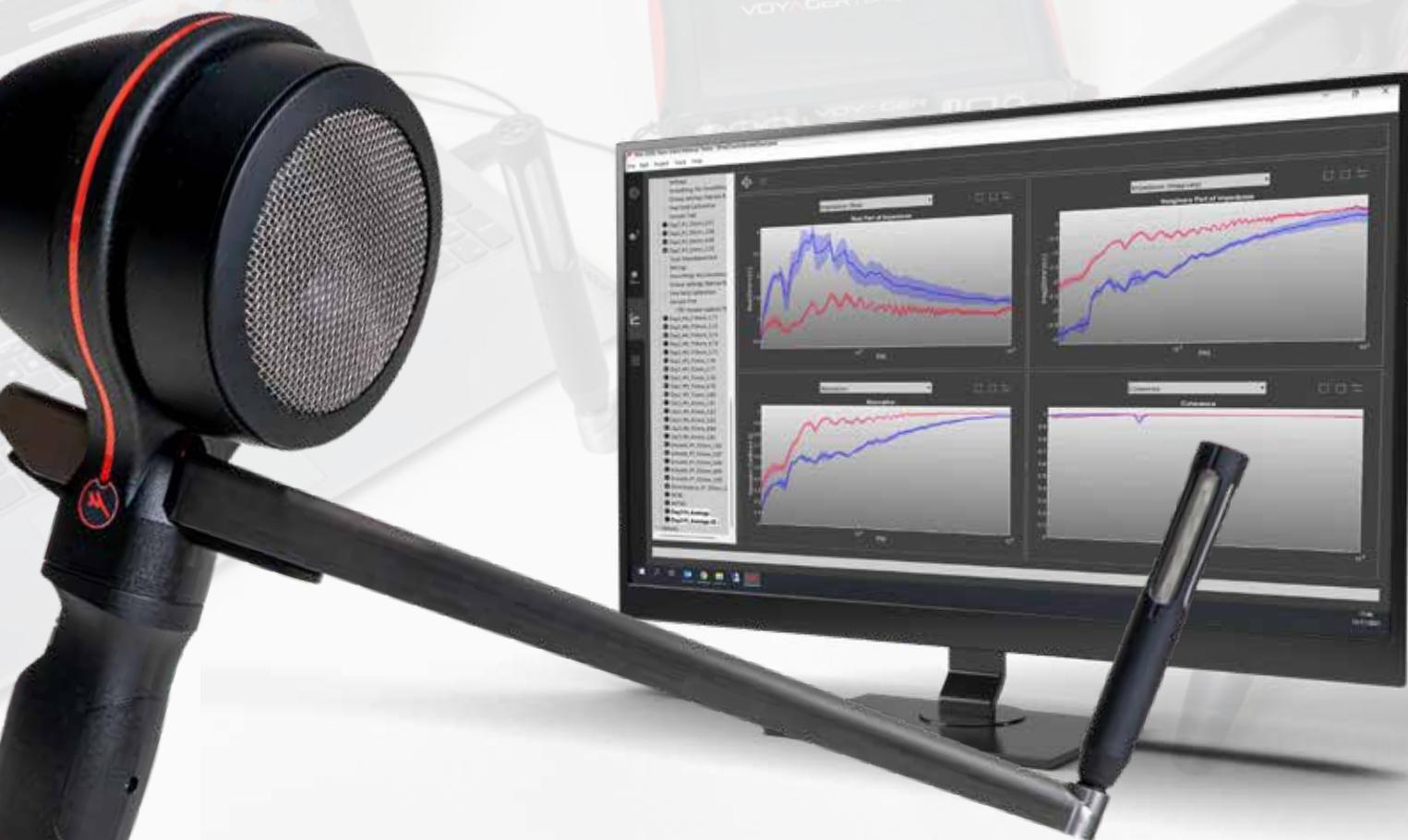


PRODUCT **BROCHURE**



NEAR-FIELD MATERIAL TESTER

**In-situ Acoustic Material
Characterization**



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THE CORE OF EVERY MICROFLOWN SOLUTION

