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Instruments status update

PRESENTED BY PREMEK BERAN

2026-04-21

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Instrument team

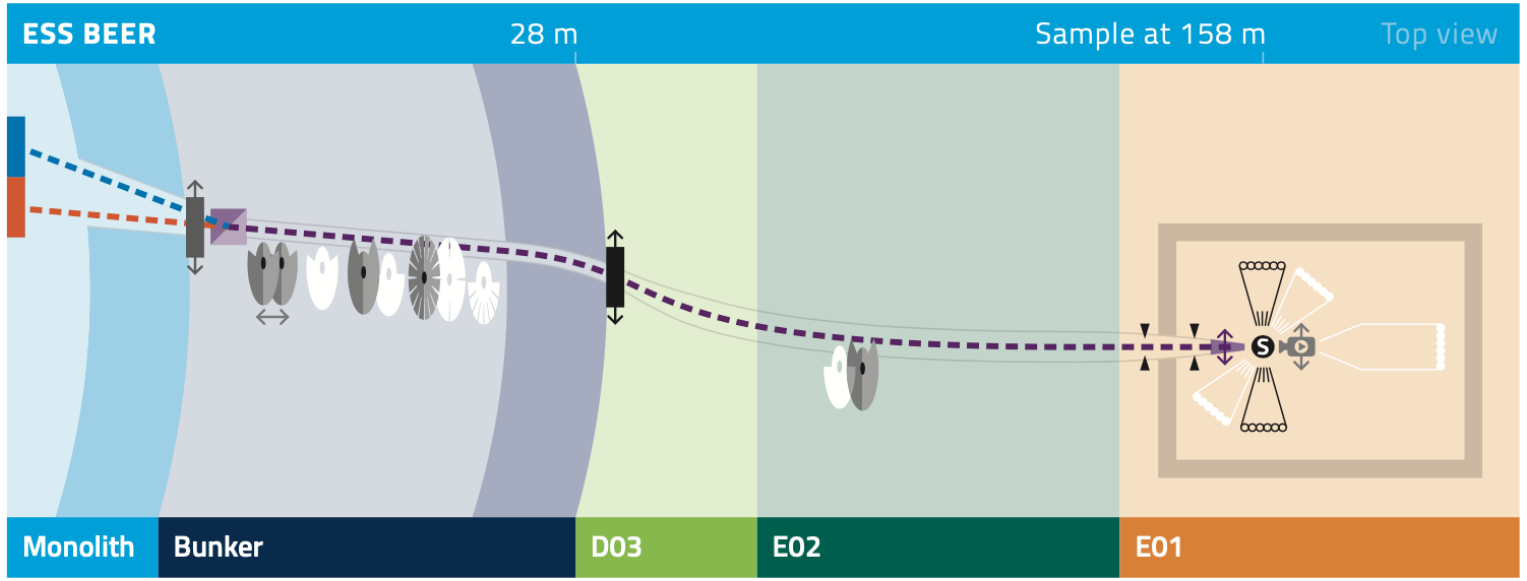
Nuclear Physics Institute CAS
Czech Republic

Helmholtz-Zentrum Hereon
Germany

Instrument team on site
Scientist: Přemysl Beran, Gergely Nétmeth
Data scientist: Céline Durniak
Engineer: Bojan Peric
Operational engineer: Grant Wallace
Installation package leader: Olof Duveklint

Instrument team behind the scenes
Jan Šaroun, Jochen Fenske
Dirk Jan Siemers, Sven Kleeband,
Malte Wiechern, Joerg Burmester, …

Tranche 2 instrument!



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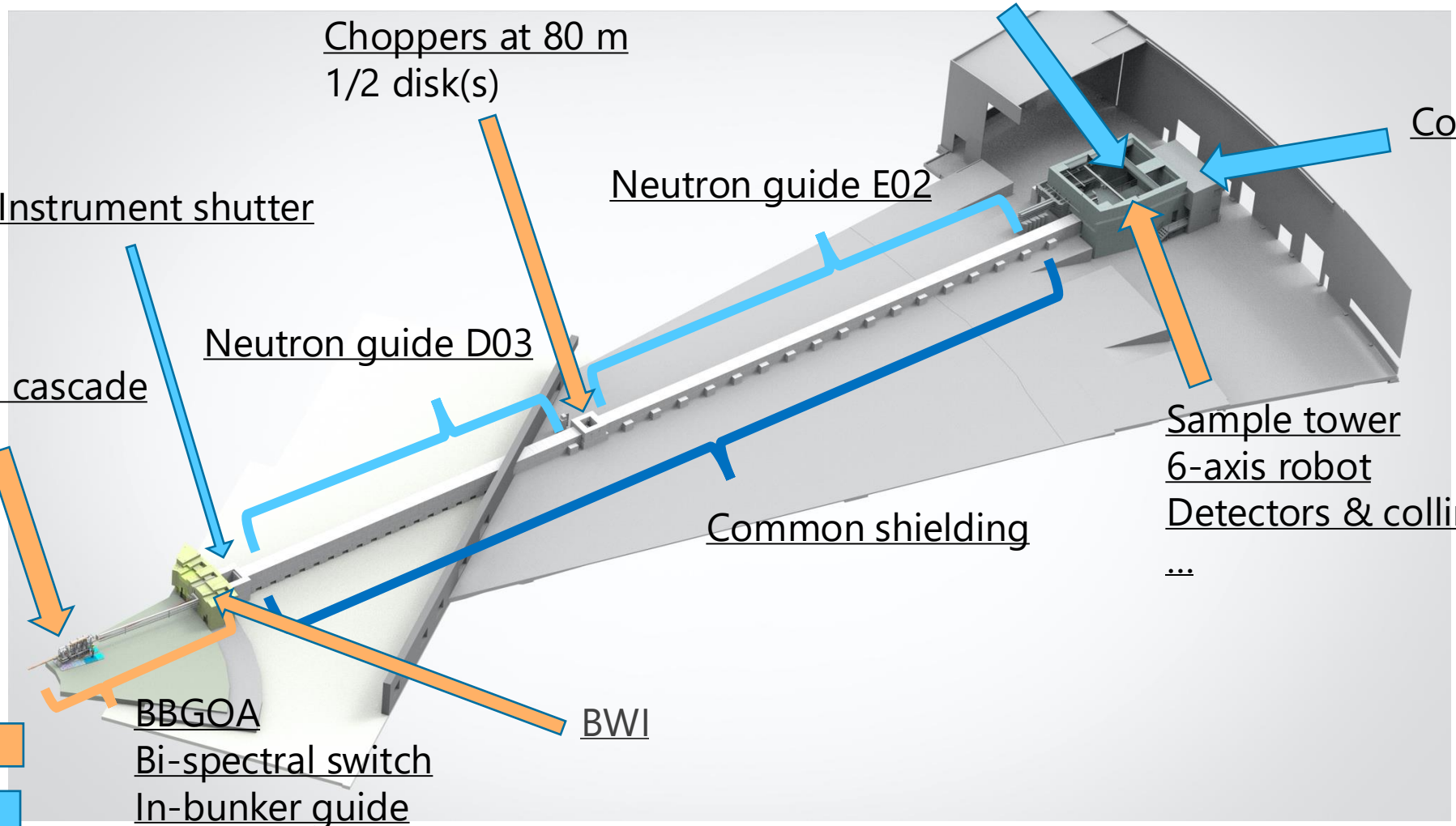
Instrument components



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General status update summary

