

A photograph of a grand theatre interior, showing rows of red seats in the foreground and a stage with ornate architectural details in the background. The image is overlaid with a blue geometric pattern.

# Architectural Acoustics Proposal for Theatre

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# 1 Space Information

Space Data and Decorative Product List

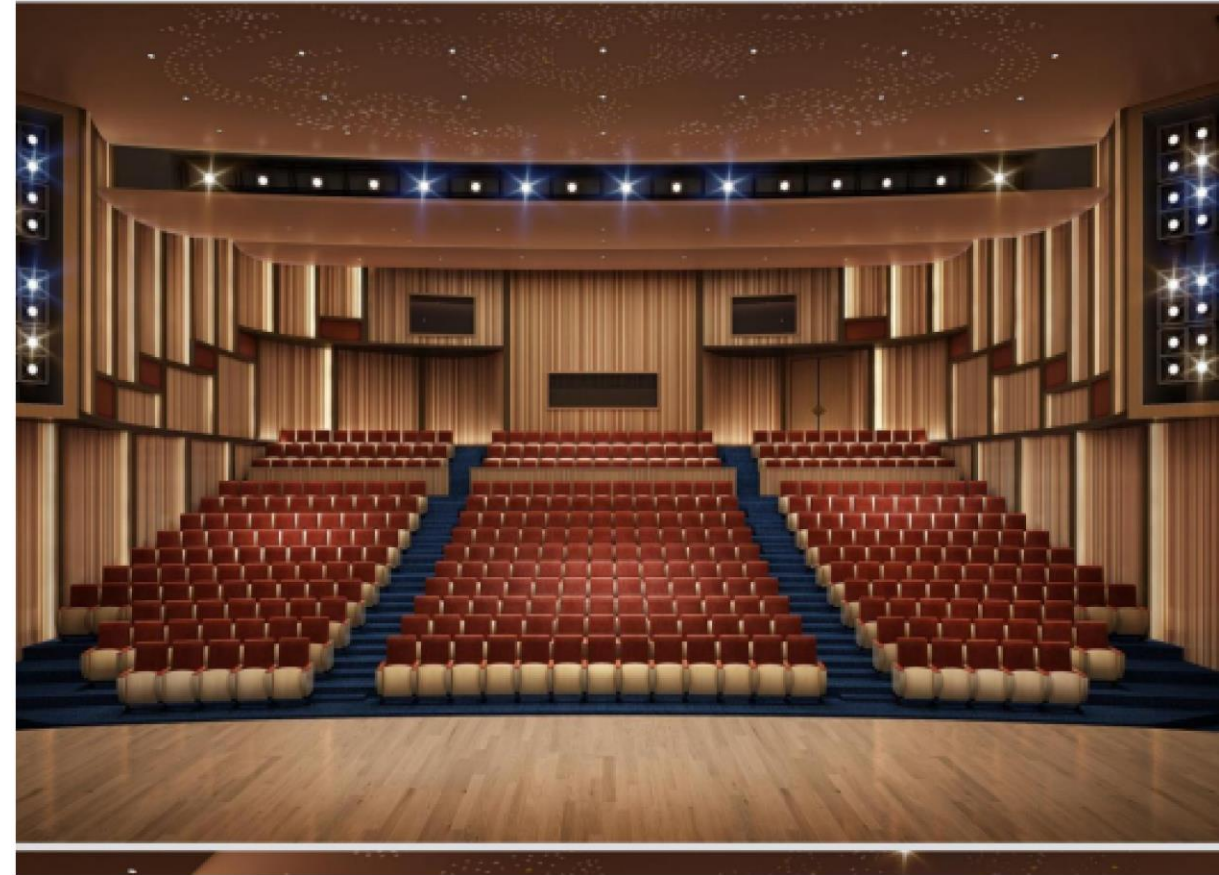
# Space Information

## 1、Space Data

The theatre project is designed to hold 374 guests and has total area of floor plan for 685.54 square meters

## 2、Decorative Product List

Area	Product	Dissipation Coefficient
Ceiling	Gypsum Board	0.2
	Concrete	0.3
Floor	Carpet	0.3
	Wood Floor	0.05
Wall	Wooden Surface Product	0.05
	Wood Door	0.05
Furniture	Chair	0.2



The logo for iSound, featuring a stylized speaker icon with sound waves to the left of the word "iSound" in a white sans-serif font, with a registered trademark symbol (®) to the upper right.

iSound®

A photograph of a theater interior, showing rows of red seats in the foreground and a stage with ornate architectural details in the background. The image is partially obscured by a large blue diagonal overlay on the left side.

