RFD Prototype Cryomodule update

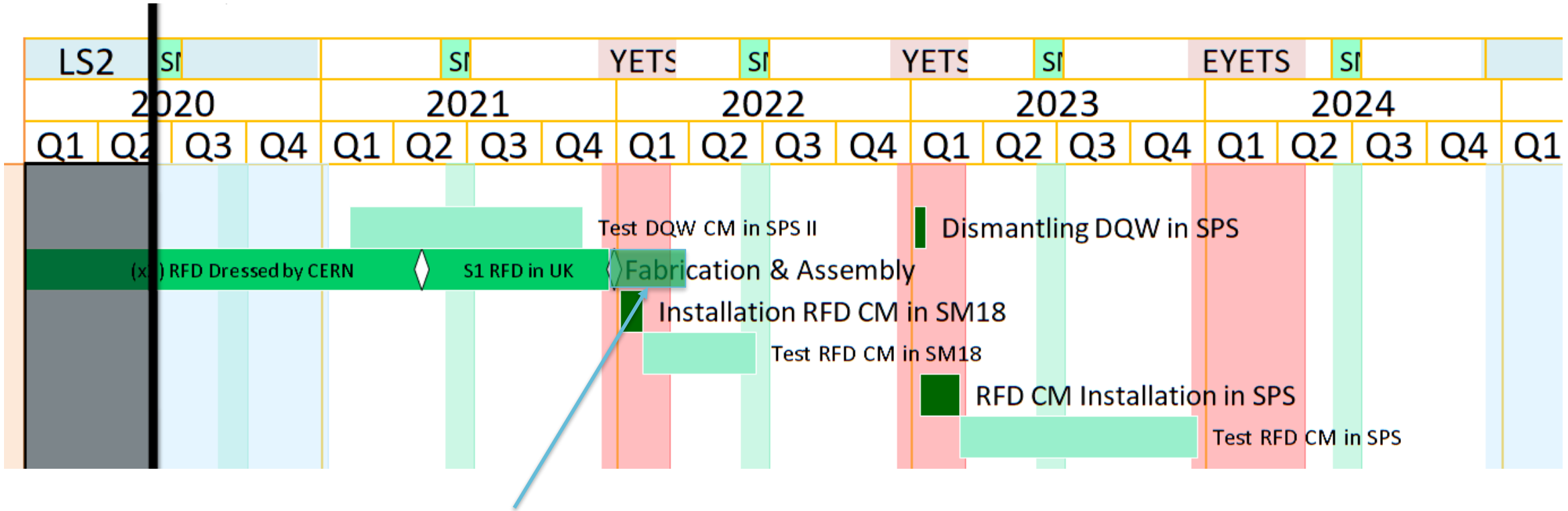
Thomas Jones on behalf of CERN-UK Team

23/10/2020

Content

- Schedule
- Cavity + ancillary update
- CM design update
- Tooling update
- Infrastructure update
- Documentation update

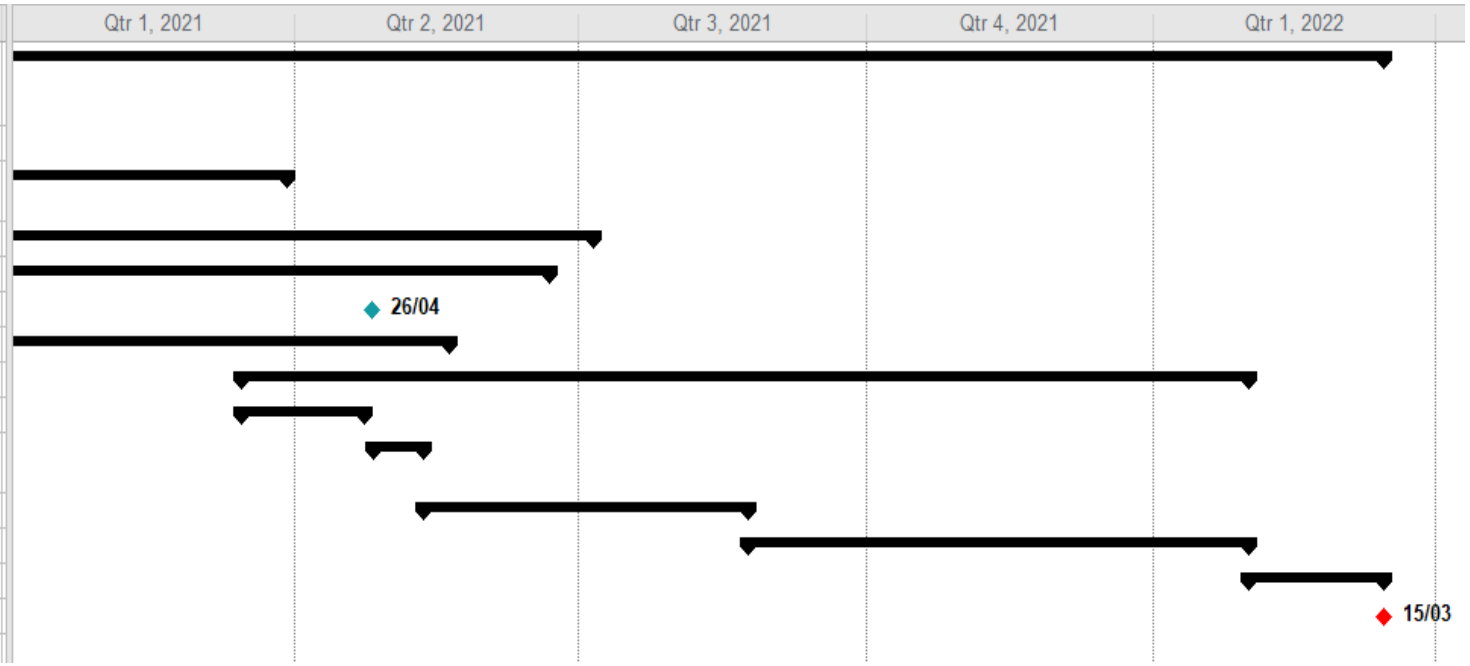
WP4 Master Plan, RFD CERN/UK



Revision to WP4 Master plan

UK Plan for 2021/22

Task Name	Start	Finish
HILumi RFD Pre Series Cryomodule	03/04/17	15/03/22
Design Study PS/SPS CM	03/04/17	19/07/19
Engineering Design, Analysis, Drawings and Specification	31/12/18	29/03/21
Manufacturing and Procurement	03/04/20	05/07/21
Transportation Frame Design and Manufacture	01/05/19	21/06/21
Deliveries from CERN	26/04/21	26/04/21
Facilities Development at DL	09/11/18	20/05/21
Pre-Series CM Assembly	15/03/21	31/01/22
Pre-Assembly in Clean room	15/03/21	23/04/21
Acceptance and external cleaning for CCs and ancillaries	26/04/21	12/05/21
Cavity String assembly in Clean room	12/05/21	24/08/21
Cryostat Integraton (Outside Clean Room)	24/08/21	31/01/22
Acceptance Tests	31/01/22	15/03/22
Project Complete	15/03/22	15/03/22



