

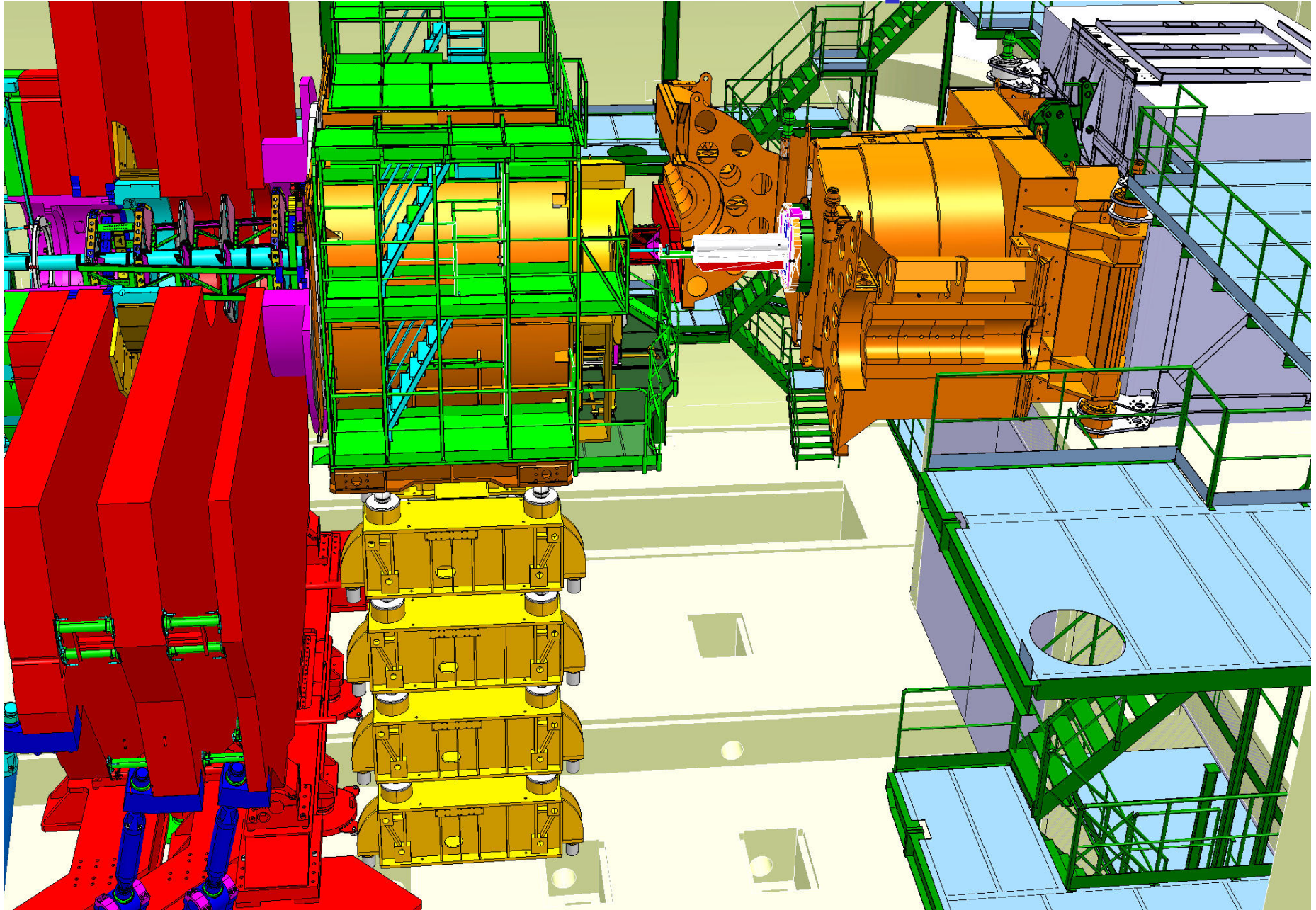


TOTEM T1 removal procedures on CMS (in UXC55)

V1

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M. Bozzo
12.02.2013

Position after Beam stop



General requirements:

- to take into consideration the activation level in T1 area all the works have to be planned and optimised including an estimate of the collective dose and of the individual effective doses to the workers participating in the completion of the task (Dossier D'Intervention en Milieu Radioactif - DIMR). The planning and optimisation should consider the limitation of the work time and manpower, also to assign the protection means. The operation works have to be confirmed by CERN **ALARA committee**.
- all the operation steps with T1 have to be confirmed by **CMS technical coordinator, Safety coordinator, GLIMOS, EAM, TSO and BP supervisor**. All the works should be satisfy the requirements and documents of works accepted in CERN, CMS, UXC55, SX5.
- all the underground works have to be planned by means of **ACT (Activity Co-ordination Tool)** with appointment of the works and safety coordinators.
- All works should be coordinated with representatives of adjacent subsystems and sub-detectors (HF, TOTEM T2, CASTOR, BRM, BP-group, gas, cooling groups) who can appoint supervisors at separate operations.
- Only skilled and experienced personnel have to be permitted to the works. Qualification and training procedures will be established.
- To use on the CMS Forward zone a non-magnetic tools (titanium) only.

Risks:

- the works close to the BP;

- ionizing radiation;

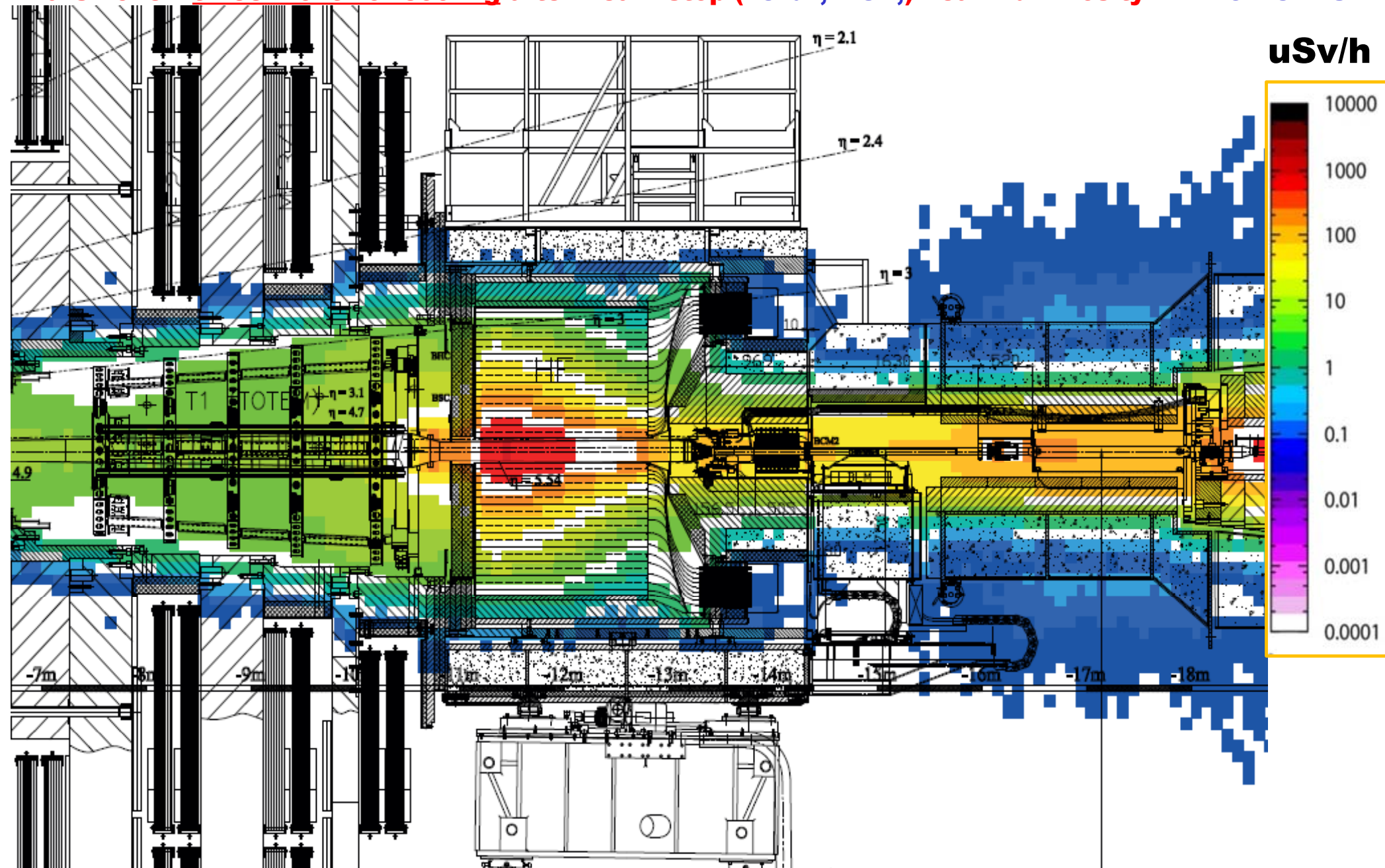


- work at height;

-the works under the overhead crane.

Activation maps (FLUKA simulation)

Mars 2013 – three month of cooling after Beam stop (25fb⁻¹;4TeV;) Peak Luminosity ~ 7x10³³ cm⁻²s⁻¹



1. Stop the gas and cooling circulation.

**T1/T2 Gas RACK
Near side on the
Collar Platform**



**T1 cooling
flowmeters**



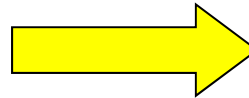
**Forward
cooling
plant**



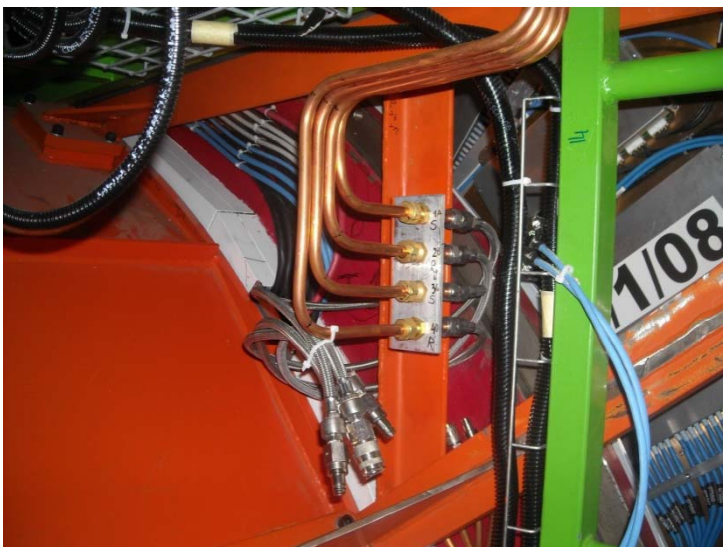
2. Disconnection of services between inner disk YE4 and HF. Works on top and side structure of HF (HF on 4 risers). Expected execution time – 2 h

- Gas (in the first place disconnect 10 inlet gas pipes – smaller diameter !)
- Cooling
- Cables (T1, Joao's. magnetic).

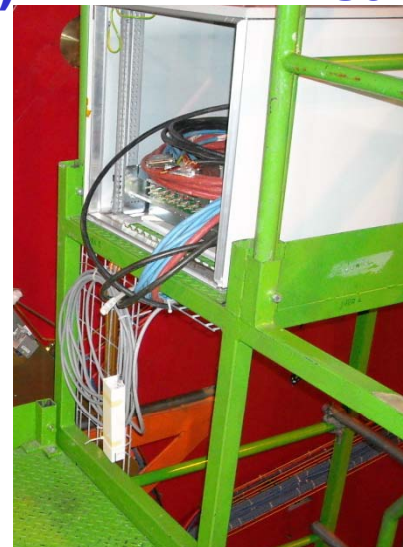
Gas (10 +10 lines;
quick-connectors). Near side



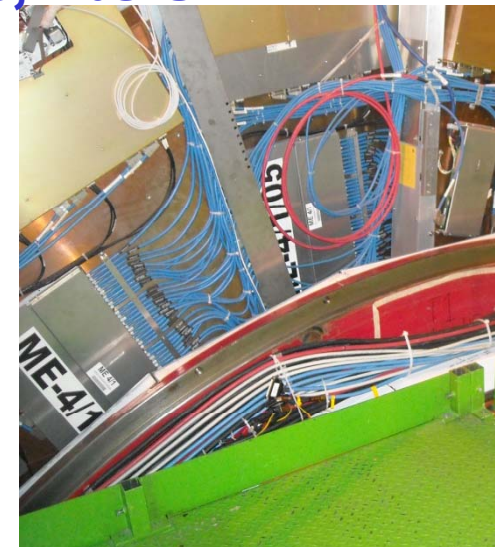
Cooling (4 lines; quick-connectors)
and magnetic lines. Far side.



Cables, fibers



T1 RACKs

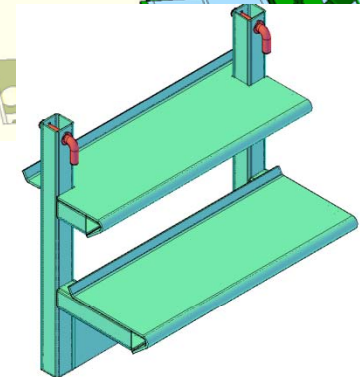
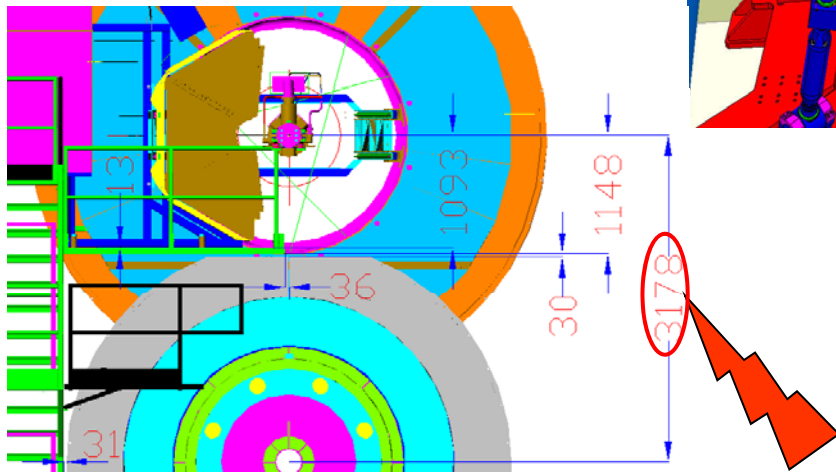
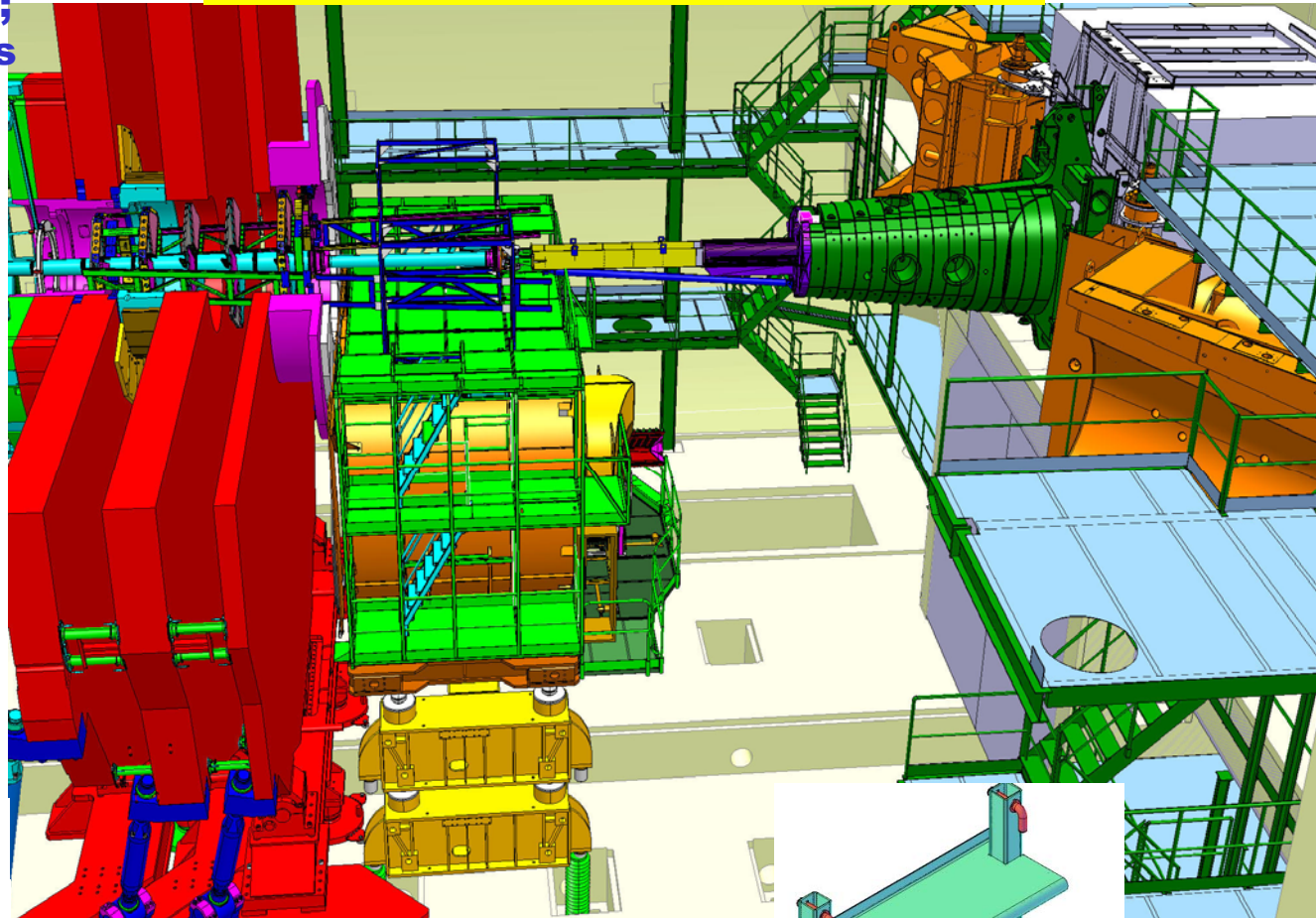


Cables fixing

3. CMS configuration:

- HF is on two Risers and closed (Forward disassembly sequence); Removing two Risers lowers HF by 3178 mm, which is what is requested for the insertion of T1.
- Handrail on IP side and 2 steps (far and near) on the top of HF should be removed;
- Mounting of extension BP support (protection of CT2 pipe).
- Remove three spider wires to allow for Truss and Detector insertion

Scaffolding in order to have the access to HF (a scissor lift ?)

