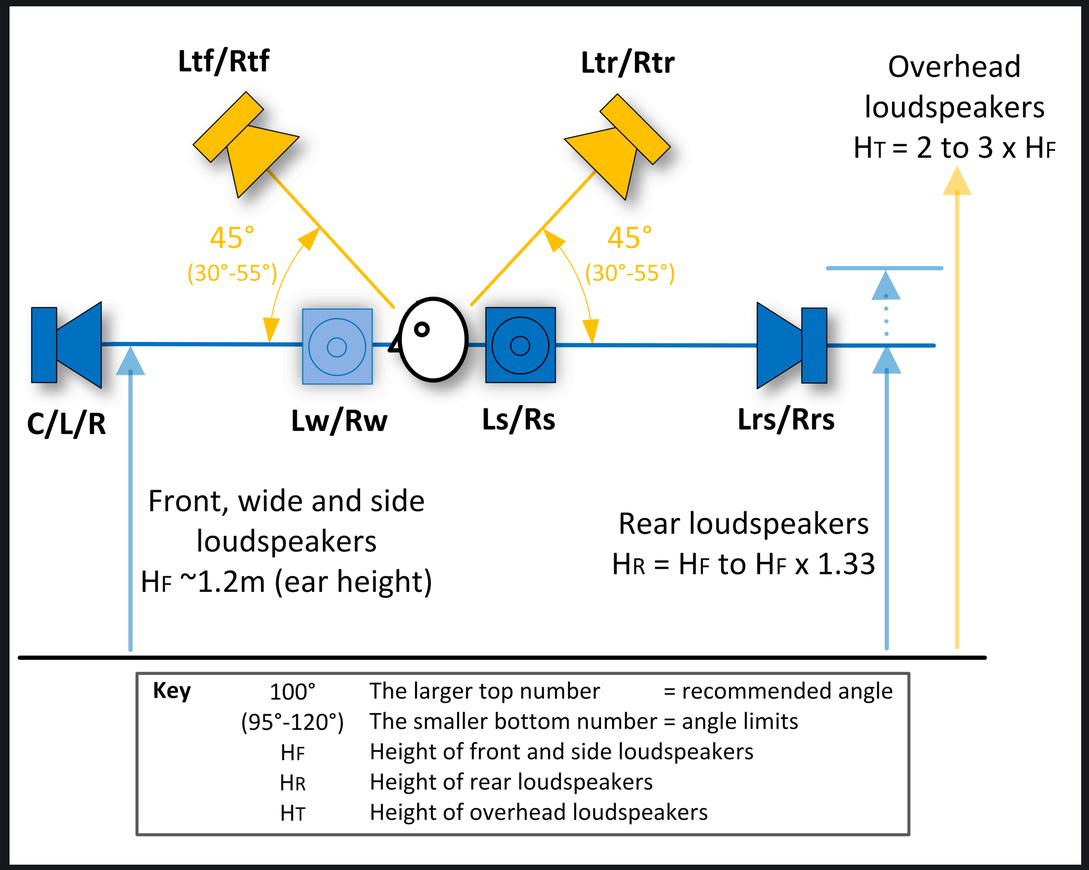


ITU standards are closer to the consumer experience so Dolby uses them for HE arrangement

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

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Case studies

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FOX UK

2015
Fox Networks UK

2 Control room
1 Vocal Booth
1 Sala Post AVID

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Nat Geo

2015
Fox Networks UK

National Geographic control room
branded

STUDIO
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Vocal

2015
Fox Networks UK

…con il Vocal-Booth sulla destra

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FOX

2015
Fox Networks UK

Fox Branded
ha il Vocal-Booth a sinistra

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CHALLENGE

2015
Fox Networks UK

A challenge:
little space and proximity

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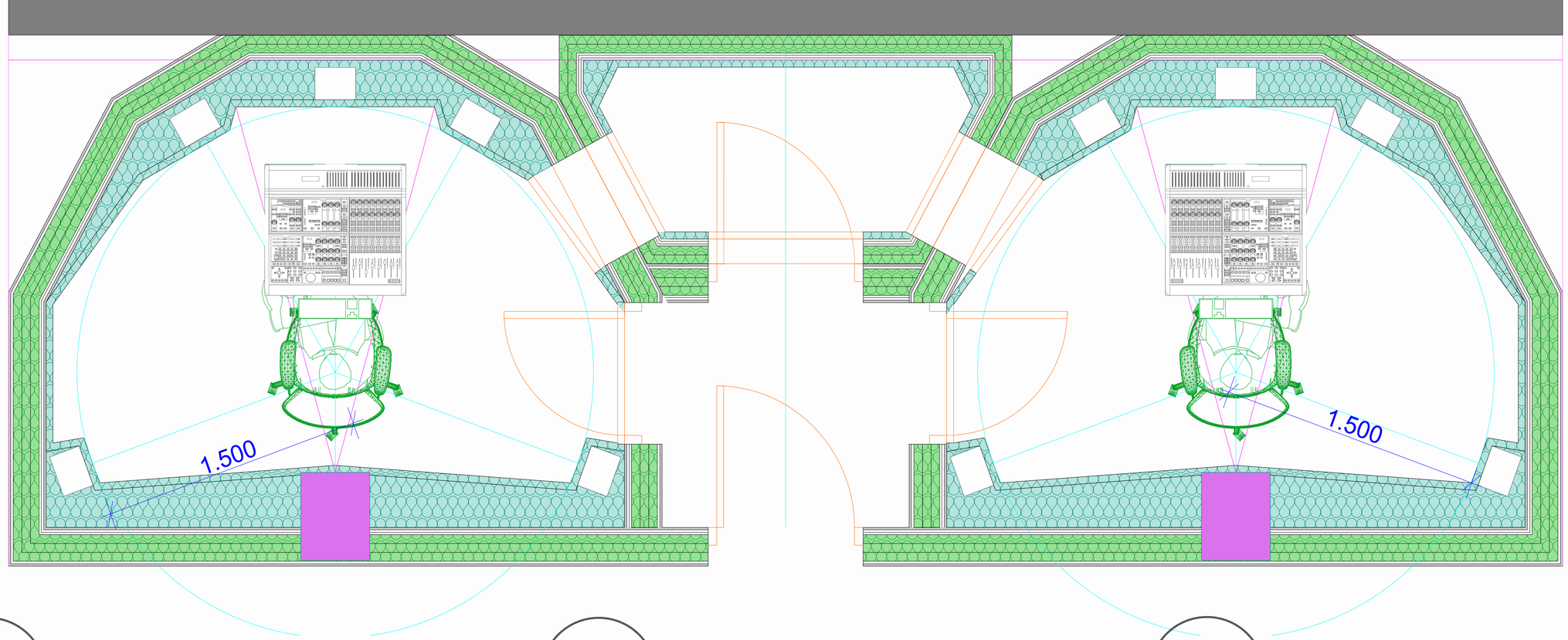