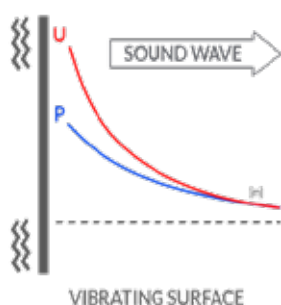
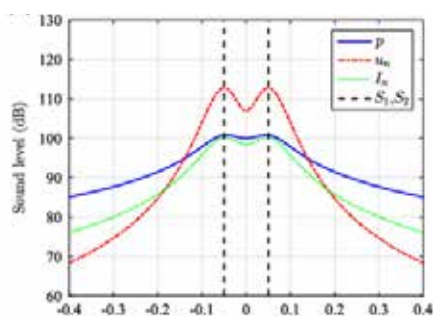
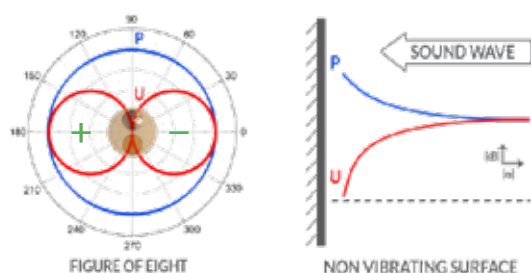
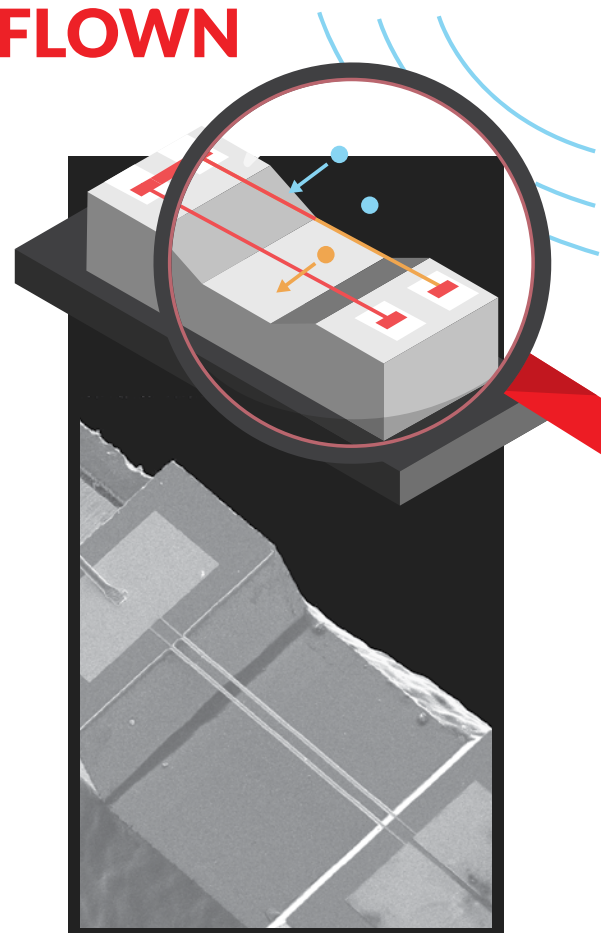
Sensing acoustic particle velocity

THE FOUNDATION

At the heart of every MicroflowN solution is the acoustic particle velocity sensor, also known as a MicroflowN. This MEMS-based sensor directly measures acoustic particle velocity, giving access to a fundamental property of sound that traditional microphones do not capture.

Particle velocity describes the local oscillating motion within a sound field and is a vector quantity, containing both magnitude and direction. This makes it possible to analyse how sound propagates, where it originates, and how energy is distributed in space.

Manufactured on silicon wafers using cleanroom technology, the sensor consists of two ultra-thin platinum wires, each heated and acting as a temperature sensor. As sound waves pass, they disturb the temperature distribution asymmetrically, creating a resistance difference between the wires. This generates a signal proportional to the acoustic particle velocity, covering a wide frequency range.



Background noise reduction

Particle velocity measurements are naturally less sensitive to surrounding noise because they combine two key advantages: directional sensitivity and vector behaviour. The MicroflowN sensor has a frequency-independent figure-of-eight directivity, allowing the most sensitive axis to be aimed toward the area of interest while rejecting sound arriving from other directions.

When measuring close to a rigid surface in a noisy environment, incoming and reflected sound waves travel in opposite directions. In terms of particle velocity, these opposite directions largely cancel each other, reducing the influence of surrounding sound fields. This helps isolate local sources and improves clarity in complex acoustic environments.

Enhanced spatial resolution

Close to a radiating source, particle velocity shows large level variations over very small distances. This is caused by near-field effects and the vector nature of this quantity.

The strong spatial gradient make it easier to separate closely spaced sources and reveal local acoustic details that can be difficult to distinguish with pressure-based measurements alone.

Low-frequency performance

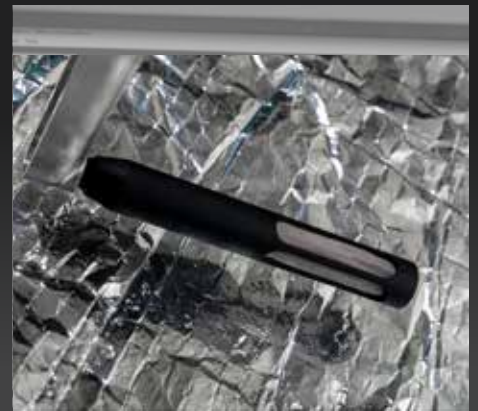
At low frequencies, near-field effects increase the particle velocity signal close to the source. This creates a stronger signal-to-noise ratio, making particle velocity especially valuable for troubleshooting low-frequency acoustic problems.



AUTOMOTIVE NVH



BUILDING ACOUSTICS



MATERIAL R&D

MEASURE MATERIALS AS THEY ARE USED

In-situ acoustic material characterization in real-world conditions

The acoustic performance of a material is strongly influenced by its dimensions, mounting conditions, backing structure, curvature, and surrounding environment. Traditional laboratory methods often require samples to be cut, removed, or mounted under standardized conditions that may not represent their final behaviour.

The NF Material Tester characterizes acoustic materials directly in their installed or intended configuration. A controlled sound field is generated over the test surface, while sound pressure and particle velocity are measured in the near-field using a PU probe.

From these measurements, the system determines key acoustic properties including the sound absorption coefficient, reflection coefficient, and complex surface impedance. Additional material parameters can be derived to support more detailed evaluation, modelling, and comparison.

Measurements can be performed on installed panels, complete assemblies, curved surfaces, layered structures, and inhomogeneous materials without cutting or removing a sample. The portable setup provides broadband results within minutes, supporting material development, installation verification, benchmarking, simulation input, and quality control directly at the point of use.