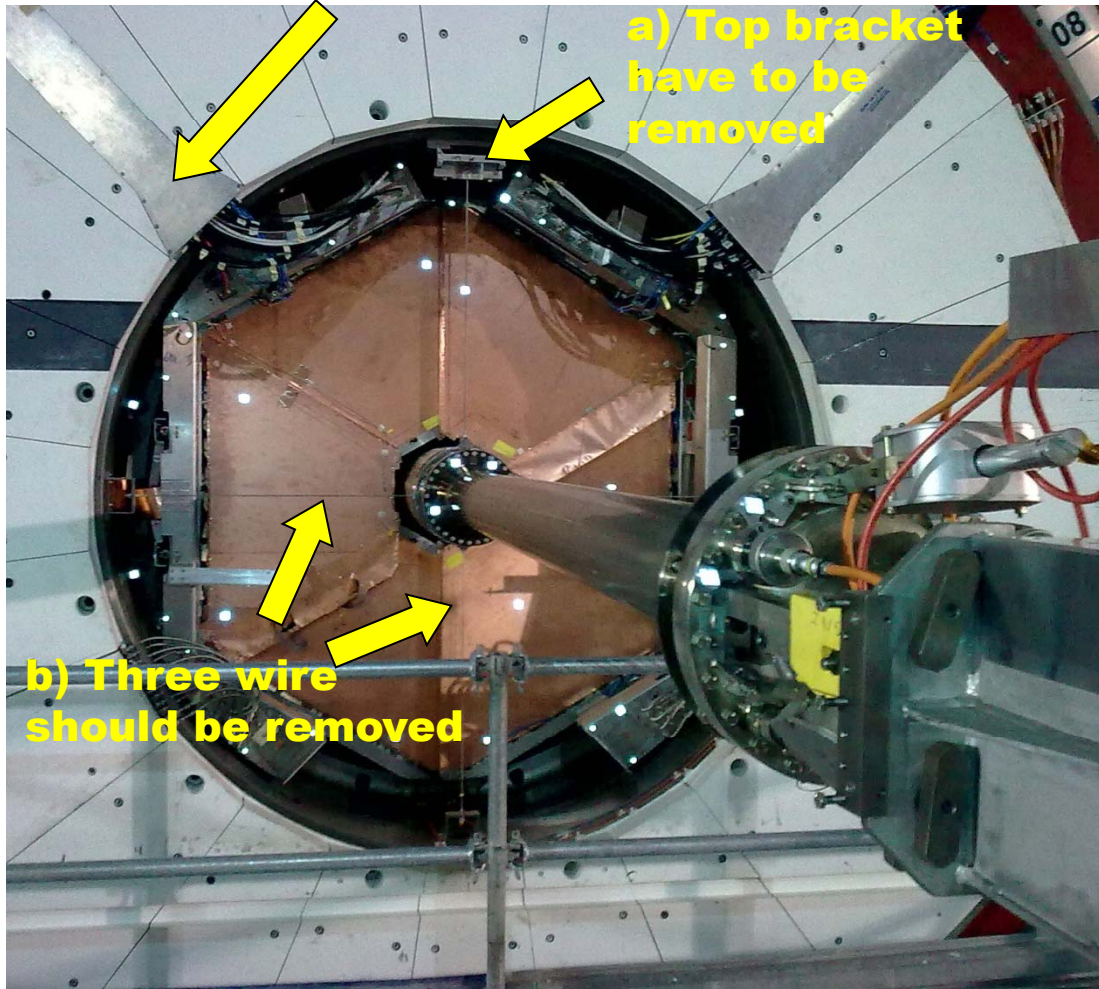


steps should be removed

c) cables should be released

a) Top bracket have to be removed

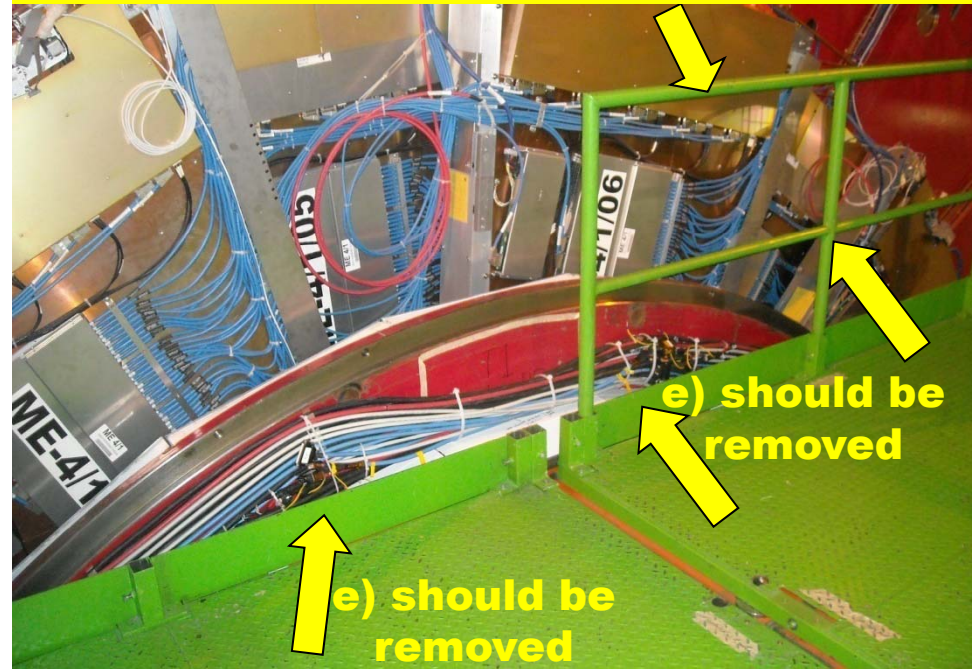
b) Three wire should be removed



Handrail on the top of HF should be removed

e) should be removed

e) should be removed

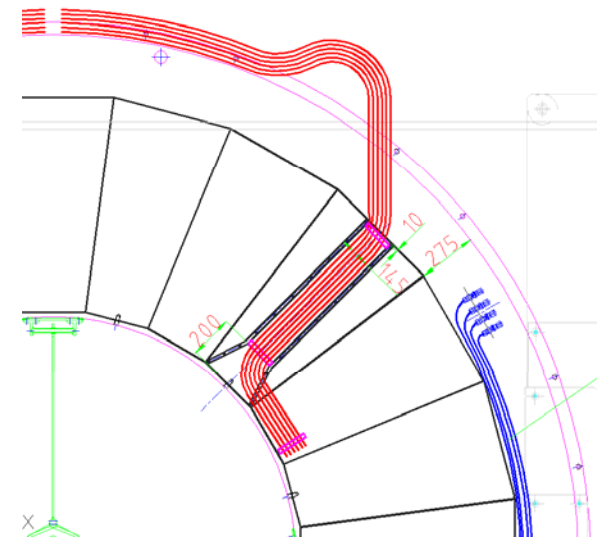


4. Disconnection of all the services lines from the T1 telescope (HF on 2 risers). Expected execution time – 2 h.

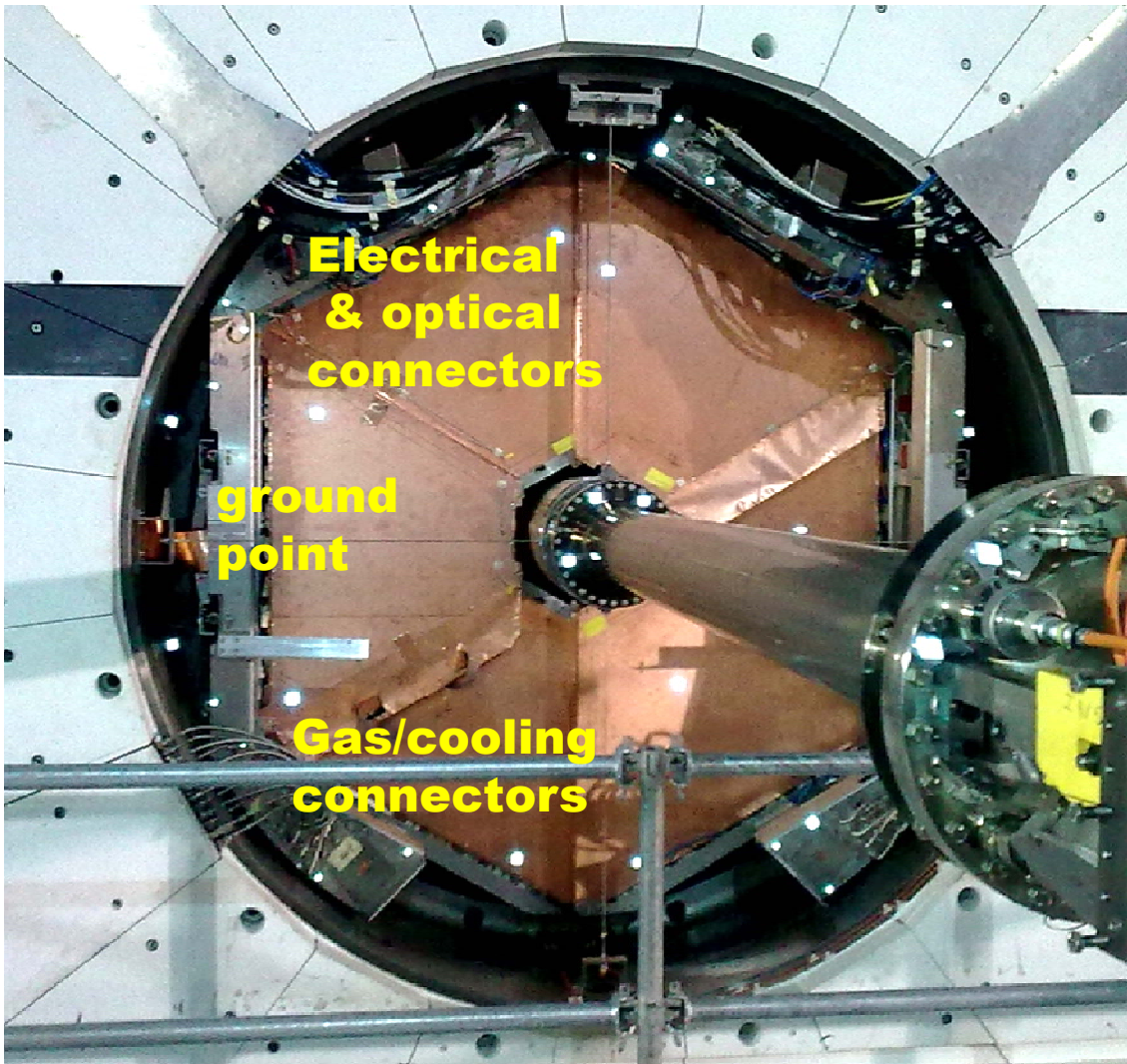
Patch panel on detector 6th layer only

- Cables, fibers DCS (connectors), grounding
- Cooling (quick-connectors)
- Gas (quick-connectors)

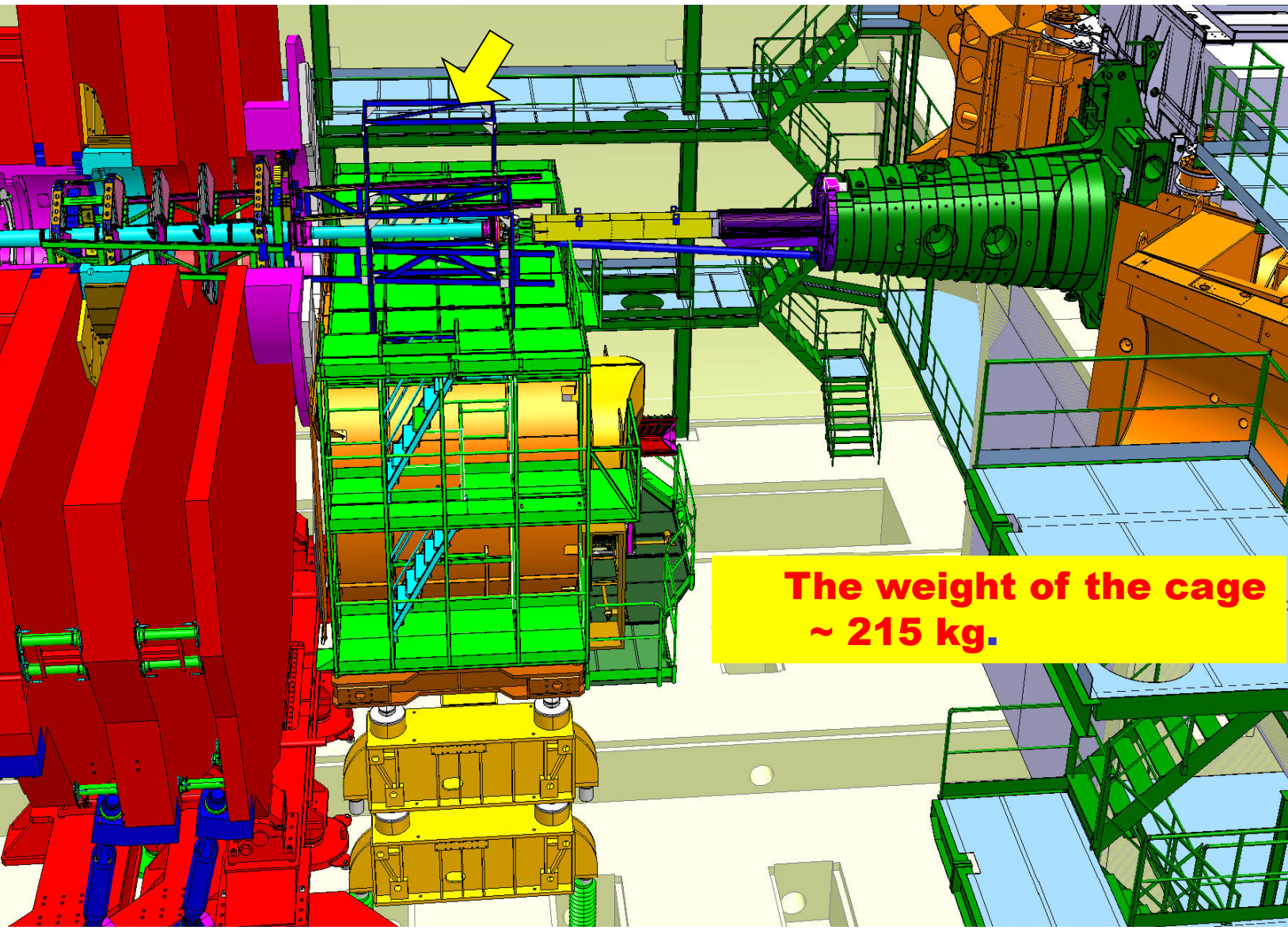
Cables, fibers should be fixed pro tempore,



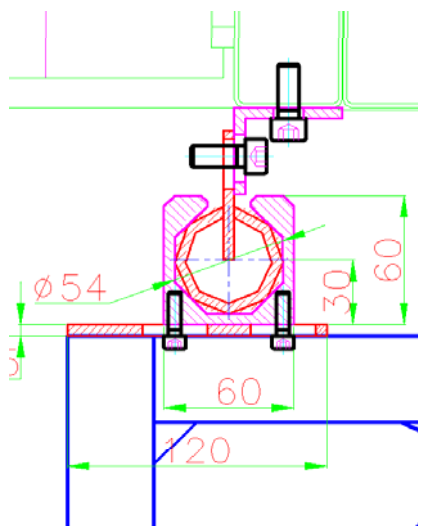
or should be removed completely on polyethylene block.



5. Putting of support cage to top of HF by crane of UXC55. HF is still 185 mm away from YE4 polyethylene disk. Expected execution time – 1 h.

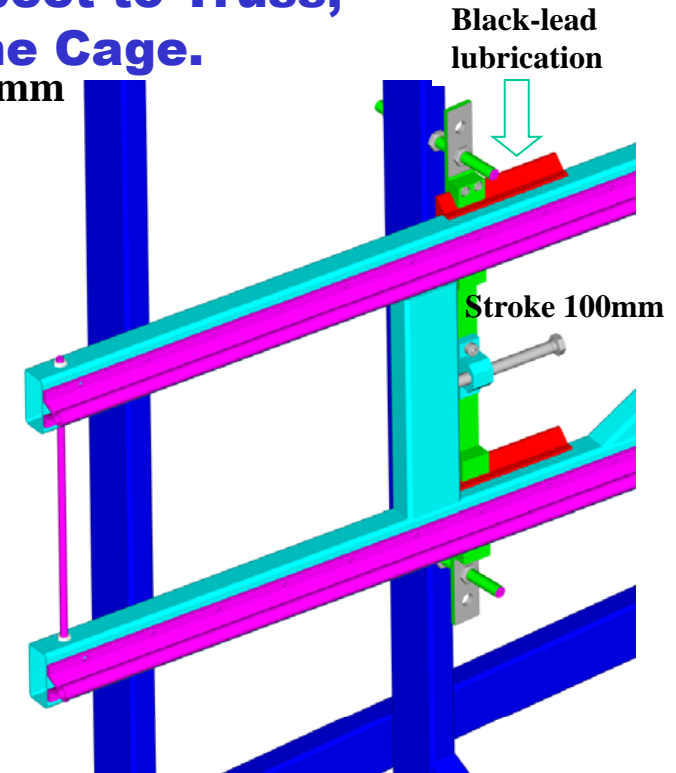
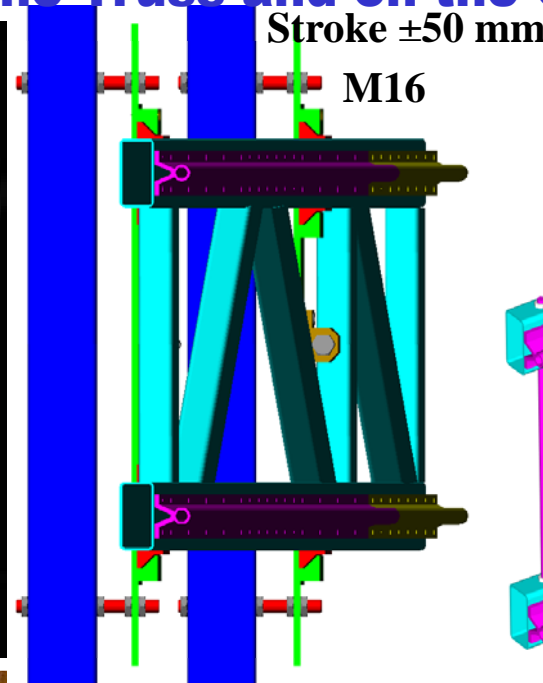
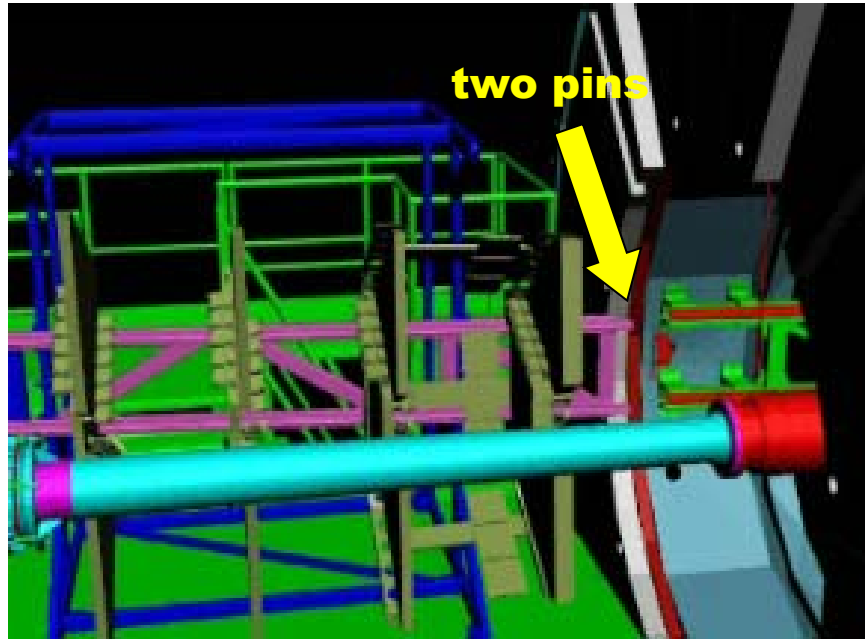


The weight of the cage ~ 215 kg.



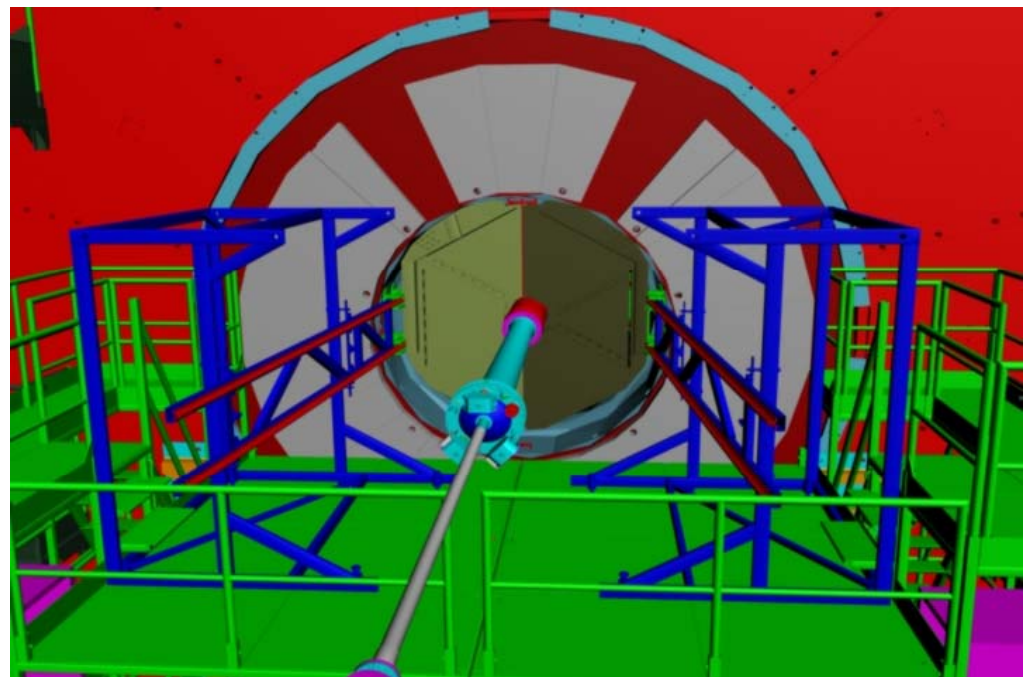
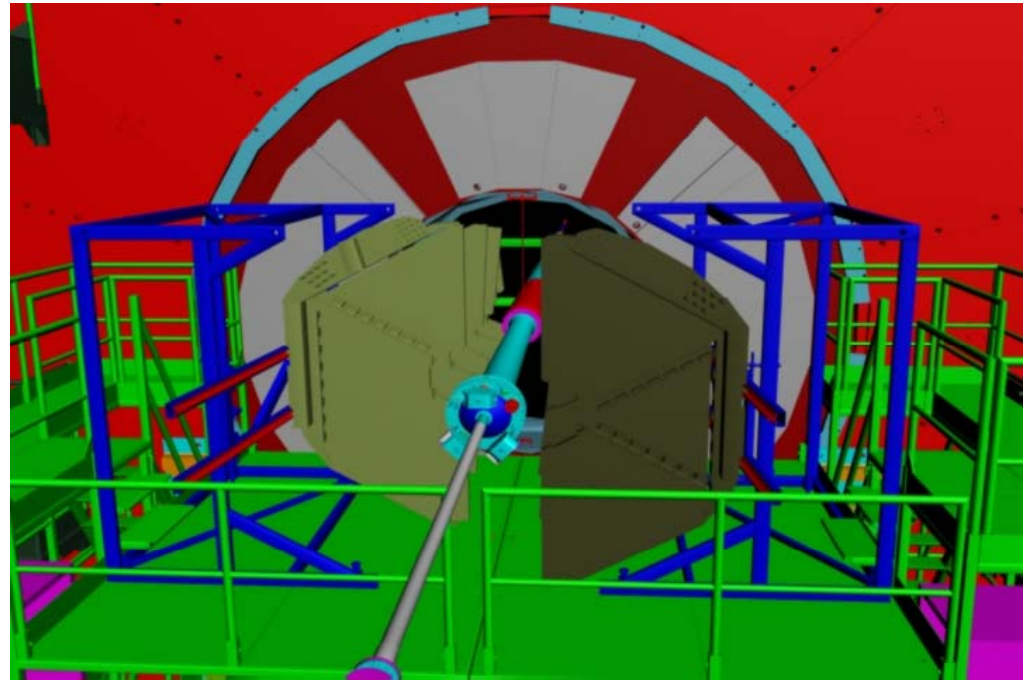
The exact places for the cages are fixed by vertical rods and are marked on the top of HF .

6. Moving HF close to the YE4 polyethylene disk (185 mm).
7. Connection and alignment of the Cage with respect to Truss; connection of IGUS-rails (on the Truss and on the Cage).



