Microflown Technologies
Charting sound fields

Microflown Technologies
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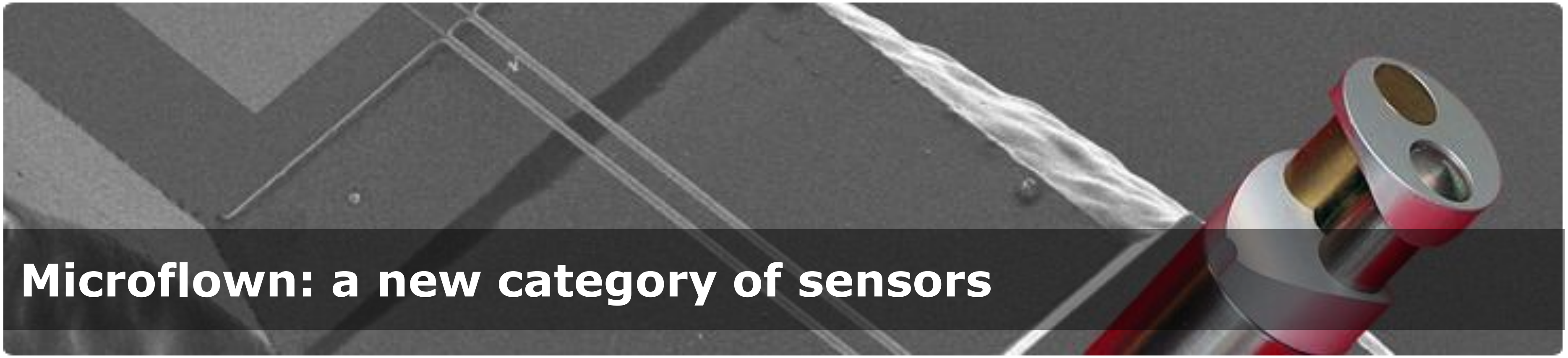
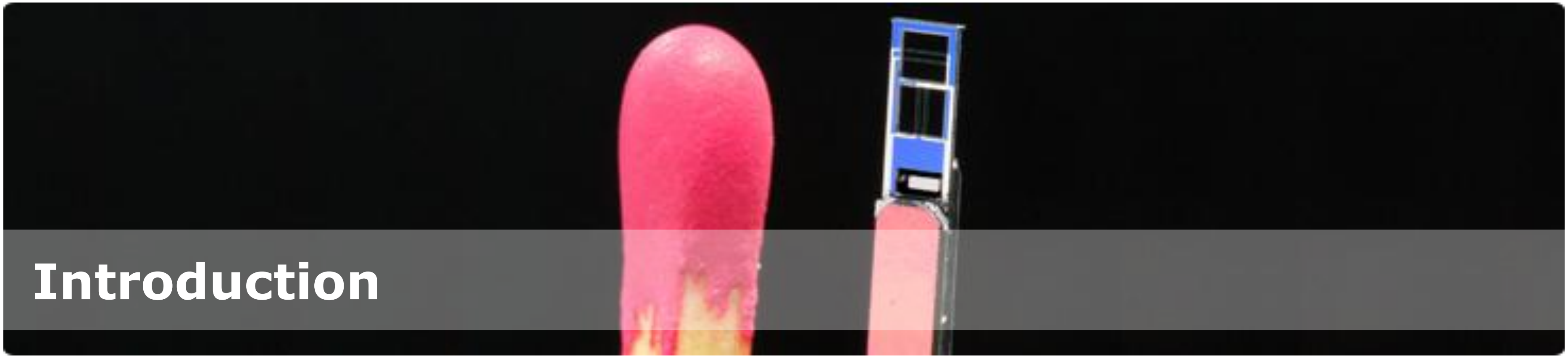




Introduction

Company Introduction

1994: Invention Microflown by Hans-Elias de Bree at University Twente

1997: Ph.D. Hans-Elias de Bree

1998: Founding Microflown Technologies B.V. (de Bree, Koers)

2001: Industrializing product

2003: Introduction broad banded sensor element

2004: First applications scientifically proven / first arrays sold

2005: Rapid growth in (automotive + aerospace) industry

2005: De Bree appointed Professor 'Vehicle Acoustics' at the HAN University, Arnhem School of Automotive Engineering

2008: Strategic decision to explore the defense & security market

2011: Microflown Avisa was founded

2011: 20 FTE company, 2 MEURO turnover (only Technologies)

References

Automotive - OEM

Audi, BMW, Chrysler, CNH, DAF Paccar, Daimler, FAW, Fiat, Ford, Freightliner, General Motors, Harley Davidson, Hyundai, Honda, Isuzu, Mahindra, Maruti-Suzuki, Mazda, Merceded Benz, Mitsubishi, Nissan, Porsche, PSA Group (Peugeot - Citroën), Renault Samsung, TATA, Toyota, Volkswagen

References

Automotive - Others

AISIN, Behr Group, Brose, Bridgestone, Denso, Eaton USA, Faurecia, Fontijne Grotnes, GKN Driveline, Harman Becker Automotive Systems, Hitachi, HP Pelzer, Ideal Automotive, IVM Automotive, Jatco, JTEKT, Kanto Auto Works, LuK, Magneti Marelli, Mirror Controls International, Mitsuba, Rieter Automotive, Rietschle Thomas, Rieter Automotive, Rochling Automotive Robert Bosch, Same Deutz, Siemens VDO, Stankiewicz, Takata Petri, TRW, ZF

References

Electronic and consumer goods

Apple, Bosch (BSH), Bose, Canon, Electrolux, Hewlett Packard, Kärcher, KAZ inc, Meizhi, Merry Electronics, Nikon, Oticon, Owens Corning, Panasonic, Philips, Pioneer, Sennheiser, Sony, Toshiba, Voith Hydro, Whirlpool

Other Industries

ASML, CAE Engineering and Services, CNAM, EMPA, Fisher-Rosemount, Foxconn, Gardner Denver Thomas, GD Electric Boat, InPro, INRS, INSA, I-Tech, Kashima, Keihin,KNMI, Kobe Seitetsusyo, Koberuko, Midea, MSX International, Nippo Hoso Kyokai, RION, Sick Maihak,

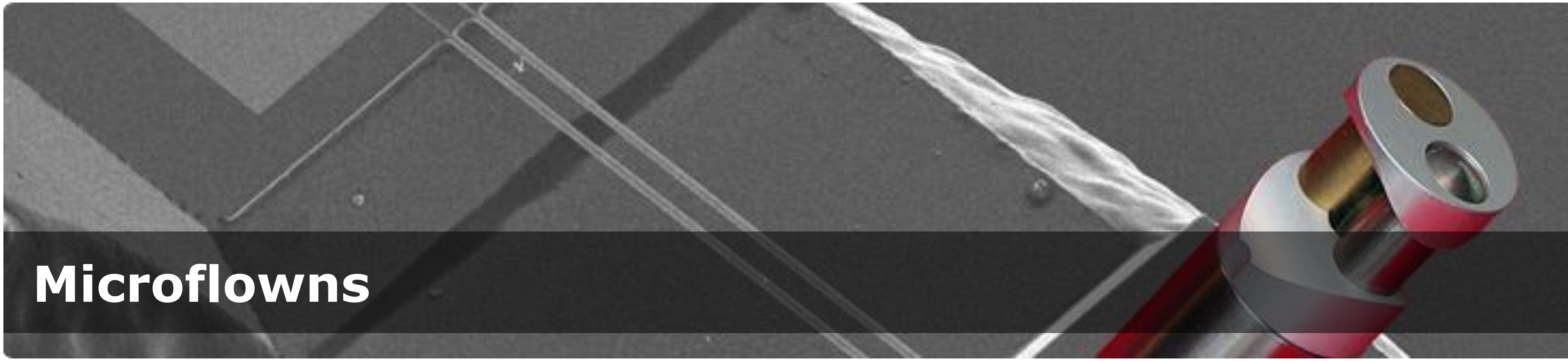
References

Aerospace

Aeronautical Development Establishment, Alenia Aeronautica, Airbus France, Airbus Germany, DLR (German Aerospace Center), General Electric Propulsion Systems, Gulfstream, Progency Systems Corporation

