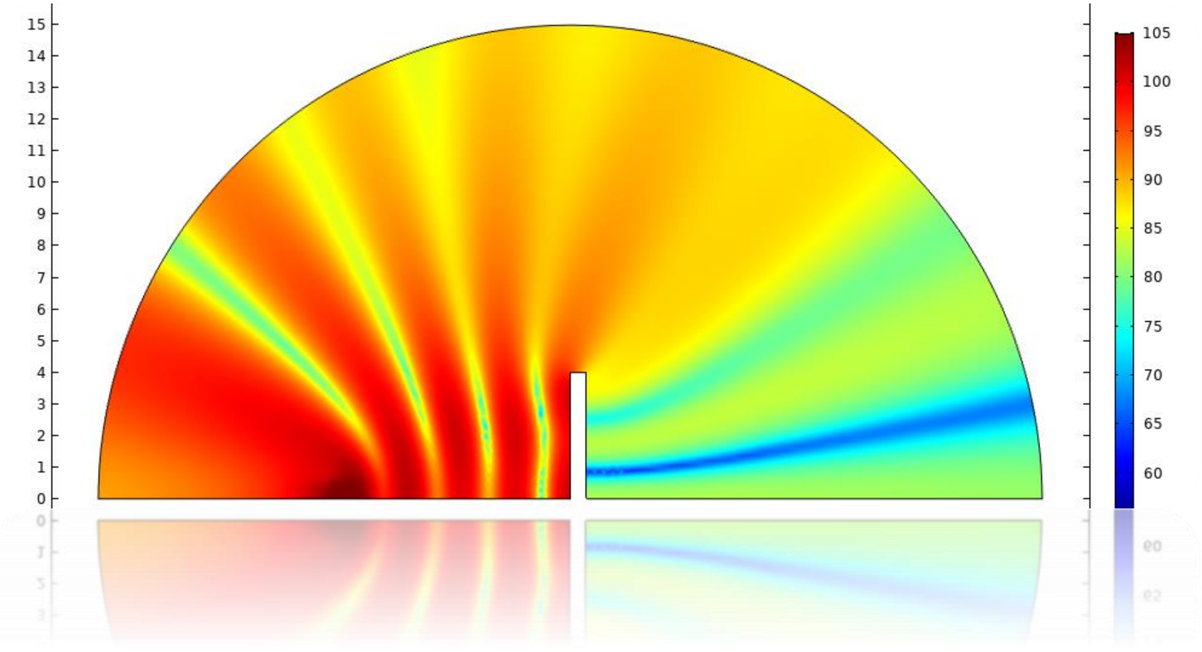
Engineering Sciences

HOCHSCHULE MITTWEIDA
University of Applied Sciences

Visualization of a Noise Barrier for Educational Purposes

Yvonne Heggemann, Tabea Breitkreutz



hs-mittweida.de

Contents

Project Idea

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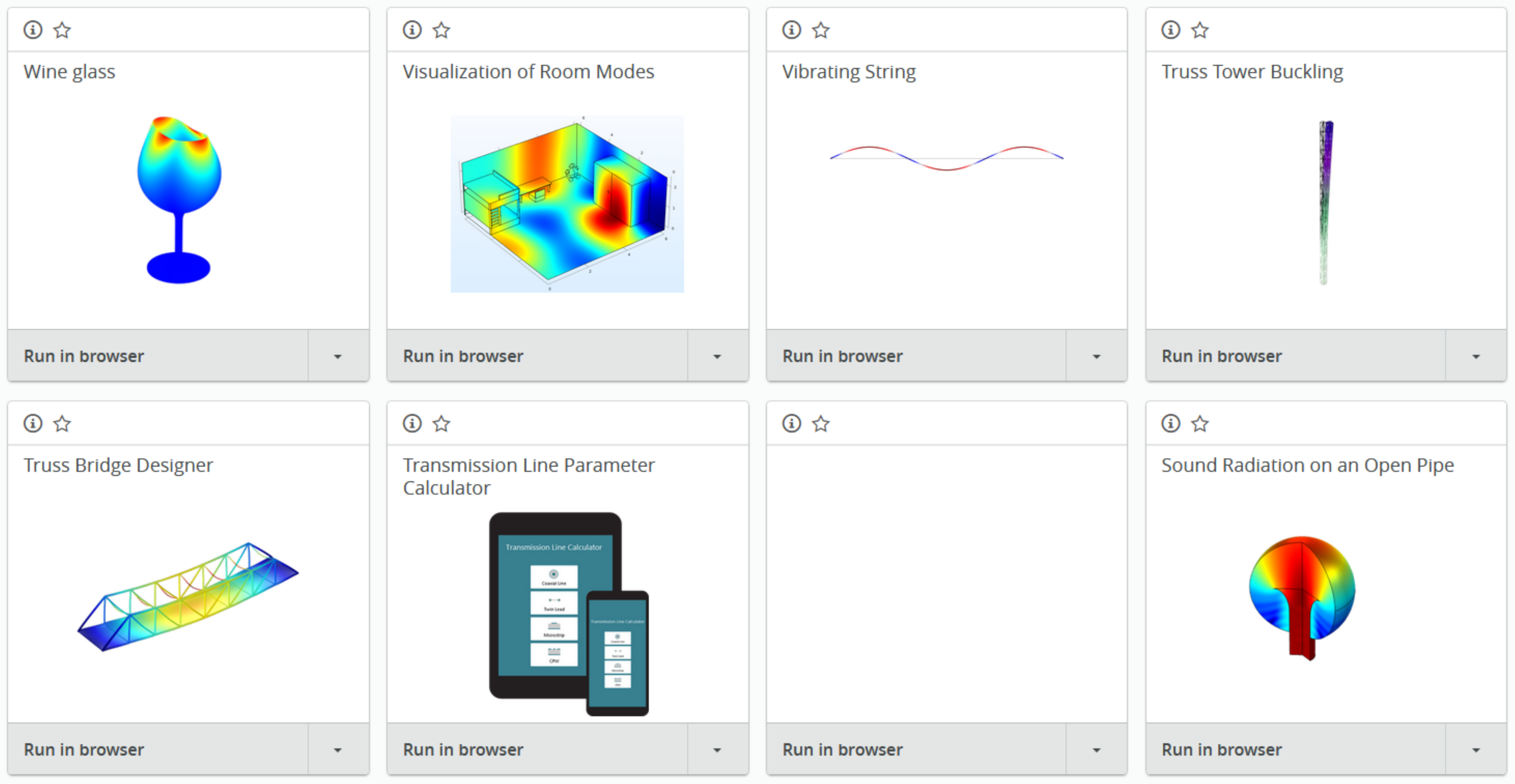
Network

