

PANDA Mechanics



Lars Schmitt, FAIR

CM 55, Vienna, Dec 3 2015

PANDA Hall Overview

Installation Sequence

Racks and Services

Integration Issues

Acknowledgements



Slides, drawings and pictures from

- Jost Lühning
- Dario Orecchini
- Beppe Girauda
- Daniela Calvo
- Tommaso Quagli
- Roserio Valente
- David Rodriguez Piñeiro
- Thomas Held
- Evgeny Antokhin

Conclusions



- Hall planning stalled for more than a year, will resume soon
- Our service planning in the hall is ongoing
- Mechanics of most detectors very advanced
- Services at the near detector side are tight
- Beampipe and vacuum need to be studied, prototype mock-up needed
- Still clashes and problems to resolve, but no unsolvable mysteries

Status of PANDA Hall



- Planning of the building is complete
 - Original planning
 - Adjustments for fire and radiation protection
 - Our planning of shielding wall & ceiling:
 - Ceiling remains in place but can be opened in emergencies
 - Shielding wall opens for TS and FS platform
- Next step: Service routing
 - Ventilation
 - Electricity
 - Cooling water
 - Our services:
 - Solenoid supplies
 - Experiment electricity
 - Cables and services (LV/HV, cooling) to E10 supply level
 - Gas pipes
- Check for clashes:
 - 3D volumes
 - Service traces

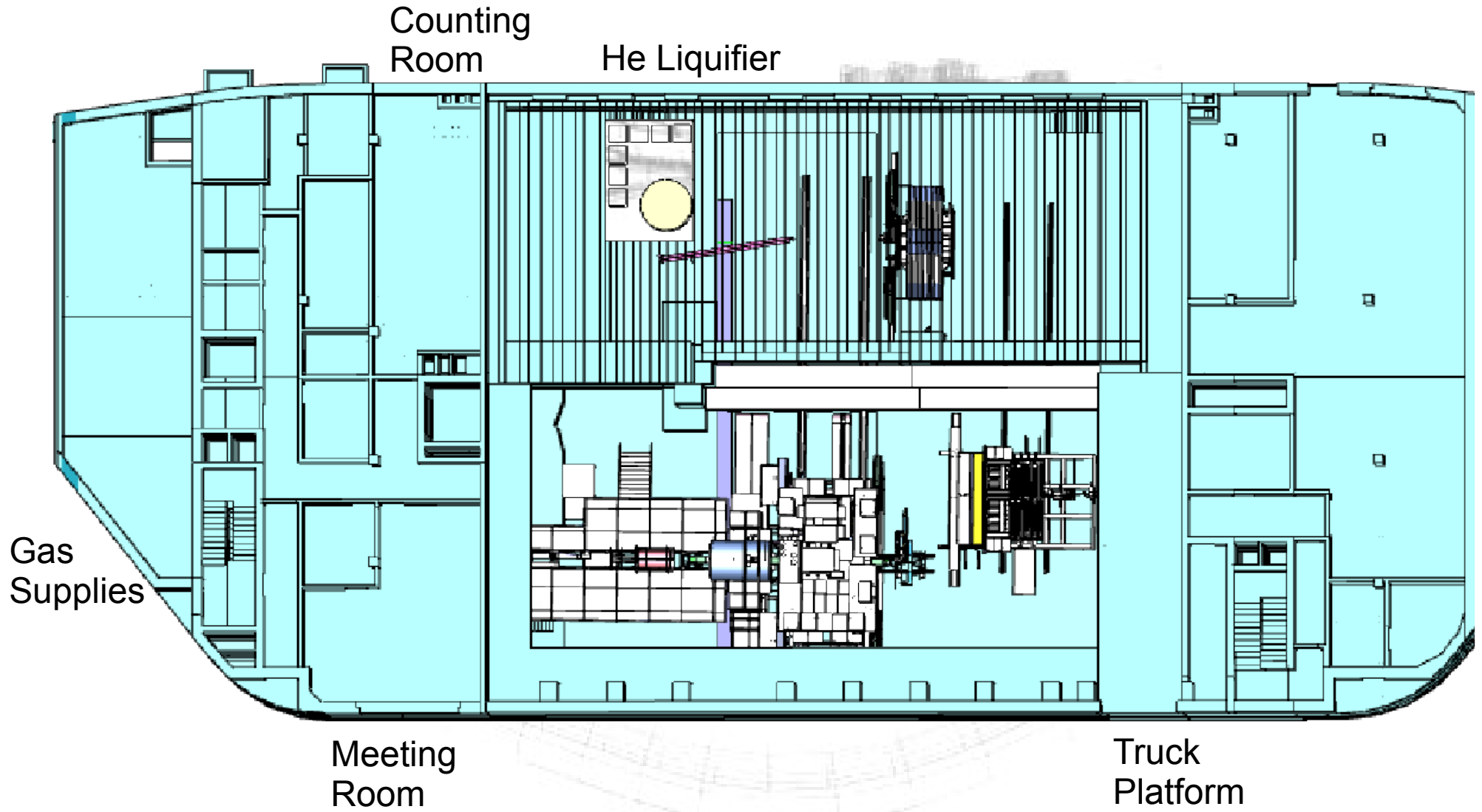
Status of PANDA Hall



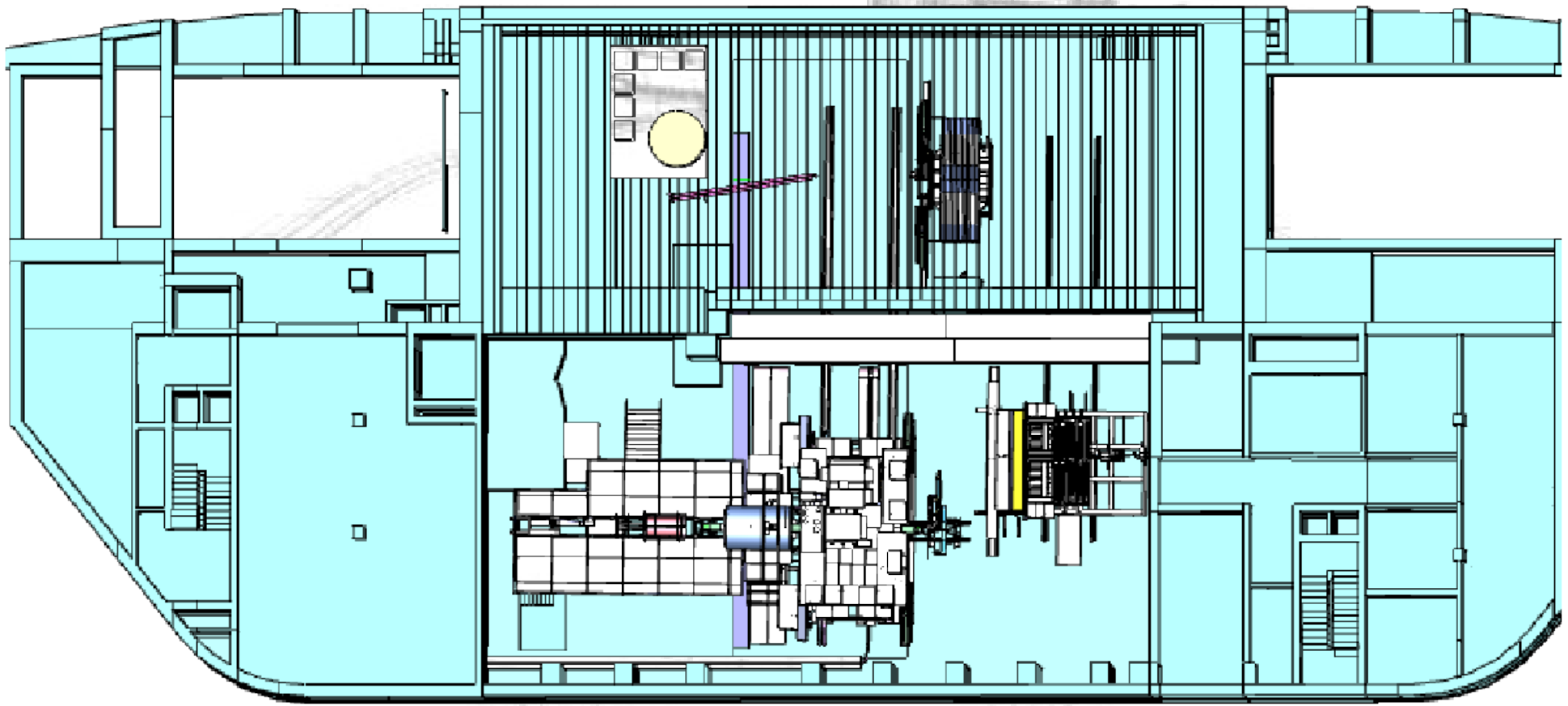
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- Check for clashes:
 - 3D volumes
 - Service traces