Expect all design and drawings complete by end of March 2021

All manufacturing complete by end of July 2021

Cleanroom ready in March 2021

Cleanroom Pre assembly mid-March to mid April 2021

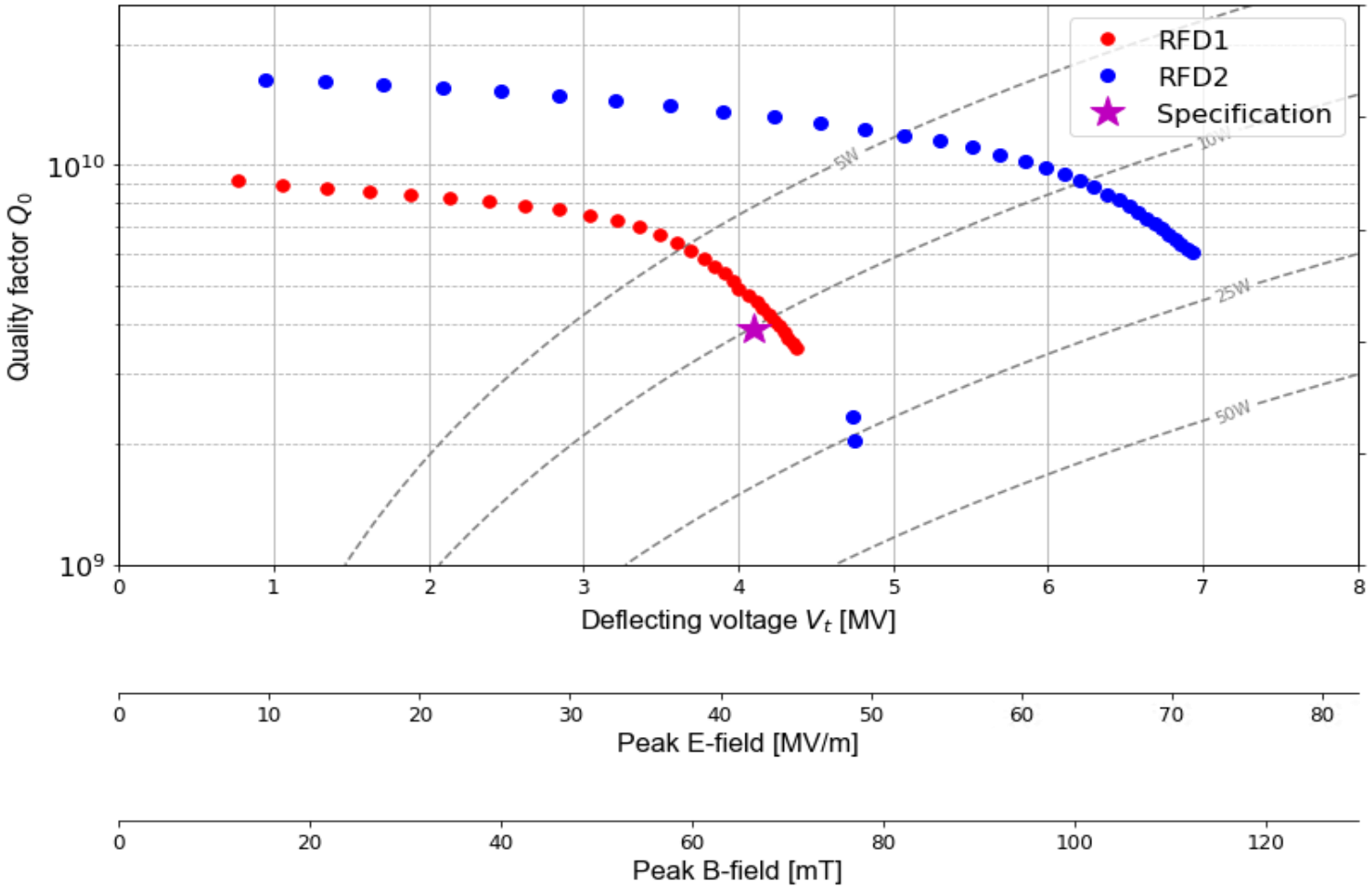
Cavity Delivery end of April 2021 followed by 2 weeks Acceptance Tests

Cavity String Assembly May to Aug ‘21

Cryomodule Assembly end Aug ’21 to end Jan ‘22

DL outgoing acceptance tests (LN2) in Feb to March 2022

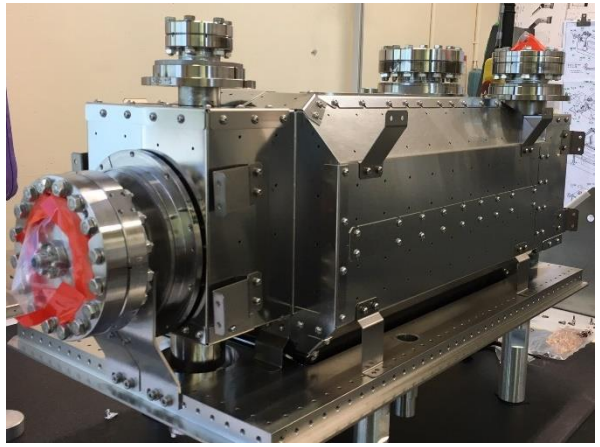
CERN-RFD, Cold Test Results

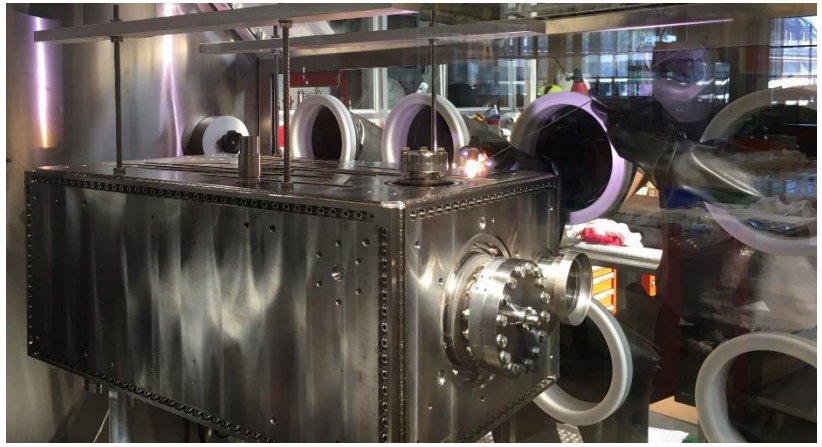


Slide from Rama's talk at HL-LHC WP4, Annual Meeting 2020

RFD cavity jacketing assembly

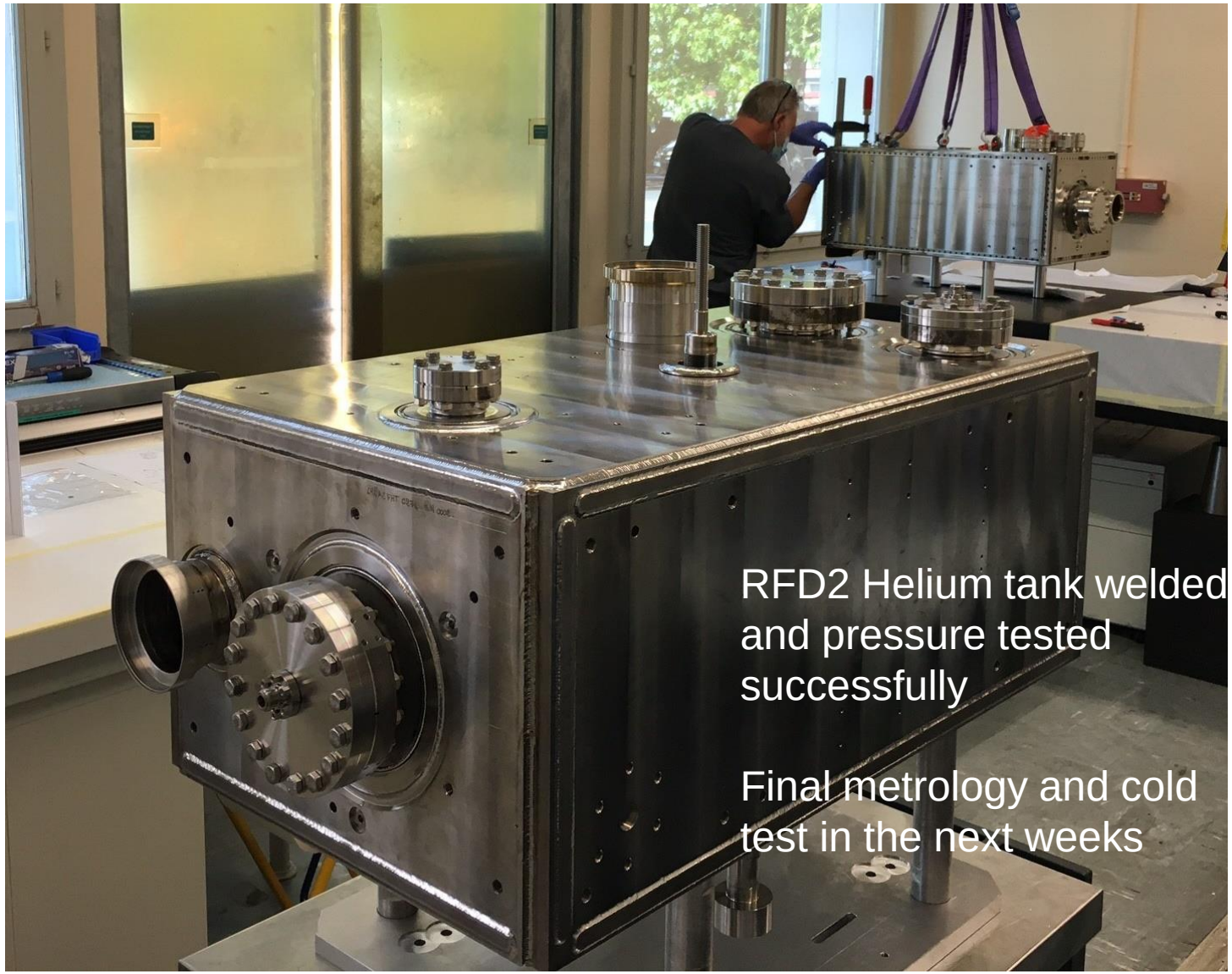
- Cold magnetic shields from UK-collaboration
- He-tank assembly very efficient (~1.5 mons) after the experience from DQW
- Frequency shift during He-tank assembly $\sim \pm 15\ \mathrm{kHz}$ (negligible)





Slide from Rama's talk at HL-LHC WP4, Annual Meeting 2020

RFD1 & 2 Jacketing



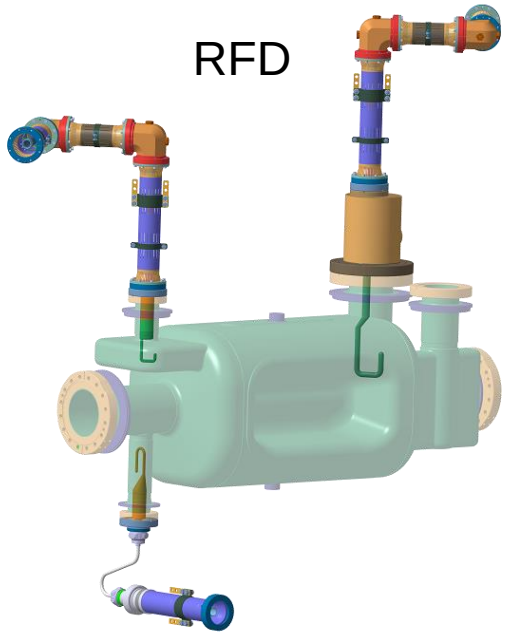
RFD1 welding to start mid-Oct and on track

