Measuring Room Acoustics to Implement into a Virtual Space

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Introduction:

In light of the global pandemic, Covid-19, an exploration of into alternative options for live concerts was proposed. Concerts across the world were cancelled/postponed throughout 2020 and the live events industry was faced with a massive loss of over $30 Billion globally (TheTicketingBusiness, 2020). With artist moving to over means of getting content to fans through live streams and/or pre-recorded live shows, there has been a lack of development of the immersive aspect of being at a live event. As virtual spaces and VR has seen improvement in education, it is proposed that those advancements can also be utilized for live events in the midst of the pandemic. This project tackles the development of an immersive virtual event experience, in which users would experience a virtual theatre space with accurate acoustics applied to the area.

Aims:

The aims of the project are as follows:

- Acoustically treat a theatre space for general music listening
- Simulate theatre design within a game engine
- Apply acoustic development to the design simulation

Methodology:

The methodology for this project has two phases:

1. *Acoustic Treatment*

Using CATT-Acoustic (CATT, 2021) and a theatre model (SketchUp, 2019), presented in figure 1, will be acoustically treated by adding and replacing materials on the model using guidelines provided by Nebraska Acoustics Group (NAG,2020) and tested from 3 different listening points within the model. Testing for: Speech Intelligibility (STI), Reverberation Time (RT60), and Sound Pressure Level (SPL). Finally, a recording of the finished theatre's impulse response is taken.

2. *Acoustic Implementation*

Using Unreal Engine 4(UE4) (Epic Games, 2018) the chosen theatre model is imported into the game engine and, using recent additions to the engine (Epic Games, 2020), the acoustic are added to the sound source within the level creating an immersive theatre in a virtual space.

Conclusion:

This project has established a method for creating acoustically accurate rooms within a virtual space and has the ability to give live events communities a more immersive experience for shows that cannot be attended due to Covid-19 restrictions.
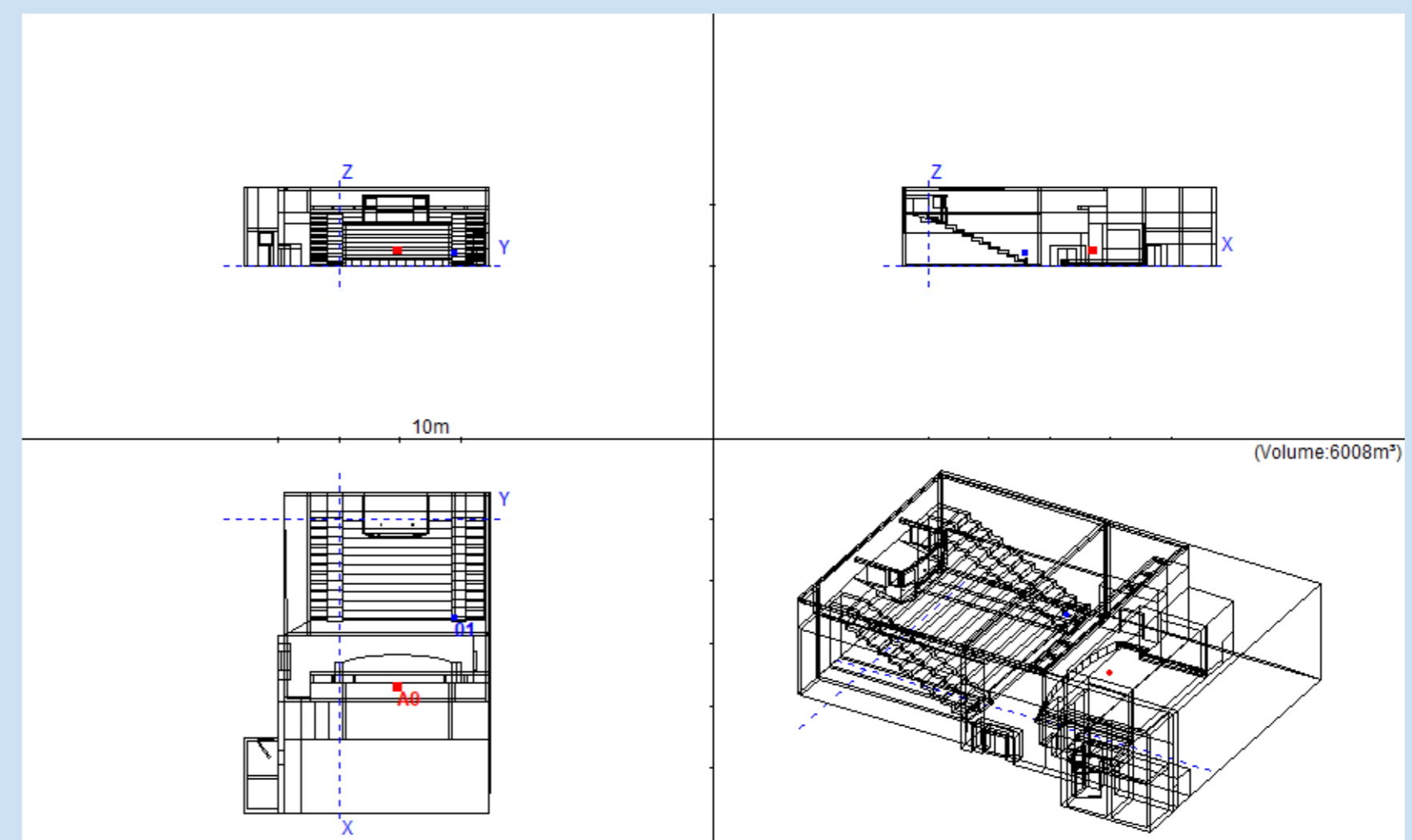

