



# Interface specification

Jaime Pérez Espinós on behalf of WP12





14th HL-LHC Collaboration Meeting, Genoa (Italy), 8 October 2024

# Contents

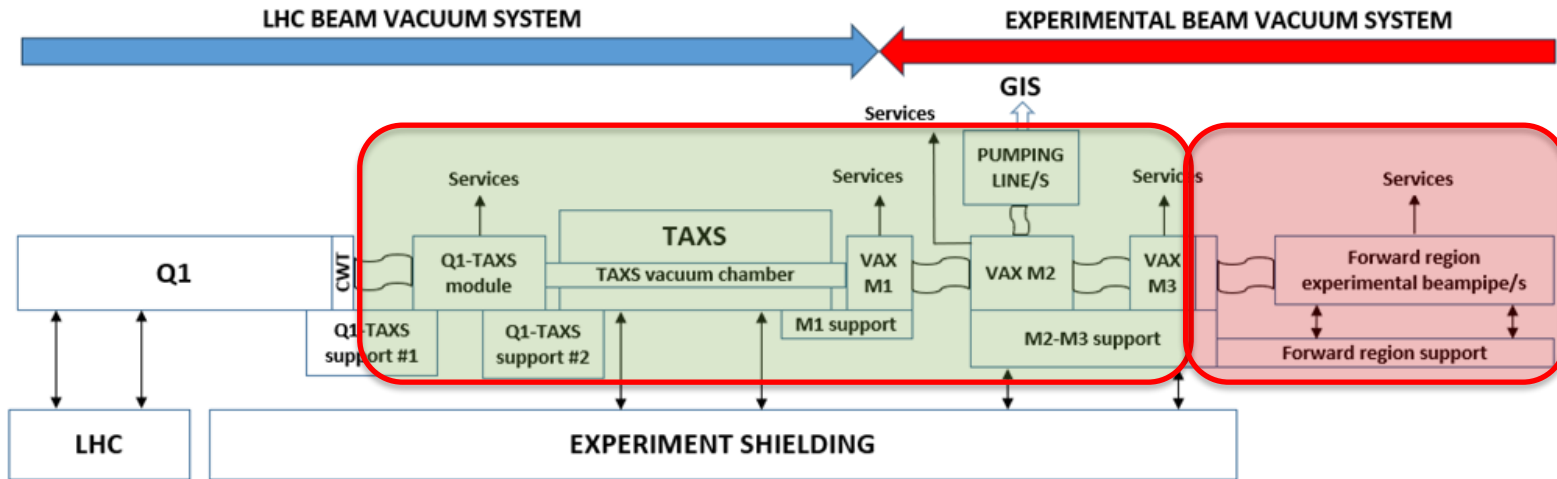
- Purpose of interface specification LHC-VAX-ES-0001
- Scope of interface specification
- Identification of deliverables and interfaces
- Conclusions

# Purpose

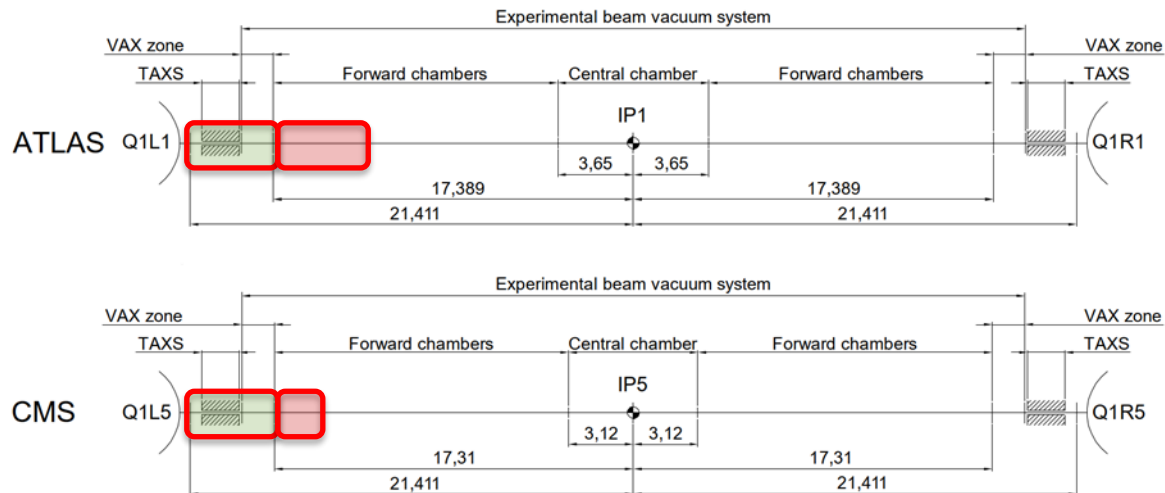
- **Purpose:** clarify deliverables included inside WP12.2.5 and interfaces linked to it  $\Rightarrow$  overview of deliverables of systems interfacing to vacuum system
- **Interfaces** involve:
  - adjacent beam vacuum equipment (including belonging services);
  - equipment installed within collider-experiment interface zone (including focusing quadrupole magnet Q1 and front quadrupole absorber TAXS);
  - LHC infrastructure at the collider-experiment interface zone;
  - shielding structures (and other experimental infrastructure) within the experimental caverns of ATLAS (UX15) and CMS (UXC55).

		EDMS NO. 3049307	REV. 0.1	VALIDITY DRAFT
REFERENCE : LHC-VAX-ES-0001				
<b>DELIVERABLES AND INTERFACES BETWEEN WP12.2.5 AND OTHER WORK PACKAGES</b>				
<b>WP12.2.5 EXPERIMENTAL VACUUM SYSTEM</b>				
<b>Abstract</b> This document summarizes the deliverables and interfaces linked to WP12.2.5 (Vacuum Layout for Experiments), for the newly designed beam vacuum systems of the collider-experiment interfaces of ATLAS and CMS. This includes the HL-LHC beam vacuum installation within the machine-to-experiment zone (so called, collider-experiment interface) as well as the part of the forward region belonging to the experimental beam vacuum systems of ATLAS and CMS. The document also clarifies the responsibilities between WP8 and WP12 and the inputs required for (or from) WP3 and WP15. The interfaces involve the LHC machine, the above experiments, and the adjacent beam vacuum equipment.				

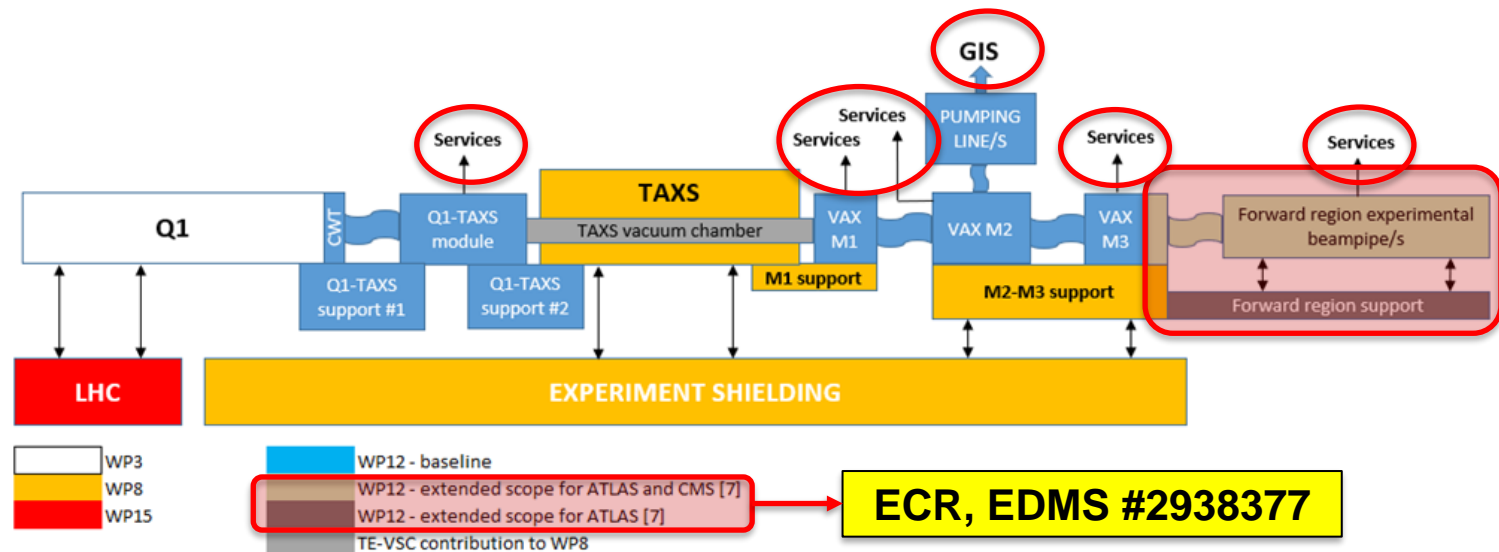
# Main subsystem block diagram



## Subsystem block diagram - left side case



# Interfaces from WP12 or TE-VSC to others



- WP3: Q1 (end cap) -to- Q1-TAXS support #1
- WP15:
  - Pumping line(s) -to- LHC (only for CMS);
  - Module(s) external services -to- LHC
- WP8: include interfaces towards equipment owned by WP8 and experimental facilities (WP8 acting as activity coordinator) [see next slide]
- Others: EN-HE (for transport) and BE-CEM-MRO (for robotic operation)