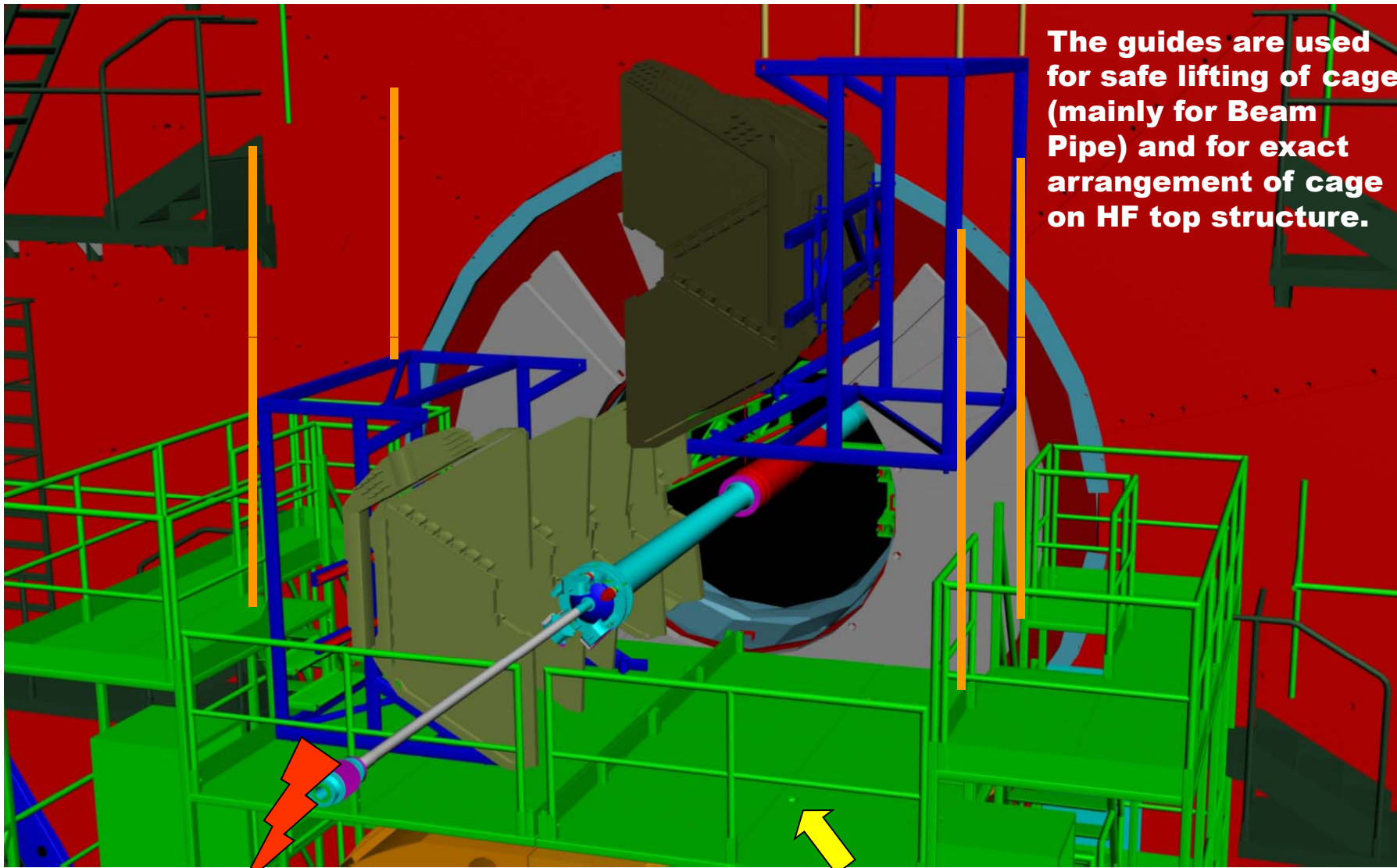
8. Extraction. Motion of two T1 half-telescopes synchronously; fastening T1 on its cage.

Expected execution time – 1 h.



9. Lifting of support cage with T1 by crane of UXC55. HF is shifted by 185 mm away from YE4 polyethylene disk.

Expected execution time – ½ d.



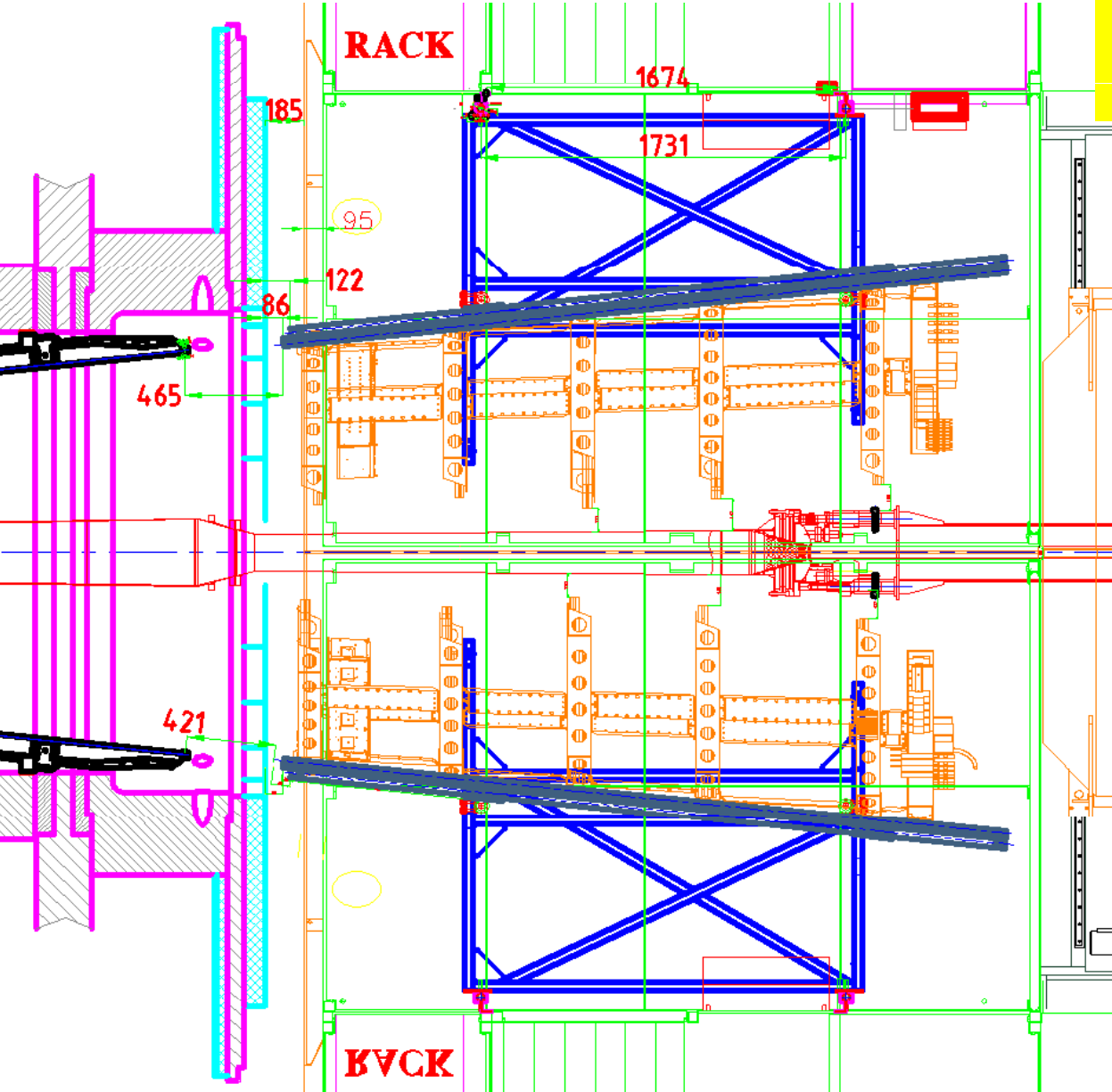
The weight of the cage ~ 215 kg

The weight of T1-quarter ~ 170 kg.

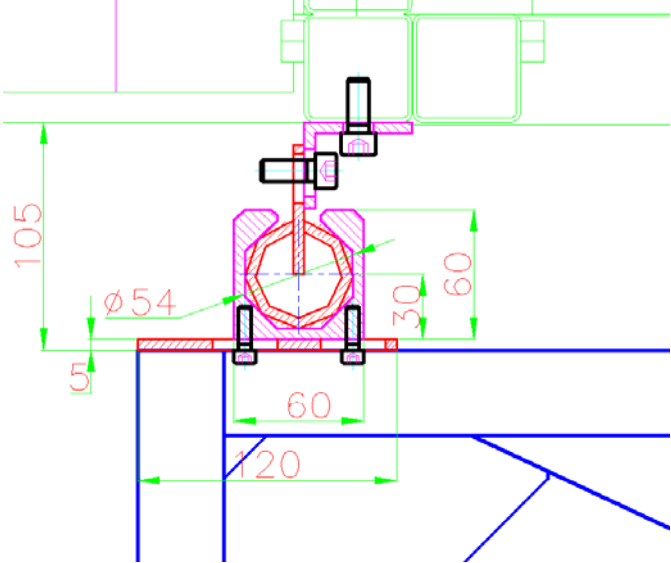
Σ ~ 385 kg

Layout during the lifting operation

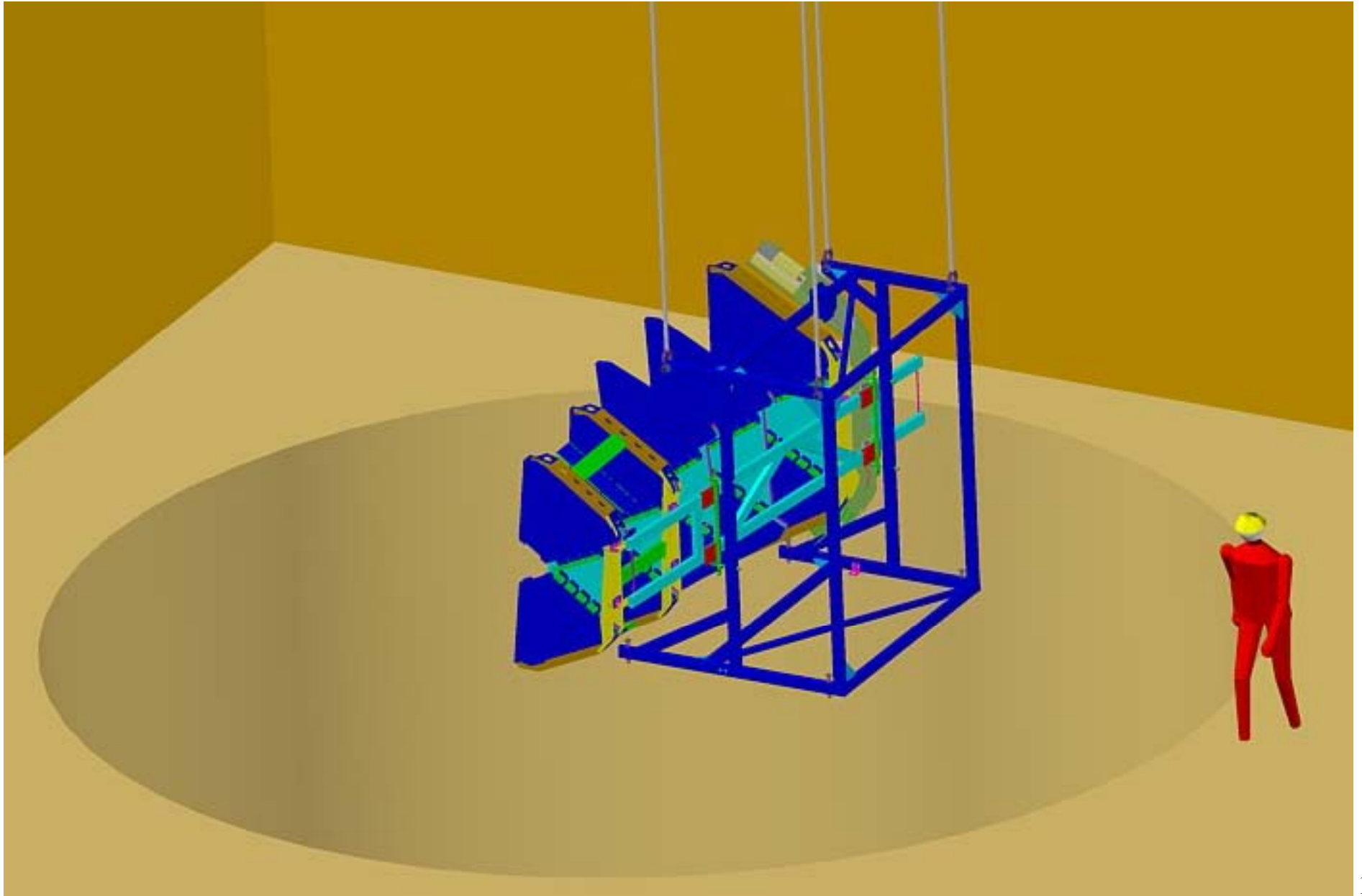
The minimum gap to Beam Pipe is 110 mm (during lowering)



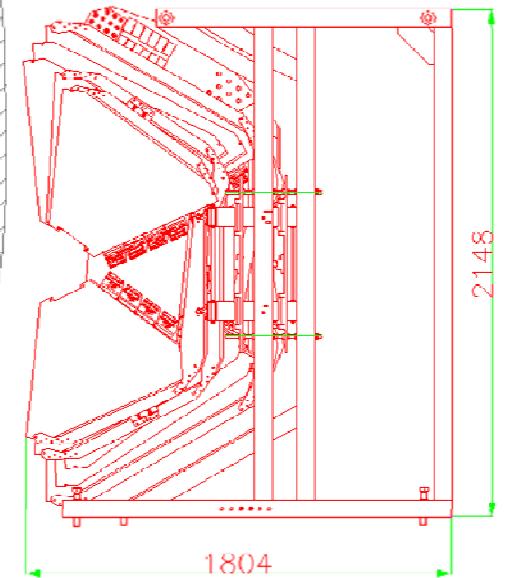
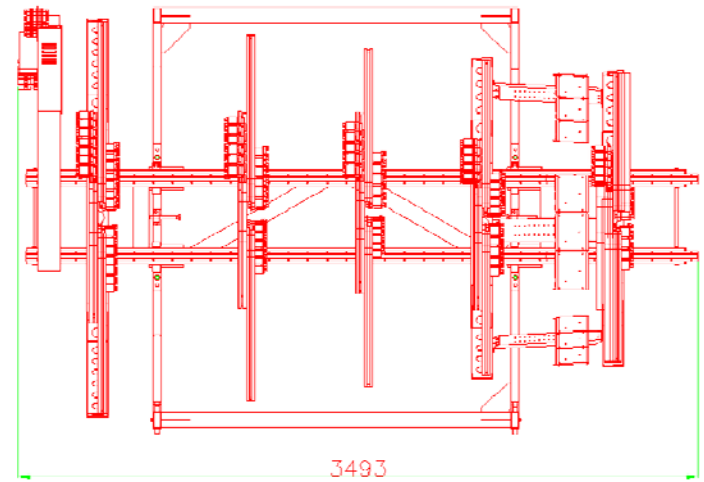
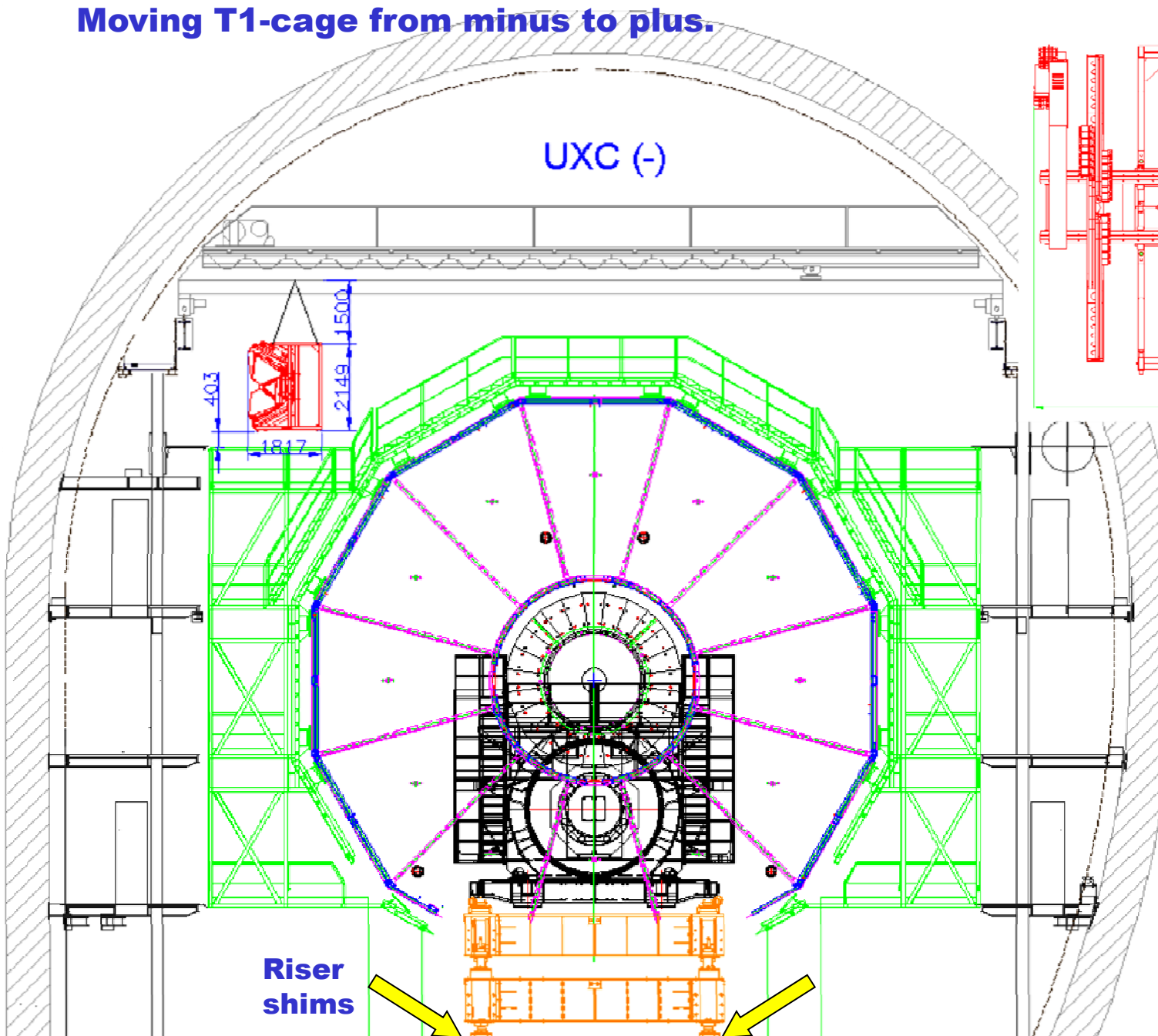
A special tool guides the Cage during lifting



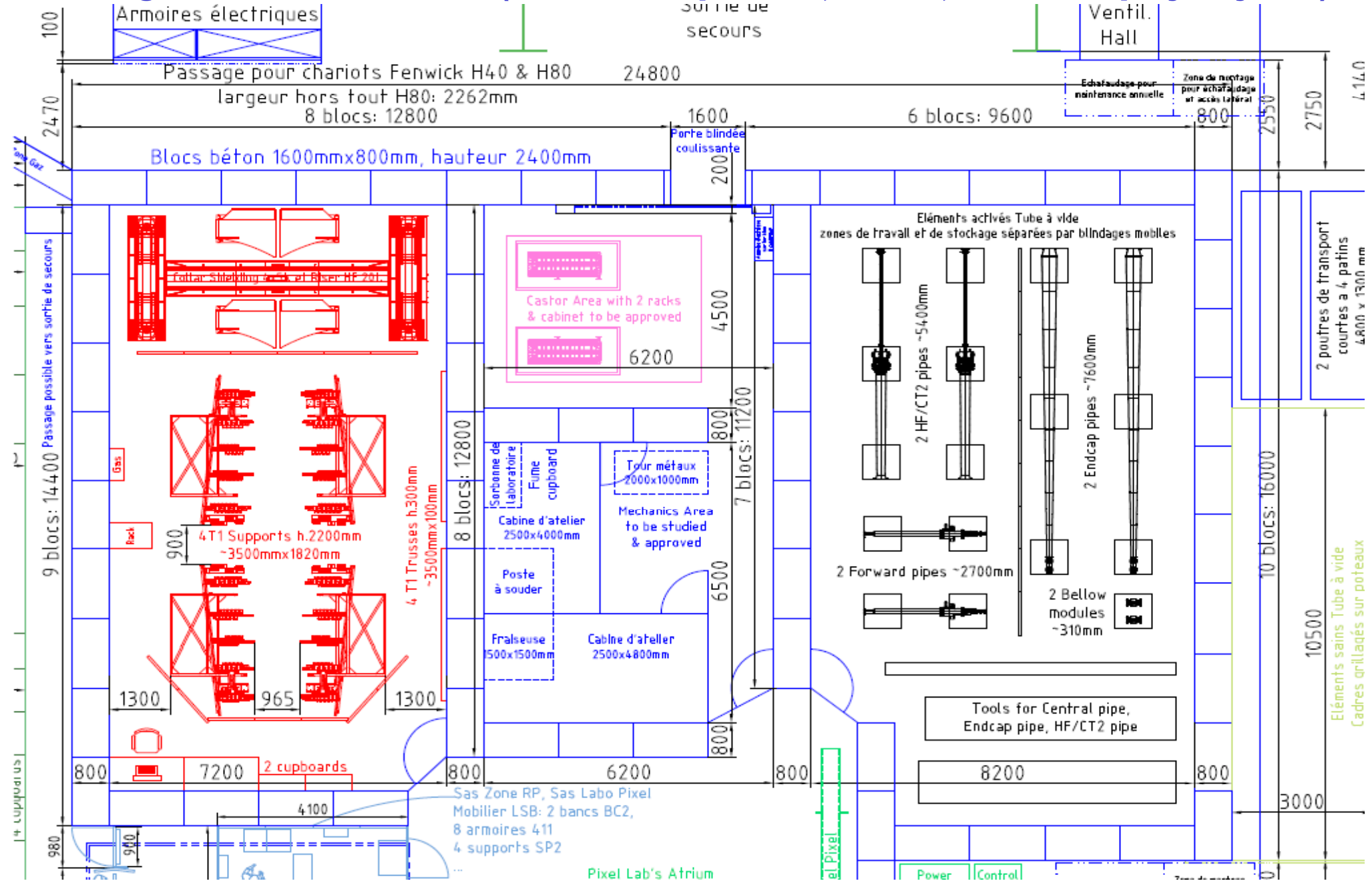
10. Transportation of T1-quarter (on its cage) to SX5 by crane of PX56 . (2 h)



Moving T1-cage from minus to plus.