Figure 1: CATT-Acoustic Models

Results:

Results for RT60, SPL and STI from three different receiver points are depicted in figure 2:
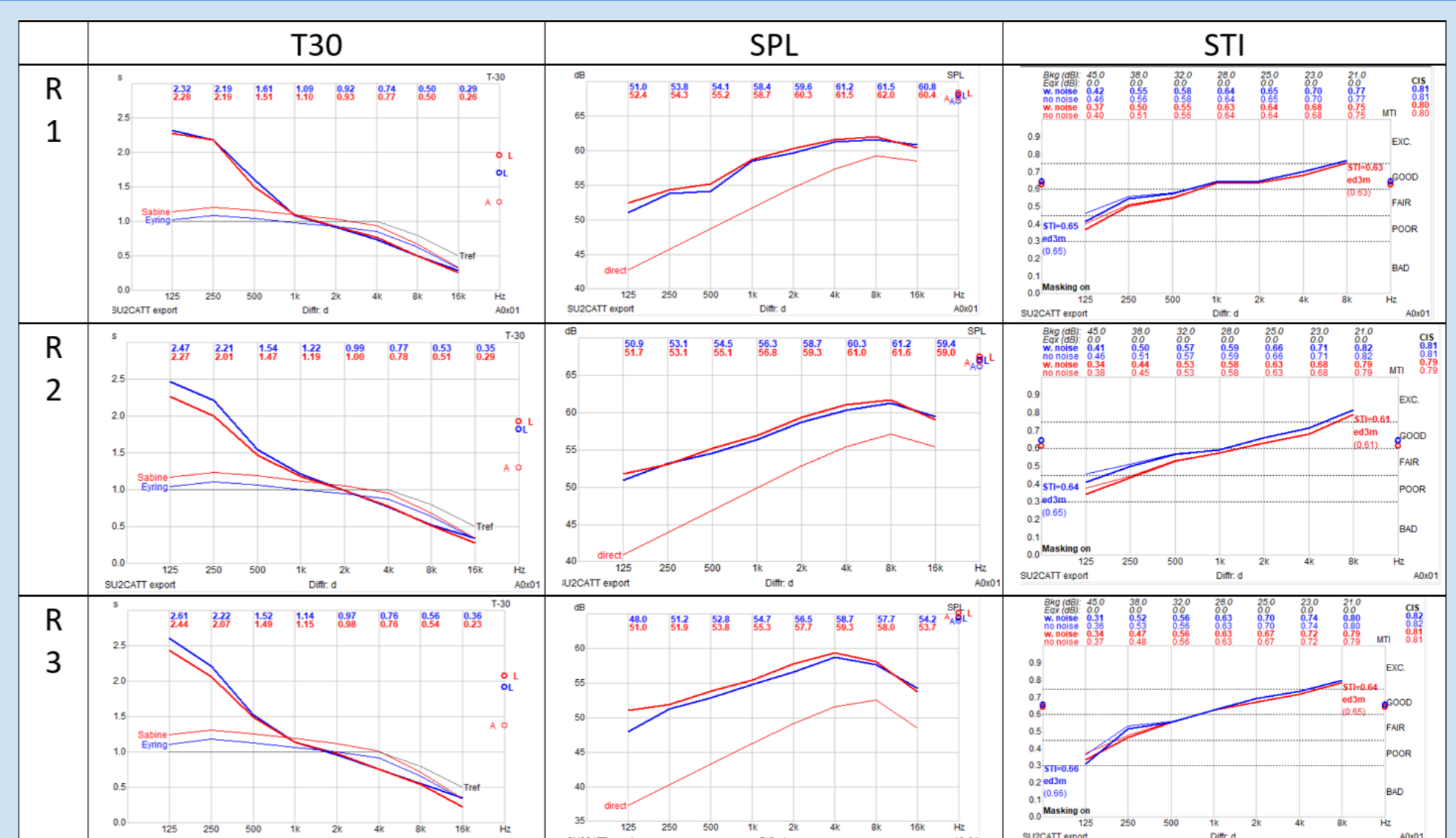

