

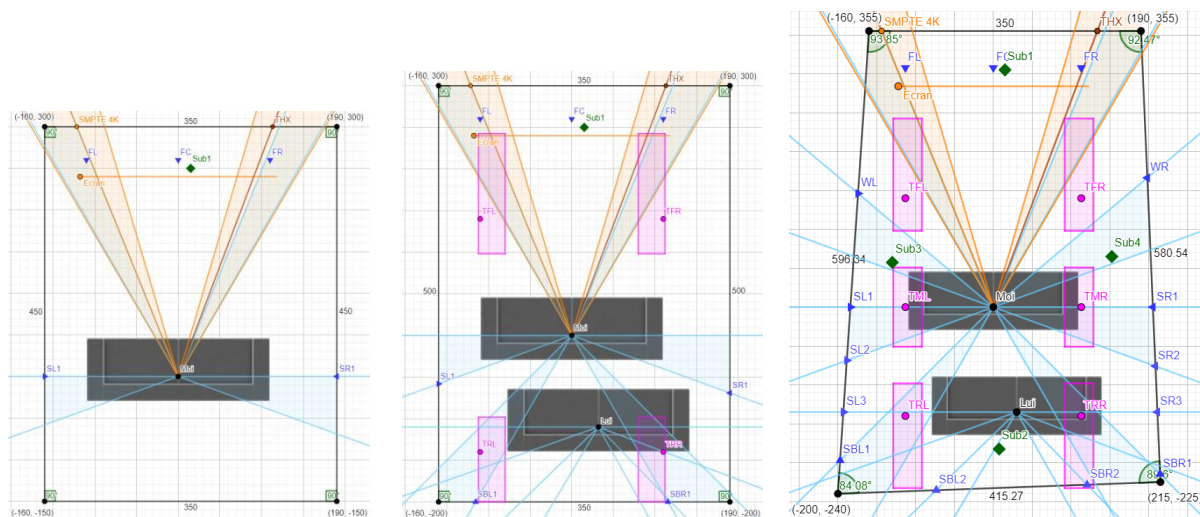
User guide for speaker and screen placement software V2

This software allows you to study the placement of the main elements in a home cinema room, checking compatibility with various recommendations. For speakers, the recommendations are those provided in this [Dolby Atmos Guide](#).

For the screen, the recommendations are those of THX and SMPTE found on the Web. For subwoofers, the suggestions for placement come from various studies published on the Web.

These are recognised references. **However, it is clear that everyone does what he wants and that a recommendation is not an obligation.** The software also gives you complete freedom of placement.

Numerous configurations are possible, from 4.0.0 to 9.1.6 channels, with up to 15.4.6 speakers and subwoofers. Moreover, since version 2, the room does not have to be a rectangle, but can be any quadrilateral (4 sides). Here are a few examples of possible configurations:



Points to watch before use:

This software doesn't take into account all the physical and acoustic constraints. Serious thought needs to be given to the layout of the entire front stage, considering these constraints.

In this software, the speakers are represented in the diagram by small triangles that represent the acoustic center of the speaker (the middle of the front). If they are flush-mounted, this triangle can remain stuck to the wall; otherwise you need to take into account both the dimensions of the speaker and the space required around it.

The choice of type of screen (material) and type of front speakers is crucial.

With a standard screen, you will have maximum brightness (necessary for HDR) but you will be forced to place the center speaker below the screen and you will lose spatial coherence between the image and the sound.

With an acoustically transparent material, just like at the movies, you retain spatial coherence but lose luminosity. With a micro-perforated material, you lose a little less luminosity but the sound is 'comb filtered'. With a woven material, you lose even more luminosity but the sound transparency is better.

Behind an acoustically transparent screen, speakers with a horn tweeter can be placed closer to the material than speakers with a dome tweeter, for example.

Placement of the screen and front speakers must take into account:

- The type of screen material: standard, micro-perforated or woven
- Type of speaker tweeter: horned or not
- The physical dimensions of the speaker
- The space required by the connectors (for active speakers, the XLR connector and the power connector may require a certain depth)
- The space required around the speaker to:
 - * Avoid, as far as possible, any acoustic problems associated with the speaker's proximity to walls
 - * Allow any port tube to fulfil their function
 - * Allow any built-in amplifiers (for active speakers) to cool properly
 - * Etc.

Some other key points:

1°) To avoid problems linked to standing waves (Room Mode), symmetry and especially central positions should be avoided as much as possible. To get the best viewing angle, we tend to take the 'middle seat'. However, for sound, right in the center - half the width (which is very common), half the length and half the height (which is also common*) - in an untreated room, this is the worst position!

* With a ceiling height of 2m40 and an ear height usually around 1m20, you are right where you should not be.

2°) The ideal opening angle recommended by Dolby for main speakers is 60°. However, if this means sticking your main speakers to the walls, it will be much more harmful than reducing this angle slightly.

Still on the subject of standing waves, it is important for both main speakers and subwoofers not to place them at equal distances from the nearest walls. For example, if the acoustic center of a main speaker is 50 cm from the sidewall, it should not also be 50 cm from the front wall.

Note: The distance between the acoustic center (the middle of the front) and the wall should be taken into account, not the distance between the rear or side of the speaker and the wall.

