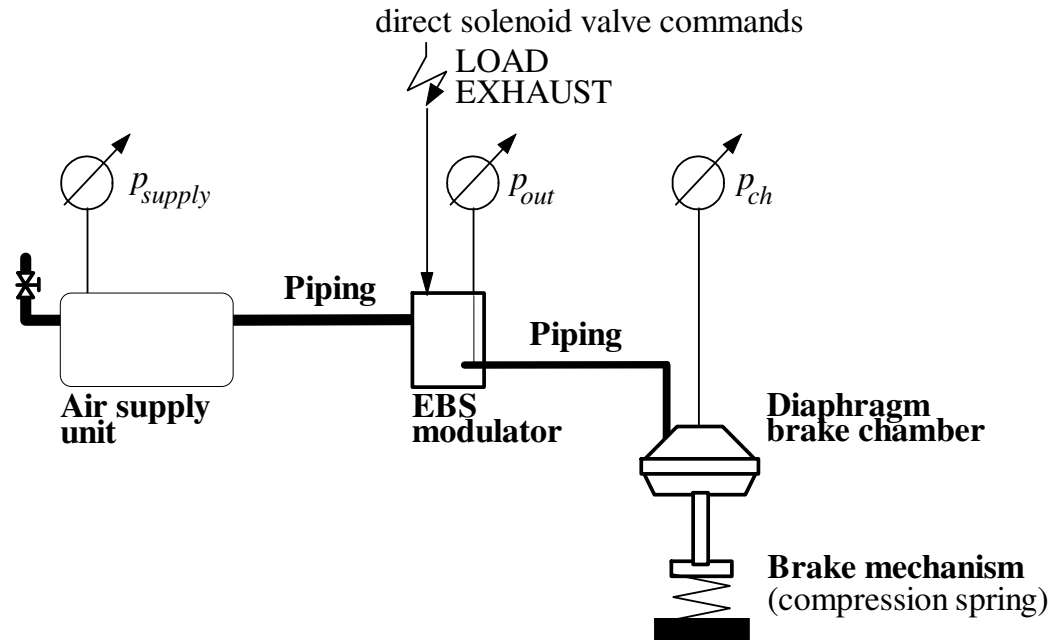


# 5. MEASUREMENT OF UNSTEADY PRESSURE

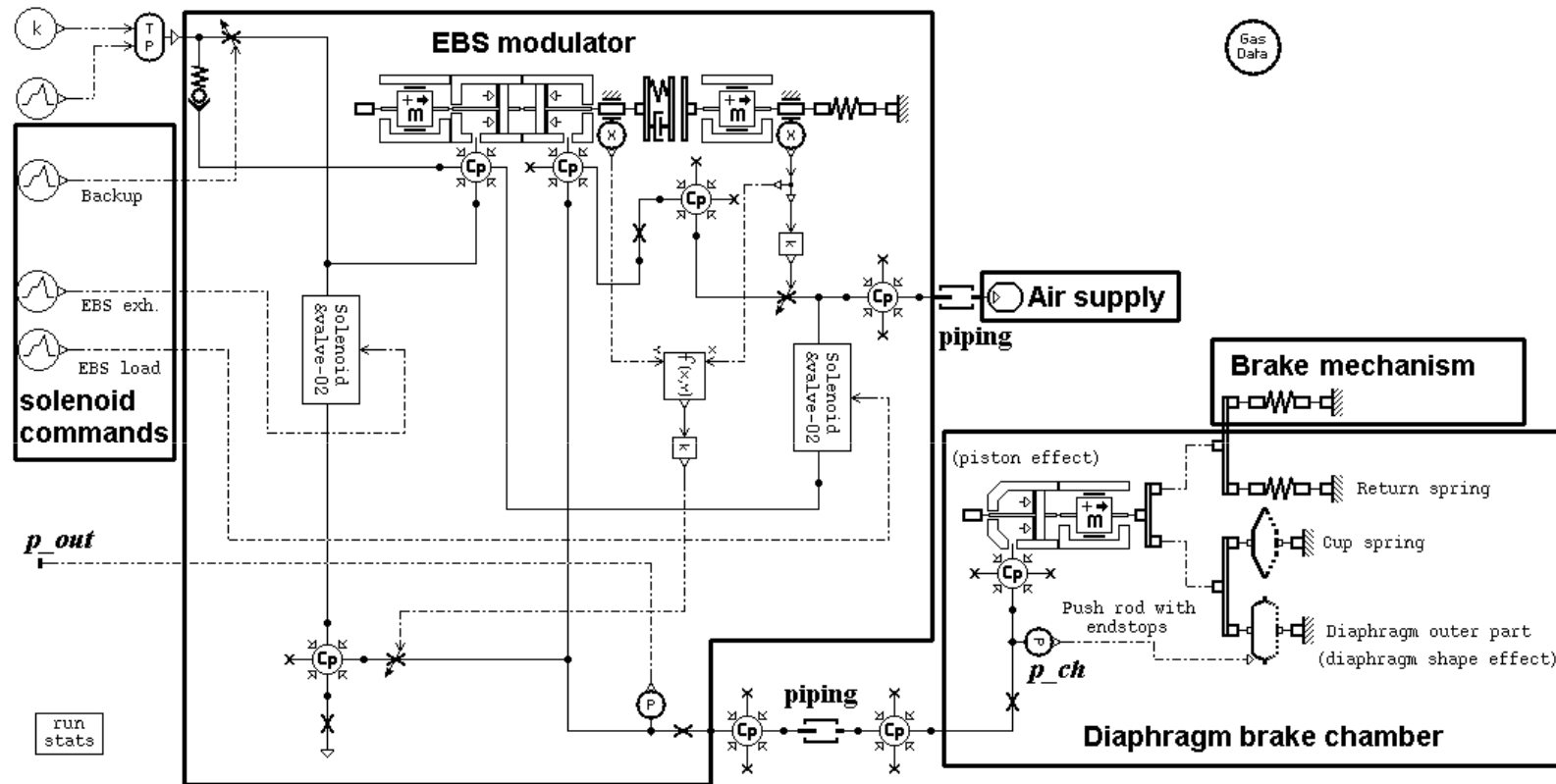
## 5.1. Examples for practical