





BGC integration on HEL – BGC Version 4 (V4)

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Terminology

Hollow Electron Lens (HEL):

- Base-lined instrument part of the collimation system of the LHC

V4 BGC (HEL BGC):

- Final instrument to be installed in the LHC during LS3

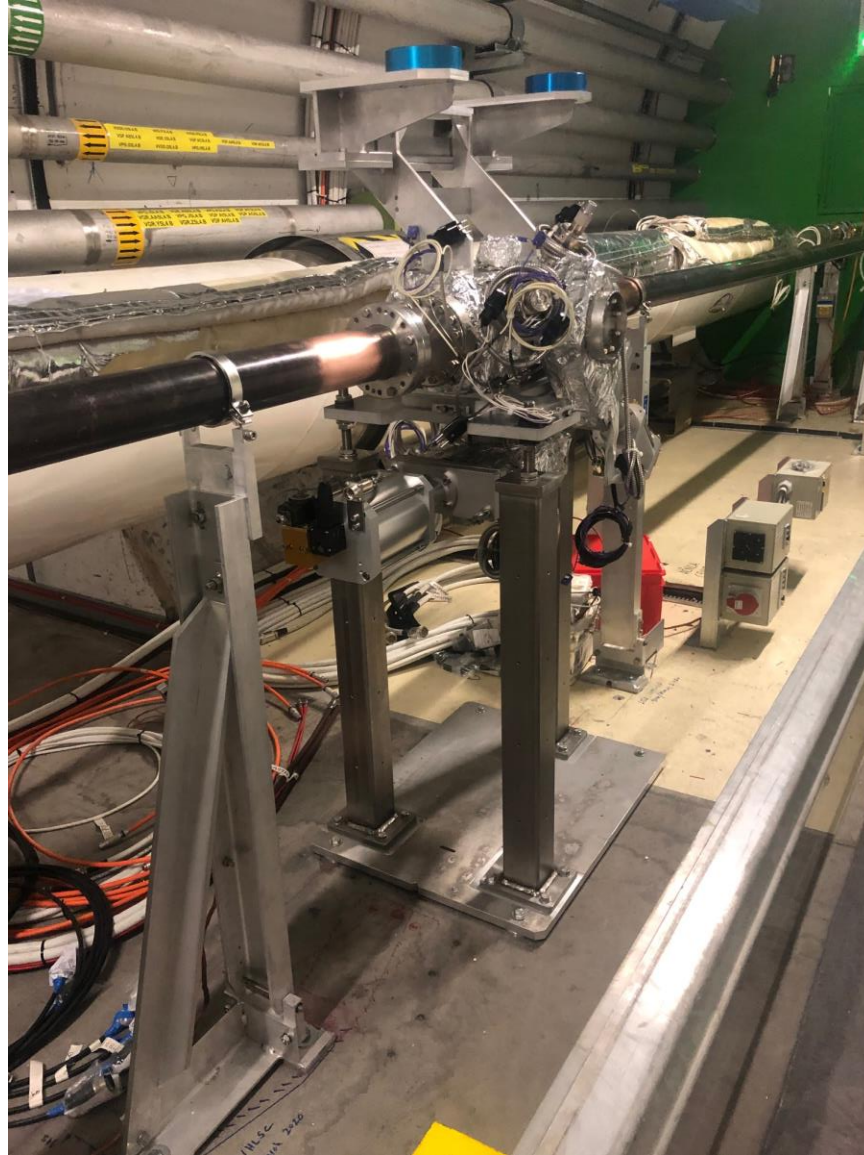
V4 Functionality

- Overlap instrument for the centroids of the circulating beam and the e-beam
 - Details discussed in Gerhard's presentation