Next meeting with planners in January 2016

Plan View E40

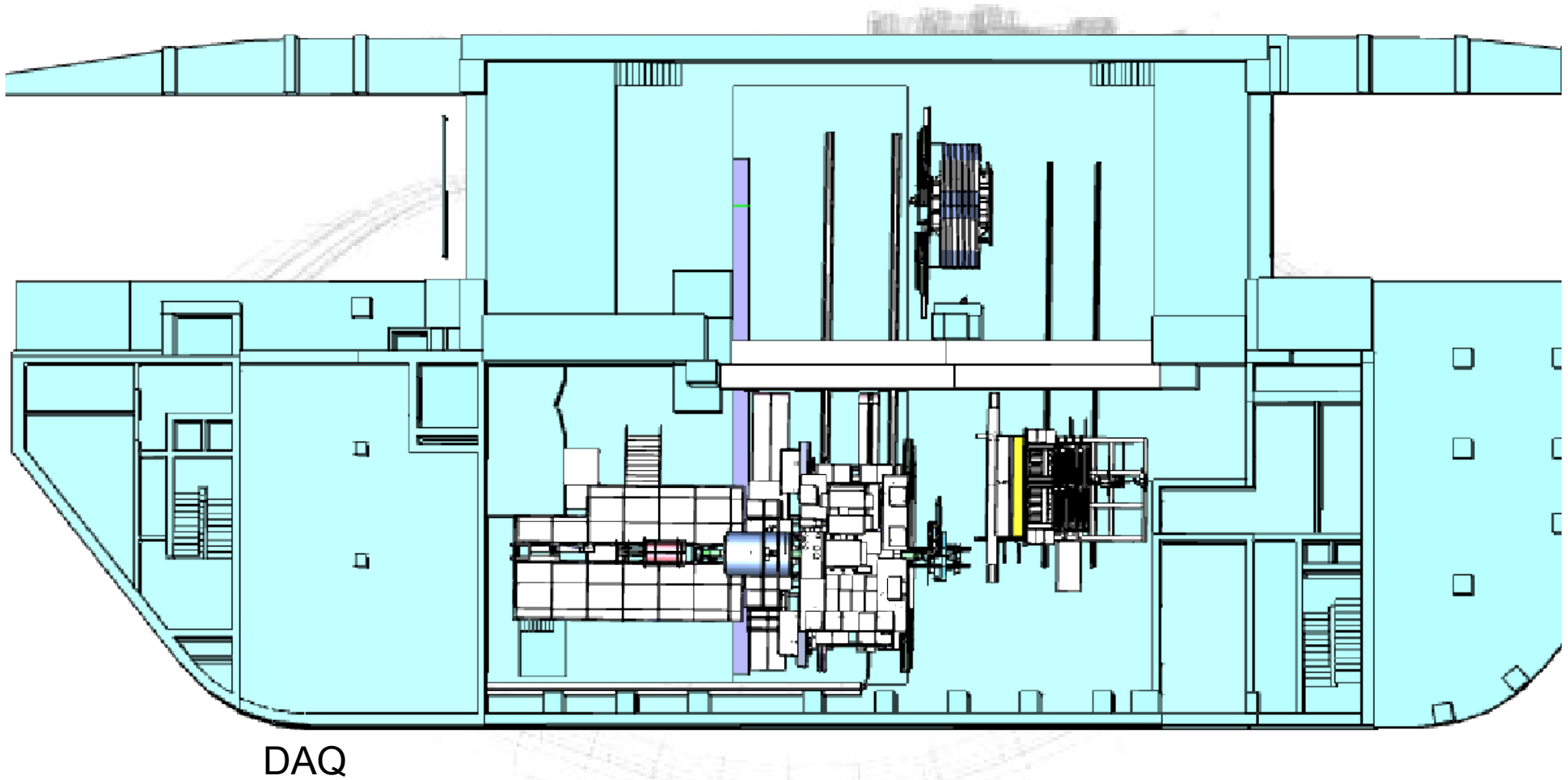


Plan View E30

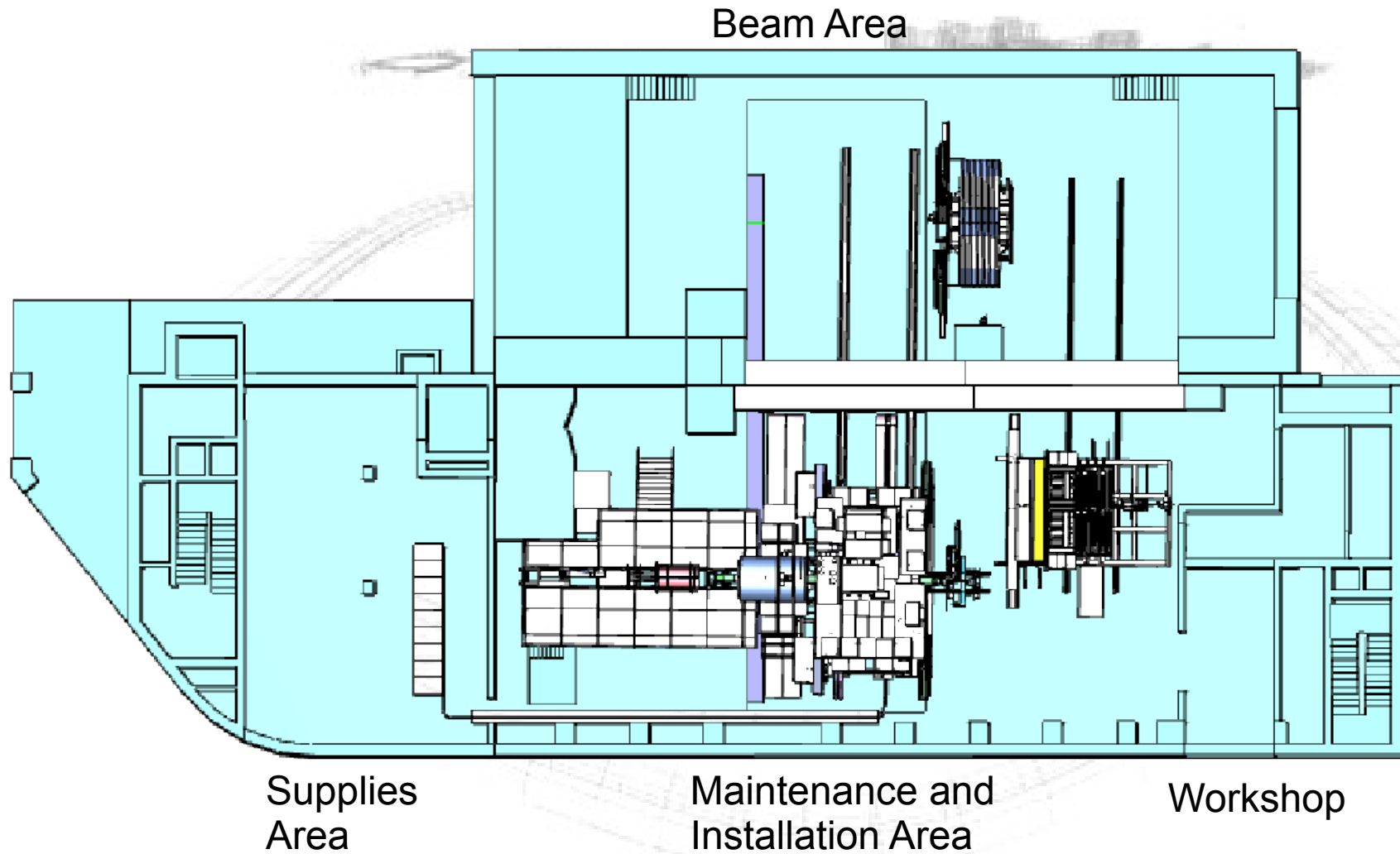


Online
Computing

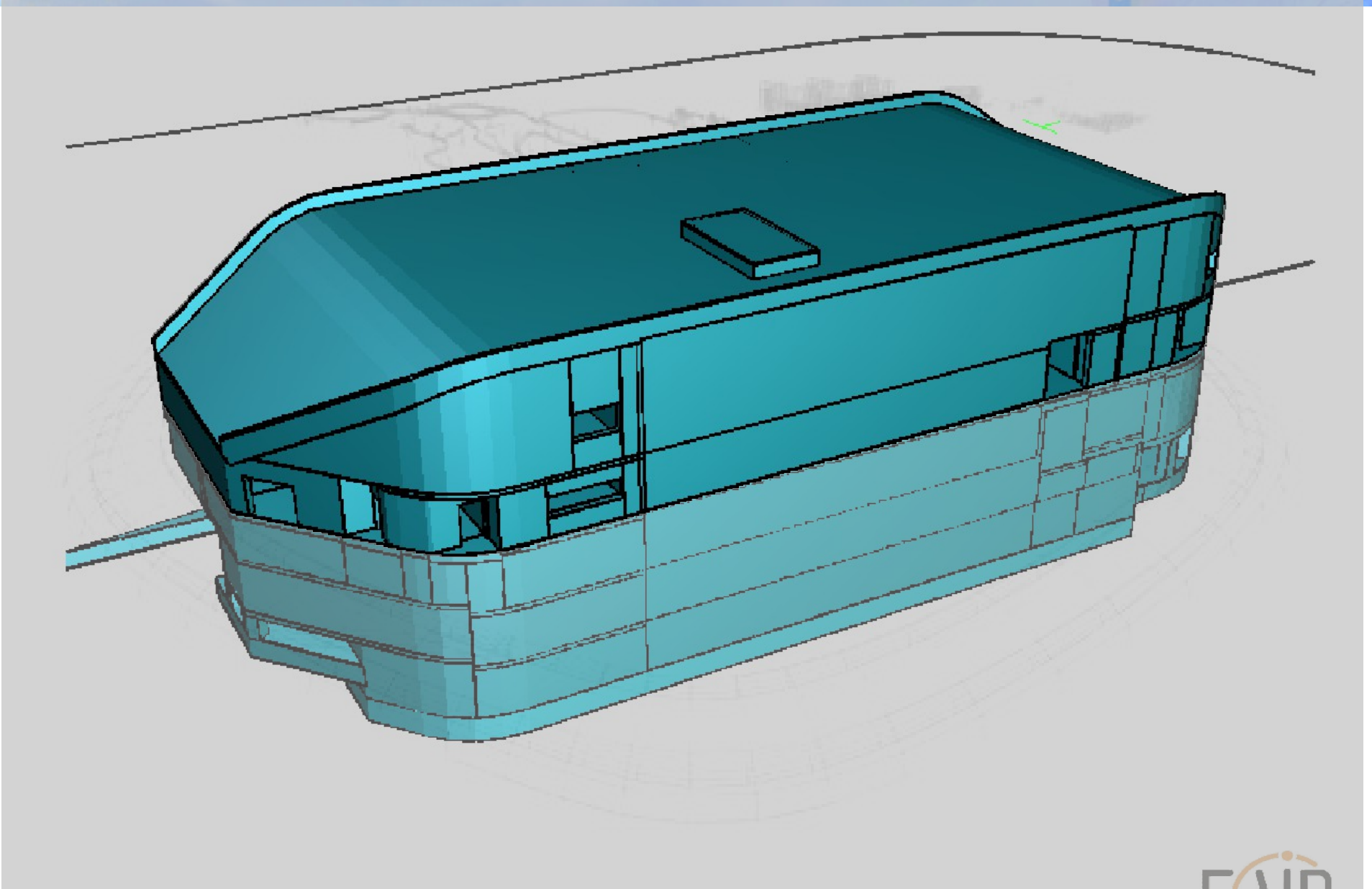
Plan View E20



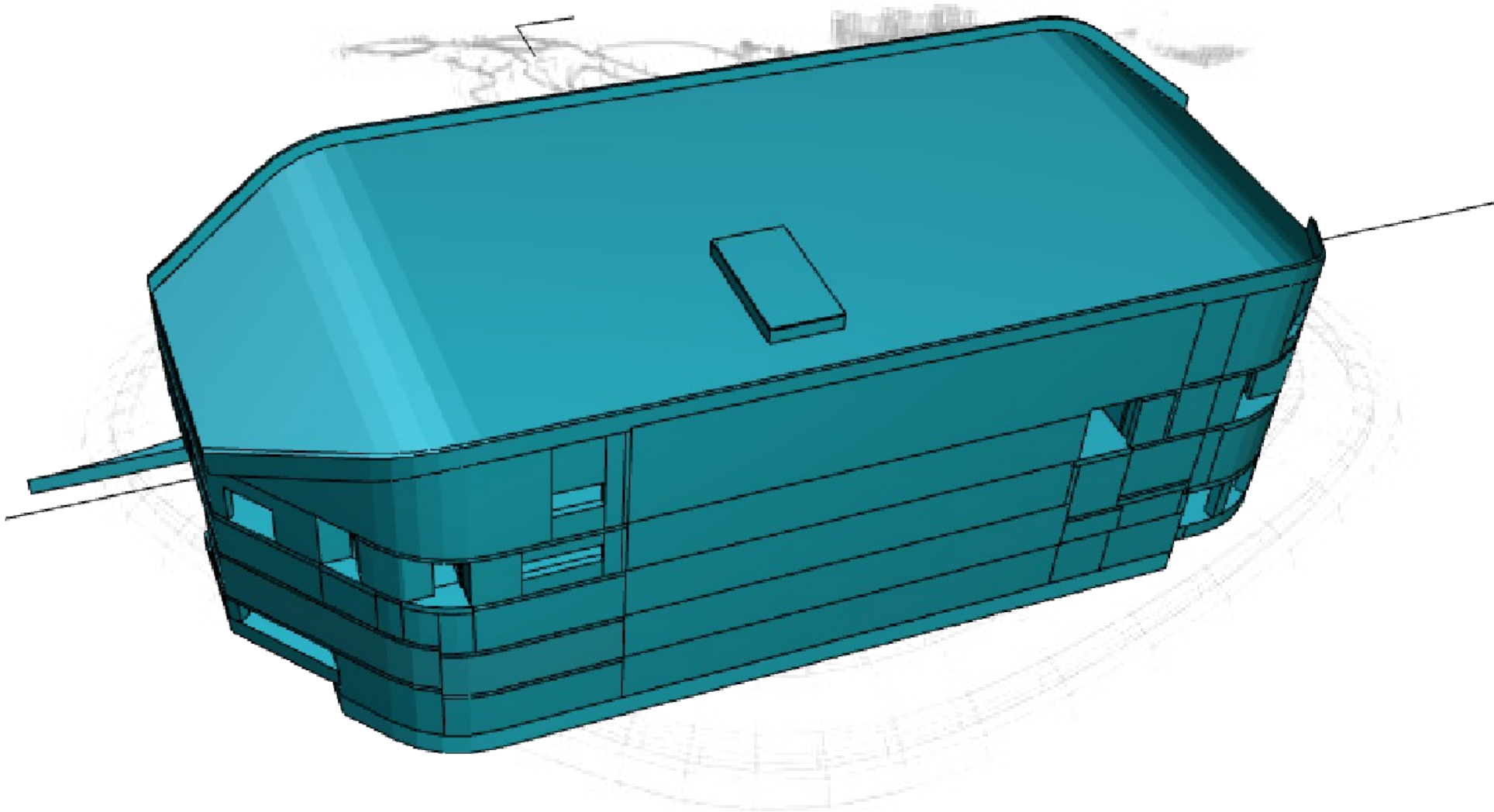
Plan View E10



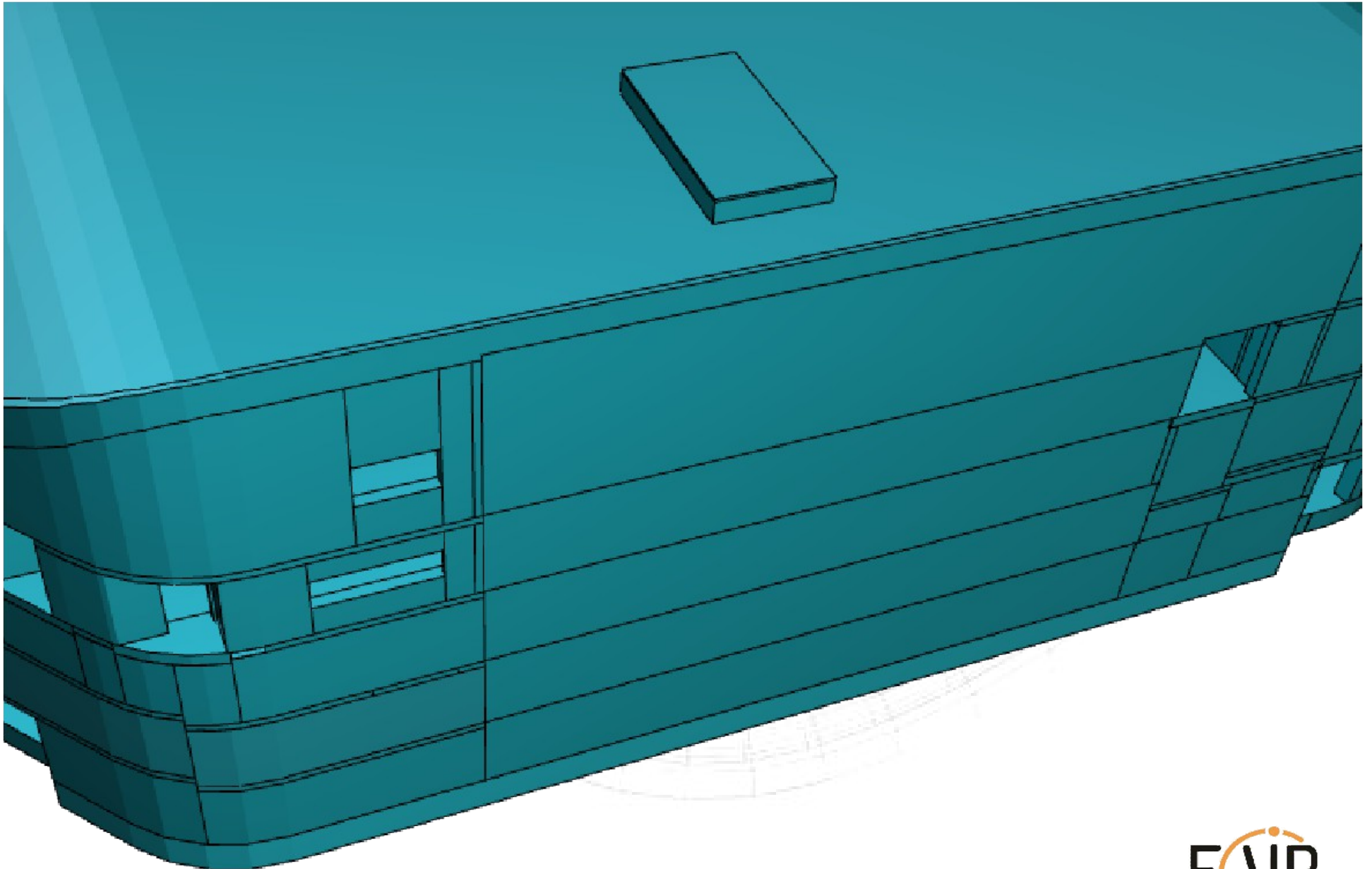
3D View: Outside



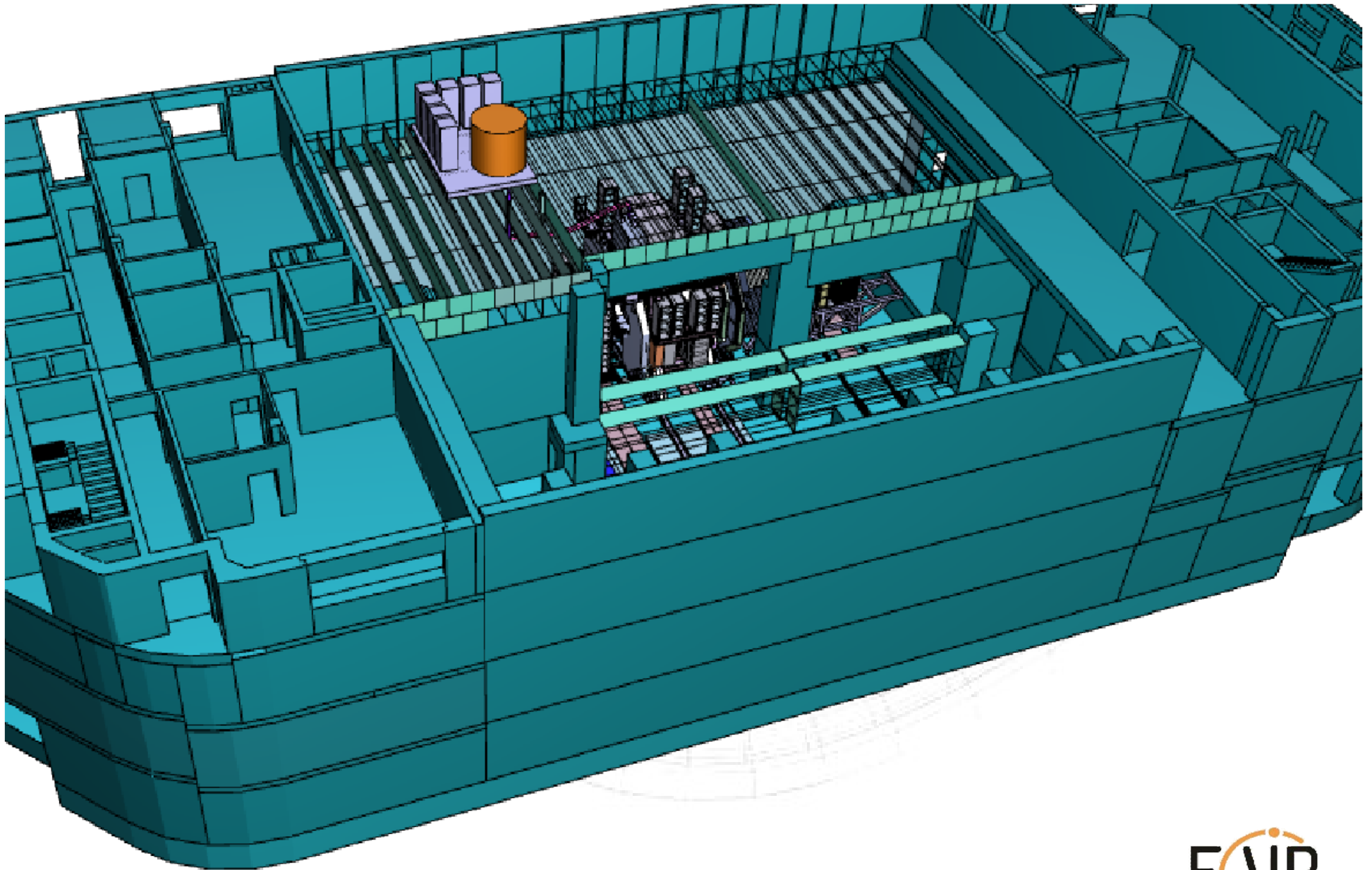
3D View: Outside



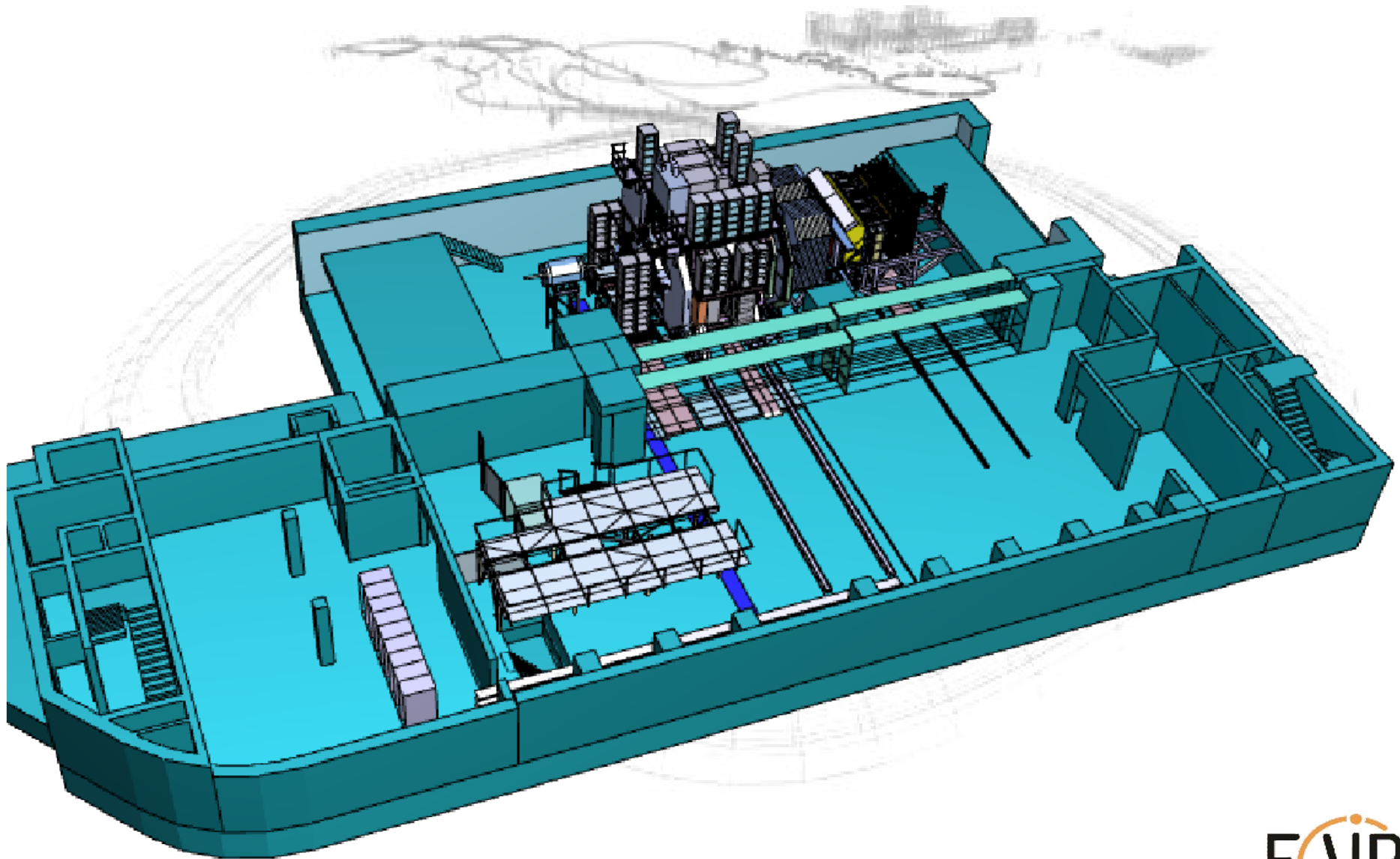
3D View: Outside



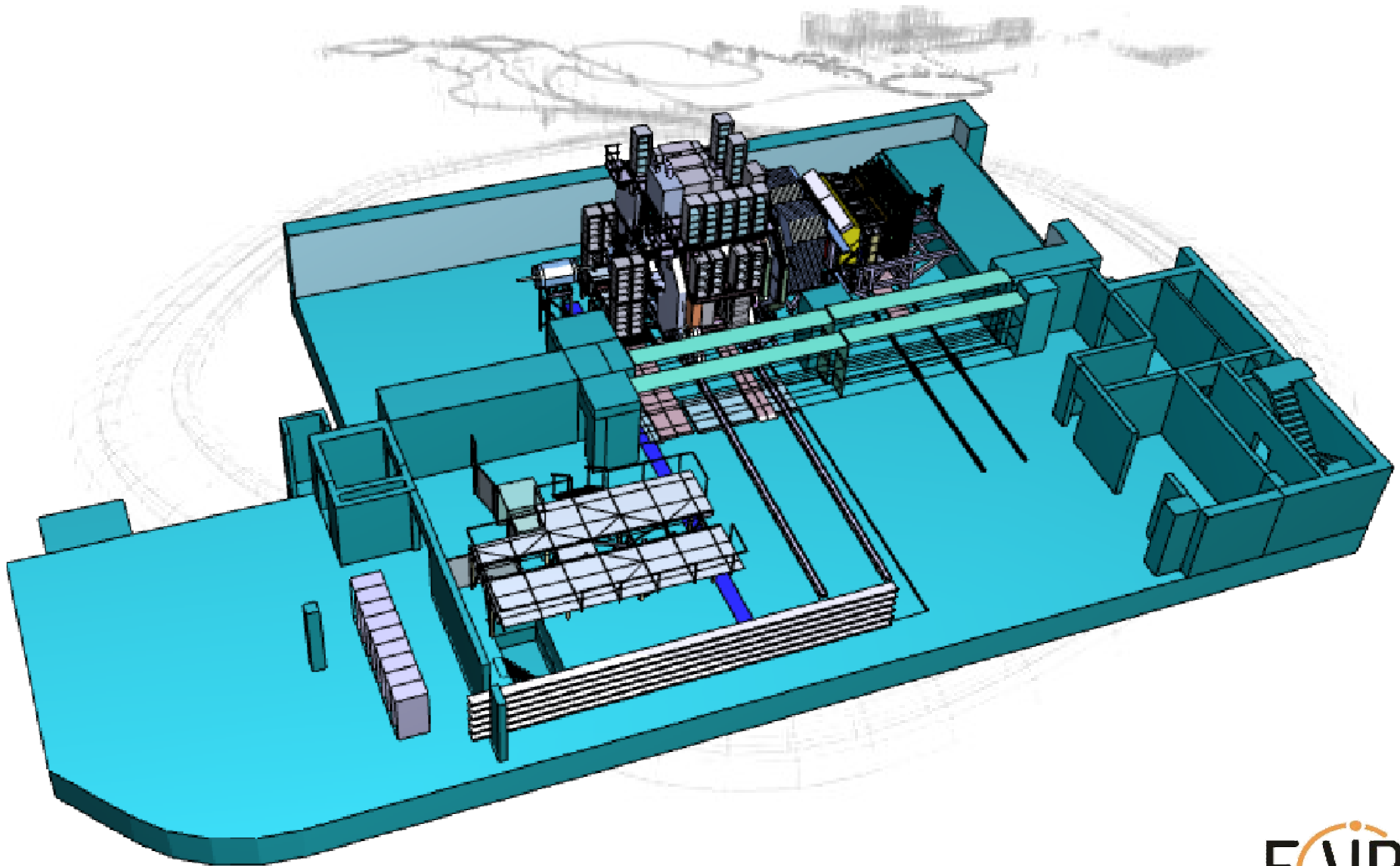
3D View: E40 with PANDA in Beam



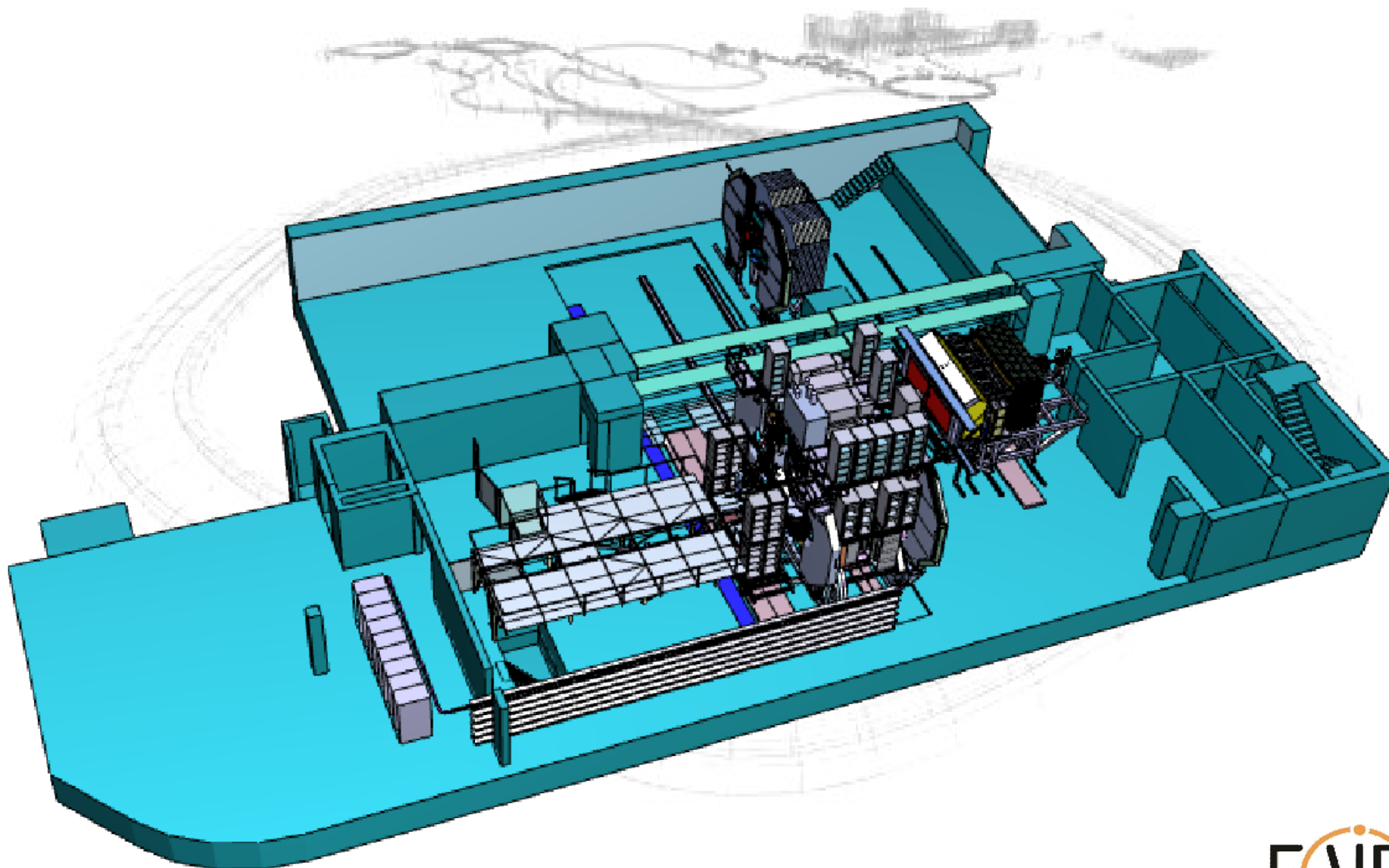
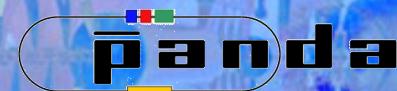
3D View: E10 with PANDA in Beam



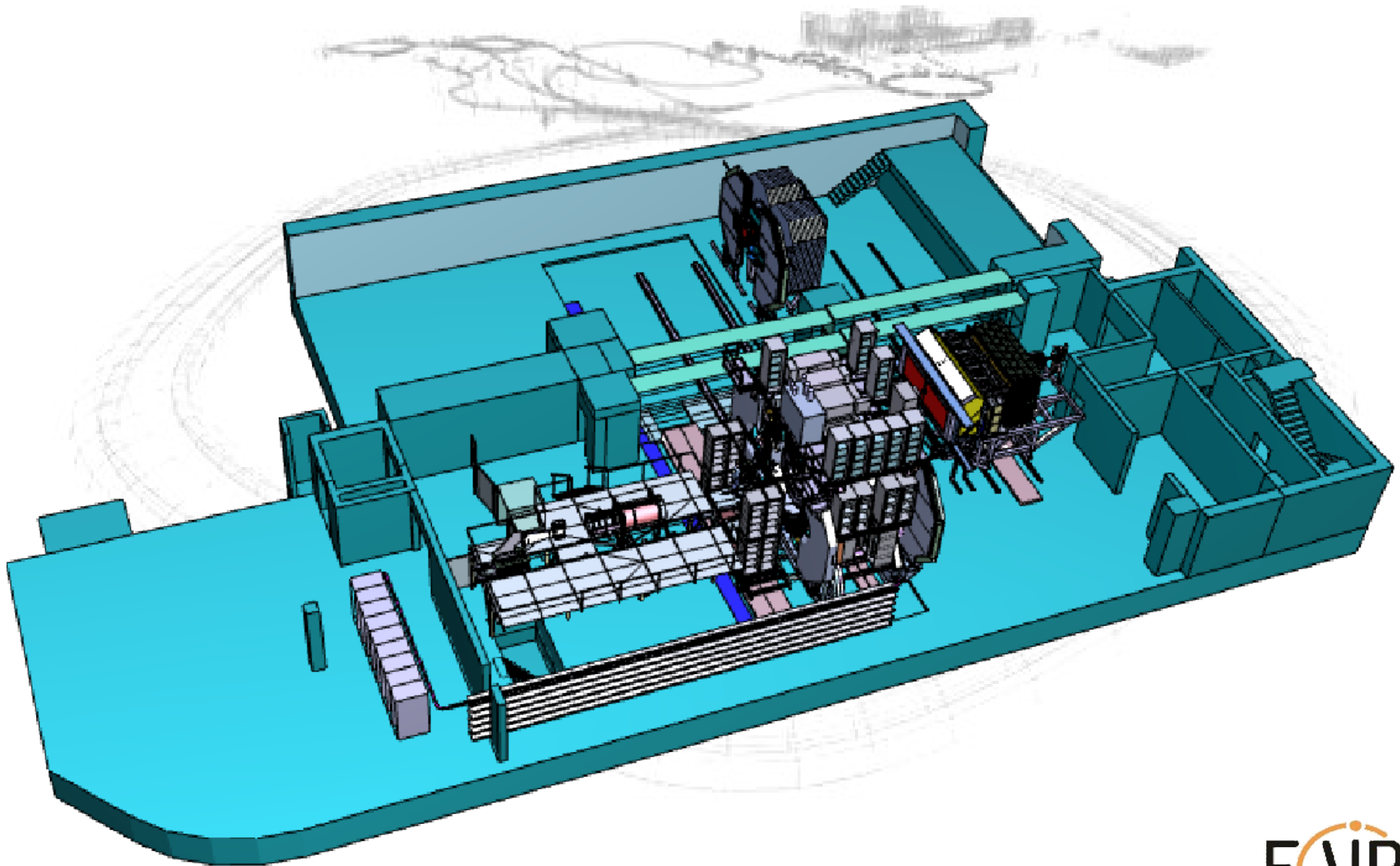
PANDA in Beam Position



PANDA in Maintenance Position



BWE EMC and Tracker extracted



Installation Sequence



Dipole: part of HESR beamline

Target Spectrometer

- Solenoid
- Muon chambers in solenoid
- Barrel EMC
- Barrel DIRC & SciTil
- Central tracker: MVD & STT with target cross
- BWE EMC
- GEM Tracker
- FW Endcap: Disc DIRC & EMC