use

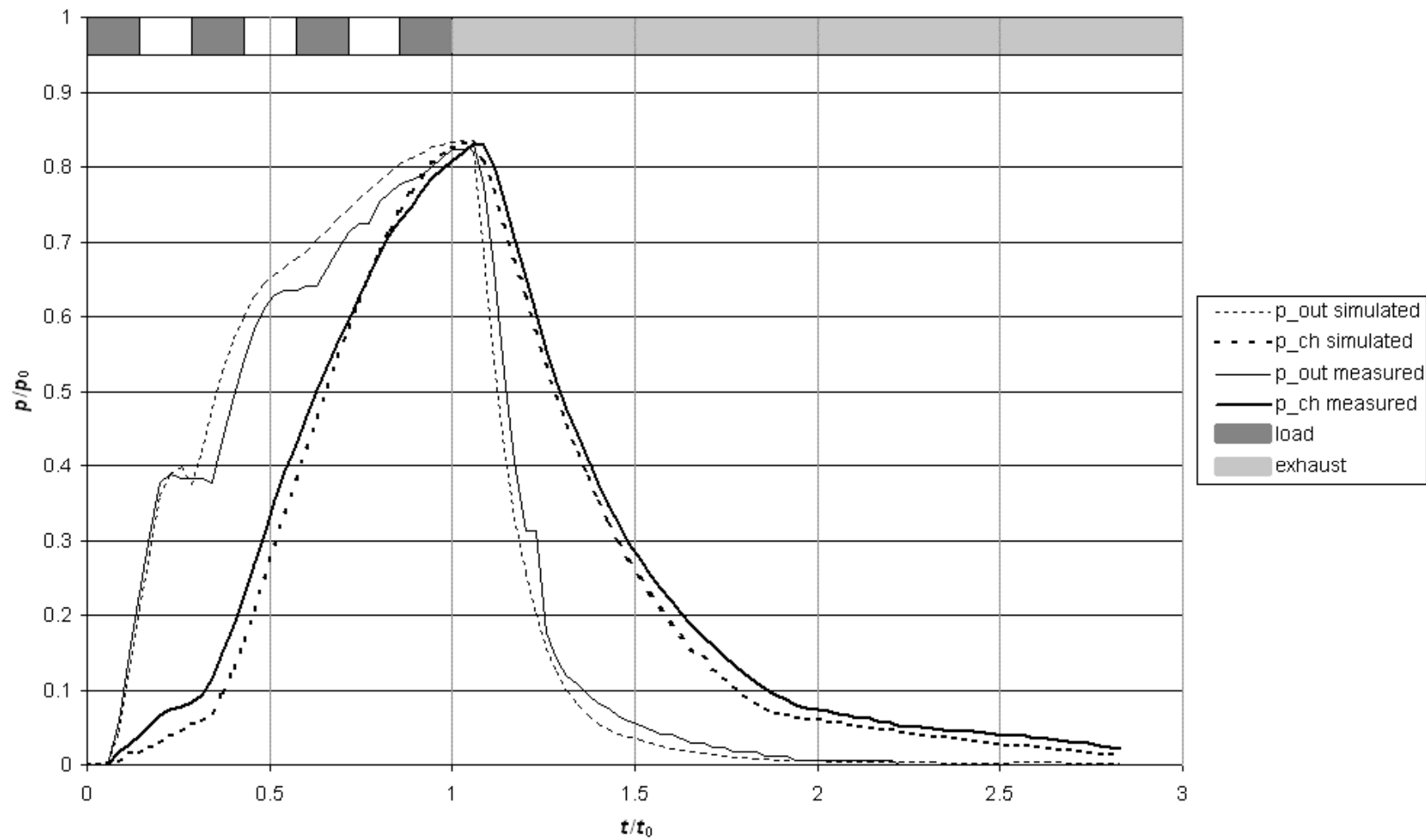
- In controlled technological and other industrial flow processes which are highly unsteady by nature