1

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

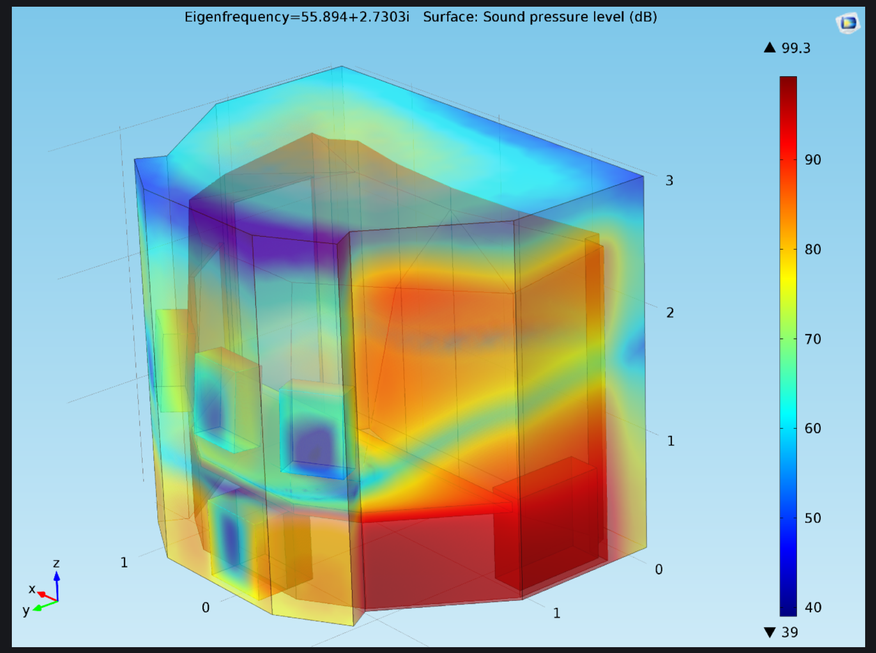
the geometry is optimized in order to keep the rooms with the necessary listening systems in the smallest possible space and to offer the best sound experience.

3

The entrance room

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

Is the FEM simulation useful for recording studio design?



A. FEM software is a **truly valuable tool for acoustic design**.
It provides considerable support to designers on a part of the spectrum range (**LF**) that we could not have much certainty on until now — unless you precisely adopt a predetermined design that you know works from trial-and-error.

B. The major innovation is that with these simulation methods you can build rooms with a good listening experience in **unconventional situations** while also studying **alternatives and innovative acoustic treatments**.

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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
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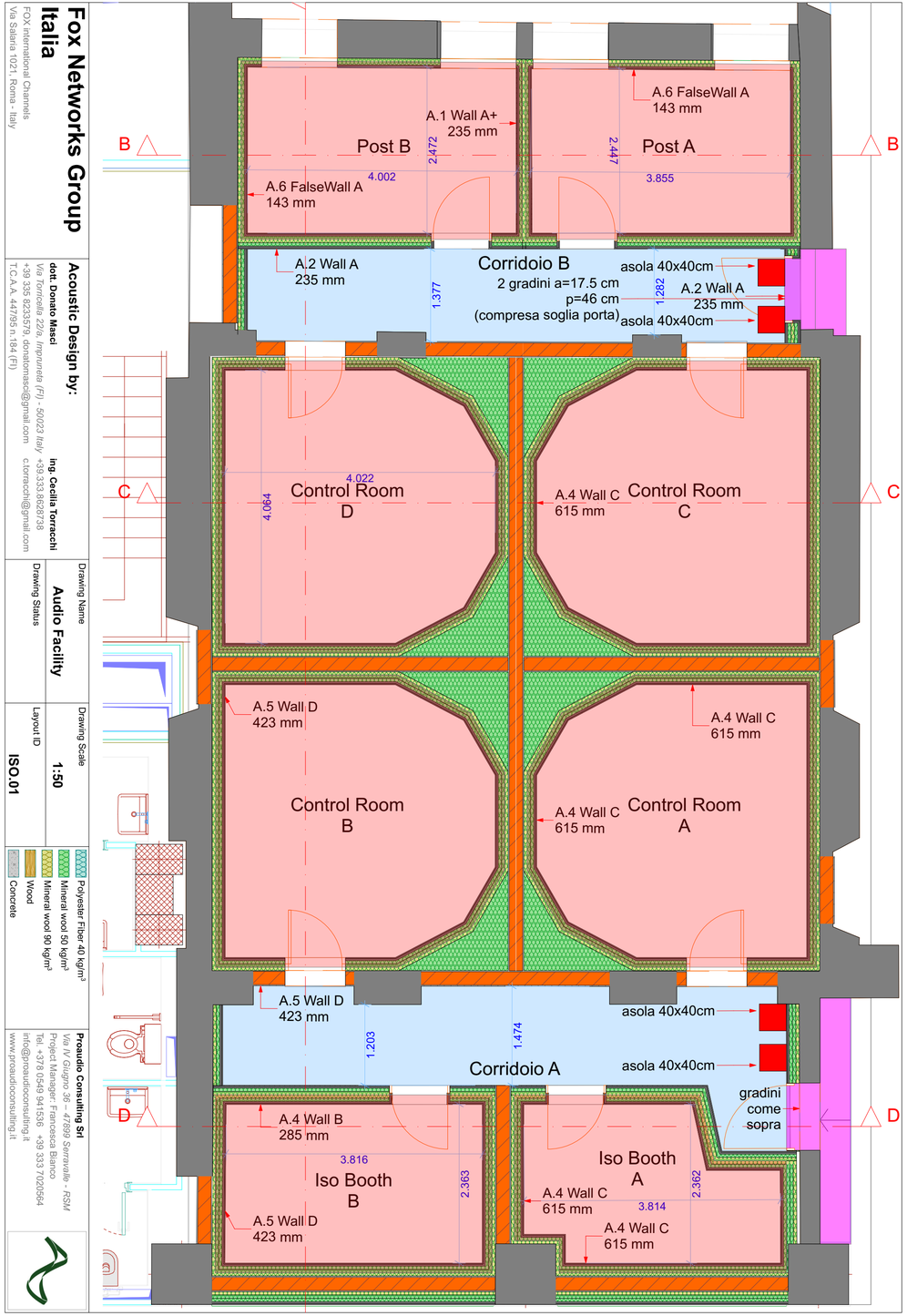
FOX Roma

