

# WHEN STRUCTURES START TO SPEAK

...AE applications from nuclear power plants to tomatoes

**František Vlačík**

INSTITUTE OF MACHINE AND INDUSTRIAL DESIGN  
Faculty of Mechanical Engineering  
BUT

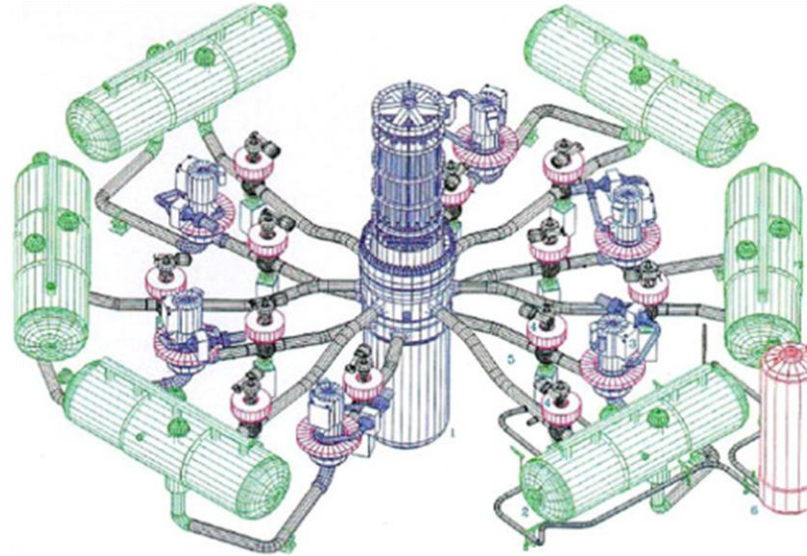
Brno, March, 2026



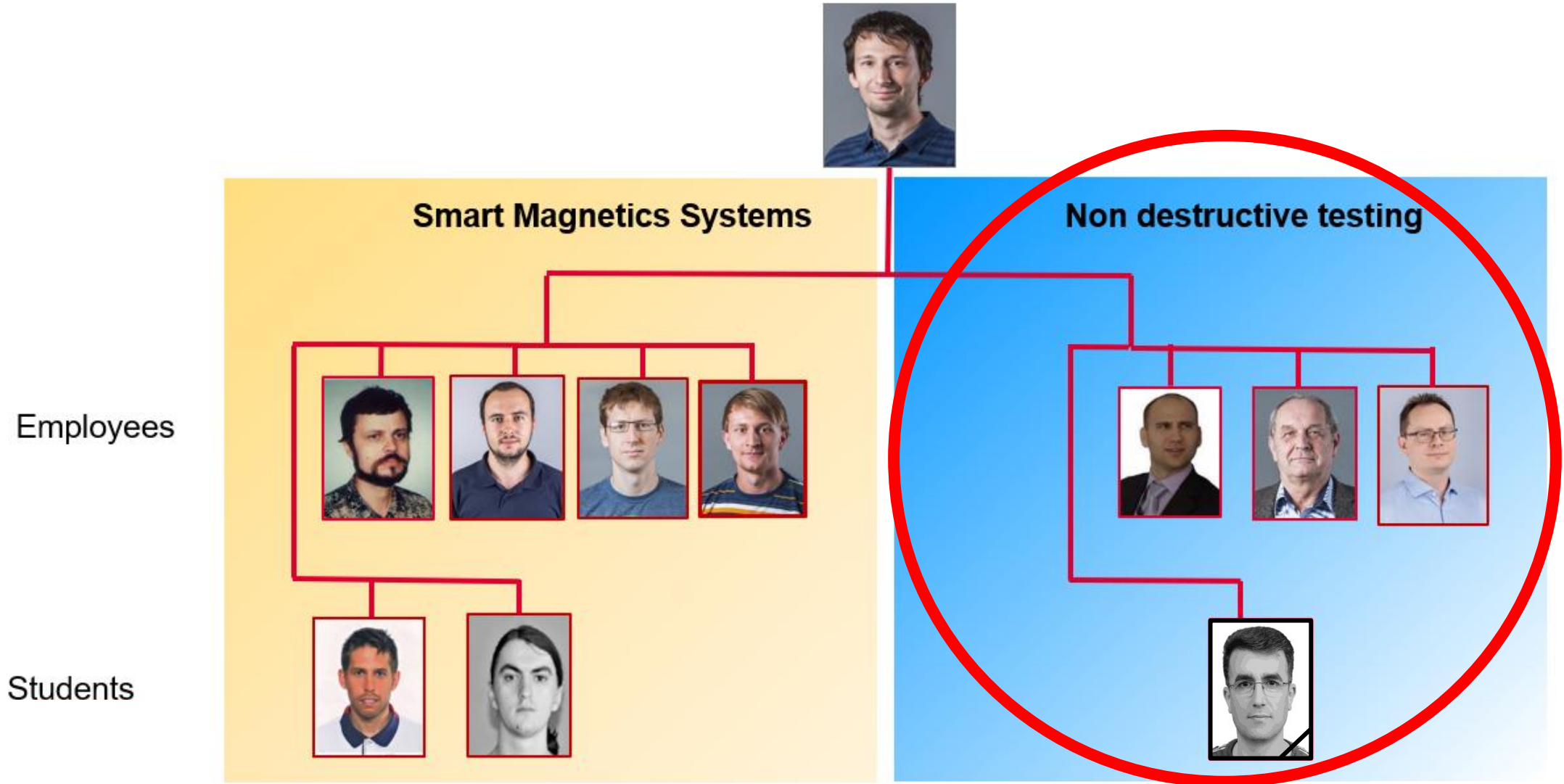
INSTITUTE OF MACHINE  
AND INDUSTRIAL DESIGN

# What You Will Hear Today

- ❑ Why structures start to speak
- ❑ From industry to research
- ❑ Selected projects
- ❑ Application outside BUT
- ❑ Education & PR
- ❑ What comes next?



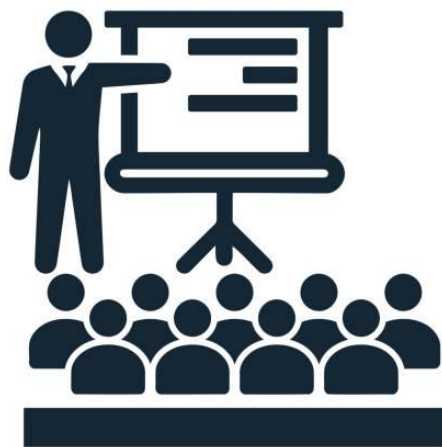
# Department of CM Hierarchy



# My position



**Department of CM**  
*part-time (0,5)*



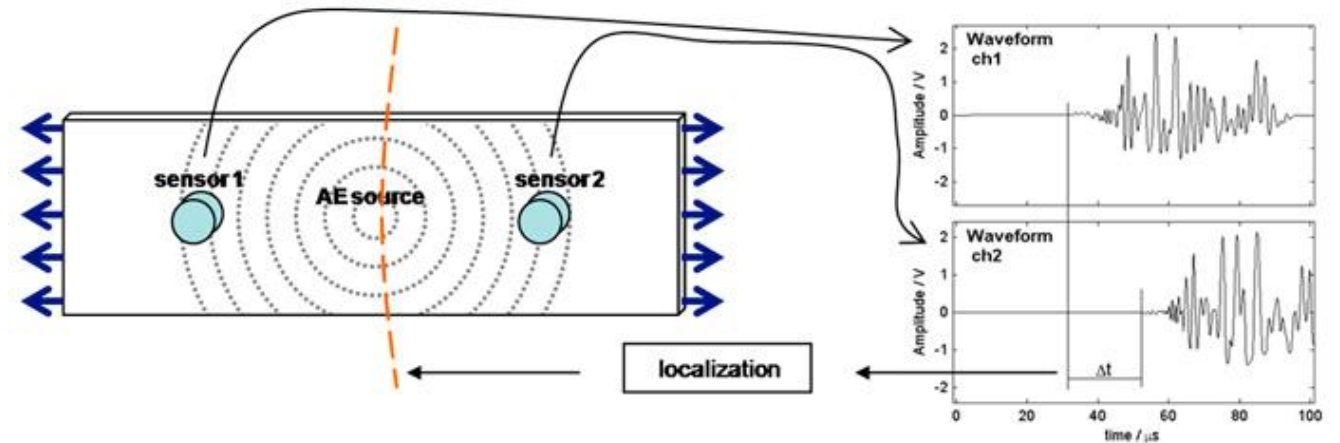
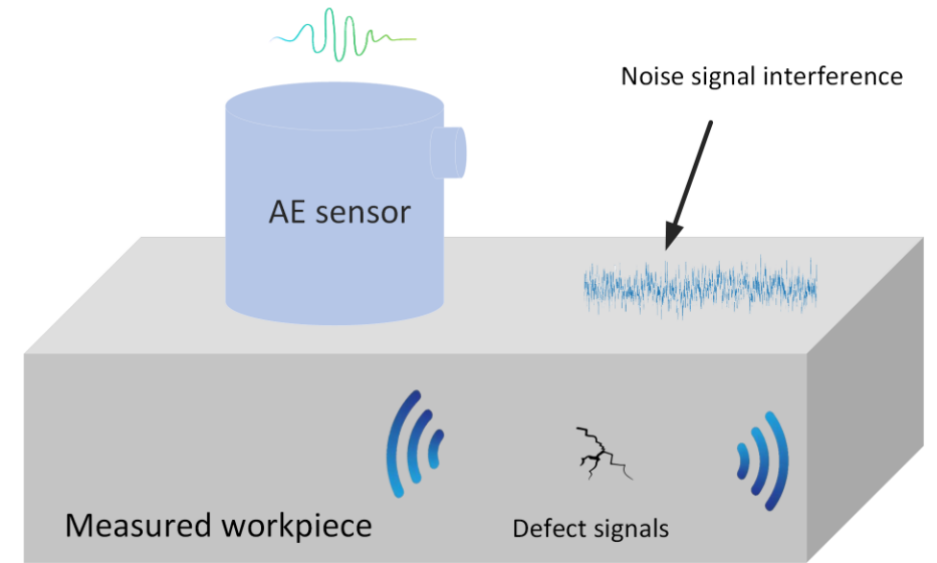
**Diagnostics department**  
*flexitime*



