



DATA HANDLING FOR PLC-BASED RESEARCH FACILITIES - HOW TO INTERACT WITH DATA?

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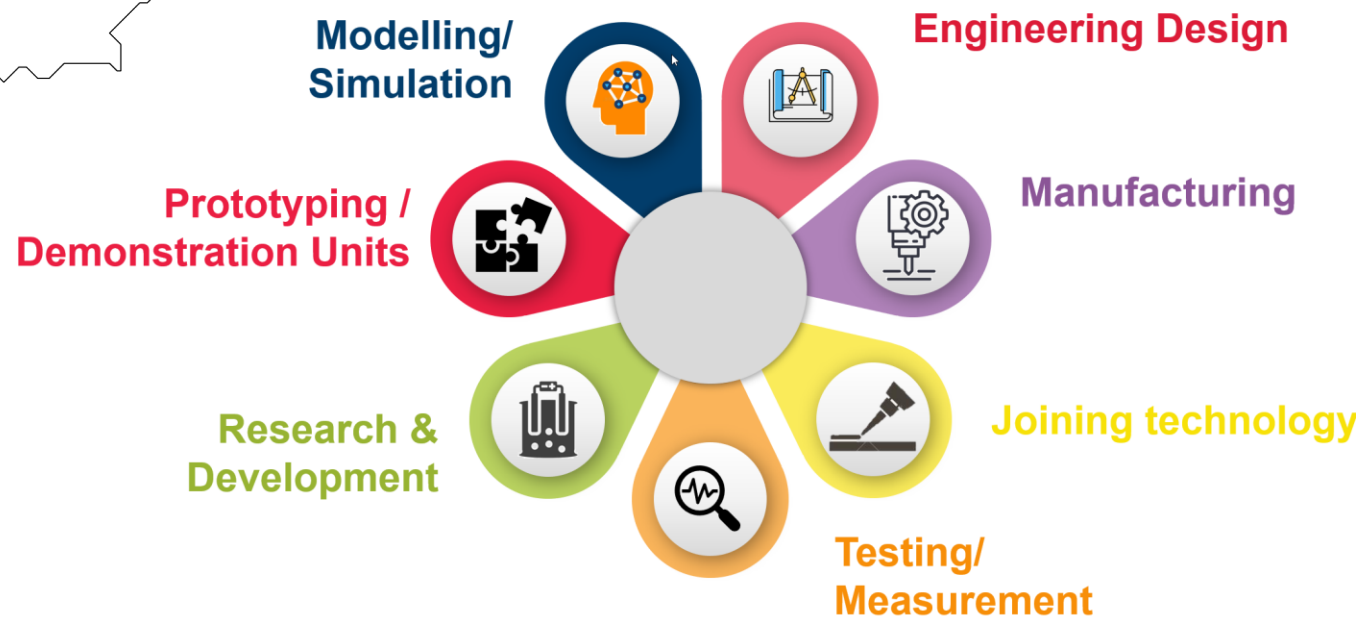
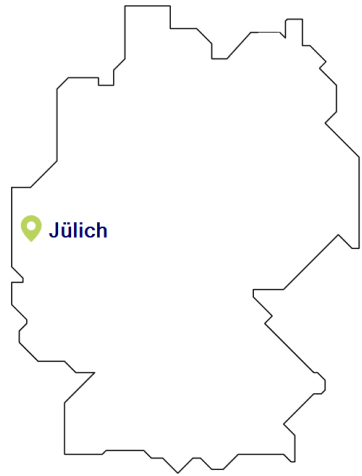
- ▶ **2013-2016:** Bachelor of Engineering – Electrical Engineering, Hochschule Düsseldorf
- ▶ **2017- now:** Automation engineer, Forschungszentrum Jülich GmbH (IKP-4, ZEA-1)
- ▶ **2017-2021:** Master of Science – Automation and Control Engineering, University of Duisburg-Essen
- ▶ **2023- now:** Promotion - Usability & User Experience in Research Facilities, RWTH Aachen University
- ▶ **2024:** Certified Usability Engineer, Fraunhofer Institute for Applied Information Technology FIT

FORSCHUNGSZENTRUM JÜLICH

Central Institute of Engineering, Electronics and Analytics (ZEA)

ZEA-1 | Engineering and Technology

“Design, development and fabrication of scientific and technical equipment, instruments and processes”



