

Low Frequency Noise in Small Rooms: Research on Sound Fields

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Background

The increasing attention in building acoustics on sound insulation at low frequencies below 100 Hz has led to the approval of the new standard ISO 16283-1 on the measurement of airborne sound insulation in buildings intending replace the ISO 140-4.

This standard describes a new method for the measurement in small rooms with approximately diffuse sound fields compared to ISO 140-4 combining corner microphone positions with positions in the central region of the room.

The new low-frequency procedure shall be used for the 50 Hz, 63 Hz, and 80 Hz one-third octave bands in the source and/or receiving room when its volume is smaller than 25 m³.

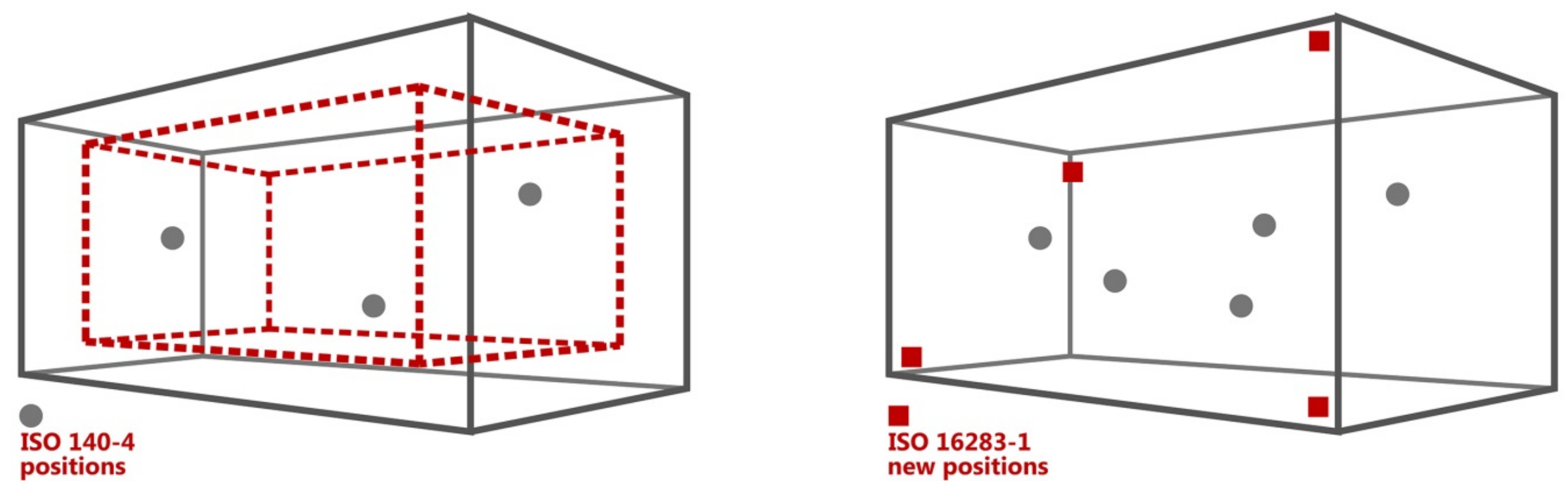


Figure 1: comparison between the microphones localization in ISO 140-4 (left) and the new standard ISO 16283-1 (right)