HOM Couplers, Antennas & RF Lines

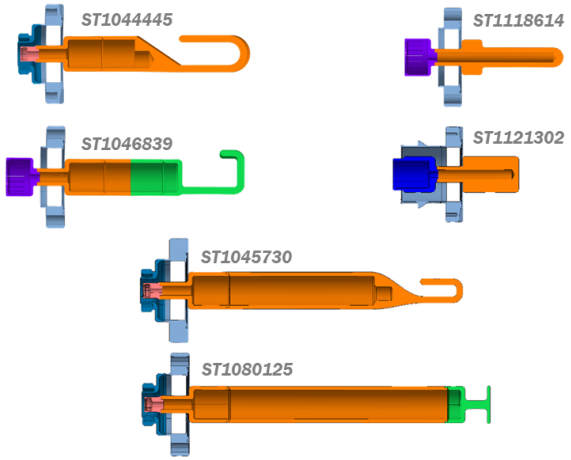
- All couplers are produced and will be integrated with RF feedthroughs. Power couplers are ready for conditioning before sending to UK in Q2-2021
- 3rd design iteration being finalized including brazing, flange tightening, and thermal cycle show no further cracks

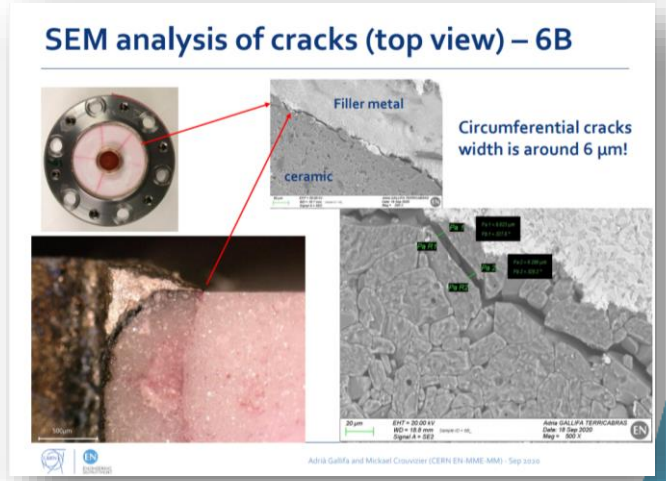
DQW

RFD



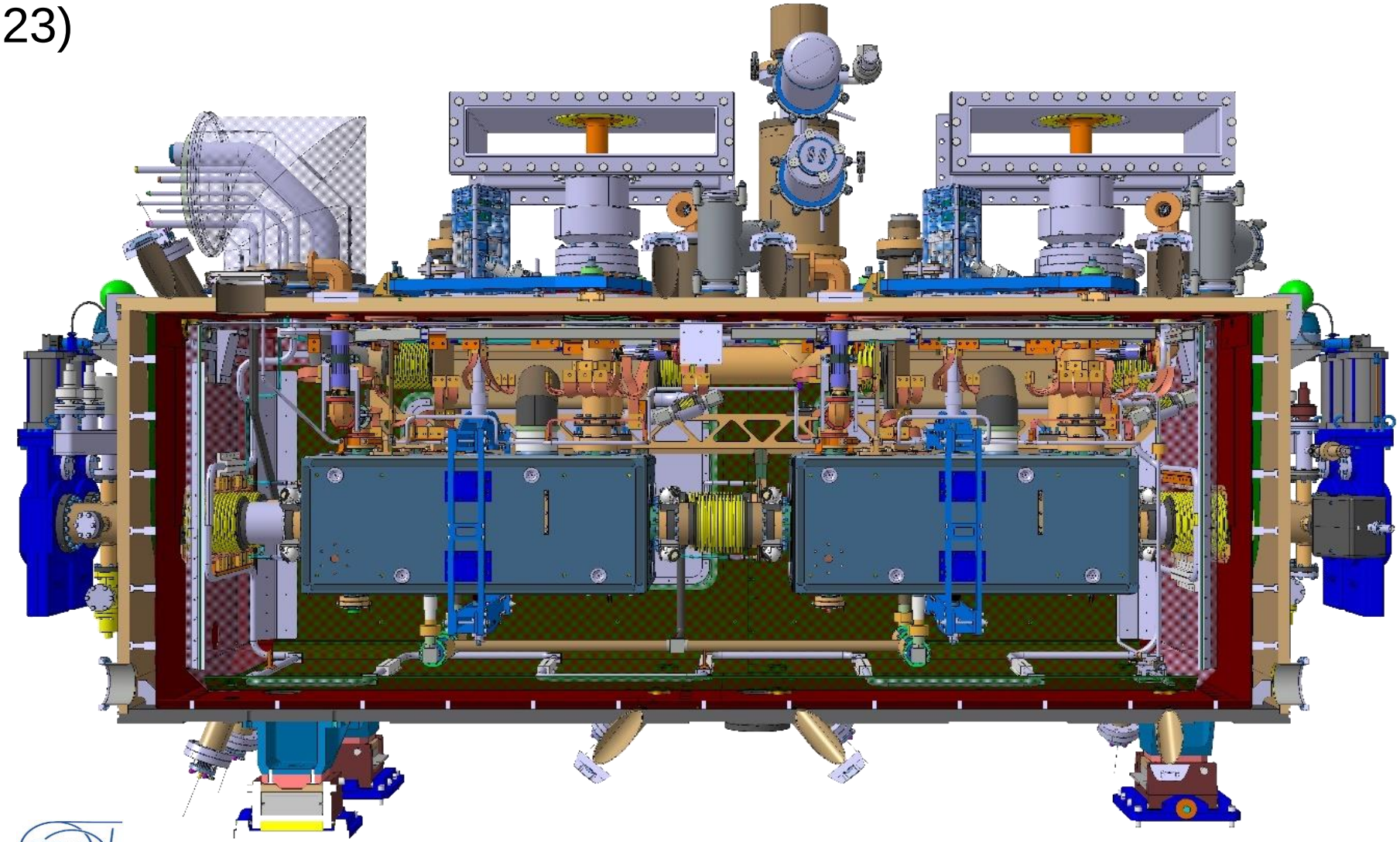
Standardized feedthrough for all HOM couplers





