

CREATING THE  
5G-MANUFACTURING  
ECOSYSTEM

5G INDUSTRY  
CAMPUS  
EUROPE

## 5G-Industry Campus Europe – Testbed for Industrial 5G

ECP Webinar

»De toepassing van draadloze connectiviteit in smart industry«

25 January 2022

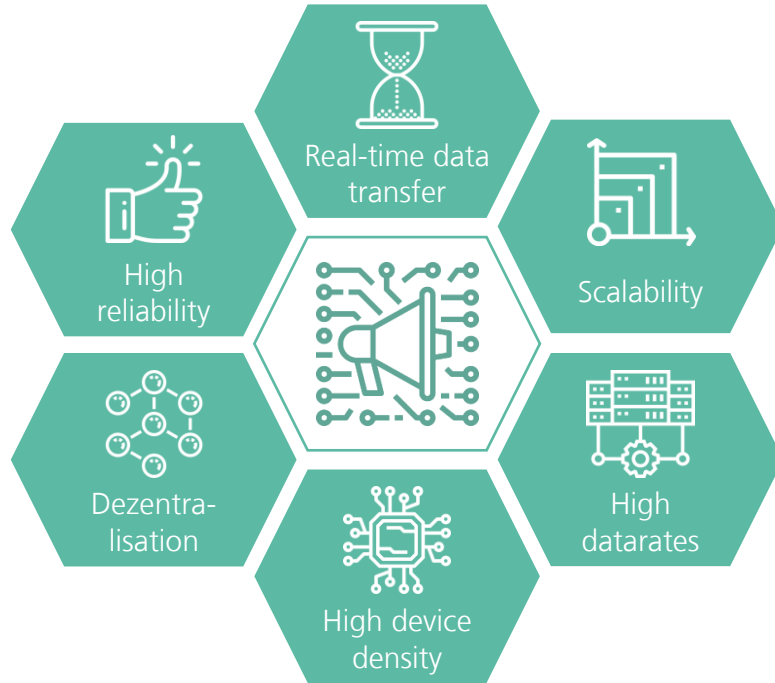
**Dipl.-Phys. Niels König**

Fraunhofer Institute for Production Technology IPT

# 5G technology offers great potential for the production

## Communication systems as the basis for the factory of the future

To realize the vision of a highly flexible and networked manufacturing system, communication systems require the following characteristics:



## 5G as future communication standard for production



Enhanced mobile broadband

20 Gb/s  
Downlink max.

10 Gb/s  
Uplink max.

10 Tbps pro km<sup>2</sup>  
Capacity



Ultra-reliable and low latency communication

<1ms  
Latency

99,999%  
Reliability

500 km/h  
Mobility



Massive machine type communication

100x  
Connected devices

~ 15 Jahre  
Battery run-time

1.000.000/km<sup>2</sup>  
Device density

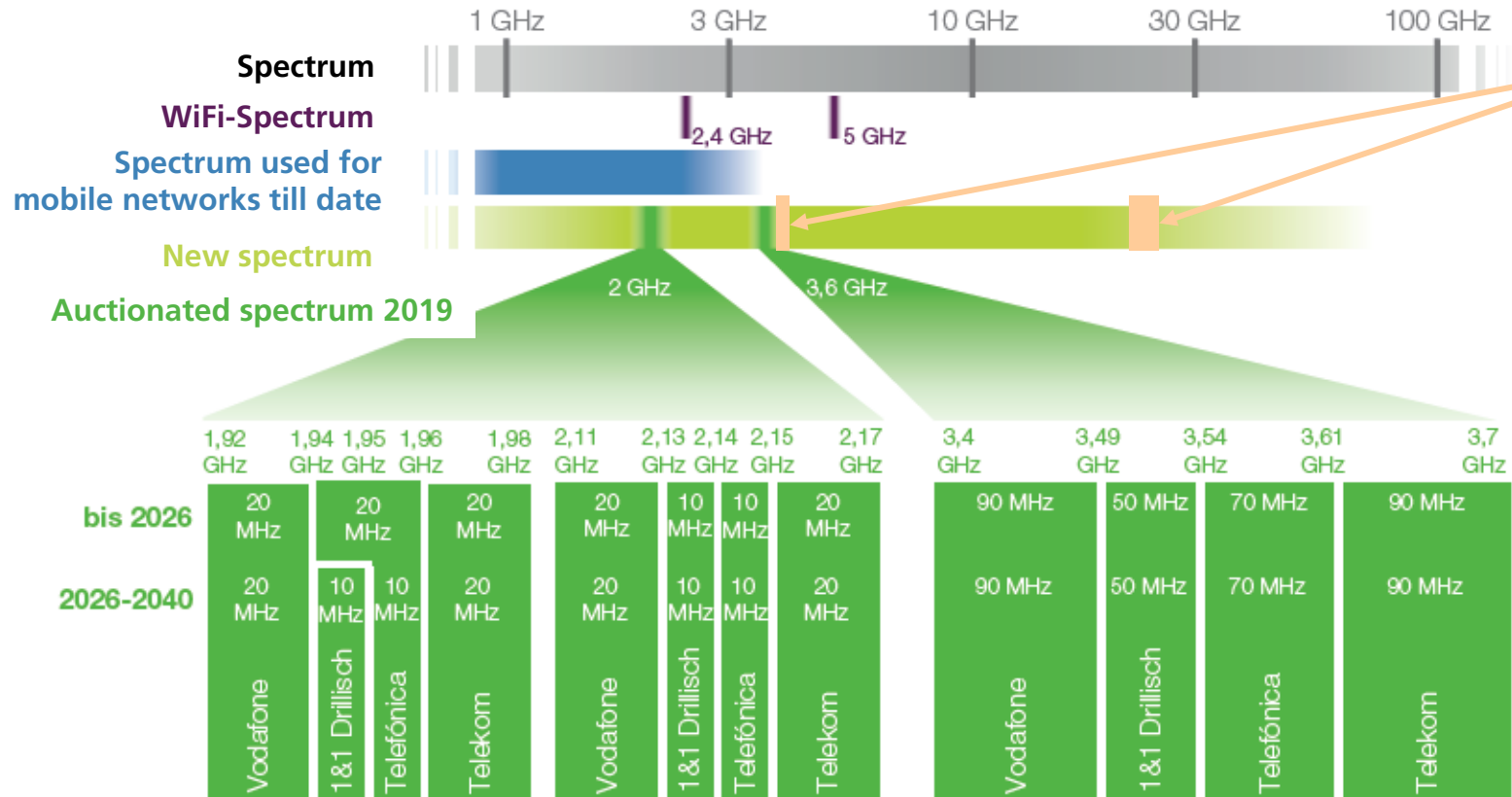
5G technology offers enormous potential for the production

