PETRA IV.
NEW DIMENSIONS

PETRA IV Logistics Concepts

5th R&I Workshop

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HELMHOLTZ

DESY.

5th R&I Workshop – PETRA IV Logistics Concepts

Agenda

- **PETRA IV overview**
- **Decommissioning**
  - Rough schedule and planning
  - Starting point
  - Tasks for the PXW
  - Task for the MvL
- **Girder Assembly Building (GAB)**
  - Schedule
  - Building
  - Assembly area
- **Demonstrator girder**
  - Leassons learned for the assembly

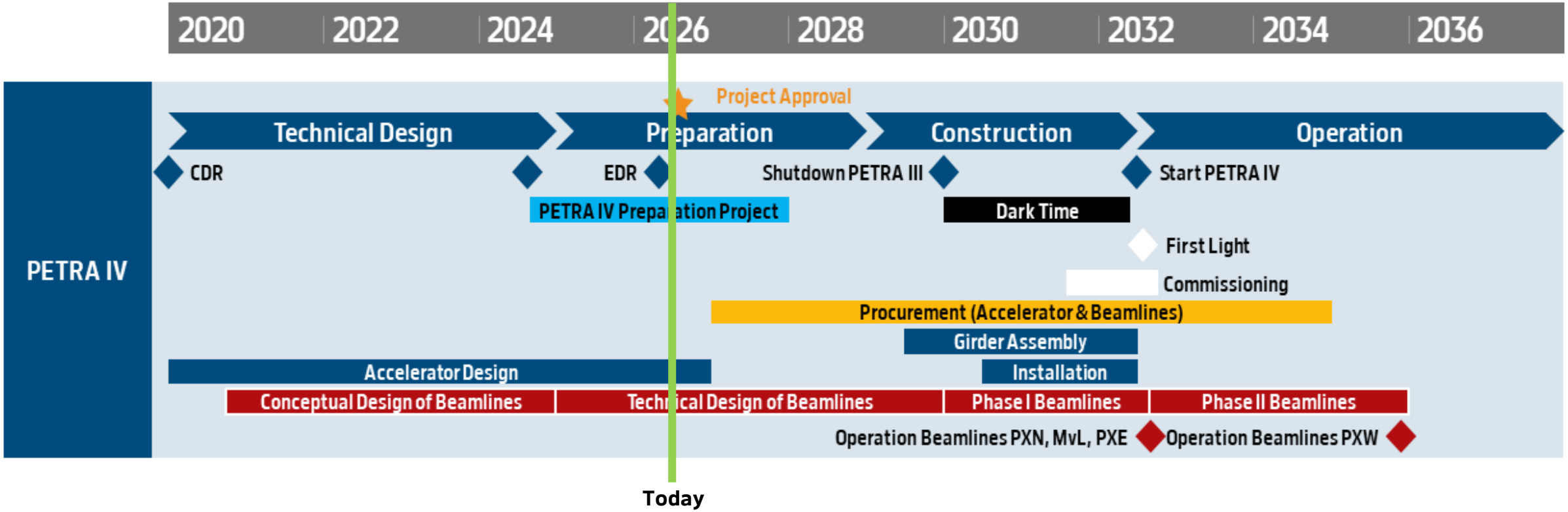
PETRA IV overview

Schedule

Shutdown of max. 2.5 years (2030/2032)

Start of operation 7/2032 with 19 beamlines

Project duration: 9 years (2027-2035)



PETRA IV overview

List of major items

Buildings/Infrastructure

Experimental Hall West (PXW)
Supply Buildings
RF Hall
Refurbishment of a large number of Buildings

- 39 New buildings & building extensions
- 11 Existing buildings to be refurbished
- 28 Buildings to be demolished
- 4 refrigeration plants (13 MW) water cooling
- Air handling systems (8 MW)
- Expansion of power supply network
- Renewal and/or expansion of IT networks
- 2400 Electronic racks

New Accelerator structures

LPA injector
DESY IV Booster synchrotron
H6BA PETRA IV storage ring
Transfer lines

- 2300 Resistive magnets (SR)
- 300 Resistive magnets (Booster)
- 432 Permanent magnet dipoles
- 288+6 Girders
- 48 RF cavities
- 48 (SR) + 9 (Booster) SSAs
- 1250 Vacuum chambers
- 1000 Vacuum pumps
- 5000 power supplies
- 10 Kickers & HV pulsers 10
- 4 septa
- BPMs, Diagnostics, etc.

Experiments

16 new beamlines
10 completely refurbished beamlines
5 partially refurbished beamlines

- 102 Hutches
- 20 Monochromators
- 41 Transfocators
- 26 Mirror systems
- 22 KB systems
- 39 Pixel detectors
- 35 Other detectors
- 62 Endstations
- 445 BL control electronics elements (ZMX, MicroTCA, Timer, NIM, ADC)
- Large amount of IT hardware