3°) A simple observation on the recommendations: It is impossible to place the 3 main speakers behind a 16:9 = 1.78 format acoustically transparent screen in compliance with Dolby and THX recommendations. The maximum viewing angle is 40° while the minimum opening angle for the speakers is 45°. If you wish to comply with the recommendations, either opt for a 2.35 or 2.40 format screen, or position the left and right speakers outside the screen.

4°) For side speakers, even if this is not indicated in the recommendations:

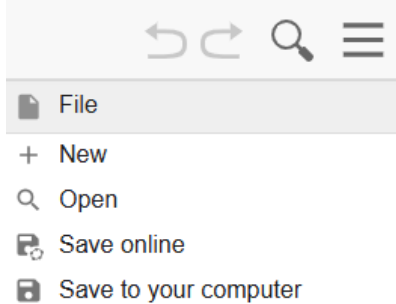
- With Monopolar speakers, it is best to avoid 90°: they risk being too easy to locate. They should be placed to the rear, between 100° and 110°.
- With Bipolar speakers, you have complete freedom of placement.
- With Dipolar speakers, they must be placed at 90°: The sound will vary greatly depending on the angle. Dolby does not recommend dipolar speakers for use in an Atmos configuration.

5°) For Atmos speakers, Dolby indicates that with a ceiling height of less than 2m40, ceiling speakers should not be used. Atmos-specific main and surround speakers should be used, with a speaker directed towards the ceiling, which will give a more diffuse, less localized result. Dolby indicates that ceiling speakers should be 2 to 3 times the height of the front speakers. Typically: $2 \times 1\text{m}20 = 2\text{m}40$.

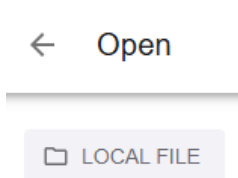
Getting started:

To use the software, first download and unzip the file “User guide for speaker and screen placement software V2.zip” into a folder. Then go to the GeoGebra website (classic version): [GeoGebra](https://www.geogebra.org/m)

In the top right corner, open the menu and select Open:

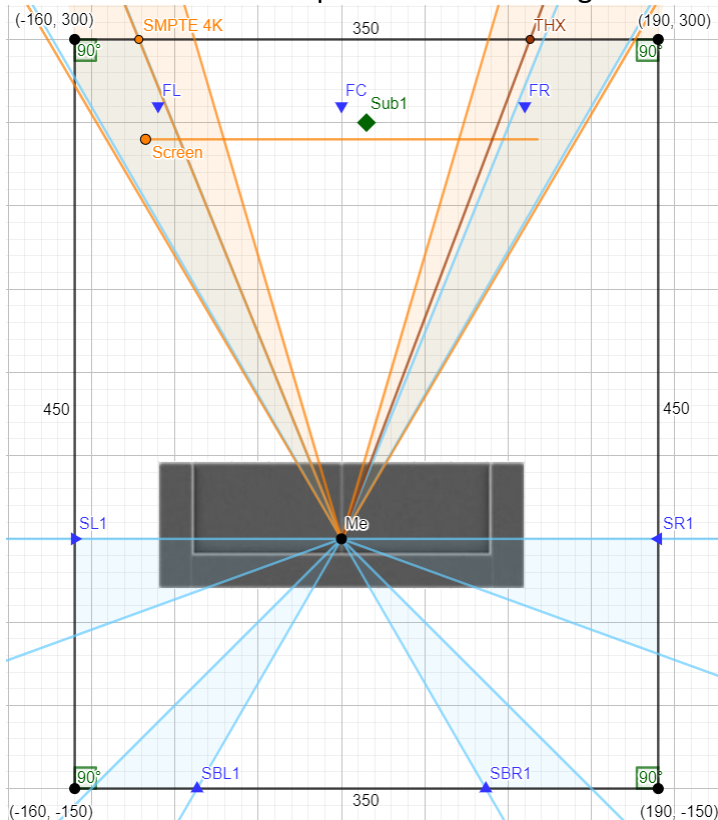


Then click on Local file, top left corner:



and fetch the downloaded file.

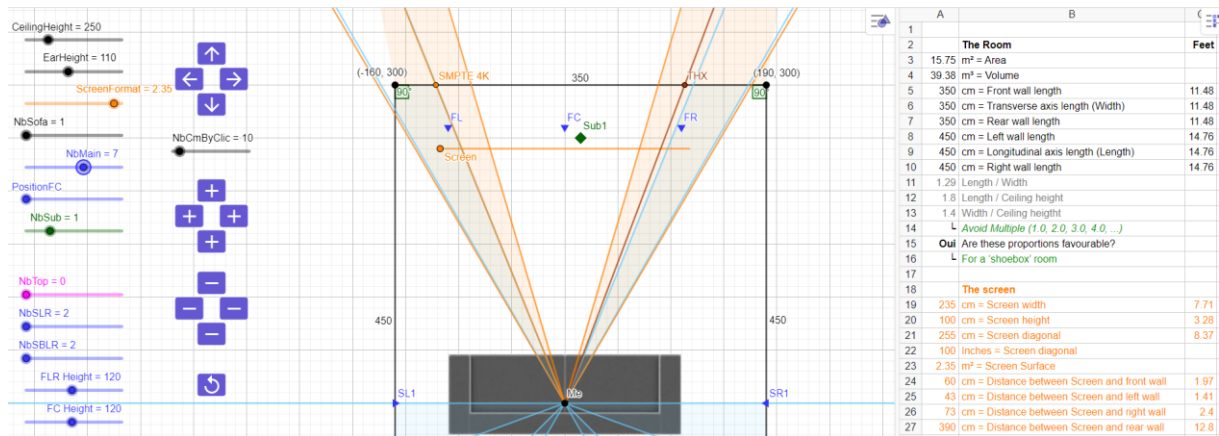
The result is a standard part with a 7.1 configuration:



Then proceed in stages:

- 1°) Draw the room around the reference point (Me), with the required dimensions and angles.
- 2°) Adjust the position of the screen, front speakers and reference position (Me).
- 3°) Define the desired complete speaker configuration.
- 4°) Adjust the position of side, rear and ceiling speakers.

The software has 4 zones:

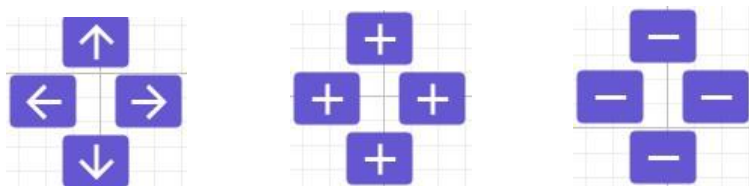


- 1°) In the center, the interactive diagram.
- 2°) On the far left, sliders to define configuration and certain dimensions.
- 3°) On the left, between the sliders and the diagram, buttons for shifting, enlarging and reducing room dimensions.
- 4°) On the right, a spreadsheet area giving all the necessary measurements, plus a few recommendations and points to watch out for.

1°) Room design:

There are several ways to define the shape, dimensions and angles of the room:

- You can select corners, one by one, and move them by dragging and dropping with the mouse or using the keyboard arrows.
- You can also use the button groups below to shift the part with the arrows; enlarge it with the **+** or reduce it with the **-**; top, left, right or bottom depending on the position of the button.



The slider below lets you define the number of centimeters that will be applied each time you click one of the above buttons. Shifts, enlargements and reductions can therefore be made centimeter by centimeter; or in steps of 5cm, 10cm, 25cm, 50cm or 100cm (1 meter).



During this step, you can view dimensions, angles and other data in real time, both on the drawing and in the spreadsheet area on the right.

	The Room	Feet	Inch
15.75	m² = Area		
39.38	m³ = Volume		
350	cm = Front wall length	11	5.8
350	cm = Transverse axis length (Width)	11	5.8
350	cm = Rear wall length	11	5.8
450	cm = Left wall length	14	9.17
450	cm = Longitudinal axis length (Length)	14	9.17
450	cm = Right wall length	14	9.17
1.29	Length / Width		
1.8	Length / Ceiling height		
1.4	Width / Ceiling height		
	⌞ <i>Avoid Multiple (1.0, 2.0, 3.0, 4.0, ...)</i>		
Yes	Are these proportions favourable?		
	⌞ <i>For a 'shoebox' room</i>		

Note: This spreadsheet area is for data display only. Do not modify anything in this area.

You can also move the whole diagram around, and use the “magnifying glass” buttons at the bottom right of the diagram to zoom in and out of the overall view.

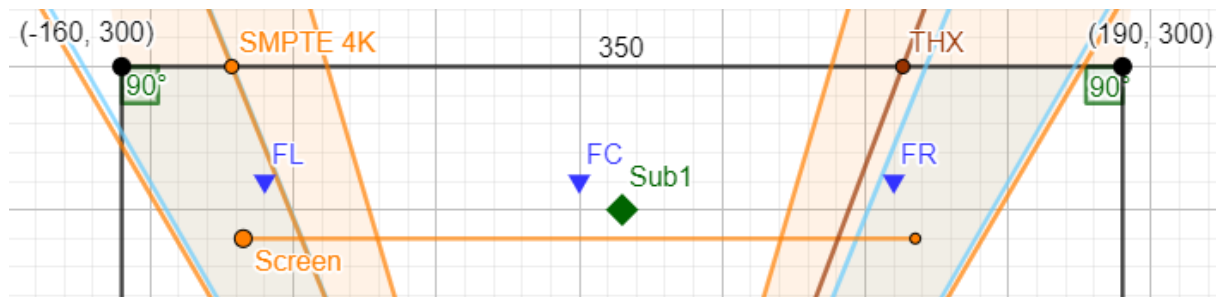
2°) The position of the screen, front speakers and reference place:

Once the room has taken on its final dimensions and shape, the second step is to set the parameters for the screen, front speakers and reference place.

To begin, with the first four sliders in the top left corner, you need to indicate the height of the ceiling, the height of your ears (seated at the reference place), the screen format (from 1.78 to 2.40) and whether there are one or two sofas.

In the diagram, with the anchor point to the left of the screen, you can define its width and position in the room: advanced if it is acoustically transparent, or stuck to the front wall if it's a full screen.

To stay within the SMPTE recommendations, the anchor point on the left of the screen must remain within the orange triangle. Ideally, it should be on the SMPTE 4K line ; or the anchor point on the right on the THX line.