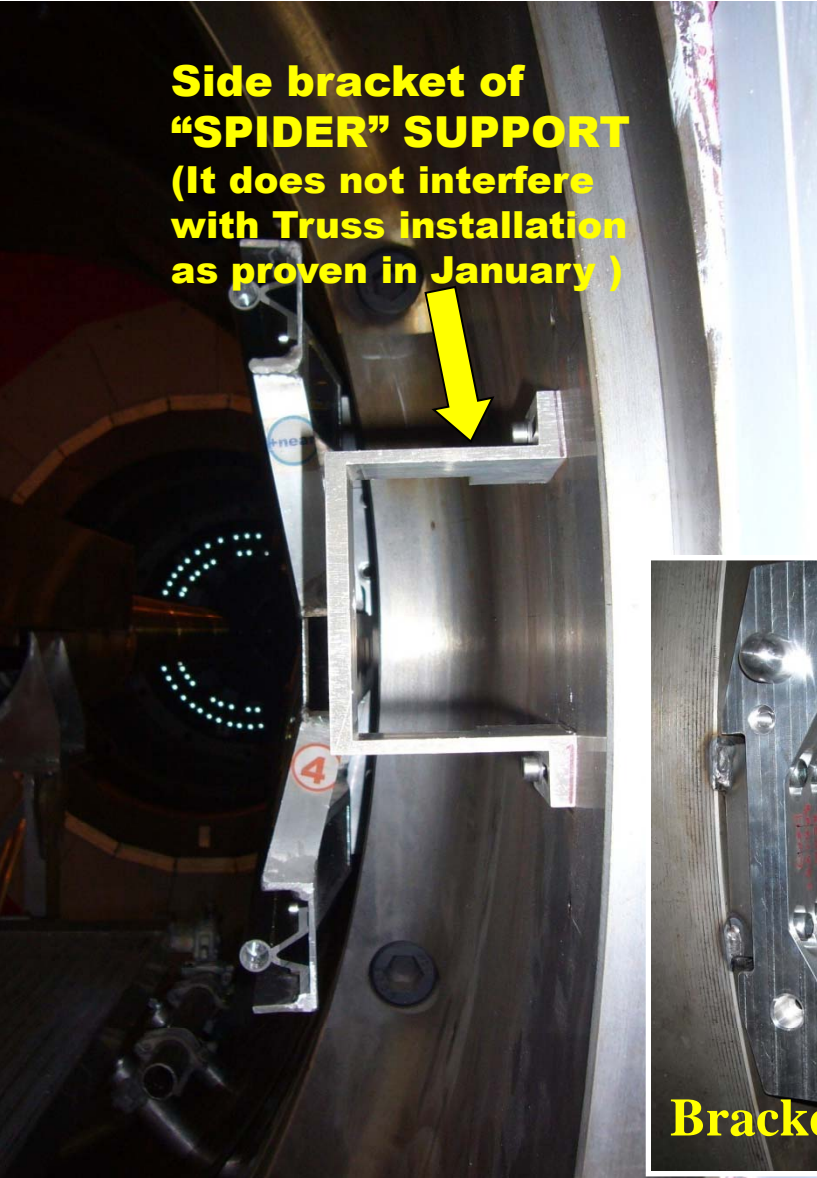
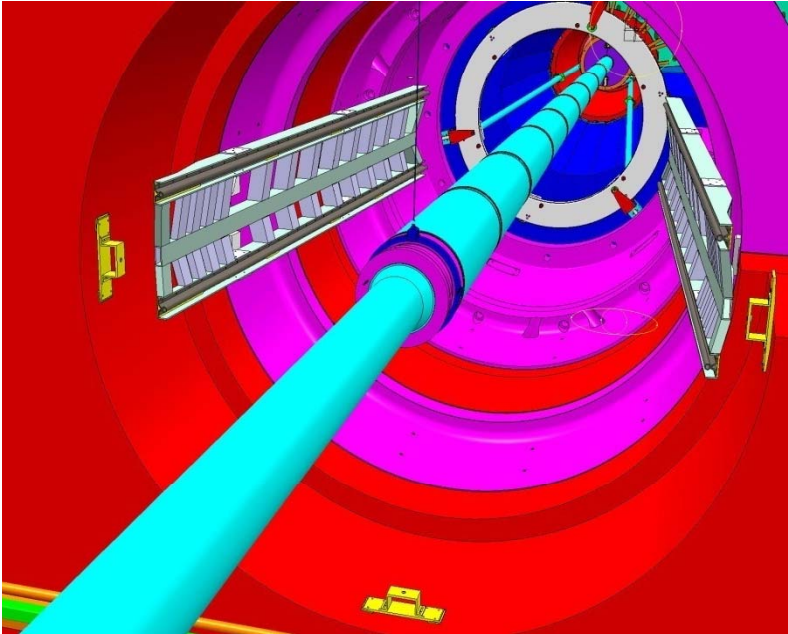
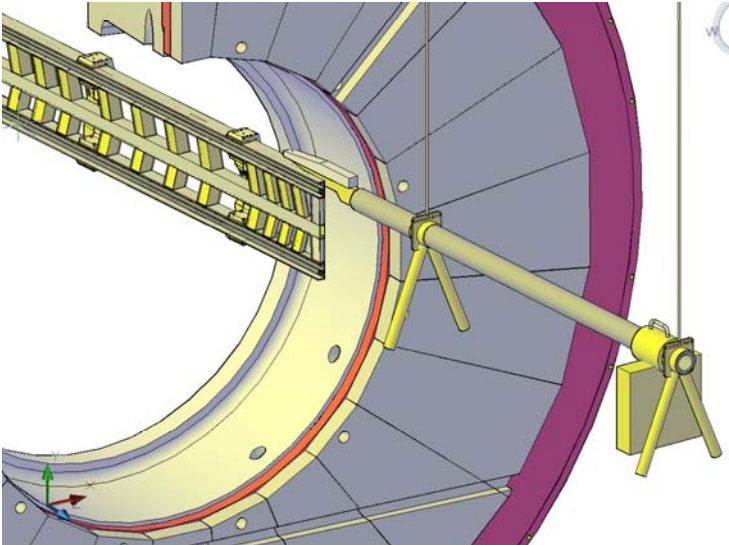
T1 storage area in B.SX5/3585. (For four T1 quarters, traces, cables on polyethylene)



Layout by Guy Duthion

11. Removal of the Trusses. See “T1-truss installation sequence”.

Expected execution time – 2 h.



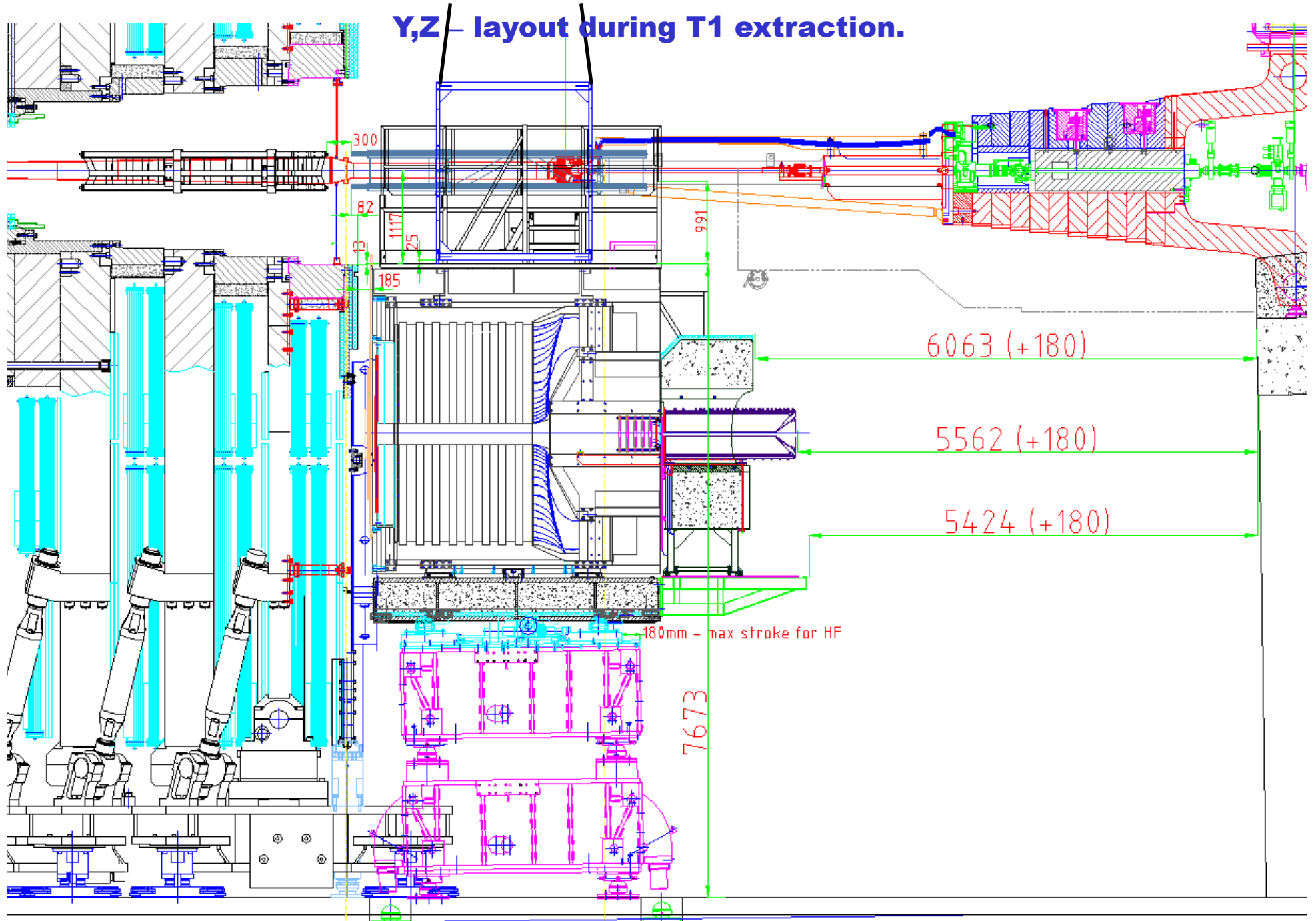
Side bracket of
“SPIDER” SUPPORT
(It does not interfere
with Truss installation
as proven in January)



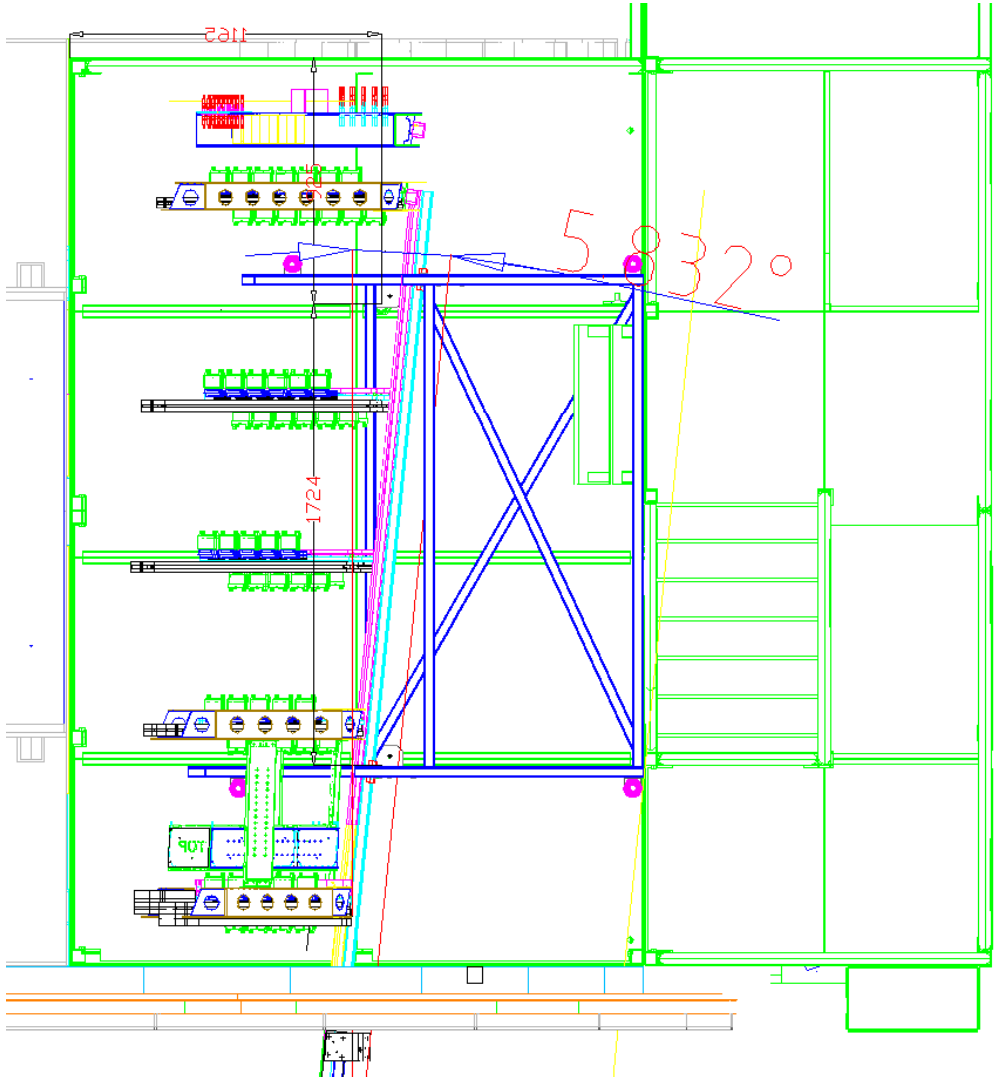
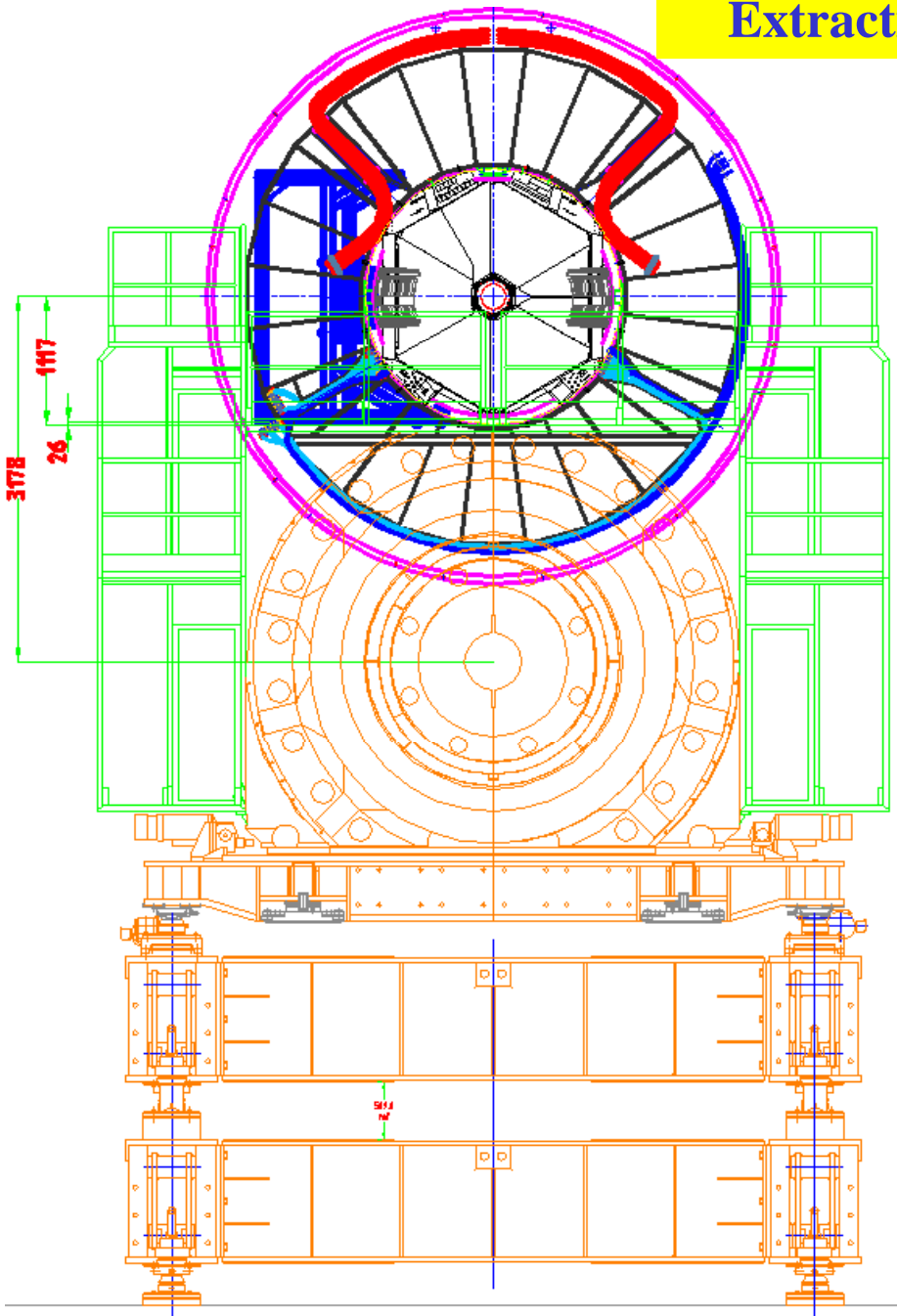
Brackets

Supplementary material

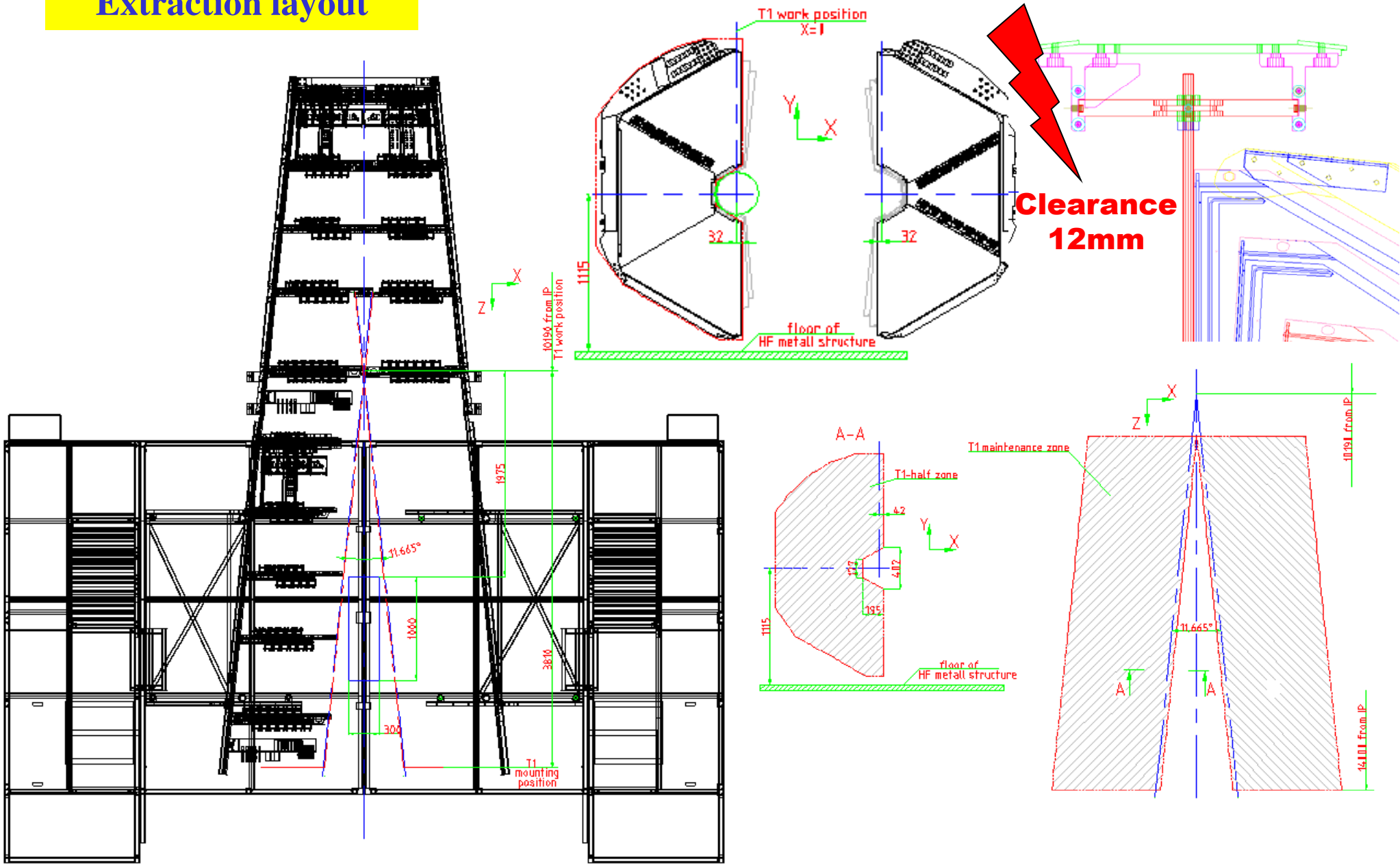
Y,Z - layout during T1 extraction.



