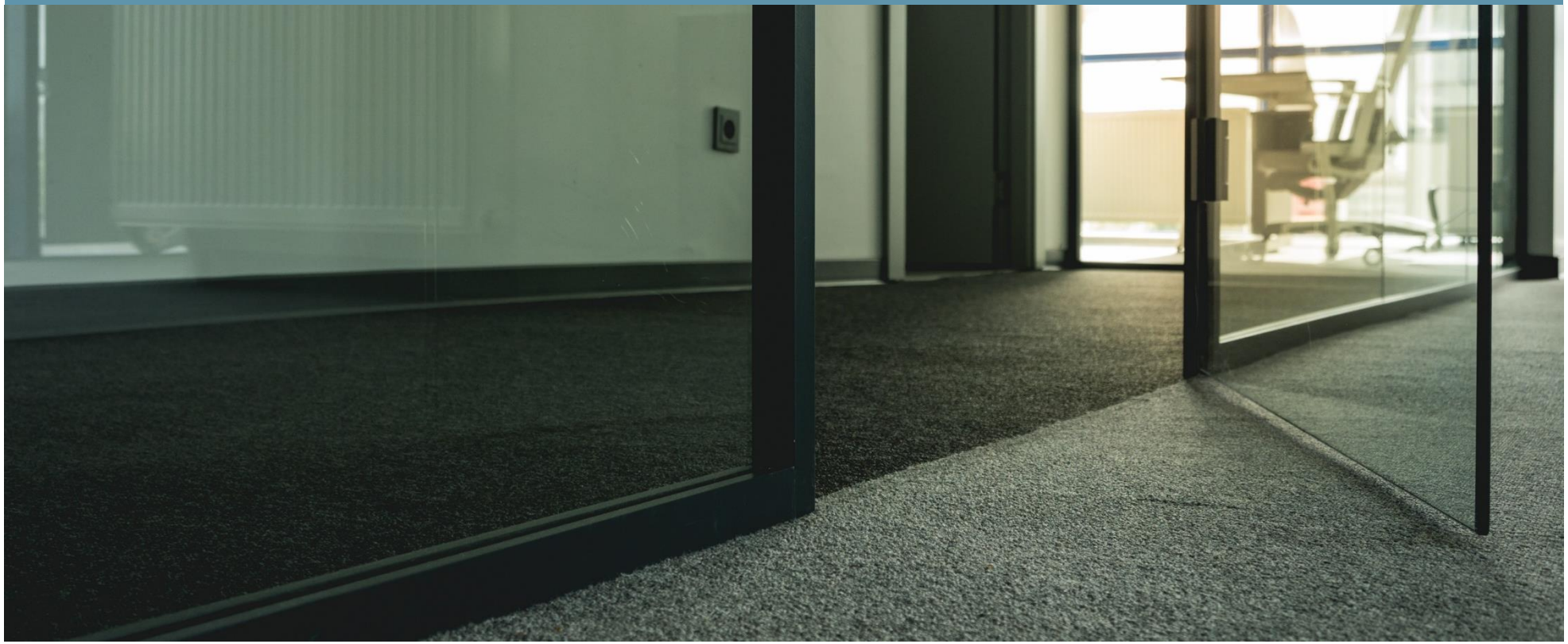
CSTB
le futur en construction

AcouSYS software

AcouSYS



AcouSYS software
Multi-scale approach

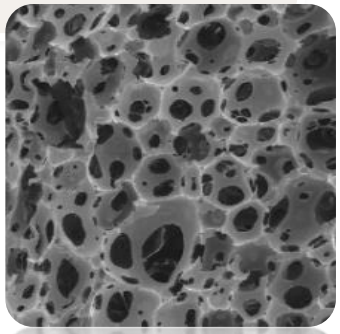
AcouSYS

AcouBAT
AcoubatBIM

Materials

- E,G,ν,η,ρ
- α,ϕ,σ,Λ,Λ'
- …

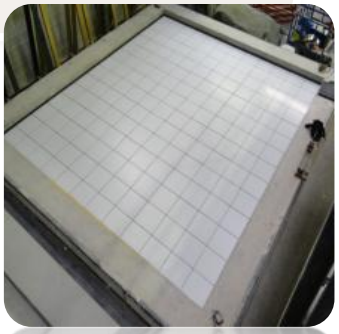
LAB MEASUREMENT



Systems

- $R_w(C,C_{tr})$
- $L_{n,w}$
- α_w
- …

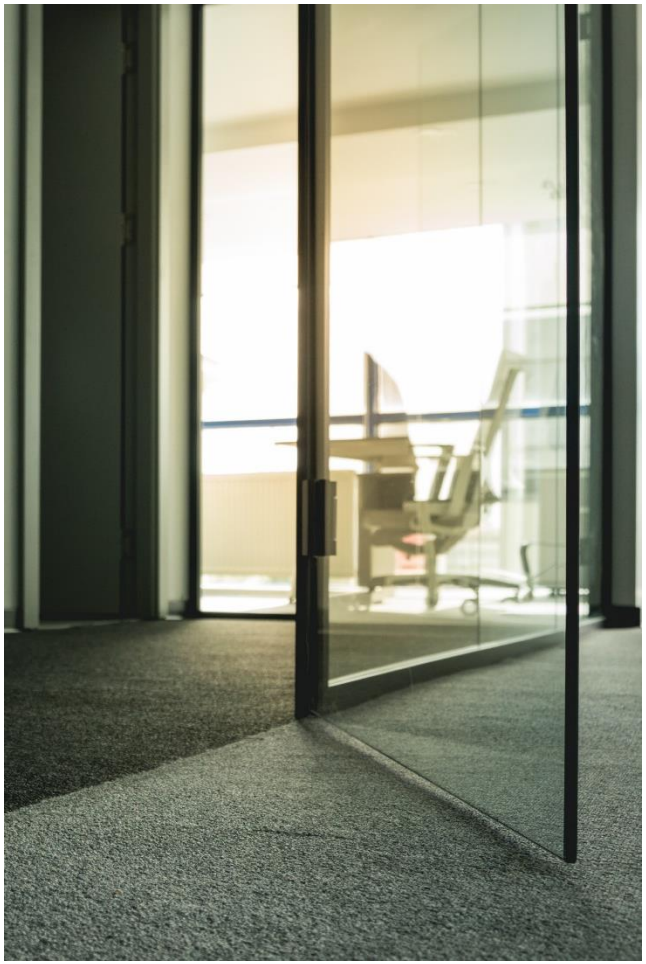
LAB MEASUREMENT



Buildings

- $D_{nT,A}$
- $D_{nT,A,tr}$
- $L'_{nT,w}$
- $L_{nA,T}$…

IN SITU MEASUREMENT



Acoustic calculation software for complex multilayer structures

Applications: buildings, transportation (automotive, aeronautic and railway).

User profiles: actors of the building or transportation industry (technical consultants, manufacturers, laboratories, etc.).

AcouSYS software
Acoustic performances

From the materials properties, AcouSYS can calculate the following standard performance indices:

- Sound reduction index R
- Normalized impact sound pressure level L_n
- Acoustic absorption coefficient α
