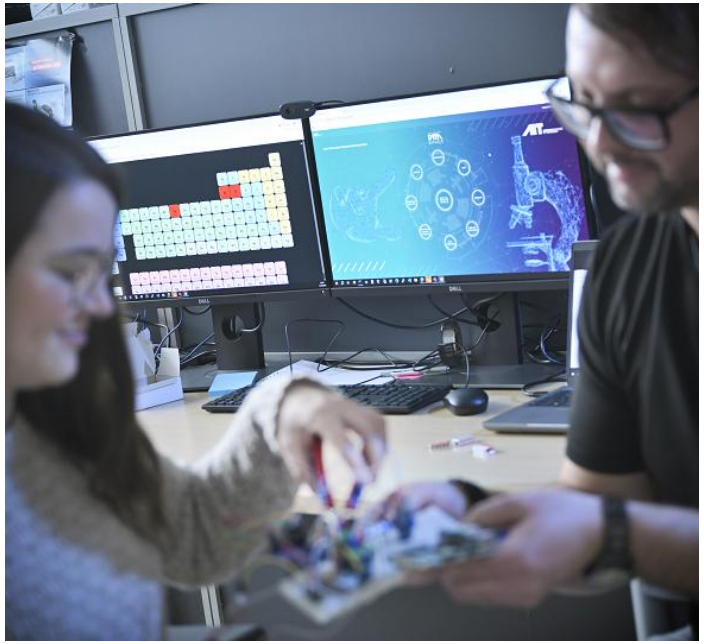
DI Dr.-mont. Carina Schlögl, MBA



12.11.2026, Wien

Digitalization in Production

A3PS – EcoMobility 2026

AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

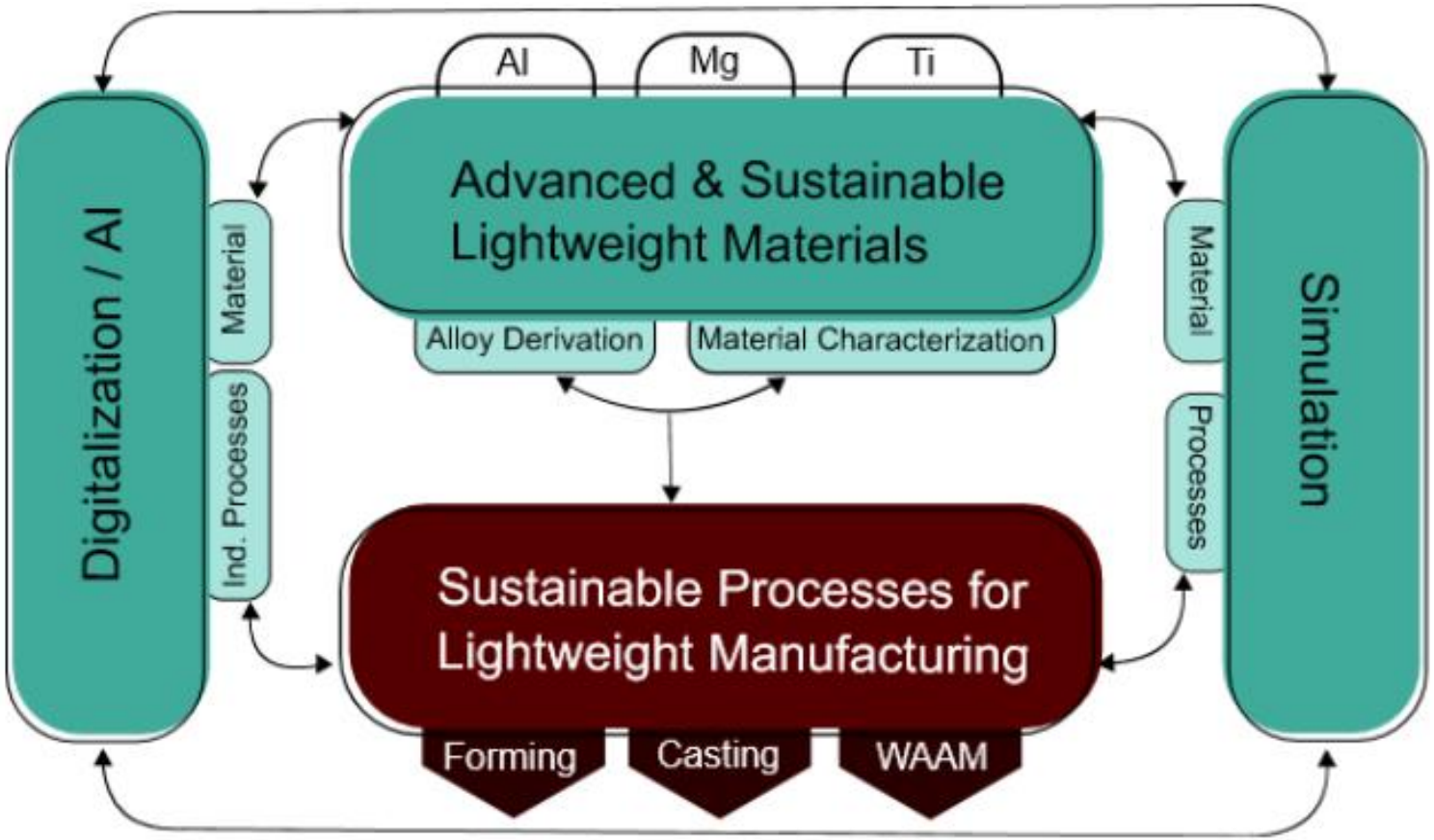
LKR

Leichtmetallkompetenzzentrum Ranshofen GmbH



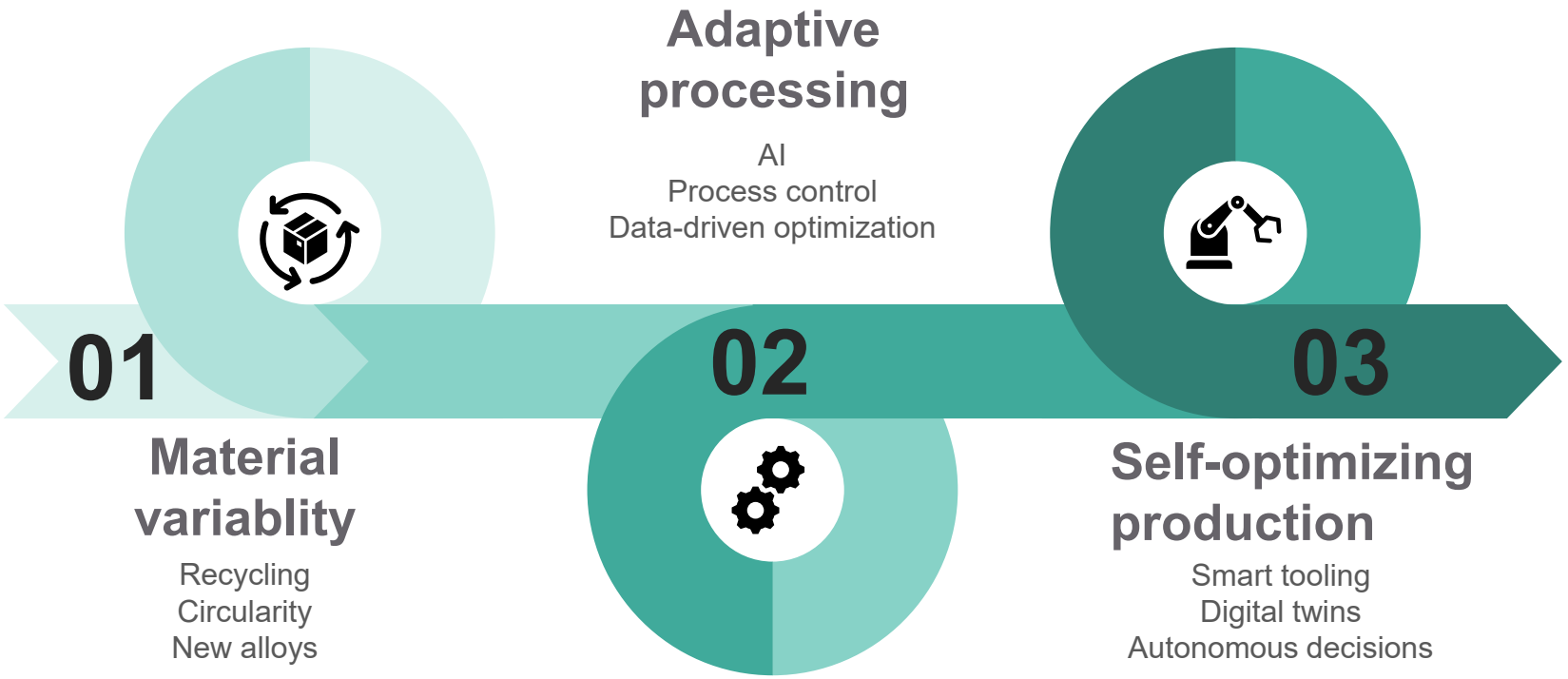
AUSTRIAN INSTITUTE OF TECHNOLOGY





- Casting Processes for High-Performance Materials
- Advanced Forming Processes and Components
- Wire-based Additive Manufacturing
- Modelling of Materials, Processes and Components

FROM MATERIALS TO SELF-OPTIMIZING PROCESSES



(Light) Metals + Advanced process control + AI = Resource-efficient and Resilient Production