Leadership: **TU Munich**
Johannes Schmid
Michael Buba

Cooperation with: DEGA

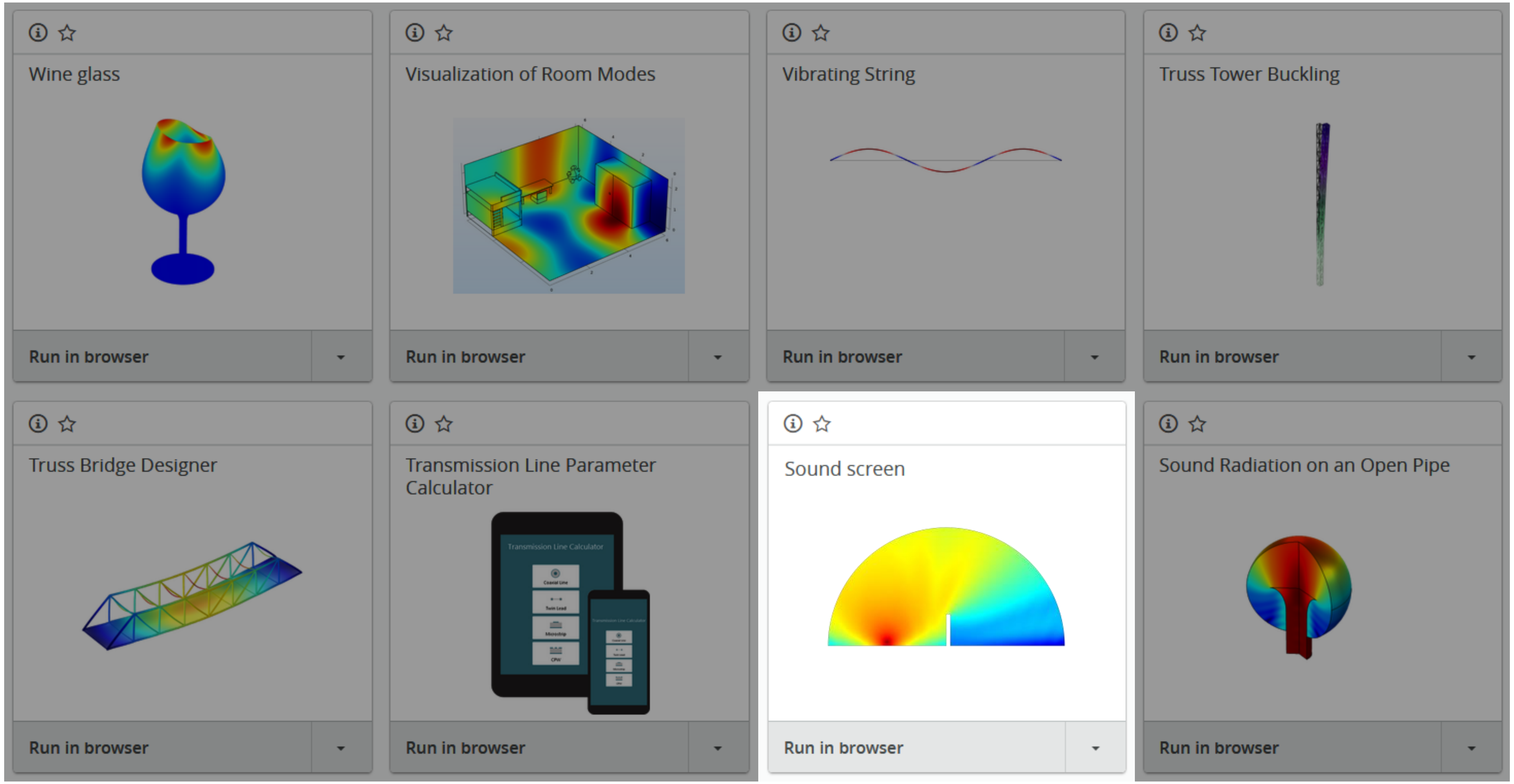
Project Idea

App Library



Source: https://apps.vib.ed.tum.de:2037/app-lib

Project Idea
App Library



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Educational Objective

Educational Objective

Simulate the impact of a noise barrier

- Diffraction on the edge of the wall
- Show the impact of a movable measurement point
- How do different absorption coefficients influence the sound?