# 2 Design Space and Details

# Design Space and Details

## 1、Design Space

The theatre space cover floor plan for 685.54 square meters for the audience load of 374 people

Area	Theatre
Interior Volume	Around 5772m <sup>3</sup>
General Surface Area	Around 2248 m <sup>2</sup>
Total Seating	374 Seat
Length	30.7m
Width	19.24m
Height	9.77m

## 2、Design Detail

Interior Acoustics Performance Design : work with interior decoration team to determine the acoustic construction , acoustic material and to present definite acoustic fidelity index as well as calculation paper.





# 3 Norm and Standard

Acoustics Norm, National Standard

# Norm and Standard



## 1、Norms

Interior Decoration Drawing for Theatre Project

National Standard GB/T50356-2005 (Architectural Design Regulation for theatre, cinema and multi-functional Venues)

National Standard GB3096-2008 ( Acoustic Field Quality Standard)

National Standard GB50118-2010 ( Architectural Acoustic Design Guideline for Civil Building)

## 2、National Standard

As per the national standard GB/T50356-2005 (rchitectural Design Regulation for theatre, cinema and multi-functional Venues), the standard of re-verboration time for theatre project as below

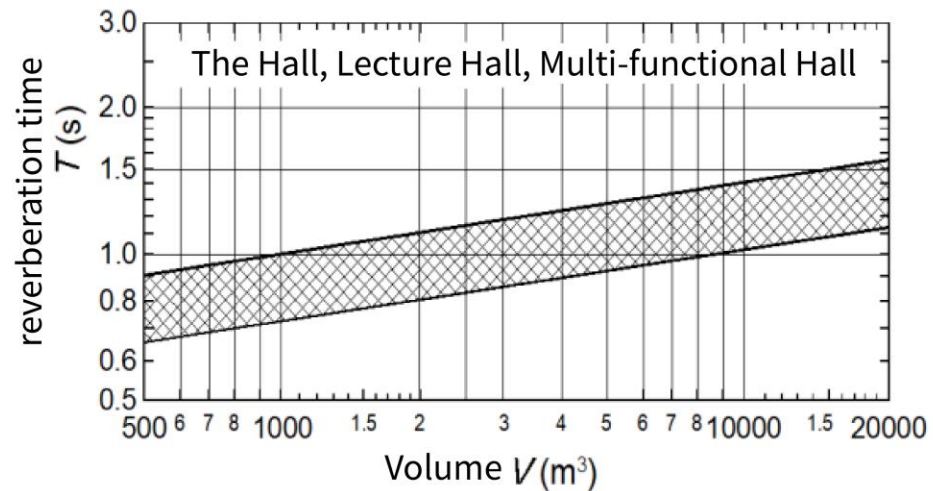




# Norm and Standard

## 2. National Standard

As per the national standard GB/T50356-2005 (Architectural Design Regulation for theatre, cinema and multi-functional Venues), the standard of reverberation time for theatre project as below



Based on the chart above, the reverberation time for the volume of 5772  $m^3$  around 1.3s



# 4 Modeling and Analysis

Space Modeling、Acoustic Field Graphic、Acoustics Parameter  
Sound Effect Simulation、Acoustic Proposal