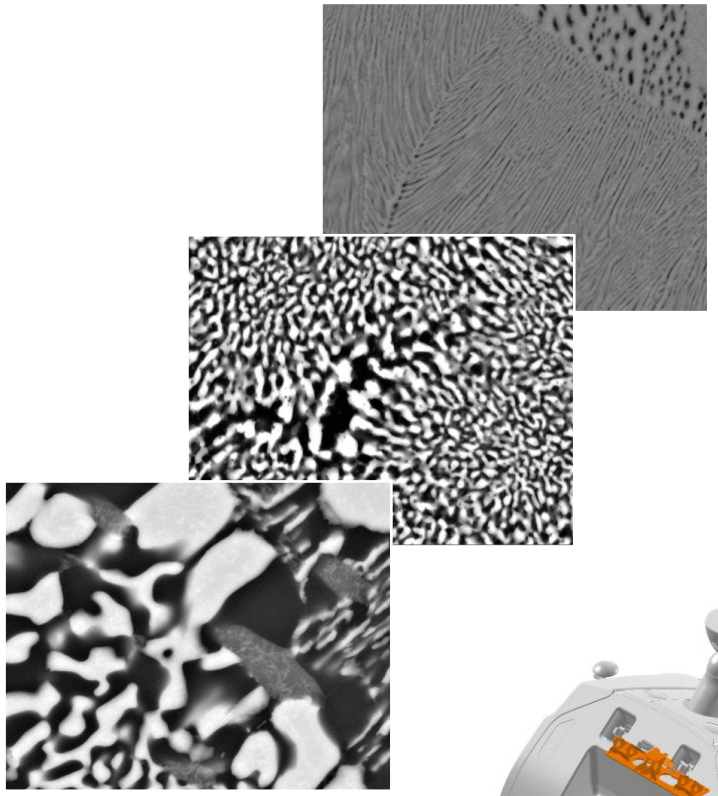
MATERIAL VARIABILITY & CIRCULAR ECONOMY

01

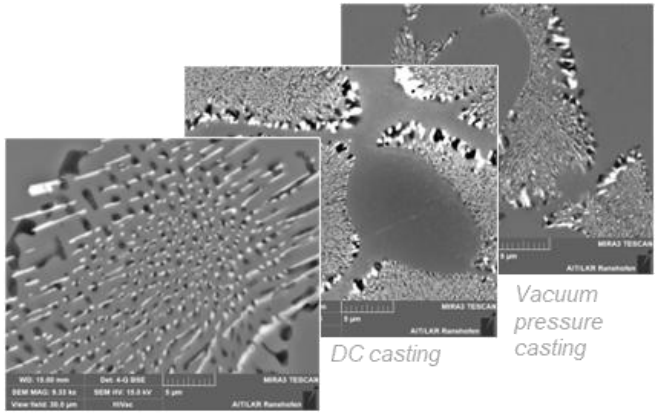
Material variablity

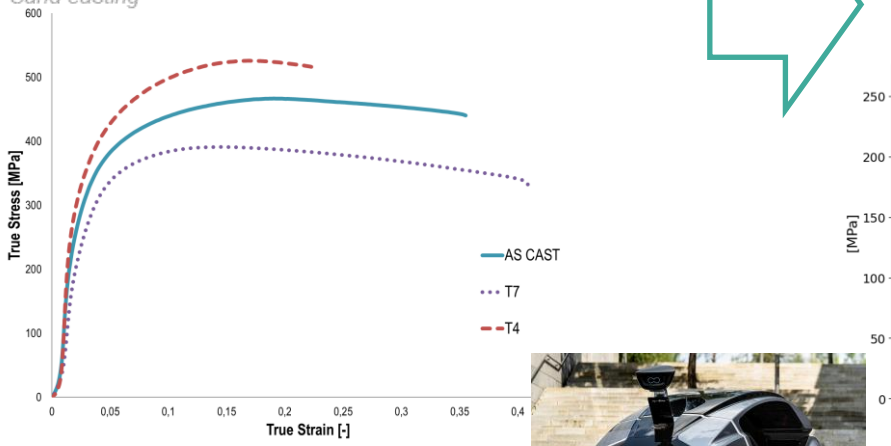


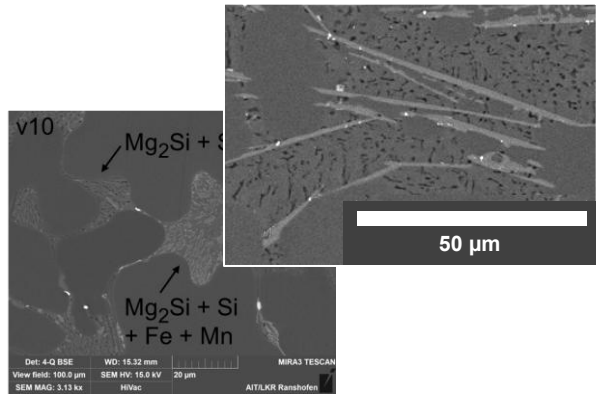
HIGHLIGHTS AUS DER LEGIERUNGSENTWICKLUNG

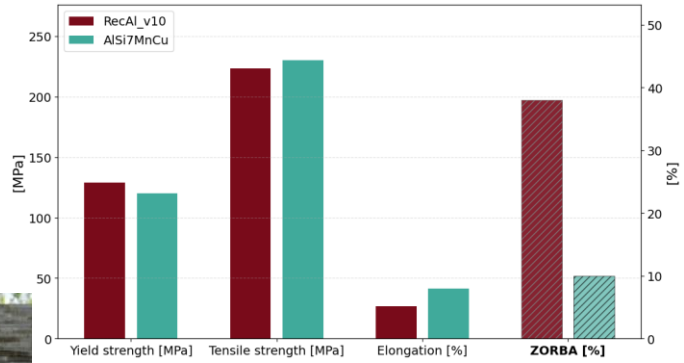








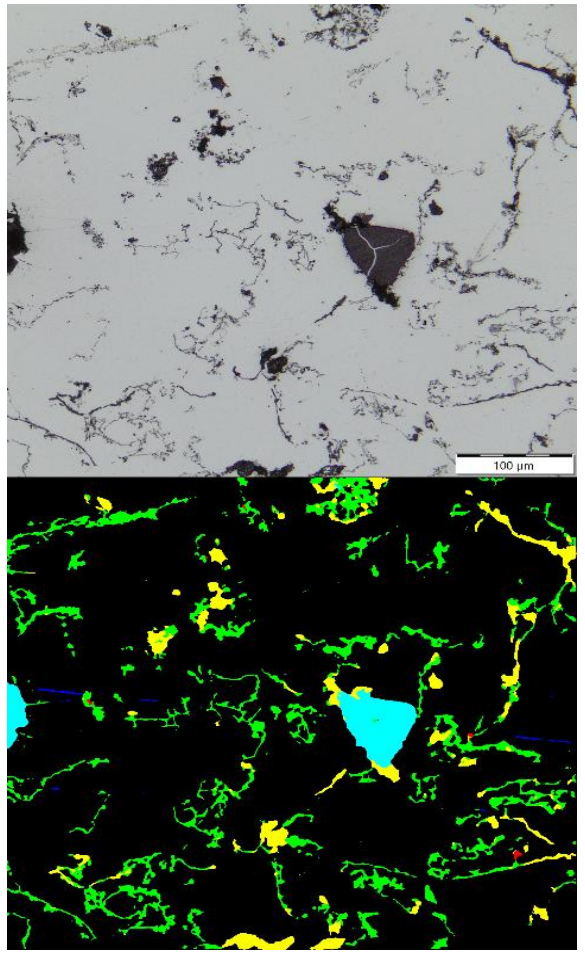






Screening & DOE

High-throughput material synthesis



High-throughput material charakteri.