2018
Fox Networks IT

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



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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

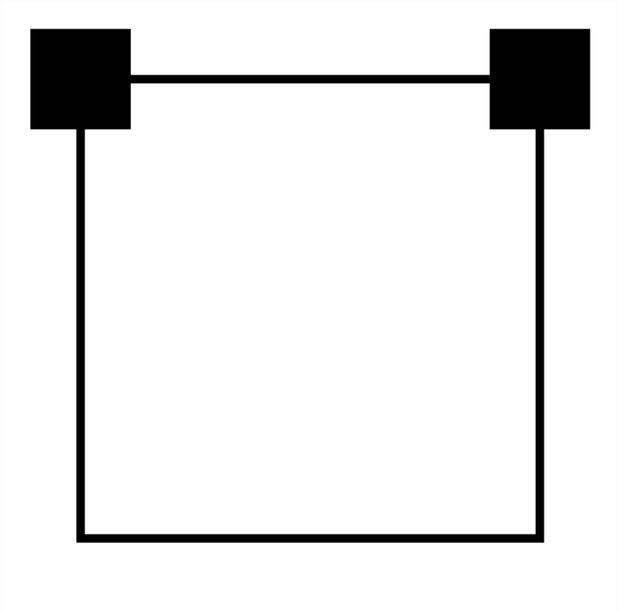
Keep the shape of the Fox room but insert it in a very complex context for divisions, columns etc. creation of two areas with independent access corridors (sound lock).

Functional choices

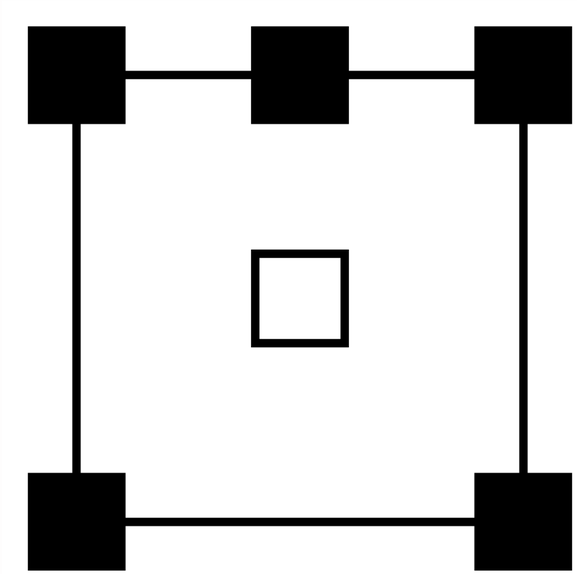
Use of a hybrid insulation system, masonry + plasterboard.
Dolby Atmos listening system.

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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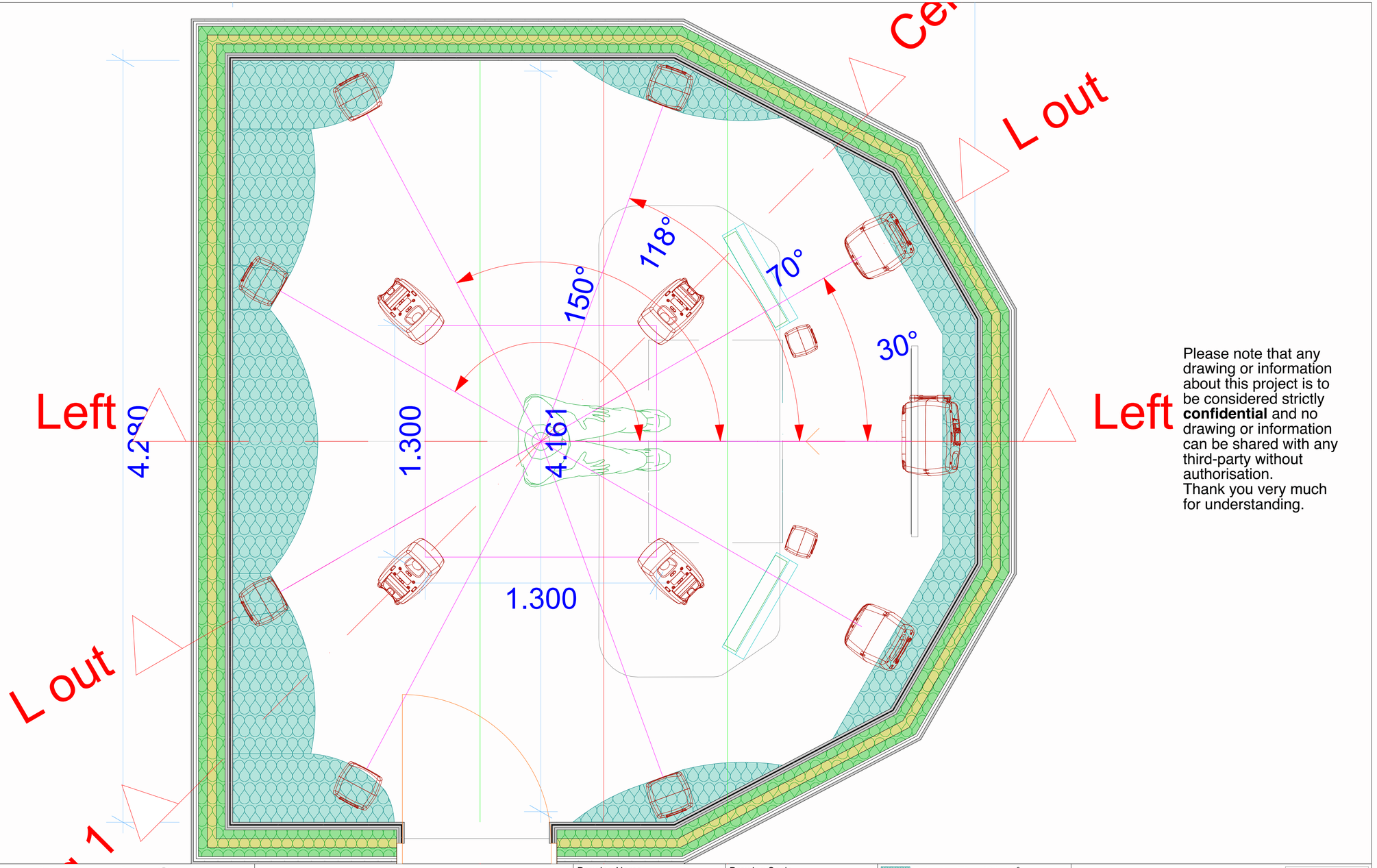


Please note that any drawing or information about this project is to be considered strictly **confidential** and no drawing or information can be shared with any third-party without authorisation.
Thank you very much for understanding.