KEY FEATURES



Non-destructive testing

Characterize materials without affecting installed conditions



Broadband solution 100 Hz to 10 kHz



Complete acoustic characterization

Measure sound absorption, reflection, and complex surface impedance



Real-world material testing

Evaluate flat, curved, layered, homogeneous, and inhomogeneous surfaces



Fast near-field method

Generate a controlled sound field and measure directly above the material surface.



Point testing & spatial mapping

Create 2D absorption maps to reveal local variations





ROAD SURFACES



VEHICLE INTERIOR



RESEARCH LABS

KEY APPLICATIONS

- Installed acoustic material verification
- Acoustic property characterization
- Surface impedance measurement
- Sound absorption measurement
- Porous and fibrous material testing
- Acoustic foam characterization
- Multilayer and composite material evaluation
- Perforated and slotted absorber testing
- Membrane and resonant absorber analysis
- Automotive trim and acoustic package testing
- Aircraft, rail, and vehicle interior materials
- Wall, ceiling, and floor treatment evaluation
- Curved surfaces and complete assemblies
- Mounting and installation effect assessment
- Supplier data verification
- Material benchmarking and development
- Local defect and inhomogeneity detection
- Production and incoming quality control
- Material model input and validation
- Road surface and porous pavement testing



THE HARDWARE BEHIND THE MEASUREMENT

A portable system for fast, repeatable acoustic material characterization

The Near-Field Material Tester is a dedicated measurement solution for characterizing the acoustic behaviour of materials directly in their installed or intended configuration. A controlled sound field is generated above the test surface while a specially designed sound intensity PU probe (PU) probe performs near-field measurements without altering the material.

The system combines an acoustically transparent PU probe, a broadband acoustic source, and a mechanical decoupling system into a mobile measurement solution. This enables accurate and repeatable characterization of a wide range of materials without the need of specialized measurement facilities.

For each evaluated material, the system determines key acoustic properties including sound absorption, reflection coefficient, and complex surface impedance. By combining the measurement data with equivalent fluid models, additional material parameters such as airflow resistivity, effective thickness, and viscous length can also be obtained.





Capturing sound pressure and particle velocity

The PU probe measures sound pressure and particle velocity directly above the material surface, while its acoustically transparent design minimizes scattering and disturbance of the sound field. Its mechanically decoupled mounting maintains a fixed measurement geometry while enabling fast installation and repeatable positioning.



Decoupled acoustic excitation

A mechanically decoupled loudspeaker generates a controlled sound field above the material surface. The integrated structure maintains a fixed relationship between source and probe throughout the measurement. Mechanical decoupling prevents unwanted vibrations from influencing the acoustic measurement.



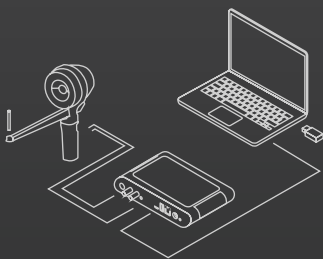
Flexible data acquisition

The system can be configured with Voyager or Scout as the acquisition platform.

Voyager combines signal conditioning, acquisition, storage, and signal generation in one portable device. Scout together with MFPA provides a modular solution for laboratory and fixed measurement environments.

WORKFLOW

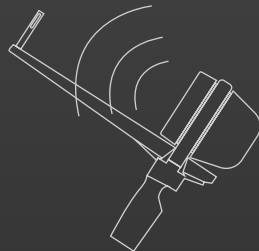
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Configure

Connect the measurement hardware and launch VELO

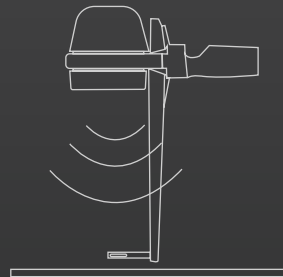
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Reference

Perform a free-field measurement to establish the excitation output before testing the material.

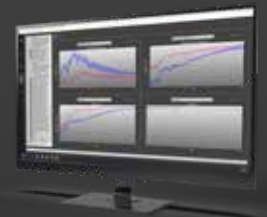
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Measure

Position the probe above the material and perform the surface measurement. Repeat at different locations to determine the spatially averaged response and identify local variations across the material surface.

4



Analyze

The software combines free-field and surface measurements to determine sound absorption, reflection coefficient, complex surface impedance, and additional derived material parameters.

HARDWARE CONFIGURATIONS

The NF Material Tester is delivered as a complete, ready-to-use measurement system for in-situ acoustic material characterization. The system is available with either Voyager or Scout + MFPA data acquisition, allowing users to select the configuration that best matches their field or laboratory requirements.

Both configurations are supplied in a rugged transport case with all hardware required for material testing. The complete system, including the dedicated PU probe, acoustic excitation source, accessories, and data acquisition hardware, remains securely organized and protected during transport and storage.

