

VIVE

VIVE 3DSP SDK Guide (Unreal Plugin)

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System Requirements

- Unreal Engine version 4.19 or higher
- Windows® 7 SP1, Windows® 8 or later, or Windows® 10
- Intel® Core™ i5-4590 equivalent or better
- NVIDIA® GeForce® GTX 1060 or AMD™ Radeon™ RX 480, equivalent or better graphics card

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Why is 3D Audio Needed in VR?

When putting on a VR headset to enjoy a scenario such as shooting at zombies or walking in a forest, people want to immerse themselves extremely in that scene. There may be awesome visuals in the scene, but it will be less immersive without accompanying audio or subpar audio. Audio is crucial to increase immersion and sense of presence in VR.

Before diving into what can be done to improve VR audio experience, the principles of how sound localization is perceived by human beings is firstly introduced.

Localization

Localization is the inherent ability of human beings to figure out where a sound is coming from based on human auditory system. By understanding the human auditory system, real-world spatialized sound is simulated in a VR environment.

These are the factors that help us with localization:

- **Lateral**
  - **Interaural time difference**: The direction of a sound source can be determined by the time difference that a sound arrives to our ears, i.e. if we hear the sound first through our right ear before our left ear, we can more or less be sure that the sound is coming from the right direction.
  - **Interaural level difference**: The direction of a sound source can also be determined by the loudness level that is awared between ears. (i.e. If the sound is louder on the right ear compared to the left ear, we can assume that the sound is coming from the right direction.)
- **Elevation and Front/Back**: In order to distinguish directions which have the same arrival time and level, direction selective cues (pinna, head, shoulder, and torso) are used as the main reliable features. These cues are used to help determine where the sound is coming from. Moreover, people can also cock the heads up or turn our heads left or right to determine the direction of the sound source more precisely.
- **Pinna**: When the sound arrives at the head, it will then be collected and filtered by the outer ears. These filters provide cues to our brain to determine where the sound is coming from.

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- **Head/Shoulder/Torso**: Sound is partially blocked or absorbed by the body before arriving at the ears. It can offer some cues as well.

Room Reverberation

If the user is inside the room, the walls and objects in that room will reflect or scatter the sound waves. The sound waves will bounce again and again, and form a particular audio perceptual experience in that room. It not only builds a realistic feeling of the room, but also improves the accuracy of the directional perception.

Distance

Another aspect of localization is our ability to gauge the distance of a sound source. Here are some of the ways we judge the distance of a sound source.

- **Loudness**: Louder sounds are usually closer while quieter sounds are usually farther. In some cases, it is hard to judge the distance by the loudness if people are not familiar to the sound. We also take into consideration the relative loudness. When sound approaches, it gets louder and vice versa.
- **Initial time delay**: This is the time between the initial sound arriving and the first early reflections. If somebody is standing right next to you in a room and talking to you, you'll hear the voice right away then the reflections of the voice a bit later. If the person is standing farther away, you'll probably hear the voice and reflections about the same time.
- **Mix of direct and indirect sounds**: A sound is judged to be near to the listener when it is louder than the background noise. Otherwise, the background noise would be easier perceived by the listener.
- **Interaural level difference**: If there is an obvious volume difference being perceived between the right and left ears, the sound is most likely to be close to the audience. If the volume difference between the two ears is negligible, the sound is probably to be far away.

Spatialization

Spatialization is an audio process which gives the listener the impression that he/she is inside a virtual 3D environment. Spatialization is a key factor for an immersive VR experience. Lots of features are accomplished to simulate the real spatial feeling in 3DSP SDK, such as:

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- Head-related transfer functions (HRTF) recording and improvement
- Higher Order Ambisonic simulation of sound direction
- Room audio simulation
- Adding background noise floor
- Real-world acoustic properties of distance
- Geometric and Raycast Occlusion
- Hi-Res audio support

and many other features

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VIVE 3DSP SDK

The VIVE 3DSP SDK provides an audio solution for simulating realistic sounds inside the virtual world. This SDK provides the tools you need to create engaging and immersive spatial audio for your VR apps or experiences.

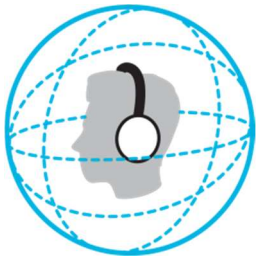
The VIVE 3DSP SDK is made for VR content developers. A host of features are designed and implemented to provide developers a rapid spatial audio solution. The audio quality and audio source localization can be further optimized if the VIVE Pro headset is used. There are some improvements made specifically for the audio system provided in the VIVE Pro headset.

Some of the unique features of the VIVE 3DSP SDK:

- Higher Order Ambisonics (HOA) that uses very low computing power.
- Head-Related Transfer Function (HRTF) based on refined real-world modeling (horizontally and vertically) resulting in a better algorithm that is applied to all sound filters and effects.
- Room Audio simulates the reflection and reverberation of a real space.
- **Hi-Res Audio** source files and playback.
- Sound Decay Model based on real-world modelling.
- Geometric Occlusion calculated the blocking area using its own algorithm.
- Ambisonic Decoder supports playing the AmbiX format ambisonic decoder.

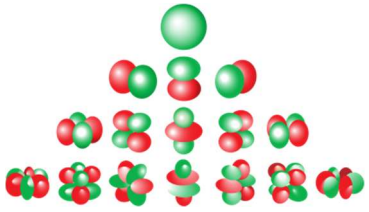
The VIVE 3DSP SDK guarantees the best audio experience when developing for VIVE. However, it can be used when developing for other VR headsets as well.

Higher Order Ambisonics (HOA)



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Ambisonics is the technology that uses a full-sphere surround sound technique to simulate spatial sound. It counts the sound pressure changes around the listener by spherical harmonics.



The order of the spherical harmonics is also called the order of ambisonics. The order of ambisonics has a big influence on the realistic depiction of the direction of sound. Therefore, 3rd order ambisonics is used as our spatial audio model as it generates spatial sound with better directivity and higher resolution.
The higher the order that is used, the higher computing power is required for the ambisonic process. However, our patent-pending technique that is used on our 3DSP ambisonic process requires low computing power akin to using the first order ambisonic, even though the 3rd order is used.

Note: Higher Order Ambisonic technology is only used for object sound spatialization and not for decoding the ambisonic file format. Ambisonic file playback support is in our future plans.

Head-Related Transfer Function (HRTF)

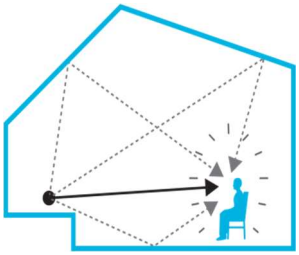
The head-related transfer function is the recordings of the acoustic responses in all directions. There are many factors that could change the audio experience coming from an audio source travelling to the human ears, and it is too complex to simulate by dedicated functions. Therefore, a database has been created where the acoustic response in any direction has been measured and saved. Audio response can then be simulated by using the recorded data from this database.

In the VIVE 3DSP SDK, there is an HRTF database which was measured with fine directional segments, both horizontally and vertically. This means that thousands of directions of HRTF have been measured. For HRTF directions that have not been measured, these could also be generated by the measured directions nearest to it, with the quality benefitting from the fine measurement

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of the HRTF database. The quality degradation caused by the environment, the measuring equipment, and other factors that affect HTRF have also been improved in our database.

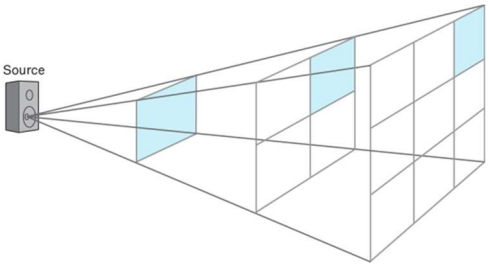
Room Audio



Room Audio is the technology that simulates room audio through the early reflection, late reverberation, background noise, and others. The early reflection is the reflected sounds within a few milliseconds, and we simulate these reflected sounds through delay.

There is also an option to choose the material for each wall (wood, carpet, concrete, and glass) in a room. Different wall materials produce different types of reflections. After the first reflection, the sound encounters more reflections and mixes with the background sound. The resulting sound could not be simulated by large amount of reflections so a well-designed formula is required for generating accurate late reverberation.

Sound Decay Model

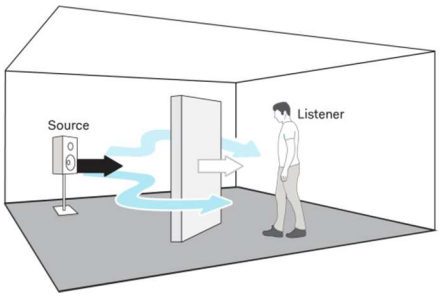


When a sound source approaches or moves away from the user, the sound heard by the user should also change depending on the distance between the sound source and the user. The inverse square law is used for this scenario to determine the change in the sound levels.

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Our SDK provides the real-world distance effect which measures the response at different distances between the sound source and listener and then applies the proper response measurement. Also, point source and line source decreasing models have been provided as well.

