ACTIVITIES AT IMID

2023-2025

Ing. **Jakub Slavíček**

ÚSTAV KONSTRUOVÁNÍ
Fakulta strojního inženýrství
VUT v Brně

Brno, 5.11.2025

ÚSTAV
KONSTRUOVÁNÍ

Content

- Research activities
- International cooperation
- Teaching activities
- Future plan

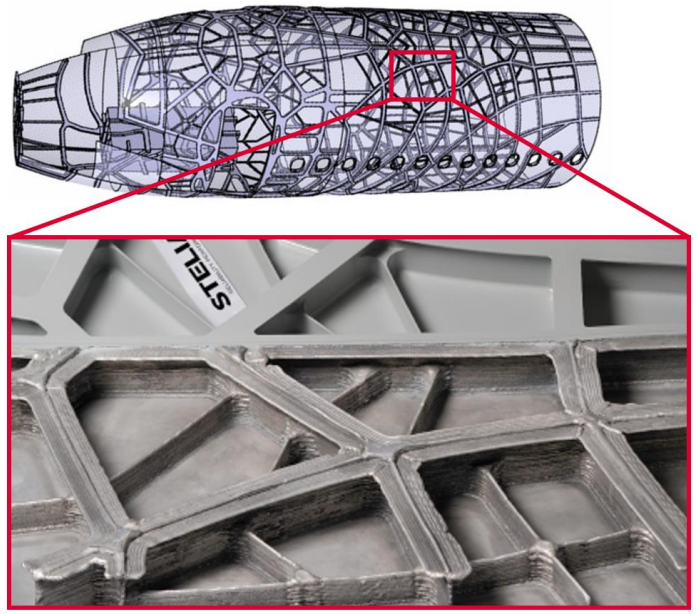
My topic and motivation

The potential of WAAM technology

- Thin-walled, optimized, structured components
- BTF ratio reduction – material, energy and financial saves
- Magnesium alloys – ρ = 1800 kg·m^{-3}, σ_k = 120 – 250 MPa

BTF ratio reduction using WAAM (bdli.de)

C-shape aircraft frame
www.visionwide-tech.com



Part of the fuselage (aerospaceengineering.net)

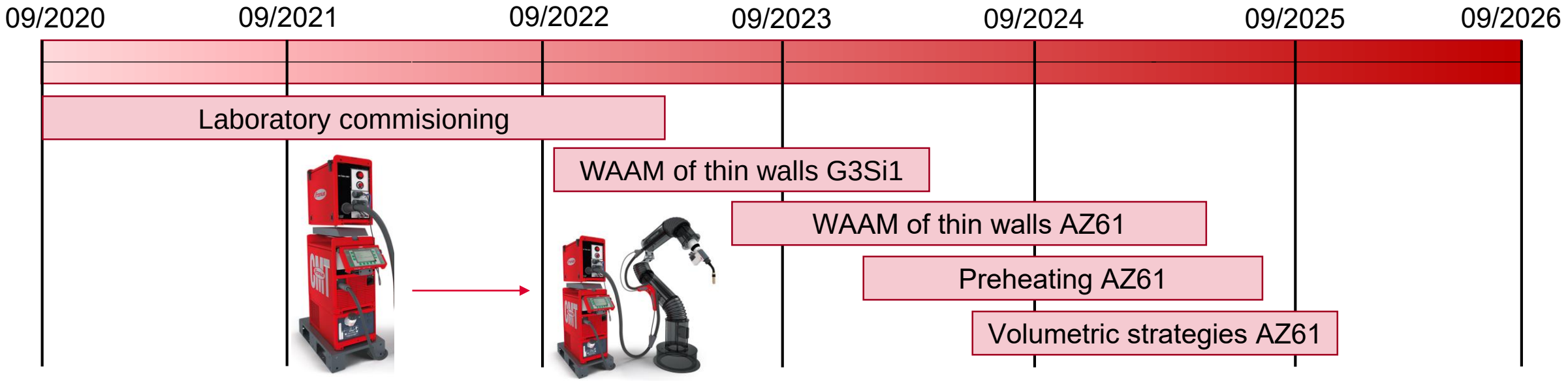
My PhD study at IMID

Dissertation topic:

- Additive manufacturing of structured components from magnesium alloys

Supervisor: doc. Ing. Daniel Koutný, Ph.D.