Near-Field Material Tester VOYAGER configuration
Voyager DAQ
- Tripod Adapter (1/4 to 3/8)
- Firmware Reset Ejector Pin
- Power supply
PU Probe (PI Gen 2)
- Metal Probe Case
- Calibration Report
Manfrotto PIXI Mini Tripod Black
Impedance Gun Gen 2
Pelicans 1150 + inlay
Cables:
- 2,5 m 4pin to 7pin LEMO cable
- 3 m speaker cable
- 2 m USB-A to Micro-B cable
Sentinel HL Max USB dongle
32 GB USB stick (Calibration report/manuals/software)
Reference Melamine sample

Near-Field material tester Scout + MFPA configuration
Scout V2
MFPA-2
Scout+ MFPA Stand
PU Probe (PI Gen 2)
- Metal Probe Case
- Calibration Report
Manfrotto PIXI Mini Tripod Black
Impedance Gun Gen 2
Pelicans 1150 + inlay
Cables:
- 2,5 m 4pin to 7pin LEMO cable
- 3 m high-speed data USB-A to USB-C cable
- 3 m speaker cable
- 20 cm BNC cable (x2)
Sentinel HL Max USB dongle
32GB USB stick (Calibration report/manuals/software)
Power supply 30W (x2)

Optional items & accessories
Intel RealSense D415
Intel RealSense D455f
Large Manfrotto tripod
Microflow class 1 field calibrator



CONFIGURATION FLEXIBILITY

DAQ

The Near-Field Material Tester is available with two data acquisition configurations, allowing the system to adapt to different measurement environments.

Voyager combines signal conditioning, data acquisition, storage, signal generation, and battery power in one portable device, making it ideal for field measurements and mobile testing.

Scout + MFPA combines the Scout acquisition system with dedicated signal conditioning to provide synchronized pressure and particle velocity measurements. This modular configuration also includes a dedicated amplified output, well suited for laboratory installations and permanent measurement setups.

Expand with Scan&Paint 2D

The Near-Field Material Tester hardware can also be combined with Scan&Paint 2D to extend the measurement capabilities with 2D sound absorption mapping.

Adding a compatible camera enables visual documentation of measurement locations and spatial mapping of material properties. Existing Scan&Paint 2D users can reuse their camera, while new users can add this functionality at any time as their measurement requirements evolve.

This modular approach provides a straightforward upgrade path from point-based material characterization to full 2D acoustic imaging within the VELO platform.



VOYAGER

Inputs:

4+ 2 AUX (IEPE)

Outputs:

1 headphones out

Battery powered : Yes

Best for: portability, simplified setup.



SCOUT + MFPA

Inputs:

4+ 1 TACHO

Outputs:

1 line out + 1 Amplified

Battery powered : No

Best for: lab use, cost-conscious setups.



Intel RealSense D415

Field of view:

69° (H) / 42° (V)

Resolution:

1920x1080

Best for: cost-conscious setups and longer working distances



Intel RealSense D455f

Field of view:

87° (H) / 58° (V)

Resolution:

1280x 800

Best for: compact spaces and close-range measurements

Accessories

Optional accessories adapt the Near Field Material Tester to different measurement scenarios. Available accessories include extended measurement cables, windscreens, and field calibration accessories expand the system possibilities and support laboratory or field measurements.



VOYAGER

ONE DAQ
FOR ALL VELO
APPLICATIONS



NF MATERIAL TESTER SOFTWARE

Near-Field Material Tester | VELO

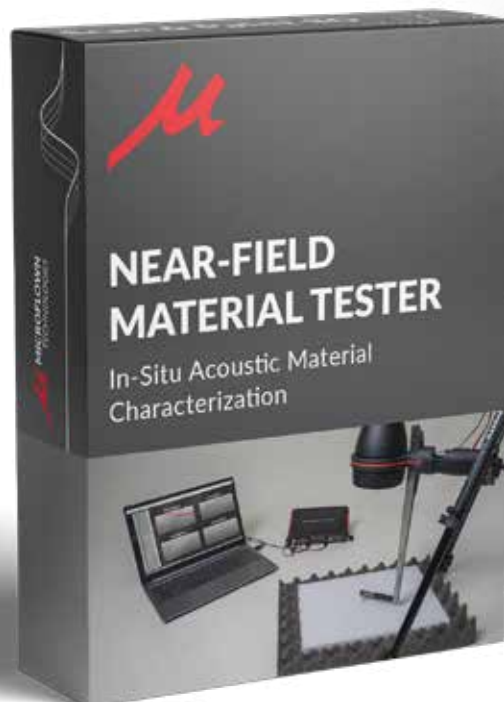
VELO

VELO is the shared software platform behind Microflown testing solutions. It provides a consistent user experience across applications while each module delivers dedicated workflows for data acquisition, visualization, analysis, and reporting.

NEAR-FIELD MATERIAL TESTER

The Near-Field Material Tester module provides a dedicated software for near-field acoustic material characterization. It combines a free-field reference measurement with measurements performed directly above the material surface to determine its acoustic behaviour under real operating conditions.

The software is available in Lite, Standard, and Pro license levels, allowing users to select the functionality that best matches their measurement requirements.