- **Neutron guide** from the chopper cascade down to the cave **installed** (148 m)
  - Missing the part inside the chopper cascade (6 m)
  - High **m** values, needs neutron test (possible delay)
- **Common shielding is installed** along the out-of-bunker guide
  - Some parts are open, but all block ready to be installed when the sub-systems are ready
- The **shutter** is **installed**
  - Missing the connection to PSS and MCA (should be done in June)
- The **cave & hutch** are **installed**
- **CUP** and **CEP** installation in progress
  - Cave and hutch energised
  - All cabinets are installed and connected to power
- Final **TG3 documentation** in **progress** (invisible work behind the scenes)
  - The approval process of the main TG3 documents is in good progress
  - Q-gate documentation - a lot of additional documents requested

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General status update summary

- The **6-axis robotic arm** under tests
  - The robot is tested at Hereon, and safety zone programming is in progress
  - Integration of the 2-camera alignment system under development (EPICS integration)
- **Hexapod** and **rotary stage delivered**
  - Discussion with ICS on how to implement various coordinate systems in the controls and files
- Sample tower and detector support structure design delayed
  - Detector supports are on the critical path (lack of resources)
- **Chopper cascade** support is partially installed
  - Concrete support bench installed
  - Array 2 with MCA and FO choppers assembling in progress out of the bunker
  - Array 1 delay due to the many stakeholders' interfaces (mainly MCA requirements changes)
  - Array 1 should come in May for assembly and installation

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General status update summary

- The **choppers** are ready for installation
  - All choppers, spindles and lower enclosers are ready (installed on Array 2)
  - 80 m chopper installed together with the cabinet, ready for testing
- The **detectors** are being assembled
  - Integration **under process,** communication with the detector team in progress
  - The first detector is ready for test at NPI in June
  - **Beam monitor** (same technology) ready for shipment to ESS by May
- Software (see Celine's talk after coffee break)
  - Full McStats model in place, simulation of various samples possible
  - Data reduction workflow under development
  - Data analysis of the simulated reduced data using FullProf was performed

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Issues

- The **chopper cascade** design finalisation is slow
  - Too complicated interfaces
  - No standards in design between various stakeholders (MCA, choppers, etc.)
  - Changing of the requirement from the MCA
  - Influencing the design of the further component – detector supports and sample tower
  - We are working to mitigate this by splitting installations and allocating more resources for design
- **Sample environment** (see Caroline's talk after coffee break)
  - Deformation rig integration is in progress, but it is very slow
  - Dilatometer ready for procurement

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NPI update

- Neutron guide out of the bunker (Installed)
- Common shielding (Installed)

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NPI update

- Cave & hutch (installed)
- CEP & CUP in the instrument area (installed)

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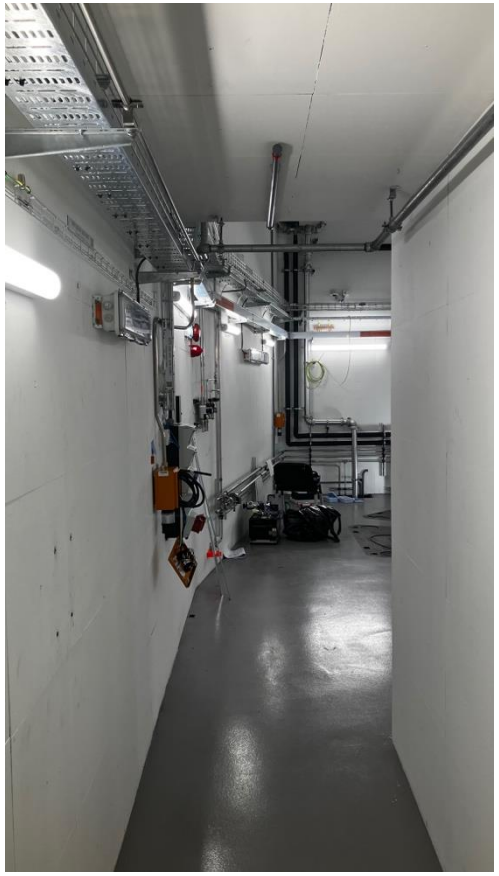
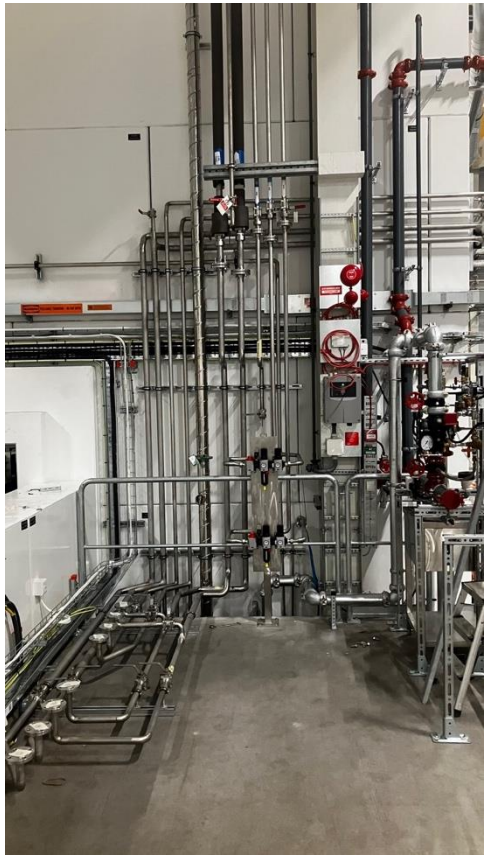
NPI update

- Cave & hutch (installed)
- CEP & CUP in the instrument area (installed)





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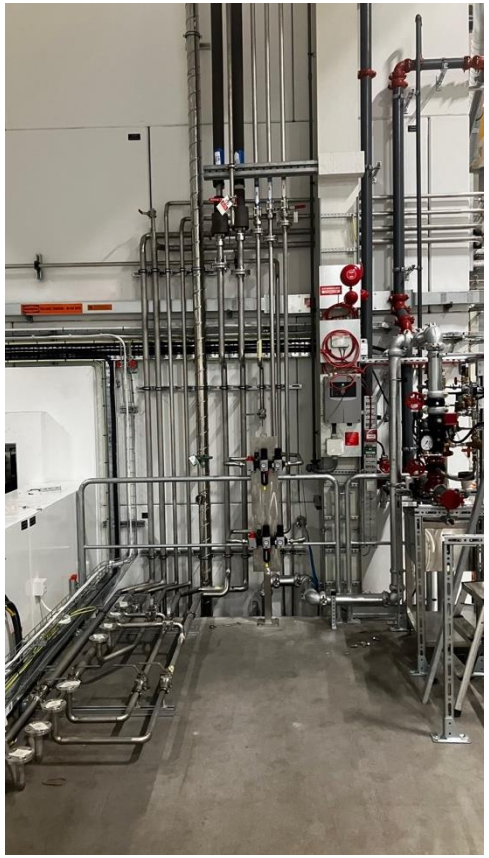
NPI update

- Cave & hutch (installed)
- CEP & CUP in the instrument area (installed)



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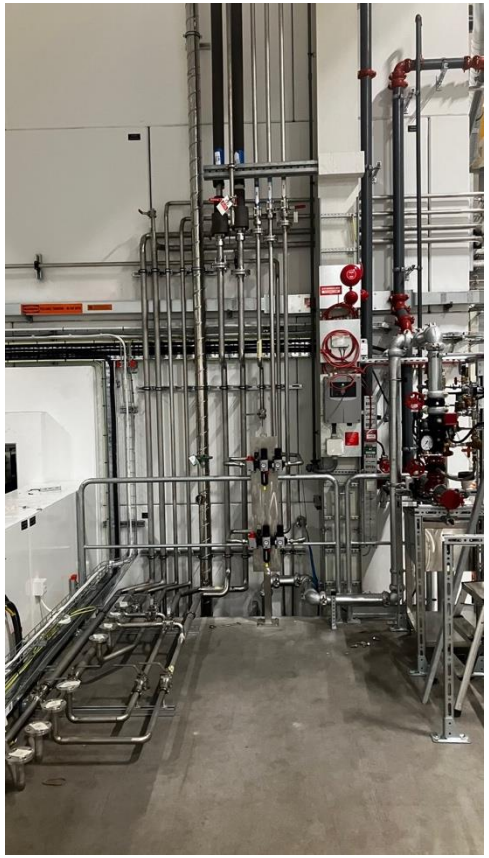

