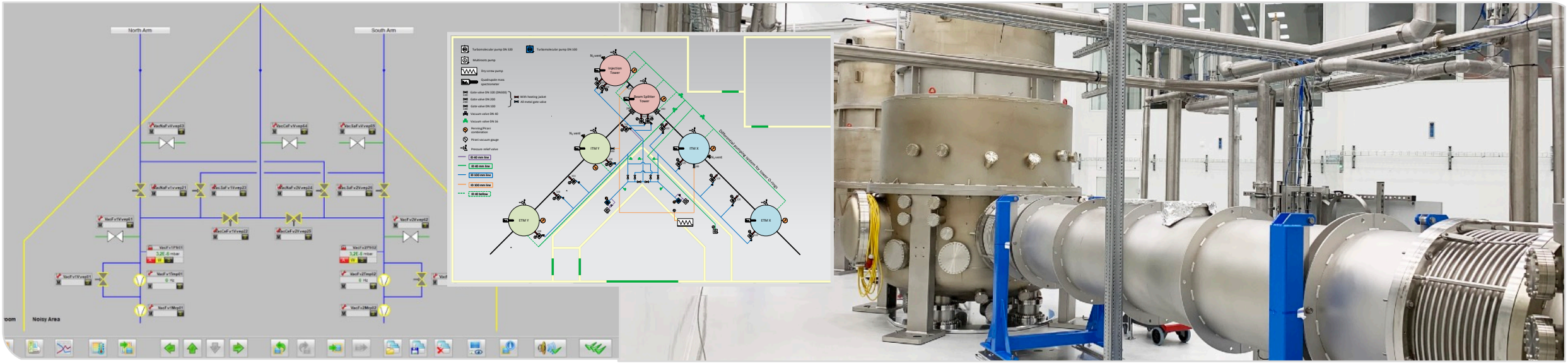
Karlsruhe Institute of Technology

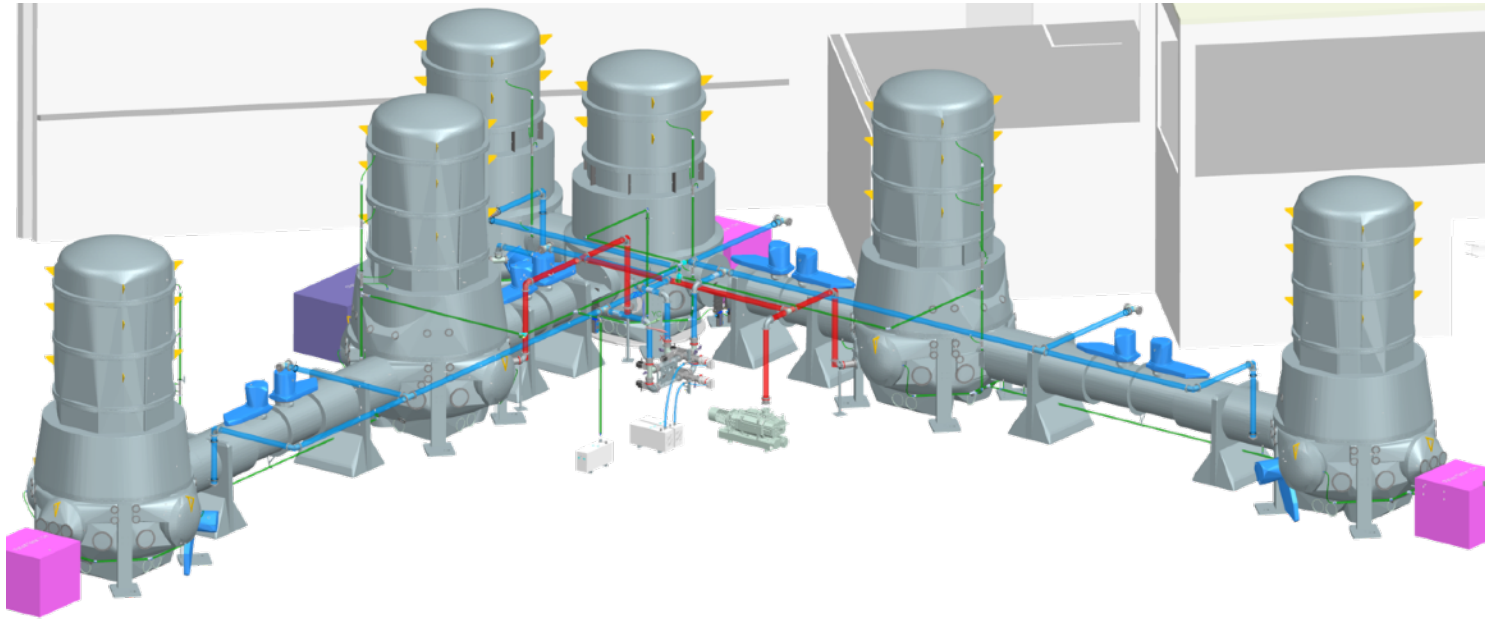
Status of the Vacuum PLC for ETpathfinder

Thomas Höhn, Thomas Thümmler, and Joachim Wolf
Maastricht, Feb 1, 2024



Introduction and Overview

- The ETpathfinder Vacuum System
  - UHV system
  - roughing system
  - differential system
  - distributed over noisy area and clean room



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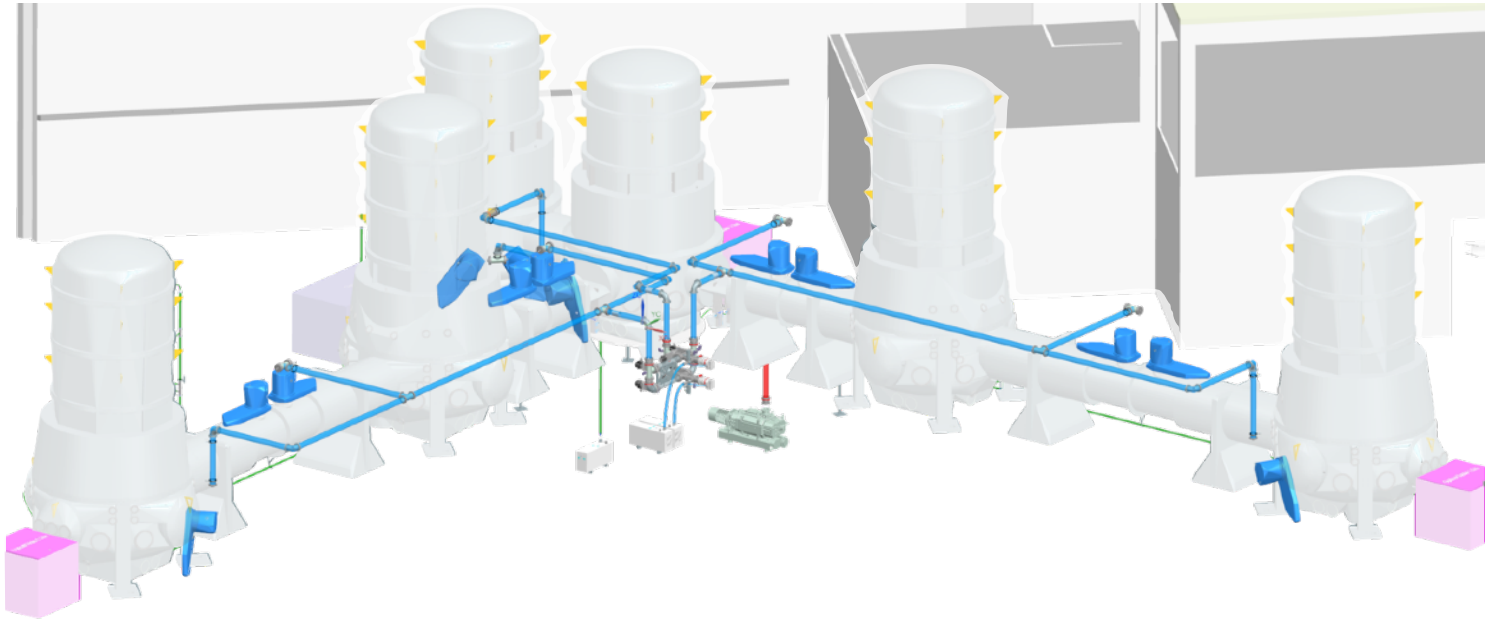

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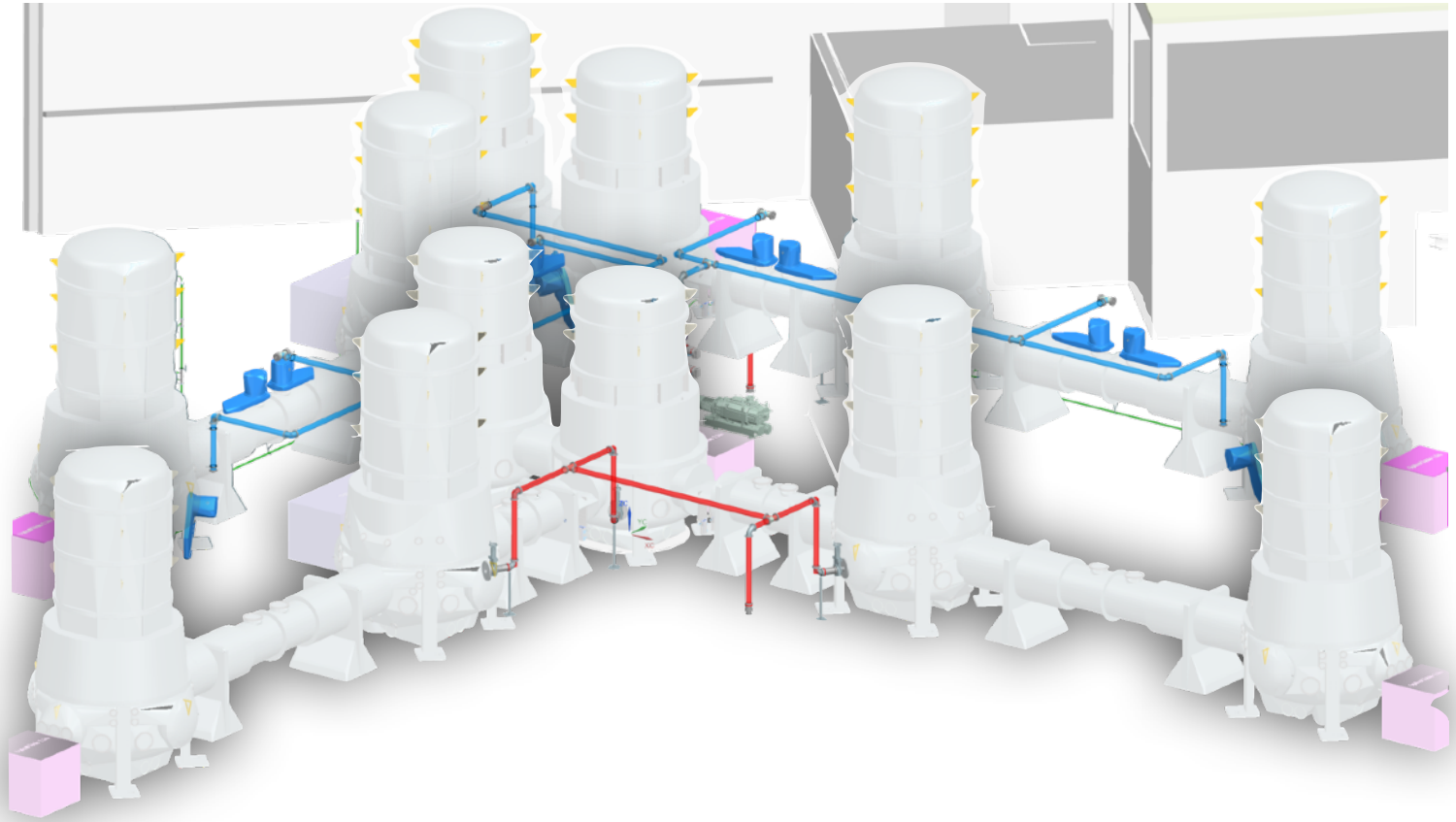

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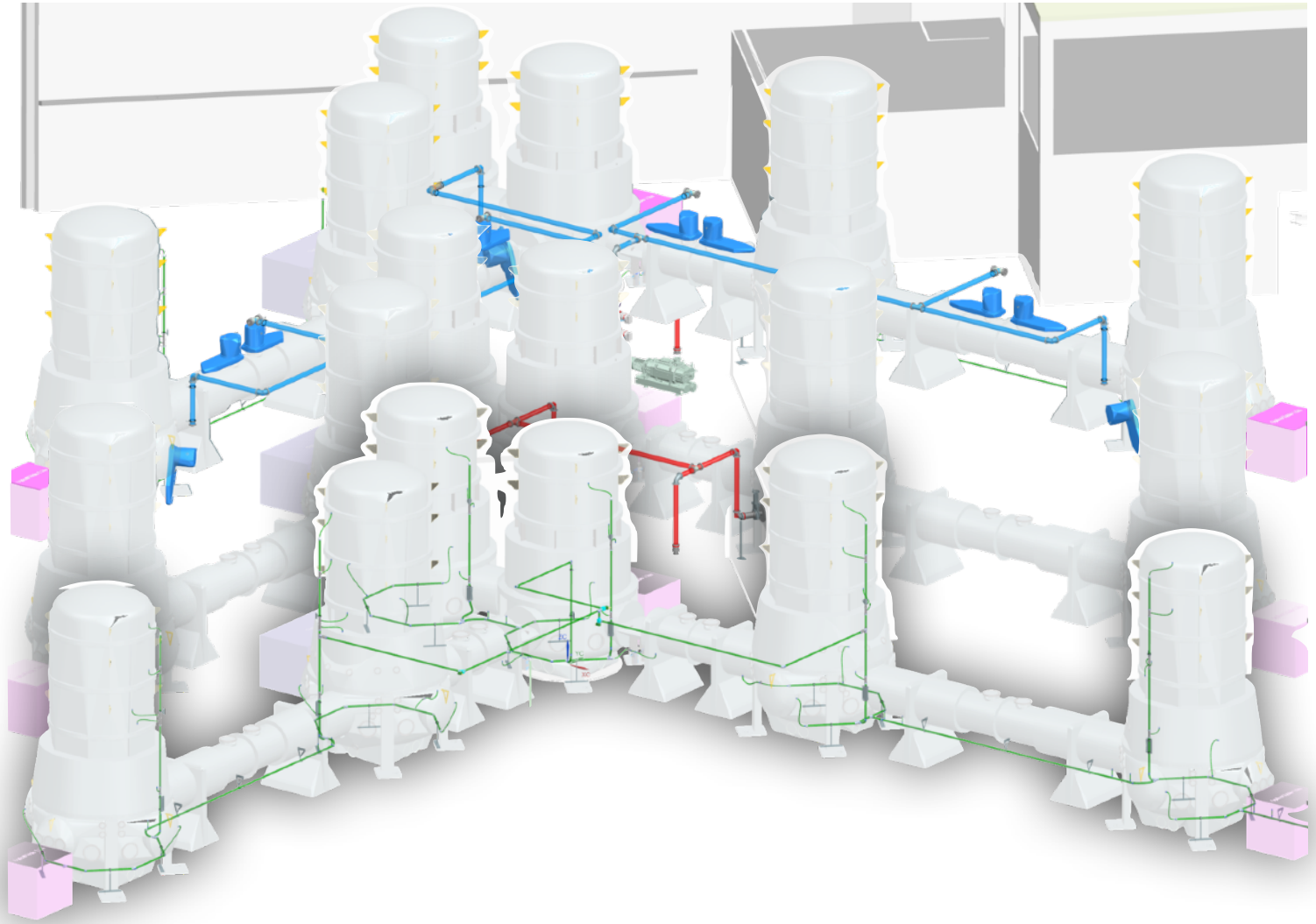