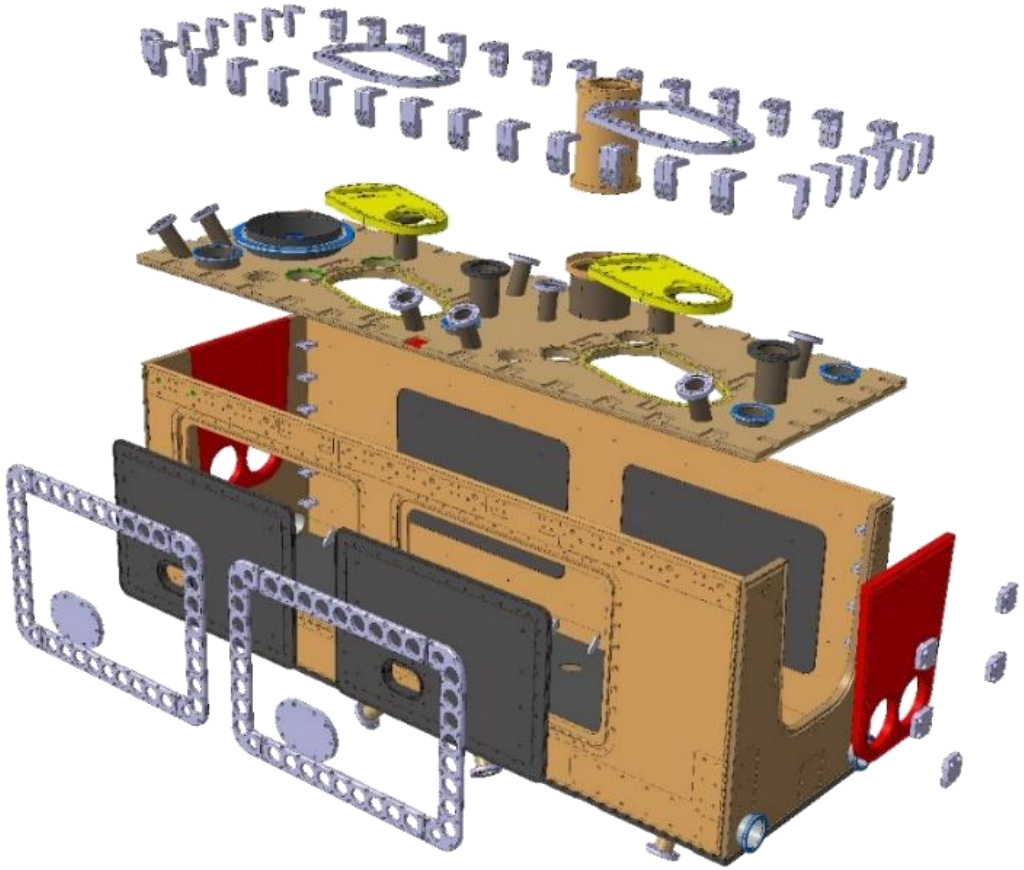
Cryomodule Design

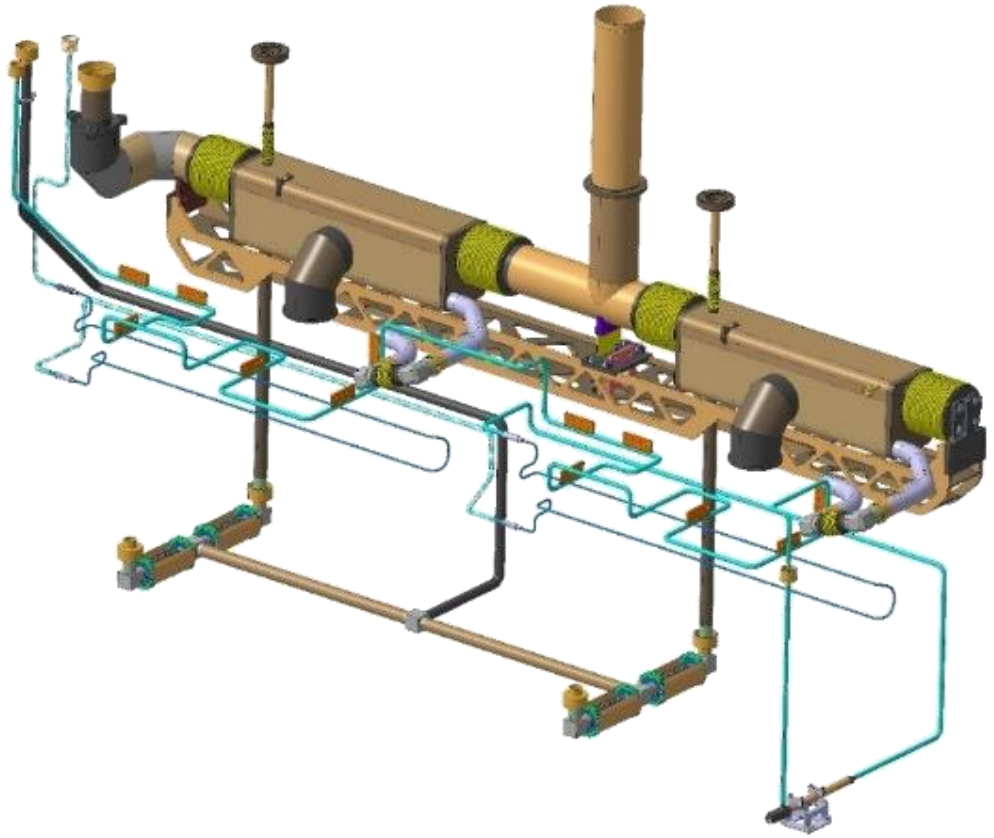
RFD module fully compatible with HL-LHC, to be tested in SM18 (2022) and SPS (2023)



Joint design between CERN & UK (STFC)

Cryomodule Design Progress (CERN/UK-STFC)
OVC and Cryolines (longest lead time)

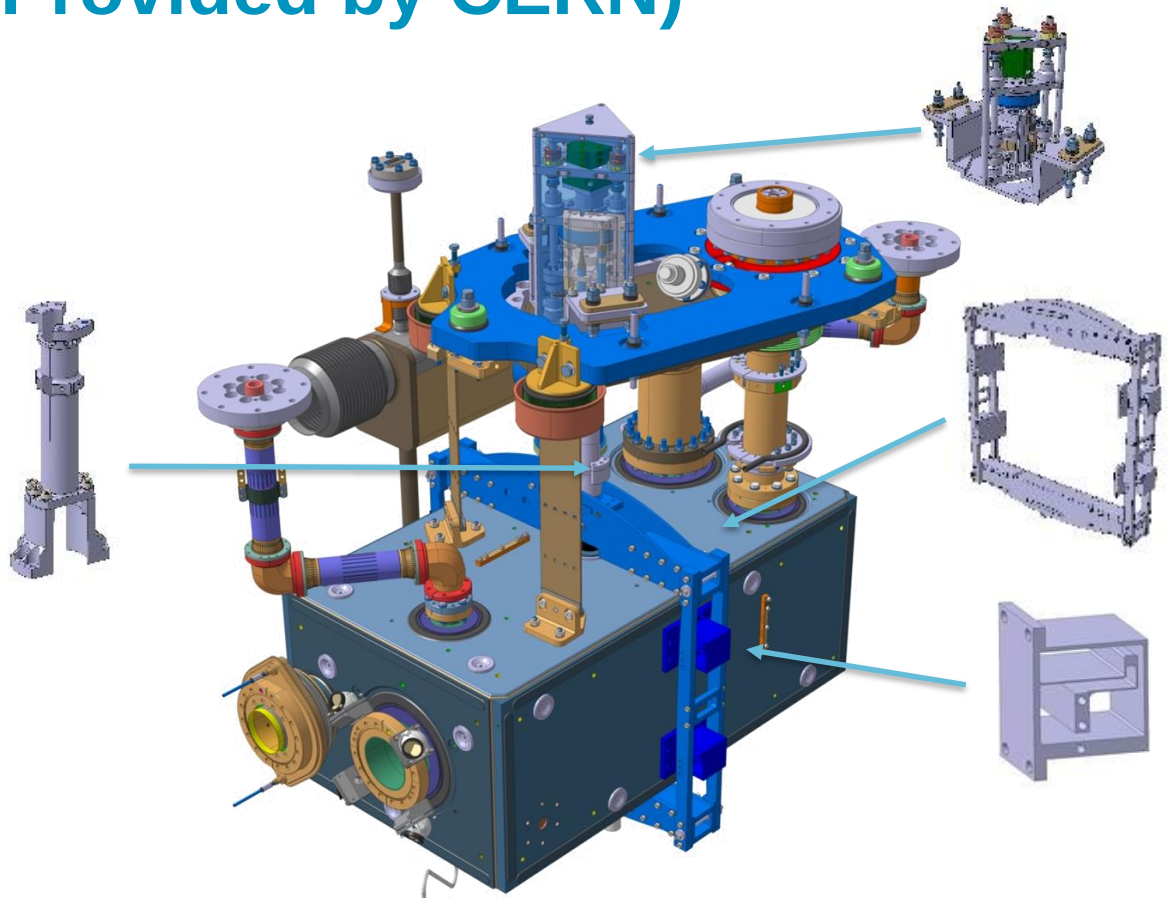




Vacuum vessel – Tender complete, order placed
Some drawings still to be released.

- Cryolines - Initial discussions taken place between STFC and suppliers who gave 6 month lead time.
- waiting on final drawings to launch procurement

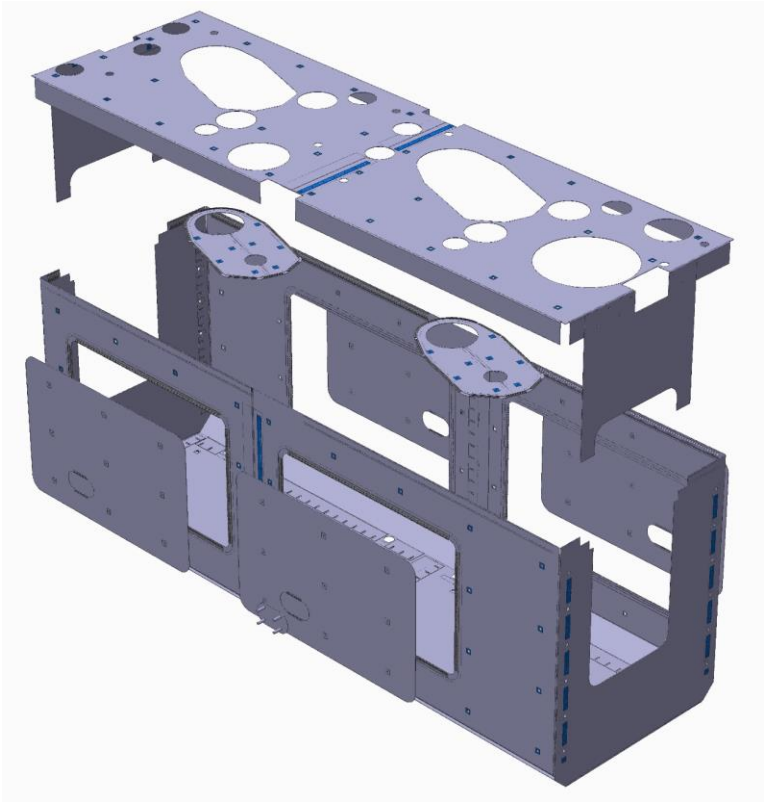
Cryomodule Design Progress (CERN/UK-STFC)
FPC and Tuner (Provided by CERN)