Electro-pneumatic braking systems of commercial vehicles



# AMESim simulation model of the case study

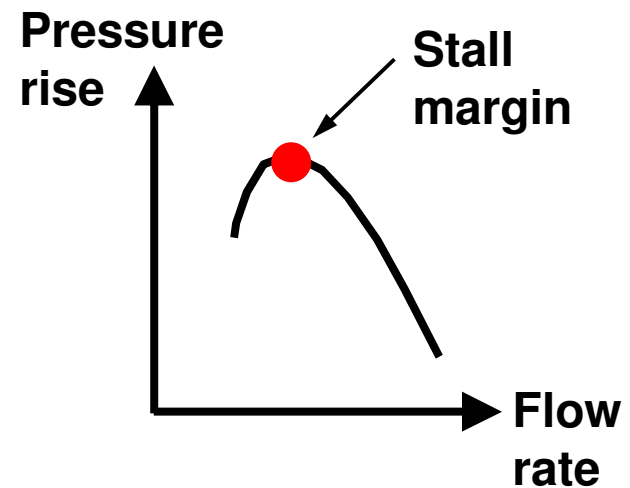
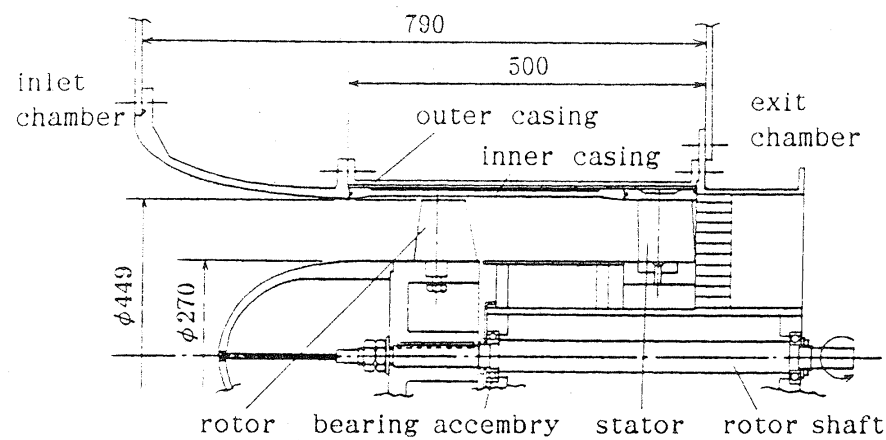




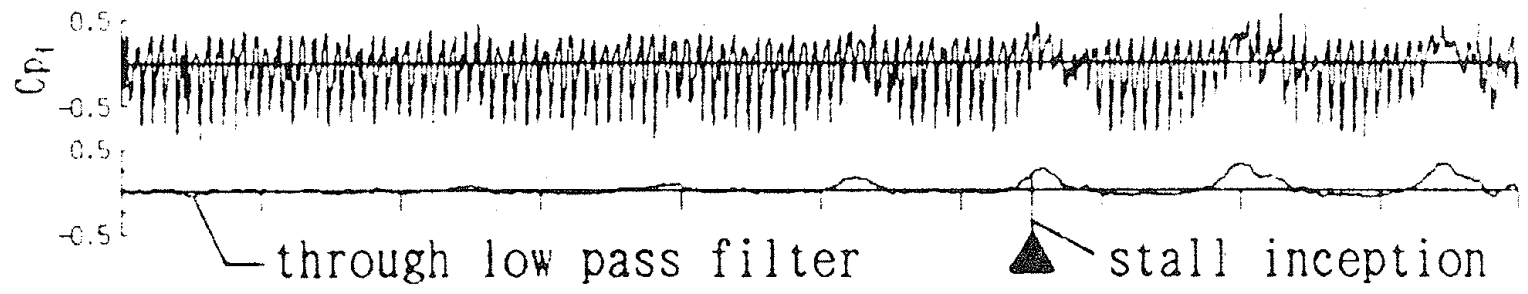
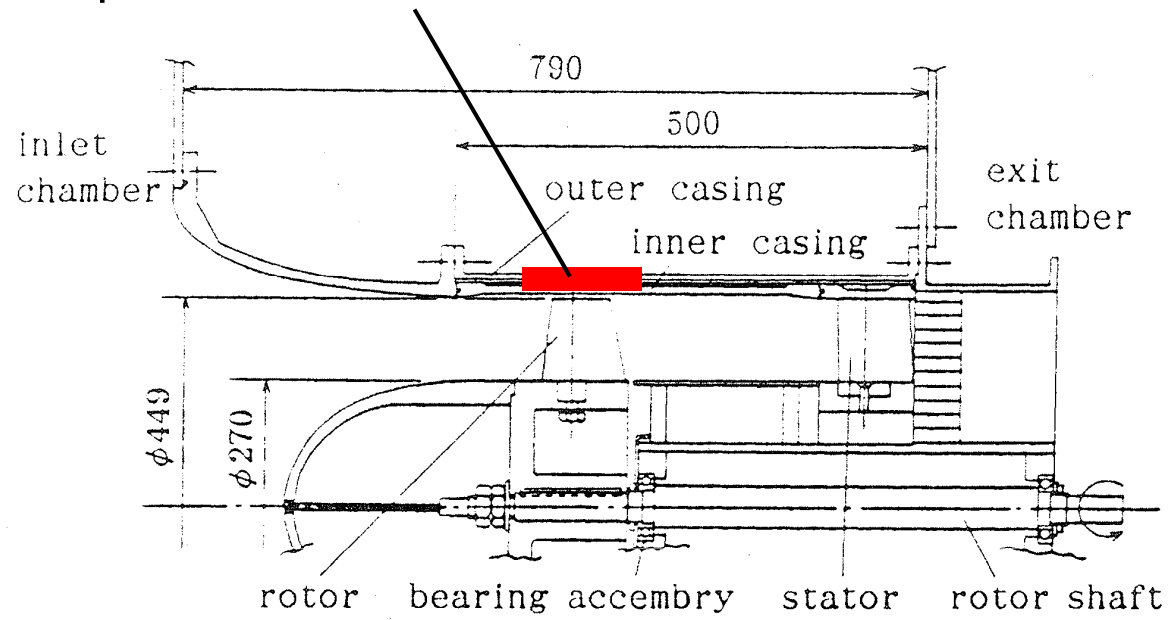
*Dr. János VAD: Flow measurements*