Occlusion



The occlusion effect is used to accurately simulate what happens to sound when it encounters an obstacle in its path. The resulting sound produced depends on the material (window, thin door, wood wall, stone wall, and curtain) and thickness of the obstacles that the sound encounters in its path.

The VIVE 3DSP SDK provides mono and binaural occlusion mode, while the binaural occlusion mode simulates a better realistic binaural sound in VR. It also provides two kinds of occlusion, Geometric Occlusion and Raycast Occlusion:

- **Geometric Occlusion:** The blocking ability of an object is calculated by analytical geometry techniques. Two shapes are currently provided: Sphere and Box.
- **Raycast Occlusion:** The blocking ability of an obstacle is calculated by pointing many rays into space and finding which ones are blocked. It can be used for any kind of obstacle shapes but uses more computing resources than Geometric Occlusion.

Ambisonic Decoder

Audio recordings for 360 and VR videos are now mostly achieved by sound field microphones in the 4-channel B-format. However, these channels do not translate to a fixed representation of sound. Instead, the ambisonic decoder can interpret and reshape the sound recordings in different ways.
The VIVE 3DSP Spatializer supports ambisonic audio. You can play 4-channel AmbiX format (in ACN ordering and SN3D normalization) audio clips, rotate the headset, and then hear the sound field effect.

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Getting Started

Enable Audio Mixer Functionality

VIVE 3DSP Audio Plugin requires the latest Audio Mixer function in Unreal Engine 4.19 (or later) to be turned on.

1. In the Epic Games Launcher, click **Unreal Engine** > **Library**.
2. In the Unreal Engine version you want to use, click 

> **Create Shortcut**.
3. On your computer desktop, duplicate the shortcut that was just created.

Next, you need to change the command-line argument used when launching the Unreal Editor using the shortcut:

1. On your computer desktop, right-click one of the Unreal Editor shortcuts and select **Properties**.
2. Click the **Shortcut** tab.
3. In **Target**, add **-audiomixer** at the end of the command line.



4. Click **OK**.

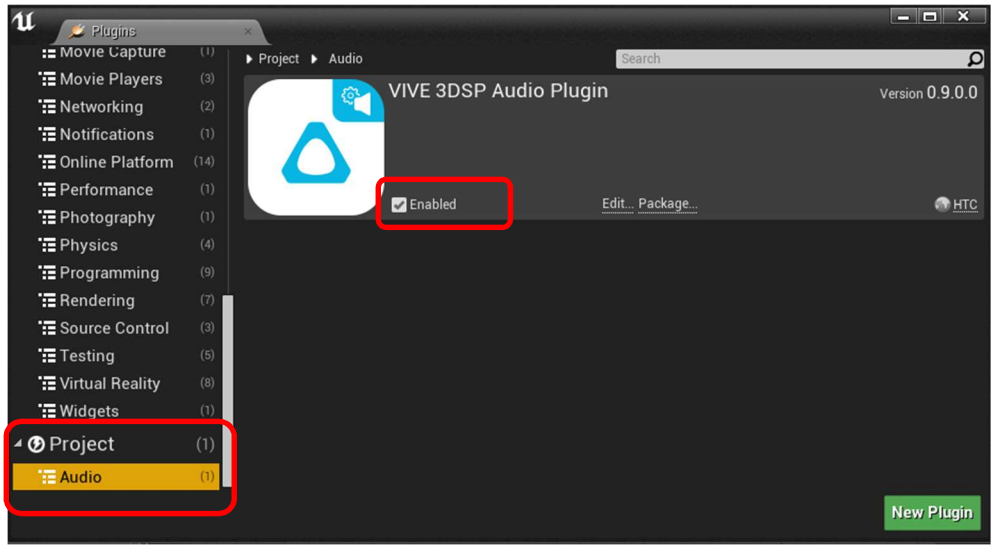
Enable VIVE 3DSP Audio Plugin

Before you can use VIVE 3DSP Audio Plugin with Unreal Engine, you need to add it and turn it on for your project.

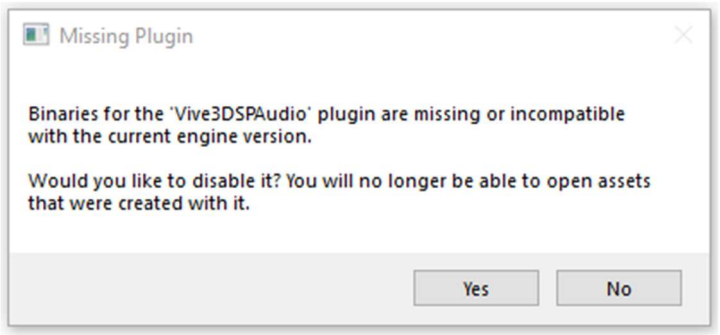
1. Create a **Plugins** folder under your game project directory.
2. Copy the **HTC** folder to the **Plugins** folder you created.
3. Launch Unreal Editor (or game.) The VIVE 3DSP Audio Plugin should be turned on. If not, do the following:
    a. In the Unreal Editor main menu, click **Edit** > **Plugins**.

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b. In the left pane of the Plugins window, under **Project**, click **Audio**.
c. In the list of plugins, look for **VIVE 3DSP Audio Plugin**, and then select the **Enabled** option.

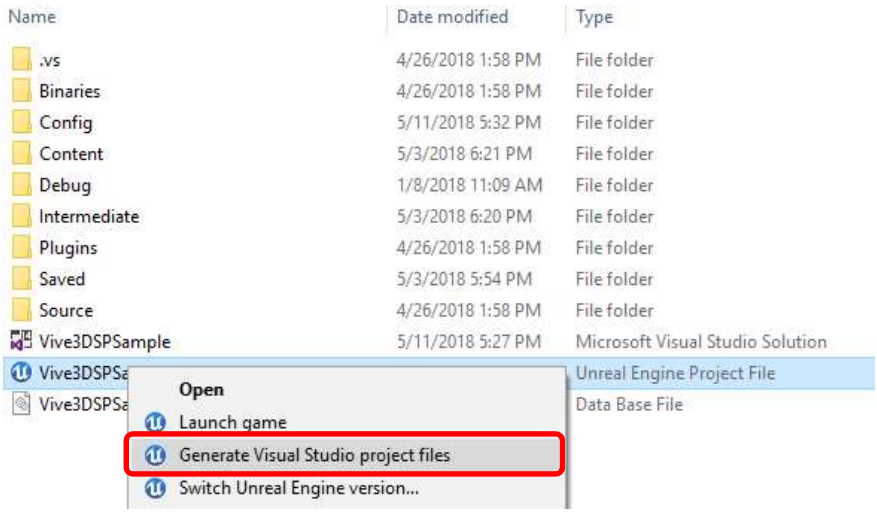


Note: If you see a warning message like the one below, you will need to rebuild the project.



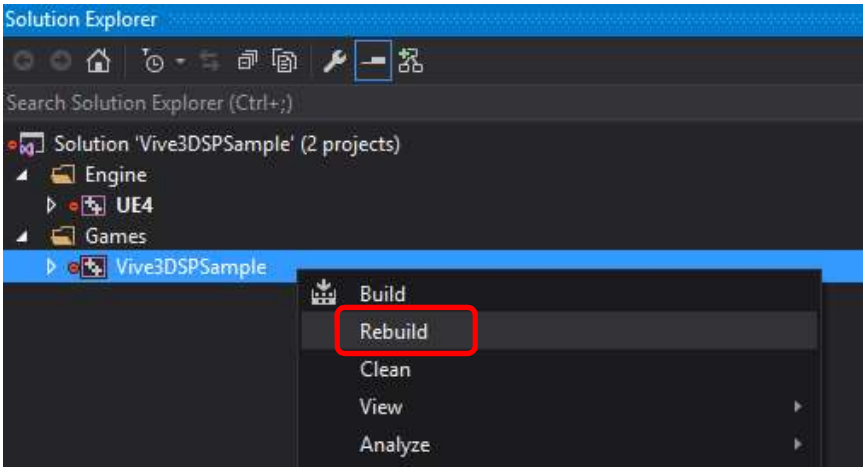
To rebuild the project

1. Open the project folder and right-click **.uproject file**.
2. In the drop-down menu, select **Generate Visual Studio project files**.



