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DIGIMAP_FP_0001_MTA

- Performed activities and main results
- Summary
- Outlook
- Discussion and next steps

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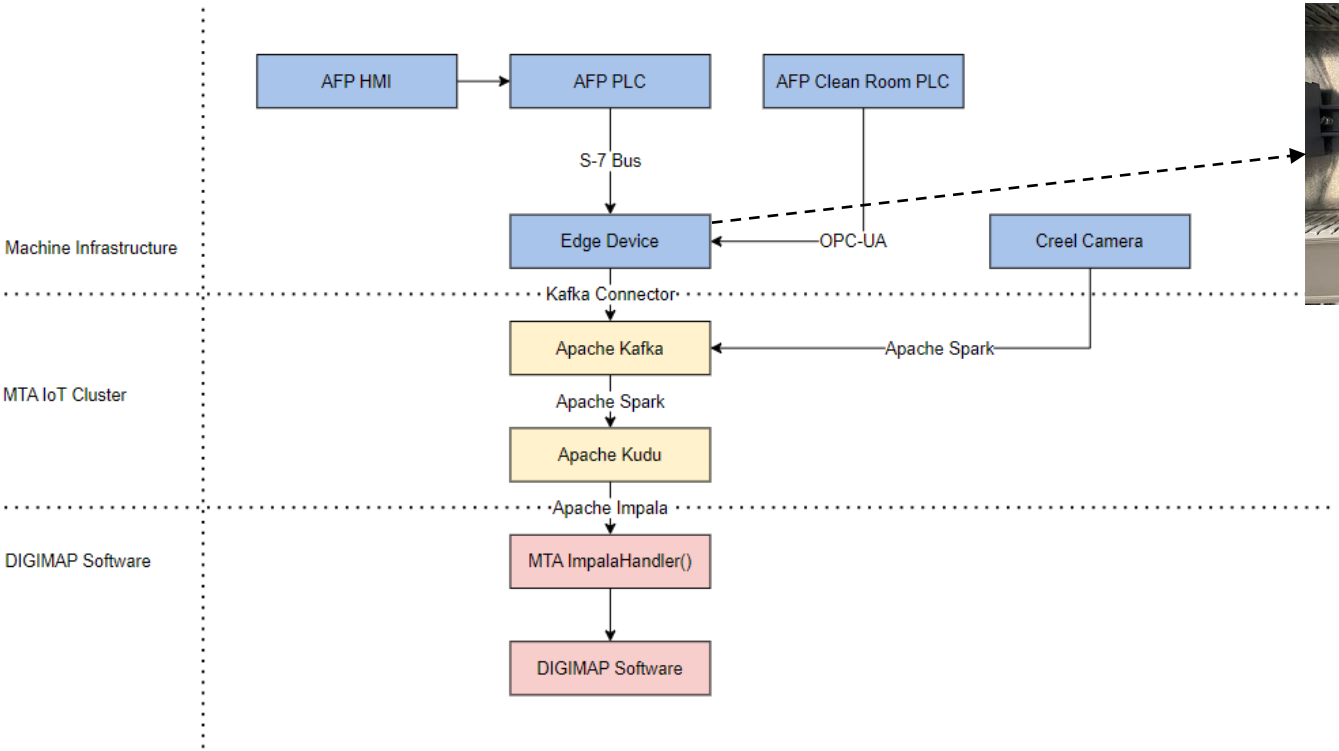
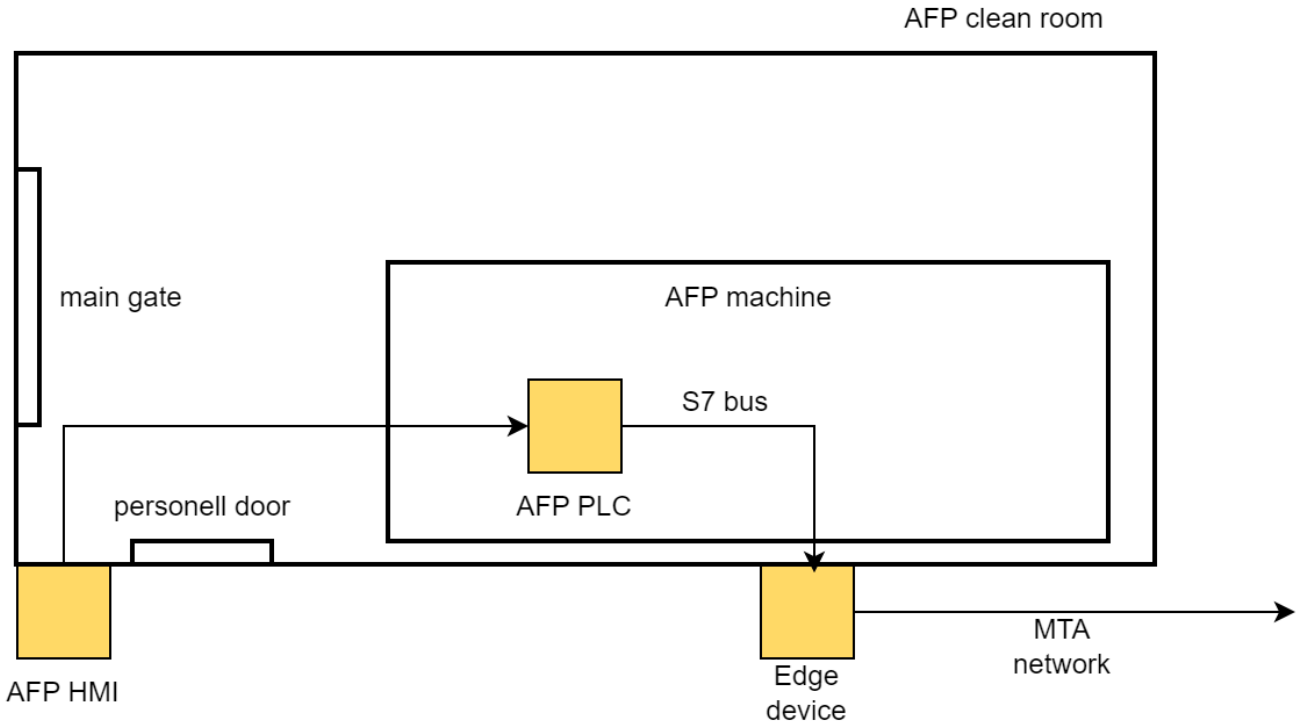
- The DIGIMAP project team successfully…
  - Configured & implemented **data pipelines**
  - Established a **database** for AFP related data
  - **Automated build&deploy** of the developed software
  - Set up an environment for deploying the software on **IoT cluster server**
  - Configured the deploy for **test/productive** system
  - Developed a **platform** for deploying dashboards related to DIGIMAP use cases
  - Developed **soultions** for several use cases
  - Created software that is in use by **shop floor**
  - Developed a Proof-of-Concept for an **AI tool** for observation of the AFP machine‘s creel

