TAXS Services integration

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on behalf of WP8 (Collider-Experiment Interface)
Special thanks to D. Brethoux & F. Luiz

HL-LHC Collaboration meeting, Genoa 7- 10 Oct 2024

Content overview

- Introduction, TAS & TAX, VAX upgrade
- Integration of service lines for VAX- ATLAS
  Integration of service lines for VAX- CMS
- Conclusions

Situation of TAS & VAX

ATLAS Forward Shielding (here TX1S)

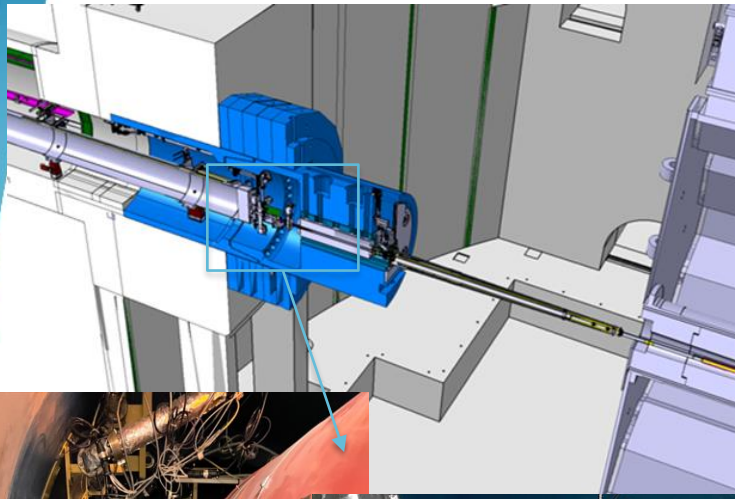
CMS Forward Shielding (rotating shielding + Fixed Iron Nose FIN)

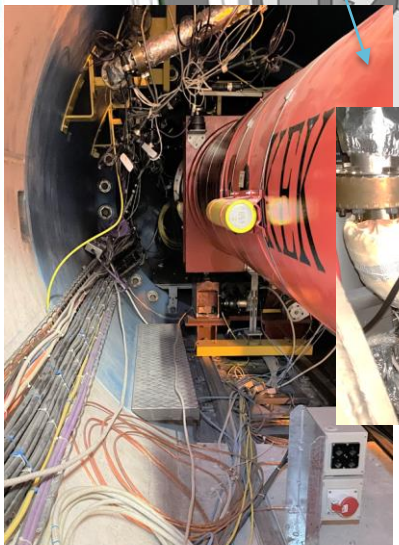
Forward shielding had been installed with TAS inside.

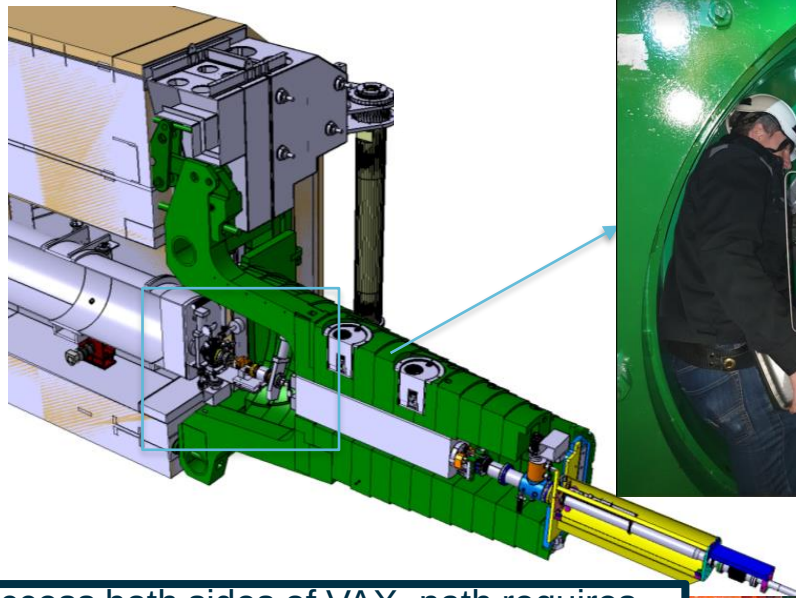
Optimized to fill space around the vacuum beampipes and be compatible with experiments openings (YETS ad LS)

Space occupancy need a delicate integration and modification of shieldings (agreement with the experiments).

Access to the TAS in IP1 (ATLAS) and IP5 (CMS)







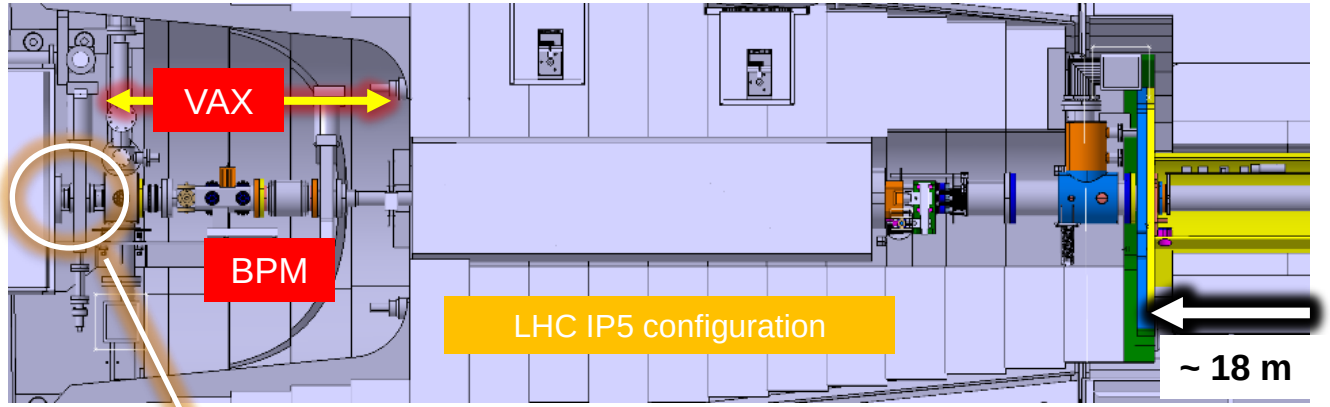
To access both sides of VAX, path requires going below IT. BPM not realigned since first installation.

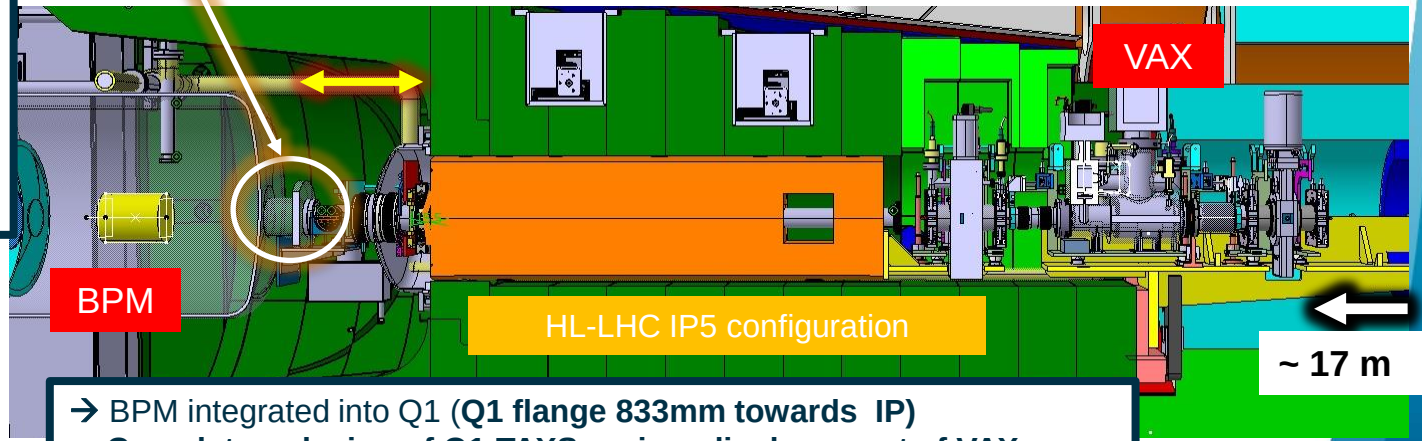
Distance from wall to activated components < 35 cm.