ACOUSTIC MATERIAL CHARACTERIZATION

- Data recording
- Smoothing tools
- Sound absorption and reflection coefficients
- Plane wave method
- Mirror source method
- Full export options (incl. *.xlsx and *.csv)
- Standard deviation
- Q-term method
- Voyager standalone measurement compatibility
- Complex impedance
- Non-destructive material parameter estimation (model fitting)
- Sound absorption mapping*

Lite	Standard	Pro
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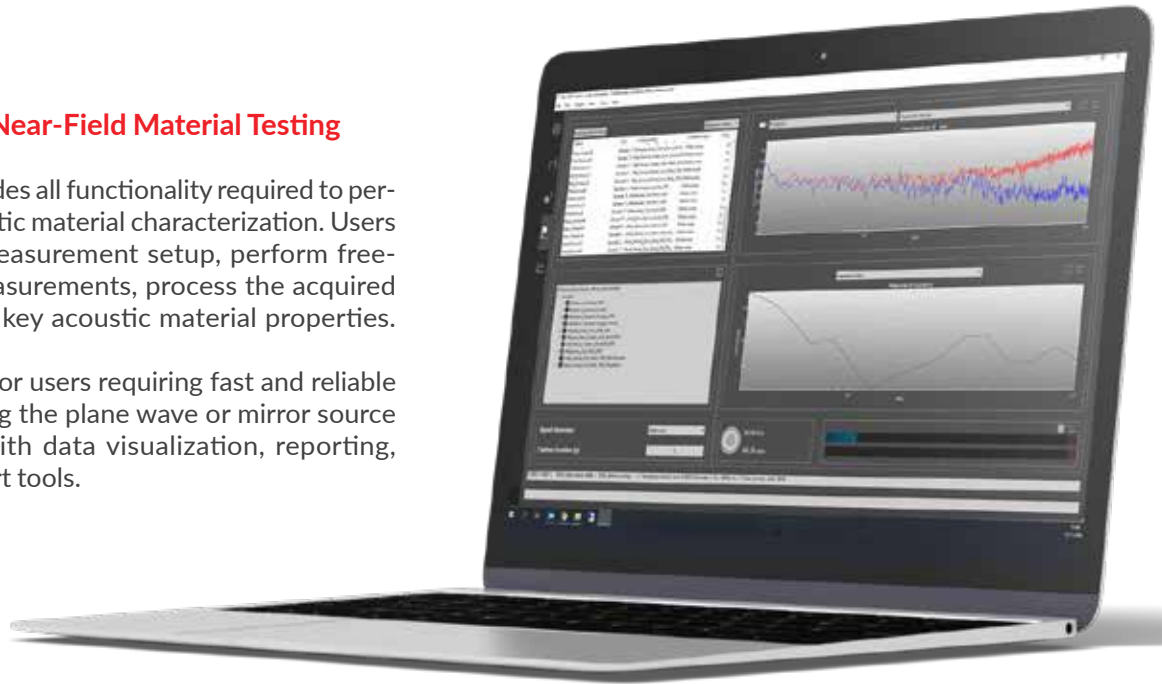
*Requires a Scan&Paint 2D software license.

LITE

The foundation of Near-Field Material Testing

The Lite license provides all functionality required to perform near-field acoustic material characterization. Users can configure the measurement setup, perform free-field and sample measurements, process the acquired data, and determine key acoustic material properties.

This tier is intended for users requiring fast and reliable characterization using the plane wave or mirror source method, together with data visualization, reporting, smoothing, and export tools.



GUIDED SETUP



The Setup workspace guides users through hardware configuration and project creation before each measurement. Connected devices, measurement channels, and acquisition settings are automatically verified to ensure the system is ready for testing.

CAPTURE MANAGEMENT



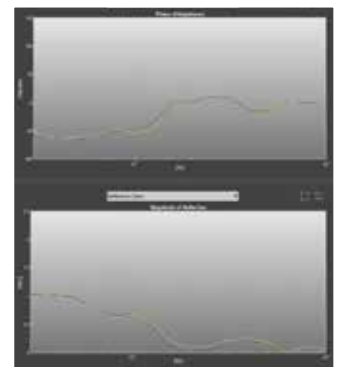
Reference and sample measurements are automatically organized within each material dataset. Users can perform multiple measurements, repeat acquisitions, and manage complete material characterization projects from a single workspace.

FLEXIBLE CALCULATION



Each measurement can be processed using the plane wave or mirror source method. Users can configure frequency resolution, smoothing, averaging, and other processing parameters to match the material under investigation.

RESULT ANALYSIS AND EXPORT



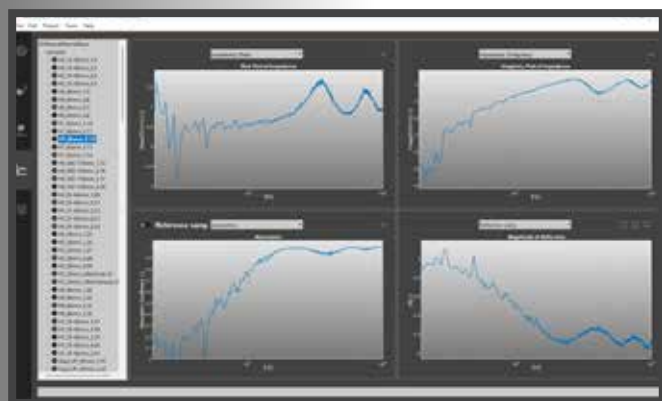
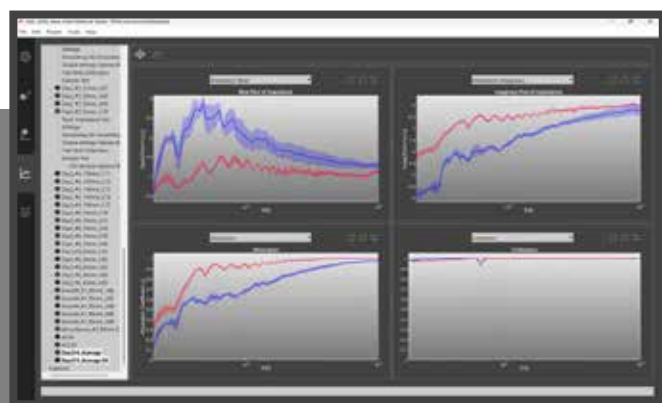
VELO automatically calculates the selected acoustic material properties and presents the results in dedicated analysis panels. Measurements can be compared, visualized, and exported in multiple formats for reporting, benchmarking, simulation, and further engineering analysis.