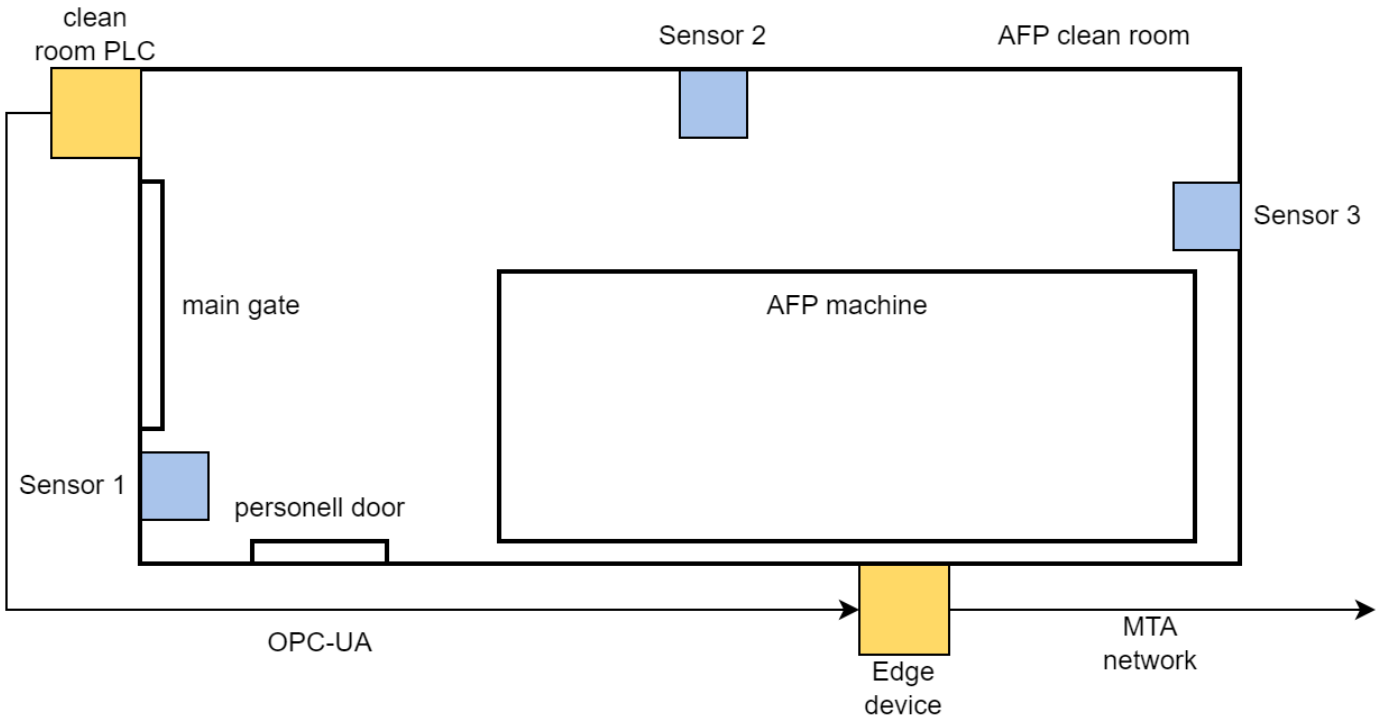
DATA PIPELINES: OVERVIEW



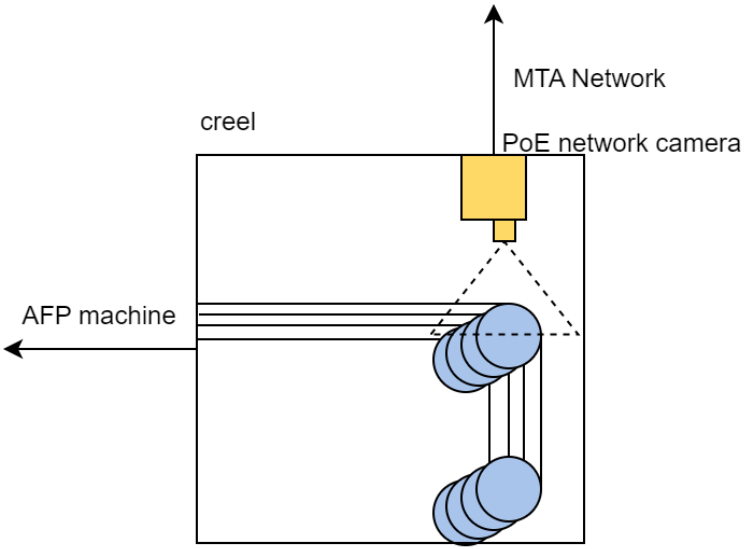
DATA PIPELINES: AFP MACHINE & PROCESS DATA