Automation and Mechatronics

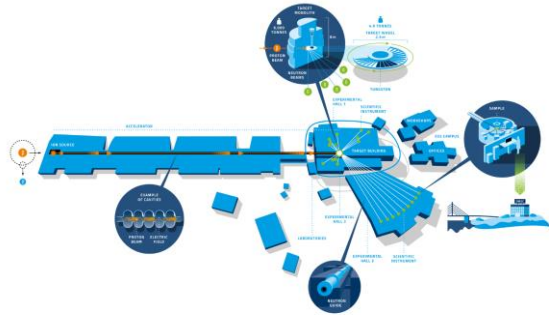
- PLC Systems
- Control Technology
- Safety Systems
- HMI Systems
- Data Handling Solutions
- Data Analysis Algorithm

OUTLINES OF THE TALK

1. Introduction
2. Data Management Portal
 - a. Context Analysis
 - b. Design
 - c. Technical Realisation
 - d. Features
3. Conclusion and Future Outlook

INTRODUCTION

Large Research Facilities



*1)

**European Spallation Source (ESS)
Lund (SWE)**

*b)

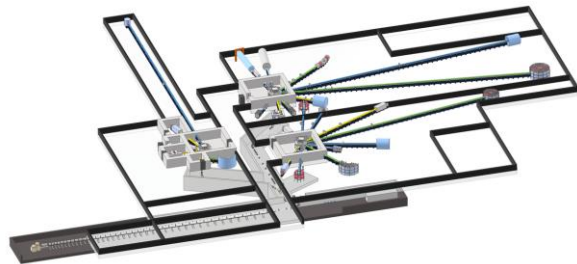
SCADA Systems:



EPICS

SIEMENS BECKHOFF
TwinCAT[®]

(Experimental Physics and Industrial Control System)

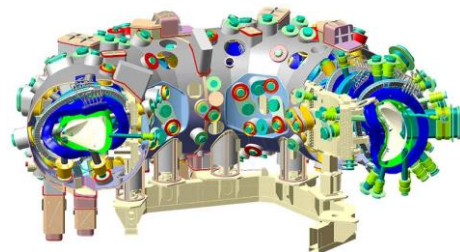


*2)

**High Brilliance Neutron Source
Jülich (GER)**

*c)

TANGO
SIEMENS



*3)

**Wendelstein 7-X,
Greifswald (GER)**

*d)

SIMATIC
PCS 7
SIEMENS

*1) <https://europeanspallationsource.se/sites/default/files/images/media/2023-09/Poster%20Example%20EXPLORE%20202-01.png>

*2) <https://www.fz-juelich.de/de/jcns/jcns-2/leistungen/high-brilliance-neutron-source>

*3) https://www.ipp.mpg.de/1456183/wendelstein_7_x

INTRODUCTION

Small to Medium Research Facilities

SCADA Systems:



*1)

LOHCTOPUS
LOHC Catalyst Screening
Erlangen (GER)

*e)

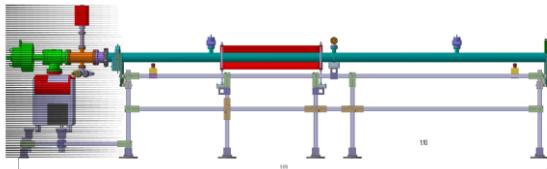
BECKHOFF
TwinCAT®



*2)

AgraSim
Plant Simulation Chamber
Jülich (GER)

*f)



*3)

Vacuum Test Stand
Jülich (GER)

*g)



*1), *2), *3) <https://www.fz-juelich.de/de>

INTRODUCTION

How to Interact with Data in Large Research Facilities?

