“Final” layout for the integration of the VAX in the TAXS region (+ P8 D2 Protection &TREX mandate)

F Sanchez Galan on behalf of HL-LHC WP8

Special thanks to C. Adorisio, J. Albertone, I. Bergstrom, C. Boccard, D. Brethoux, I. Efthymiopoulos, S. Evrard, P. Fessia, A. Gaddi, L. Krzempek, M. Diogo Dos Santos, M. Lazzaroni, D. Mergelkuhl, J. Perez Espinos, G. Pigny, M. Raymond, H. Vincke

Hi Lumi Collaboration , Paris 14-16 November 2016

Outline

- Scope TAXS, **VAX** for WP8
- Recall on radiation levels, space constraints
- VAX layout: concept, radiation analysis, services
- Implications in shielding: modifications in LS2.

- TANB (Protection D2@P8)
- TREX Extended

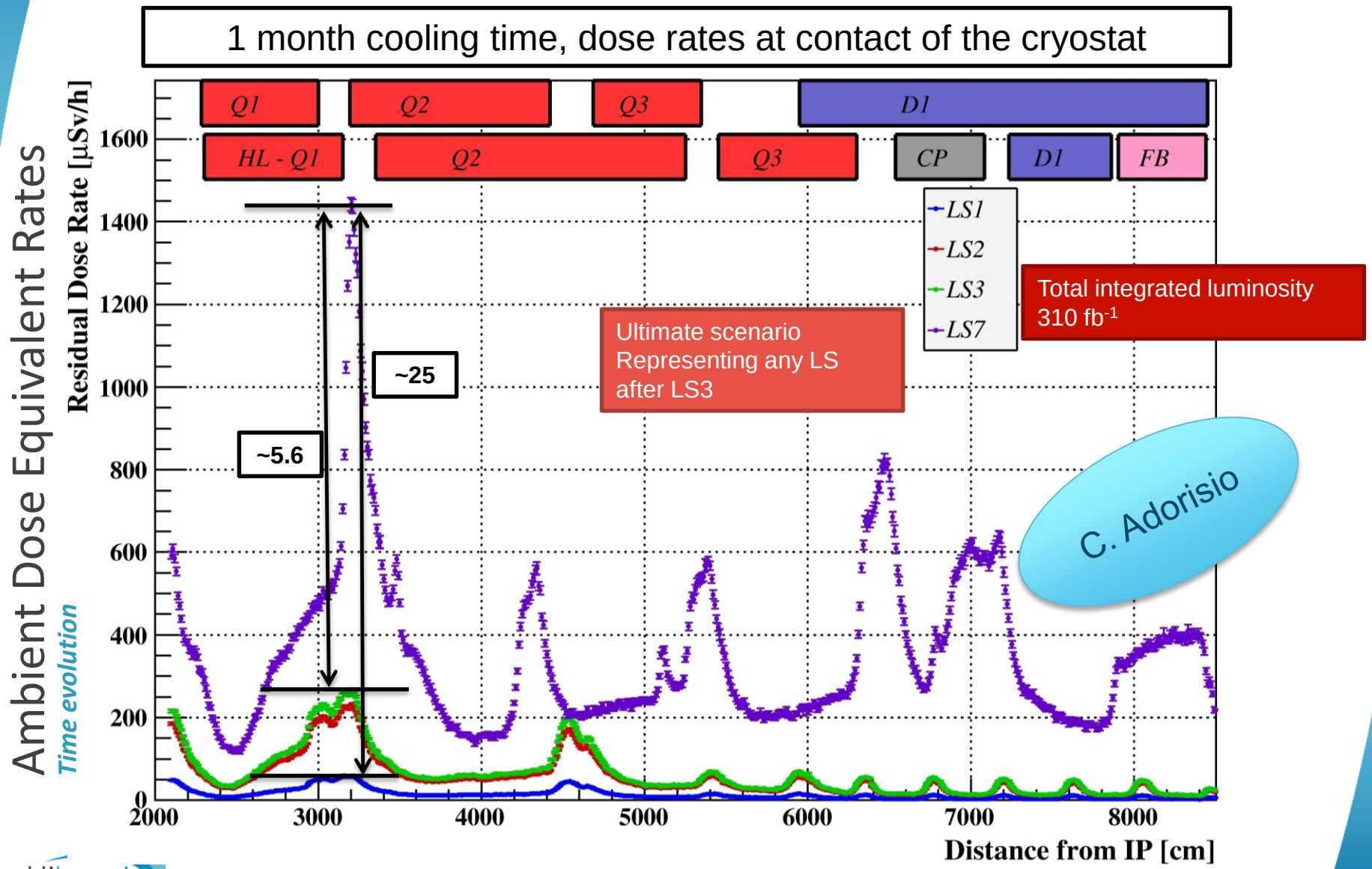
Scope – from TAS to TAXS @ P1& P5

- To increase the aperture for the beam, **TAXS will replace TAS**, which are embedded in the forward shielding, at the limit of the experimental cavern and LHC tunnel.

- Functionality and design principles will be kept, adapting to the he **increased deposited energy.**

- **VAX region** will be optimized following the **ALARA** principle.

Overview of Radiation (EDMS 1434476)



in short…

Depending on the operational scenarios, cooling time and materials:

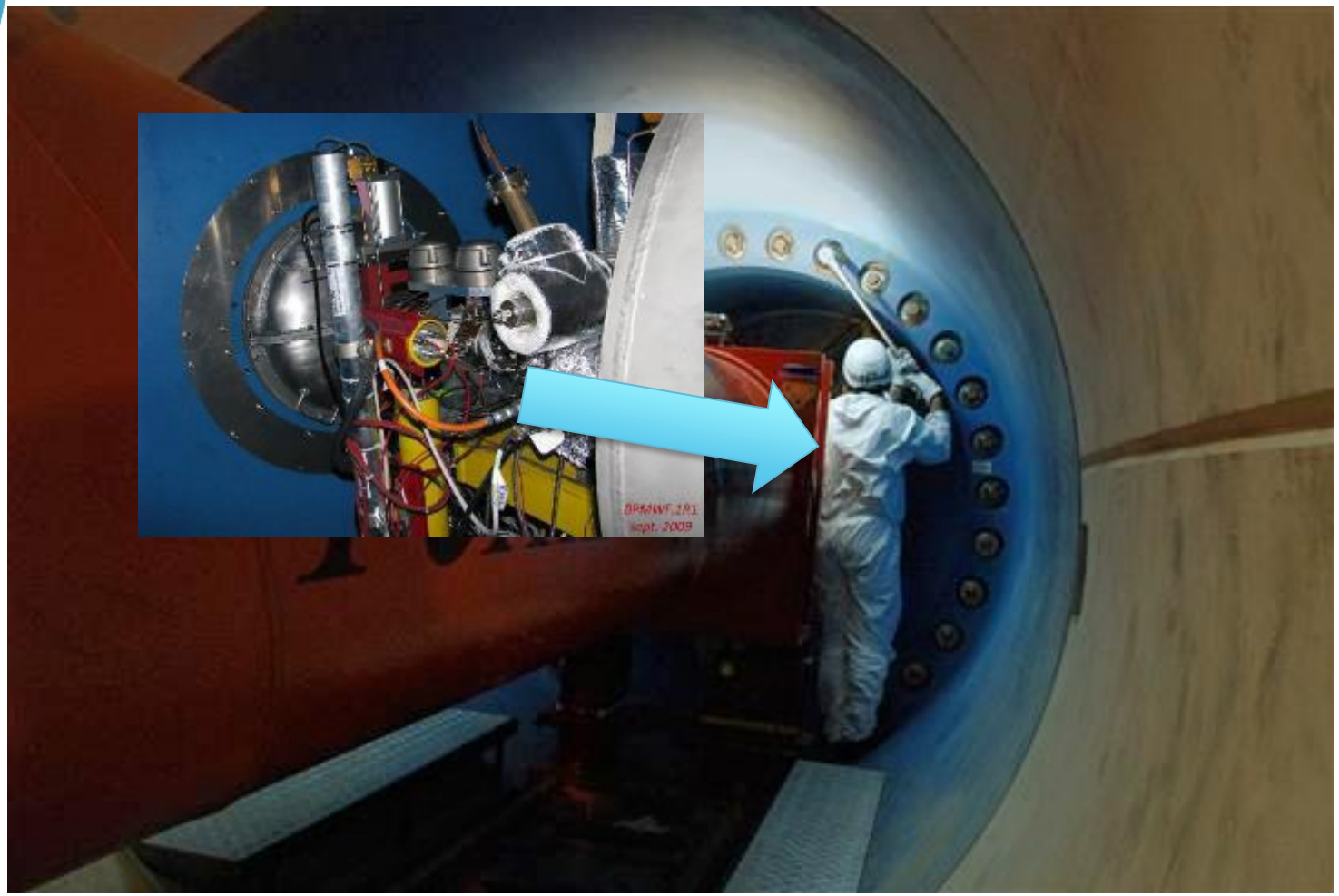
- Residual dose rate increase from LS1 until LS3 is about a factor 4 to 6.
- The increase from LS1 to HL-LHC is a factor 15 to 30.

Access Q1 to TAS region (ATLAS)

C.BAULT le 25/09/2003

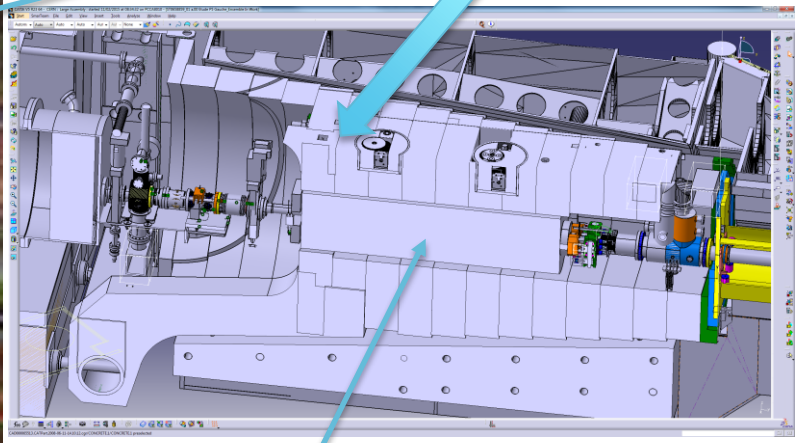
Access Q1 to TAS region (ATLAS)

Access Q1 to TAS region (ATLAS)



TAS region in CMS Forward Shielding

Fixed Iron nose

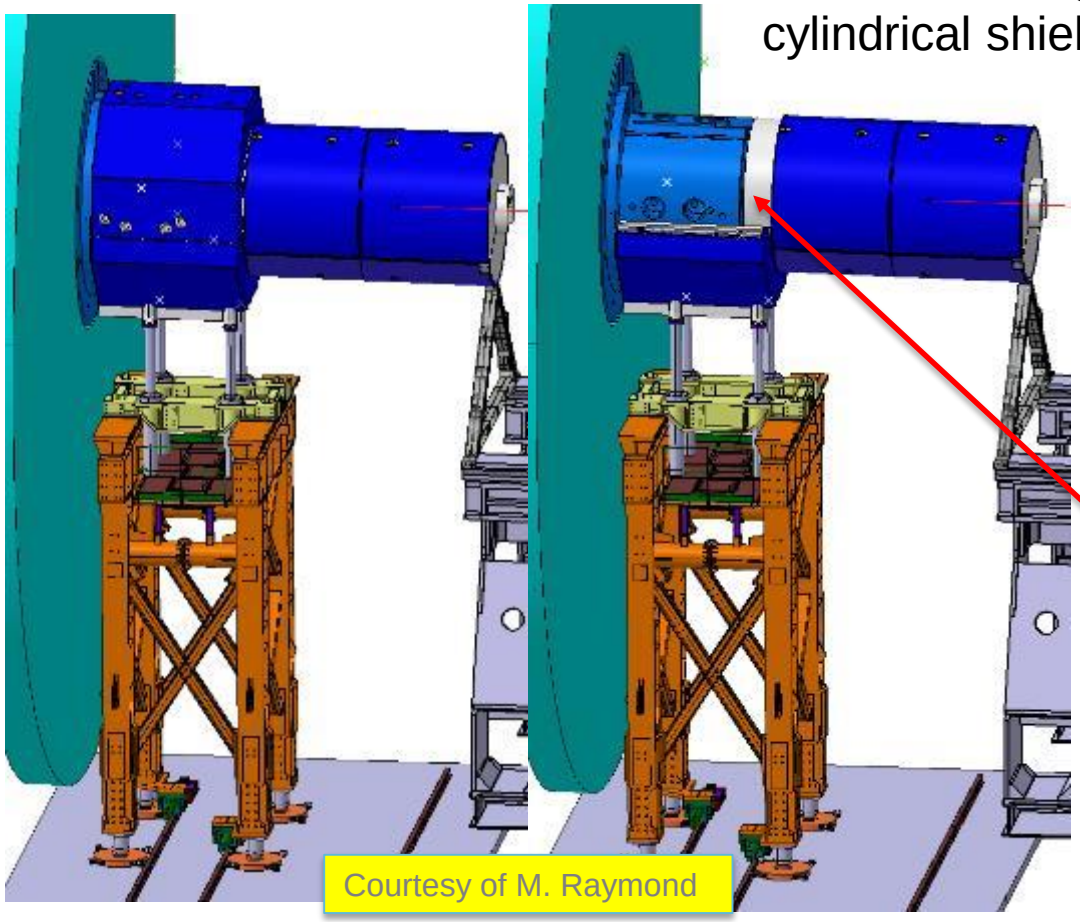


TAS absorber

Rotating shielding

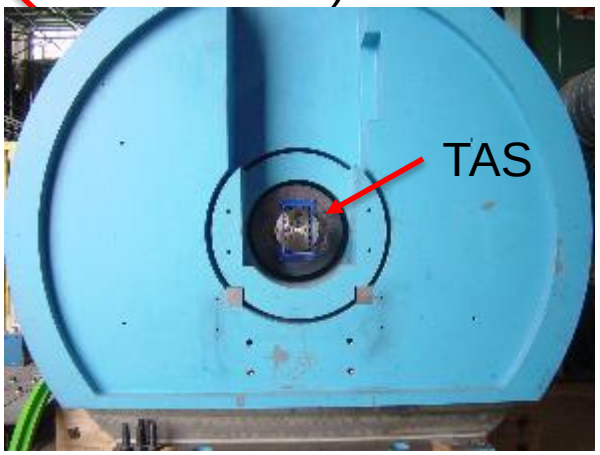
TAS region in ATLAS Forward Shielding

Movable: Octagonal shielding (JFS), cylindrical shielding (JFC)



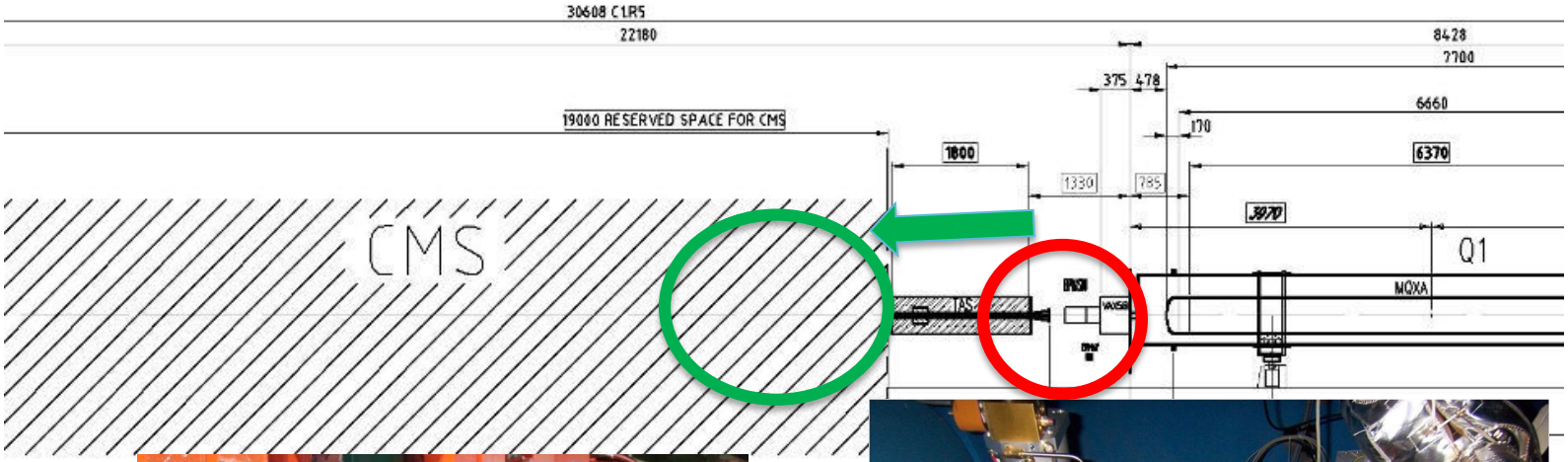
Courtesy of M. Raymond

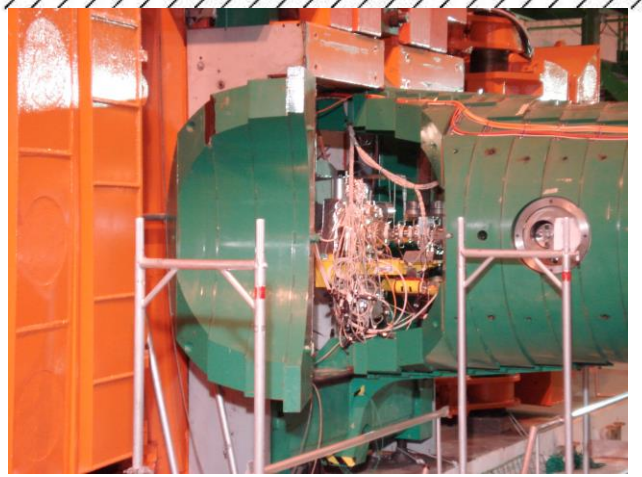
TAS absorber (inside fixed TX1S)