Introduction and Overview

- The ETpathfinder Vacuum System
  - UHV system
  - roughing system
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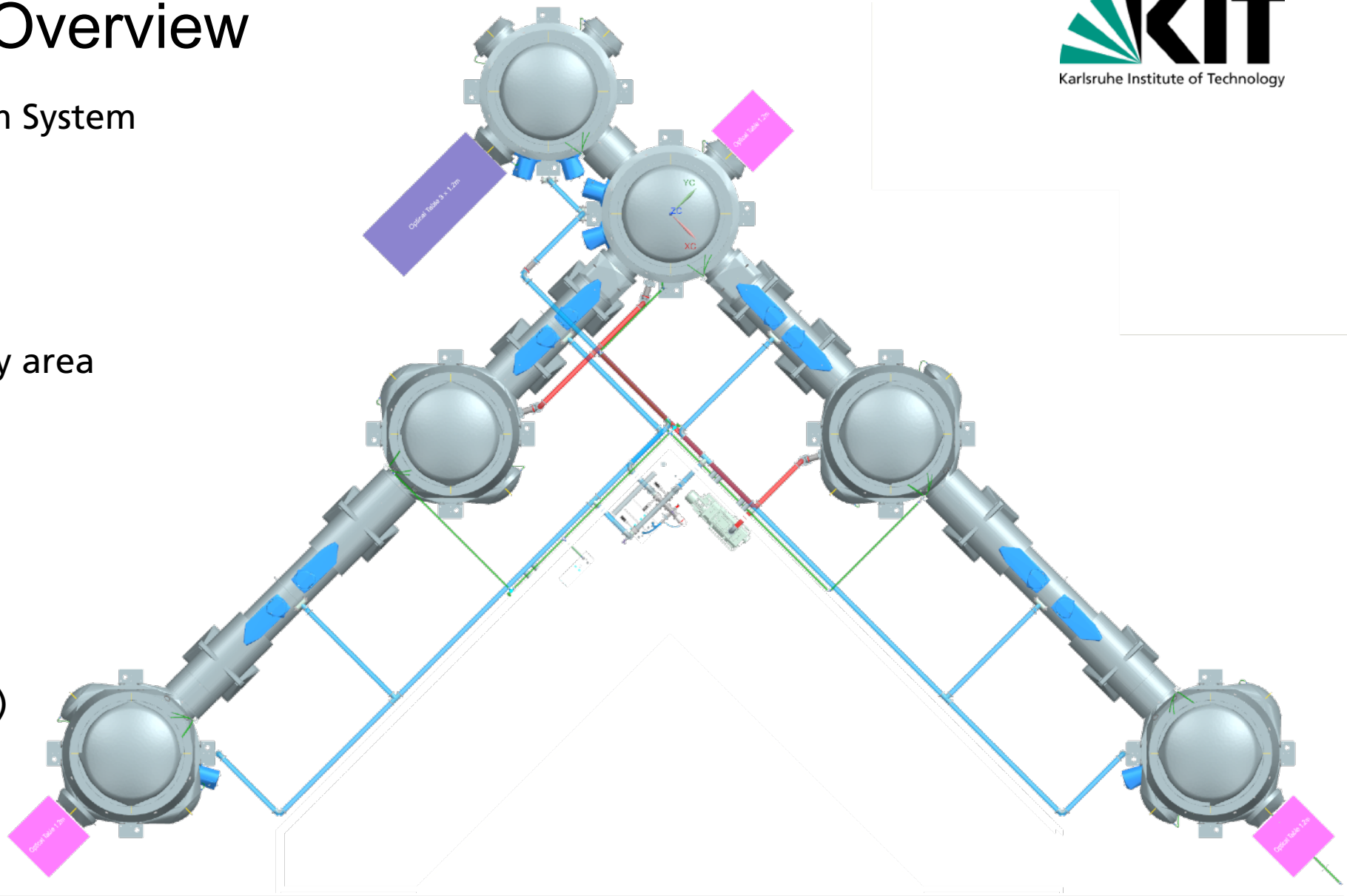
- In total:
  - 20 Pumps (all types)
  - 51 Valves (all types)
  - 24 Gauges (incl. RGA)



Concept and PCS7

- Concept of Vacuum PLC (Programmable Logic Controller)
  - based on Siemens PCS7, a SCADA (Supervisory Control and Data Aquisiton) system
  - provides user authorisation, alarm management, interlocks, data storage, …
  - it has isolated terminal (client) and system (hardware) busses
  - focus on availability, safety, and reliability

Concept and PCS7

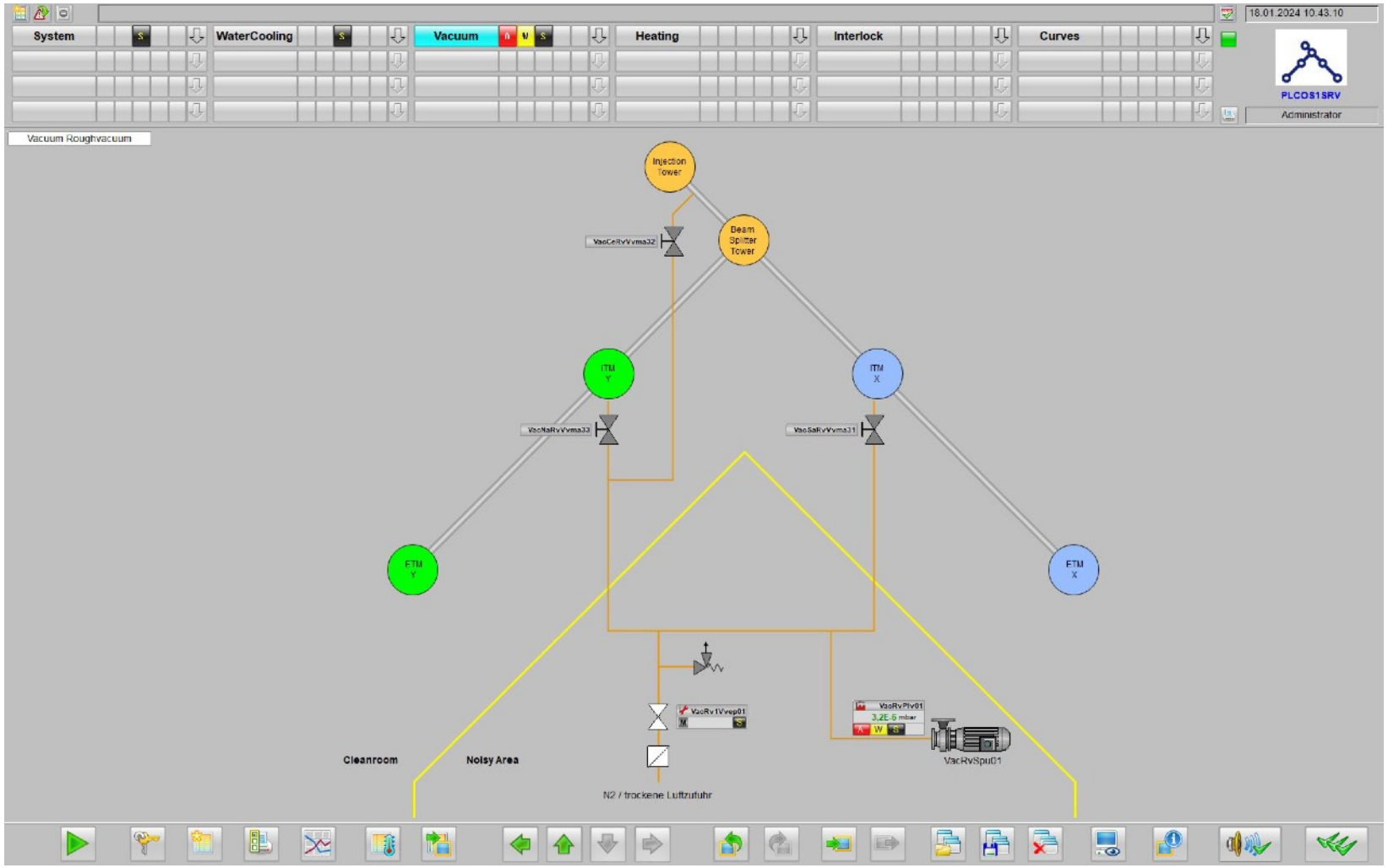
Alarms, Warnings, Errors

Technical labels of hierarchy

Interactive process flow diagram

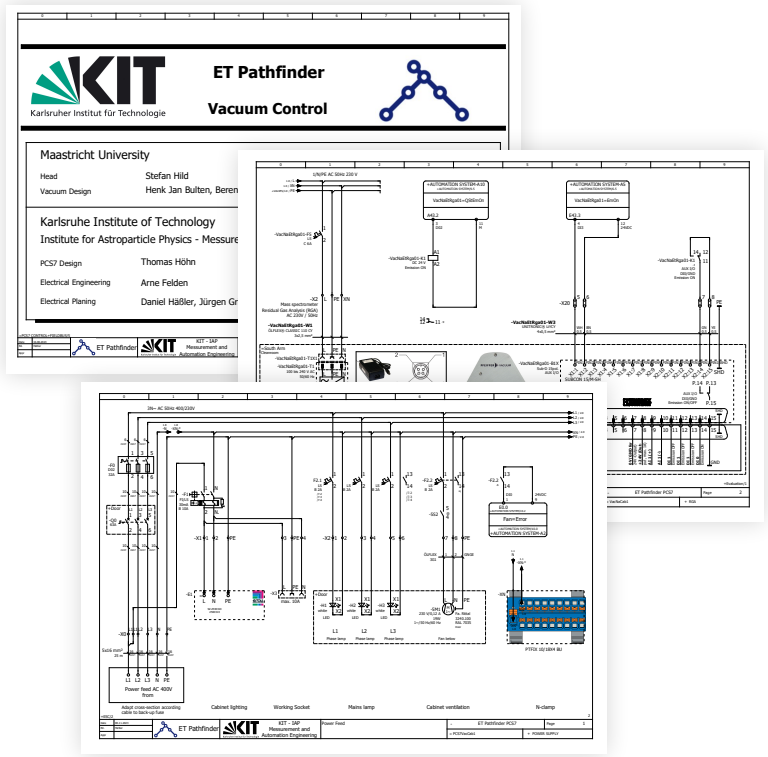
Dynamic object of pumps, valves, sensors….

Control buttons

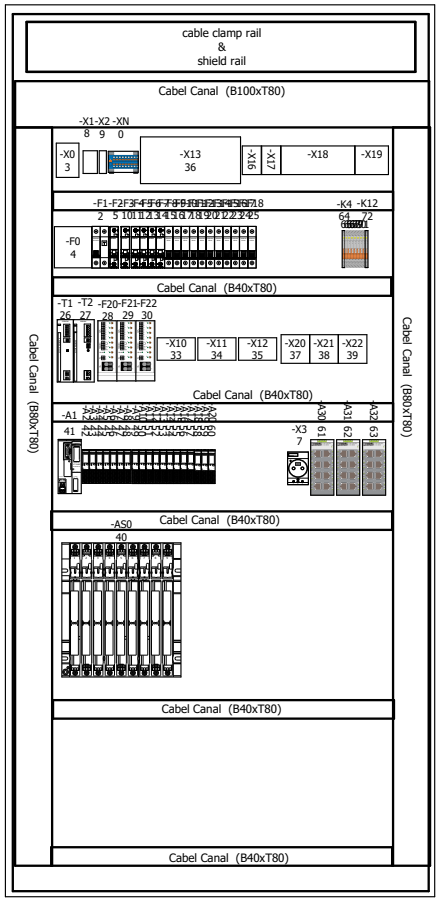


Control Cabinets and Layout

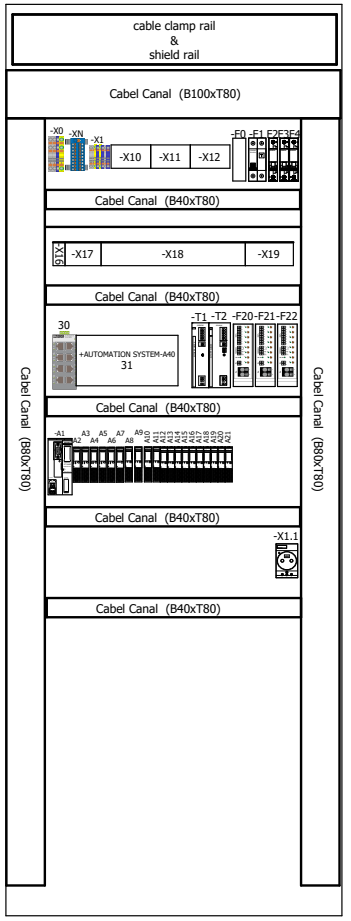
- Before going into operation, electronic racks, clients, servers, and spaces are needed.



