



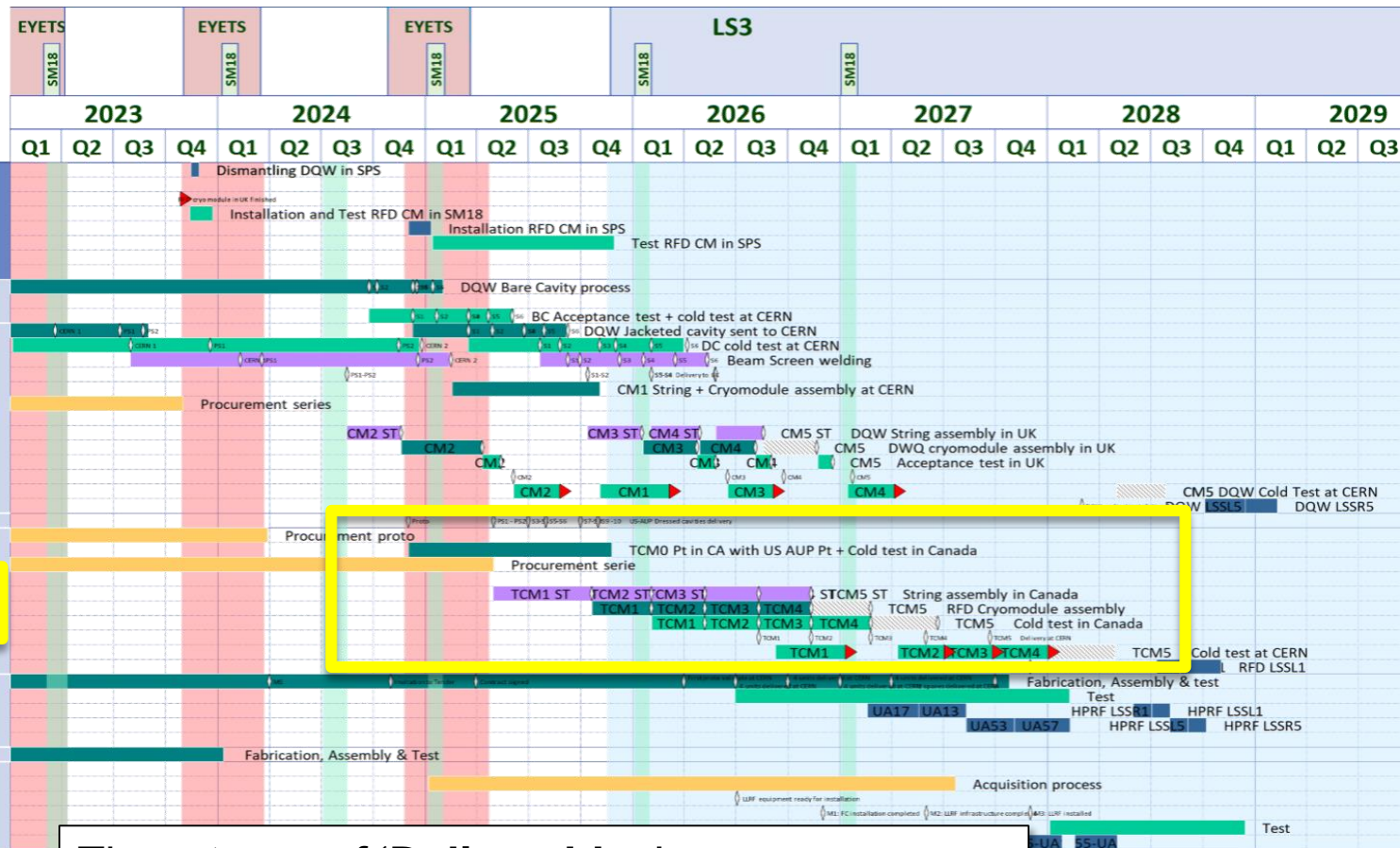
TRIUMF - CERN Steering Committee

CERN Comments

Marco Garlaschè on behalf of CERN WP4 Team

Reminder on WP4 Master Plan - RFD CM

WP4 - In work for CSR2024



Three types of 'Deliverables':

- Info : CERN Specifications
- Info : **Design Packages** (components, CM)
- **Hardware** (Part Exchange) and related handling/assembly procedures