Perform the
Experiment



Export the
Measurement Data



Analyse the
Measurement Data



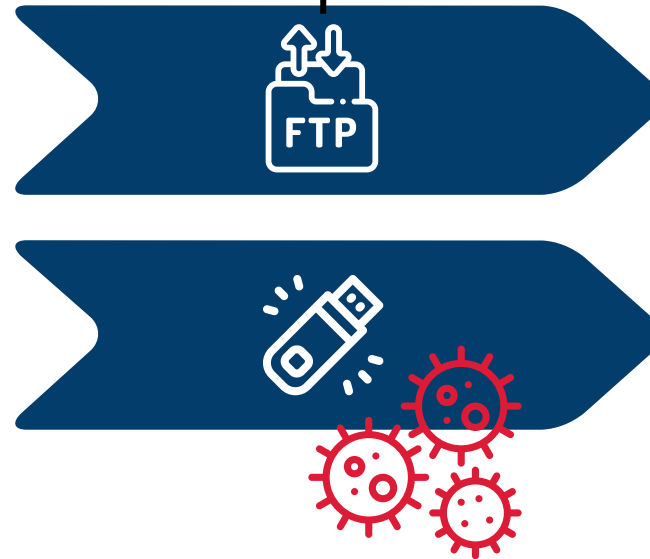
INTRODUCTION

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INTRODUCTION

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DATA MANAGEMENT PORTAL

Context Analysis due to IOS 9241-11



DATA MANAGEMENT PORTAL

Context Analysis due to IOS 9241-11

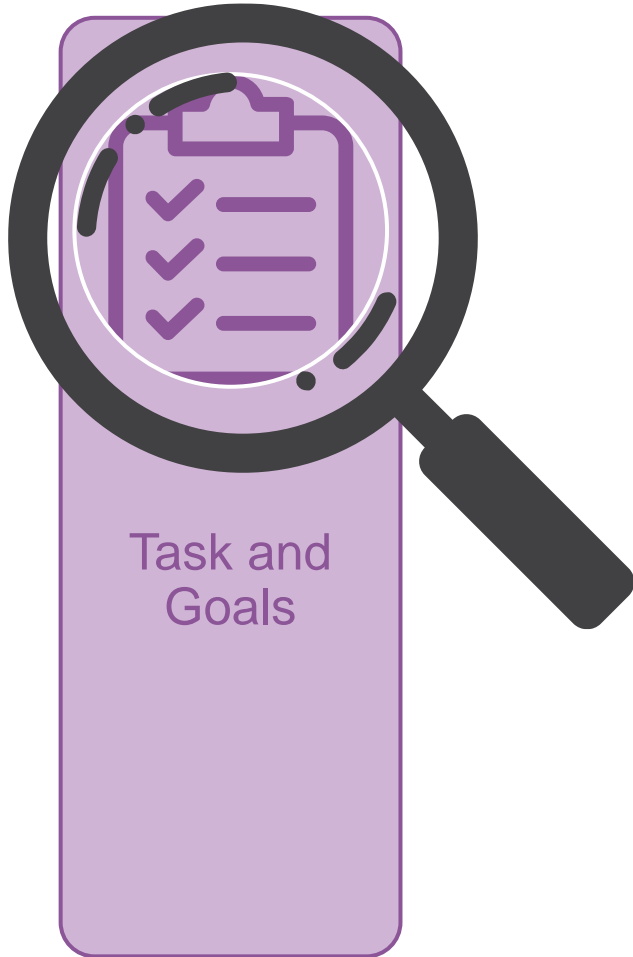


- Define personas for:
 - Plant operator
 - Engineers
 - **Scientists** in Information, Energy or Bioeconomy