Dead-end & uneven floor

Upgrade VAX Region (ALARA)

Access to the region & residual dose increase requires redesign of VAX area

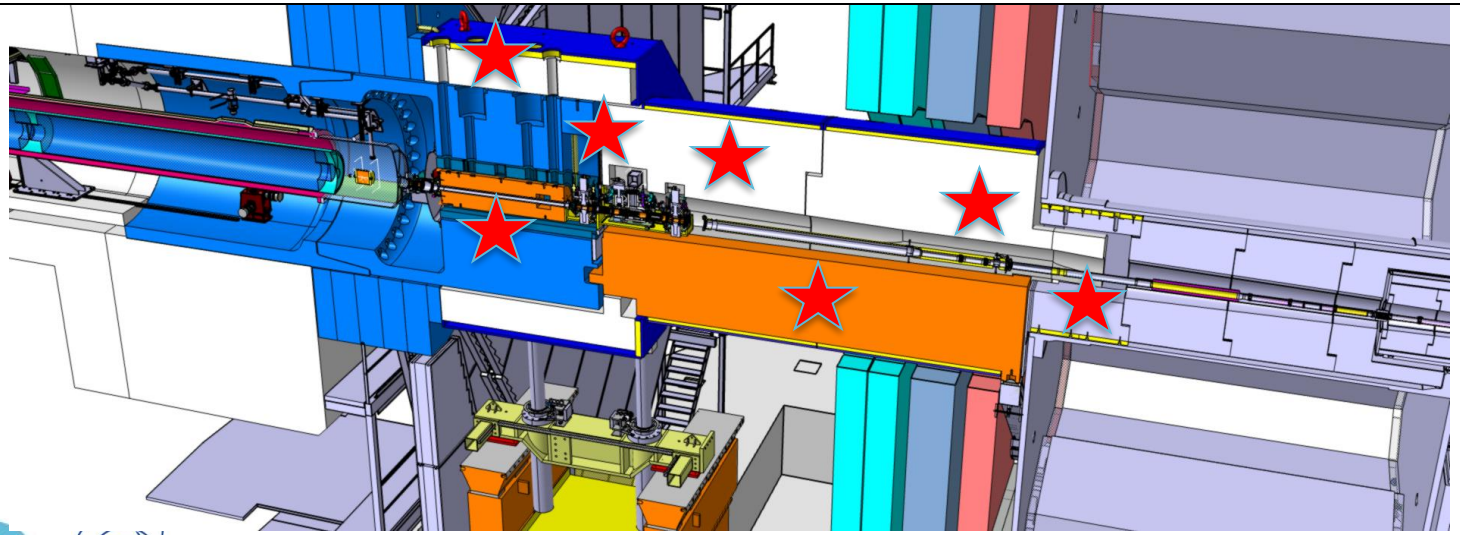




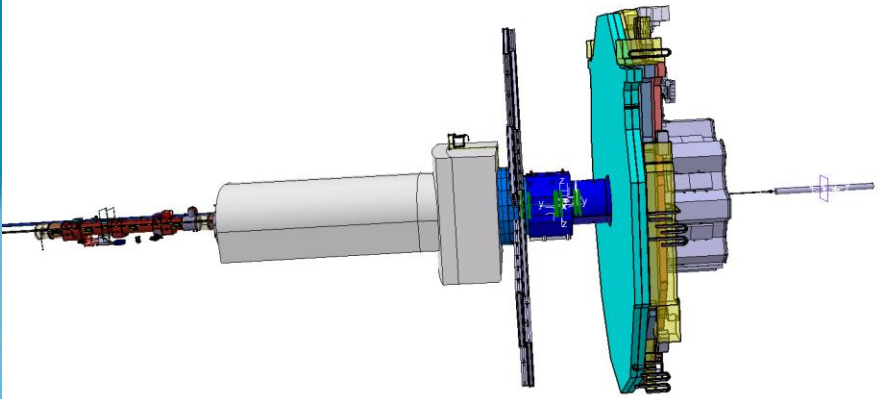
→ BPM integrated into Q1 (**Q1 flange 833mm towards IP**)
Complete redesign of Q1-TAXS region, displacement of VAX area to experimental side + remote handling of vacuum components

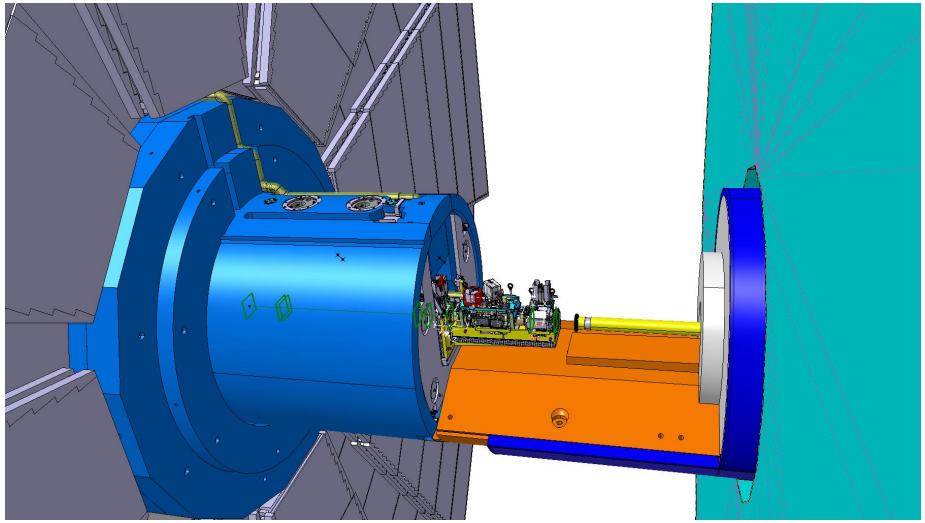
HL-LHC ATLAS VAX & service lines

- VAX modules supported from the TAXS (M1) and TX1S (M2 & M3)
- Pumping & venting lines routed from LHC IT area along TX1S and connect to new VAX
- Shielding modifications: new components and in-situ machining



Services routing in TX1S (side A)- I



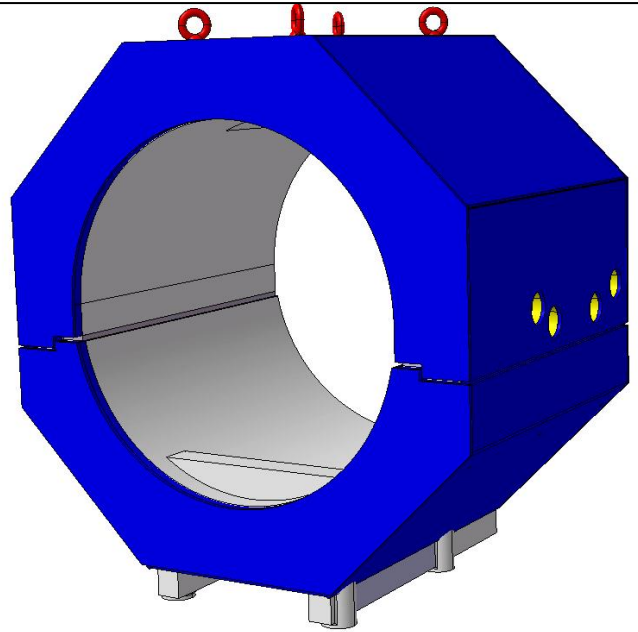


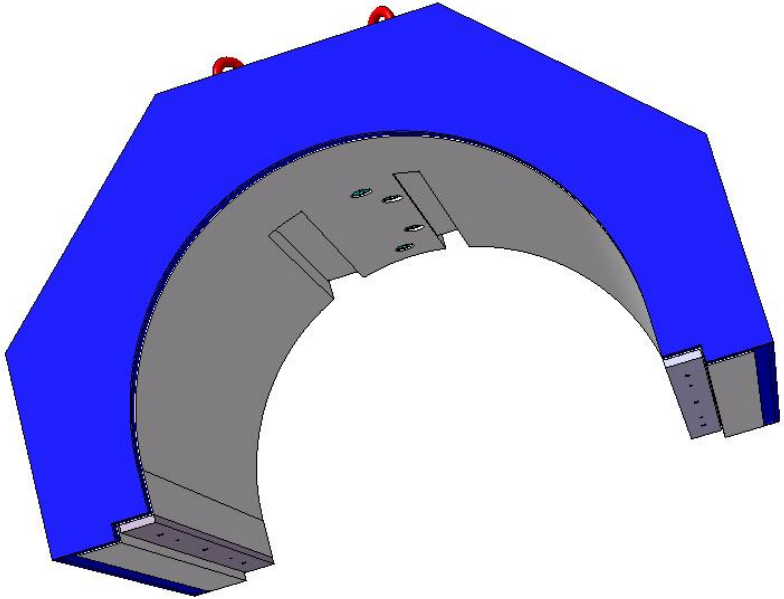
Services routed to the TAXS (M1) and TX1S (M2 & M3)