PETRA IV

Storage ring

72 sectors

consisting of

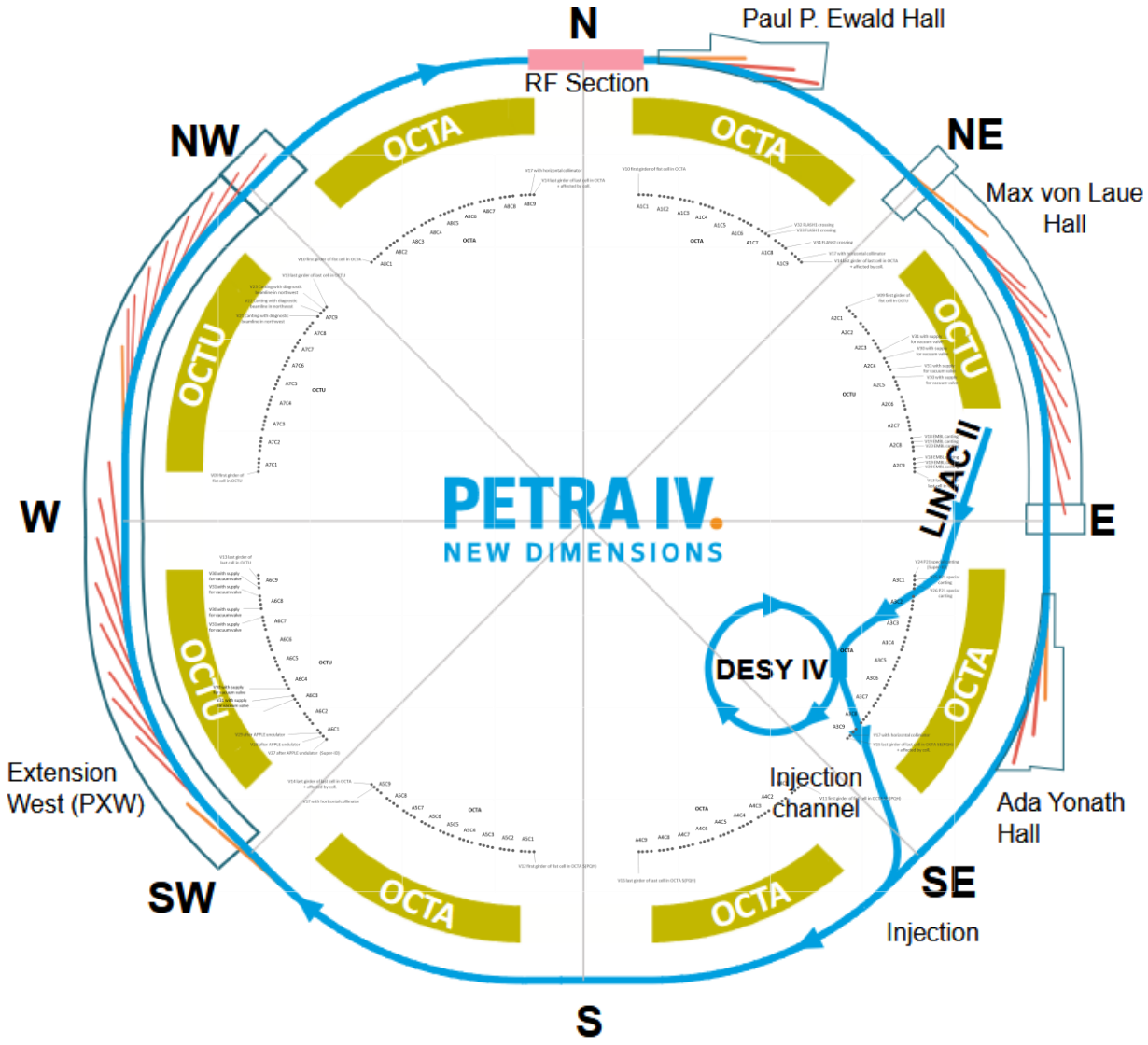
288 girders
(4 girders per sector)

arranged in

8 octants

connected by

8 long straight sections



Decommissioning

- Rough schedule and planning
- Starting point
- Tasks for the PXW
- Task for the MvL

Decommissioning

Rough schedule and planning

2026 - mid 2029

1. Decision on which components are to be kept (reinstallation in PETRA IV, return to the group, disposal).
2. Labeling of components (reinstallation in PETRA IV, return to the group, disposal).
3. Small components that are not required for operation will be removed by the individual groups before dark time.

Dark time starting at 2030

1. Activation measurement and clearance of components & removing of shielding stones
2. Dismantling of infrastructure
   - Ensure that there is no voltage remaining (aluminum rails, power cables, etc.)
   - Drain water
   - Cut pipes
3. Machine
   - Disconnect all connections (cables, hoses, pipes, connections, etc.)
4. Front-Ends
   - Disconnect all connections (cables, hoses, pipes, connections, etc.)

Parallel work starting in 2030 in approved sections

- Removal of retained components by the groups themselves
- Removal of machine and front-end components
- Removal of cables and pipes

The goal is to make the decommissioning as fast as possible!
→ Therefore, we have to minimize the number of groups in the tunnel.
→ Tasks have been distributed to different groups.

- Infrastructure (MKK1, MKK2, MPC)
- Machine (MKK1, MKK2, MVS)
- Front-Ends (MKK1, MKK2, MVS)
- Dismantling (MKK1, MKK2, MEA)

Decommissioning

Starting point

PXW

3 months: Jan – Mar 2030

- The shutdown starts with the removal of the storage ring PETRA III.
- We have 3 months for the decommissioning in this area before the demolishing starts.

Max-von-Laue hall

Start in Jan 2030

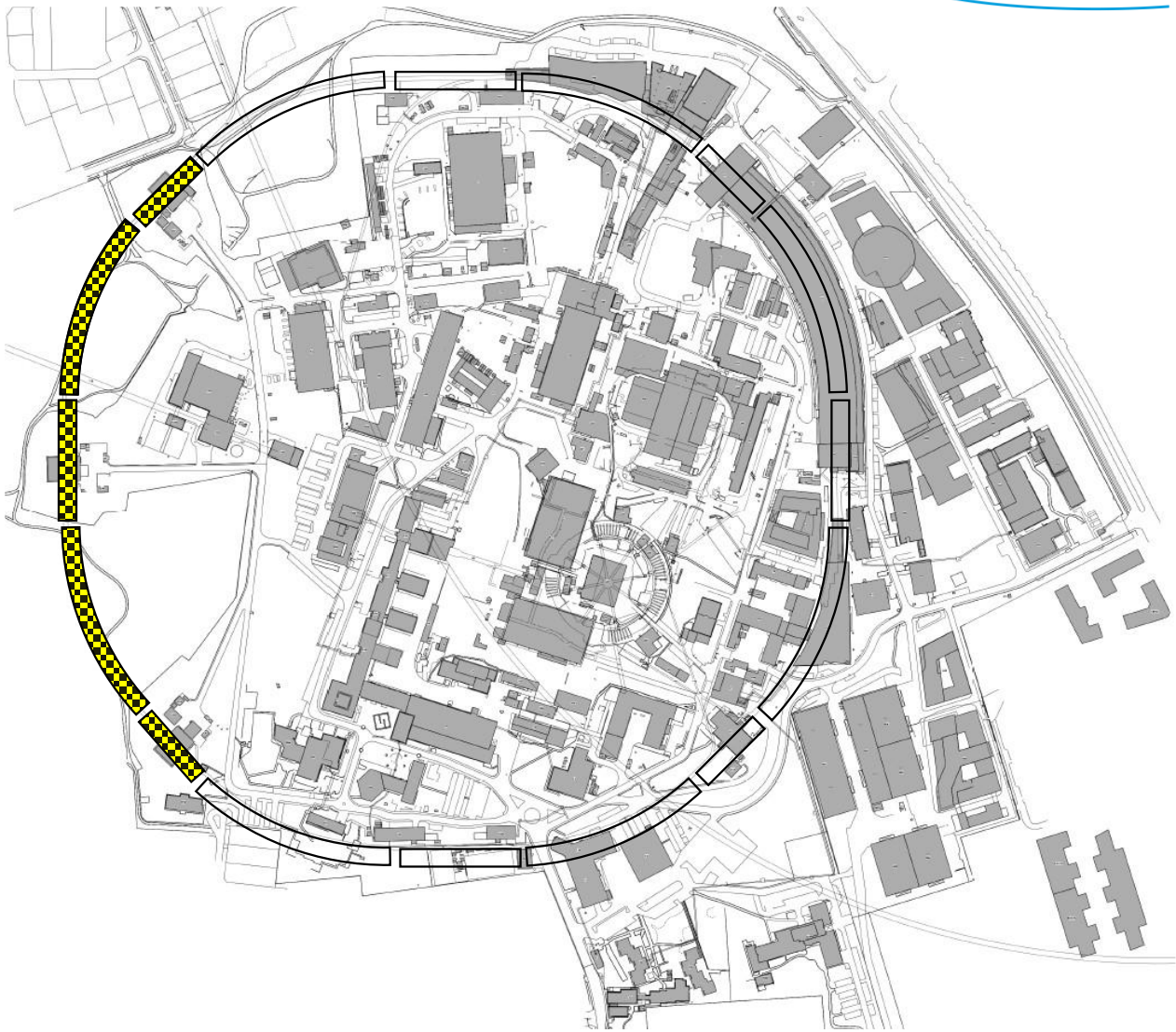
- Removal of front-ends to refurbish/upgrade/replace them for PETRA IV.