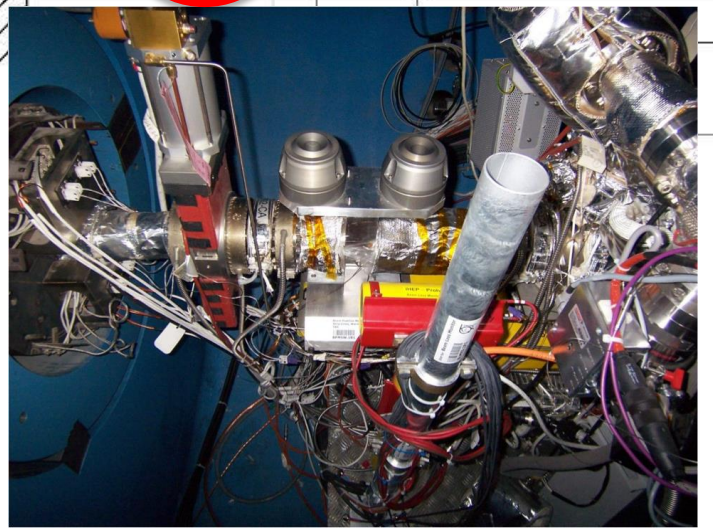


Finding space

- Q1-TAS: 1.3 m. Equipment installed: warm BPM, 2 vacuum valves, bellows, bake-out equipment, He tightness dome, Z-stops.

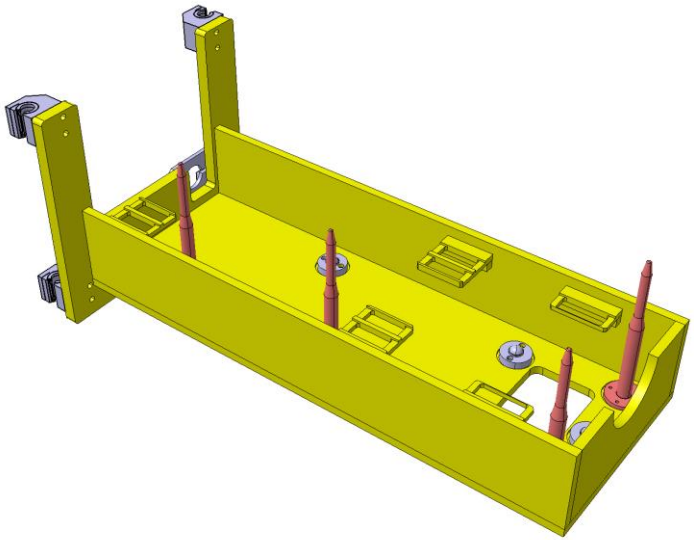


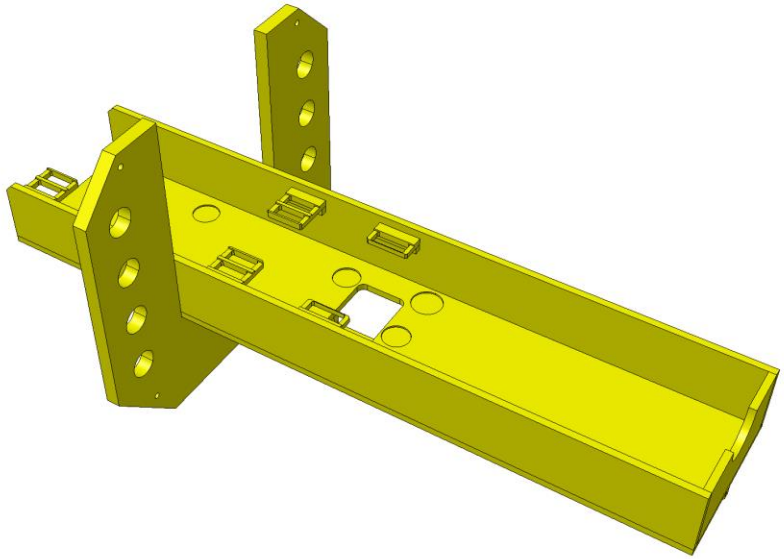




Proposal

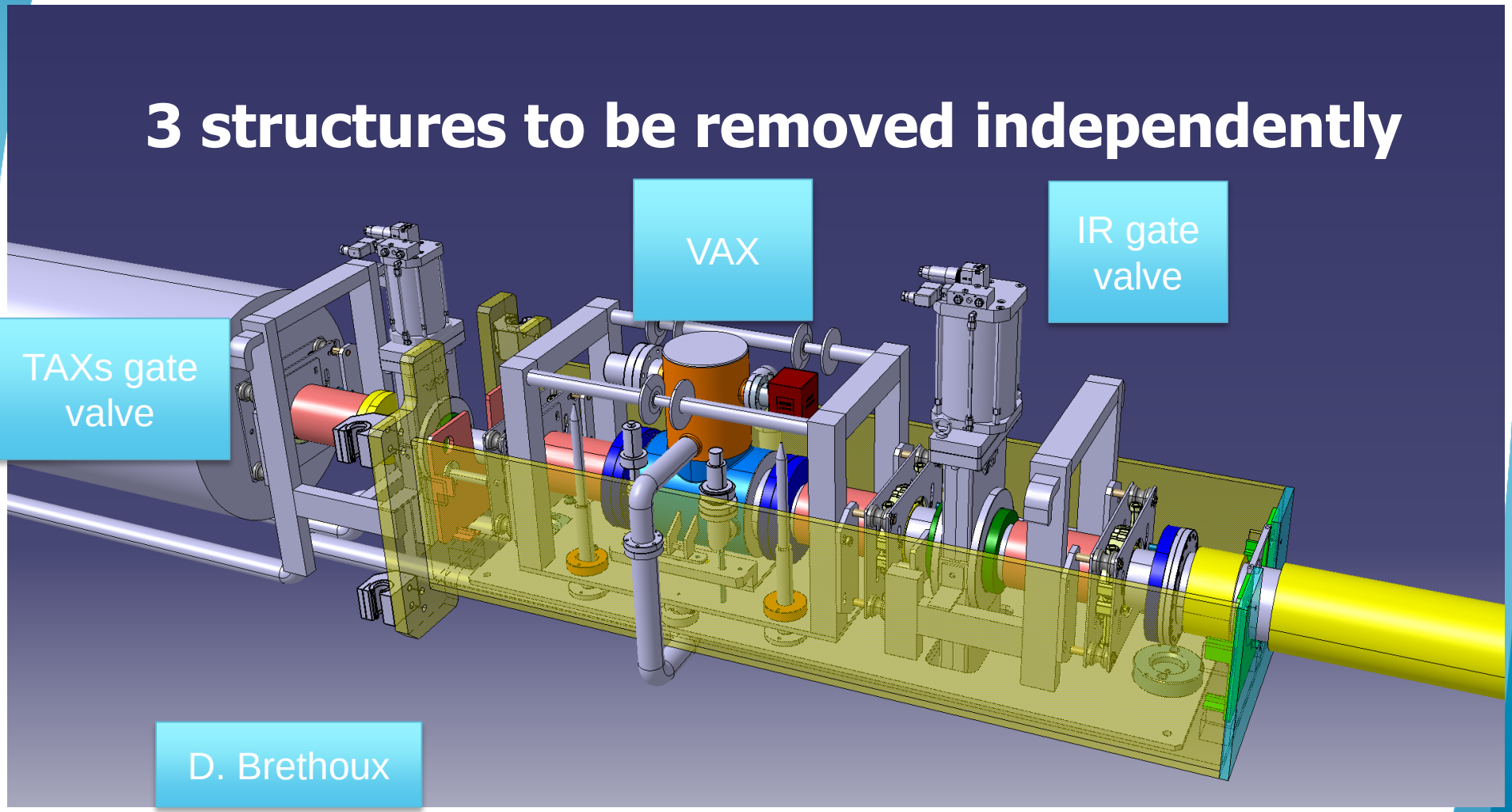
- Integrate the BPM in Q1 and relocate the VAX equipment from the tunnel to the experiment side in order to improve access & minimize operations.



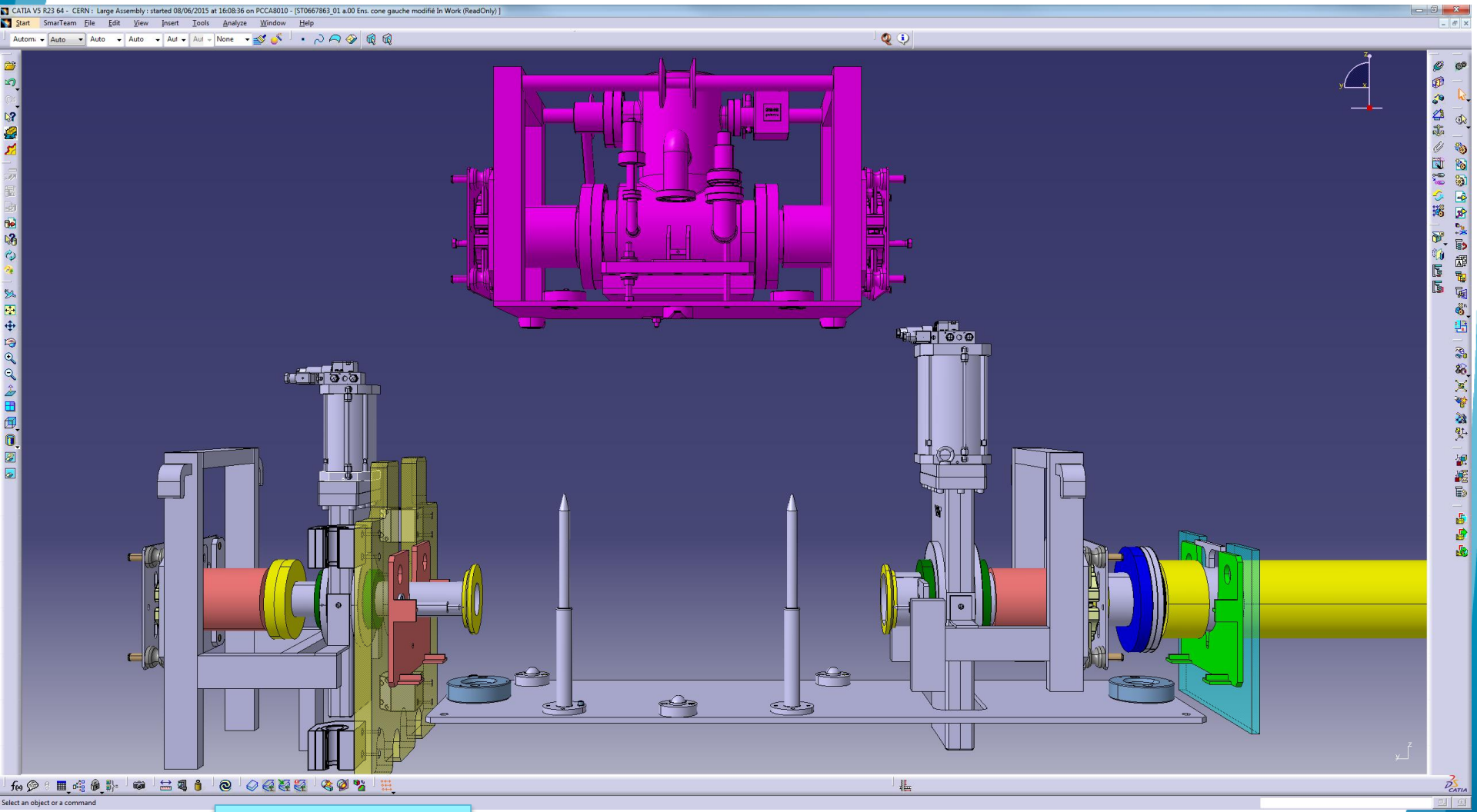


- Support structure, remote handling of modules, quick connectors plugins.