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3. Double-click the **.sln file** to start Visual Studio.
4. In **Solution Explorer**, right-click the folder of your project and select **Rebuild.**



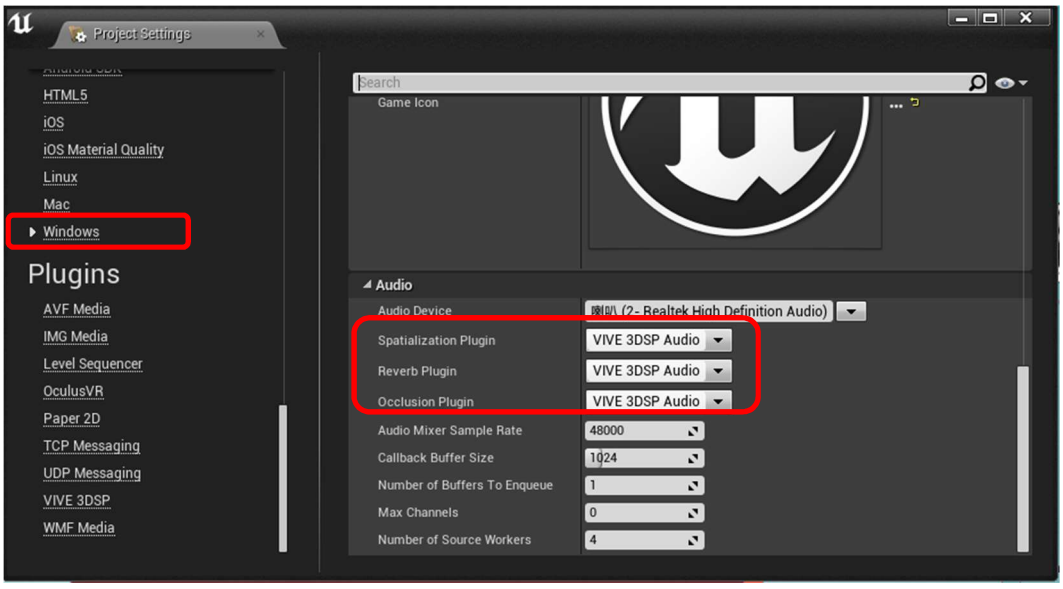
Set Up Required Plugins

In Unreal Engine, you can individually configure the spatialization, occlusion, and reverb plugins per platform. Currently, the VIVE 3DSP Audio Plugin only supports the **Windows** platform.

For Windows:

1. In the Unreal Editor main menu, click **Edit** > **Project Settings**.
2. In **Platforms**, select **Windows**.
3. In **Audio**, select **VIVE 3DSP Audio** for all the plugins.

Important: **VIVE 3DSP Audio** needs to be selected in all three plugins in order for the VIVE 3DSP Audio plugin to work properly.



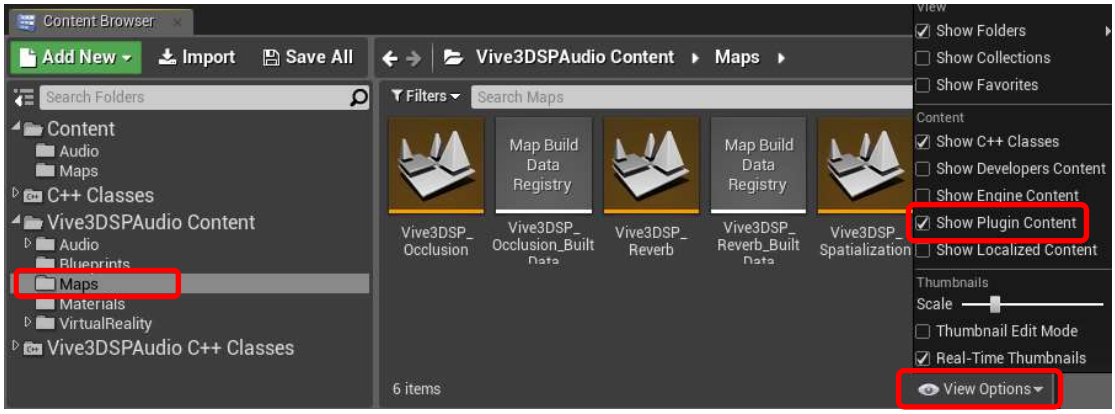
4. Restart Unreal Editor.

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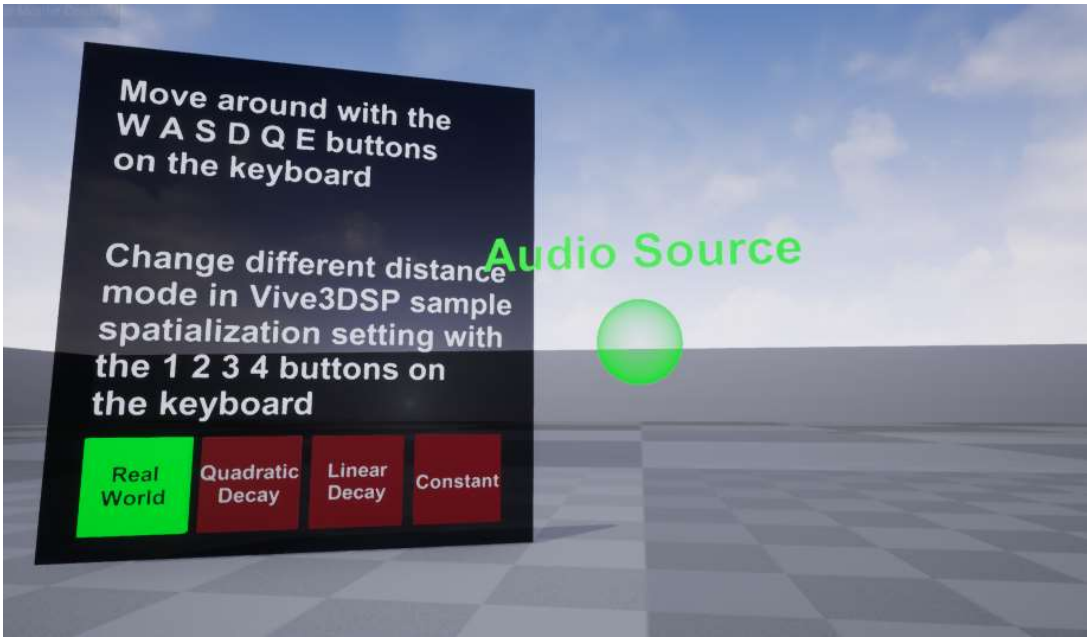
Try Out VIVE 3DSP Sample Maps

The VIVE 3DSP Audio Plugin includes three sample maps where you can hear different sound effects. The green sphere in the map represents the audio source.

1. In the **Content Browser**, select **View Options** on the bottom-right corner, and then select **Show Plugin Content**. The Vive3DSPAudio Content folder will then show on the left.
2. The sample maps are in **Vive3DSPAudio Content** > **Maps**. Double-click one to try it.

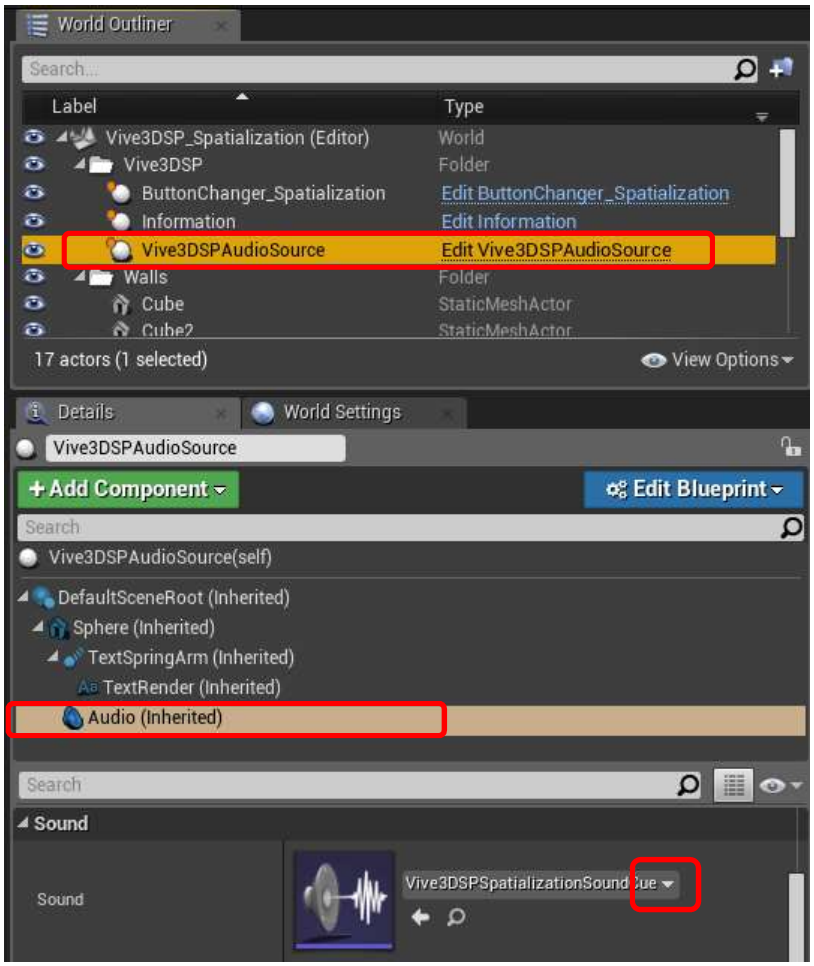


3. Make sure to wear headphones to experience the spatialized, reverbed, or occluded audio. Click **Play** in the Unreal Editor. You can play the sample map in **VR Preview** or **Selected View Port**.
4. Interact with the scene using the keyboard or controller by following the instructions on the floating panel.