# Why structures start to speak

## Acoustic Emission – Listening to Active Damage

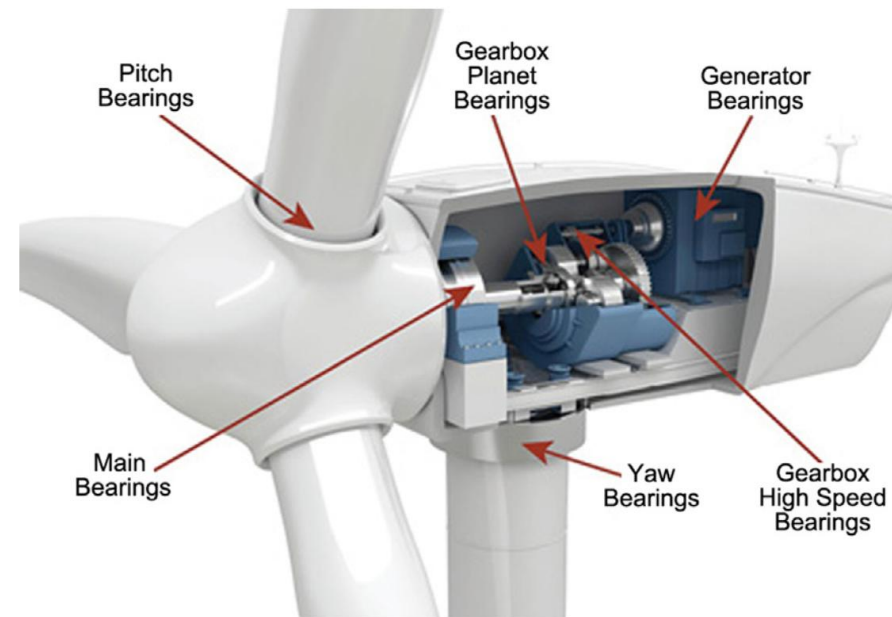
- material releases energy during deformation
- (micro)cracks generate elastic waves
- we detect events in real time
- not after failure – during its birth



# Why structures start to speak

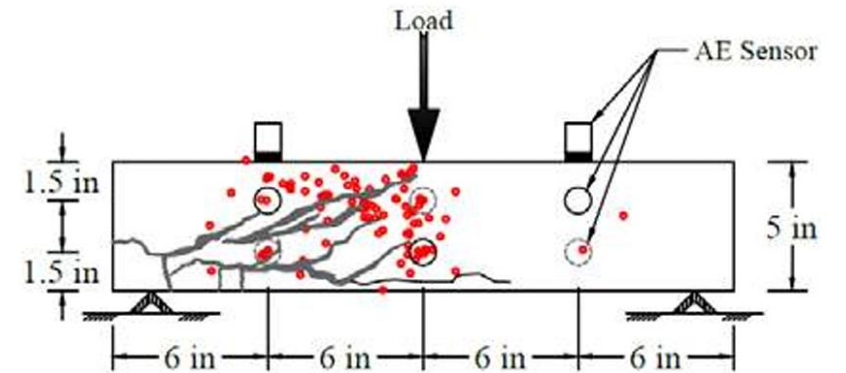
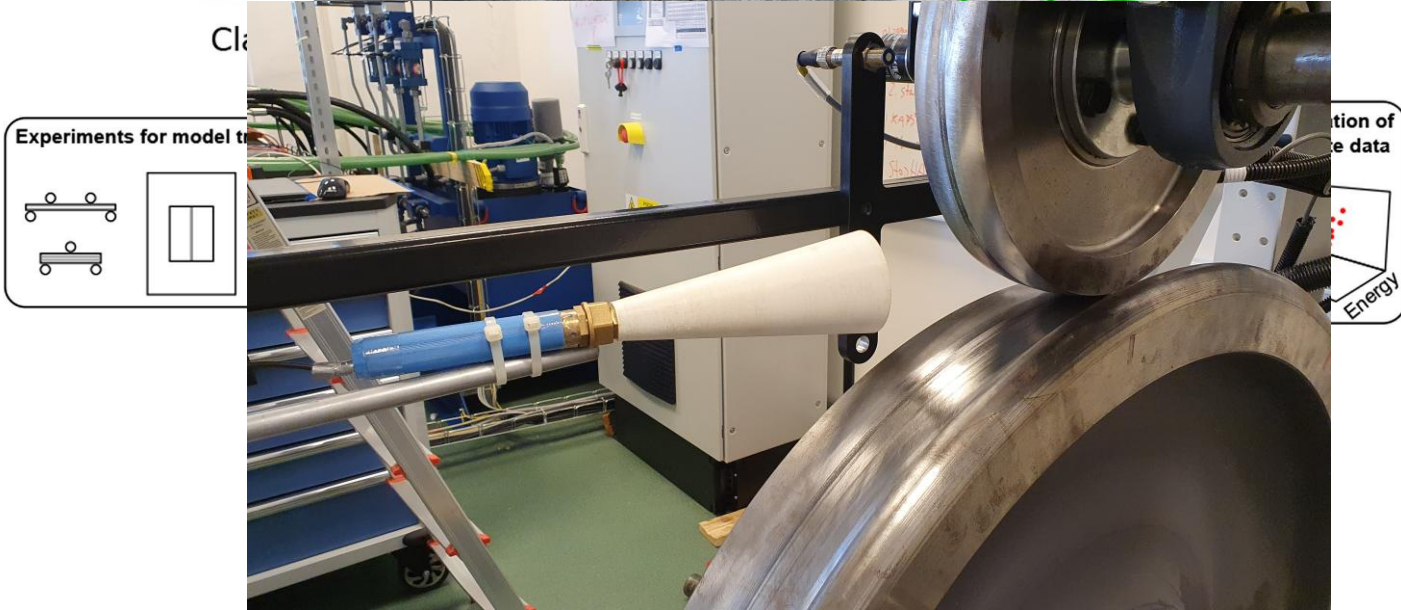
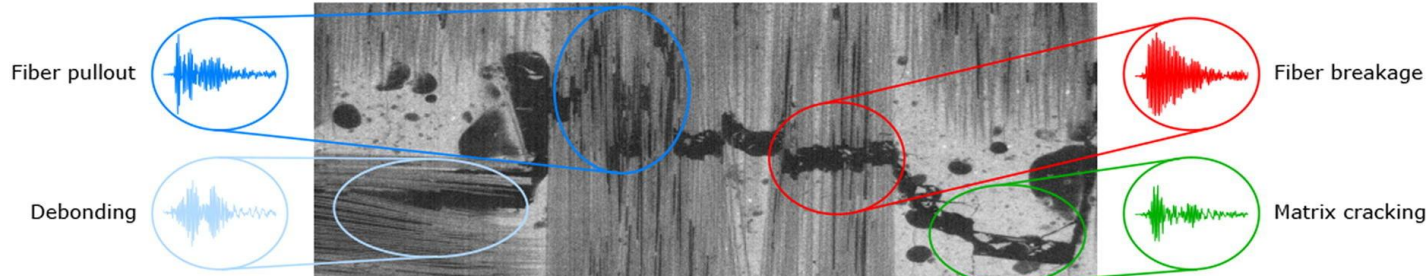
## Why acoustic emission?