9.1.4

2018
Fox Networks IT

9.1.4 Dolby Atmos
Home Entertainment

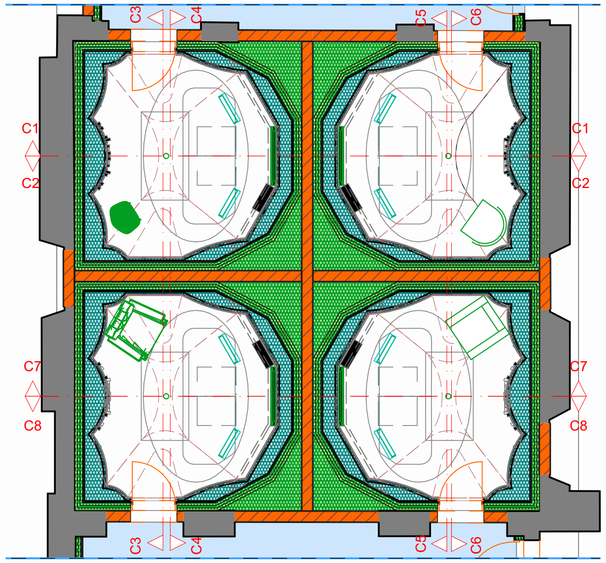
Fox Networks Group Italia
FOX international Channels
Via Salaria 1021, Roma - Italy

Acoustic Design by:
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

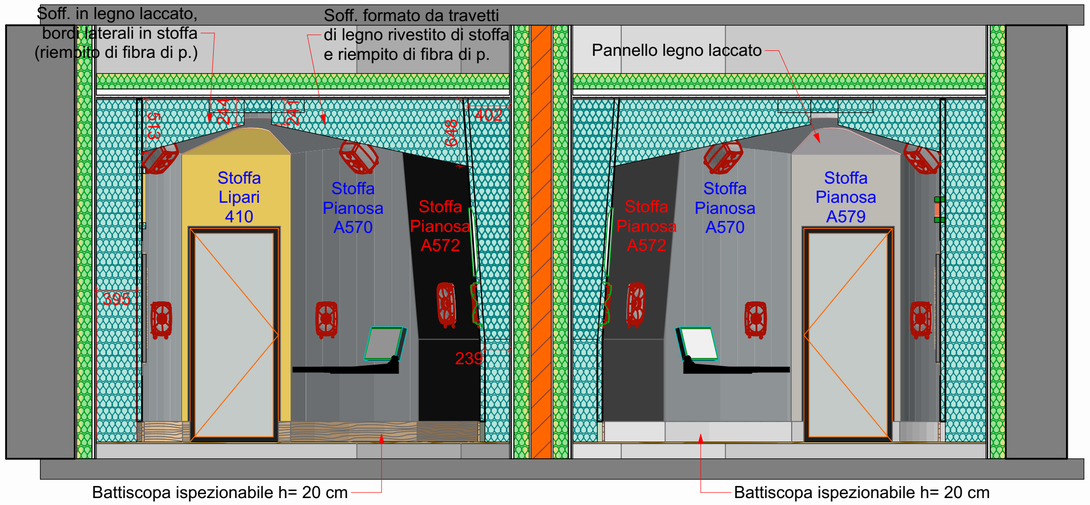
Drawing Name	Floor
Drawing Scale	1:20
Drawing Status	
Layout ID	Tav.00

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

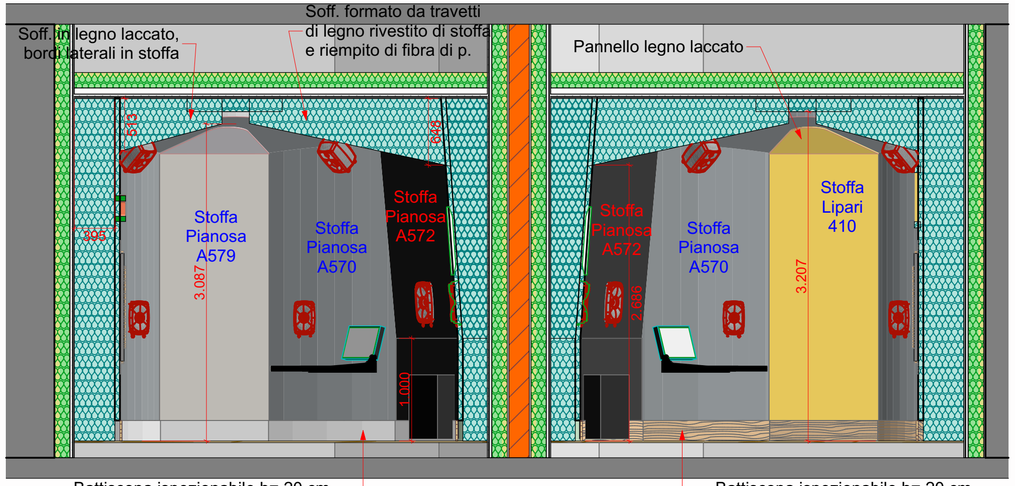
Proaudio Consulting Srl
Via IV Giugno 36 – 47899 Serravalle - RSM
Project Manager: Francesca Bianco
Tel. +378 0549 941536 +39 333 7020564
info@proaudioconsulting.it
www.proaudioconsulting.it