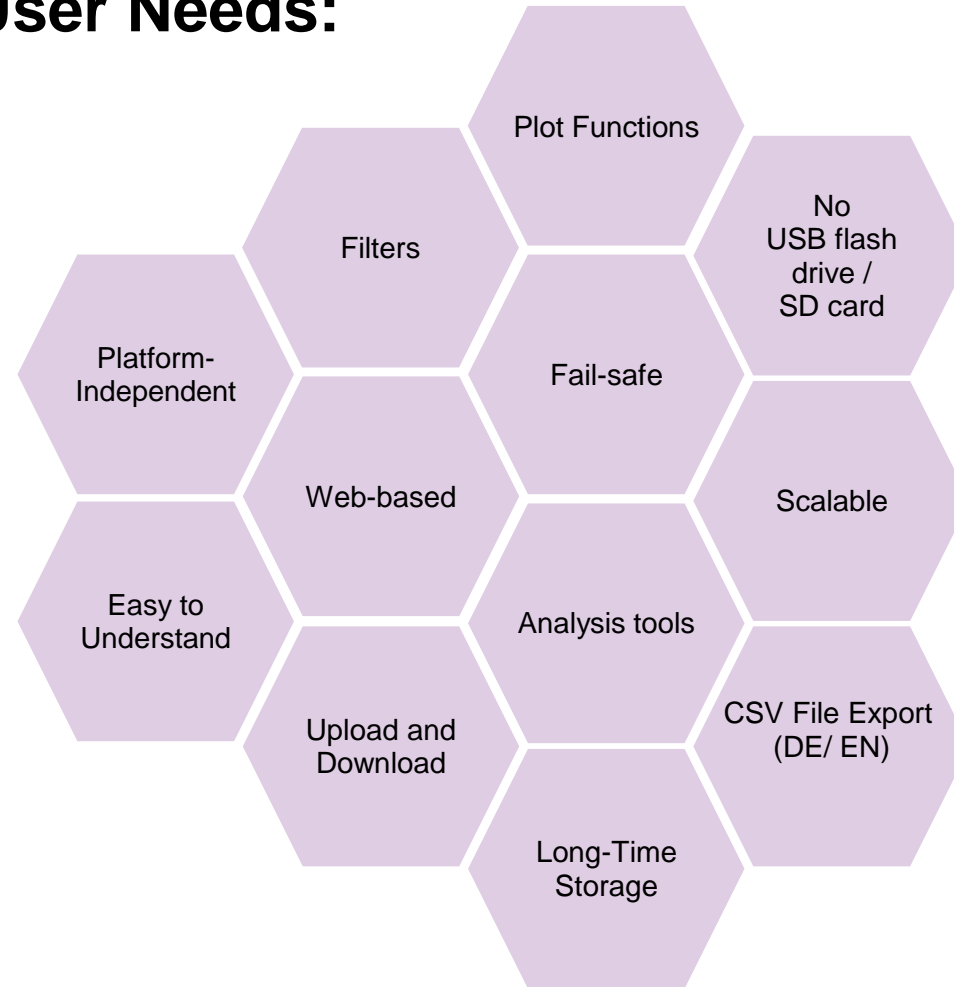


DATA MANAGEMENT PORTAL

Context Analysis due to IOS 9241-11



User Needs:



DATA MANAGEMENT PORTAL

Requirements



User Interface → Website (DE, EN)



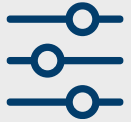
Scalable Hardware, Platform-Independent



Long-Time Storage = 10 years



Import and Export (.XLSX, .CSV)

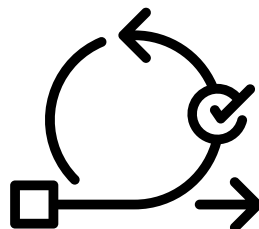
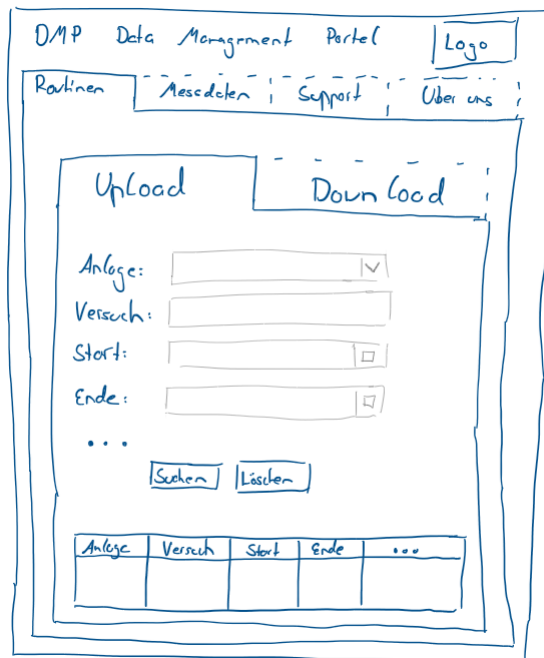


Configurable Structure

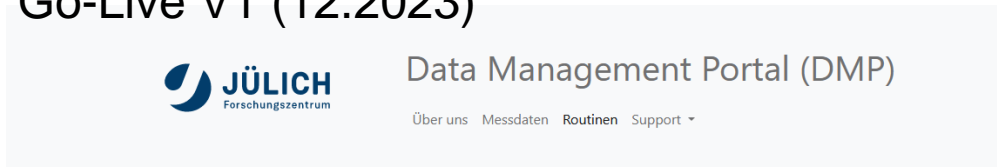
DATA MANAGEMENT PORTAL

Design

First Sketch (05.2023)



Go-Live V1 (12.2023)