5G is the first mobile standard that meets the requirements of future industry  
**However, requirements are best met with private networks**

# Spectrum situation in Germany

End of german **spectrum auction process** at **2nd August 2019**

Participants of spectrum auction: **Deutsche Telekom, Telefónica (O2), Vodafone and 1&1 Drillisch AG**



**Local 5G-Applications:  
3,7-3,8 GHz & 26-28 GHz**

23 countries have decided for spectrum for 5G non-public networks

Netherlands:  
3.410-3750 MHz available only until 1st September 2022



# 5G INDUSTRY CAMPUS EUROPE

5G-Industry Campus Europe is the largest industrial 5G testbed

- 5G indoor networks on 3 different shopfloors fully equipped with machines and robots
- 5G outdoor network of 1 km<sup>2</sup> at the RWTH Aachen Campus
- 5G-NSA and 5G-SA running on industry spectrum @3.7 – 3.8 GHz
- Simultaneous 4G network running @2.3 GHz as anchor band

Supported by:



Federal Ministry of Transport and Digital Infrastructure

on the basis of a decision by the German Bundestag

5G network supplier:



ERICSSON



RWTHAACHEN UNIVERSITY



Fraunhofer

IPT



RWTHAACHEN UNIVERSITY

**fir** an der  
RWTH Aachen





# INDUSTRY CAMPUS EUROPE

5G-Industry Campus Europe is

- the entity in Europe for the holistic application of 5G to manufacturing and logistics
- pioneer for establishing 5G in industry
- application-oriented with real world use Cases
- single-site as well as cross-site perspective

Supported by:



Federal Ministry  
of Transport and  
Digital Infrastructure

on the basis of a decision  
by the German Bundestag

5G network supplier:



ERICSSON



RWTHAACHEN  
UNIVERSITY



Fraunhofer

IPT

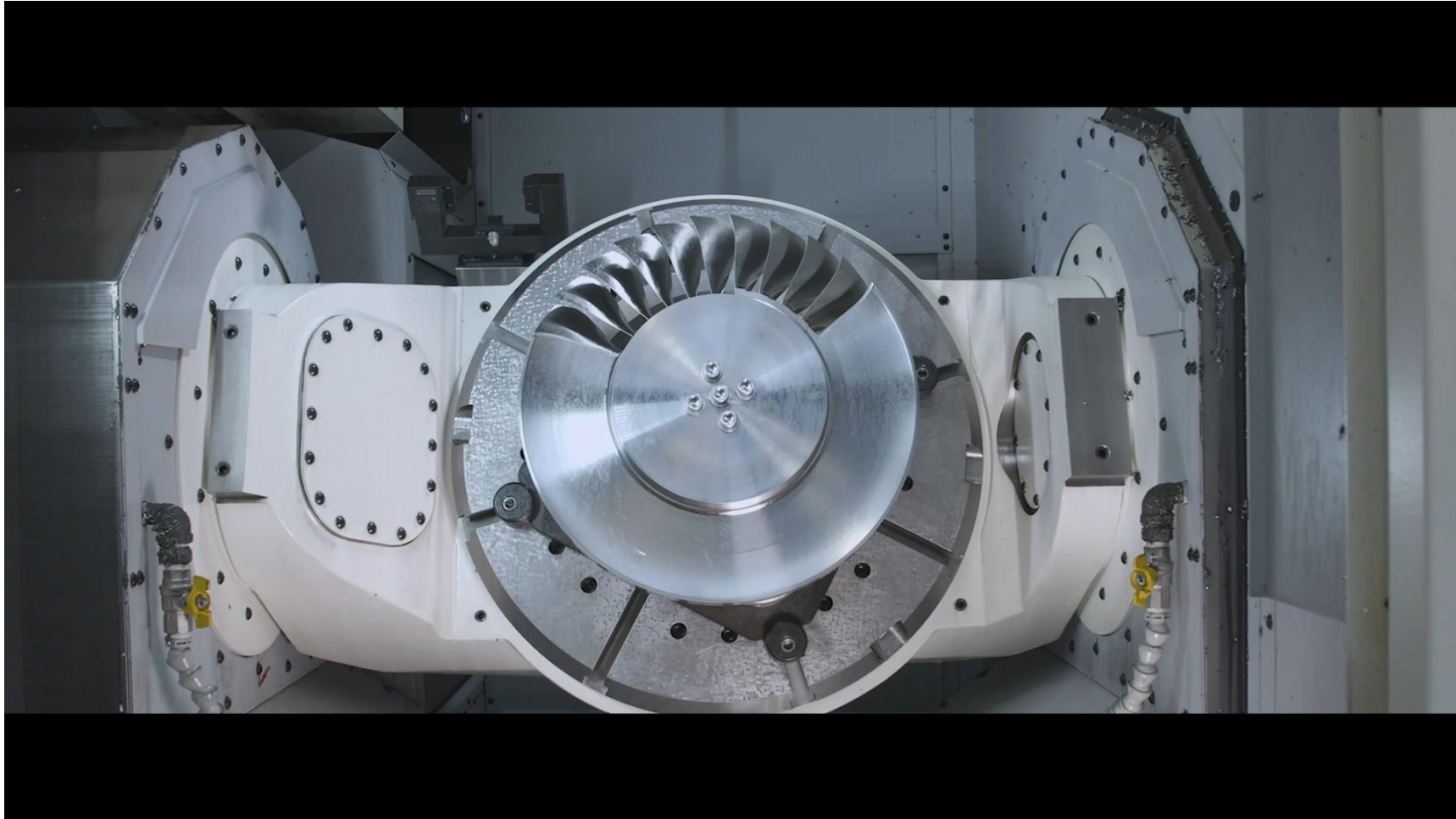


RWTHAACHEN  
UNIVERSITY

**fir**  
an der  
RWTH Aachen

# 5G-Industry Campus Europe

---



[https://www.youtube.com/watch?v=sXbCWWNztuQ&feature=emb\\_logo](https://www.youtube.com/watch?v=sXbCWWNztuQ&feature=emb_logo)