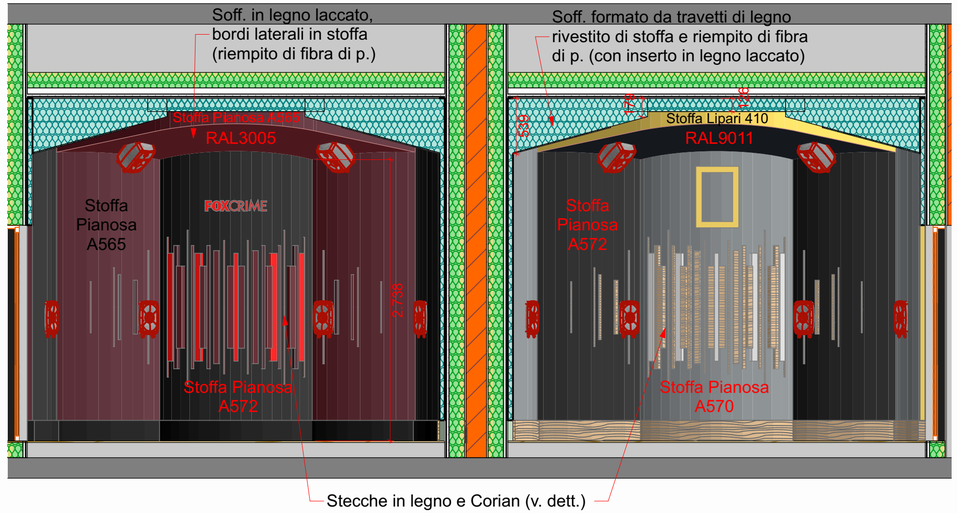
1 Control Rooms (Sezioni) 1:100



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

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The ones

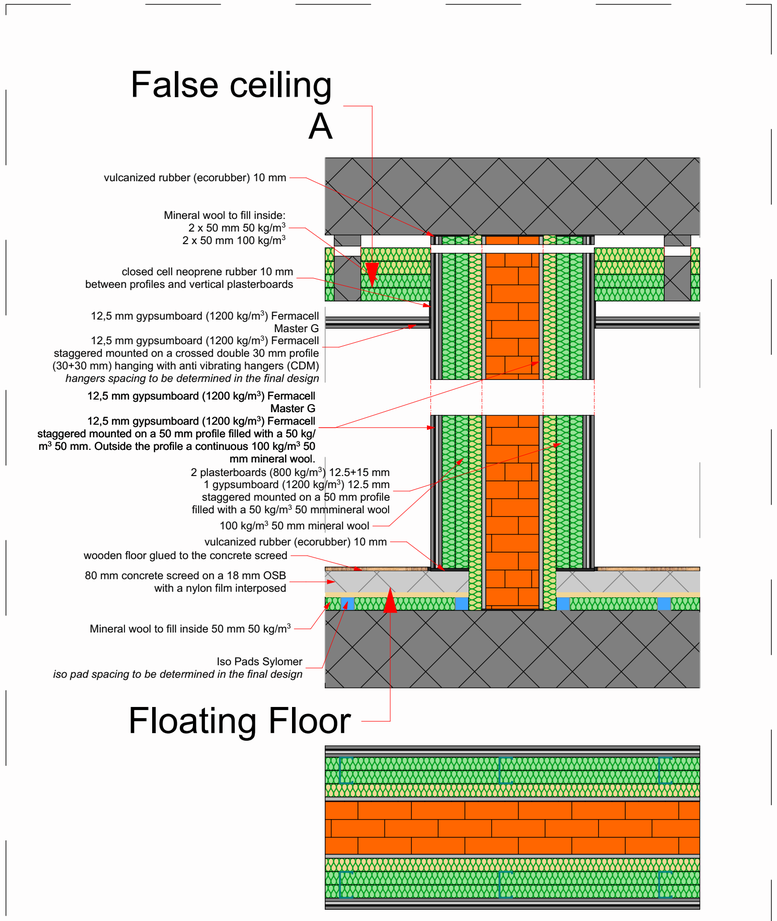
LCR 8351
Surround 8341
Ceiling 8341
Subwoofer 7370

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

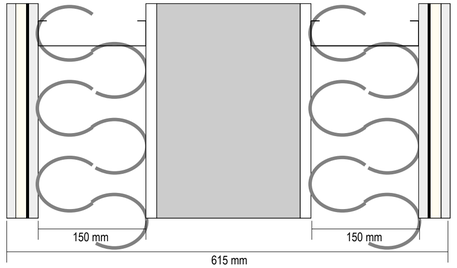
Margin of error is generally within Rw +/- 3 dB

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]

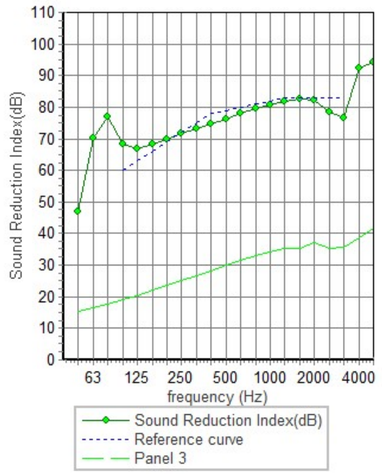
System description

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	



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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 Scale
1:20, 1:1,23

Drawing Status

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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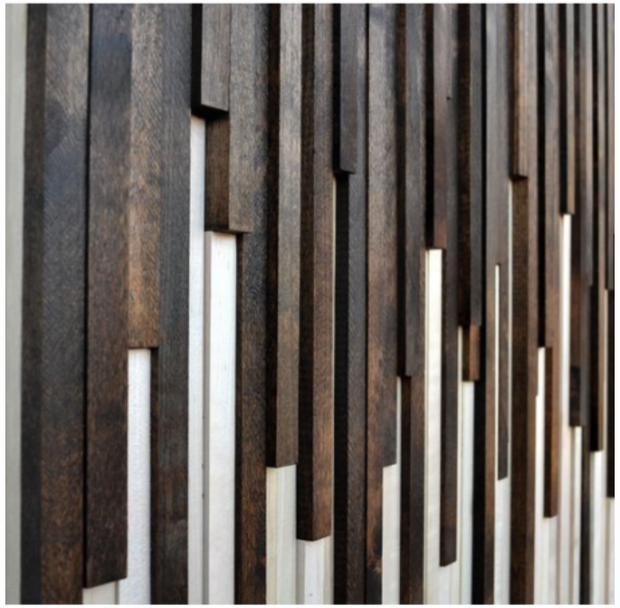
Combining with the style of the facility.