If the first sofa and the reference place are fixed and serve as a reference for all other elements, the second sofa can be moved as you wish by simply dragging and dropping it.

As in step 1, you can of course continue to shift the room in relation to the reference place to increase or decrease the distance between the screen and the reference place.

The anchor point on the right of the screen, although not advisable, allows you to offset the screen, and even position it at an angle.

After or at the same time as you position the screen, you can position the front speakers around it. By selecting the left front speaker (FL), you can move it as you wish. The right speaker will move simultaneously, symmetrically in relation to the axis of the reference place.

If however their positioning is not symmetrical, although not recommended, you can then move the right speaker independently.

Moreover, as with the screen, to stay within the recommendations (Dolby for speakers), it's best to stay within the colored triangles (light blue for speakers).

In the spreadsheet area, you can visualize in real time the distances between elements, opening and vertical angles, ratios and compare them with recommendations; both for the reference position (Me on the first sofa, **My** angle ...) and, if applicable, for the second position (Him on the second sofa, **His** angle ...).

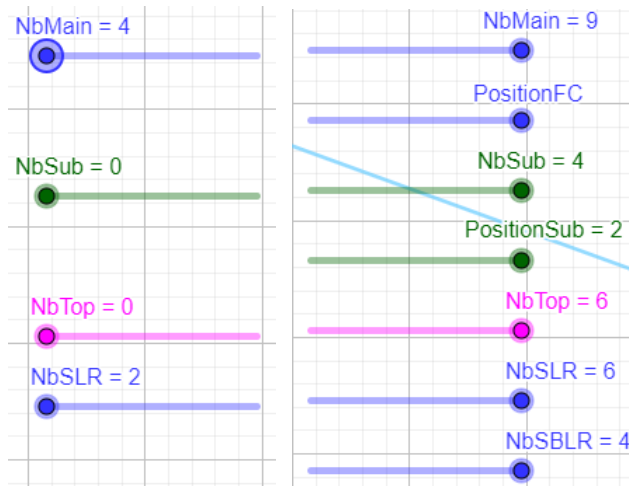
The Room		Feet	Inch
15.75	m² = Area		
39.38	m³ = Volume		
350	cm = Front wall length	11	5.8
350	cm = Transverse axis length (Width)	11	5.8
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450	cm = Left wall length	14	9.17
450	cm = Longitudinal axis length (Length)	14	9.17
450	cm = Right wall length	14	9.17
1.29	Length / Width		
1.8	Length / Ceiling height		
1.4	Width / Ceiling height		
L Avoid Multiple (1.0, 2.0, 3.0, 4.0, ...)			
Yes Are these proportions favourable?			
L For a 'shoebox' room			
The screen			
235	cm = Screen width	7	8.52
100	cm = Screen height	3	3.37
255	cm = Screen diagonal	8	4.39
100	Inches = Screen diagonal		
2.35	m² = Screen Surface		
60	cm = Distance between Screen and front wall	1	11.62
43	cm = Distance between Screen and left wall	1	4.93
73	cm = Distance between Screen and right wall	2	4.74
390	cm = Distance between Screen and rear wall	12	9.54
Front Left Speaker			
40	cm = Distance between FL and front wall	1	3.75
L Avoid identical or too close distances			
50	cm = Distance between FL and left wall	1	7.69
L Avoid getting too close to left wall			
300	cm = Distance between FL and right wall	9	10.11
410	cm = Distance between FL and rear wall	13	5.42
2.08	Ceiling height / FL height		
L Avoid being too close to 2.0			
20	cm = Distance between FL and Screen	0	7.87
282	cm = Distance between FL and Me	9	3.02
22.93°	degree = My FL opening angle		
L Dolby recommends 30° between 22° and 40°			
16.54°	degree = His FL opening angle		
Front Center Speaker			
40	cm = Distance between FC and front wall	1	3.75
160	cm = Distance between FC and left wall	5	2.99
190	cm = Distance between FC and right wall	6	2.8
410	cm = Distance between FC and rear wall	13	5.42
2.08	Ceiling height / FC height		
L Avoid being too close to 2.0			
20	cm = Distance between FC and Screen	0	7.87
L Acoustically transparent: avoid getting too close			
260	cm = Distance between FC and Me	8	6.36
0°	degree = Reference axis between FC and Me		

My position (Me)			
300	cm = Distance between Me and front wall	9	10.11
160	cm = Distance between Me and left wall	5	2.99
190	cm = Distance between Me and right wall	6	2.8
150	cm = Distance between Me and rear wall	4	11.06
240	cm = Distance between Me and screen	7	10.49
2.4	Distance Screen => Me / Screen height		
L SMPTE recommends a ratio of 2.9 in 4K			
0.94	Distance Screen => Me / Screen diagonal		
L THX recommends a ratio of 1.2			
52.17°	degree = My horizontal angle of vision		
L THX recommends 40° for a 1.78 format			
2.27	Ceiling Height / Ear height		
L Avoid being too close to 2.0			
15	cm = Distance Me => Longitudinal axis	0	5.91
L Avoid being too close to 0			
0.67	Distance Me => Front wall / Length		
L Avoid being too close to 0.5 or 1.0			
His position (Him on the 2nd sofa)			
410	cm = Distance between Him and front wall	13	5.42
190	cm = Distance between Him and left wall	6	2.8
160	cm = Distance between Him and right wall	5	2.99
40	cm = Distance between Him and rear wall	1	3.75
350	cm = Distance between Him and screen	11	5.8
3.5	Distance Screen => Him / Screen height		
L SMPTE recommends a ratio of 2.9 in 4K			
1.37	Distance Screen => Him / Screen diagonal		
L THX recommends a ratio of 1.2			
36.89°	degree = His horizontal angle of vision		
L THX recommends 40° for a 1.78 format			