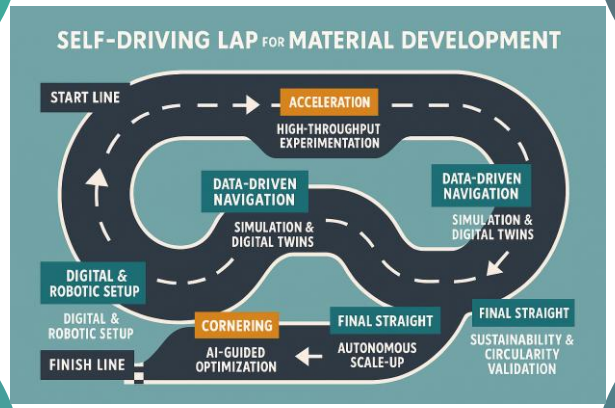


Data-management & AI

Closed Loop-Optimierung



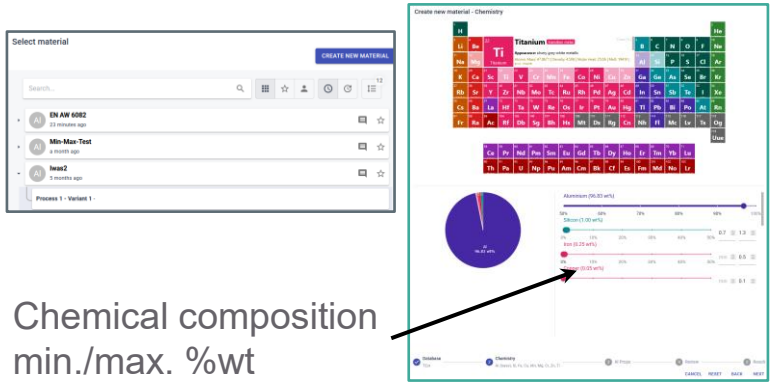
Upscaling/ Validation



CALPHAD „Pipeline“ – Material Screening

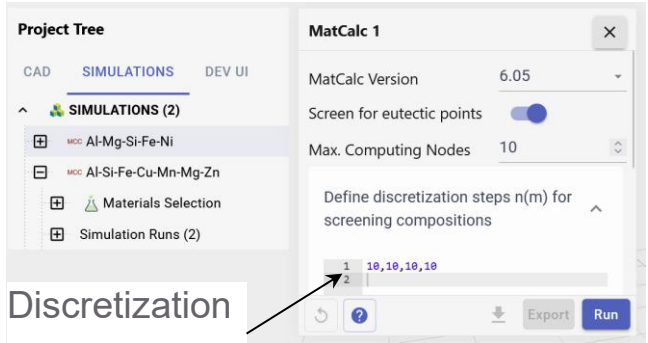
User Workflow in PhysicsWorks

1. Select a pre-defined Material



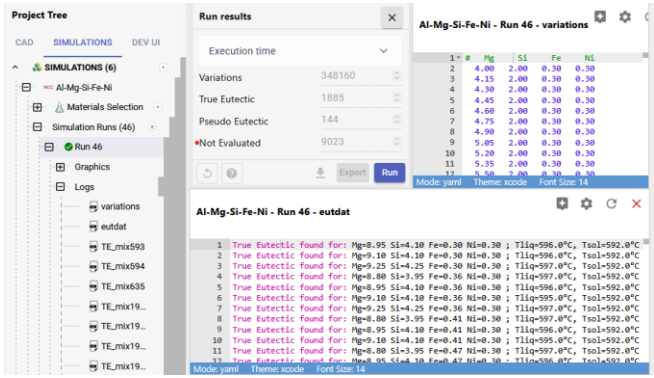
Chemical composition
min./max. %wt

2. Set screening details



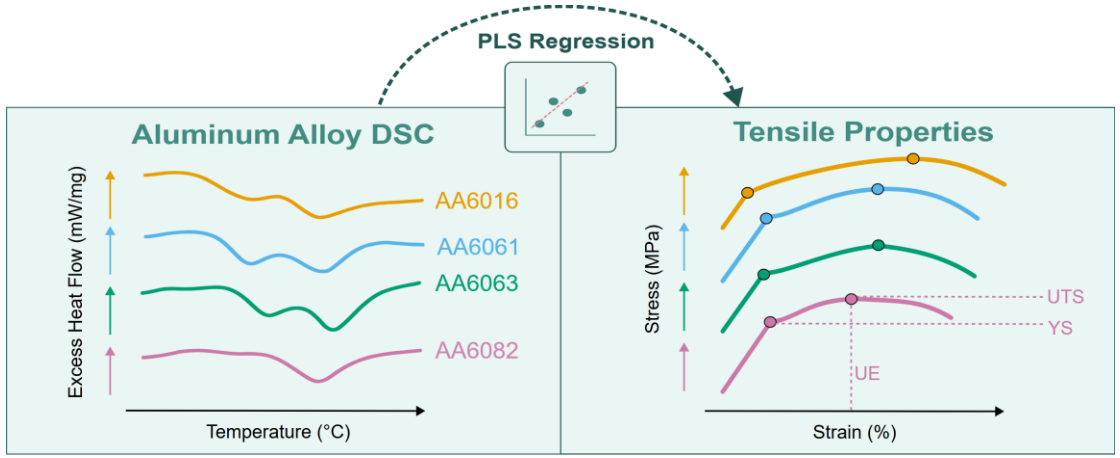
Discretization
sample space

3. Analyse Output

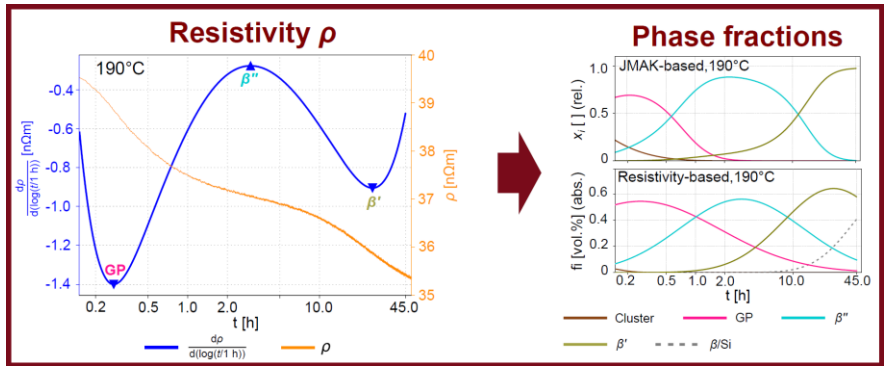


KPI: Screening of 200.000 cases within a hours (depending on the hardware used)

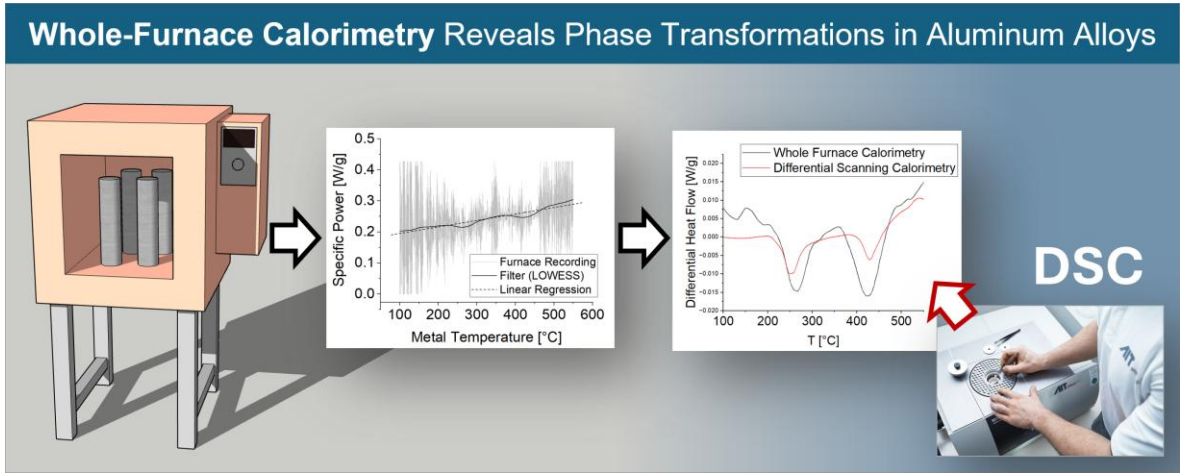
High Throughput Analysis



Pichlmann et al., 2026: accepted at *Materials & Design*, preprint at https://arxiv.org/abs/2603.19905



Hohm, …, Pogatscher, Österreicher: 2026: accepted at *Scripta Materialia*, preprint at http://dx.doi.org/10.2139/



Österreicher & Arnoldt, 2025: https://doi.org/10.1016/j.tca.2025.180113

Picture right: Ebner



KPI: The heat treatment process itself becomes a tool for material characterization and data generation, enabling advanced process control.

LKR DATA-SPACE







MATERIAL VARIABILITY & CIRCULAR ECONOMY

01

Material variablity

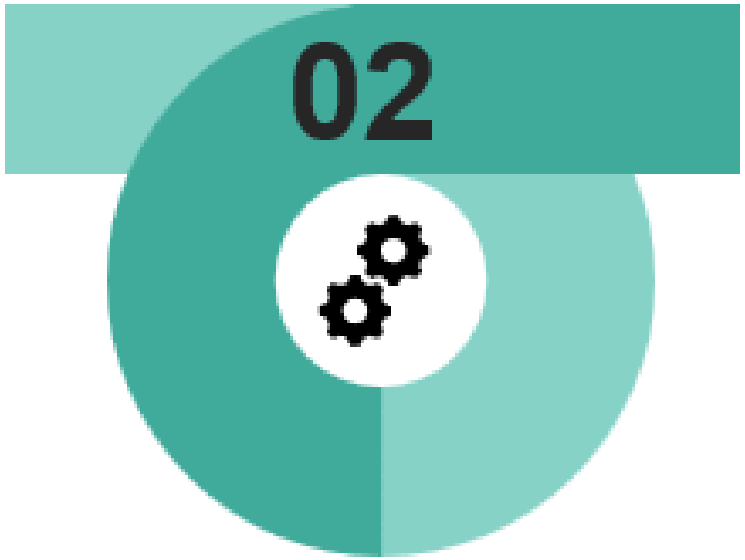


INTELLIGENT MANUFACTURING



Adaptive processing

AI
Process control
Data-driven optimization



DATA BRATA





DATA BRATA

DATA BRATA | Boxed | Reconfigurable | Adaptive | Transportable | Analysis









Fotos : Autarker, mobiler Prüfstand im „Feld“.