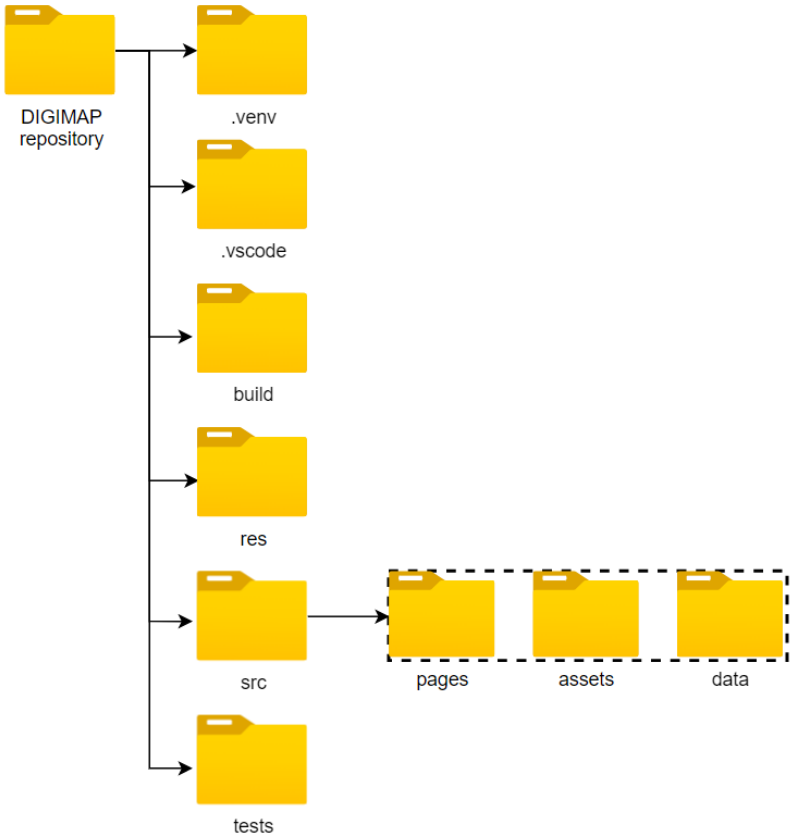
DATA PIPELINES: AFP CLEAN ROOM DATA



DATA PIPELINES: CREEL OBSERVATION



SOFTWARE OVERVIEW



- Lines of code: **7538**
- Non-comment lines of code: **4275**
- Number of commits: **240**
- Files: **35**
- Classes: **35**
- Tests: **976**
- Unit test coverage: **93%**

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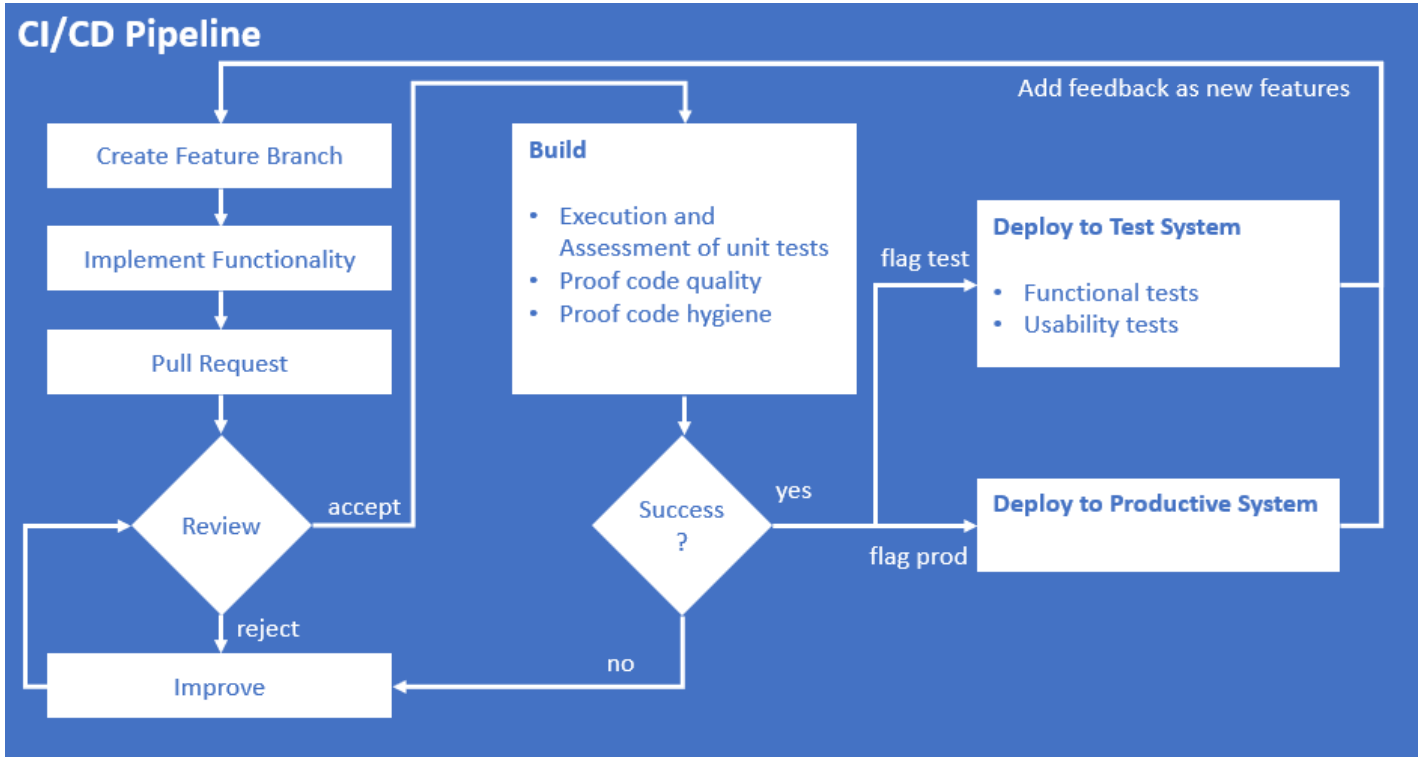