# Interfaces to WP8

Interfaces listed are at subsystem level

- **Interfaces between WP8 and WP12.2.5 (original scope);**

- Q1-TAXS support #2 -to- TAXS absorber;
- VAX M1 module -to- VAX M1 support;
- VAX M2 module -to- VAX M2/M3 support;
- VAX M3 module -to- VAX M2/M3 support;
- Pumping line(s) -to- shielding(s) and other experiment facilities;
- Pumping line(s) -to- VAX M2/M3 support;
- Module(s) external services -to- shielding(s) and other experiment facilities;
- Module(s) external services -to- VAX M2/M3 support;

VSC contact → Jaime

VSC contact → Jaime/Nikos

- **Interfaces between WP8 and WP12.2.5 (extended scope);**

- VAX M2/M3 support -to- forward experimental beam pipe;
- VAX M2/M3 support -to- forward experimental beam pipe support;

VSC contact → Josef

- **Interfaces between WP8 and TE-VSC contribution to WP8;**

- Clamping chain -to- TAXS absorber (for vacuum connection of the Q1-TAXS module and the TAXS vacuum chamber);
- TAXS vacuum chamber -to- TAXS absorber;

VSC contact → **Josef** ⇒ Jaime /Marco (for manufacturing follow-up)

SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/ supply	Acceptance	Reception	Installation	Operation
Q1-TAXS	MODULE		WP8, WP15 (1)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	EXTERNAL SERVICES (A)	CABLING	WP8, WP15 (2)	WP12	EN-EL	EN-EL	WP12	EN-EL	TE-VSC
		INSTR. CONTROLS	WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	Q1-TAXS SUPPORT #1 (B)	SUPPORT ASSEMBLY	WP3, WP15 (2)	WP12	WP12	WP12	WP3	WP12	TE-VSC
		VACUUM CONNECTOR		WP12	WP12	WP12	WP12	WP12	TE-VSC
	Q1-TAXS SUPPORT #2	SUPPORT ASSEMBLY	WP8 (1)	WP12	WP12	WP12	WP8	WP8 (+WP12)	TE-VSC
TAXS	ABSORBER	I/F TO BEAMPIPE AND VAC. CONNECTOR	WP12 (1)	WP8	WP8	WP8	WP12	WP8 (+ ESA)	BE-EA
	VAC. CHAMBER		WP8 (1)	WP12	WP12	WP12	WP8	WP8 (+WP12)	TE-VSC
	VAC. CONNECTOR			WP12	WP12	WP12	WP8	WP8 (+WP12)	TE-VSC
	STOP END		WP12 (1)	WP8	WP8	WP8	WP8	WP8 (+ ESA)	BE-EA
	HE DOME		WP12 (2)	WP8	WP8	WP8	WP8	WP8	BE-EA
VAX	M1-M2-M3	MODULE	WP8 (1)	WP12	WP12	WP12	WP12		TE-VSC
		QUICK SERVICE CONNECTOR - MALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8	WP12	WP12 (+WP8 + MRO + HE)	TE-VSC
		GUIDING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC
		POSITIONING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC
	M1 SUPPORT	STRUCTURE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)		WP8 (+ ESA)
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8		WP8	TE-VSC
		POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8		WP8	TE-VSC
	M2-M3 SUPPORT	STRUCTURE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	WP8 (+ WP12 + ESA + HE)	TE-VSC
		QUICK SERVICE CONNECTOR - FEMALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8			TE-VSC
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
		POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
	M1-M2-M3 EXTERNAL SERVICES	CABLING ACROSS EXP. SHIELDING AND FACILITIES (C)	WP8, WP15 (2)	WP12	WP8/EN-EL	WP8/EN-EL	WP12 (+WP8)	WP8/EN-EL	TE-VSC
		CABLING ACROSS VAX MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-EL	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	TE-VSC
		COMPR. AIR TUBING THRU EXP. SHIELDING AND FACILITIES (E)	WP8, WP15 (2)	WP12	WP8/EN-CV	WP8/EN-CV	WP12 (+WP8)	WP8/EN-CV	EP/EN-CV
		COMPRESSED AIR TUBING THRU MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-CV	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	EP/TE-VSC
		QUICK SERVICE CONNECTORS (MALE-FEMALE) FOR M1-M2-M3 CABLING AT TOP (ATLAS)	WP12 (1)	WP8	WP8	WP8	WP12	WP8 (+WP12)	TE-VSC
		PNEUMATIC DISTRIBUTOR		WP12	WP12	WP12	WP12	WP12	TE-VSC
		INSTR. AND VALVE CONTROLS	WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
		VAX MODULE SUPPORT INTERFACE (A)	WP12 (1)	WP8	WP8	WP8	WP12	WP8	TE-VSC
	FORWARD REGION EXPERIMENTAL BEAMPIPS (*)	BEAM PIPES		EP, WP8 (2)	WP12	WP12	WP12	WP12	WP12
SUPPORT			EP, WP8 (2)	WP12	WP12	WP12	WP8 (+WP12)	WP12 (+ WP8 + ESA + HE)	TE-VSC
EXTERNAL SERVICES (A)		CABLING ACROSS EXP. SHIELDING AND FACILITIES (C)	WP8, WP15 (2)	WP12	WP8/EN-EL	WP8/EN-EL	WP12 (+WP8)	WP8/EN-EL	TE-VSC
		CABLING ACROSS VAX MODULE SUPPORTS (D)	EP, WP8 (2)	WP12	WP8/EN-EL	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	TE-VSC
		CABLING ACROSS FORWARD REGION SUPPORT		WP12	WP12	WP12	WP12	WP12	TE-VSC
	INSTR. CONTROLS	WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC	
VACUUM SERVICE LINES (F)	PUMPING LINES	PIPES	WP8, WP15 (2)	WP12	WP12	WP12	WP12 (+WP8 + WP15)	WP12	TE-VSC
		BELLOWS	WP8, WP15 (2)	WP12	WP12	WP12	WP12 (+WP8 + WP15)	WP12	TE-VSC
		SUPPORTS (A)	WP8, WP15 (2)	WP12	WP12	WP12	WP8 (+WP12)	WP12 (+WP8)	TE-VSC
	BAKE-OUT	JACKET	WP8 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	CABLING	WP8 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC	
GIS	GIS ATLAS A-SIDE (REWORKING)		EP (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	GIS ATLAS C-SIDE (NEW)		EP (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC

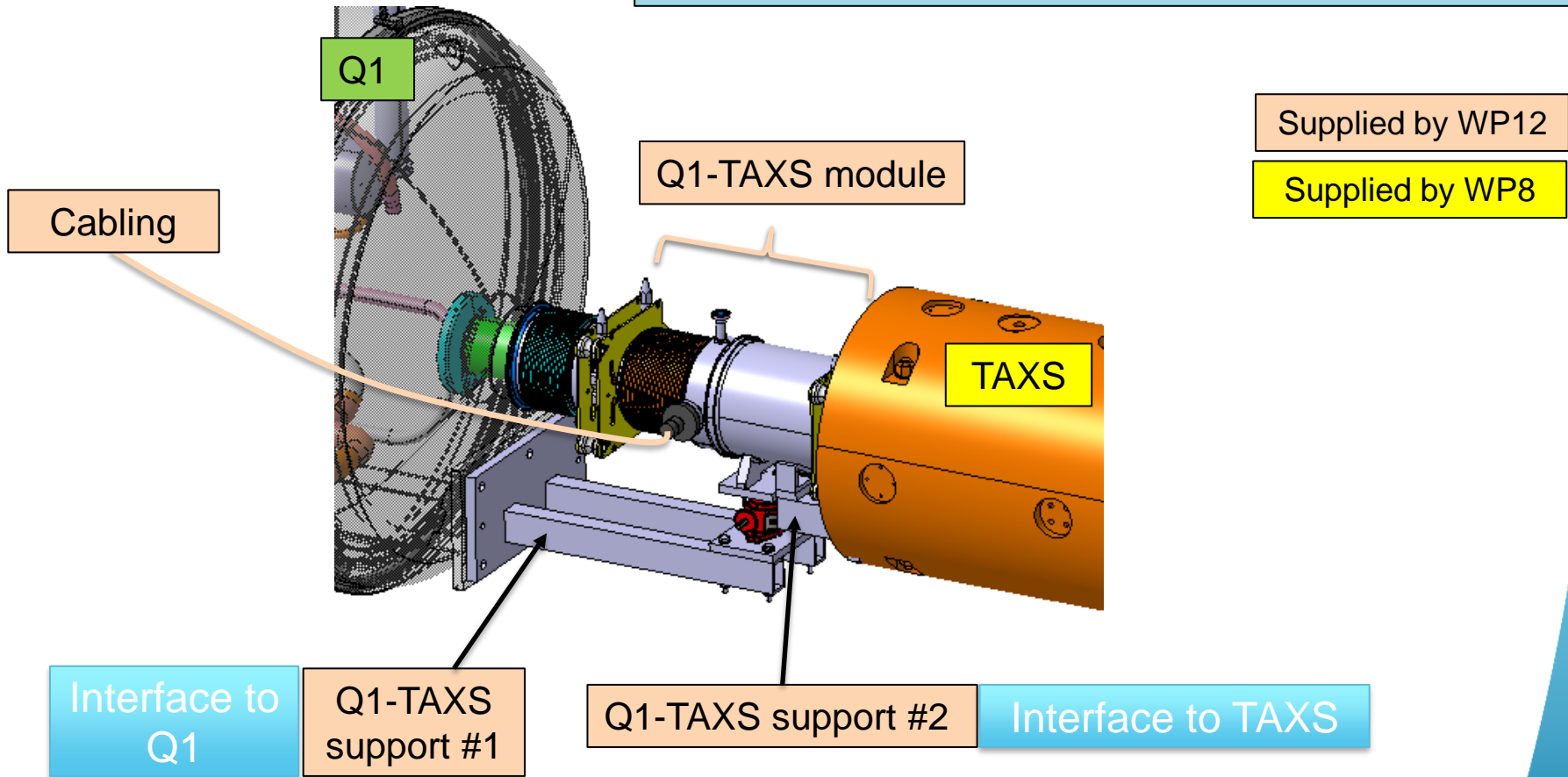
## WP involvement and deliverables

Alignment, handling and robotic operation procedures and support provided by related teams must be available for future interventions (out of HL period)

**References:** HE → EN-HE; ESA → BE-GM-ESA; MRO → BE-CEM-MRO; EP → ATLAS or CMS  
 (A) Interface to support attachment delivered by (or through) WP8 or WP15 (including design, preparation, execution and/or installation)  
 (B) Use of a temporary installation support only at pt. 5 (TBC)  
 (C) Cabling details: provided by WP12. Integration studies: made by WP15 (LHC) and WP8 (experiment). Installation: made by EN-EL (LHC); organized by WP8 (experim.) [ see ANNEX1]  
 (D) Service (cabling and compressed air) details: provided by WP12. Integration studies: made by WP8. Installation: made by WP8 and WP12 [ see ANNEX1]  
 (E) Compress. air need details: provided by WP12. Integration studies: made by WP15 (LHC) and WP8 (exp.). Installation: made by EN-CV (LHC); organized by WP8 (exp.) [ see ANNEX1]  
 (F) Extension of current lines at pt. 5. Development of new lines at pt. 1  
 (G) External inputs to WP designer  
 (1) Functional and physical (interface and/or envelope) inputs are required  
 (2) Only physical (interface and/or envelope) inputs are required  
 (\*) Deliverables requested are out of the scope of the Host-Lab activities [8]  
**Integration studies and models (including services): made by WP15 (LHC) and WP8 (experimental areas and interface areas with LHC)**  
**Interfaces with LHC, EP, MRO and ESA are managed by WP8. Interfaces with HE are managed by WP8 (experimental areas) and WP15 (LHC)**  
**NOTE: when several teams are involved, the first team indicated (out of the brackets) becomes responsible for the activity.**

SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/s supply	Acceptance	Reception	Installation	Operation
Q1-TAXS	MODULE		WP8, WP15 (1)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	EXTERNAL SERVICES (A)	CABLING	WP8, WP15 (2)	WP12	EN-EL	EN-EL	WP12	EN-EL	TE-VSC
		INSTR. CONTROLS	WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	Q1-TAXS SUPPORT #1 (B)	SUPPORT ASSEMBLY	WP8, WP15 (1)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	Q1-TAXS SUPPORT #2	SUPPORT ASSEMBLY							

WP15 ensures cabling and racks integration inside LHC, coordinates planning and manages activity → WP12 provides inputs (cabling and racks details), EN-EL pulls cables and coordinates in-situ intervention





SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/s upply	Acceptance	Reception	Installation	Operation
TAXS	ABSORBER	I/F TO BEAMPIPE AND VAC. CONNECTOR	WP12 (1)	WP8	WP8	WP8	WP12	WP8 (+ ESA)	BE-EA
	VAC. CHAMBER		WP8 (1)	WP12	WP12	WP12	WP8	WP8 (+WP12)	TE-VSC
	VAC. CONNECTOR			WP12	WP12	WP12	WP8	WP8 (+WP12)	TE-VSC
	STOP END		WP12 (1)	WP8	WP8	WP8	WP8	WP8 (+ ESA)	BE-EA
	HE DOME		WP12 (2)	WP8	WP8	WP8	WP8	WP8	BE-EA

Supplied by WP12

(actually, TE-VSC contribution to WP8)

Supplied by WP8

TAXS  
(absorber)

TAXS chamber

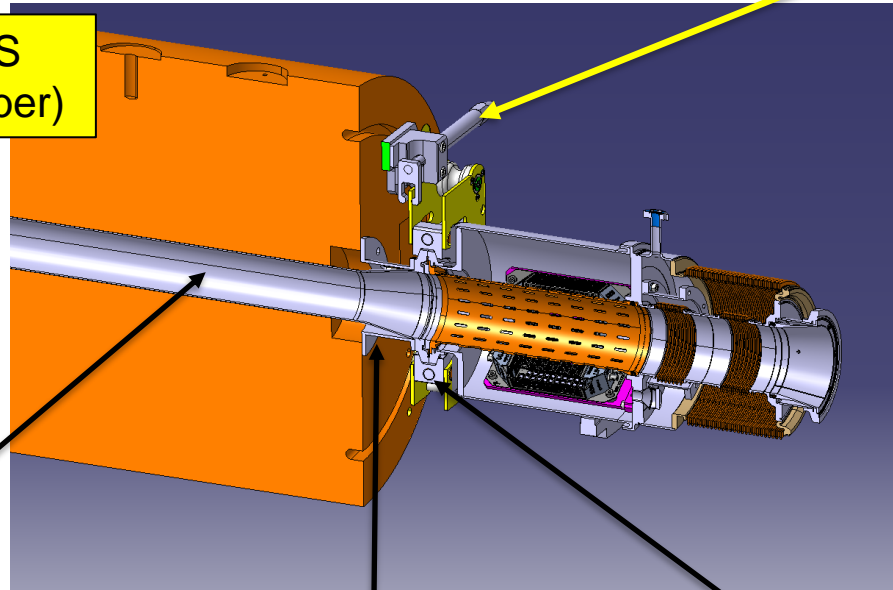
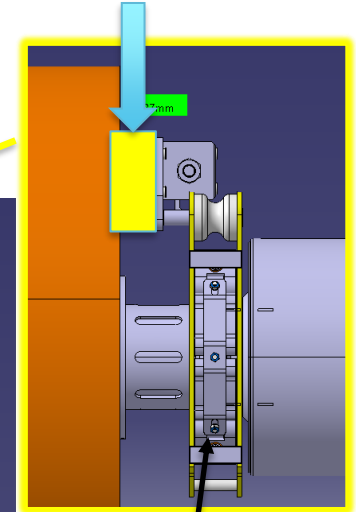
Interface to  
TAXS (tube)

TAXS chamber  
(Z-stop)

Interface to  
TAXS (Z-stop)