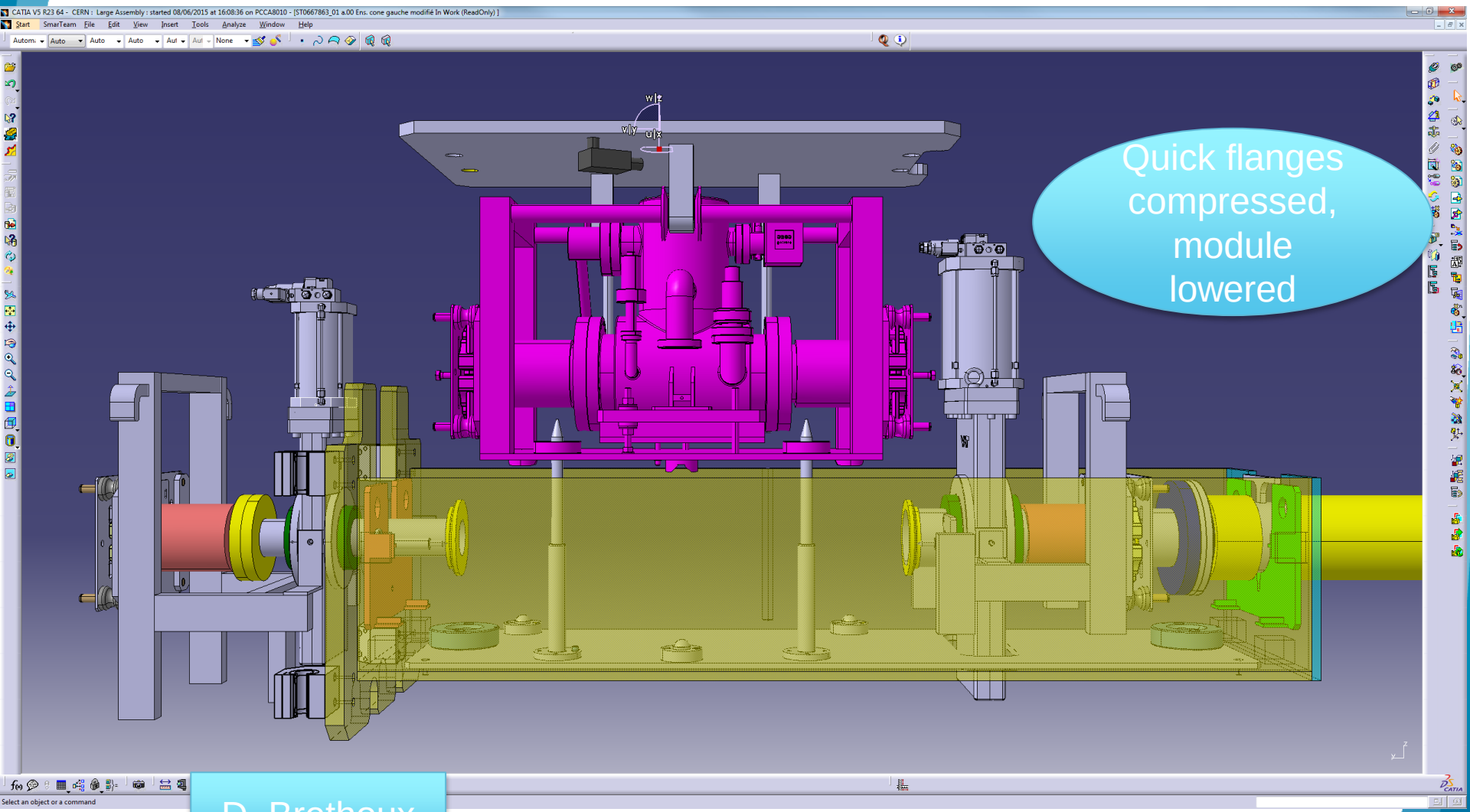
Concept of VAX maintenance



VAX Installation sequence

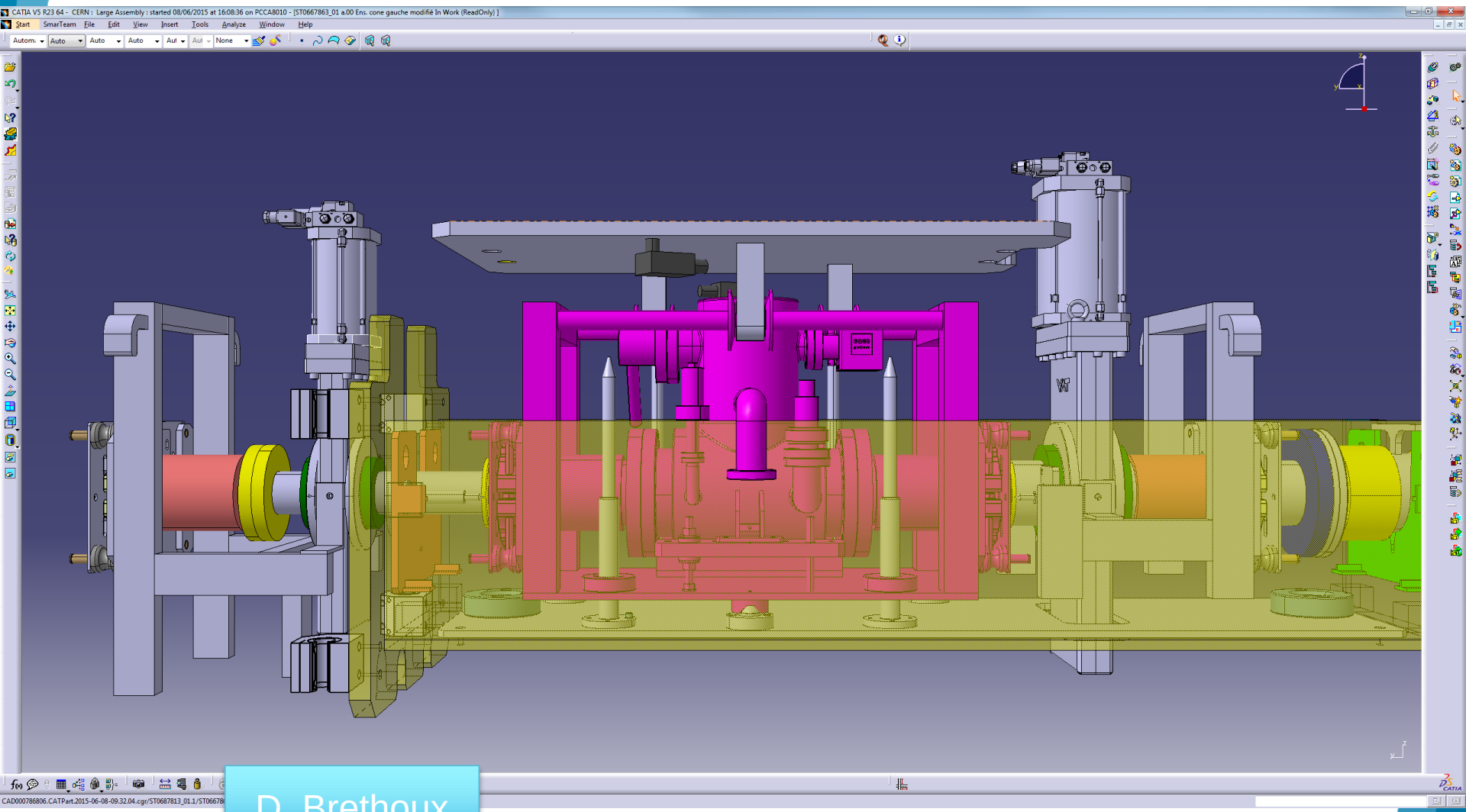


VAX Installation sequence



D. Brethoux

VAX Installation sequence



D. Brethoux

Remote connectors definition

Cabling requirements defined

List of Vacuum cables for ATLAS-CMS

(Table of cables for one side only)

#	Cable name	Cable ID	starting point	Destination	Cable		AS side	Notes
1	Heating			TAS, valve module 1	Type E- NiCr-CuNi, MCTR6	0.22 Right		ex. DAI5568208
2	Heating			TAS, valve mo	Type E- NiCr-CuNi, MCTR6	0.22 Right		ex. DAI5568208
3	Heating			TAS	Type E- NiCr-CuNi, MCTR6	0.22 Right		ex. DAI5568208
4	Heating			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	0.22 Right		ex. DAI5568208
5	Heating			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	0.22 Right		ex. DAI5568208
6	Thermocouple			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	2.5 Right		ex. DAI5119959
7	Thermocouple			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	2.5 Right		ex. DAI5119959
8	Thermocouple			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	2.5 Right		ex. DAI5119959
9	Thermocouple			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	2.5 Right		ex. DAI5119959
10	Thermocouple			TAS, valve module 2	Type E- NiCr-CuNi, MCTR6	2.5 Right		ex. DAI5119959
11	Position valve			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
12	Heating			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
13	Heating			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
14	Heating			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
15	Heating			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
16	Heating			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
17	Thermocouple			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
18	Thermocouple			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
19	Thermocouple			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
20	Thermocouple			TAS, valve module 2	Bake-out VEC (heating collars)	2.5 Right		ex. DAI5568208
21	Thermocouple			TAS, valve module 2	Bake-out VET (heating tapes)	2.5 Right		ex. DAI5568208
22	Position valve			TAS, valve module 2	Bake-out VET (heating tapes)	2.5 Right		ex. DAI5568208
23	Thermocouple			TAS, valve module 2	Bake-out VET (heating tapes)	2.5 Right		ex. DAI5568208
24	Thermocouple			TAS, valve module 2	Bake-out VET (heating tapes)	2.5 Right		ex. DAI5568208
25	Thermocouple			TAS, valve module 2	Bake-out VET (heating tapes)	2.5 Right		ex. DAI5568208
26	Thermocouple			TAS, valve module 2	Bake-out VEJ (heating jackets)	2.5 Right		
27	Thermocouple			TAS, valve module 2	Bake-out VEJ (heating jackets)	2.5 Right		
28	Thermocouple			TAS, valve module 2	Bake-out VEJ (heating jackets)	2.5 Right		
					Bake-out VEJ (heating jackets)	2.5 Right		
					Bayard-Alpert power, NF12/NFR12	0.75 Right	Triax	
					Bayard-Alpert measure, TCA3	Right	Coax	
					Ionic pump power + measure, SVA3/SVR3	Right	Triax	
					Penning Power + measure TFA3/TFAR3	Right		
					Pirani Power + measure NG4/NGR4	1 Right		
					NEG cartridge power NG4/NGR4	1.5 Right		ex. DAI5119959
					NEG cartridge measure (tbc)	0.22 Right		ex. DAI5119959
						0.75 Right		
						0.22 Right		ex. DAI5119959
						0.22 Right		ex. DAI5119959
						0.22 Right		ex. DAI5119959
						0.22 Right		ex. DAI5119959
						0.22 Right		ex. DAI5119959
						0.22 Right		ex. DAI5119959

(initial meeting July @CERN)

Meeting connectors, 15-sept-2016

(Gregory Pigny (TE/VSC), Francisco Sanchez Galan (EN/EA), Damien Brethoux(EN/EA), Lukasz Krzkempek (TE/VSC), Michael Lazzaroni(EN/EA))

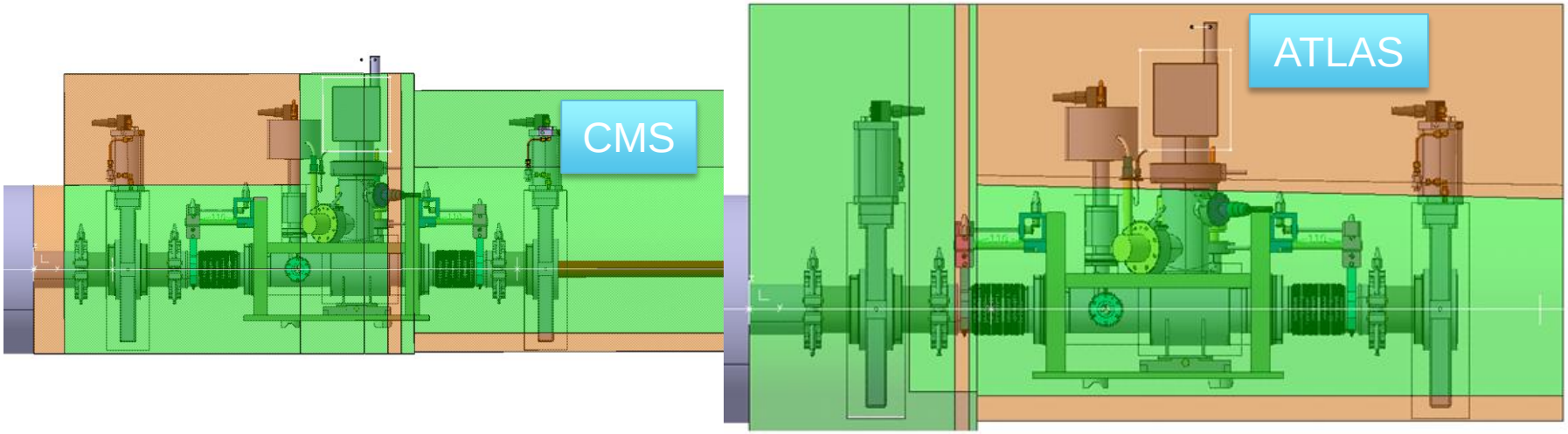
Goal of the visit: *Definition of the connectors according to TE/VSC specifications*

Connector “Combitac”

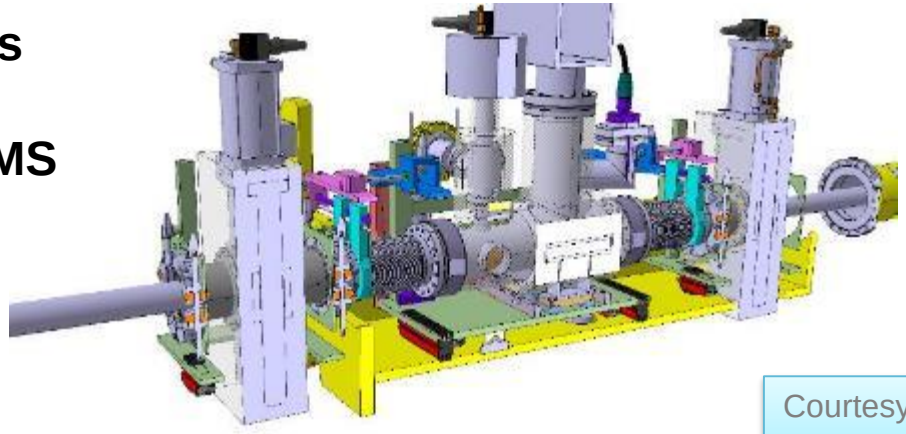
Connector “REP”

Pictures from the visit @Staubli (sept-2016)

VAX integration

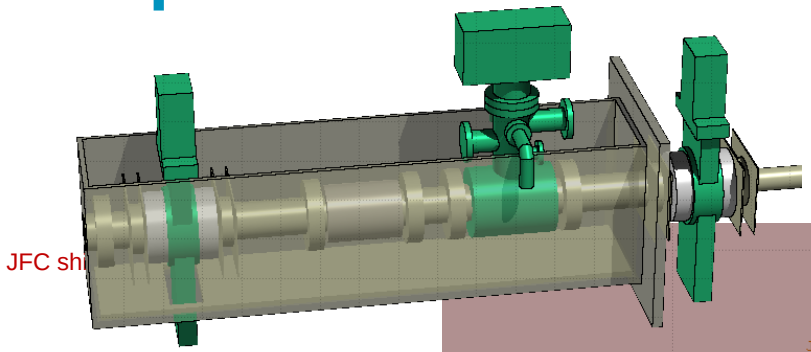


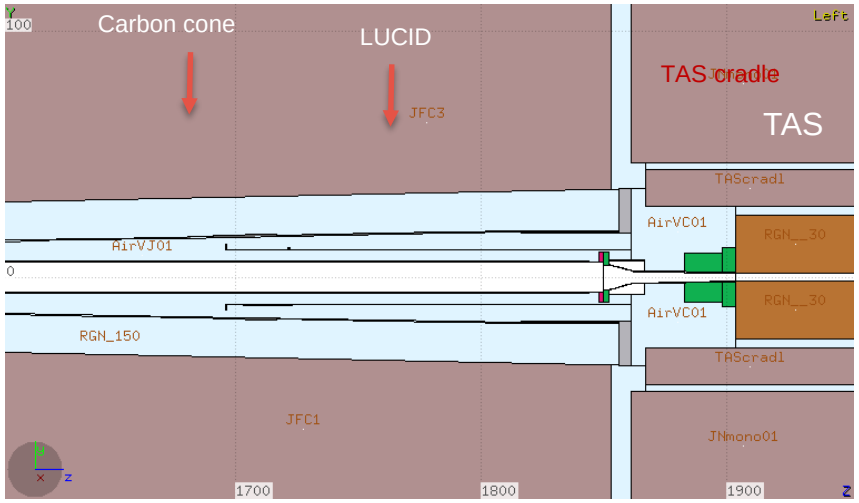
Proposed layout fits inside the volumes both in ATLAS & CMS



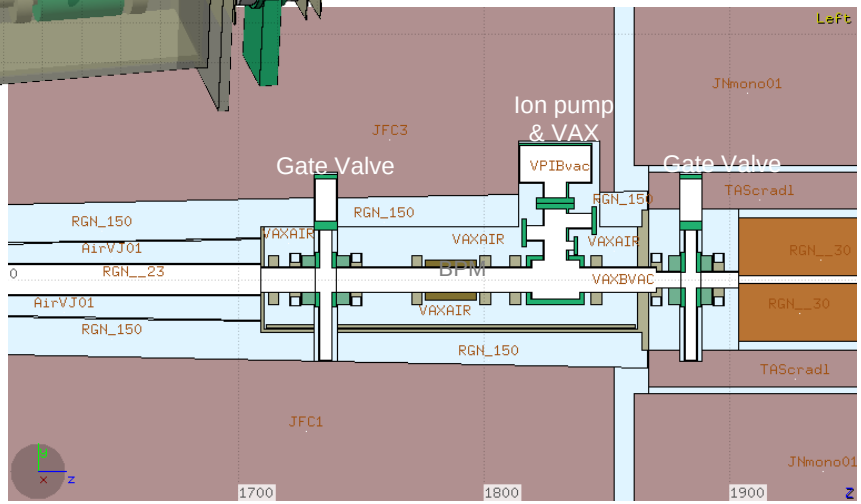
Courtesy of L, Krzkempek, J. Perez Espinos

VAX implementation in ATLAS





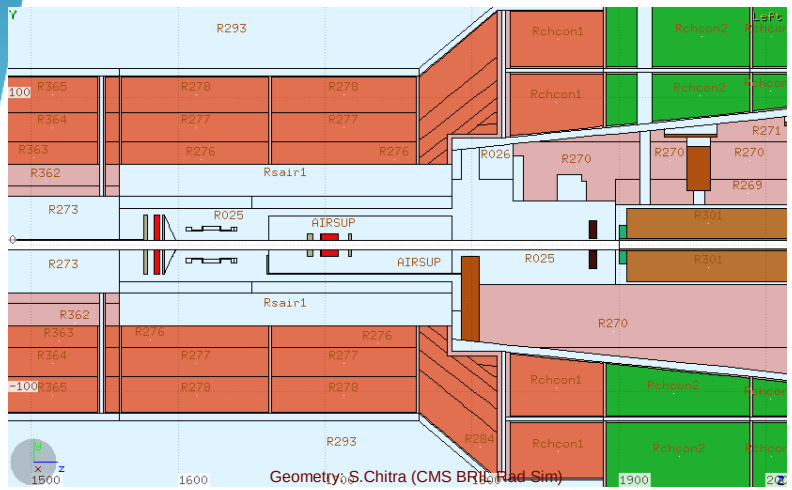
Reference geometry.
LUCID installed.

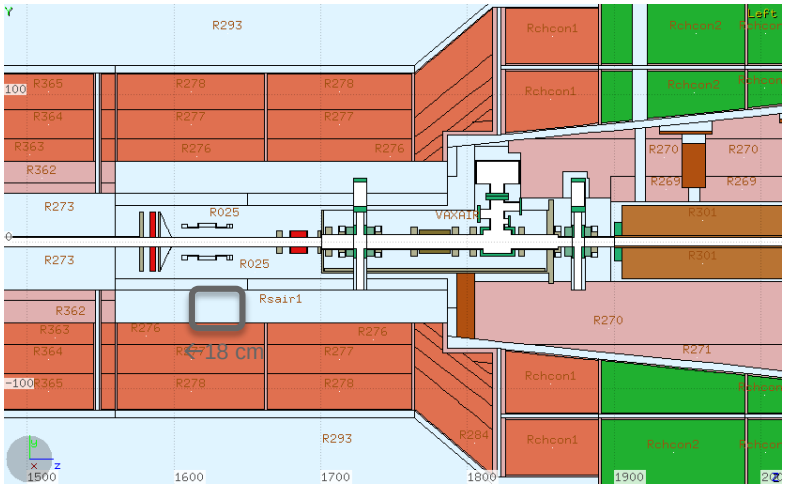


VAX installation. Beam pipes cut off, LUCID & TAS flanges removed, few cut-outs in shielding.