Objectives

- Automating building, testing and deployment of the software
- Ensuring robustness of the software product
- Assuring Software Product Quality
- Enabling Configuration Management

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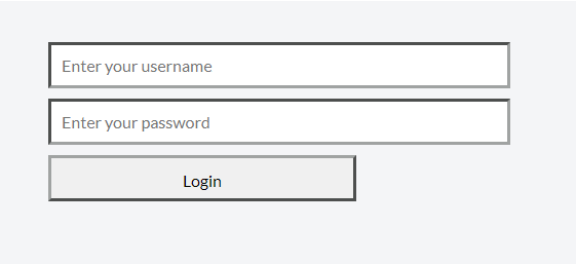
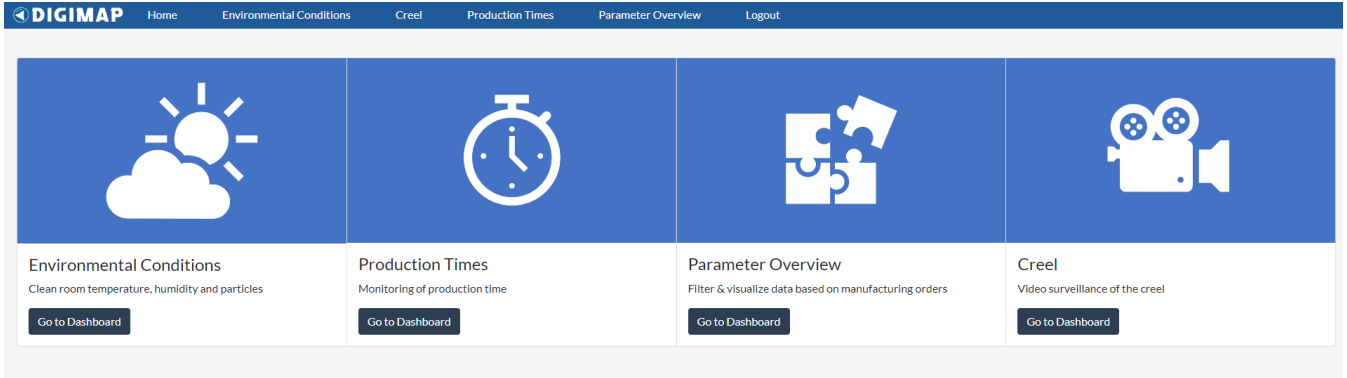
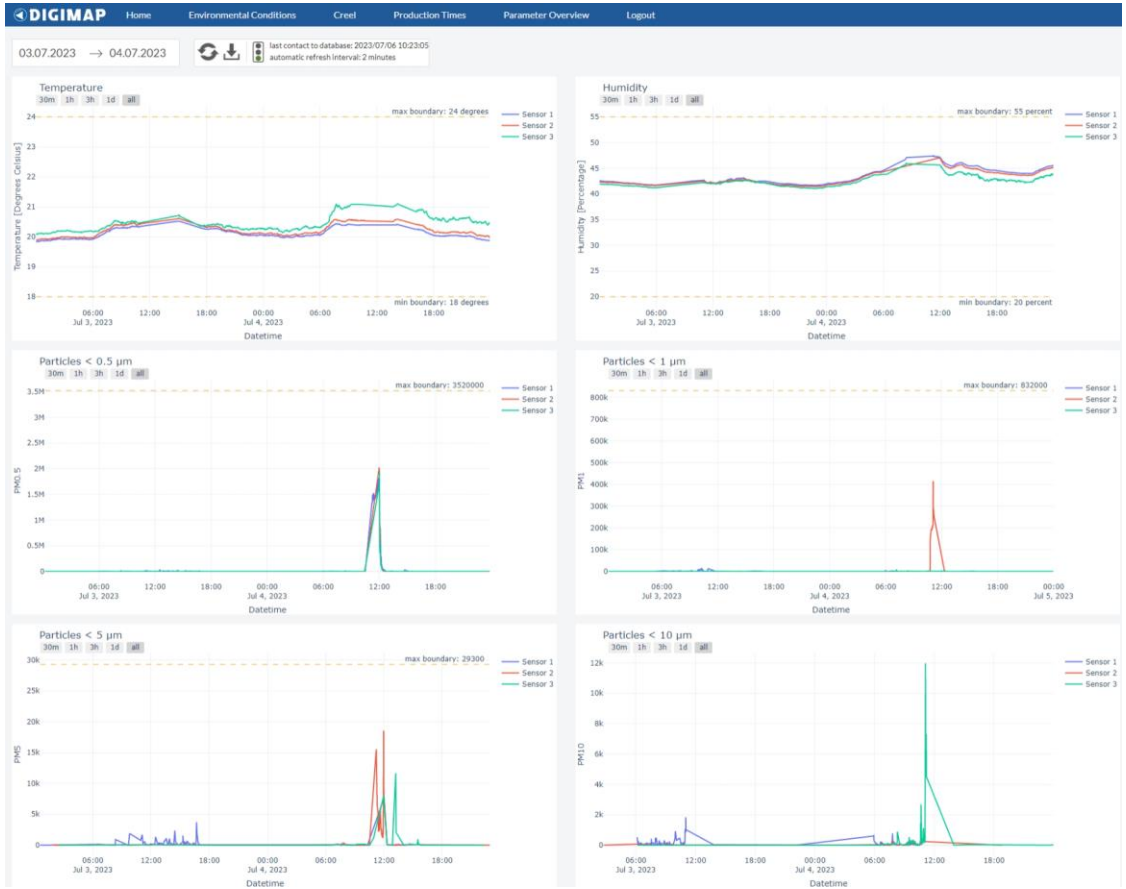
- Login-function:



- Navigation via menu & home-page:



MTA USE CASE – ENVIRONMENTAL CONDITIONS



MTA USE CASE – PARAMETER OVERVIEW

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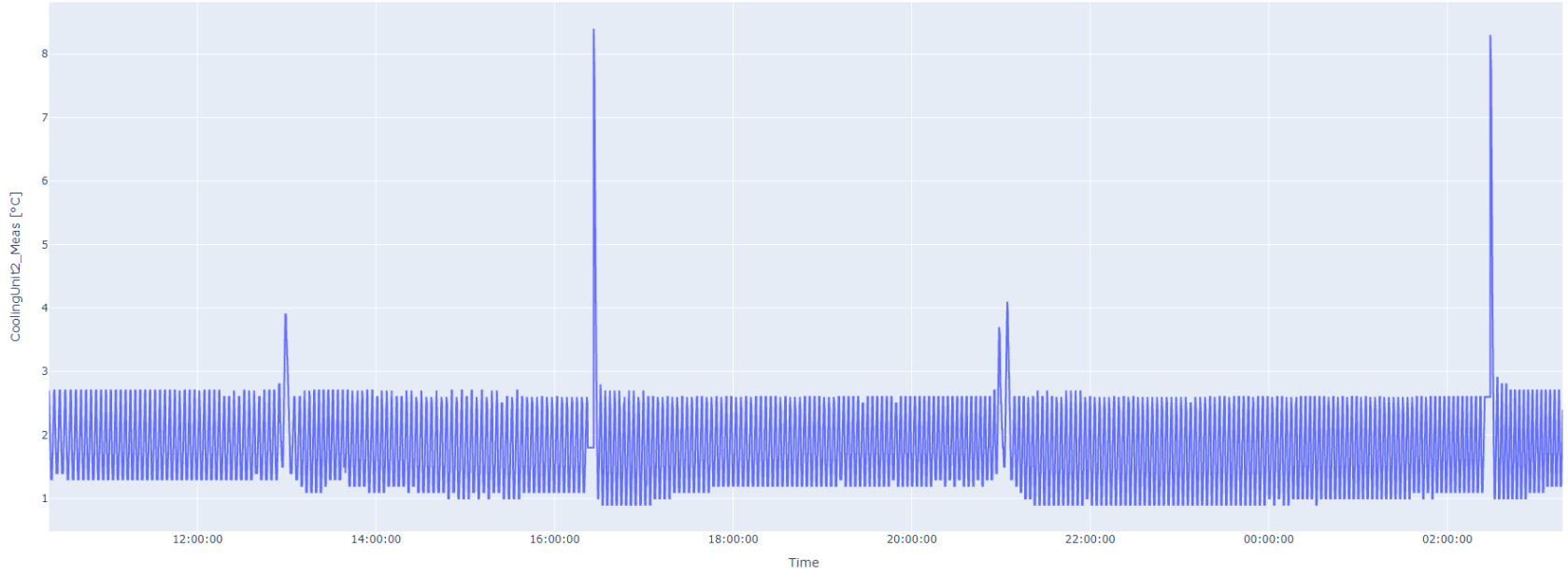
DIGIMAP | Home | Environmental Conditions | Creel | Production Times | Parameter_overview | Logout

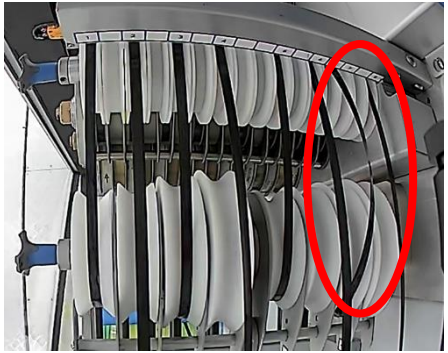
from: 09:32:42 until: 09:32:42 manufacturing order: subprogram: Select... Presettings: Select...