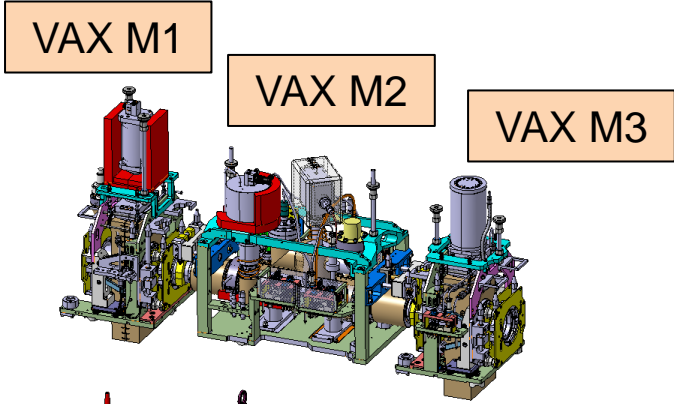
Vacuum connector

Interface to  
TAXS

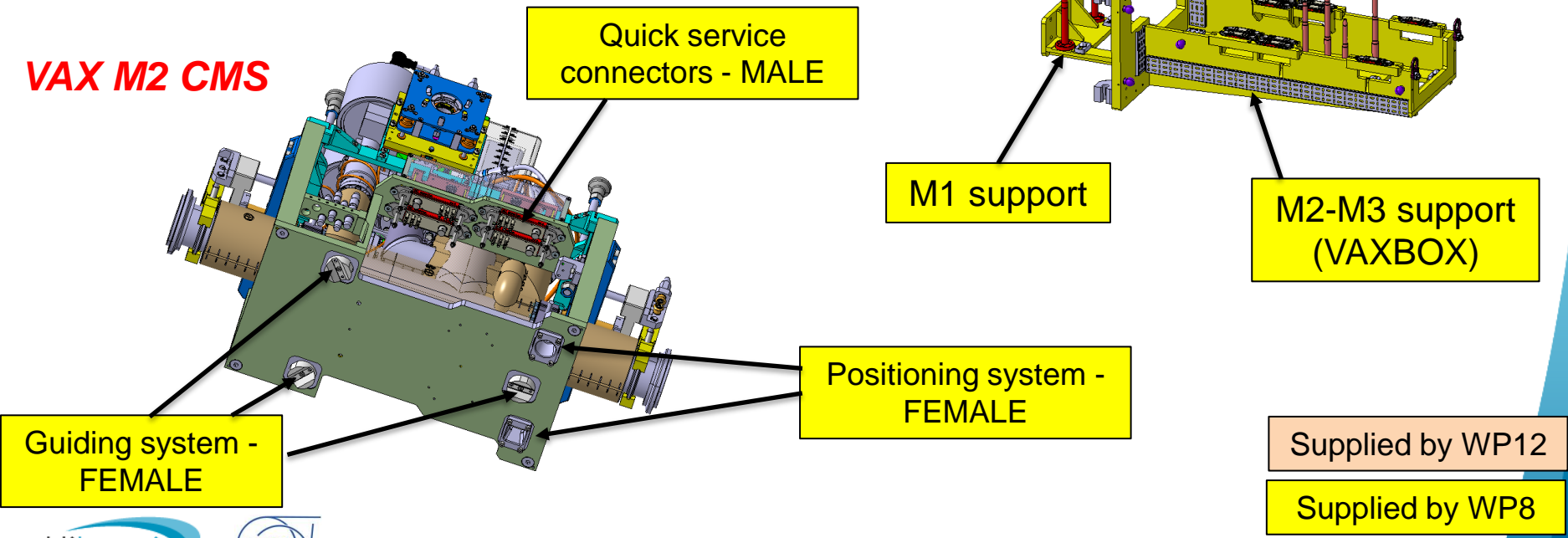


SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/s supply	Acceptance	Reception	Installation	Operation	
VAX	M1-M2-M3	MODULE	WP8 (1)	WP12	WP12	WP12	WP12	WP12 (+WP8 + MRO + HE)	TE-VSC	
		QUICK SERVICE CONNECTOR - MALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC	
		GUIDING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC	
	M1 SUPPORT	POSITIONING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12	TE-VSC		
		STRUCTURE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	TE-VSC		
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8		TE-VSC		
	M2-M3 SUPPORT	POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	TE-VSC		
		STRUCTURE	WP12 (1)	WP8	WP8	WP8		TE-VSC		
		QUICK SERVICE CONNECTOR - FEMALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8		TE-VSC		
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8		TE-VSC		
	M1-M2-M3 EXTERNAL SERVICES	POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	TE-VSC		
		CABLING ACROSS EXP. SHIELDING AND FACILITIES (C)	WP8, WP15 (2)	WP12	WP8/EN-EL	WP8/EN-EL		WP12 (+WP8)	TE-VSC	
		CABLING ACROSS VAX MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-EL	WP8 (+WP12)		WP12 (+WP8)	WP8 (+WP12)	TE-VSC
		COMPR. AIR TUBING THRU EXP. SHIELDING AND FACILITIES (E)	WP8, WP15 (2)	WP12	WP8/EN-CV	WP8/EN-CV		WP12 (+WP8)	WP8/EN-CV	EP/EN-CV
		COMPRESSED AIR TUBING THRU MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-CV	WP8 (+WP12)		WP12 (+WP8)	WP8 (+WP12)	EP/TE-VSC
		QUICK SERVICE CONNECTORS (MALE-FEMALE) FOR M1-M2-M3 CABLING AT TOP (ATLAS)	WP12 (1)	WP8	WP8	WP8		WP12	WP8 (+WP12)	TE-VSC
		PNEUMATIC DISTRIBUTOR		WP12	WP12	WP12		WP12	WP12	TE-VSC
INSTR. AND VALVE CONTROLS		WP15 (2)	WP12	WP12	WP12	WP12		WP12	TE-VSC	
VAX MODULE SUPPORT INTERFACE (A)		WP12 (1)	WP8	WP8	WP8	WP12		WP8	TE-VSC	

# VAX modules in ATLAS



## VAX M2 CMS

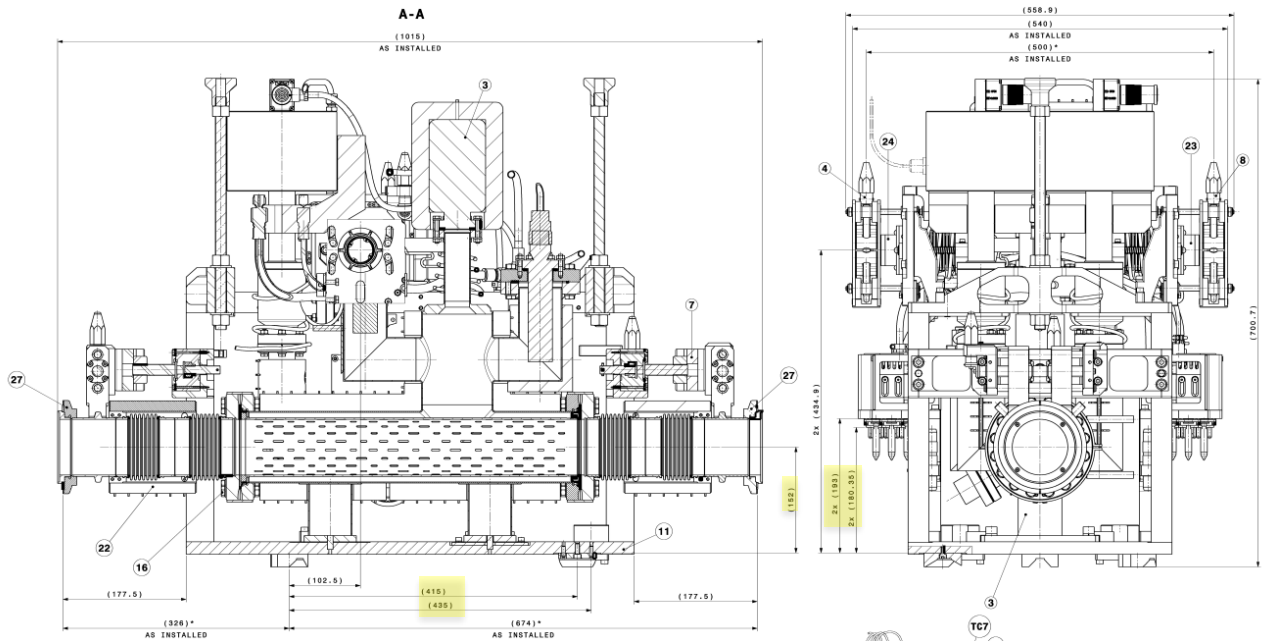


# VAX M2 module -to- VAX M2/M3 support interface (example)

- M2 module subsystem interface can be broken down into:
  - Module envelope;
  - Module -to- handling tool (mechanical + local accessibility);
  - Module -to- robotic operating tool (mechanical + vacuum connection operation);
  - Module -to- STAUBLI connector;
  - Module -to- guiding system;
  - Module -to- positioning system;
  - **Module -to- support (locking system).**