Forward Systems around Dipole

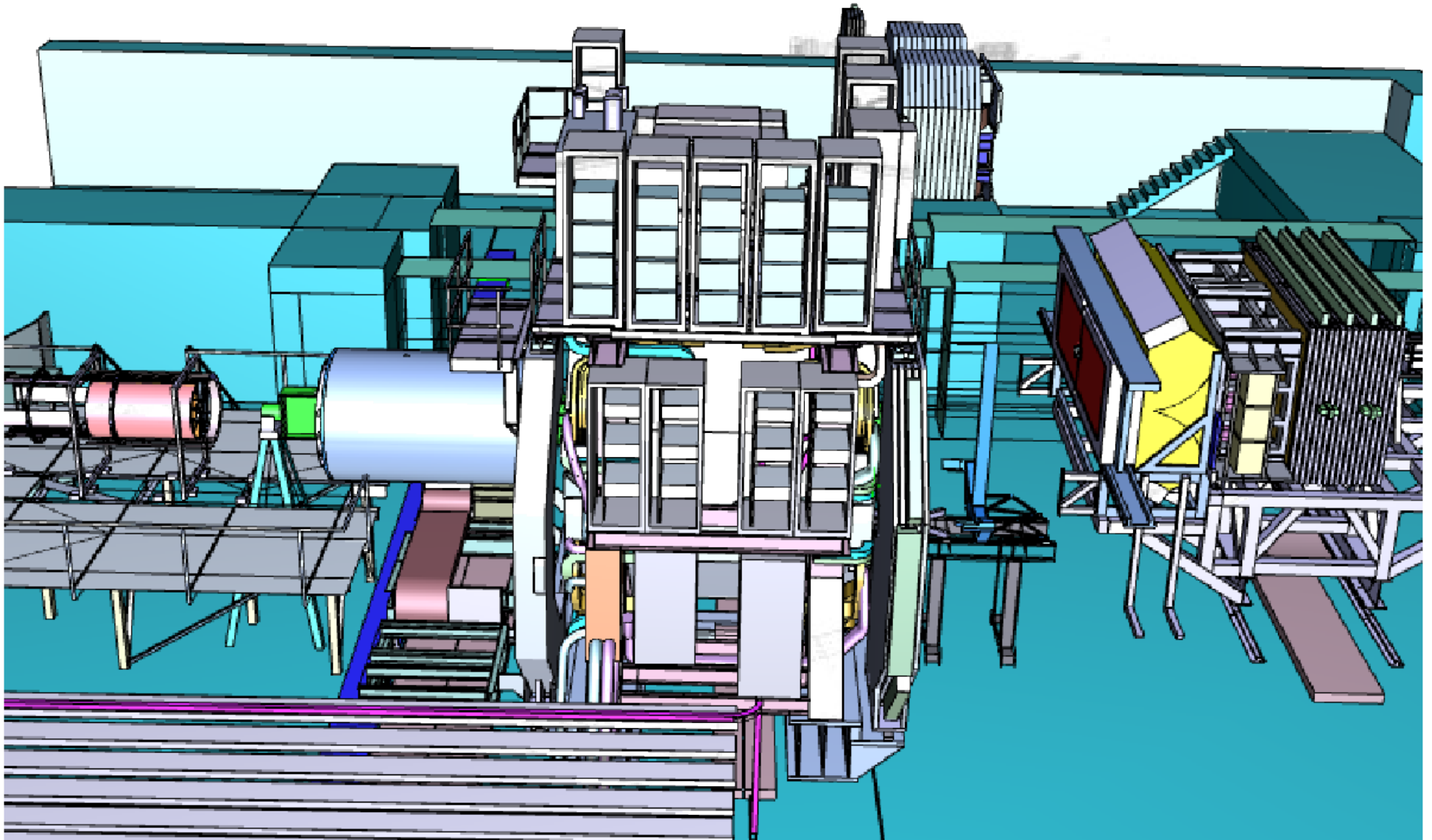
- Forward Tracker 1-4
- Dipole ToF
- Muon Filter

Forward Systems on Platform

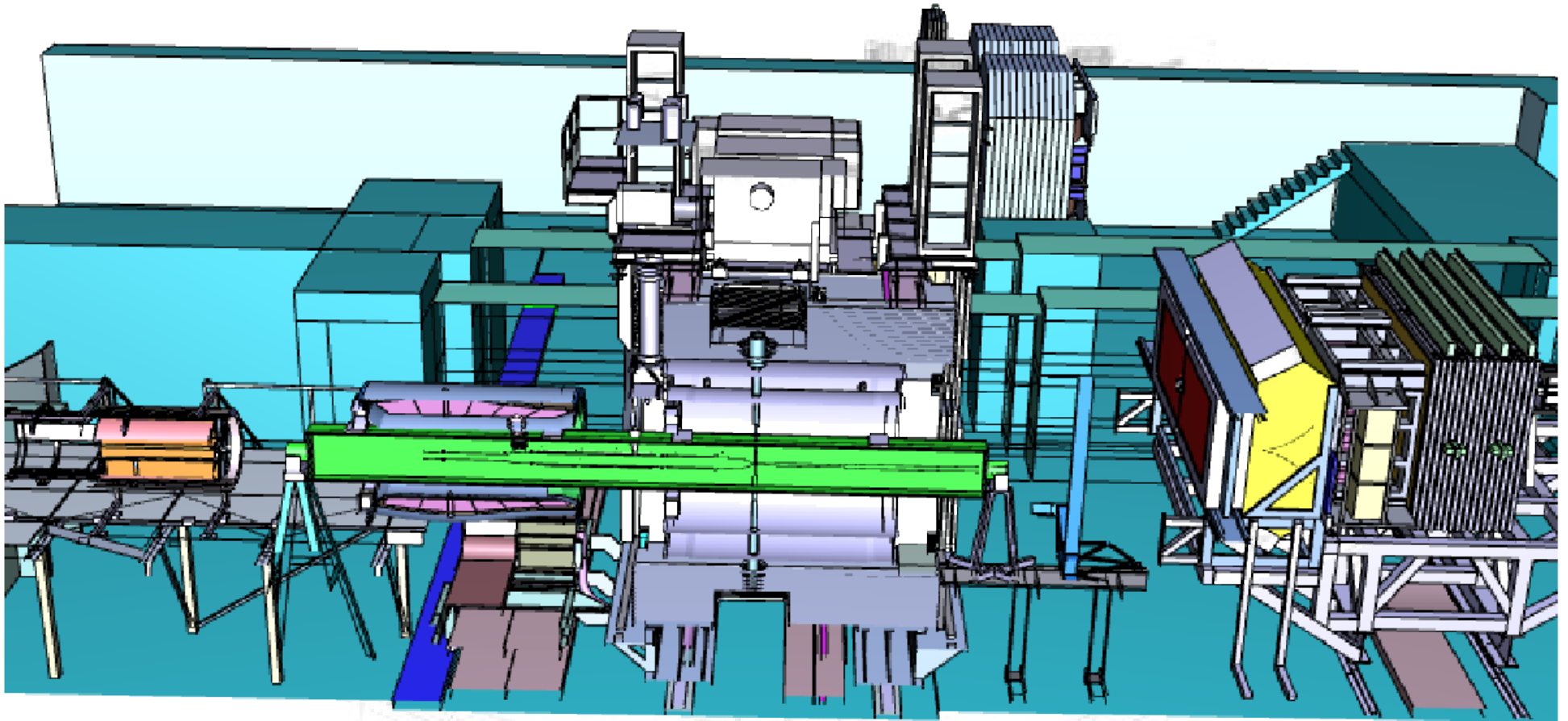
- Forward Tracker 5&6
- Forward RICH
- Forward ToF
- Forward Calorimeter
- Muon Range System
- Luminosity Monitor

Surveying of all systems along the installation

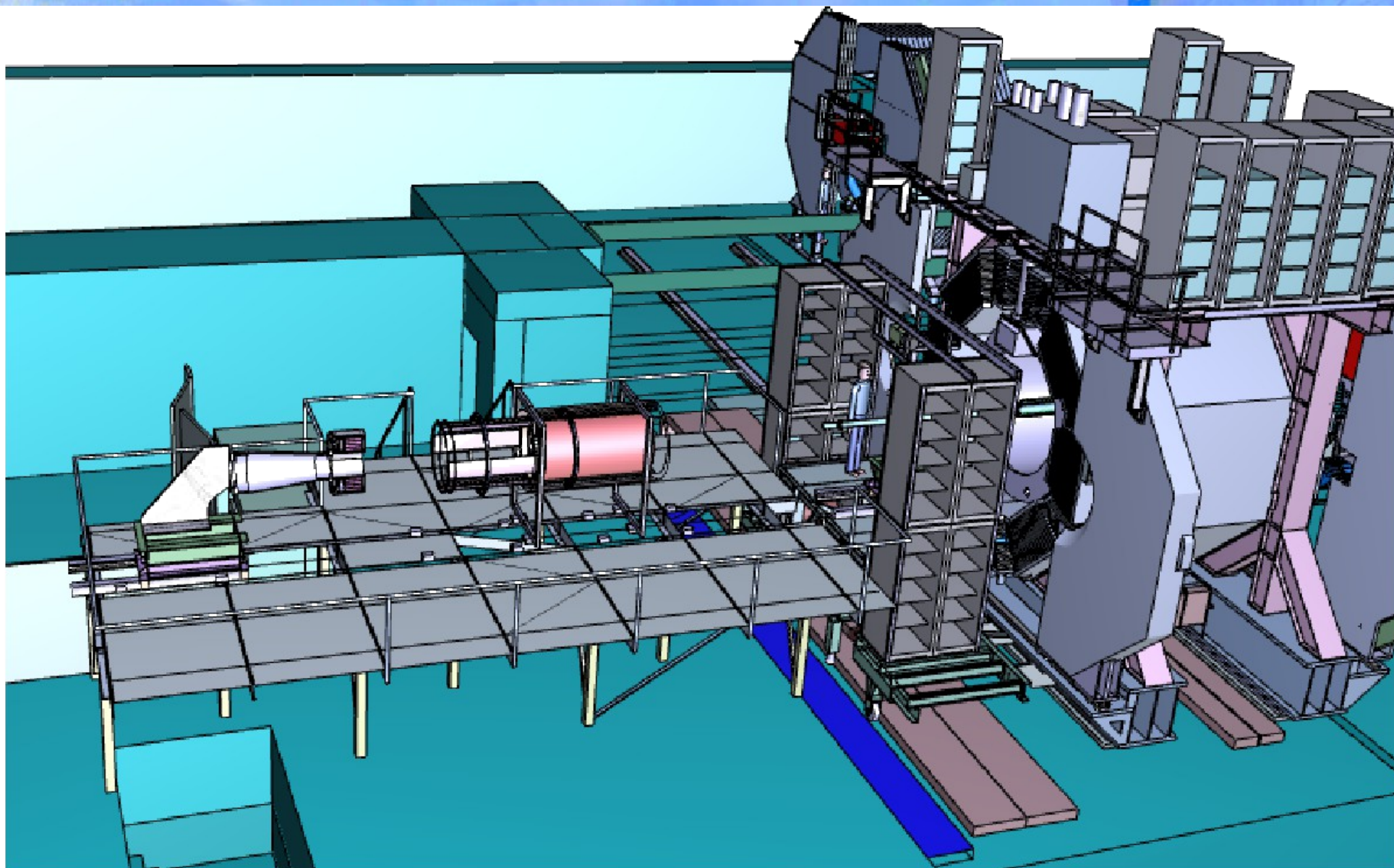
Barrel EMC Insertion



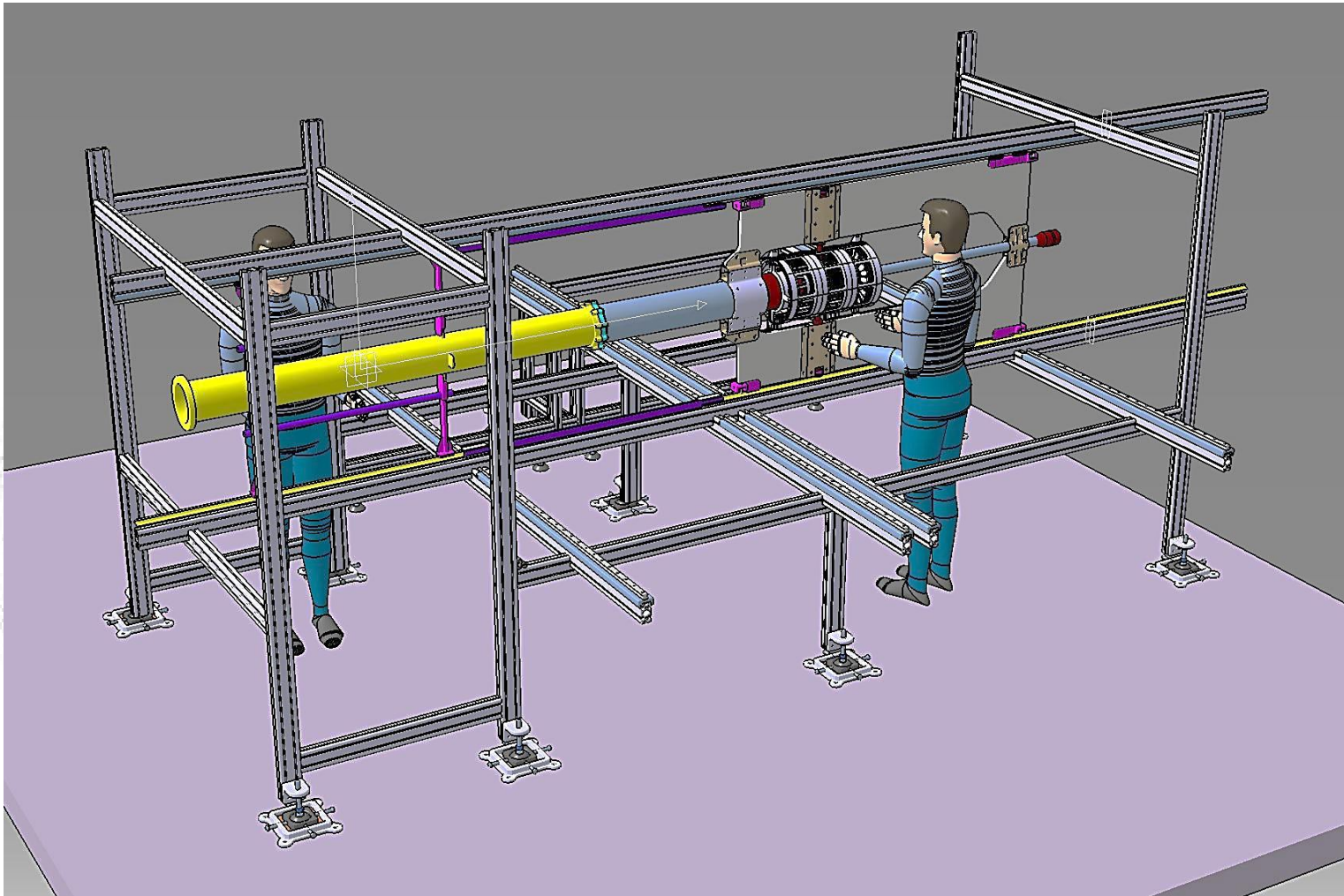
Barrel EMC Insertion



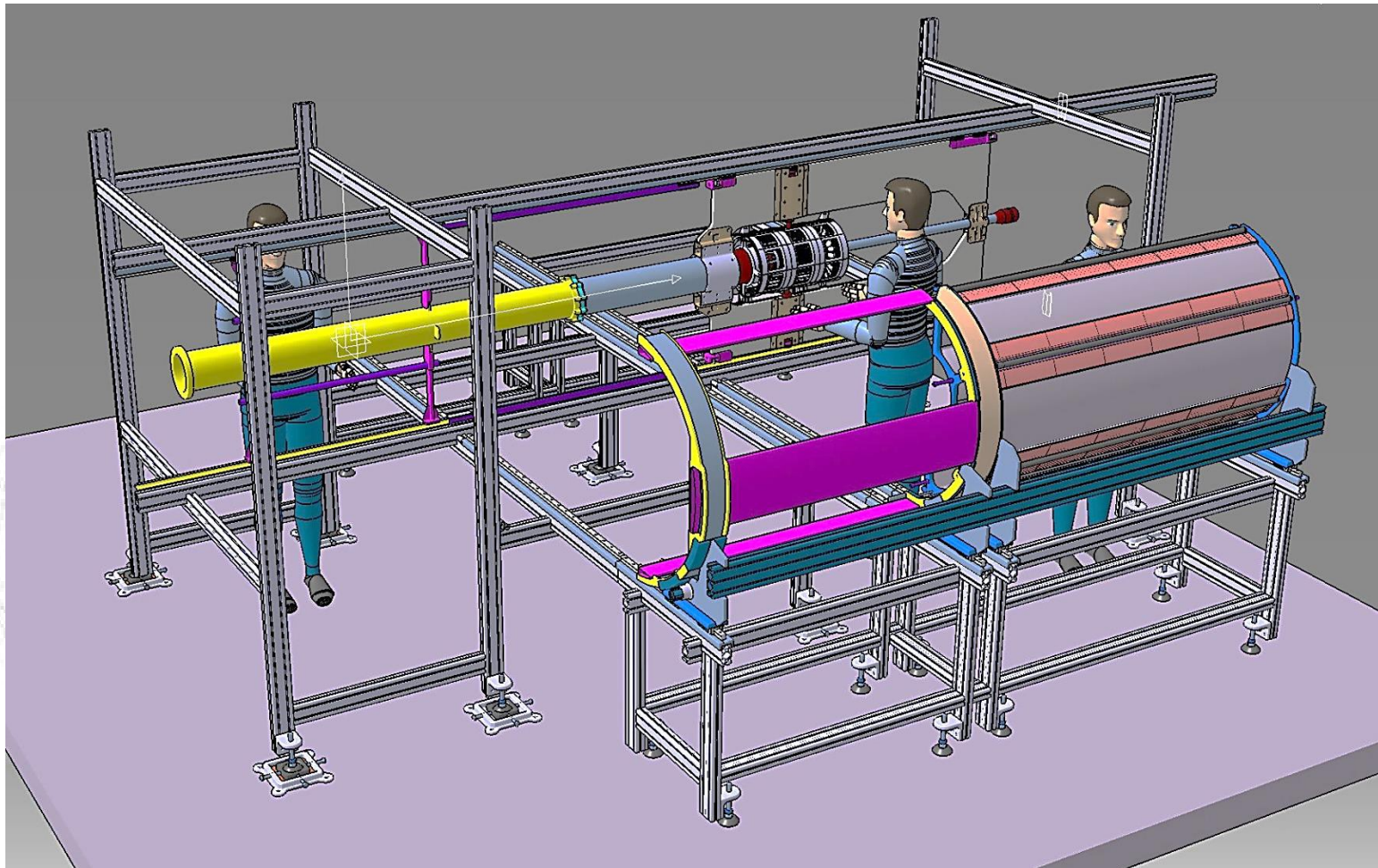
Mounting Platform for BWE & CT



STT and MVD Integration



STT and MVD Integration

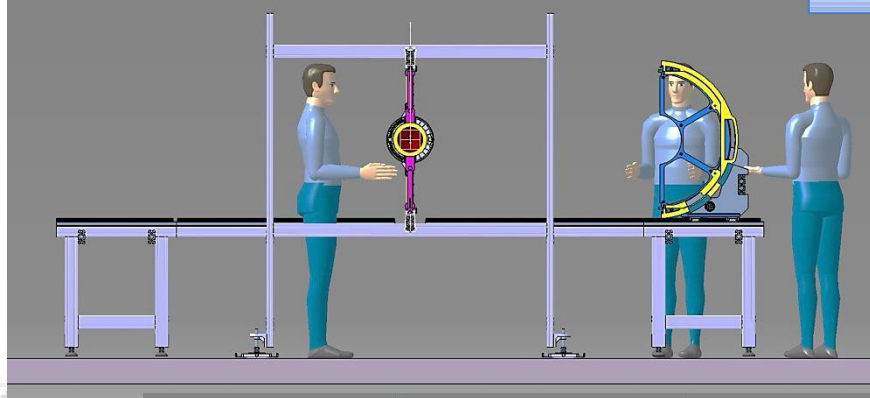


- STT layout in two fully separated halves
- Mounting on top of MVD on common central frame

