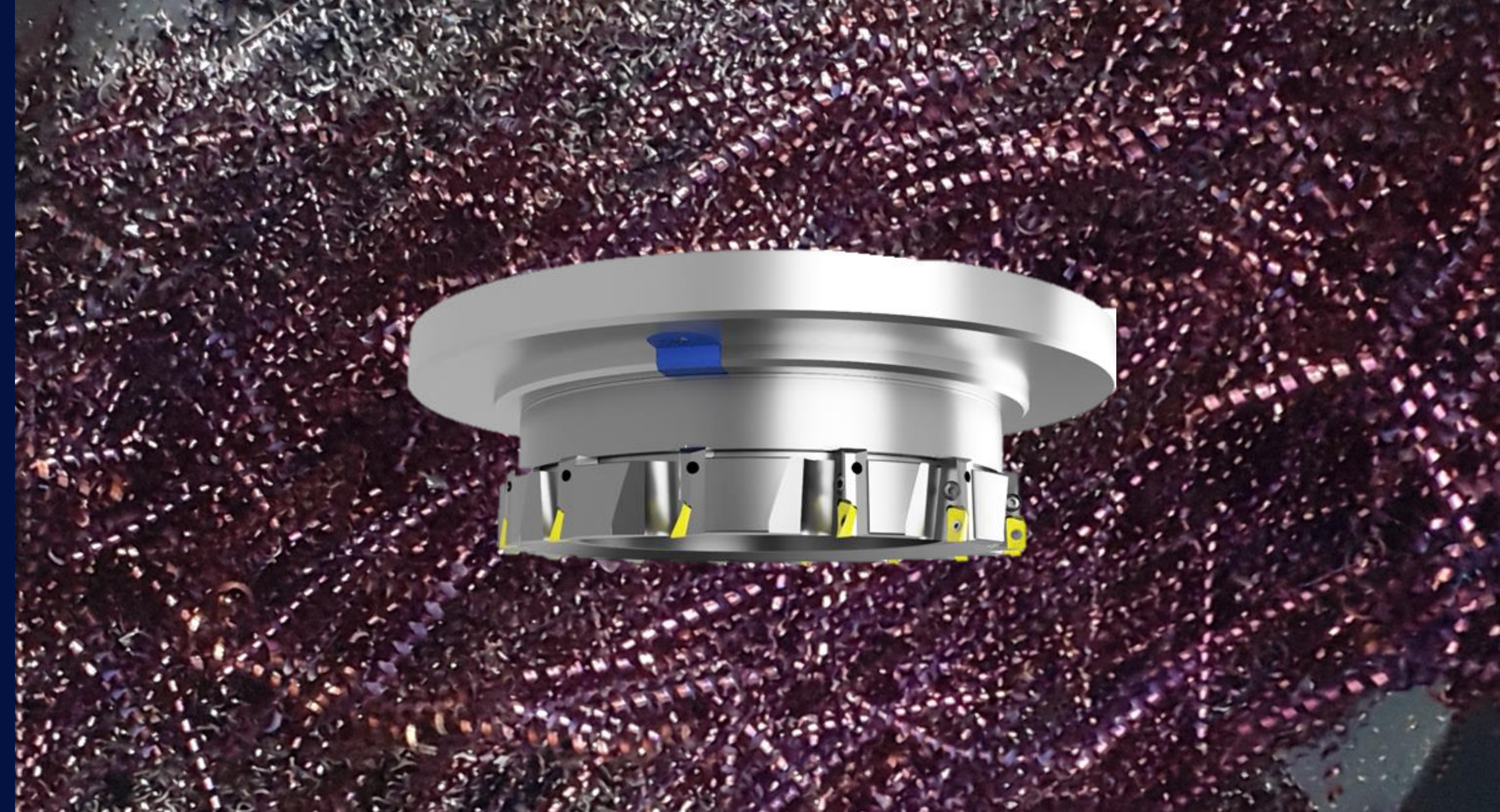


# EIT Manufacturing

## MACH 4 ZERO DEFECT

sensor integrated machining for zero-defects



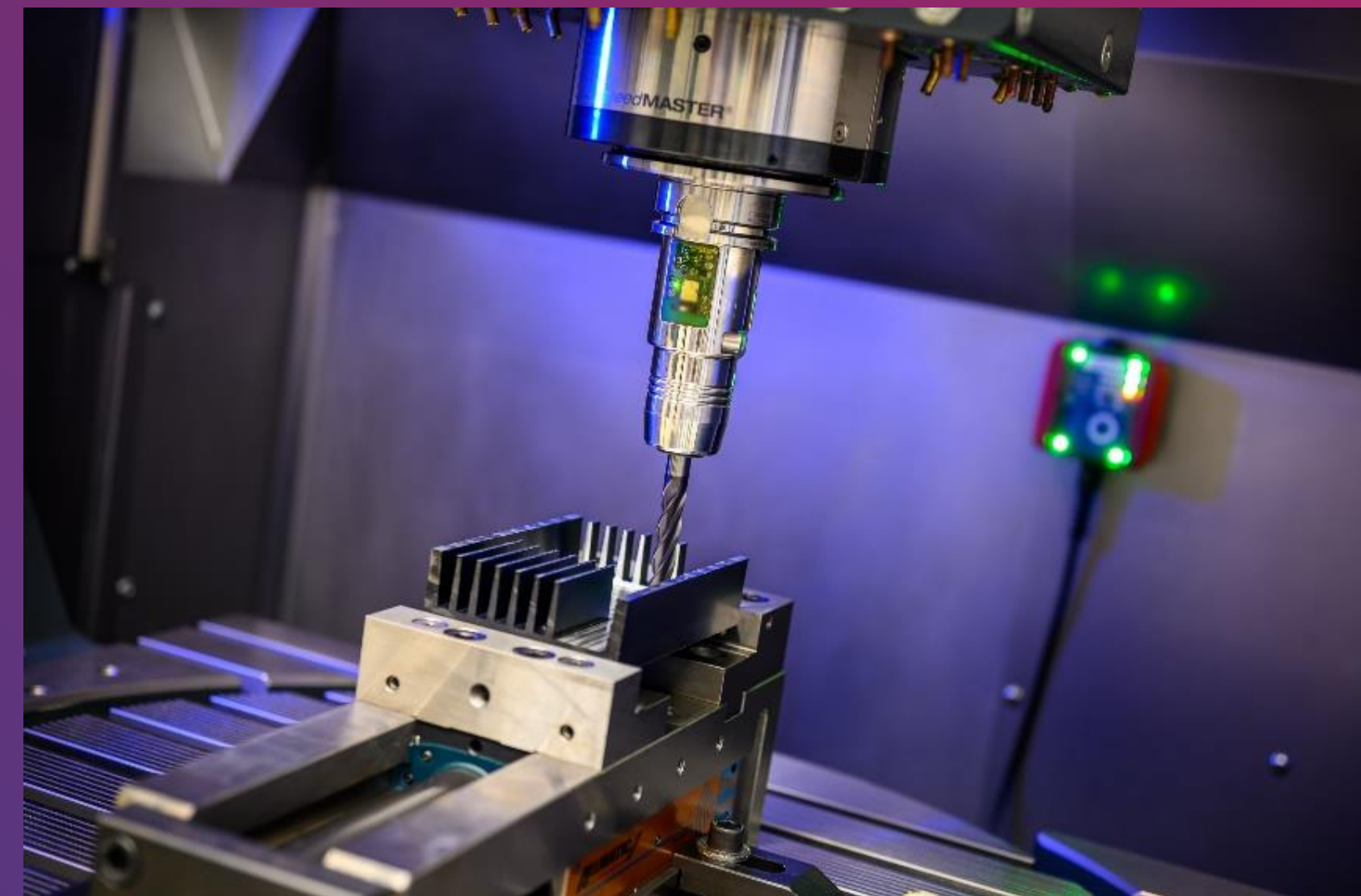


# Fact sheet

- Pillar: Innovation
  - Flagship: Waste-free Manufacturing for a circular economy
  - Project duration: 01.01.2020 – 31.12.2021
  - Consortium partners: 5
- 
- Total costs in 2020: 405,081 € (reported)
  - Funding in 2020: 342,348 €
- 
- Total costs in 2021: 603,662 € (by proposal)
  - Funding in 2021: 422,563 €

# Activity description and project-basis

- Aim: bring a newly developed sensory milling head (SMH) to market
- Scope: upgrade of large-scale machining to a High-Speed Zero-Defect process via adaptive control of milling process parameters
- Basis: already developed in-process-control-system with Sensory Tool Holders for wireless vibration measurement



Sensory Tool Holder  
Source: IFT



# Consortium

voestalpine HPM GmbH

end user, provides application scenario



Walter AG

tool supplier, experts for special tools



MyTool IT GmbH

supplier for in-process-control components,  
experts for electronic circuit design