Decommissioning

Task for the PXW

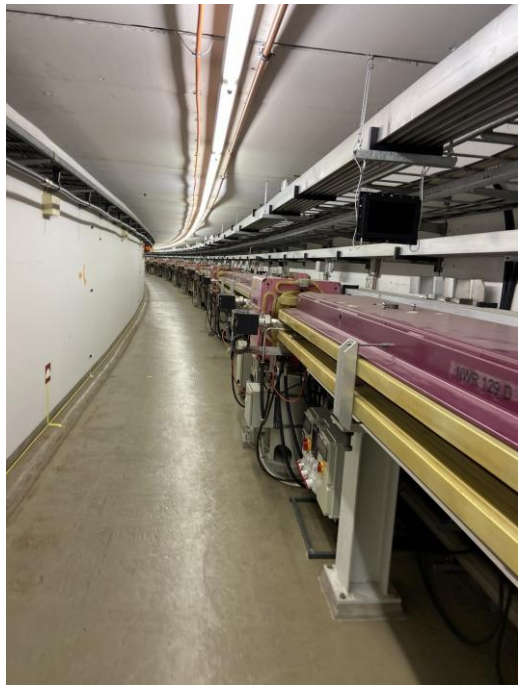
PXW

- Complete survey of the tunnel
- Saving infrastructure for
  - Smoke detection
  - Communication
  - Light
  - Power
- Halls
  - Removal of shielding stones
  - Removal of infrastructure
- Tunnel
  - Activation measurement
  - Making sure that there is no voltage remaining on any components
  - Drain water
  - Disconnect all connections on the machine
  - Removal of components to be retained
  - Removal of machine components
  - Removal of electronics, cables and pipes



Decommissioning

Task for the PXW



- Most of the machine components in this area are repetitive.
- No special requirements for decommissioning.
- Rate limiting step: removal of the dipoles using the Dwarslöper.

Decommissioning

Task for the PXW

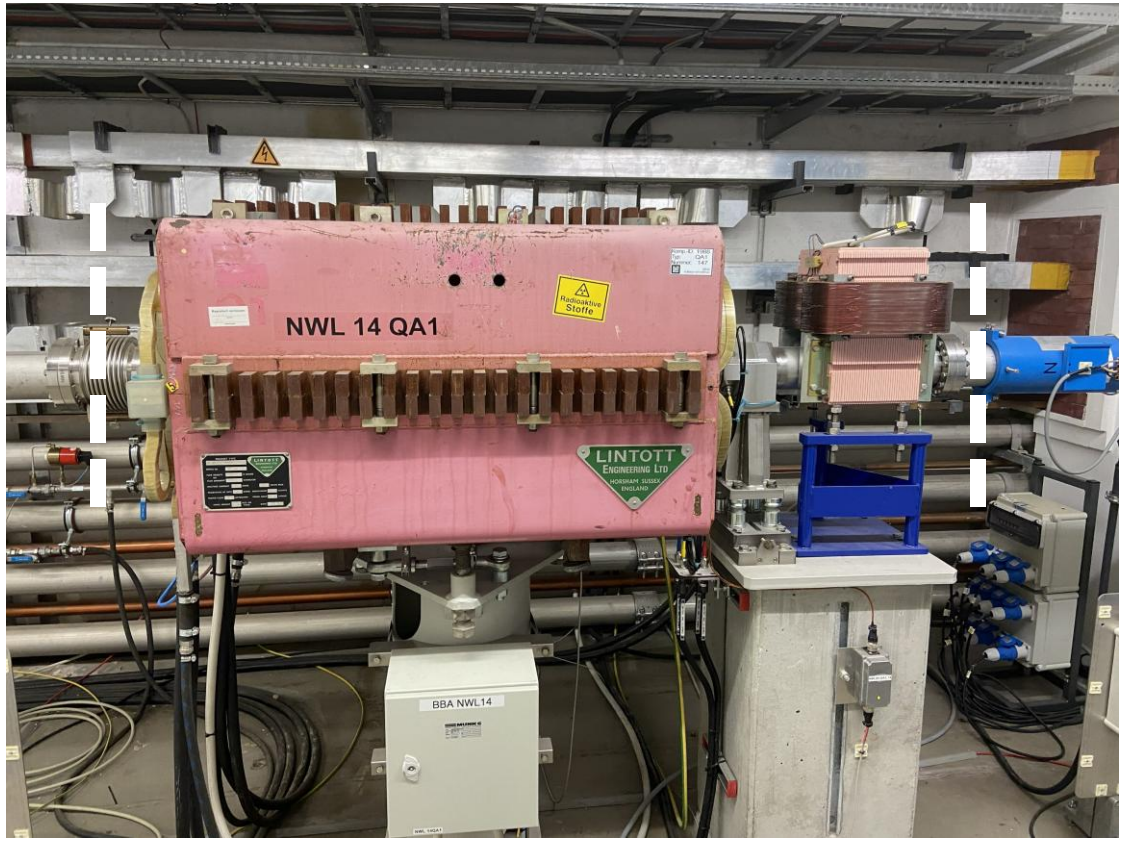
Dwarslöper

Infrastructure

Wiggler, Wiggler-Absorber

Decommissioning

Task for the PXW



Slow

Fast

Options to remove the magnets

Option 1:
1. Open magnets
2. Remove the vacuum chamber
3. Close magnets
4. Remove the magnets