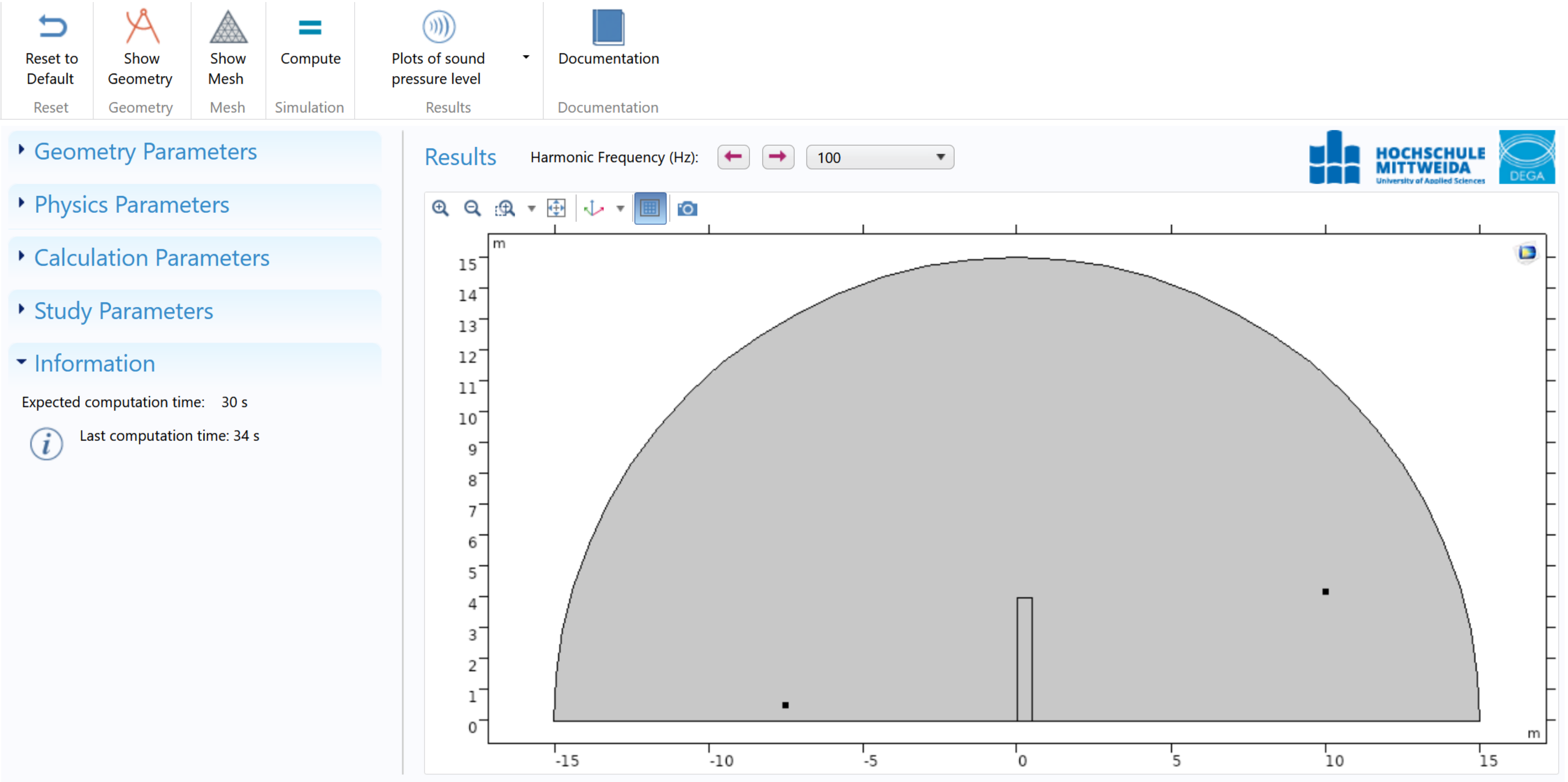
Compare simulation and calculations

regarding different parameters in DIN compliant scenarios

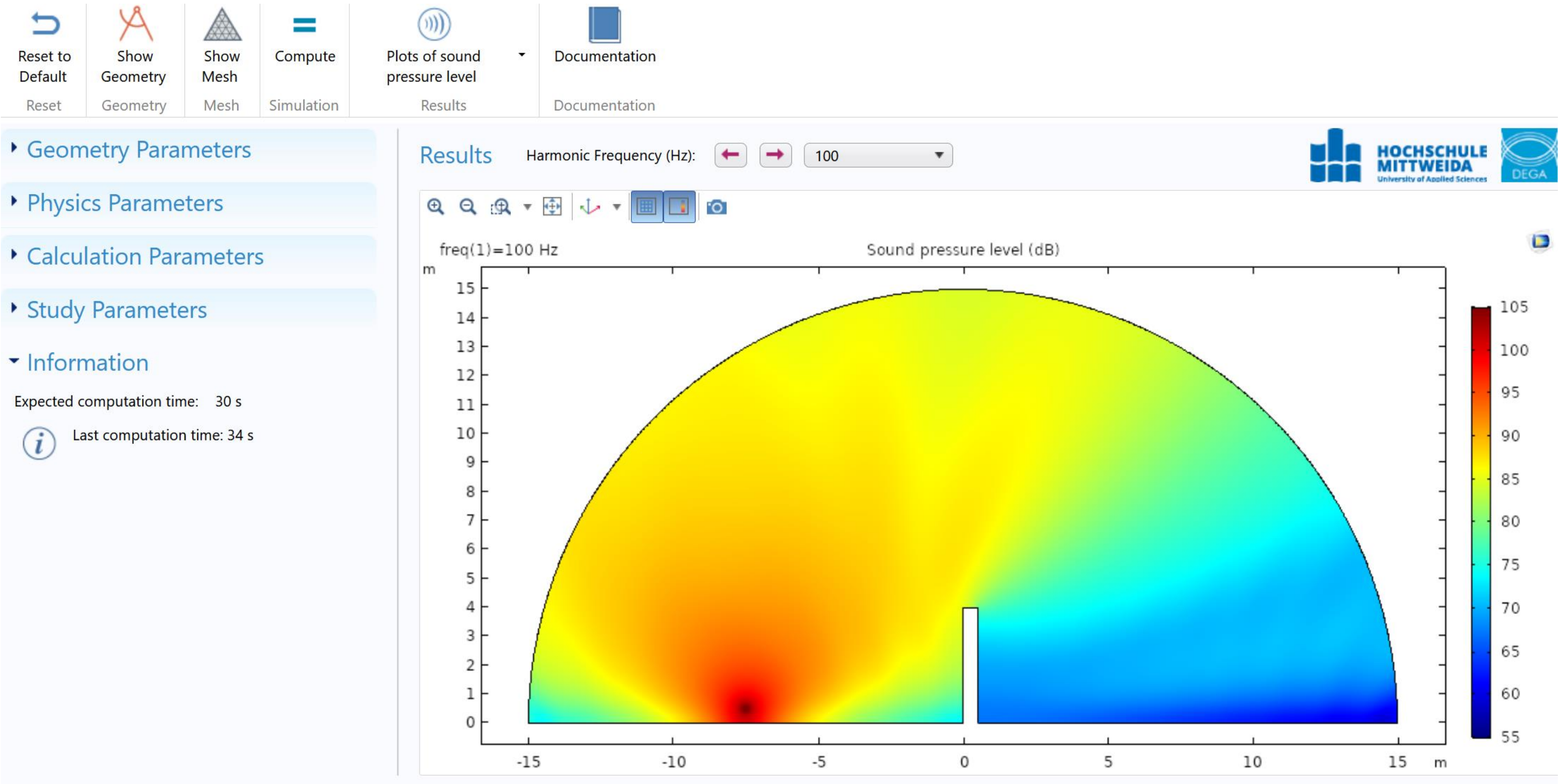
App Layout

App Layout

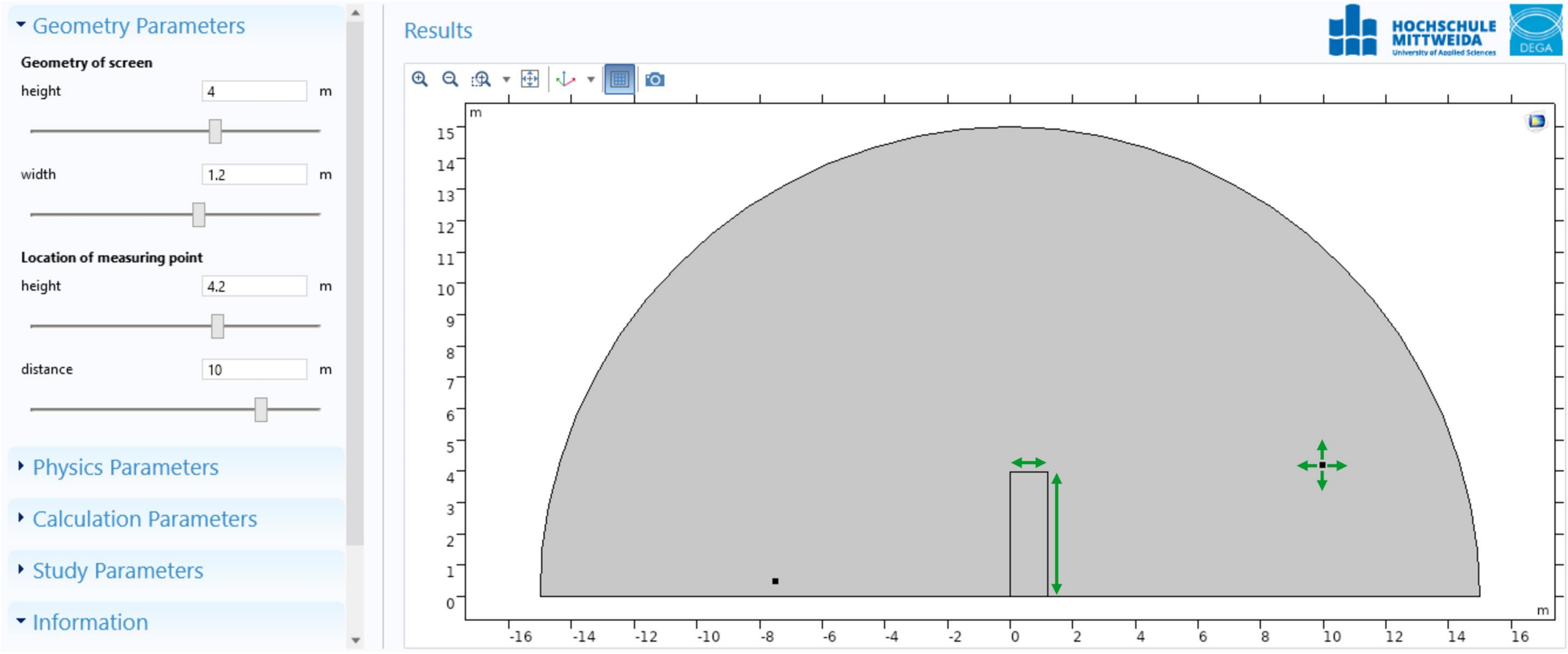
General Structure