STANDARD

Expanded material characterization and mobile testing

The Standard license extends the NF Material Tester with faster processing, richer analysis capabilities, and support for advanced material characterization workflows. It enables engineers to move beyond basic property determination with extended acoustic indicators, source ranking, and standalone field acquisition.

This tier is suited for troubleshooting, benchmarking, product development, and engineering investigations where understanding both material behaviour and acoustic radiation is important.



Standard deviation

Confidence intervals can be displayed for every dataset extracted from the measurements, providing a clear indication of variability across the entire frequency spectrum. This makes it possible to assess variation between repeated measurements and spatial variation across different measurement positions, adding context to the extracted material properties.

Complex surface impedance

The Standard license provides access to the complex surface impedance calculated from the measured sound pressure and particle velocity. Its real and imaginary components describe the resistive and reactive behaviour of the material.

This provides more information than absorption alone and supports detailed material comparison, acoustic modelling, and design validation

Standalone Voyager acquisition

Voyager can independently record the free-field reference and sample measurements without requiring a computer beside the test surface. Signal conditioning, acquisition, storage, and excitation are combined in one portable device.

The recorded files can later be transferred to VELO and imported into the project, where free-field and sample captures are directed to their corresponding sections for analysis.



PRO

Model-based material characterization and spatial mapping

The Pro license extends the NF Material Tester with model-based material analysis, automatic parameter estimation, and advanced spatial mapping. It is intended for engineers and researchers requiring deeper insight into material behaviour, simulation input, and detailed comparison of acoustic treatments.

This tier is suited for research, product development, simulation validation, and investigations where local material variations or derived parameters must be determined.



JCAL model fitting

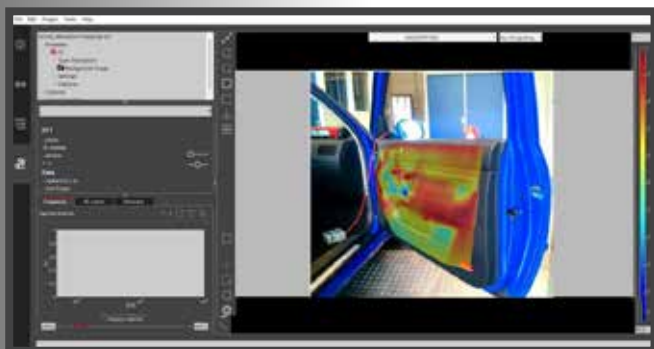
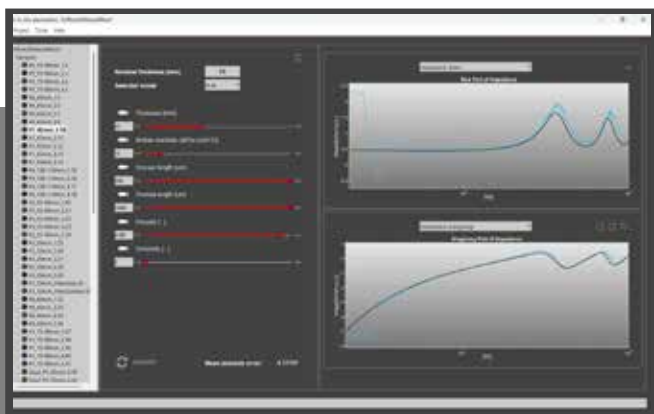
Each model parameter can be adjusted manually or automatically, giving maximum flexibility to identify an equivalent model that best represents the tested material. The modelled response is displayed together with the measured result, making it possible to evaluate how accurately the estimated material properties reproduce the observed acoustic behaviour.

Available parameters:

- Thickness (mm)
- Airflow resistivity (kPa s/m^2)
- Viscous length (μm)
- Thermal length (μm)
- Porosity (.)
- Tortuosity (.)

2D absorption mapping

Combined with Scan&Paint 2D (software license is required*) , transforms point measurements into spatial absorption maps across the tested surface. These maps reveal local defects, inhomogeneities, edge effects, and differences in mounting or layer adhesion that may not be visible from a single measurement position.



CASE STUDY: COMPARING MATERIAL TESTING METHODS

Uncovering the membrane effect in multi-layered materials

Multi-layered materials are often used to enhance both acoustic and thermal performance, but accurately characterizing their behavior is far from simple. A recent joint study by Knauf Insulation and Microflown Technologies compared several standardized measurement methods to understand how a thin aluminum foil layer affects the acoustic absorption of a mineral-wool composite. The results revealed a phenomenon known as the membrane effect, which can greatly improve low-frequency absorption but is easily missed by conventional testing techniques.