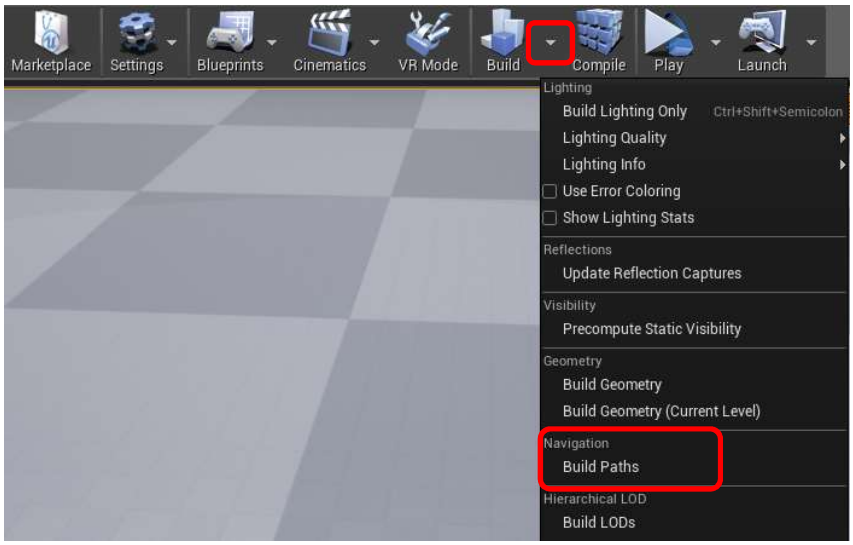
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5. To change the audio, in the **World Outliner**, select **Vive3DSPAudioSource.** Then, in the **Details** tab, select **Audio Component** to change the **Sound**.



Notes:

- Currently in UE4, only mono audio sources can be spatialized, reverbed, or occluded.
- If you cannot teleport in VR Preview, rebuild the navigation in **Build** > **Navigation** > **Build Path**.



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VIVE 3DSP Ambisonic Decoder

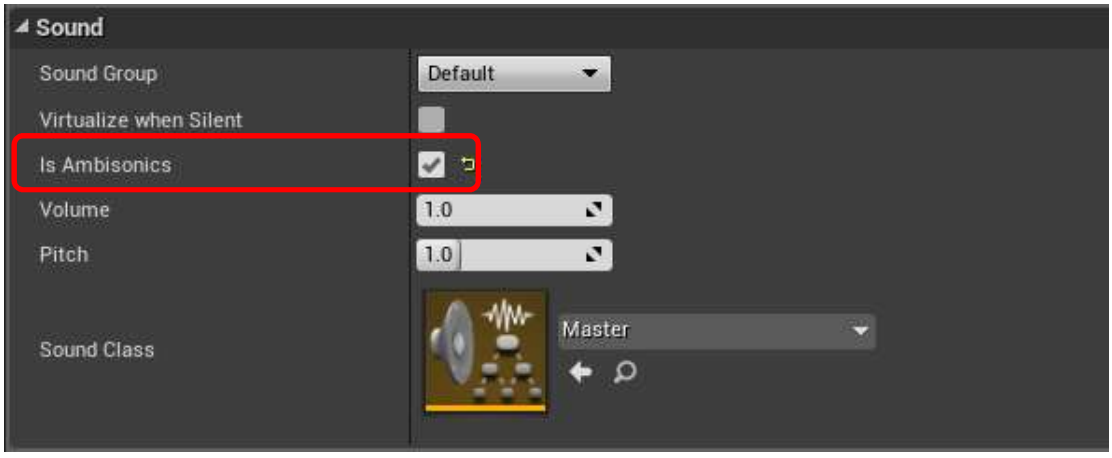
The following steps here build on the completed steps in Getting Started. If you are new to working with the VIVE 3DSP Audio plugin for Unreal or have not yet set up your development environment, start there.

The VIVE 3DSP Audio plugin supports decoding First Order Ambisonic files that are imported into projects. When playing back an Ambisonic-formatted audio file in an app, the VIVE 3DSP Ambisonic decoder automatically detects the listener's orientation so sounds are always depicted correctly. This feature requires Unreal Engine version 4.19 or higher.

Import an AmbiX file into your project

Before importing the Ambisonic-formatted audio file into a project, append **_ambix** to its file name. This is required so that Unreal can decode the Ambisonic audio file correctly.

1. Click **Import** or drag the audio file into the **Content Browser**.
2. Double-click the imported audio file.
3. In the **Details** panel > **Sound**, make sure the **Is Ambisonics** option is selected.



4. Drag the ambisonic file to the scene and click **Play**. You will hear the Ambisonic file decoded binaurally using the VIVE 3DSP ambisonic decoder.

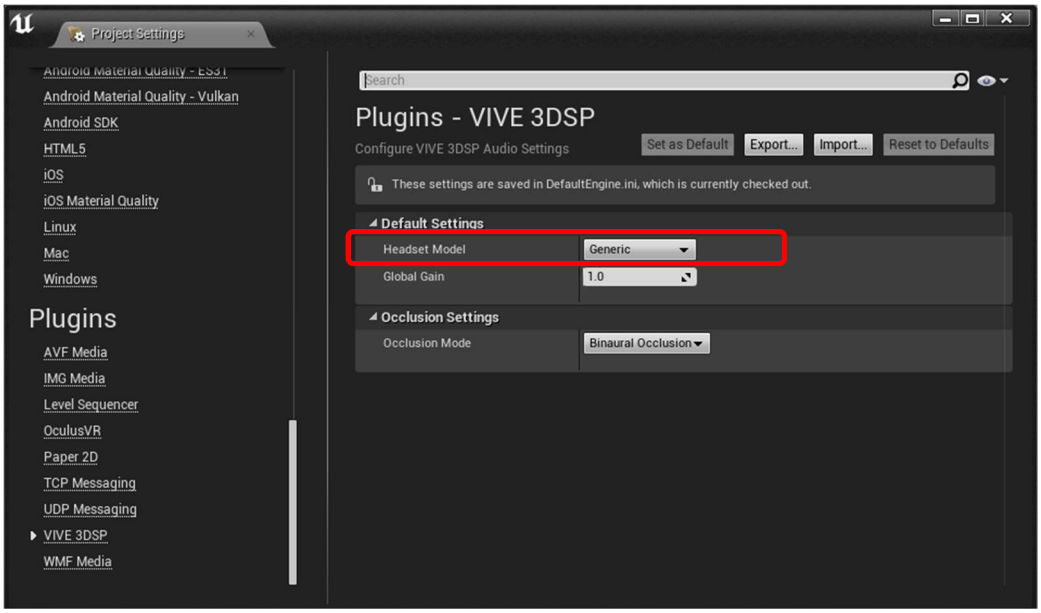
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VIVE 3DSP Audio Plugin Settings

The following steps here build on the completed steps in Getting Started. If you are new to working with the VIVE 3DSP Audio plugin for Unreal or have not yet set up your development environment, start there.

VIVE 3DSP Audio Plugin provides optimized audio tuning for the VIVE Pro. If you are using the VIVE Pro, set it as the headset model.

1. In the Unreal Editor main menu, click **Edit** > **Project Settings**.
2. In **Plugins**, select **Vive 3DSP**.
3. In **Headset Model**, select **VIVE Pro** to tune and optimize the audio localization. If you are using a different device, select **Generic**.



The **Global Gain** is the total volume of the audio sources from the VIVE 3DSP Audio Plugin.

You can also set the occlusion type of the VIVE 3DSP Audio Plugin by choosing the **Occlusion Mode**. Select **Mono Occlusion** to render the same occlusion effect in both ears; select **Binaural Occlusion** to render the occlusion effect separately in both ears.

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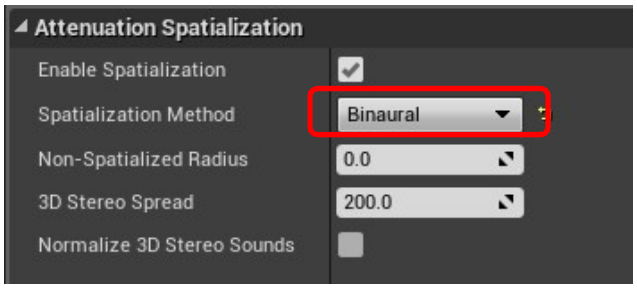
VIVE 3DSP Spatialization Effect

VIVE 3DSP Audio Plugin offers an easy way to add 3D Audio for VR games and experiences. You can apply **VIVE 3DSP Audio Spatialization** to any Actor in your scene that contains an Audio Component.

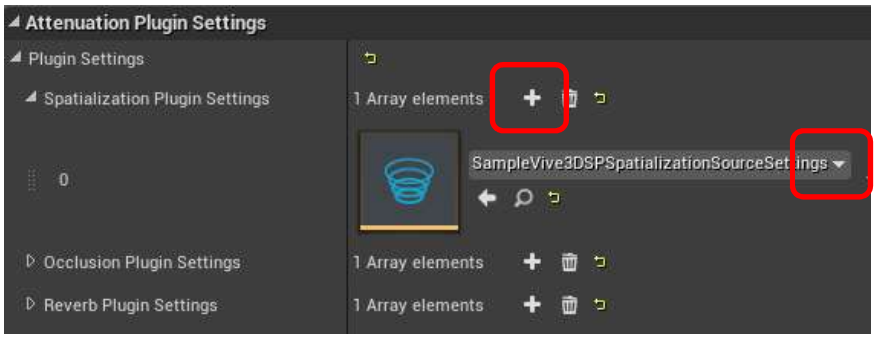
The following steps here build on the completed steps in Getting Started. If you are new to working with the VIVE 3DSP Audio plugin for Unreal or have not yet set up your development environment, start there.