Ida Bergstrom, Heinz Vincke (HSE/RP)

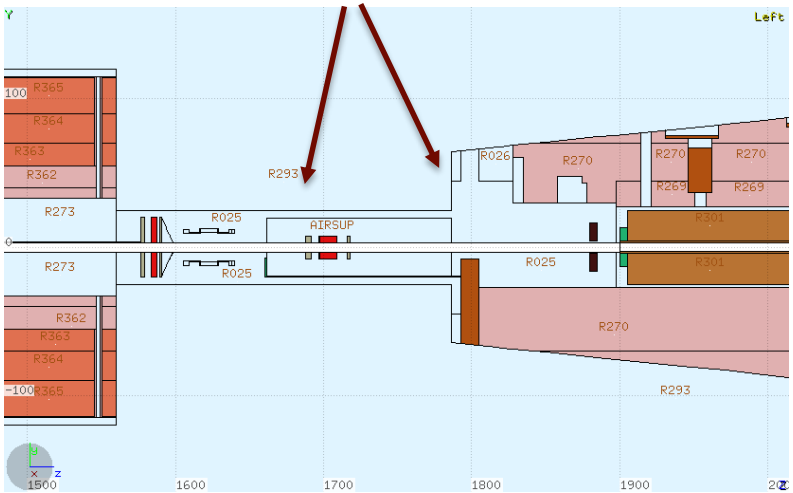
VAX implementation in CMS

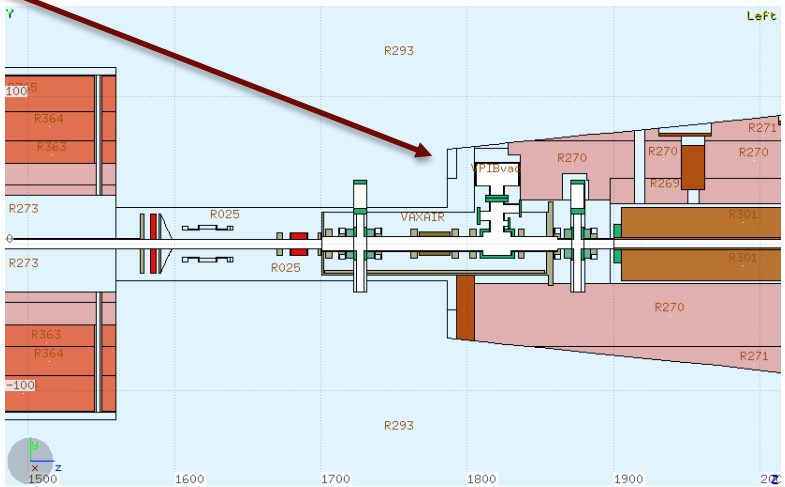




Geometry: S.Chitra (CMS BRIL Rad Sim)

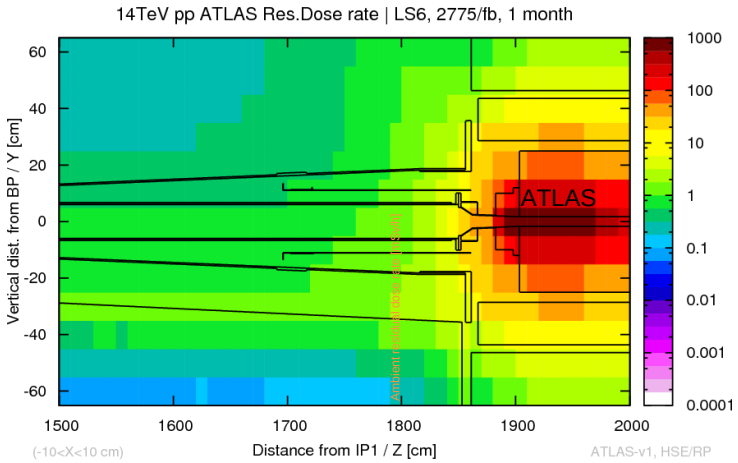
Included gaps in support tube and FIN



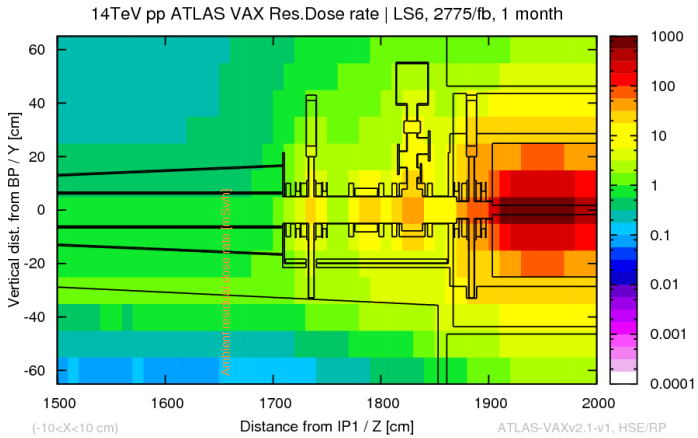


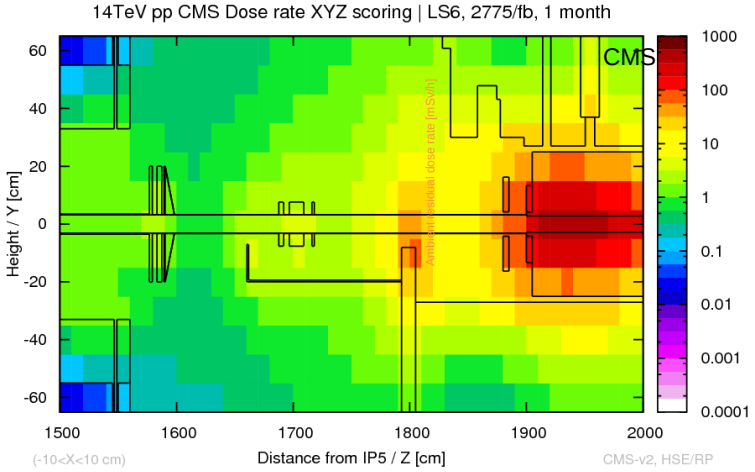
Ida Bergstrom, Heinz Vincke (HSE/RP)

H*(10) in mSv/h, LS6 1 months cooling

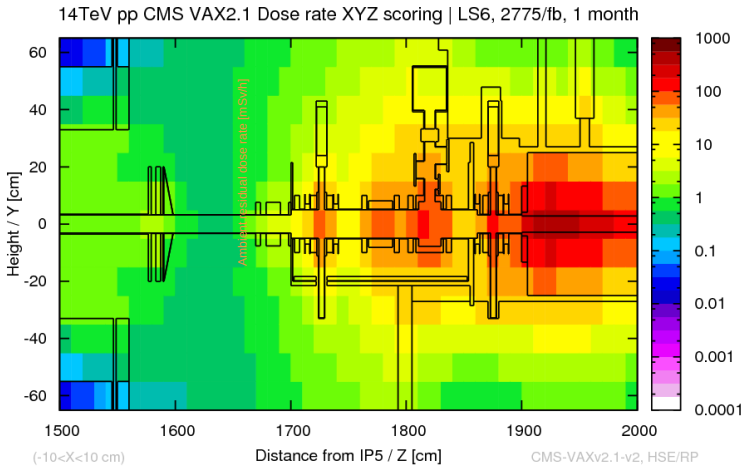


ATLAS



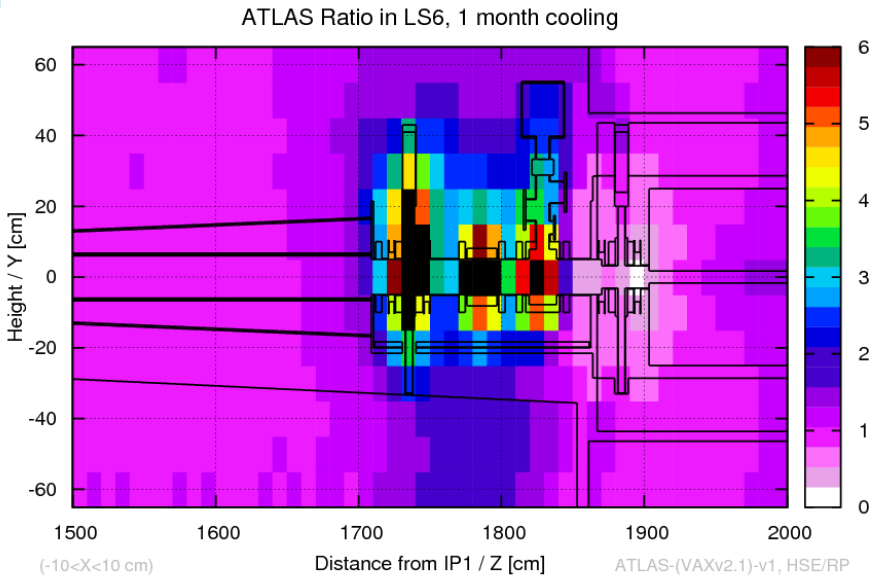


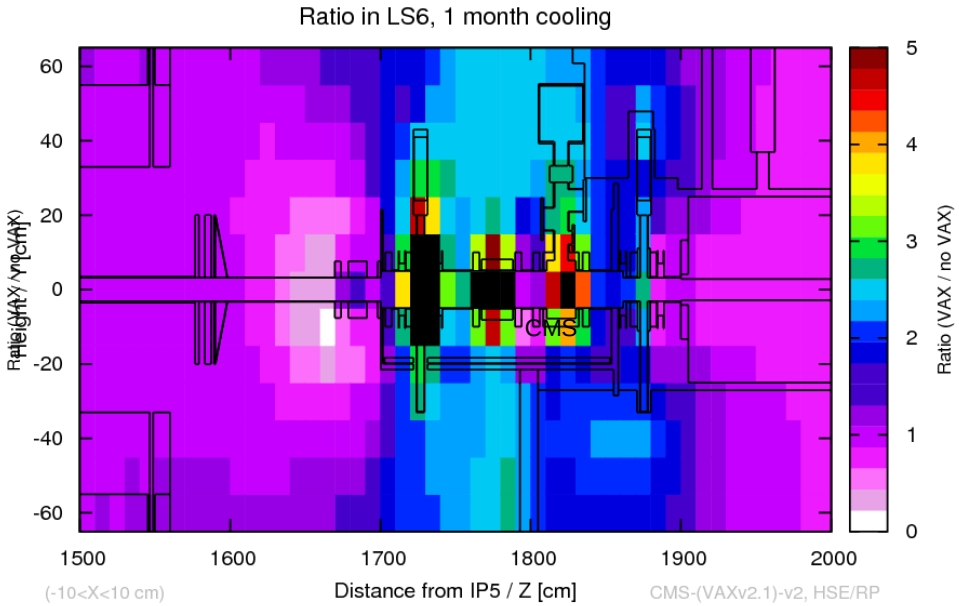
CMS



Ida Bergstrom, Heinz Vincke (HSE/RP)

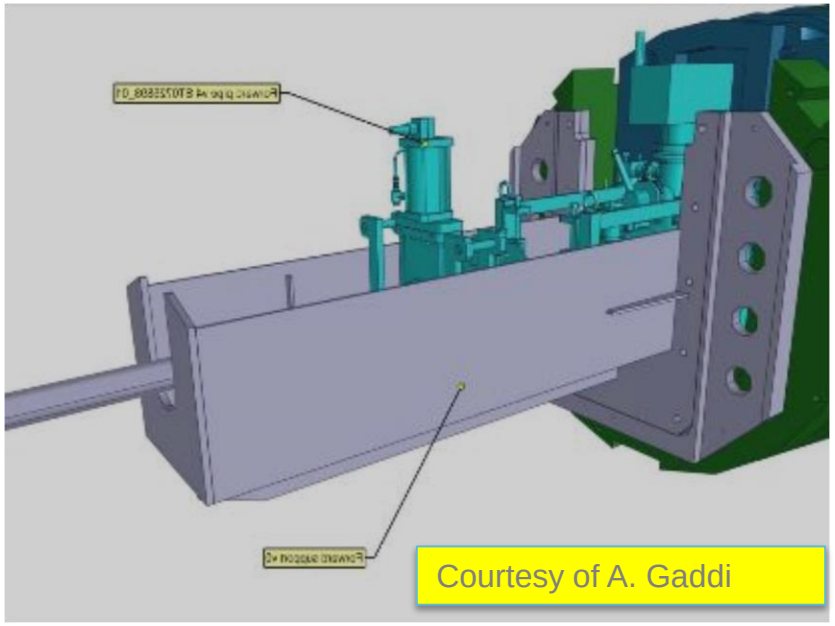
H*(10) in mSv/h, LS6 1 months cooling





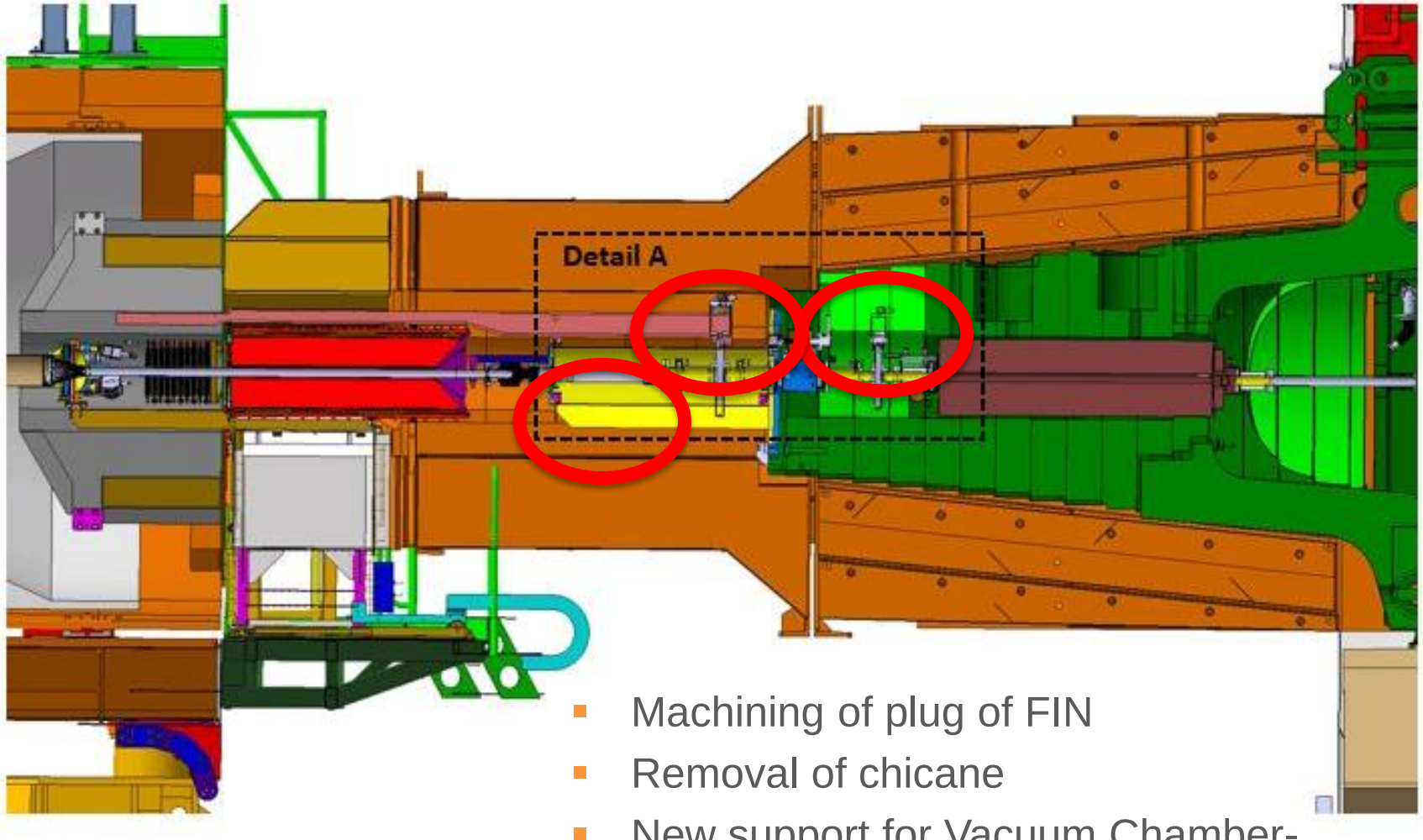
Ida Bergstrom, Heinz Vincke (HSE/RP)