**To be included once STAUBLI connector is finalized**

Alignment and mechanical tolerancing logics are a must



# and integration at areas

SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/supply	Acceptance	Reception	Installation	Operation
VAX	M1-M2-M3	MODULE	WP8 (1)	WP12	WP12	WP12	WP12	WP12 (+WP8 + MRO + HE)	TE-VSC
		QUICK SERVICE CONNECTOR - MALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC
		GUIDING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC
		POSITIONING SYSTEM - FEMALE	WP12 (1)	WP8	WP8	WP8	WP12		TE-VSC
	M1 SUPPORT	STRUCTURE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	WP8 (+ ESA)	TE-VSC
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
		POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
	M2-M3 SUPPORT	STRUCTURE	WP12 (1)	WP8	WP8	WP8	WP12 (+WP8)	WP8 (+ WP12 + ESA + HE)	TE-VSC
		QUICK SERVICE CONNECTOR - FEMALE (FOR M2-M3)	WP12 (1)	WP8	WP8	WP8			TE-VSC
		GUIDING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
		POSITIONING SYSTEM - MALE	WP12 (1)	WP8	WP8	WP8			TE-VSC
	M1-M2-M3 EXTERNAL SERVICES	CABLING ACROSS EXP. SHIELDING AND FACILITIES (C)	WP8, WP15 (2)	WP12	WP8/EN-EL	WP8/EN-EL	WP12 (+WP8)	WP8/EN-EL	TE-VSC
		CABLING ACROSS VAX MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-EL	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	TE-VSC
		COMPR. AIR TUBING THRU EXP. SHIELDING AND FACILITIES (E)	WP8, WP15 (2)	WP12	WP8/EN-CV	WP8/EN-CV	WP12 (+WP8)	WP8/EN-CV	EP/EN-CV
		COMPRESSED AIR TUBING THRU MODULE SUPPORTS (D)	WP8 (2)	WP12	WP8/EN-CV	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	EP/TE-VSC
		QUICK SERVICE CONNECTORS (MALE-FEMALE) FOR M1-M2-M3 CABLING AT TOP (ATLAS)	WP12 (1)	WP8	WP8	WP8	WP12	WP8 (+WP12)	TE-VSC
		PNEUMATIC DISTRIBUTOR		WP12	WP12	WP12	WP12	WP12	TE-VSC
		INSTR. AND VALVE CONTROLS	WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
		VAX MODULE SUPPORT INTERFACE (A)	WP12 (1)	WP8	WP8	WP8	WP12	WP8	TE-VSC

**Similar approach to LHC is considered for experimental areas:** WP8 would identify executors, integrate services and additional needs, and ensure activity inside experimental plannings, in coordination with LHC one

**References:** HE → EN-HE; ESA → BE-GM-ESA; MRO → BE-CEM-MRO; EP → ATLAS or CMS

(A) Interface to support attachment delivered by (or through) WP8 or WP15 (including design, preparation, execution and/or installation)

(B) Use of a temporary installation support only at pt. 5 (TBC)

(C) Cabling details: provided by WP12. Integration studies: made by WP15 (LHC) and WP8 (experiment). Installation: made by EN-EL (LHC); organized by WP8 (experim.) [see ANNEX1]

(D) Service (cabling and compressed air) details: provided by WP12. Integration studies: made by WP8. Installation: made by WP8 and WP12 [see ANNEX1]

(E) Compress. air need details: provided by WP12. Integration studies: made by WP15 (LHC) and WP8 (exp.). Installation: made by EN-CV (LHC); organized by WP8 (exp.) [see ANNEX1]

(F) Extension of current lines at pt. 5. Development of new lines at pt. 1

(G) External inputs to WP designer

(1) Functional and physical (interface and/or envelope) inputs are required

(2) Only physical (interface and/or envelope) inputs are required

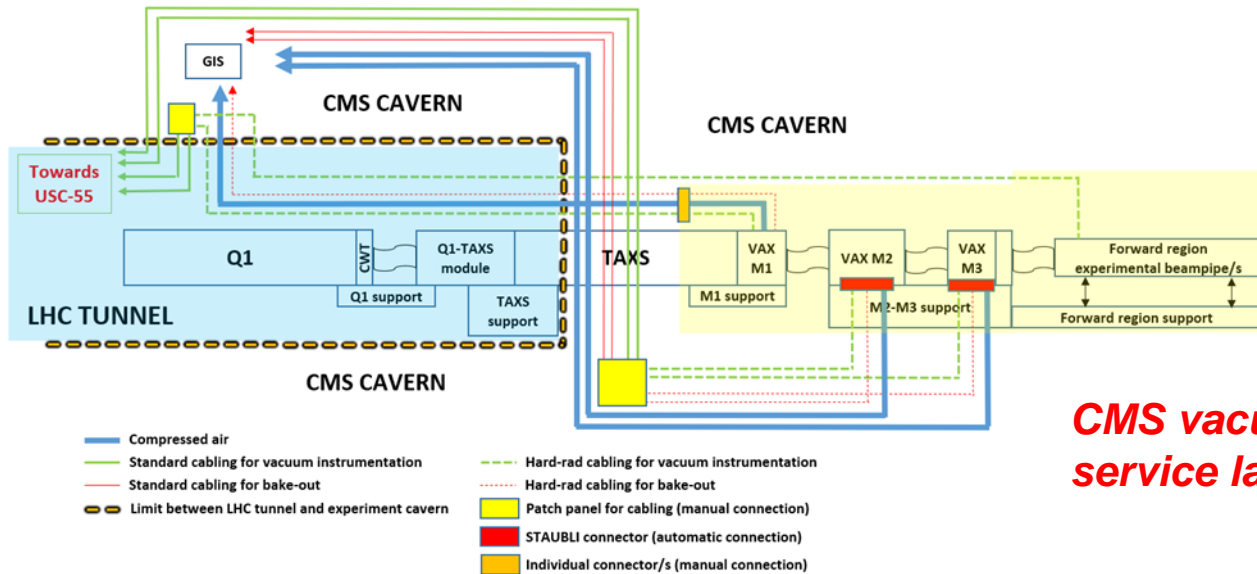
(\*) Deliverables requested are out of the scope of the Host-Lab activities [8]

**Integration studies and models (including services): made by WP15 (LHC) and WP8 (experimental areas and interface areas with LHC)**

**Interfaces with LHC, EP, MRO and ESA are managed by WP8. Interfaces with HE are managed by WP8 (experimental areas) and WP15 (LHC)**

**NOTE: when several teams are involved, the first team indicated (out of the brackets) becomes responsible for the activity.**

# M1-M2-M3 external services and integration at experimental areas



**CMS vacuum service layout**

M2 CMS				
Component	Rad-Hard cable type and overall diameter	Bending radius	Normal cable type and overall diameter	Bending radius
2x Angle valves	4x NER4 – D6.8mm	R50mm	4x NE4 - D8.5mm	R85mm
VVFC	4x Tube D8mm compressed air. Hose: D16mm. Connector: 20mm			
Penning VGPB	1x TFA3 – D10mm	R103mm	1x TFA3 - D10.3mm	R103mm
Pirani VGRB	1x NGR4 – D7.3mm	R36mm	1x NG4 - D9mm	R90mm
NEG VPNCA	1x NGR4 – D7.3mm	R36mm	1x NG4 - D9mm	R90mm
Bayard-Alpert VGIA	1x NER8 – D9.8mm	R50mm	1x NE8 - D10.5mm	R105mm
	1x TCAR3 – D10mm	R103mm	1x TCA3 - D7mm	R70mm
Ion pump VPIXD	1x SDF04_17 – D4.5mm	R45mm	1x SVA3 - D10.7mm	R107mm
Rupture disk				
Heating jacket	Power: 48x AXON FHT1619NPC – D1.73mm	R30mm	1x NH48* - D29mm	R290mm
	TCK: 48x Horst- ZD 00006 - D2.6mm		2x MCT32** - D15mm	R150mm