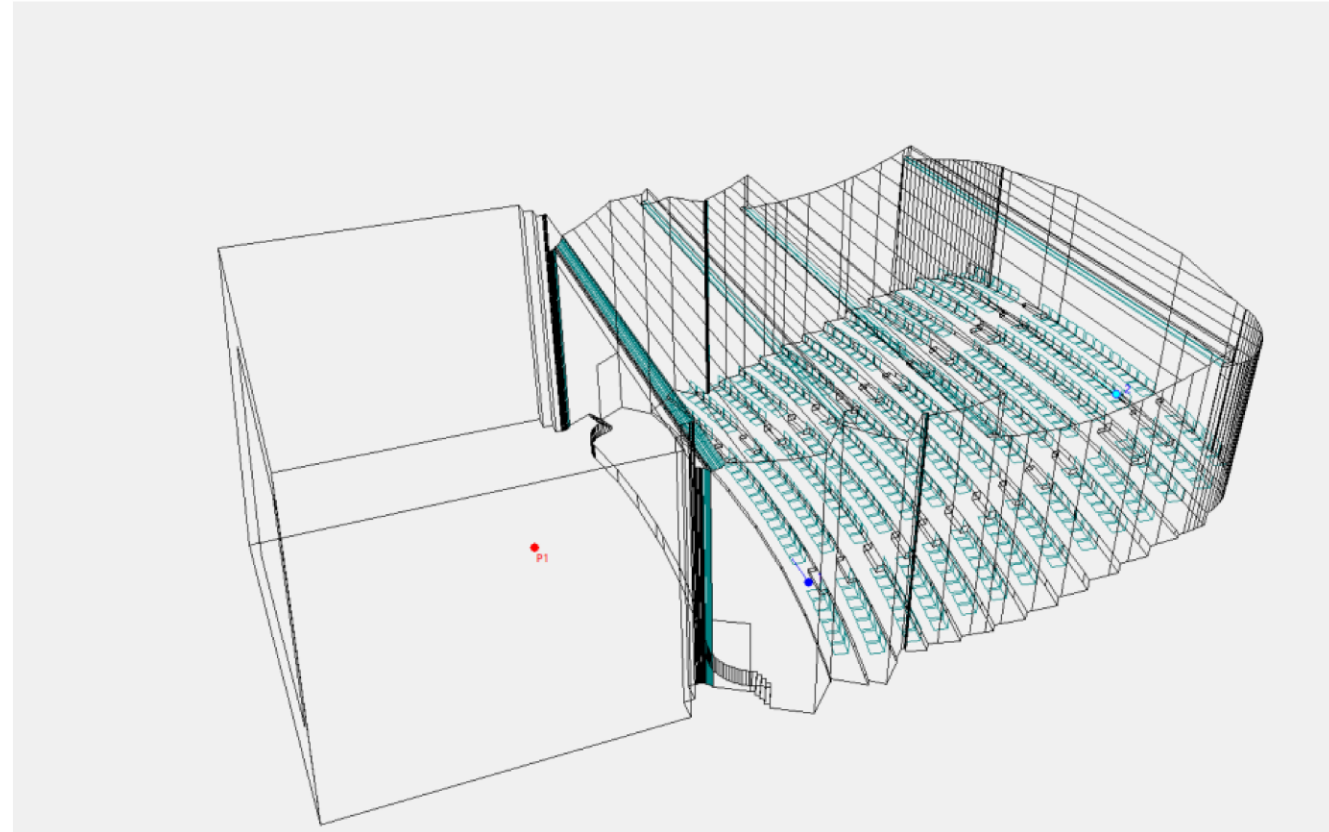
# Modeling and Analysis

## 1、Space Modeling

Modeling the actual project site based on the drawing

The Red PI marks the acoustic source

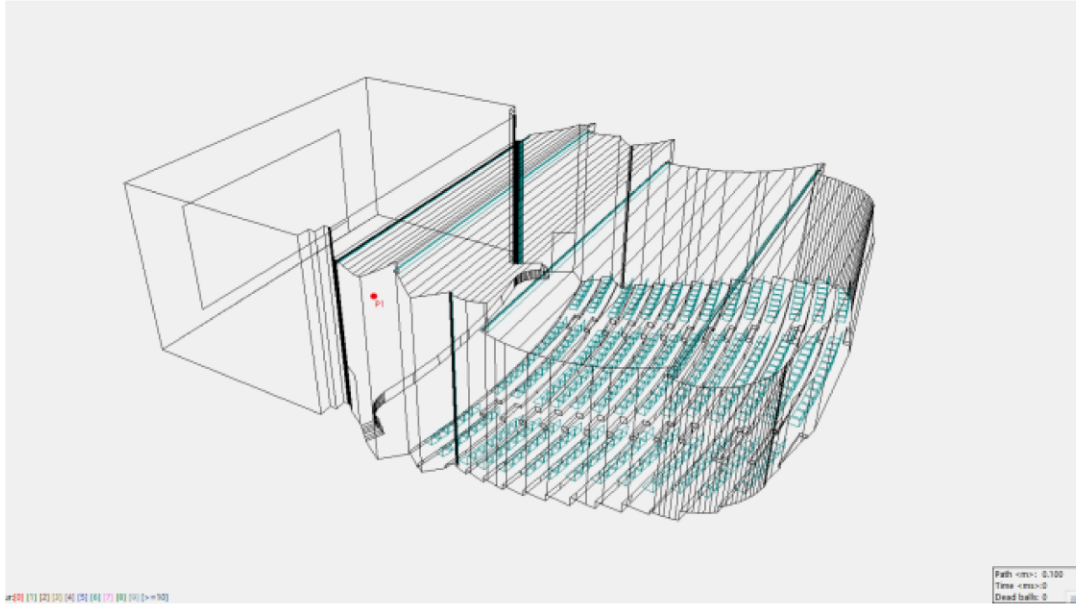
Blue 1,2 marks the audience



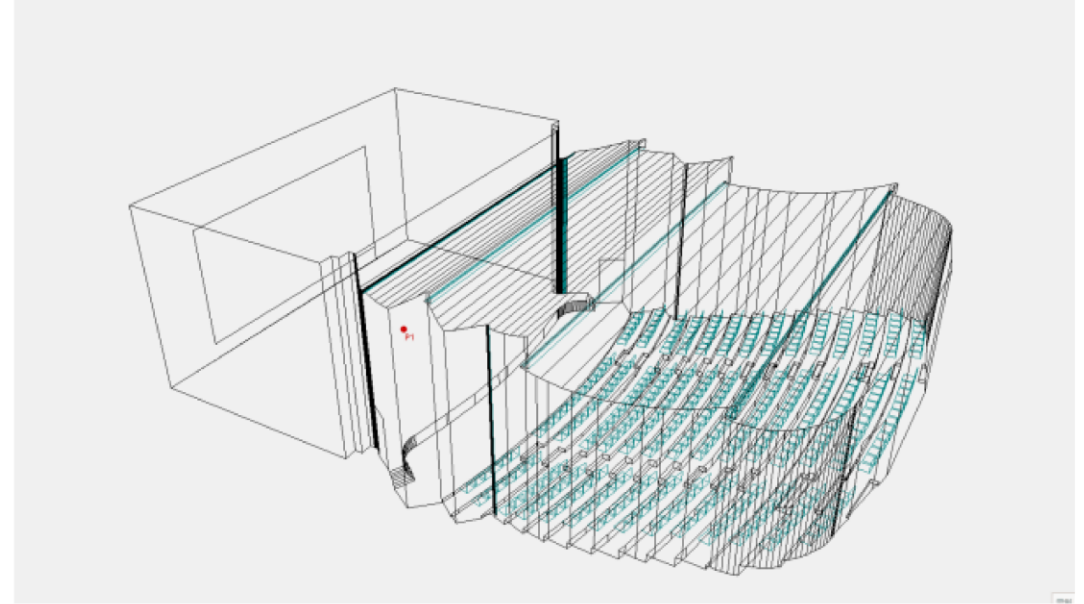
# Modeling and Analysis

## 2、Analysis and Graphic

Sound Particle Reflex



Sound Tracking

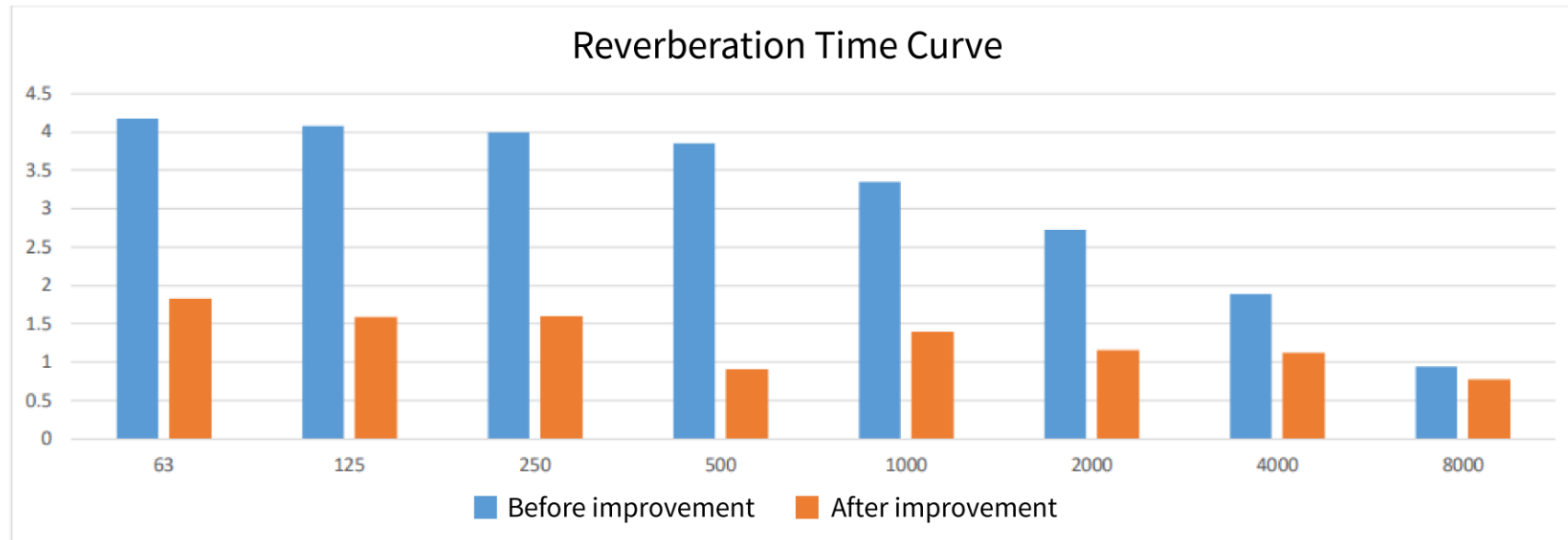


### Remarks:

- 1、Ensure the accuracy of the structure via tracing the sound particle reflex and the sound path.