- Pumping & venting lines routed from GIS area below muon wheels- along & inside TX1S and connect to new VAX modules
- Last meters of services need to be removed remotely & independently, together with M1 or with the VAXBOX. (Similar routing for VJ services)
- **External patch panel/connexion design to be completed (open point), locations decided.**

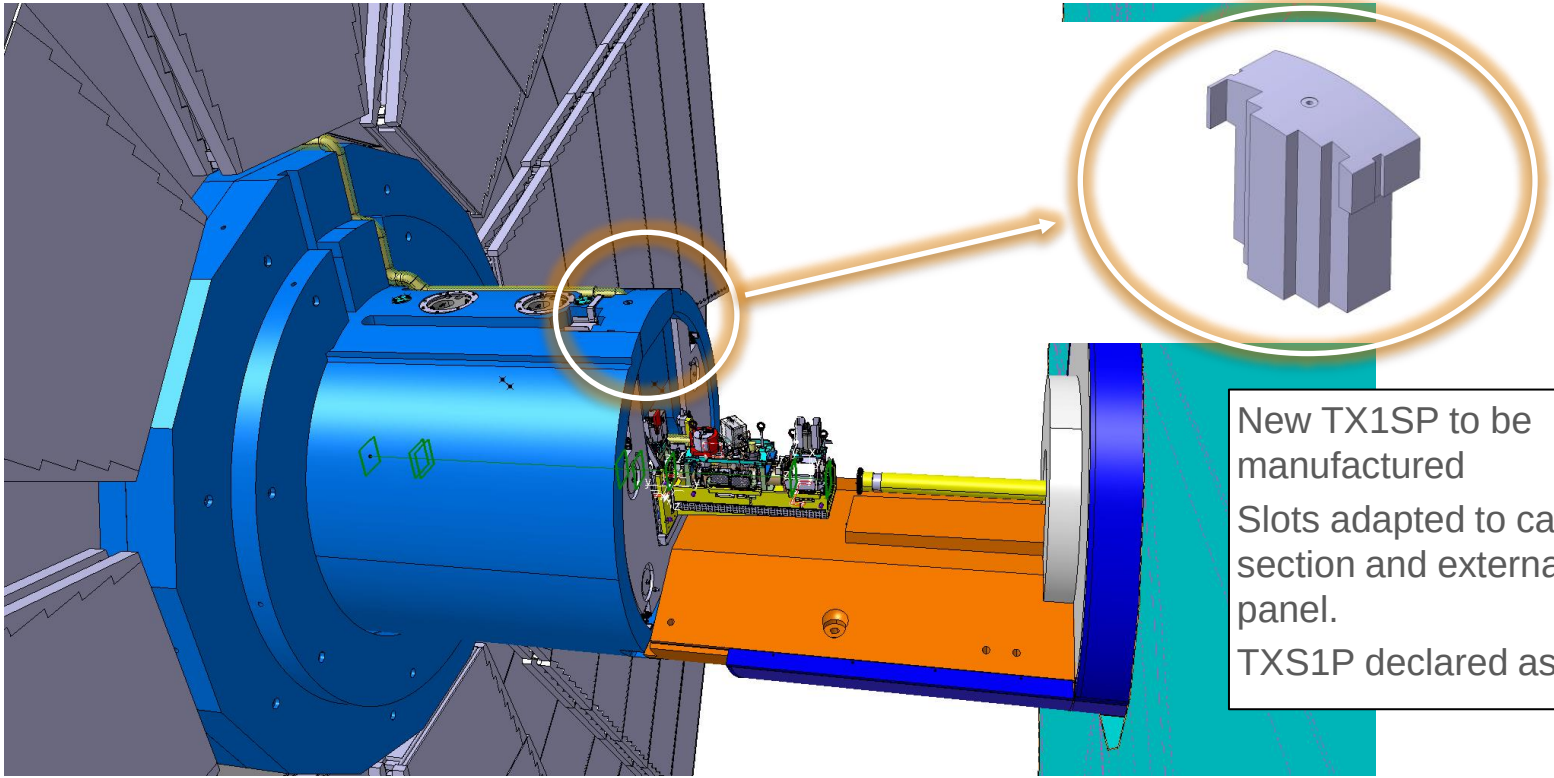
Services routing along TX1S (side A)

Slots to be machined in the octogon defined. Operation to be done in Bd 191 (support BE/CEM, EN/HE BE/GM)





Services routing inside TX1S (side A)- I



New TX1SP to be manufactured

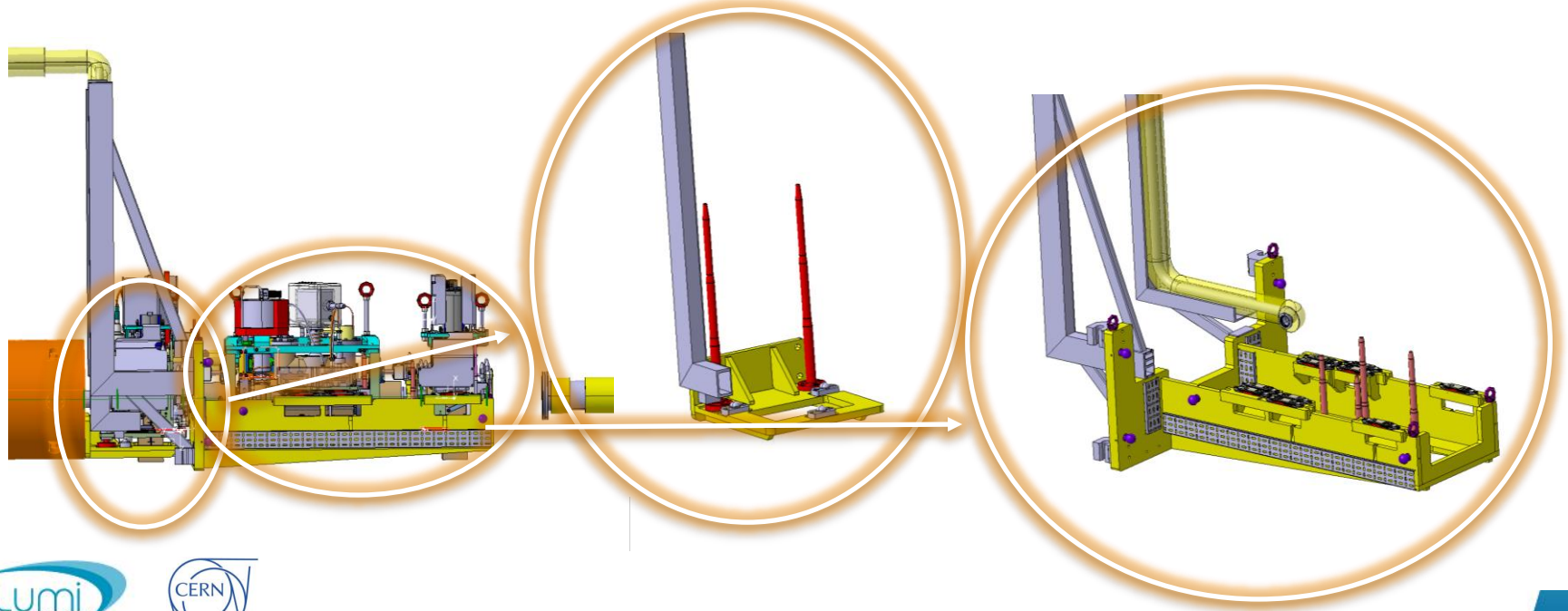
Slots adapted to cable section and external patch panel.