Configure Spatialization Plugin Settings

1. In the **World Outliner** tab, select the Actor that contains the **Audio Component** you want to spatialize.
2. In the **Details** tab, select the Audio Component you want to spatialize.
3. Under **Attenuation**, select **Override Attenuation**.
4. Under **Attenuation Spatialization** > **Spatialization Method**, select **Binaural**.



5. Under **Attenuation Plugin Settings > Spatialization Plugin Settings** , click +, and click the down arrow shown in the image below.

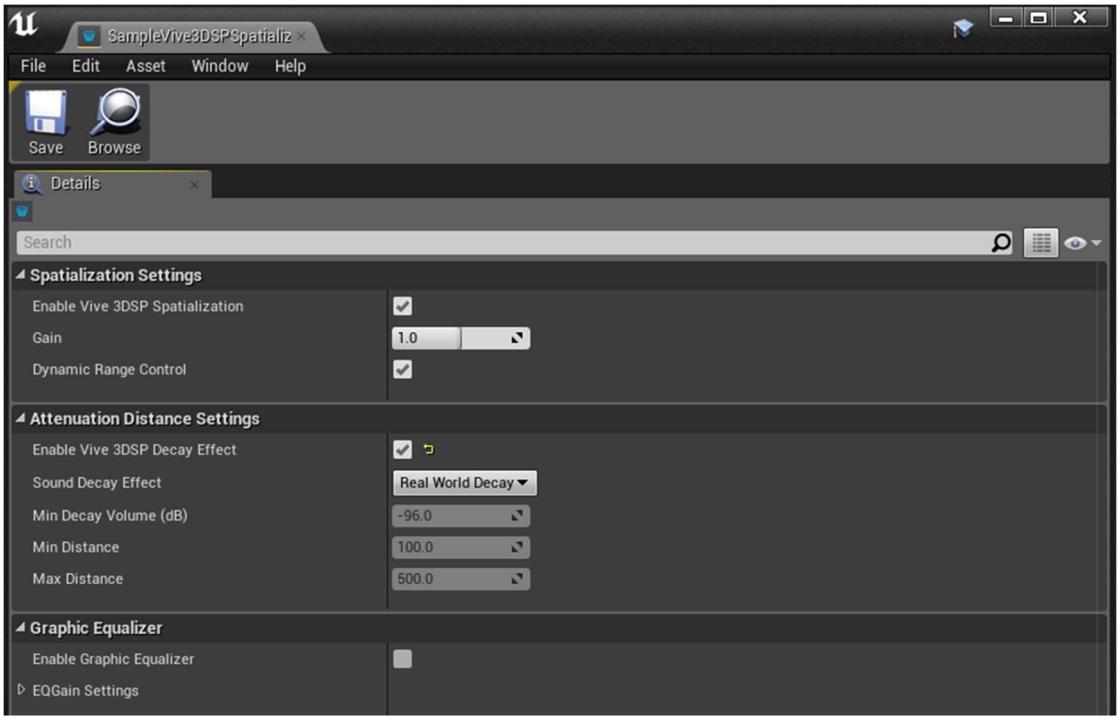


If you've created a Spatialization Settings asset, select it from the list. If not, click **Vive3DSP Audio Source Spatialization Settings** under **Create New Asset**.

6. Give the new asset a name, then double-click it in the **Content Browser** tab.

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VIVE 3DSP Spatialization Settings



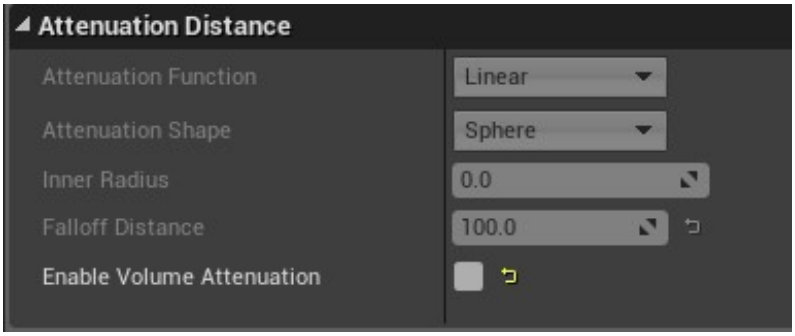
In the window that opens, you can configure the following settings:

- **Enable Vive 3DSP Spatialization** : Turn on or off the spatialization effect.
- **Gain**: Set the output gain of the specific audio source. [0.0, 1.0]
- **Dynamic Range Control**: Select to use the dynamic compression function to prevent sound clipping.
- **Enable Vive 3DSP Sound Decay Effect** : Turn on or off the Vive 3DSP sound decay effect. Turn it off to use the UE4 built-in attenuation function.

  Notes:

  a. If you want to only use Vive 3DSP Sound Decay Effect, clear the **Enable Volume Attenuation** option under **Attenuation Distance** in the **Details** tab to close the UE4 built-in attenuation.

  b. If both (Vive 3DSP Audio Plugin and UE4 built-in) attenuations are turned on, the sound source will be processed **by both functions**.



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- **Sound Decay Effect**: Set the decay effect for a specific audio source.
    a. **Real World Decay**: Distance effect based on real-world measurement database.
    b. **Point Source Decay**: Distance effect based on inverse-square law. It behaves as the point source where the sound energy decreased ratio is based on the propagation area (the square of the propagation distance)
    c. **Line Source Decay**: Distance effect based on inverse law. It behaves as the line source where the sound energy decreased ratio is based on the propagation distance.
    d. **Linear Decay**: Customized sound decay effect. The volume decay is linear to the distance between the source and the listener.
    e. **Constant**: No distance effect applied.

  Note: Selecting **Constant** means no attenuation effect.
- **Minimum Decay Volume (dB)**: When **Sound Decay Effect** is set to **Point Source Decay, Line Source Decay,** or **Linear Decay**, you can also set the **Minimum Decay Volume** value to keep the minimum volume. [-96.0, 0.0]
- **Min Distance**: Only enabled when **Linear Decay** is selected in **Sound Decay Effect**. When the listener moves from the source through the **Min Distance**, the volume of the source will stay at the loudest possible volume. Outside this distance, the source volume will gradually decay. When the listener passes between the **Min Distance** and the **Max Distance**, the volume of the source gradually fades from 100% to the **Minimum Decay Volume.**
- **Max Distance**: Only enabled when **Linear Decay** is selected in **Sound Decay Effect**. The distance where the volume of the source stops decaying. Beyond this distance the source will stay at the **Minimum Decay Volume.**
- **Graphic Equalizer**: The graphic equalizer is a convenient tool for tuning audio. In VIVE 3DSP Audio Source, the graphic equalizer has 20 bands and each band's level bar ranges from -12dB to 12dB.

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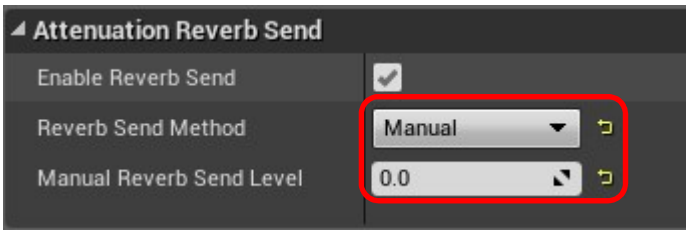
VIVE 3DSP Reverb Effect

VIVE 3DSP Audio Plugin analyzes the size and material properties of the audio rooms in your scene. It uses this information to automatically calculate the reverb effects as the sound flows from the source to the listener.
You can apply VIVE 3DSP Reverb Effect to any Actor in your scene that contains an Audio Component.

The following steps here build on the completed steps in Getting Started. If you are new to working with the VIVE 3DSP Audio plugin for Unreal or have not yet set up your development environment, start there.

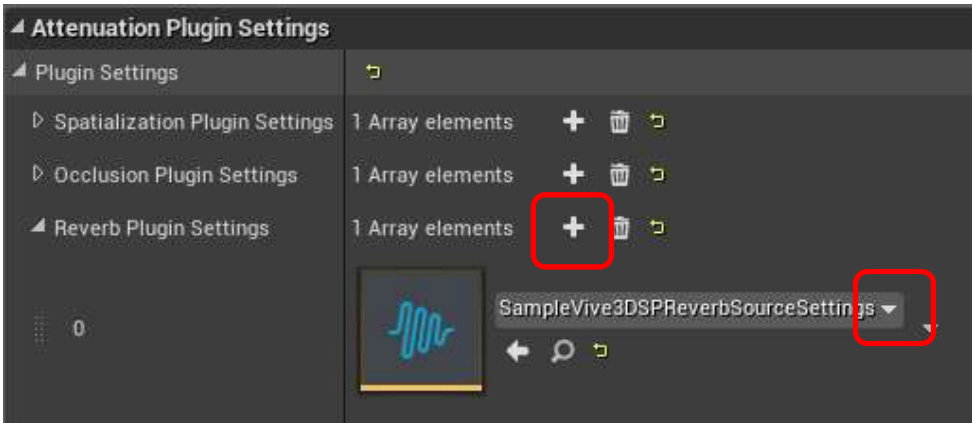
Configure Reverb Plugin Settings

1. In the **World Outliner** tab, select the Actor that contains the **Audio Component** you want to have a reverb effect.
2. In the **Details** tab, select the Audio Component you want to add the reverb effect to.
3. Under **Attenuation Reverb Send**, select the **Enable Reverb Send** option.