Extraction layout



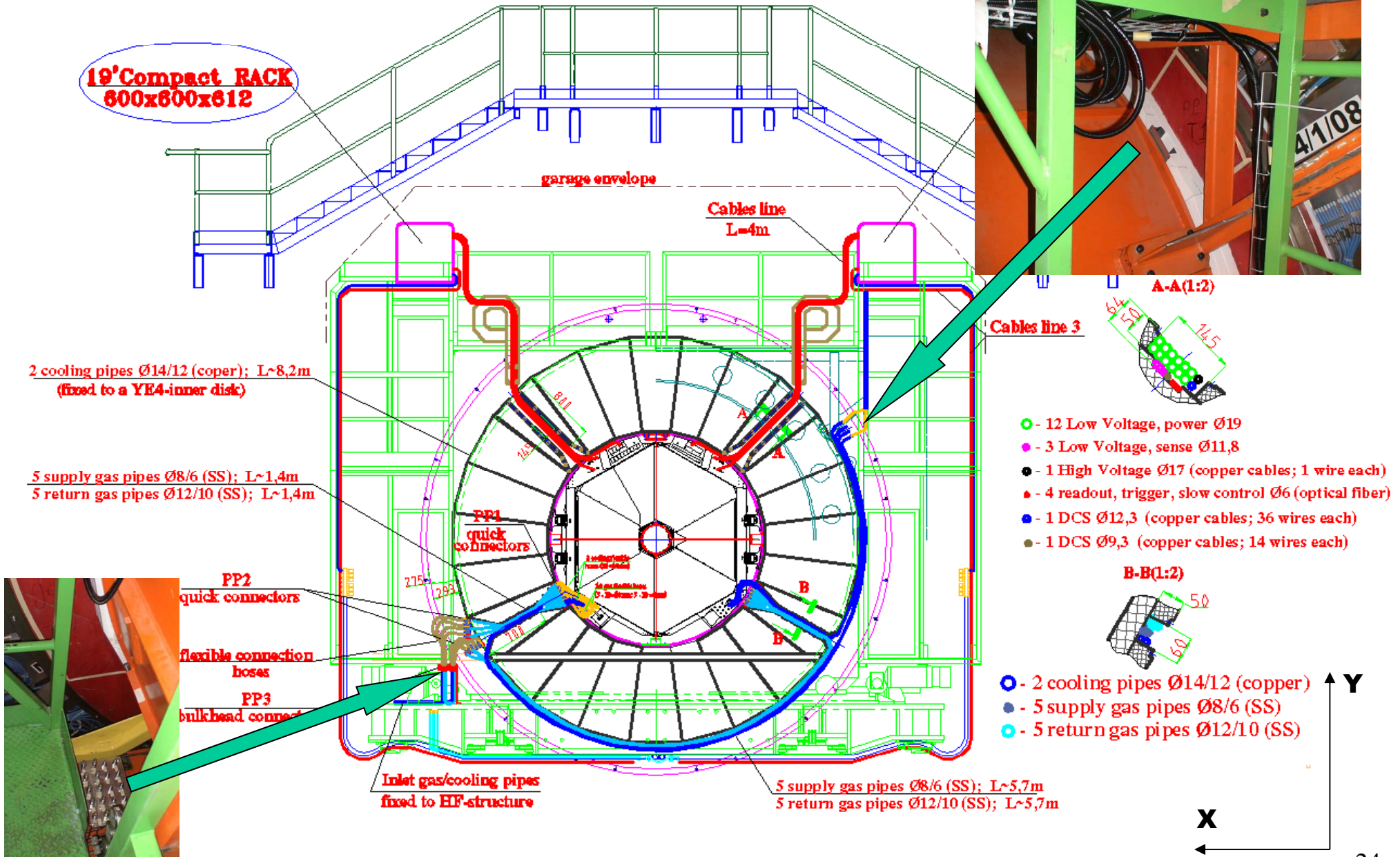
Extraction layout



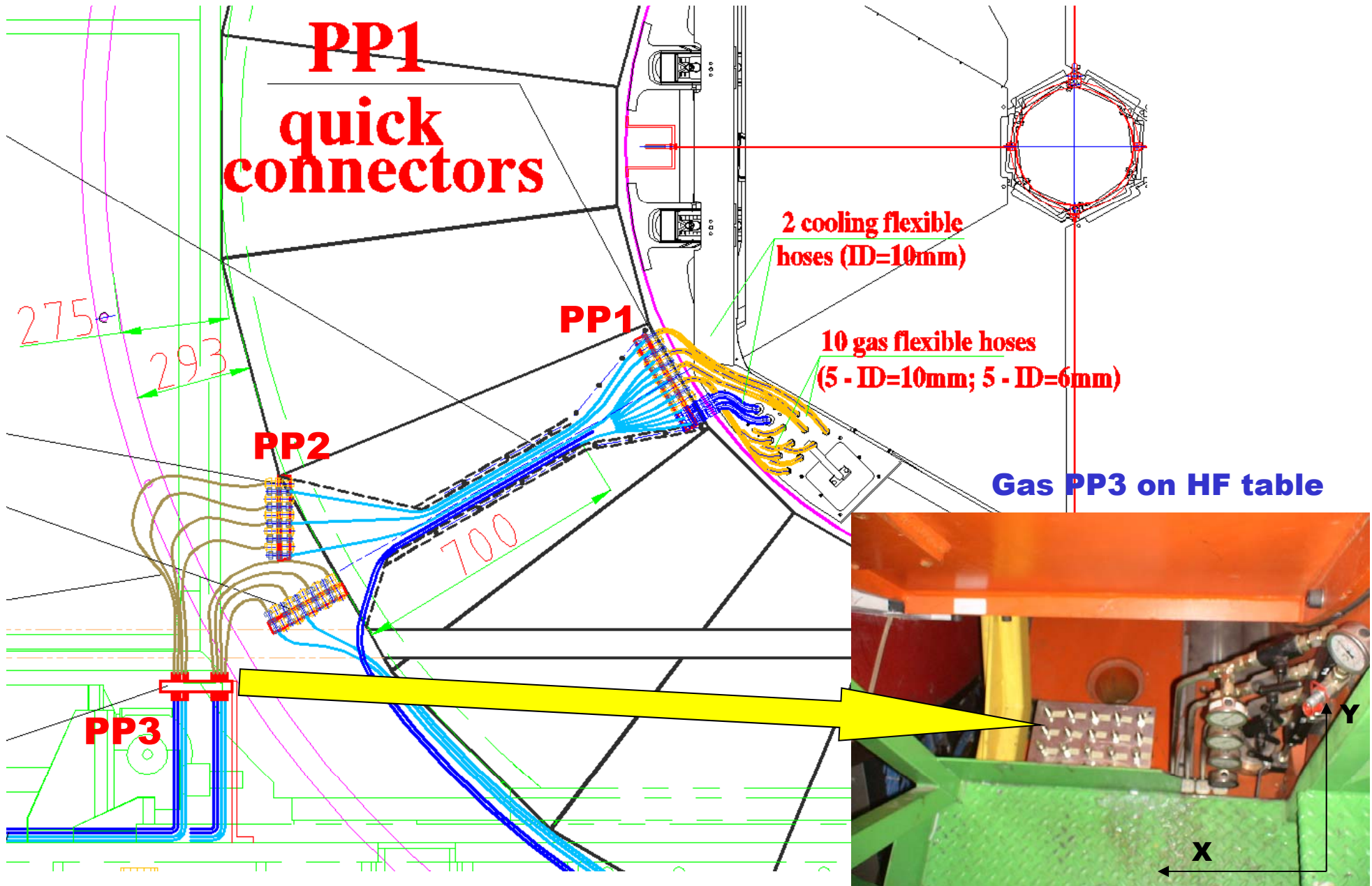
Connections of cables and pipes from T1-telescope

workway of YE4

Cooling PP on YE4-inner

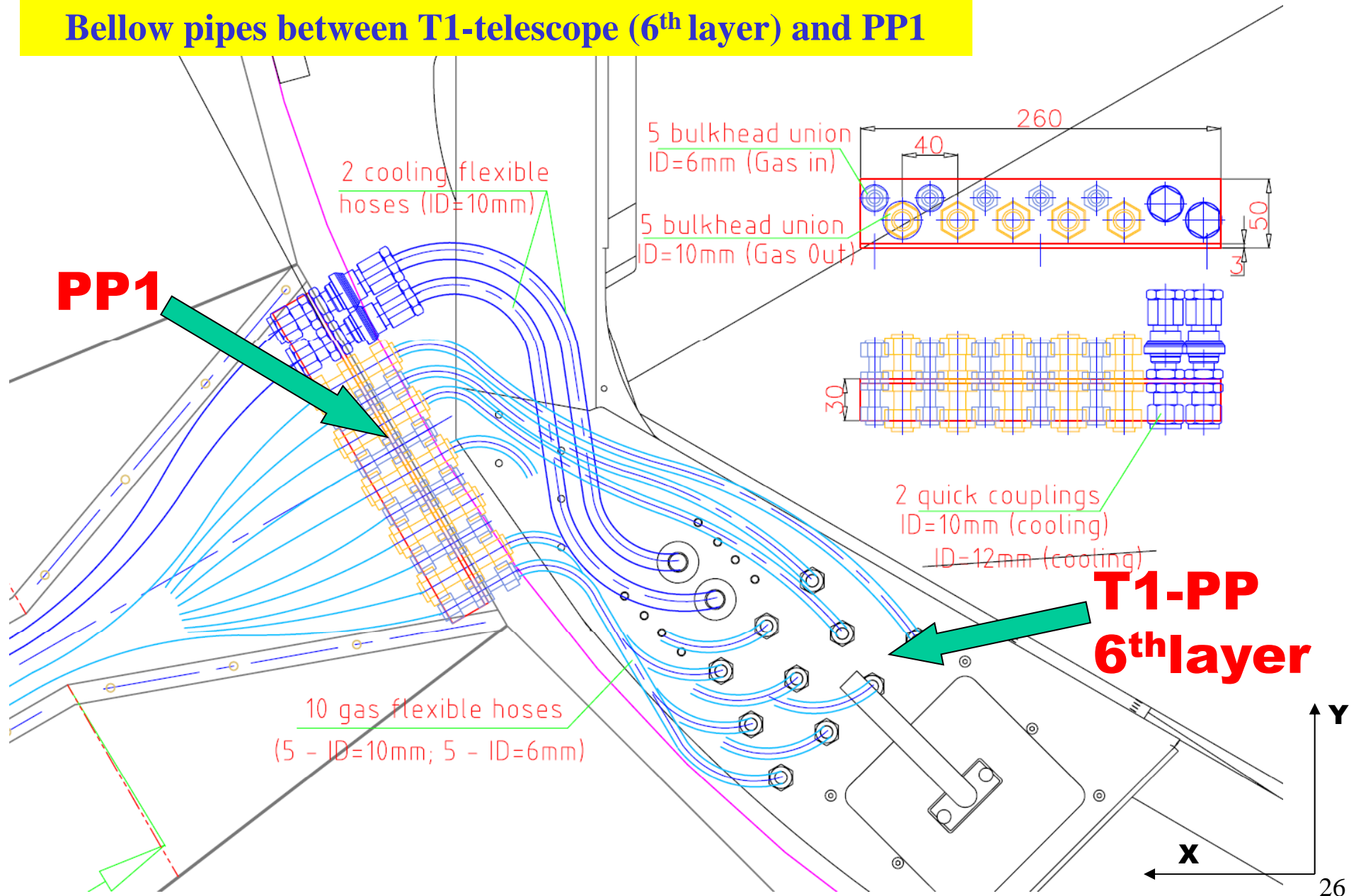


Connections of cables and pipes from T1-telescope



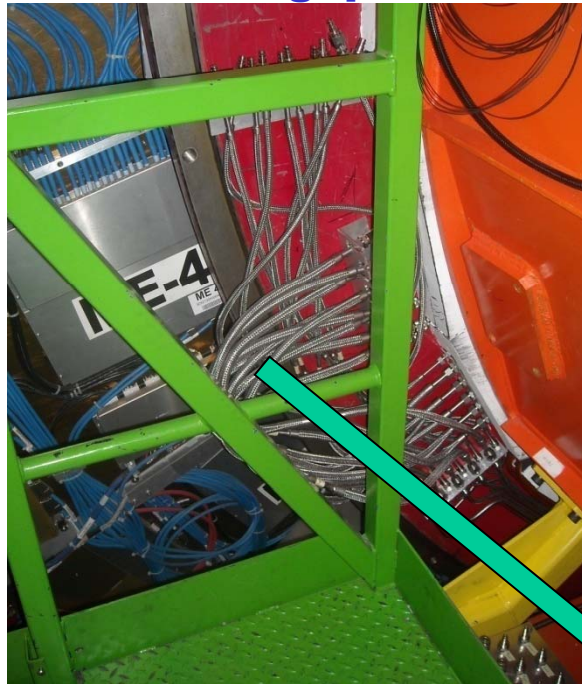
Connections of cables and pipes from T1-telescope

Bellow pipes between T1-telescope (6th layer) and PP1



T1 gas routing on HF support table

105mm gap



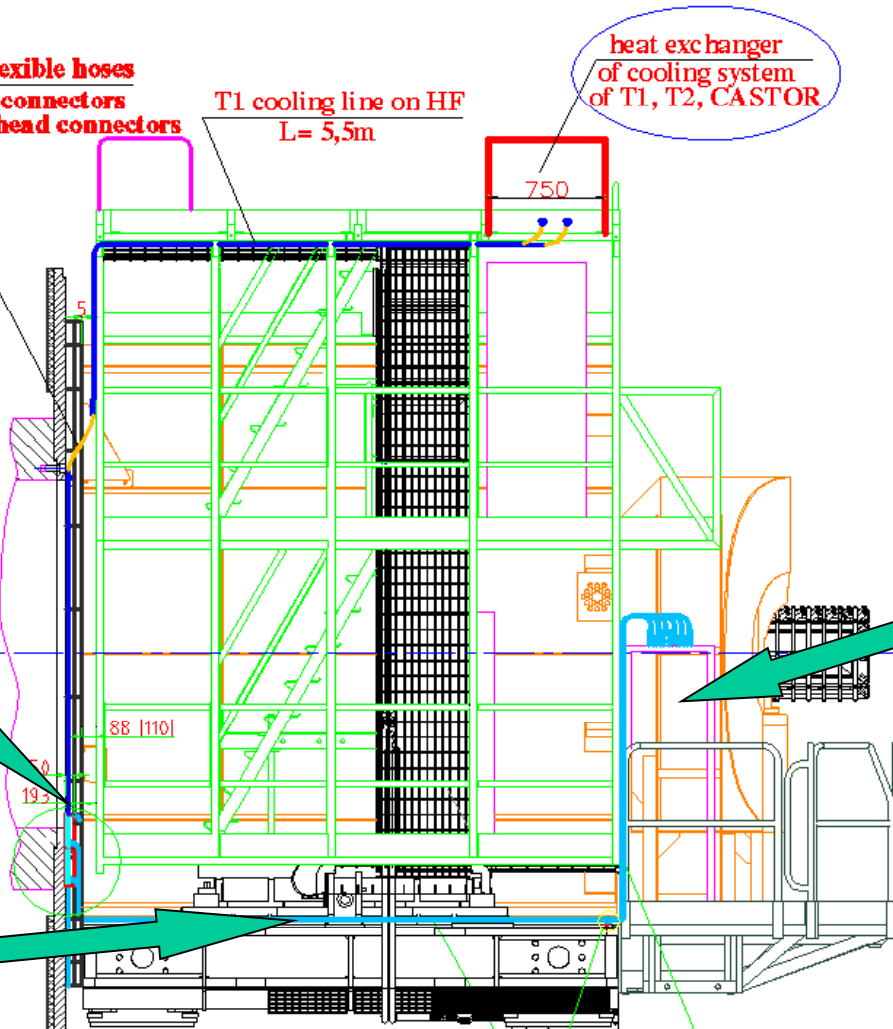
Gas line on HF table



cooling flexible hoses
4 quick connectors
4 bulkhead connectors

T1 cooling line on HF
L= 5,5m

heat exchanger
of cooling system
of T1, T2, CASTOR

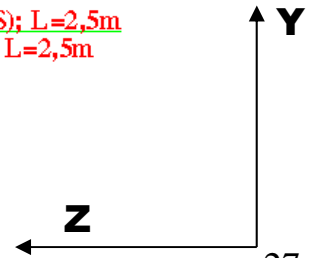


10 Gas pipes Ø12/10 (SS); L=4,5m
10 Gas pipes Ø8/6 (SS); L=4,5m

10 Gas pipes Ø12/10 (SS); L=2,5m
10 Gas pipes Ø8/6 (SS); L=2,5m

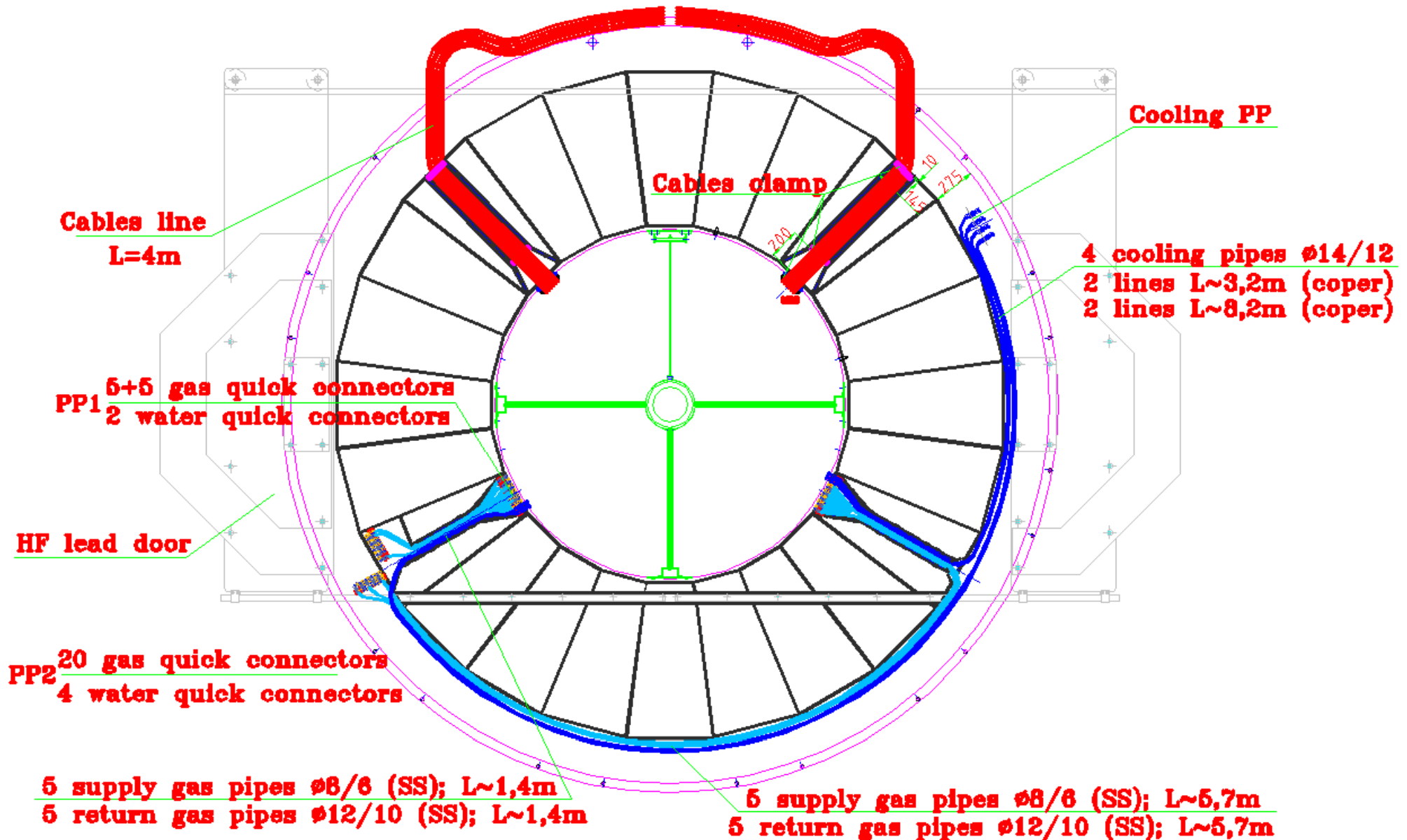
PP4
10 bulkhead connectors (for OD=12mm)
10 bulkhead connectors (for OD=8mm)

T1,T2 gas RACK

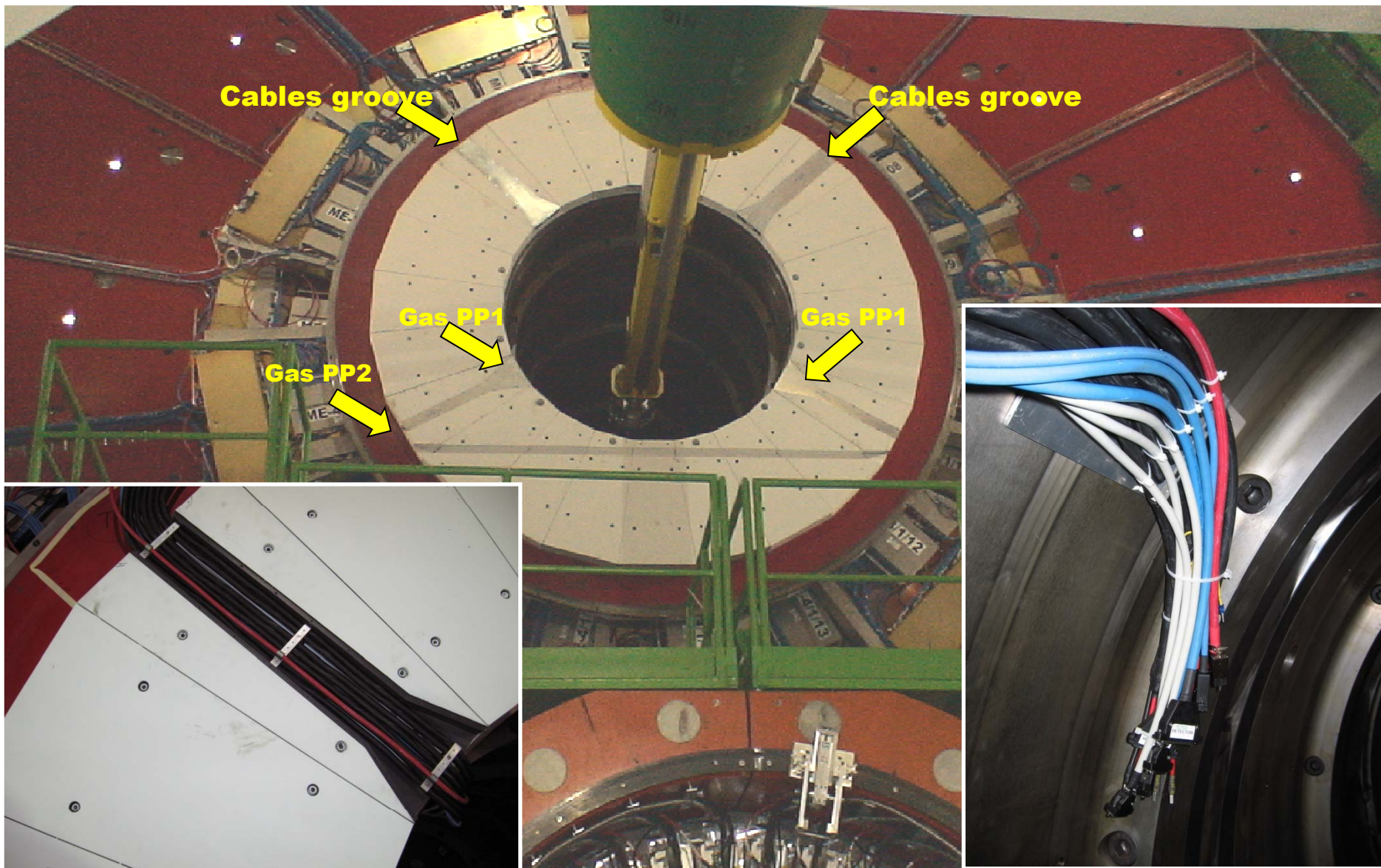


T1 services routing on YE4 inner disk

(All services should be fixed before T1 installation)