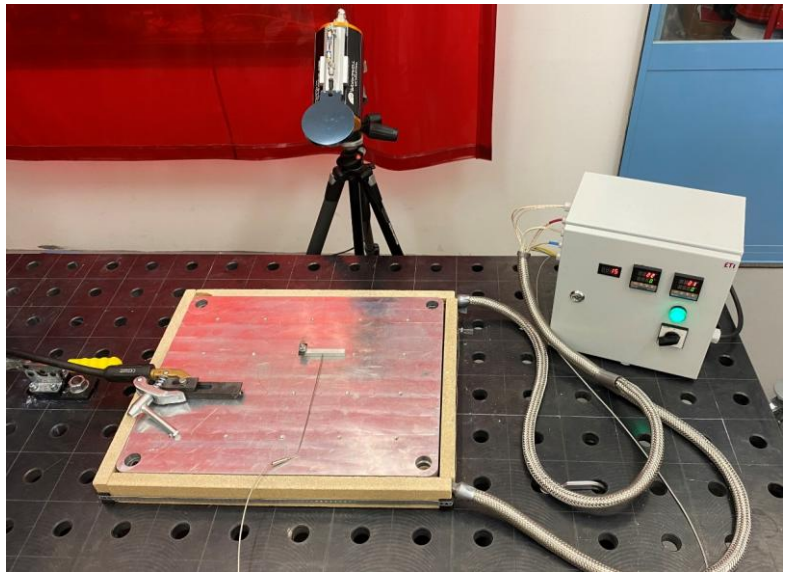
Specialist: doc. Ing. David Paloušek, Ph.D

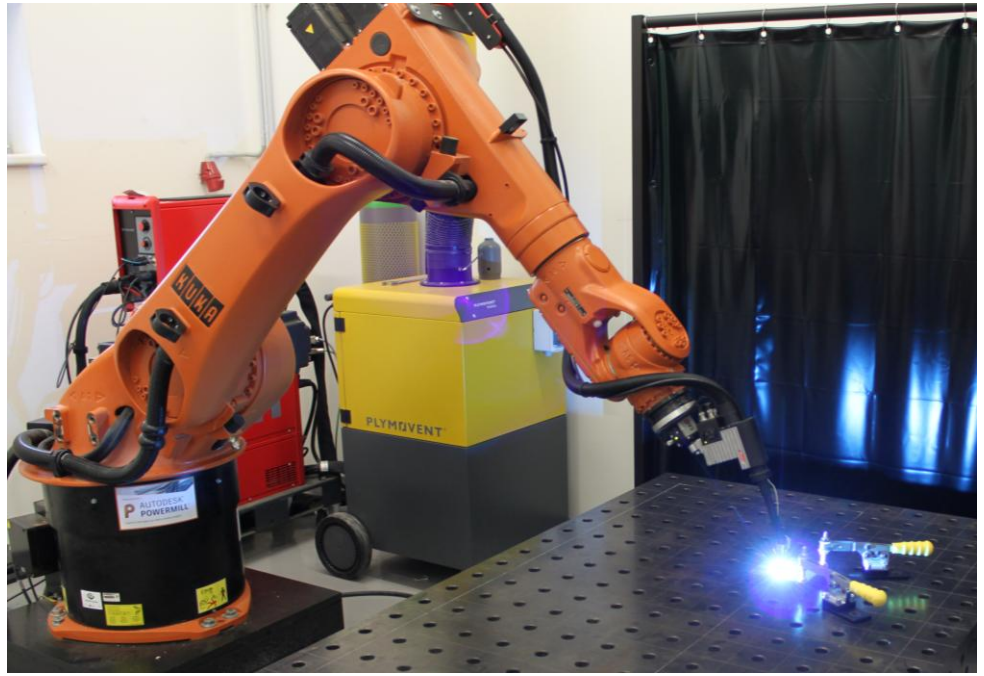


Research activities – Laboratory

Infrastructure of robotic laboratory

- Robotic arm - KUKA KR60 HA + welding power source - Fronius 3200 CMT
- Thermo camera, custom wire cleaning system
- Preheating baseplate – 400°C
- Materials – G3Si1, AZ61