Note: To achieve the best VIVE 3DSP reverb effect, it is recommended to set **Reverb Send Method** to **Manual** and **Manual Reverb Send Level** to **0.0.**

4. In **Attenuation Plugin Settings** > **Reverb Plugin Settings**, click **+**, and then click the down arrow as shown in the image below.

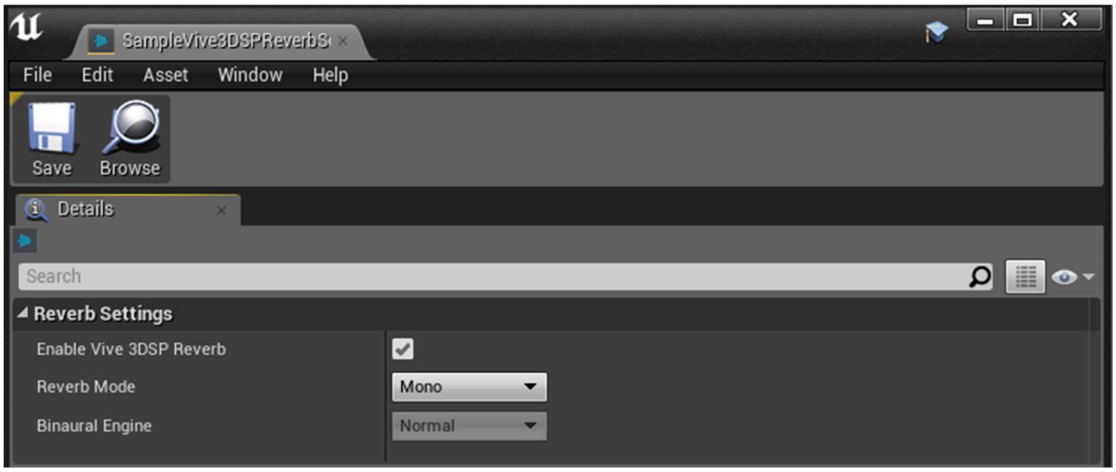


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If you've created a Reverb Settings asset, select it from the list. If not, click **Vive3DSP Audio Source Reverb Settings** under **Create New Asset**.

5. Give the new asset a name, then double-click it in the **Content Browser** tab.

VIVE 3DSP Reverb Settings



In the window that opens, you can configure the following setting:

- **Enable Vive 3DSP Reverb**: Turn on or off the reverb effect of the specific sound source. When turned off, the audio clip will not be processed with room reverberation properties.
- **Reverb Mode**: The room reverb mode contains two options: **Mono** and **Binaural**. Mono means that the room effect engine returns mono reverberant output for both ears. Binaural means the room reverb effect engine returns reverberant spatial audio.
- **Binaural Engine**: When **Binaural** mode is selected, you can also set the binaural engine.
    a. **Normal**: It is the theoretically accurate method to calculate the binaural output. Theoretically accuracy requires high computing power but the output will be better.
    b. **Speed Up**: Compared to **Normal** mode, the numerical simplification method is used and the required computing power is much lower.

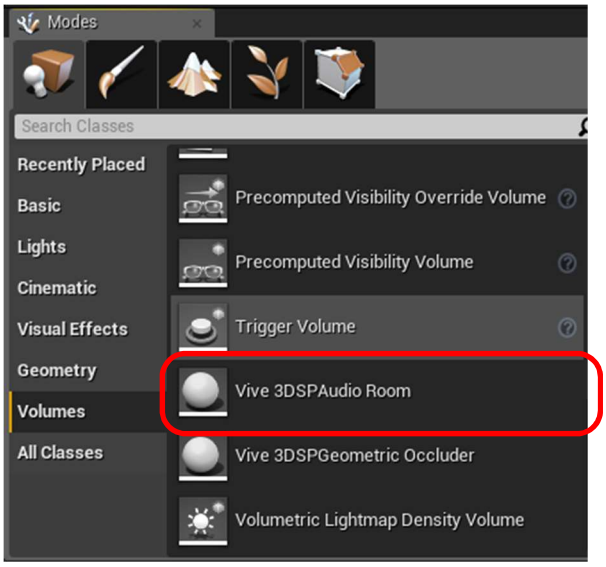
Create VIVE 3DSP Audio Room

Before you can have a reverb effect, you need to place the **VIVE 3DSP Audio Room** in your scene. VIVE 3DSP Audio Room passes their room transform properties (position, rotation and dimensions) and the room effect parameters

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to the VIVE 3DSP Reverb Plugin. The VIVE 3DSP Audio Plugin enables multiple room effect volumes in a single level. This provides an intuitive visual interface for creating multiple reverberant environments.

1. In the **Modes** tab, click **Volumes**, and then select **Vive 3DSP Audio Room**.
2. Drag and drop the Vive 3DSP Audio Room into the editor window.
3. Adjust the position and size of the Vive 3DSP Audio Room so that it covers the audio source.
4. Adjust the Vive 3DSP Audio Room settings in the **Details** panel.

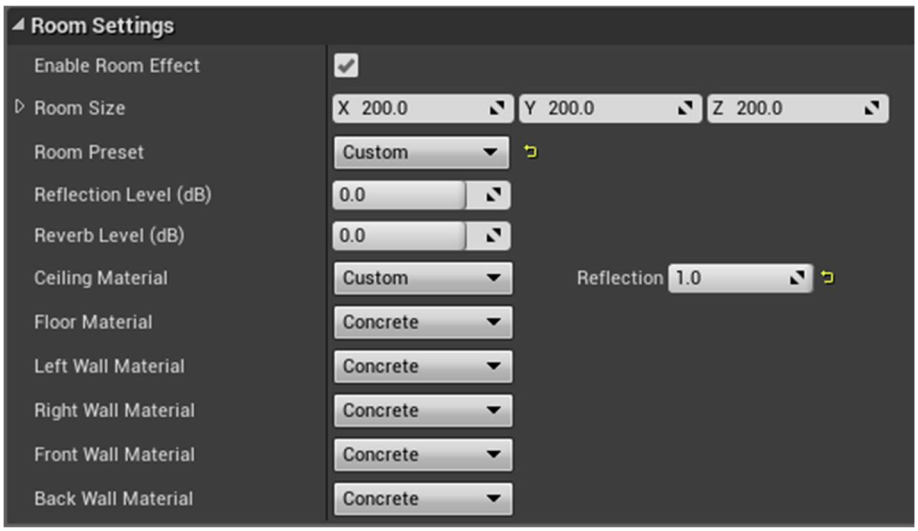


VIVE 3DSP Audio Room Settings

In the VIVE 3DSP Audio Room, there are reverberations that can be set to create a specific room sound effect. All sounds inside a room are affected by the room size, wall materials, etc. How much influence these variables have on the sound depends on the reflection and reverb levels.

We've provided several reverb preset that are used most frequently. Select **Custom** so you can select from a list of surface materials and customize the surface material's property. The background sound feature has also been provided in our audio room. You can add your own audio as the background sound as well.

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- **Enable Room Effect**: Turn on or off the room effect of this audio room.
- **Room Size**: Set the dimensions of the audio room. The actual room size is calculated by multiplying the room size with the corresponding scale in the Transform.
- **Room Preset**: Set the default room preset or select **Custom** to customize the following parameters.
    - **Reflection Level**: Set the reflection volume level for the room effect (dB). [-30.0, 10.0]
    - **Reverb Level**: Set the reverb volume level for the room effect (dB). [-30.0, 10.0]
    - **[Room Surface] Material**: The material for each of the six walls of a room affects how sound is reflected, which is the key component of a room sound field. There are pre-defined material options for each wall. Or, to create a custom material, choose **Custom** and set the **Reflection Rate** as the parameter of the sound reflection ability of the wall.



- **Enable Background Sound:** Turn on or off playing the background sound when the listener enters the reverb room.
- **Background Sound**: Set the background sound cue.
- **Background Volume**: Set the main volume of the background sound.