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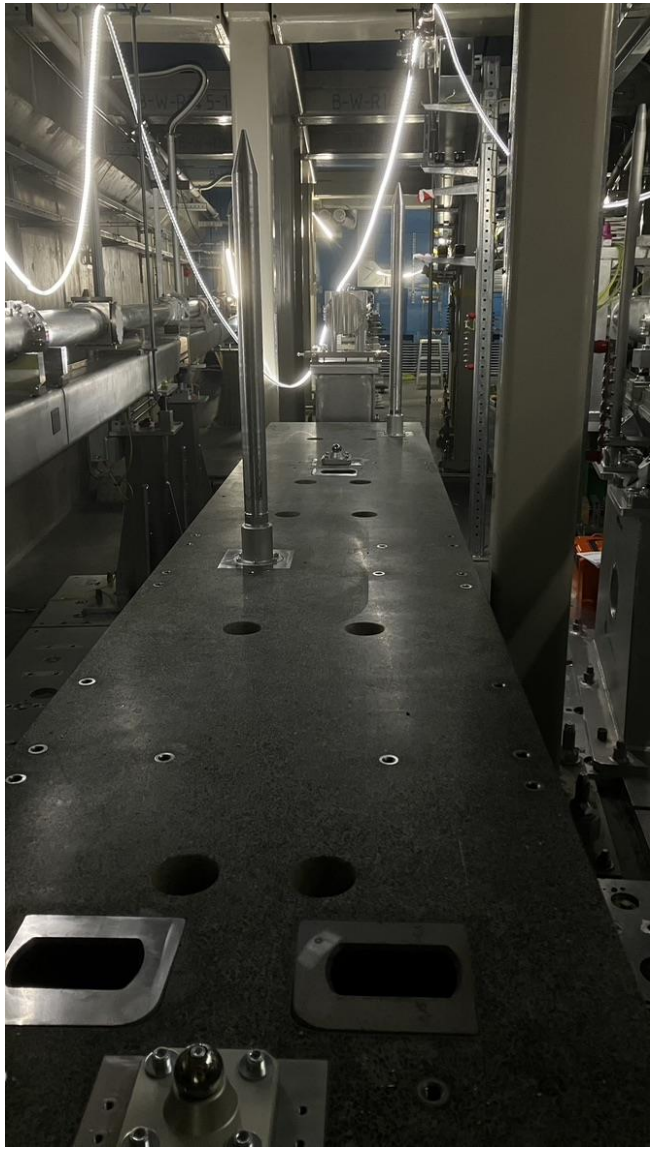
Hereon update

- Neutron Optics in-bunker
  - After chopper cascade (installed)
- The concrete chopper support (installed)



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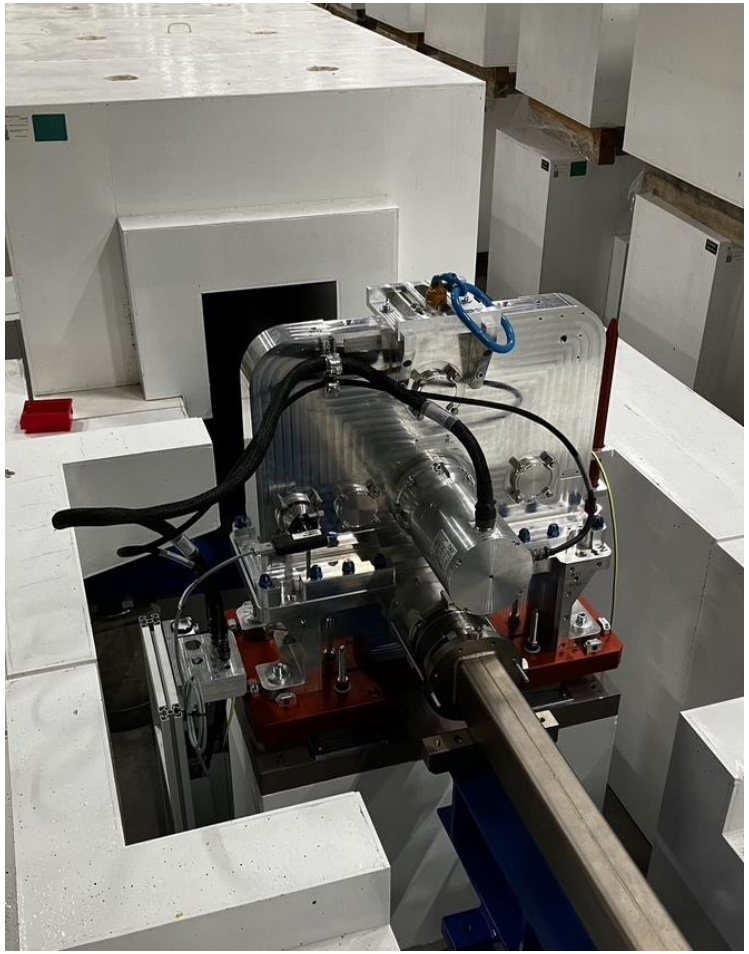
Hereon update

- The 80 m chopper (installed)
- Array 2 (assembling)



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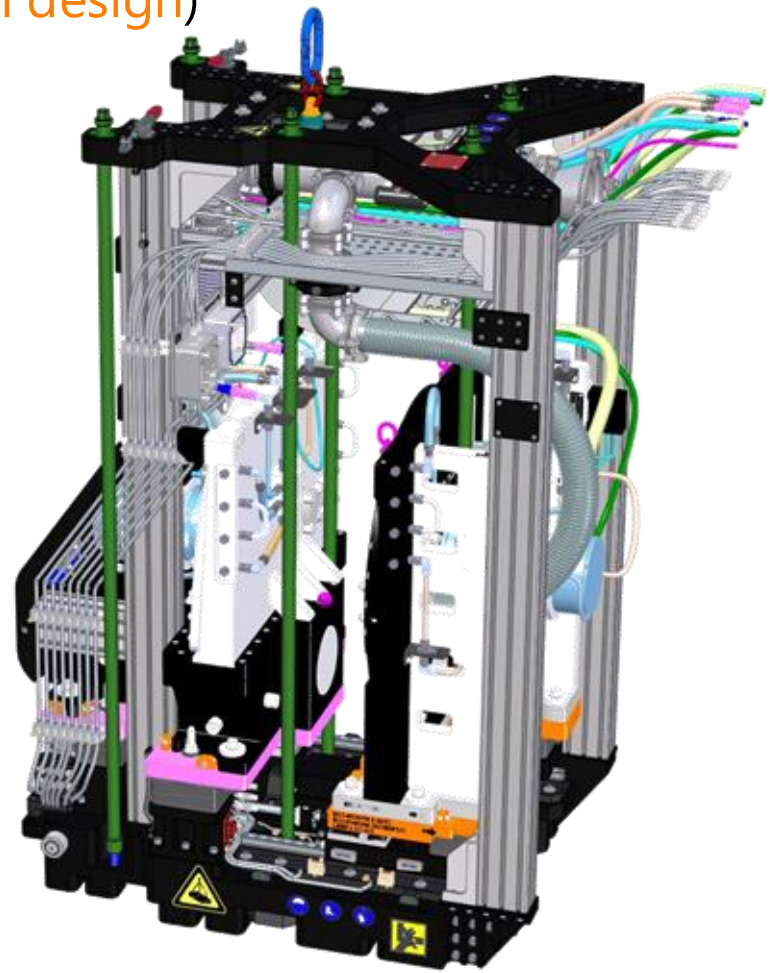
Hereon update