LMS, University of Patras

research institute, knowledge in  
modelling and experimental investigation



IFT, TU Wien

research institute, knowledge in signal analysis  
and in-process-control-algorithms





# Use Case

- 6-sided milling of big steel blocks
- Tool: Diameter 315 mm
- Machine: spindle motor power 113 kW
- Mould steel with oxide scale layer and strong bending due to rolling and forging
- Inefficient machining due to cutting depth variation and heavy tool wear



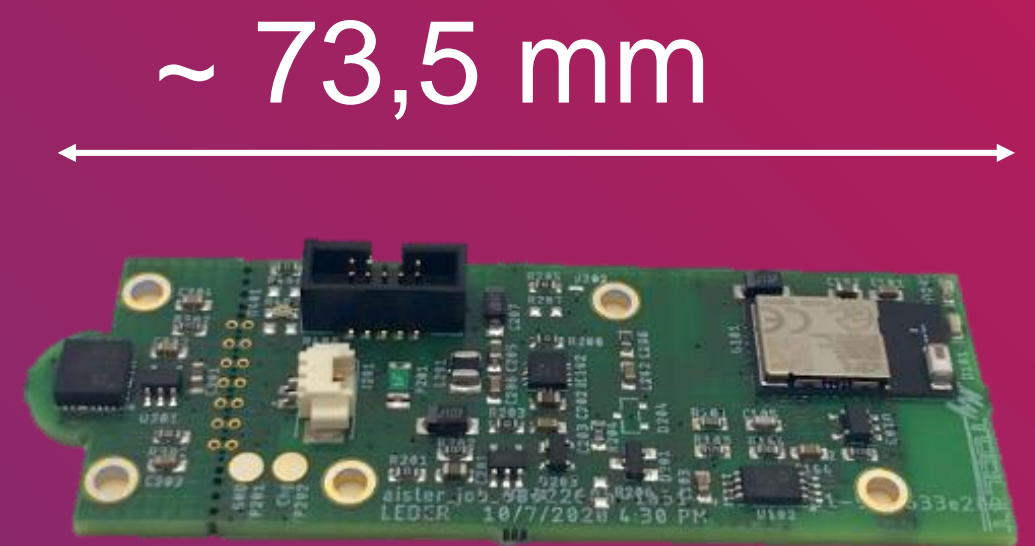
Source:  
voestalpine HPM GmbH





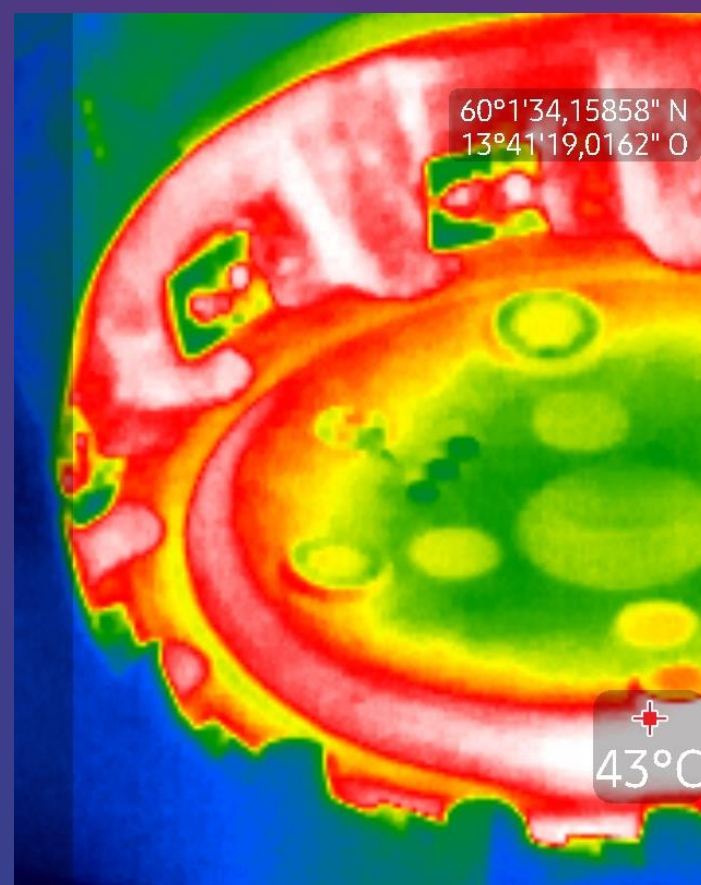
# Approach for sensor integration by MyTool IT