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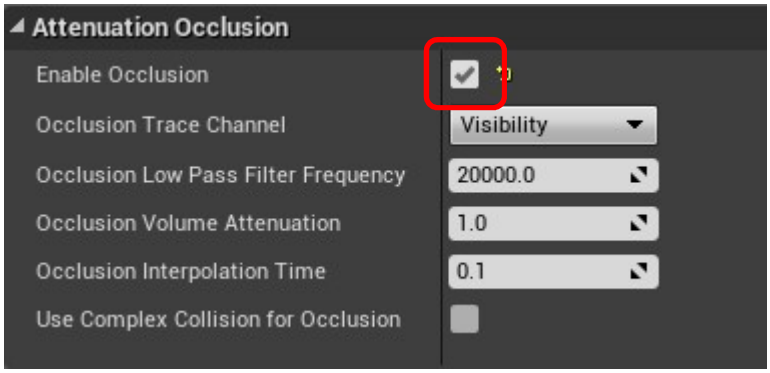
VIVE 3DSP Occlusion Effect

The VIVE 3DSP Audio Plugin analyzes the size, material properties, and type of the occluders in your scene. It uses this information to automatically calculate the occlusion effects as the sound flows from the source to the listener. There are two types of occlusion methods: **Geometric** and **Line Trace**. Each one uses a different occluder in the VIVE 3DSP Audio Plugin.
You can apply the VIVE 3DSP Occlusion Effect to any Actor in your scene that contains an Audio Component.

The following steps here build on the completed steps in Getting Started. If you are new to working with the VIVE 3DSP Audio plugin for Unreal or have not yet set up your development environment, start there.

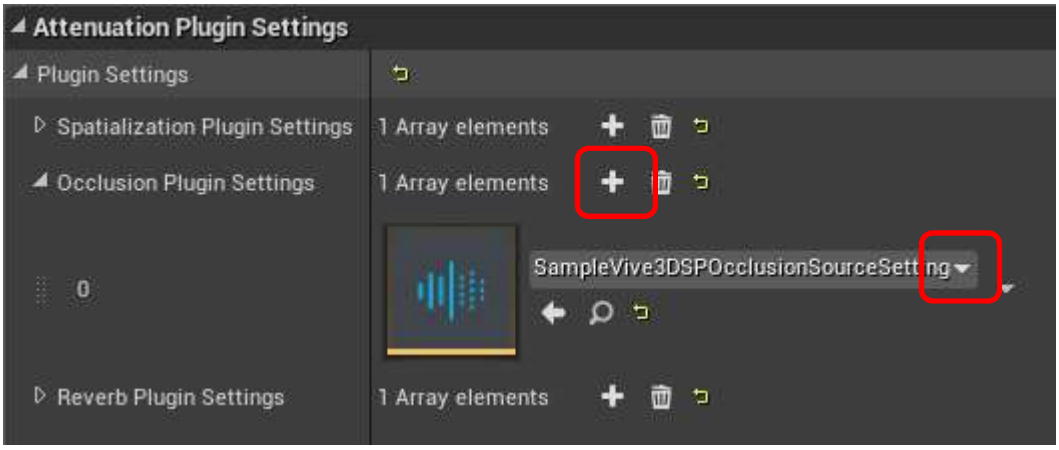
Configure Occlusion Plugin Settings

1. In the **World Outliner** tab, select the Actor that contains the **Audio Component** you want to have an occlusion effect.
2. In the **Details** tab, select the Audio Component you want to add an occlusion effect to.
3. Under **Attenuation Occlusion**, select the **Enable Occlusion** option.



4. In **Attenuation Plugin Settings** > **Occlusion Plugin Settings**, click +, and then click the down arrow as shown in the image below.

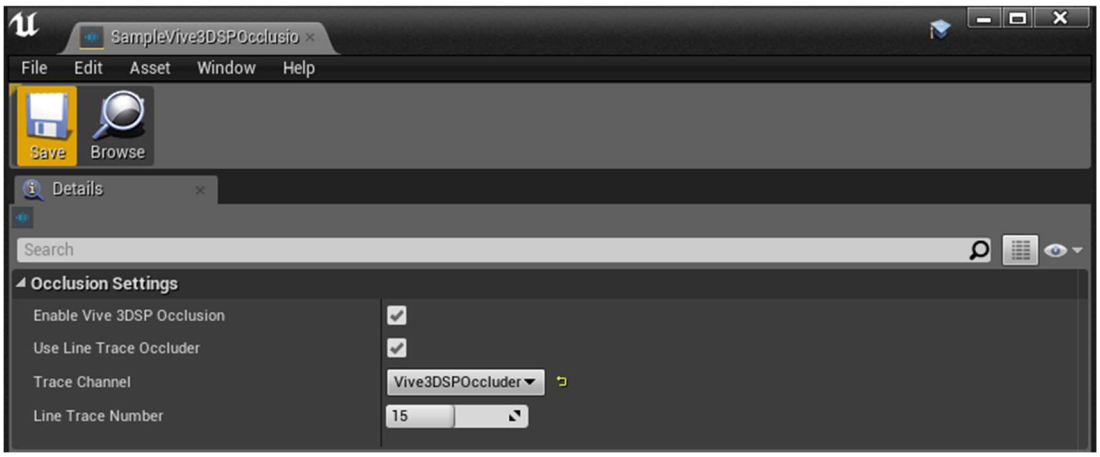
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If you've created an Occlusion Settings asset, select it from the list. If not, click **Vive3DSP Audio Source Occlusion Settings** under **Create New Asset**.

5. Give the new asset a name, then double-click it in the **Content Browser** tab.

VIVE 3DSP Occlusion Settings



In the window that opens, you can configure the following setting:

- **Enable Vive 3DSP Occlusion**: Turn on or off the occlusion effect of the specific sound source.
- **Use Line Trace Occluder:** Turn on or off to use the VIVE 3DSP line trace occlusion method.
- **Trace Channel:** Set the channel to use for the VIVE 3DSP line trace to calculate the occlusion effect.
- **Line Trace Number:** Set the line trace number to use for the VIVE 3DSP occlusion method. The higher the number, the better the occlusion effect quality. [1, 30]

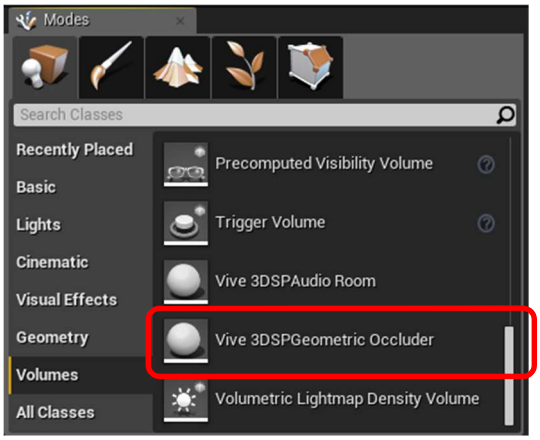
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Create VIVE 3DSP Occluder

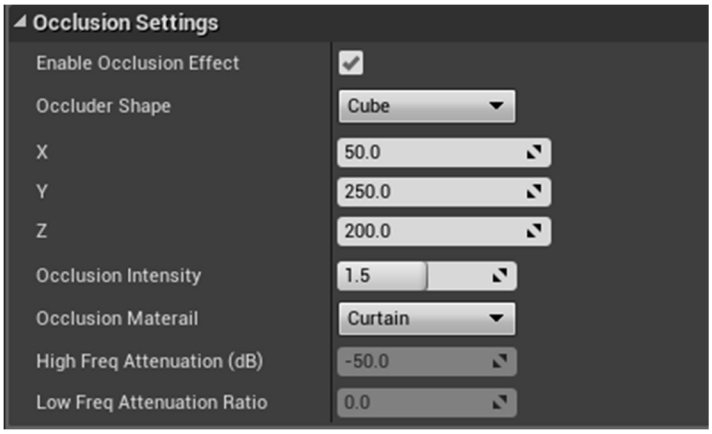
Before you can have an occlusion effect, you must place one of the VIVE 3DSP Occluder into your scene. The VIVE 3DSP Occluder passes their transform properties (position, rotation and dimensions) and the occlusion effect parameters to the VIVE 3DSP Occlusion plugin. There are two types of occluders: **Geometric Occluder** and **Line Trace Occluder**.

VIVE 3DSP Geometric Occluder

1. In the **Modes** tab, click **Volumes**, and then select **Vive 3DSP Geometric Occluder**.
2. Drag and drop the Vive 3DSP Geometric Occluder into the editor window.
3. Adjust the position and size of the Vive 3DSP Geometric Occluder.
4. Adjust the Vive 3DSP Geometric Occluder settings in the **Details** panel.



VIVE 3DSP Geometric Occluder Settings



- **Enable Occlusion Effect**: Turn on or off the occlusion effect of the object.
- **Occluder Shape:** Set the geometric occluder shape, Cube or Sphere.