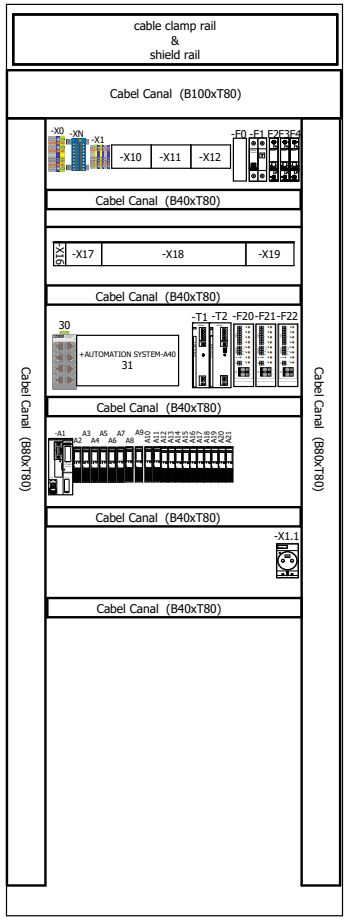
Noisy Area



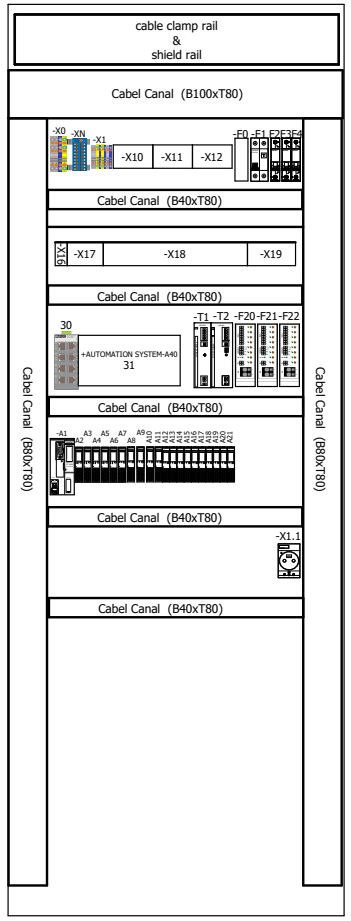
North Arm



Central



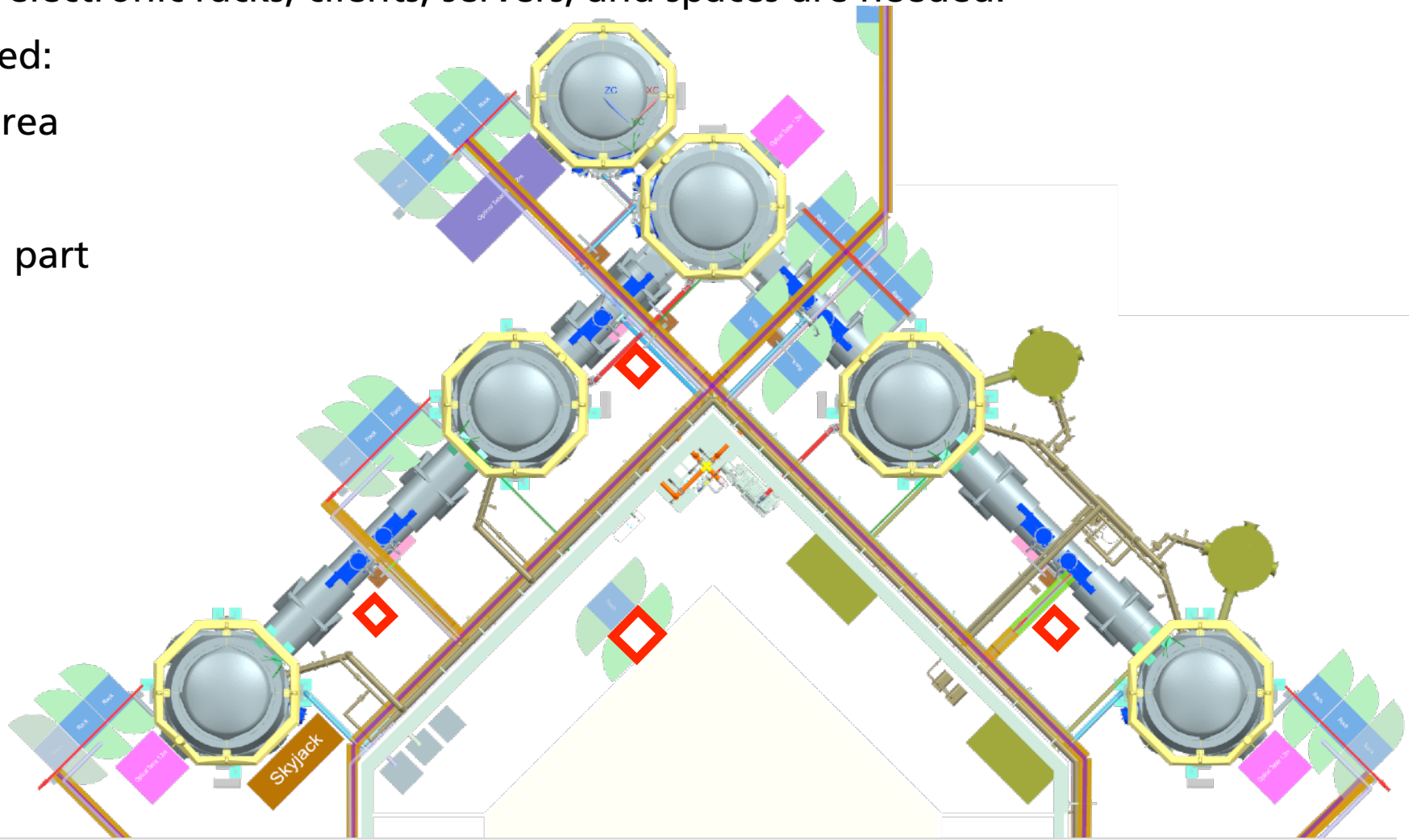
South Arm



- Circuit specification - done
- Assembling - in progress

Control Cabinets and Layout

- Before going into operation, electronic racks, clients, servers, and spaces are needed.
- Cabinet space has been located:
  - 1 cabinet ( ) in noisy area
  - 2 cabinets at each arm
  - 1 cabinet close to central part



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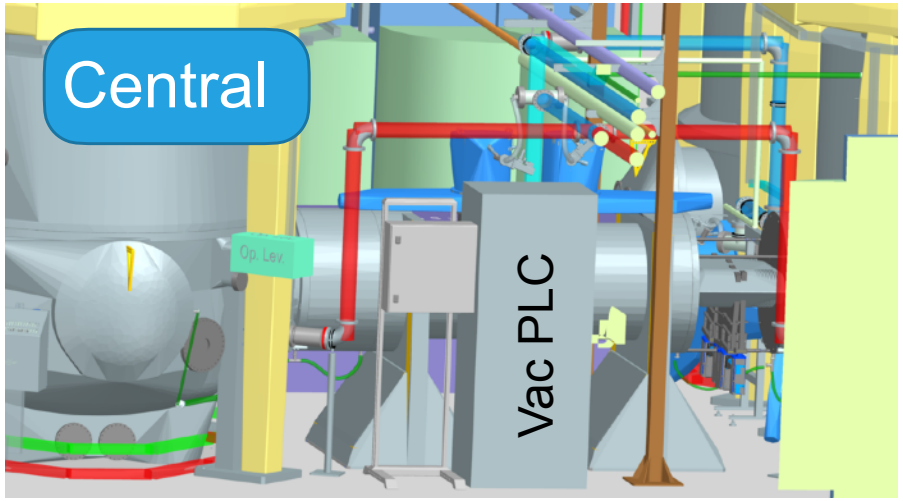
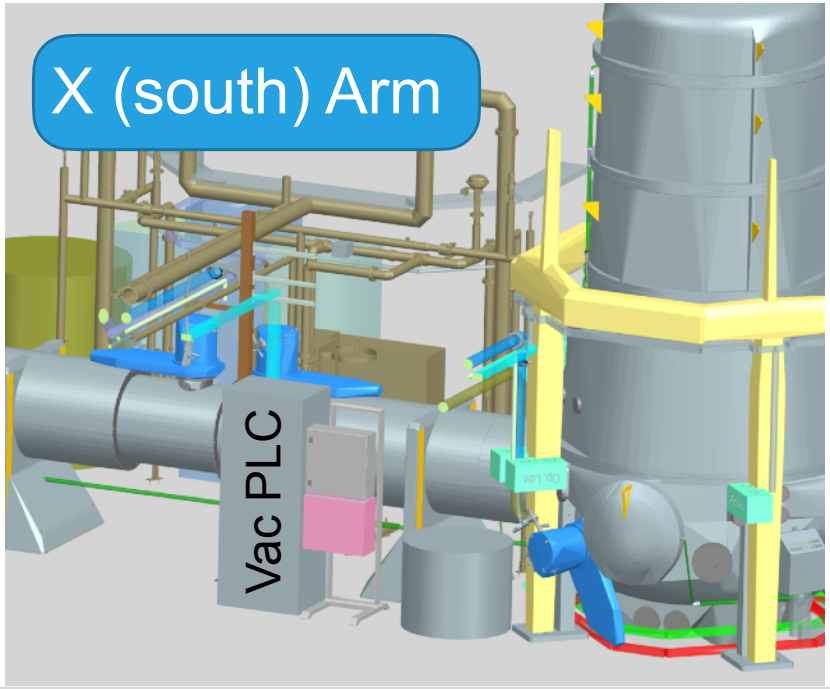
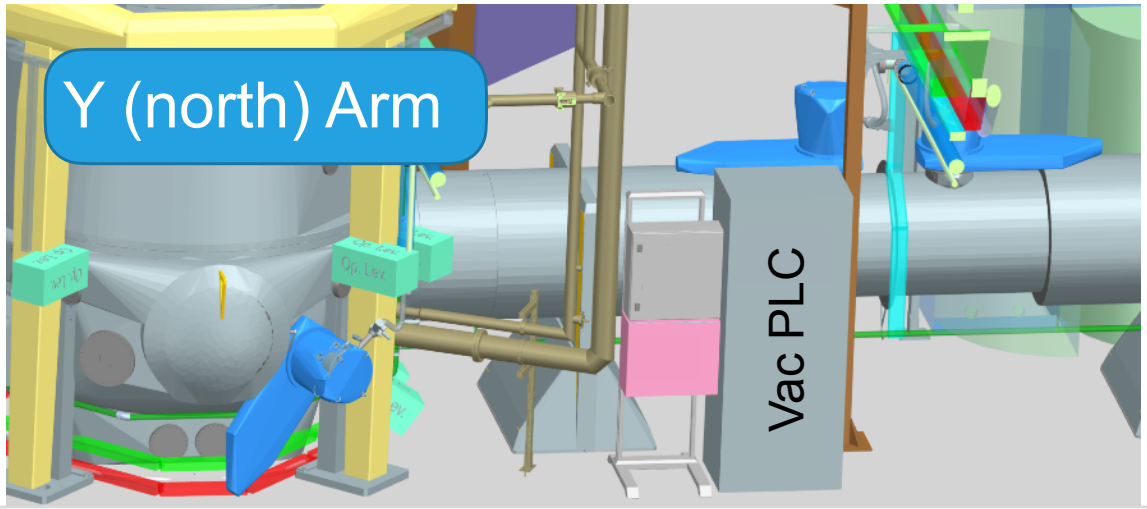
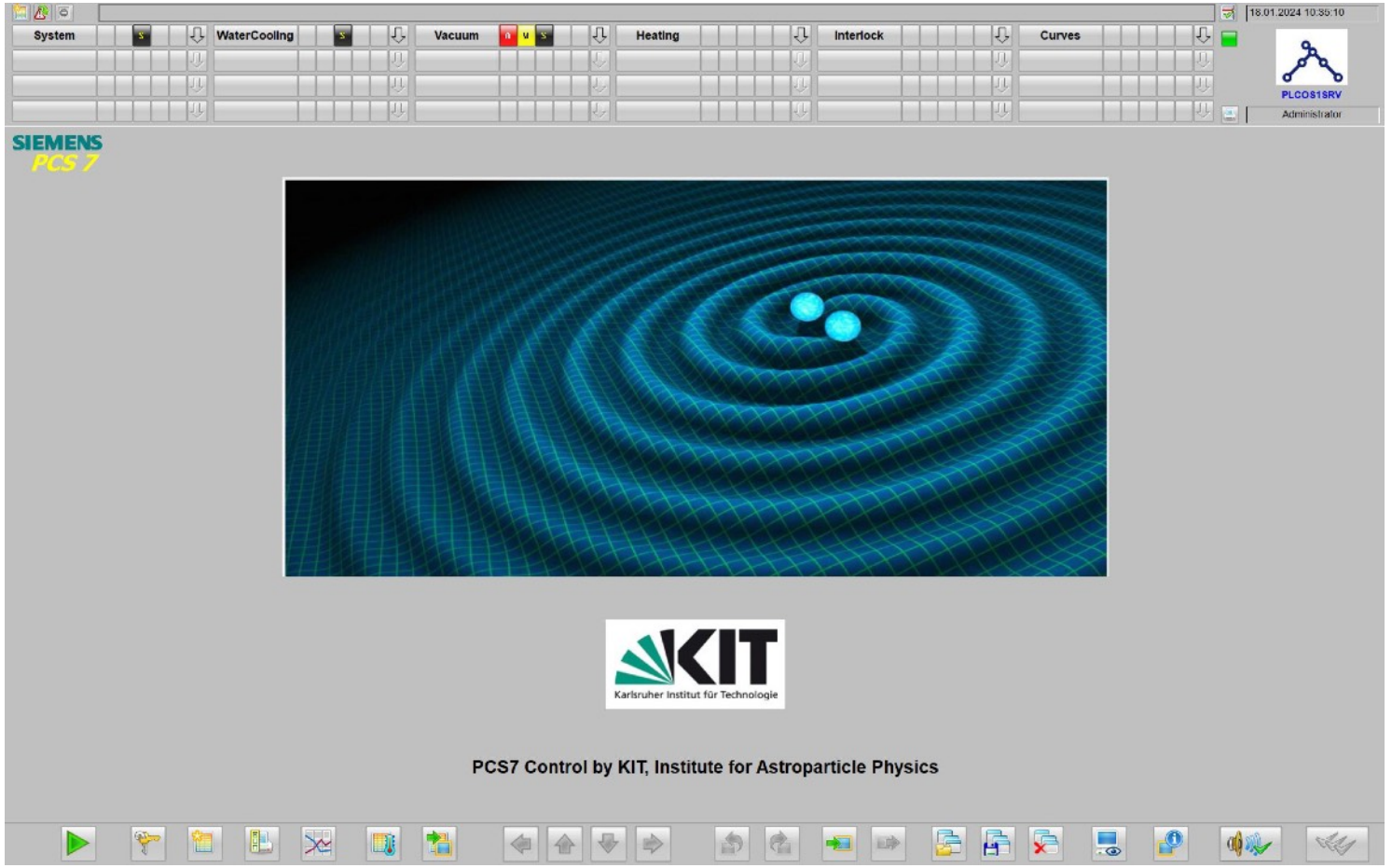