TXS1P declared as waste

Services routing inside TX1S (side A)- II

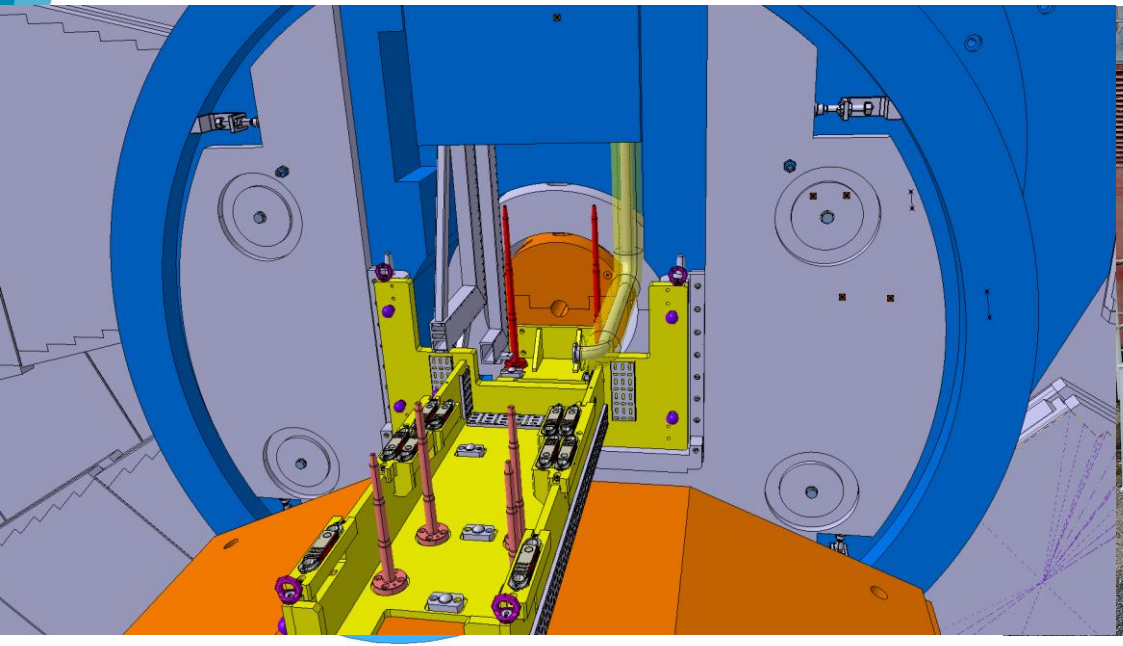
Removable Services routed to M1 and (M2 & M3) inside closed profiles

To be removed remotely & independently, together with M1 or with the VAXBOX (M2 & M3 removed without services). Solution integrated in Bd 867 mock-up for remote handling.



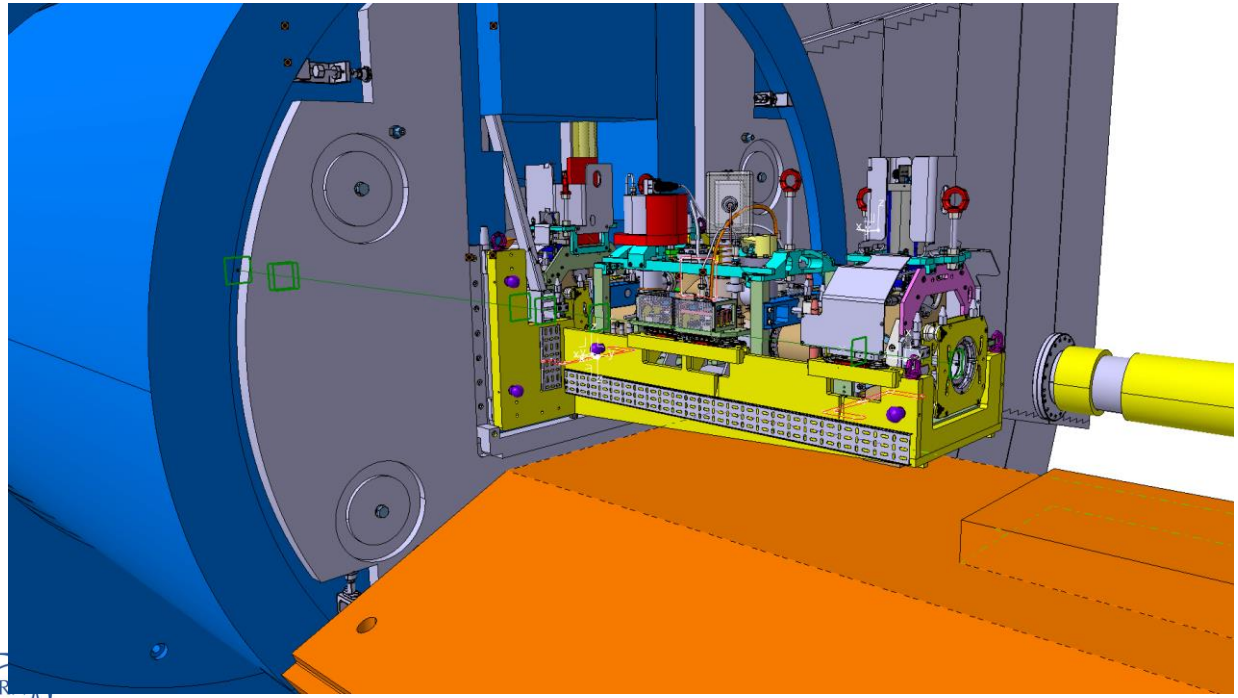
Services routing from TX1S to VAX (side A)

To minimize machining of JFC shielding and straighten the routing, a modification of the VJ plate is required. Analysis & final design to be completed, and new VJ plates to be manufactured.



Services routing along VAX (side A)

VAXBOX includes telex to fix the cabling & machined slots placed below Staubli connectors where required to guarantee a straight connexion.



Summary- Modifications in ATLAS Shieldings

- TX1S- New plug to be produced adapted to the service lines
- TAS New Cradle to provide space for M1
- JFS (octogon) upper- Machining slots at the lower face to allow the passage of services .
- JFC3- Slot to provide space for the VAXBox and M2- M3 modules (partially done in LS2)
- JFC1- Slot to provide space for VAXBox and modules (completed in LS2)
- JFC2- New nose (installed in LS2)
- JTT-1 New shielding compatible with VAXbox & modules (manufactured & Installed in LS2)
- New supports for the VT chamber (manufactured & installed in LS2 / TE-VSC)
- New VJ alignment plate to route services from TX1S to VAXbox

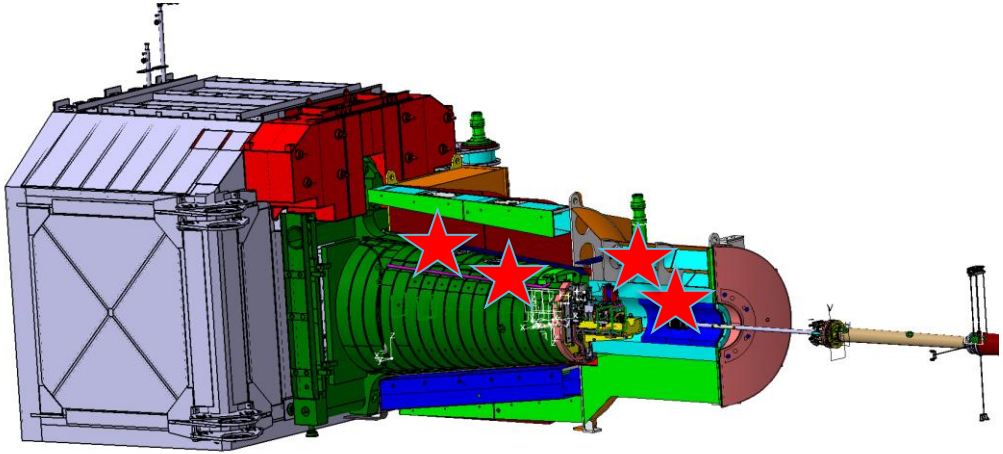
HL-LHC CMS service lines

VAX modules supported from the TAXS (M1) and FIN (M2 & M3)