# Implementation projects 5G-Industry Campus Europe



**MOBILE ROBOTICS**



**LOGISTICS**



**DATA ECONOMY**



**PROCESS MONITORING**



**CROSS-SITE PROCESSING**



**SMART SENSORS**





GF Machining Solutions

+GF+

# Use Case with Georg Fischer Machining Solutions Real-time 5G-based smart manufacturing

 Fraunhofer  
IPT

+GF+

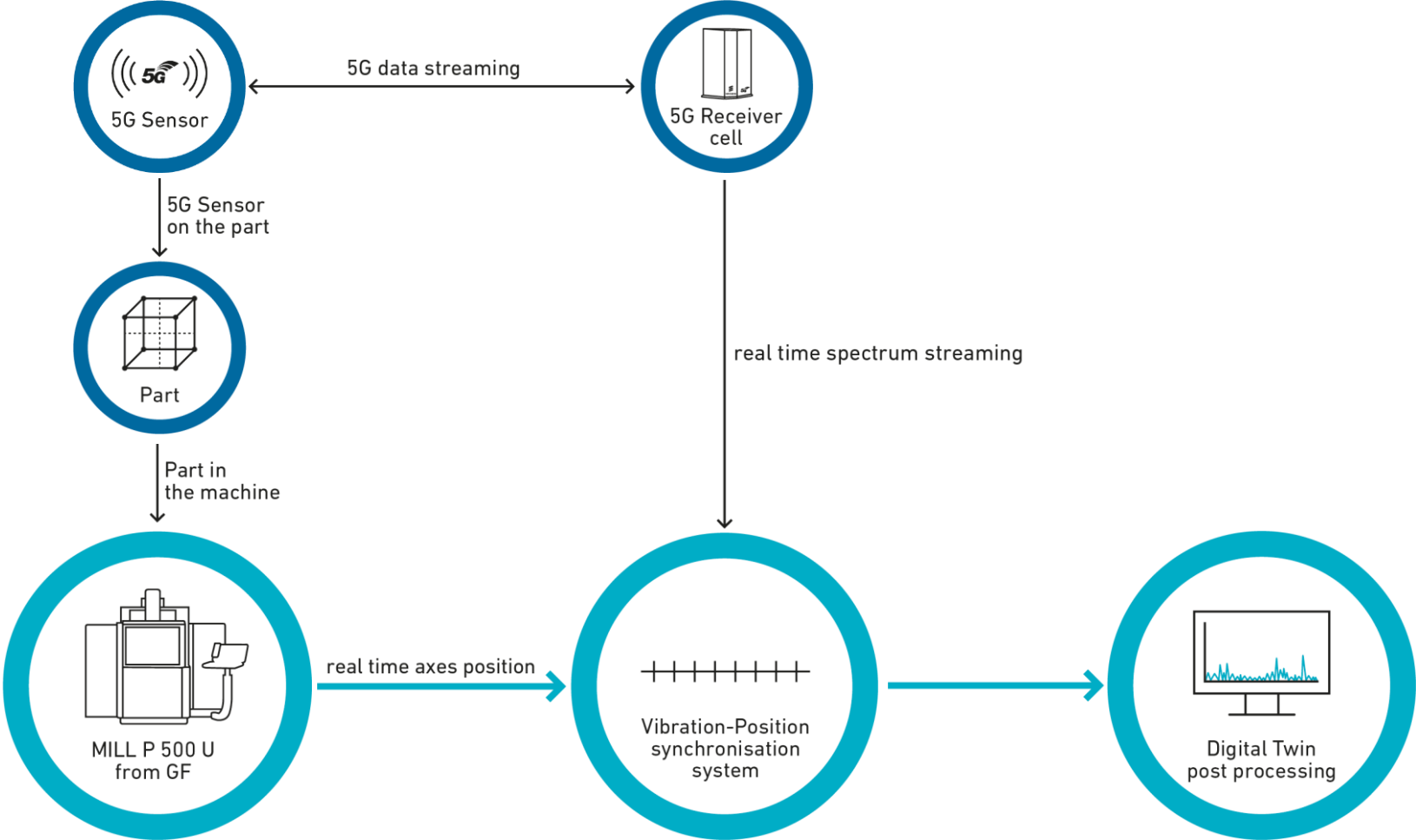


# The Task

Position-synchronized **vibration monitoring system** reconciliating the machining program and monitored data as a **digital twin**, thus enabling product integrity, process compliance, as well as equipment cost and efficiency optimization.