- Sound reduction index with a turbulent boundary layer excitation R_{TBL}
- Rain sound intensity level L_i

Performances directly comparable to measurement results from LABE

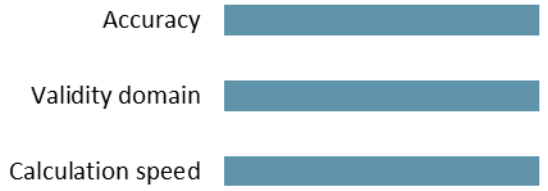
AcouSYS software
An engineering tool

Types of prediction methods

- Empirical (e.g. mass law)

- Numerical (e.g. FEM)

- Analytical (e.g. TMM)



AcouSYS software
Input parameters

A system is described as

- Homogeneous, parallel layers (unlimited number)
- Lateral dimensions (spatial windowing technique)

Each layer is described as

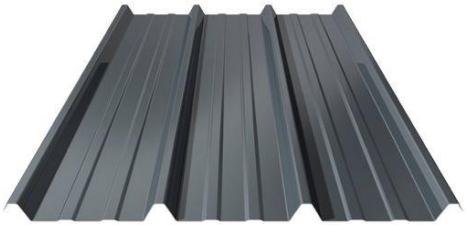
- Material properties
- Thickness
- Contact conditions to adjacent layers (free or glued)

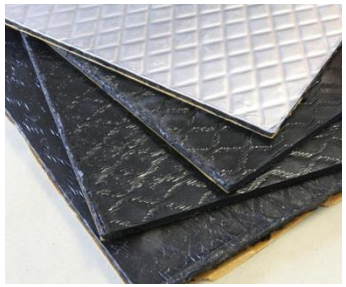
Material database

- Generic materials
- User-specific materials



- Fluid materials
- Isotropic solid materials
- Orthotropic solid materials
- Anisotropic solid materials
- Membrane materials
- Viscoelastic materials
- Porous materials
- Equivalent fluid materials
- Perforated solid materials
- Equivalent fluid double porosity materials