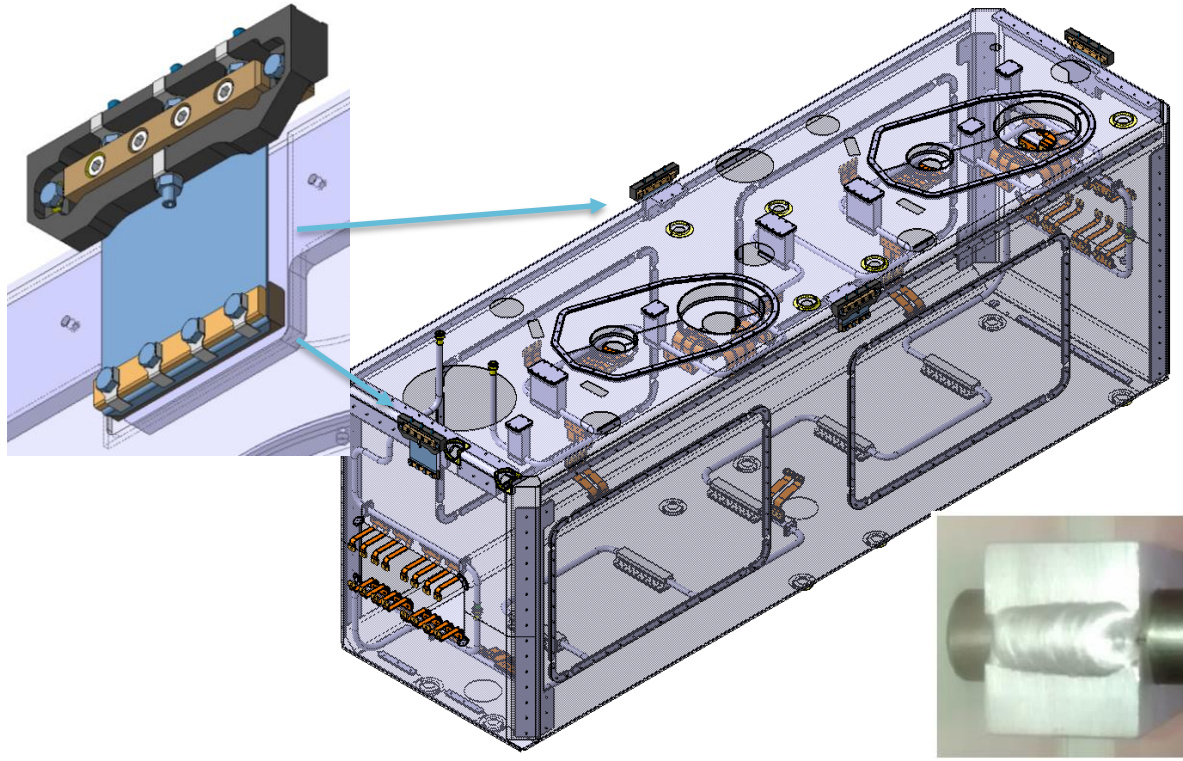


- FPC - Will be delivered to UK in April/May 2021.
- Currently finalising details of delivery configuration.

- Tuner Frame and Tuner Actuation drawings released and two frames in manufacture.
- Other tuner components with shorter lead times are in advanced phase of design.

Cryomodule Design Progress (UK-STFC/CERN)
Thermal and Outer Magnetic shielding

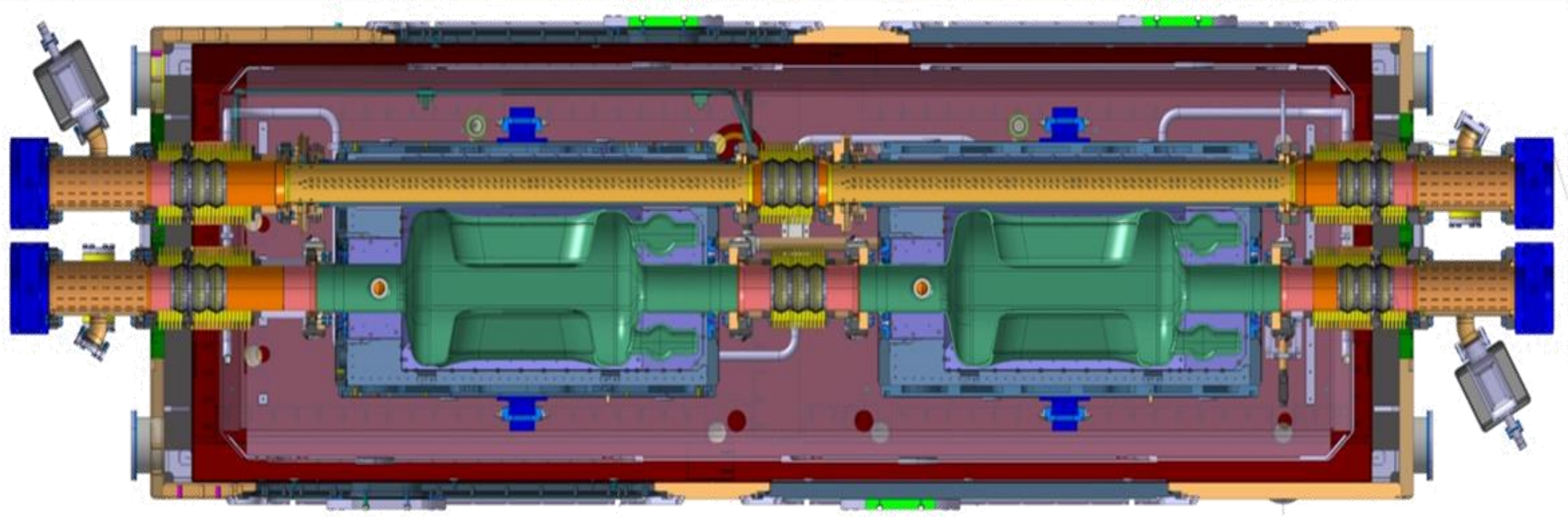




- Outer magnetic shielding – 3D model complete, STFC negotiations with UK supplier regarding spring contacts.
- Drawings being produced aim to complete by end of November and place order by end of January.

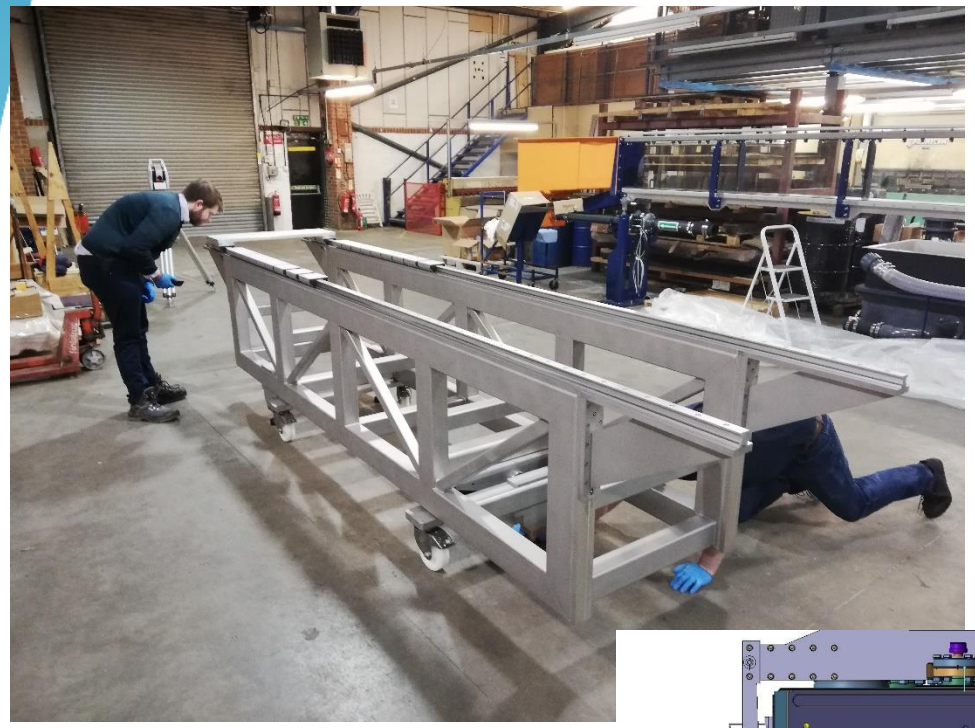
- Thermal shield – **Design Report complete** including analysis for full range of scenarios including ‘shock cooldown’ and transportation loads etc.
- Stainless Steel pipework to Aluminium Alloy Panels (clamp weld block connection)
- To be manufactured by CERN for Prototype