- real-time monitoring
- large structures (pressure vessels, pipelines, bearings)
- no need to scan the entire surface
- suitable for remote & continuous monitoring
- early warning capability



# Why structures start to speak

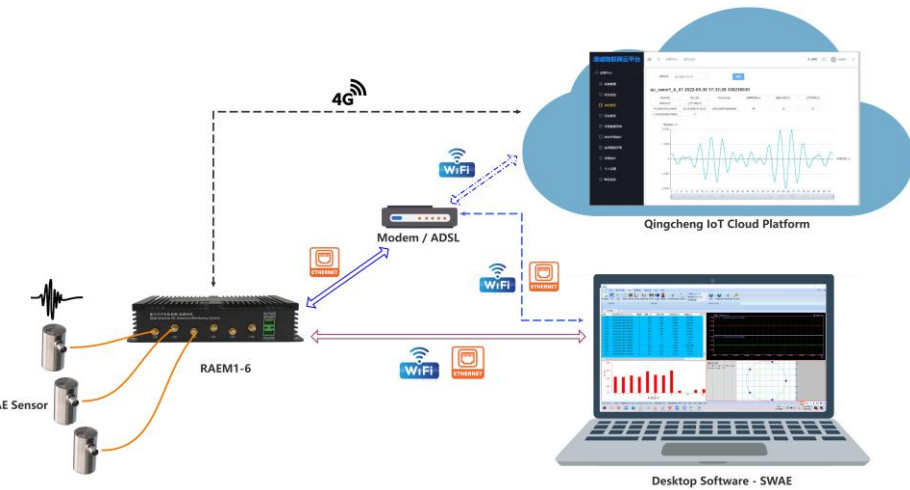
Damage mechanisms during loading of composite



(Lee, 2019)

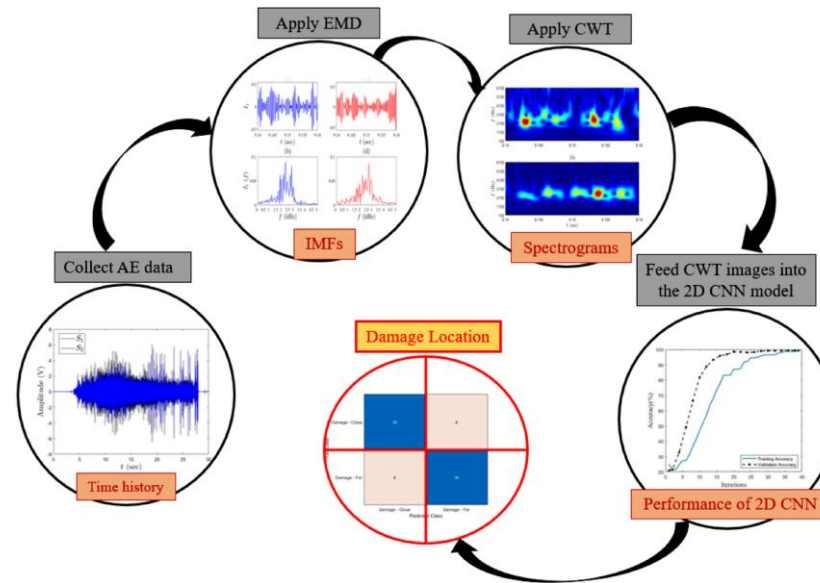
# AE in Industry – Key Directions

## Remote & Continuous Monitoring



(RAEM1-6 System Diagram)

## AI-Assisted Evaluation



(Barbosh, 2022)

## Wireless & Smart Sensors

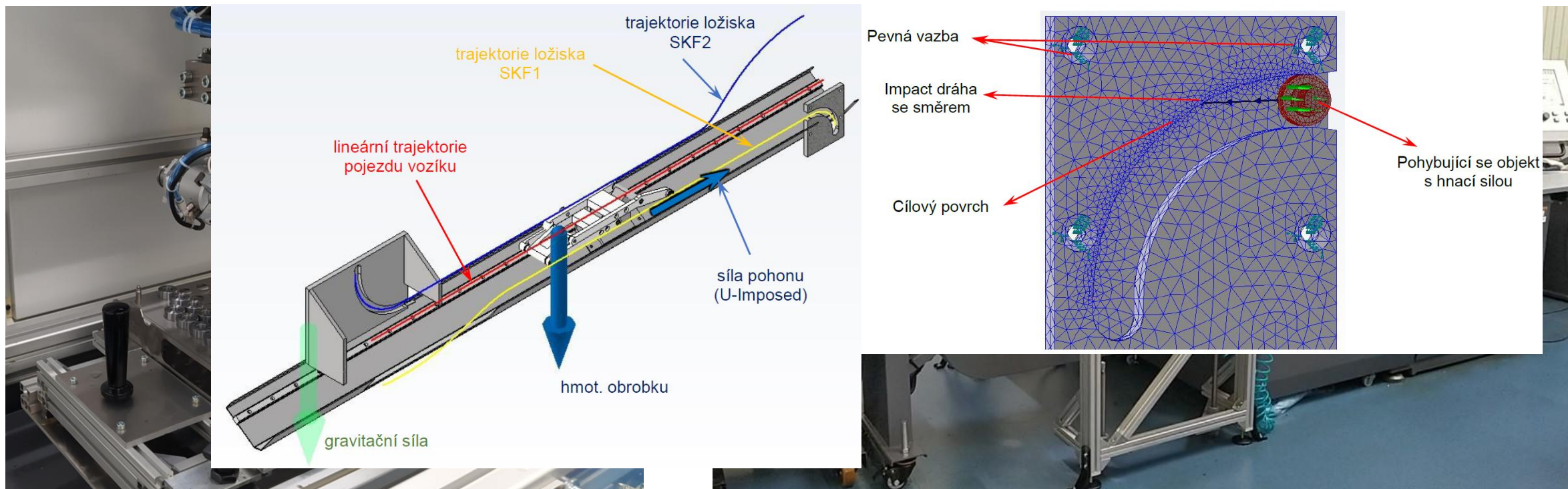


(RAEM1 – Full Remote System)

# From Industry to Research

## TACR TREND “New workpiece manipulator for productive CNC lathes”

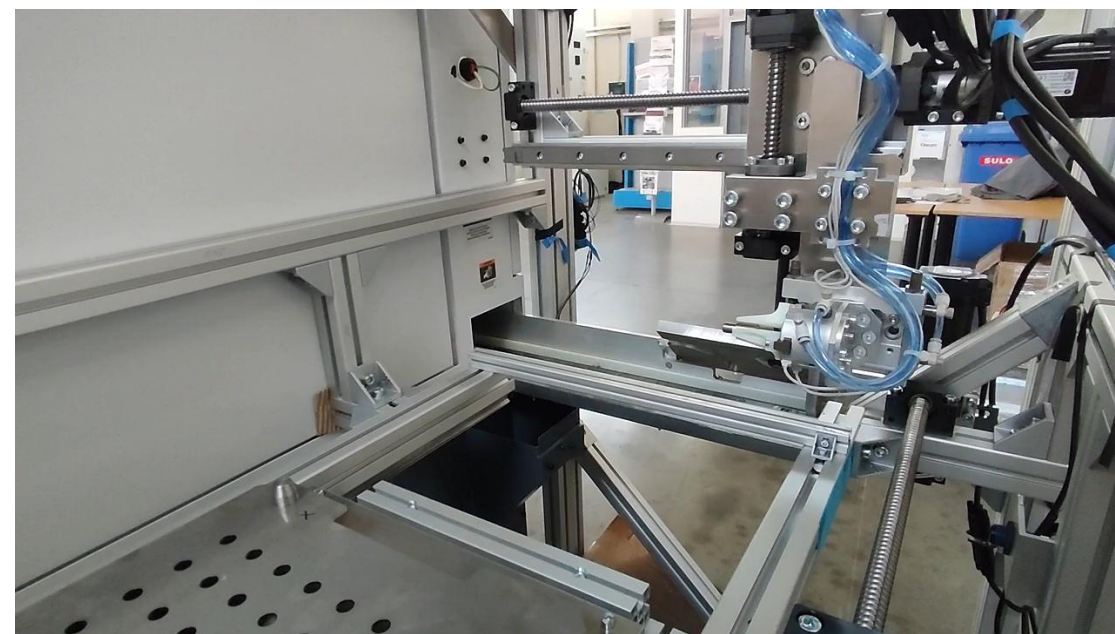
(2021 – 2024)