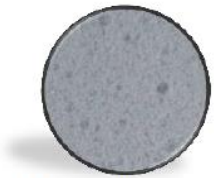

Laine de roche

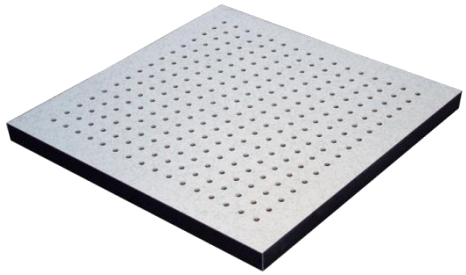

Laine de verre


Laine de bois


Fibres de bois

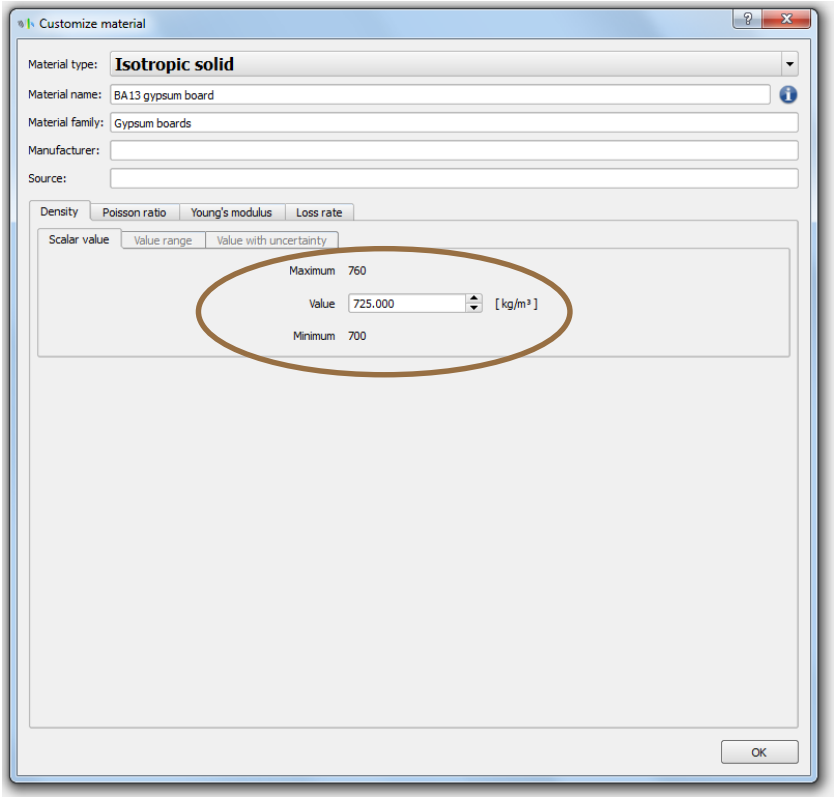

Fibres de polyester

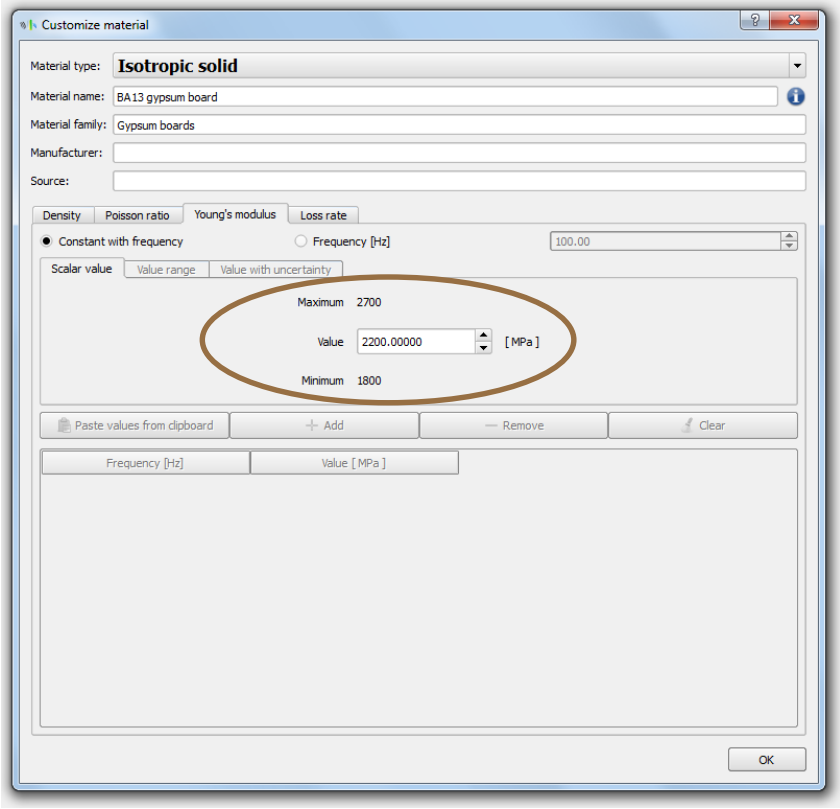

Mousse de mélamine (cellules ouvertes)



Variation range for physical parameters of known materials

- New feature (version 3)





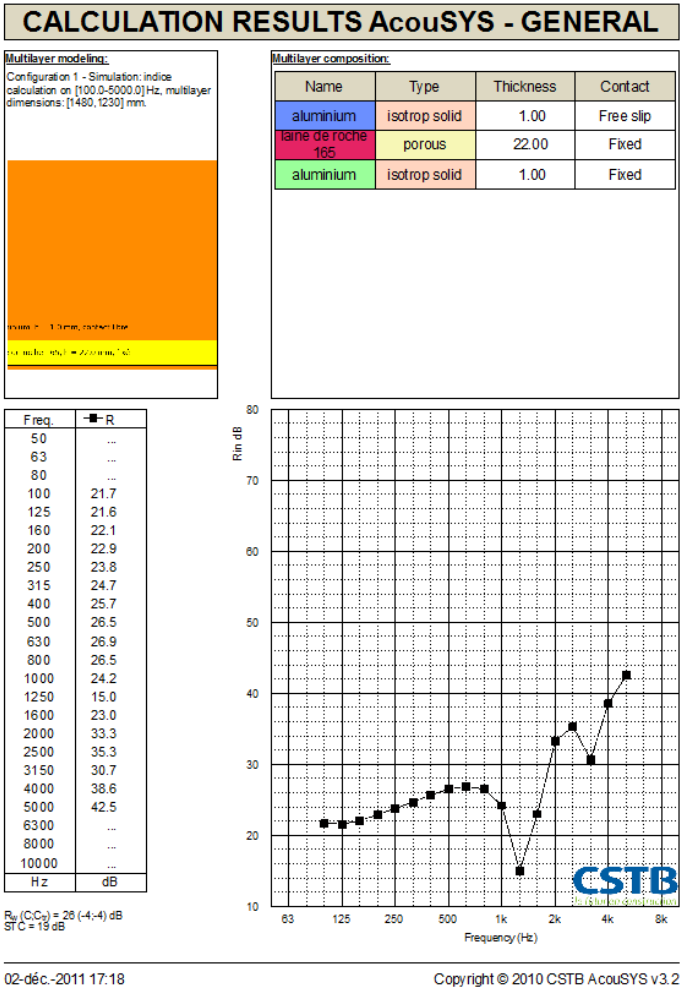
AcouSYS software
Calculation results

Display window

- Inputs summary
- 1/3 octave band values (table + graph)
- Single number ratings
- New feature (version 3): North American performance indices STC and IIC

Export options

- Copy as image
- Copy values to table/spreadsheet
- Copy to AcouBAT



CALCULATION RESULTS AcouSYS - GENERAL

Multilayer modeling:

Configuration 1 - Simulation: indice calculation on [100.0-5000.0] Hz, multilayer dimensions: [1480, 1230] mm.