Cryomodule Design Progress (CERN/UK-STFC)
Beamline vacuum chambers

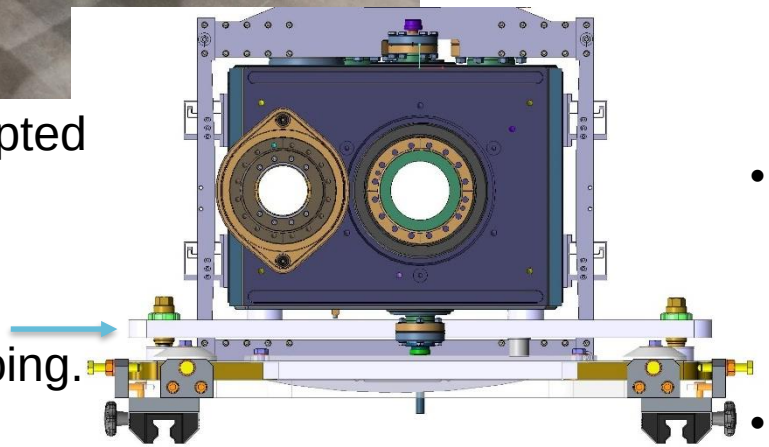


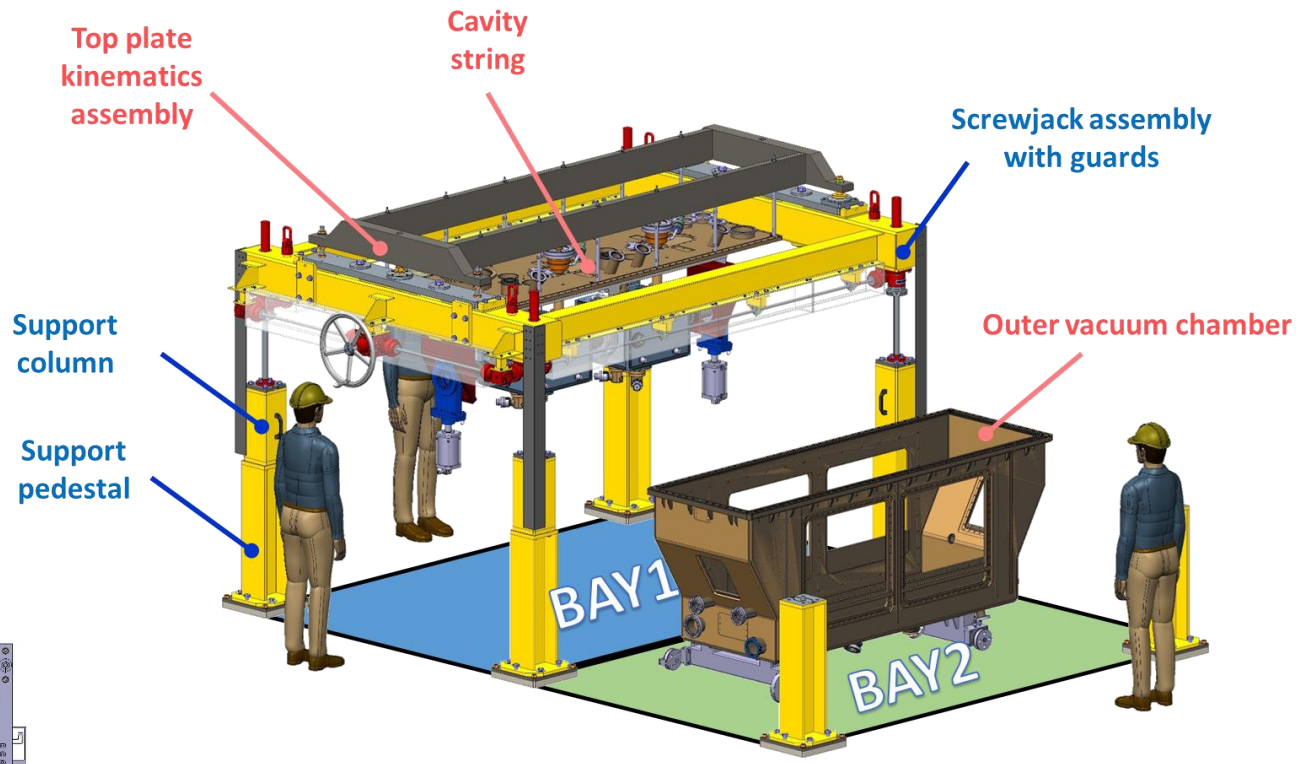
Beam lines & vacuum layout – Decisions to be made on exact configuration of items arriving from CERN to UK which effect assembly procedures and tooling designs.

Cryomodule Design Progress (UK-STFC/CERN)
Tooling



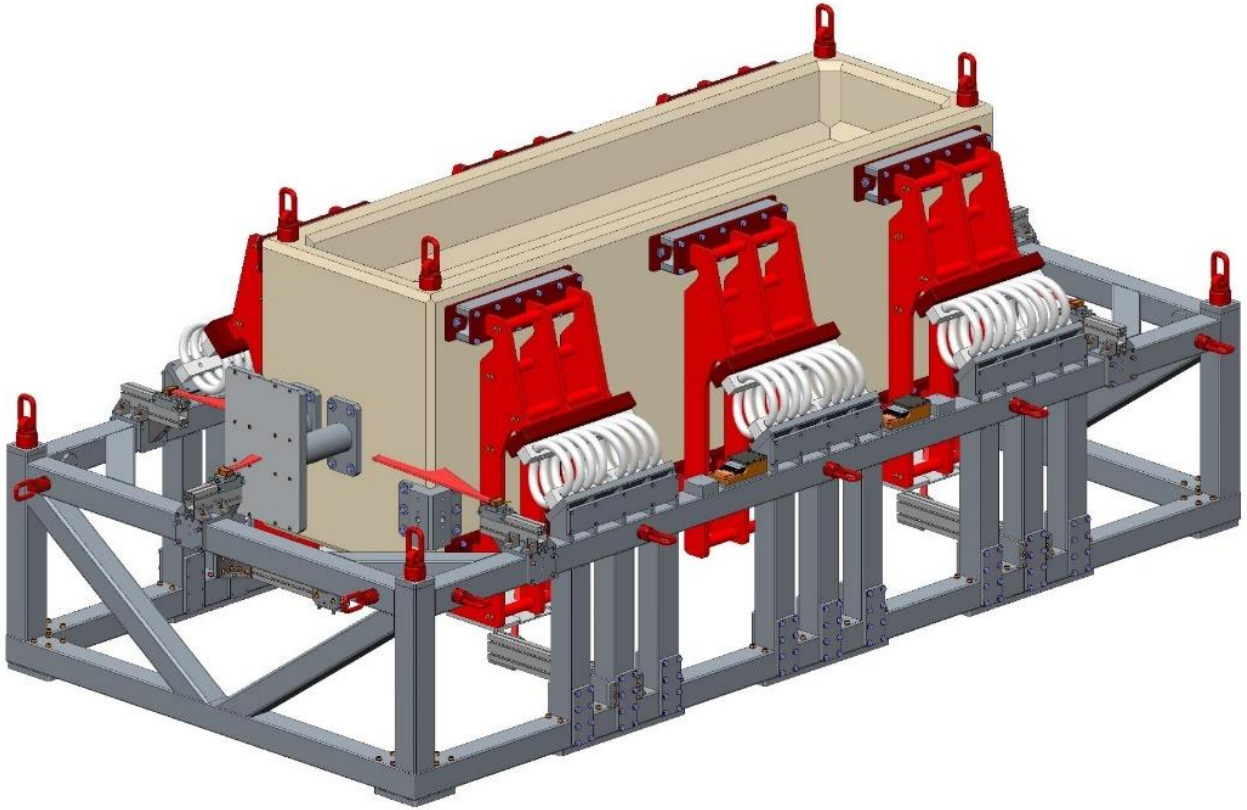
- Cleanroom trolley accepted and on site.
- Design of Cleanroom positioning tooling ongoing.





- Manufacture of Cavity String Lifting tooling almost complete. Testing to take place at manufacturer's premises by end of October, then install at DL after this.
- Kinematics assembly to be ordered (design complete).

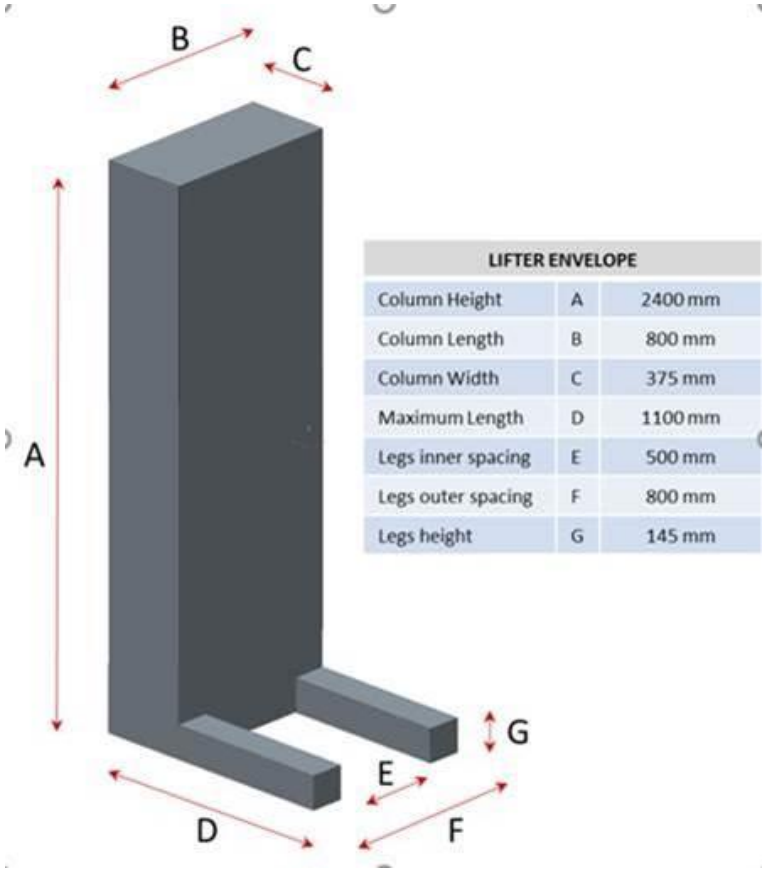
Cryomodule Design Progress (UK-STFC/CERN)
Transport Frame



Test Block has been cast

Transport Frame – **Design report and Manufacturing drawings complete.** Currently out for quotations. Testing in Spring 2021.
Isolators checked by supplier and on order.