# From Industry to Research

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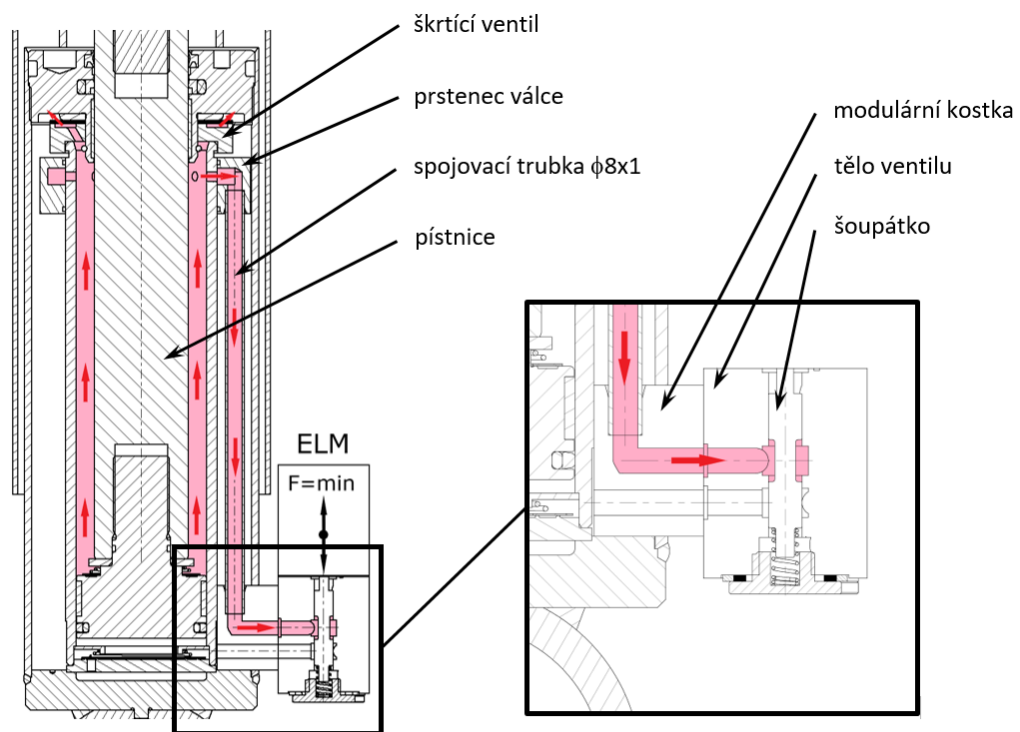
(2021 – 2024)



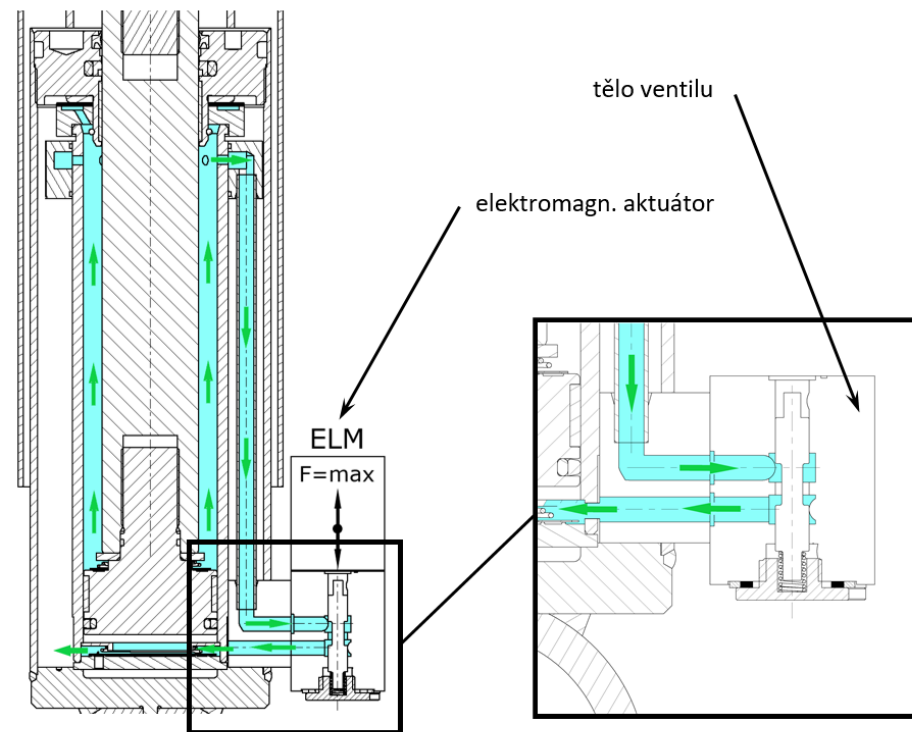
# From Industry to Research

## TACR DOPRAVA "Hydraulic semi-active damper for intelligent rail bogie"

(2022 – 2025)

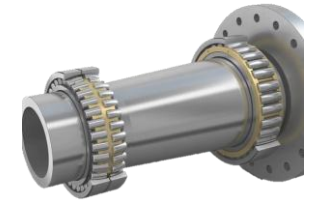


■ vysoký tlak oleje

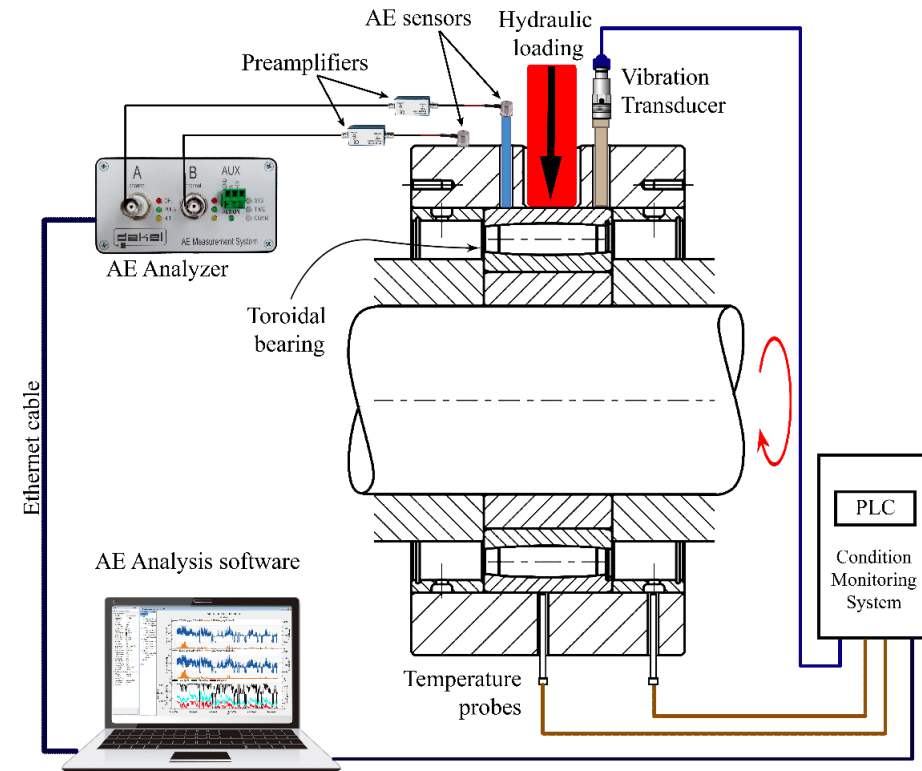
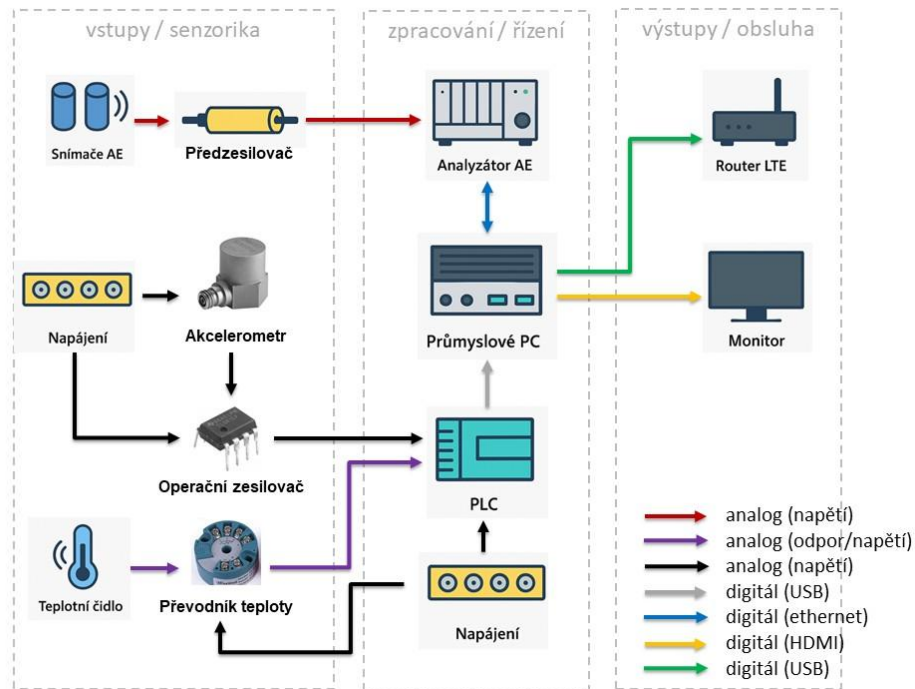