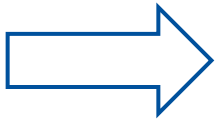
time interval [s]: x-parameter: Time y-parameter: CoolingUnit2_Meas y2-parameter: Select... color: Select... additional-parameter: Select... Download Data

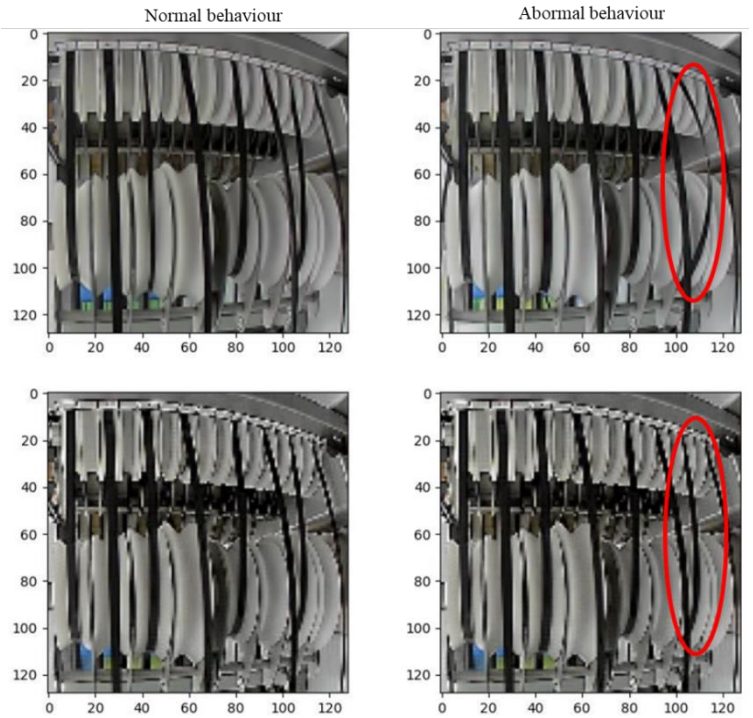
Boxplot SD TT.mm.jjjj -- TT.mm.jjjj -- lines target min max lines target min max bluered min max



MTA USE CASE – CREEL OBSERVATION







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Before

- No check of real production times (including plant downtimes, manual production steps)
- No database for the calculation and estimation of the plant‘s productivity

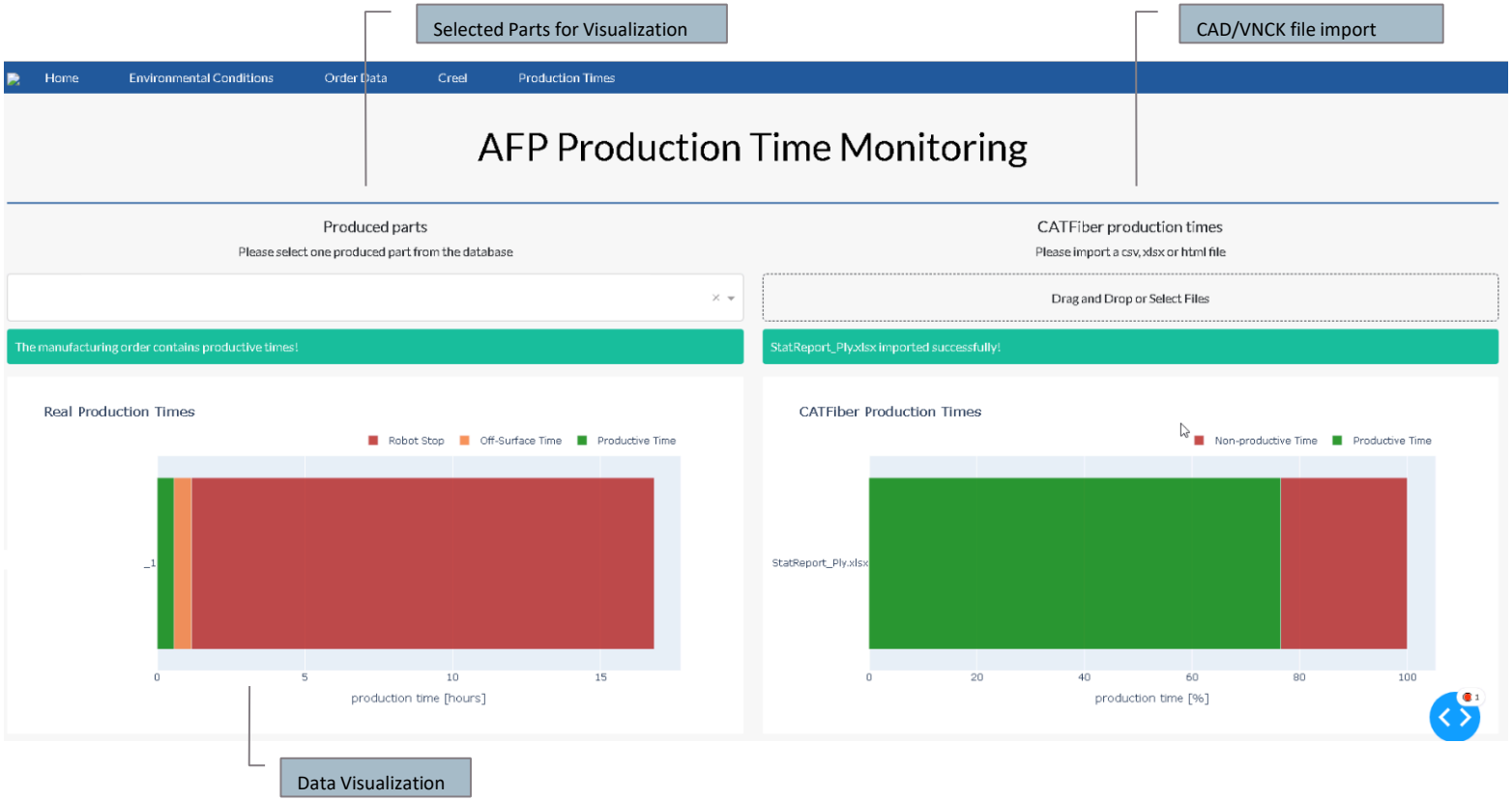
After

- Continuous tracking of the production times and machine productivity for the manufactured parts based on machine data
- Monitoring application integrated into the IoT platform developed within DIGIMAP
- Integrated into MTA Dashboard for easy access