Multilayer composition:

Name	Type	Thickness	Contact
aluminium	isotrop solid	1.00	Free slip
laine de roche 165	porous	22.00	Fixed
aluminium	isotrop solid	1.00	Fixed

Freq.	R
50	...
63	...
80	...
100	21.7
125	21.6
160	22.1
200	22.9
250	23.8
315	24.7
400	25.7
500	26.5
630	26.9
800	26.5
1000	24.2
1250	15.0
1600	23.0
2000	33.3
2500	35.3
3150	30.7
4000	38.6
5000	42.5
6300	...
8000	...
10000	...
Hz	dB

R_w ($C;C_{Tr}$) = 26 (-4;-4) dB
STC = 19 dB

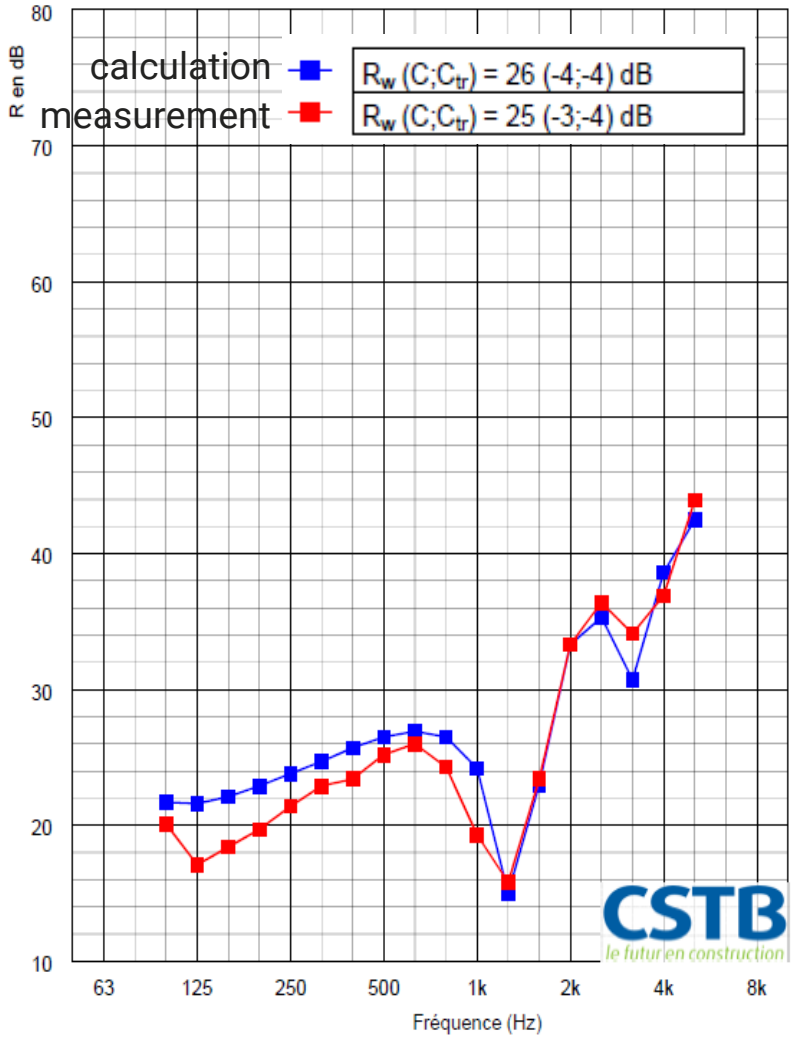
02-déc.-2011 17:18

AcouSYS software
Examples

Prediction/measurement comparisons

- Door unit
  Airborne noise insulation R
- Heating floor
  Impact sound reduction ΔL
- Perforated panel
  Absorption coefficient α_s
- Roofing panel
  Rain sound intensity level L_i