■ nízký tlak oleje

# From Industry to Research

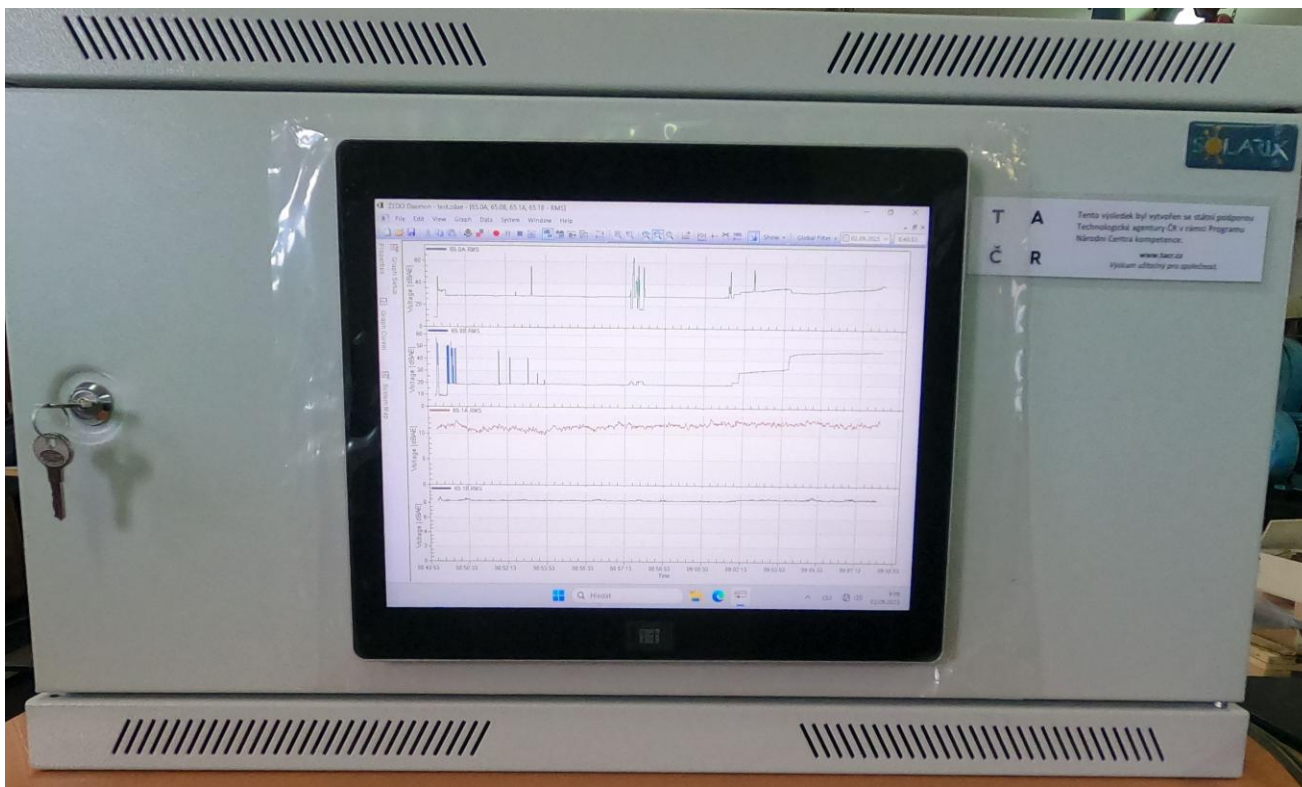


## NCK MESTEC2 “Large-scale bearings with advanced diagnostics for wind energy” (2023 – 2025)



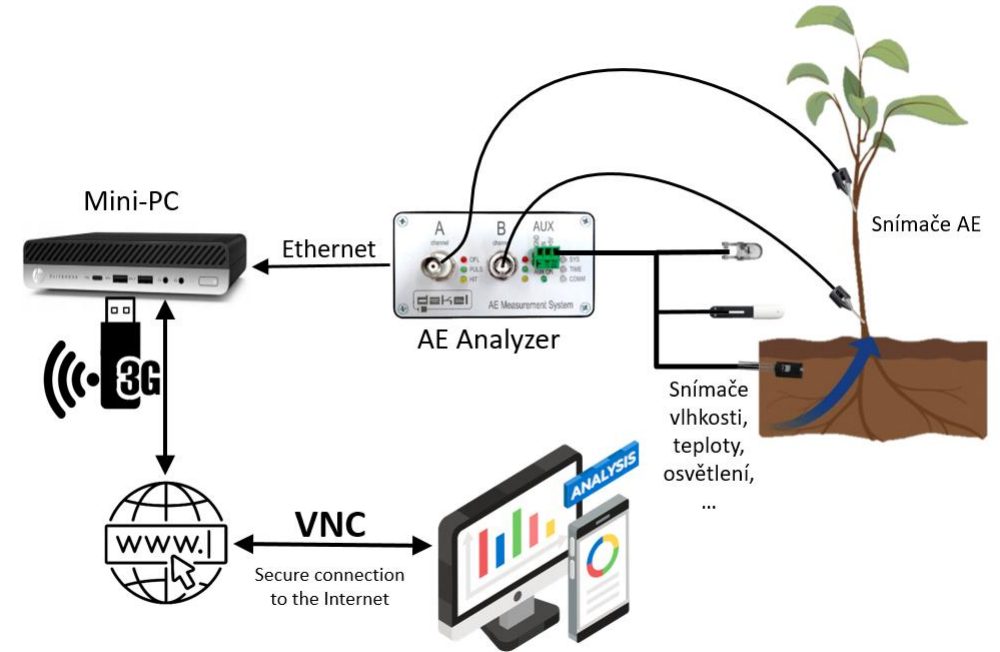
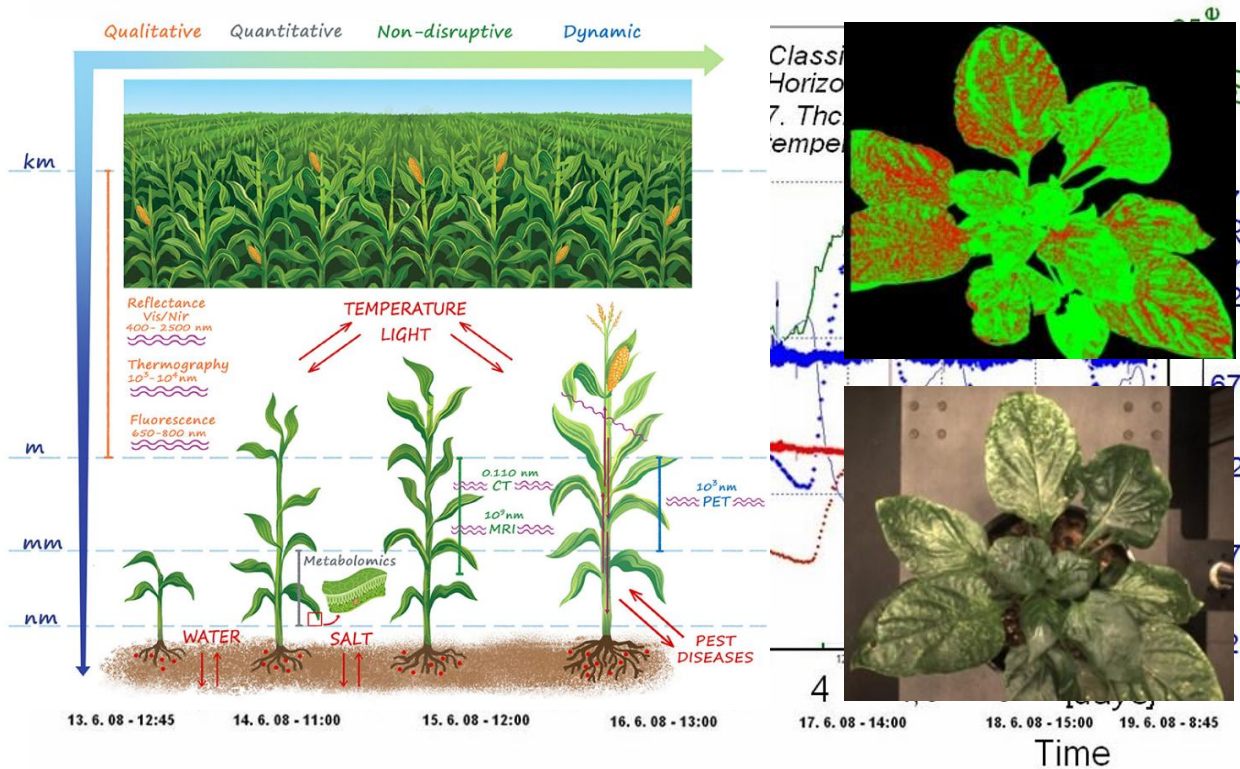
# From Industry to Research