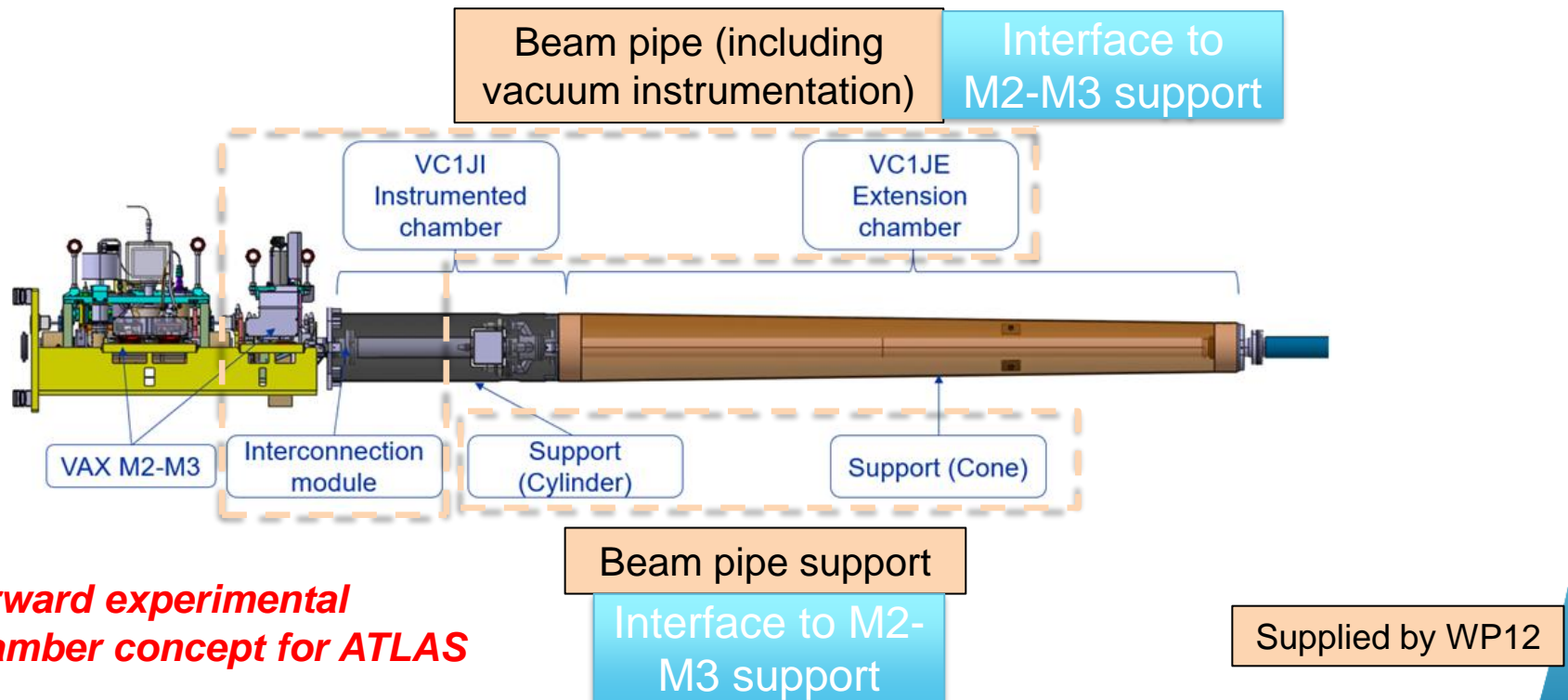
\*Cable type depends on the numbers of wires needed. Other NH variants exist

\*\*Number of cables depends on the numbers of wires needed.

**VAX M2 cabling needs at CMS**

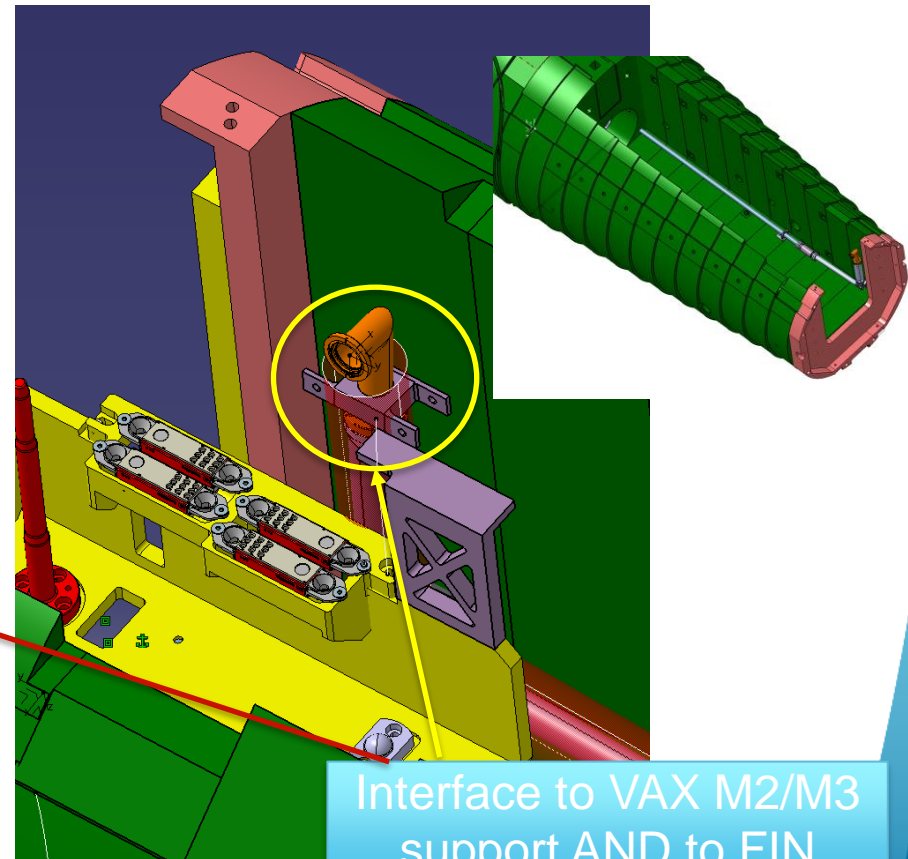
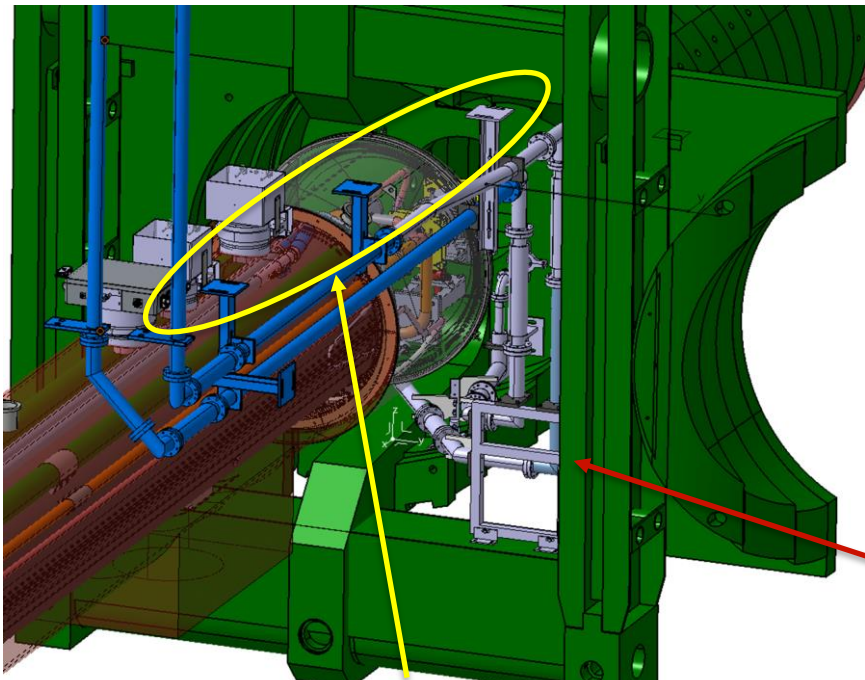
SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/supply	Acceptance	Reception	Installation	Operation
FORWARD REGION EXPERIMENTAL BEAMPIPES (*)	BEAM PIPES		EP, WP8 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
	SUPPORT		EP, WP8 (2)	WP12	WP12	WP12	WP8 (+WP12)	WP12 (+ WP8 + ESA + HE)	TE-VSC
	EXTERNAL SERVICES (A)	CABLING ACROSS EXP. SHIELDING AND FACILITIES (C)	WP8, WP15 (2)	WP12	WP8/EN-EL	WP8/EN-EL	WP12 (+WP8)	WP8/EN-EL	TE-VSC
		CABLING ACROSS VAX MODULE SUPPORTS (D)	EP, WP8 (2)	WP12	WP8/EN-EL	WP8 (+WP12)	WP12 (+WP8)	WP8 (+WP12)	TE-VSC
		CABLING ACROSS FORWARD REGION SUPPORT		WP12	WP12	WP12	WP12	WP12	TE-VSC
	INSTR. CONTROLS		WP15 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC

Cabling for forward experimental chamber vacuum instrumentation (ATLAS and CMS) and bake-out (ATLAS) is integrated and pulled following the same approach as for VAX M1-M2-M3



SYSTEM	SUB-SYSTEM	ITEM / ASSEMBLY	Inputs (G)	Design	Manufacturing/s upply	Acceptance	Reception	Installation	Operation
VACUUM SERVICE LINES (F)	PUMPING LINES	PIPES	WP8, WP15 (2)	WP12	WP12	WP12	WP12 (+WP8 + WP15)	WP12	TE-VSC
		BELLOWS	WP8, WP15 (2)	WP12	WP12	WP12	WP12 (+WP8 + WP15)	WP12	TE-VSC
		SUPPORTS (A)	WP8, WP15 (2)	WP12	WP12	WP12	WP8 (+WP12)	WP12 (+WP8)	TE-VSC
	BAKE-OUT	JACKET	WP8 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC
		CABLING	WP8 (2)	WP12	WP12	WP12	WP12	WP12	TE-VSC

Cabling for bake-out of pumping lines is routed following the routing of the pumping lines → cable trays would be required