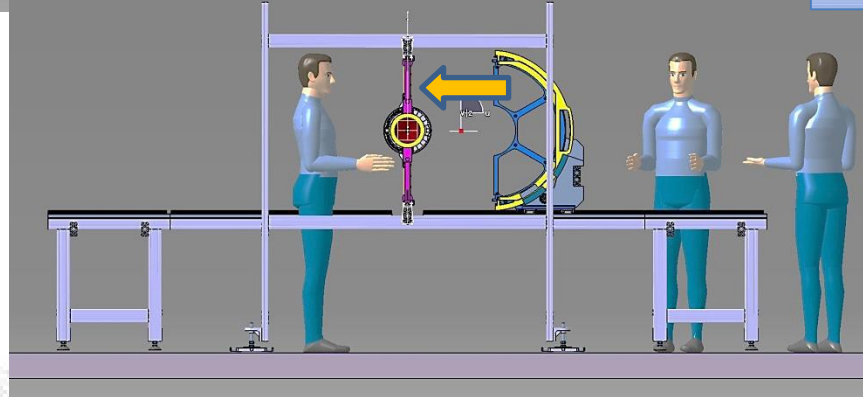
STT and MVD Integration



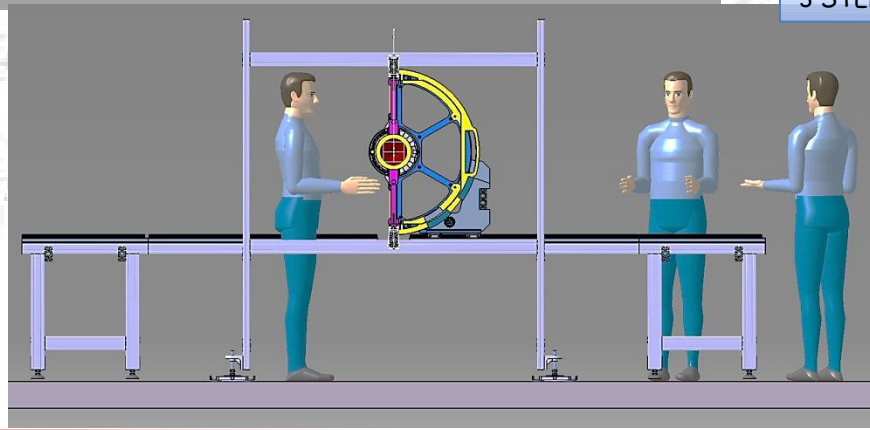
1 STEP



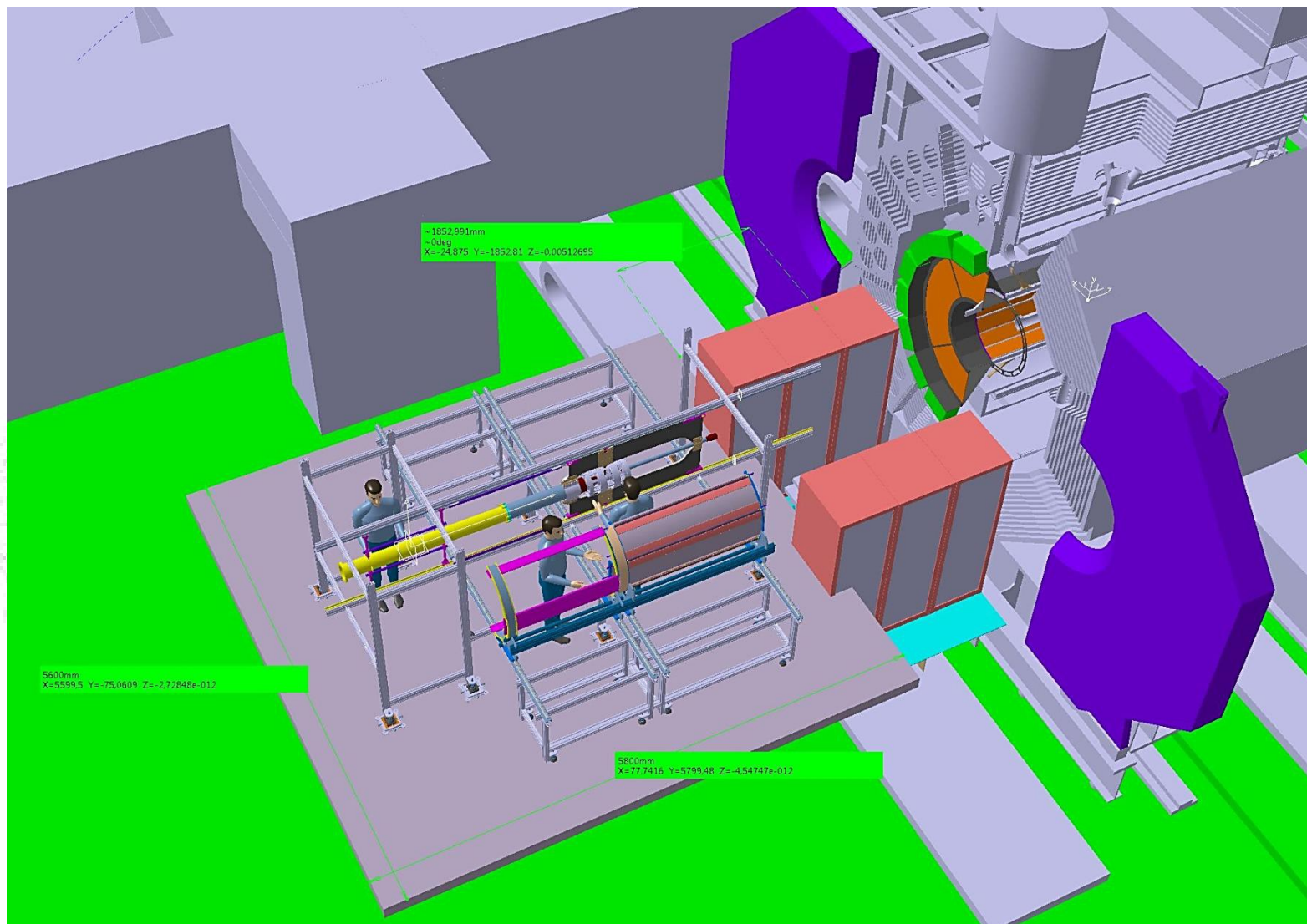
2 STEP



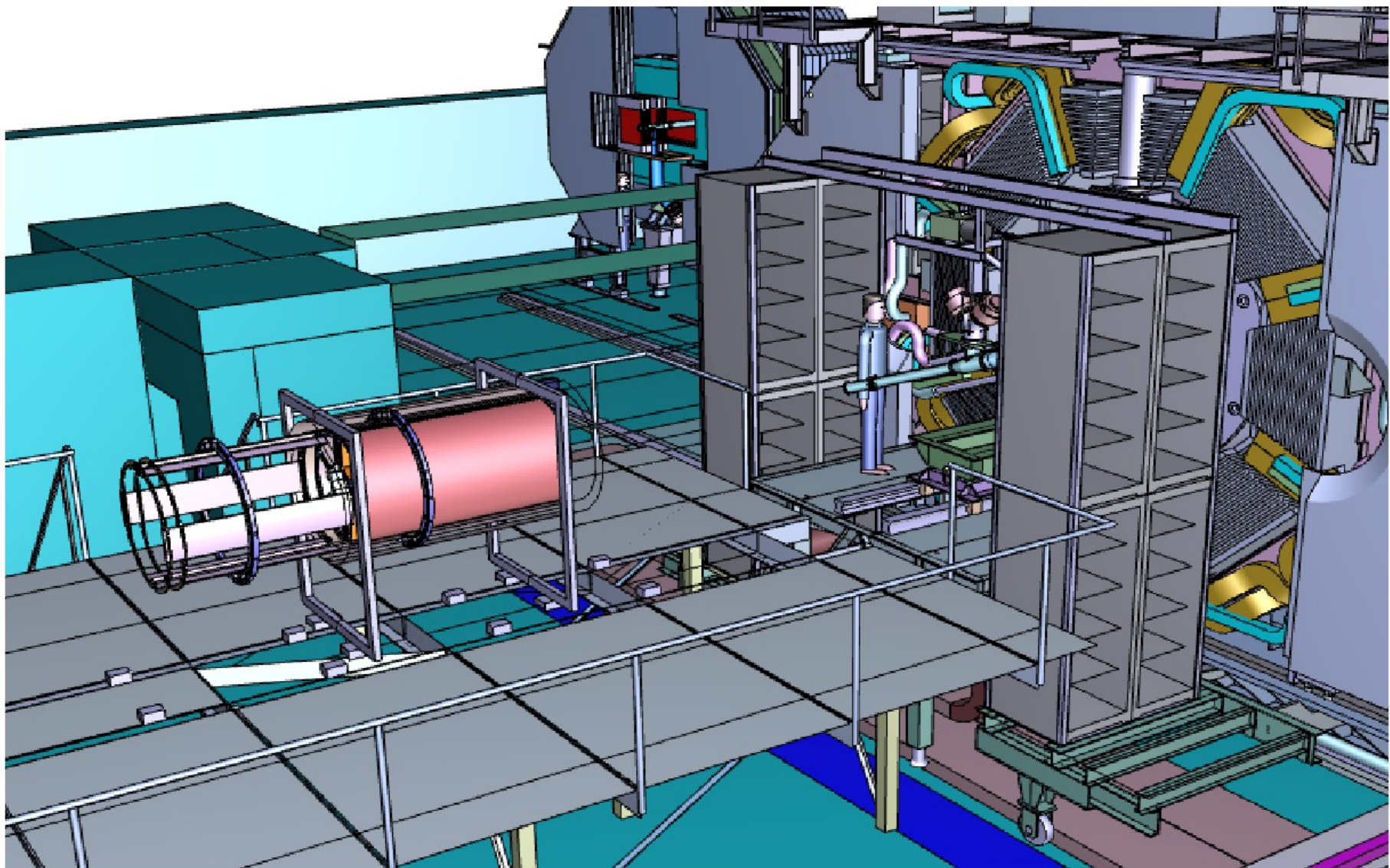
3 STEP

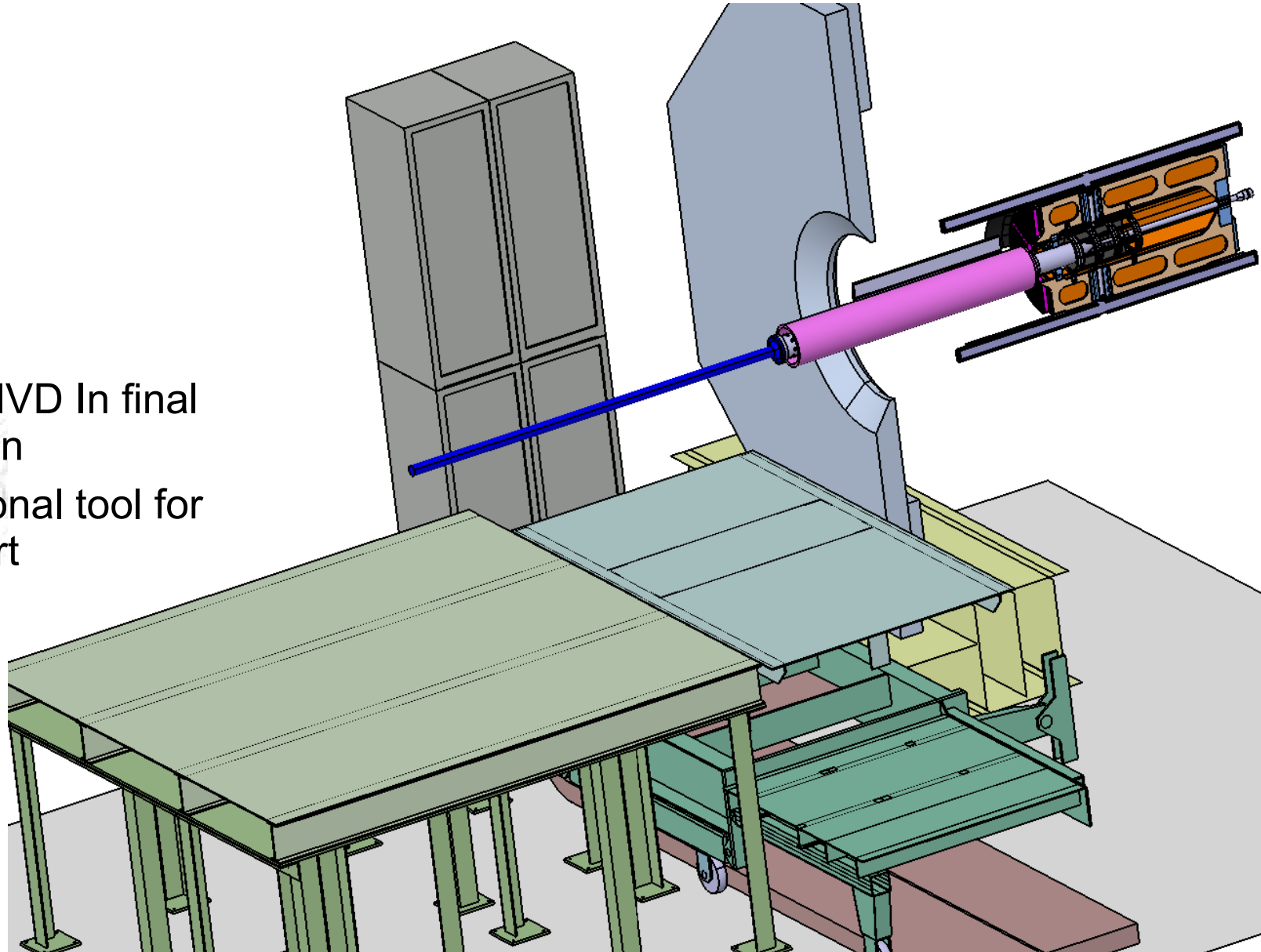


STT and MVD Integration

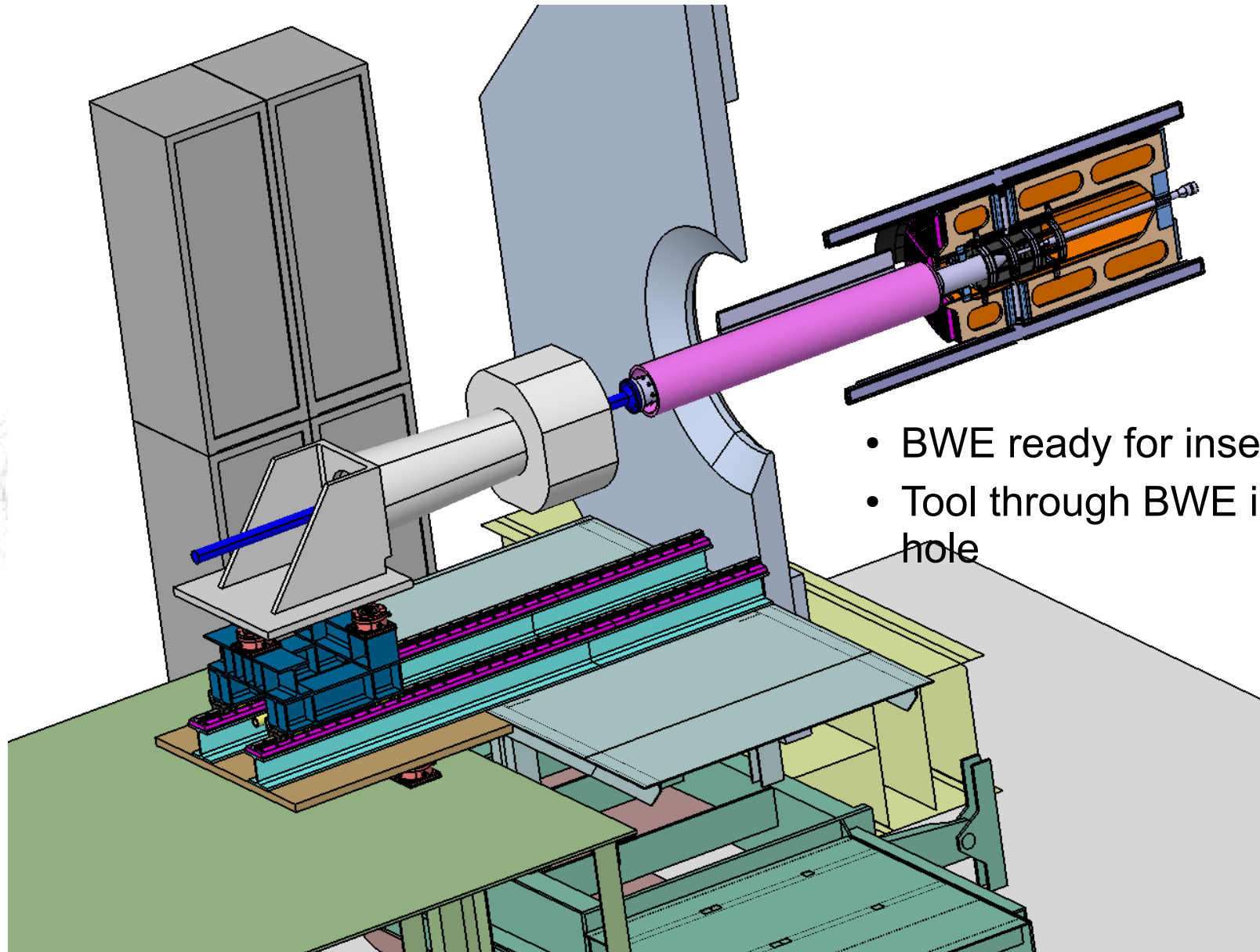


STT and MVD Integration

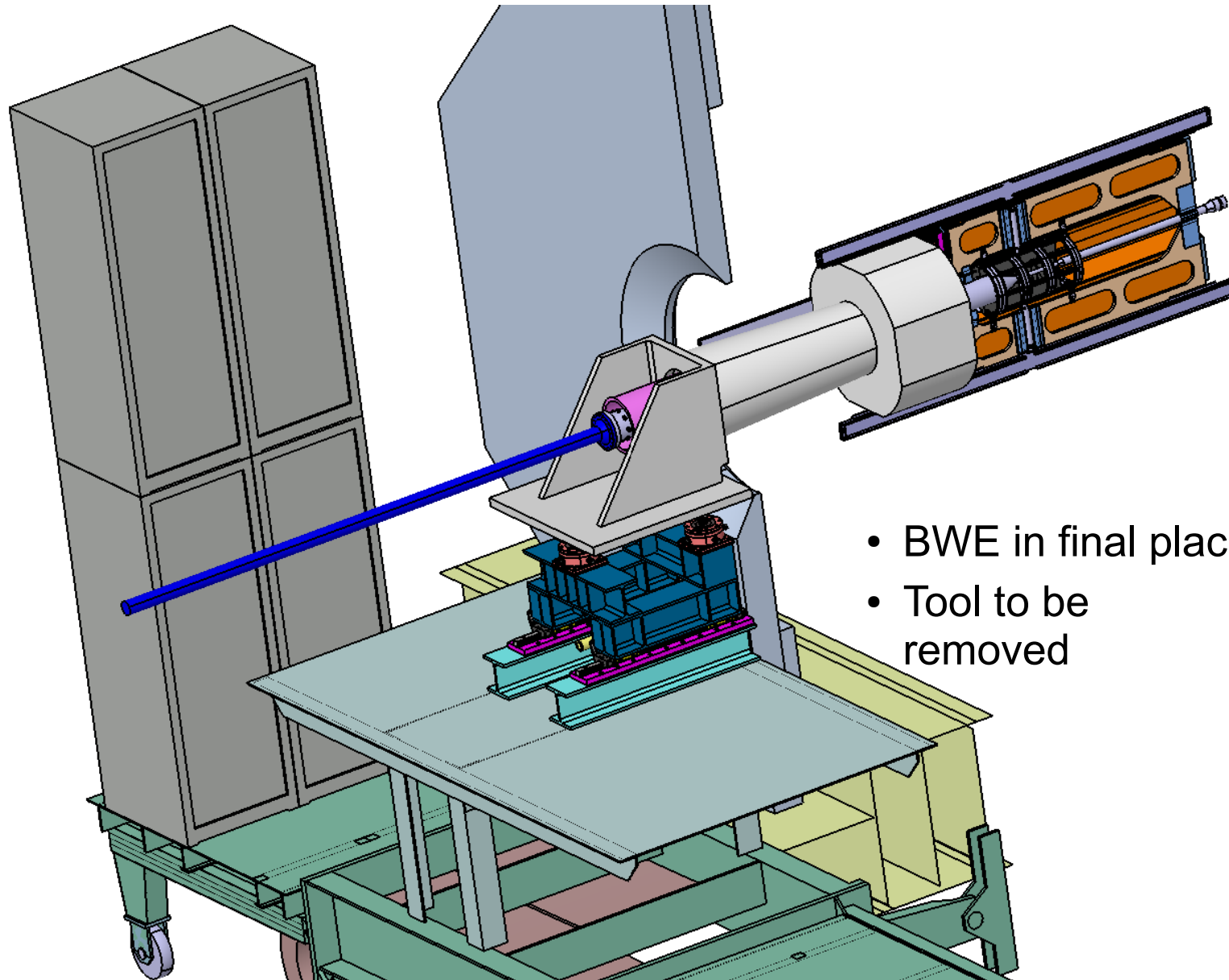




- STT/MVD In final position
- Additional tool for support

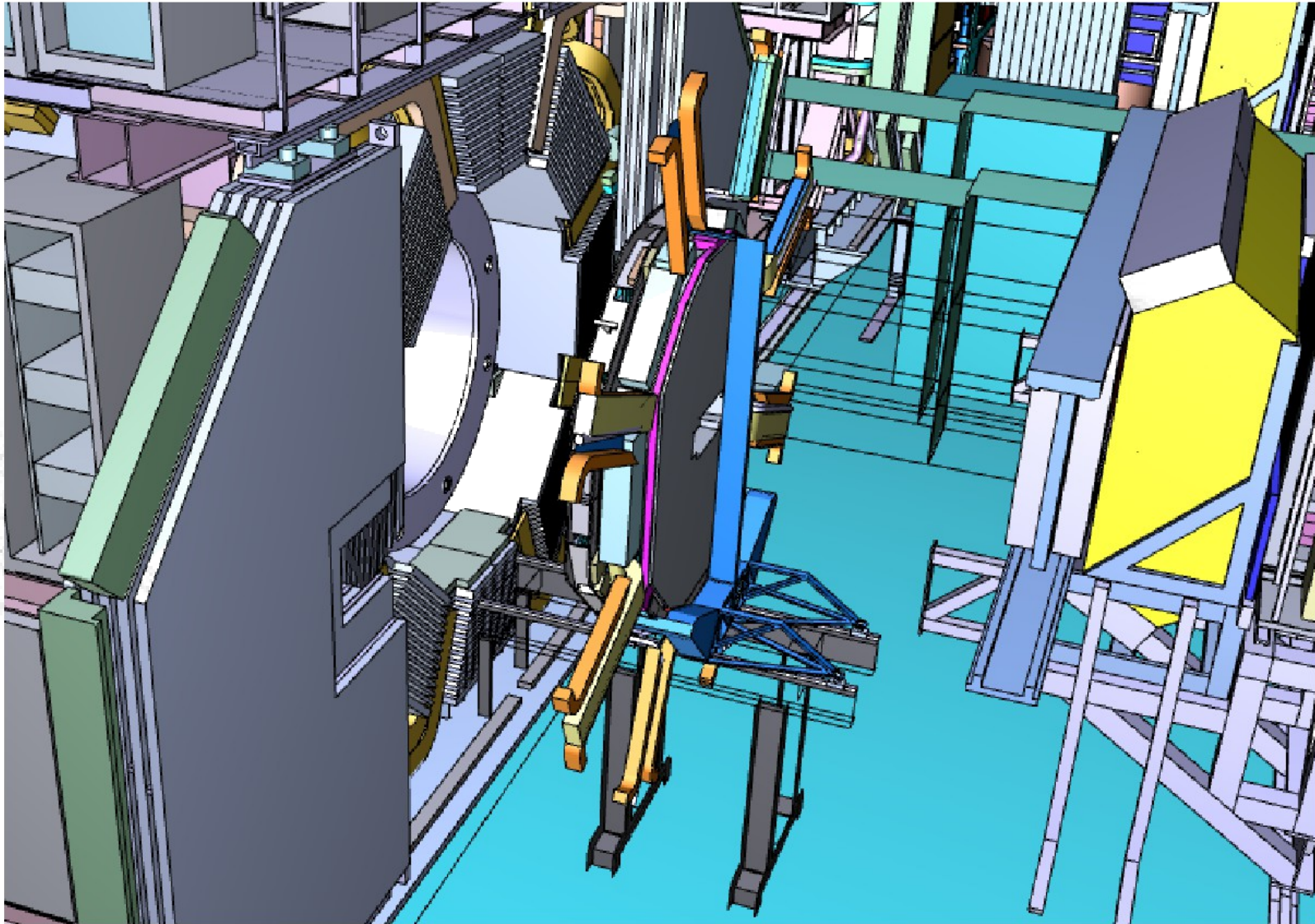


- BWE ready for insertion:
- Tool through BWE inner hole

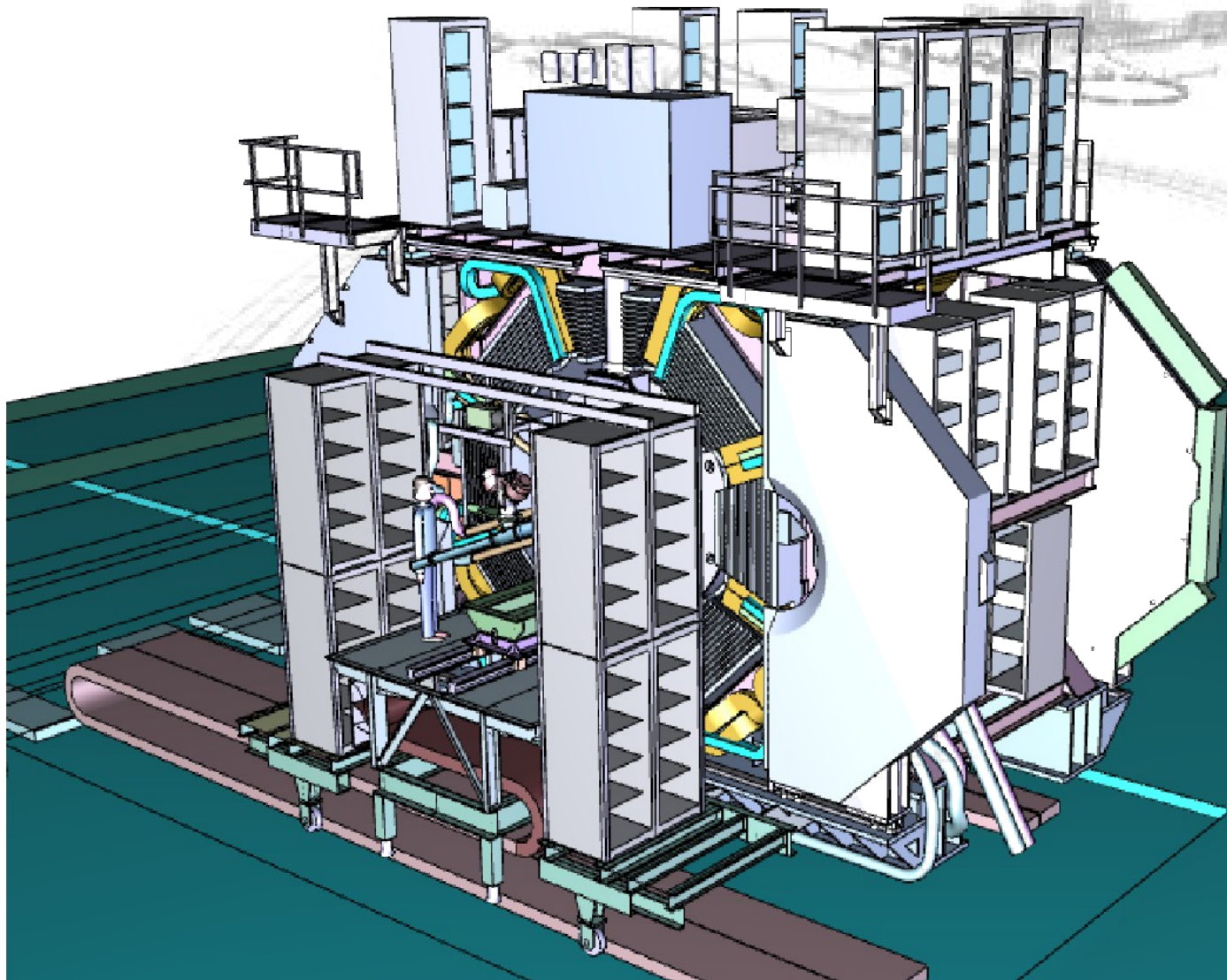


- BWE in final place
- Tool to be removed

Forward Endcap Insertion



Racks at the Target Spectrometer



Target Platform

- 7 racks muon FEE
- 1 rack target

TS E (EMC, GEM, EDD)