Upload Download

Anlage*

Benutzer ⓘ

Versuchsname ⓘ

Startzeitpunkt ⓘ

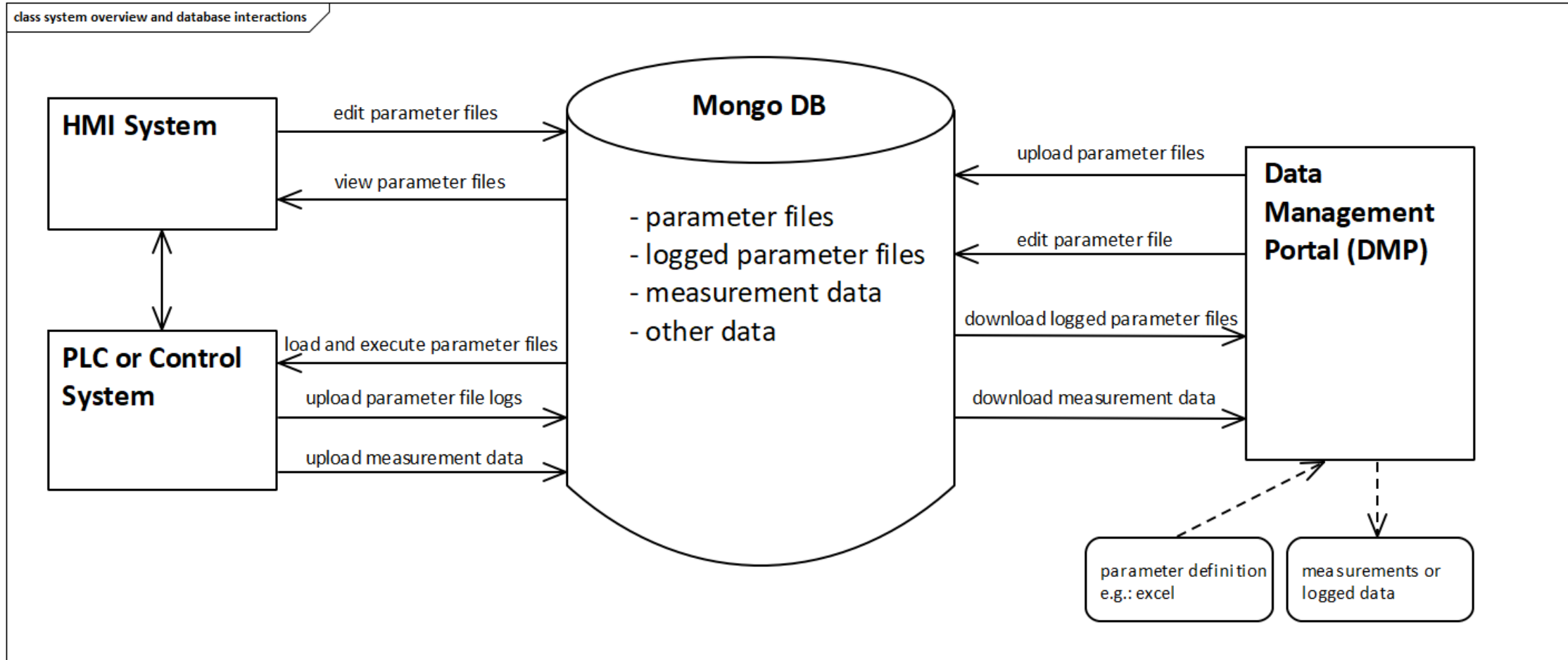
Endzeitpunkt ⓘ

Suchen Zurücksetzen

Versuchsname	Benutzer	Anlage	Reaktorslot	Gestartet	Beendet ^{TF}	Download	Copy	Messdaten
test_umbau_V39__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC2	2024-03-06 06:46	2024-03-06 09:39	Download		
test_umbau_V38__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC3	2024-03-05 08:55	2024-03-05 10:21	Download		
test_umbau_V37__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC3	2024-03-05 07:51	2024-03-05 08:17	Download		
test_umbau_V36__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC3	2024-02-29 14:18	2024-02-29 14:28	Download		
test_umbau_V35__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC1	2024-02-28 14:21	2024-02-28 14:51	Download		
test_umbau_V34__n.bergs_LOHCTOPUS	n.bergs	LOHCTOPUS	LOHC4	2024-02-19 13:47	2024-02-19 14:58	Download		