- 2、It is proposed that the acoustic material be applied to the wall the of the audience hall, the wall of the parados, the grille type acoustic product be applied to the ceiling of the stage to avoid the stationary wave caused from the stage.

# Simulation Analysis

## 3、Acoustic Engineering Design



### Intruction

- 1、The original acoustic proposal with reverberation time around 3S does not comply with the requirement for 1.3S stated in GB/50118 standard
- 2、The interior acoustic engineering design should be applied : the I Micro Acoustic Panel should be applied to the side wall of the audience hall, acoustic grille ceiling should be applied to the stage entrance. After the optimization, the reverberation time through analog computing can be reduced to 1.3S

# Simulation Analysis

## Acoustic Parameter by original Proposal

SPL(A)	13.3	dB
SPL(Lin)	17.3	dB
SPL(C)	17.0	dB
SPL(A_Direct)	-0.1	dB
STI	0.36	
STI(Female)	0.15	
STI(Male)	0.15	
STIPA	0.16	
RASTI	0.34	
STI(expected)	0.12	
EDT(Average)	3.35	s
T(20_Average)	3.48	s
T(30_Average)	3.60	s
G(Average)	8.3	dB
D(50_Average)	0.16	
C(80_Average)	-4.8	dB
Ts(Average)	254	ms
LF(80_Average)	0.575	
Lj(Average)	4.6	dB
BR(RT)	1.1	
BR(SPL)	1.6	dB
SIL	0.0	dB
AI	1.00	
Alcons(STI)	24.31	%
Arrival(early)	62	ms
Density(reflections)	23	/ms