Front Right Speaker			
40	cm = Distance between FR and front wall	1	3.75
L Avoid identical or too close distances			
80	cm = Distance between FR and left wall	2	7.5
L Avoid getting too close to left wall			
270	cm = Distance between FR and right wall	8	10.3
410	cm = Distance between FR and rear wall	13	5.42
2.08	Ceiling height / FR height		
L Avoid being too close to 2			
20	cm = Distance between FR and Screen	0	7.87
282	cm = Distance between FR and Me	9	3.02
22.93°	degree = My FR opening angle		
L Dolby recommends 30° between 22° and 40°			
16.39°	degree = His FR opening angle		
Surround Left #1 Speaker			
358	cm = Distance between SL1 and front wall	11	8.94
0	cm = Distance between SL1 and left wall	0	0
350	cm = Distance between SL1 and right wall	11	5.8
92	cm = Distance between SL1 and rear wall	3	0.22
184	cm = Distance between SL1 and Me	6	0.44
110°	degree = My SL1 opening angle		
L Dolby recommends between 90° and 110°			
22.35	degree = My SL1 vertical angle		

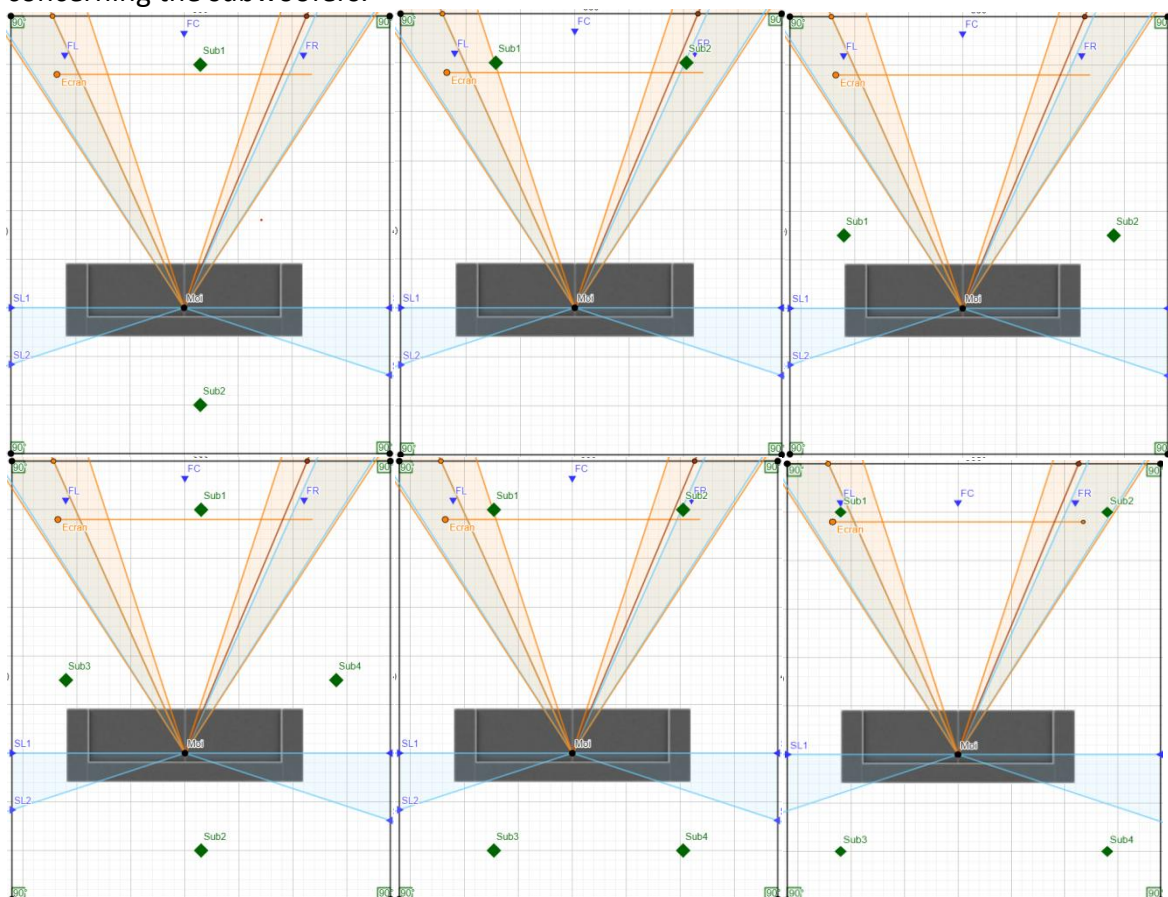
3°) La configuration complète des enceintes :

The sliders on the left let you precisely define the complete speaker configuration. From 4.0.0 to 9.1.6 channels with up to 4 subwoofers, 3 pairs of side speakers and 2 pairs of rear speakers:



For the center speaker (FC), a slider lets you choose between a position aligned with the left and right fronts (FL and FR) or in an arc (at equal distance from the reference place).

