TREBLE CASE STUDY

IMPROVING SIMULATION EFFICIENCY WITH AUTOMATIC 3D MESHING

Market
CAE

Product & Services
3D Precise Mesh/Meshgems

Improving Scalable, Physics-Accurate Audio Data Generation and Analysis

Treble Technologies accelerated their simulation pipeline by integrating Spatial's Meshing SDK, enabling faster, high-fidelity acoustic simulations at scale.

SUMMARY

Spatial Meshing SDK (3D Precise Mesh) helped Treble deliver faster turnaround times to customers and support more complex acoustic simulation use cases without sacrificing performance. The automatic and reliable 3D mesh generation from the Spatial SDK integrates seamlessly with Treble's innovative simulation application. The automatic meshing SDK improved volumetric mesh quality and efficiency by up to 30%, helping Treble focus on delivering value to their customers.

Their flagship products are the Treble Web Application, a cloud-native environment for acoustic simulation and auralization, and the Treble SDK, a Python-based development kit that enables scalable simulations, synthetic data generation, and seamless integration into R&D and machine learning pipelines.

Treble Web Application

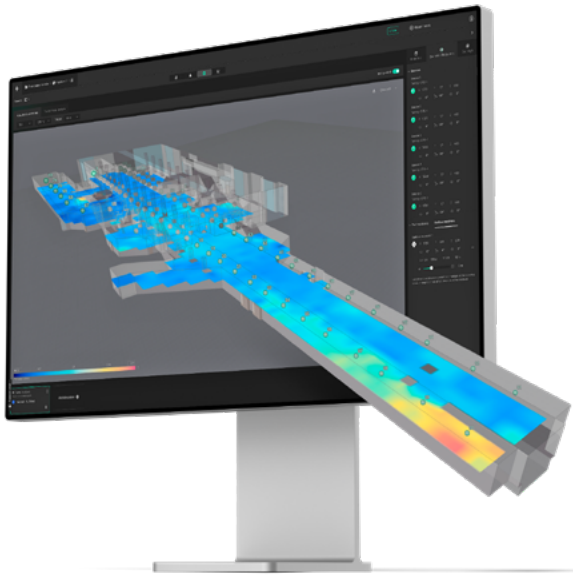
The Treble Web Application is the industry's first cloud-native simulation platform for room and product acoustics, purpose-built to align with modern architectural and engineering workflows. It integrates a wave-based finite element solver and geometrical acoustics into a seamless hybrid engine, delivering full-spectrum simulation fidelity. Designed for professionals in the built environment, the platform enables rapid, high-accuracy simulation of complex environments.

THE COMPANY

Treble Technologies redefines the future of sound through state-of-the-art acoustic simulation and spatial audio solutions. The company's impressive products provide advanced acoustic simulation, spatial audio rendering, and synthetic audio data generation. Treble's mission is to make the world a better-sounding place by equipping professionals with the most accurate, scalable, and efficient sound simulation tools.

Since 2020, Treble has rapidly scaled its technological footprint, establishing partnerships with leading global tech firms and driving adoption across key verticals where precision audio is mission-critical. Treble's technology leverages a hybrid wave-based and geometrical acoustics engine that delivers unprecedented accuracy across a wide frequency spectrum.

Treble serves acoustic engineers in the building industry, consumer electronics, and professionals in the pro audio sector, including venue designers and manufacturers of audio equipment. They also collaborate with industry leaders like L-Acoustics.



Treble SDK

The Treble SDK is a Python-based programmatic interface to Treble's high-fidelity acoustic simulation engine, designed for scale, speed, and seamless integration. It is engineered for advanced R&D, audio algorithm development, and synthetic data generation. Leading global tech companies use the Treble SDK to set the benchmark for scalable, physics-accurate audio data generation and analysis.

Leveraging Treble's proprietary hybrid simulation core engine, the SDK delivers wave-accurate and high-fidelity monaural and spatial impulse responses with up to 32nd-order ambisonics. It supports thousands of simulations in parallel, enabling robust machine learning pipelines, virtual prototyping, and automated parametric design.

CHALLENGE

Seeking High-Quality Meshing Components for Simulations

To understand Treble's application needs, it is helpful first to understand the workflow.

Using the Treble Web Application, users begin by importing a 3D model of a room or space via IFC, SketchUp, or other standard formats. Within the web app, they can place sound sources and receivers, assign acoustic materials to surfaces, and configure simulation parameters. From there, the system automatically handles geometry processing, meshing, and acoustic simulation using Treble's proprietary solver. The results can then be rendered, analyzed, and shared instantly with collaborators through simple web links. The entire workflow is browser-based, with no local installation or specialized hardware required.

In the Treble SDK, users define acoustic scenes via code, specifying geometry, materials, source, and receiver configurations, and trigger simulations through a Python API. The SDK handles geometry preprocessing, meshing, solving, and output generation in the cloud.