Test houses and Research insitutes

Autoneum, Batelle Memorial Institue, Carcoustics, FKFS, Fraunhofer, Head Acoustics, HHMI, LMS International, MIRA, Mueller-BBM, NURC (NATO), Ricardo UK, SPEKTRA



Microflowns

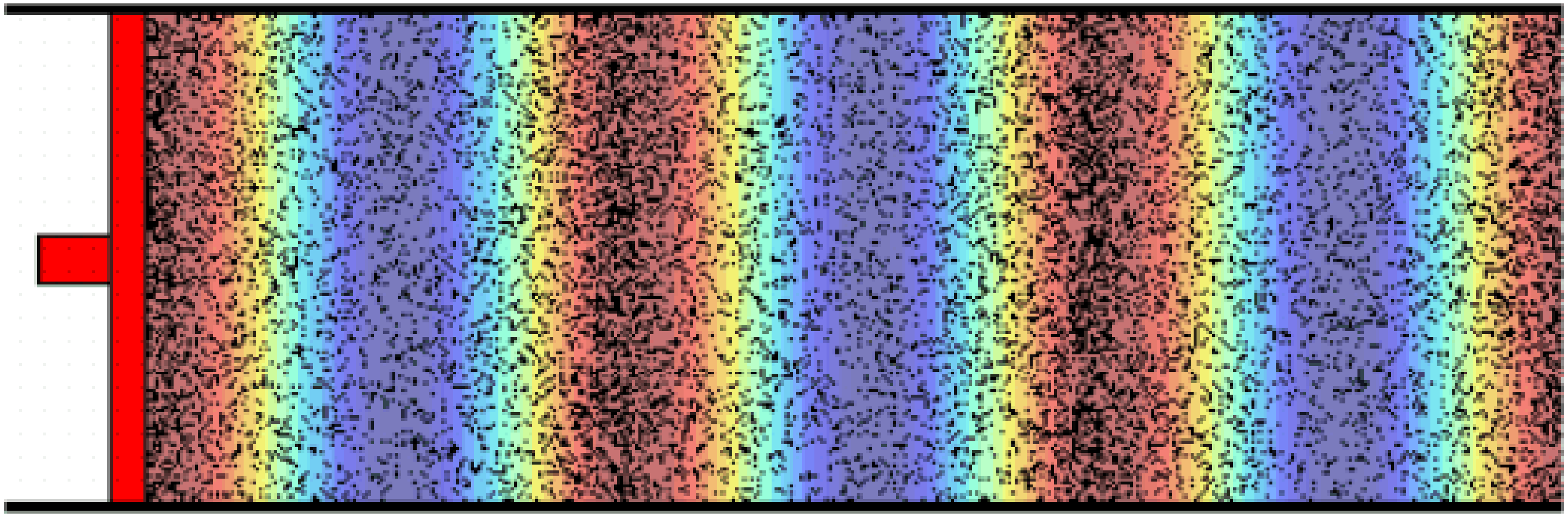
Working principle

Microphone measures sound pressure (result)

Microflown measures Particle Velocity (cause)

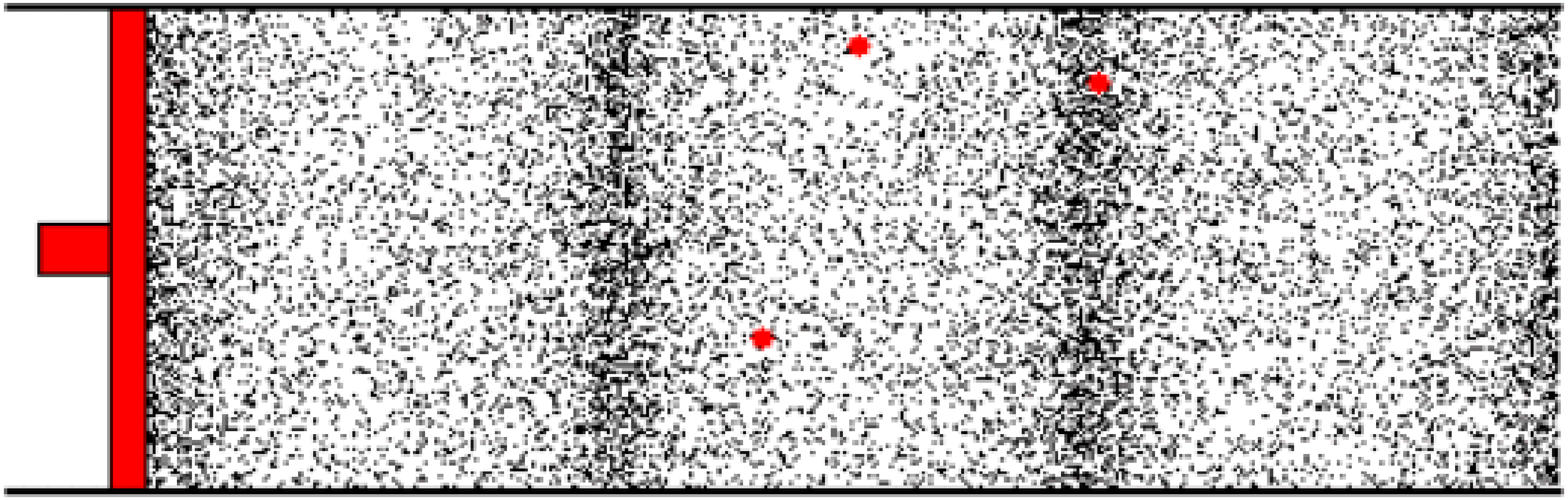
Acoustical	<->	electrical	<->	energy
Sound pressure	<->	voltage	<->	potential
Particle velocity	<->	amperes	<->	kinetic