speech intelligibility

After Optimization

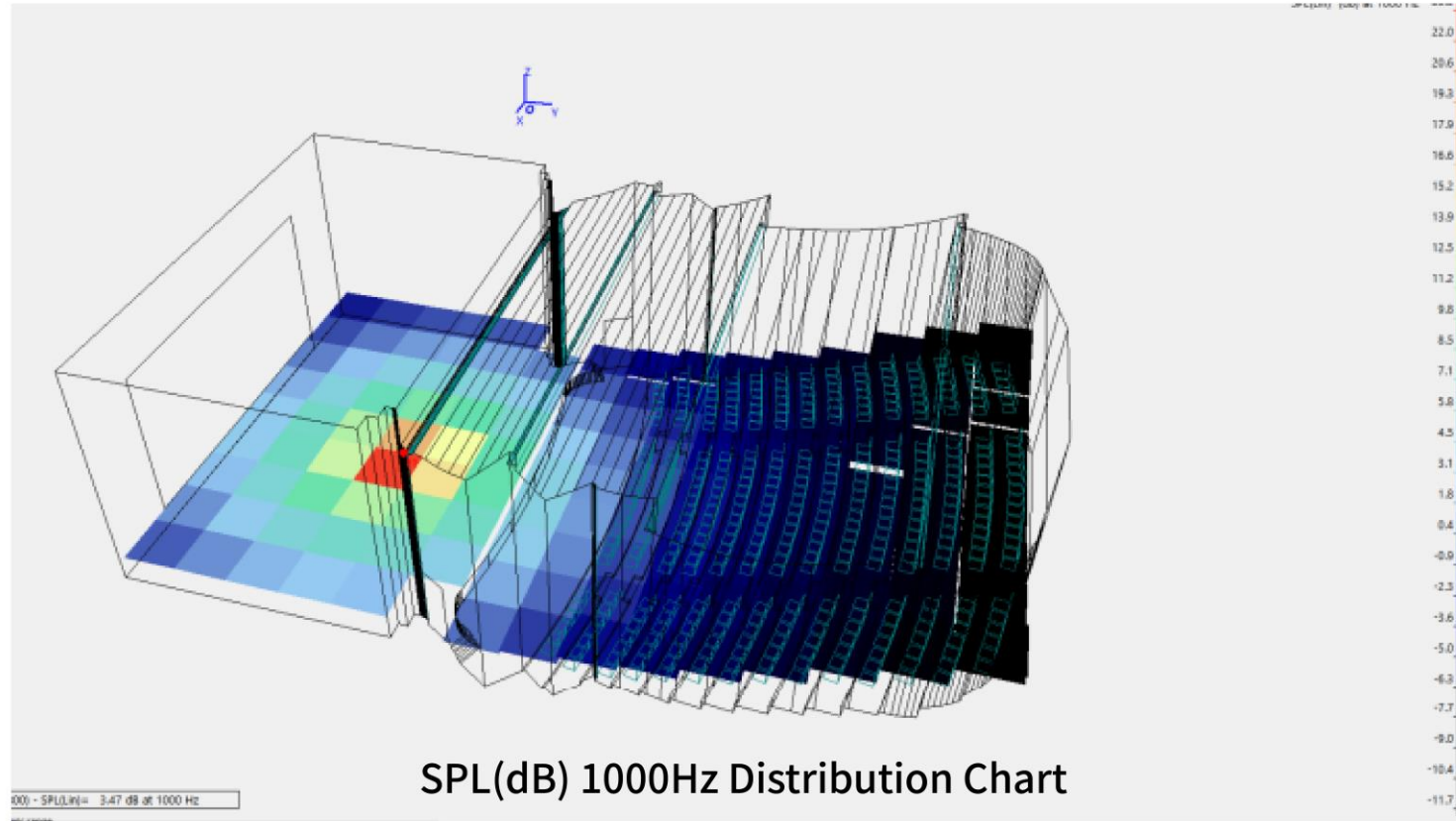
Reverberation Time

## Acoustic Parameter after Optimization

SPL(A)	7.7	dB
SPL(Lin)	11.8	dB
SPL(C)	11.4	dB
SPL(A_Direct)	-0.1	dB
STI	0.57	
STI(Female)	0.13	
STI(Male)	0.13	
STIPA	0.14	
RASTI	0.60	
STI(expected)	0.19	
EDT(Average)	1.53	s
T(20_Average)	1.06	s
T(30_Average)	1.15	s
G(Average)	1.0	dB
D(50_Average)	0.56	
C(80_Average)	2.9	dB
Ts(Average)	70	ms
LF(80_Average)	0.560	
Lj(Average)	-2.7	dB
BR(RT)	1.4	
BR(SPL)	3.5	dB
SIL	0.0	dB
AI	1.00	
Alcons(STI)	8.78	%
Arrival(early)	62	ms
Density(reflections)	23	/ms