# The Solution





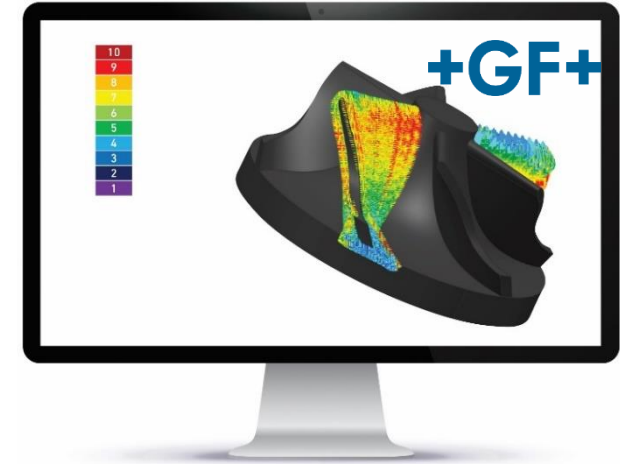
# The Solution



5G multi-sensor platform by  
Fraunhofer IPT & Marposs



measurement signals



position-synchronized  
digital twin processing





# Service offering 5G-Industry Campus Europe

---

## Hardware

Development of wireless  
Sensors

Sensor Integration

Process-Monitoring /  
Control

Mobile Robotiscs

Machine Connectivity

## IT

5G public/private  
network configurations

Edge-Cloud-  
Infrastructures

Multi-Site Connectivity

Remote Applications

## Strategy

Business Case Analysis

Technology Monitoring

Roll-out Strategies

5G Industry Audit

# 5G-Audit – Modular Consultancy and Service Offer

## IN 5 STEPS TO YOUR OWN APPLICATION OF 5G

Module 0



### EXPERIENCE DAY IN AACHEN



Getting to know the 5G use cases implemented at 5G-Industry Campus Europe



5G use cases  
1 day

Building block 1



### PROCESS IDENTIFICATION



Identification of potential 5G use cases



2-5 days

Building block 2



### POTENTIAL ANALYSIS

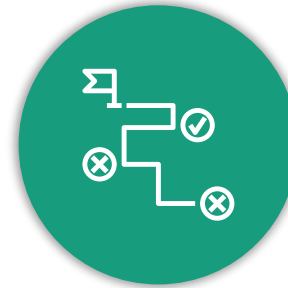


Analysis of the economic potential of the 5G use cases



1-3 days

Building block 3



### ROADMAPPING & IMPLEMENTATION STRATEGY



Concrete Implementation strategy for the introduction of 5G



3-5 days

Building block 4



### IMPLEMENTATION SUPPORT



Implementation of the defined 5G implementation strategy



5-10 days



# THE ADVANCED MANUFACTURING CENTER

- ✓ International Center for Manufacturing 4.0
- ✓ Pre-competitive development projects, demonstrators and test beds
- ✓ Customized programs for competence and skills building in Manufacturing 4.0
- ✓ Full integration of nonconventional technologies e.g. Additive Manufacturing into digital environment: Digital Twinning, AR/VR, AI, Advanced Robotics, etc.
- ✓ Access to technology and know-how regarding the holistic hybrid process chain that could be directly applied
- ✓ Co-location for industry involved in longer term developments (2-10 years)
- ✓ International network and visibility
- ✓ Fast track to talent and future workforce

AMC 5G SATELLITE



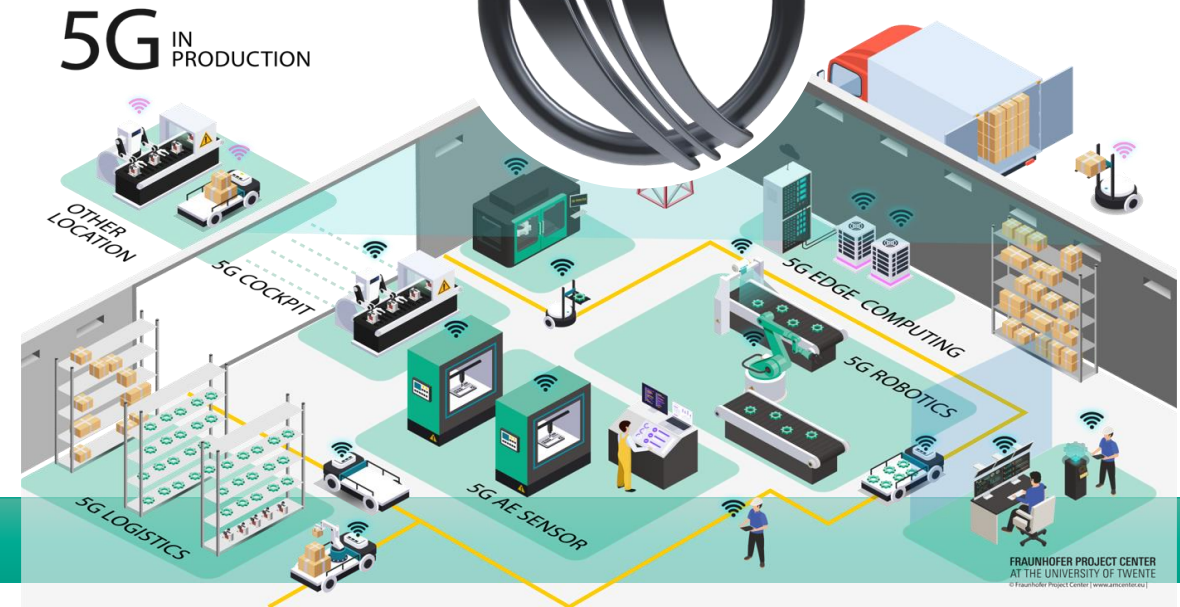
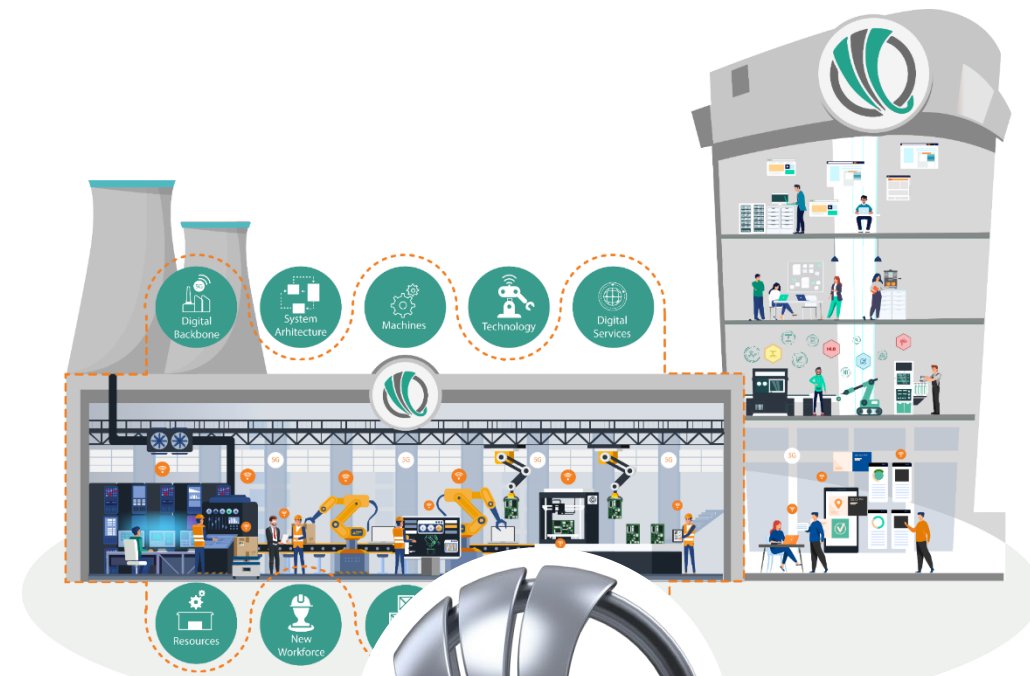
PART OF THE  
5G-MANUFACTURING  
ECOSYSTEM