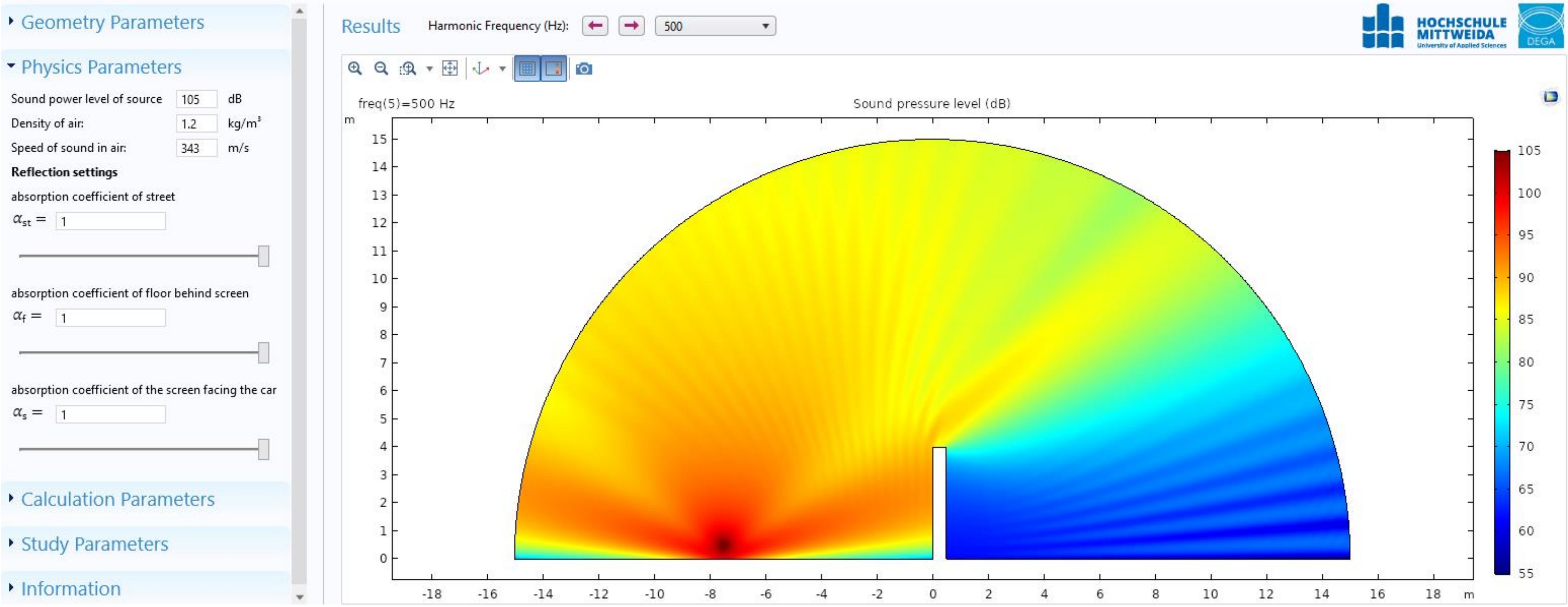
App Layout
General Structure



App Layout
Geometry

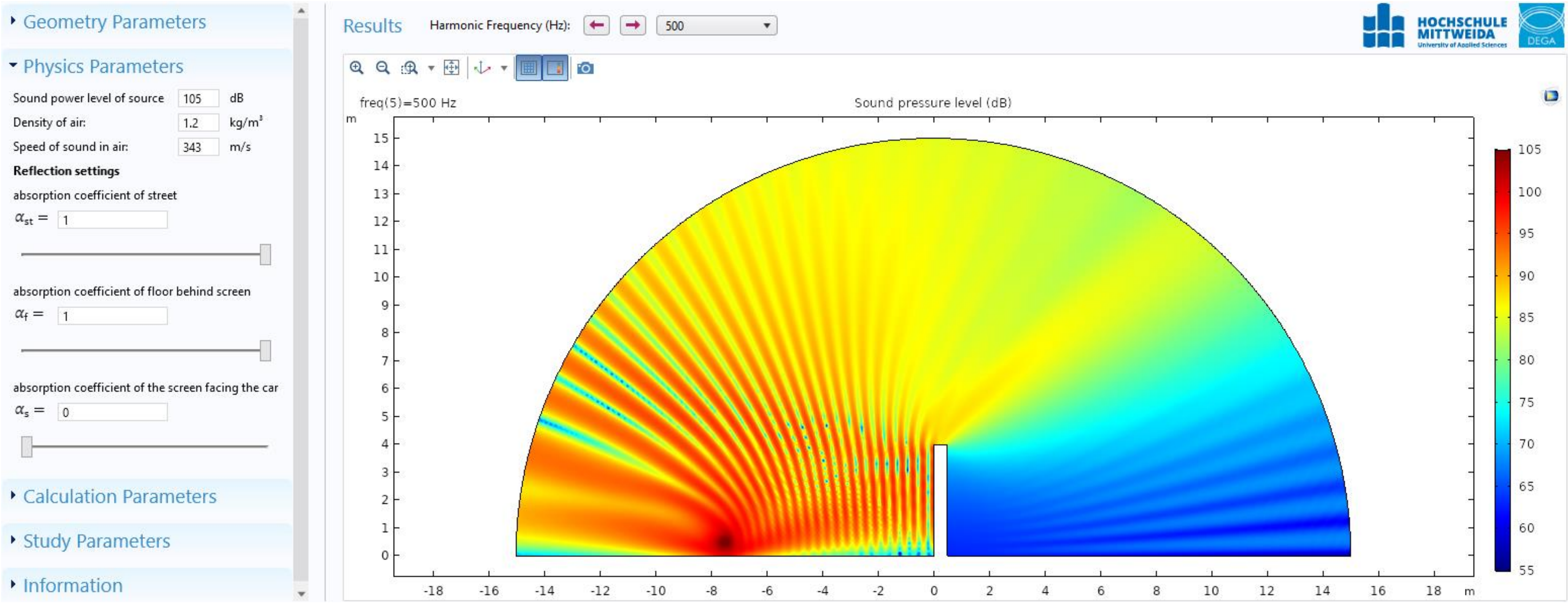


App Layout
Physics



App Layout

Physics



App Layout
Calculations

Calculation Parameters

$f =$ 500 Hz

$N =$ 0.9613