AcouSYS software
Example 1: sound reduction index R of a door unit



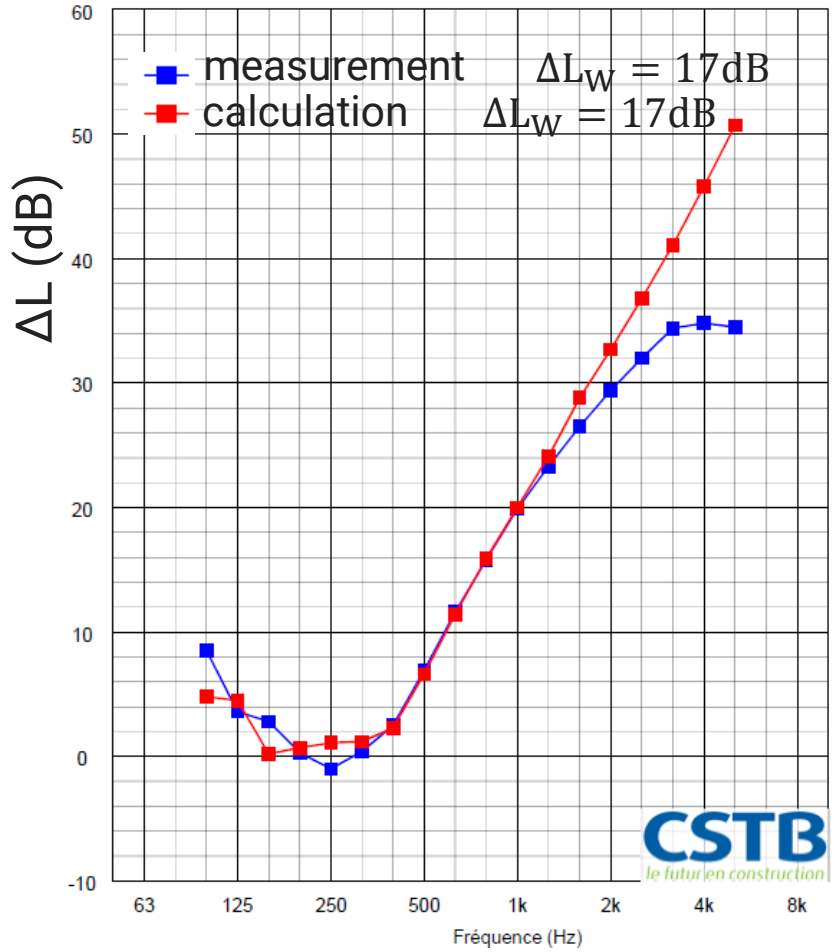
Panel dimensions 1.48 x 1.23 m²:

- 2 aluminum plates , each 1 mm thick
- 22 mm rockwool interlayer (165 kg/m³), glued on both sides

Physical phenomena:

- Mass/spring/mass resonance
- Resonance due to the compression wave inside the porous layer

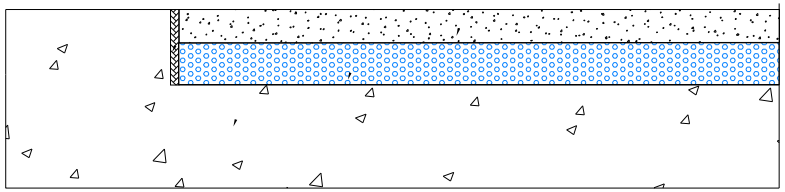
AcouSYS software
Example 2: ΔL of a heating floor



Heating floor dimensions 4.22 x 3.60 m²:

- 65 mm mortar screed
- 24 mm EPS layer
- 140 mm concrete slab

$$\Delta L = L_n(support) - L_n(system)$$

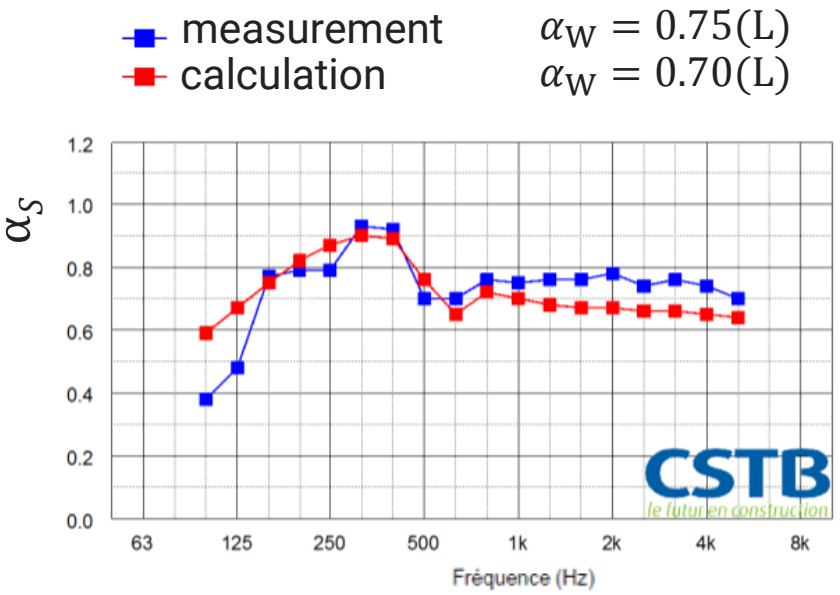


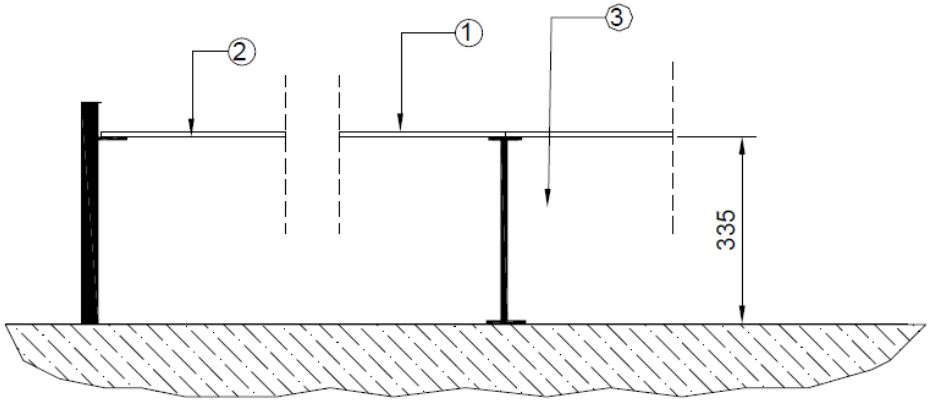
AcouSYS software

Example 3: absorption coefficient α_S of a perforated panel

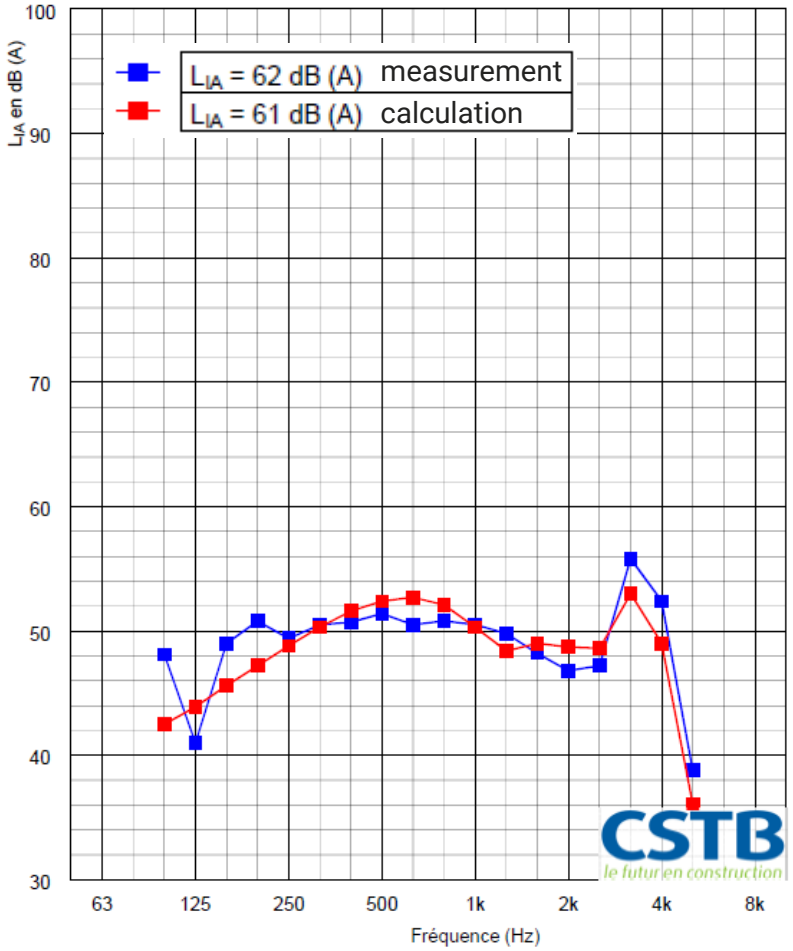
Panel dimensions 3.60 x 3.00 m²:

- Perforated solid (11%, Ø 1.5 mm) 0.6 mm
- Resistive veil 0.2 mm
- Cavity (air) 335 mm





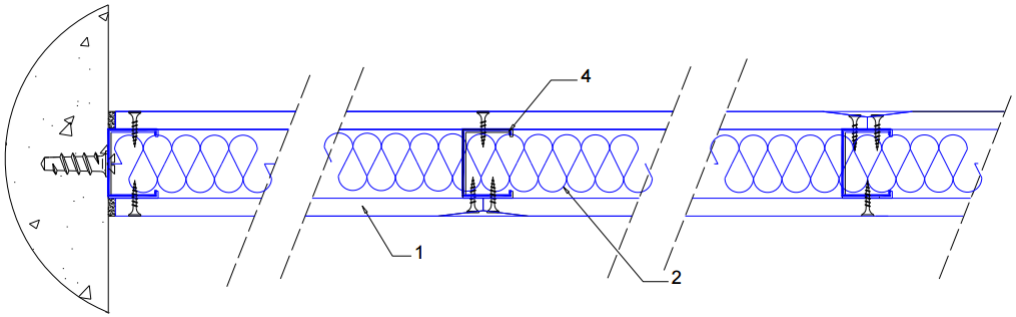
AcouSYS software
Example 4: L_i level of a roofing panel



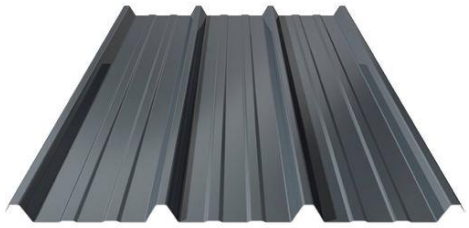
- 0.7 mm aluminum plate
- 3 mm heavy mass (700 kg/m^3)
- 5 mm XPS (30 kg/m^3)
- 0.7 mm aluminum plate

Extend the scope of TMM

- Vibration transmissions across framework

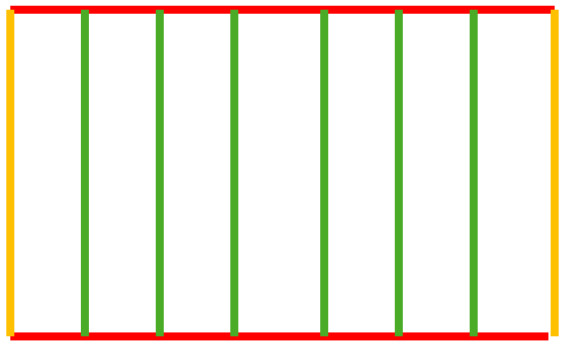


- Inhomogeneous elements (e.g. profiled plates, hollow blocks…)