Translating the concept of the 5G-Industry Campus Europe ,in front of the door' of dutch industry

# THE VISION OF THE AMC SHOP FLOOR

- Seamless exchange of information between machines and systems (M2M)
- Showcasing IoT and 5G use cases in production
  - Advanced Robotics
  - Smart Logistics
  - Cloud and Edge technologies
  - Showcasing the benefits of AI and Digital Twinning as decision support tools in production
  - Use of AR,VR,XR technology in production
  - Remote and predictive maintenance
- Learning by doing on demonstrators and testbeds
- Test and development of product service systems

Please contact me if you are interesting!





# Your Contact



## **Dipl.-Phys. Niels König**

Head of Department Production Metrology  
Coordinator 5G-Industry Campus Europe  
Fraunhofer Institute for Production Technology



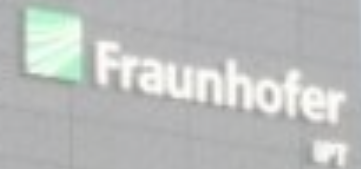
+49 241 8904-113



+49 241 8904 -6113



[niels.koenig@ipt.fraunhofer.de](mailto:niels.koenig@ipt.fraunhofer.de)

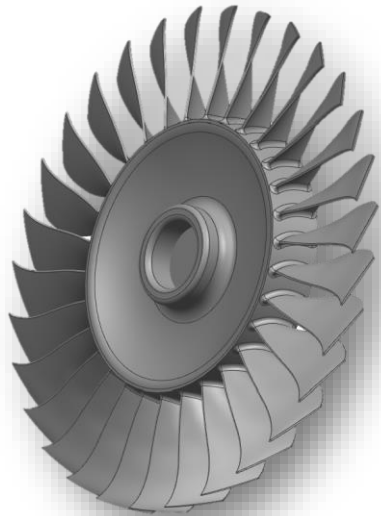
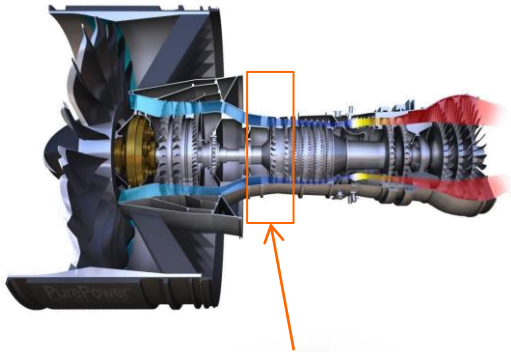