GOALS & OBJECTIVES

The objective of the study was to investigate why traditional laboratory methods, such as the impedance tube and reverberation room, sometimes yield contradictory results when testing complex, layered materials. The team sought to determine which technique provides the most realistic representation of acoustic performance under real-world conditions and to examine the influence of the aluminum foil layer on low-frequency absorption.

METHOD

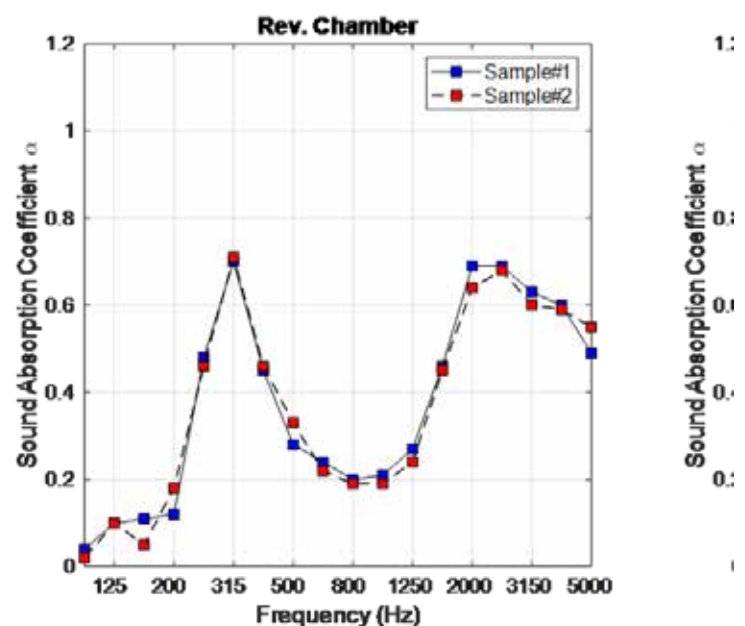
Three standardized approaches were compared:

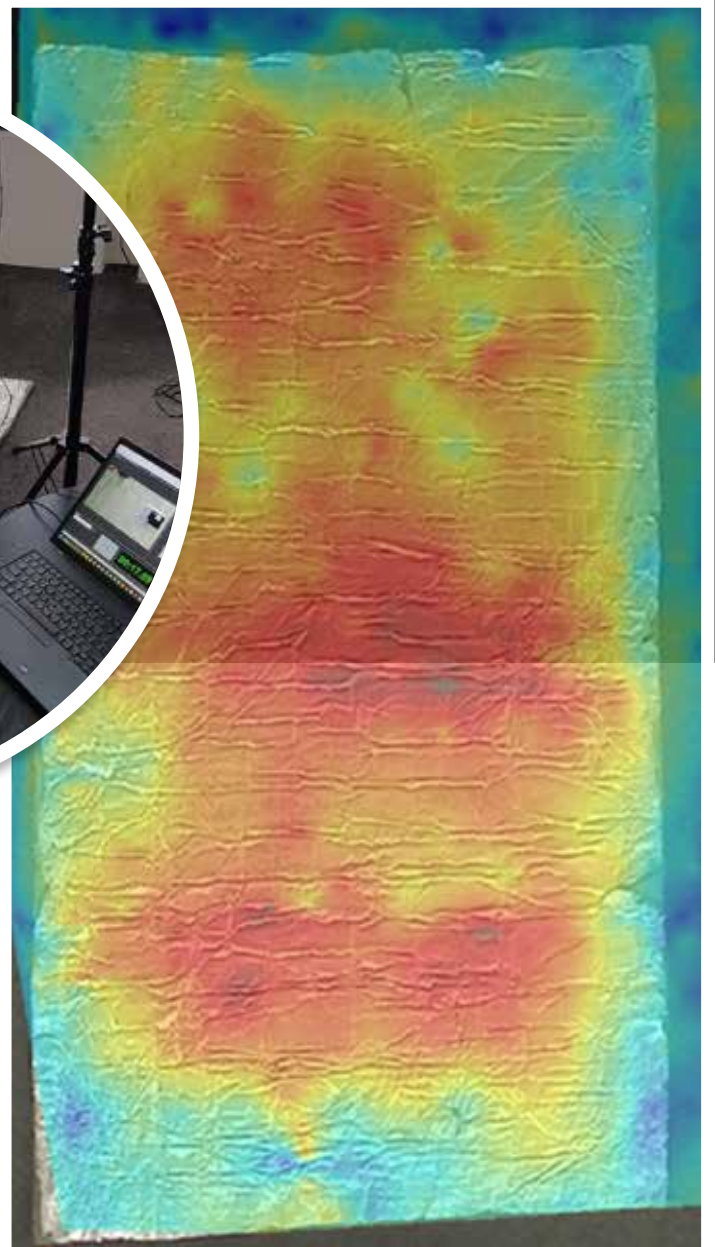
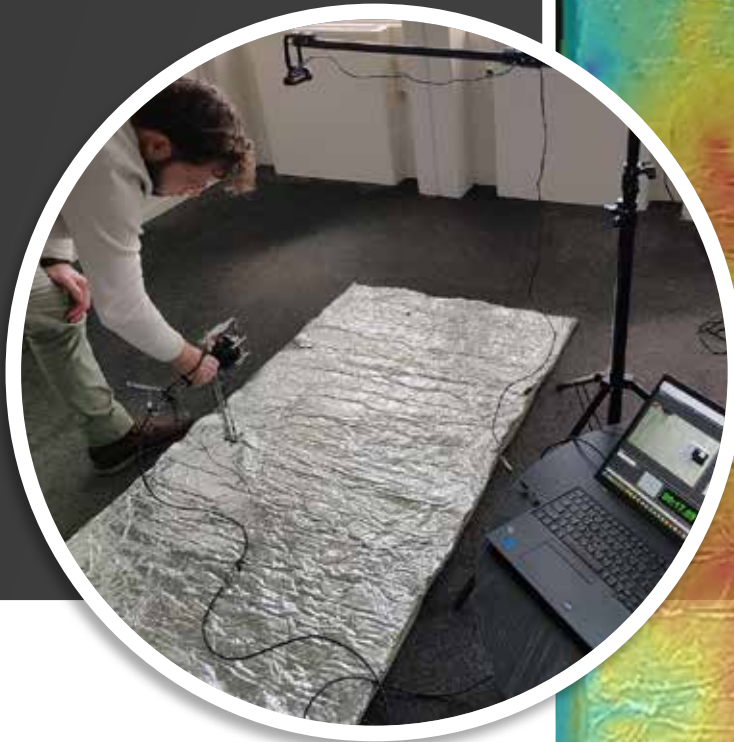
- Reverberation room (ISO 354) – large 10.8 m² sample, diffuse-field conditions.
- Impedance tube (ISO 0534-2) – small circular samples, normal incidence.
- In-situ PU method – portable system measuring sound pressure and particle velocity directly above the surface.