Option 2:
1. Open the vacuum chamber at the flange
2. Remove the magnet, including the vacuum chamber

Option 3 (not allowed for us):
1. Cut the vacuum chamber (Hydraulic cutters, etc.)
2. Remove the magnet, including the vacuum chamber

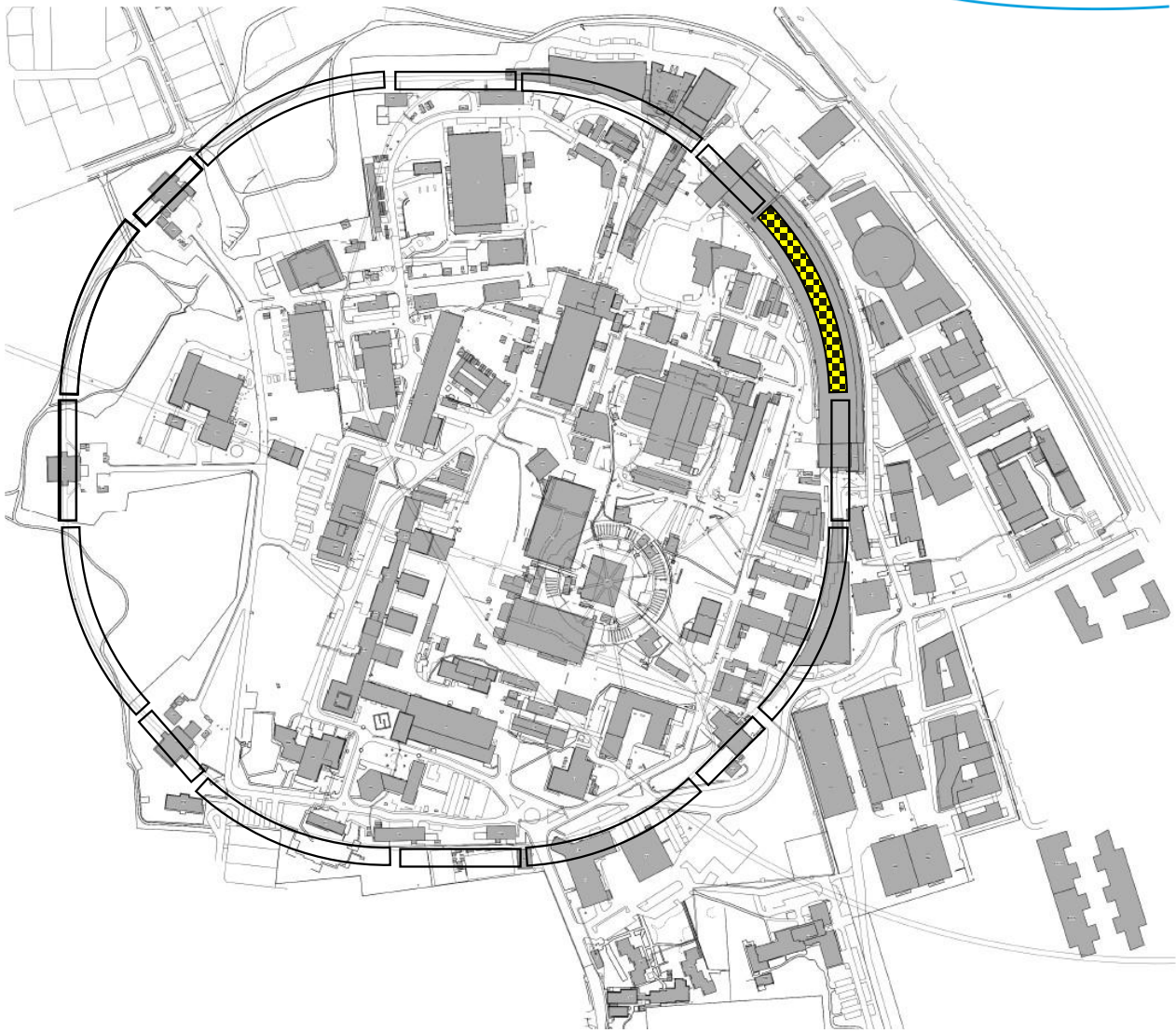
Decommissioning

Tasks for the MvL

Max-von-Laue hall

- Activation measurement
- Drain water
- Disconnect all connections on the machine and front-ends
- Partly opening the tunnel ceiling
- **Removal of front-end components**
- Removal of components to be retained
- Removal of machine components
- Removal of electronics, cables and pipes
- Survey of the tunnel

→ By opening the tunnel ceiling partly we don't need to store the stones somewhere and reduce the transports.
→ But we have to open it twice.