Cryomodule & Components Specifications

Scope	ID code	<u>Eng. Spec.</u> <u>[EDMS nr]</u>	<u>Guideline for compl.</u> <u>with CERN Saf. Req.</u> <u>[EDMS nr]</u>
Full Cryomodule, including beam screens and references to requirements for vacuum components (Sector valves, Plug-in modules)	ACFGA	2043014 v.2.0	2043016 v1..0
Safety Request WP4 - Co CONTENT FOR THE DQW & RFD CRYOMODULE FOR LHC	ACFGA	2514225 v.2.0	
HL-LHC LHC CRAB CAVITIES: welded joints for cryomodule assembly	ACFGA	2706475 v.1.3	
Minimum Material Requirements for Austenitic Stainless Steel and Aluminium Alloys to be employed in non-critical applications	ACFGA	2632333 v.1.0	

CRYOMODULE

Dressed cavities, HOMs couplers, Pick-up antennas, Cold magnetic shield	ACFDC,ACFHC, ACFPU, ACFCM	1389669 v.2.6	2058183 v.1.0
Cryogenic circuits	ACFQC	2093032 v.1.4	2101920 v.1.1
Thermal shield	ACFTS	2101922 v.1.2	2101923 v.1.0
He guard	-	2806004 v.1.4	
MLI	ACFTS	2144140 v.1.3	-
Vacuum vessel	ACFVT	2101924 v.1.6	2101925 v.1.1
Warm Magnetic shield	ACFWM	2101926 v.1.4	-
Alignment monitoring system	ACFAM	-	-
Support and alignment system	ACFAH	-	-
Instrumentation (ONLY FOR RFD SPS)	ACFIS	2450567 v.4 + CRNLSQLj0070 v.AA (PID)	-
Fundamental Power Coupler	ACFMC	2101934 v.1.0	
RF internal lines	ACFRL	2605345 v.1.0	-
Tuning system	ACFTU	2101938 v.0.1	-
Safety protecting devices	ACFGA	2101940 v.1.0	2101943 v.1.0
Sector Valves (beam line)	VVG (TBC)	§ 7.7 of 2043014 v.1.0	-
Plug-in modules for Cold-Warm transition + Intercavity bellow	ACFVW + ACFVC (TBC)	§ 7.7 of 2043014 v.1.0	-
Beam screen	VSSC_	§ 7.7 of 2043014 v.1.0	-

COMPONENTS

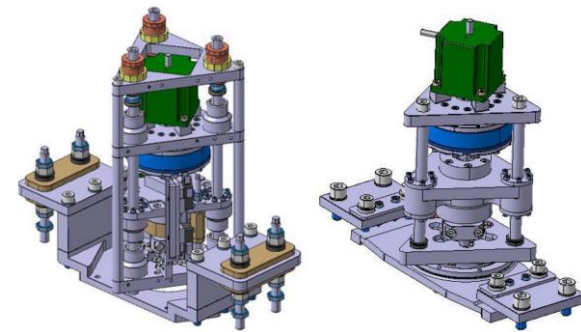
STATUS

- Released
- In Work

Relevant for Safety








- For all released : no modifications foreseen. (DevReqs)
- Instrumentation : deemed less critical for TRIUMF supply
- Tuning : modif.s following UK RFD CM

CERN Design




Drawing packages status for the cryomodules :

- Status of drawing folders for cryomodule **internal** components :

	Status
OVC & internal support 	✓
Cryogenic lines, jumper, and cryogenic supports 	✓
Thermal screen, MLI blankets 2K/50K, thermal intercept 	✓
RF coaxial lines, FPC, FPC outer pipe 	✓
UHV vacuum equipment 	✓
Magnetic shield 	✓
Mechanical and cryogenic instrumentation 	× (Q4 2024)

Ref EDMS Doc 2730814

- Status drawing folders for cryomodule **external** components :

	Status
Cryogenic safety extension*	× (Q1 2025)
Tuner actuation* 	× pending
FSI heads	✓
Rooting of cable for LHC integration (2 configurations)	✓
Mechanical and cryogenic instrumentation	× (Q4 2024)
Drawing & BOM for STEP of assembly – Step 1->5	✓
Drawing & BOM for STEP of assembly – Step 6->12	× (Q1 2025)

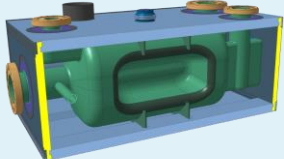
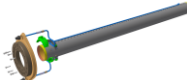

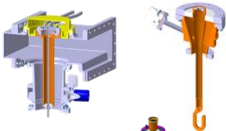

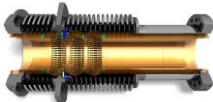
* Improvement of the original design

CERN Contr. : Hardware - RFD (TCM0 &) Series

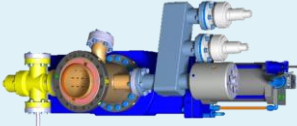

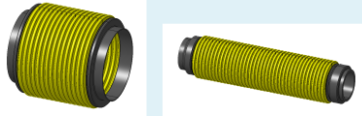
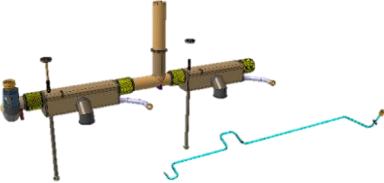
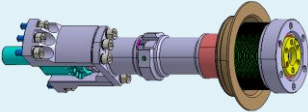