Pumping & venting lines routed from LHC IT area along FIN and connect to new VAX

Shielding modifications: new components and in-situ machining

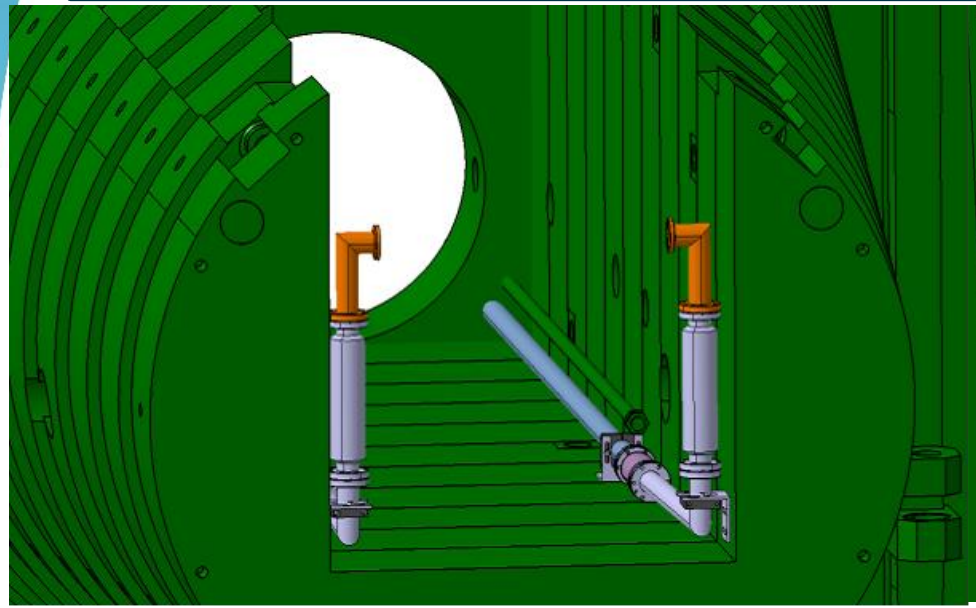
Proof of principle mid November (Bd 867)

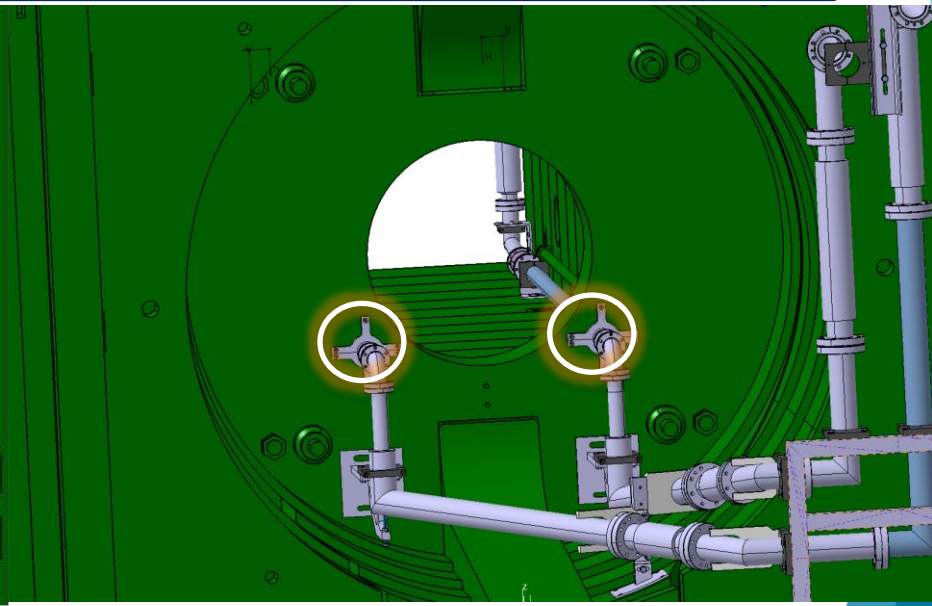


Services routing along FIN R54 (II)

Pumping & venting lines routed from LHC IT area along inside section of FIN and connect to new VAX