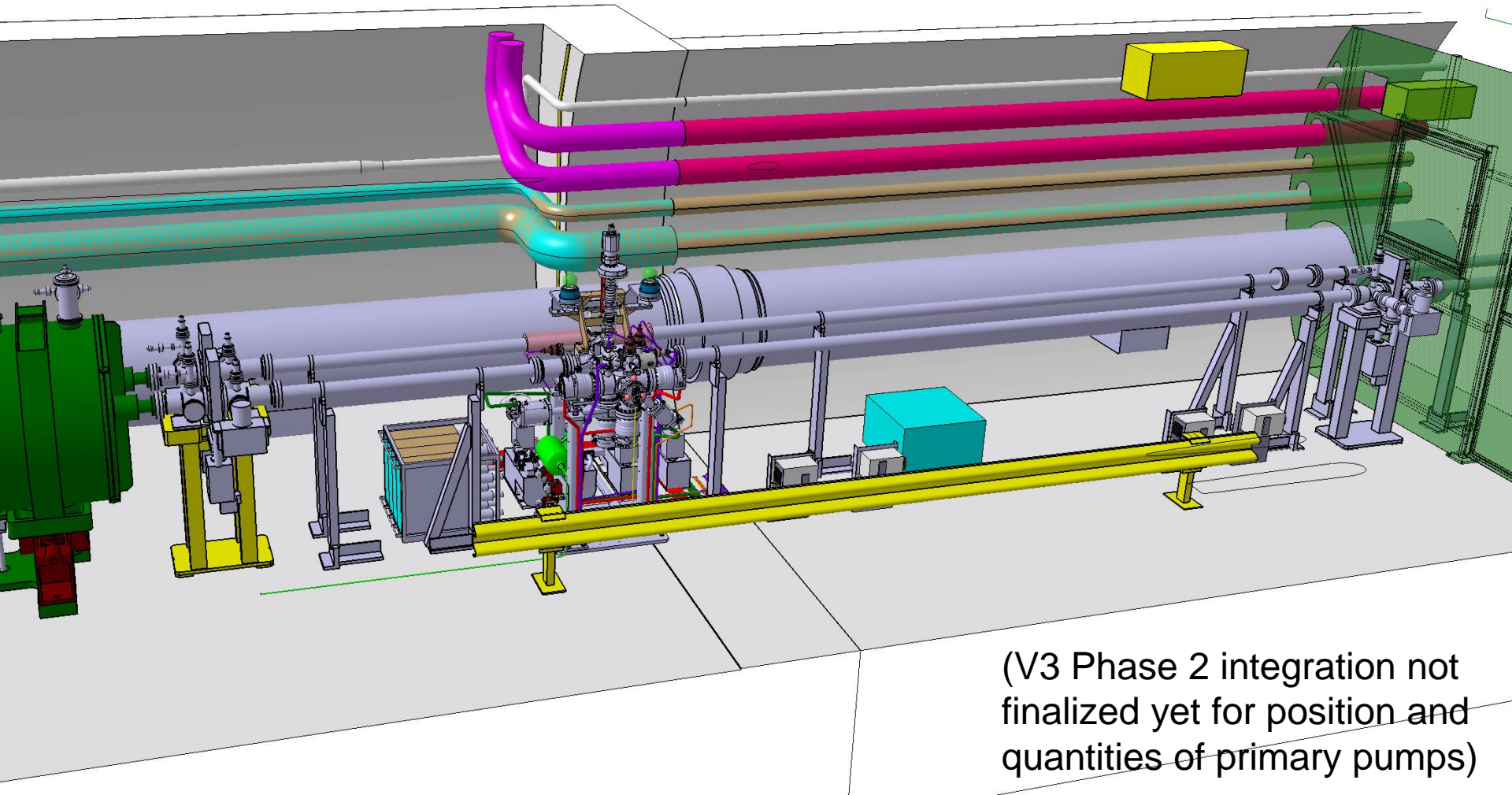
Location in the LHC

- Left and right side instruments to be developed:
 - Left: C5L4
 - Right: (B)5R4
- Design objective:
 - Aim for only 1, reversible instrument
 - Less resources in duplicate design
 - Easier to handle the spares

How it looks now (V3 installed)