DATA ANALYSIS

- **Data Audit:** Structuring measurement data and assessing process stability
- **Quality Analysis:** Identifying key factors (e.g., coating) driving process variability
- **Defect Analysis:** Correlating and identifying different defect signature
- **Predictive Models:** Automated defect detection using machine learning

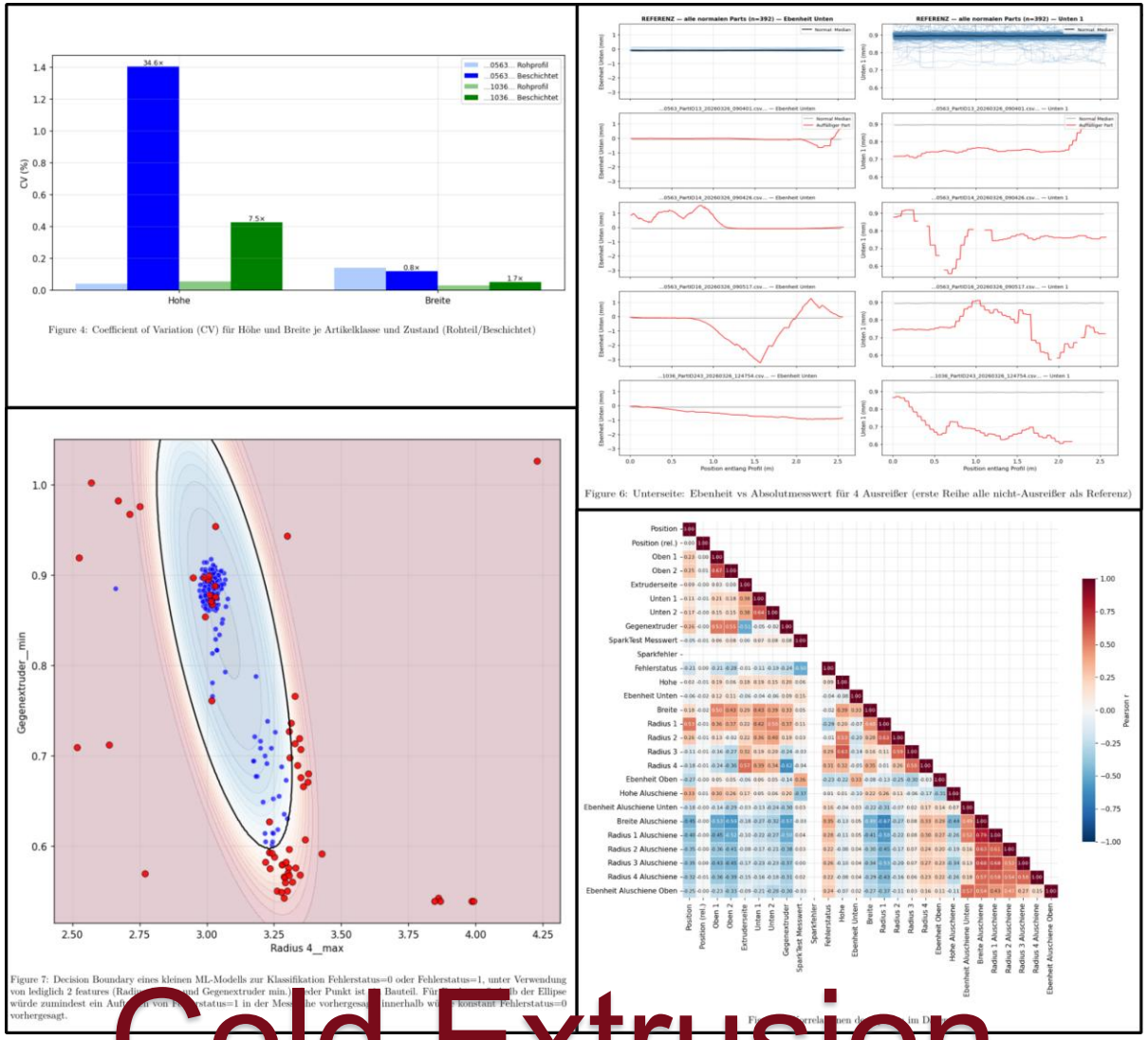


Figure 4: Coefficient of Variation (CV) für Höhe und Breite je Artikelklasse und Zustand (Rohteil/Beschichtet)

Figure 6: Unterseite: Ebenheit vs Absolutmesswert für 4 Ausreißer (erste Reihe alle nicht-Ausreißer als Referenz)

Figure 7: Decision Boundary eines kleinen ML-Modells zur Klassifikation Fehlerstatus=0 oder Fehlerstatus=1, unter Verwendung von lediglich 2 features (Radi nd Gegenextruder min.) der Punkt ist Bauteil. Für b der Ellipse würde zumindest ein Auf n von F tatus=1 in der Mess he vorhergesa innerhalb w konstant Fehlerstatus=0 vorhergesagt.

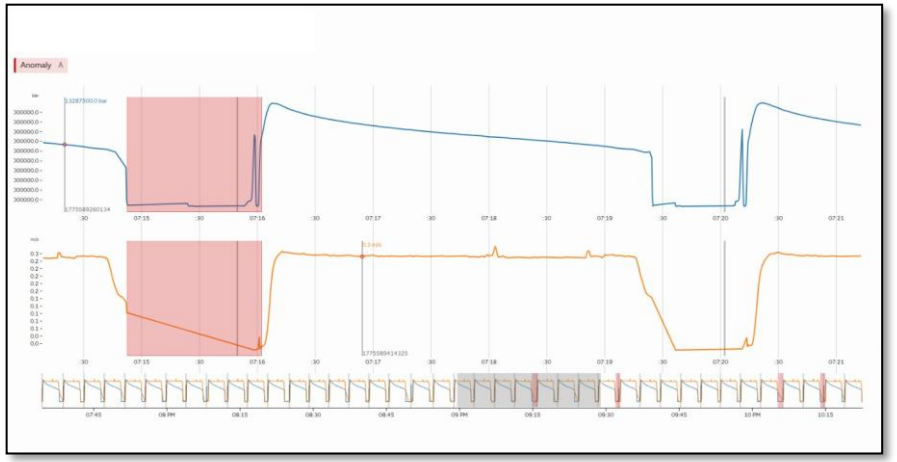
Cold Extrusion

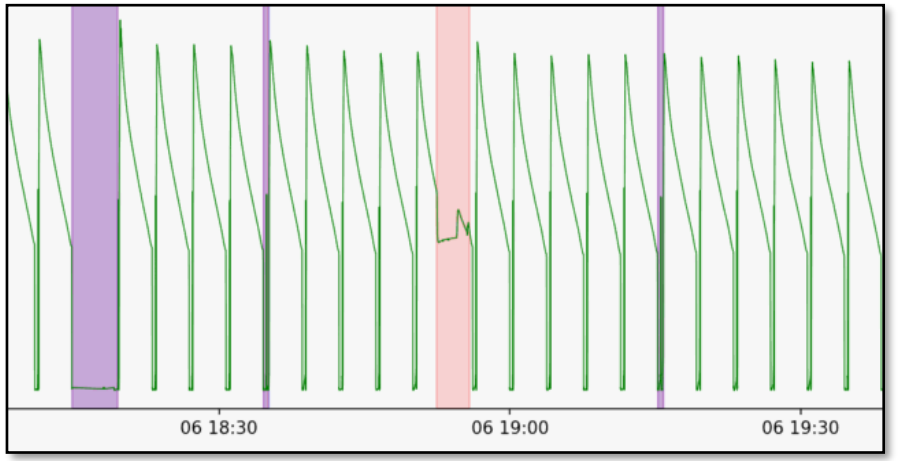
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DATA ANALYSIS

- **Signal Preprocessing:** Prepare time-series data for AI models
- **Pattern Recognition:** Learn normal process behavior
- **Defect Detection:** Identify anomalies automatically
- **Localization:** Pinpoint disturbances within the process timeline

KPI: AI-based anomaly detection and operator assistance



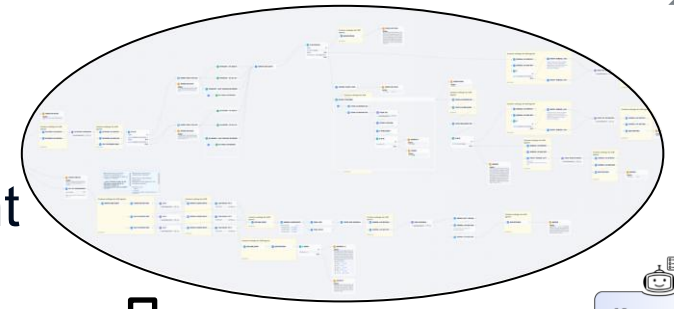


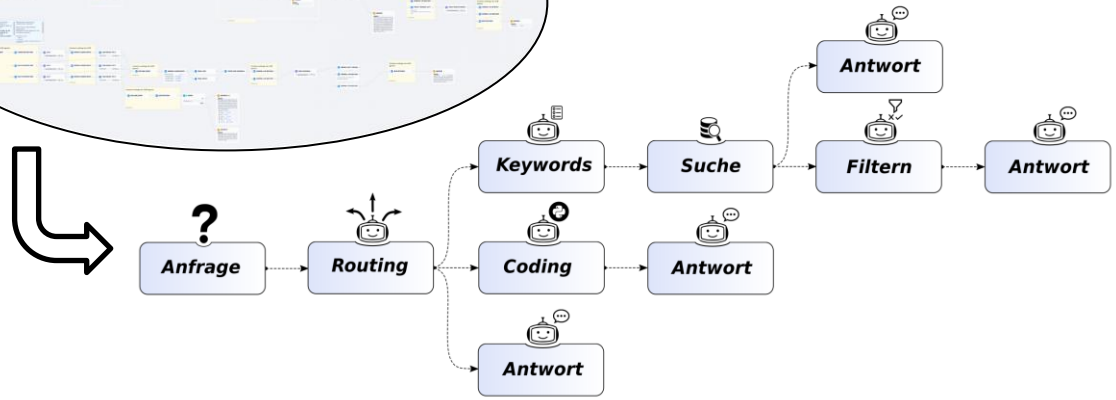
Extrusion

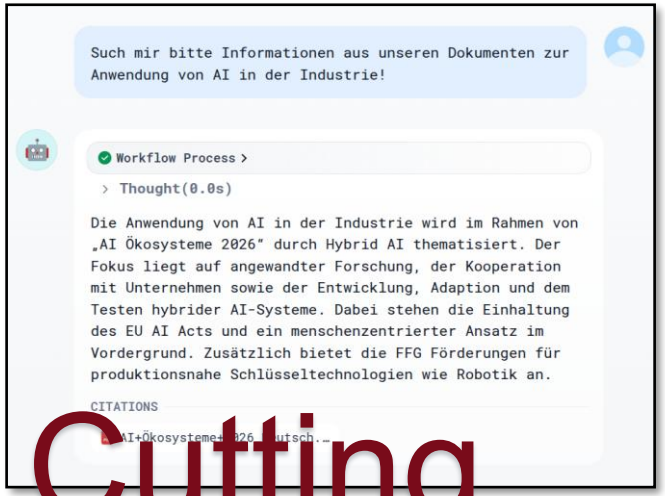
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DATA ANALYSIS