> "Integrating Spatial SDK helps us deliver faster turnaround times to customers and support more complex use cases without sacrificing performance. This scalability and speed have become key."
>
> ~ Jesper Pedersen, Co-founder

Treble came to Spatial for industry-proven meshing components. They needed a solution that could generate surface and volumetric meshes on which to run simulations. Spatial's 3D Precise Mesh fit the bill perfectly.

SOLUTION

Saving Data Preparation Time with Automatic 3D Meshing

When Treble explored different solutions for generating surface and volumetric meshes, they quickly discovered that Spatial's 3D Precise Mesh could be integrated quickly and easily into their application. It was not only the right solution for their product, but it would save them valuable time in the implementation process.

3D Precise Mesh is an automatic and reliable 3D mesh generation SDK by Spatial. Designed to enhance CAE workflows, this advanced tool offers unmatched control, ensuring accuracy and simulation performance. Its integration with leading modelers like CGM Modeler and 3D ACIS Modeler, and innovative features such as automatic CAD associativity and periodic meshing, streamlines the entire design process. It also reduces data preparation time because the SDK generates optimal quality mesh elements in just one step, allowing the generation of millions of elements per minute.

Improving Business Operations

Improved simulation efficiency directly impacted Treble's business operations by strengthening one of its core value propositions: enabling high-fidelity acoustic simulations at scale. The ability to run large volumes of simulations quickly and reliably is central to the services they provide, whether supporting consultants working on building design or teams generating synthetic data for machine learning.

3D Precise Mesh helps Treble deliver faster turnaround times to customers and support more complex use cases without sacrificing performance. Scalability and speed have become key differentiators for Treble and are a major reason why customers choose their platform over alternatives.

Treble also benefits from 3D Precise Mesh in elevating the 3D mesh generation user experience. The robust SDK minimizes the effort involved in mesh generation and streamlines every stage of the product design cycle, allowing Treble to concentrate on building the physics and solver simulation in their application.

3D Precise Mesh supports Treble's application for the following use cases:

- Training and validating ML models for speech enhancement, dereverberation, and source localization
- Acoustic performance evaluation for voice tech, AR/VR systems, and automotive audio
- Simulation-driven hardware optimization and generative audio design

Development Support and Best Practices

During the integration process, Treble's developers received support from Spatial Technical Account Managers (TAMs). Workshops with the TAMs navigated the integration process while covering best practices the Spatial team has come to learn. The integration took three months, including the initial steps. Treble continues to develop with new builds for their application, so updated integrations happen continuously, with full support from Spatial TAMs when needed.

KEY INSIGHTS

Marked Improvement in Simulation Efficiency

Before integrating Spatial SDKs, Treble relied on open-source mesh generation tools, many of which stemmed from academic research. These solutions often lacked robustness and required significant manual handling. With Spatial, Treble has experienced clear improvements in mesh quality and data handling, making their simulations more reliable and the workflow more streamlined.

Simulation efficiency is critical for Treble's customers, many of whom operate in fast-paced design environments where quick iteration is essential. The most significant gain since integrating 3D Precise Mesh has been in volumetric meshing, where Treble estimates up to 30% improvement in simulation efficiency. This has allowed them to run more simulations in less time and reduced the need for manual adjustments. It also helps reduce the operational overhead associated with simulation setup and troubleshooting. This performance boost has become a meaningful differentiator for Treble's platform in a market where accuracy and turnaround time are key. Overall, the integration has made their simulation pipeline more stable and easier to scale.

Spatial's SDK helps Treble focus on its main value proposition: efficiently performing acoustic simulations at scale.

About Spatial Corp

Spatial Corp, a Dassault Systèmes subsidiary, is the leading provider of 3D software development toolkits for technical applications across a broad range of industries. Spatial **3D modeling**, **3D visualization**, **3D Meshing** and **CAD translation software development toolkits** help application developers deliver market-leading products, maintain focus on core competencies, and reduce time-to-market. For over 35 years, Spatial's 3D software development toolkits have been adopted by many of the world's most recognized software developers, manufacturers, research institutes, and universities. Headquartered in Broomfield, Colorado, Spatial has offices in the USA, France, Germany, Japan, China, and the United Kingdom. For more information on Spatial's latest updates and product offerings, please visit **www.spatial.com.**

SPATIAL

Europe/Middle East/Africa
Spatial Corp, Dassault Systèmes
10, rue Marcel Dassault
CS 40501
78946 Vélizy-Villacoublay Cedex
France

Asia-Pacific
Spatial Corp, Dassault Systèmes
17F, Foxconn Building,
No. 1366, Lujiazui Ring Road
Pilot Free Trade Zone, Shanghai 200120
China

Americas
Spatial Corp Headquarters
310 Interlocken Pkwy #200
Broomfield, CO 80021-3468
USA