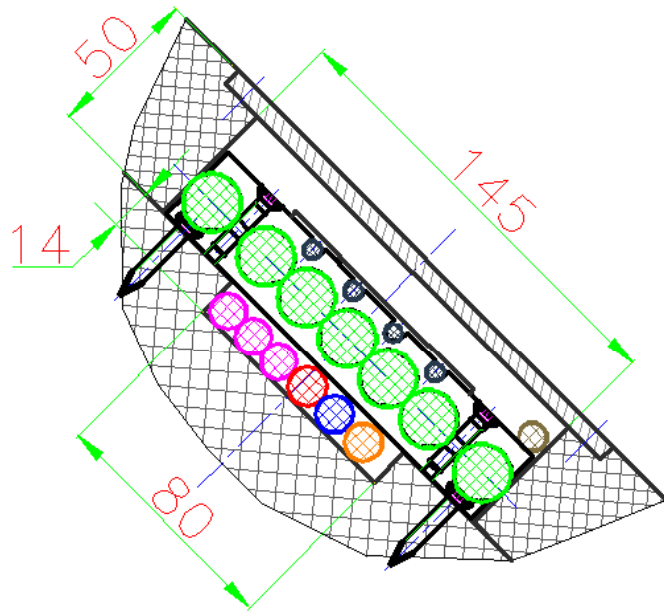
T1 services routing on YE4 inner disk




X
Y
29

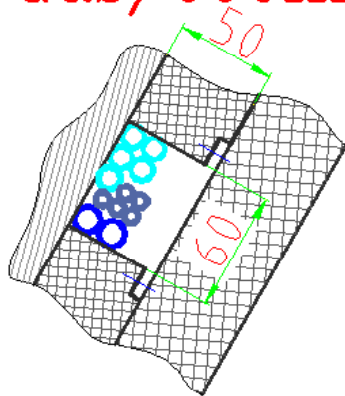
T1 services routing on YE4 inner disk




Cables for T1-quarter



-  – 7 Low Voltage, power $\phi 19$
-  – 3 Low Voltage, sense $\phi 11,8$
-  – 1 High Voltage $\phi 13$ (37wires copper cables)
-  – 4 (readout, trigger, slow control) $\phi 6$ (fiber)
-  – 1 DCS $\phi 12,3$ (36wires copper cables)
-  – 1 DSS $\phi 9,3$ (14 wires copper cables)
- ?  – 1 DCS_PS $\phi 12,3$ (36 wires copper cables)

Gas/cooling services for T1-quarter



-  – 2 cooling pipes $\phi 14/12$ (copper)
-  – 5 supply gas pipes $\phi 8/6$ (SS)
-  – 5 return gas pipes $\phi 12/10$ (SS)

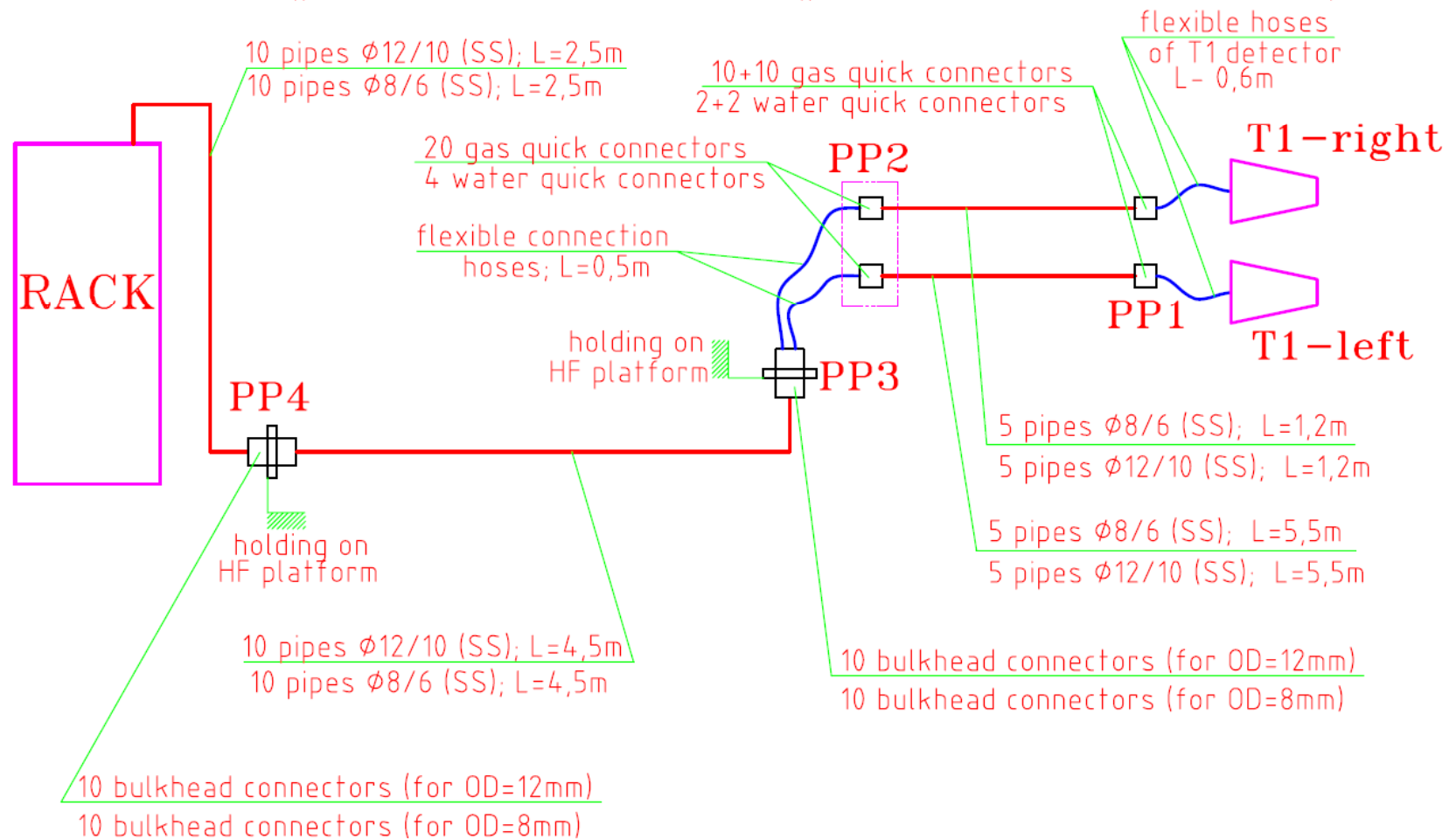
T1 gas supply scheme

T1 gas scheme

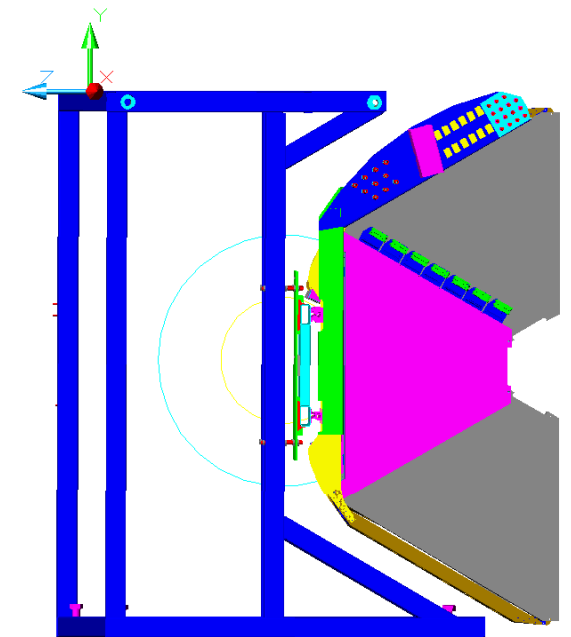
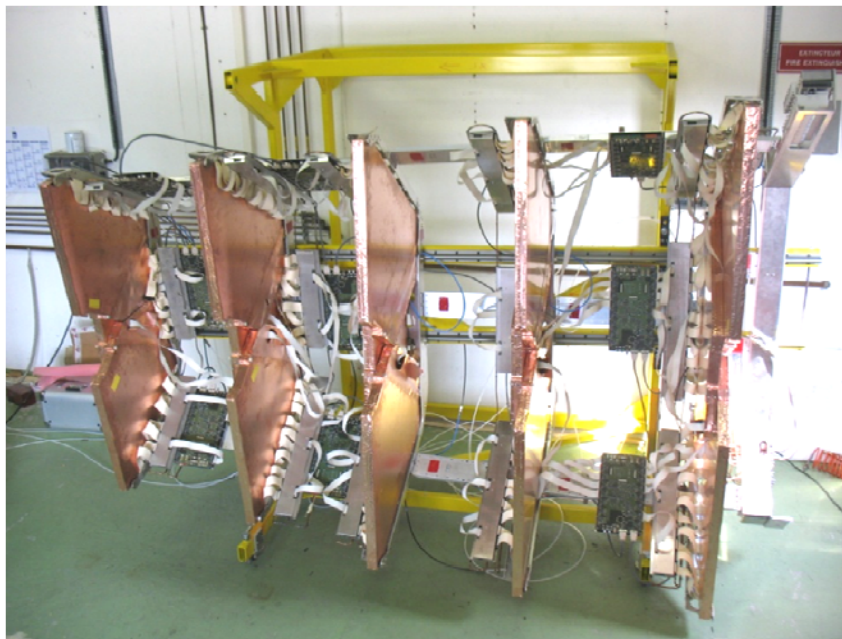
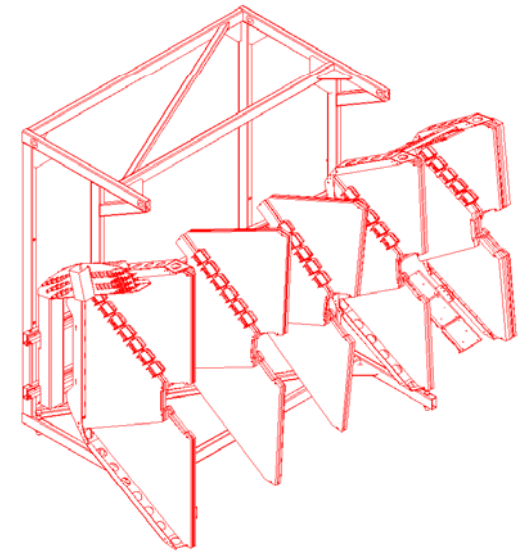
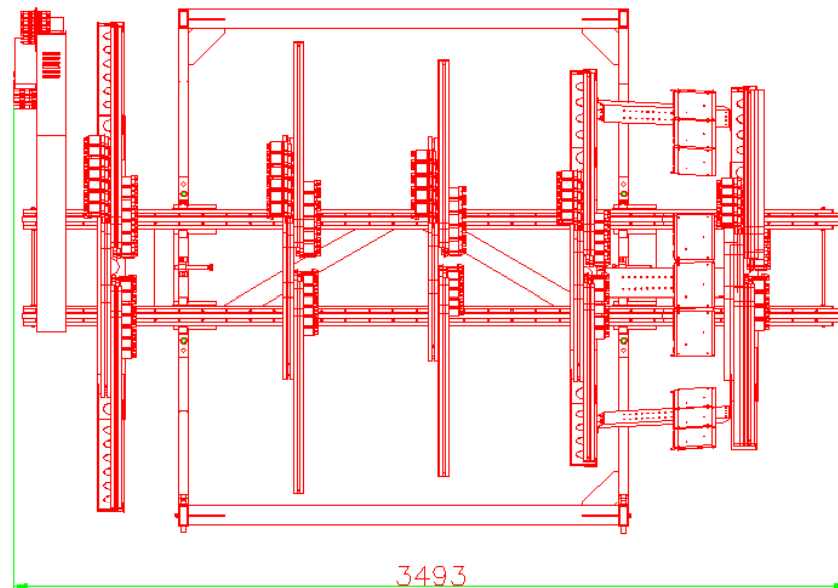
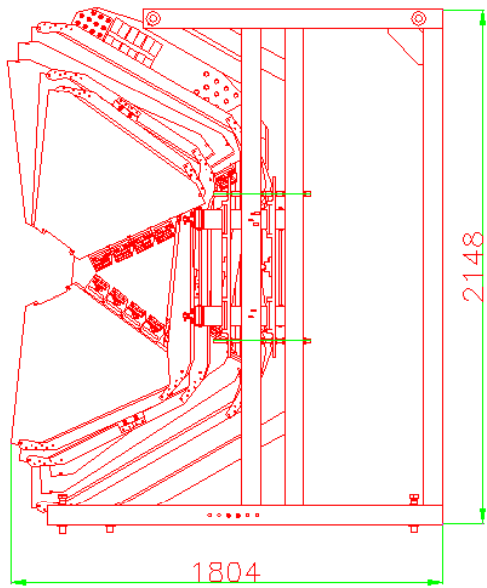
holding on Collar platform

holding on HF platform

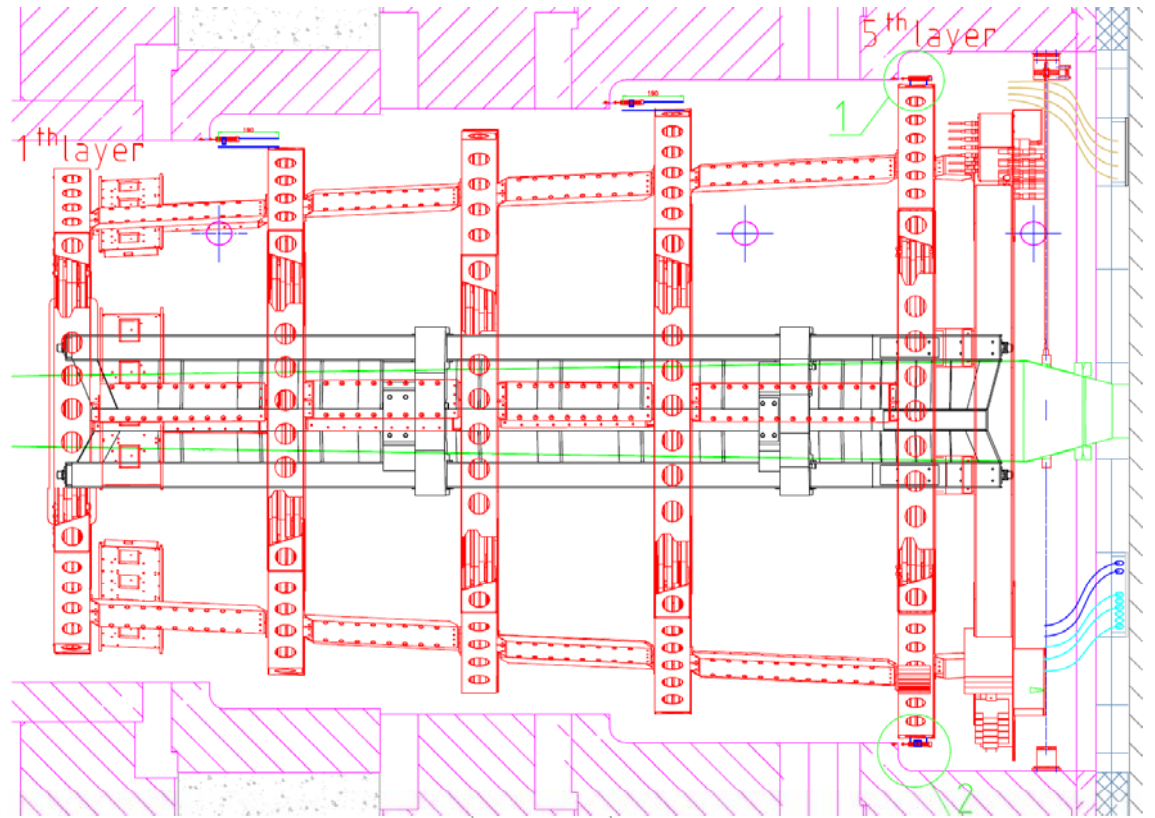
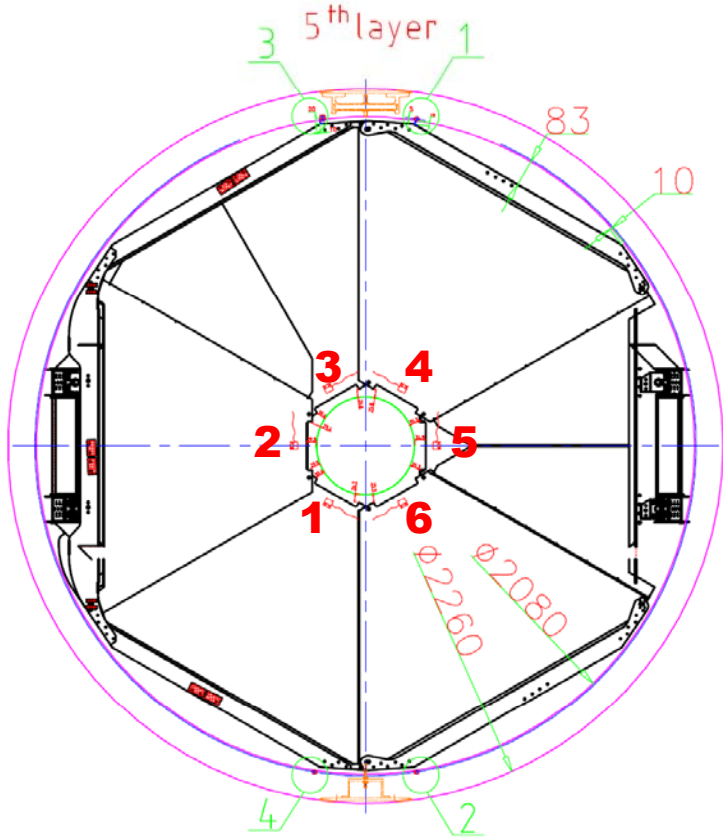
holding on YE4inner



