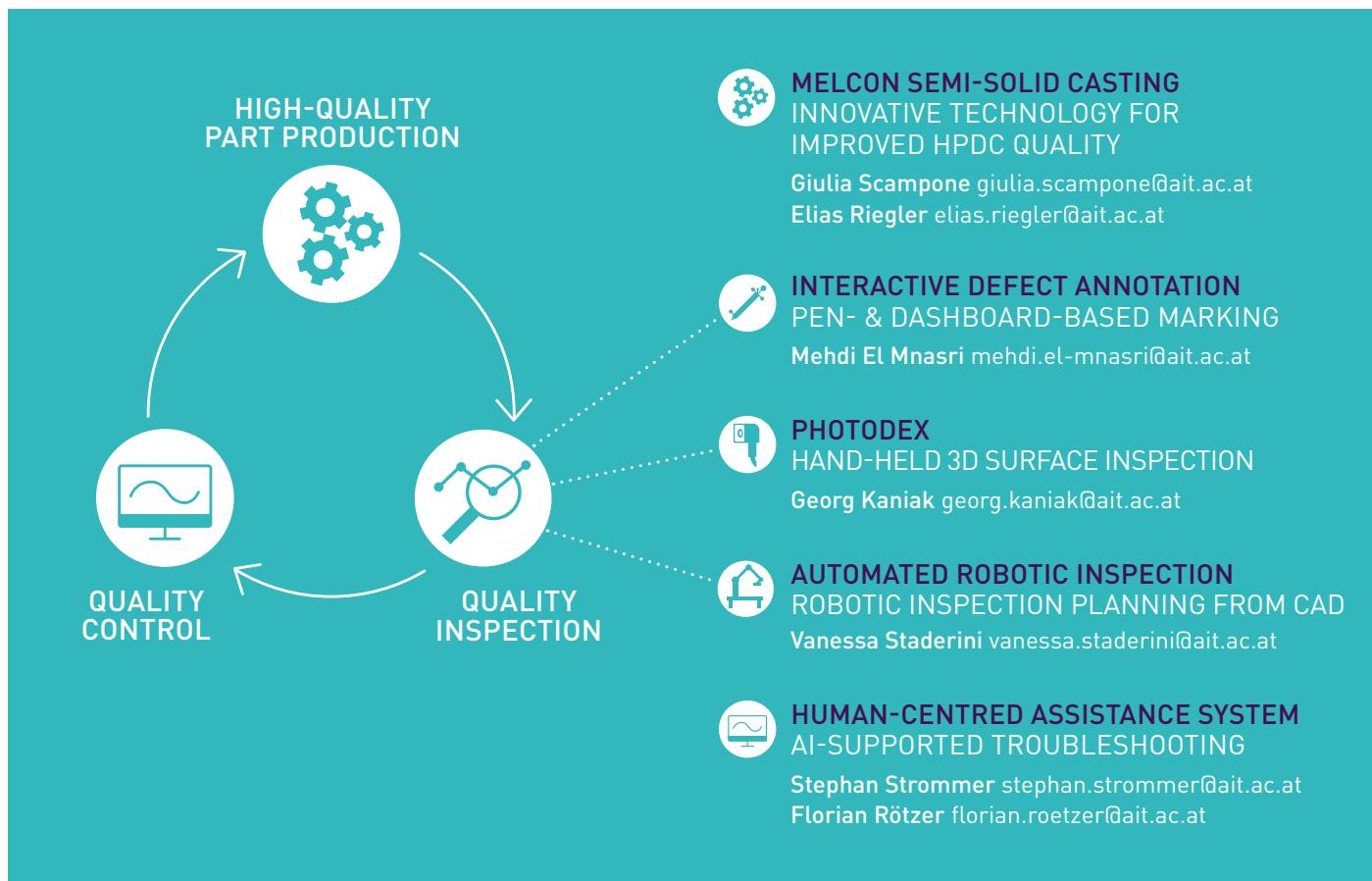




ZERO DEFECT DIGITAL MANUFACTURING RESEARCH & SOLUTIONS FOR SMART PRODUCTION OF THE FUTURE

The AIT Austrian Institute of Technology, Austria's largest applied and industry-oriented research organization, presents innovative technologies for smart, quality-driven die casting production.

The scope ranges from production and advanced methods of quality inspection to human-centred assistance systems for quality control – fully in line with Industry 5.0, with AI-based approaches playing a key role.



HIGH-QUALITY PART PRODUCTION



MELCON SEMI-SOLID CASTING INNOVATIVE TECHNOLOGY FOR IMPROVED HPDC QUALITY

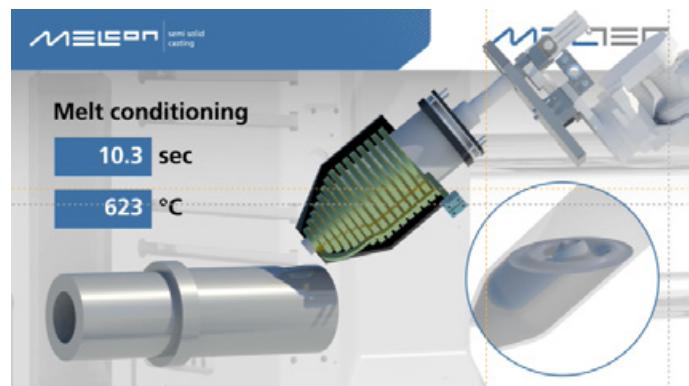
MELcon is a technologically innovative system for producing **high-quality semi-solid castings** using conventional HPDC equipment.