- Array 2 cable bridge (in design)
- Array 1 (in design)



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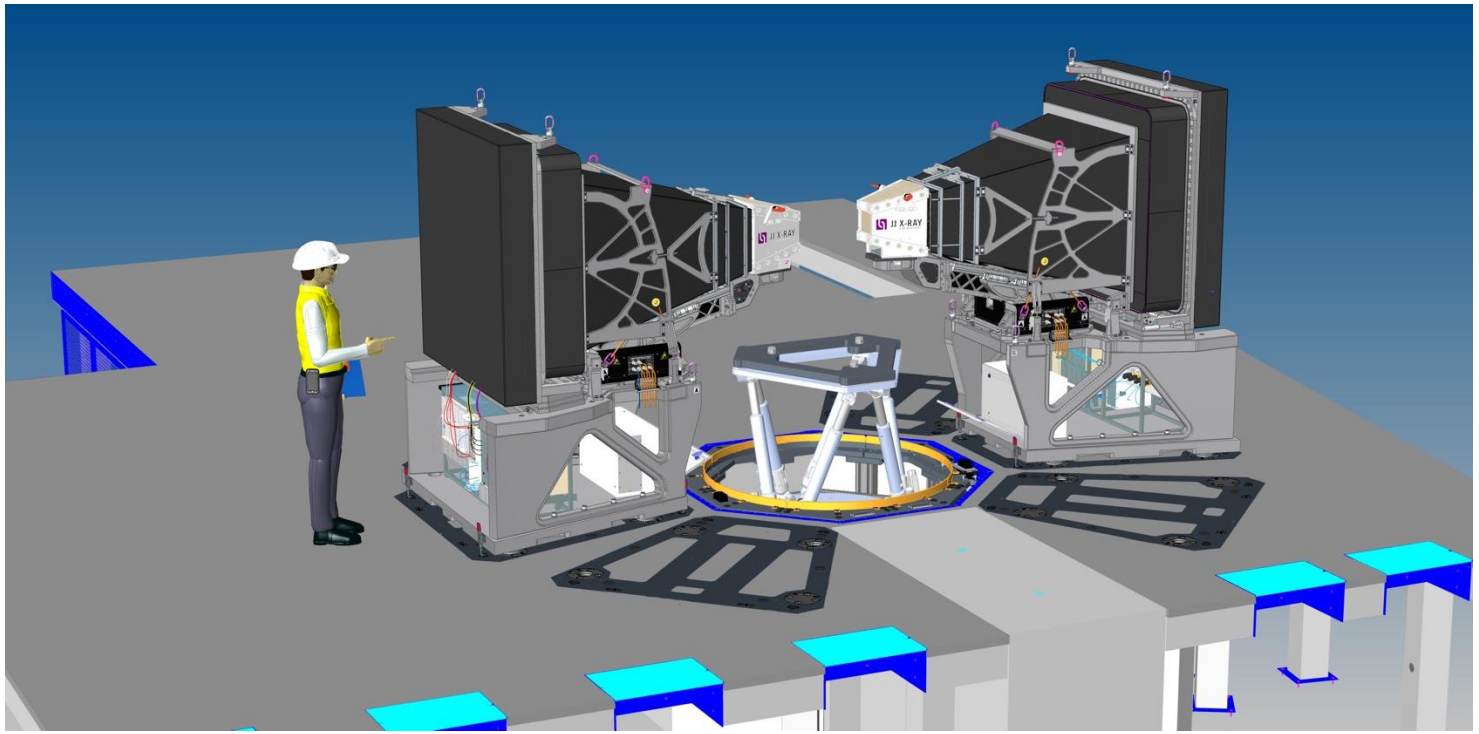
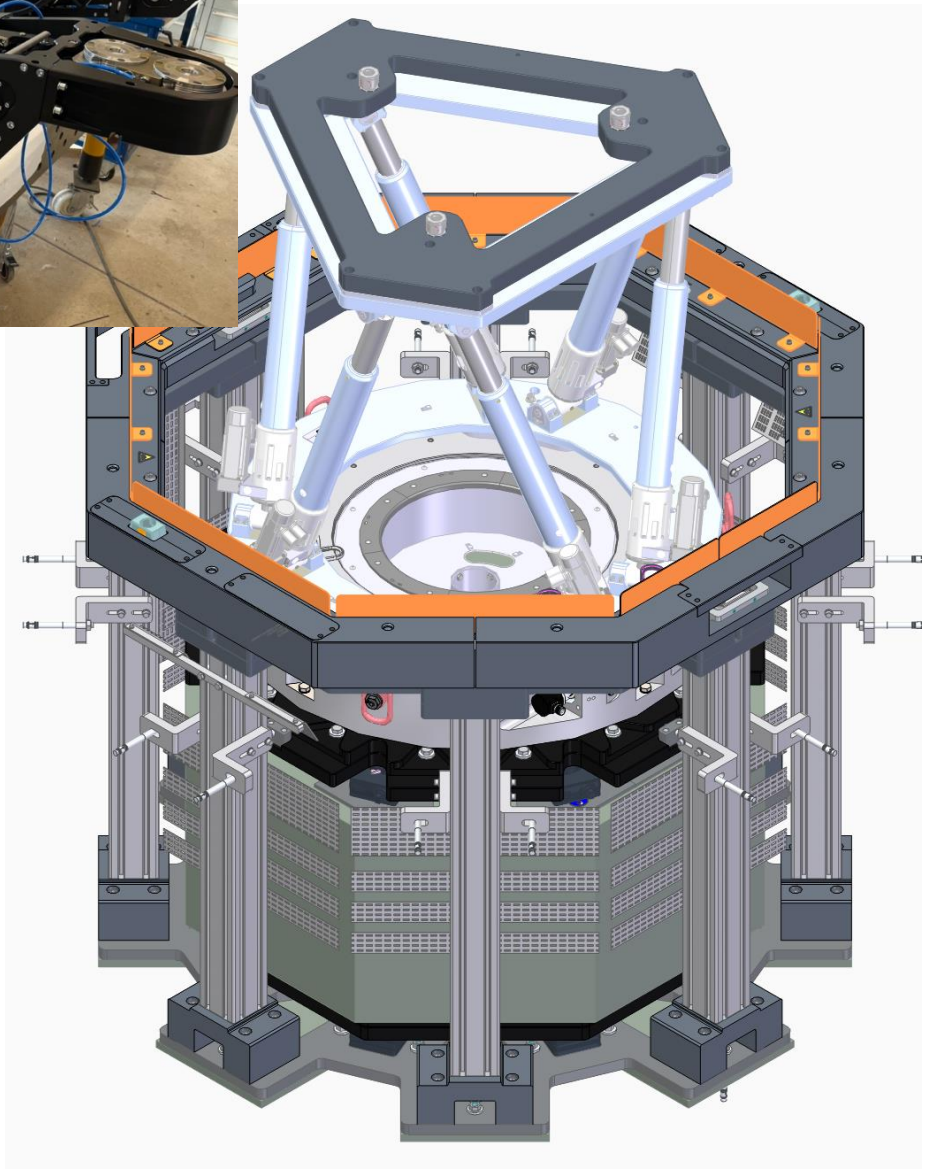
Hereon update

- Sample tower (in design)
- Detector support (in design)
- Collimator manipulator (ready to ship)