- Measurement of **turbulence-related** pressure fluctuations

Axial flow fan / compressor:

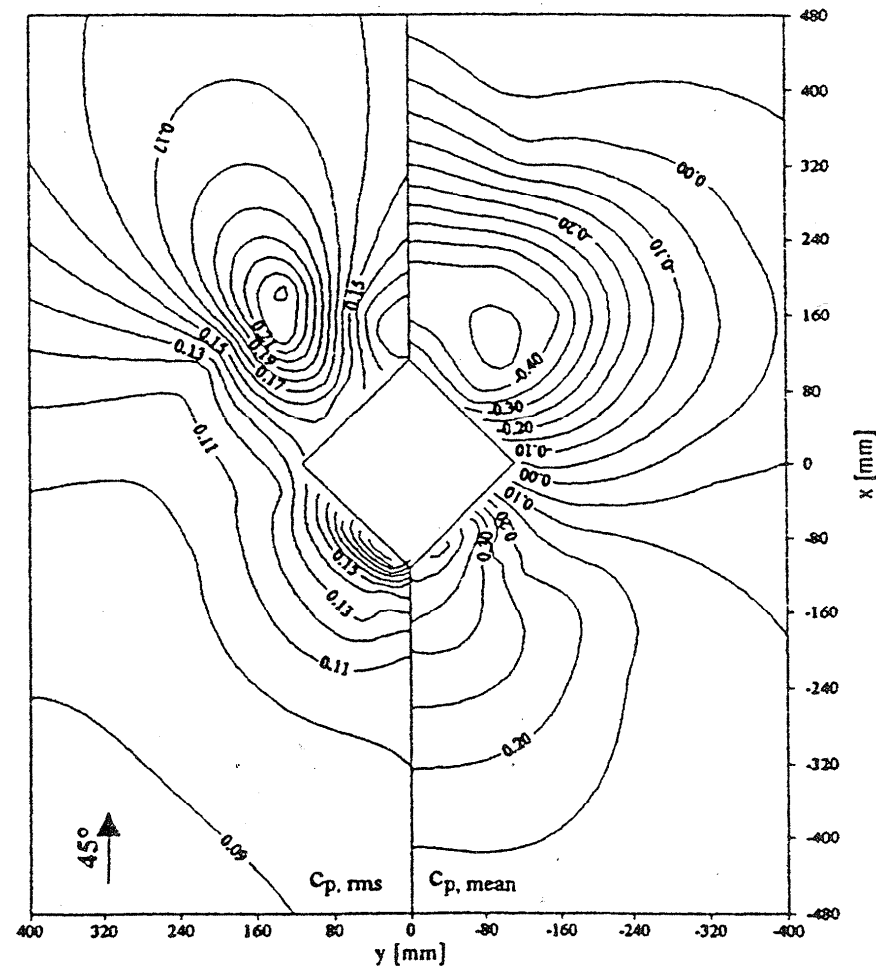


# Zone of pressure transducers

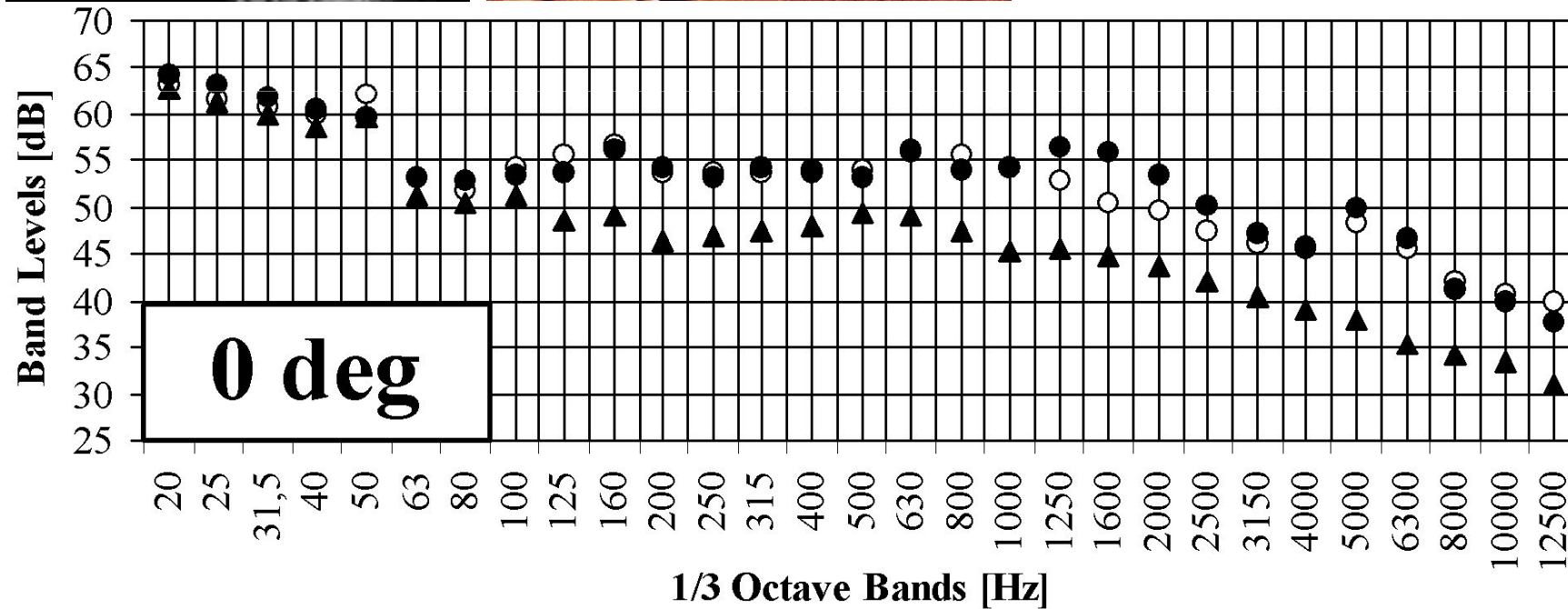
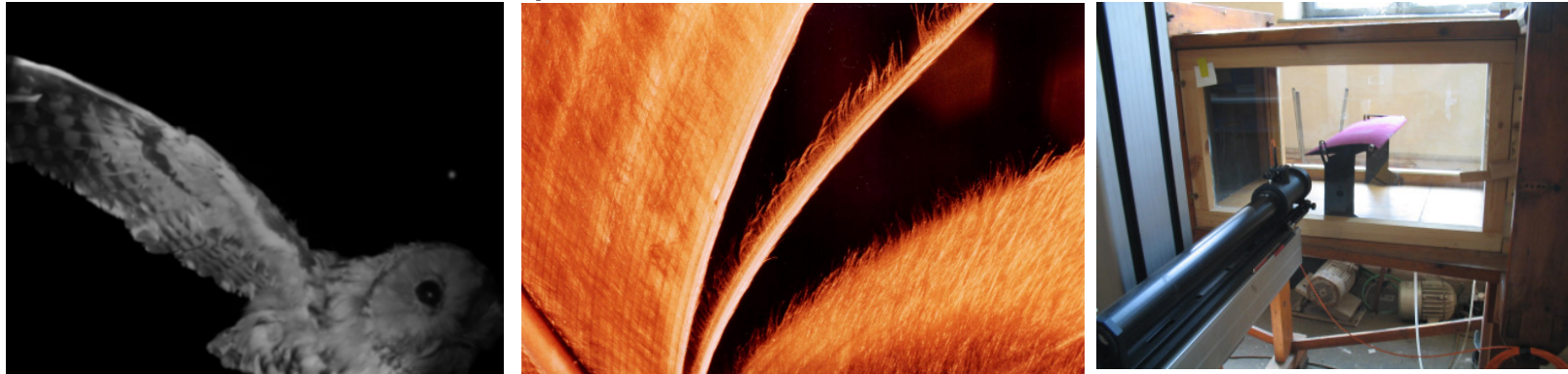