- **RAG Chatbot:** Internal knowledge assistant
- **Enterprise LLM:** Access to company documents
- **Local Deployment:** Full data sovereignty
- **Employee Enablement:** Search, onboarding, content support
- **Custom AI Workflows:** Tailored expert assistance







KPI: >80% retrieval accuracy for complex knowledge queries in the first response (scrap rate)

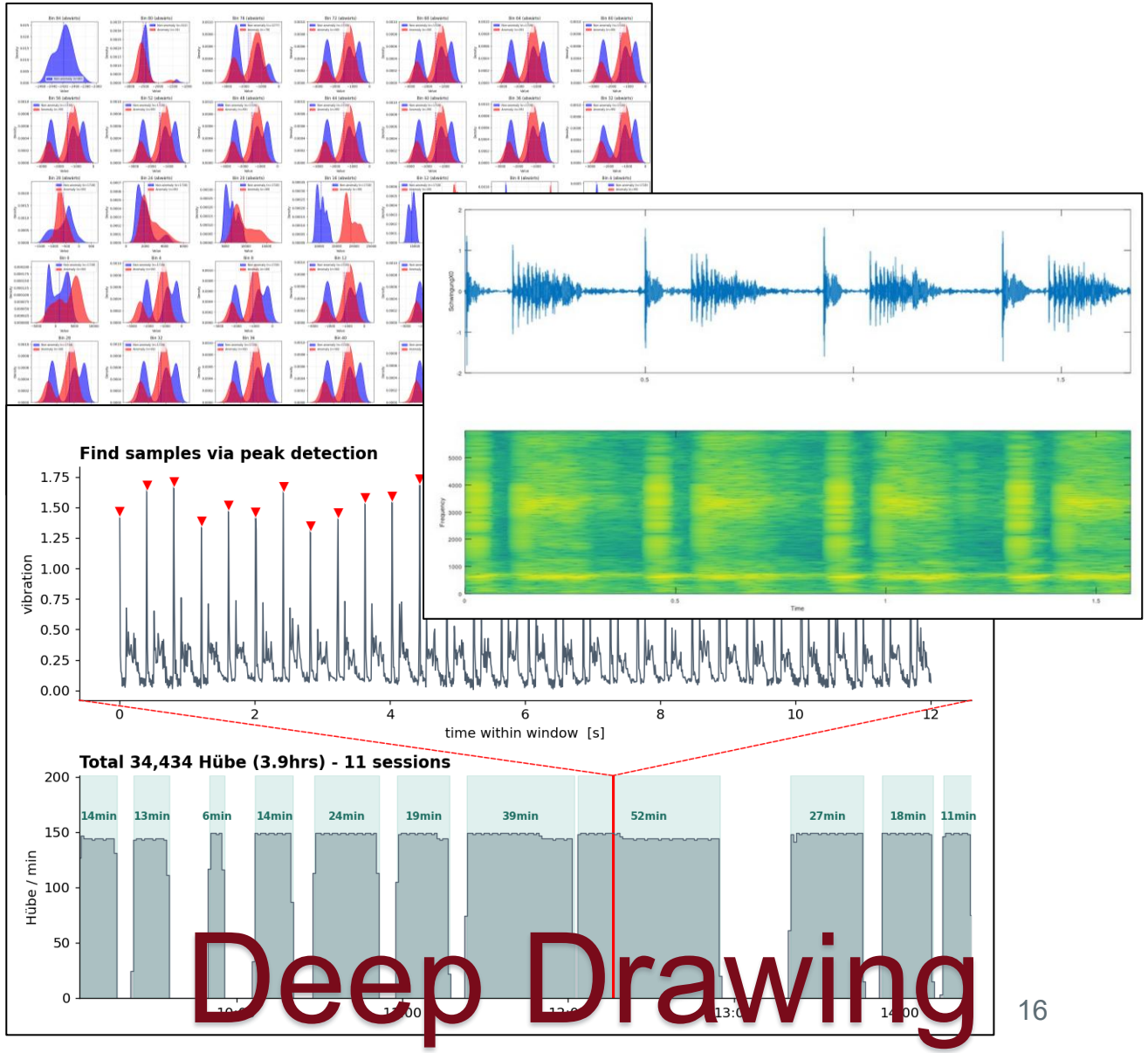
Cutting

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DATA ANALYSIS

- **Automated Detection:** Identifying process anomalies and defects to ensure process quality
- **Rapid Deployment:** Mobile sensor-based measurement system installed directly on-site
- **Validation Testing:** Targeted simulation of defects and process variations
- **Proof of Detectability:** Demonstrating detection of process deviations as a foundation for AI-driven monitoring

KPI: 34,434 press strokes acquired and analyzed at high frequency within 3.9 hours, enabling an expected scrap reduction of up to 20%



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ADAPTIVE PROCESSING

Turning Data into Action …



DIGITALIZATION IN PROCESS OPTIMIZATION

opt1mus Framework (Horizontal DCC demonstrator)

AUSTRIAN INSTITUTE OF TECHNOLOGY

opt1mus

- Geometry
- Alloy
- Quality

Customer Requirements

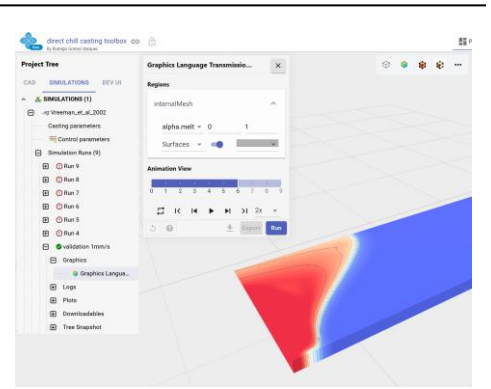
Modelling

- MatCalc
- CFD
- Machine Learning

- LCA / LCC
- Parameters
- Realtime Model

Advisory System

LKR CLUSTER PIPELINE

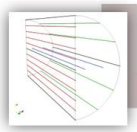


LKR EXPERT INTERFACE

PHYSICSWORKS

CFD

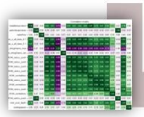
- Training: calibrate on trials data
- Generate [~1.5h]: Full 3D mesh (steady state)



reduce to 18 lines

ROM

- Training [min]: ~20 reduced CFD cases
- Generate [min]: 100 new

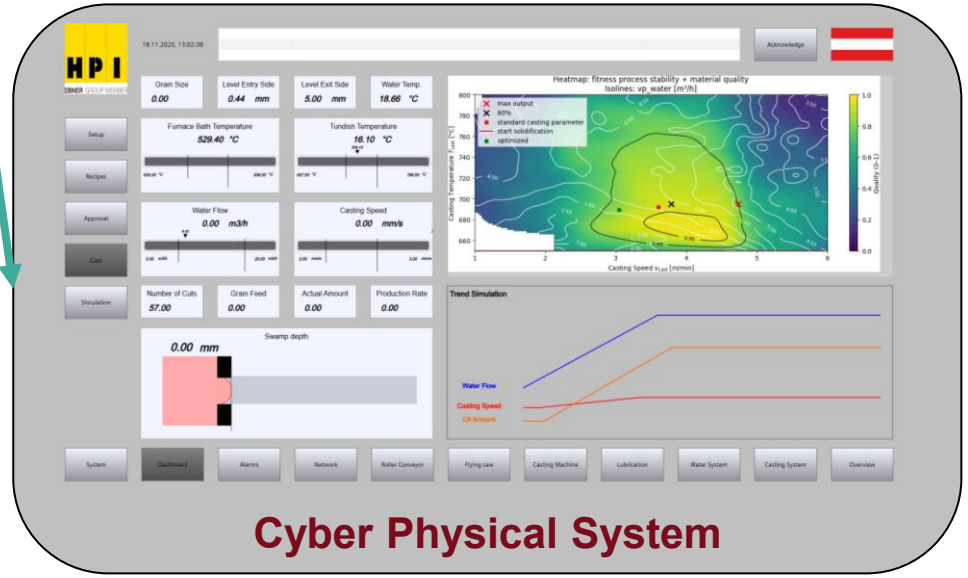


define relevant features

NN

- Training [~1h]: ~10k case features
- Generate [~ 6sec]: 2k cases for given constraints