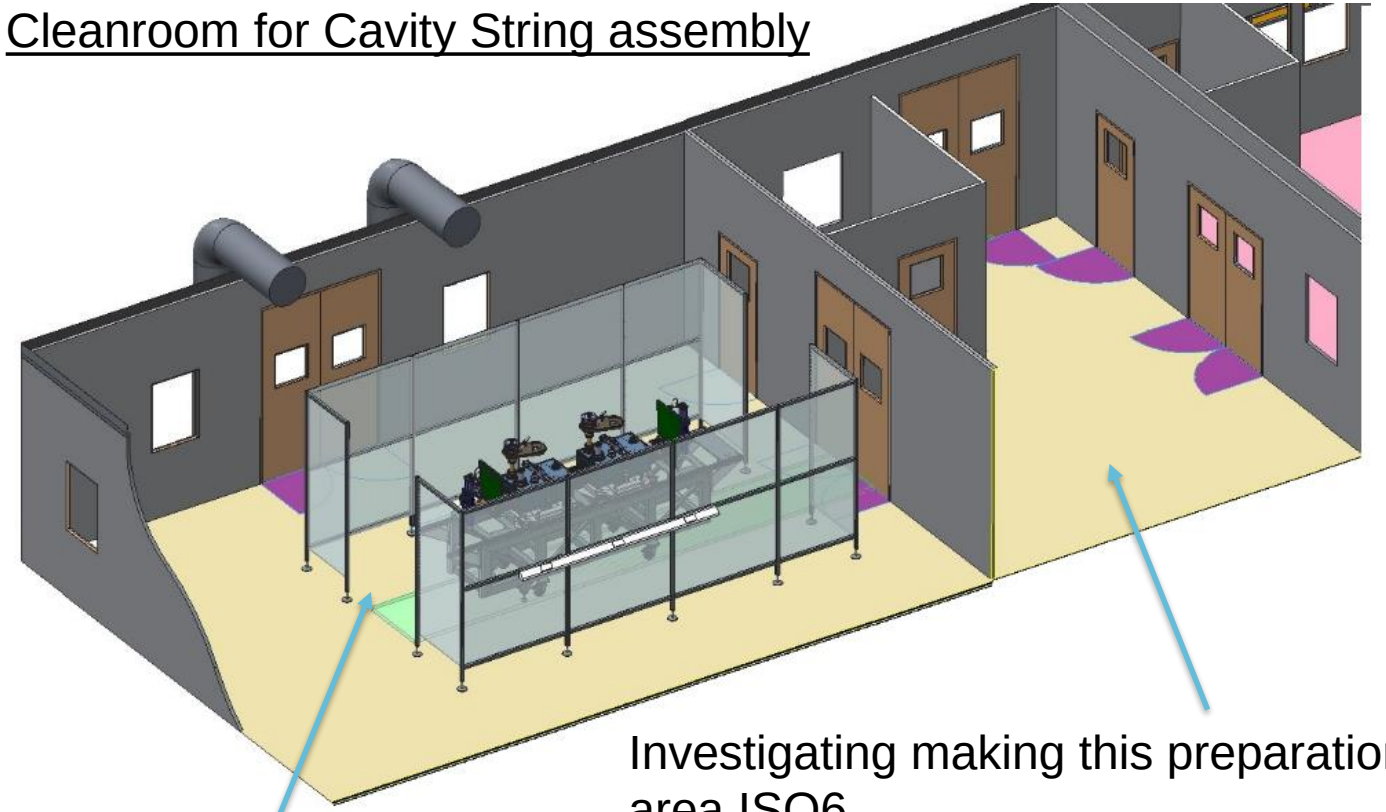
Cryomodule Design Progress (UK-STFC/CERN) Infrastructure



LIFTER ENVELOPE		
Column Height	A	2400 mm
Column Length	B	800 mm
Column Width	C	375 mm
Maximum Length	D	1100 mm
Legs inner spacing	E	500 mm
Legs outer spacing	F	800 mm
Legs height	G	145 mm

- Cleanroom lifter for FPC insertion will be procured by Lancaster.
- Currently working on the specification.

Cleanroom for Cavity String assembly

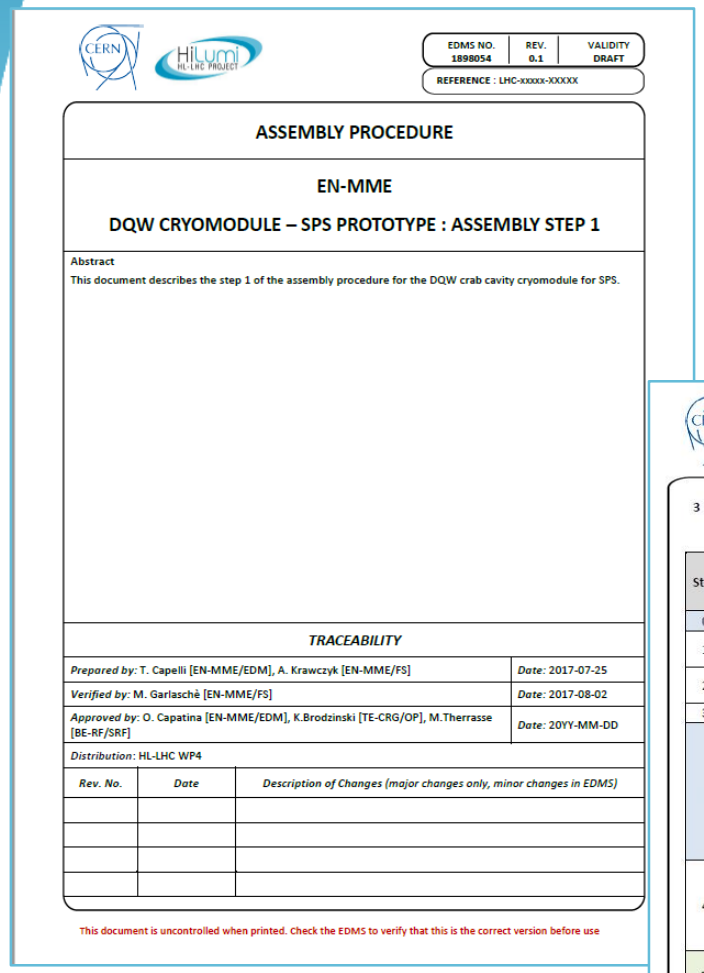


Investigating making this preparation area ISO6

ISO4 area to be increased in length.

- ESS Beam Transport Module Project currently using this cleanroom – Mitigation to build another Clean area for them.

Cryomodule Progress (UK-STFC/CERN)
Assembly procedures and QA



EDMS NO. 1898054 | REV. 0.1 | VALIDITY DRAFT

REFERENCE : LHC-xxxxx-XXXXX

ASSEMBLY PROCEDURE

EN-MME

DQW CRYOMODULE – SPS PROTOTYPE : ASSEMBLY STEP 1

Abstract

This document describes the step 1 of the assembly procedure for the DQW crab cavity cryomodule for SPS.