Supplied by WP12

Interface to LHC tunnel

Interface to VAX M2/M3  
support AND to FIN

# Conclusions

- An specification document is proposed to clarify deliverables of WP12.2.5 and interfaces with other teams and/or WPs
- Deliverables are based on WP12 understanding and common coherent approach between LHC and experimental areas
- Interfaces need to be detailed in order to ensure functionality and common understanding
  - Especially relevant on aspects impacted by activities involving several teams (e.g. installation, alignment)
- Feedback by other teams and/or WPs is expected



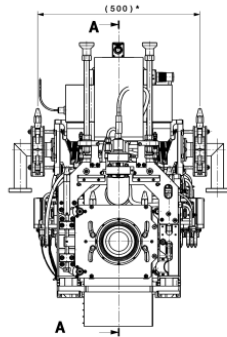


***Thanks for your attention***

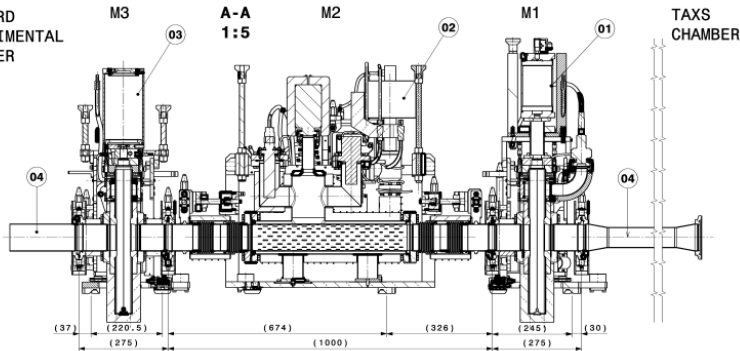
Special thanks to WP12 members, and rest of WPs and teams involved



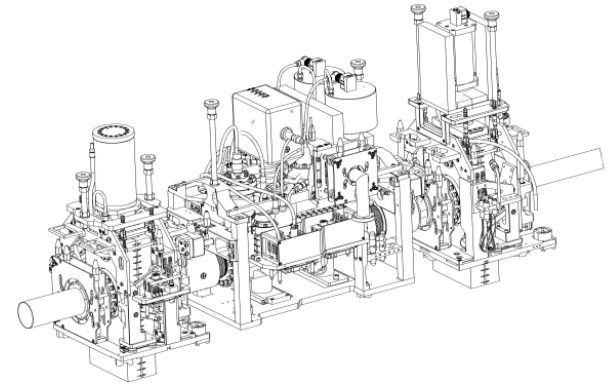
AS INSTALLED CONFIGURATION



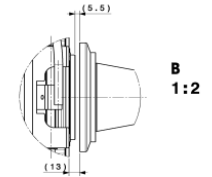
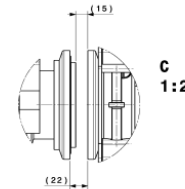
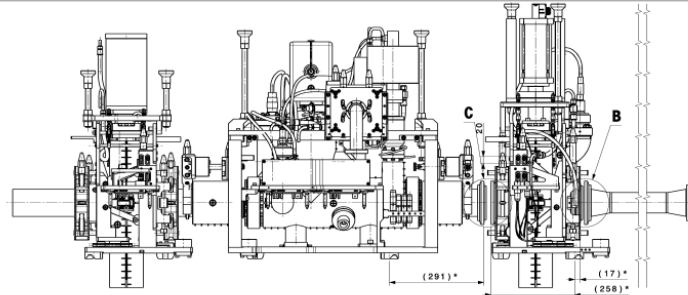
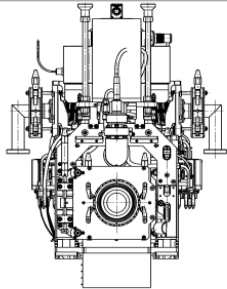
FORWARD EXPERIMENTAL CHAMBER



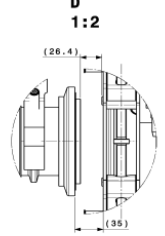
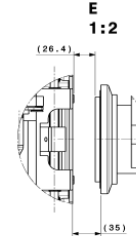
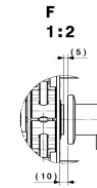
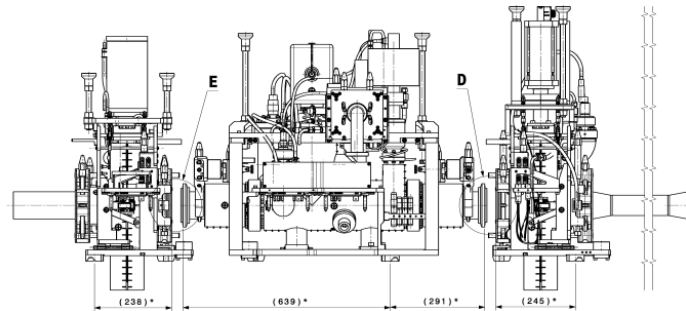
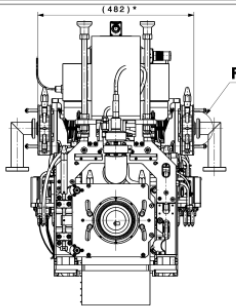
TAXIS CHAMBER



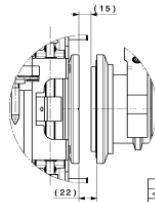
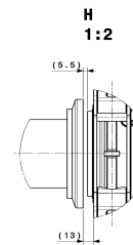
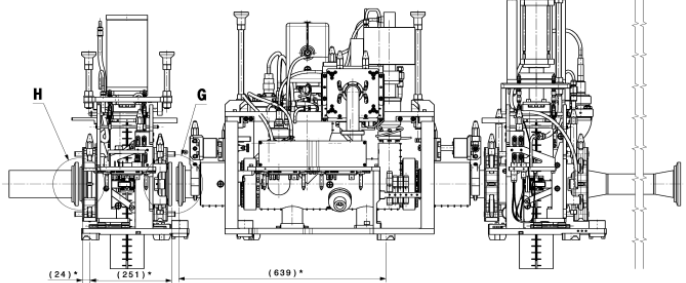
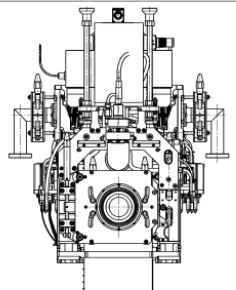
CONFIGURATION FOR M1 REMOVAL