Working principle



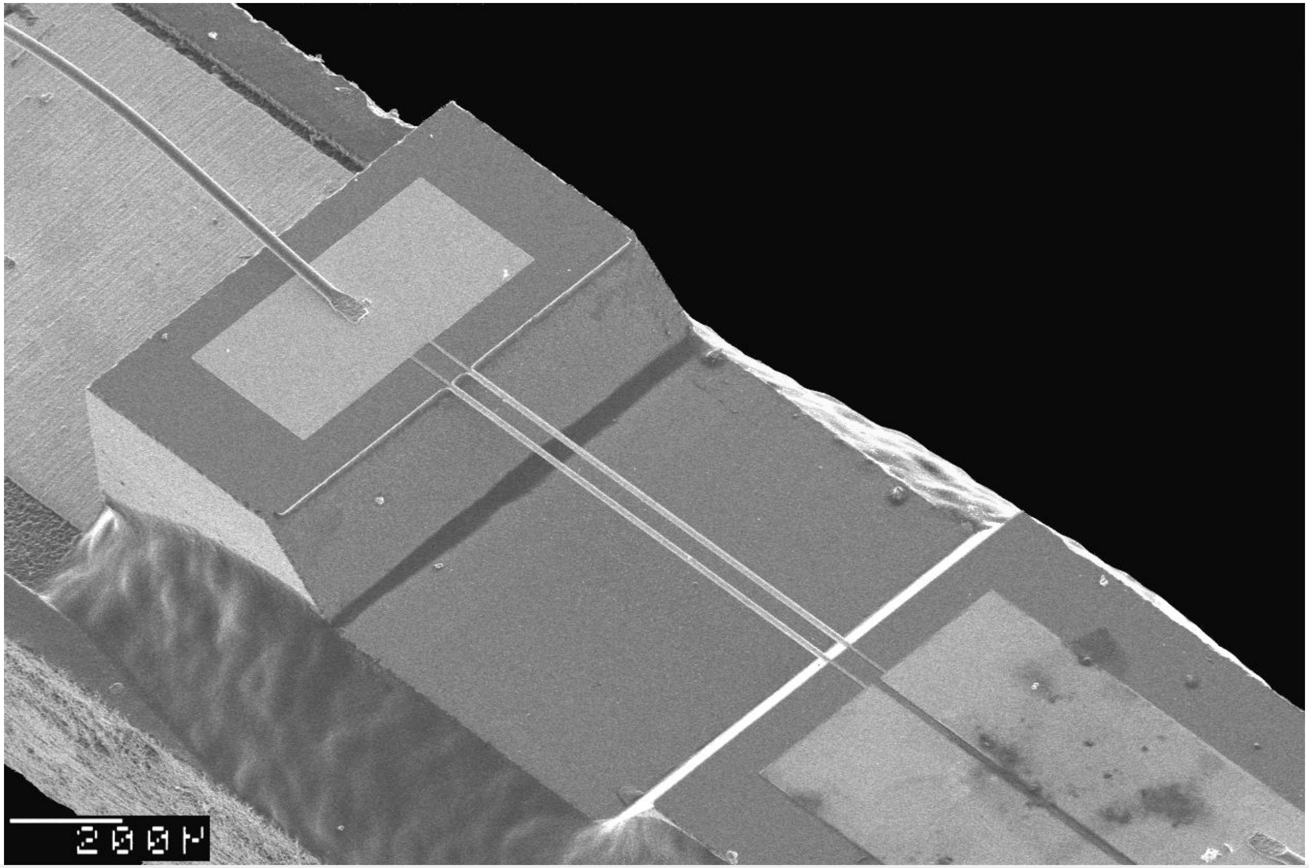
Working principle

PRESSURE WAVE ≠ PARTICLE VELOCITY

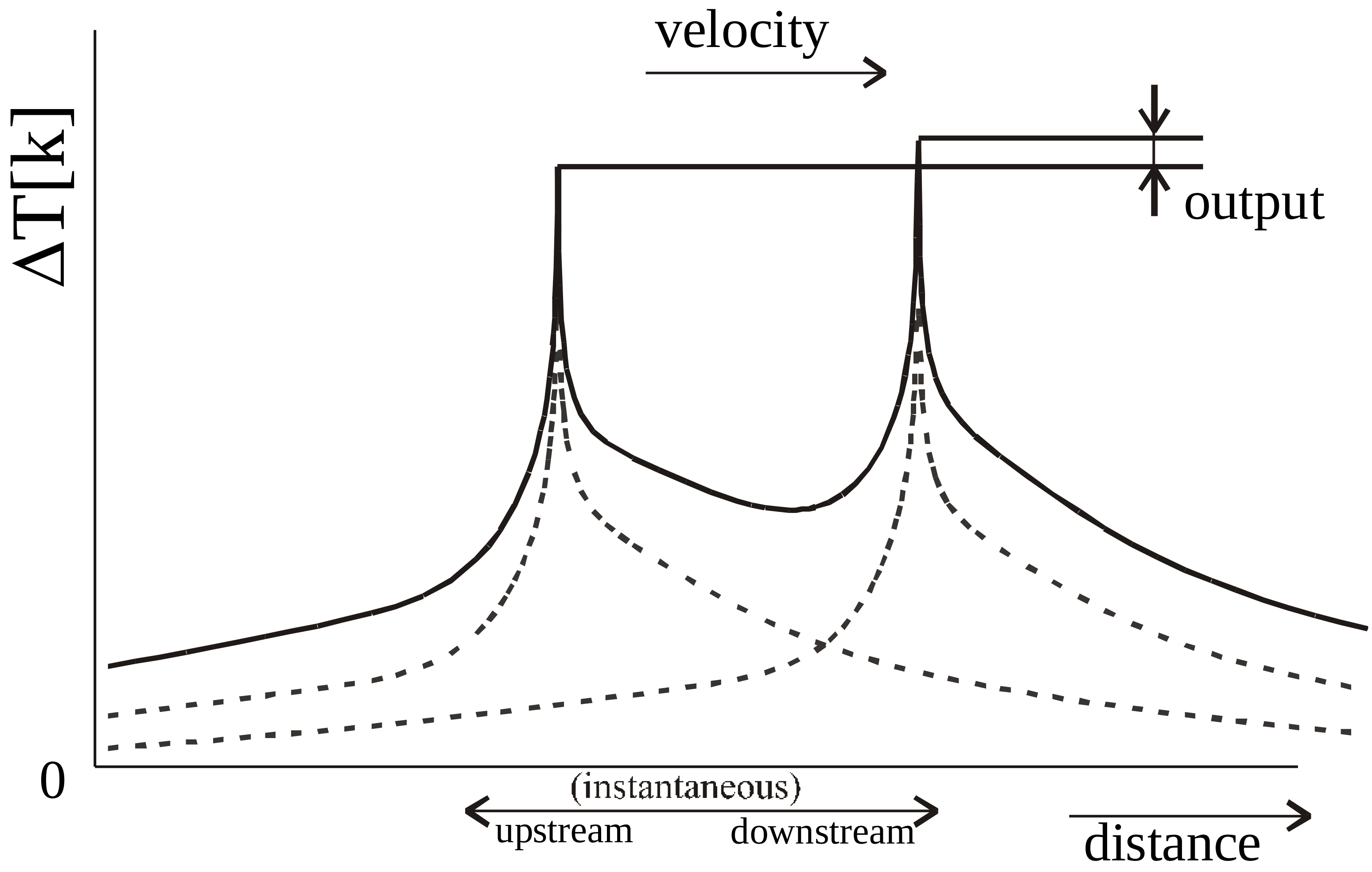


Working principle

Microflown SEM picture: two heated wires



Working principle



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Working principle

Surface velocity measurement:

- **Low susceptibility background noise and reflection problems**

1. Directivity

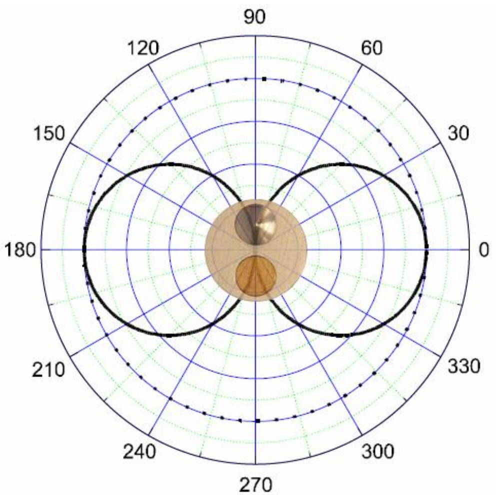
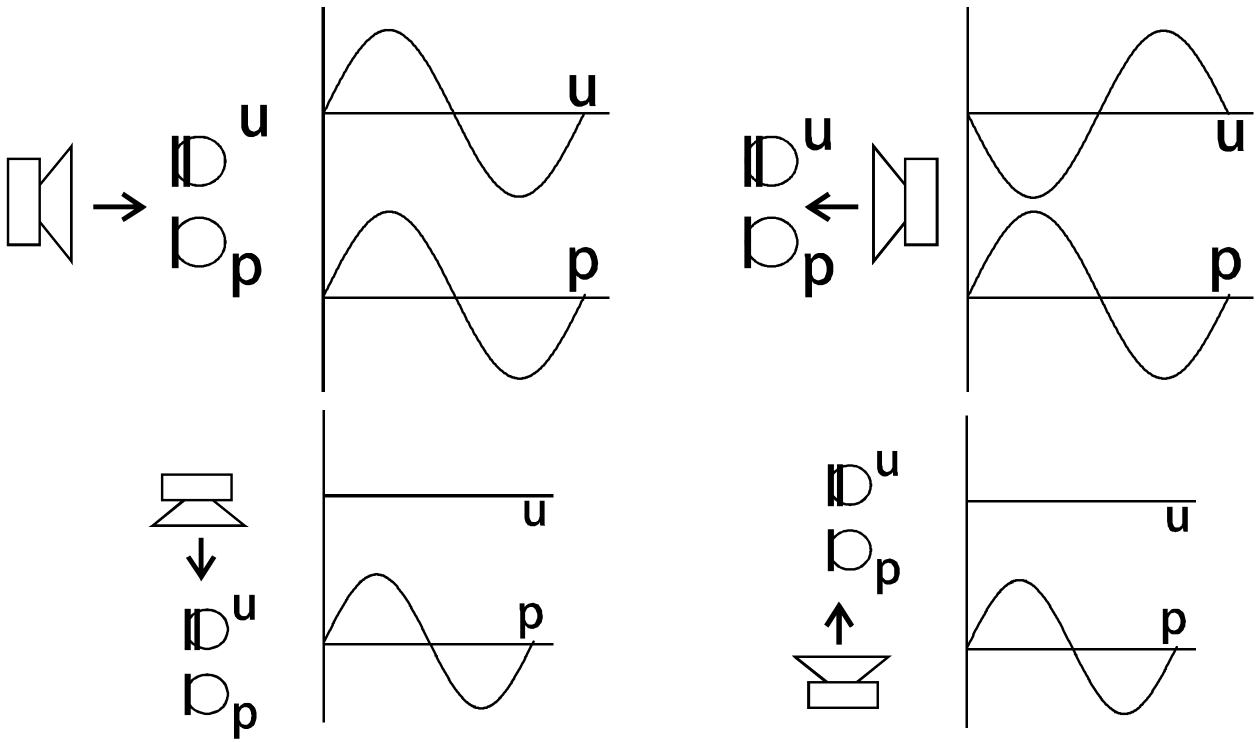


Figure of eight

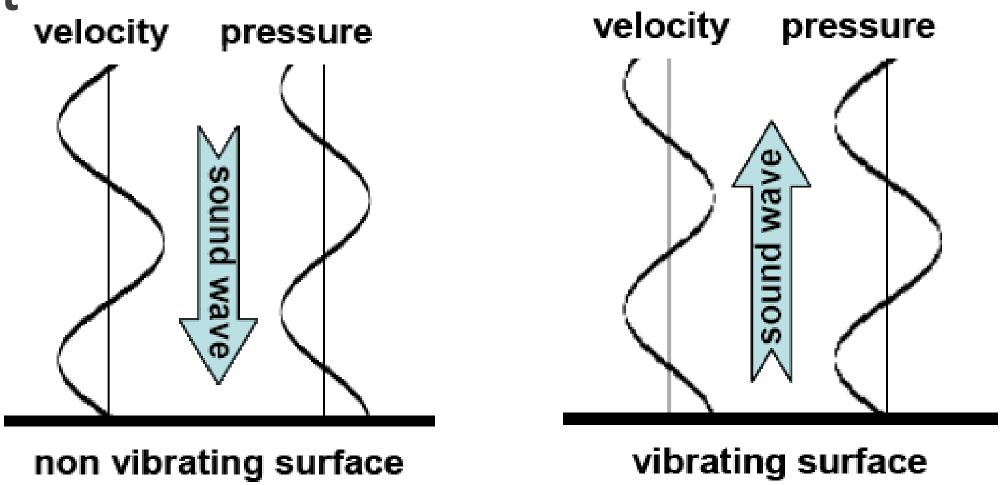


Working principle

Surface velocity measurement:

- **Low susceptibility background noise and reflection problems**

2. Near field effect



Low surface velocity and high surface pressure

High surface velocity and low surface pressure

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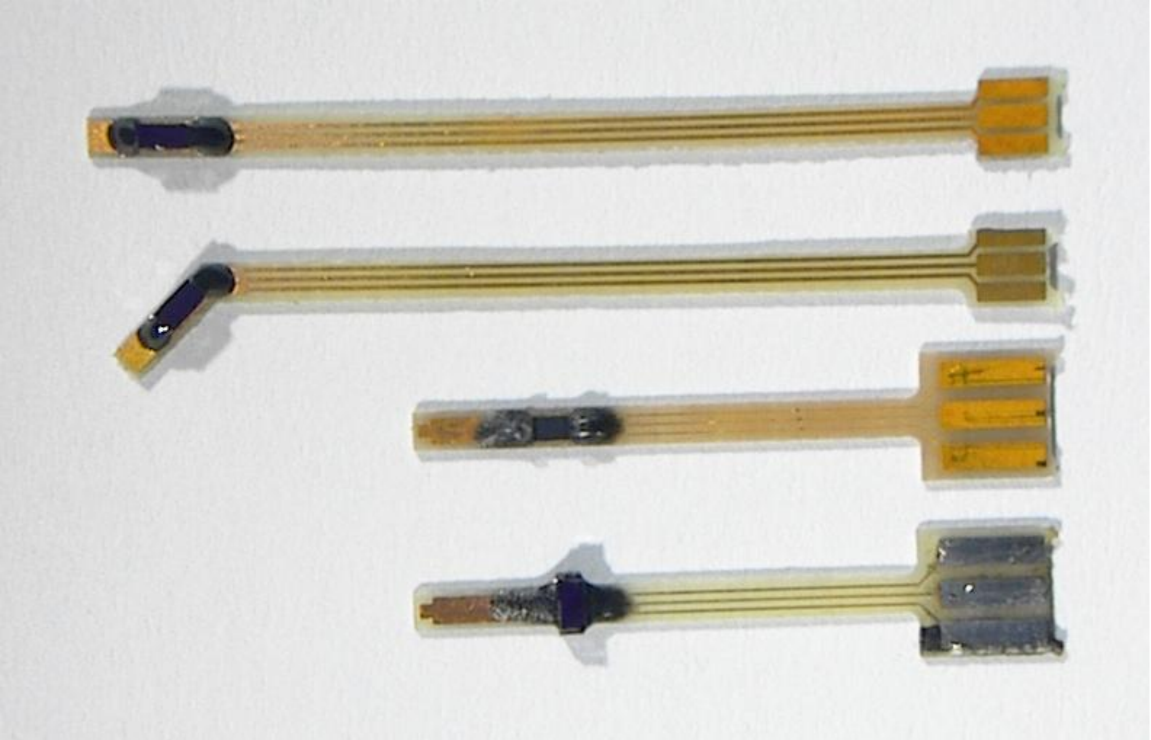
Working principle