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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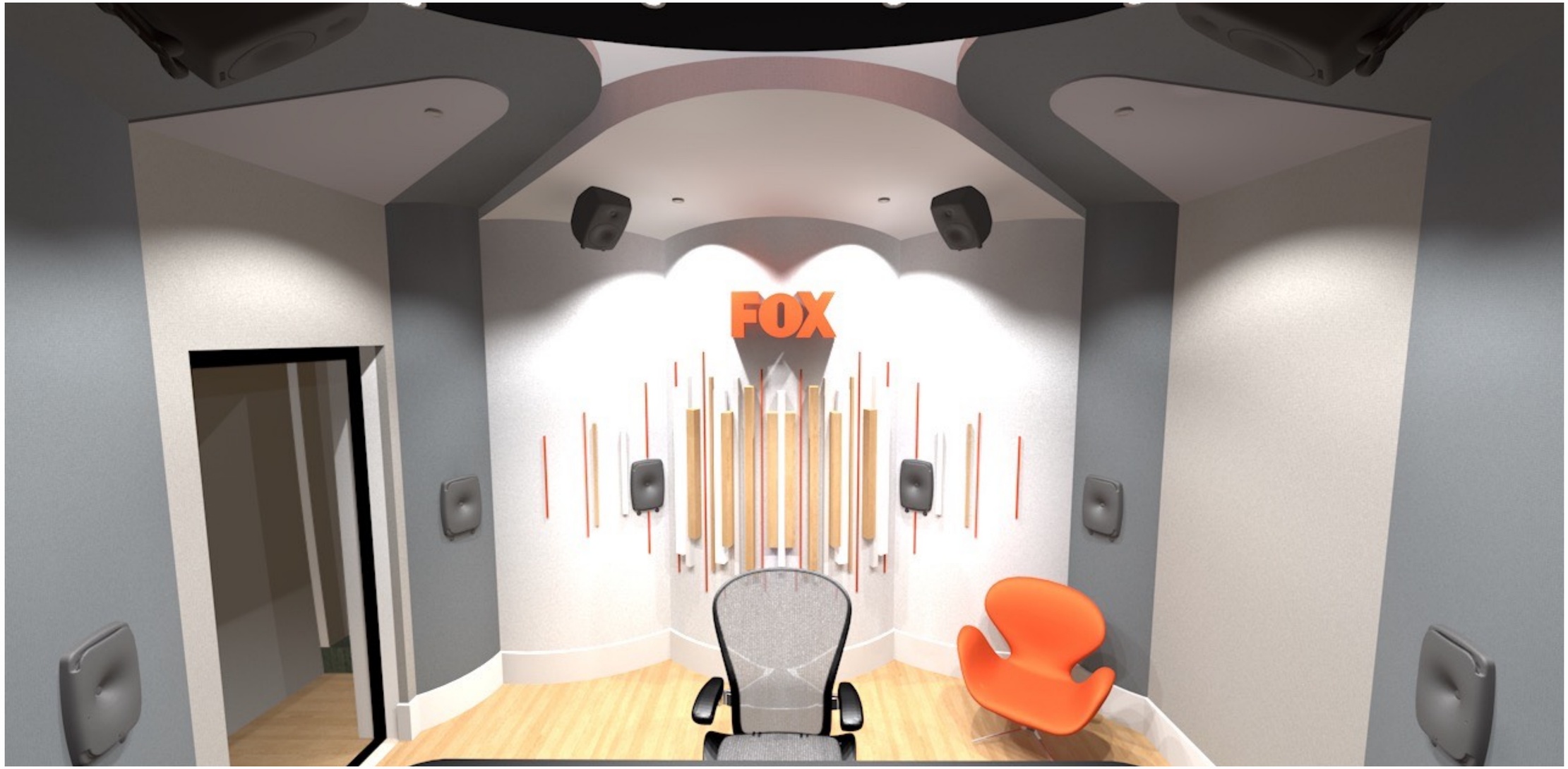