Shielding modifications: machining of FIN, new-modified cradle

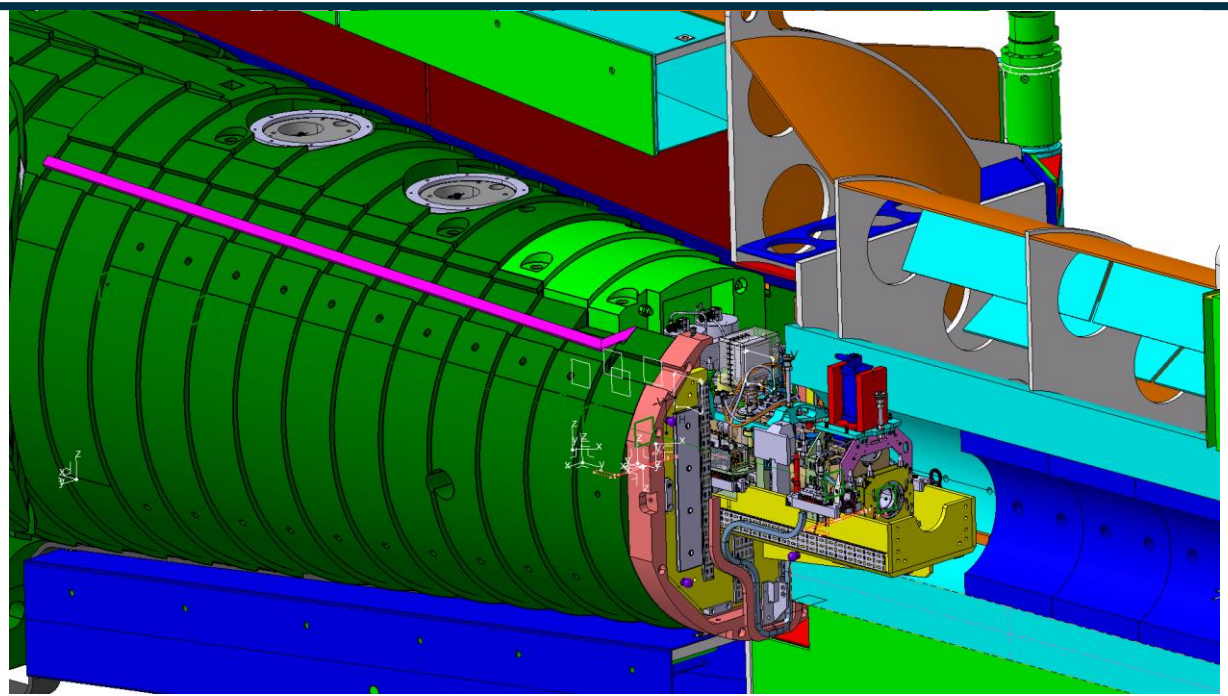




Services routing along FIN R54

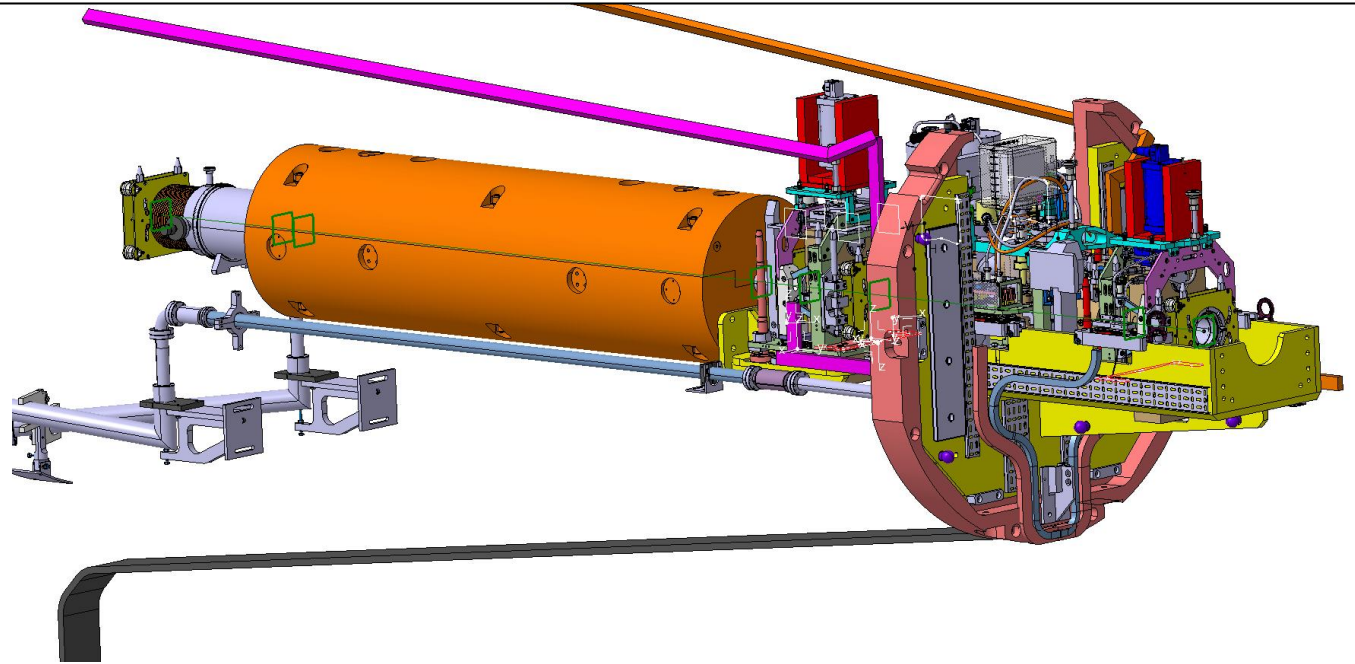
Services routed along existing slots

Shielding modifications: new-modified cradle compatible with pumping/venting lines, new plug insert compatible with M1/M2



Services routing from FIN R54 to VAX

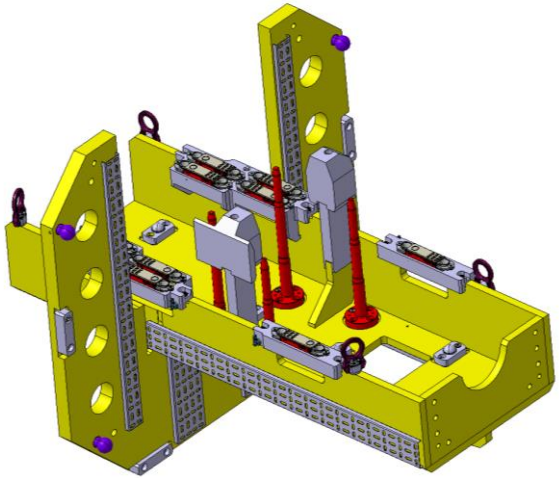
VAXBOX includes telex to fix the cabling & machined slots placed below Staubli connectors where required to guarantee a straight connexion.

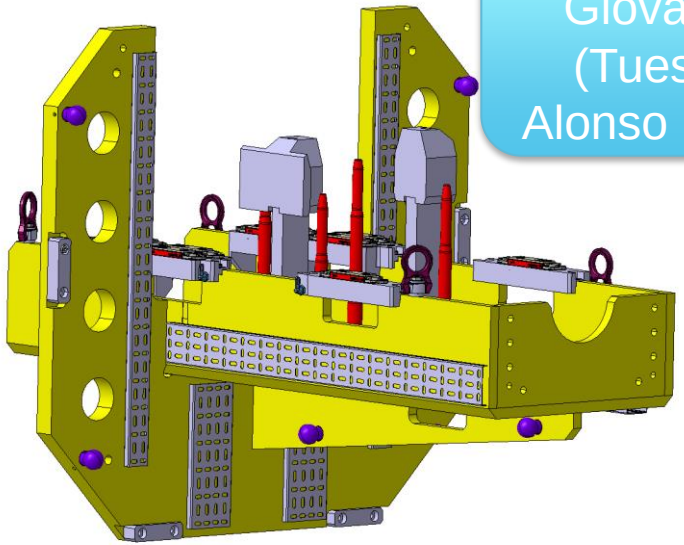


Services routing in VAX

Services are being integrated in the VAX mock-up. Iterative process to optimize with feedback from experts (BE-CEM, EN-HE, WP12, WP8)

See talks S. Di Giovannantonio (Tuesday) & A. Alonso (Thursday)





M3 Integration of Extra shielding

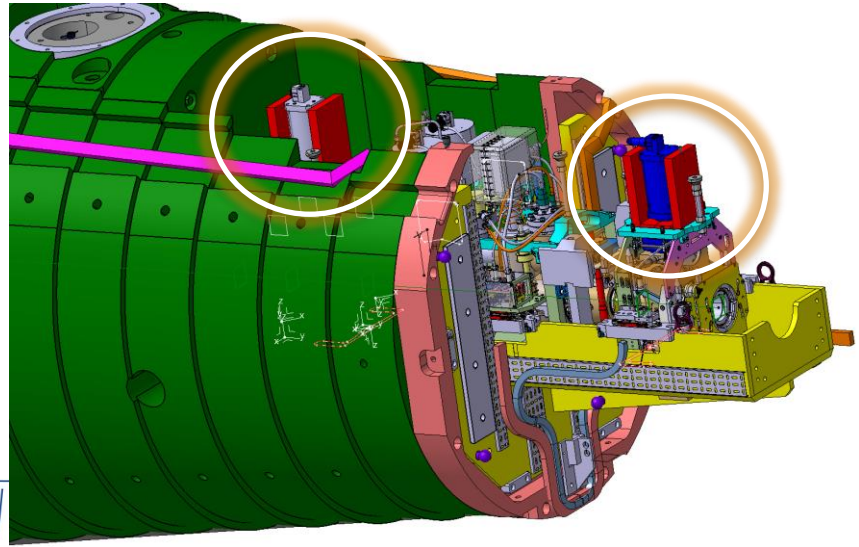
Strong interest of CMS to improve the shielding.

A new FIN plug will be adapted to the shape of M1- M2.

Machining of RS necessary for integration of M3, to be done in-situ @ YETS 2025

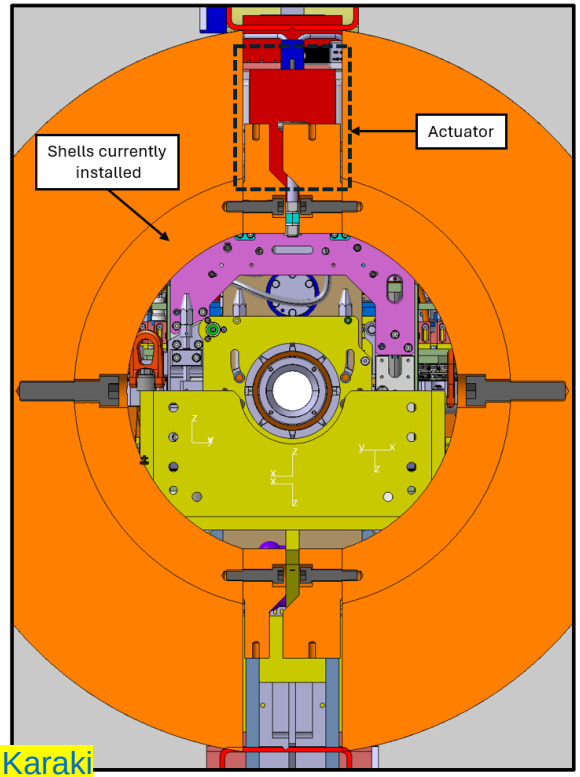
Extra shielding provided within vacuum modules integrated