- 4+3 racks
- Cooling manifold

TS W (EMC, GEM, EDD)

- 4+2 racks
- Cooling manifold
- Target pump

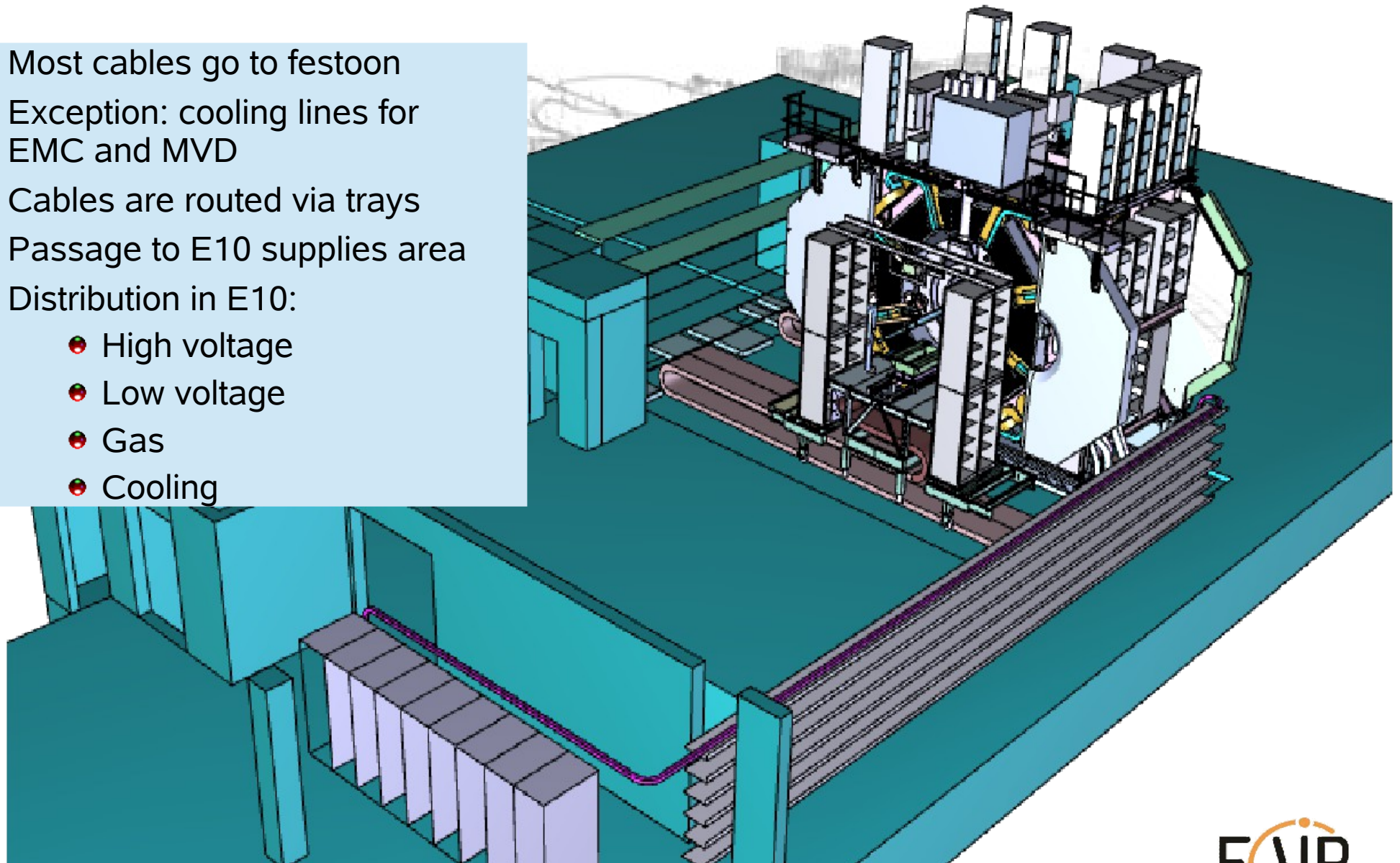
Aux Platform (MVD, BWE, STT)

- 4+4 racks

Routing from TS to Supplies Area



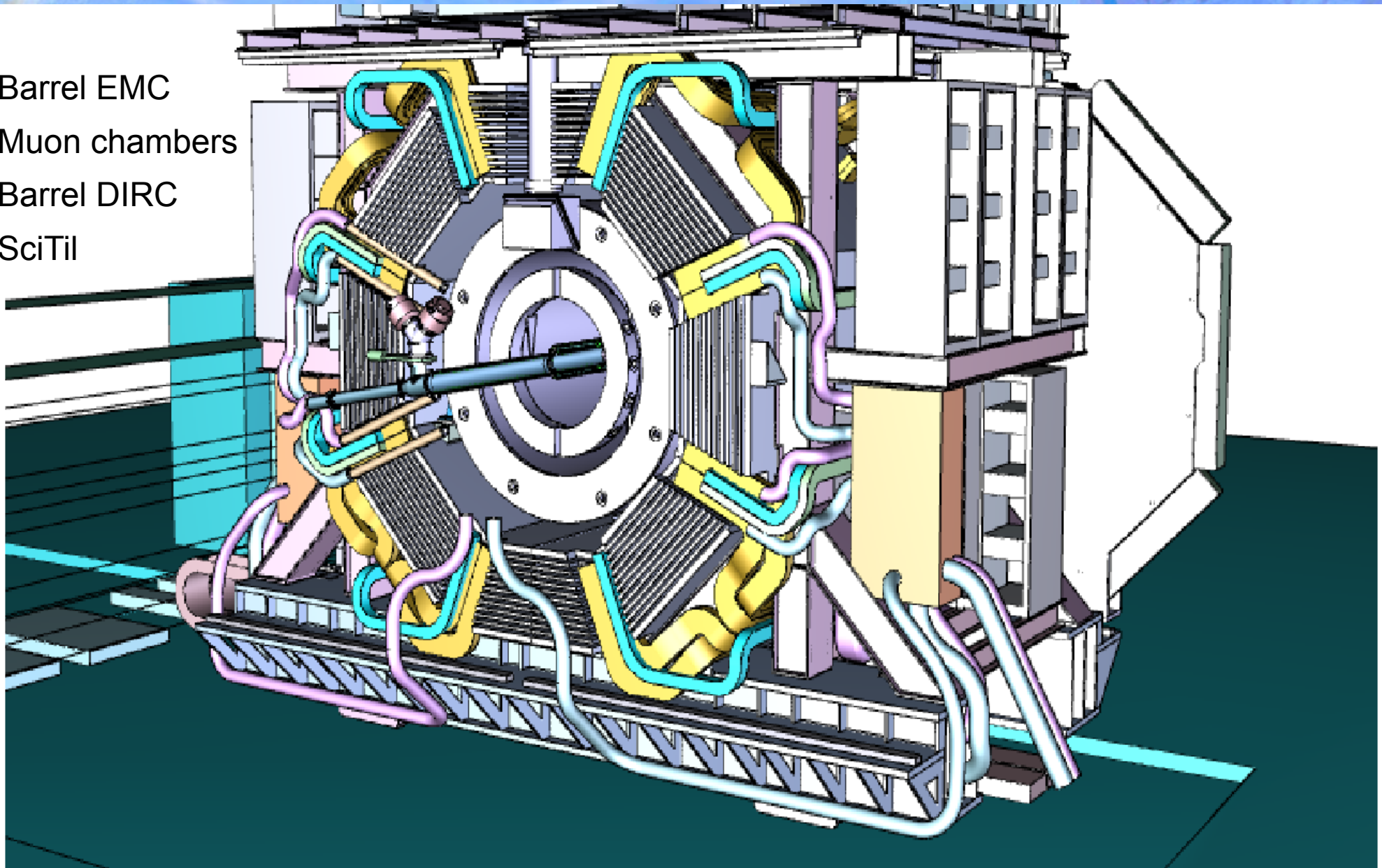
- Most cables go to festoon
- Exception: cooling lines for EMC and MVD
- Cables are routed via trays
- Passage to E10 supplies area
- Distribution in E10:
 - High voltage
 - Low voltage
 - Gas
 - Cooling



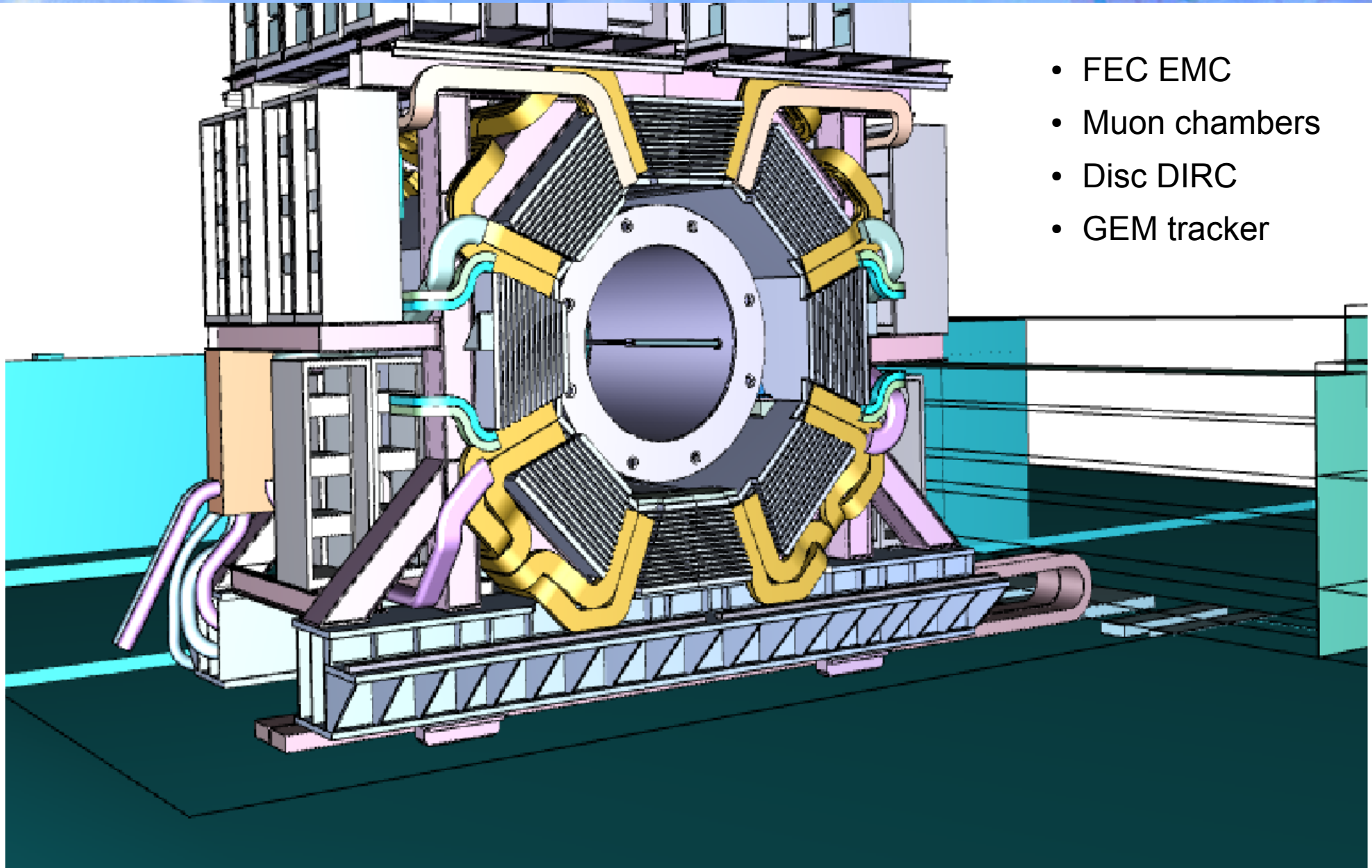
Services at Target Spectrometer



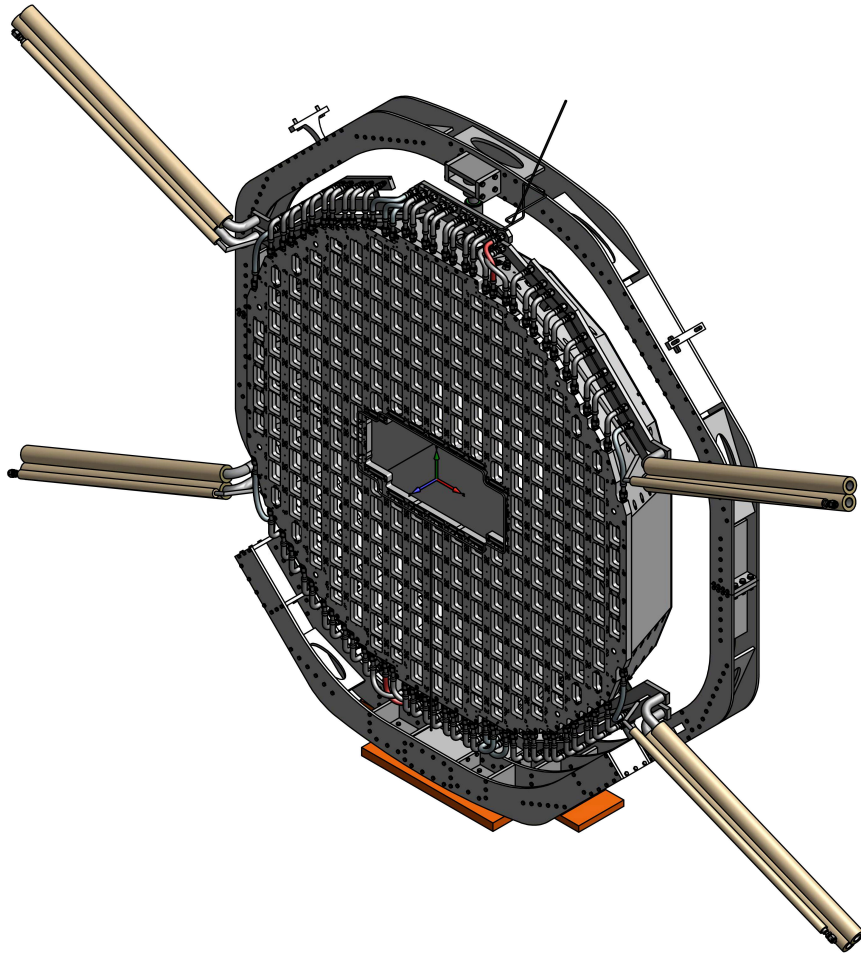
- Barrel EMC
- Muon chambers
- Barrel DIRC
- SciTil



Cables at the TS: Forward Endcap



- FEC EMC
- Muon chambers
- Disc DIRC
- GEM tracker

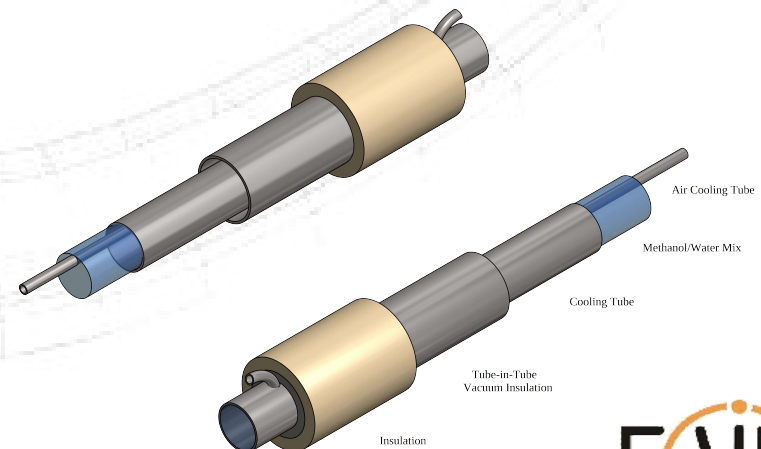


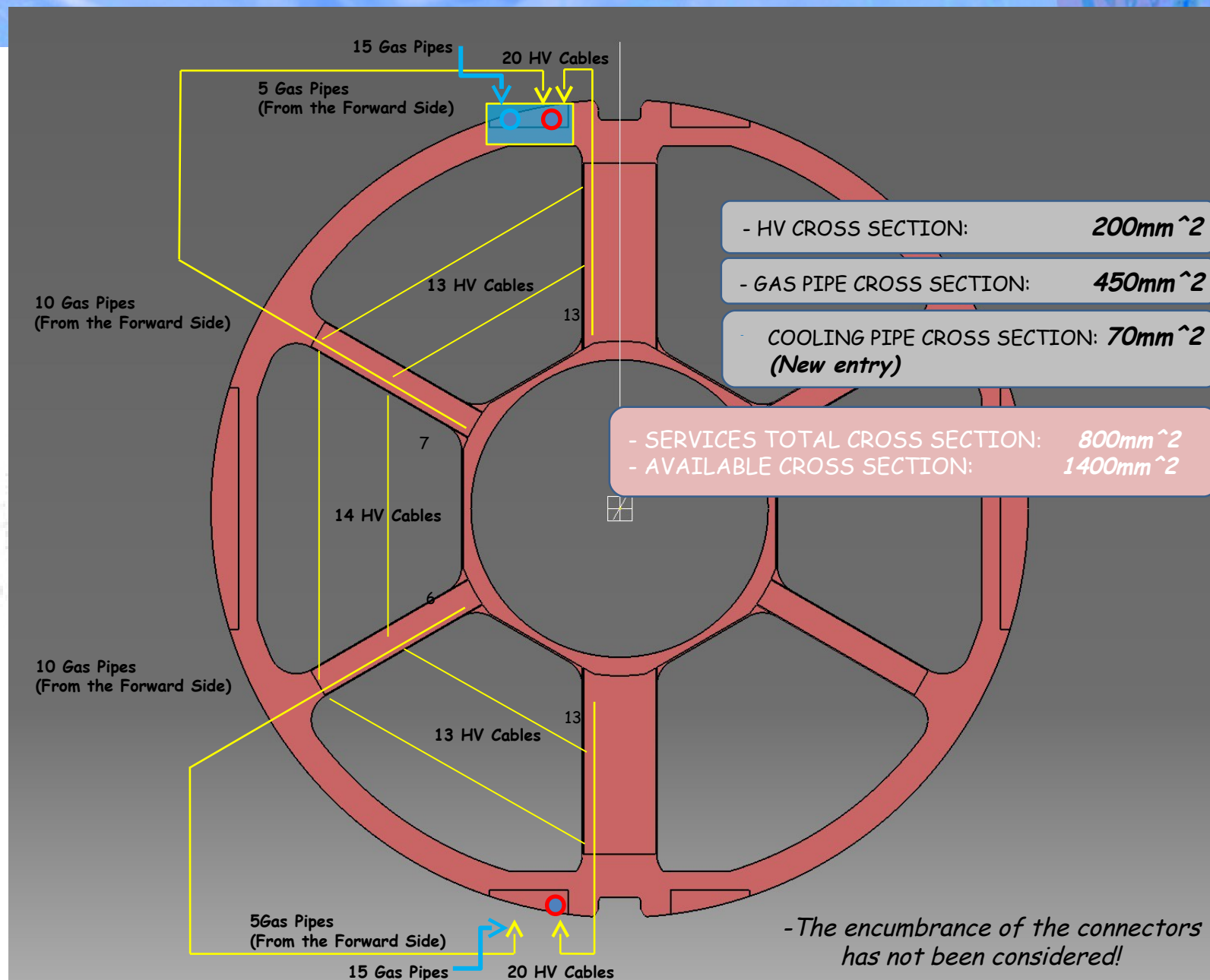
Optimisation of coolant supply lines:

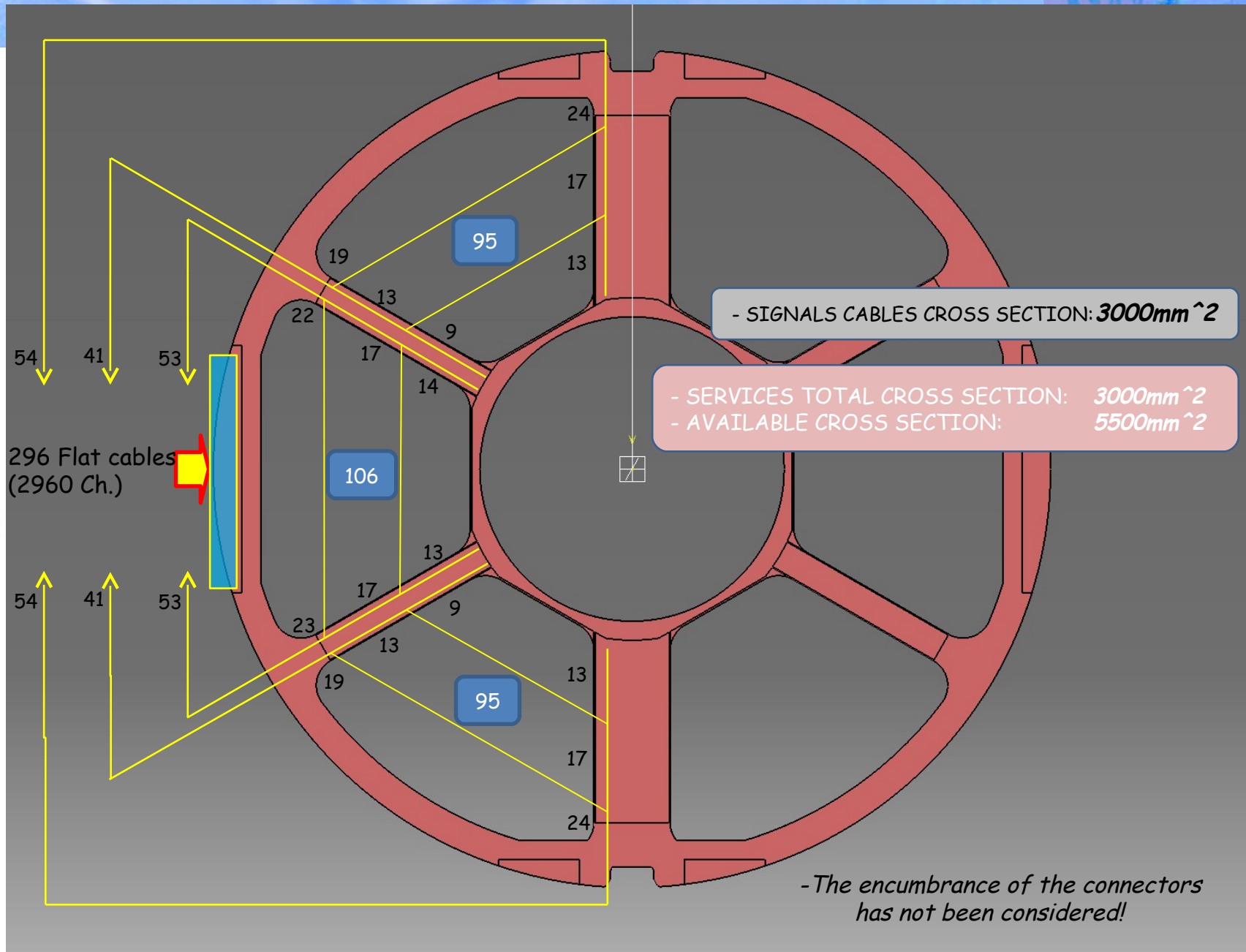
- One line instead per quadrant of bundle
- No mixer boxes
- Dry air cooling through coolant pipe