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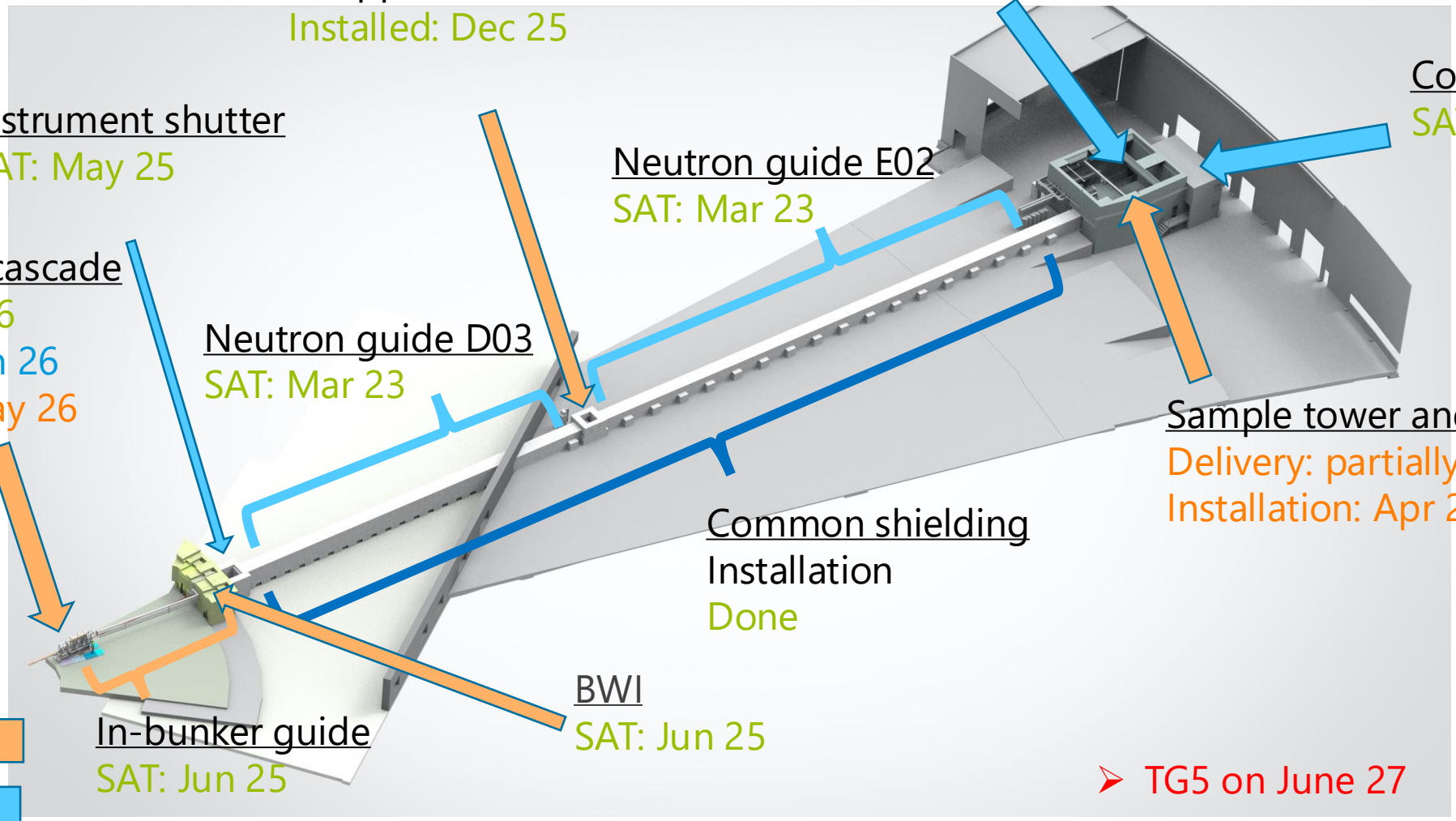
Components status after re-planning



Choppers at 80 m
Installed: Dec 25

Experimental cave
SAT: Dec25

Instrument shutter
SAT: May 25

Neutron guide E02
SAT: Mar 23

Control hutch
SAT: Mar 26

Choppers cascade
Base: Jan 26
Array 2: Jan 26
Array 1: May 26

Neutron guide D03
SAT: Mar 23

Sample tower and detectors
Delivery: partially delivered
Installation: Apr 26-Nov 26

Common shielding
Installation
Done

BWI
SAT: Jun 25

In-bunker guide
SAT: Jun 25

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NPI

➢ TG5 on June 27

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What we struggle with

- Communication with technical groups, …
  - Complicated interfaces ECDC/ICS/DMSC, MCA/CEP/ECDS, …
  - The scope of the work is sometimes not clearly defined (change request/payment for small additional tasks)
  - Change of requirements after the manufacturing or CDR (mainly MCA)
- Rules and new requirements are placed over time – it is difficult to catch up
  - Based on bad experience with other installations, ESS places further and further control over all instruments, which may hinder real progress
- Lack of decision-making and active support
  - Competence fight between technical groups
  - The instrument team has to chase the technical groups
- PSS team – lack of communication
  - No discussion about the placement and design of the safety equipment
  - No information about the access procedure and implications

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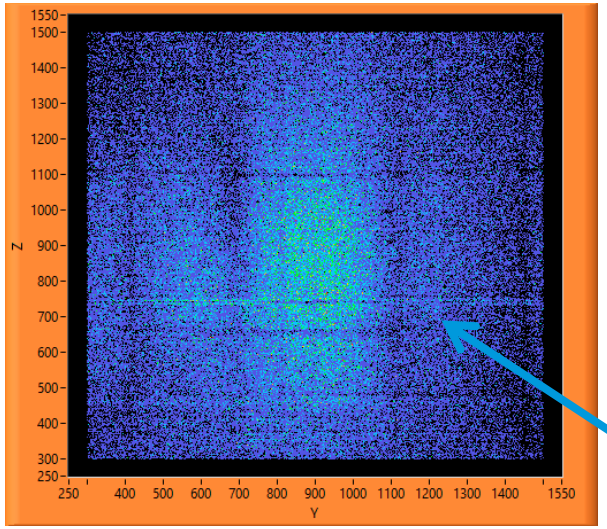
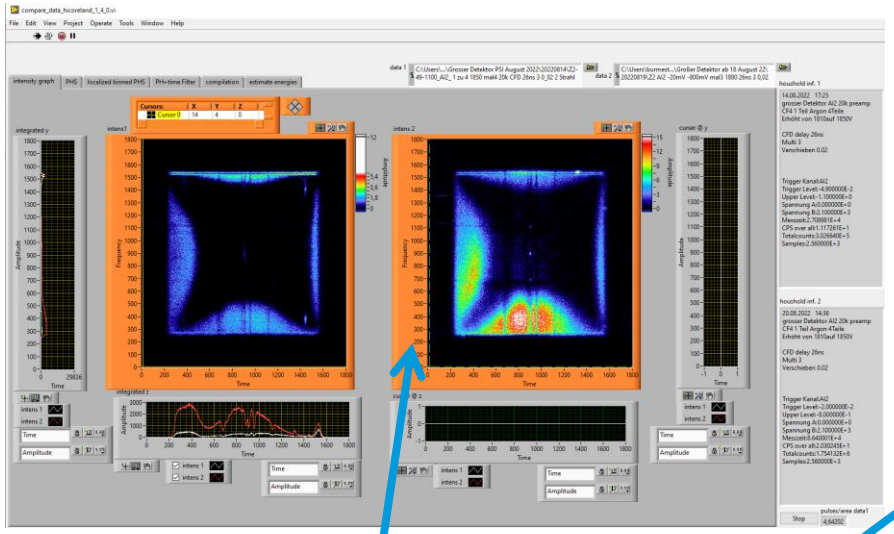
Detector update