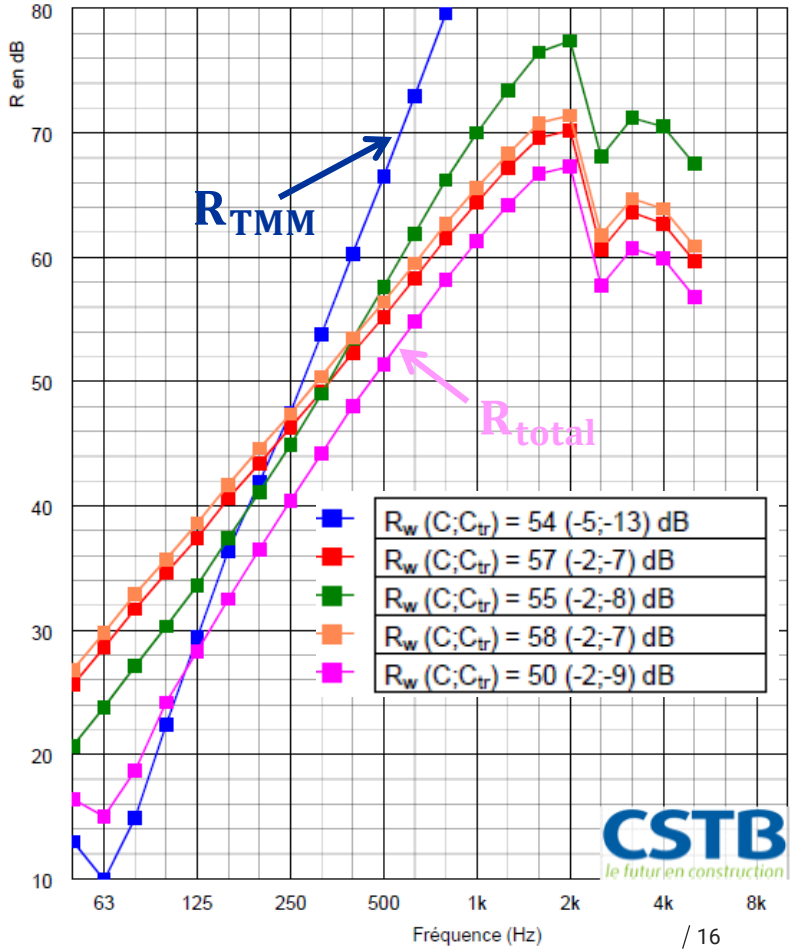


TMM + SEA approach

- Based on CSTB research
- Application: single leaf lightweight partition walls on metal single frame
- Input parameters: frame stiffness, screwing distance, stud spacing
- Allows quick identification of main transmission paths