Decommissioning

Tasks for the MvL

MvL hall – tunnel ceiling

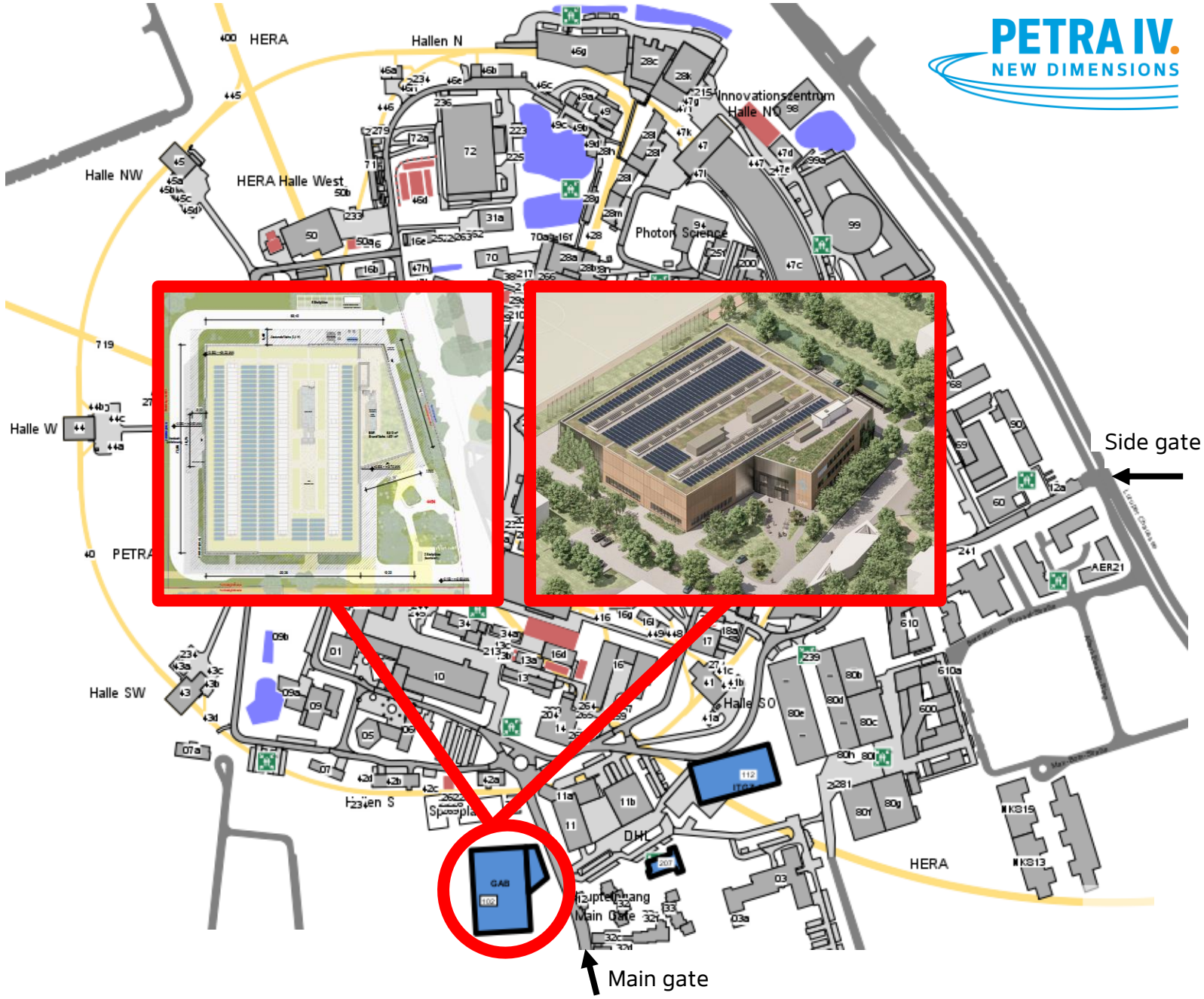
Girder Assembly Building (GAB)

- Schedule
- Building
- Assembly area

GAB

Schedule

Status	
Hiring a general planner	**08.06.2023**
Building application	**13.03.2025**
Building permit	**30.01.2026**
Start of implementation planning	**04.11.2025**
Start of preparation for tendering	**03/2026**
Start of tender process for trades	05/2026
End of all tenders	02/2028
Start of construction	03/2027
Completion of construction	10/2028



GAB

Building

Storage area:

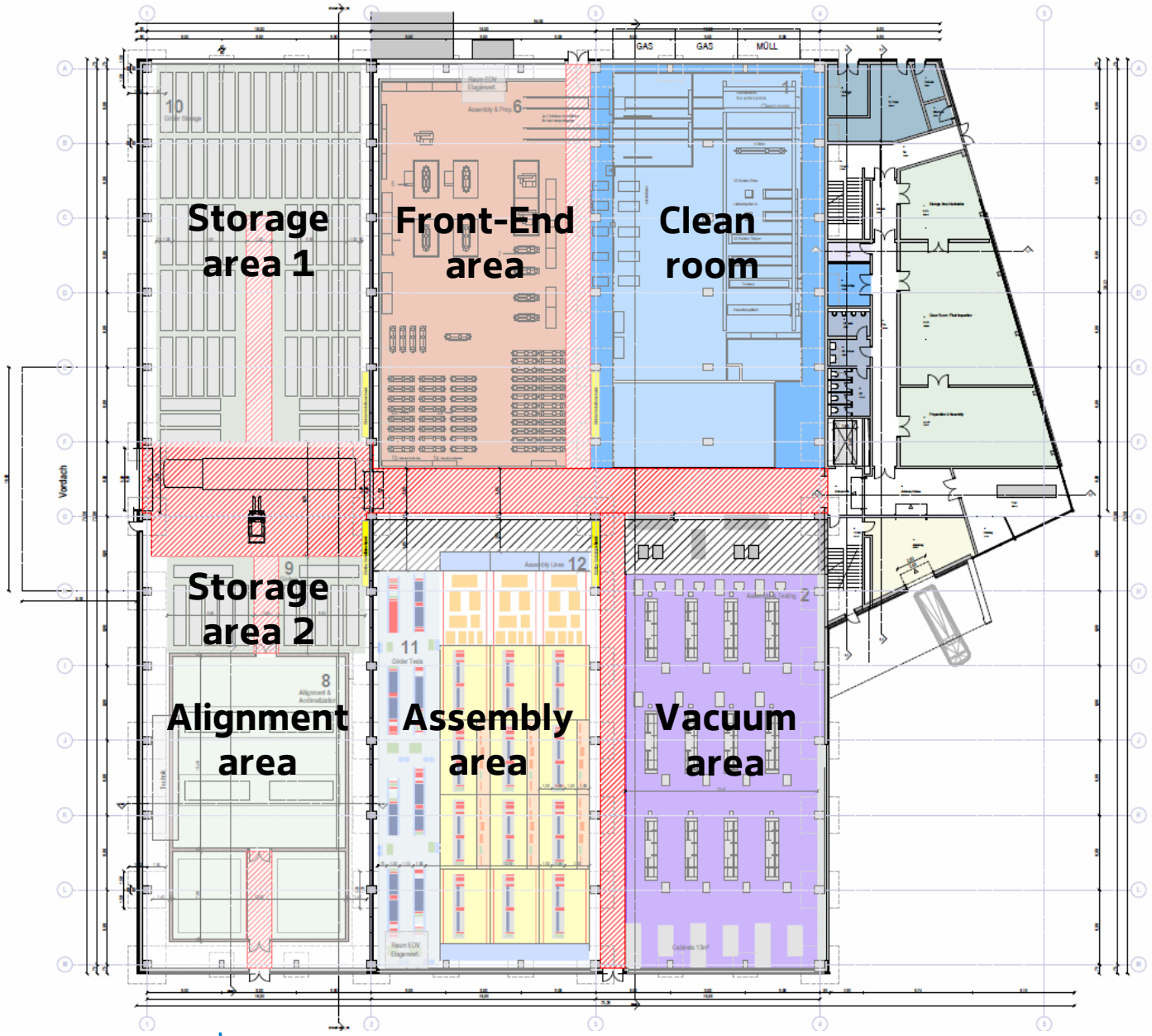
- Space for 68 girders

Front-End area:

- Assembly of front-end chambers for PETRA IV
- Assembly of front-end girders for PETRA IV
- Preparation of PETRA III front-ends for reuse
- Dismantling of discarded PETRA III front-ends

Clean room:

- Will be shared by the front-end and vacuum group



Vacuum area:

- Assembly of vacuum chambers for PETRA IV

Assembly area:

- 3 Assembly lines
- Test area

Alignment area:

- Space for 6 girders to climatize
- Space for 4 girders to be aligned

GAB

Building

PETRA IV. NEW DIMENSIONS

Storage area:

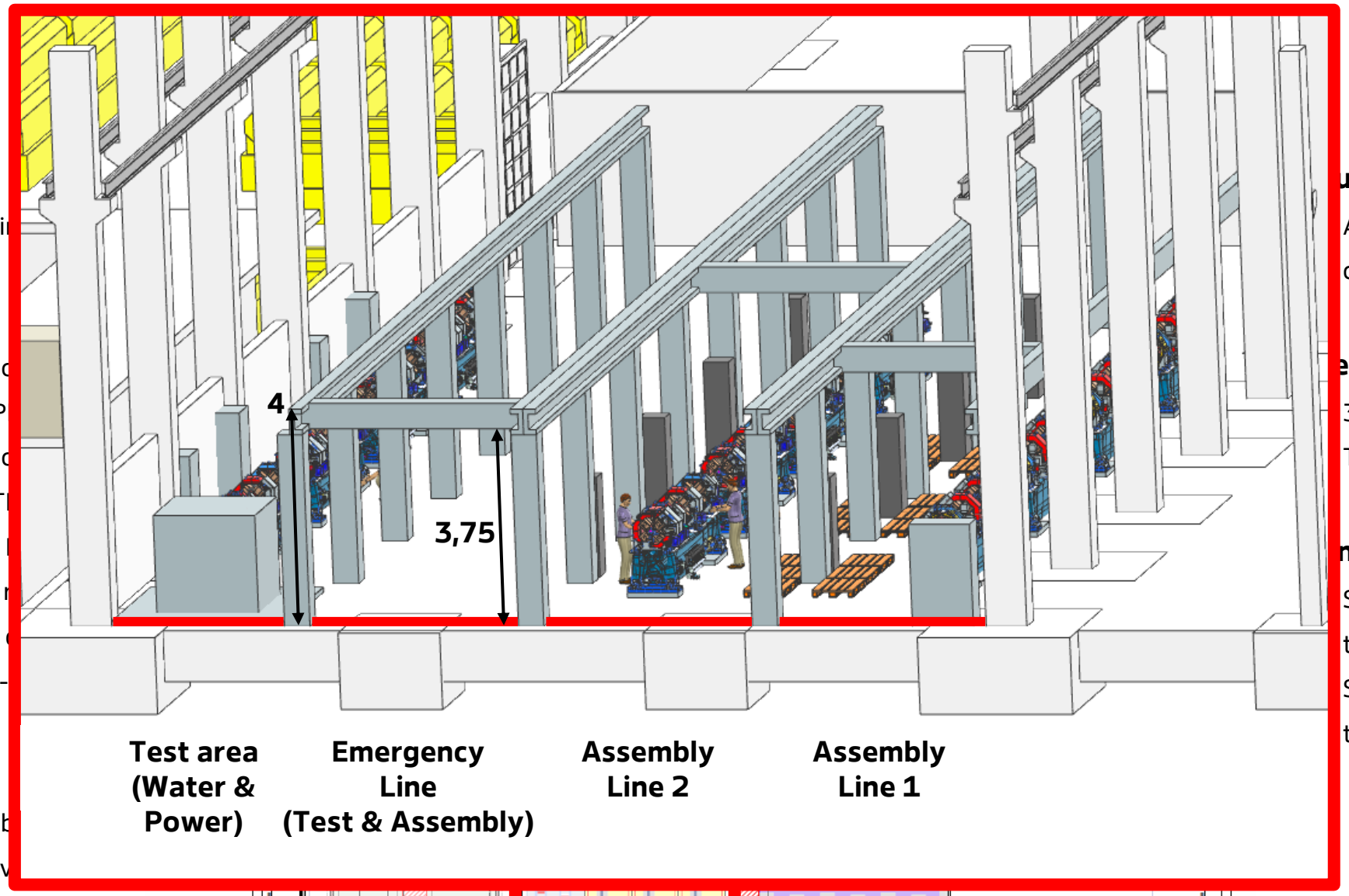
- Space for 68 gi

Front-End area:

- Assembly of fr
  chambers for P
- Assembly of fr
  girders for PET
- Preparation of
  front-ends for
- Dismantling of
  PETRA III front-

Clean room:

- Will be shared b
  front-end and v
  group



uum area:

Assembly of vacuum chambers for PETRA IV

embly area:

3 Assembly lines
Test area

nment area:

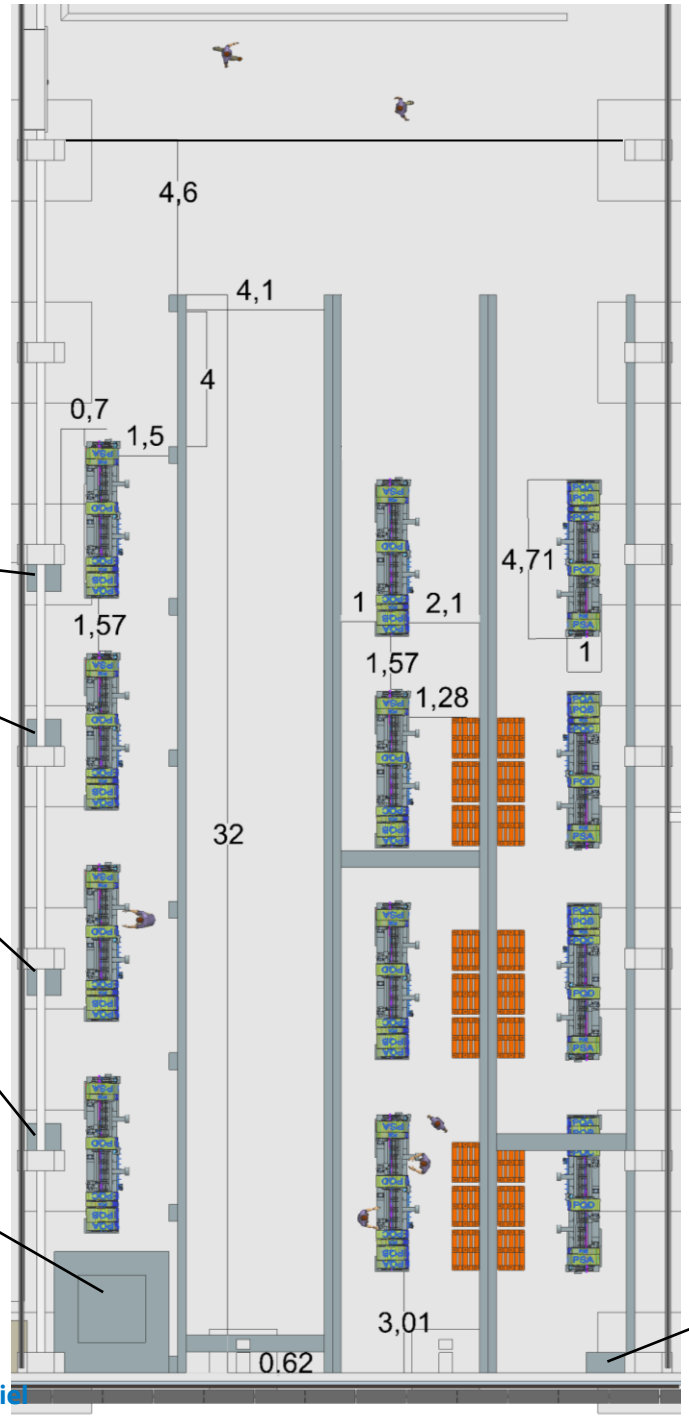
Space for 6 girders to climatize
Space for 4 girders to be aligned

GAB

Assembly area

Electronics cabinets for the power test

Water pump for the water test



Battery cabinet for assembly tools

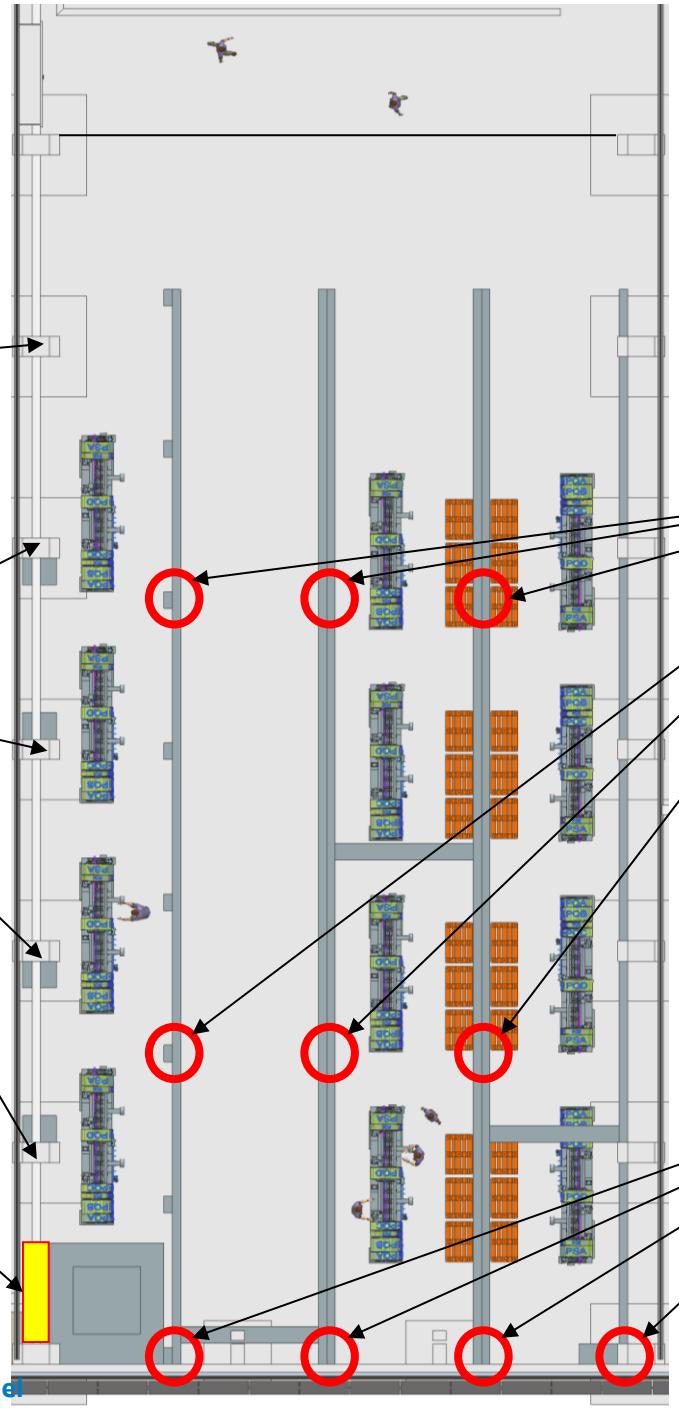
GAB

Assembly area

Hand basin

Connections per column
- Water inlet and outlet for the leak/pressure test
- Compressed air for blowing through magnets and pipes
- Power outlets

Electrical distribution (& IT)
to supply the assembly lines and small cranes
→ every line is electrically independent.