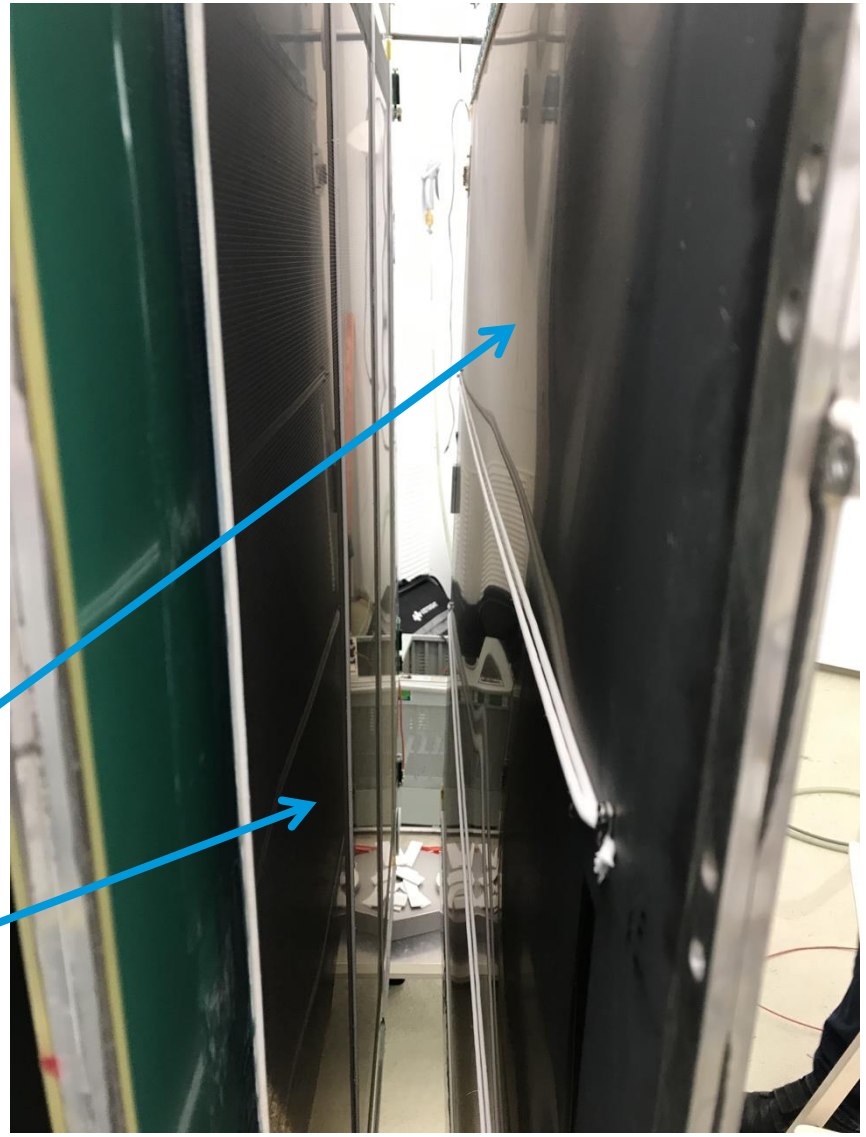
- Redesign of the frames holding the converter sheets
- The test showed the resolved issue





Measurements at PSI with the old frame are uneven and not homogeneous

New frame flat and homogeneous



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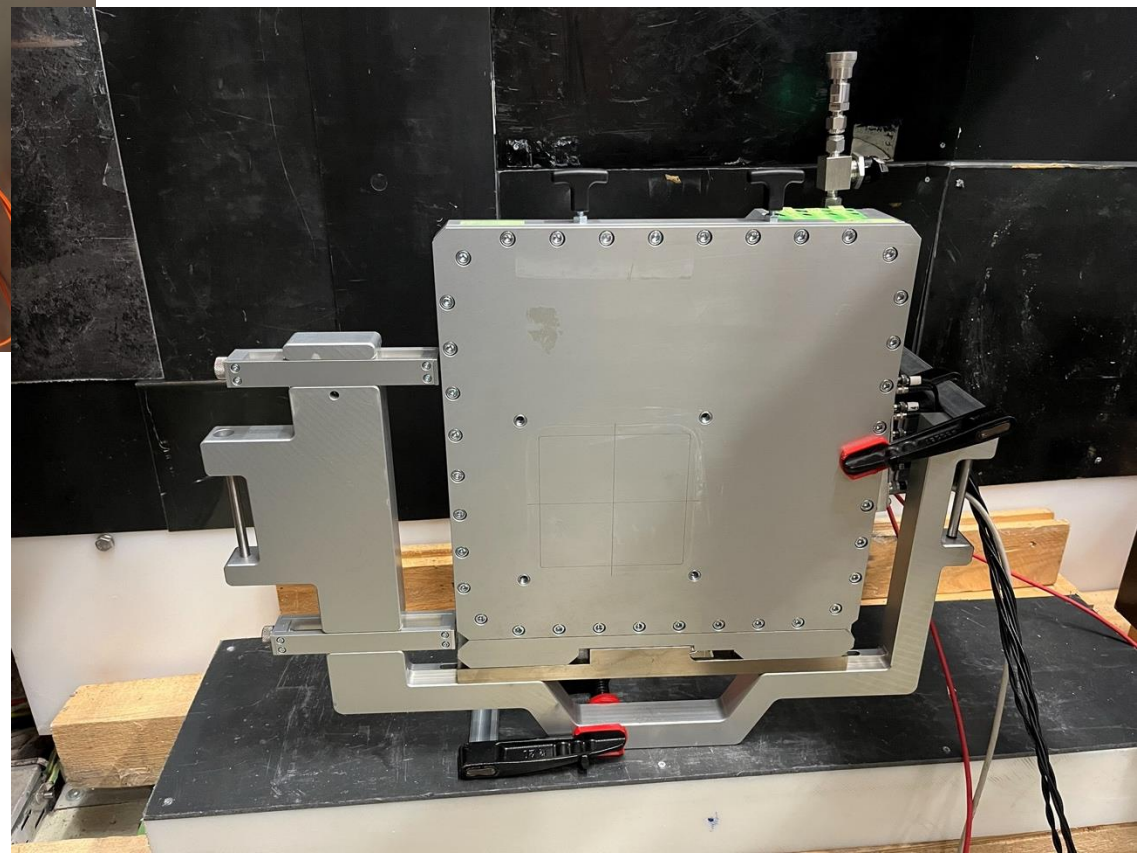
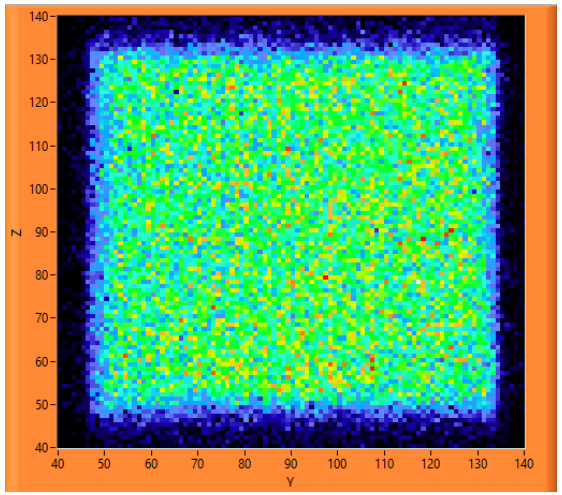
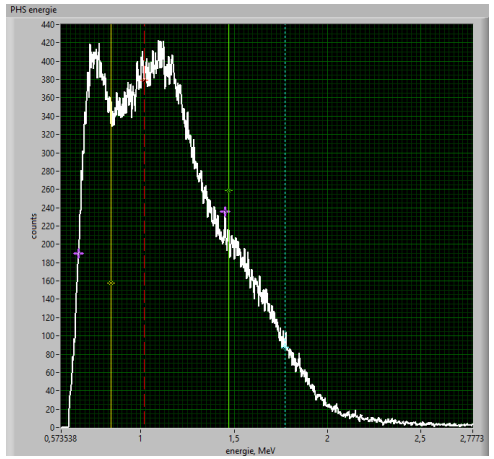
Detector update