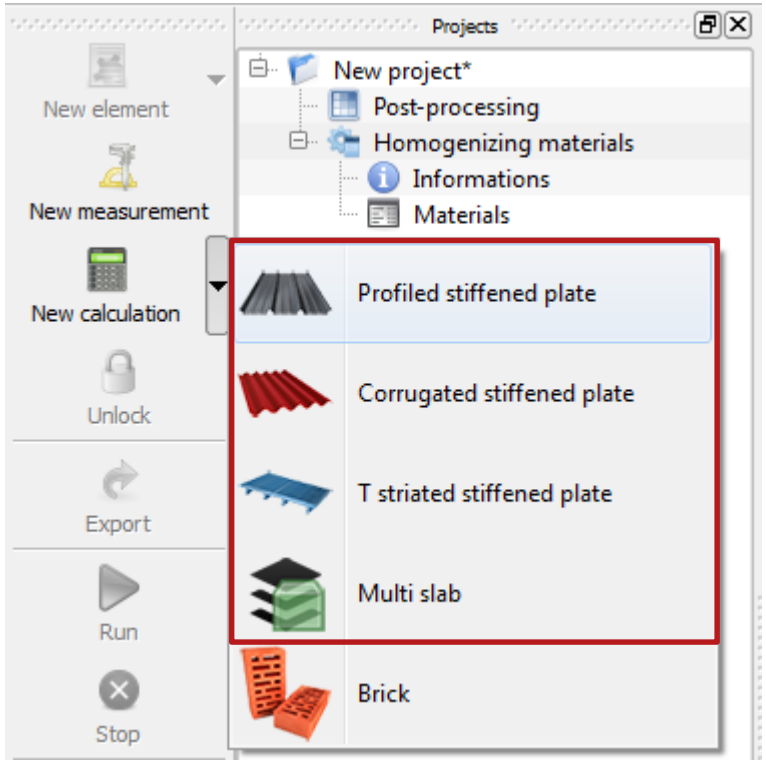


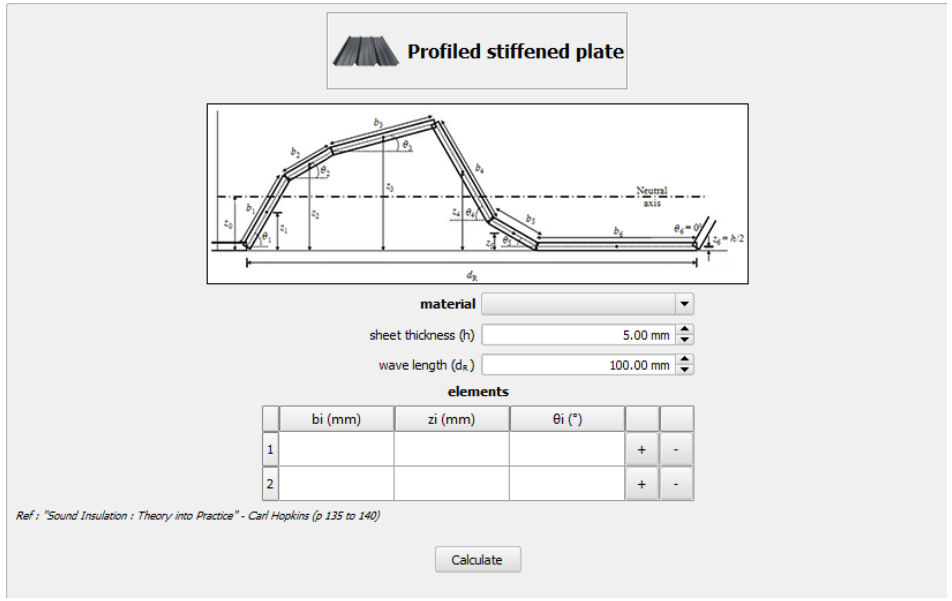
Rails
Studs
Peripheral studs



Homogenization of complex elements

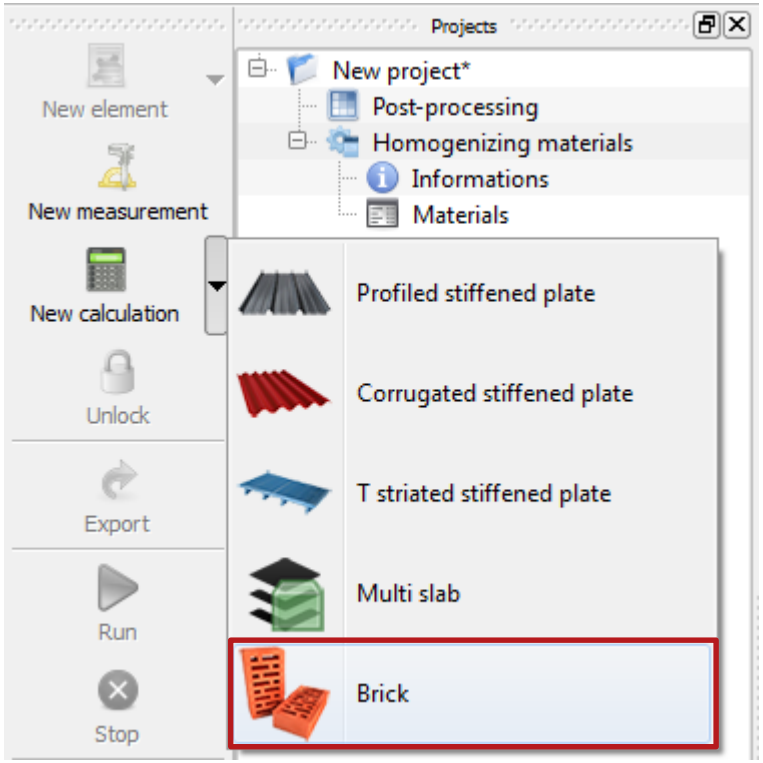
- New feature (version 3)
- Profiled plates, corrugated plates, stiffened plates, stacked plates

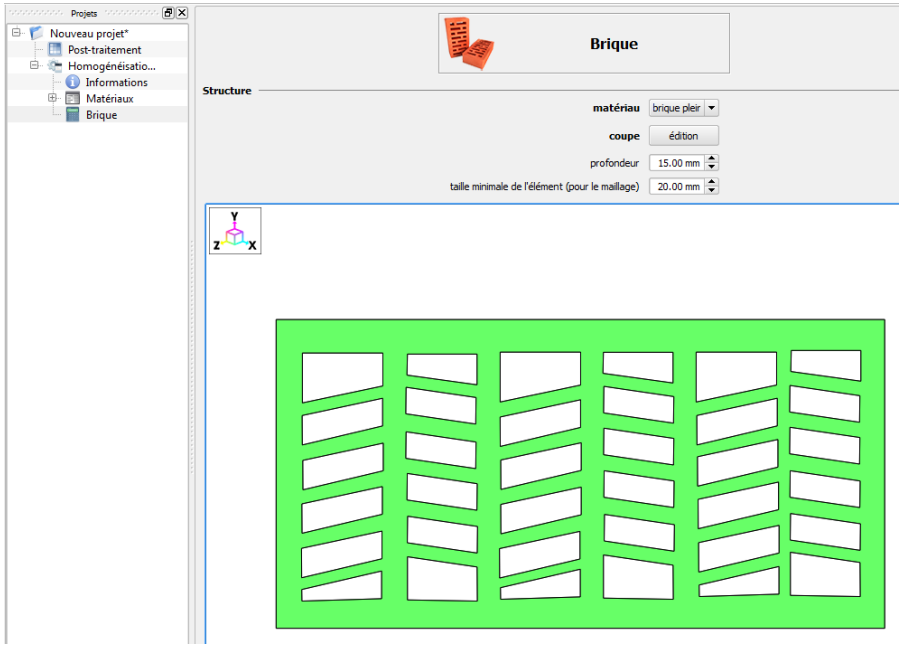




Homogenization of complex elements

- New feature (version 3)
- Hollow masonry elements





AcouSYS software
Capabilities/limits

Validation booklet

- 25 fully documented case studies
- Horizontal and vertical applications
- Available online
- Language: English

A few perspectives

- « Modal » module
  - ➔ Method: analytical
  - ➔ Applications: small glazings (low frequency domain)
- « Cylindrical » module
  - ➔ Method: cylindrical TMM
  - ➔ Applications: transmission/insertion loss of curved systems
- « Development/optimization » module
  - ➔ Methods: stochastic, genetic algorithm
  - ➔ Applications: multi-criteria optimization, influence of uncertainty on input data

AcouSYS software
Customer accompaniment

Training options

- In-house, tailor-made training
- e-learning module (included in software purchase)

CSTB
le futur en construction