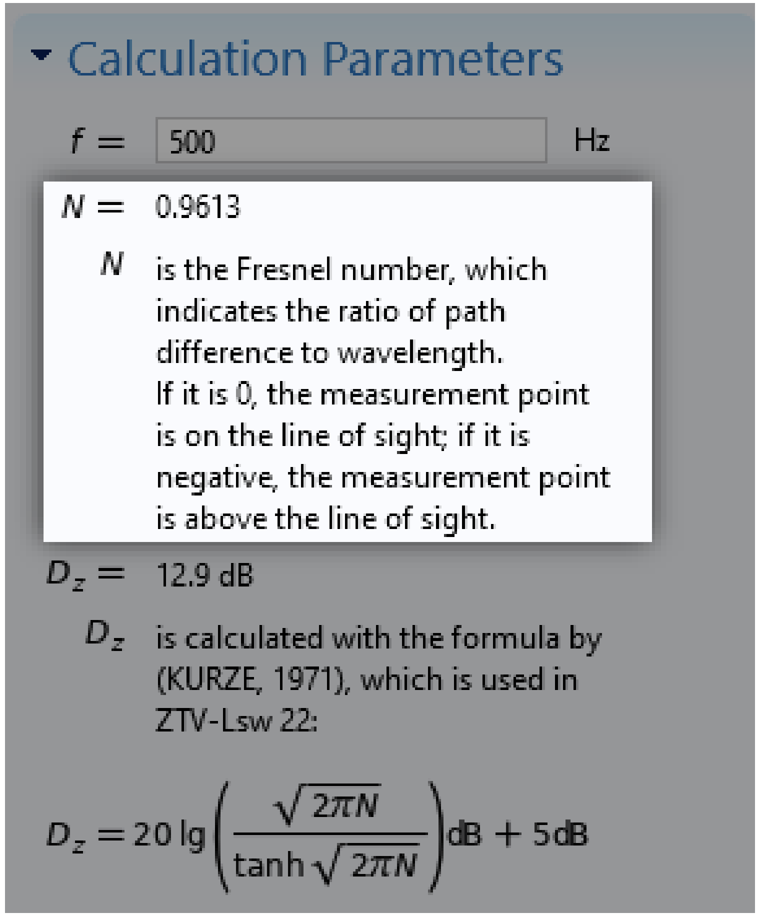
N is the Fresnel number, which indicates the ratio of path difference to wavelength.
If it is 0, the measurement point is on the line of sight; if it is negative, the measurement point is above the line of sight.