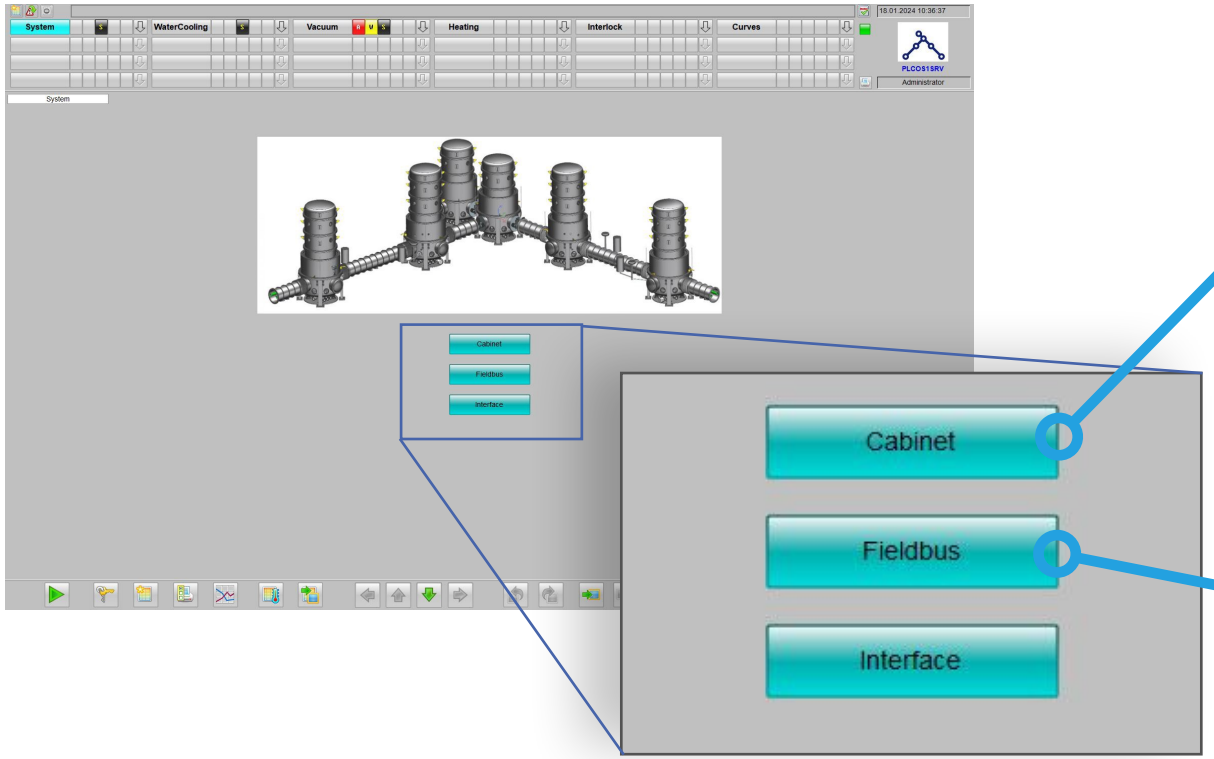
PCS7 Control Program

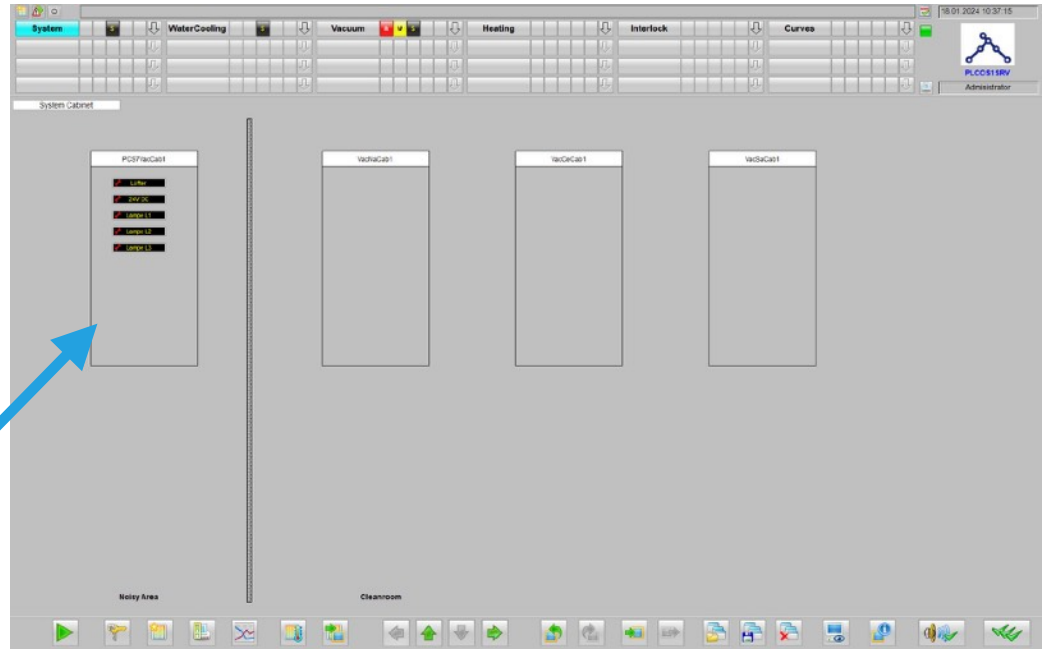
- The PCS7 software framework has been set up
- A preliminary version with all components is running
- More refinements further down the road, like
  - alarms, interlocks
  - optical improvements
  - and user interface
  - make operation as easy as possible

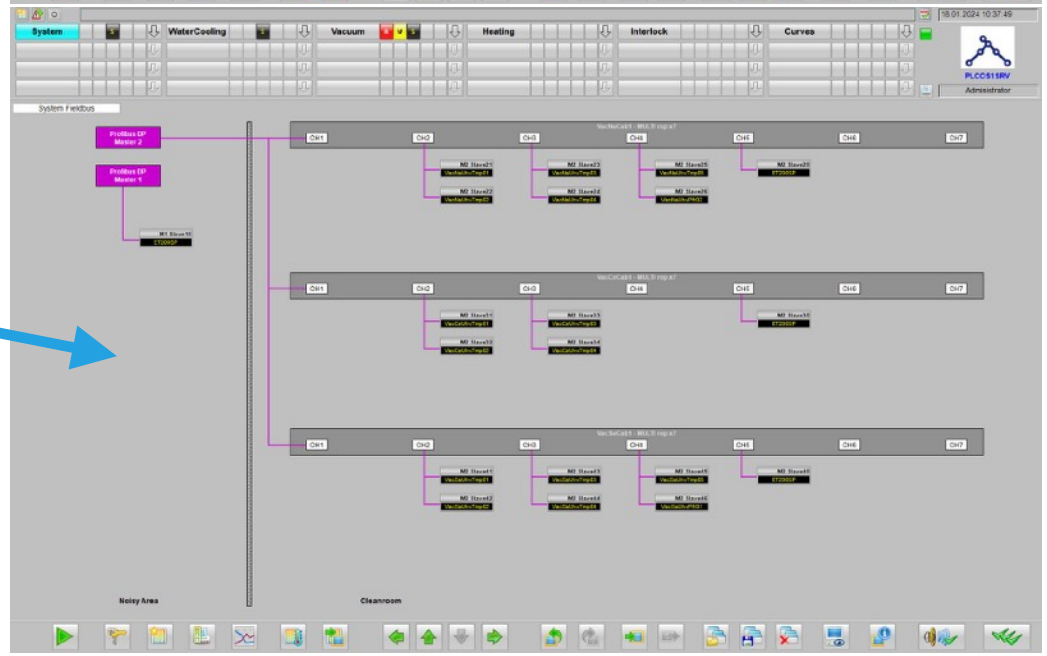


PCS7 Control Program

- System related controls







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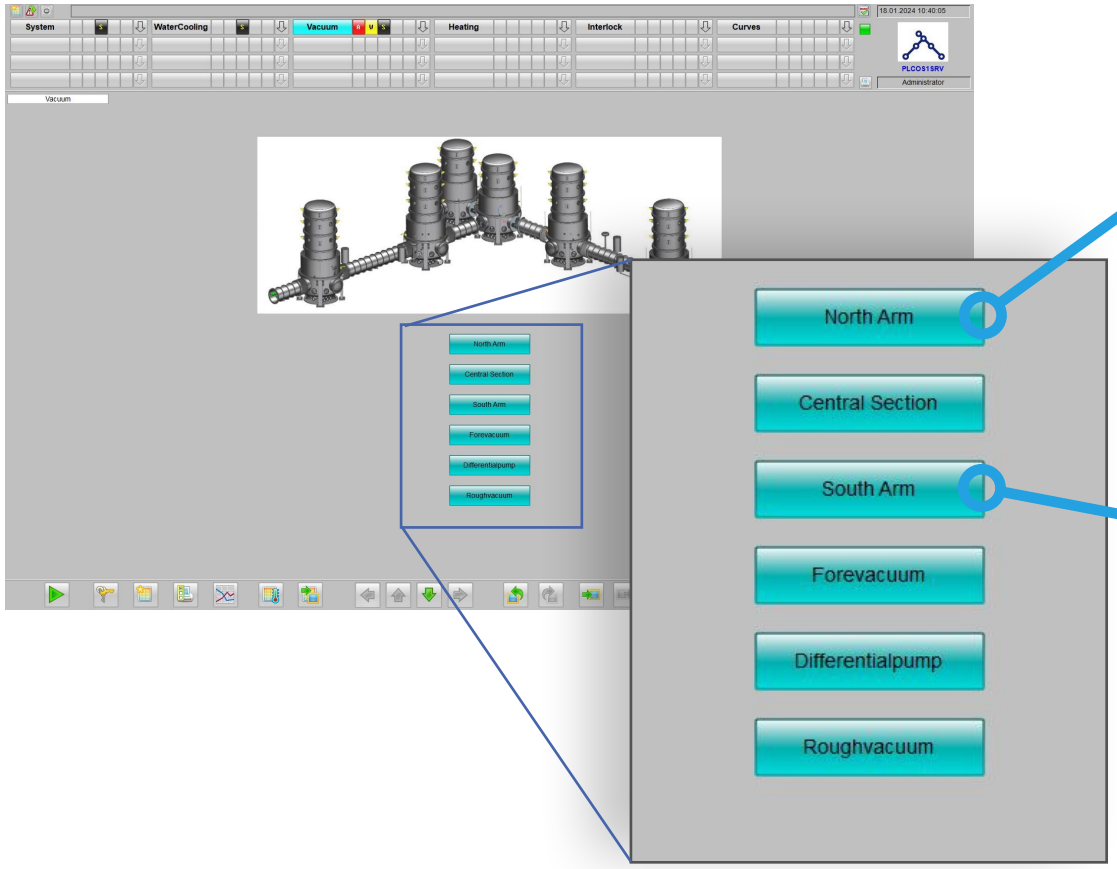
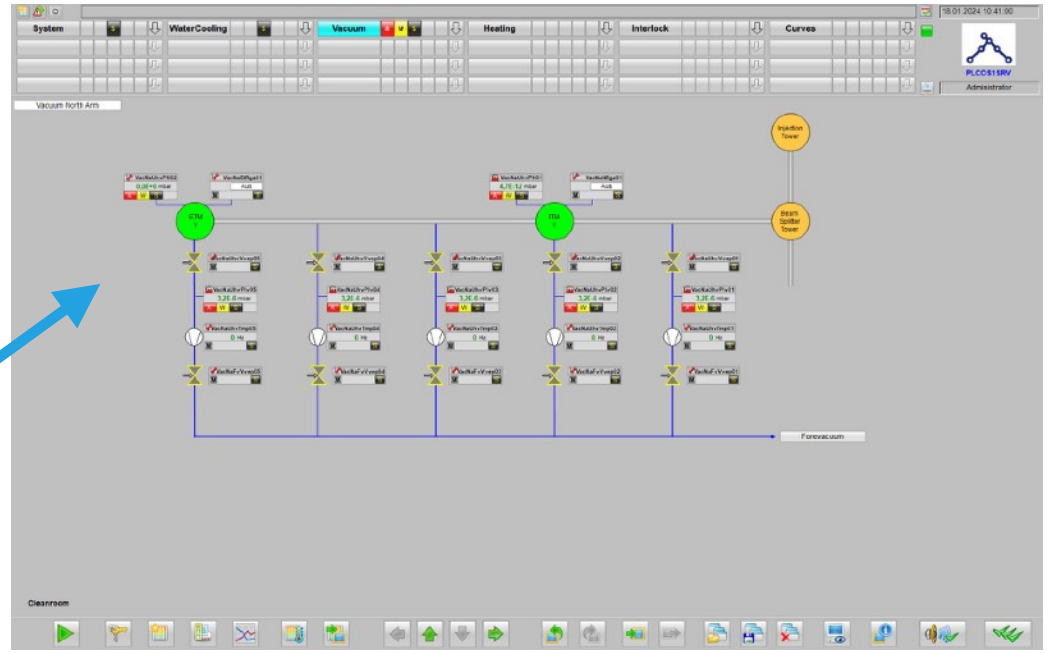
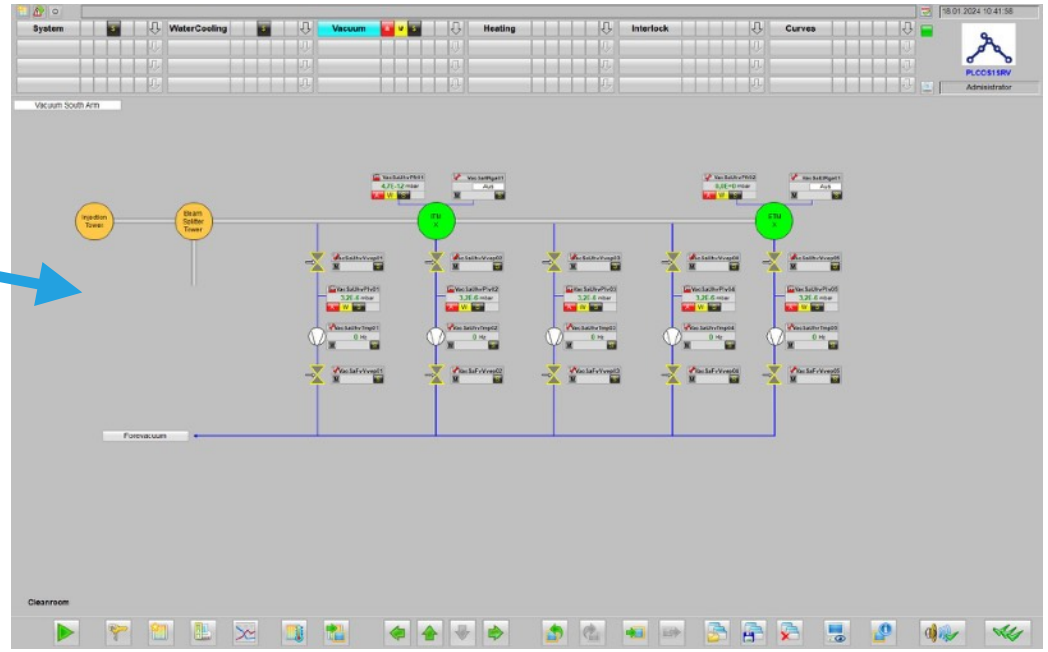
- Vacuum related controls