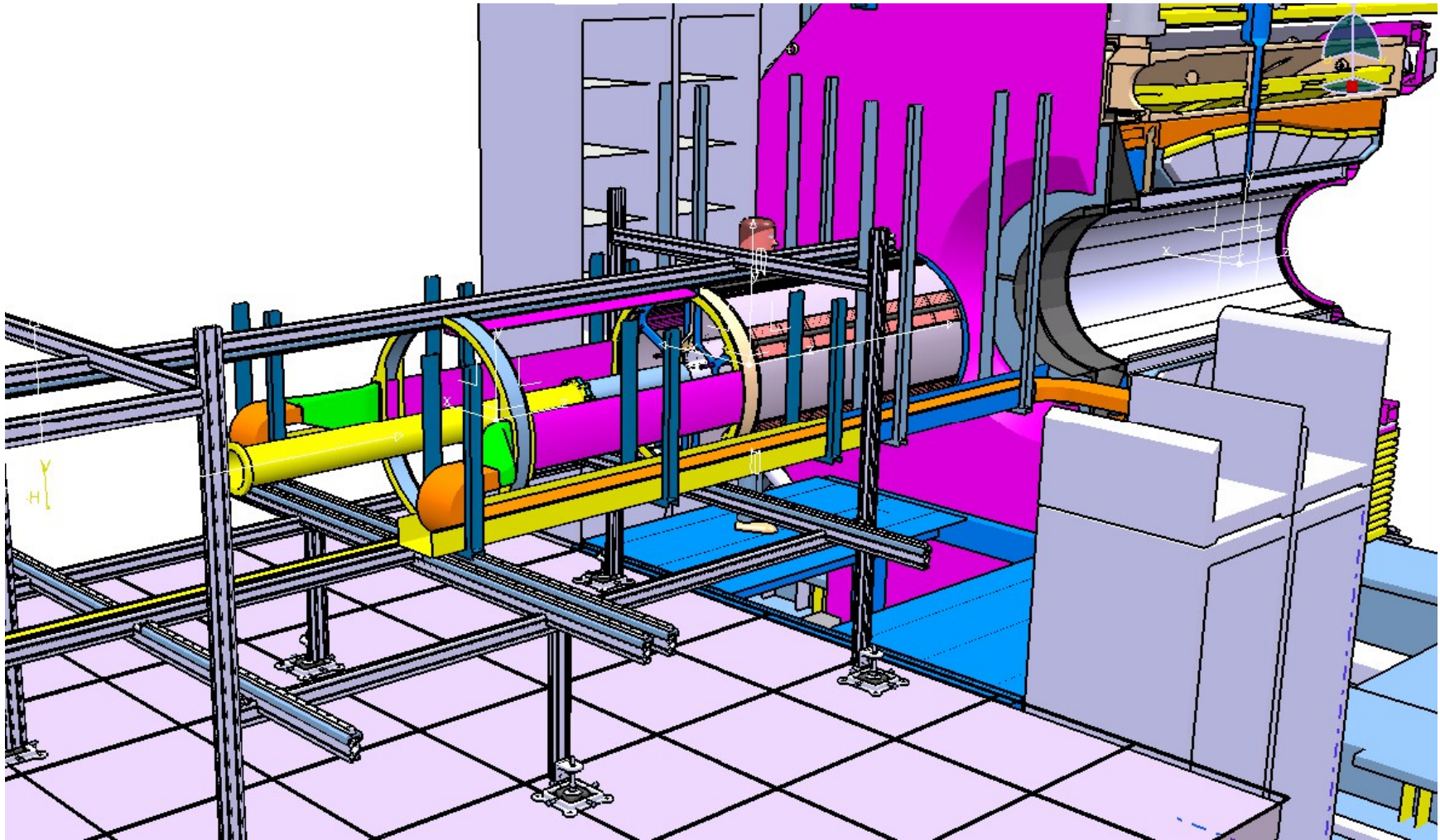
Consequences:

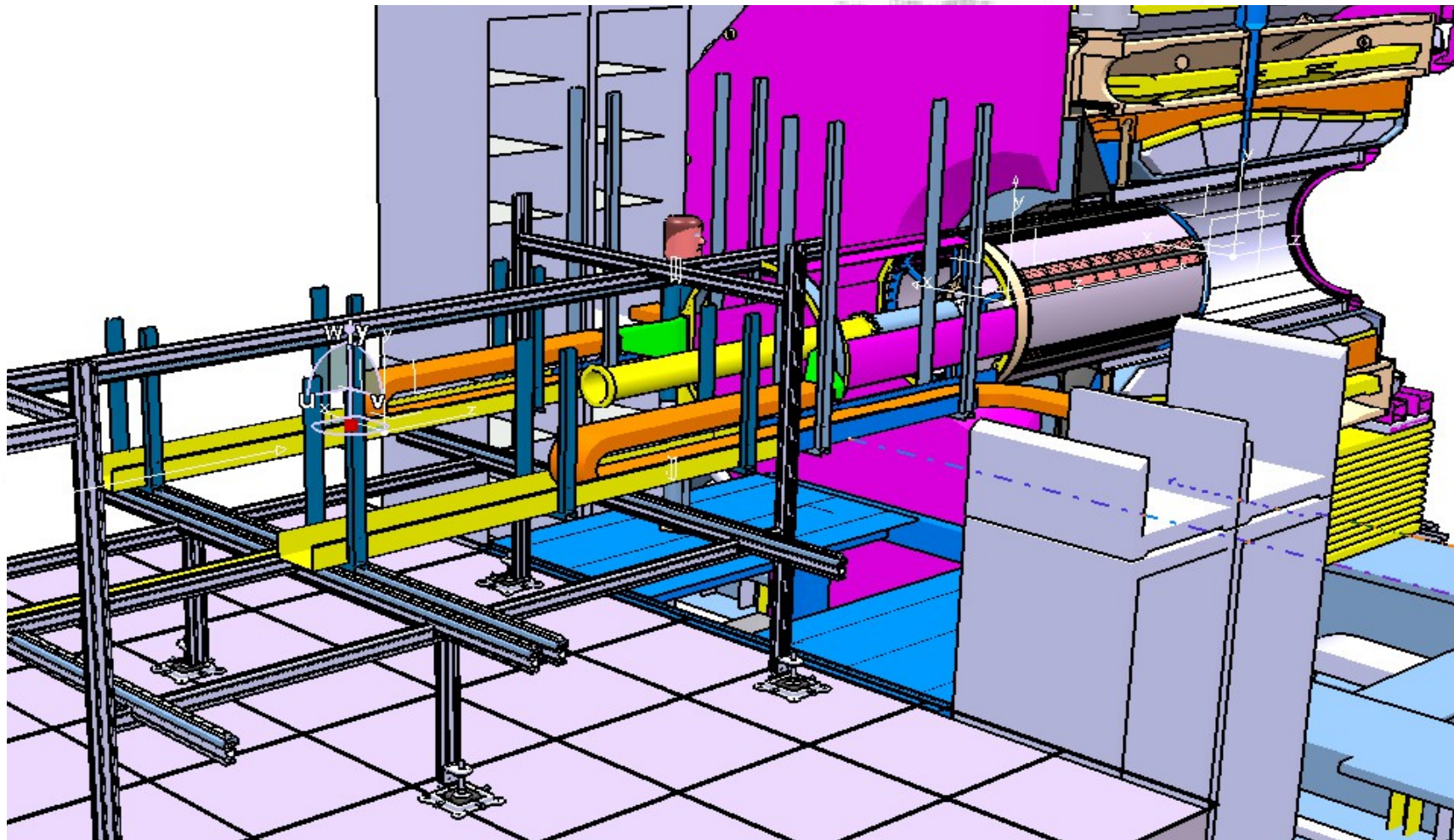
- No mixer boxes attached to yoke
- Magnet door opening +20cm extra for installation (was +50cm)
- Duct occupancy 61.5% each (was 83% on top, 63% on bottom)

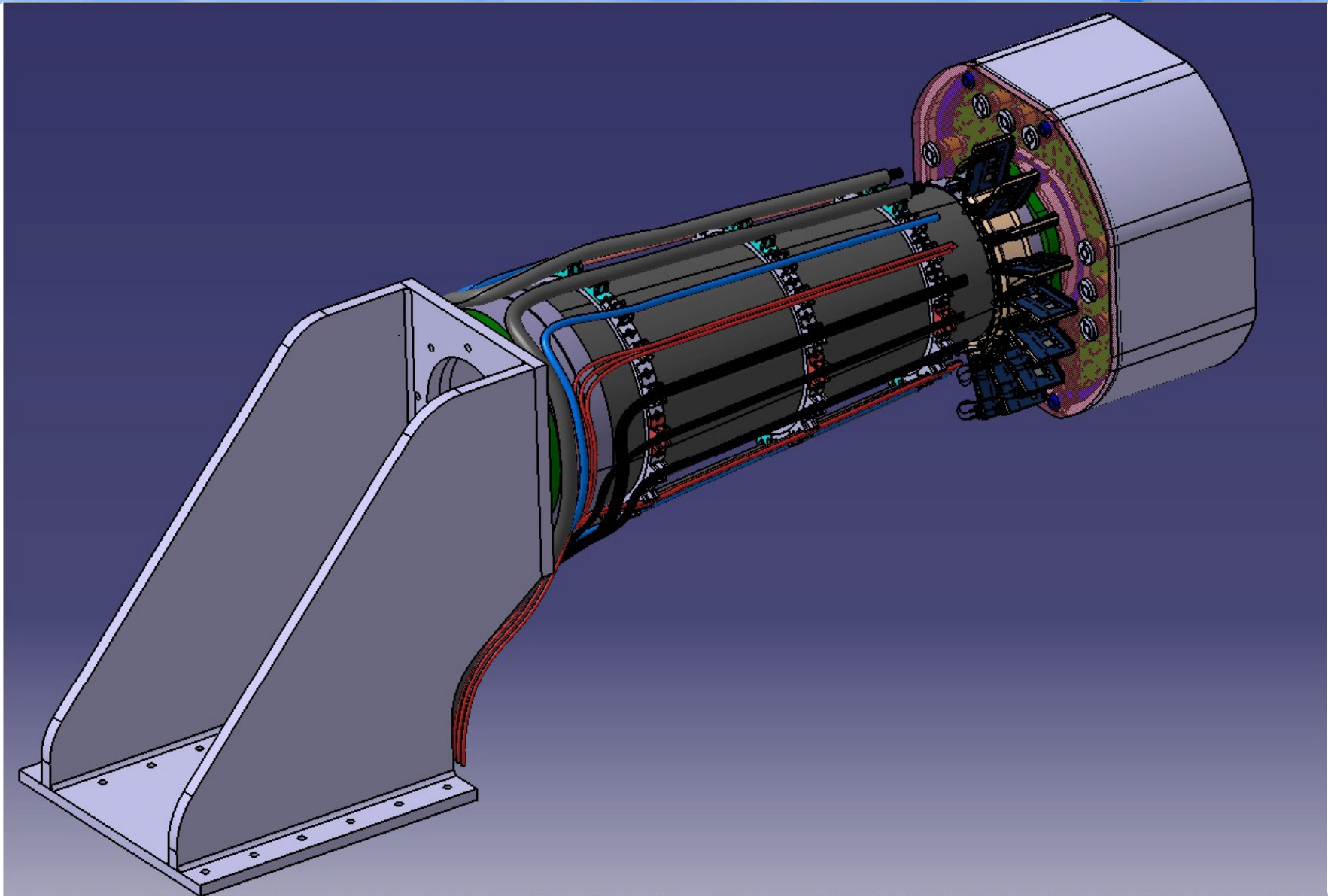




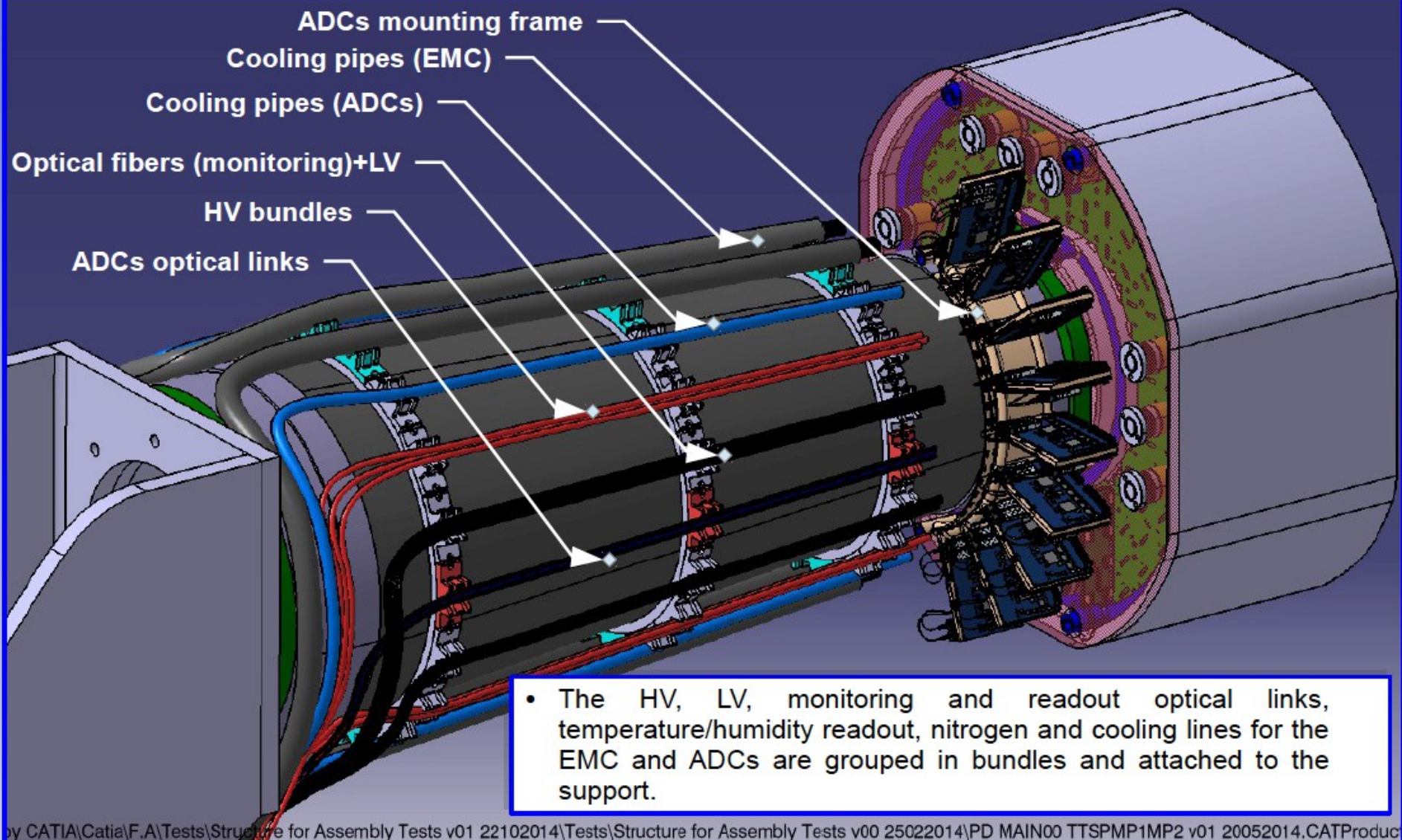


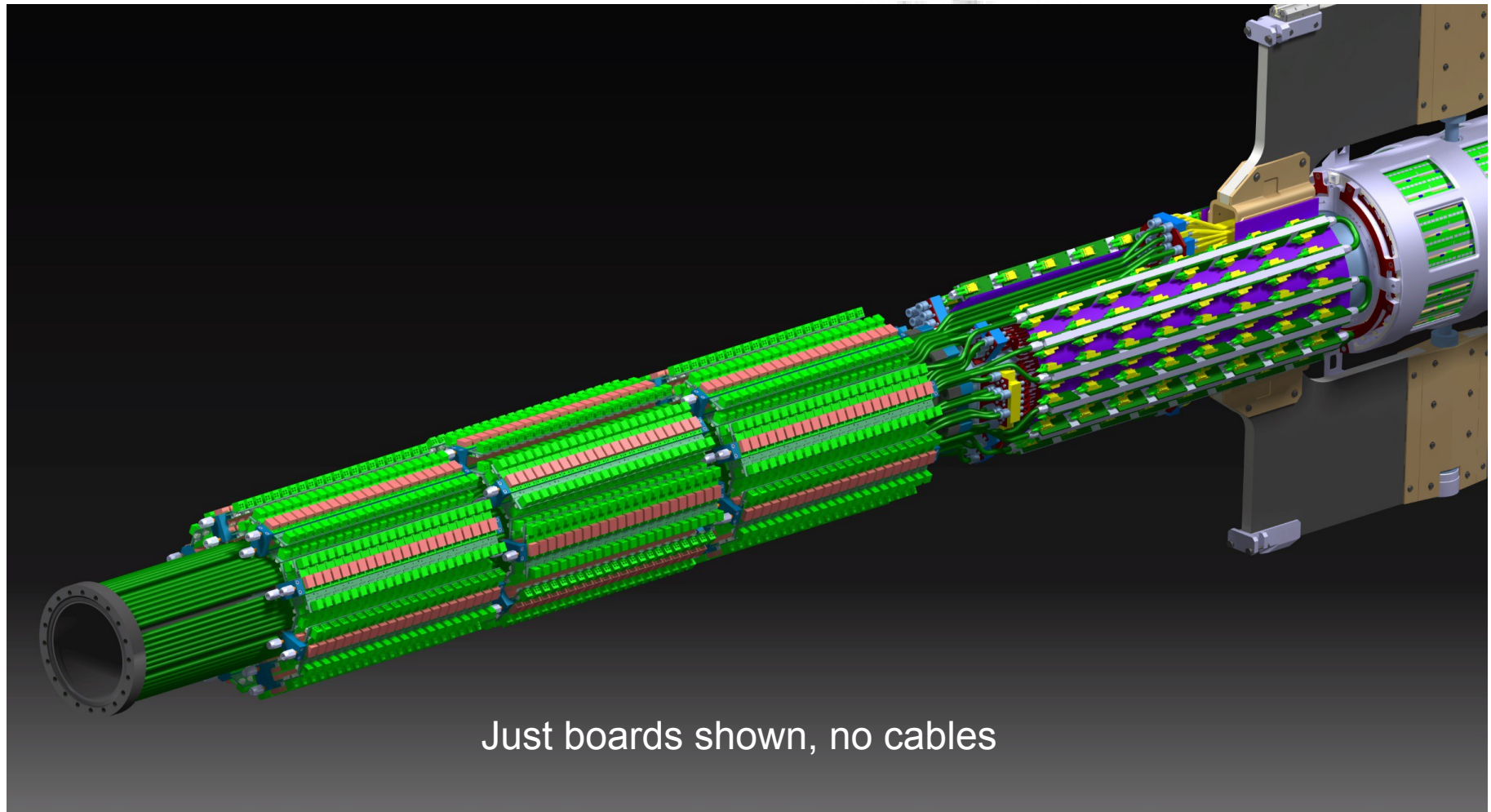






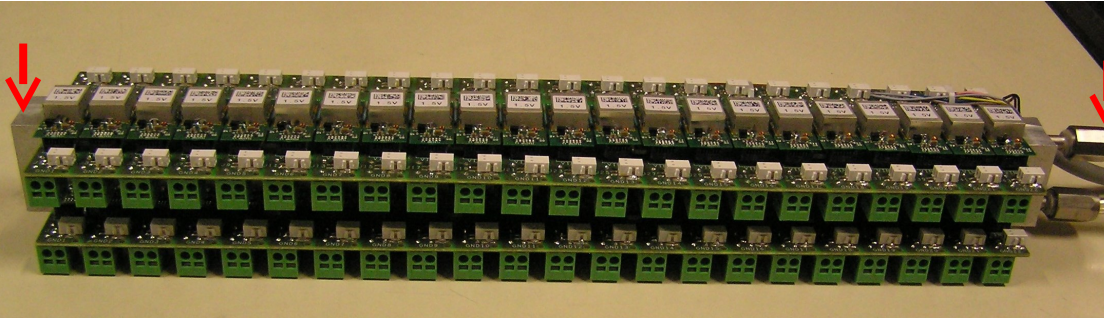
Snapshot of D:\Temp Copy CATIA\Catia\F.A\Tests\Structure for Assembly Tests v01 22102014\Tests\Structure for Assembly Tests v00 25022014\PD MAIN00 TTSPMP1MP2 v01 20052014.CATProduct - 10/24/2014 8:42:22 AM