- Electrical engineering
  - Mixed signal circuit design
  - Embedded RF-systems
- Mechanical/electrical co-design
  - Integration of electronics in machining components
  - Robust system for industrial use (e. g. temperature resistant)

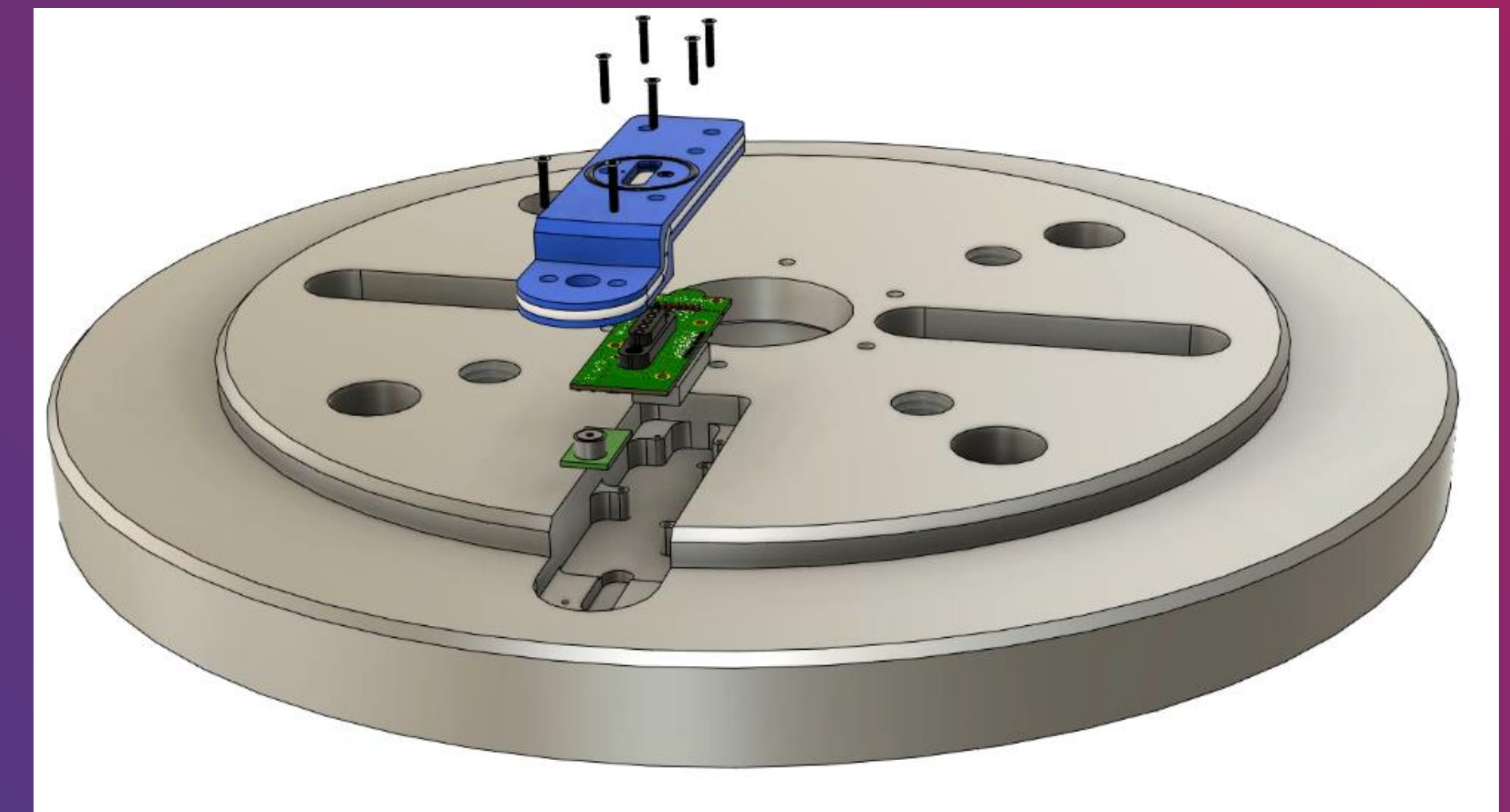


Source: MyTool IT GmbH

PCB for wireless  
acceleration measurement



Thermal image of milling head



Sensory adapter plate



# Sensory Milling Head

- Based on tool body of Walter AG  
D = 315 mm
- Antenna and transmission-system
- Battery
- Sensors
  - Acceleration measurement
  - Cutting force measurement
  - Temperature measurement