$D_z =$ 12.9 dB

D_z is calculated with the formula by (KURZE, 1971), which is used in ZTV-Lsw 22:

$$D_z = 20\,\lg\left(\frac{\sqrt{2\pi N}}{\tanh\sqrt{2\pi N}}\right)\mathrm{dB} + 5\mathrm{dB}$$

App Layout
Calculations



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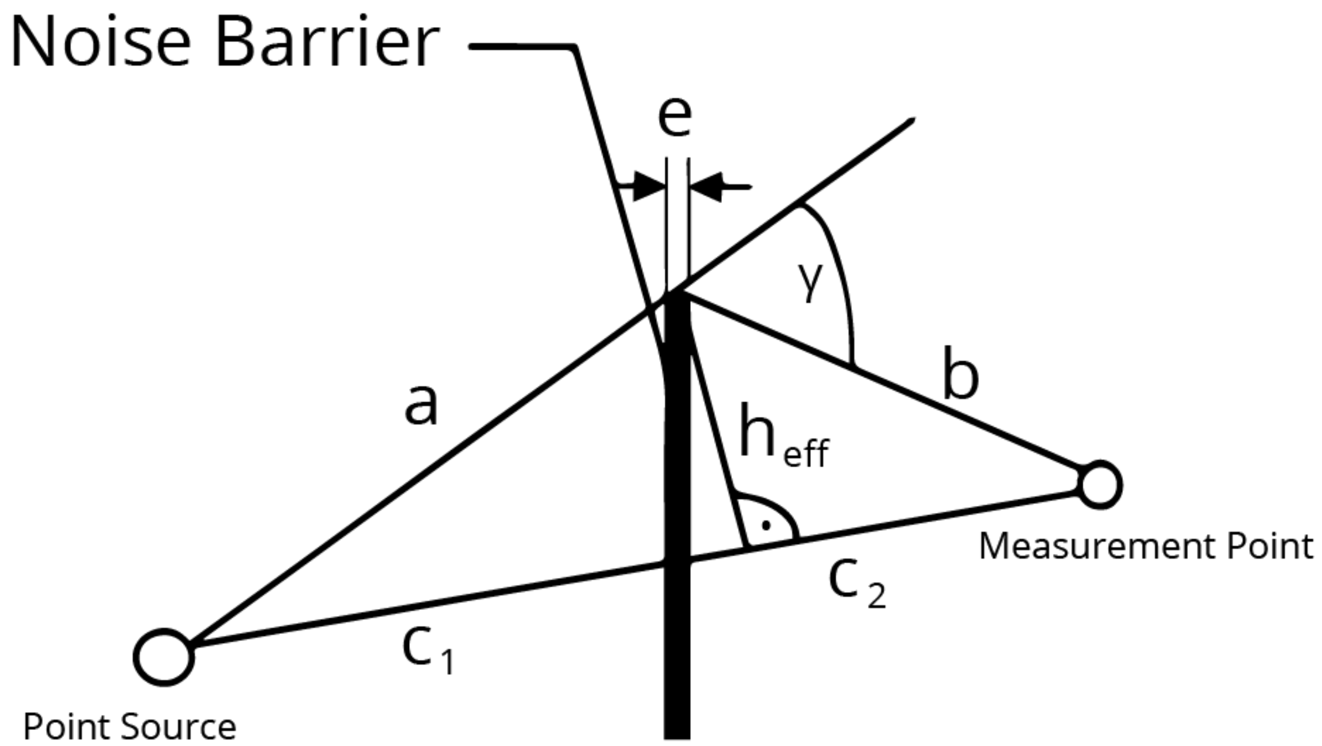
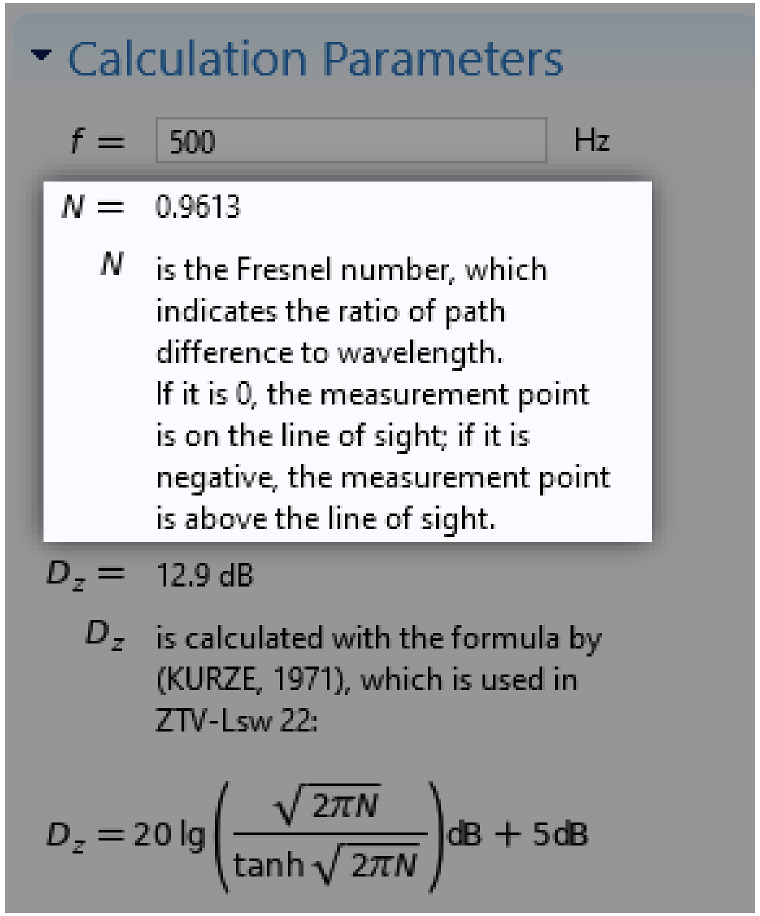


Hübelt, J. and Schulze, C. (2007), Forschung Strassenbau und Strassenverkehrstechnik, Vol. 973, Wirtschaftsverlag N. W. Verlag für neue Wissenschaft, Bremerhaven, p. 19.

App Layout
Calculations



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App Layout
Calculations

Caution!

All calculations refer to the standard setting (all absorption coefficients set to 1).
The barrier attenuation Dz can only be calculated for a measurement point within and below the line of sight. Above the line of sight the inverse square law for sound propagation in full space applies and Dz will be set to 0, even though in reality the value steadily decreases from 5 to 0 dB.