Mems based sensor
Clean room technology is used to create the small elements on a waver

University of Twente

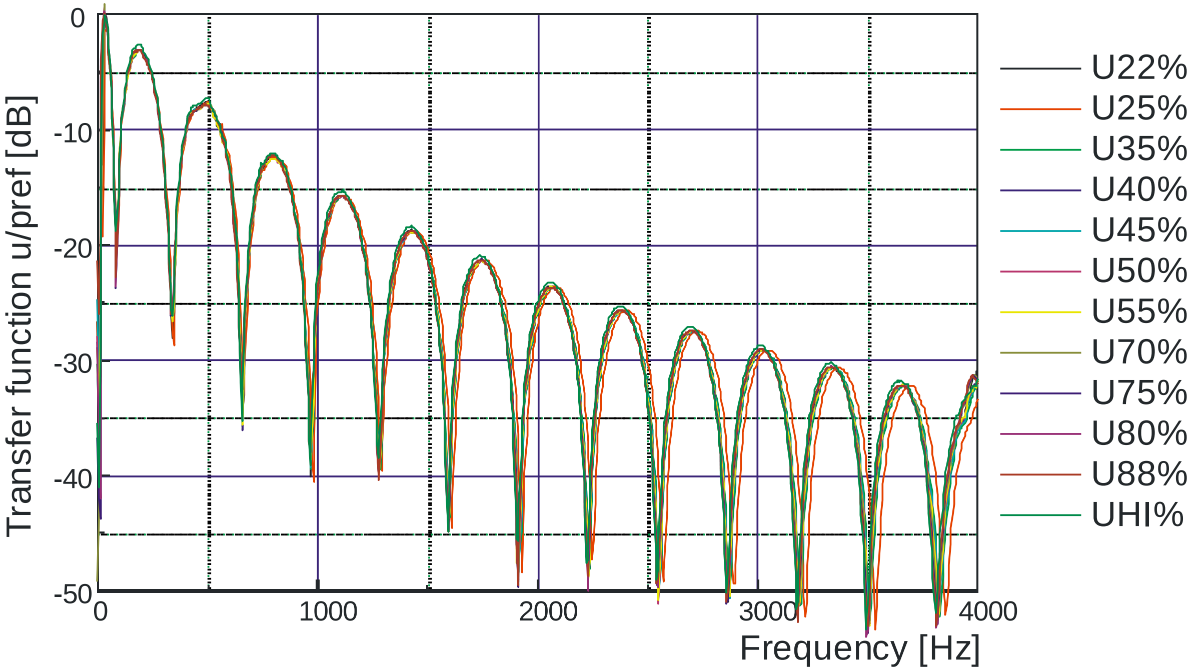
Working principle

Wirebonded elements



Working principle

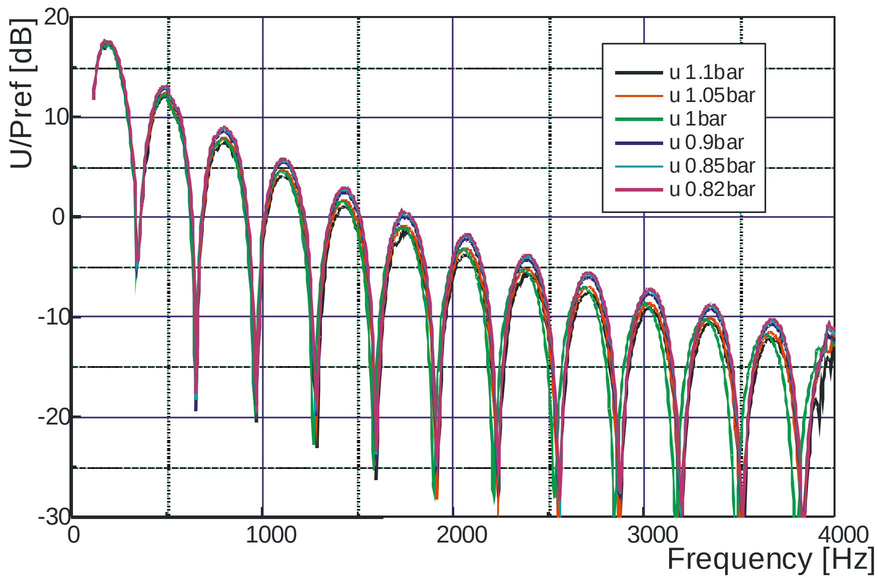
Influence of various humidities

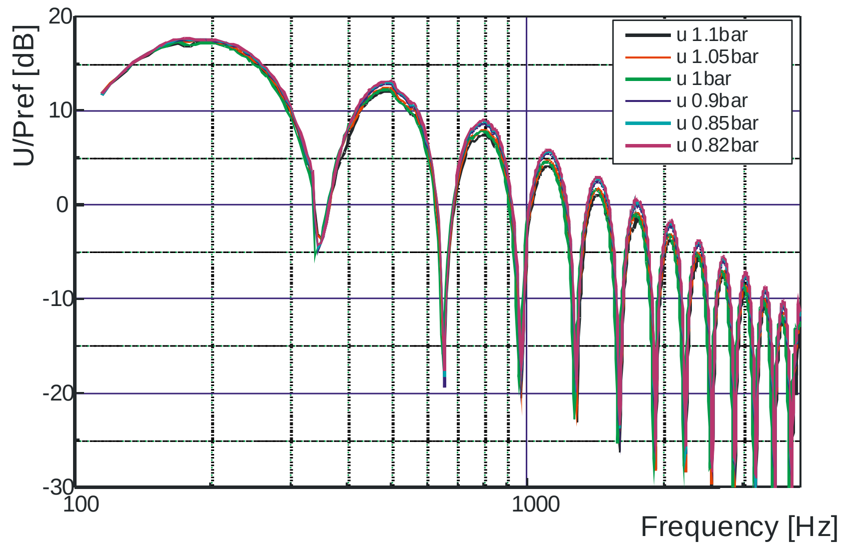