The system can be easily integrated into existing HPDC installations and is designed to carry out **both conventional HPDC and semi-solid casting**.

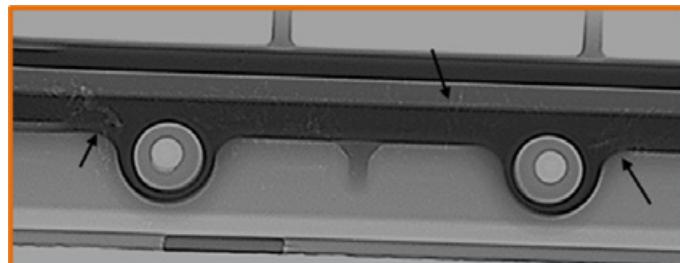
It operates with a nominal solid fraction of 5–10%, which is sufficient to reduce melt flow turbulence during die filling, without requiring a drastic change in the mindset for selecting casting parameters.

Main advantages:

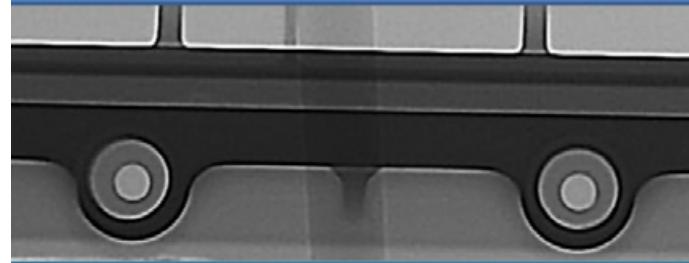
1. **Reduction of porosity**, leading to an **improvement in mechanical properties**.
2. **Minimization of oxide entrapment**, enhancing material integrity.
3. **Extended tool life** due to the reduction of thermal fatigue stresses.



CONVENTIONAL HPDC



MELCON SEMI-SOLID CASTING



QUALITY INSPECTION



INTERACTIVE DEFECT ANNOTATION PEN- & DASHBOARD-BASED MARKING

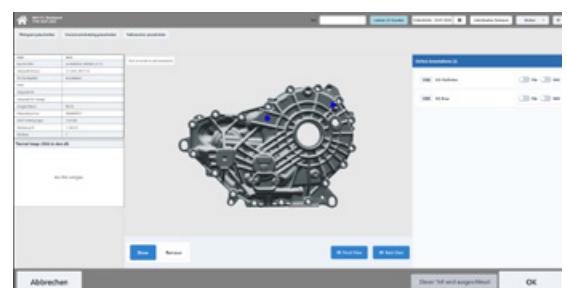
Defect annotation enables teams to identify root causes, reduce scrap, and improve customer satisfaction. We compare the workflows of two interactive systems for visual inspection.

Screen-Based Annotation System:

- Centralized interface for viewing and annotating defects
- Interactive 3D models: rotate, zoom, and inspect parts with high precision
- Unified workflow for interaction and classification

Pen-Based Assistance System:

- Direct, spatial annotation on physical parts
- Digital pen links the real object with its digital model (tablet)
- Accurate localization of defects, both physically and digitally



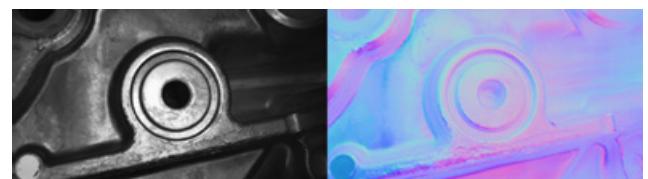
PHOTODEX HAND-HELD 3D SURFACE INSPECTION AND DEFECT ANNOTATION



The **Photonic Defect Explorer** captures high-resolution images enriched with surface information. It leverages multi-directional illumination to deliver high-quality imaging under motion (handheld or robotic).

Point the device at a defect to obtain:

- **High-resolution synthetic greyscale image** (albedo)
- **High-resolution surface normal map**
- Precise defect **localization** through comparison to a CAD model
- AI-based defect **classification**



High-res. albedo

Surface normal map



AUTOMATED ROBOTIC INSPECTION ROBOTIC INSPECTION PLANNING FROM CAD

Flexible inspection planning framework that adapts to any robotic cell and any vision sensor. From full-part digitization to feature-specific inspection. Transferable across cells, sensors, and parts.

Dual inspection modes:

- **Full inspection** for complete surface coverage (geometry reconstruction / digital twin generation)
- **Targeted inspection** for critical regions and specific features (cycle-time optimized)



QUALITY CONTROL



HUMAN-CENTRED ASSISTANCE SYSTEM AI-SUPPORTED TROUBLESHOOTING

The **human-centred assistance system** supports operators during troubleshooting at the die-casting cell, transforming a complex task into a guided, knowledge- and data-driven process.

Main advantages:

1. Reducing downtime, scrap, and the use of materials and energy.
2. Accelerating detection of defect causes.
3. Supporting the execution of effective countermeasures based on the operator's level of qualification.

