REDUCE

Reduced Carbon Footprint using Explainable AI for Human Empowerment in Design/Engineering and Production

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MOTIVATION & GOALS

- **Industry Challenges:** Low sustainability awareness, data uncertainty, and missing redesign tools hinder CO_2 reduction in manufacturing.
- **Core Goal:** Developing an AI-driven **Decision Support Tool (DST)** to cut CO_2 emissions and production costs by up to **30%**.
- **CAD Integration:** Extracting **STEP geometric features and metadata** to predict tool changes, compute variances for additive finishing, and optimize CAD designs directly.

Project FactBox

Project Name REDUCE
Project ID 925795
Duration 36 Months

Area 4.2
Cognitive Production Systems

Project Lead
Dr. Philipp Eisele

APPROACH & Methodology

- **Additive Baseline (HARATECH):** Linear regression models (**Gen0 AIDM**) capture material/time dependency on slicing parameters (infill, layer height).
- **Subtractive Baseline (TRIPAN):** Physical laws and extracted STEP features (volume, milling path) form initial **KDM** energy baselines.
- **Next Step:** Benchmarking Gen0 to develop advanced hybrid predictive models.

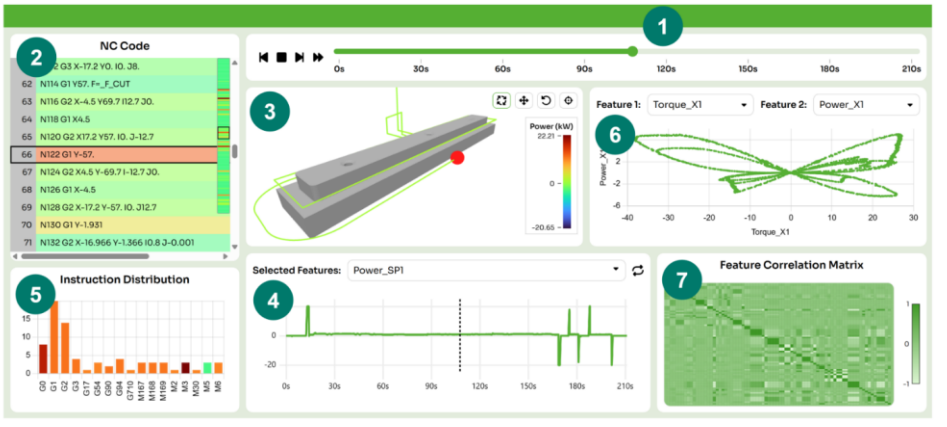
SYSTEM ARCHITECTURE

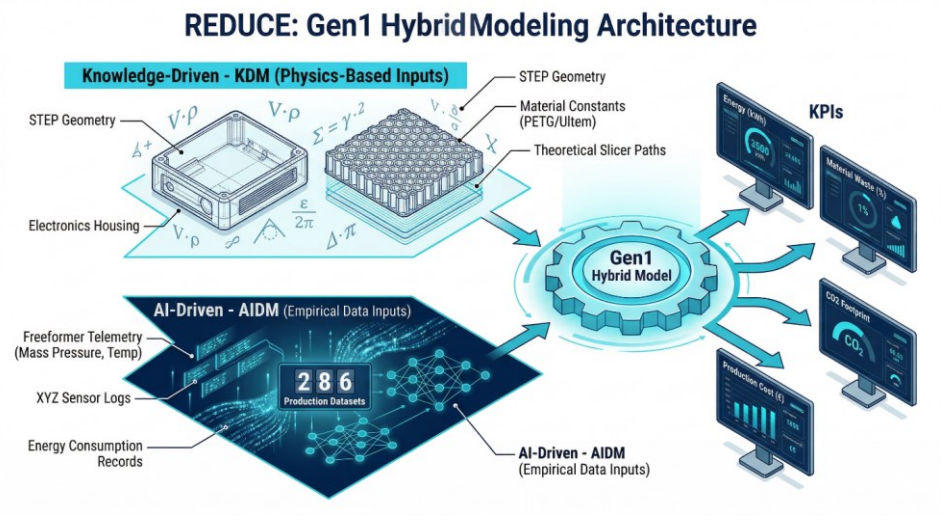
- **DEXPRO Interface:** Coordinated multi-view system (EuroVA 2026) syncing 3D toolpaths, NC-code, and machine plots via a time slider.
- **Visual Explainability: Color-coded toolpaths** instantly highlight energy-intensive features in the design.
- **Decision Support:** Links CAD geometry directly to shopfloor data to eliminate energy bottlenecks early.

CONTRIBUTION

Scientific contribution
- Automated extraction of **geometric CAD features** and **metadata** from **STEP files**.
- Synergistic **hybrid predictive modelling** combining **explainable AI** with **physical knowledge**.

Economic contribution
- Lower **cycle times** and **machine wear** via minimized **tool changes** and **waste**.
- Increased **competitiveness** and **resilience** for **Austrian and EU manufacturing**.





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