- Fluid mechanics R&D. Measurements for validation and further development of turbulence models and CFD tools.

Wind tunnel  
measurements: flow  
past a building block  
model

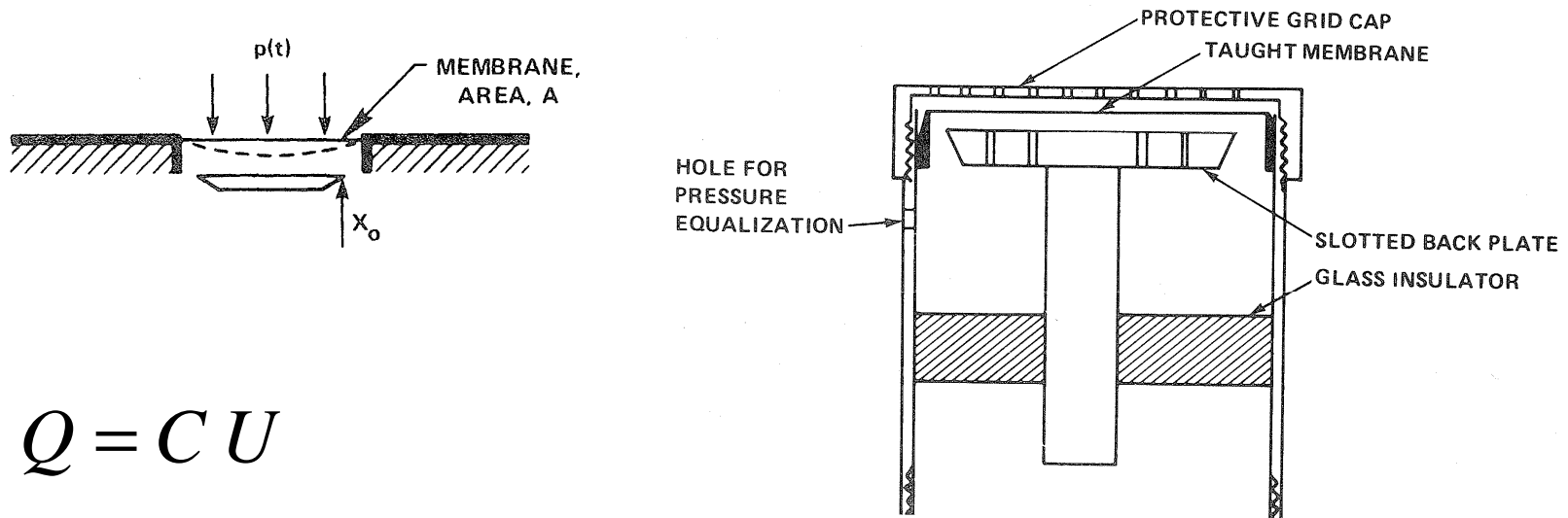


- Acoustics, sound pressure level measurements, spectral distribution of sound pressure



