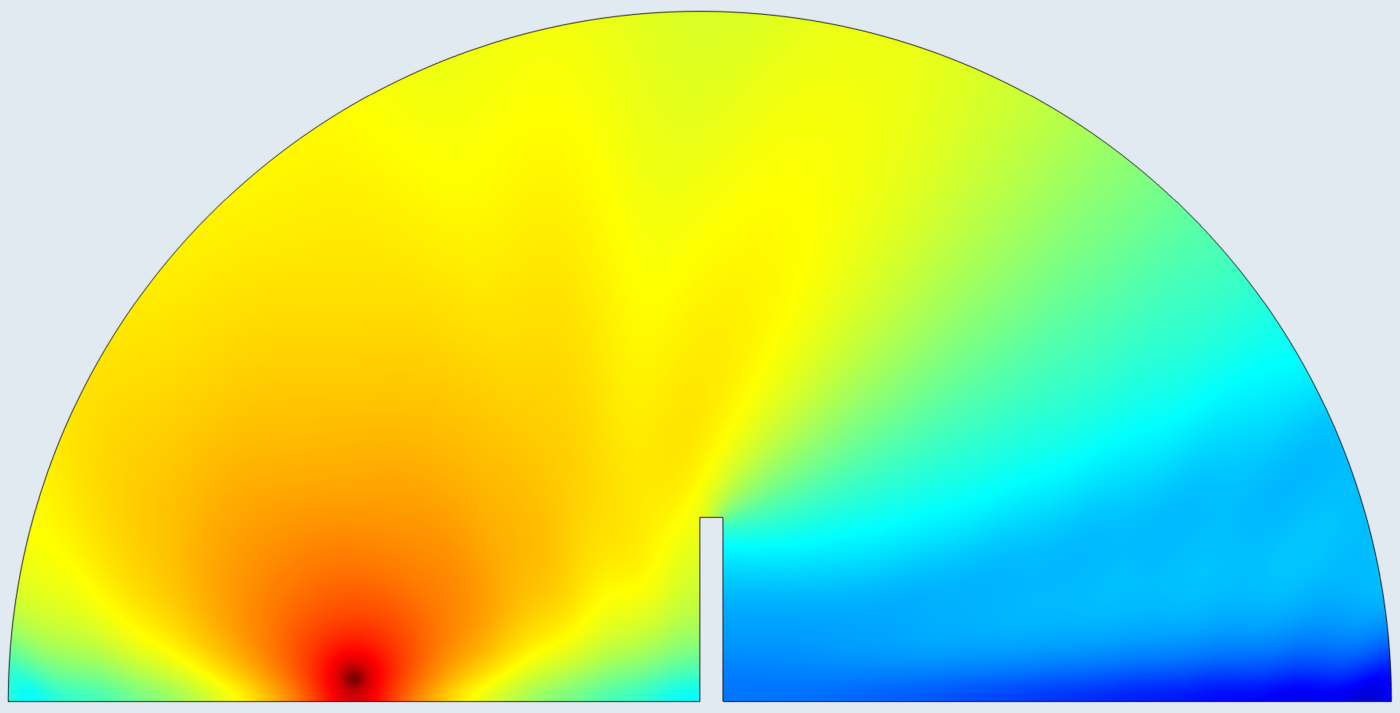

# Visualization of a Noise Barrier for Educational Purposes

Since noise pollution poses a notable challenge, sound screens, serving as noise barriers, are increasingly utilized to obstruct sound waves. This app demonstrates these effects adjacent to a road to provide learners with a visual comprehension.

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## Introduction & Goals

The COMSOL® app library of the Technical University of Munich is a collection of applications for simulating acoustic phenomena. They are used in the teaching of acoustics to visually represent fundamental vibrational aspects and provide learners with a visual understanding.

In the current project of the young DEGA (German Acoustical Society), new apps are being developed under the leadership of the Technical University of Munich. The simulation developed within this framework by the Mittweida University of Applied Sciences demonstrates the effect of a sound screen on sound propagation.

The goal is to integrate simulation and calculation according to DIN (German Institute for Standardization) standards.