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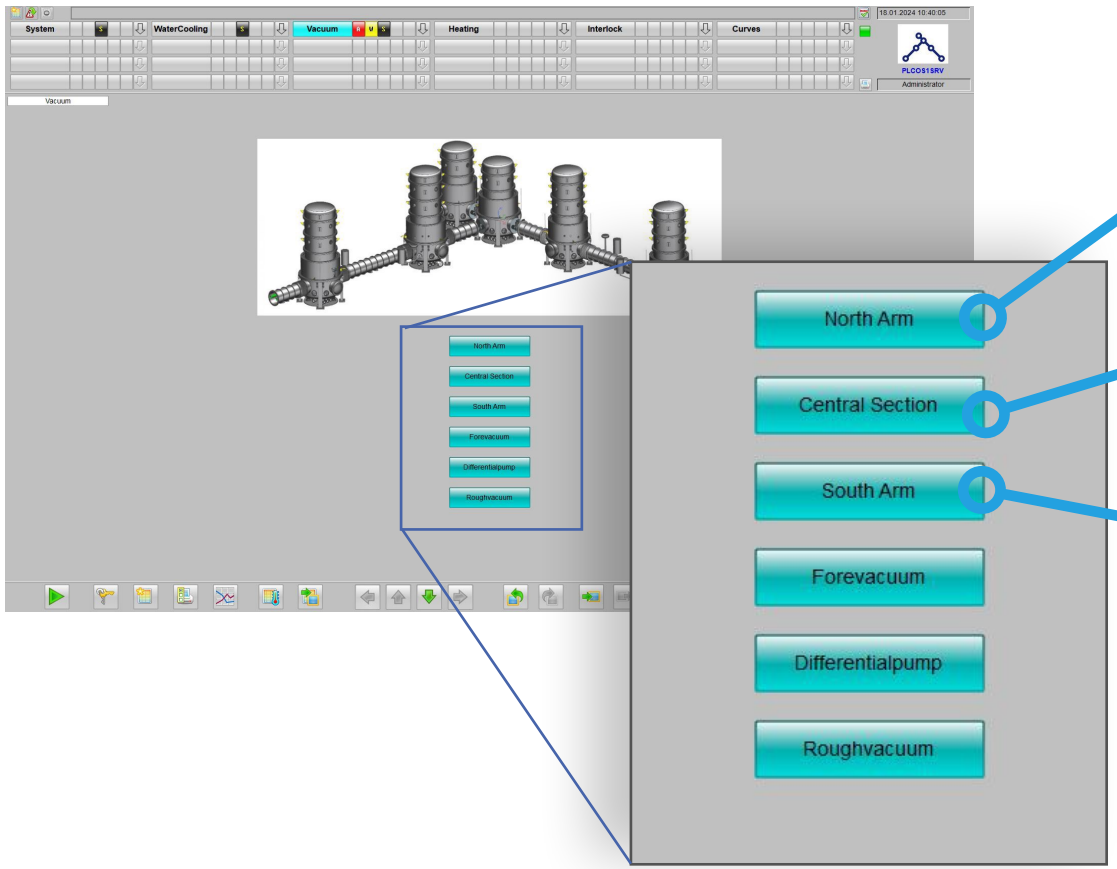

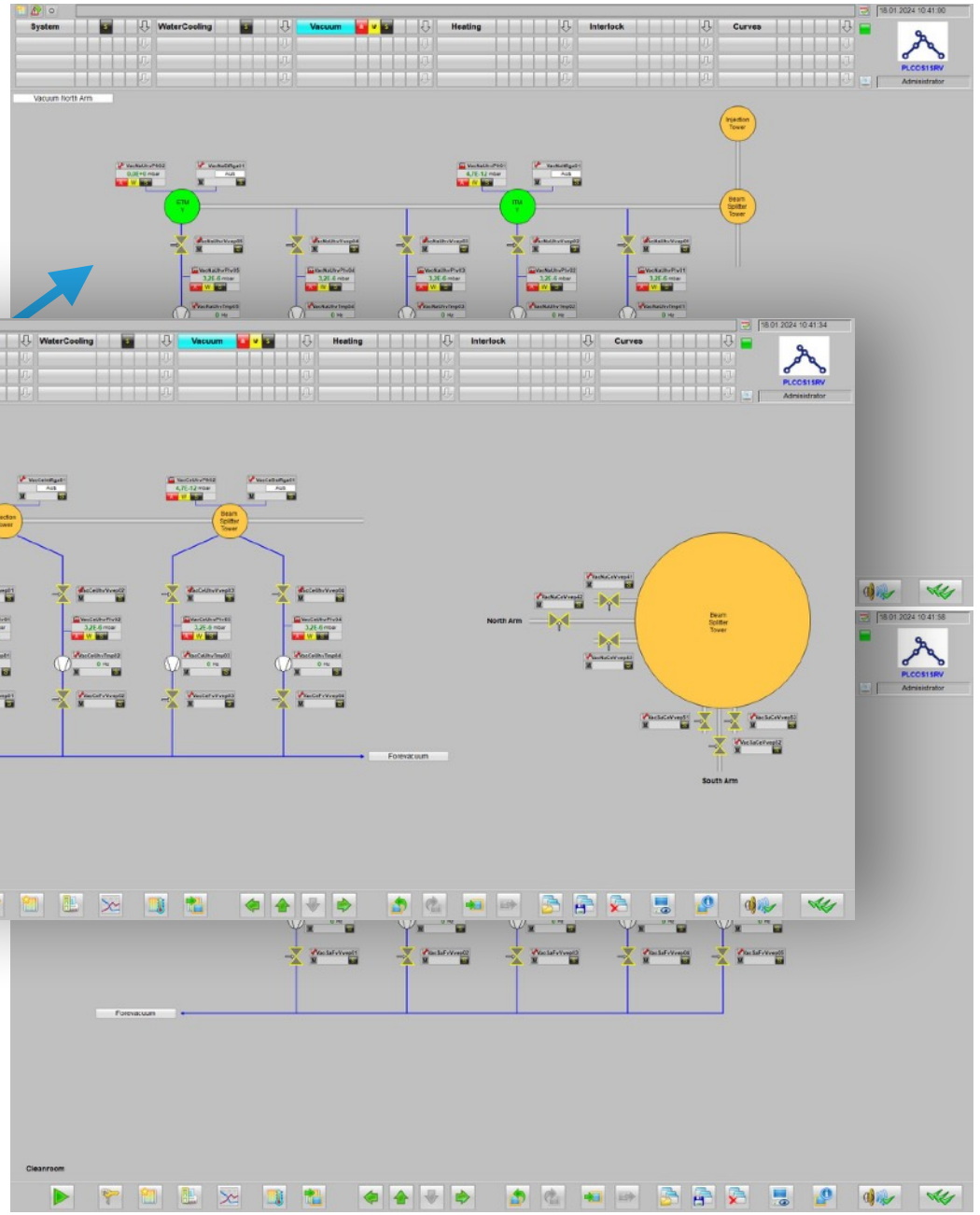

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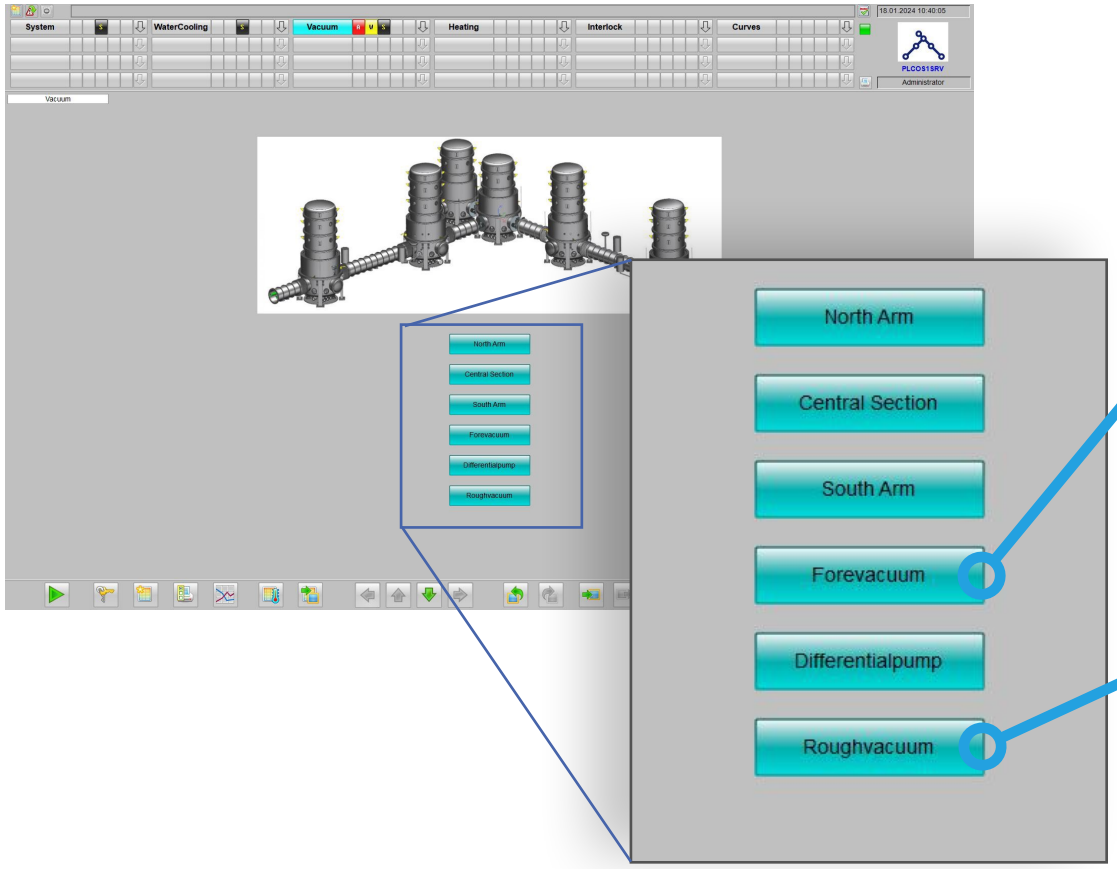
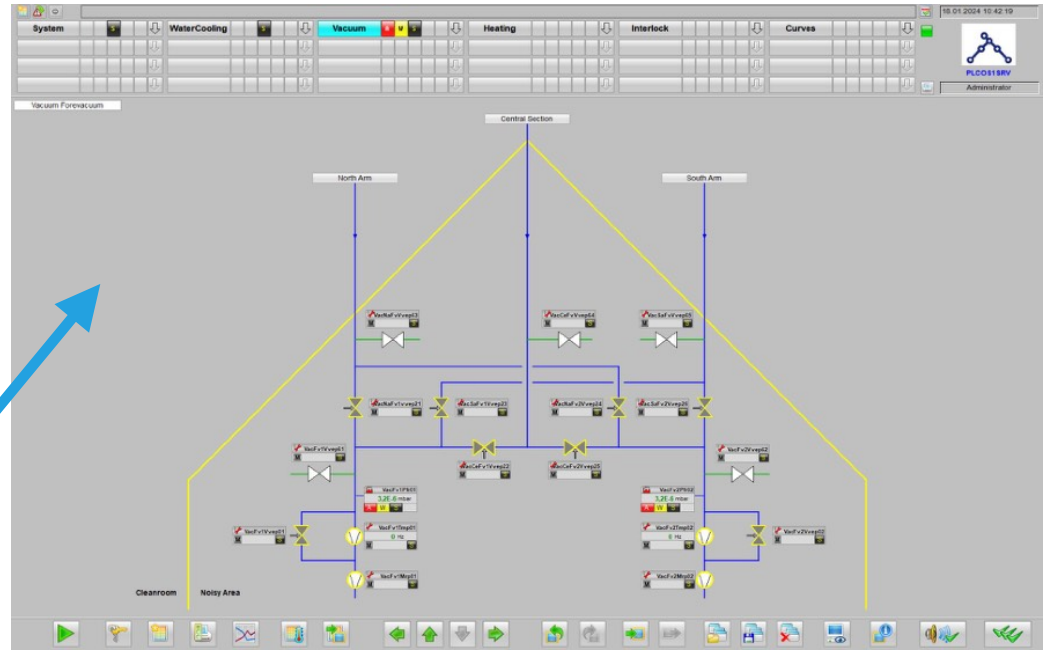
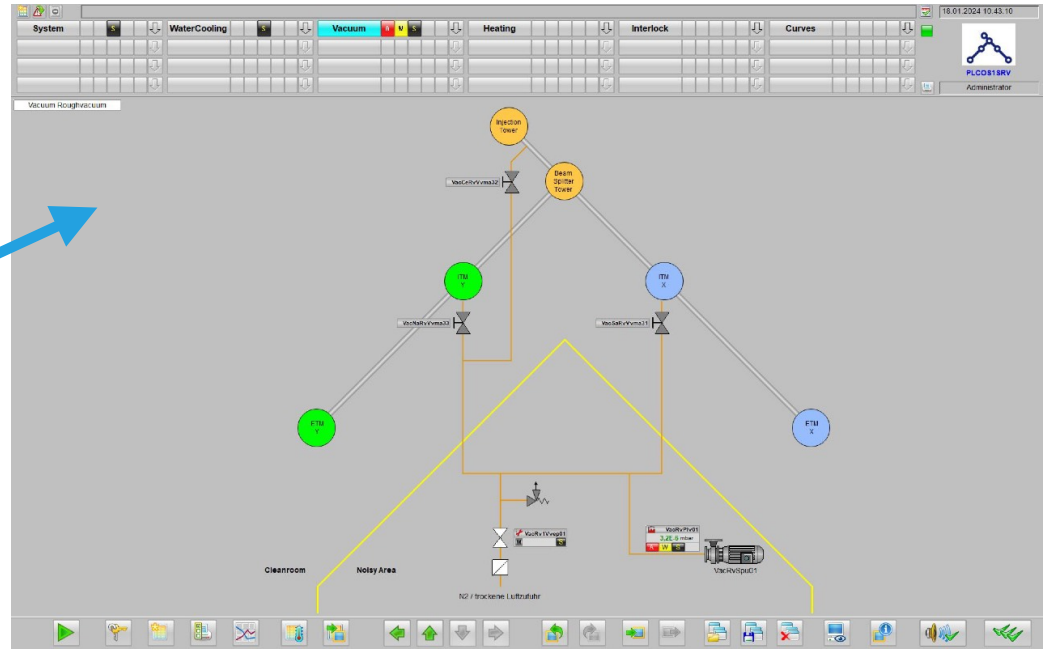
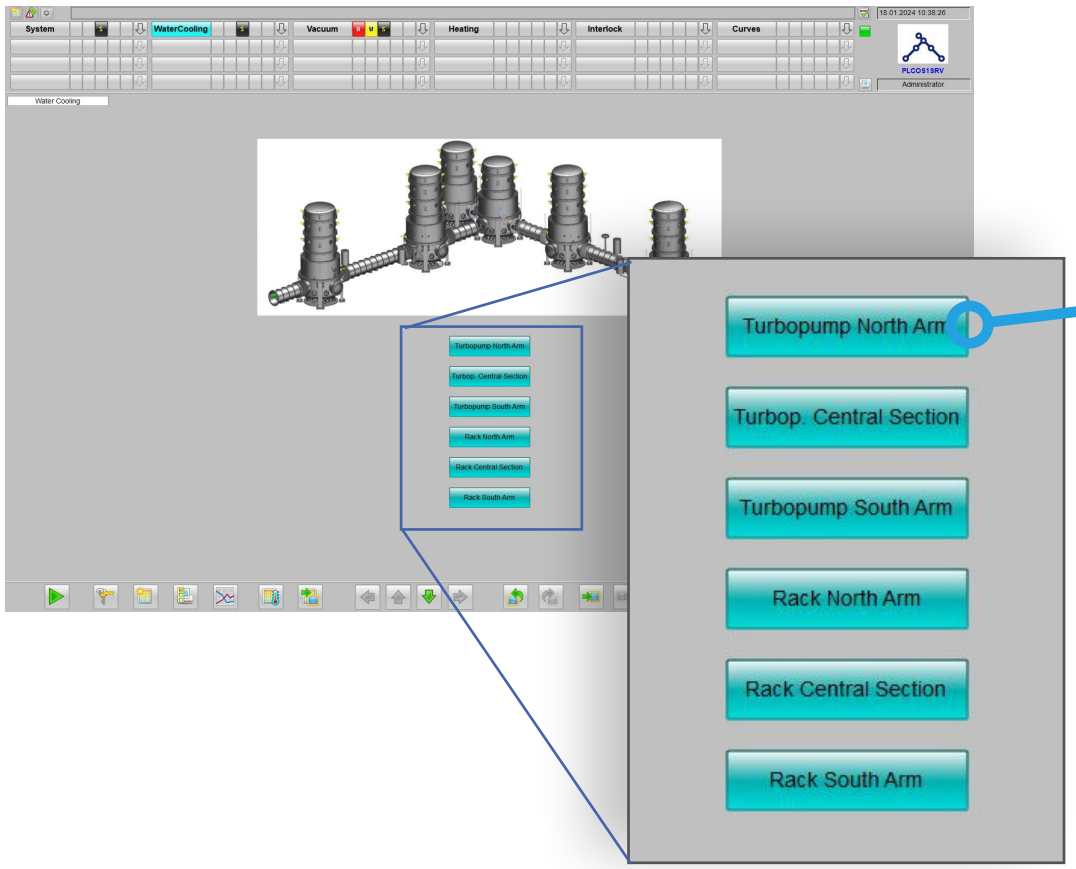