Fox Core

Fox Core

Fox Core

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Fox Crime

Fox Crime

Fox Crime

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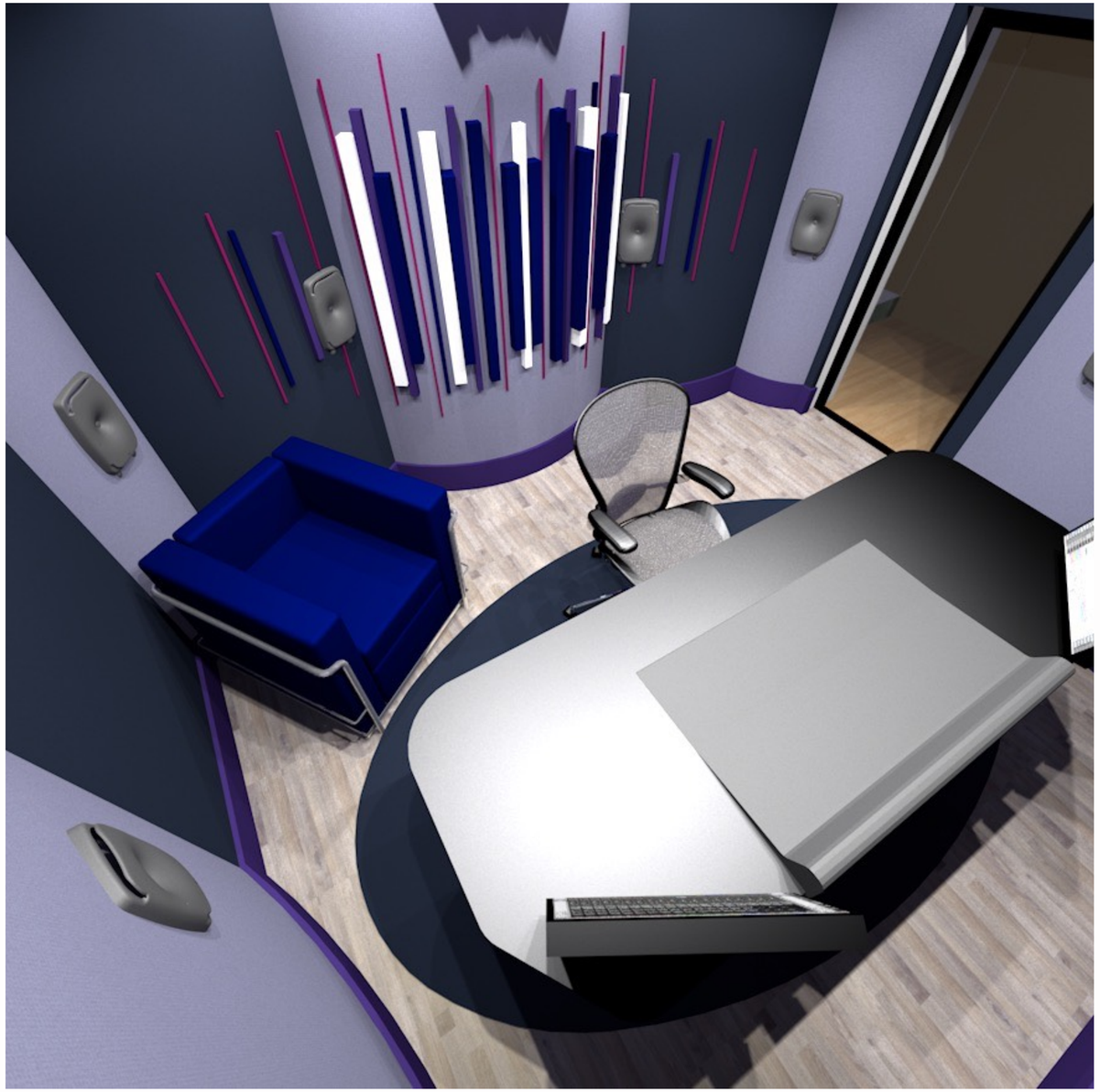
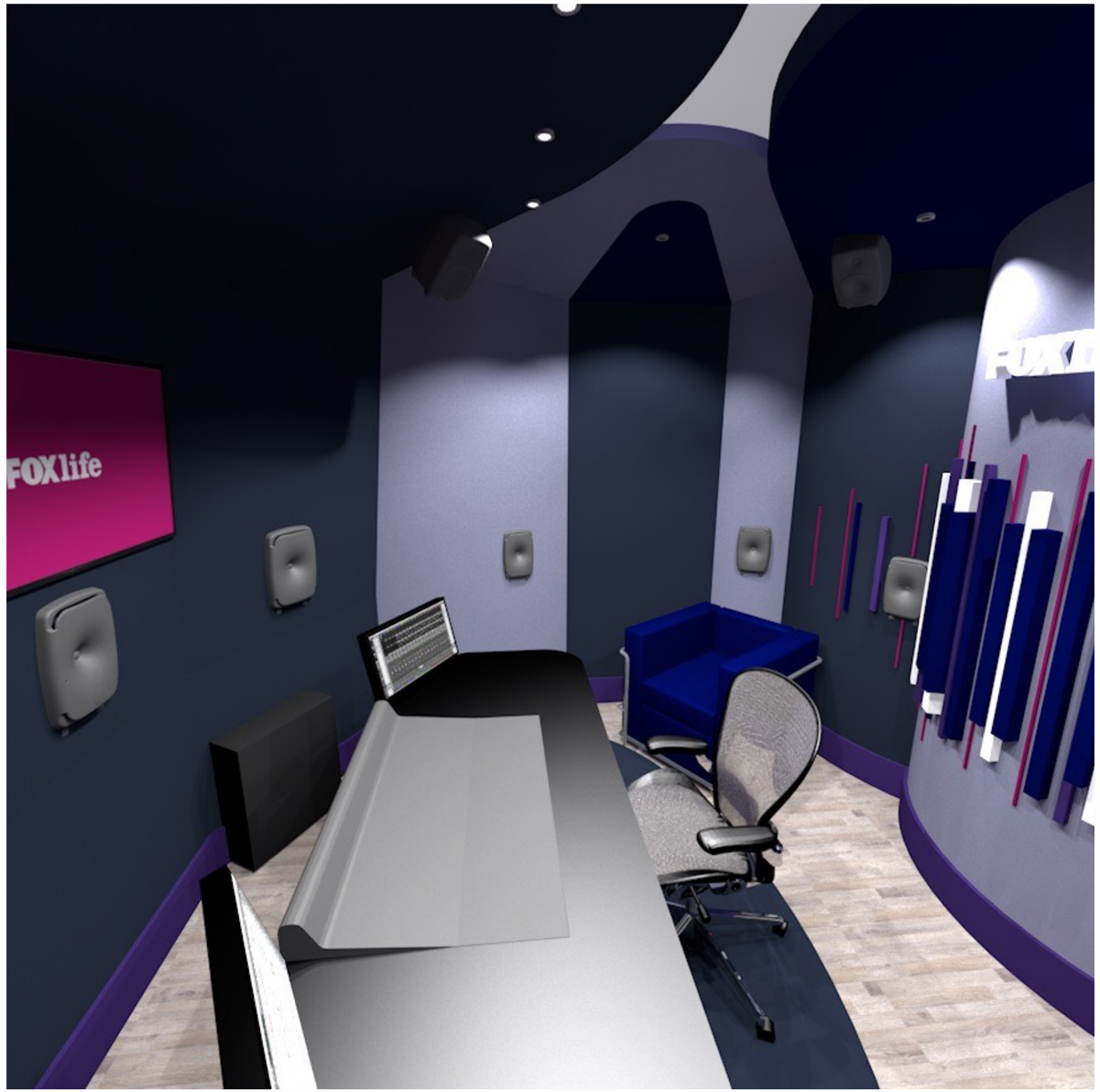
Fox Life