For the subwoofers, a slider allows you to choose between several recommended starting positions; although there are no official recommendations, nor any guarantee of results concerning the subwoofers.



Not all sliders are visible from the beginning. They are only visible if they are useful in the chosen configuration. Likewise, the proposed values vary with the configuration.

Sliders define starting values and positions for elements (speakers, subwoofers), which can then be modified. Please note that if you change the value of a slider again after moving an element linked to it in the diagram, the element will revert to its starting position.

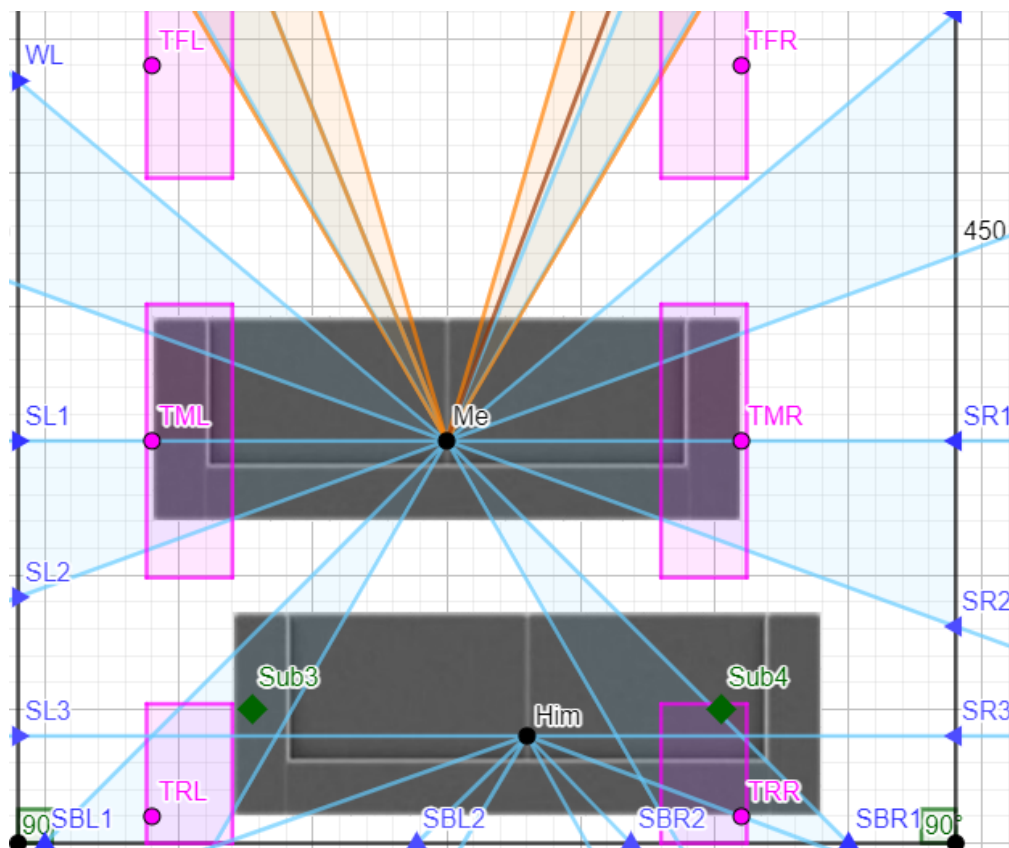
4°) Adjust the position of side, rear and ceiling speakers:

As with the front speakers, you can move the left speaker in a group as you wish. The right speaker will be moved symmetrically at the same time. You can then move the right speaker separately, if required.

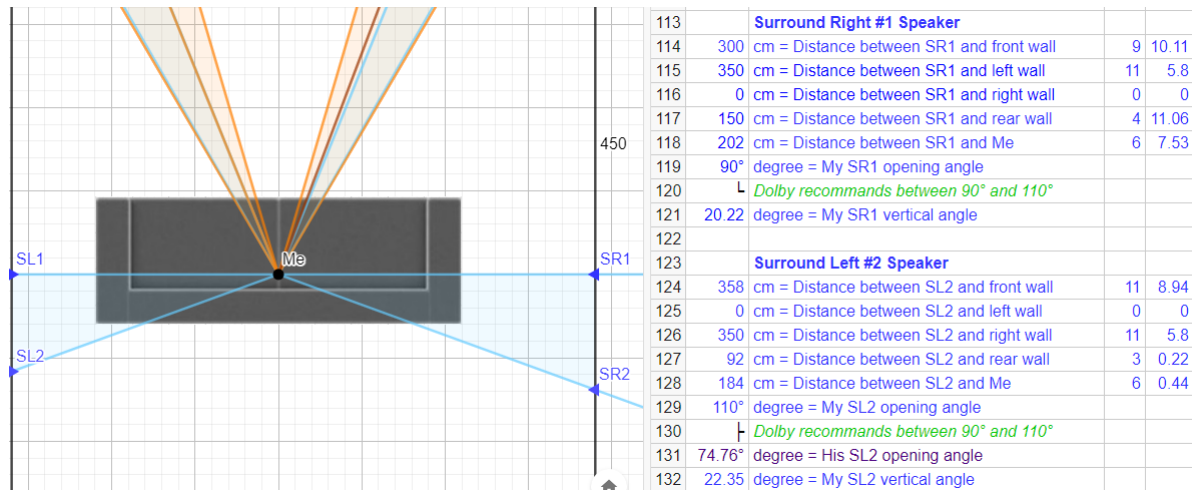
For wide and side speakers (WL and WR, SL1, SL2, SL3 and SR1, SR2, SR3), as for the rear speakers (SBL1, SBL2 and SBR1, SBR2) to stay within the Dolby recommendations, you need to stay within the light blue triangles where they were originally positioned.