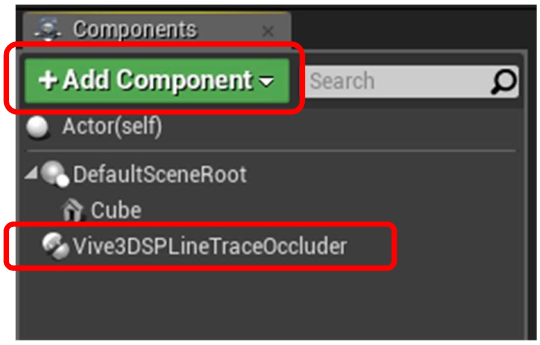
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- **Occluder Size**: Set the size of the occluder (Length, width, and height for cube; radius for sphere).
- **Occlusion Intensity**: Set the intensity of the occlusion effect for the selected **Material**. This parameter is defined to represent the object density and the thickness which affects the blocking effect of an occluder. The higher the value the more occlusion effect is applied.
- **Occlusion Material**: Select the material of the object which blocks the transmission path from the audio source to the listener. This will cause the audio to be colored when the sound passes through it. Select **Custom** to set the **High Freq. Attenuation (dB)** and **Low Freq. Attenuation Ratio** of the occlusion object.
    - **High Freq. Attenuation (dB):** Sets the attenuation level of our filter. The default cut-off frequency is 5 kHz.
    - **Low Freq. Attenuation Ratio:** Defined as a parameter which influences both the cut-off and attenuation gain. [0, 1] 0 means heavily attenuated and 1 means not attenuated.

VIVE 3DSP Line Trace Occluder

The VIVE 3DSP Line Trace Occlusion method uses the **Line Trace by Channel** in Unreal Engine, where the hit information will return only if the object is set to specifically respond to a specified Trace Channel. Therefore, the object you want to have a VIVE 3DSP Line Trace Occluder effect must have its **Collision Settings** set to respond to the specified **Trace Channel** assigned in the **VIVE 3DSP Occlusion Settings**.

1. In the actor you want to have an occluder effect, click **Add Components**, and then select **Vive3DSPLineTraceOccluder**.

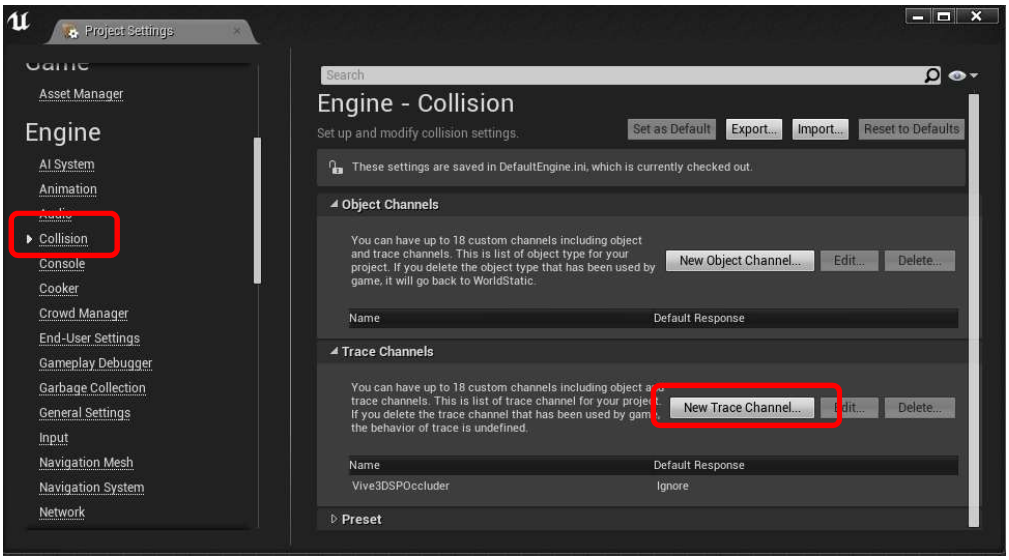


2. Adjust the Vive 3DSP Geometric Occluder settings in the **Details** panel.

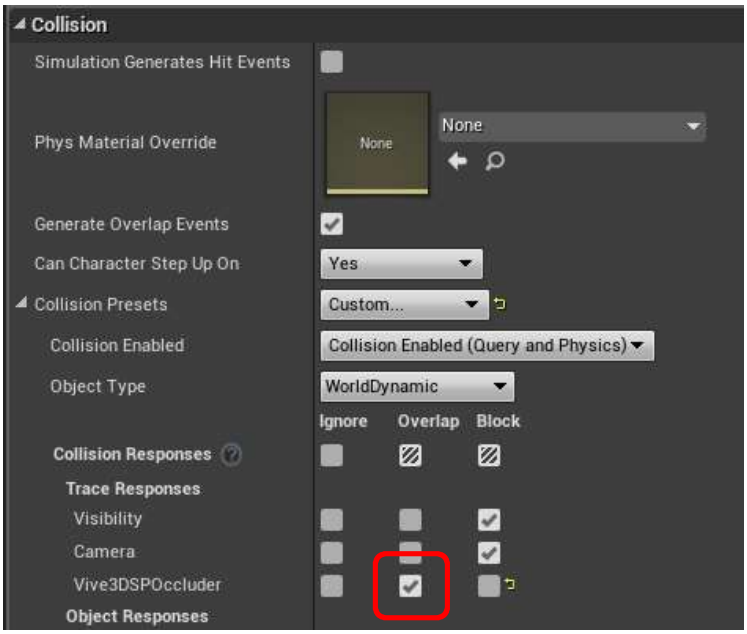
Note: Optional steps you can do:

- Add a new trace channel in **Edit** > **Project Settings** > **Collision** > **New Trace Channel...**

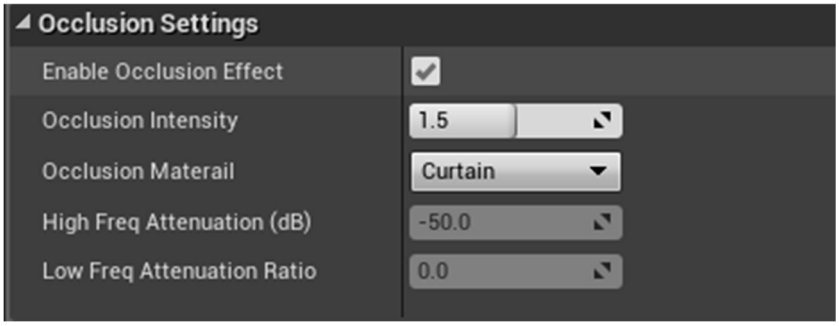
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- Adjust the collision response (in the **Collision Settings**) of the object so it can respond to the VIVE 3DSP line trace channel set in the [VIVE 3DSP Occlusion Settings](#).



VIVE 3DSP Line Trace Occluder Settings



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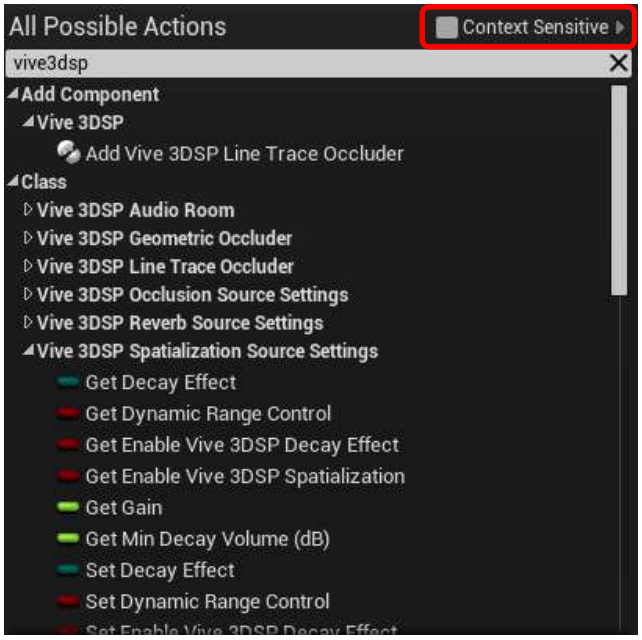
- **Enable Occlusion Effect**: Turn on or off the occlusion effect of the object.
- **Occlusion Intensity**: Set the intensity of the occlusion effect for the selected **Material**. This parameter is defined to represent the object density and the thickness which affects the blocking effect of an occluder. The higher the value the more occlusion effect is applied.
- **Occlusion Material**: Select the material of the object which blocks the transmission path from the audio source to the listener. This will cause the audio to be colored when the sound passes through it. Select **Custom** to set the **High Freq. Attenuation (dB)** and **Low Freq. Attenuation Ratio** of the occlusion object.
    - **High Freq. Attenuation (dB):** Sets the attenuation level of our filter. The default cut-off frequency is 5 kHz.
    - **Low Freq. Attenuation Ratio:** Defined as a parameter which influences both the cut-off and attenuation gain. It ranges from 0 to 1, which 0 means heavily attenuated and 1 means not attenuated.

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Control VIVE 3DSP Parameters Using Blueprints

You can control all the VIVE 3DSP Audio Plugin parameters in real time using Blueprints.

1. Open the **Blueprint Editor** and go to the **Event Graph** tab.
2. Right-click anywhere in the blueprint editor window to bring up a window with possible actions.
3. Clear the **Context Sensitive** option.



4. Enter "vive3dsp" to filter the available actions.

Note: Modified spatialization, reverb, and occlusion source settings in run time will affect other sounds that are using the same settings, and **will be saved** even when the play mode is stopped. Therefore, it is recommended to initialize your spatialization, reverb, and occlusion source settings at **BeginPlay** if you want to change parameters in run time.

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