**NCK MESTEC2** “Large-scale bearings with advanced diagnostics for wind energy”  
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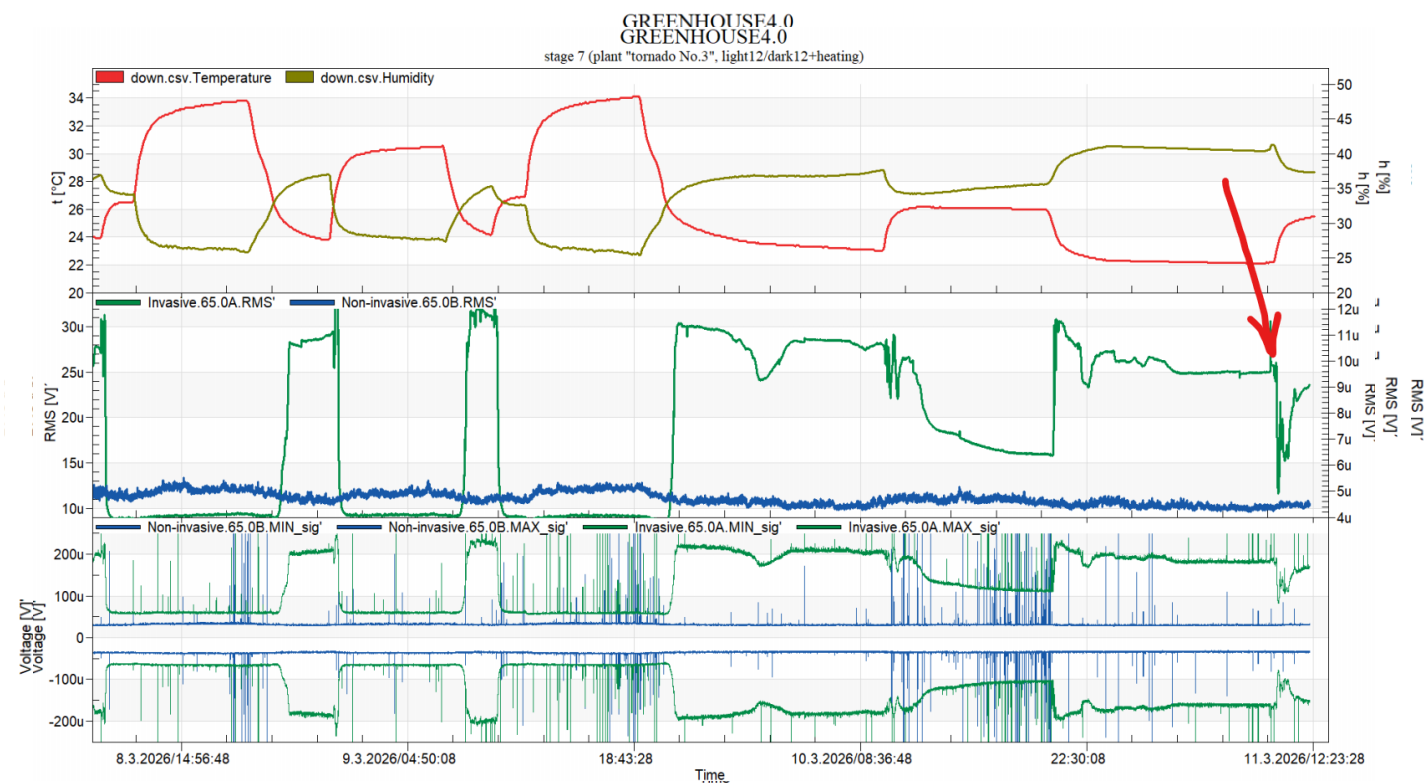
# From Industry to Research

## TAČR TREND “Measuring system for monitoring and optimizing plant growth conditions” (2024 – 2026)



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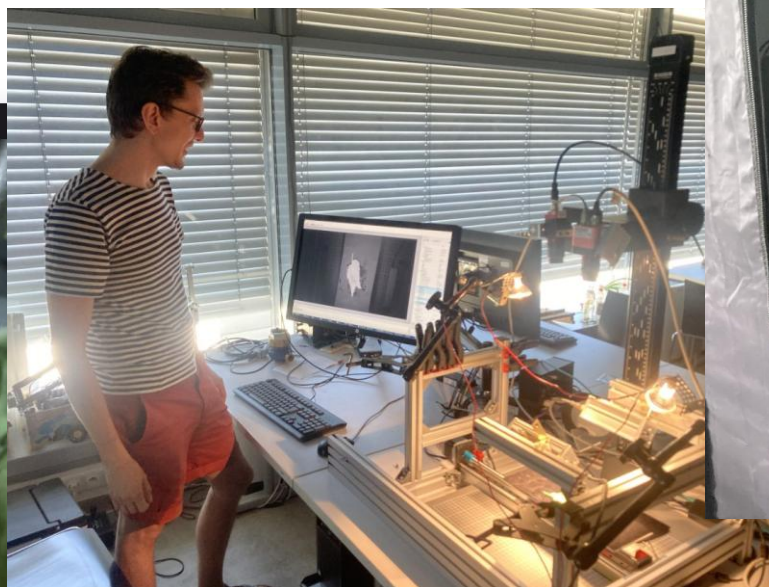
Magazín experiment: Co dokáže změřit akustický snímač rostlin? A jak funguje automatizovaný skleník?