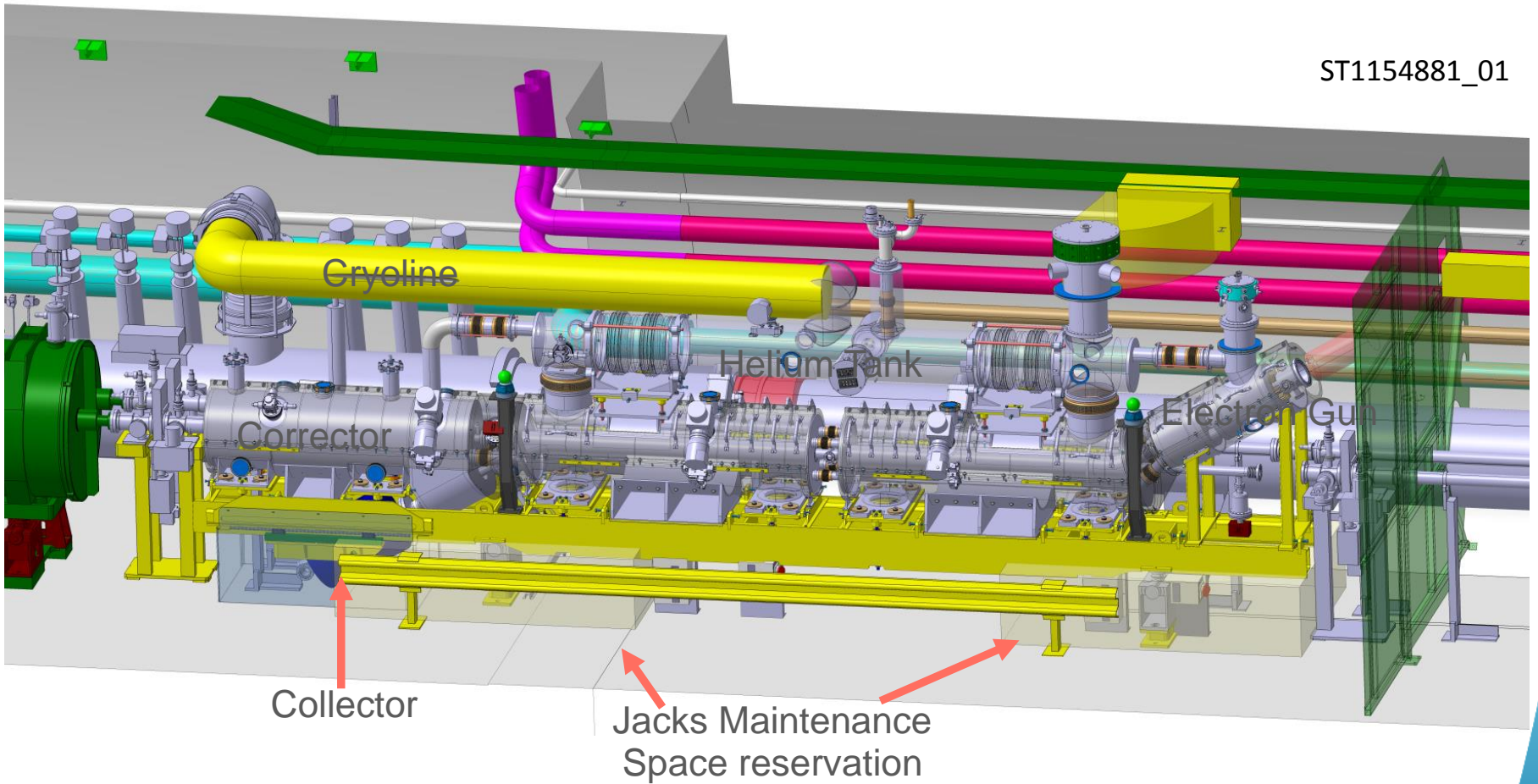
V3 fully installed



(V3 Phase 2 integration not finalized yet for position and quantities of primary pumps)

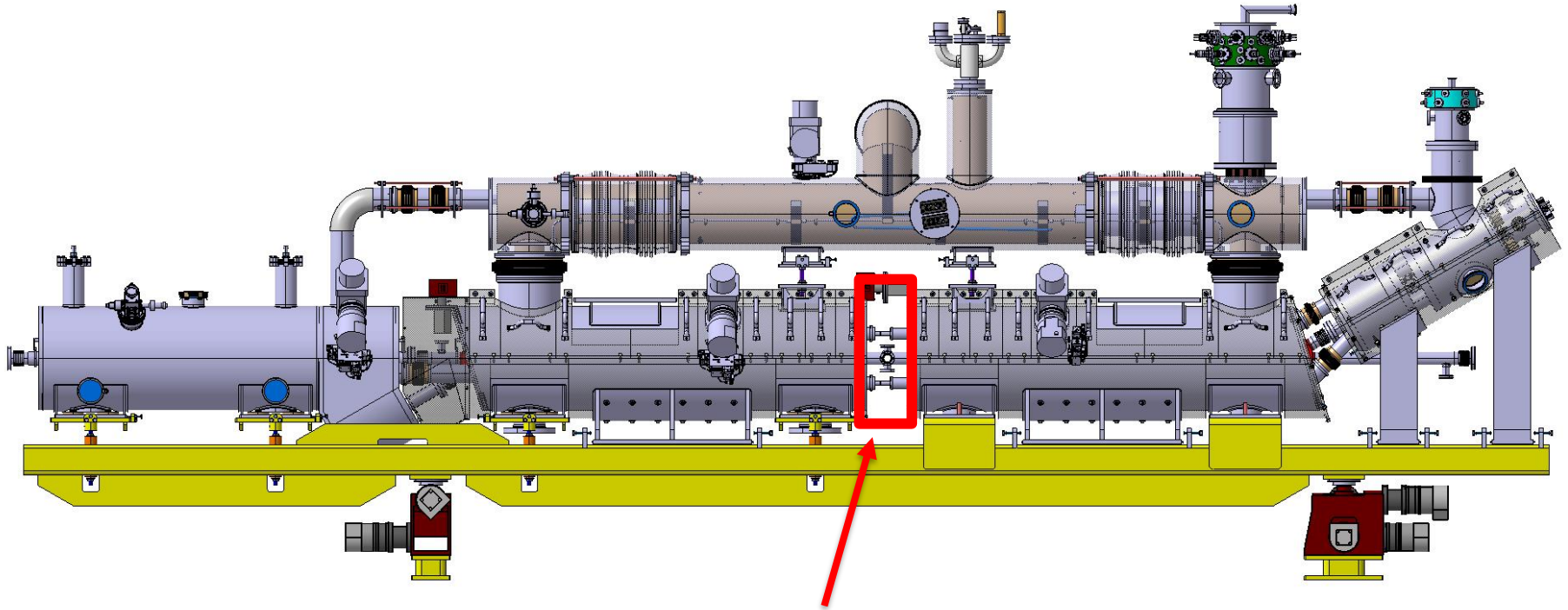
With HEL in it (left side P4)