Approach

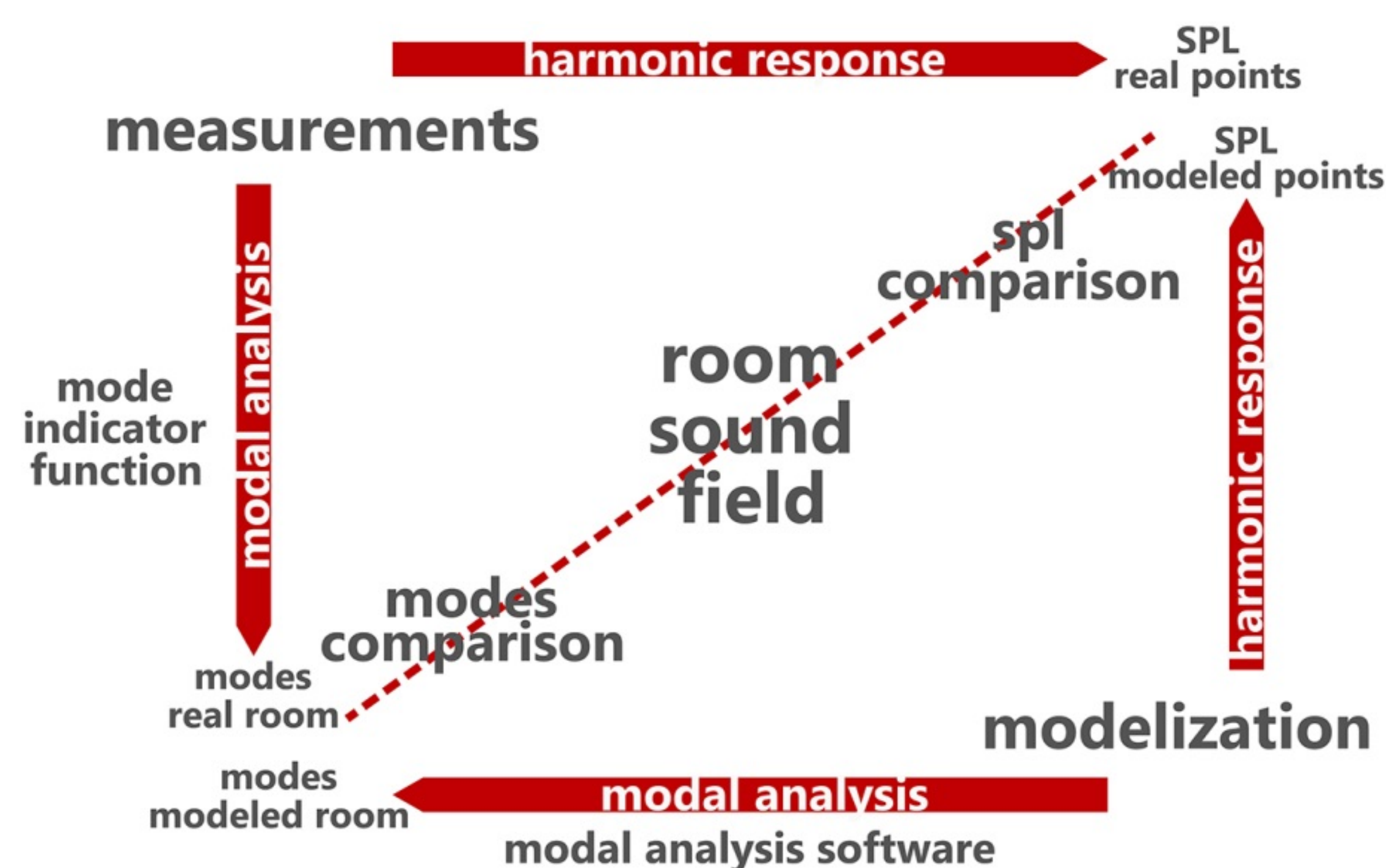


Figure 2: Project workflow

To obtain significant results for the measurement uncertainty of the different methods and to make a recommendation for their application in real rooms the sound field has to be characterized in a variety of rooms with different furnishing conditions.

Therefore, the project utilizes a hybrid approach to investigate the sound field in small rooms to draw conclusions on the application of different measurement approaches :

- measuring the sound field in representative rooms using a impulse response method
- modelling the sound field using a Finite Element Modeling (FEM) software

FEM-simulation is chosen to reduce the number of necessary measurements to a minimum, if possible.

Measurements are conducted for validation of the computer model, as well as for validation of the results.

Hereby, measured and modeled frequency response functions, mode shapes as well as sound pressure levels are compared with predicted ones.