Max deviation of 0.2dB

Working principle

Influence various static pressure





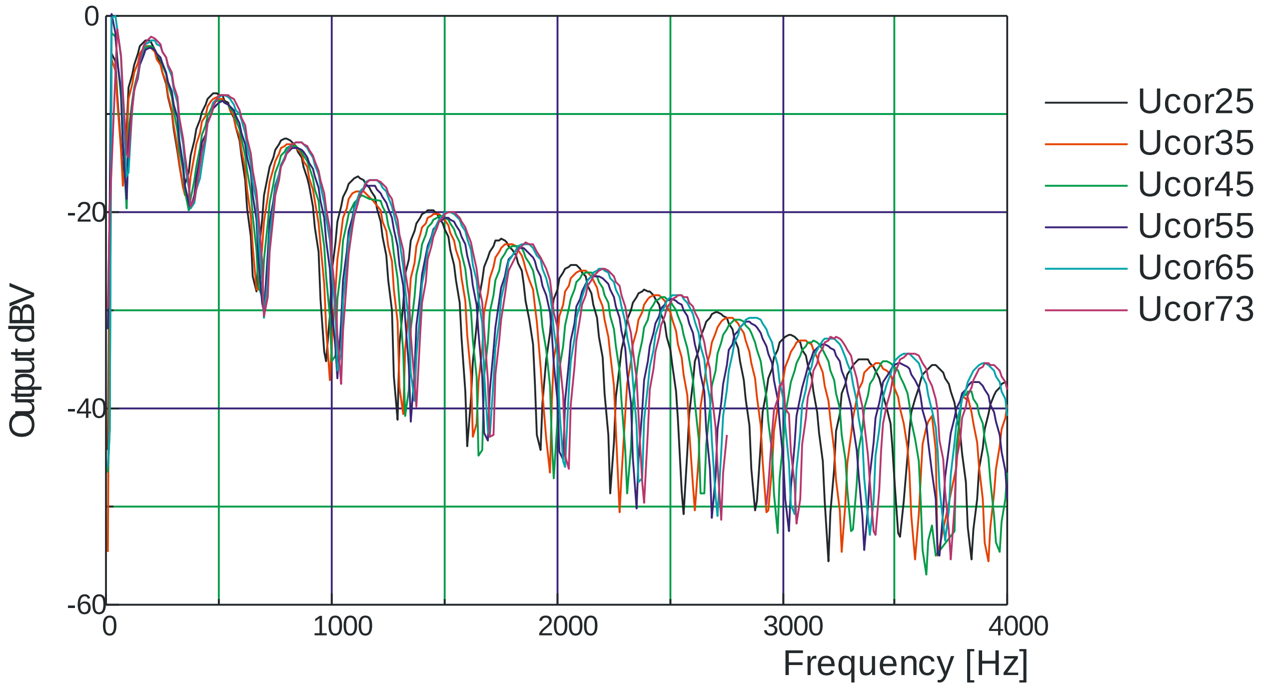
Linear scale

Logaritmic scale

Max deviation of 0.5dB

Working principle

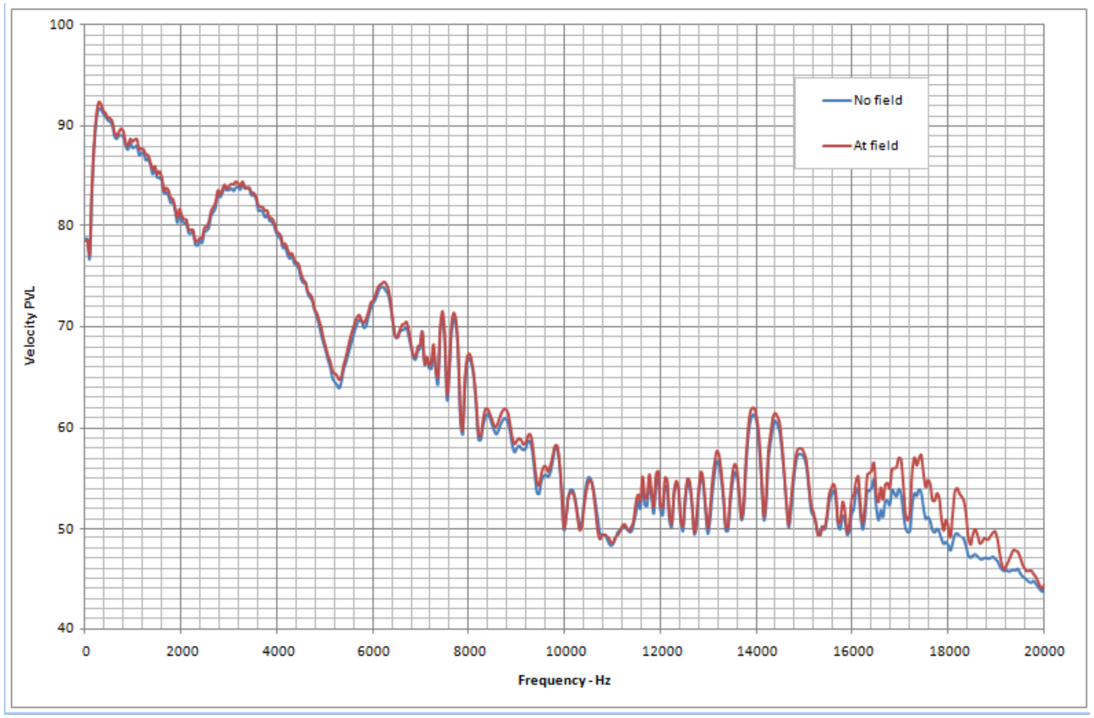
Influence various ambient temperatures



Max deviation less than 1dB (less than 0.02dB/K)