ST1154881_01



Courtesy of J. Oliveira

HEL – Design space



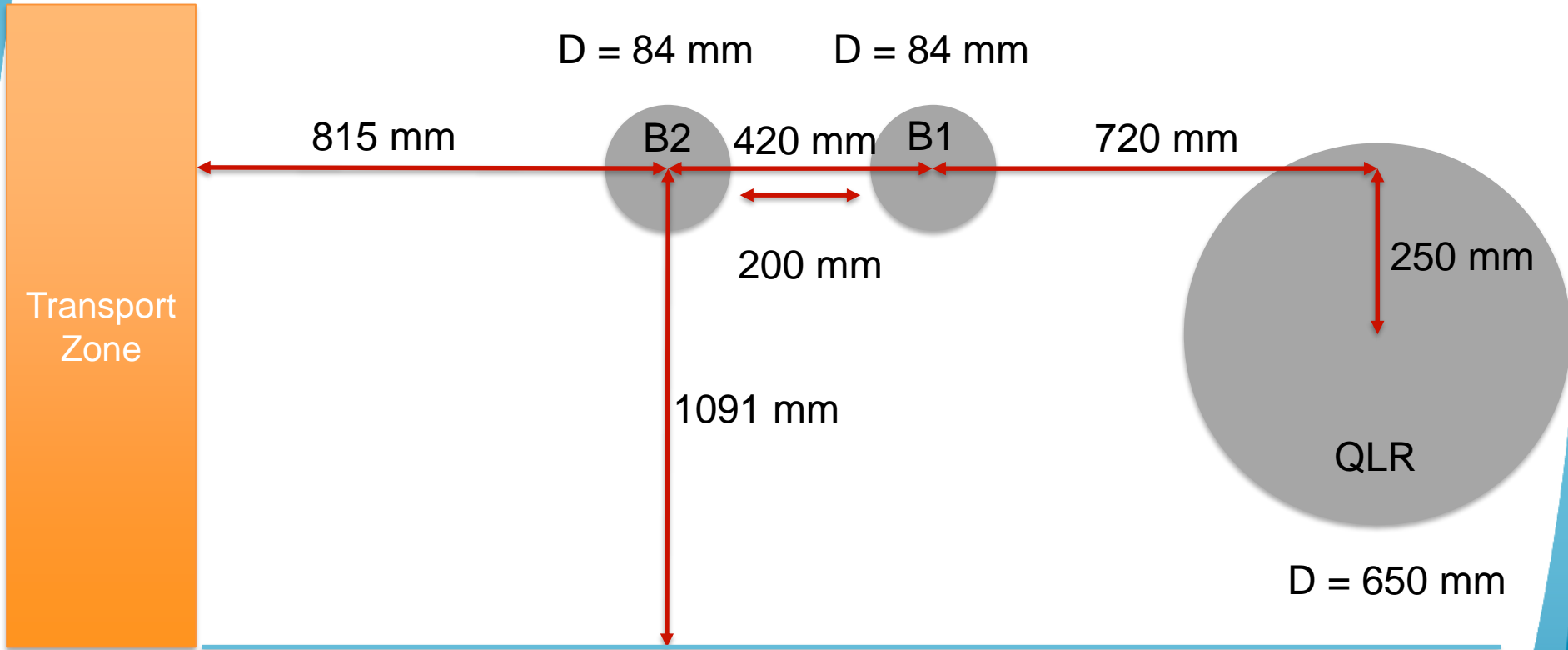
**BGC Space reservation:
200 mm axially**