For ceiling speakers (TL, TFL, TML, TRL and TR, TFR, TMR and TRR), you must stay within the purple rectangles and, if possible, align them with the front speakers (FL and FR).

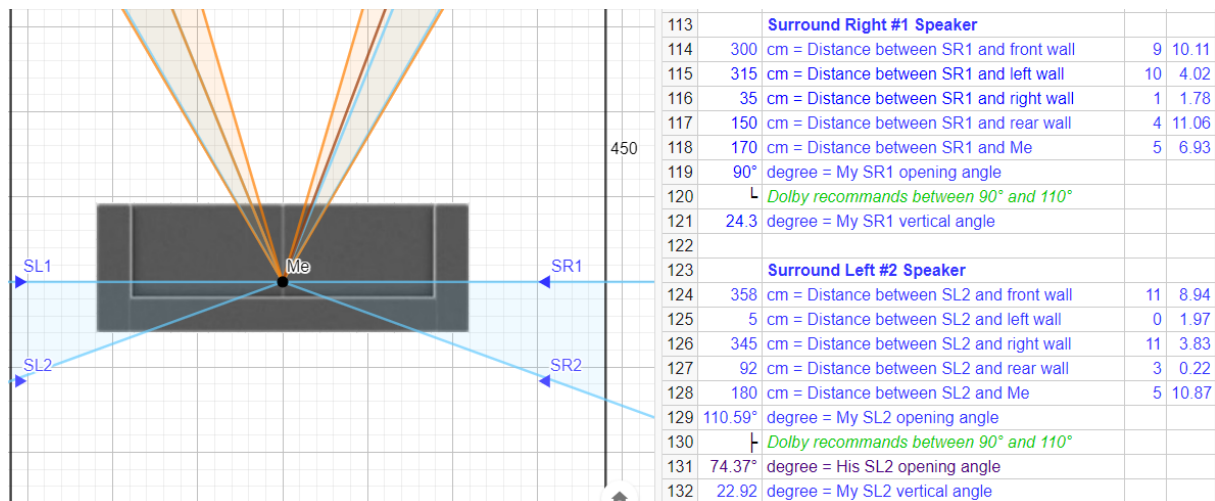
However, all placements remain free (in the normal zone of the speaker).



For side speakers, when you move the left speaker but keep it fixed to the wall, the right speaker will also remain fixed to the wall at the same angle to the listener. If the reference position is not in the middle of the room, the two speakers will not necessarily be at the same “level” on the walls, nor at the same distance from the listener.

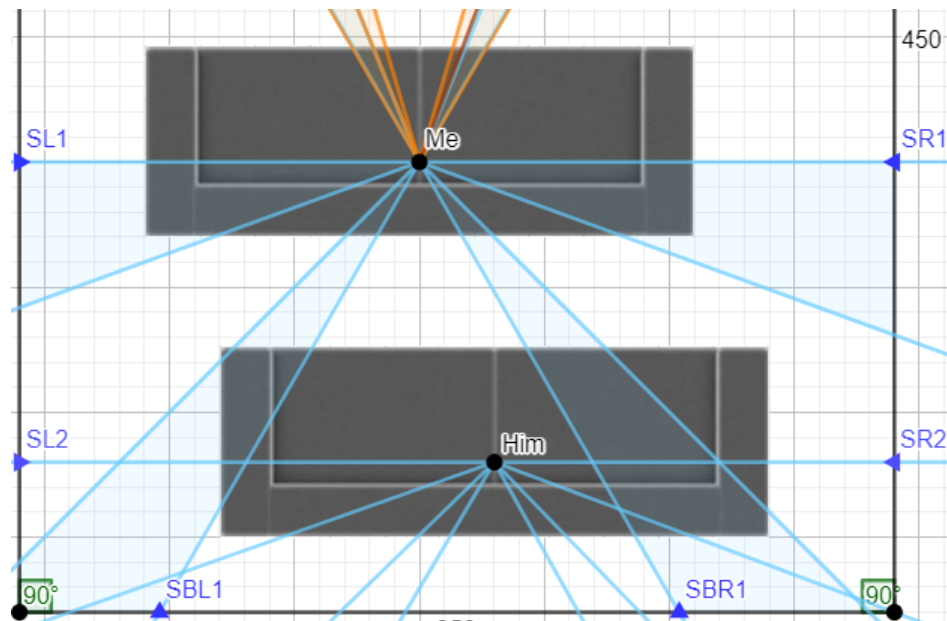


If you move the left speaker away from the wall (floor-standing speakers), when you move it, the right speaker also moves in the room in a completely symmetrical way (see below). The angle remains the same, as do the distances from the listener. But the distances between the speakers and the walls will be different between left and right.