- Beam-monitor under test
- Electronic under test
- Documentation under progress
- CE-marking process initiated
- Monitor and electronics shall be shipped asap to Lund for pre-tests by the detector group







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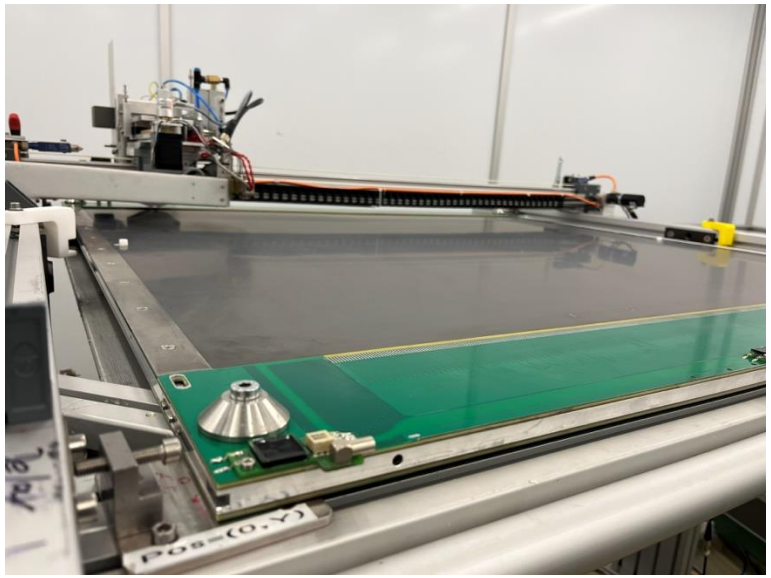
Detector update

- Detector modules in production
- Fine-tuning of the production process
- Automation of the production process
- Documentation under progress
- Steel-hood ready for evacuation
- CE-marking process initiated
- Detector test at Rez in June



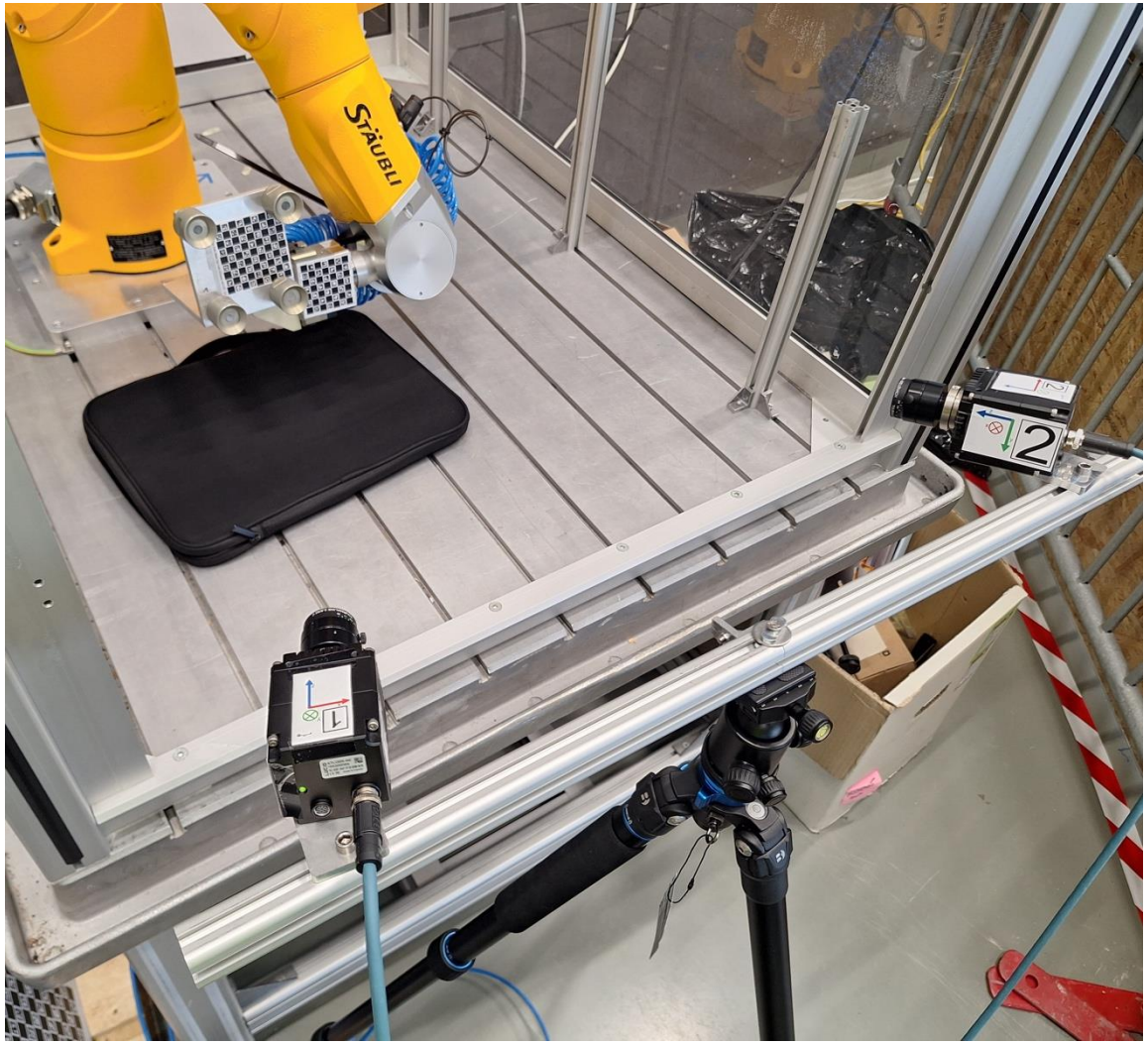
Computer Vision-Based Feedback

System for a Sample Handling Robot

Gabriel Andersson & Pontus Sjöstedt

Master's Thesis Project in Automatic Control at LTH

- Design and implement a computer vision-based feedback system for the absolute positioning of the robot arm end-effector.
- The system should improve the absolute positioning accuracy to better than 50 µm.
- The system should estimate pose estimation uncertainty.
- Hopefully integrated with EPICS and NICOS.