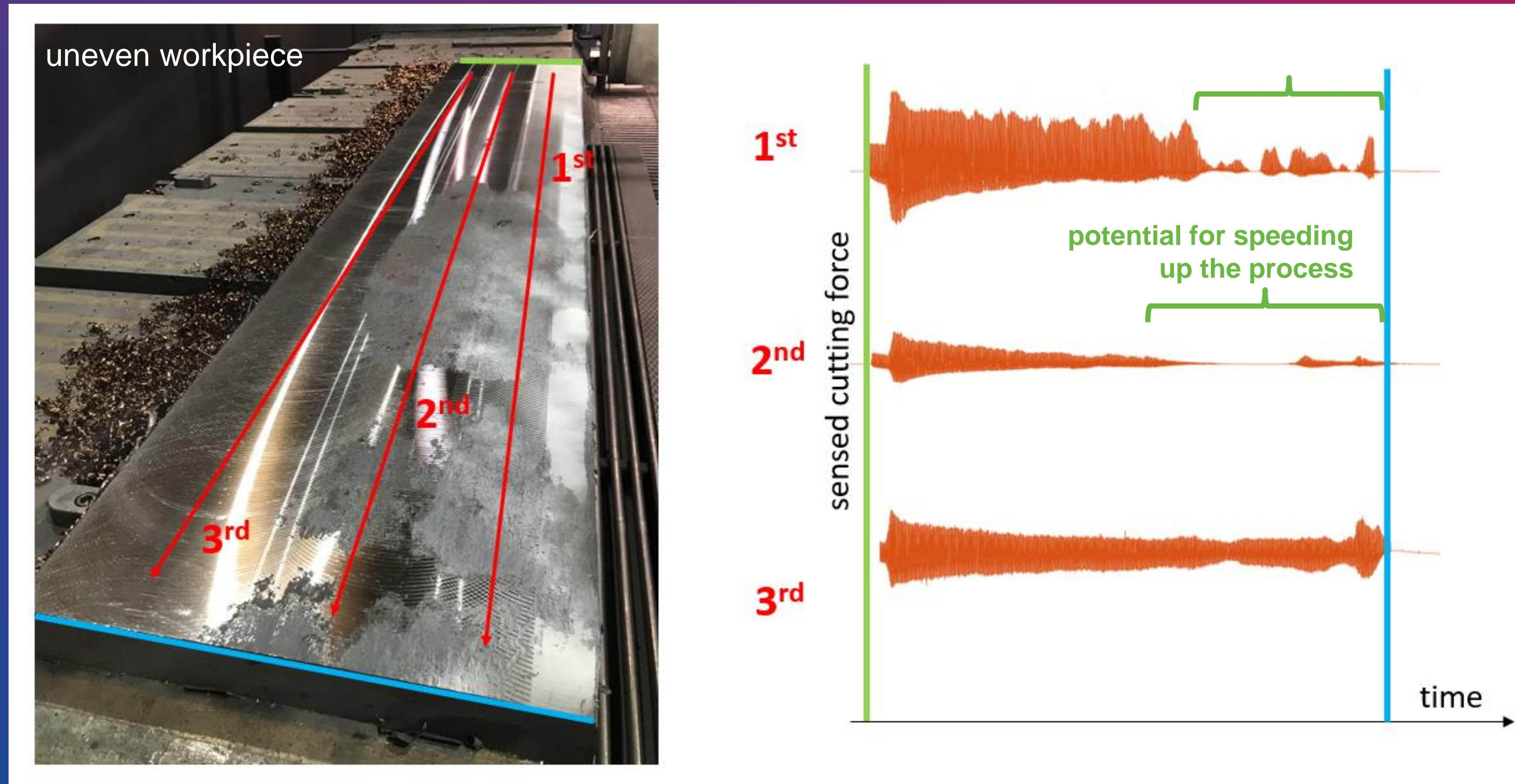
# Implementation at end user

- Sensing the condition of the process  
work piece quality  
cutting insert performance
- Process monitoring  
6<sup>th</sup> sense for machine operator
- Possibilities for process control  
speeding up process  
slow down process, if needed  
emergency interaction





# Successful validation





# Benefits

- Monitoring of process condition via acceleration measurement
- Force measurement to monitor each cutting insert separately
- Possibility for improvement of the process time by up to 20% via in-process-control based on sensor-integrated tool system data
- Ability to monitor tool wear states
- Waste-free Manufacturing for a circular economy