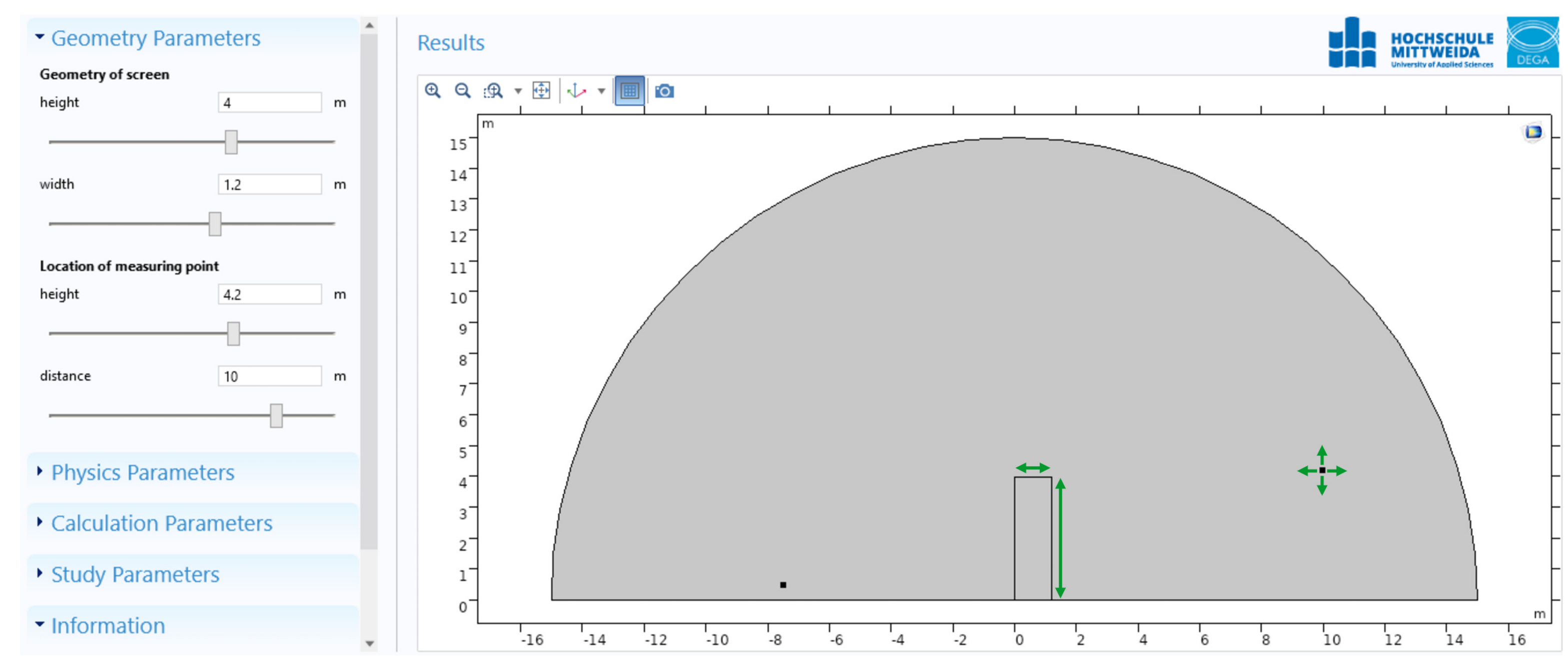


FIGURE 1: Possible adjustments in the geometry settings

## Methodology

Using the Acoustics Module, the two-dimensional finite element method (FEM) simulation illustrates the refraction and diffraction of sound waves at the edge of the screen and the impact of different absorption coefficients α on several surfaces.

The selected view shows a cross-section through a noise barrier. On the left side, a point source is positioned at a height of 0,5 m, representing a vehicle. The freely adjustable noise barrier is placed in the center of the computational domain. On the right side, a movable measurement point is placed. The lower boundary symbolizes the ground, while the curvature transitions into a perfectly matched layer, allowing for modelling the free sound propagation.

## Results

The calculations are evaluated in two different ways: The 2D surface plot (Fig. 2) shows the impacts on sound propagation for just one changeable frequency, while a point graph shows the sound pressure level as a function of the frequencies.

Everything is supported by a theoretical calculation of the insertion loss $D_z$ and the Fresnel number $N$ according to Kurze (Ref. 1). These parameters form the theoretical framework for a range of DIN standards.

The final publication is available on COMSOL Server™ of the Technical University of Munich at https://apps.vib.ed.tum.de:2037/ or via scanning the QR code.