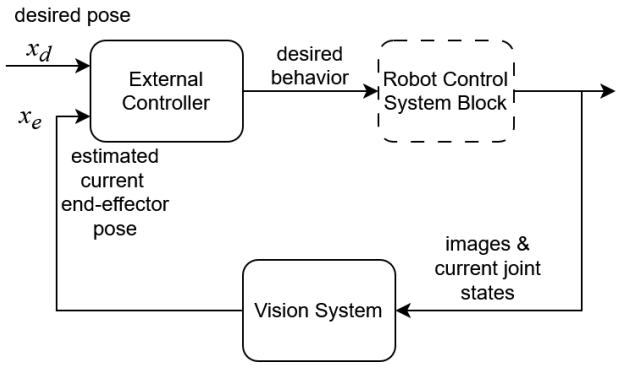


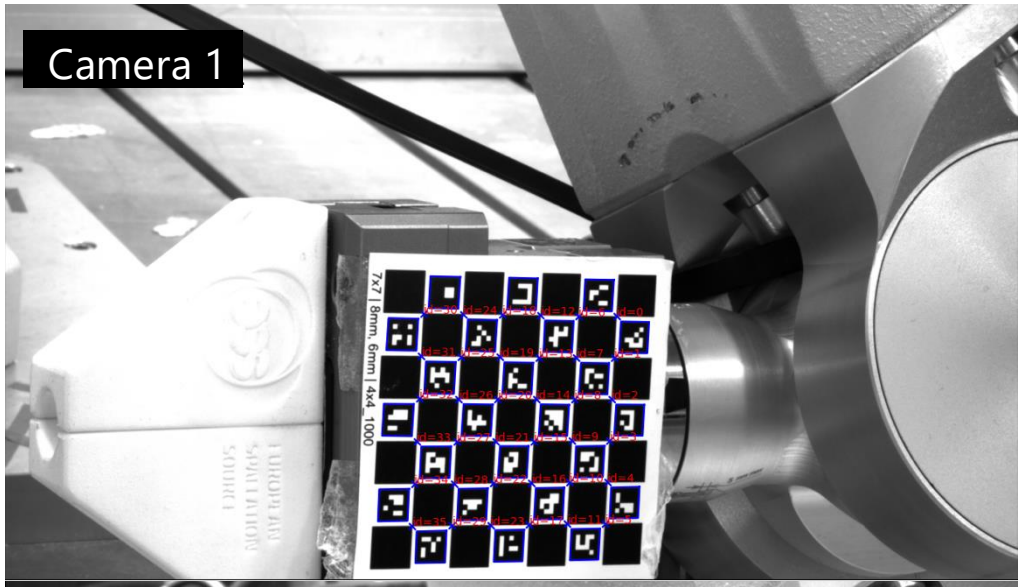
Computer Vision-Based Feedback

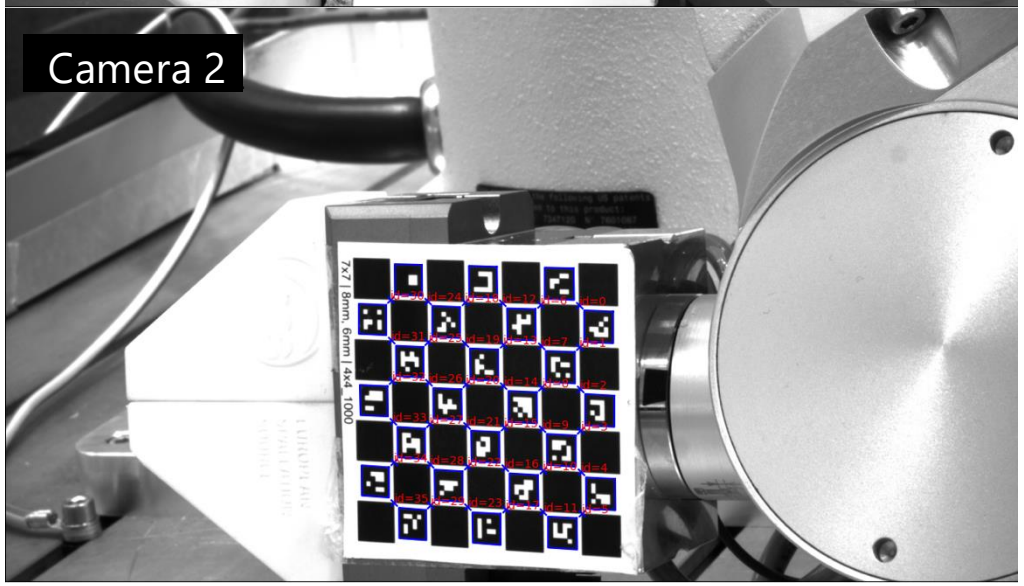
The system and status

- Stereo vision for accurate depth perception
- Computer vision (pose estimation and calibration) implemented using OpenCV.
- **Currently implemented on a Stäubli TX60**

- Feedback system designed and implemented
- Laser tracker measurements conducted for accuracy validation
- Sub-50 µm target not yet met (test results still under evaluation)
- Currently investigating camera calibration and marker quality effects to improve performance







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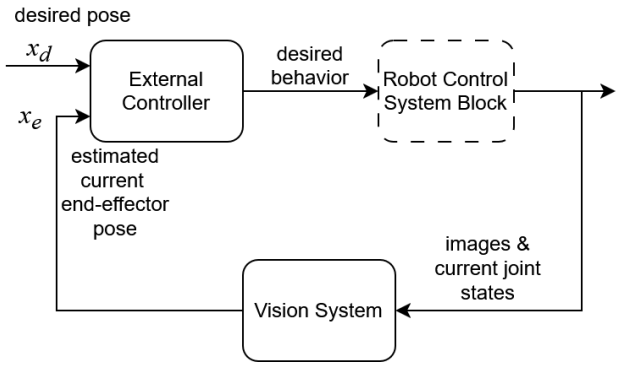

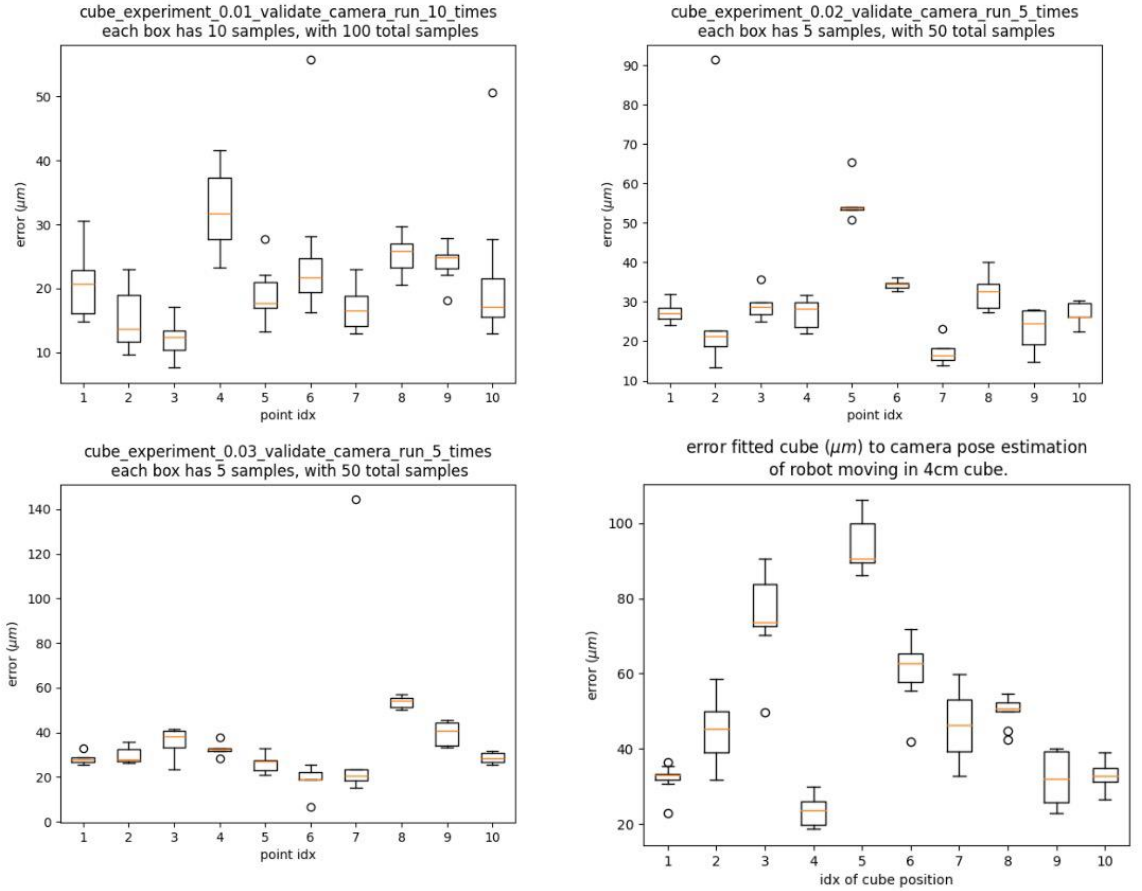

Figure 4: Errors (μm) for cubes with side (1, 2, 3, 4) cm. The 4 cm was analysised in differently structured data and thus looks different. The 4cm cube was measured 10 times. Point idx 1 and 10 are both located in the origin.