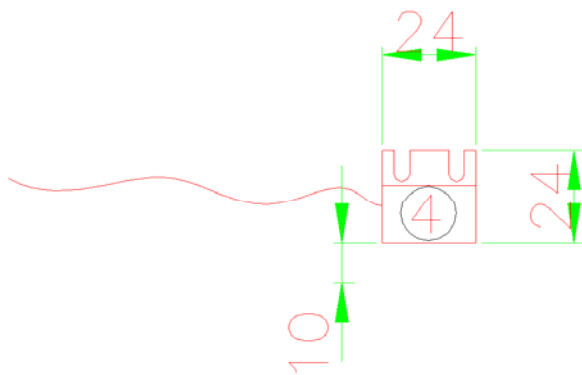
T1-quarter layout



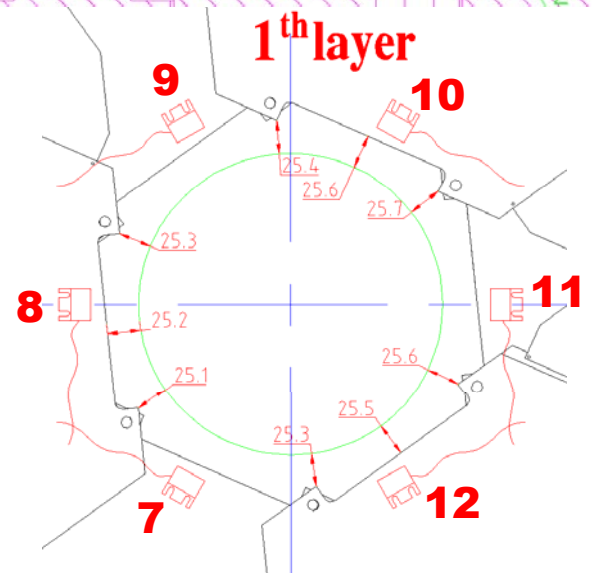
Sensors position



Ultrasonic sensor UNDK_10U6914

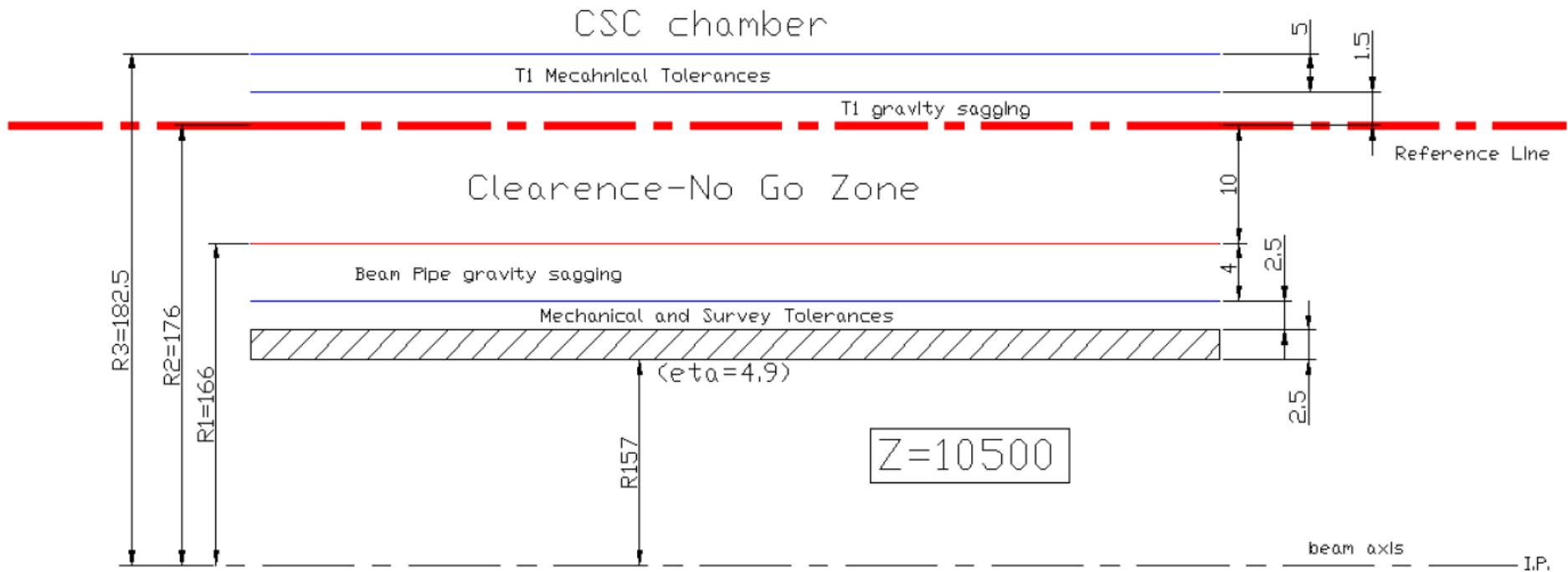


T1
 $\Sigma(-)$ 14 pieces
 $\Sigma(+)$ 14 pieces
 Σ 28 pieces



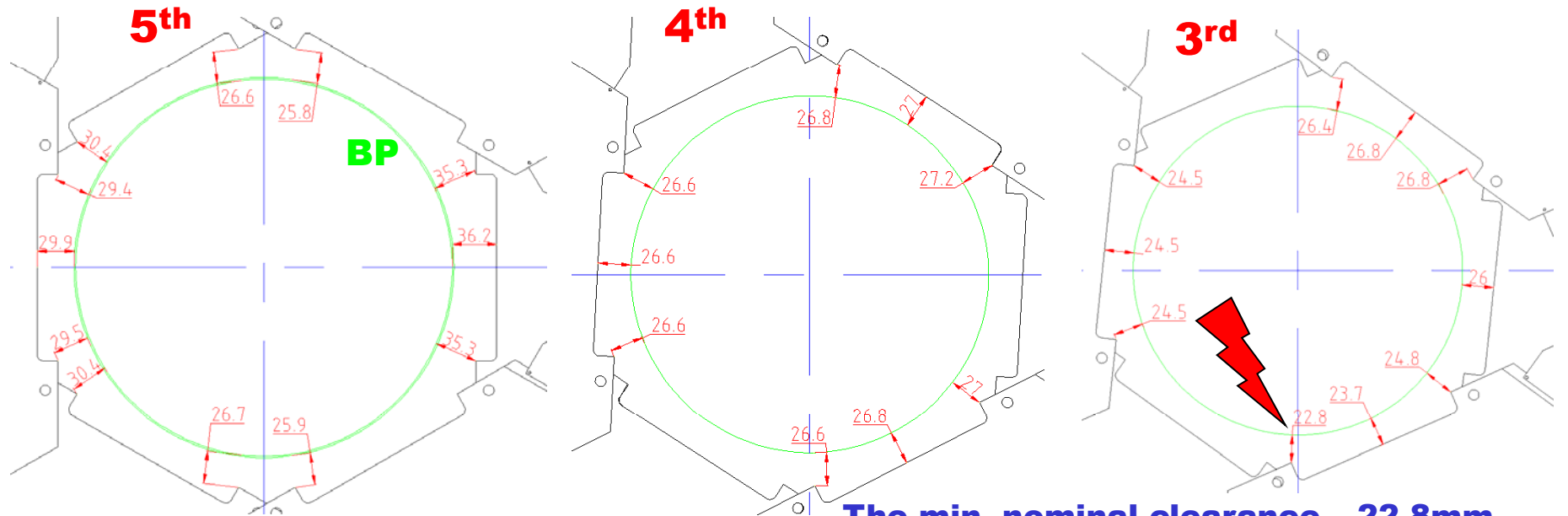


T1 vs. Vacuum Chamber Interfaces



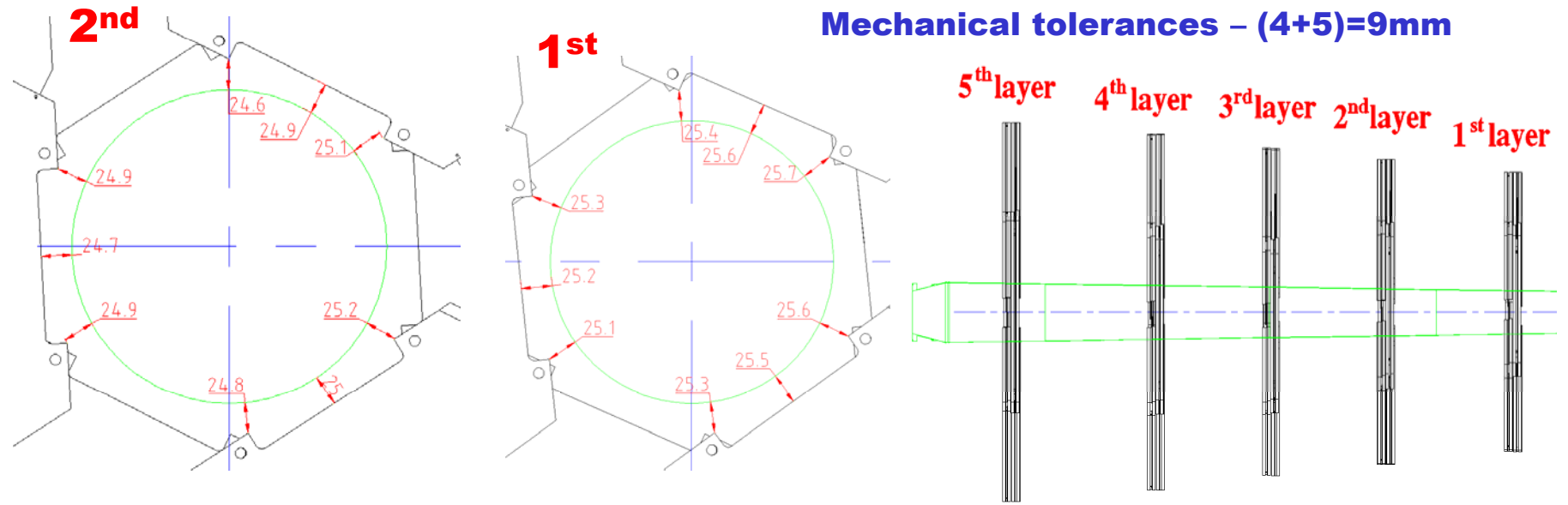
Vacuum Chamber wall thickness	2.5mm
Mechanical Tolerances	2.5mm
Deformation under gravity	3.5mm
No-go zone between envelopes	10mm
T1 support deformation under gravity	1.5mm
T1 mechanical tolerances	5mm

Nominal clearances between T1-chambers and Beam Pipe

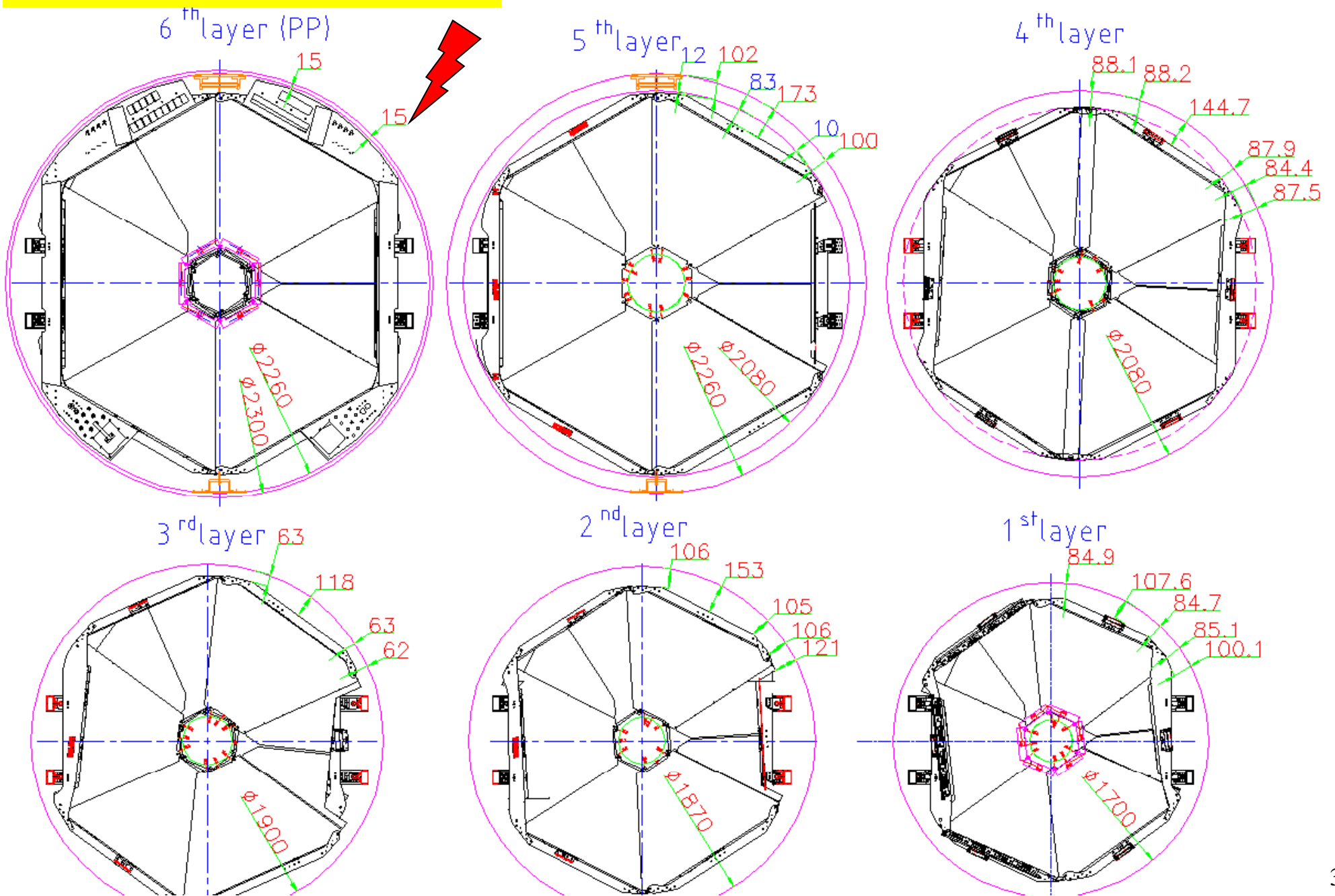


The min. nominal clearance – 22.8mm

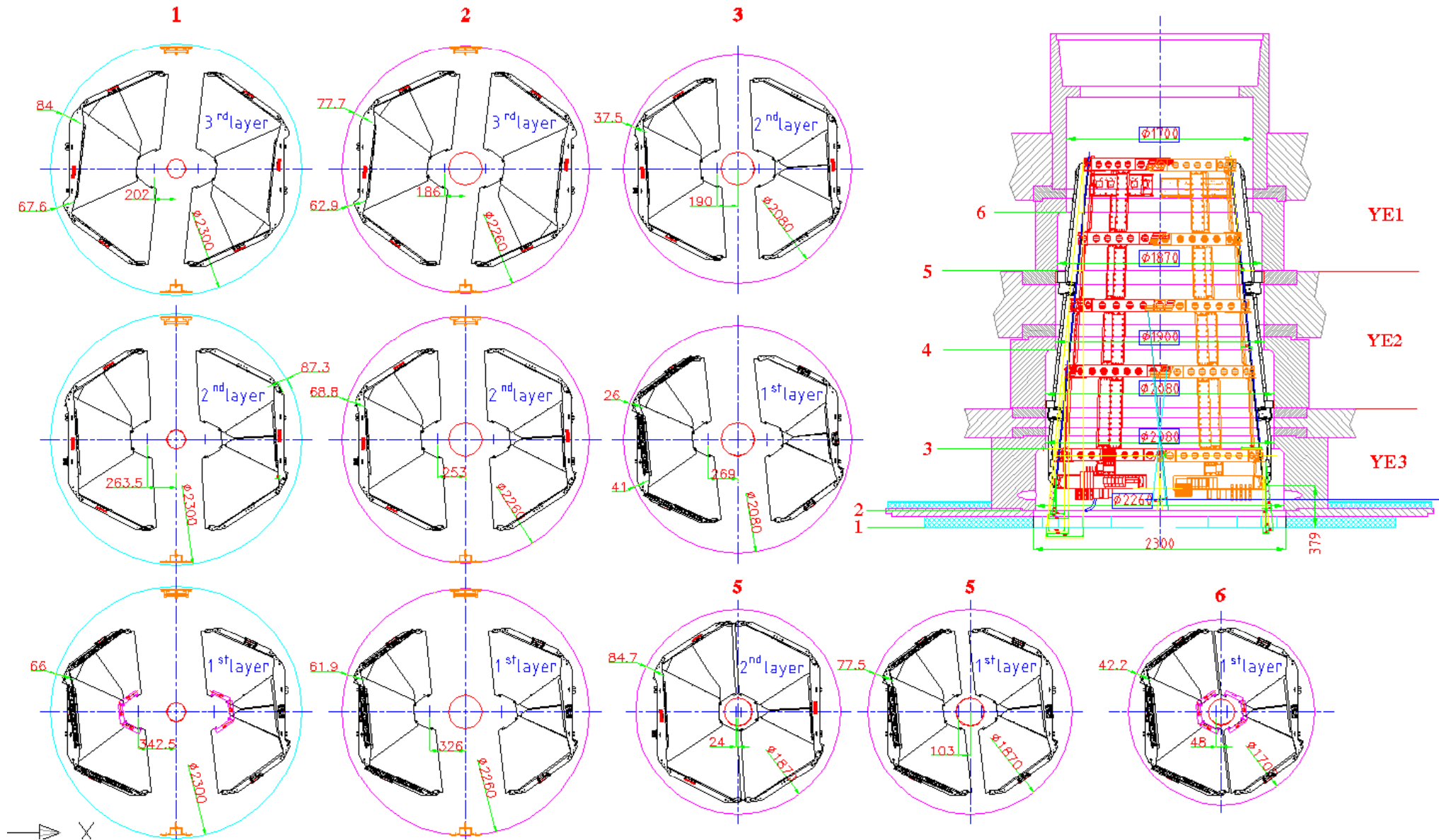
Mechanical tolerances – (4+5)=9mm



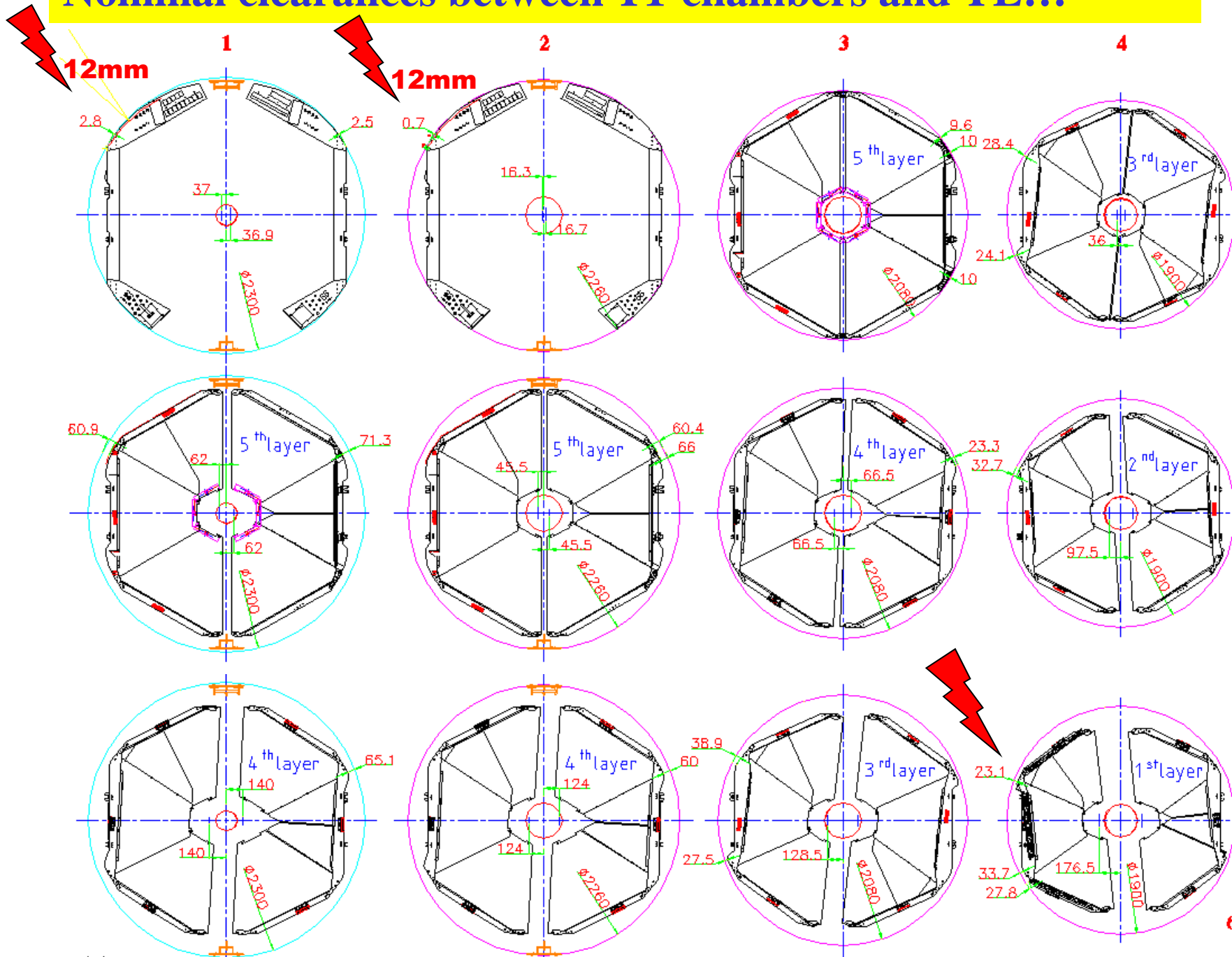
Run position. Clearances



Nominal clearances between T1-chambers and YE...

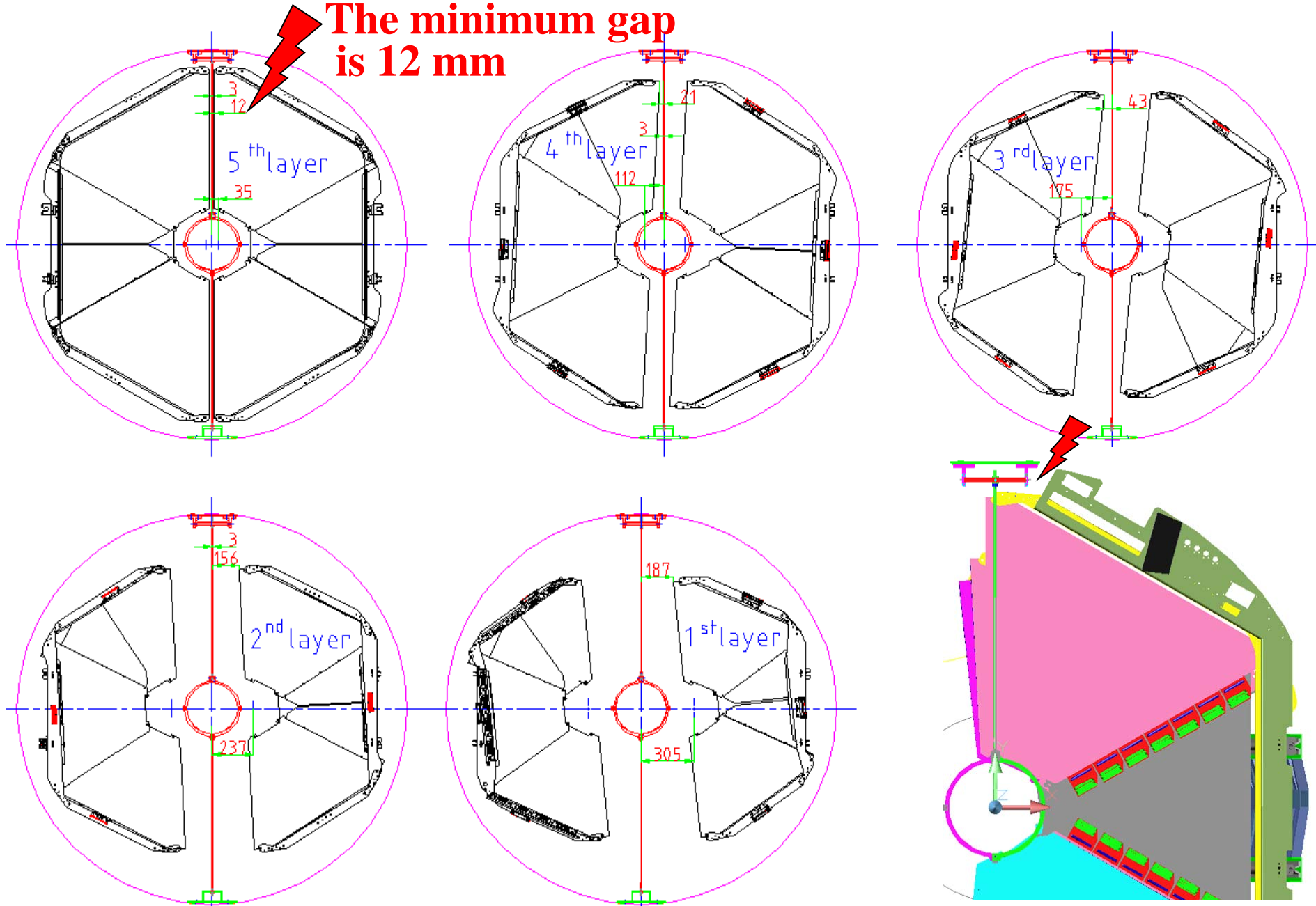


Nominal clearances between T1-chambers and YE...