In addition, absorption mapping using Scan & Paint 2D was performed to visualize how absorption varies spatially across the material. This allowed researchers to correlate local variations with physical features of the top aluminum layer.

FINDINGS

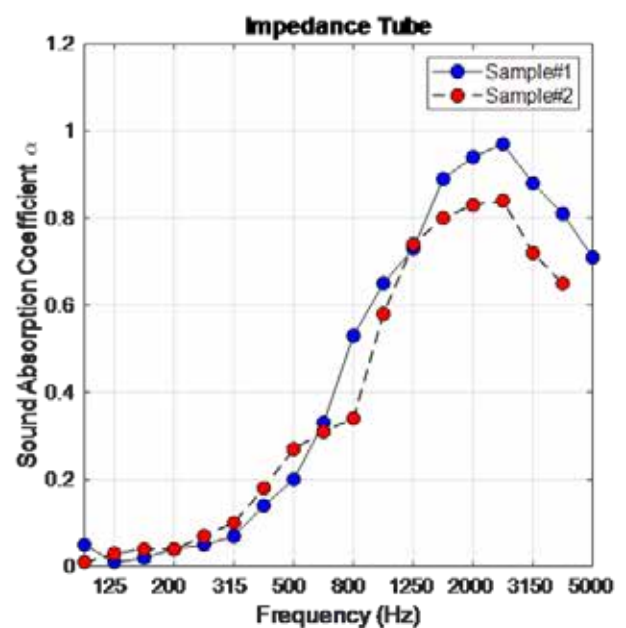
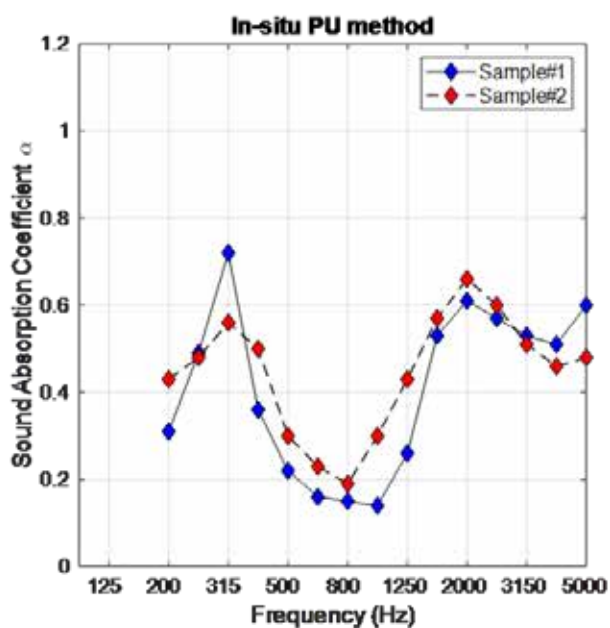
While the impedance-tube results suggested modest performance at low frequencies, both the in-situ and reverberant-room measurements showed a pronounced absorption peak around 315 Hz—evidence of a resonant behavior caused by the flexible aluminum membrane. Further experiments confirmed that reversing the sample orientation or re-attaching the foil shifted this resonance to higher frequencies, proving that the thin metal layer acts as a vibrating membrane enhancing low-frequency absorption. The absorption maps also exposed clear spatial patterns, with stronger absorption near the material's center and reduced values at the edges, emphasizing how small-scale defects or variations in layer adhesion can impact performance.





CONCLUSION

The study demonstrated that in-situ PU measurements align closely with reverberation-room data, offering a practical and accurate alternative to laboratory testing—especially for multi-layered or asymmetric materials. It also highlighted that impedance-tube measurements alone may underestimate low-frequency performance due to the inability to capture membrane effects. Ultimately, this comparative analysis confirms that selecting the right measurement technique is essential for understanding the true acoustic behavior of advanced composite materials.





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Near-Field Material Tester Product Brochure V. 20261022