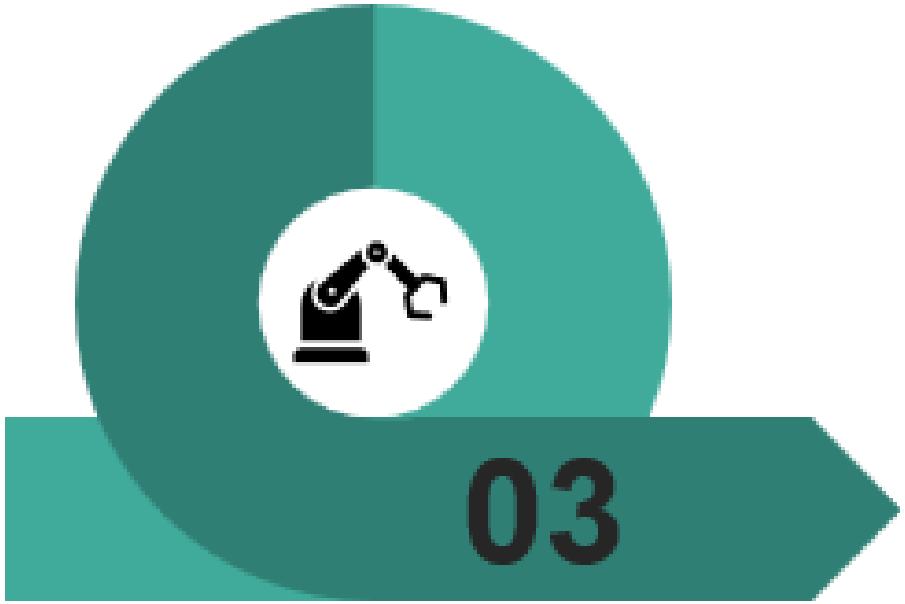
Predict suitable parameters / recipes under constraints!