## 5.2. Instruments

### 5.2.1. Capacitor principle (condenser microphone)



$$Q = C U$$

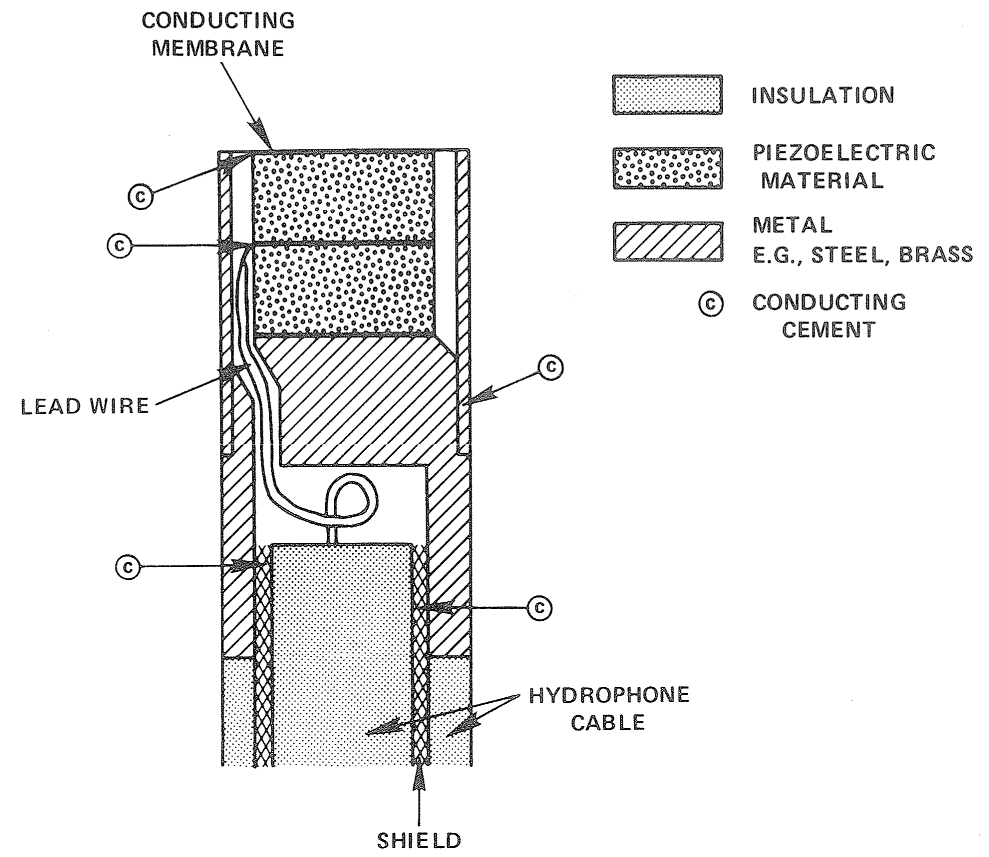
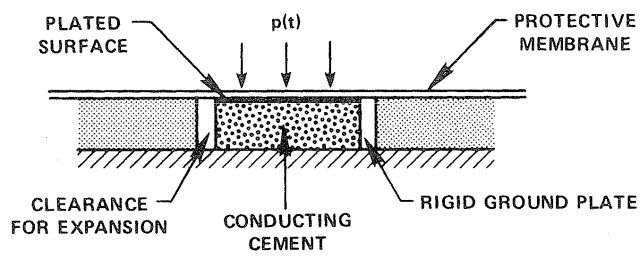
$$L = 20 \lg \frac{p}{p_0}$$

0 ÷ 120 dB: 6 orders of magnitude!