L_p is calculated with the inverse square law in full space.

$$L_p = L_w - 11\,\mathrm{dB} - 20\lg\left(\frac{r}{\mathrm{m}}\right)\mathrm{dB}$$

$$= 70.2\ \mathrm{dB}$$

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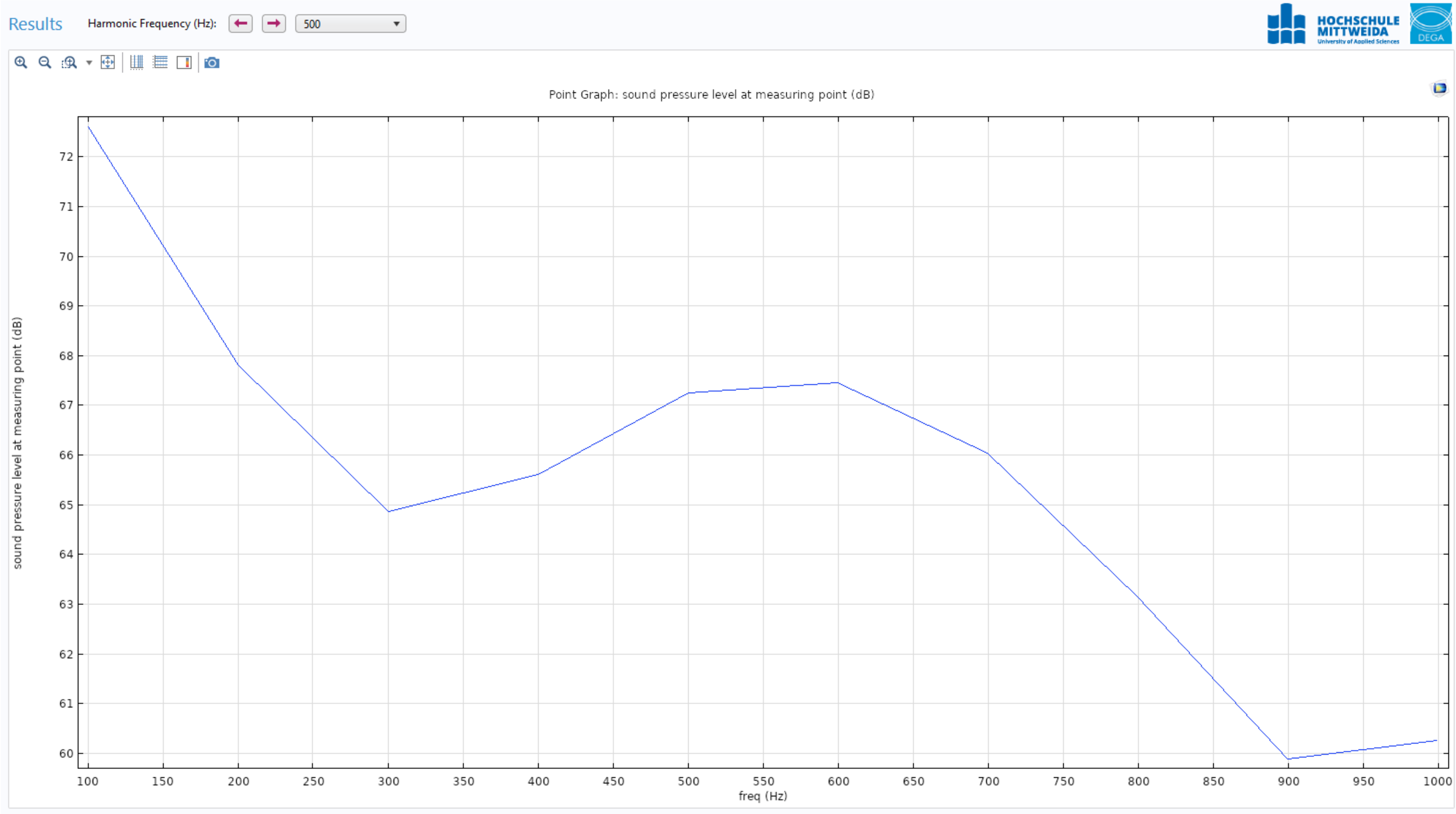
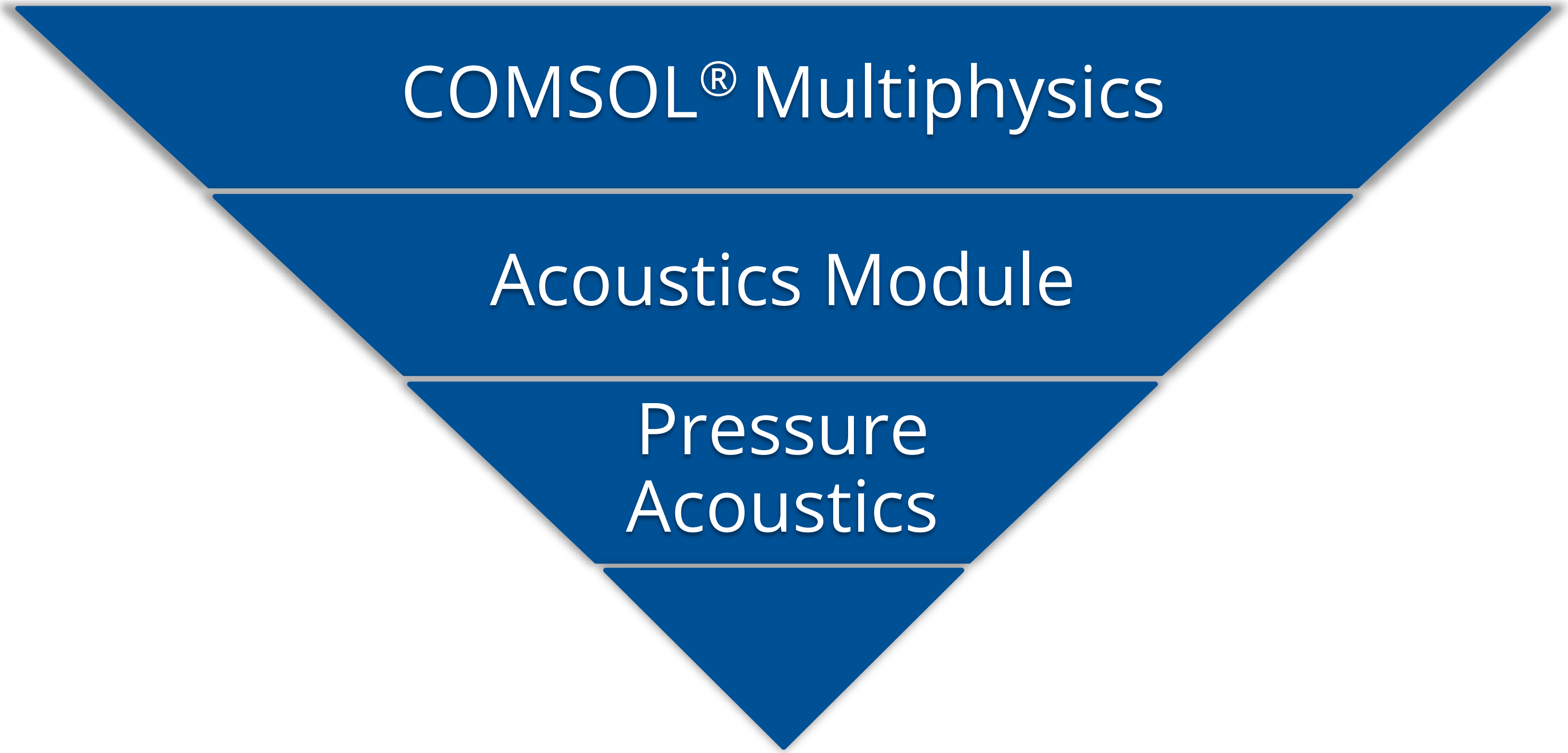
App Layout
Point Graph