- 4x power outlets
- 2x Ethernet
- Compressed air

- Power for the crane rails

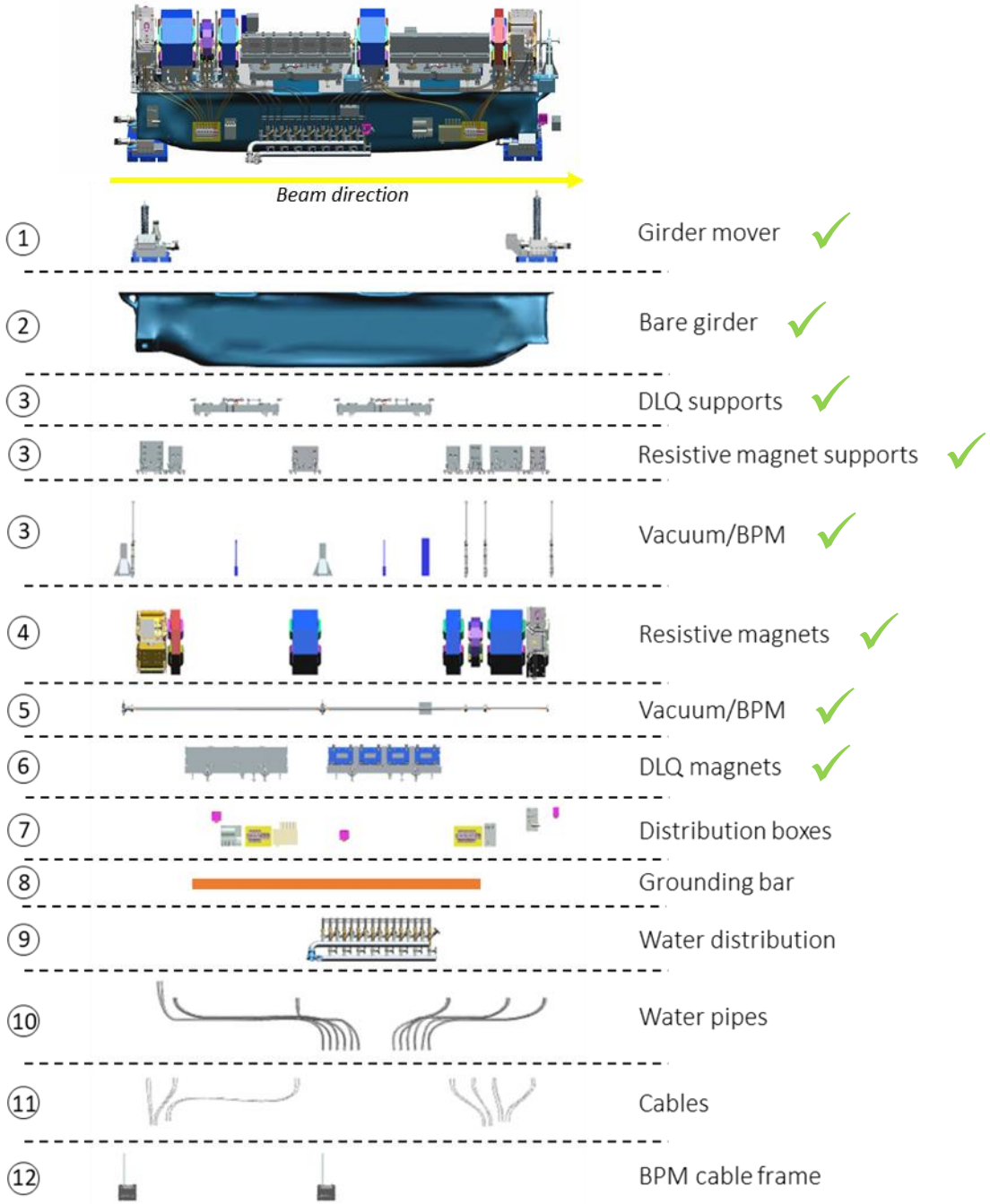
Demonstrator girder

- Lessons learned for the assembly

Demonstrator girder

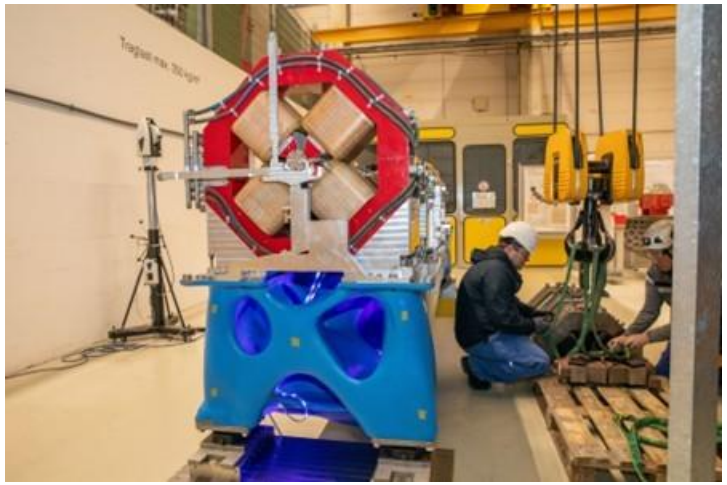
Lessons learned for the assembly

Assembly sequence of the components



Demonstrator girder

Lessons learned for the assembly



Girder

- Anything that falls into the girder is very difficult to recover.
- The feet and movers are difficult to assemble because force is exerted on the springs. We are currently working on a different design.

Supports

- The magnet supports are tilting during crane operation. A transport lock is necessary here because there is a risk of crushing your fingers when the magnets are set down.
- Some of the support screws are difficult to access during the assembly process. Screws should be moved further outwards or reduced in number. In addition, the number of different screws should be kept to a minimum in order to reduce the number of tools required.
- Some of the vacuum supports interfere with the installation of the magnets. This makes crane operation with the magnets more difficult.

Demonstrator girder

Lessons learned for the assembly

Resistive Magnets

- Overall, the assembly worked well. The working height is comfortable.
- Pallets work well as temporary storage. However, the finished magnets must be free along the line separating the upper and the lower half of the magnet.
- The installation space is very tight. Screws, hoses, and cables are partly inaccessible once other magnets are installed. Cables and hoses should be attached to the outside of the magnets.

Permanent Magnets

- The permanent magnets were installed in one piece with the supports attached. This worked well. In series production they will be installed in two parts (support and magnet). This eases handling, but should be tested.
- Moving the permanent magnets is also possible without a crank.

Demonstrator girder

Lessons learned for the assembly

Vacuum

- The installation of the vacuum chamber was done by-hand. For series production, the development of a strongback is very mandatory to ease the handling of the vacuum string and protect the vacuum string from damage.
- The chamber fitted well. No contact with the magnets, no jamming. Closing and opening worked well.

Future work

- Installing the permanent magnets in two parts (support and magnet).
- Installing and testing the electrical distribution boxes.
- Cabling and hosing.
- Testing the manifold, extracting/pumping out water.
- Once the strongback has been developed, it will be tested (also with cranes).
- Planning and testing a lifting-beam for the magnets.
- Planning and testing a lifting-beam for the girder.

Thank you

Contact

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