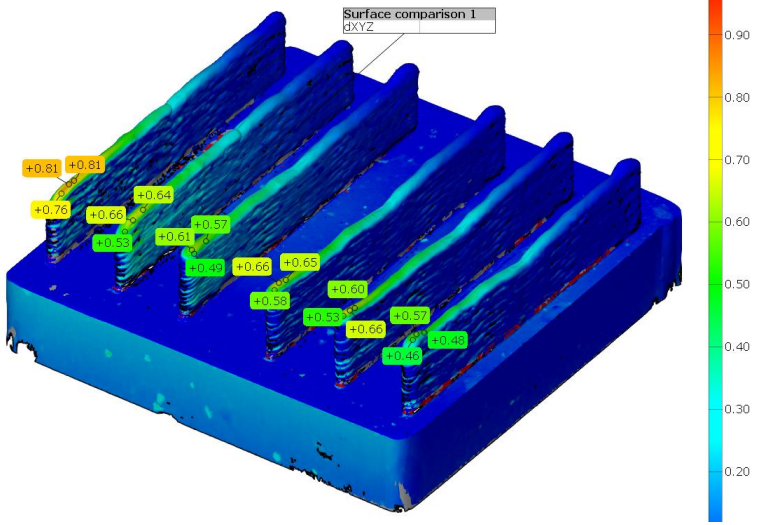


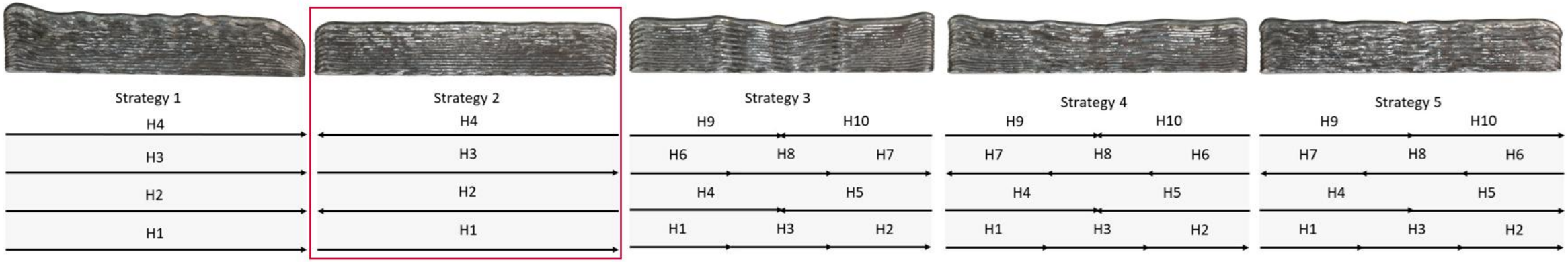


Research activities – WAAM of thin walls G3Si1

Strategies for WAAM:

- Thin walls – residual stresses
- Overhangs – accuracy, buildability
- Filler wire – basic carbon steel G3Si1
- Location of begginings and ends
- Project BUT King – paper + conference