Design Space

$D = 84 + 25$ mm bake-out reservation

$D = 84$ mm

$D = 84$ mm



Design Space

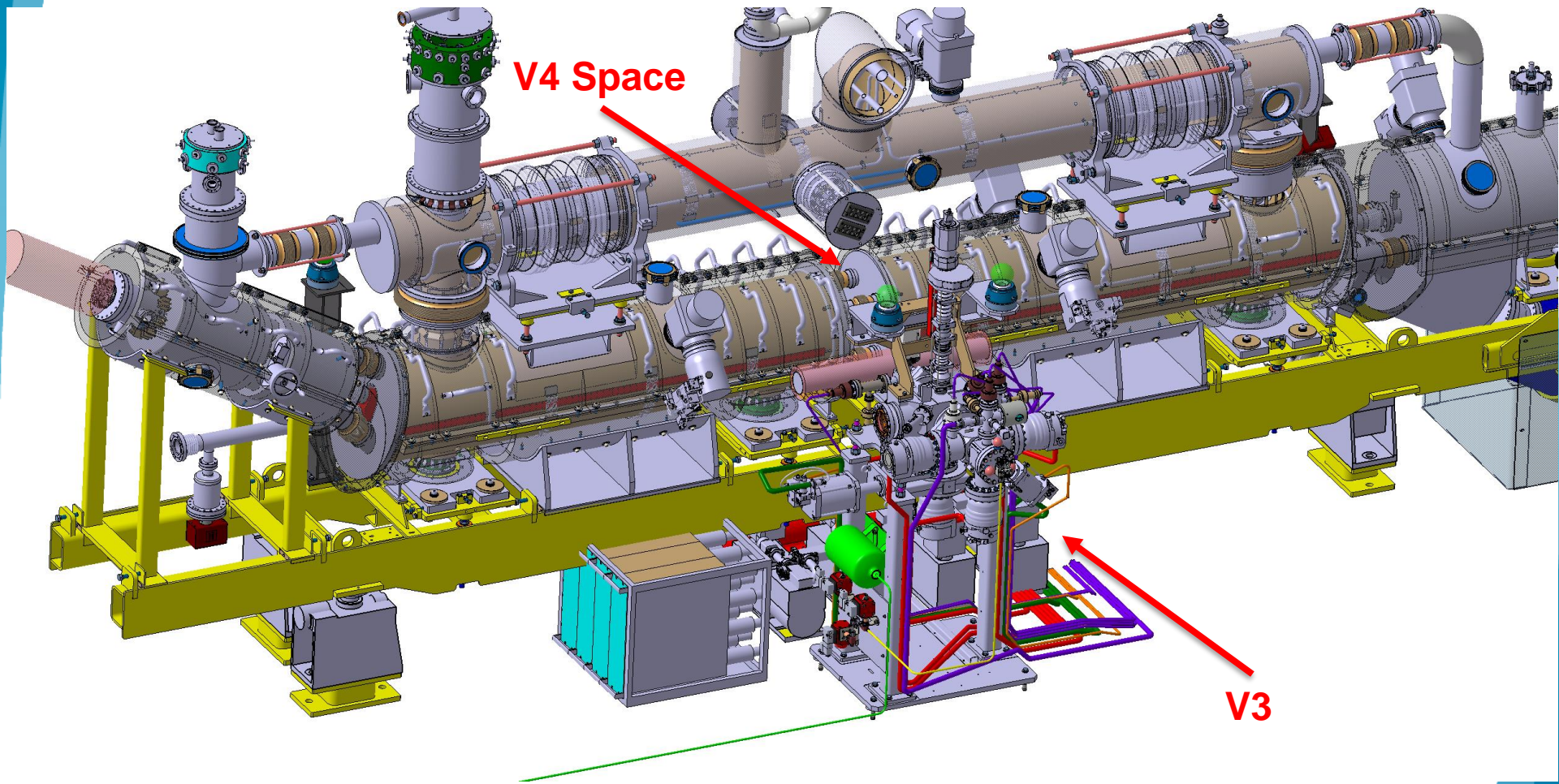
Second beam line & QRL: Limited space

Instrument orientation: 0 or 90 deg gas jet direction
→ identical to the rest of the instrumentation

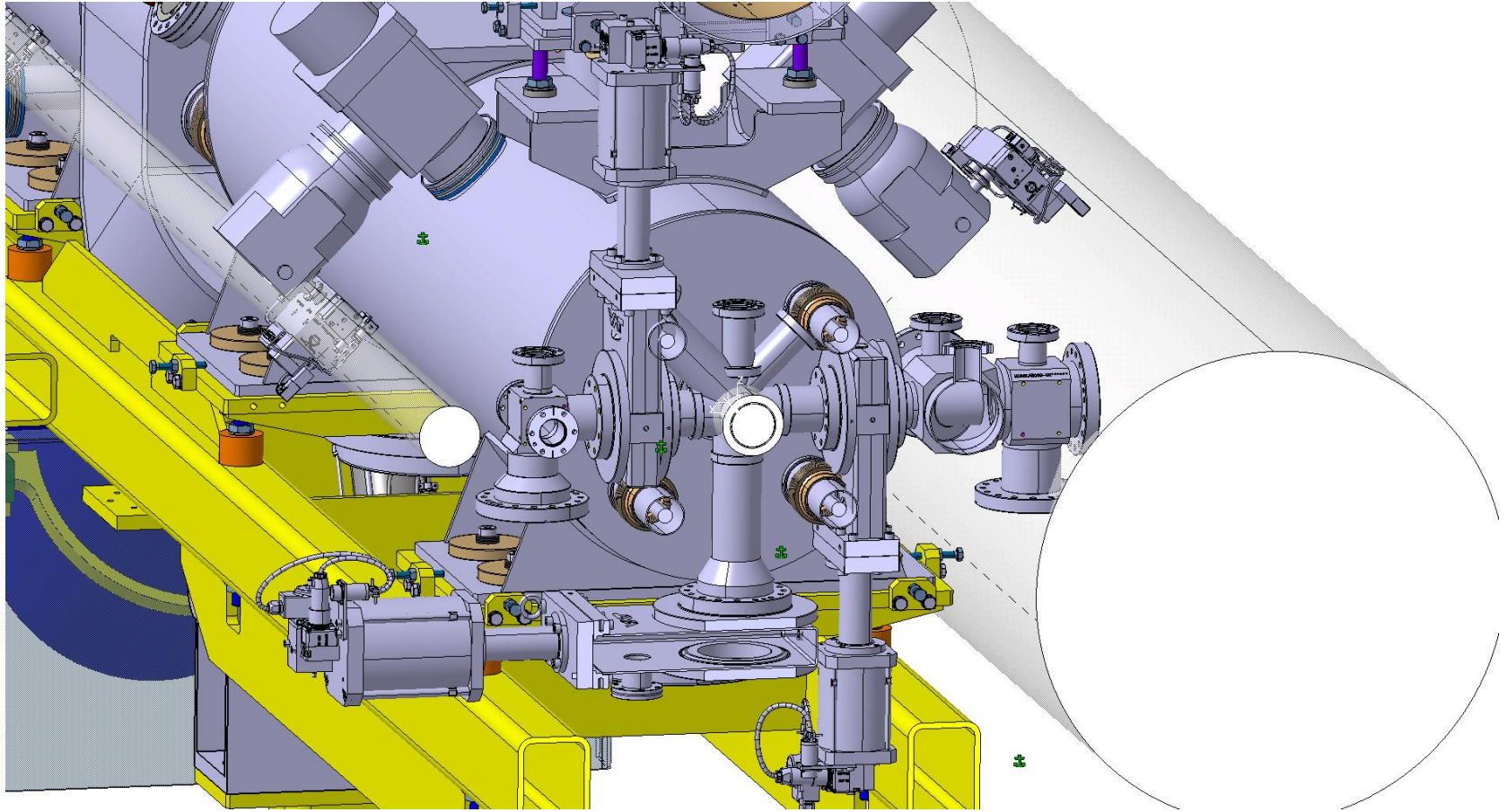
Assembly: limited space between the two magnets and their spacers and small dimensions overall