Fox Life

Fox Life

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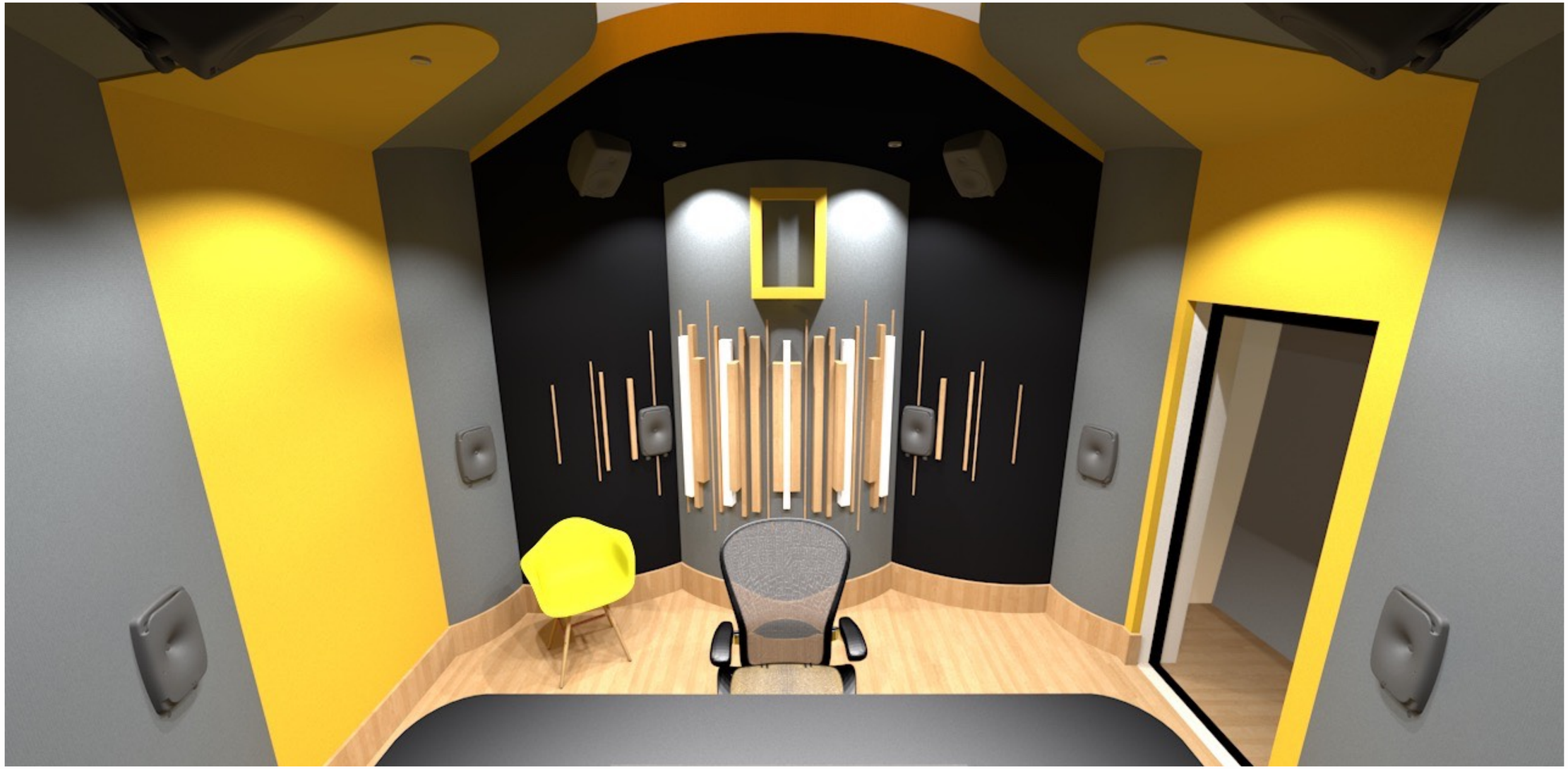
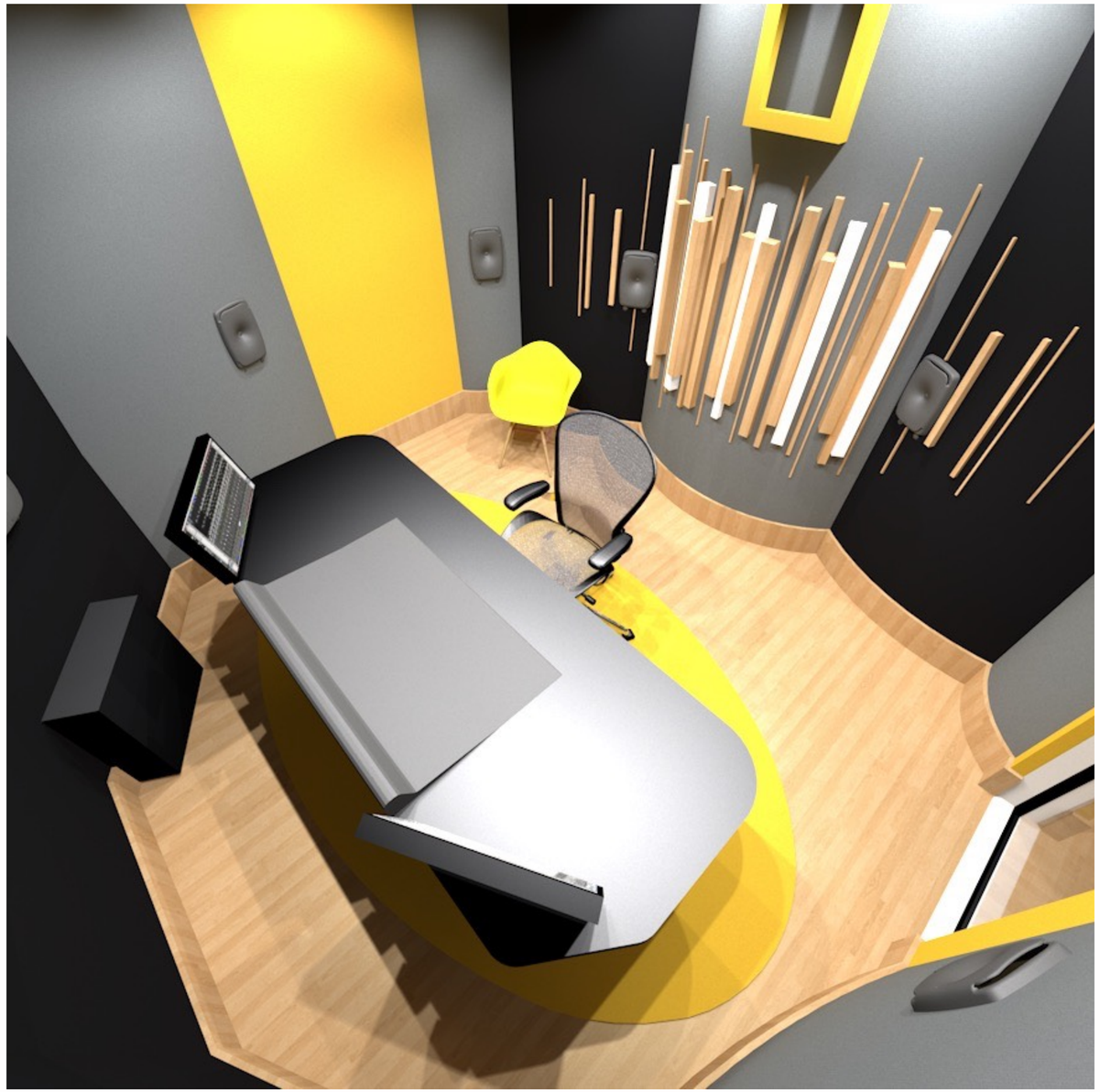


Nat Geo



Nat Geo

Nat Geo

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Iso-Booth 1

Iso-Booth 1

Iso-Booth 1

FOX Crime

FOX Core

Vocal Booth

LampFuserSSS
FOXlife
FOX

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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?

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Thank you!

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Contacts

info@studiosoundservice.com

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