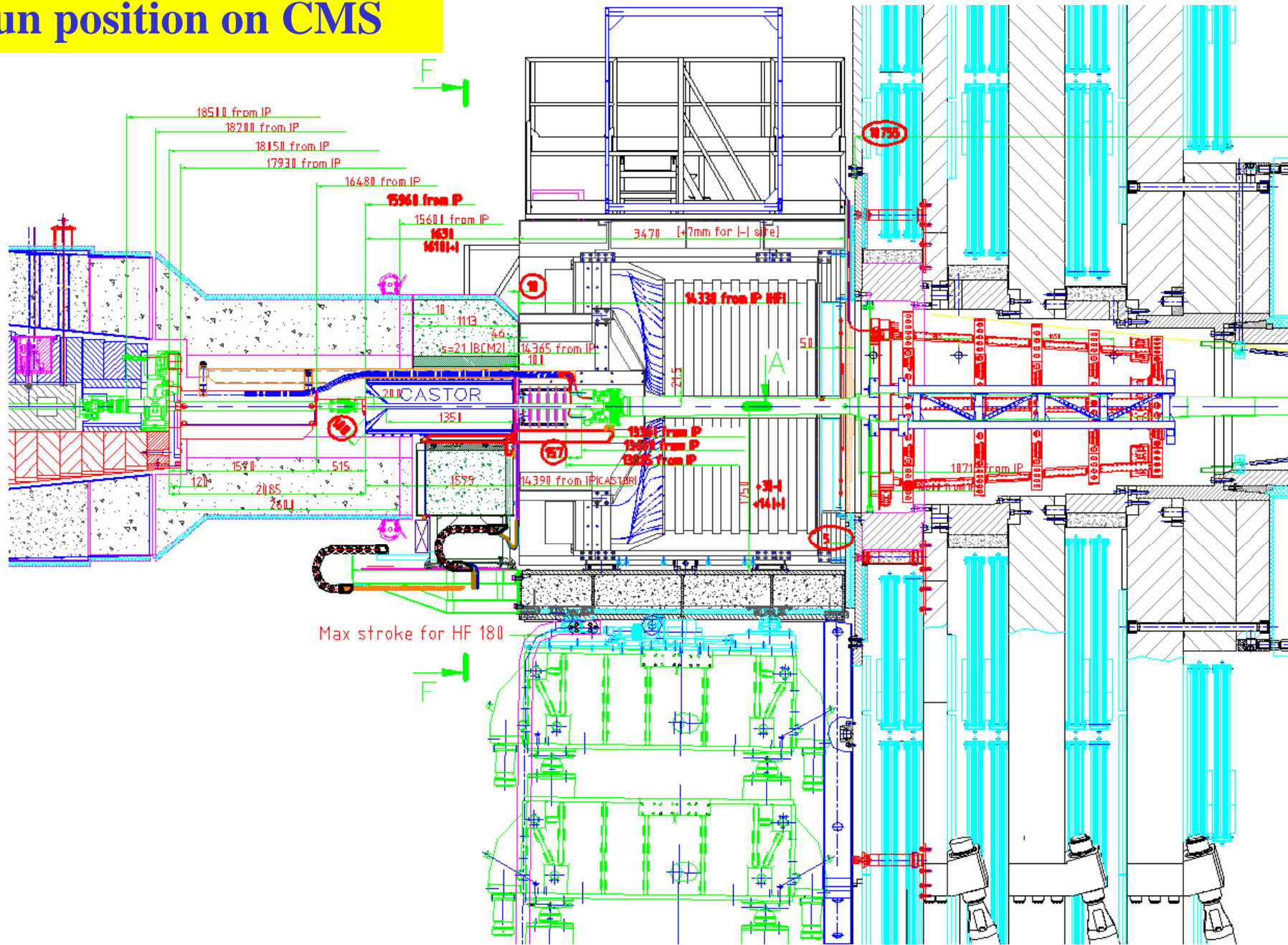


Nominal clearances between T1-chambers and BP-support 10.6

The minimum gap is 12 mm



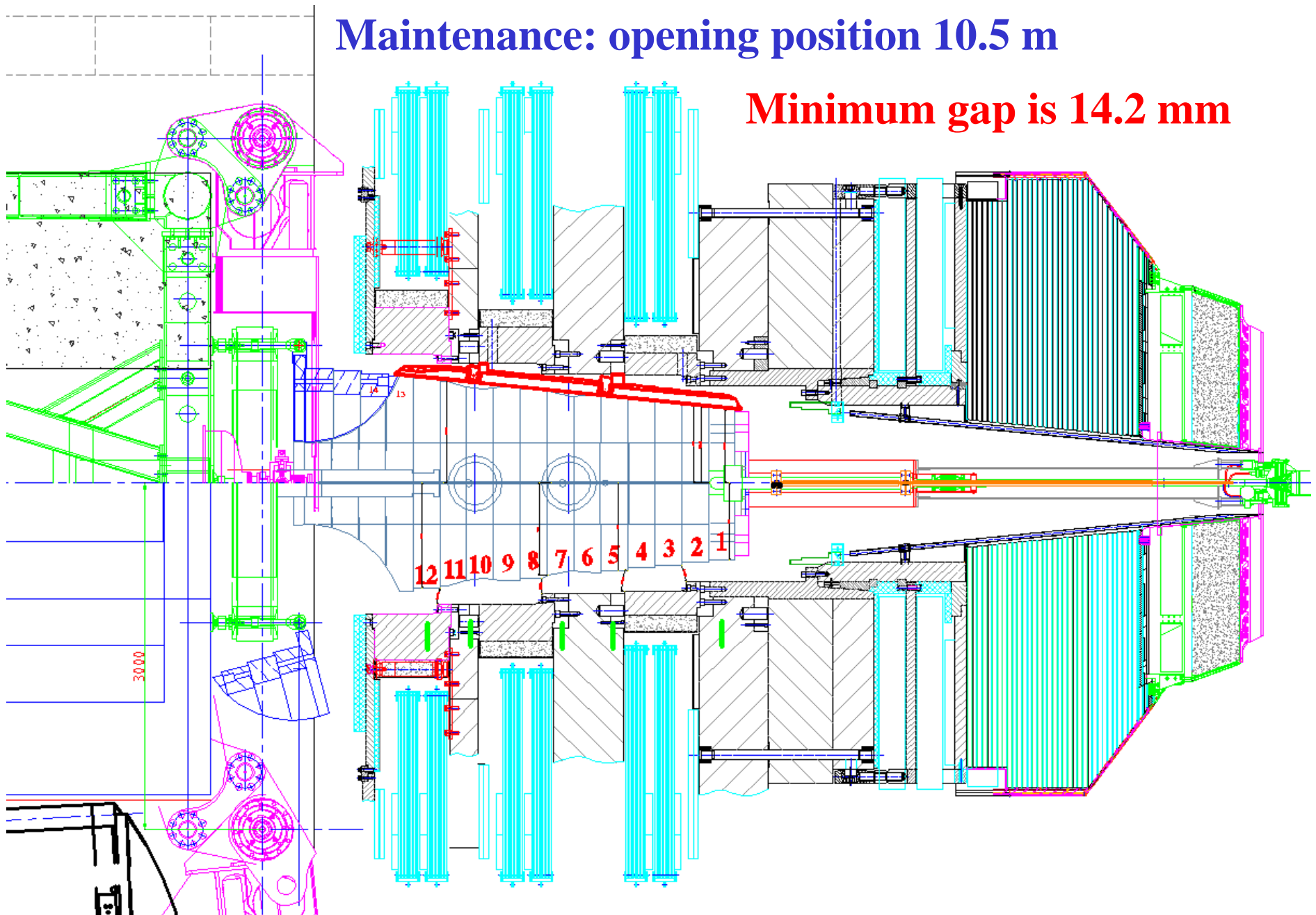
Run position on CMS



Nominal clearances between T1-truss and FIN

Maintenance: opening position 10.5 m

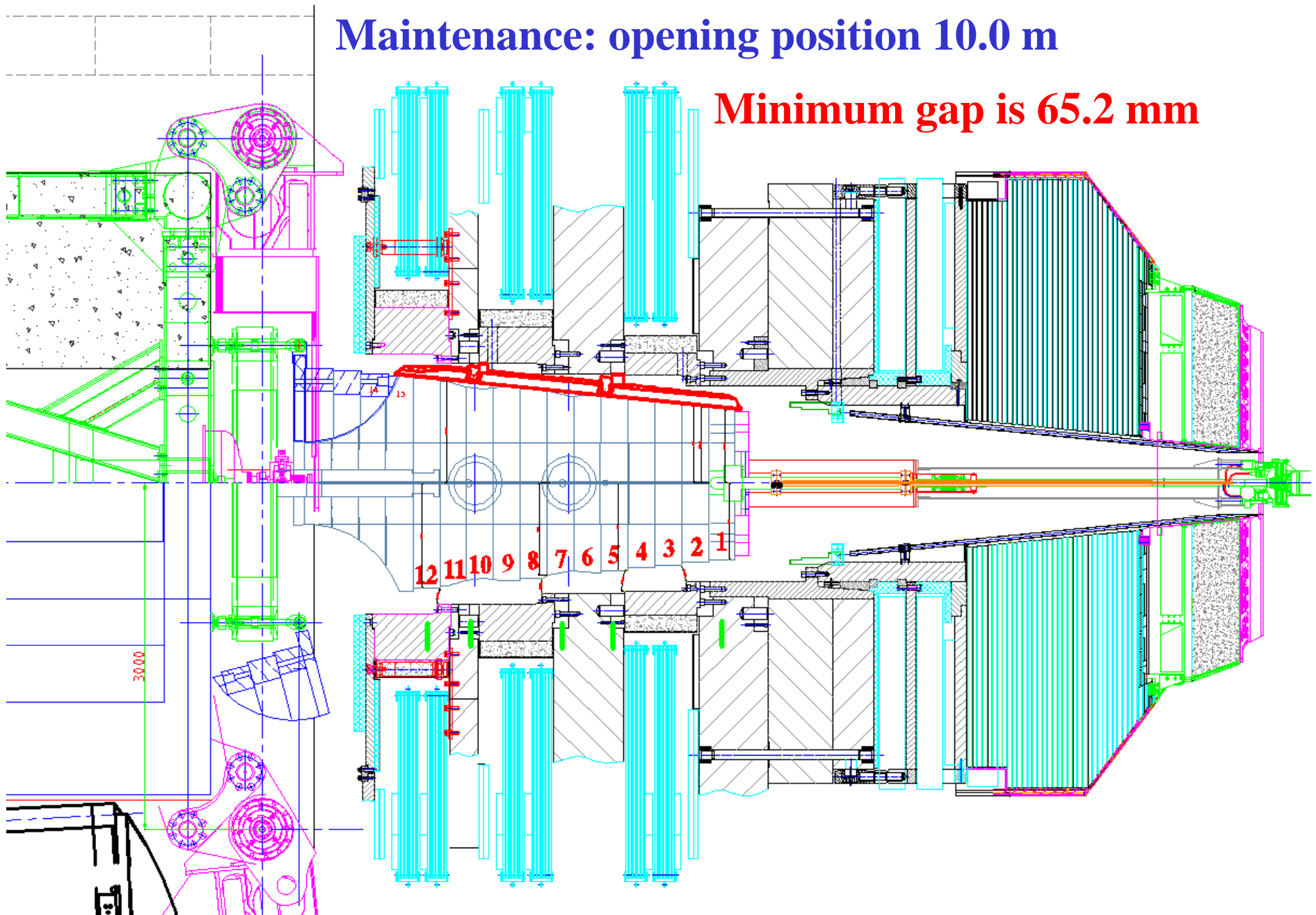
Minimum gap is 14.2 mm



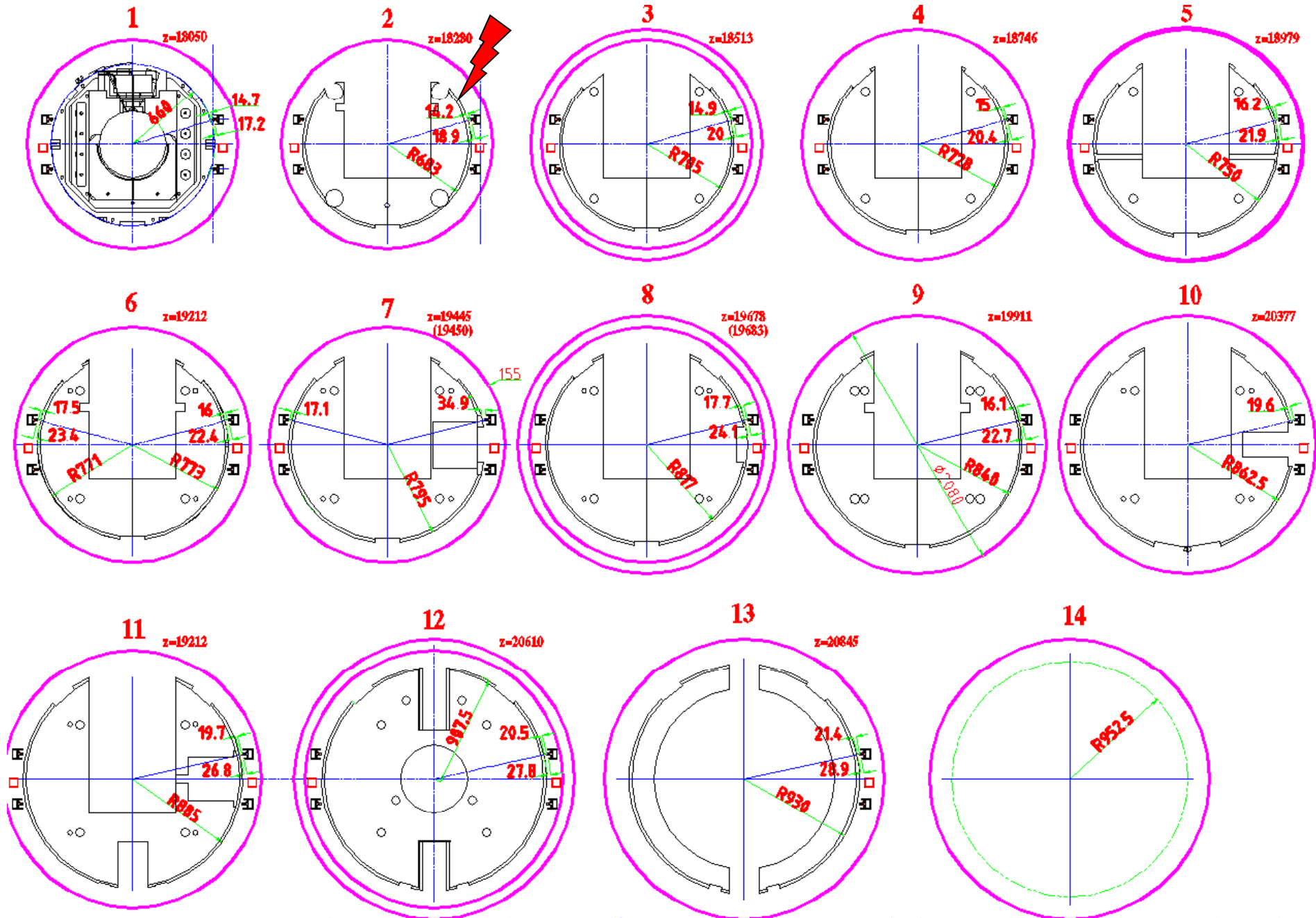
Nominal clearances between T1-truss and FIN

Maintenance: opening position 10.0 m

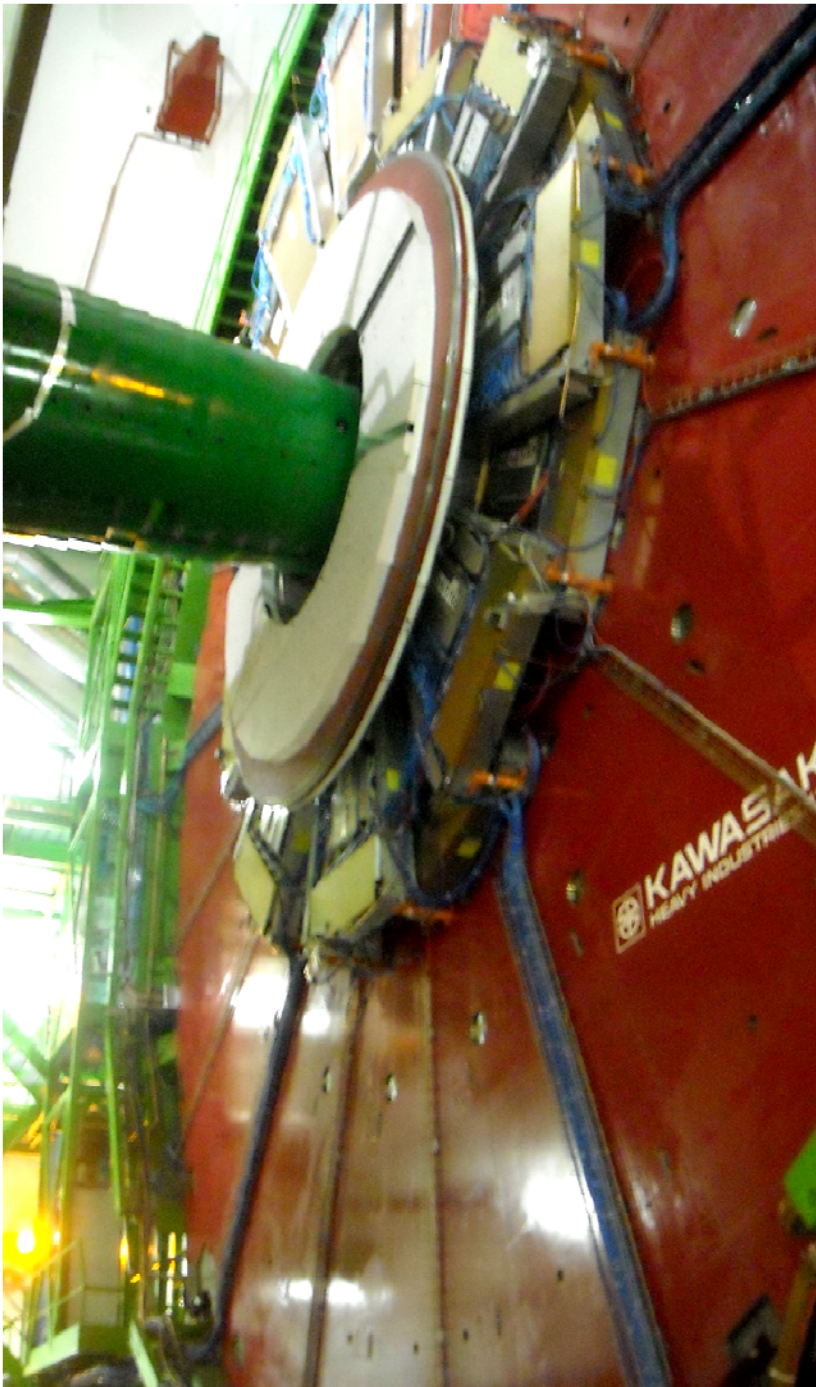
Minimum gap is 65.2 mm



Nominal clearances between T1-truss and FIN



opening position 10.5 m (for position 10.5 m it is necessary to add 51mm)



3 SUMMARY RESULTS

3.1 Centre of the YEs

Centre	X [mm]	Y [mm]	Z [mm]
YE+3	-0.3	2.0	9909.3
YE+2	-1.2	-1.2	8825.0
YE+1	1.5	-0.2	7567.0
YE+1 ES	2.5	-9.3	3088.5
YE-1 ES	-1.1	-7.9	-3091.1
YE-1	-1.1	-0.5	-7567.9
YE-2	1.1	0.3	-8825.3
YE-3	-1.4	-0.2	-9903.1

Reminder:

- The theoretical Z value for YE1 is +/- 7565 mm
- The theoretical Z value for YE2 is +/- 8820 mm
- The theoretical Z value for YE3 is +/- 9900 mm

3.2 Rotation of the YEs

Centre	Rx [mrad]	Ry [mrad]	Rz [mrad]
YE+3	0.7	-0.5	-0.3
YE+2	-0.3	-0.1	0.2
YE+1	-0.5	-0.4	0.4
YE-1	0.4	0.0	-0.3
YE-2	0.9	-0.2	0.1
YE-3	0.8	0.1	-0.2

- **Remark:** the bad orientation about X axis of YE-2 and YE-3 has been explained afterwards. Indeed, a shimming in the YB-2 feet went off implying a displacement of the detectors towards Z- side during the closure of the YE- detectors. This movement was detected the 9th of February 2010 and corrected. Since it was not possible to re-measure the position of the YE+/-1 and the YE+/-2. One can find the final position of YE+/-3 measured on the 10th February on EDMS at the following address: CMS-SG-UR-0161