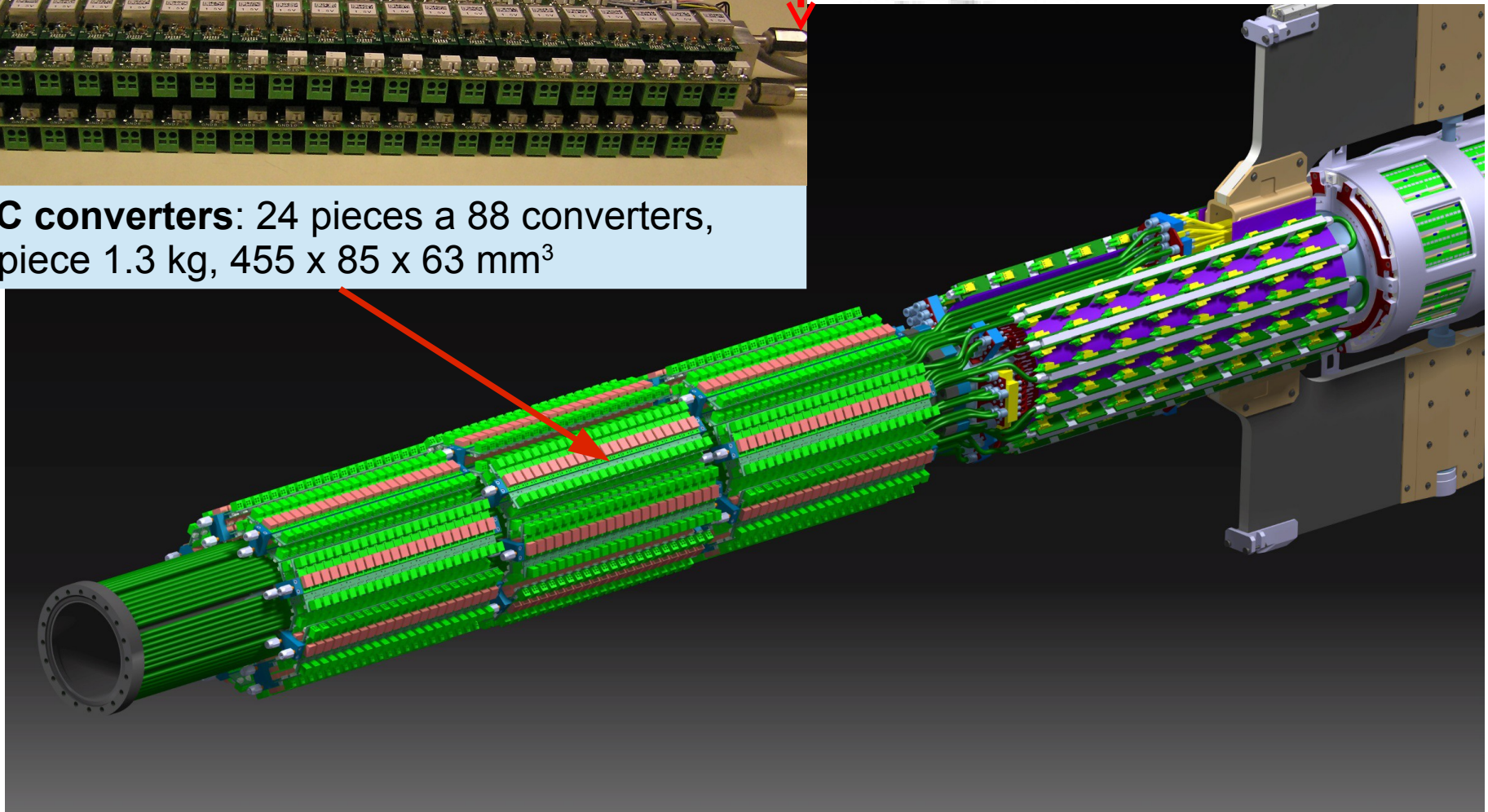


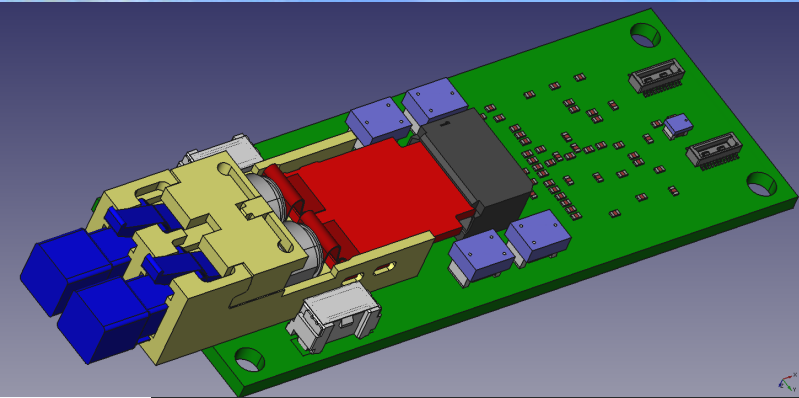
Just boards shown, no cables

MVD Cables & Services



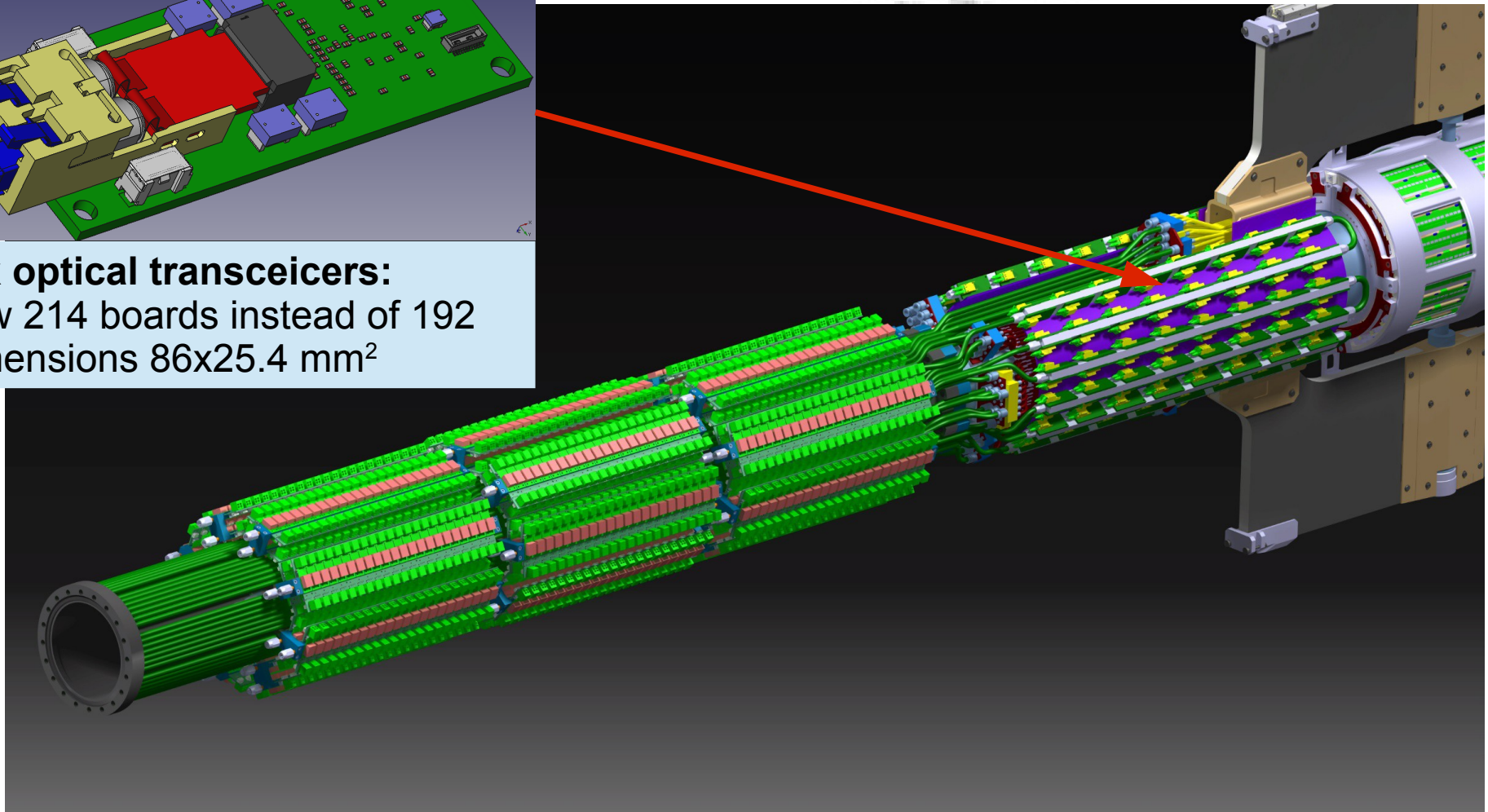
DC-DC converters: 24 pieces a 88 converters,
Each piece 1.3 kg, 455 x 85 x 63 mm³





GBTx optical transceivers:

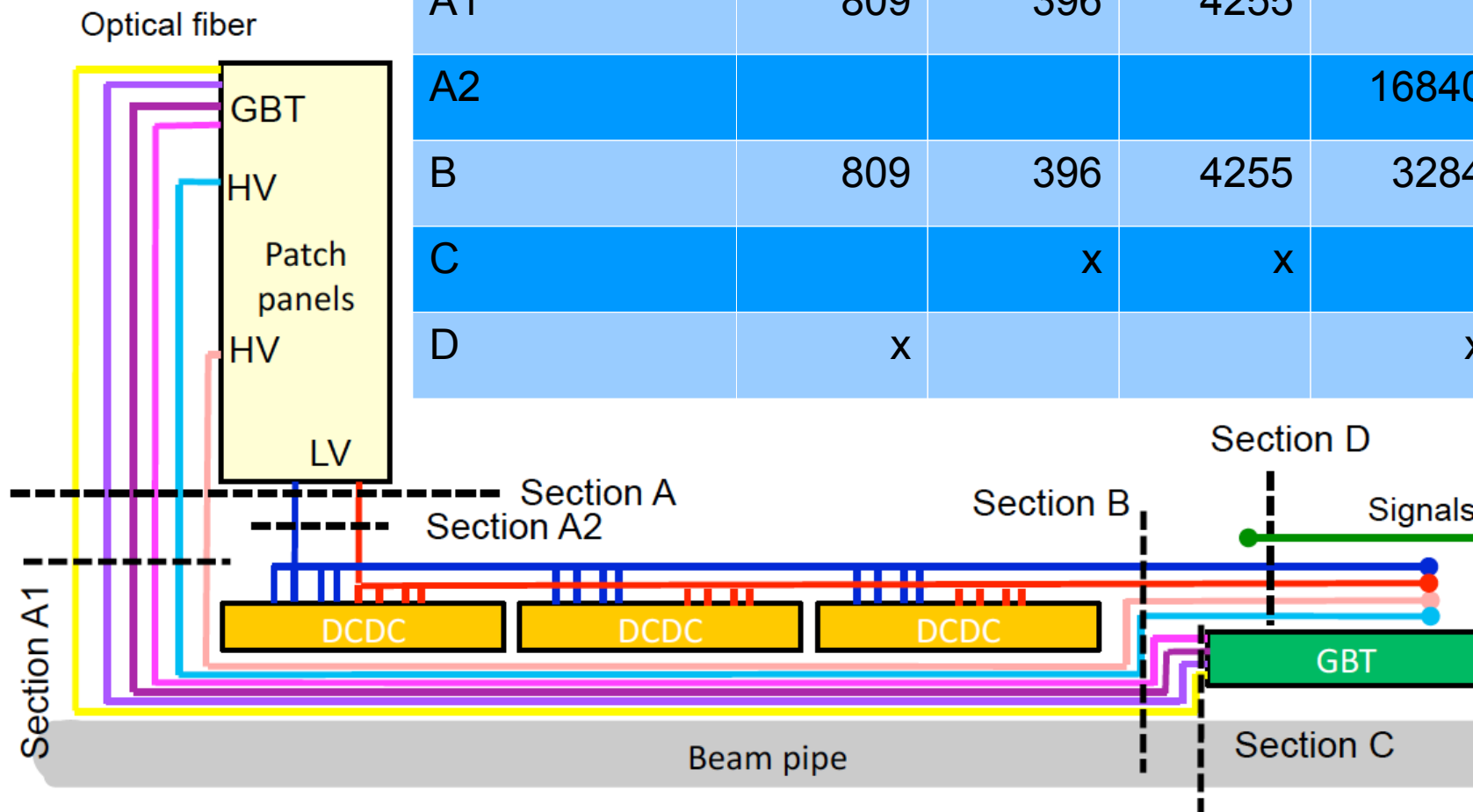
- Now 214 boards instead of 192
- Dimensions 86x25.4 mm²



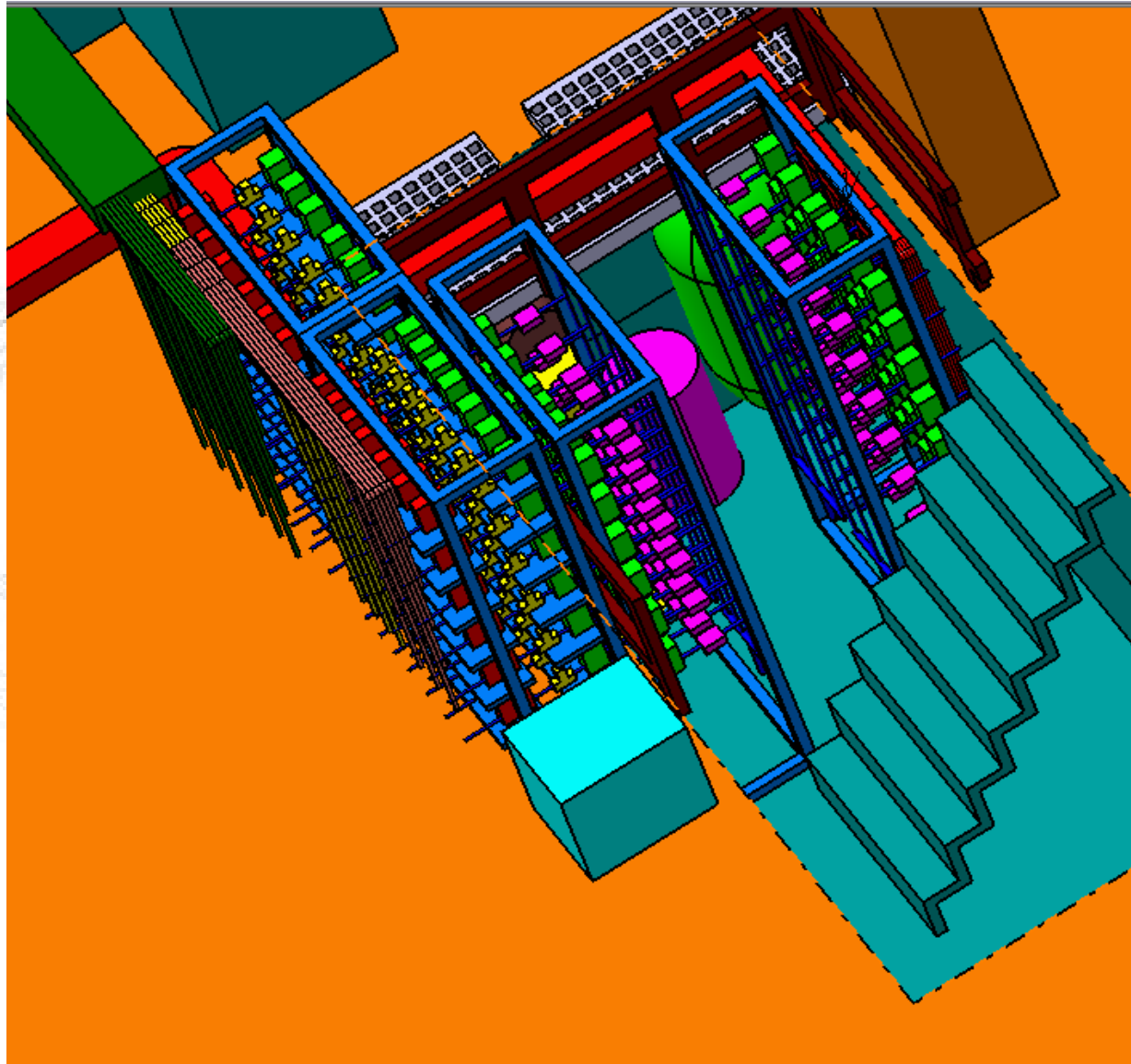
MVD Cables & Services



Section Name	HV	Optical	LV GBT	LV FEE	Total
A (A1+A2)	809	396	4255		22300
A1	809	396	4255		5460
A2				16840	16840
B	809	396	4255	3284	8744
C		x	x		4659
D	x			x	5595

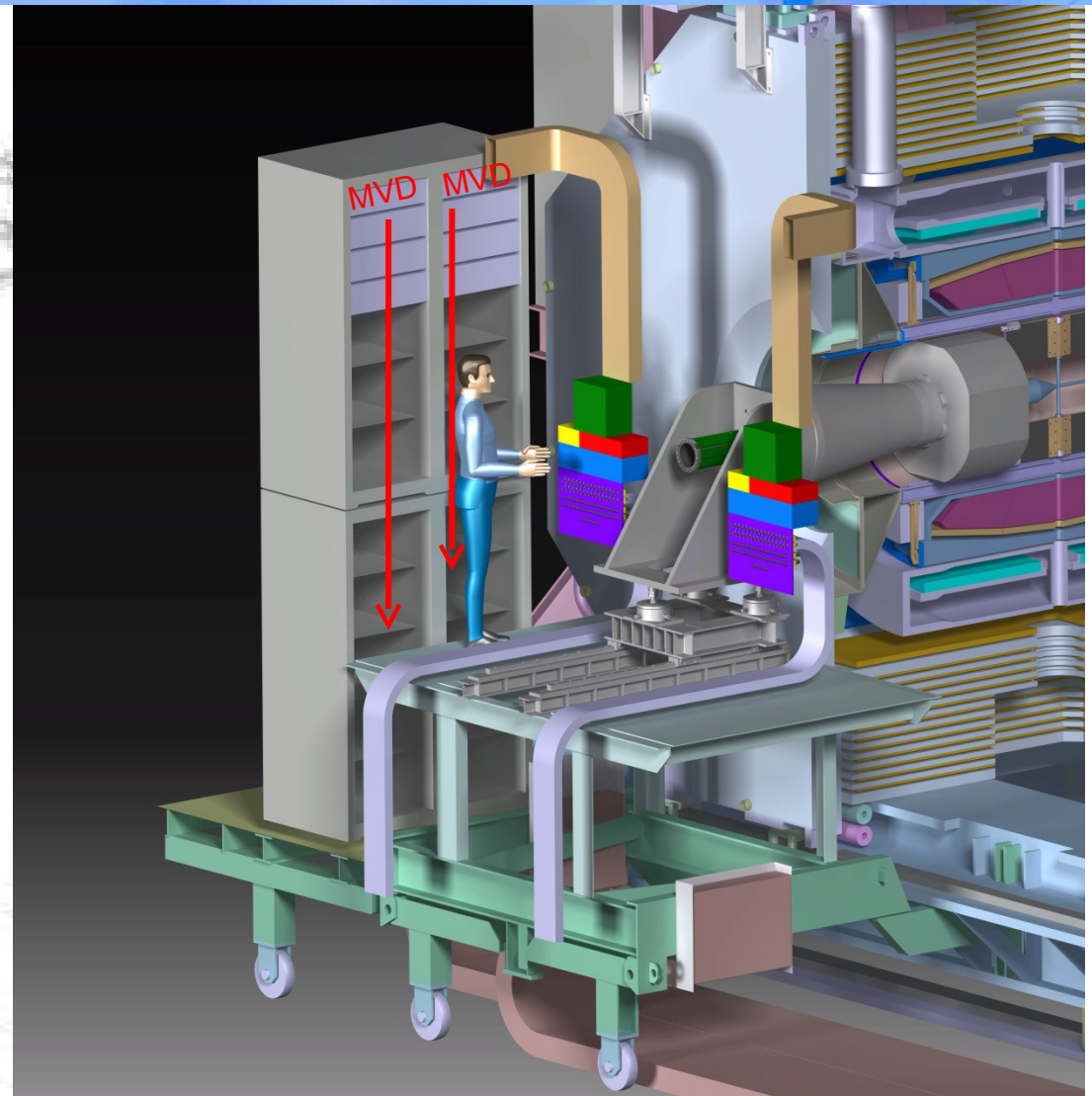


MVD cooling plant in the pit



Racks and patch panels

- Top 4 racks
- Patch panel planning still needs coordination

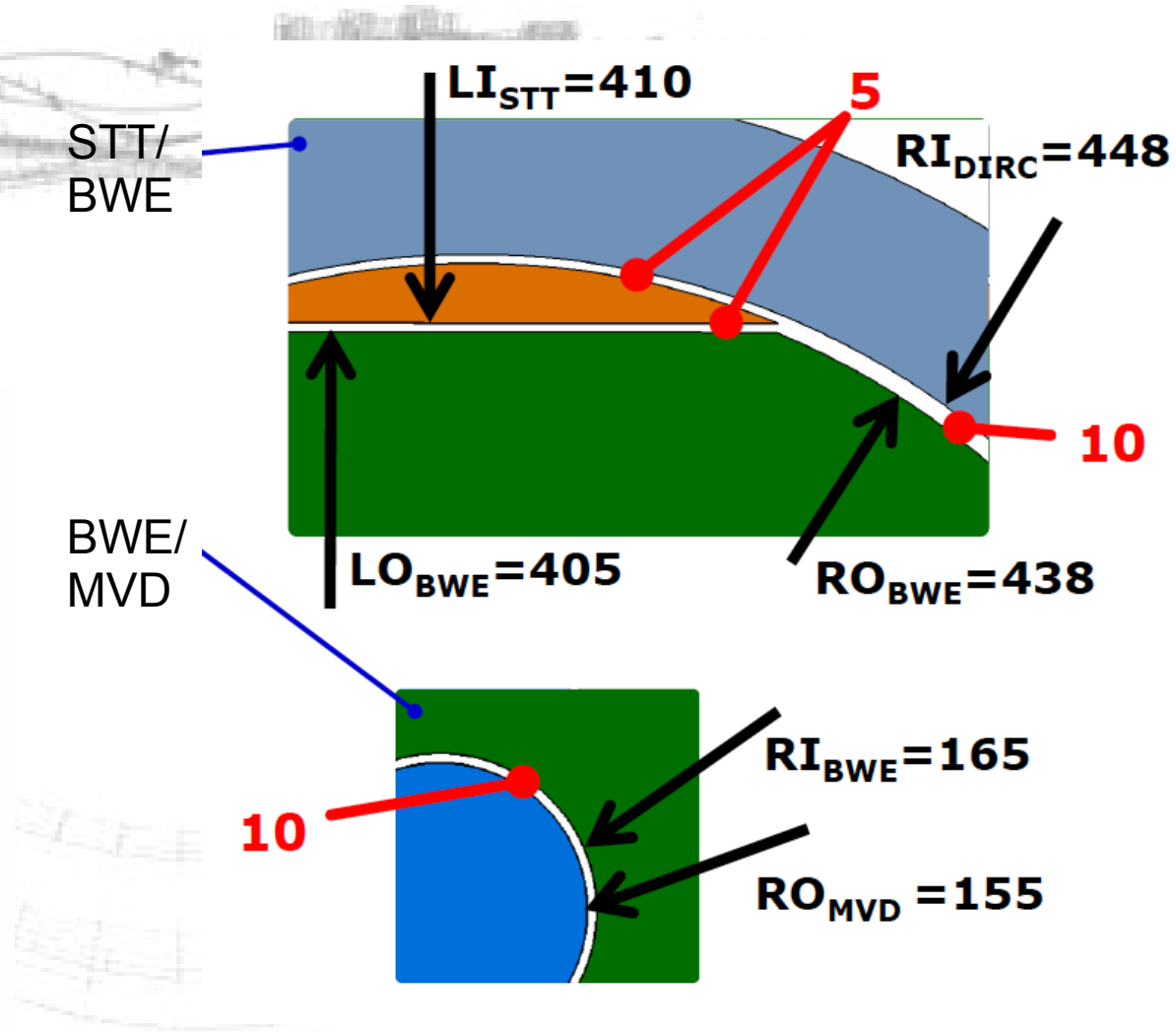
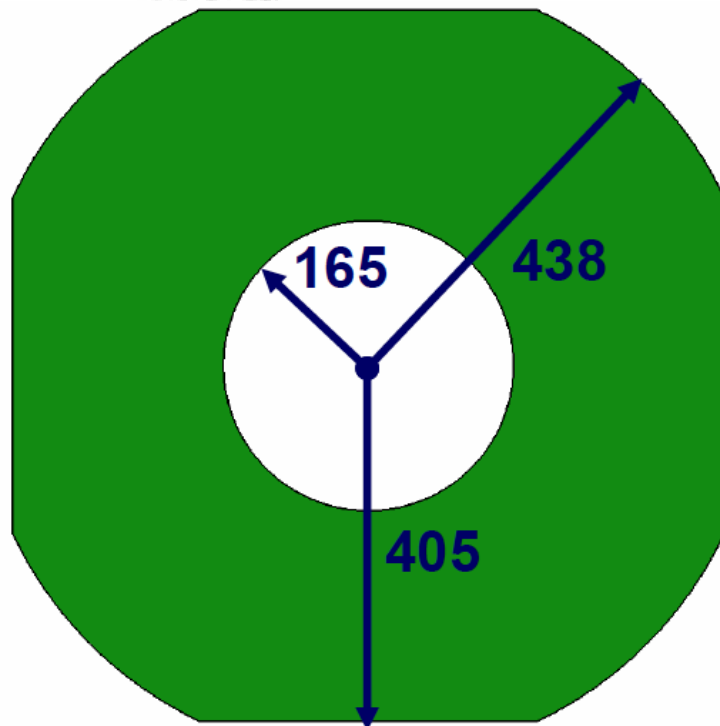


Integration of BWE and MVD



Original numbers

- BWE EMC design are based on this
- Safety tolerances 10mm, partly reduced to 5mm