Transportation: In one block with HEL

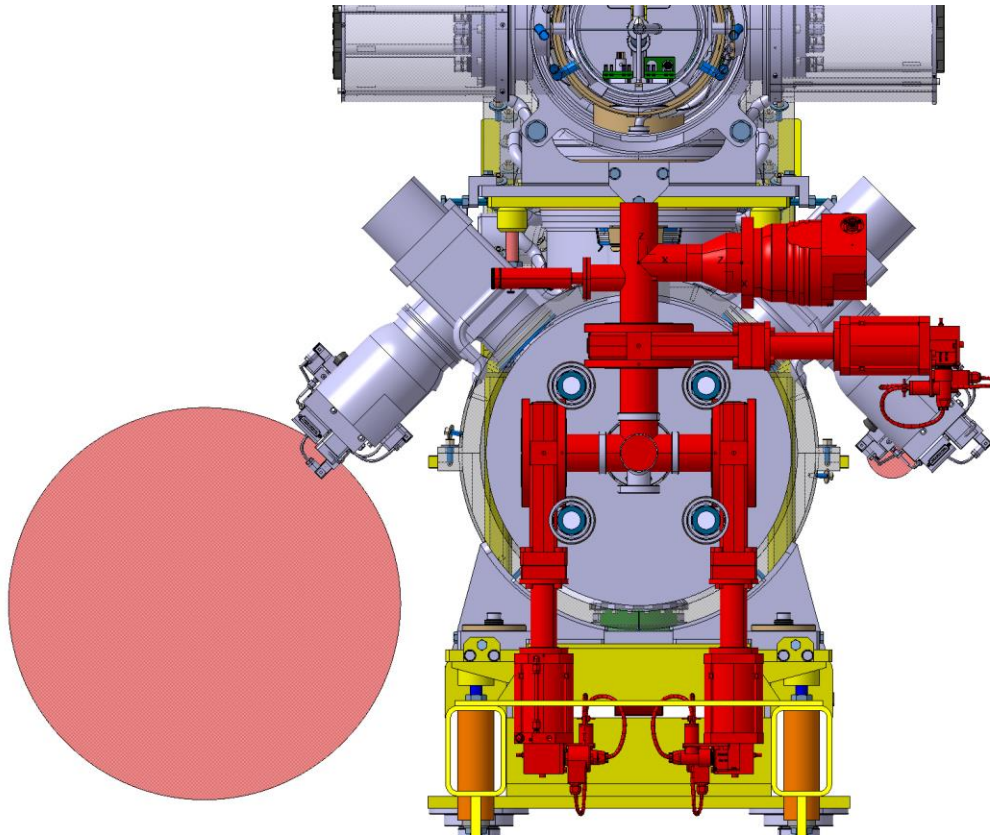
Minimization is required!