VAX relocation- CMS



New support will host VAX modules, services re-routed inside FIN. Shielding modified

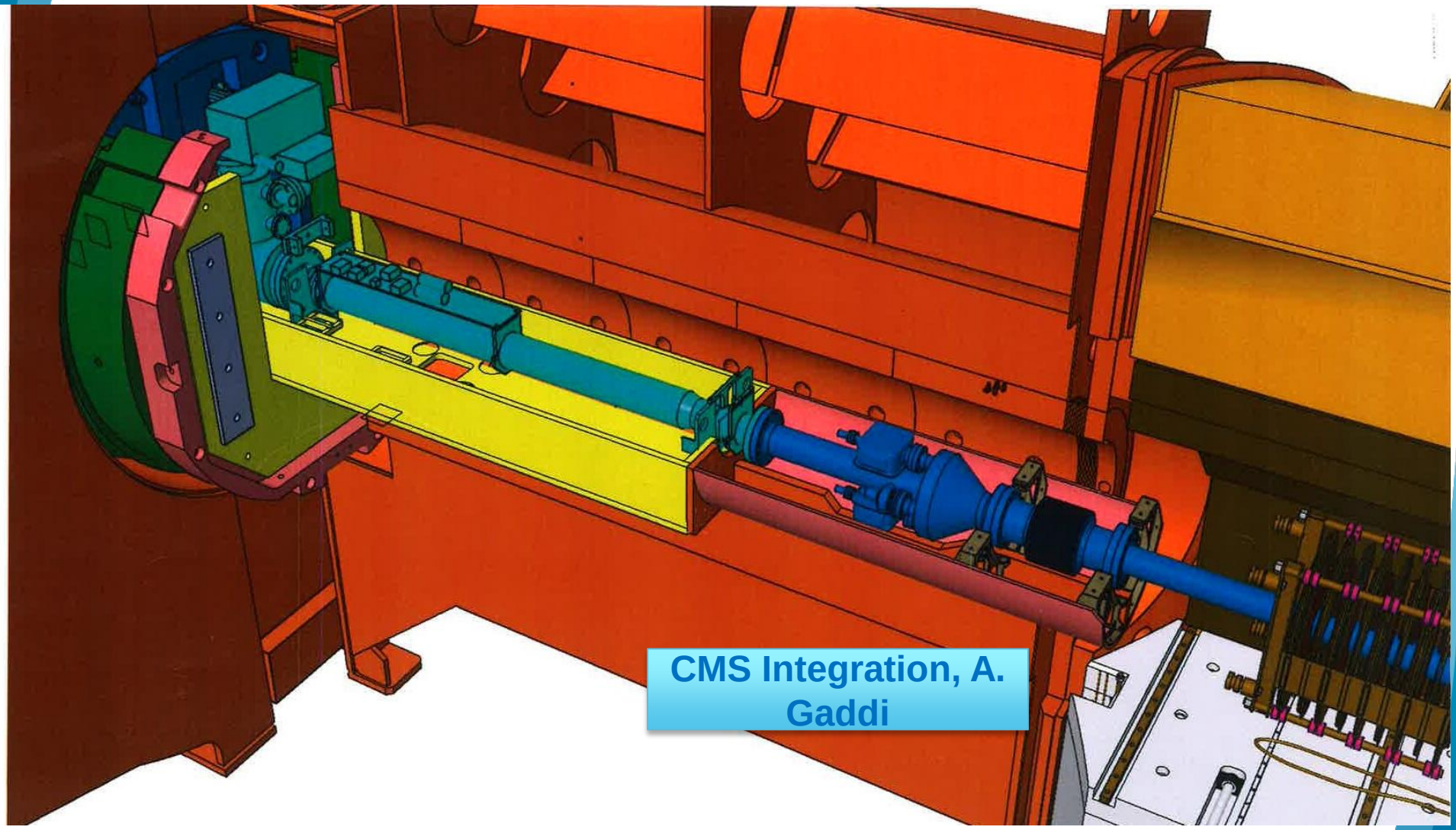
Shielding modifications (1/2)



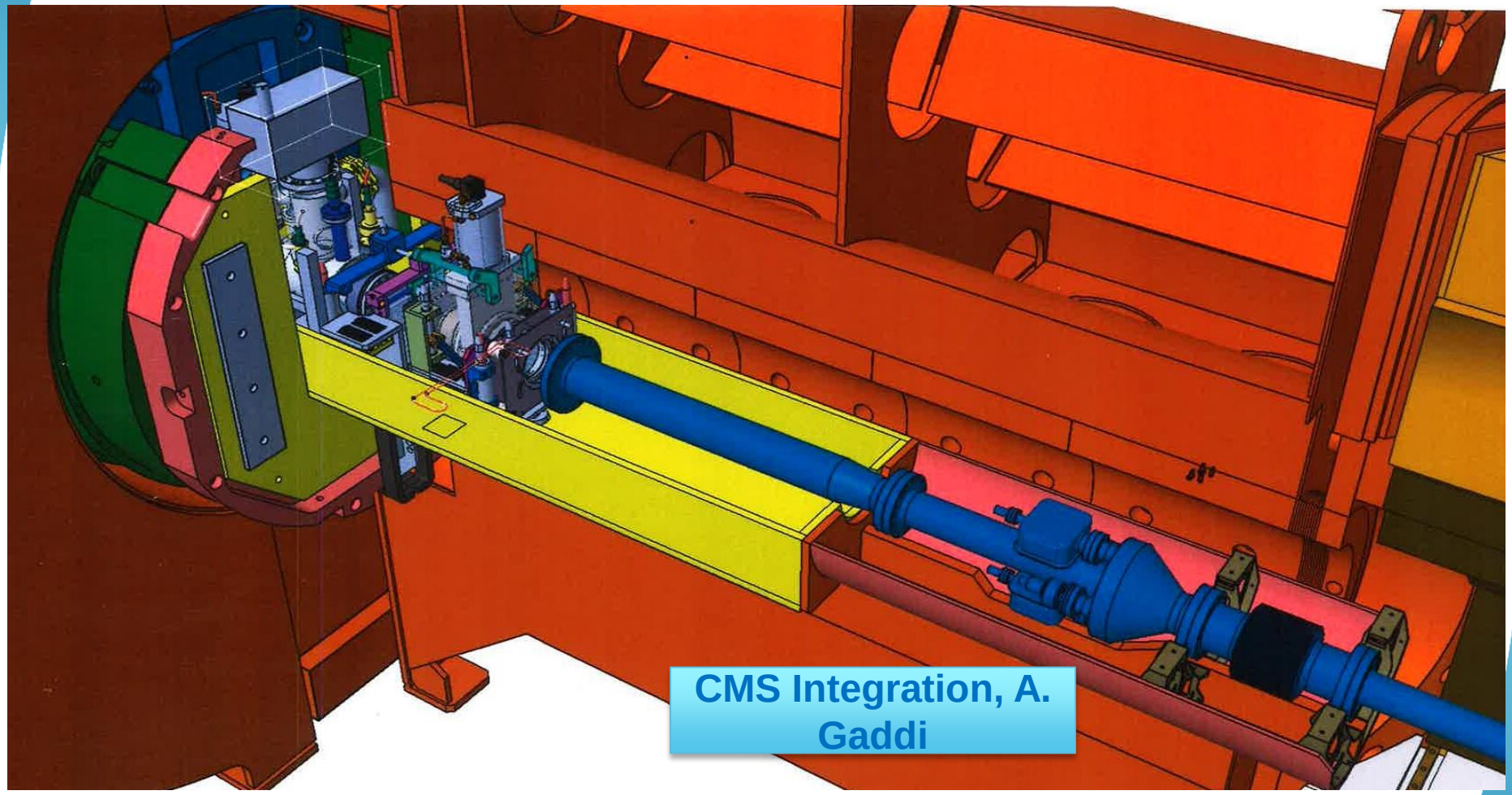
Courtesy A. Gaddi

- Machining of plug of FIN
- Removal of chicane
- New support for Vacuum Chamber- Advance installation to LS2 (!)
- Re-routing of services to pumps