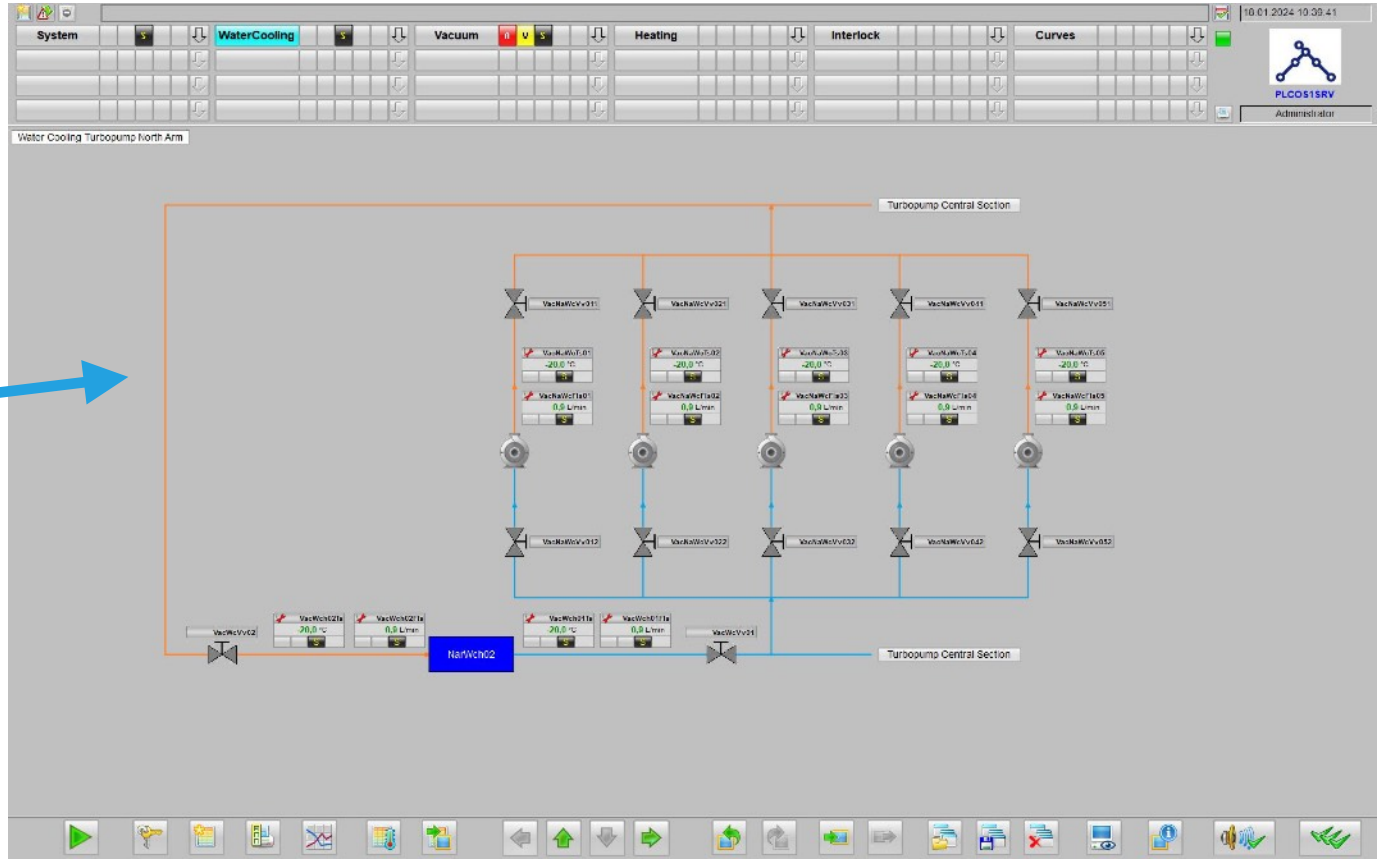




PCS7 Control Program

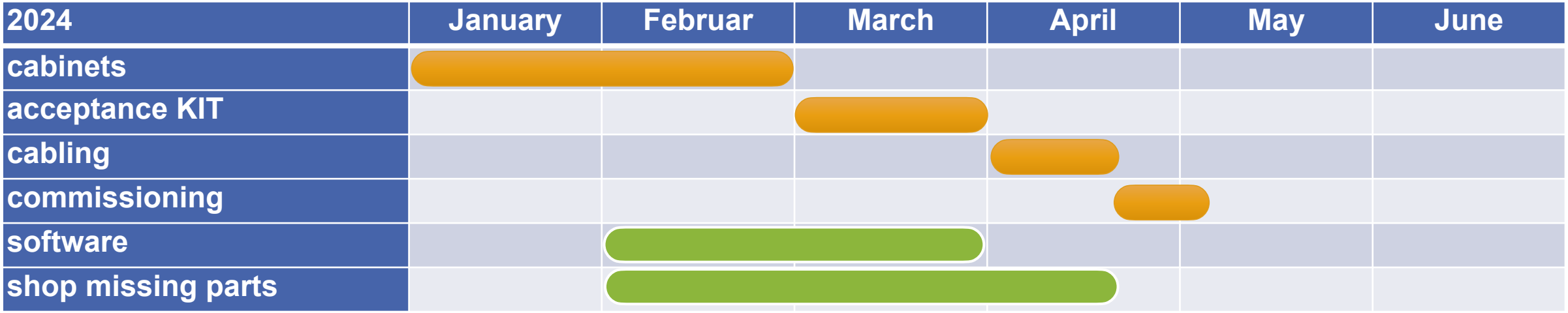
- Cooling water related controls





Schedule and Next Steps

- Cabinets assembly at external company, coordinated by Antwerp.
- Refine software, define alarms, interlocks, and operation modes.
- Purchase missing equipment from shopping list, incl. OS license and PCS7 license.
- Cabinets to be delivered to KIT, acceptance test (3 - 4 weeks), ship to Maastricht.
- Draw cables and connect to instruments and cabinets (external company).
- Come with KIT team to test and commission cabinets, PCS7, etc.

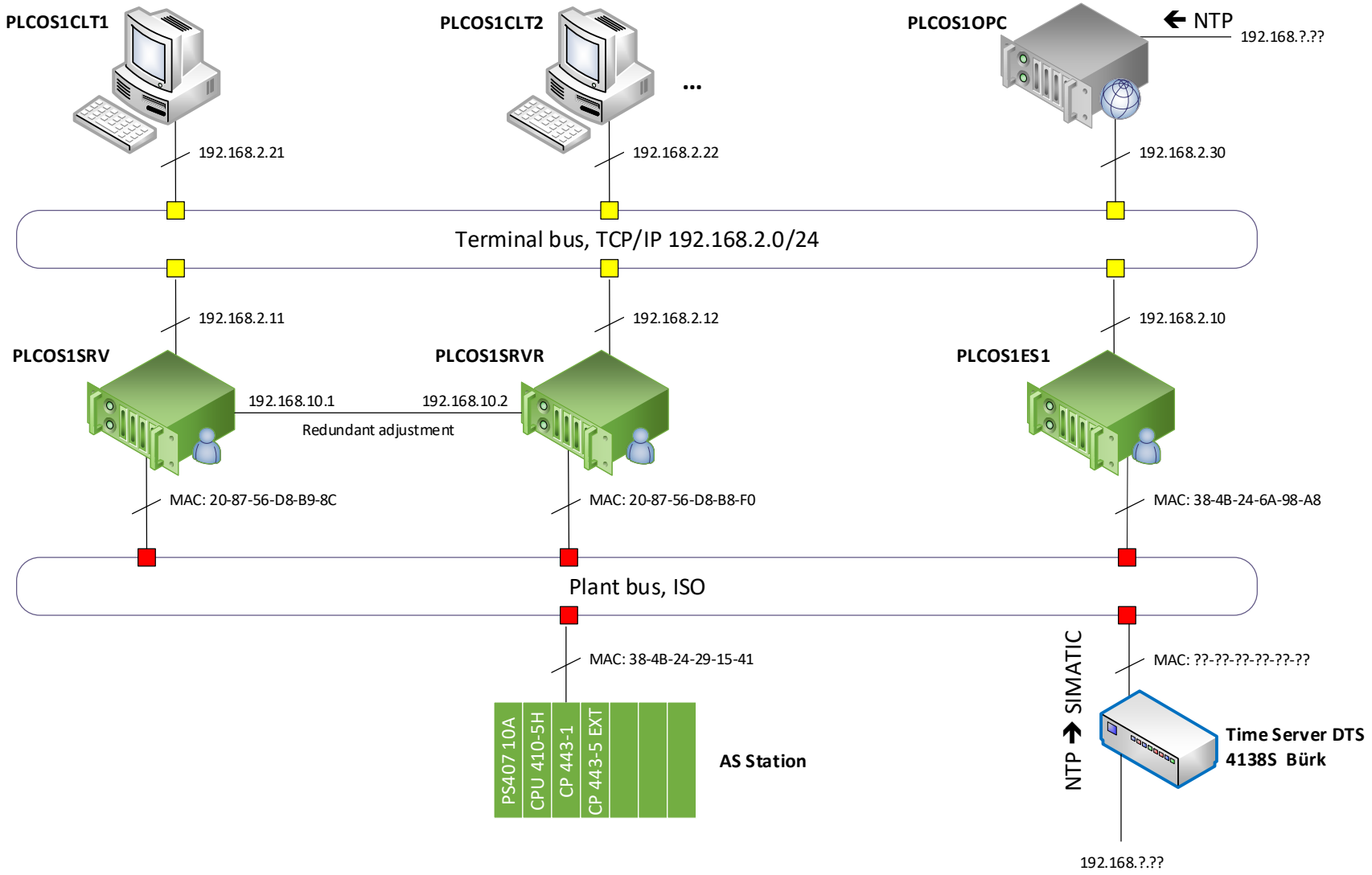


Questions to be solved

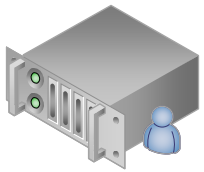
- Work out requirements (safety, experience) for interlocks and alarms. (WP4)
- Define cabling team or contractor to have cables ready in time. (in progress)
- Who will become the on-site control system expert, needs training, introduction. (open)
- Check shopping list, remaining computers, servers, and especially OS and PCS7 licenses:
  - 3 computer with OS license
  - all required PCS7 licenses
  - displays with 1920x1200 pixel resolution
  - KVM switch, LAN cabling
  - time server 4138S from Co. Büro (NTP to SIMATIC)

- How to access the server infrastructure, is remote access permitted / wanted / planned?
- Is a general remote monitoring service planned?