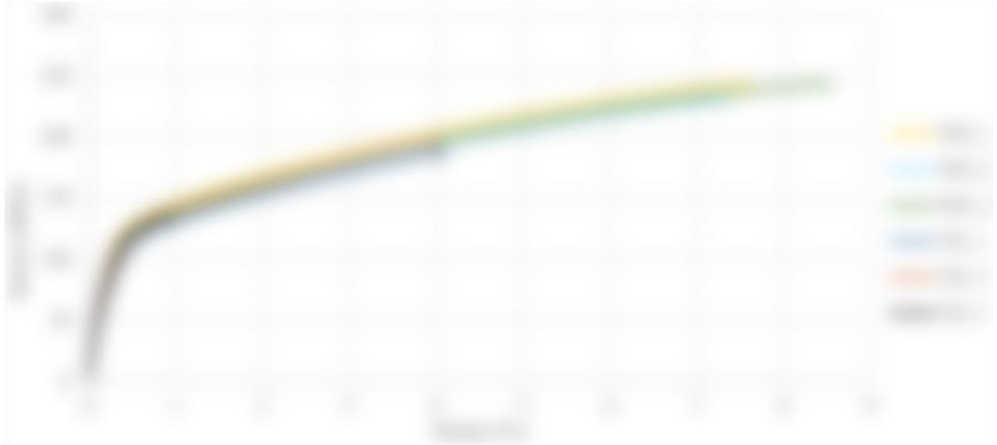


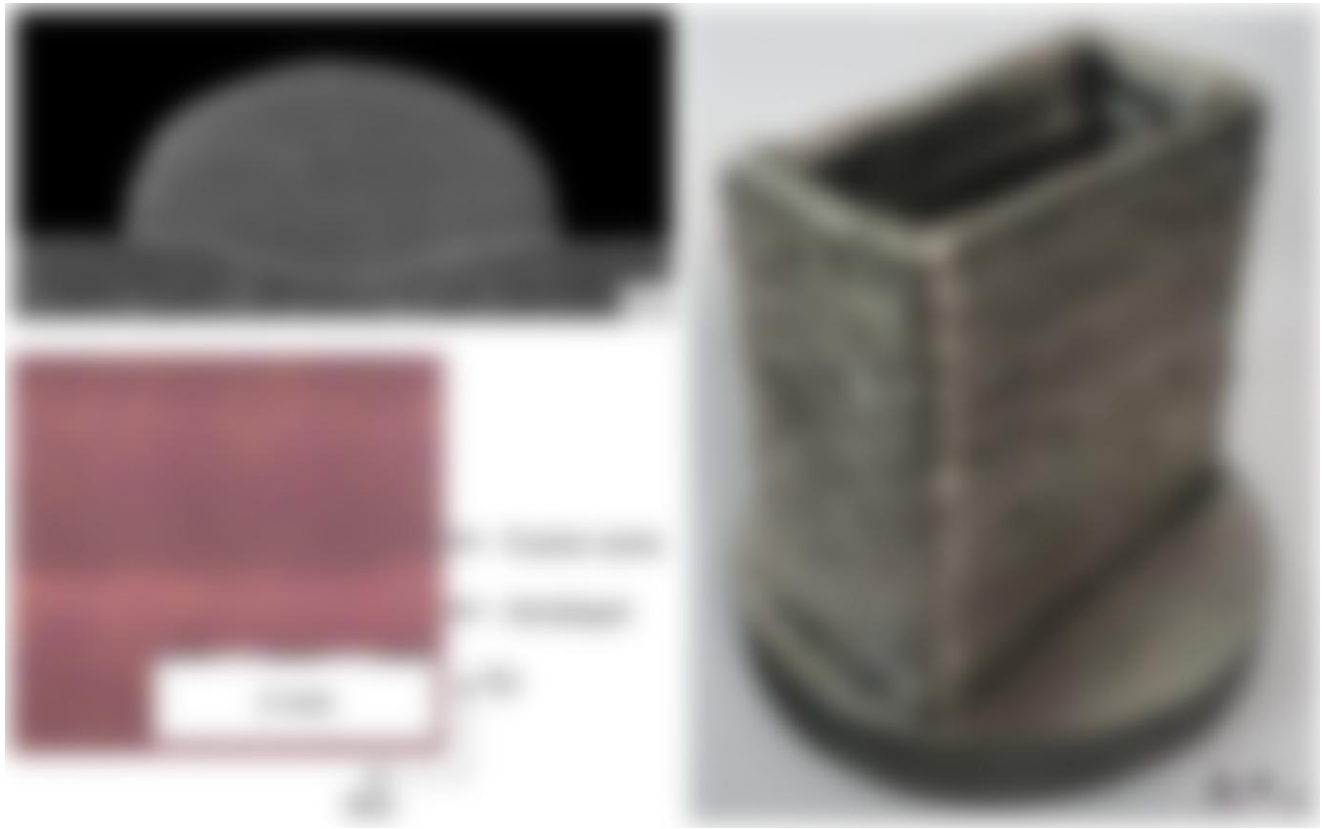


Research activities – WAAM of thin walls AZ61

CMT parameters for WAAM:

- Influence of CMT parameters on weld geometry
- Process parameter map, thin-walled parts
- Filler wire – magnezium alloy AZ61
- Diploma thesis Čeněk Šváb