Benefits & opportunities

- Real production times are tracked and can be visualised by workers/managers
- Database for predicting the production times of future parts

IGCV USE CASE – PRODUCTION TIMES



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Before

- No traceability of machine parameters for the manufactured parts
- Process errors are documented manually during the lay-up and subject to mistakes or incompleteness

After

- Automated traceability of process parameters and machine errors
- Cloud storage of data
- 3D visualization of collected data within the Nebumind software with several filter possibilities

Benefits & opportunities

- Better and more accurate process traceability
- Database for the AFP process analysis, understanding and improvement

IGCV USE CASE – DATA VISUALIZATION FOR PRODUCT TWIN

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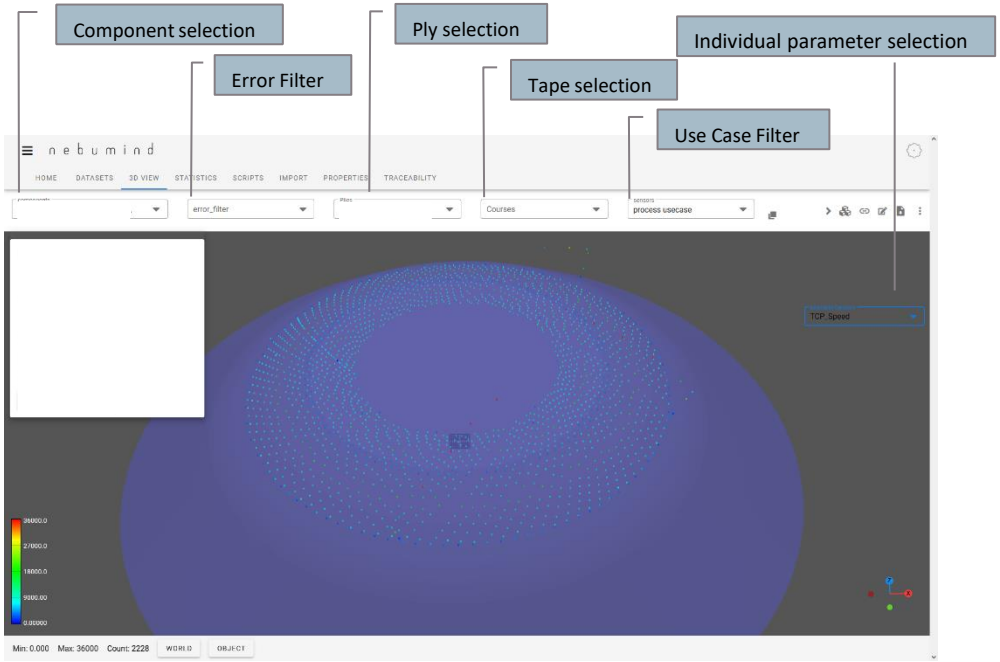
- **Challenge**
  - Up to 10.000 parameters from machine PLC + external sensors (e.g. machine environment)
  - Export not suitable for usage regarding
    - Process robustness, understanding
    - Part quality
    - Correlation of several parametes
    - Product twin regarding machine parameters
- **Motivation**
  - Point out correlations and dependency of different parameters on component (Ply, Tape) level
- **Goal**
  - Clustering of parameters into specific use cases
  - Define needed parameters
  - Define useable and flexible visualization

IGCV USE CASE – DATA VISUALIZATION FOR PRODUCT TWIN



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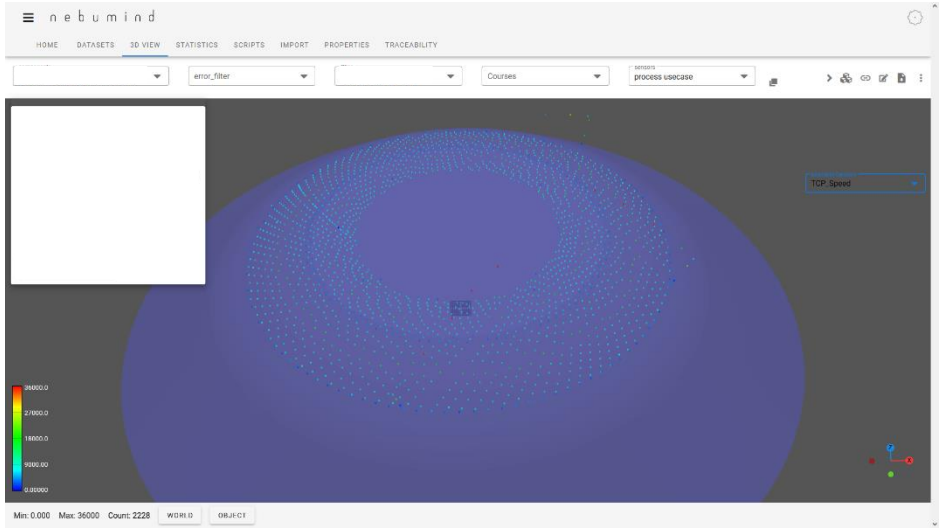
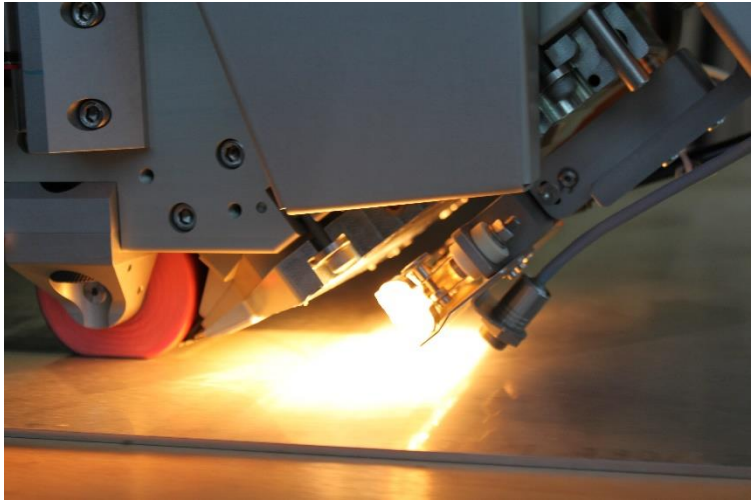
Specific Use-cases