PCS7 Network Topology



Resolution: 1920 x 1200

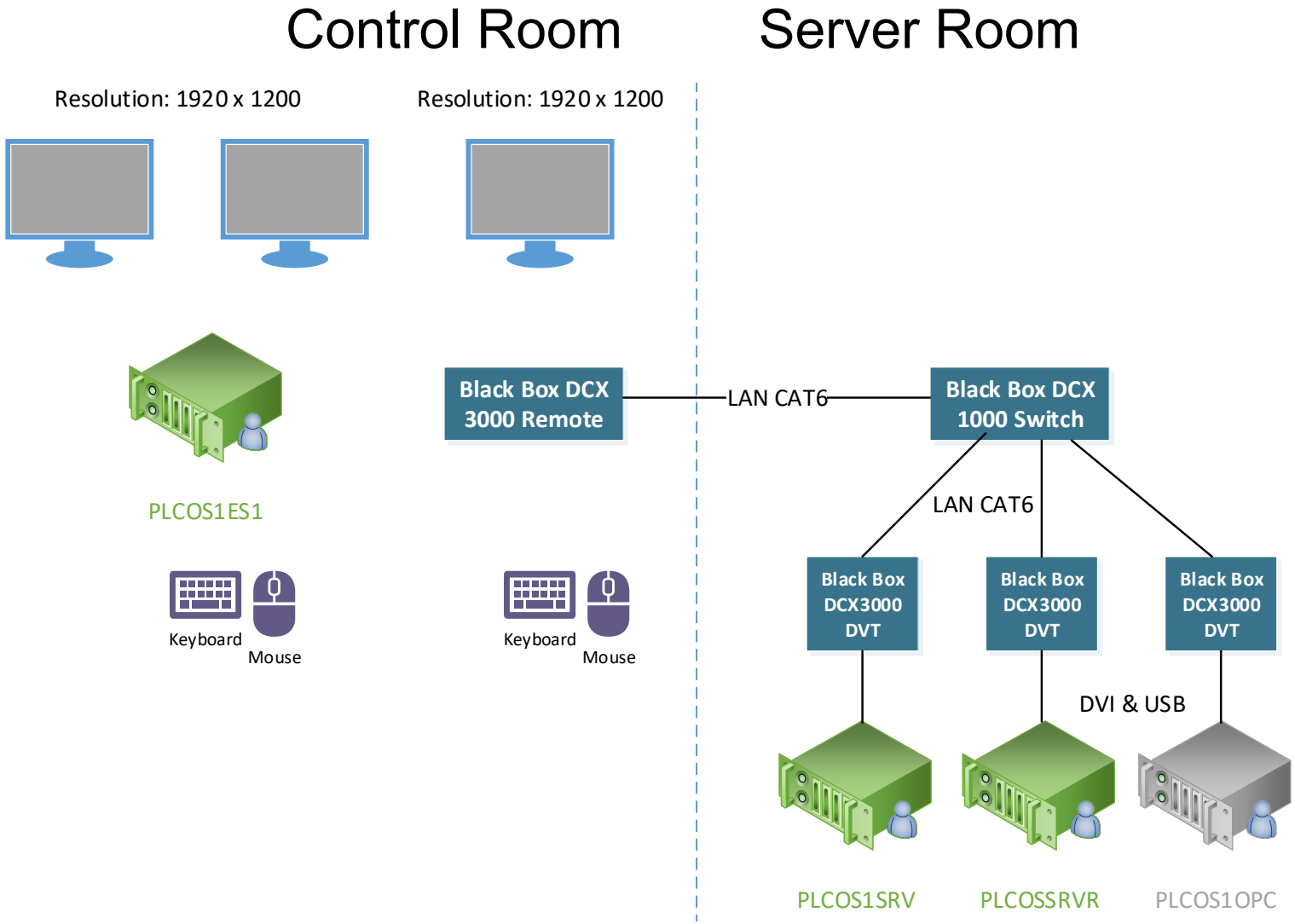


PLCOS1CLT2

Keyboard Mouse

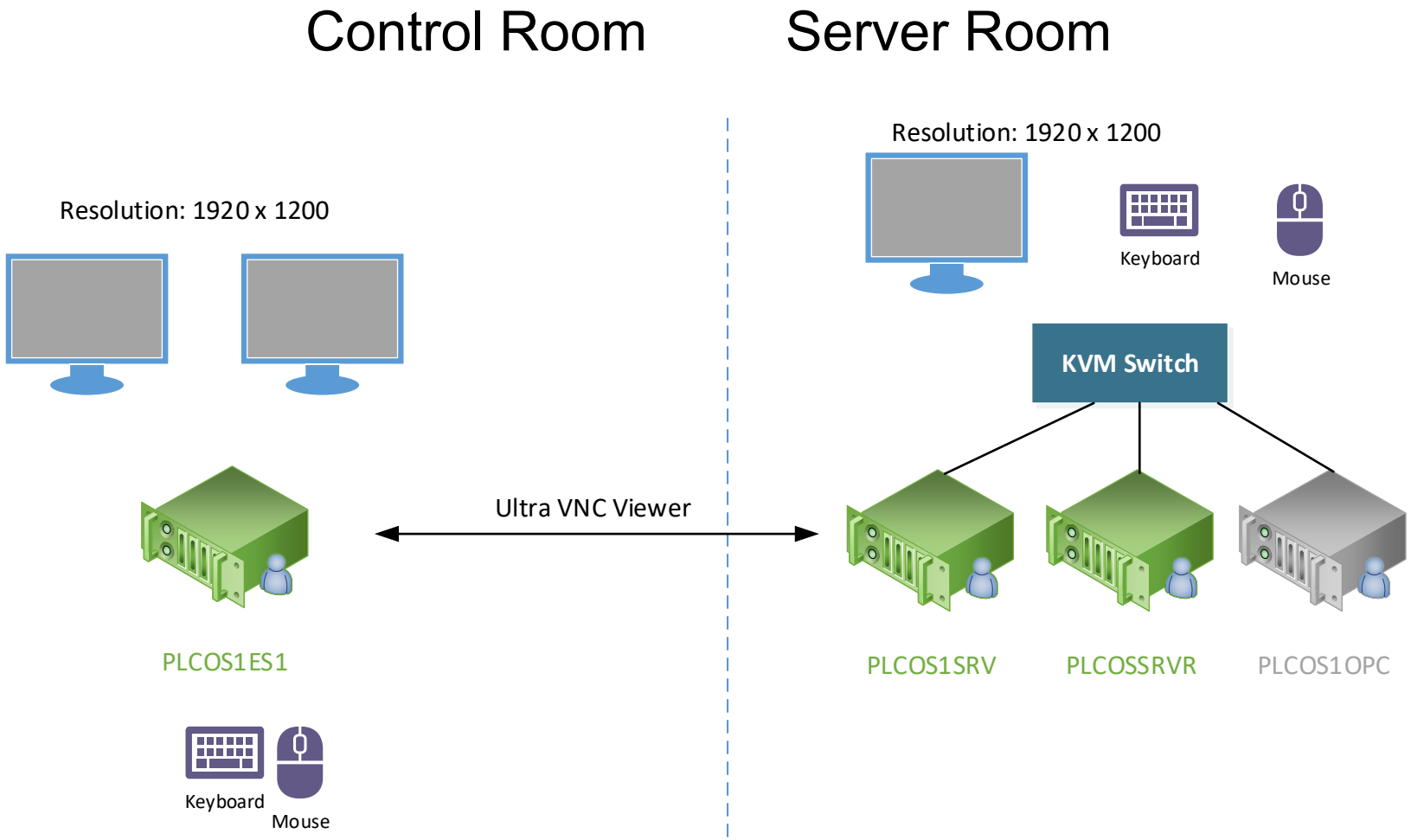
PCS7 System Access

- Use Block Box Remote



PCS7 System Access

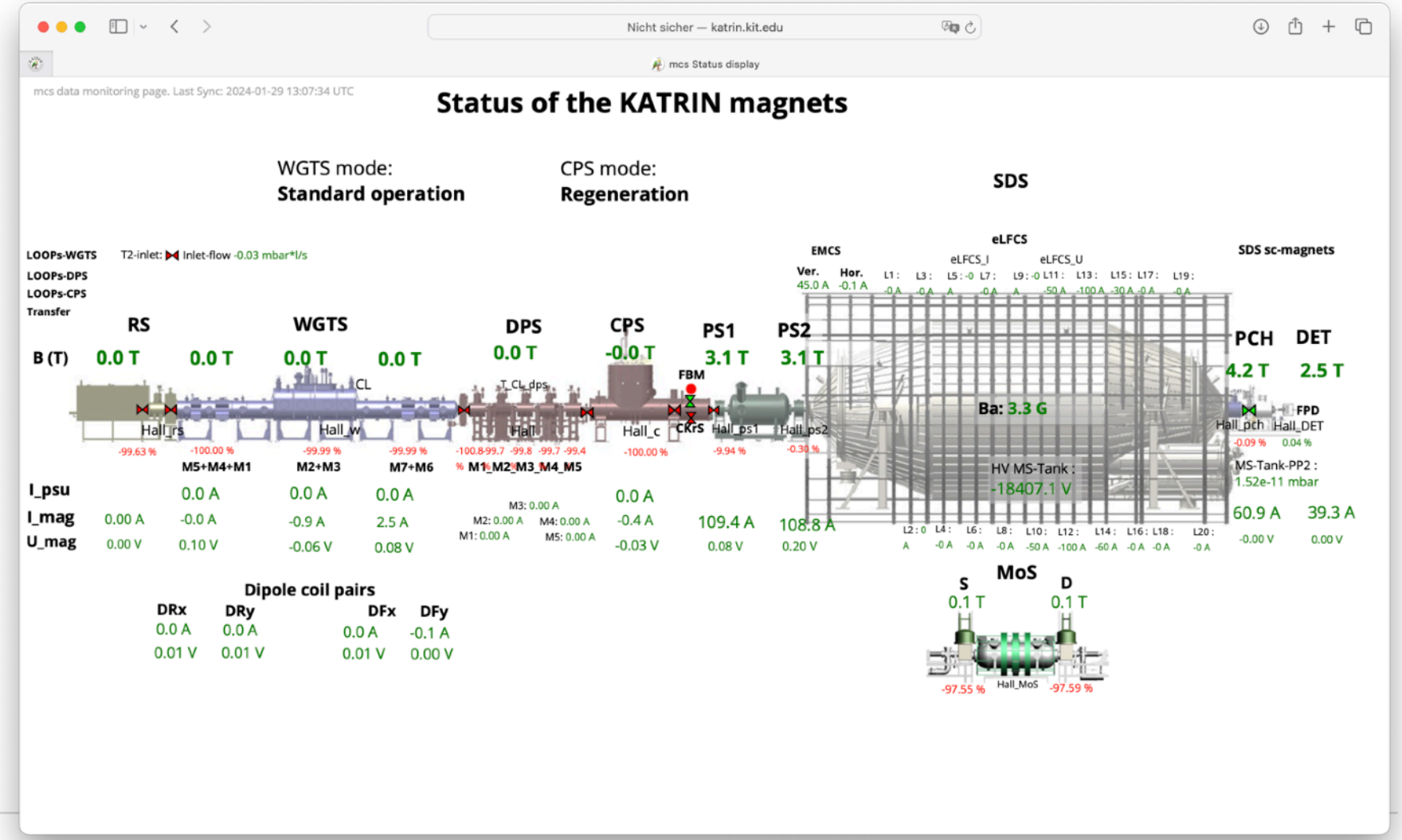
- Use KVM switch inside
- Access via VNC



BORA: personalized collaBORA-tive data display

- Not an event display.
- Gives overview.
- Only watching, no control.
- Runs in web browser.
- Direct data access.
- Raw data protected by PW.

- Customised views.
- No programming required.



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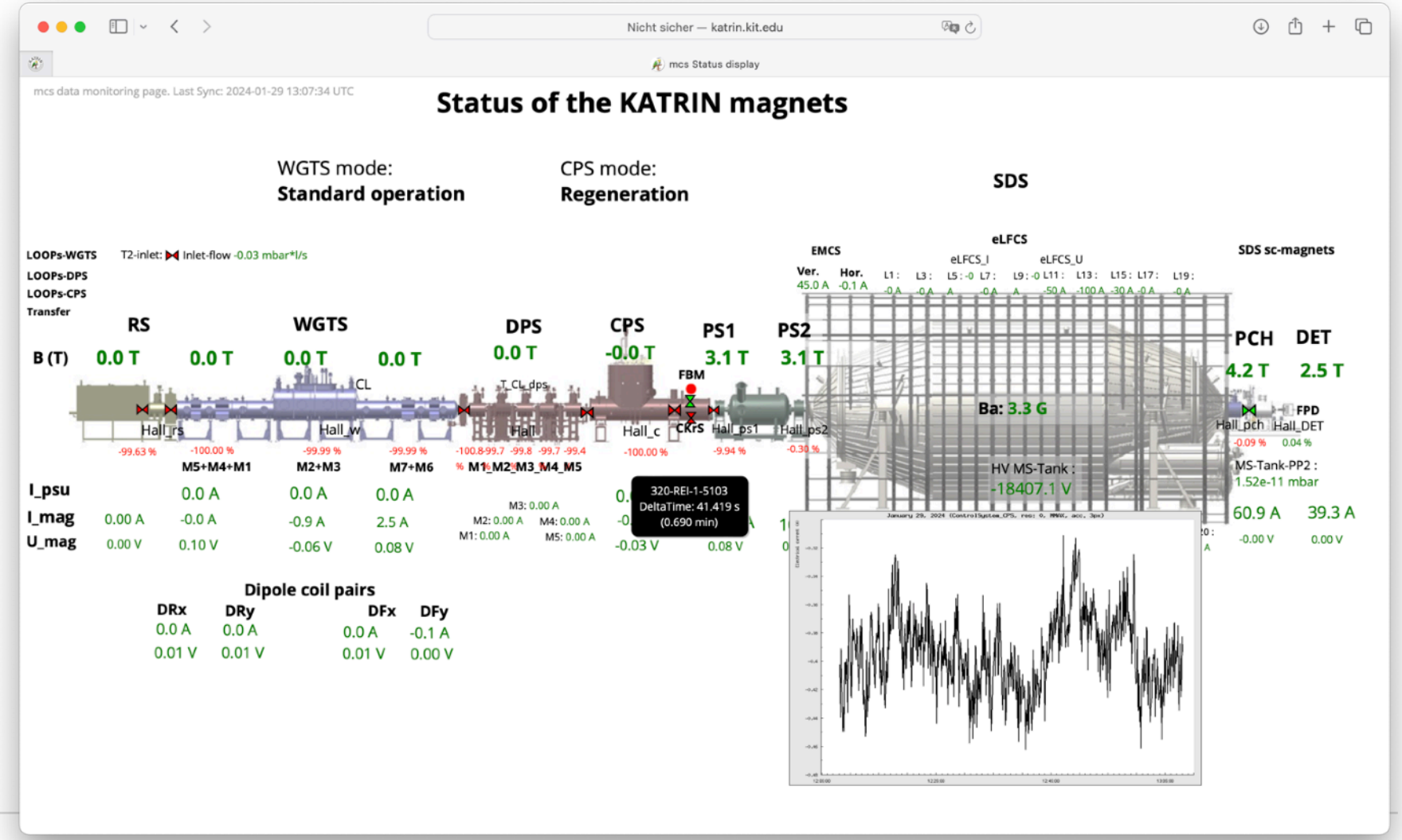