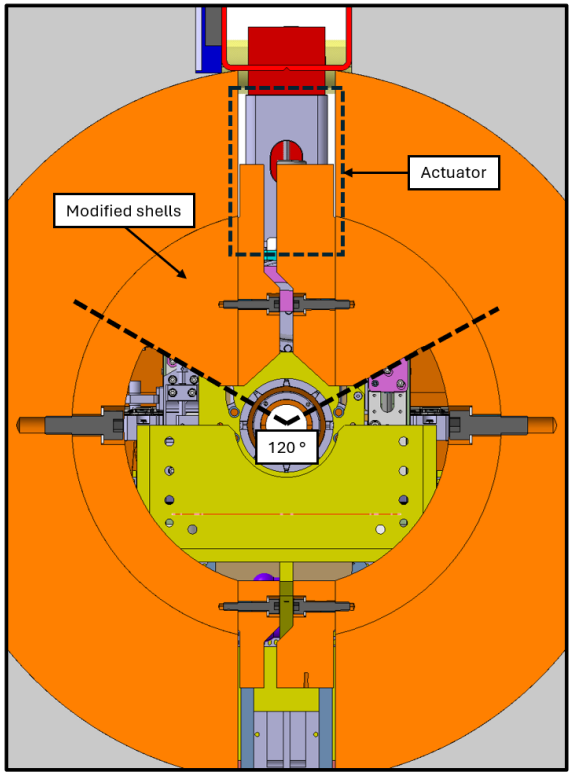
New shielding inserts proposed by CMS Integration office will improve a step further, performance currently under study by WP10



Modifications of the CMS rotating shielding inner shells (I)

Present design





CMS proposal for Enhanced shielding (RUN4)

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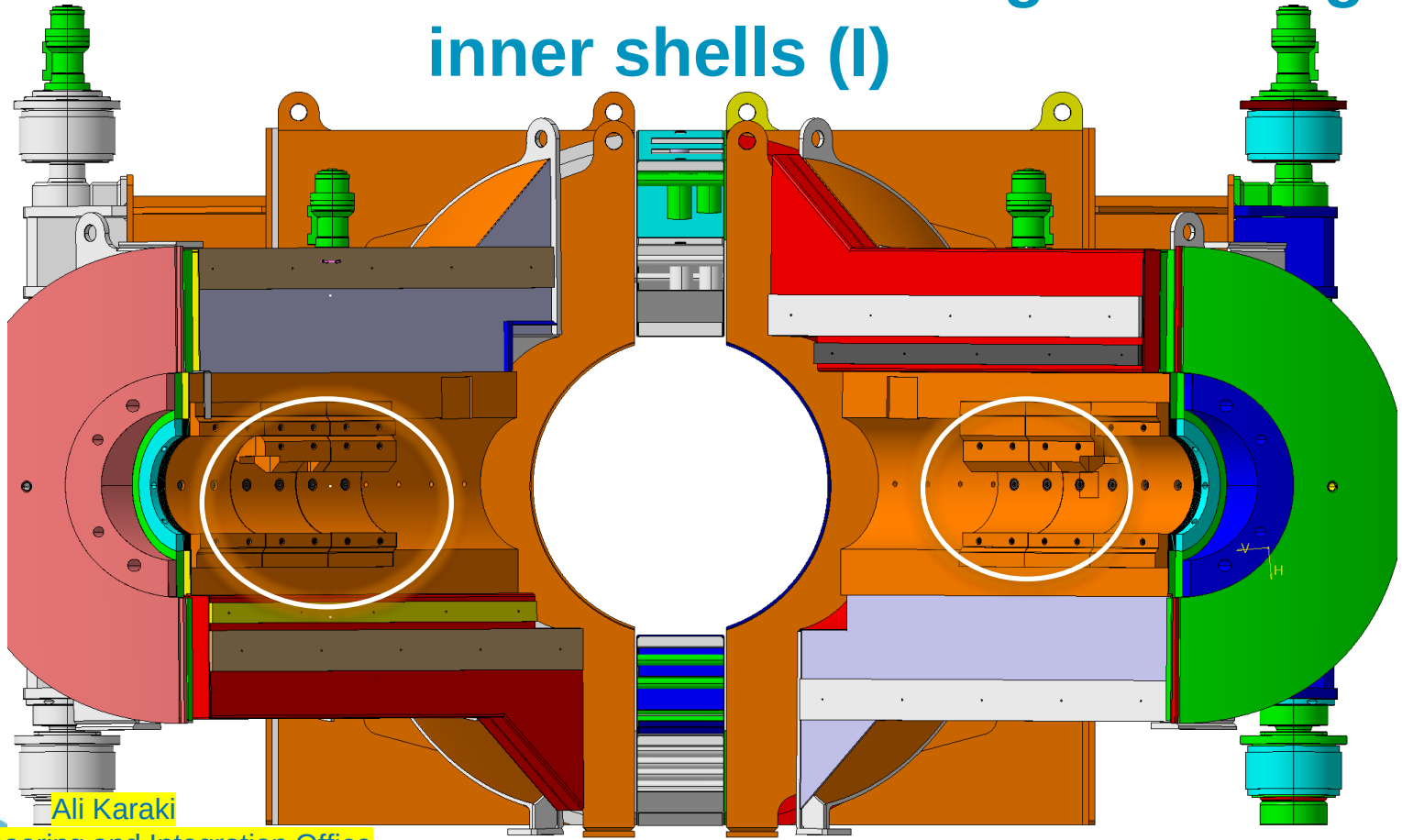
CMS Engineering and Integration Office

Modifications of the CMS rotating shielding inner shells (I)



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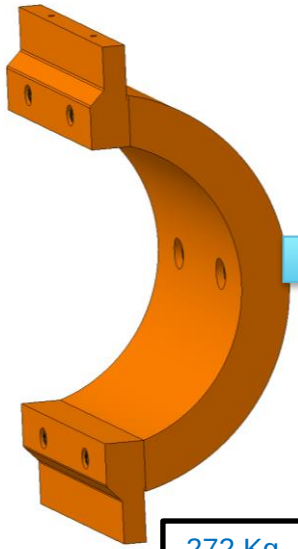
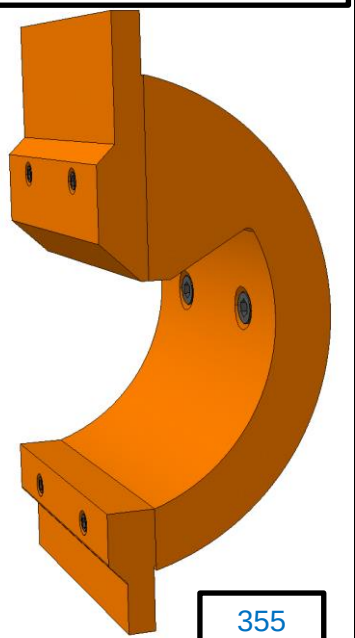
Design comparison