Method

After an analysis of which are the most common dimensions in residential buildings, a case study room has been chosen for a measurement and modelling comparison in different furnishing and material conditions.

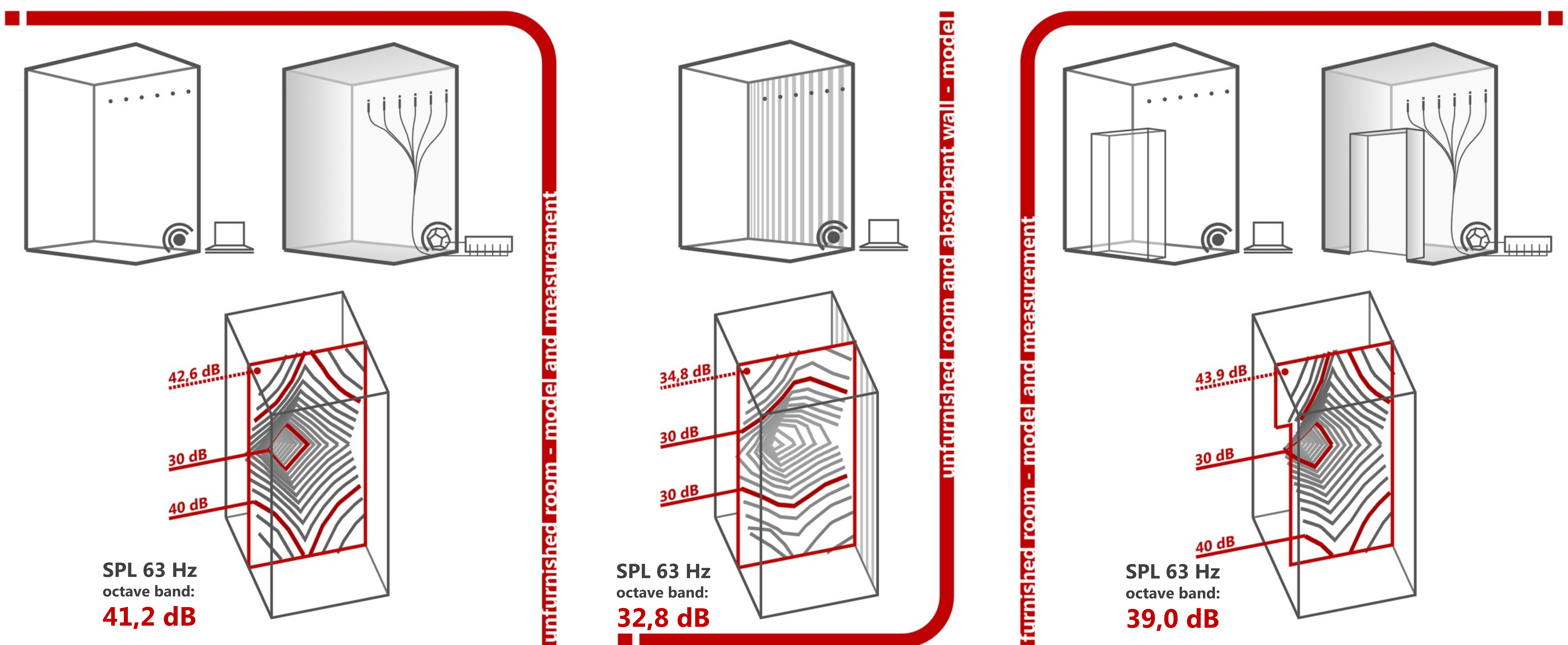


Figure 3: Sound pressure level in the 63 Hz octave band in different room conditions

Expected results

Purpose of the research project is to investigate the feasibility of application of the method in rooms of common Swiss buildings, to establish limits for the measurement uncertainty, as well as to develop simple and reliable recommendations for the measurement of low frequency noise in special situations as basis for a guideline for Swiss engineers.