# Backup



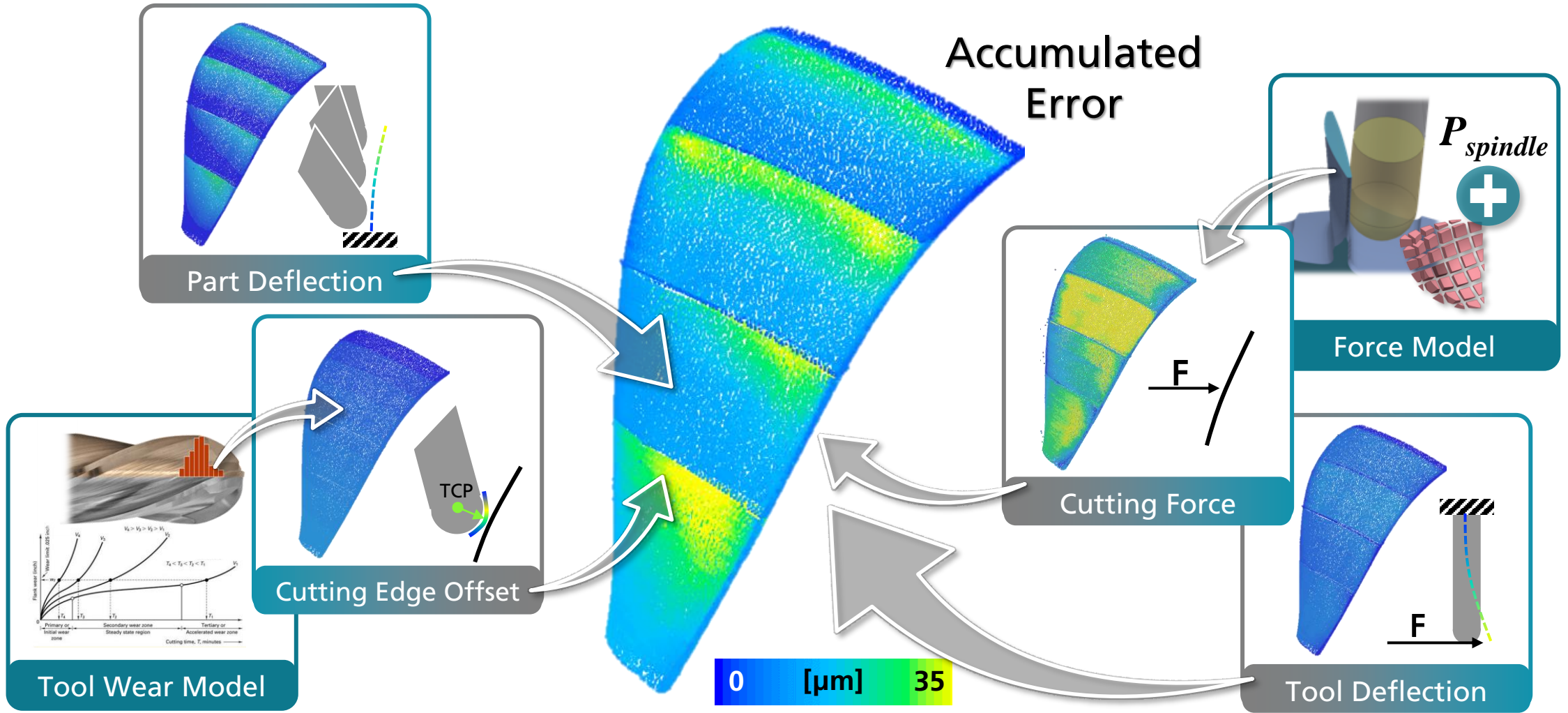
# Use Cases 5G-Industry Campus Europe – Multi-sensor platform

Pratt & Whitney  
PW1100G Engine

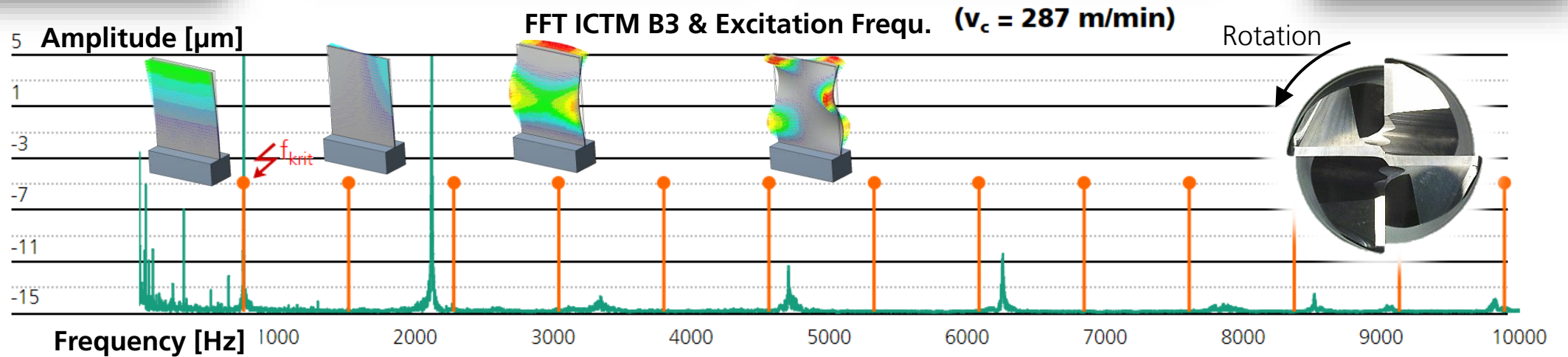
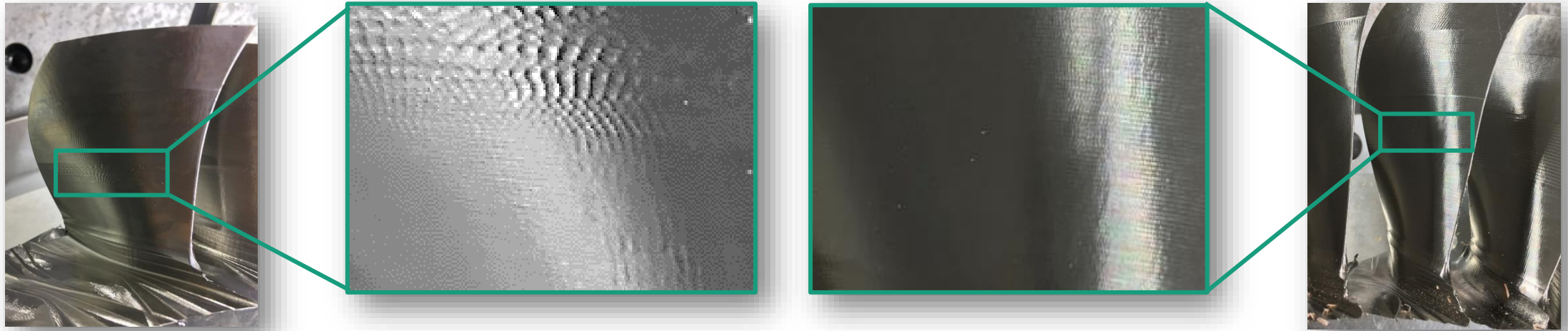