Inner shell – thin extension
Run 3



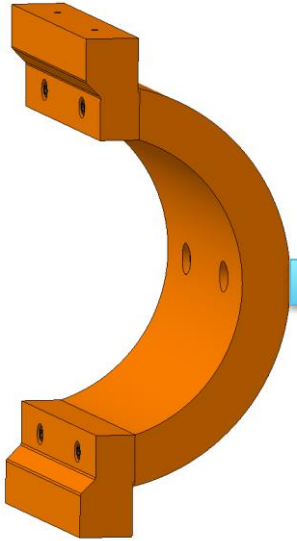
272 Kg

Inner shell – thin
extension
Run 4



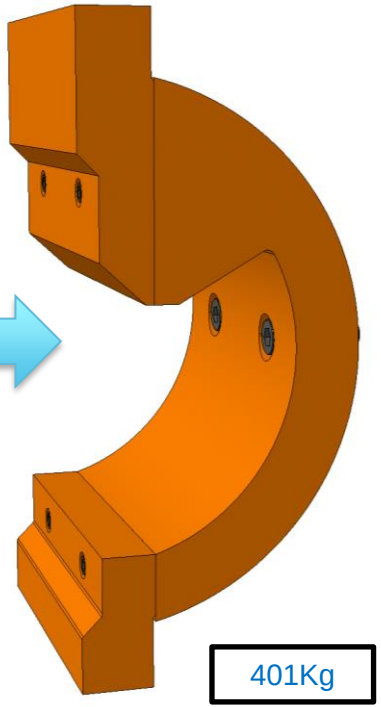
355
Kg

Inner shell – thick
extension
Run 3



301Kg

Inner shell – thick
extension
Run 4



401Kg

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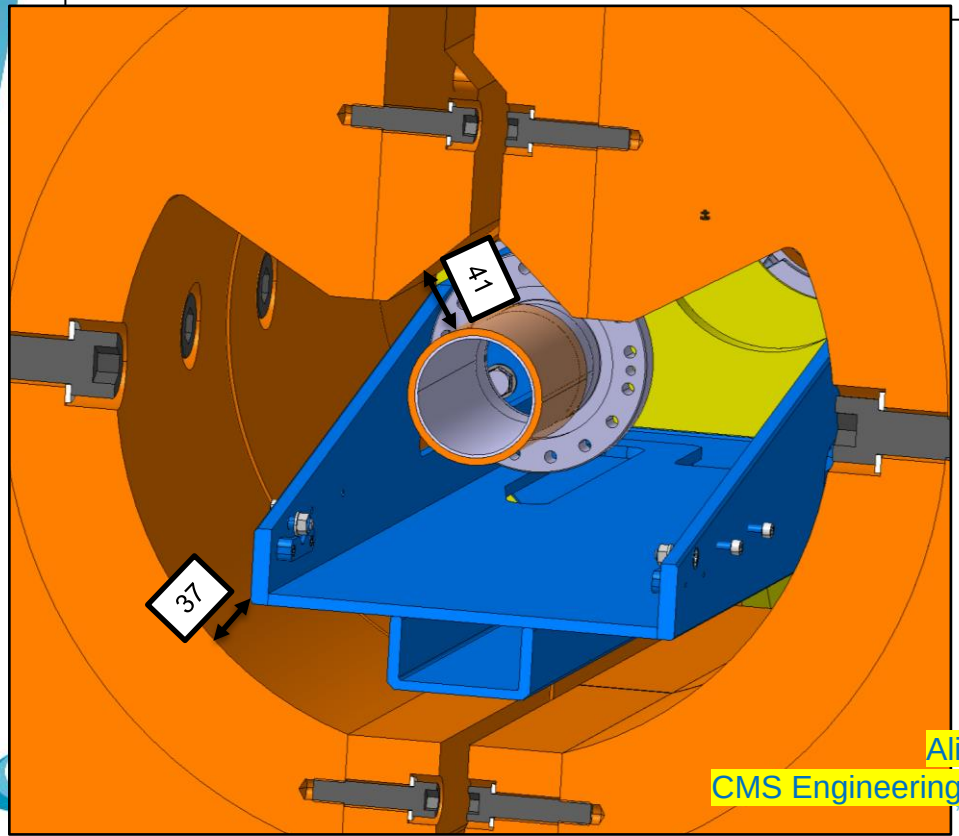
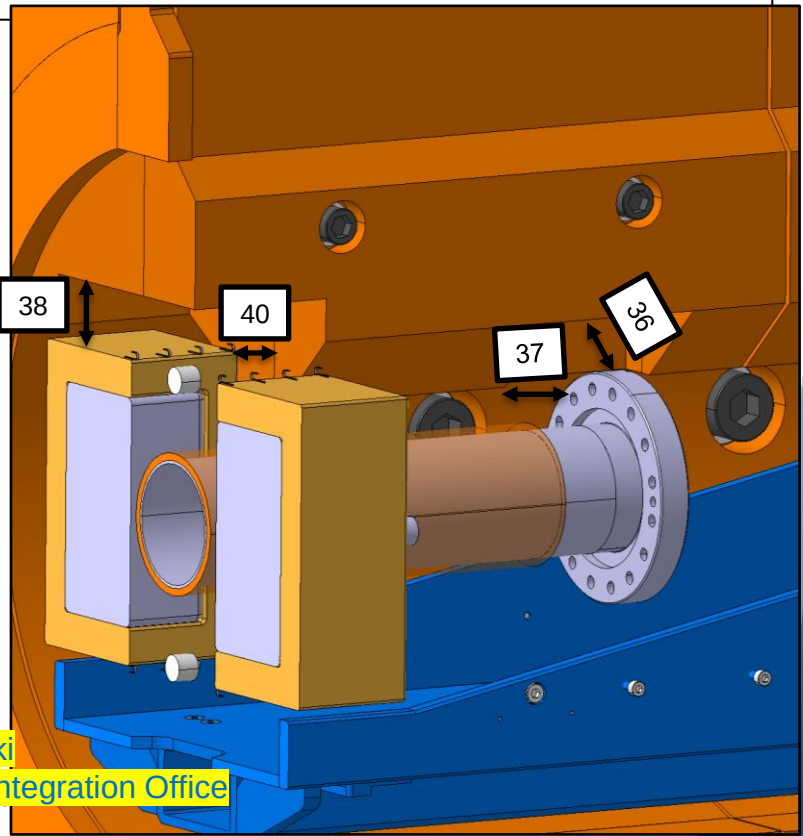
Compatibility with the BP forward layout

The new shells are designed to be compatible with the forward layout for Run 4, ensuring enough clearance from the beam pipe.





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Summary- Modifications in CMS Shieldings

- FIN- New plug to be produced adapted to M1
- FIN- through holes for the passage of pumping/venting lines
- FIN- New TAS cradle adapted to pumping/venting lines
- Rotating shielding- machining of pocket to be compatible with head of M3
- Rotating shielding- Inserts compatible with VAXbox (LS2)
- Rotating shielding- New inserts to provide additional shielding

CATIA- Integration models & contact designers

- Atlas LS3 side A : ST0667842_01 (D. Brethoux)
- Atlas LS3 side C : ST1554083_01 (D. Brethoux)
- CMS LS3 side RB54 : ST0711686_01 (F. Luiz)
- CMS LS3 side RB56 : ST1553945_01 (F. Luiz)

Conclusions & next steps

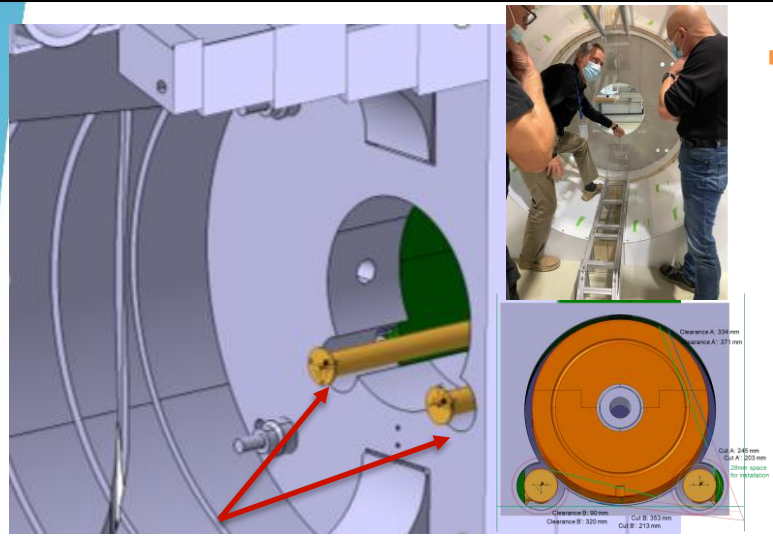
- Services routing towards VAX defined, and detail design close to completion
- NEXT STEPS:
  - models from vacuum for A-C, R54-R56
  - Design of patch panels/external connectors
  - crosscheck from Experiments

- Mock-up used for final validation with installation of modules, thanks to the collaboration of everyone (BE-CEM, EN-HE, BE-GM, BE-EA, TE-VSC, WP8, WP12).

- Shielding modifications in ATLAS & CMS required for the passage of services. New shielding inserts (CMS) and VJ plate (ATLAS) added to the scope.

WP8-1: VAX service pipe passages machining
(CMS, Region preparation)

Test description	Requirements for mock-up	Expected results
Demonstration of passages machining ∅=160mm in 235mm thick steel probes. Fitting of machine into Q1-TAXS mock-up. Study of operation procedure.	Detailed representation of the CMS shielding inside FIN (doors closed, tunnel empty).	- Feasability approved - Procedure+Safety document



Passages up to ∅ = 160 mm and through 235mm shielding

- Investigation of different machining methods in collaboration with different CERN service ongoing:
  - BE-CEM robotic team (ready for tests)
  - SY-STI beam dump destruction (contacts machining specialist),
  - SCE-SAM civil engineering (MARTI confirmed)

Next steps: make available steel probes for tests, continue investigating different methods to find machining with lowest risks for LS3 planning, (take decision mid 2023)

Thank you for your attention and for the collaboration of everyone (BE-CEM, EN-HE, BE-GM, BE-EA, TE-VSC, WP8, WP12, WP10).