© 3. srpen 2024 | Magazín Experiment

>> Největší audioportál na českém internetu



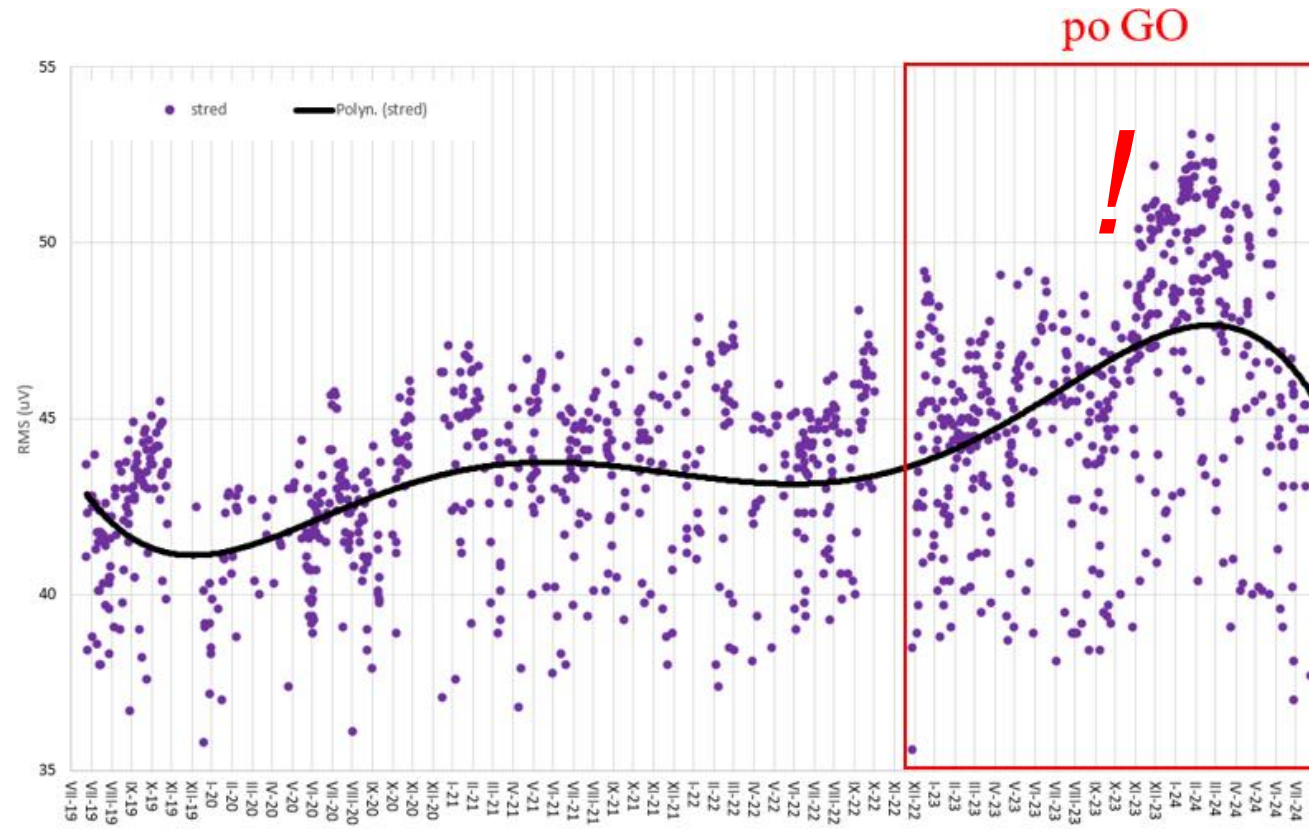
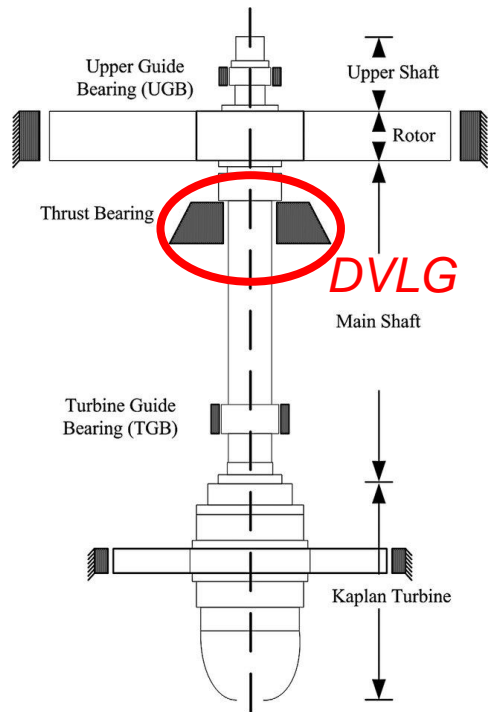
Akustický senzor napícheme do stonku rostliny | Foto: Michal Šafařík, Český rozhlas



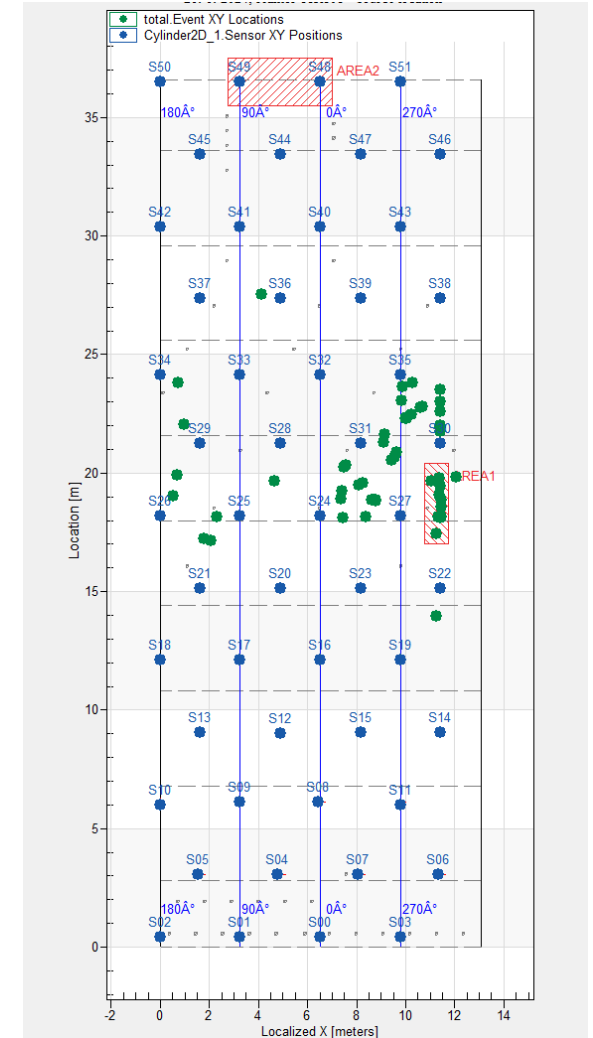
Poslechněte si celý Magazín Experiment z 3. srpna 2024