- **Process**
  - Velocity of TCP, compaction pressure, tool depth, temperature, pyrometers
- **Process environment**
  - Head, tube, creel conditions (humidity, temperature)
- **Machine environment**
  - Particles, humidity temperature
- **Machine errors**
  - Rotation Fault, Spool Overload
  - Manually Specified Errors (e.g. temperature range) regarding process boundries

IGCV USE CASE – DATA VISUALIZATION FOR PRODUCT TWIN





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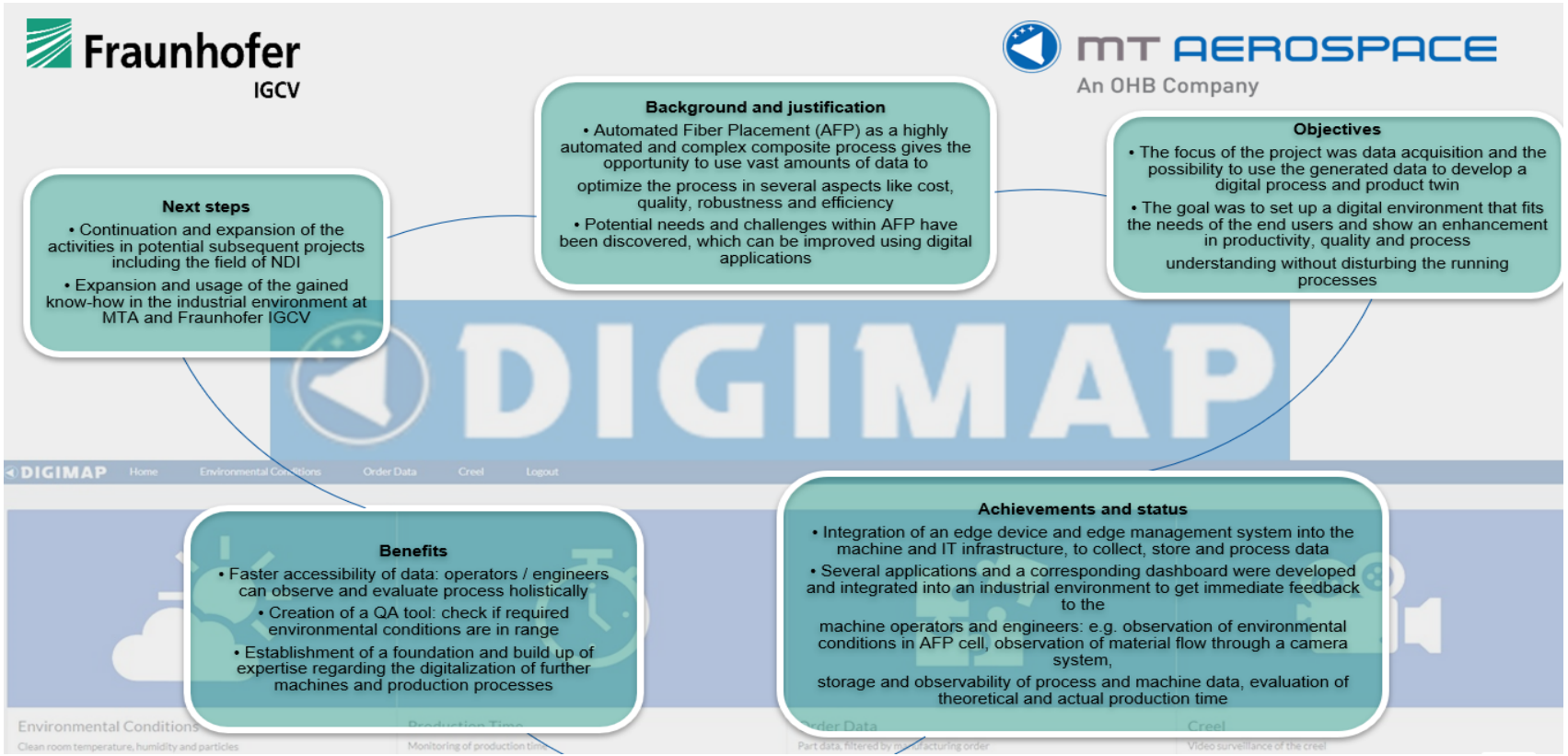
Use Case Process

(1) Tool Depth, (2) Compaction Force, (3) Velocity, (4) Pyrometer Temperature

→ Check process window, Process understanding, evaluate cause of error or layup defect, check tooling/substrate surface (tool depth and target path)

SUMMARY



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