Methodology

Methodology

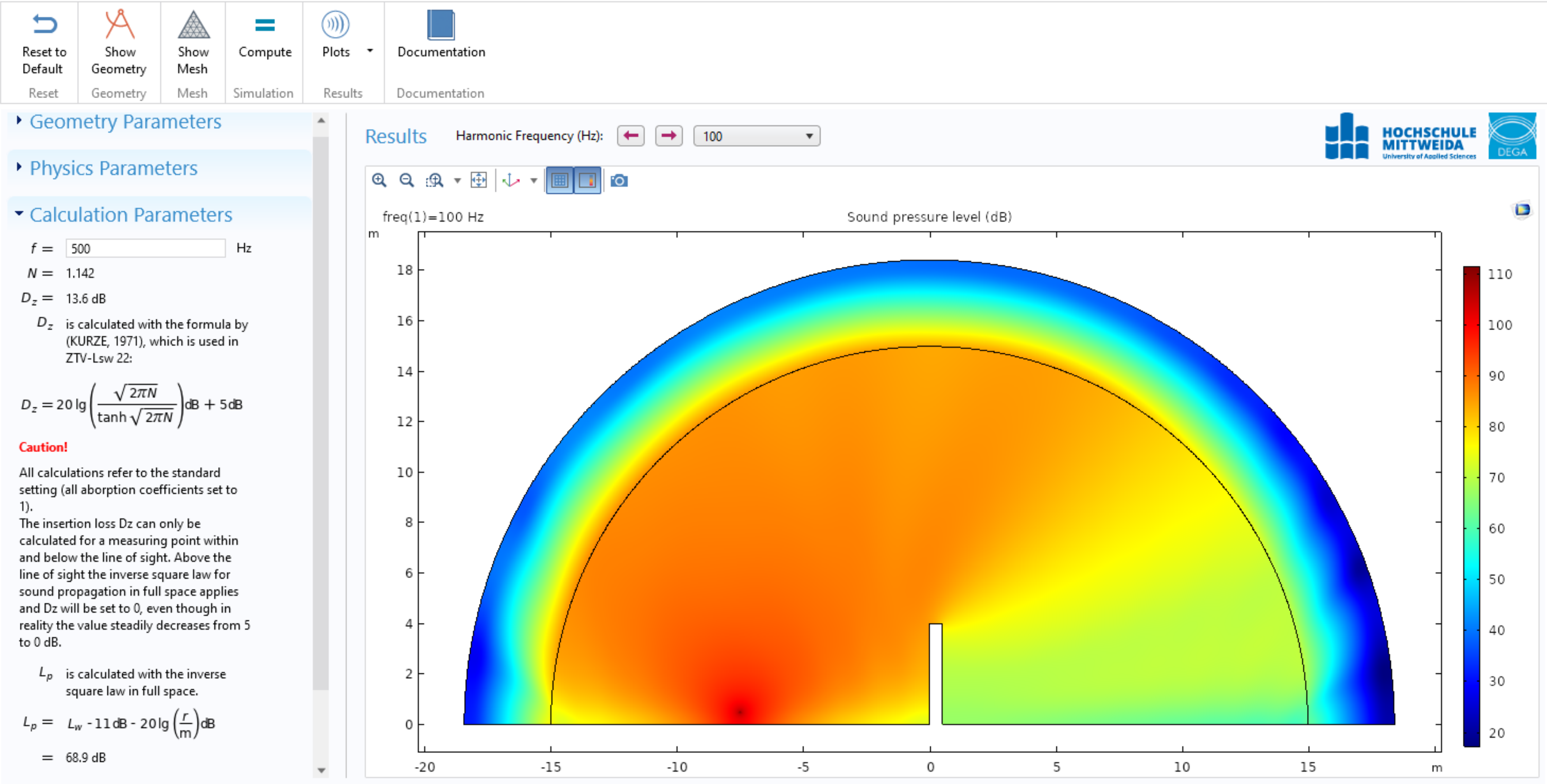
COMSOL Modules



Finite **E**lement **M**ethod

Methodology

Perfectly Matched Layer



Fields of application

Fields of application

Mittweida UAS: Media / Audio and Acoustical Engineering

Specialisation: Acoustics (Prof. Jörn Hübelt)

- Noise Protection (4th semester)
- Acoustic Modeling and Simulation (6th semester)

Free to use for everyone:

https://apps.vib.ed.tum.de:2037/app-lib

Thank You

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