LS2 CONFIGURATION

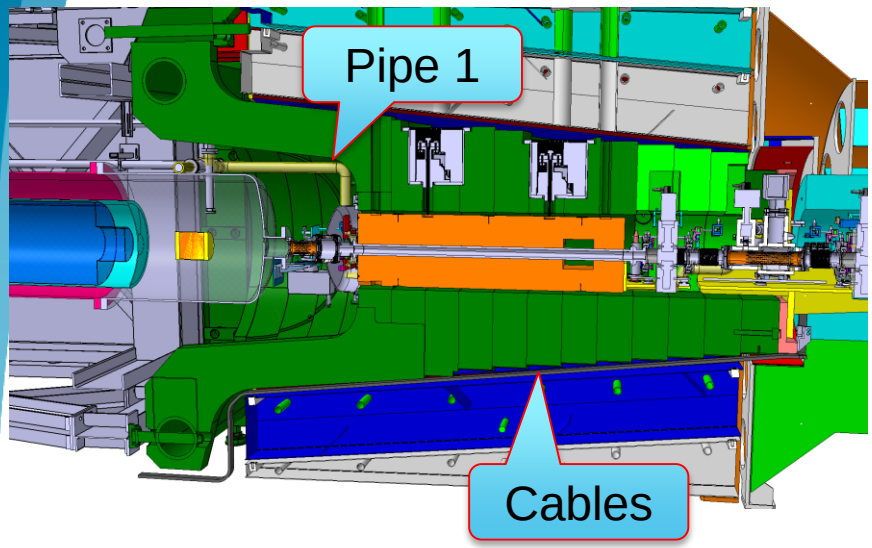


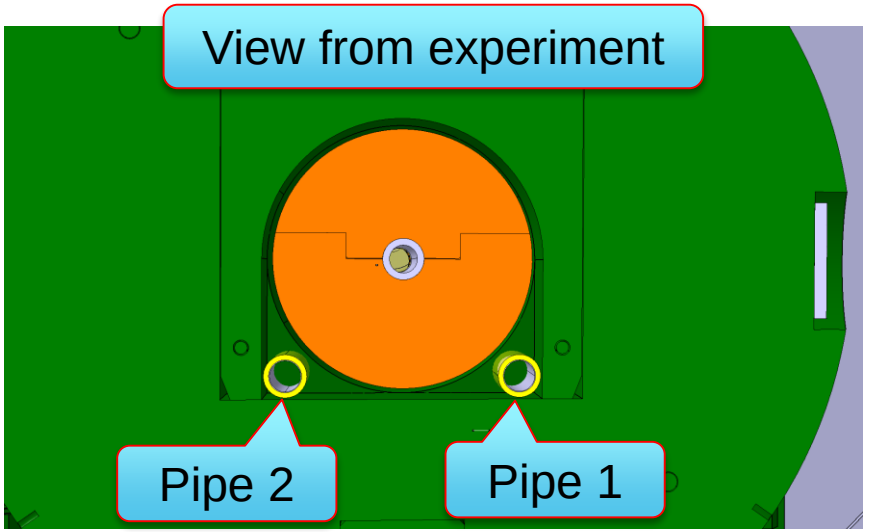
LS3, HL-LHC CONFIGURATION

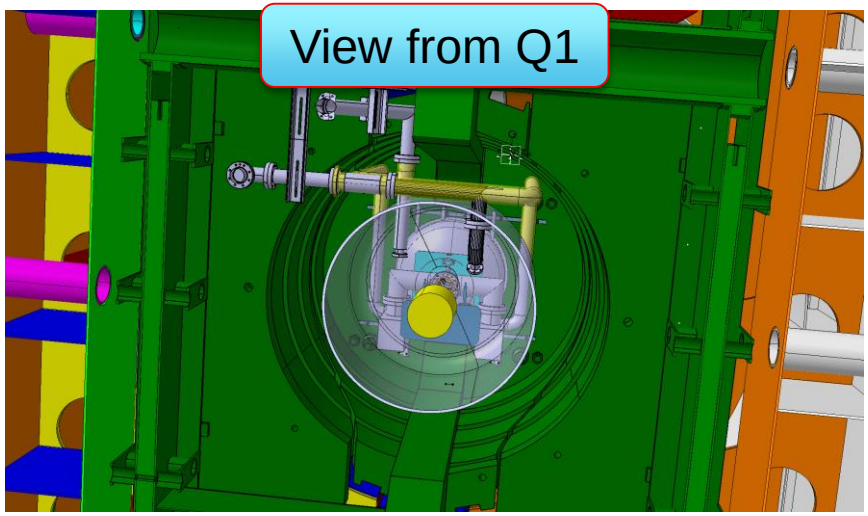


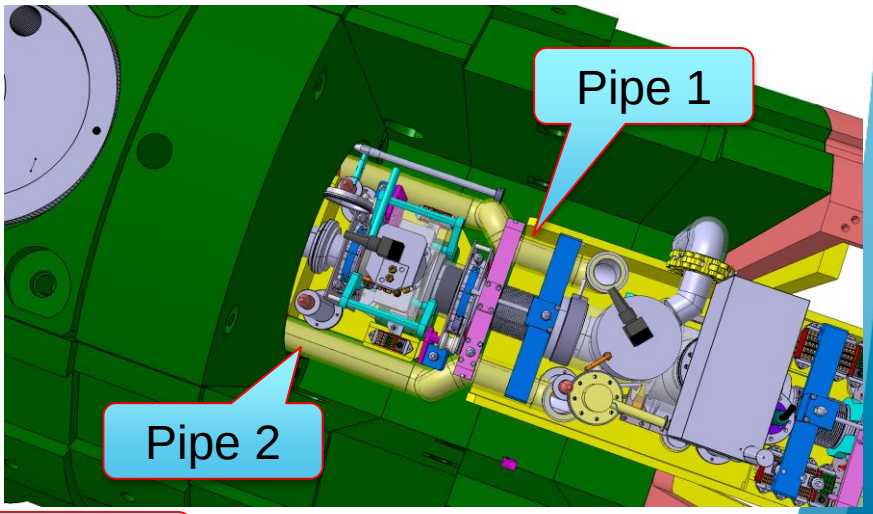
LS3

Services routing in CMS



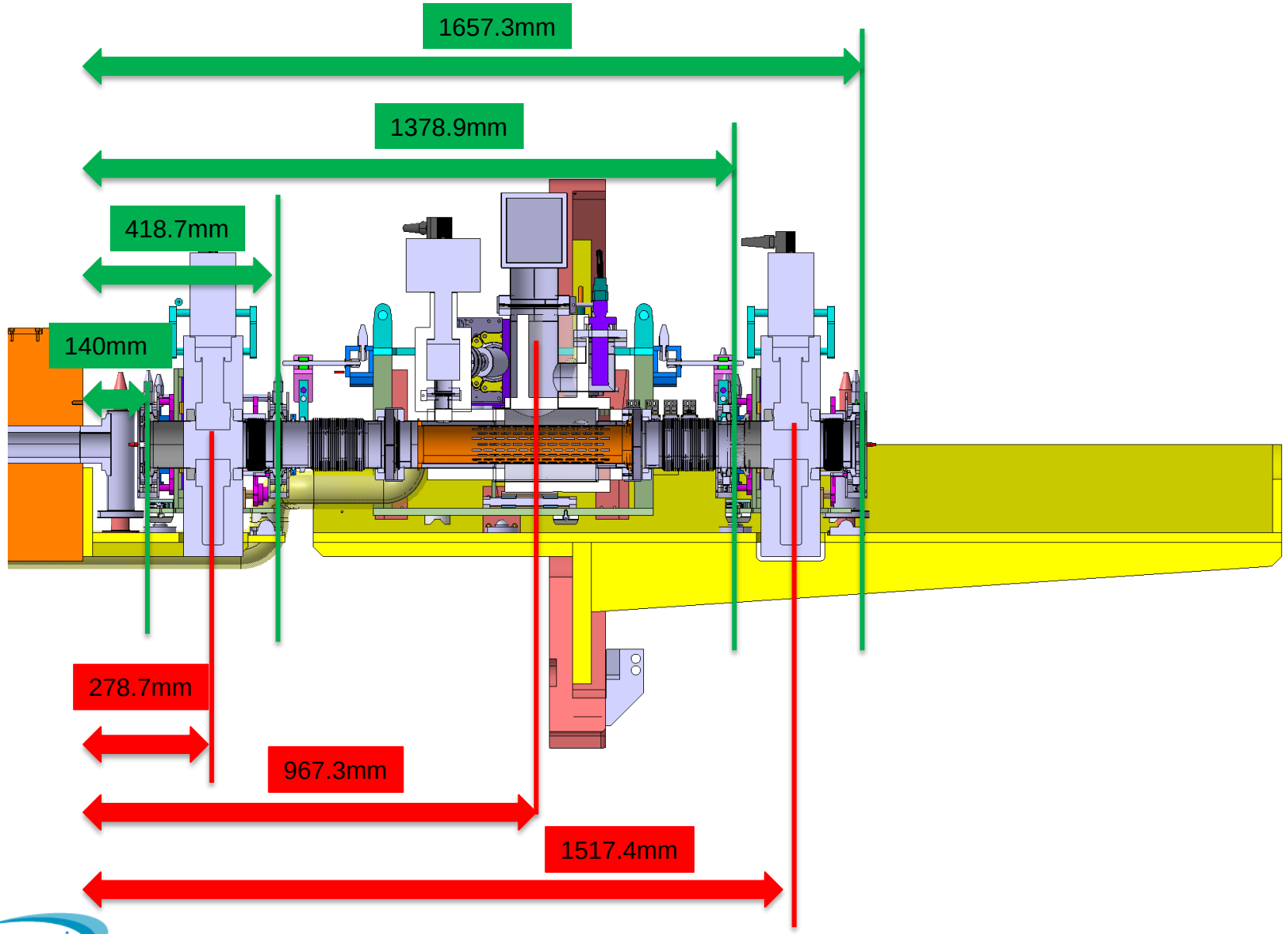




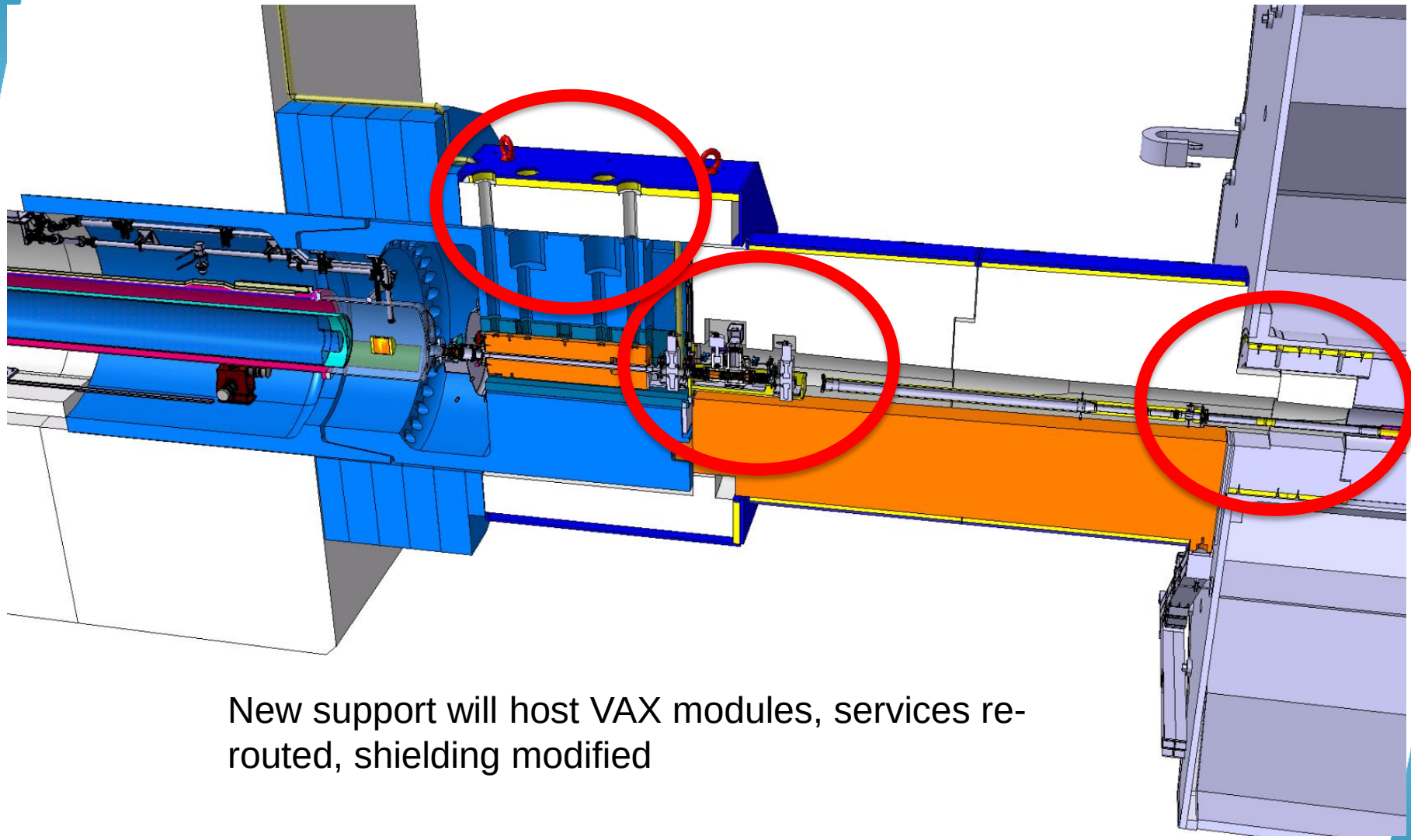


Pipe length = +/- 5.2m

VAX Relocation (CMS). Layout Oct 2016



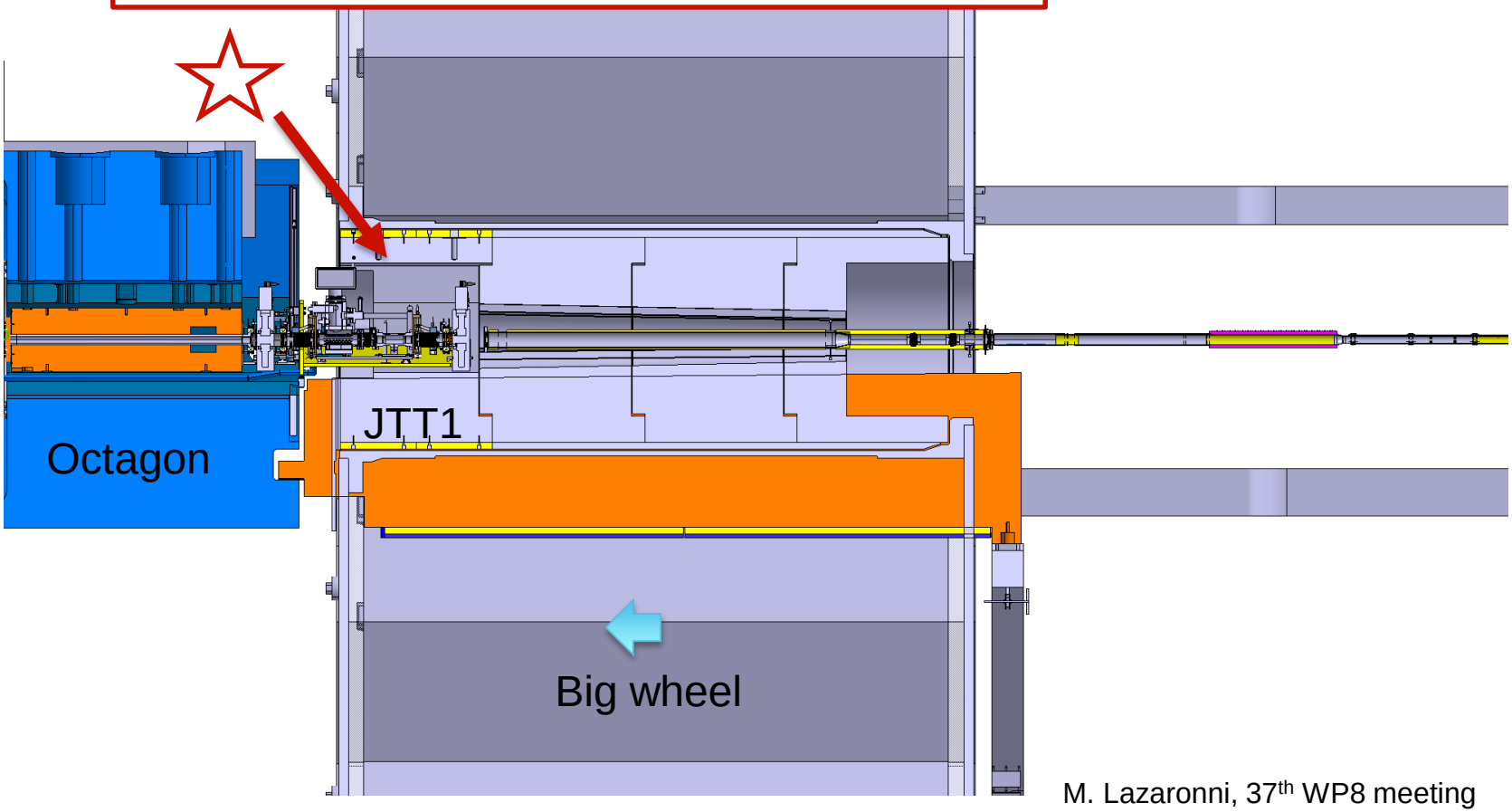
VAX relocation-ATLAS



New support will host VAX modules, services re-routed, shielding modified

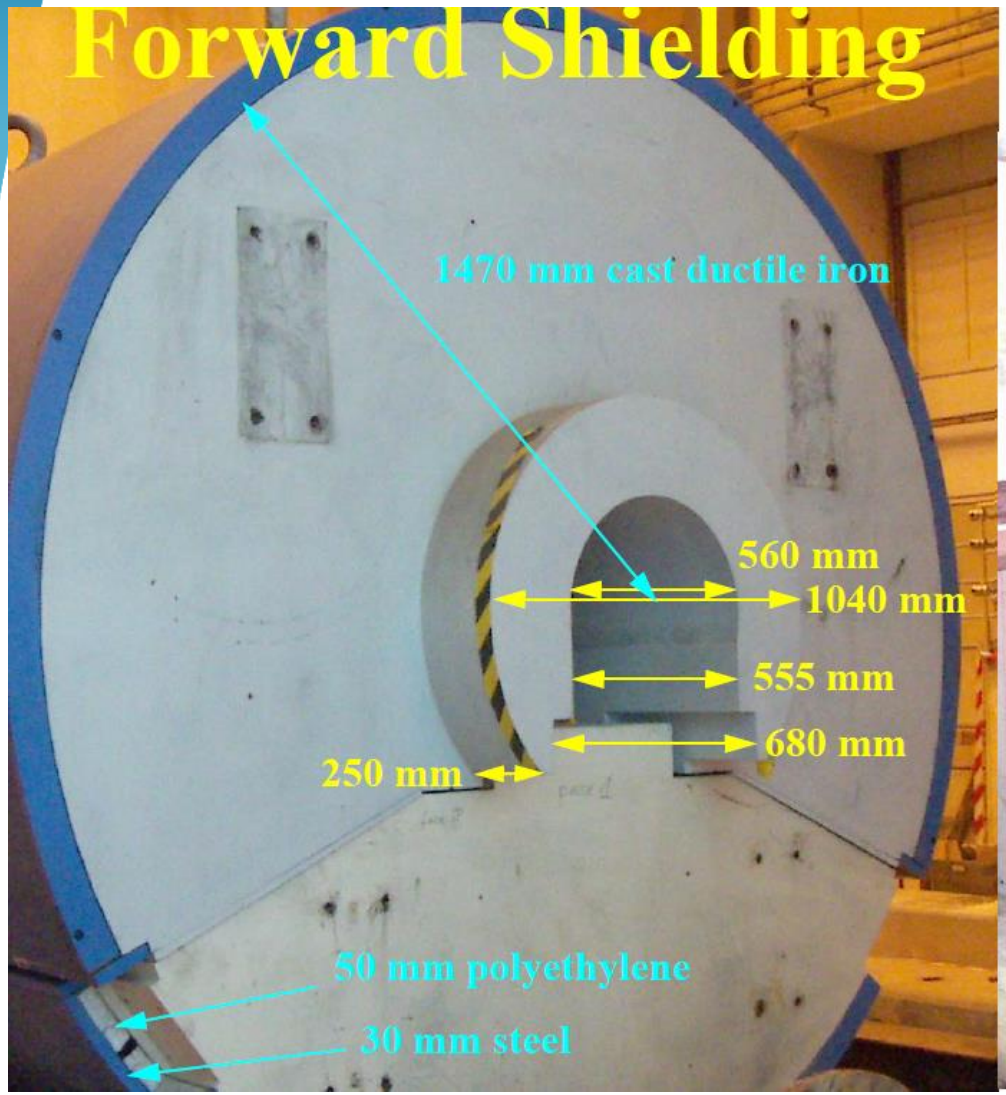
During Shutdown period: Toroid moved toward the octagon

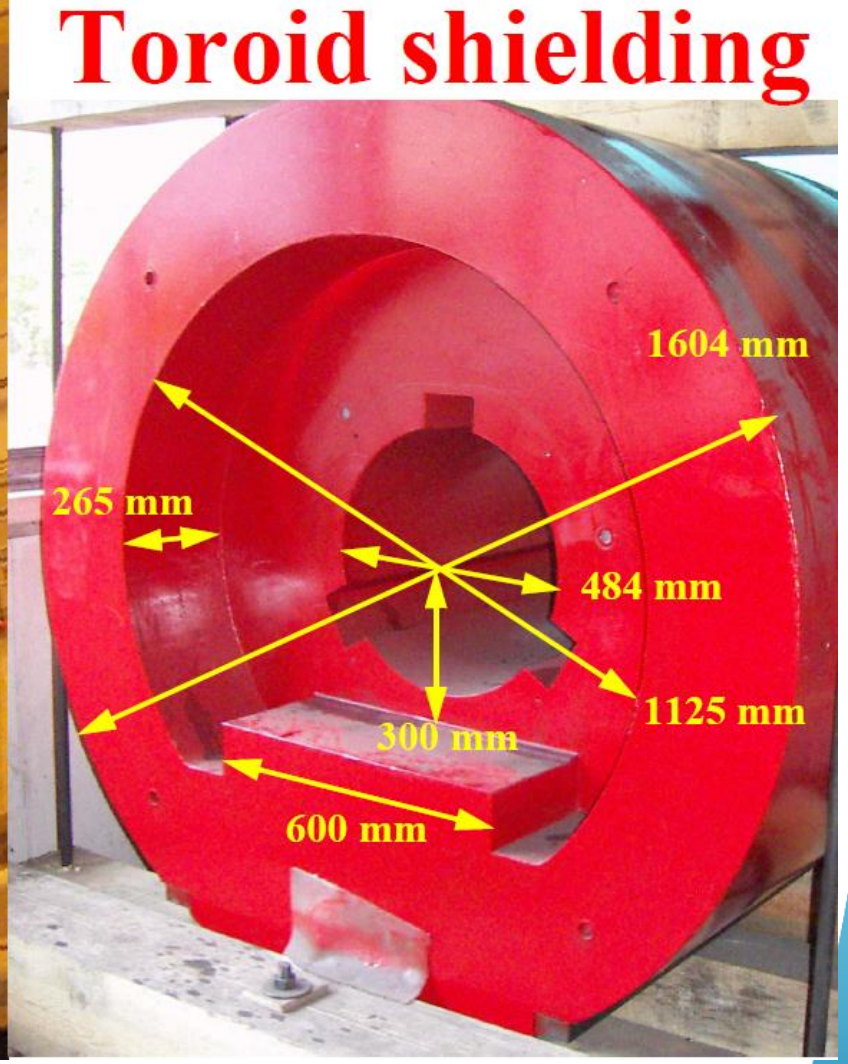
To avoid clash with new HL vacuum configuration, the JTT 1 has to be modified.