CONFIGURATION FOR M2 REMOVAL



CONFIGURATION FOR M3 REMOVAL



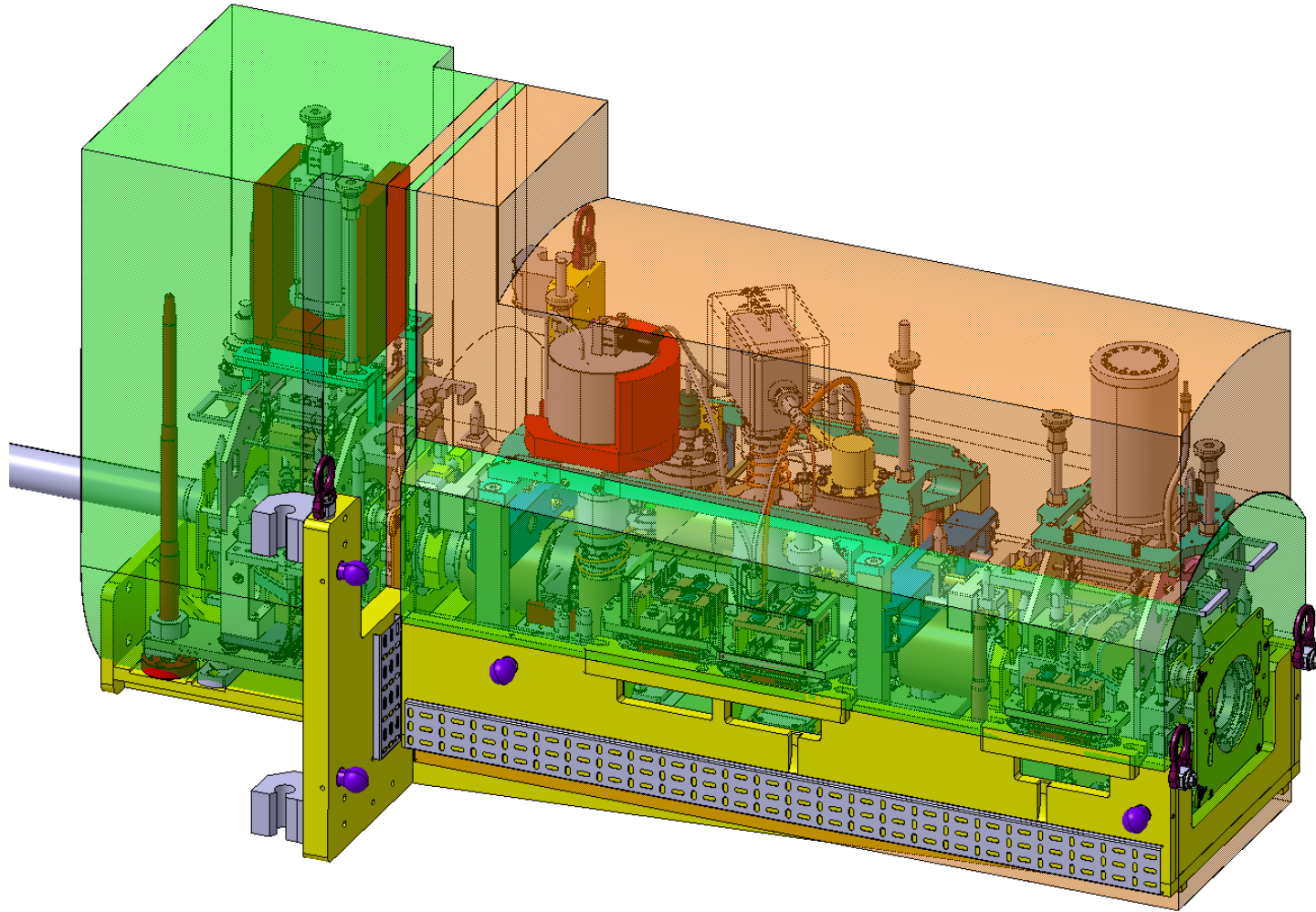
NOTE \* : UP TO FLANGE SURFACE

DIMENSIONS GIVEN ARE NOMINAL. NO MISALIGNMENTS ARE CONSIDERED  
SEE DRAWINGS LHCVAXR001 AND LHCVAX\_0045 FOR CONFIGURATIONS AND RELATIVE LENGTHS OF EXPANSION JOINTS AT EXTREMITIES OF VAX MODULE M2

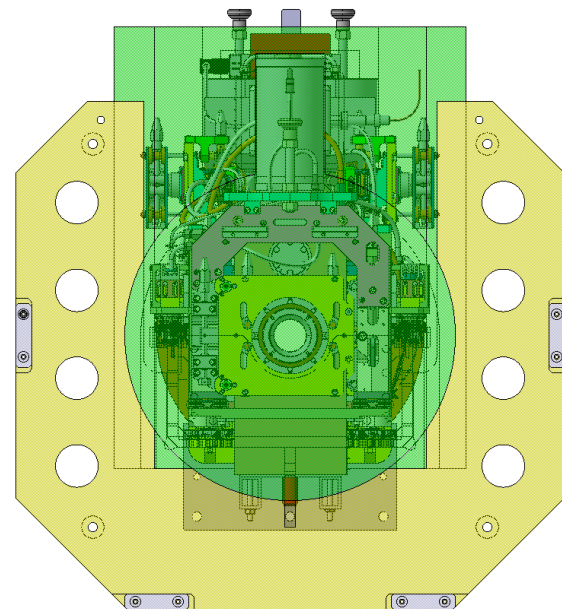
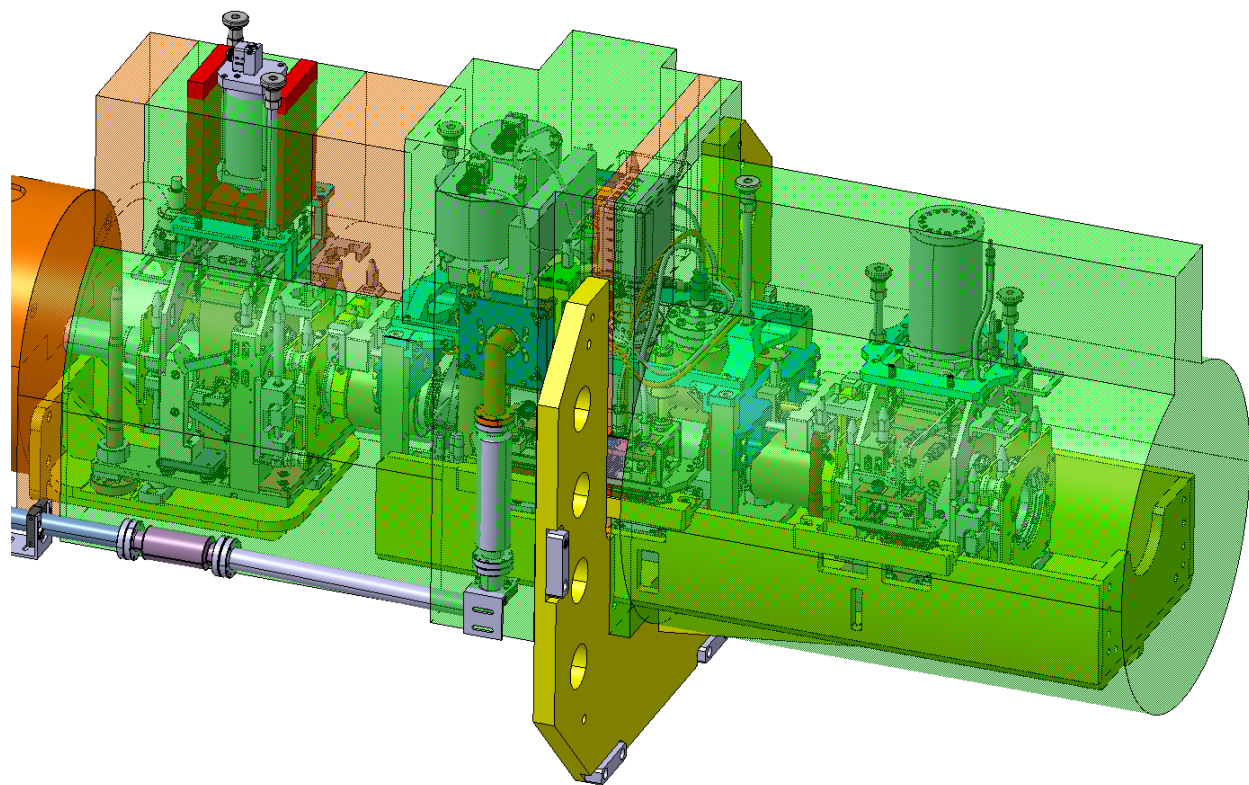
BILL OF MATERIALS			
NO	QTY	DESCRIPTION	REF
01	3	ALL TOP SIDE VALVE ASSEMBLY FOR LHCVAXR001	
02	4	VAX GENERAL ASSEMBLY FOR CMS LHCVAXR001	
03	3	W/ END SIDE VALVE ASSEMBLY AT STRIBR002	
04	1	external ref	

REFERENCE: Doc No: ST189202.00  
 LHCVAX\_0002  
 DRAFT FOR REVIEW  
 1/1

# Integration of ATLAS-A VAX assembly on allocated envelope



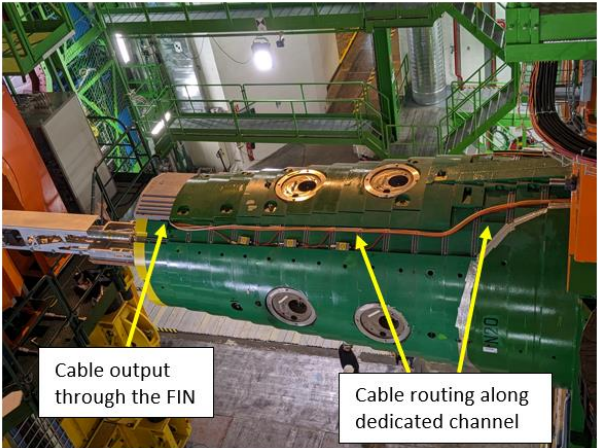
# Integration of CMS VAX assembly on allocated envelope



# CMS service routing proposal

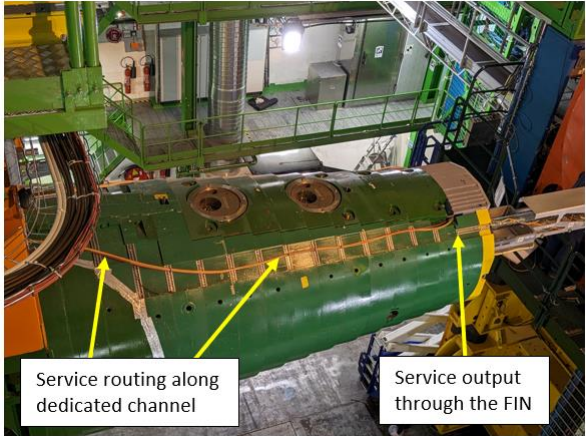


Service routing along dedicated channel



Cable output through the FIN

Cable routing along dedicated channel



Service routing along dedicated channel

Service output through the FIN