Figure 2: CATT-Acoustic Results

The UE4 model now has accurate acoustics applied to the sound source and now varies based on the position of the player to the source forming an immersive audio experience for players within the level.
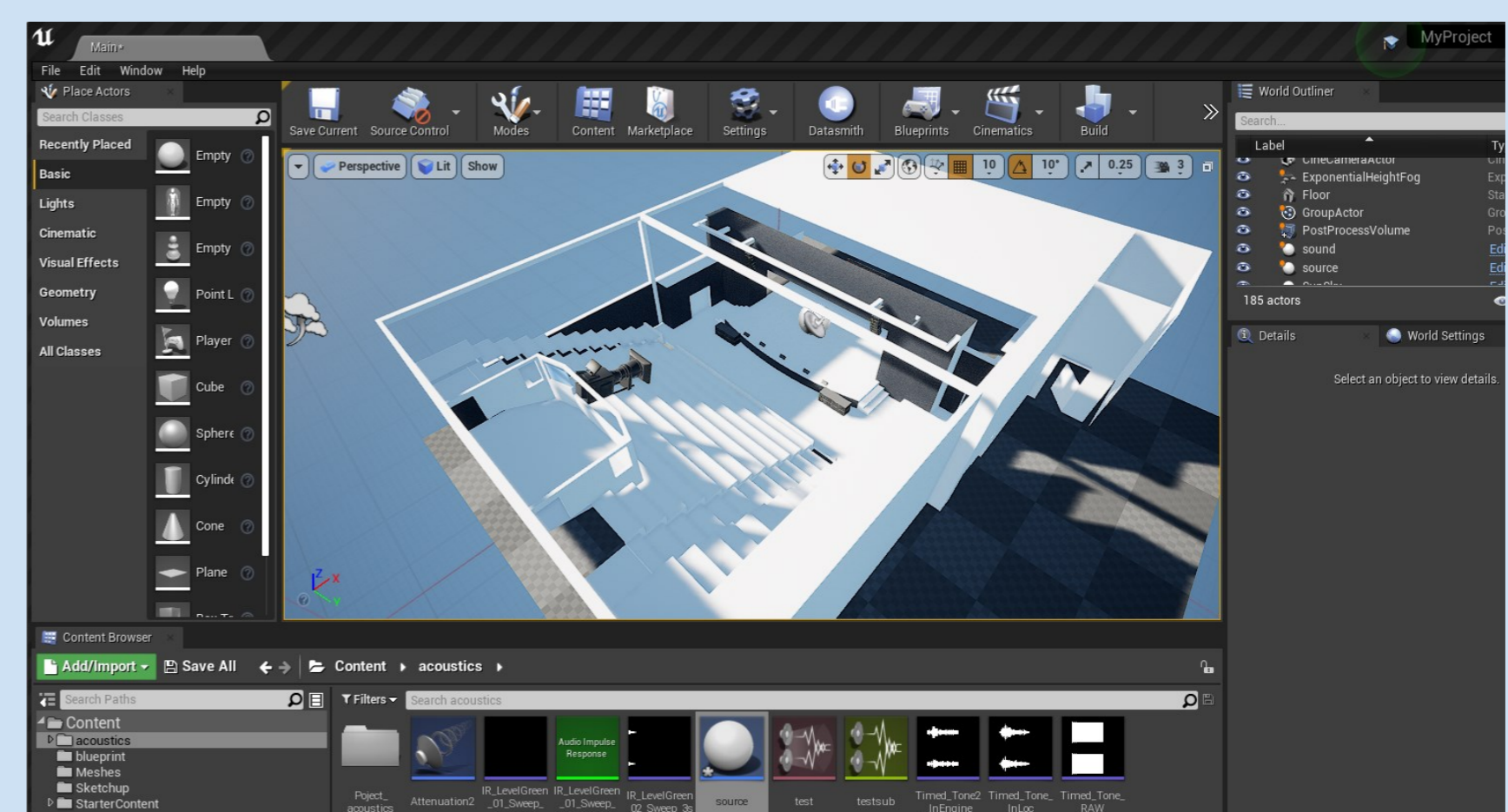

Figure 3: Model in Unreal Engine 4

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