# Simulation Analysis

## 4、Acoustic Pressure with Different Location

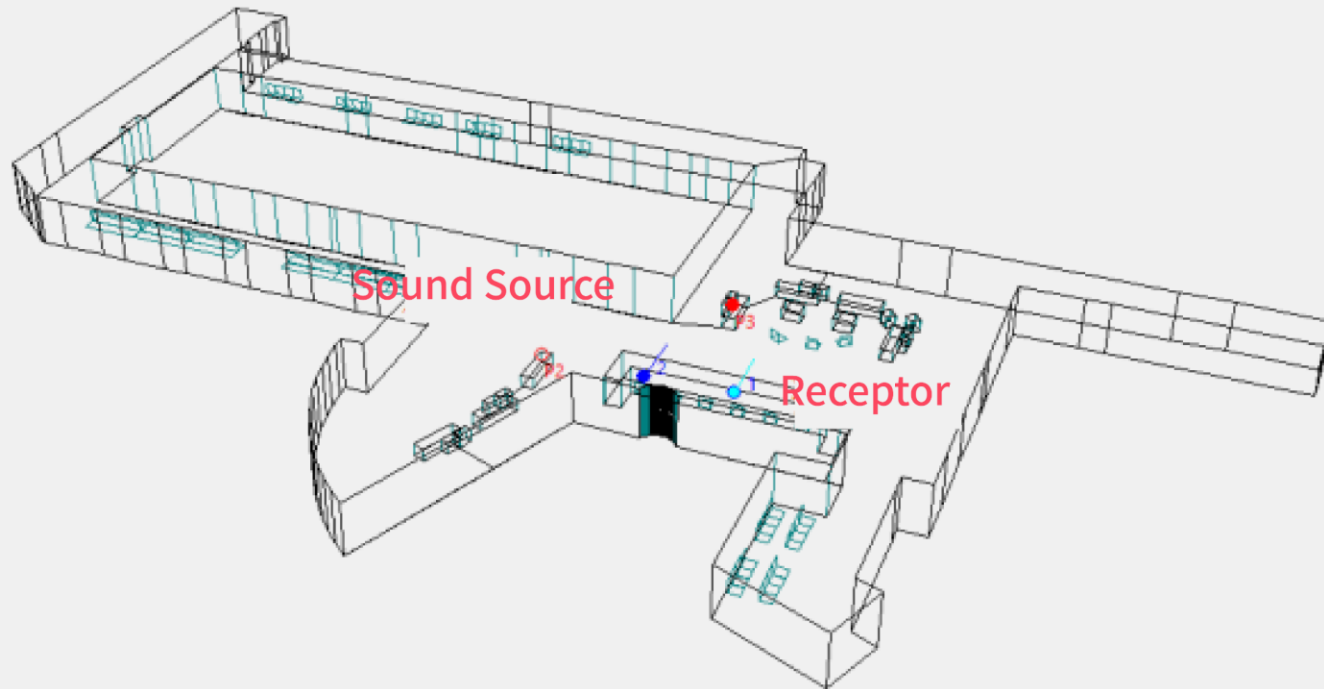


### Instruction

1、The acoustic pressure from sound source to difference location in the hall keep the same and meet with the theatre demand

# Simulation Analysis

## 5、Sound Effect Simulation



Press to play : the old acoustic proposal



Press to play : The optimized acoustic Proposal



# Simulation Analysis



## 6、Acoustic Proposal

The interior designer intends to present the culture of South Yangtze-River through this project and thus showcase the traditional Chinese Art.

So the I Micro Wood Grain Acoustic Panel which is applied to the interior wall to fulfill the idea of the designer while achieve the required acoustic function. The product is free of formaldehyde and could achieve A Level FR rating.

Acoustic Quality Design	National Standard		Rough Cast	After Optimization
	Reverberation Time < 1.3s		3-4S	About 1.3S
	Material Recommendation	I Micro MAX product for around 715.54 m <sup>2</sup> will be applied to the wall, and 50-100mm space made from the surface to the wall		
		I Micro Grille Ceiling Oak Color with 50*50mm size will be applied to the entrance ceiling		
Noise Control	National Standard		Original Proposal	After Optimization
	Sound under 40db		/	/
	Material Recommendation	Above 50db for the Wall		
		Denoise wood door be used to achieve acoustic function above 35db		

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