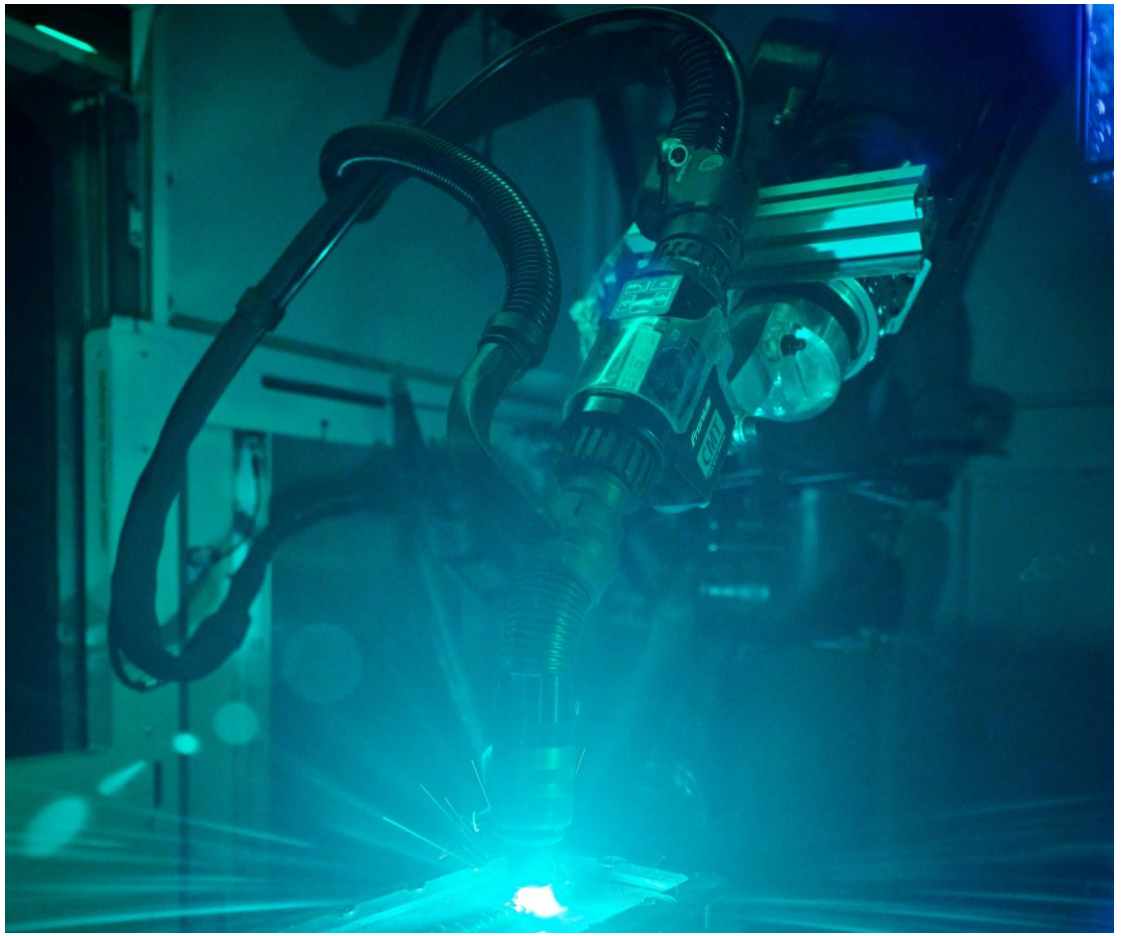
Cyber Physical System

ROM=Reduced Order Model

NN=Neural Network

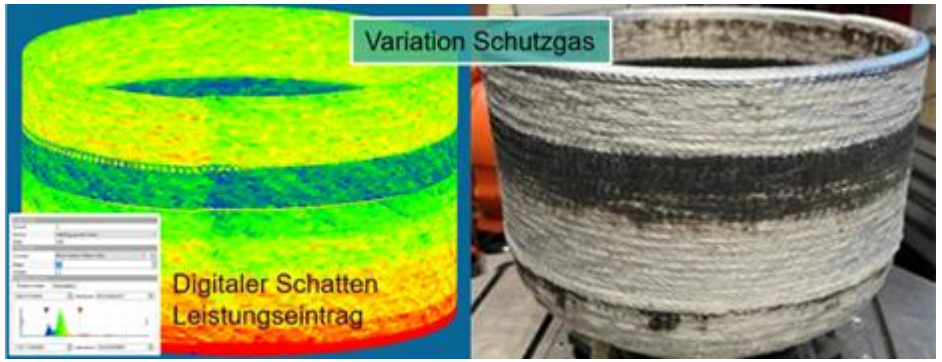


Self-optimizing production



TURNING DATA INTO ACTION

Online Digital Shadow of Robot Paths in WAM

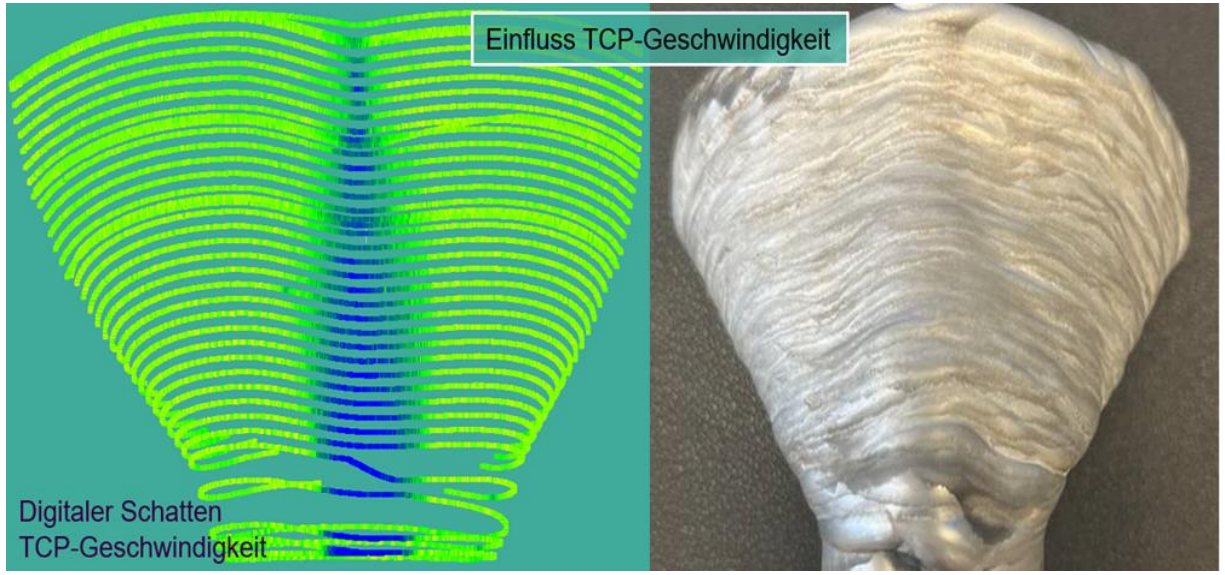


Data Preparation

- Sensor validation & calibration
- Physics-based feature engineering

Data Reduction

- Data aggregation
- **9 GB** raw data → **5 MB** point cloud per feature

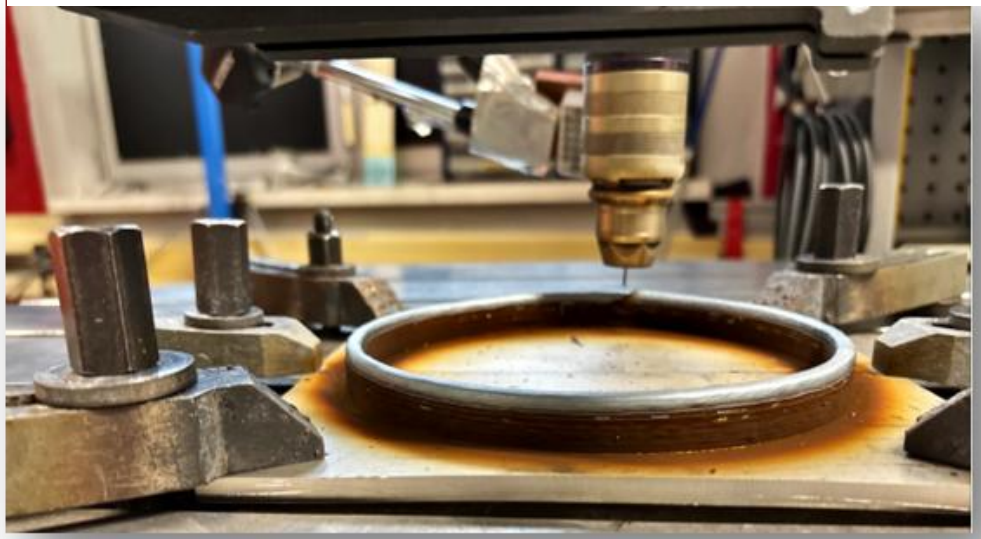


KPI: 9 GB → 5 MB, enabling major storage and cost savings

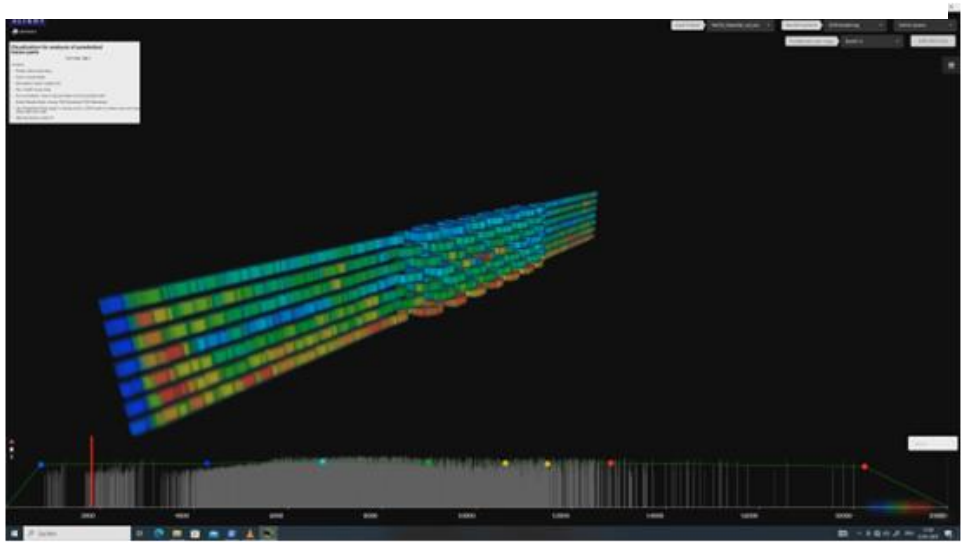
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TURNING DATA INTO ACTION)

- **Example: Closed-Loop Control of Actual Layer Height**
- **Example: Digital Shadow, Expert-in-the-Loop, XAI & Augmented AI**



Data produziert im COMET Projekt We3D gefördert durch die FFG



In Zusammenarbeit mit

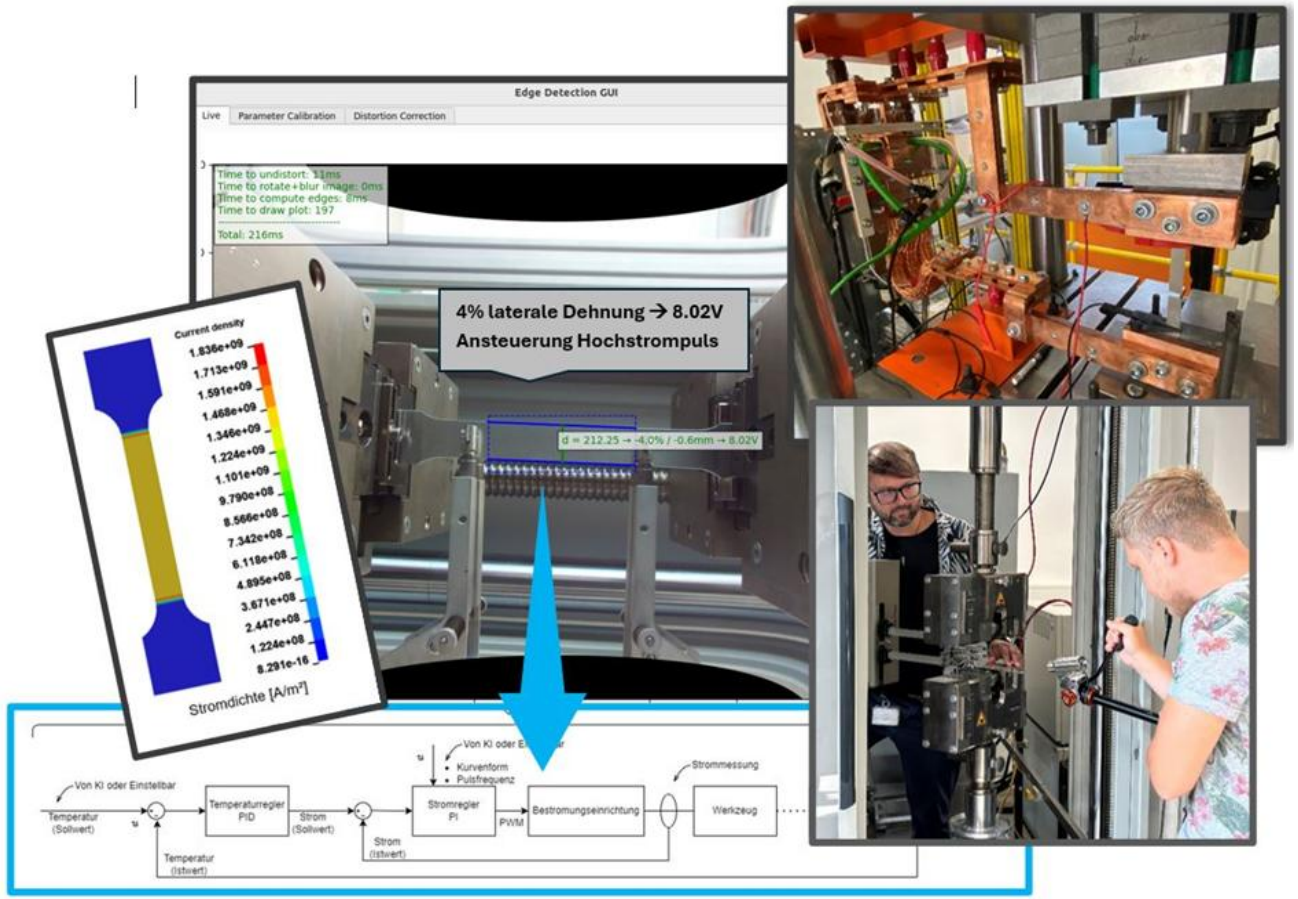
Aardworx GmbH

www.aardworx.com

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TURNING DATA INTO ACTION

- **Edge AI Vision System:** Real-time detection of sheet thinning
- **Adaptive Closed-Loop Control:** Current pulse regulation up to **40 kA**
- **Electroplasticity Control:** Targeted management of the electroplastic effect
- **Modular Vision Processing:** Calibration and live visualization
- **Low Latency:** System response below **30 ms**
- **Impact:** Higher precision and resource-efficient forming processes



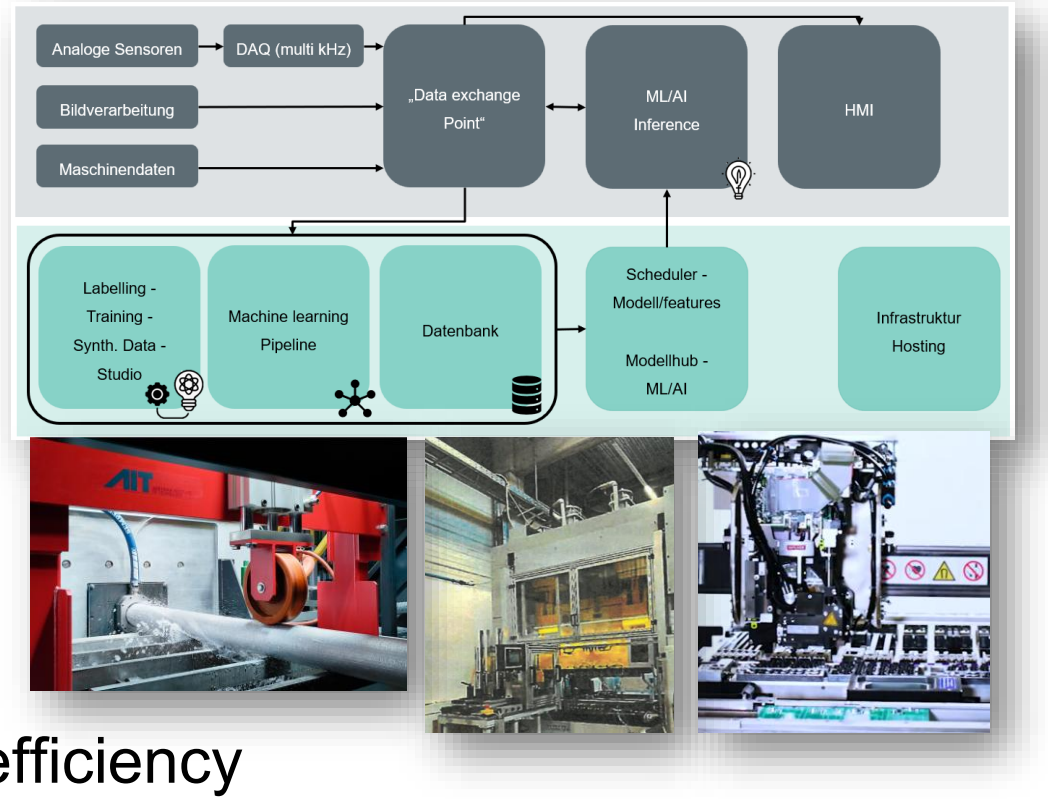
KPI: PoC demonstrated closed-loop control via real-time vision processing up to 40 kA with system latency < 30 ms