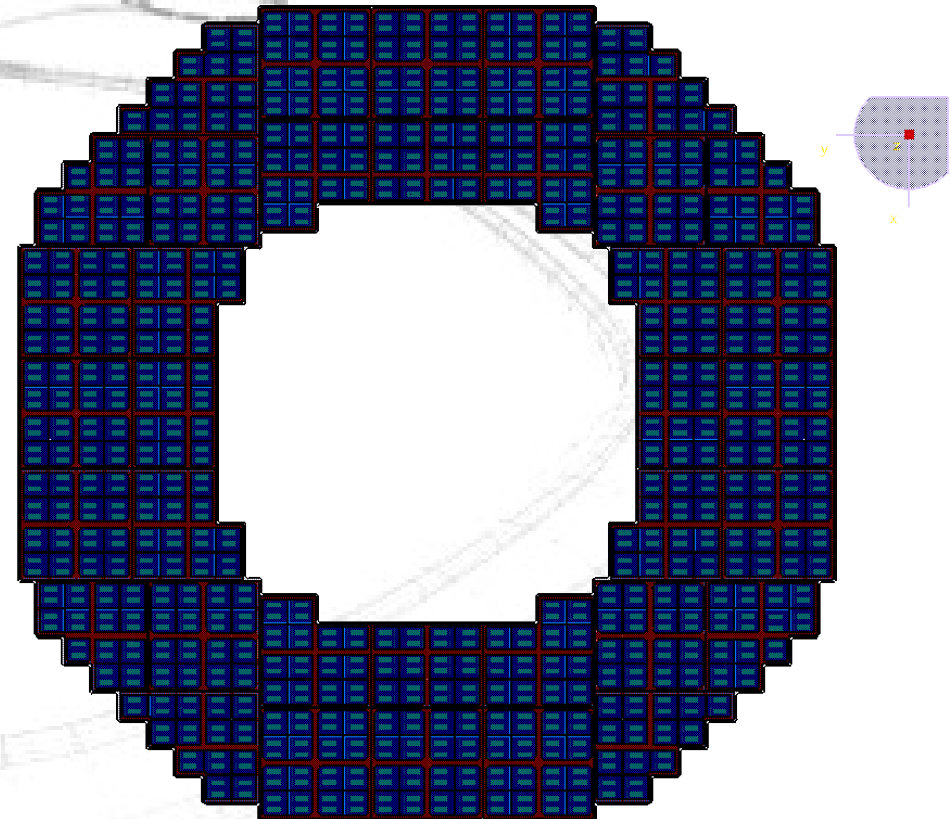
MVD requirements

- DC-DC converters leave too little space for cables
- Optoboards (production version from CERN) are larger than originally planned
- Connectors require larger distance
 - *More space in r around beam pipe*
 - *Additional 30cm shift of vacuum pump*

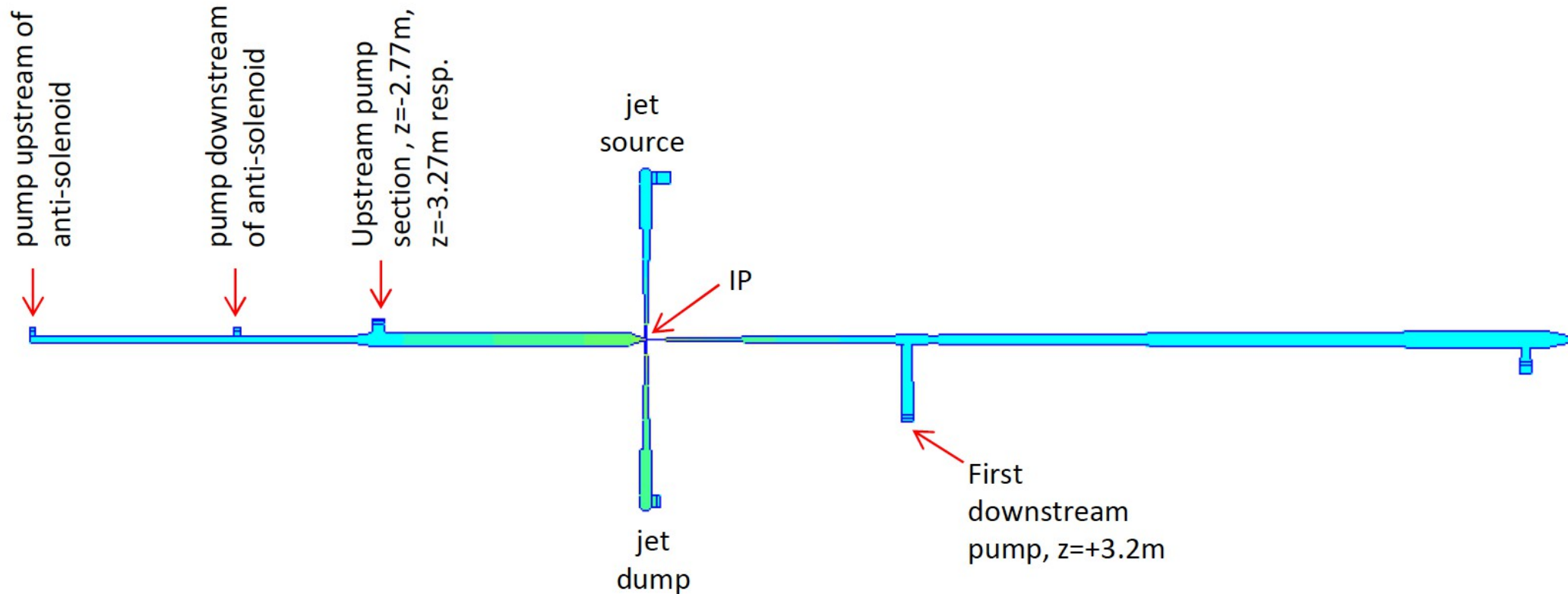
MVD services squeezed tight inside BWE

Procedure to fix interface

- Final design of MVD services
 - GBTx layout
 - DC-DC layout
 - All cooling lines
 - All cables
- Evaluation of impact on BWE
 - Finalize dimensions & tolerances
 - Minimize impact on design
 - Max. one change
- Impact on beampipe & vacuum
- Documentation and agreement (if needed with signatures)



Beampipe and Vacuum

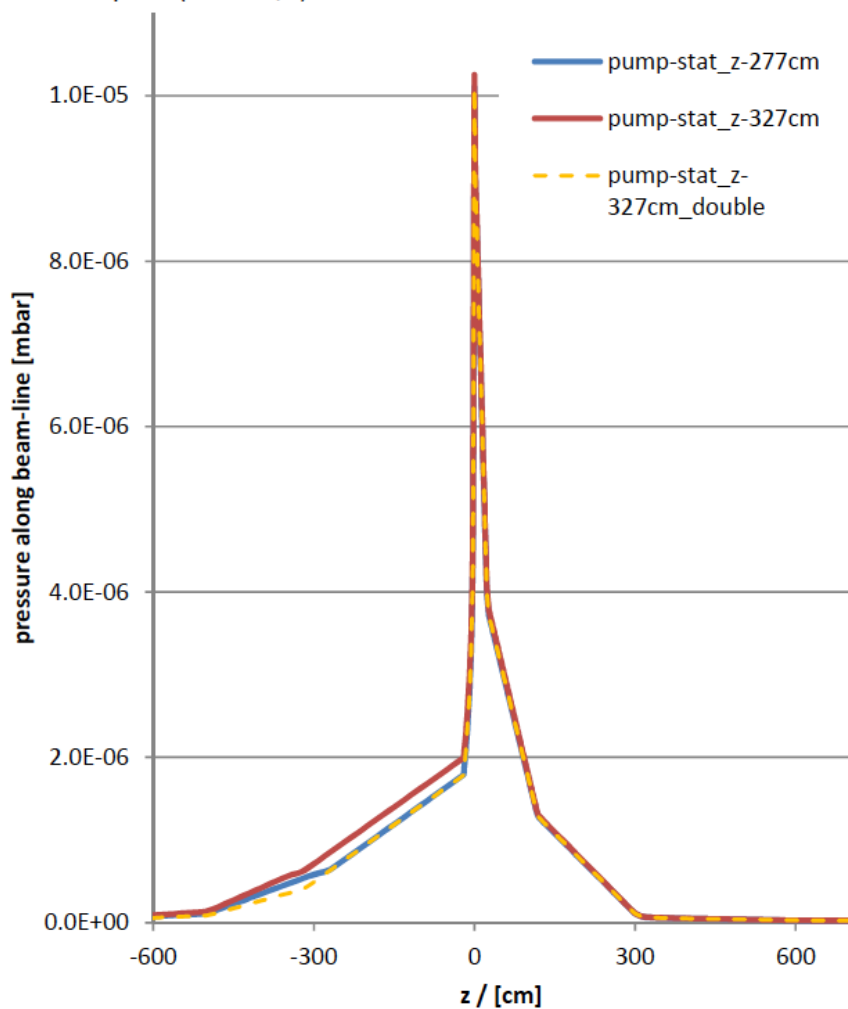


- Request by MVD/STT/BWE to shift pump by 20cm
- Additional request by MVD for 30cm more
- Total shift of 50cm impacts on vacuum!

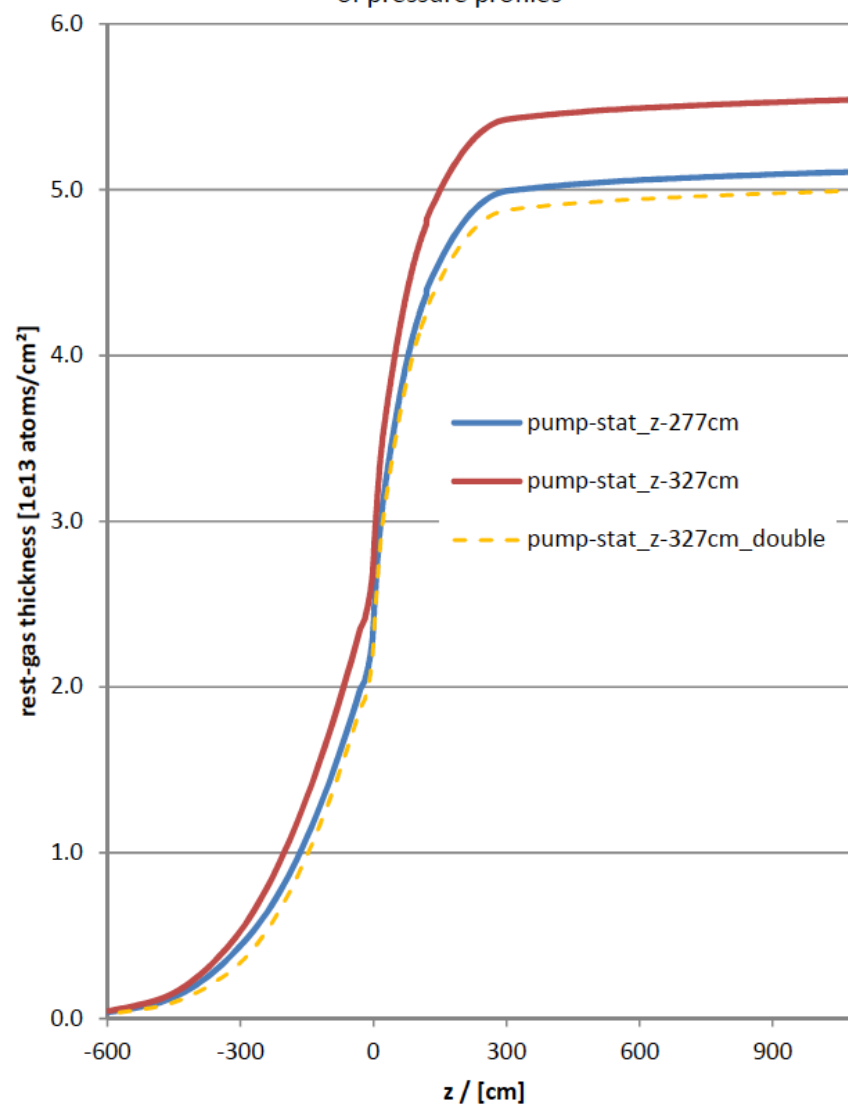
Beampipe and Vacuum



Pressure profile of rest gas along beam-line, assumed gas load at IP due to beam-target interaction 0.001 mbar·ltr/s (unknown, just a rough guess), position of upstream turbos at $z=-277\text{cm}$, $z=-327\text{cm}$ resp., dashed line double pumping speed (2700 ltr/s)

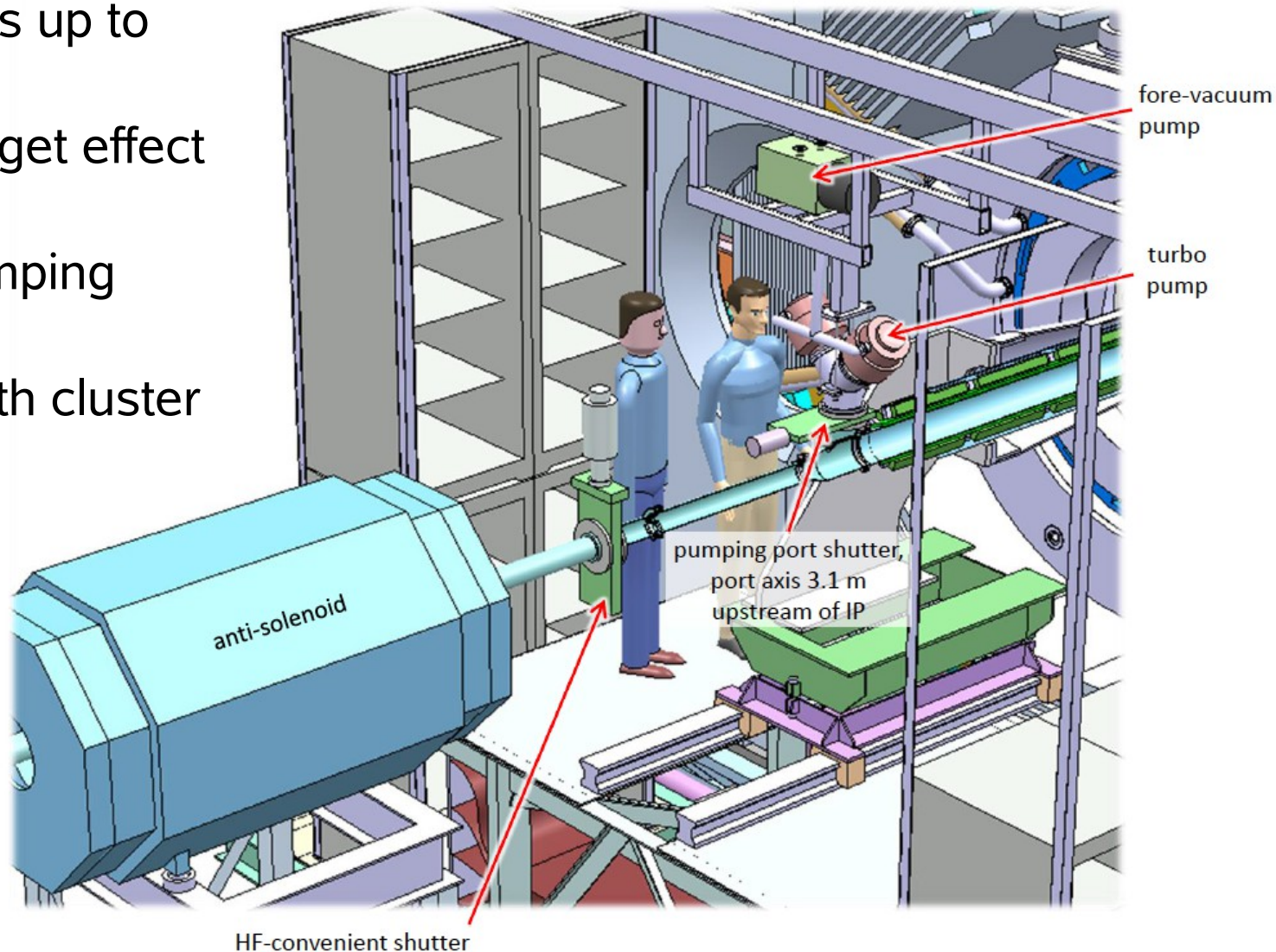


Rest-gas thickness (hydrogen atoms), derived from integral of pressure profiles



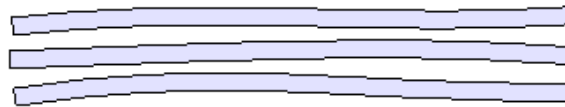
Beampipe and Vacuum

- Rest gas thickness up to 20% of target
- Unknown beam-target effect on rest gas
- Tests to verify pumping scheme
- Measurements with cluster target at COSY

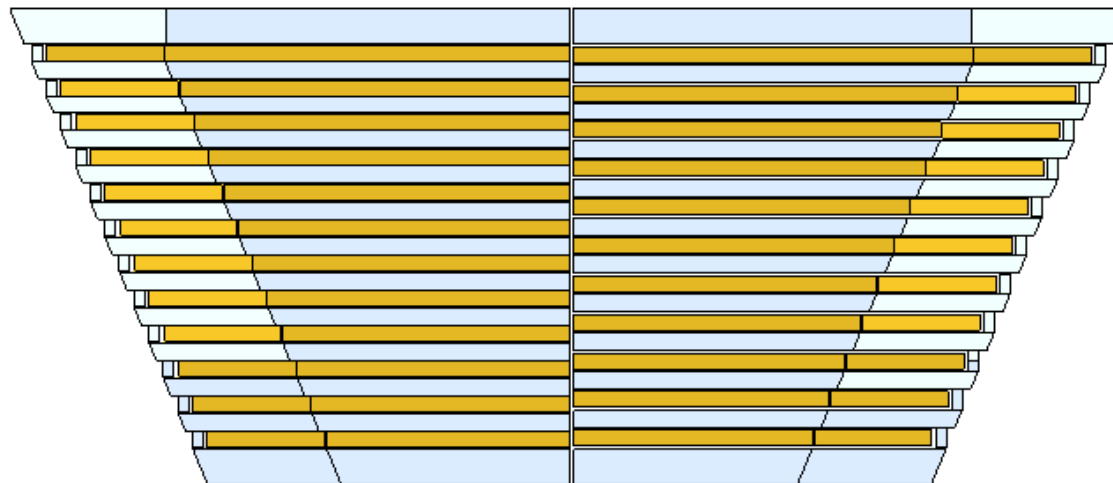


Modification of TS Barrel Yoke

- Maximum thickness of muon counter 27 mm
- Nominal distance between barrel plates in previous design: 30 mm
- Flatness of not machined steel plates worse than 3 mm



- Nominal distance between barrel plates in modified design 35.5 mm
- Cost reduction expected due to wider tolerances

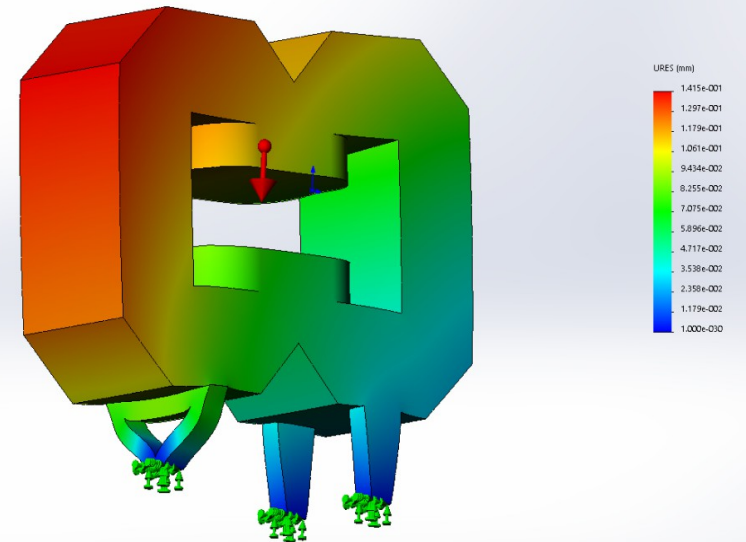
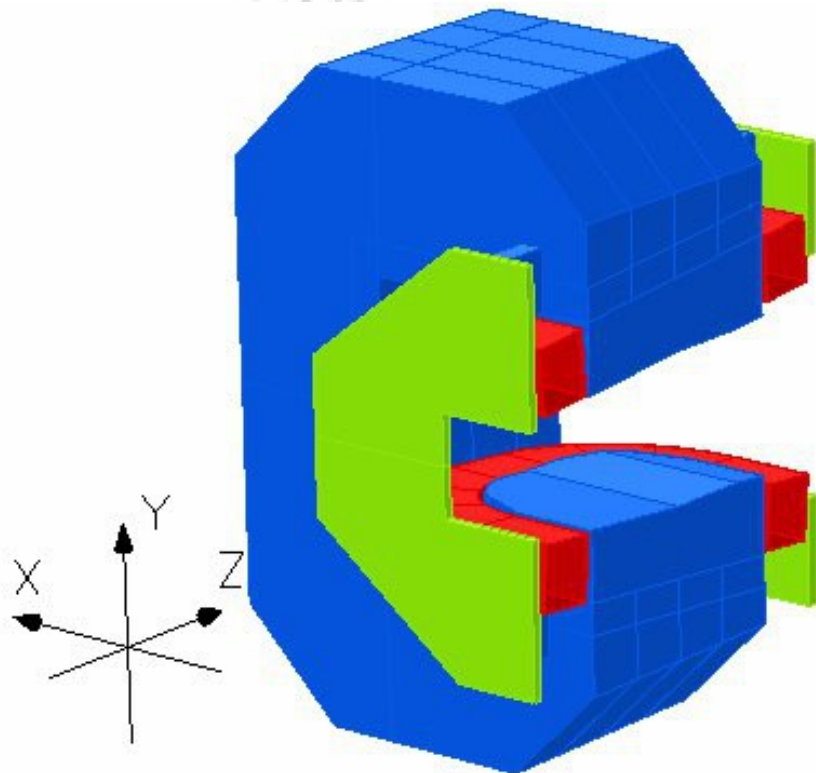


previous design
(12 muon layers
between barrel plates)

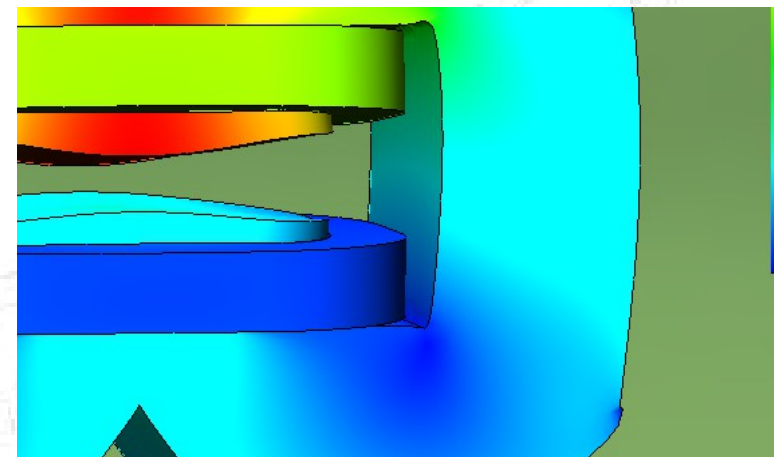
modified design
(11 muon layers)

Dipole Magnet Status

- ANSYS for field calculation and simulation of mech. and mag. Forces
- Yoke segmentation 20cm (was 10cm) sufficient for 60s ramp time



Deformation due to gravity 12 μ m



Magnetic force 240t, deformation 40 μ m

Conclusions



- Hall planning stalled for more than a year, will resume soon
- Our service planning in the hall is ongoing
- Mechanics of most detectors very advanced
- Services at the near detector side are tight
- Beampipe and vacuum need to be studied, prototype mock-up needed
- Still clashes and problems to resolve, but no unsolvable mysteries