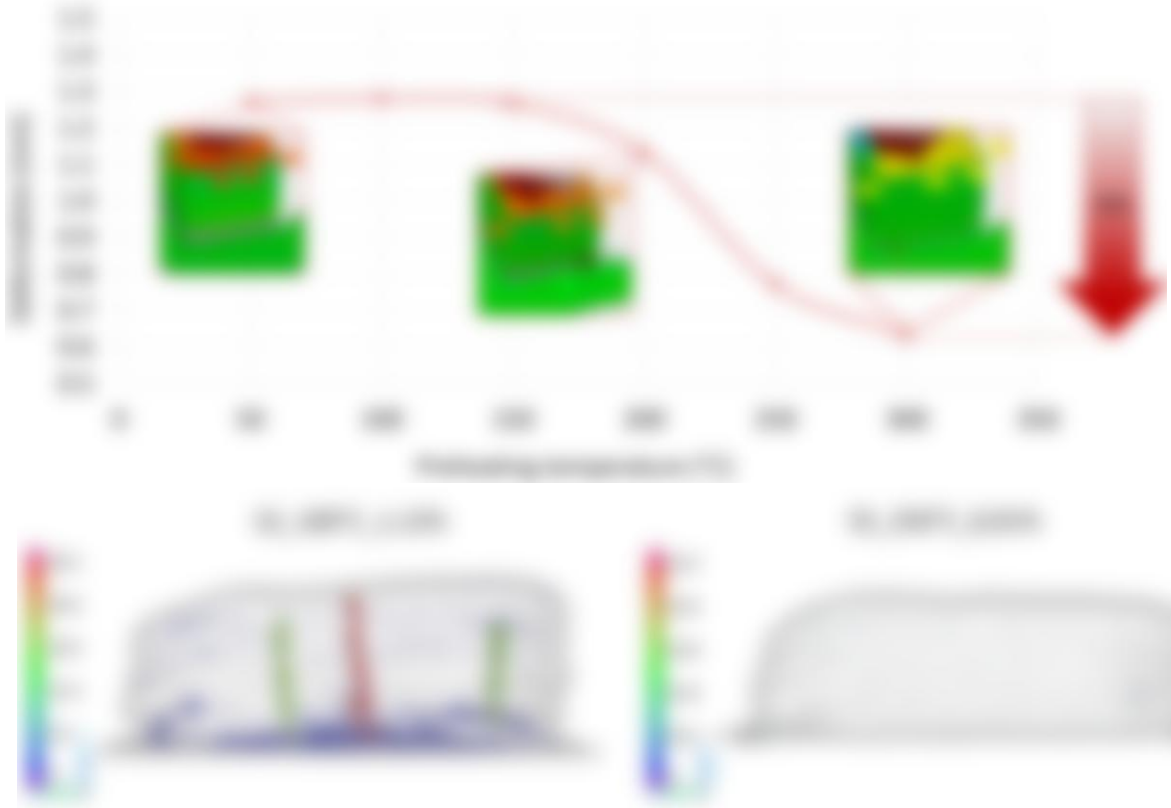


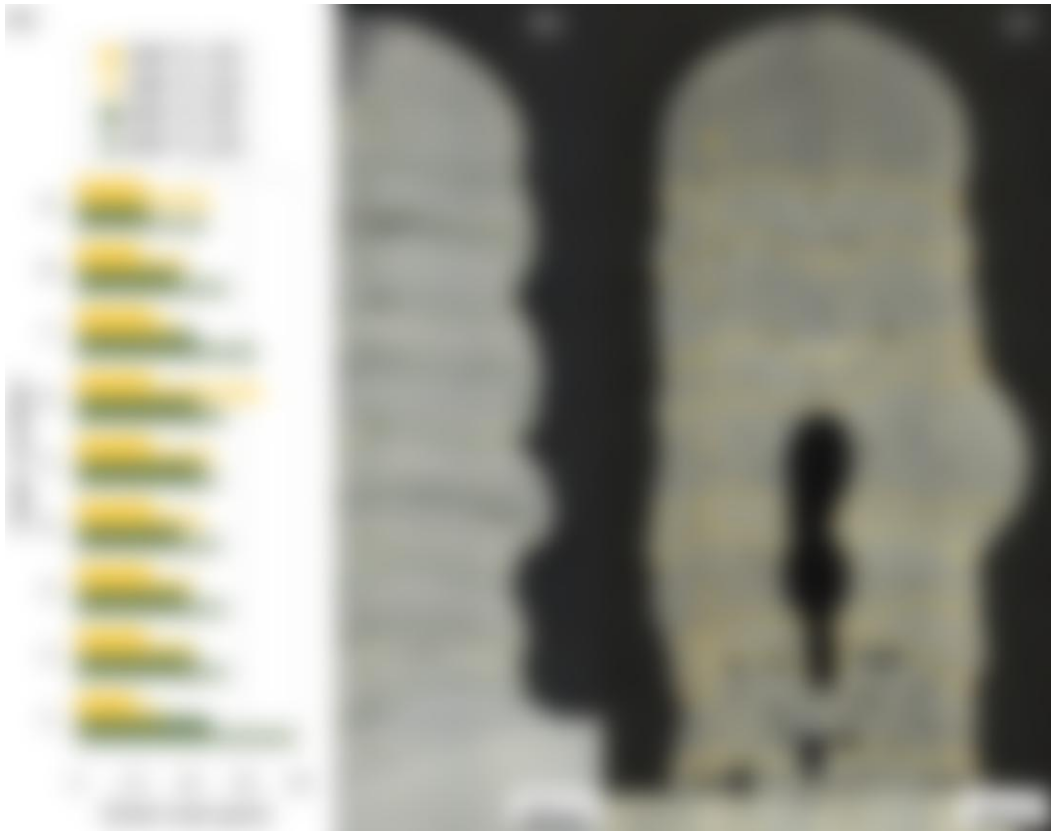


Research activities – Preheating AZ61

Influence of preheating:

- Weld geometry, residual stresses, microstructure and porosity





Research activities – Volumetric strategies AZ61

Preheating, volume part:

- Zig-Zag, S-pattern, Spiral - Thermal simulations, grain size distribution
- Diploma thesis Filip Seidler

Research activities – Publications and conferences

Publications:

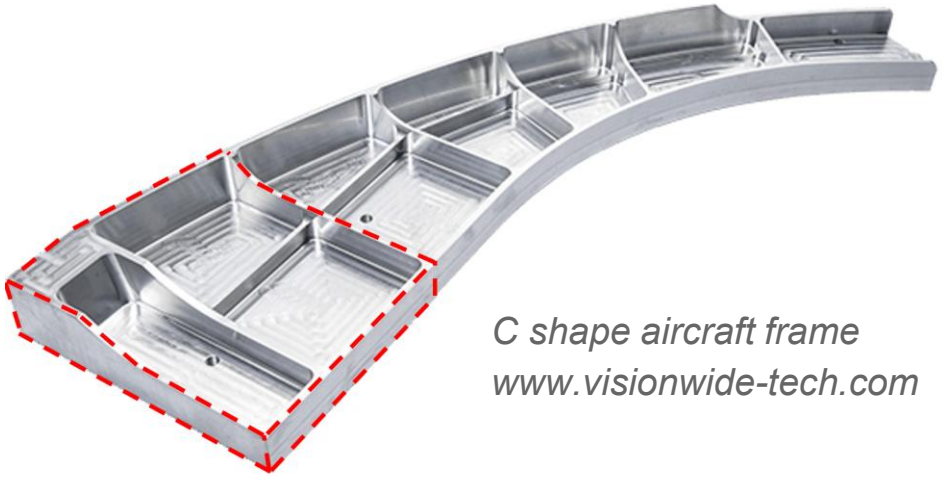
- CHOVANČÍKOVÁ, V.; GULAN, L.; KOREC, F.; NOVÁK, P; **SLAVÍČEK, J**.; ĎURIŠKA, M.; Comparison of methods of topological optimization of a selected module of a mobile working machine and assessment of the possibilities of production by additive technology, Advances in Science and Technology Research Journal, 2025 *(Politechnika Lubelska, Q3, PUBLISHED)*
- **SLAVÍČEK, J**.; FRANKE, J.; JAROŠ, J.; KOUTNÝ, D.; Strategies for Wire Arc Additive Manufacturing of thin walls and overhangs, Journal of Mechanical Science and Technology, 2023 (Springer, Q3, PUBLISHED)
- **SLAVÍČEK, J**.; ŠVÁB, Č.; GNEIGER, S.; HURNÍK, J.; PROCHÁZKA, P.; KOUTNÝ, D.; Wire-arc directed energy deposition of AZ61 magnesium alloy fabricated by cold metal transfer: Processing, microstructure, and mechanical properties, Scientific Reports *(Nature Portfolio, Q1, MAJOR REVISION)*
- **SLAVÍČEK, J**.; ZEMAN, S.; HORYNOVÁ, M.; SENCK, S.; KOUTNÝ, D.; Optimisation of preheating and interpass temperature in WADED magnesium alloy AZ61: A comparative study on microstructure, residual stresses, and internal defects , Scientific Reports *(Q1, REJECTED → Q2)*
- SEIDLER, F.; **SLAVÍČEK, J**.; KOUTNÝ, D.; Influence of deposition strategy on the microstructure of volumetric WADED-fabricated AZ61 magnesium alloy components, Additive manufacturing letters *(Elsevier, Q2, SENT)*