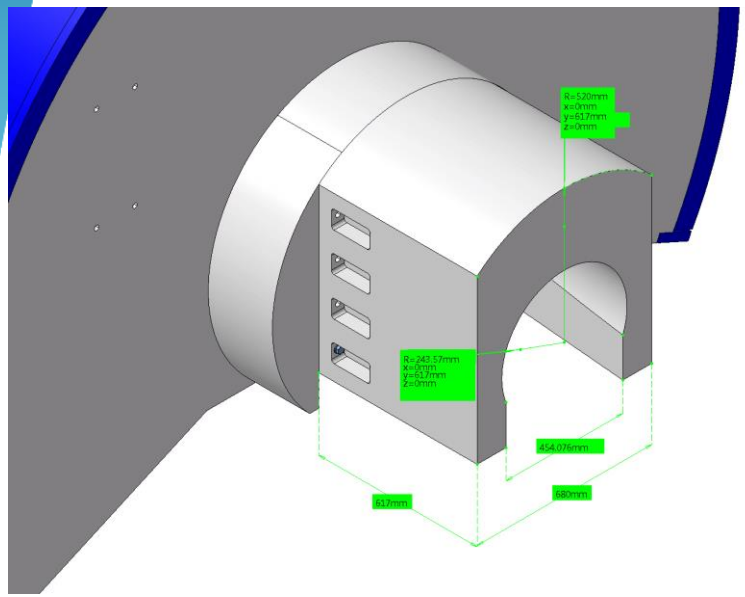
M. Lazaronni, 37th WP8 meeting

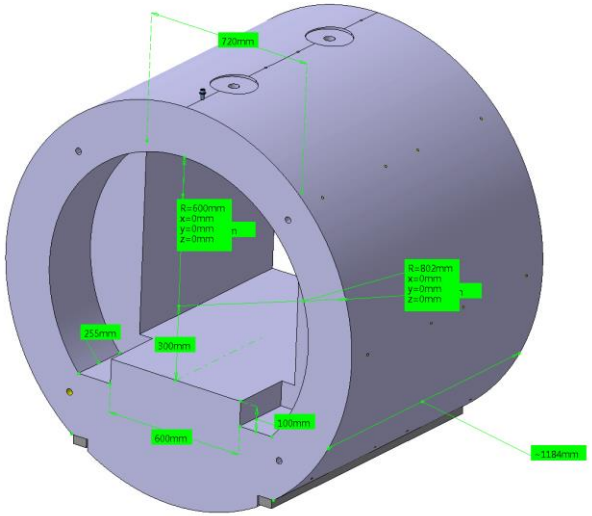
Current Shielding





Shielding's modifications on JTT&JFC2



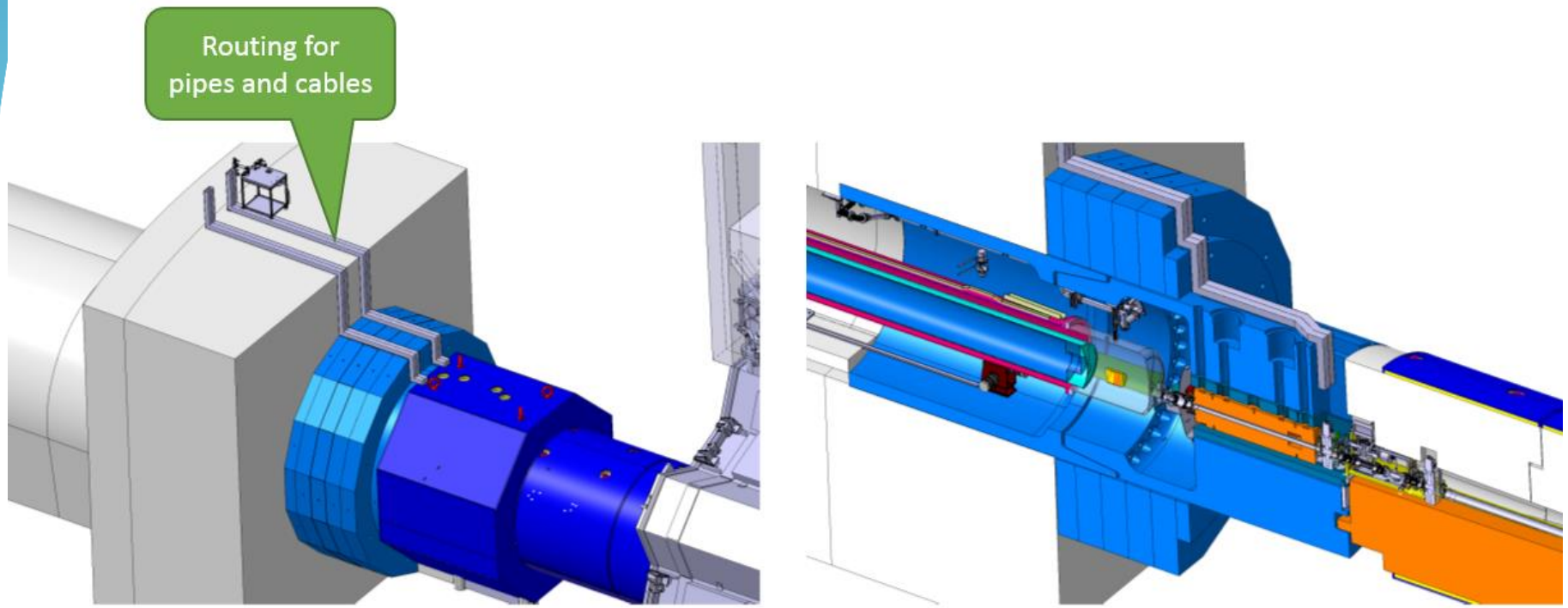


D. Brethoux

The bore inside of the ECT (JTT) needs to be modified
Shielding performance not affected as the shielding will be added on the JFC2 side.

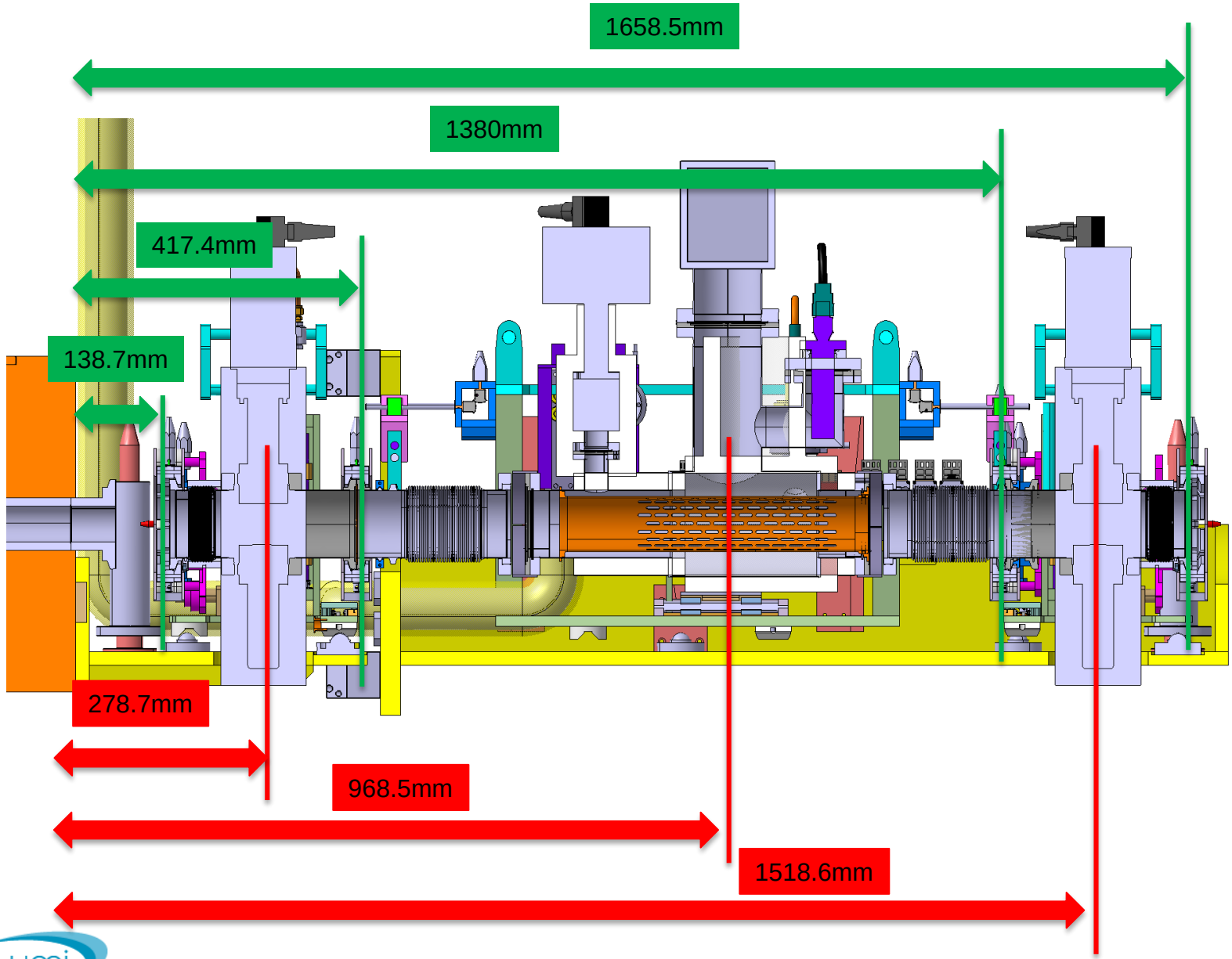
This activity is proposed to be advanced to LS2 (Activation, planning, synergies with TE VSC plans for VT chamber.

Services routing in ATLAS



Services routed on the TX1 nose

VAX Relocation (ATLAS). Layout Oct 2016



HL-LHC Layout (WP15)

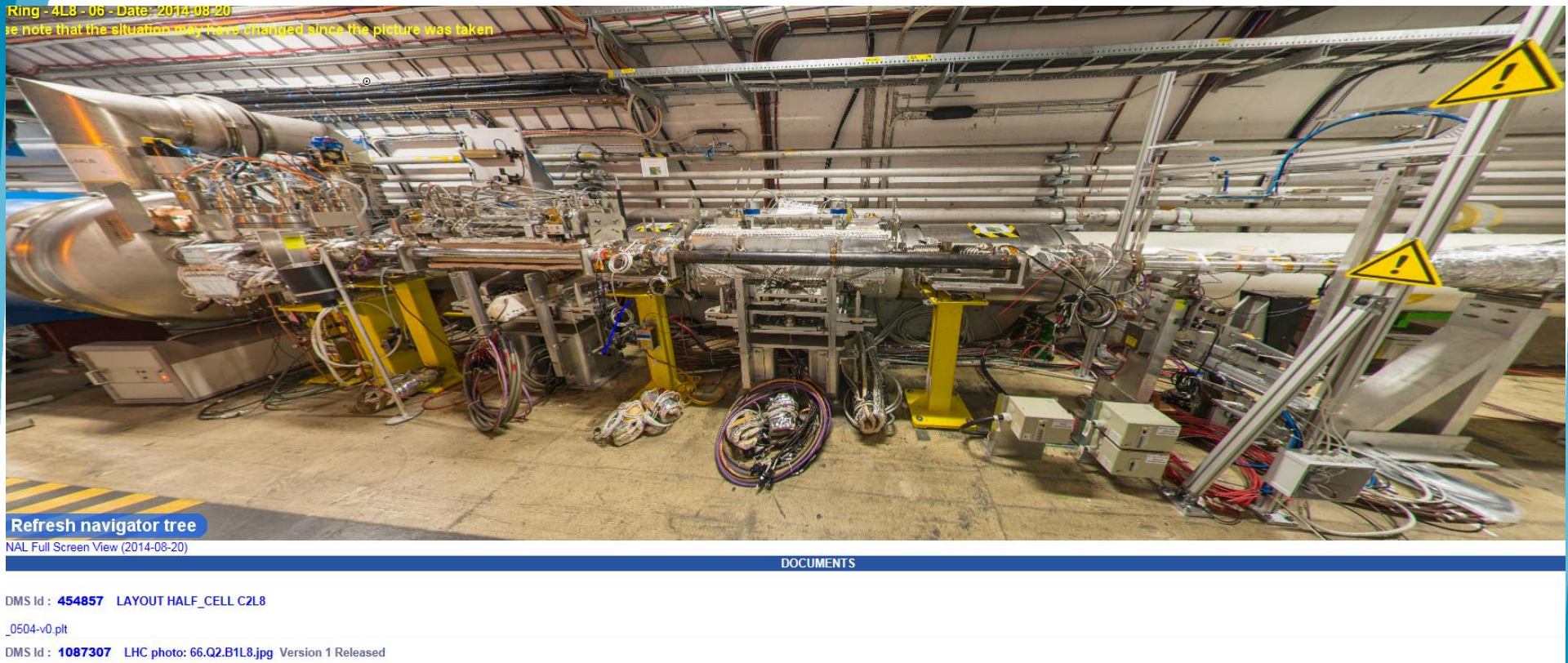
- P5 & P1 layout drawings released.

  https://espace.cern.ch/HiLumi/WP15/Layout%20drawings/Forms/AllItems.aspx

  - TAXS space reserved “VAX position and space occupation is provided only as information and subjected to agreement with the concerned LHC experiment ”

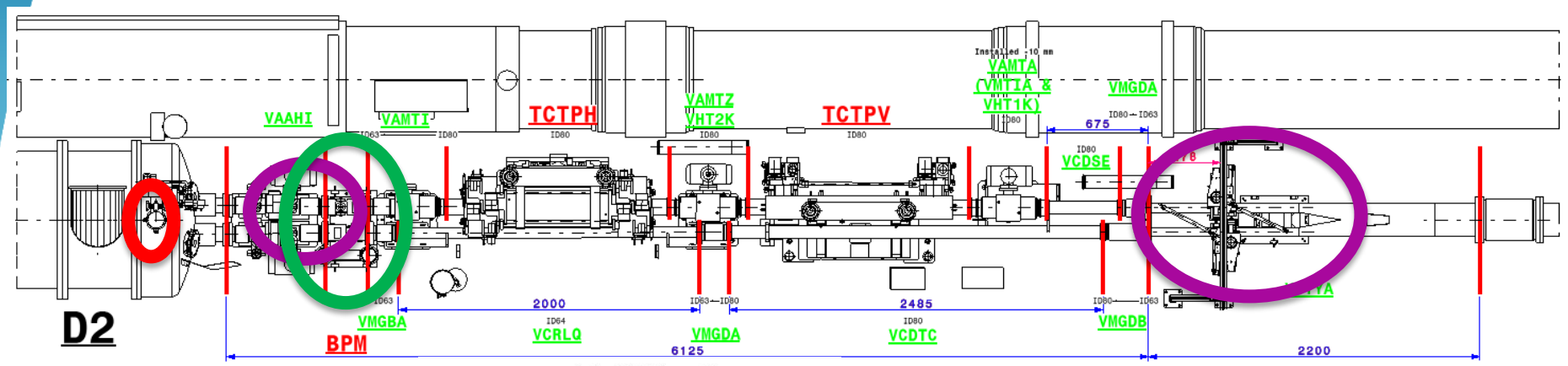
WP15

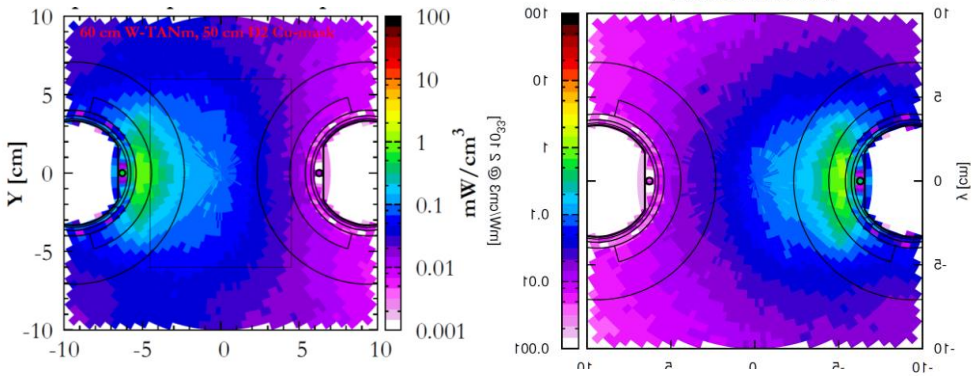
Absorber for P8

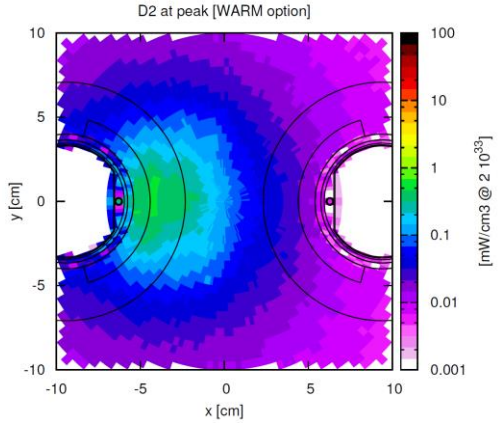


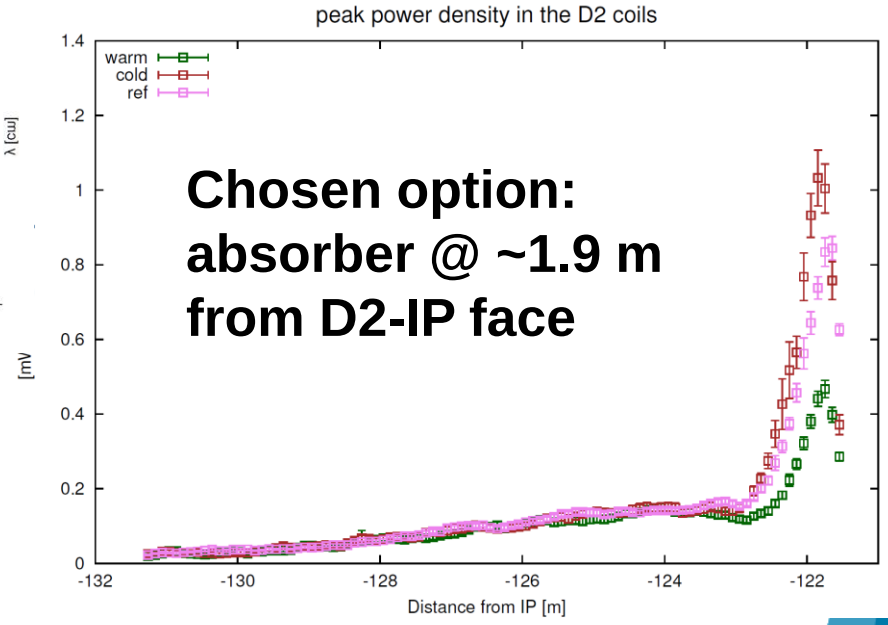
Target is to give protection for D2 @ Run 3 (Nominal LHCb operation at 2 10^{33} cm^{-2} s^{-1}) having the lesser impact in P8 layout.