# Use Cases 5G-Industry Campus Europe – Multi-sensor platform

## Data Conditioning, Filtering, Synchronization and Merging

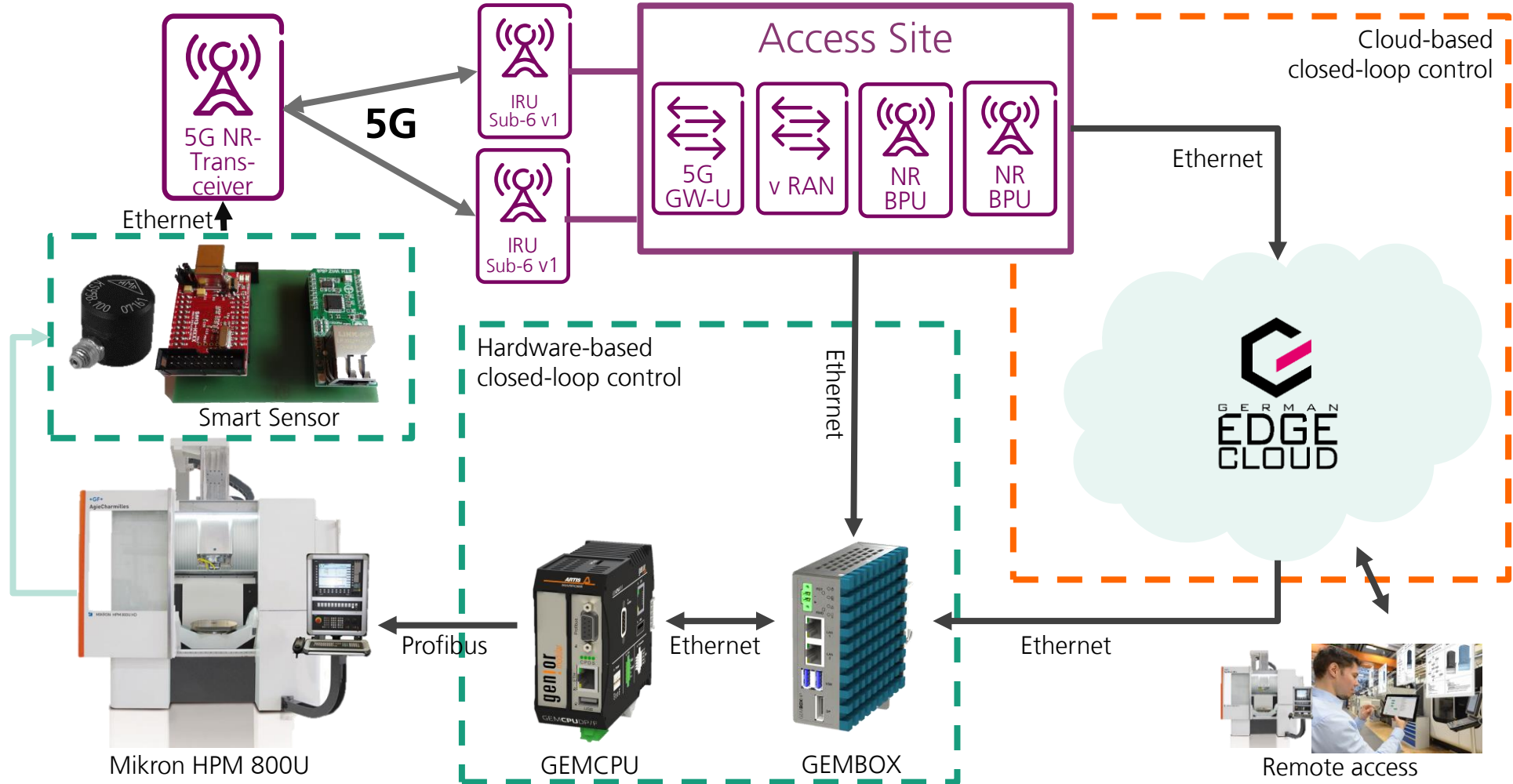


# Multi-sensor platform - Stability Indication from FFT





# 5G System Architecture for Closed-Loop Manufacturing



# Use Cases 5G-Industry Campus Europe – Multi-sensor platform Visualization of Critical Vibrations vs. *Real* Surface Finish