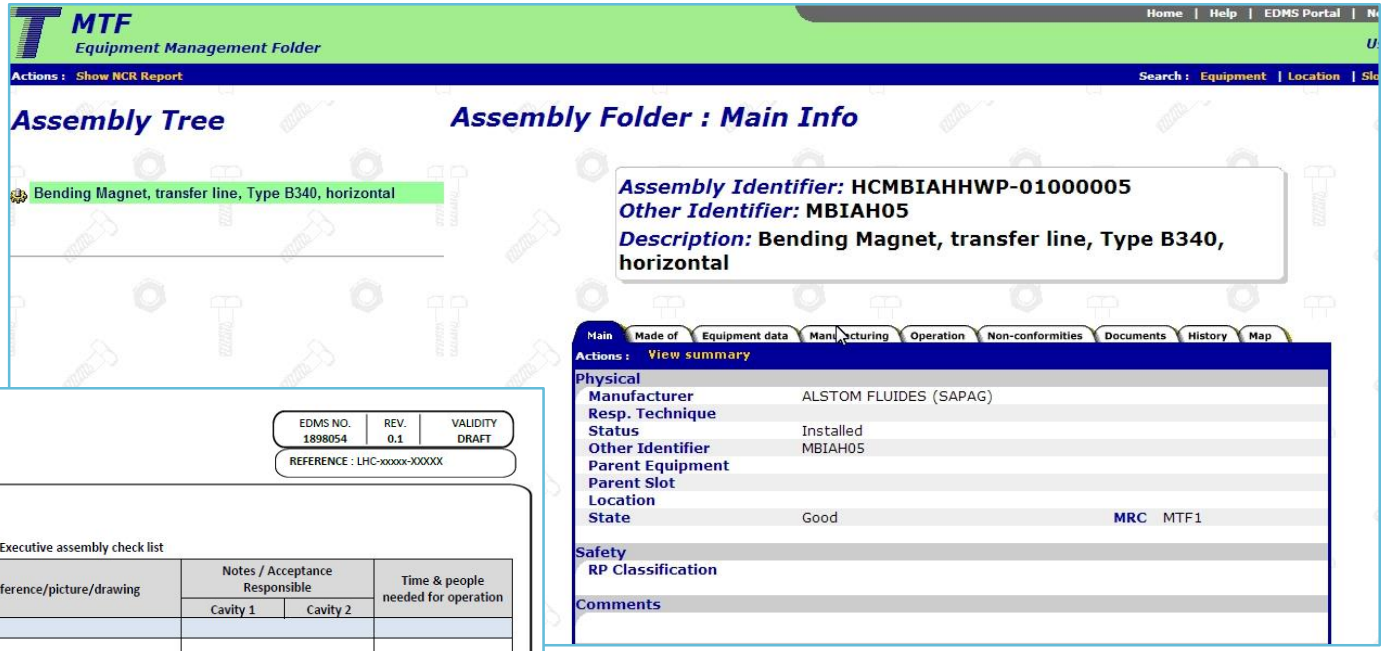
TRACEABILITY

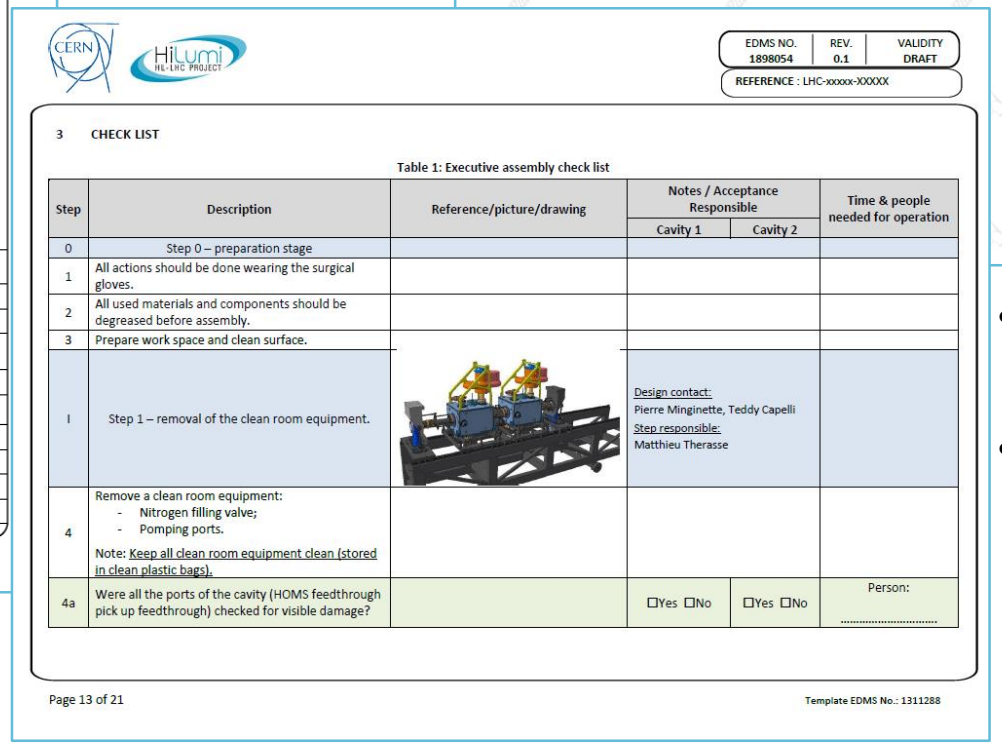
Prepared by: T. Capelli [EN-MME/EDM], A. Krawczyk [EN-MME/FS]	*Date:* 2017-07-25
Verified by: M. Garlaschè [EN-MME/FS]	*Date:* 2017-08-02
Approved by: O. Capatina [EN-MME/EDM], K.Brodzinski [TE-CRG/OP], M.Therrasse [BE-RF/SRF]	*Date:* 20YY-MM-DD

Distribution: HL-LHC WP4

Rev. No.	*Date*	*Description of Changes (major changes only, minor changes in EDMS)*

This document is uncontrolled when printed. Check the EDMS to verify that this is the correct version before use





EDMS NO. 1898054 | REV. 0.1 | VALIDITY DRAFT

REFERENCE : LHC-xxxxx-XXXXX

3 CHECK LIST

Table 1: Executive assembly check list

Step	Description	Reference/picture/drawing	Notes / Acceptance Responsible		Time & people needed for operation
			Cavity 1	Cavity 2	
0	Step 0 – preparation stage				
1	All actions should be done wearing the surgical gloves.				
2	All used materials and components should be degreased before assembly.				
3	Prepare work space and clean surface.				
I	Step 1 – removal of the clean room equipment.		Design contact: Pierre Minginette, Teddy Capelli Step responsible: Matthieu Therasse		
4	Remove a clean room equipment: - Nitrogen filling valve; - Pomping ports. Note: Keep all clean room equipment clean (stored in clean plastic bags).				
4a	Were all the ports of the cavity (HOMS feedthrough pick up feedthrough) checked for visible damage?		☐Yes ☐No	☐Yes ☐No	Person: .....

Page 13 of 21

Template EDMS No.: 1311288

- Work just starting on assembly procedure and MTF development
- Have a good starting point from the documentation produced for DQW build.

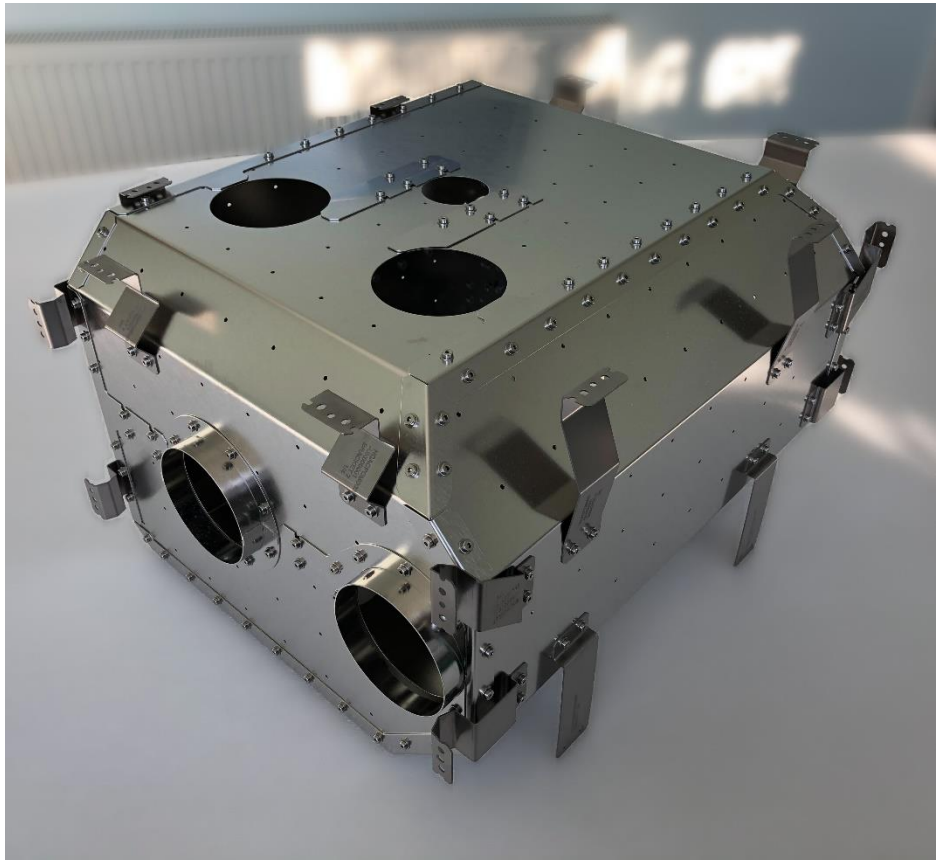
Overview

- Cavities and ancillaries are well on track for the April ‘21 delivery to DL.
- Cryomodule Design well advanced, long lead items have drawings released/in approval.
- Long lead Tooling on schedule. Cavity string cleanroom tooling to be on order by end of December.
- Transport frame drawings out for quote, preparations in place for testing.
- Infrastructure upgrades to be completed (some mitigation required for CV-19 and ESS project delays which use the cleanroom)
- Detailed planning for assembly steps and Quality Assurance to begin as of next week (W/C 26/10/2020)

Other news

New working from home colleague

Marla Jones
15/09/2020



DQW Series Cold magnetic shield, first Hardware of HL-LHC-UK2.
Two have been delivered to CERN and tested successfully.