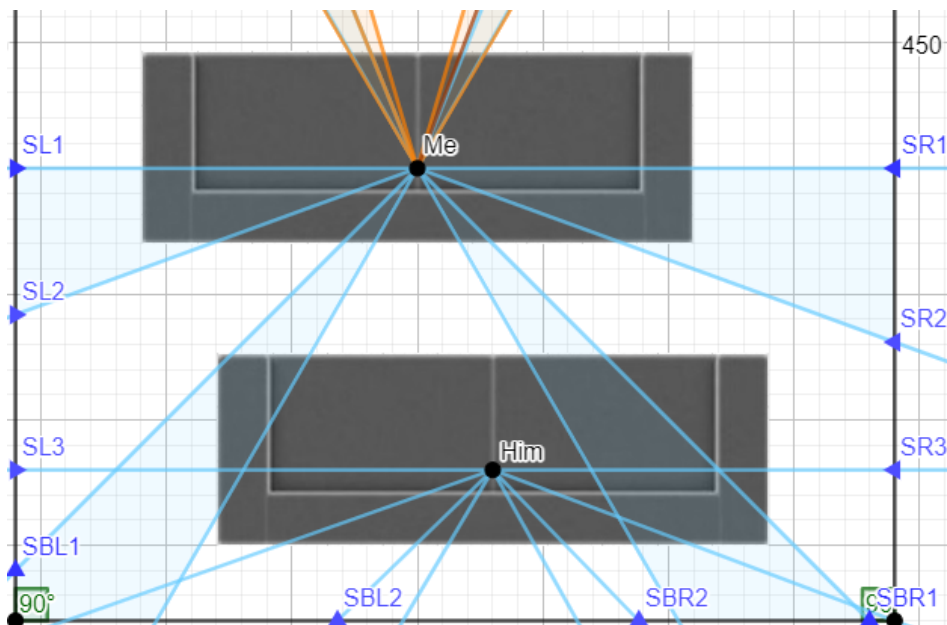


Note: As priority is always given to respecting angles, a side speaker can be located on the rear wall (this proves that your sofa is too close to it); a rear speaker can be located on a side wall; and in the same pair of speakers (SBL1 and SBR1 for example) one of the speakers can be on a side wall and the other on the rear wall.

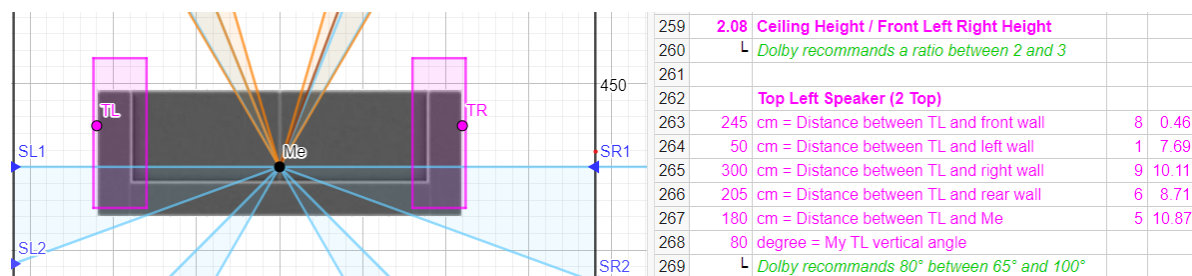
If you have only one sofa, the reference listener will always be “Me” on the first sofa. If you have two sofas and two pairs of side speakers, SL1 and SR1 will be positioned according to “Me”; SL2 and SR2 according to “Him” on the second sofa.




If you have two sofas and three pairs of side speakers, SL1, SL2 and SR1, SR2 will position themselves according to Me and SL3 and SR3 will position themselves according to Him. And if you have two sofas and two pairs of rear speakers, SBL1 and SBR1 will position themselves according to Me, and SBL2 and SBR2 according to Him.



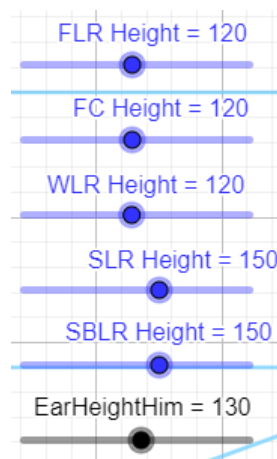
You can also move the ceiling speakers (TL, TFL, TML, TRL and TR, TFR, TMR and TRR) as you wish. To judge their correct placement, you can use both the areas shown on the diagram and the data provided in the spreadsheet area.



Note: Before moving elements, remember to use the vertical scroll bar in the spreadsheet area to place the data corresponding to the elements you wish to move on the right side of the diagram, so as to have a complete view in real time.

When you've moved elements or modified the room for testing and you want all the speakers to be repositioned as they were at the start, you can use the reset button: 

Finally, to fine-tune the data provided in the spreadsheet area (distances to speakers and vertical angles), you can modify the proposed heights with the bottom sliders.



Note: The heights of the center and wide speakers, as well as the side and rear speakers, depend on the height of the main speakers. For side and rear speakers it depend too whether or not have ceiling speakers.