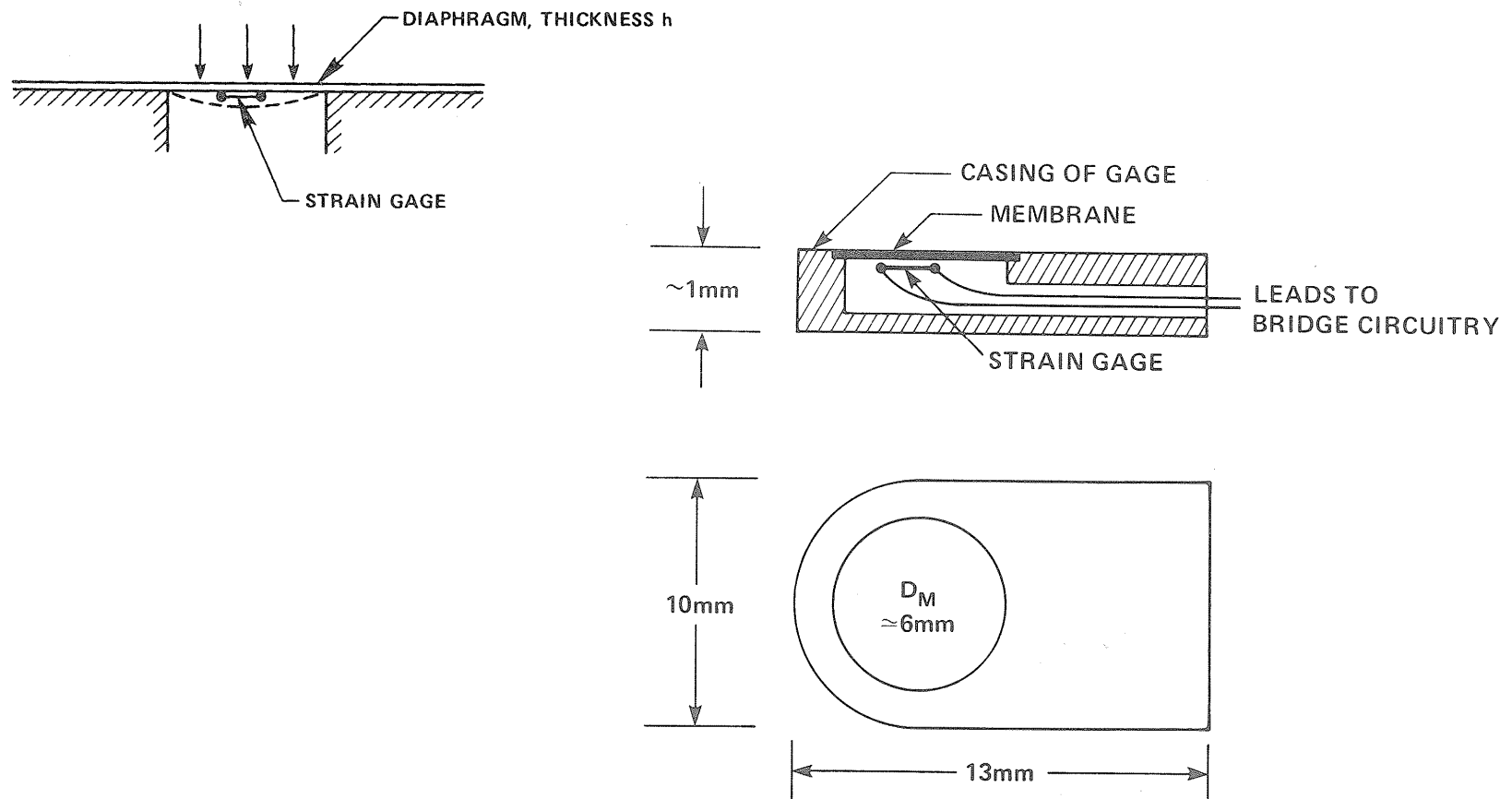
## 5.2.2. Piezo-inductive principle

- Hydrophones
- Indication of IC engines



„Acceleration canceling”  
 ⇔ Accelerometers!