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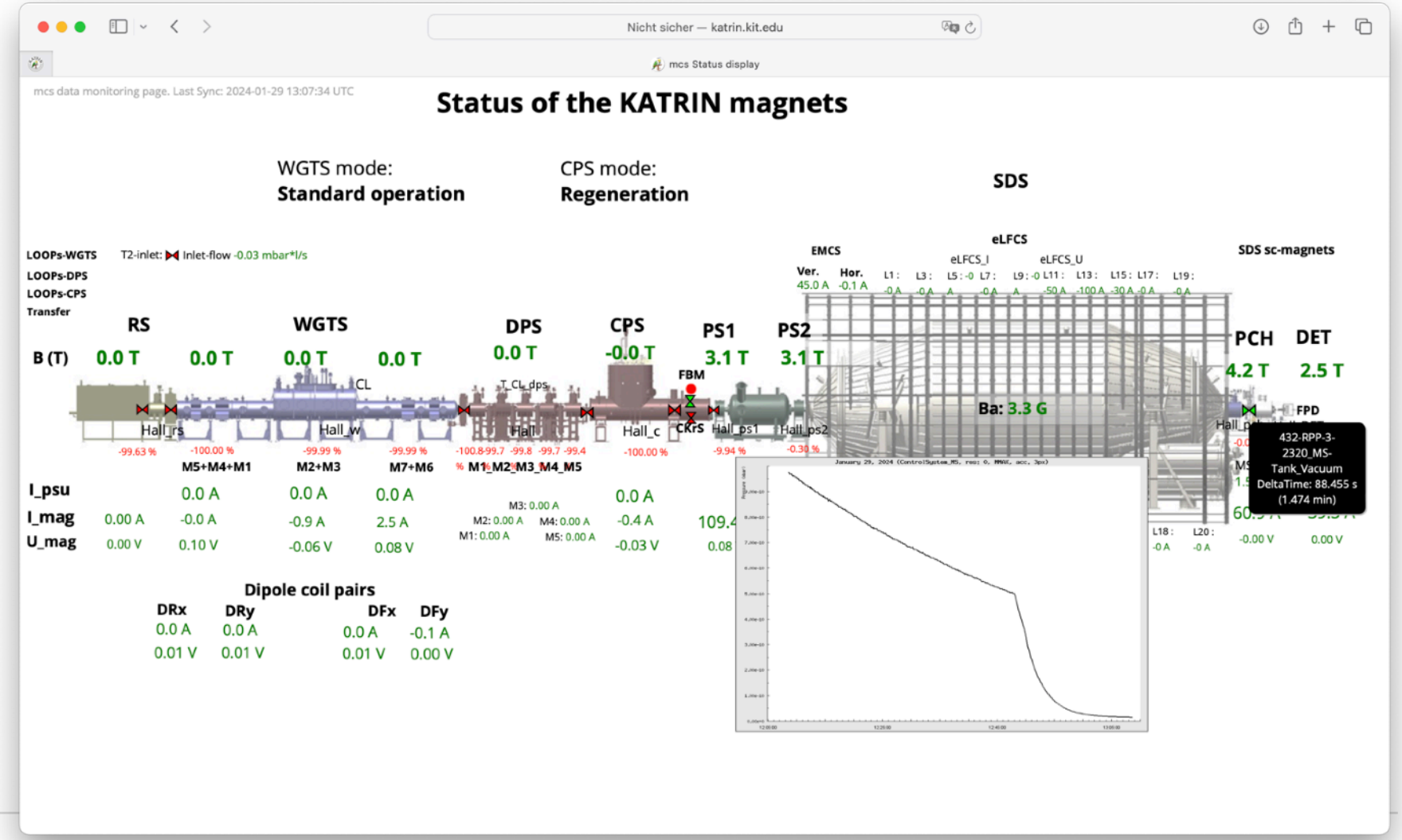

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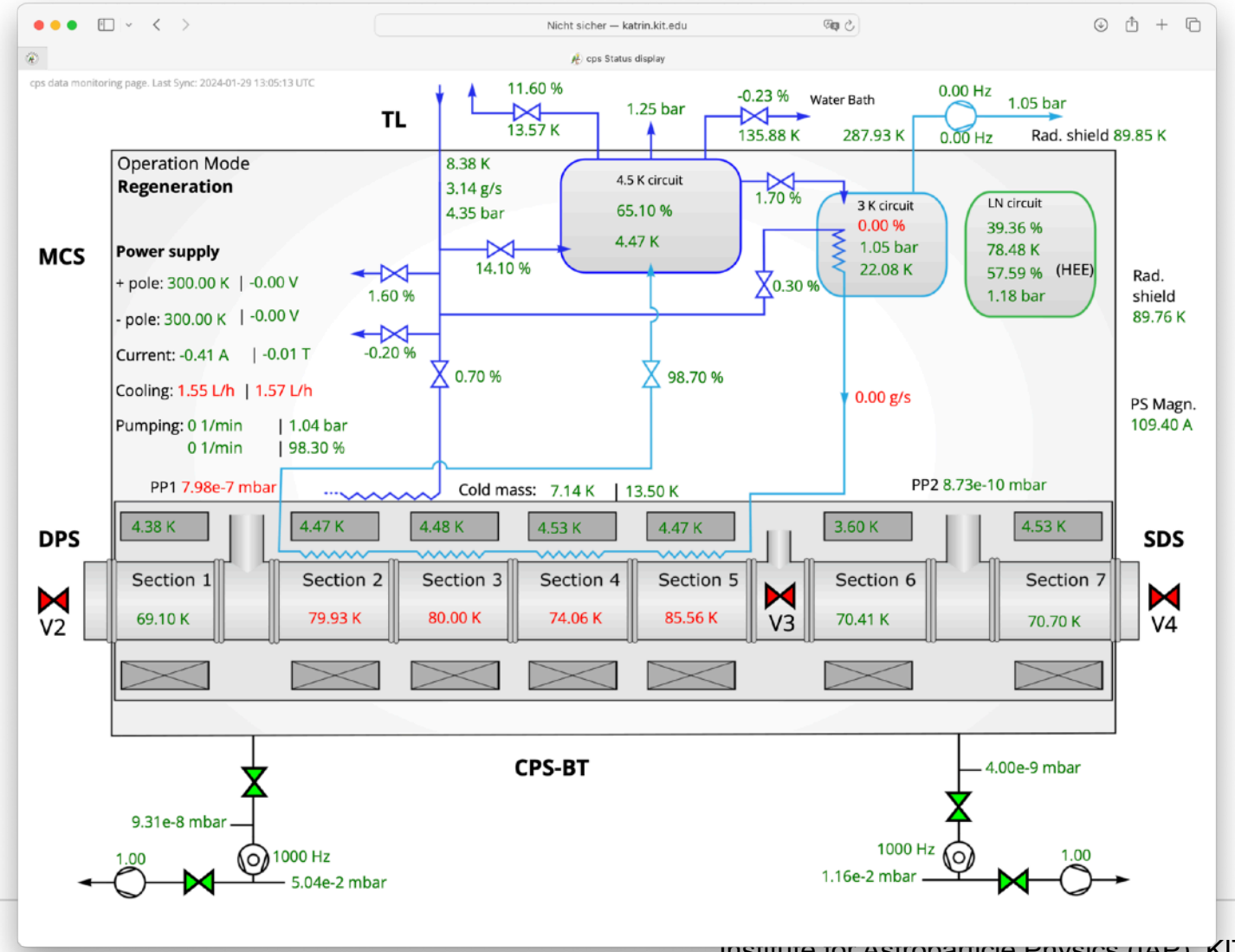

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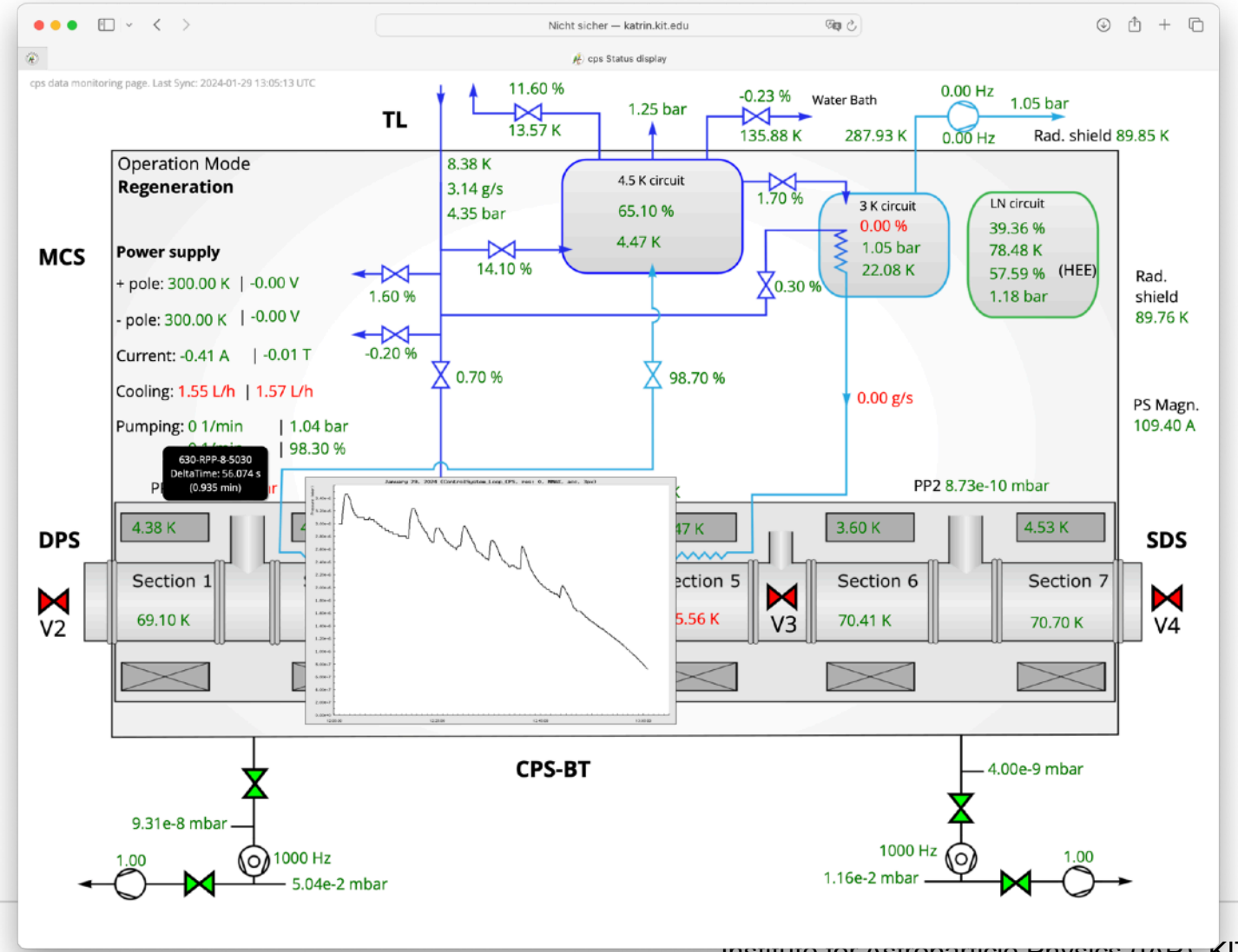
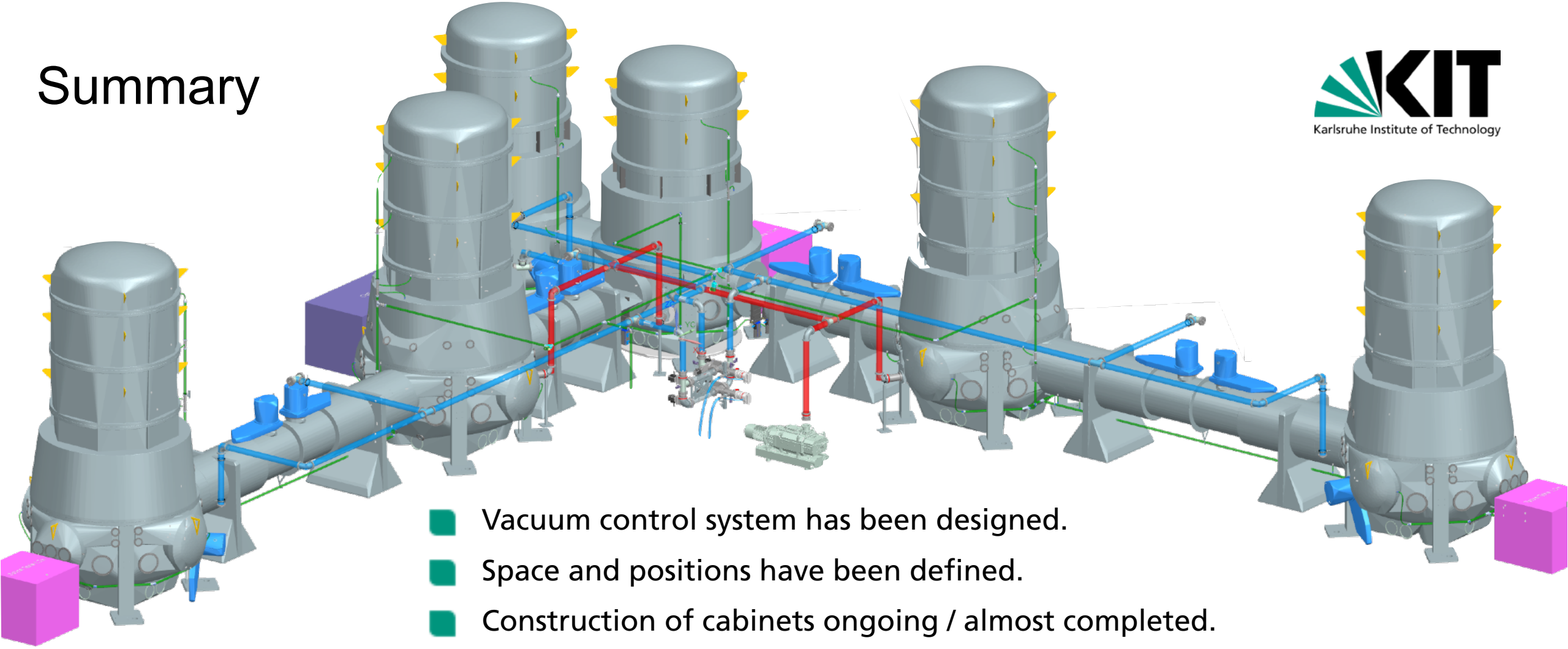


Summary



- Vacuum control system has been designed.
- Space and positions have been defined.
- Construction of cabinets ongoing / almost completed.
- The control system is ready to be tested.
- Depending on delivery time,
  completed or segmented solution is possible for bench tower.