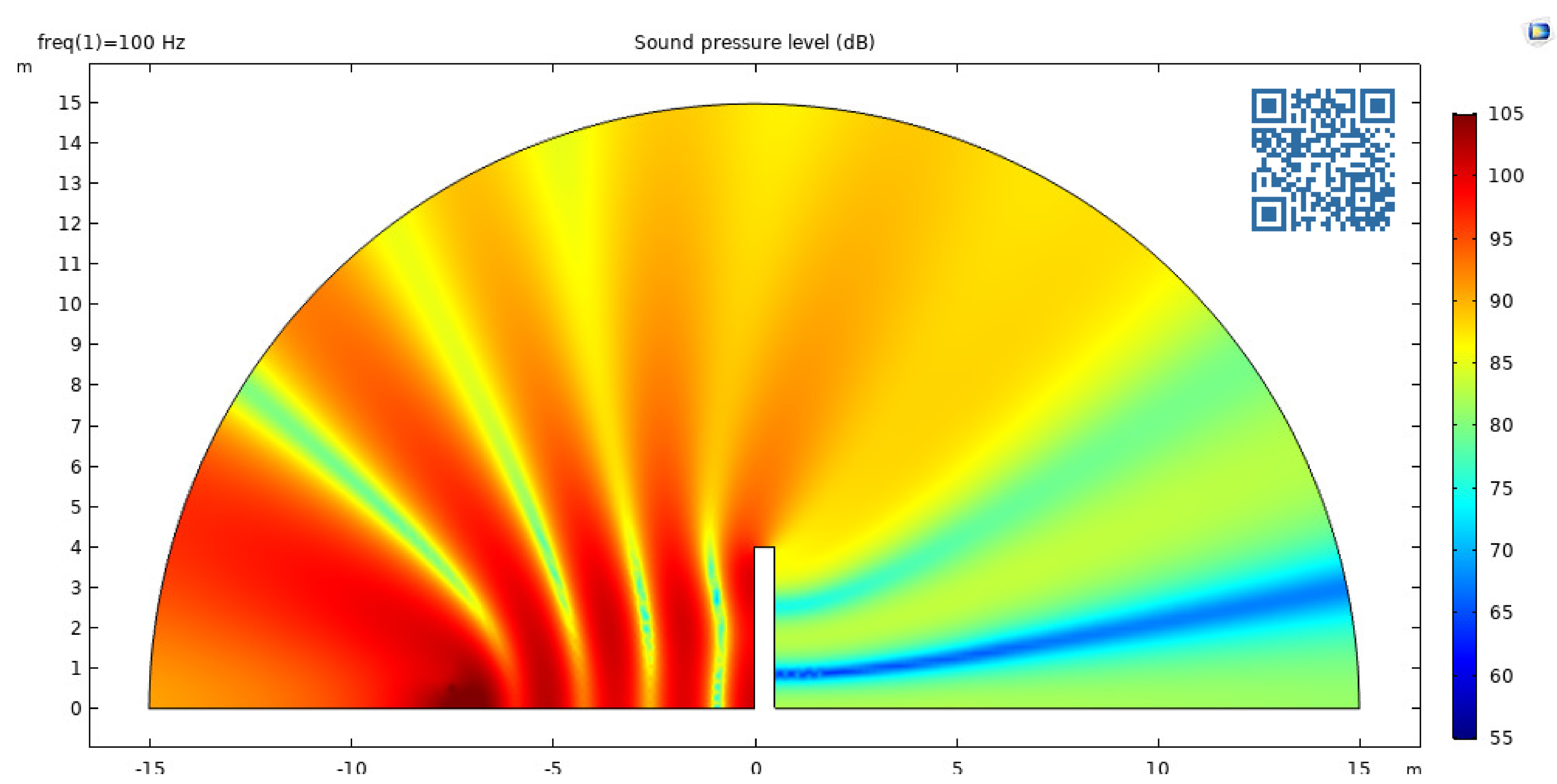


FIGURE 2: Simulation results at a frequency of 100 Hz with all α set to zero.

REFERENCES

1. J. Hübelt and C. Schulze, "Reflexion von Schall an seitlichen Hindernissen", *Forschung Straßenbau und Verkehrstechnik*, 973, 20, 2007.

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