Conferences:

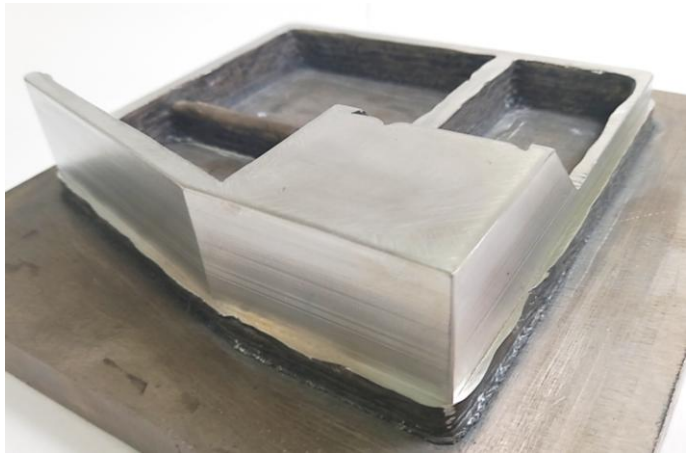
- Strategy for wire arc additive manufacturing of thin walls - Reliability and Design of Additively Manufactured Materials (Belgrade, Serbia, 2022)
- Process development for thin-walled AZ61 components produced by WADED - MEBioSys conference - poster session (Brno, Czech Republic, 2025)

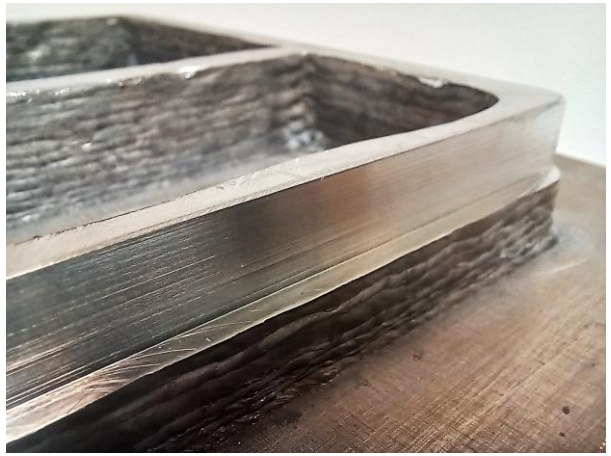
Research activities – summary

Possibility to manufacture magnesium alloy components:



C shape aircraft frame
www.visionwide-tech.com



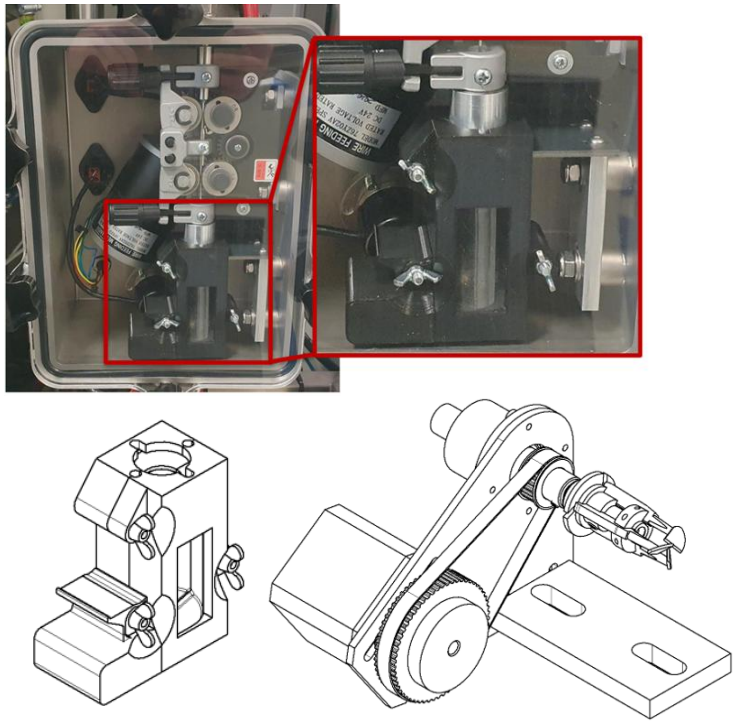


My project applications:

- VUT King – 2021 – Development of a system for robotic 3D printing of complex concrete structures
- VUT King – 2022 – The strategy for wire arc additive manufacturing of overhangs
- TAČR SIGMA – 2023 – Výrobní systém pro robotickou aditivní výrobu kovových materiálů
- TAČR SIGMA – 2024 – Výrobní́ systém pro robotickou aditivní́ výrobu obtížně zpracovatelných kovových materiálů
- GAČR Restart – 2025 – Influence of WAAM process parameters on microstructure.. (Miroslava Horynová)

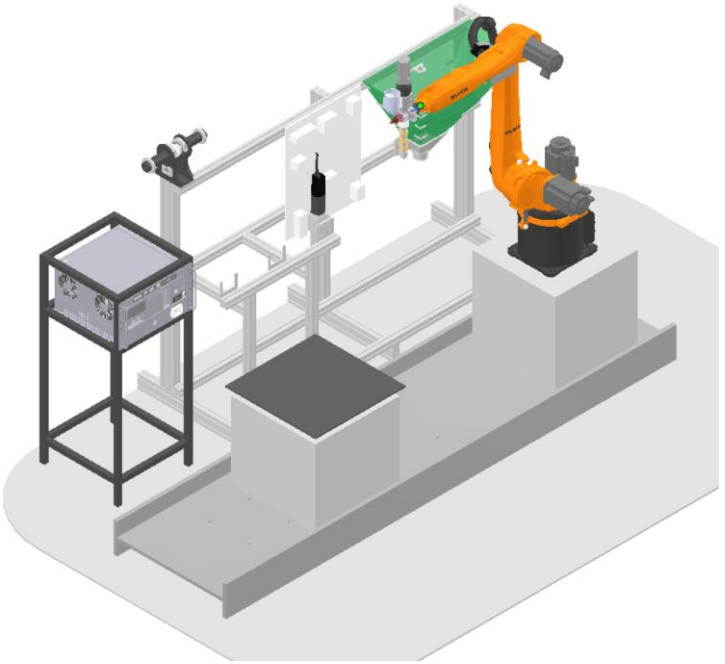
Research activities – other projects

- 2020 – 2023, ReMaP, ATCZ229, Research of Magnesium Alloys for Manufacturing of Structural and Biodegradable Parts

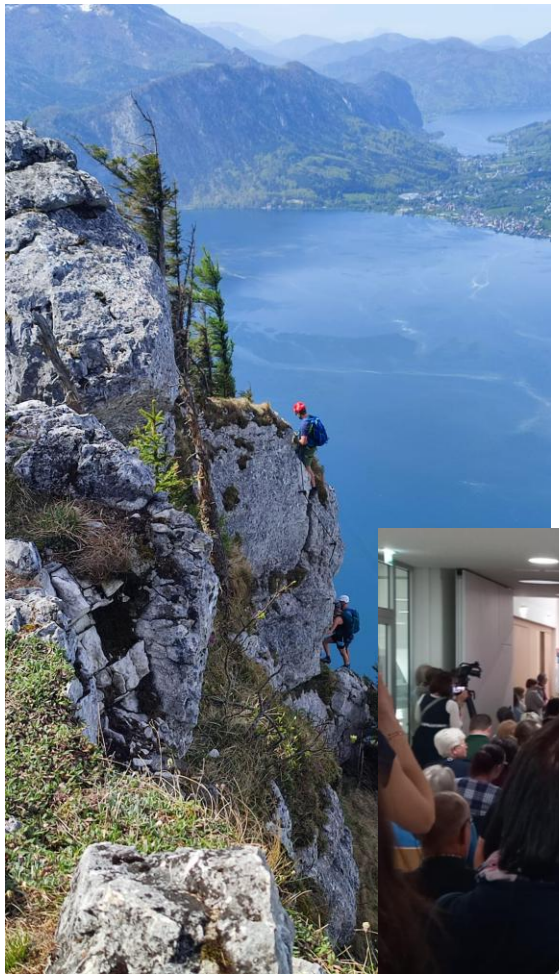


- 2021 – 2023, OP PIK - Aplikace, CZ.01.1.02/0.0/0.0/21_374/0026857 Increasing the shear and flexural strength of composite profiles by using 3D elements for guiding and shaping the mats