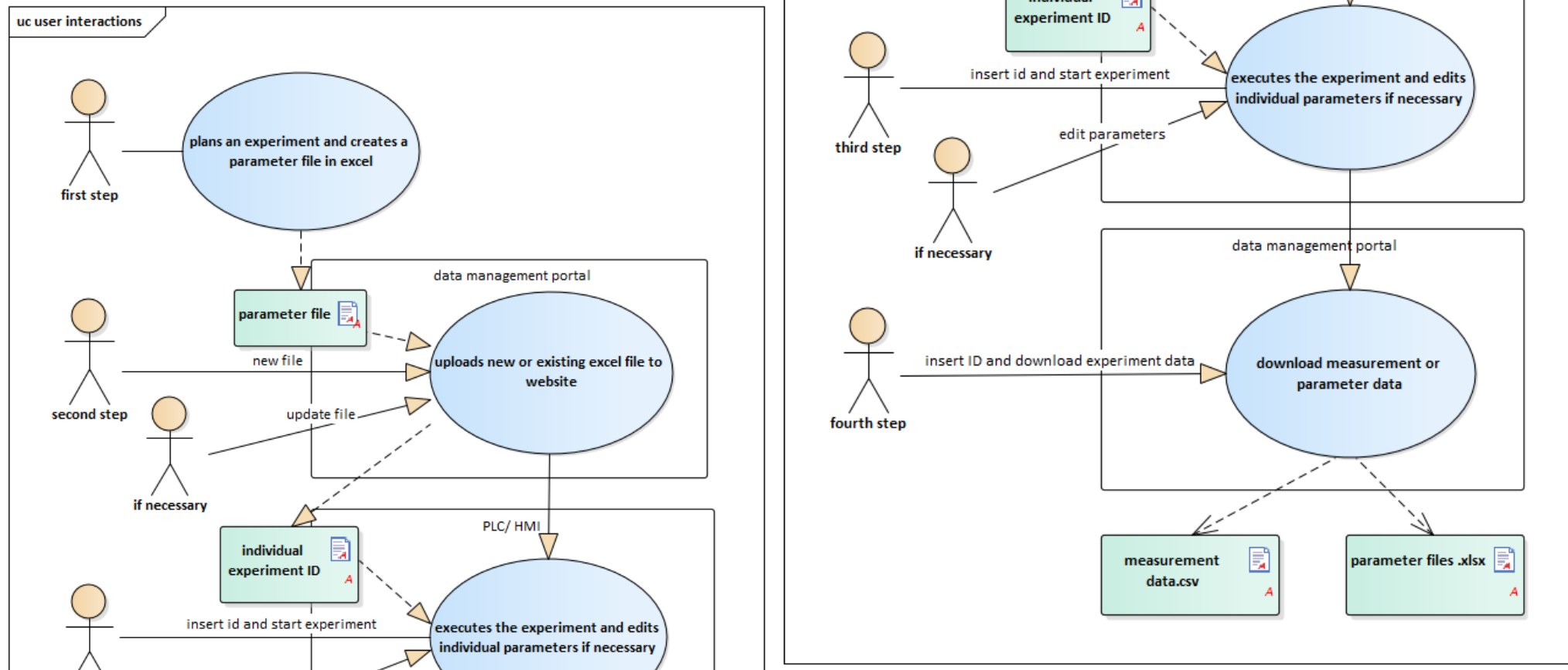
DATA MANAGEMENT PORTAL

Technical Realization



DATA MANAGEMENT PORTAL

User Interactions



DATA MANAGEMENT PORTAL

Features



Databased Storage → NoSQL with Optimised Collections



Import and Export Configfiles, Export Measurent Data



Various Filter Options



Docker Image to Become Platform Independent and Scalable



frictionless-py → Data Management Framework

CONCLUSION AND FUTURE OUTLOOK

**Go-Live
(First Facility)**



**Performance-
Test**



Usability-Test



**User
Management**



**Improve
Backup
Strategy**



**Integrated
Plot and
Analysis
Tools**



QUESTIONS



REFERENCES

- *a) <https://bilddb.fz-juelich.de/search?p=15> (Forschungszentrum Jülich / Sascha Kreklau)
- *b) <https://europeanspallationsource.se/>
- *c) <https://hbs.fz-juelich.de/>
- *d) <https://www.ipp.mpg.de/wendelstein7x>
- *e) <https://www.fz-juelich.de/de/zea/zea-1/forschung/forschungsbereiche/energy/lohctopus-1>
- *f) <https://www.fz-juelich.de/de/aktuelles/news/feature/die-pflanzen-zeitmaschine>
- *g) https://www.fz-juelich.de/de/zea/zea-1/forschung/forschungsbereiche/beschleuniger_physik/hesr-auszeizstand