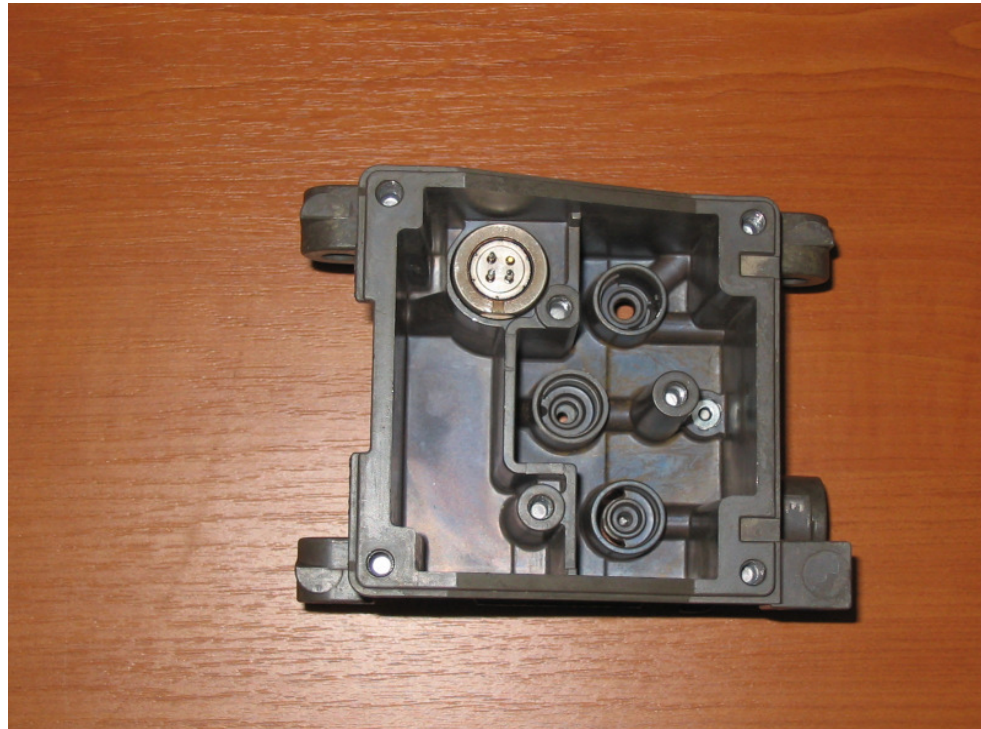
### 5.2.3. Piezo-resistive principle



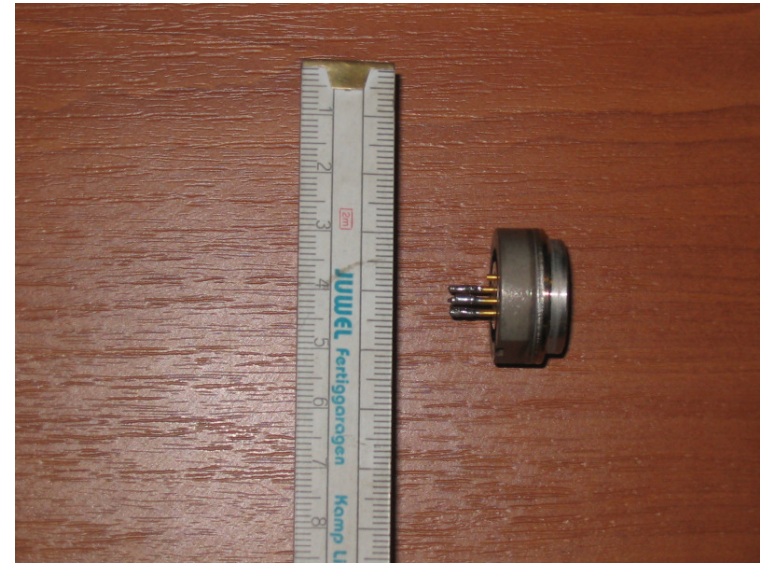


Kulite sensor

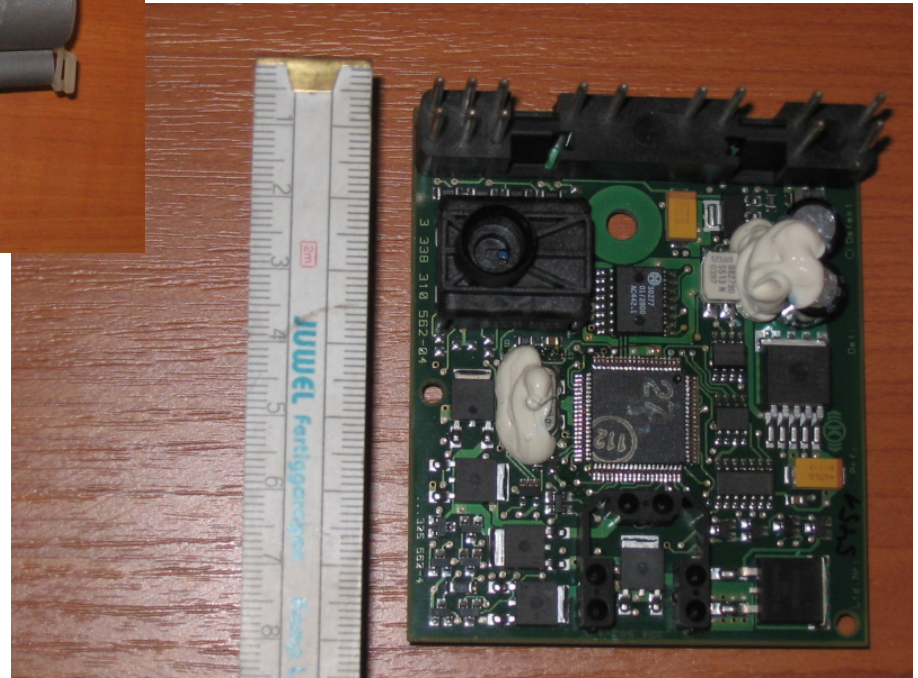
*Dr. János VAD: Flow measurements*



- EBS modulators





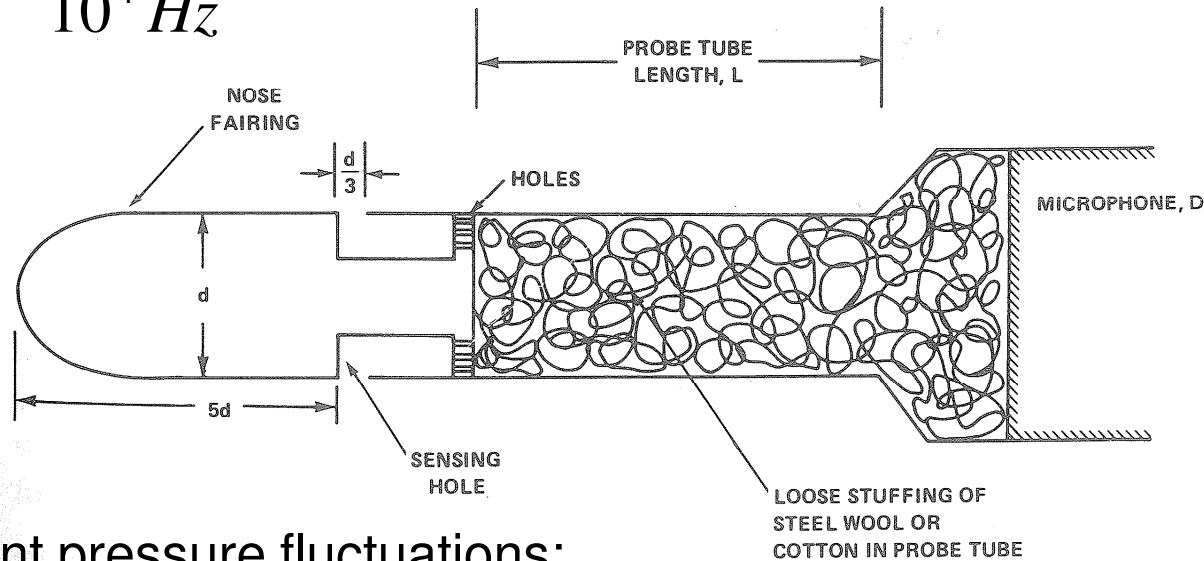


*Dr. János VAD: Flow measurements*

### 5.3. Applications in acoustics and in turbulence studies

Pressure waves:

$$\lambda = \frac{a}{f} \approx \frac{340 \text{ m/s}}{10^4 \text{ Hz}} \approx 30 \text{ mm}$$



Turbulent pressure fluctuations:

$$\lambda = \frac{v}{f} \approx \frac{1 \text{ m/s}}{1000 \text{ Hz}} \approx 1 \text{ mm}$$