- 2023 – so far, FW09020130, Robotic cell for hybrid production in Industry 4.0



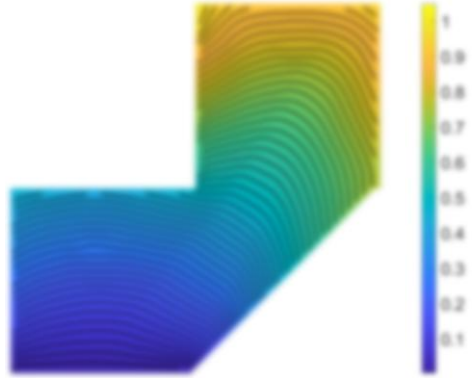
International cooperation – Wels Internship 2024

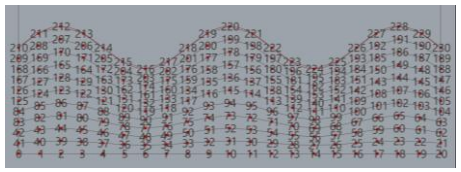


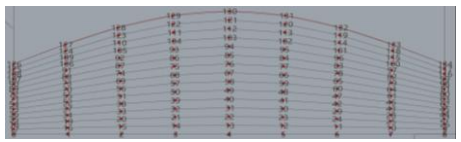
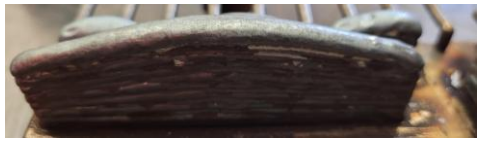
International cooperation – TU Delft, STU Bratislava

TU Delft

- Space-time topology optimization method to concurrently optimize the fabrication sequences
- SIM-AM 2025, Italy





STU Bratislava

- Topological optimization of a selected module of a mobile working machine


Teaching activities

Teaching activities:

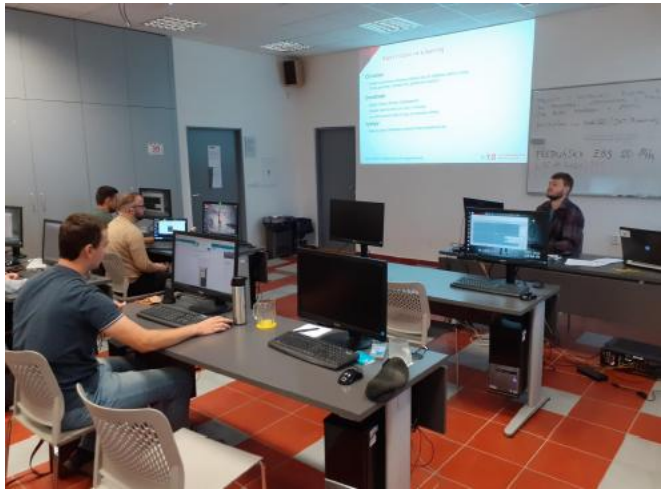
- 3CD, 4KC, ZAT
- DiSTT member - Metal printing workshop
  - StrojLAB challenge

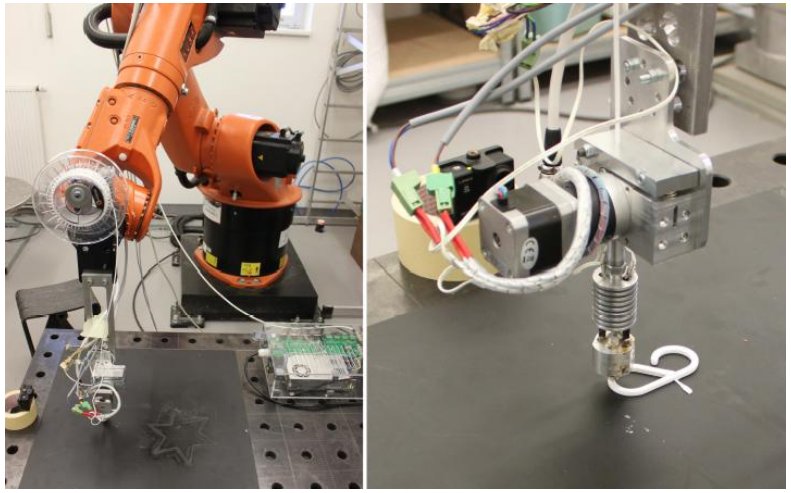
Bachelor's thesis:

- Filler wire cleaning – Filip Seidler ✓
- 3D printed fixtures – Jan Gregora ✓
- Bee frame wiring – Miroslav Běhávka

Master's thesis:

- CMT parameters AZ61 – Čeněk Šváb ✓
- Preheating table – Stanislav Zeman ✓
- Volumetric strategies – Filip Seidler ✓
- Lattice structures – Martin Kouba





Future plans

Papers publishing

- IF 2/3 published THEN
- WAAM of thin walls AZ61
- Effect of preheating AZ61
- Volumetric strategies AZ61

Submission of dissertation

- IF January 2026 THEN

PhD. Defense

- Spring – summer 2026

Internship

- TU Delft – Jun Wu

Teaching

- Bachelor’s thesis and master’s thesis

THANK YOU FOR YOUR ATTENTION

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