Working principle

Influence of Magnetic Fields

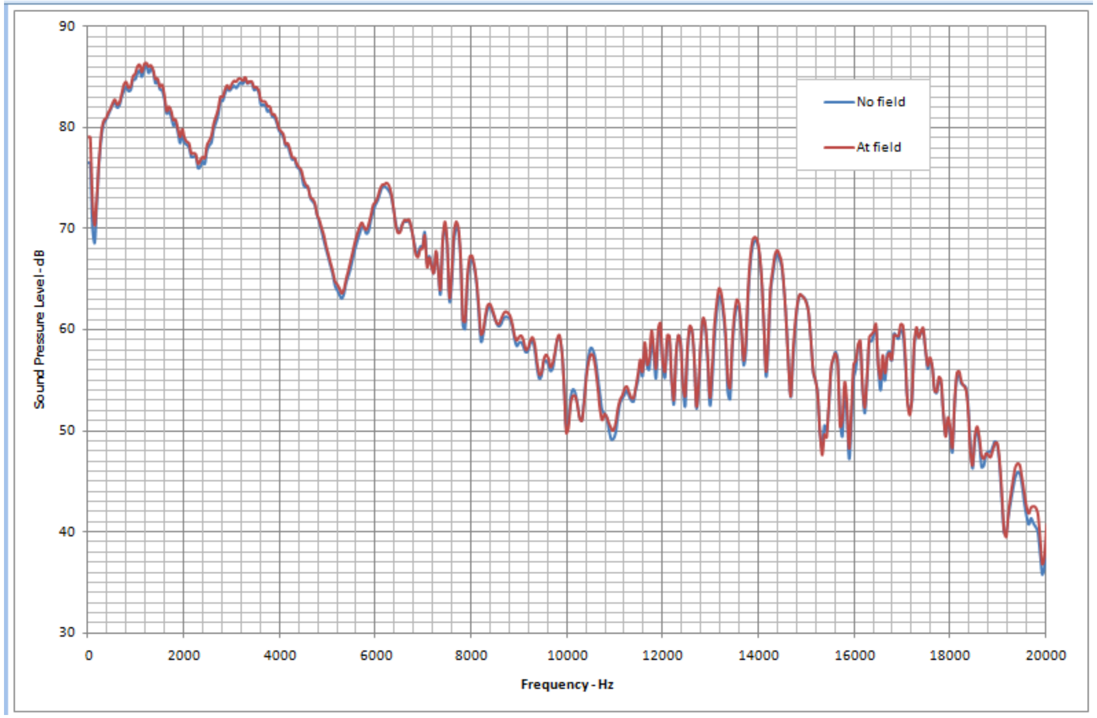


Particle Velocity

Magnetic Field of 6 Tesla

Working principle

Influence of Magnetic Fields

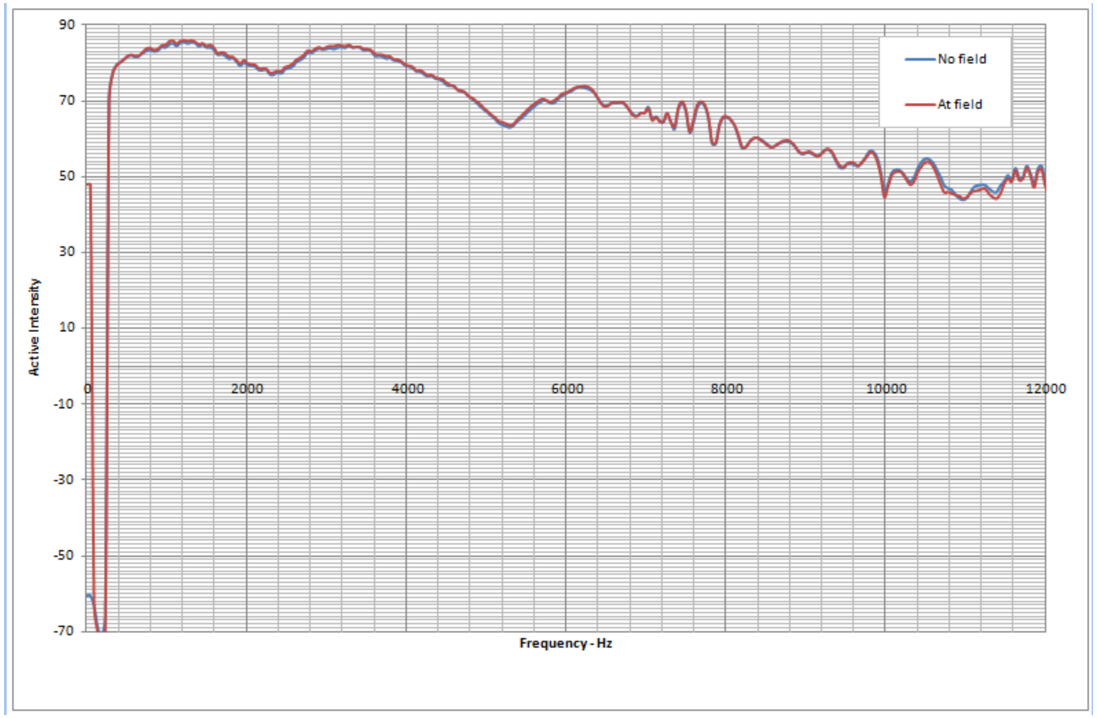


Sound Pressure

Magnetic Field of 6 Tesla

Working principle

Influence of Magnetic Fields



Active Intensity

Magnetic Field of 6 Tesla

Standard probes

Scanning Probes

- 1D Velocity
- For small object
- High temperatures
- Non contact vibration

Standard probes

PU probes

- Particle Velocity
- Sound Pressure
- 1D Sound Intensity
- 1D Sound Energy
- Impedance

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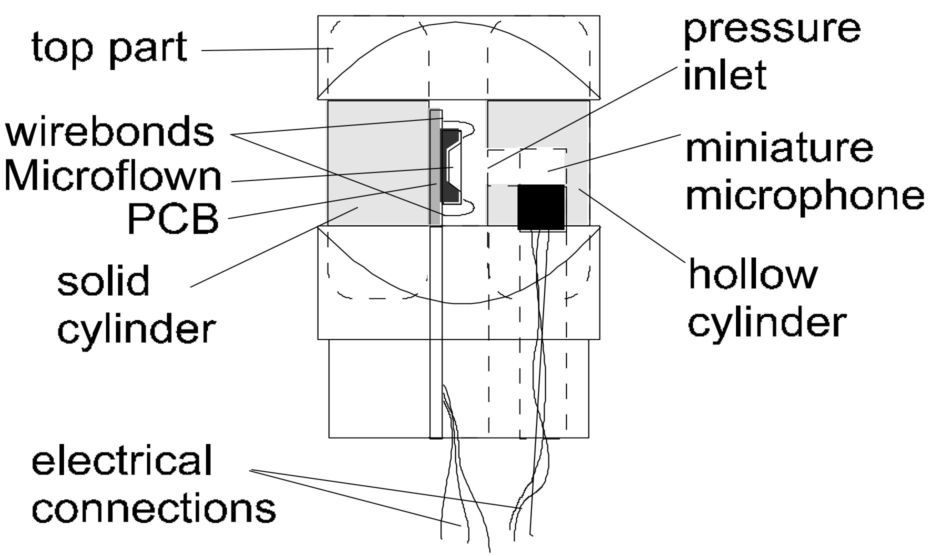
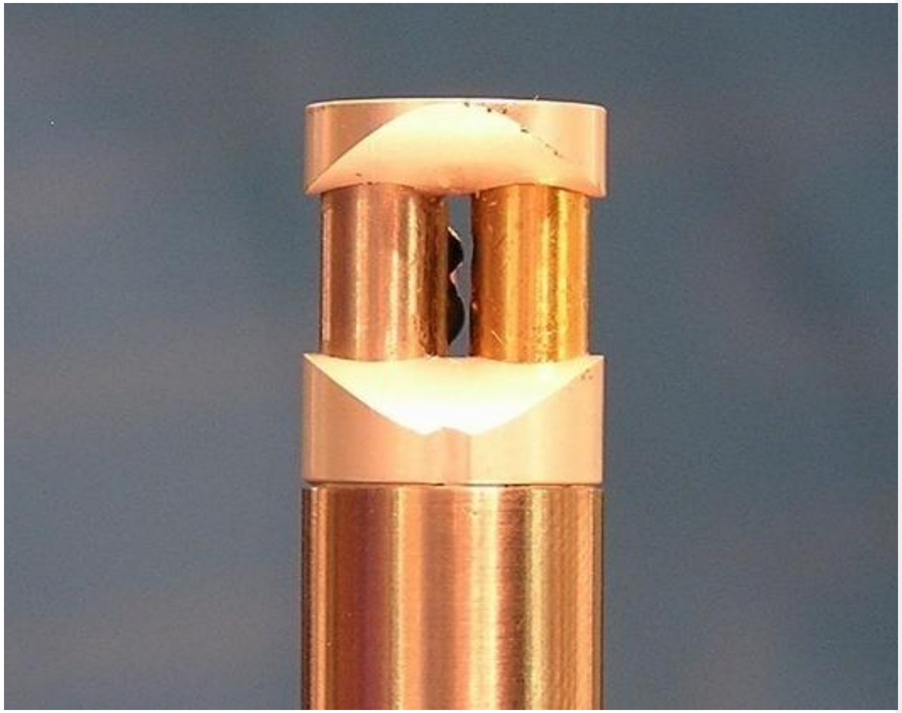
Standard probes

PU Probes: Placement of p and u





Standard probes

Metal Mesh

- Protecion of the wires
- Wind shield, DC flow up to 2 m/s
- Calibration including mesh