# Application of AE outside BUT



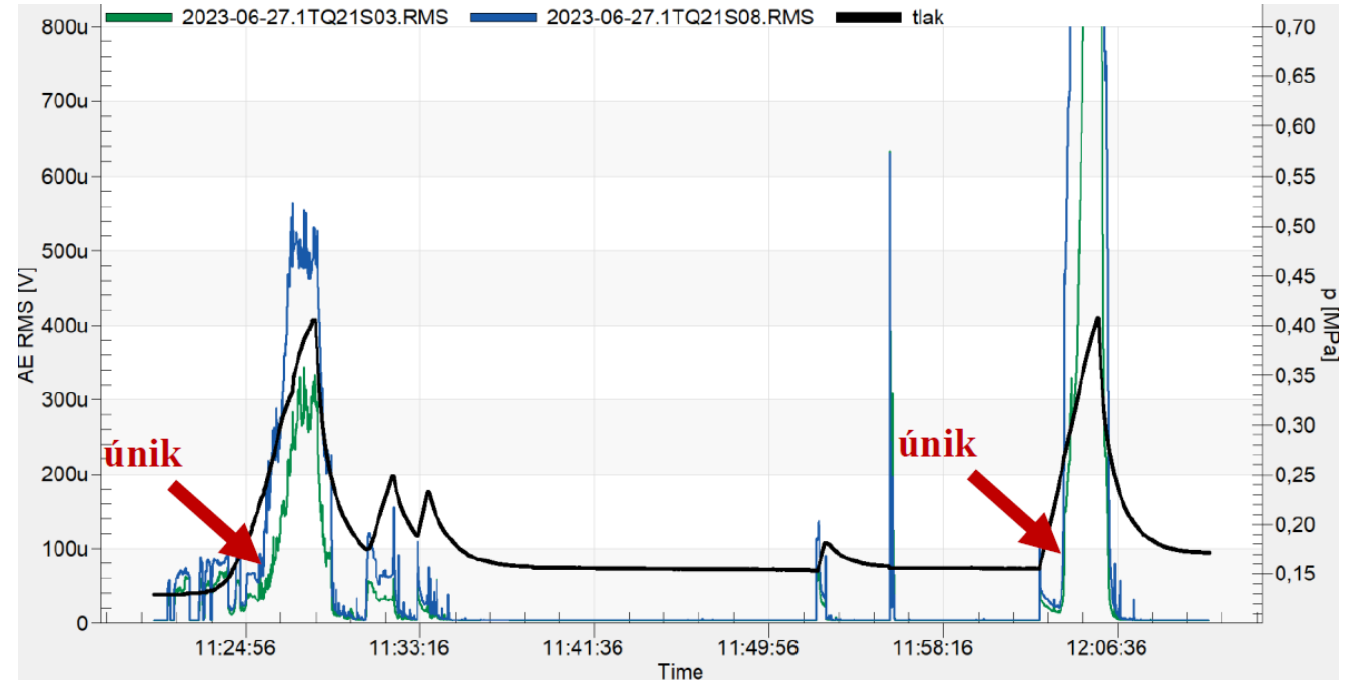
# Application of AE outside BUT



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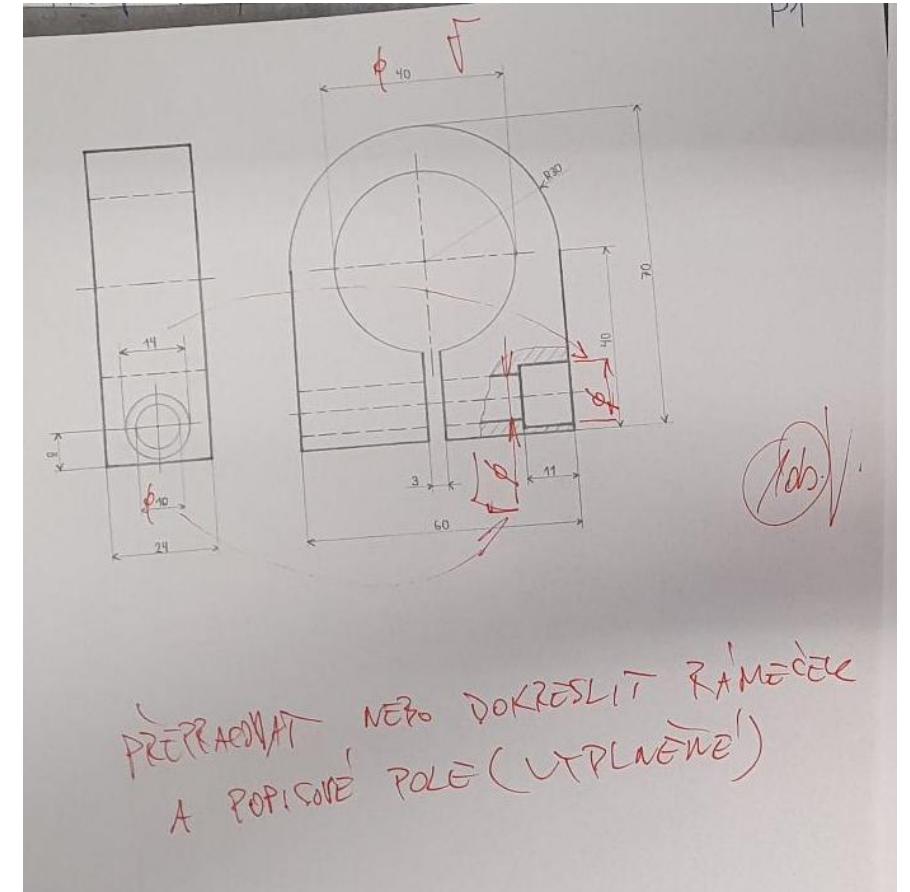
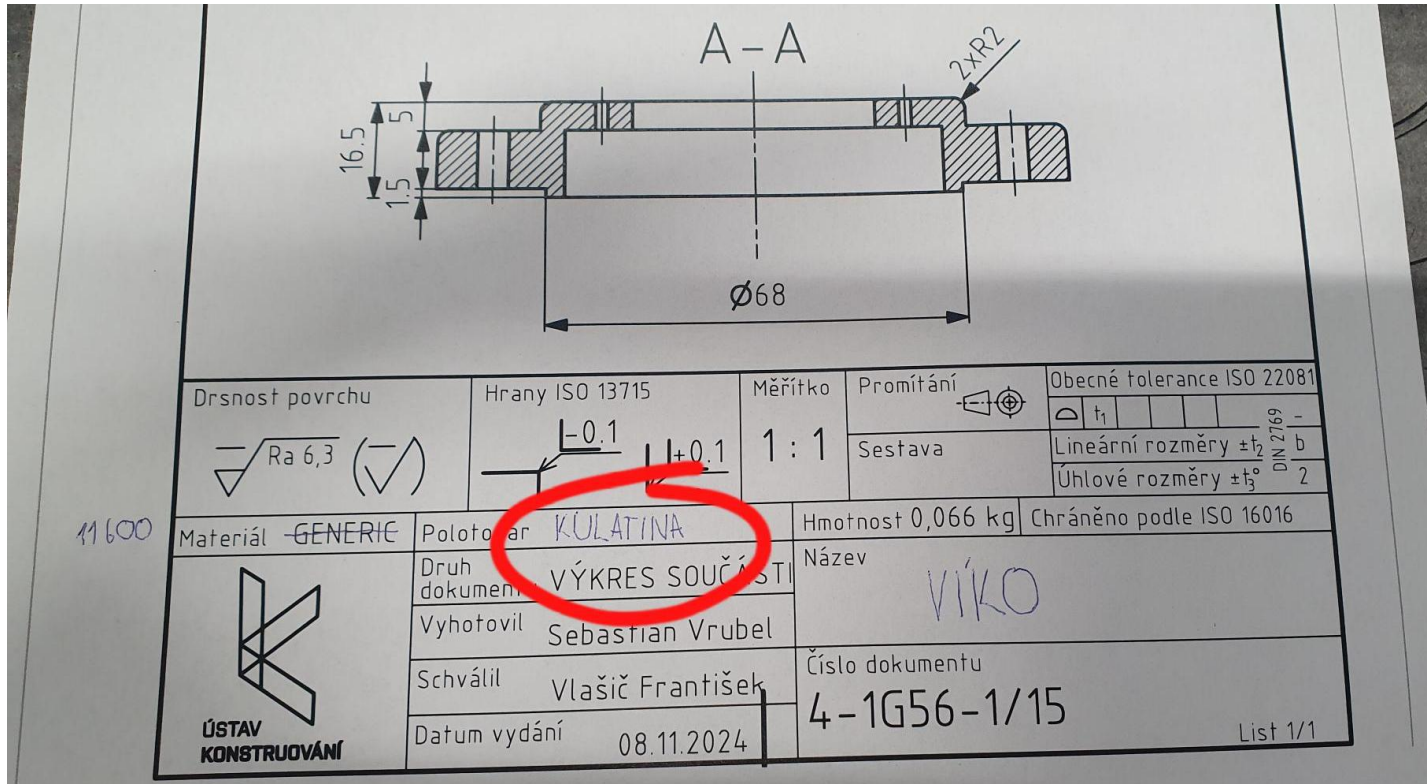


# Application of AE outside BUT



# Education

1K / 2K



# Education

ZIP



## Optimalizace návrhu udržitelného produktu: Technologičnost konstrukce, modularita a servis

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Fakulta strojního inženýrství  
VUT v Brně



## MSV 2023



## Ultrazvukový detektor netěsností



FLUCTUS



## Na co je možné detektor použít?

- spoje a příruby
- pneumatické hadice a vedení
- jednoduché pneumatické prvky (válcce, ventily...)
- pneumatiky a systémy vzduchových tlumičů



## Nastavení parametrů přístroje:

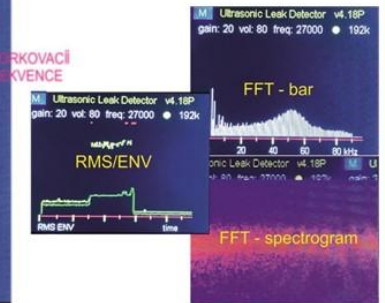
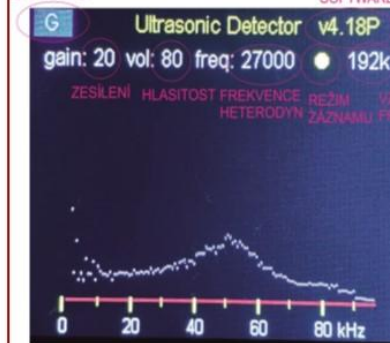
Nastavení	Individuálně	MENU
Brightness – jas displeje		Ano
Gain – zesílení přístroje	G	Ano
Volume – hlasitost sluchátkového výstupu	V	Ano
Heterodyne – frekvence heterodynu	F	Ano
Sample rate – vzorkovací frekvence signálu	SR	Ano
Mode – režim zobrazení	M	Ano
Info – zobrazení informace o přístroji		Ano
EEPROM read – načtení uživatelského nastavení z		Ano
EEPROM		
Factory default – načtení továrního nastavení		Ano
EEPROM write – zapsání aktuálního nastavení do EEPROM		Ano
Delete all records – smazání všech záznamů na SD kartě		Ano
Set record number – nastavení čísla nového záznamu		Ano

## Indikace režimu záznamu:

- v tomto režimu není záznam/přehrávání povoleno
- stop v režimu záznam/přehrávání
- běží záznam
- ▶ běží přehrávání
- ✗ není k dispozici SD karta

REŽIM ENKODÉRU

VERZE SOFTWARE



**KONTAKTY:**  
Odbor technické diagnostiky

Milan.Klapka@vutbr.cz  
Frantisek.Vlasic@vutbr.cz

**VYSOKÉ UČENÍ FAKULTA  
TECHNICKÉ STROJNÍHO  
V BRNĚ INŽENÝRSTVÍ**

# What comes next???



# Thank you for your attention

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