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AIPROCELL
AI DRIVEN PRODUCTION CELL

Democratizing AI for Manufacturing

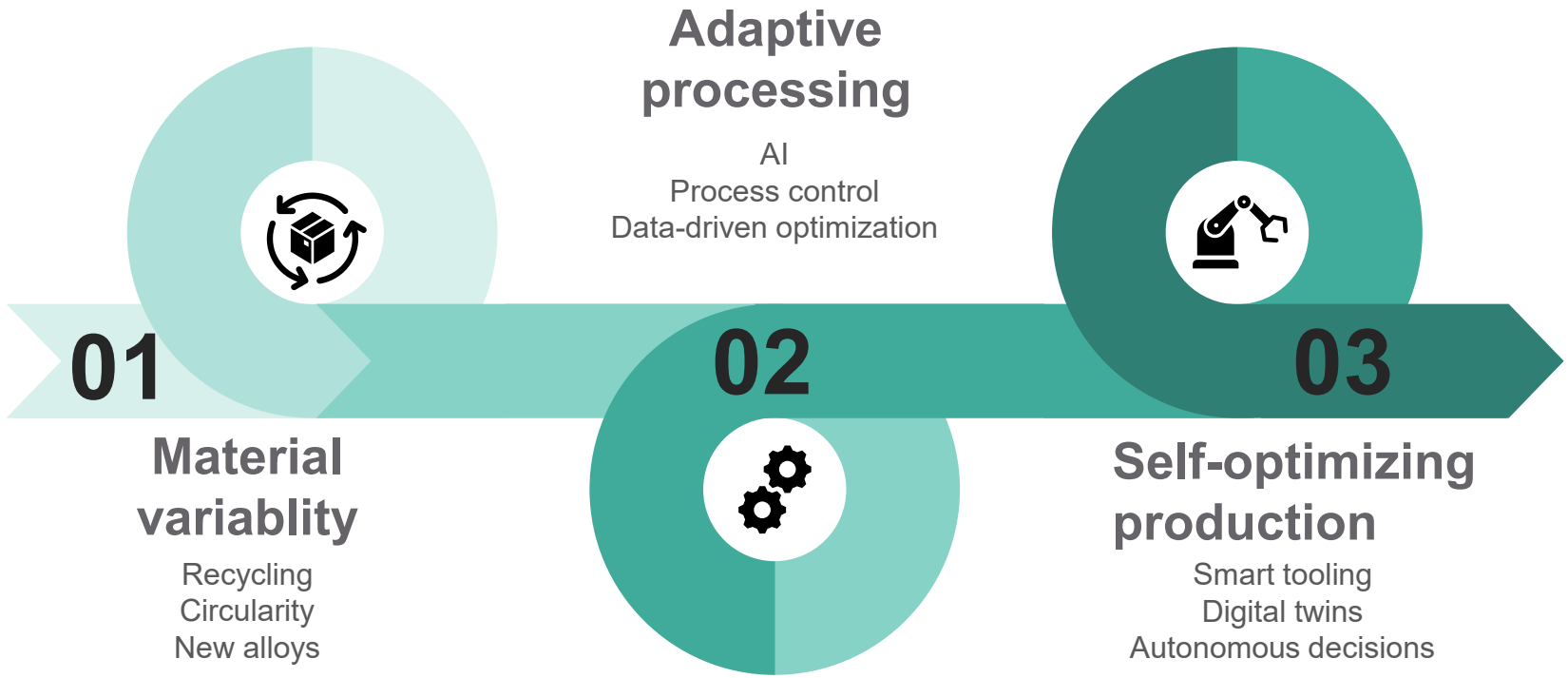
- **Edge-to-Cloud AI Platform**
  - Predictive Maintenance
  - Quality Inspection
  - Alarm Detection
- **Cross-Domain AI Learning**
  - Analytical & Generative AI



Impact: Increased resilience and resource efficiency

Applications: Pick-and-Place Systems • Deep Drawing • Continuous Casting

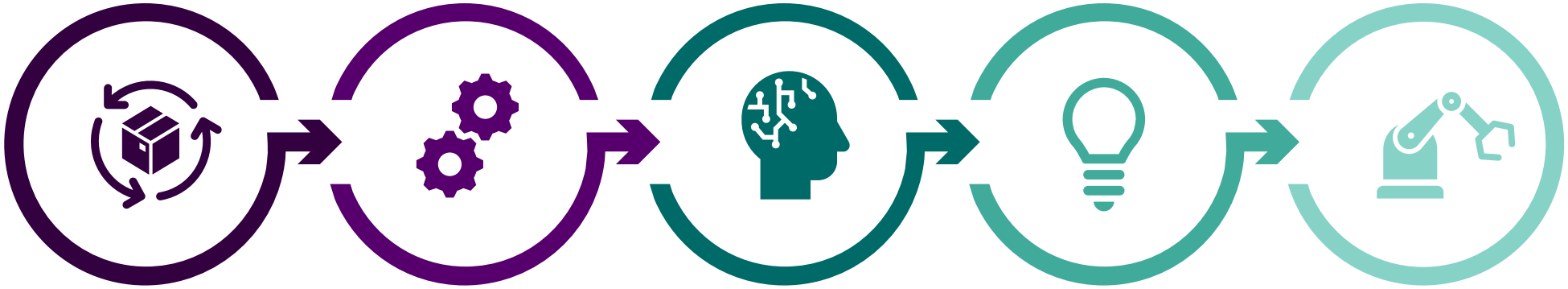
FROM MATERIALS TO SELF-OPTIMIZING PROCESSES



Light metals + advanced process control + AI = resource-efficient and resilient production

FROM VARIABLE MATERIALS TO SELF-OPTIMIZING PRODUCTION

Development and production of the future go hand in hand …



REFERENCE PROJECTS

Comet-Projekt (FFG)

ProMetHeus

Production and processing of metals for high-performance, energy efficiency, environmental protection, and sustainability

20 Partners from Insutry & Research



FFG

AIPCell

Artificial Intelligence-driven Production Cell

5 Center des AIT arbeiten an 3 verschiedenen Materialentwicklungsumgebungen, > 8 PhDs im Bereich der Agentic AI, Robotic, …



FTI-Land OÖ

DATA-T-REX(2)

DATENBASIERTE OPTIMIERUNG VON METALLURGISCHEN PHÄNOMENEN – REKRISTALLISATION, TEXTUR & EIGENSPANNUNGEN

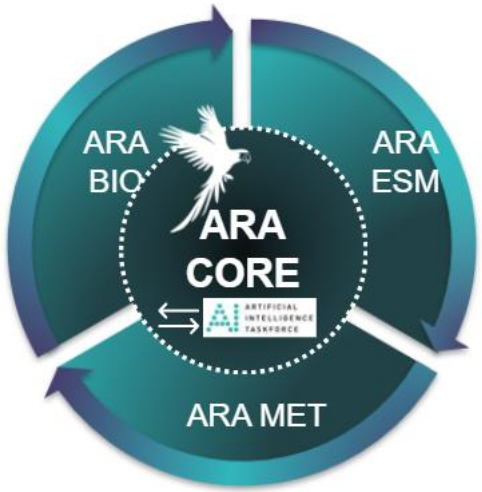
WIE GEHT‘S WEITER?

HORIZON-CL4-2026-01-MAT-PROD-23

Accl-Iot-tl

ACcelerated Creation of materials via Open Laboratory Optimization, Transfer and industrial Launch

17 Partner, 4 SDL (AI, HM, Pulver, Keramik), 6 Mio. Projektbudget in AT (LKR, 4a, HAI, TU Wien, BC)



AIT Fokusprojekt

ARA

***ARA** - **A**IT **R**ESEARCH **A**CCELERATION PLATFORM*

5 Center des AIT arbeiten an 3 verschiedenen Materialentwicklungsumgebungen, > 8 PhDs im Bereich der Agentic AI, Robotic, …



Comet-Projekt

PERSEPHONE

Beschleunigung von Entwicklungs-prozessen & intelligenter Prozessüberwachung

> 15 Partner aus Industrie und Forschung

AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY



THANK YOU!

Carina Schlögl

LKR Leichtmetallkompetenzzentrum Ranshofen GmbH