Standard probes

USP probes

- 3D Particle Velocity
- Sound Pressure
- 3D Sound Intensity
- 3D Sound Energy
- Impedance
- Acoustic Vector Sensor

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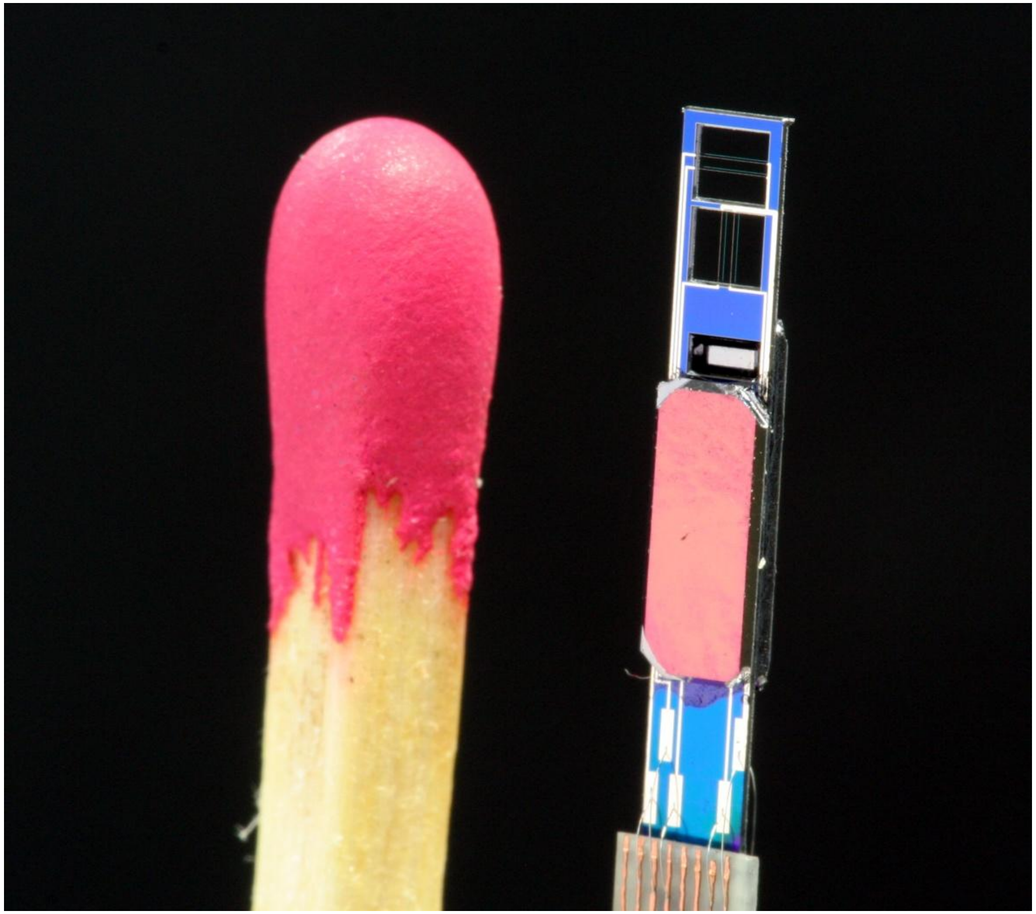
Standard probes



3D Sound Chip

Standard probes

Application examples

- Hostile fire localization
- Air to ground applications (PGM, UAV’s, etc.)
- Border control (passive, unattended ground sensor node)
- Passive surveillance (also in urban environment)
- Environmental monitoring
- Etc.

Standard probes

Standard signal conditioner

Standard probes

Standard signal conditioner

- Powering the sensor
- High or low gain setting
- Option for hardware correction

Standard probes

High dB Scanning Probe

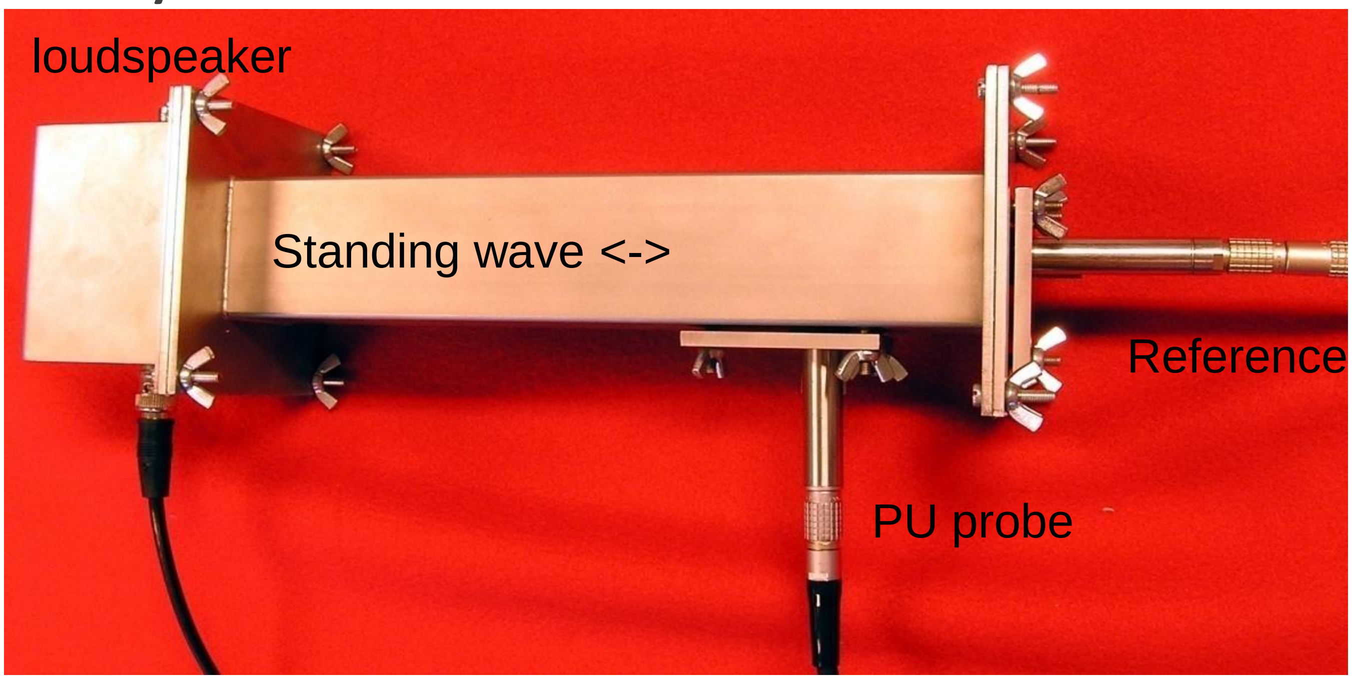
- Above 135dB acoustics becomes non linear
- Standard sensor overloads at 130dB
- Measurement at 170dB is possible with packaged sensor


Calibration

Calibration

Standing Wave Tube

Loudspeaker on one side, reference pressure microphone at the other side in the tube, known relation between pressure at the end and pressure and velocity in the tube. Limited bandwith of 20Hz – 4kHz



Calibration

Piston on a Sphere

Known relation between sound pressure and particle velocity in front of the speaker. And the vibration just in front of the speaker.

Use a reference pressure microphone to calibrate the Microflown probe.