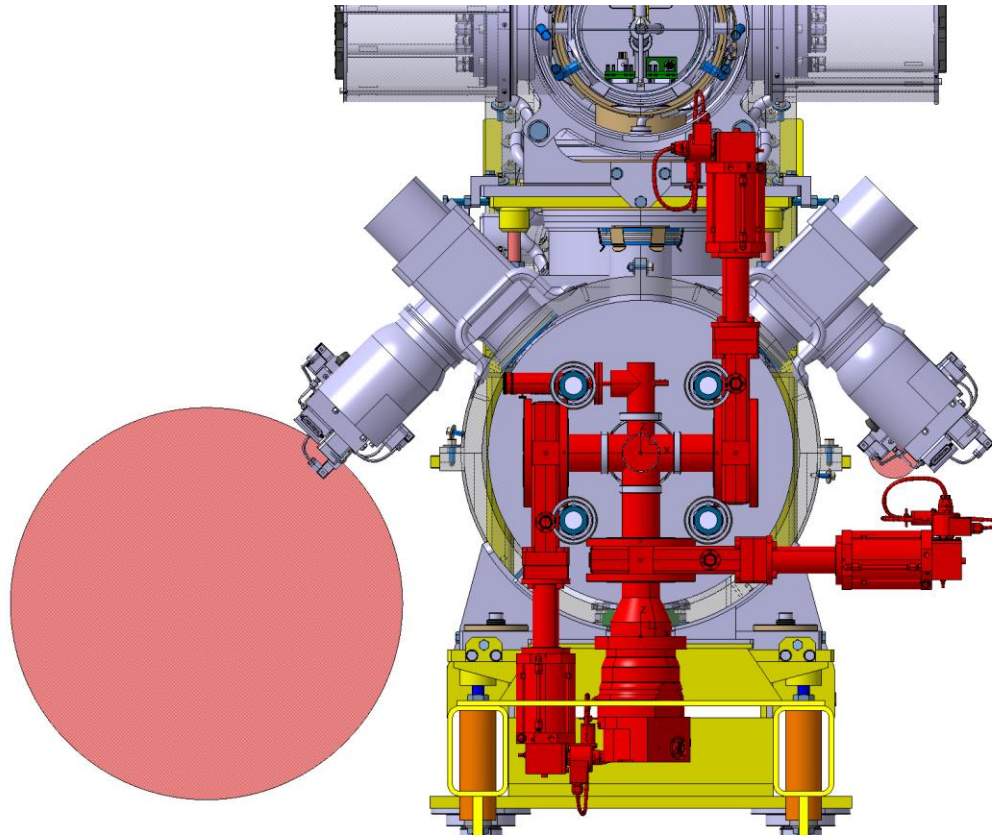
HEL-TS chamber



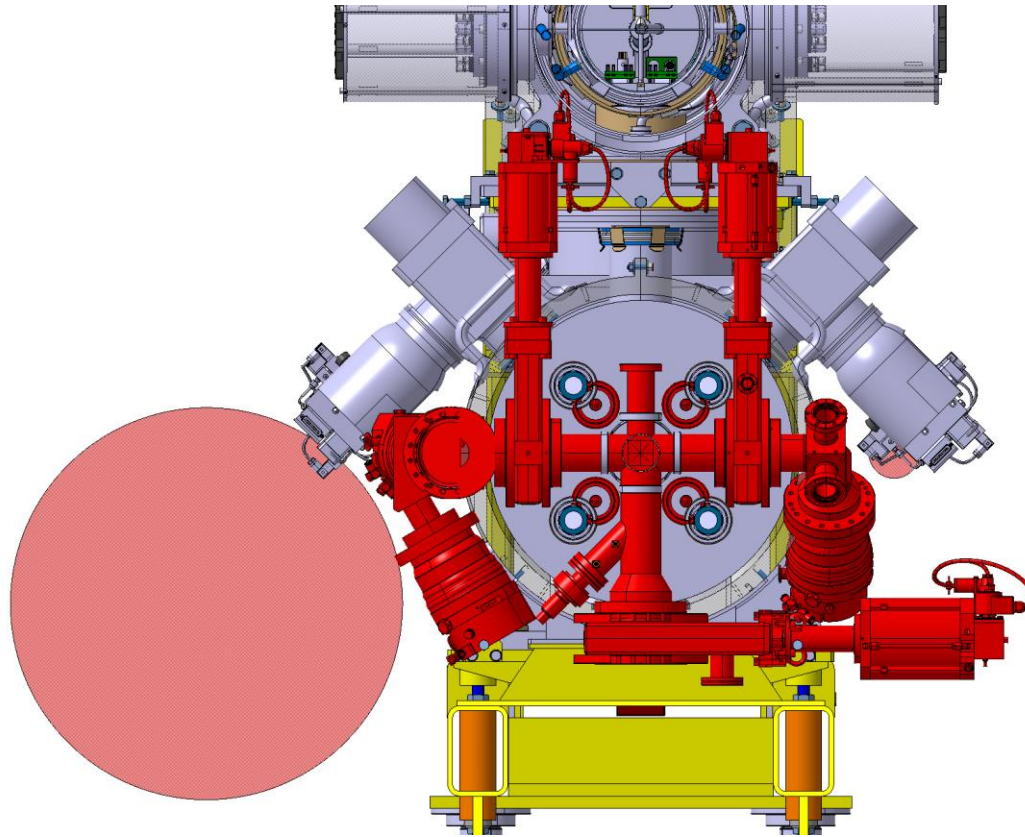
Concept 1



Concept 2



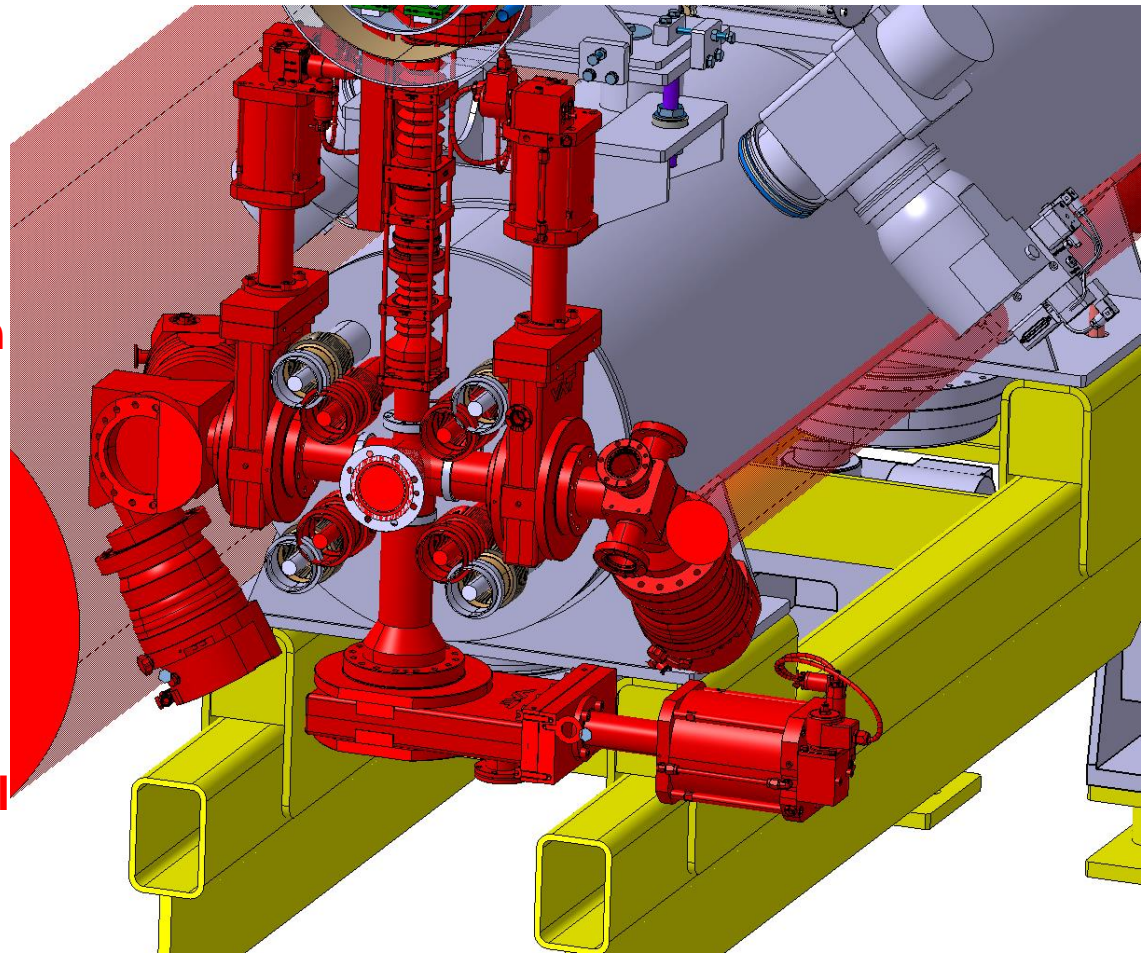
Concept 3



Current HEL-BGC concept

Integration still in **conceptual phase** → **No solution found yet**

- **Currently no mounting option (bellows on both sides)**
- **Magnetic field issues**
- **Integration design still in very early phase**
- **Will proceed in physical models to find a solution.**



Vacuum considerations

With TMPs out of the magnet's envelope:

- Effective pumping speed: **Reduces**
- Interaction chamber pressure: **Increases**

Magnetic field concerns

- TMPs overheating
 - Operation limit: 5 mT
- HEL design:
 - Updated iron shielding → New distribution of B field
 - Preliminary results: Shielding for the TMPs is necessary
- TMP Shiled design → Shield, not lens!

Overview

Contradicting design requirements → Need to find the right balance between performance and feasibility:

- Limited design space → System needs to be **compact**
- Assembly/service difficulty → Enough **space** for assembly necessary
- Vacuum → TMPs need to be **close** to the Beamline
- Magnetic concerns → TMPs need to be **far** from the magnets (and beamline)

Plan of attack

Coordination between different teams in an iterative process:

- **HEL mechanical design:** check the assembly/transport and modifications could be done to accommodate the BGC in the HEL
 - **HEL magnets design:** Check the magnetic field in the BGC location in order to position and protect the TMPs
 - **Vacuum group:** Check the design choices impact on the vacuum performance of the system
 - **BGC design:** implement all the feedback and propose solutions
- Bi-weekly meetings between these teams are arranged
 - A mock up of the area of interest should be made to better understand the space constraints for practical reasons (assembly-maintenance)
 - Who will participate?

Conclusions

- Design **still in preliminary phase**
- Most constraints and points of interest are now identified:
 - Assembly: the most critical point is how are we going to assemble it → **Very challenging!**
 - Camera system in conflict with He tank
 - Gas dump system fits in foreseen space
 - Gas injection: a lot of work necessary to fit
 - Magnet spacers in conflict to accommodate the BGC



Thank you!
What questions do you have?