Status – Absorber for P8





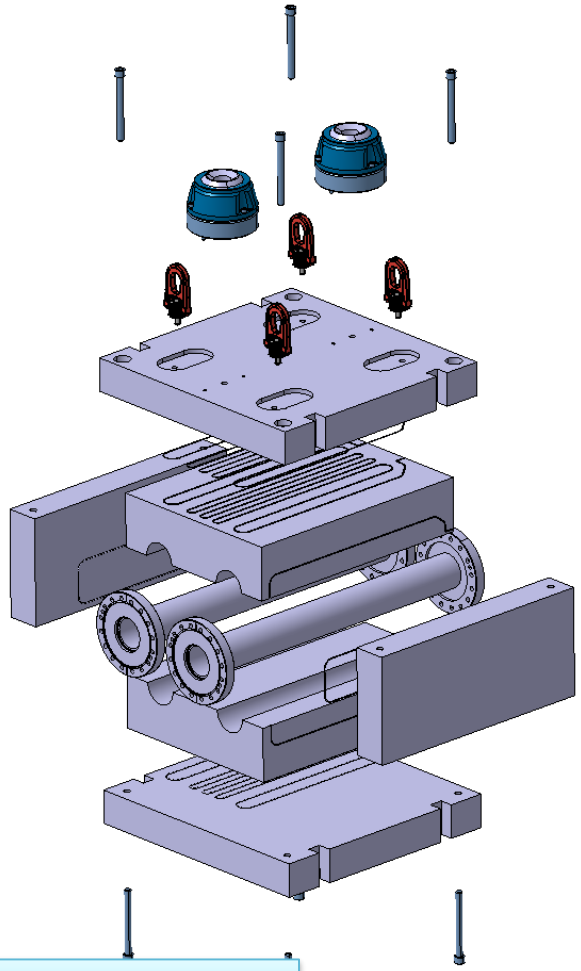




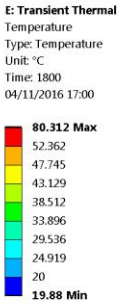
Chosen option: absorber @ ~1.9 m from D2-IP face

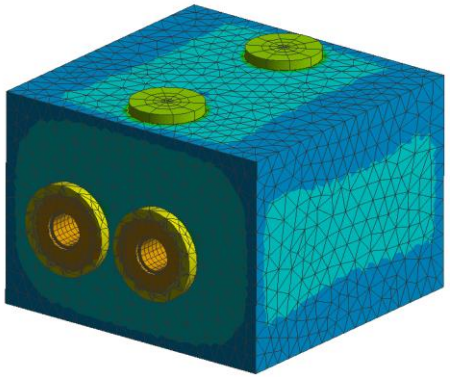
WP10, WP12,WP15

TANB



M.L.Diogo Dos Santos

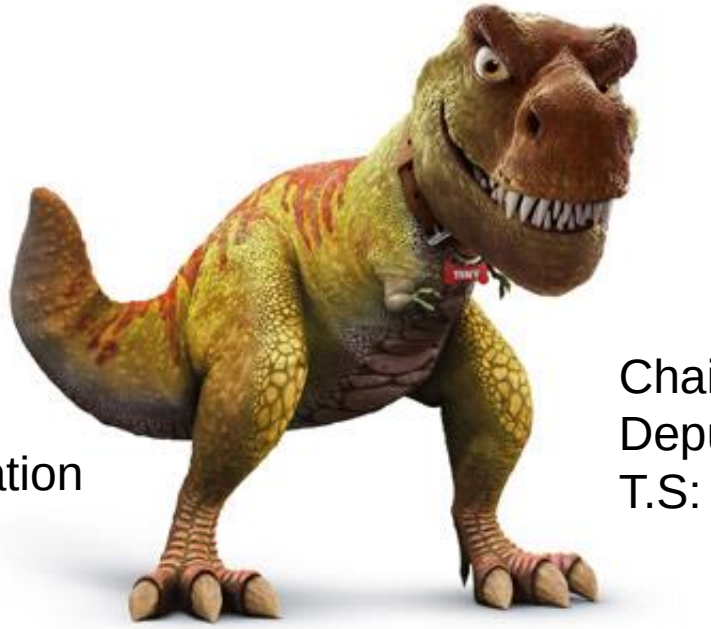




Detailed design started,
Target is to go for
tender in Q3 2017

TREX

Forum to discuss planned operation of forward facilities, planned upgrades, and acts as an oversight body to check the compatibility and possible interference during installation and operation. The mandate was originally limited to the LHC proper (RUN1-3), without the HL-LHC



Reporting line:

- LMC,
- HL-LHC technical coordination
- LPC as required

Chair: M. Lamont
Deputy: M. Gallilee
T.S: F. Sanchez Galan

Present mandate 1/2

- The working group is responsible for coordinating the activities related to the experimental detectors installed or to be installed in the LSS of the LHC. This responsibility is limited to activities planned to take place before LS3.
- The mandate covers all topics required to ensure the installation and operation of all modified or new beam-related components and their associated supports, alignment, and access equipment. This includes checks of apertures, impedance, specifications and follow-up of R&D and design.

Present mandate 2/2

- The mandate extends to beam vacuum related issues of new physics experiments to be installed before LS3 in the LHC long straight sections (LSS).
- The working group is also respon… coordinating the activities re… mental detector components i… lled within the vacuum secto… uding issues relat… sorbers.
  - This re… vities planned to take place b…
  - Where th… ts are foreseen to be in place during the HL-LH… compatibility checks pertinent to Run 2 and Run 3 shall be performed. The HL-LHC project team shall be responsible for HL-LHC related compatibility checks.

17th HL-LHC-CG, July 2016
The mandate is now extended to also cover the HL-LHC, i.e. LS3 and later. For HL-LHC related changes, the reporting body is the HL-TCC

Conclusions (1/2)

- A new layout relocating the vacuum equipment and auxiliary services from the tunnel to the experimental area (from 22-21m to 19 to 17m) is feasible for ATLAS and CMS, including: Sector valves, VAX module & remote connections. BPM will be installed inside Q1.
- The new layout requires modifications in experiment shielding.
- Some shielding modifications could be advanced to LS2, reducing exposure and relaxing LS3 planning. Ideally, decision should be taken within Q1 2017.

HiLumi HL-LHC PROJECT

Conclusions (2/2)

- TANB scheme provides the required level of protection for D2 in P8 while minimizing the impact for the machine layout.

- TREX mandate will be extended to cover post LS3 activities

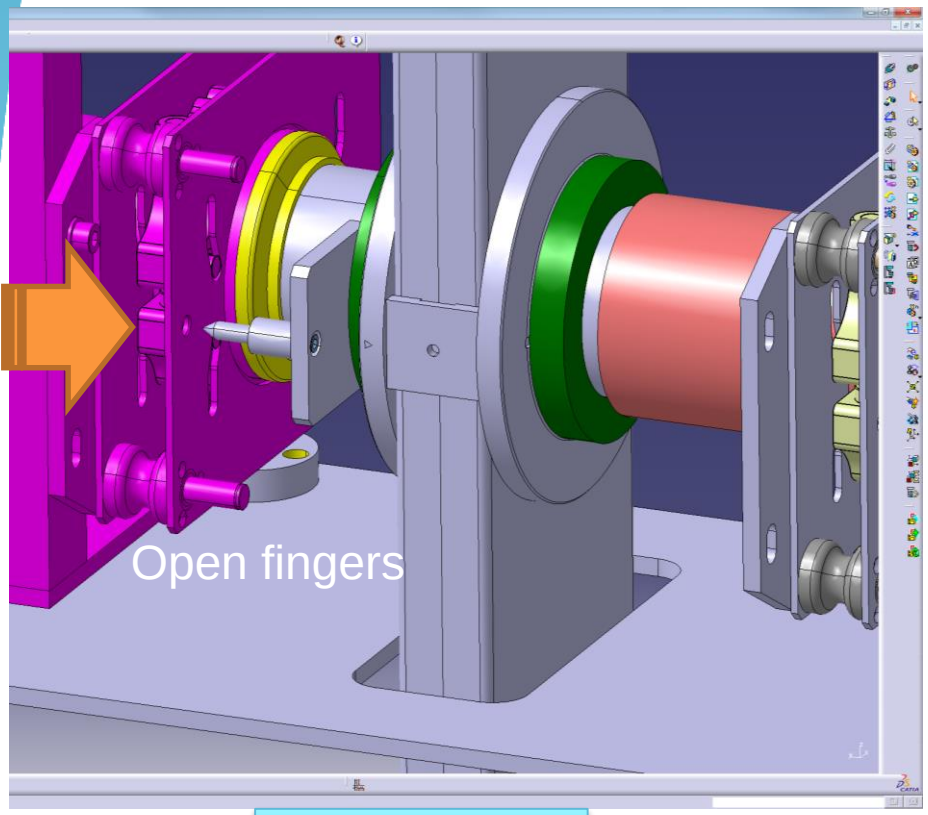
Thanks to all members of WP8 & contributors

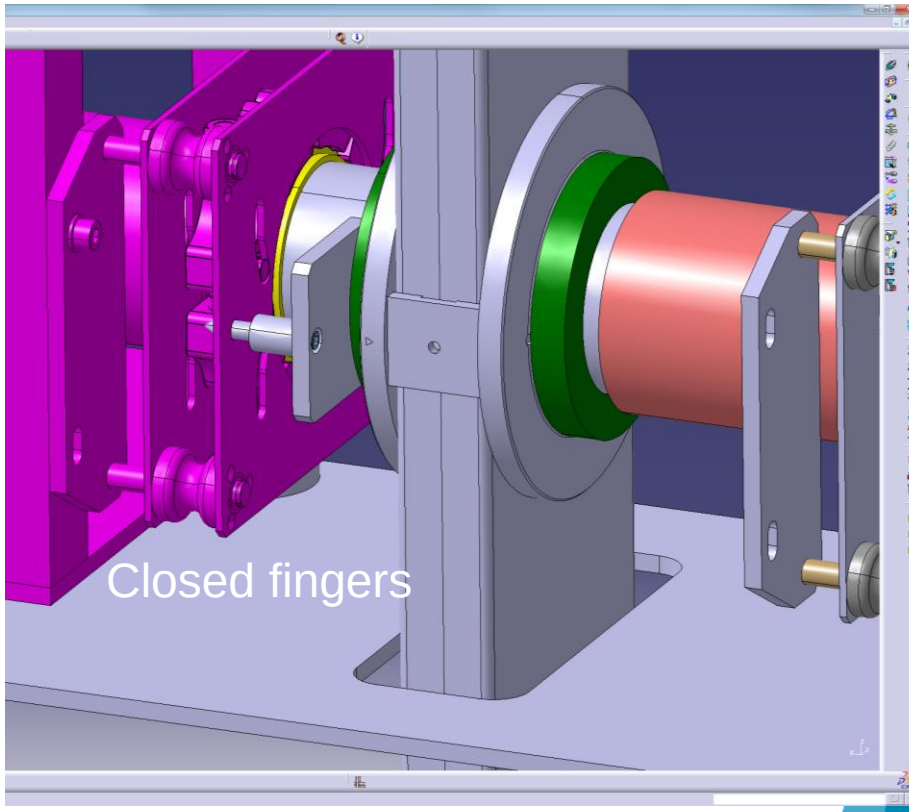
C. Adorisio, J. Albertone, V. Baglin, C. Boccard, I. Bergstrom, E. Bravin, D. Brethoux, H. Burkhardt, F. Cerutti, JP. Corso, S. Evrard, P. Fessia, A. Gaddi, B. Di Girolamo, L. Krzempek ,M. Lazzaroni, H. Mainaud-Durand, R. De Maria, D. Mergelkuhl, G. Pigny, J. Perez Espinos, M. Raymond, A. Santamaria Garcia, P. Santos Diaz, E. Thomas, B. Vazquez De Prada, H. Vincke.

VAX Installation sequence

Flange connection

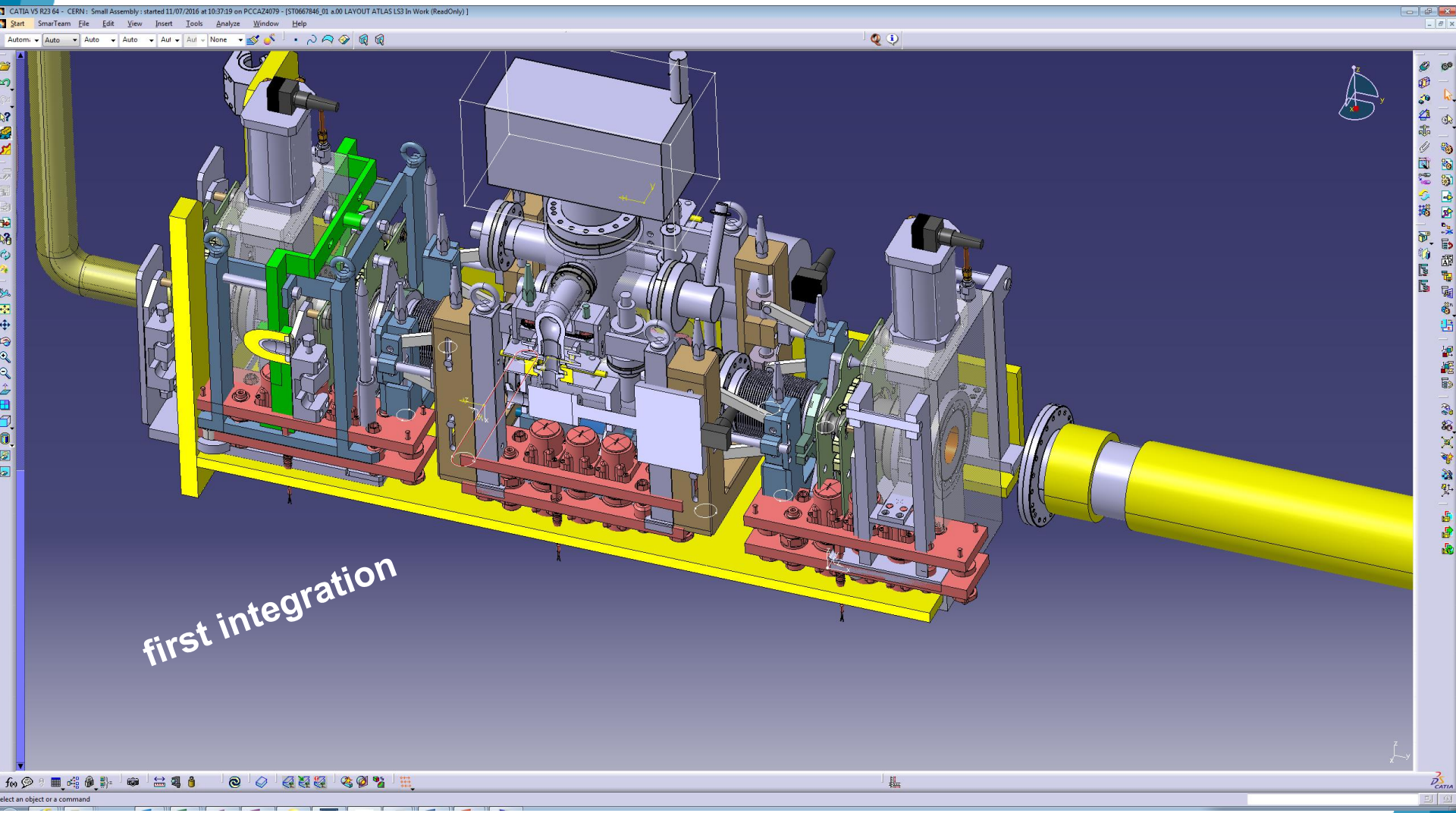
(Quick flange centering based on current collimator's approach)





D. Brethoux

Integration automatic plug-in connectors



Design presented during the WP8 meeting in July 2016