Ref. Part Exchange UK-CAN : EDMS 2508819 + Amnd Add5 of P095

Delivered or ready to be delivered

Delivery in line with requirements as per Master Plan and TRIUMF TCM0+series Strategy

Component		Status & Estimated Delivery Date
Jacketed Cavities (Bare Cavity + Cold Magnetic Shield + Helium Vessel)		N.A.
Beam Screens		All Series: Ready
Full set of HOMs and HF-HOMs & Feedthroughs (High Order Modes Suppressors)		N.A. (See presentation by S. Barrière)
DQW FPC (Fundamental Power Coupler)		Delivery in line with requirements as per Master Plan See presentation by S. Barrière
RF Internal Coaxial Lines		2x RFD cryomodule: Q1-2025 3x RFD cryomodules: Q3-2025
PIMS (Interconnections for string assembly)		1x RFD cryomodule: 2 PIMS shipped, 4 PIMS ready 4x RFD cryomodules: Q3-Q4 2024

CERN Contr. : Hardware - RFD (TCM0 &) Series

Component		Status
Vacuum Modules & Gate Valves		5x RFD cryomodules: Delivered to Canada
Cryogenic Instrumentation		Discussions ongoing (full list & responsibility for each done, procurement ongoing) Delivery : ref. prez. Delprat / Gahier
Expansion joints for Cryogenic Lines*		Ready for all DQW & RFD cryogenic lines
RFD Upper & Lower Cryogenic Lines*		1x RFD cryomodule: Shipped 4x RFD cryomodules: beg Q2-2025
Tuner Double Tubes*		1x RFD cryomodule: end Q1-2025 4x RFD cryomodules: late Q2 & Q3-2025
Blades for Cavity Support System, instrumented *		1x RFD cryomodule: end Q1-2025 4x RFD cryomodules: late Q2 & Q3-2025

*Amendment to initial Part Exchange

NEXT : Part Exchange Compt Delivery Conditions

Tech. Support on specific topics during CM manufacturing:

- Feedback on **activities** : QA, fabrication (welding, outsource)...
- **Tech. documentation** of Collab : Check **assy** and **test procedures**, **techSpecs** for prod
- Coaching & shadowing for **assembly of components under CERN responsibility**

CERN Reference people for topic / component / activity :

WP4 Crab Cavities Cryomodules CERN Front Line and Responsibilities	
Project ACTIVITY	RESPONSIBLE
General	Marco GARLASCHE
Tracking of design changes , 'as built'	Teddy CAPELLI
CERN Components Center (i.e. CERN Production Readiness, feedbacks fro production...)	Simon BARRIERE
Tracking of assets. CERN Logistics & Shipping IN / OUT	Simon BARRIERE
WP4 Q/A/QC Follow-up [+ Welding]	Julien DEBELUX, Myrtilm BENAHMED
Conformity to HL Quality Assurance & Control (CERN Reference Entity) + DevReqs	Hector GARCIA GAVELA
Specifications & Conformity thereof (ref. person for WP4 CERN)	Luca DASSA, Isabel BEJAR ALONSO
MTF steps approval, procedures, NCRs, DevReqs drafting, ...	EDMS distribution list: WP4_Cryomodule_LK/CERN, WP4_Cryomodule_CANADACERN
Conformity to Specifications	EDMS distribution list: WP4_Cryomodule_LK/CERN, WP4_Cryomodule_CANADACERN
Cryomodule ACTIVITY	CERN KEY PERSON
Overall Cryomodule Design , Assembly (& support thereof)	Teddy CAPELLI, Laurene GIORNANO
Vacuum	Giuseppe BREGIOZZI
Alignment	Vivien RUDE
Cryogenics	Laurent DELPRAT, Vaneesa GAHIER
Materials	Akris GALLIFA TERRICABRAS, Claudia SANTOS MALDONADO
Transport Engineering & Design	Kurt ARTOOS
Clean Room	Nuria VALVERDE
RF testing + CM SM18 Activities	Rama CALAGA, Nuria VALVERDE
Component	
Couplers & RF Tuner	Elic MONTE SINOS, Sebastian CALVO
Transport Equipment	Kurt ARTOOS
Jacketed Cavity	Simon BARRIERE, Kurt ARTOOS
PIMS & Vac Components	Nuria VALVERDE
	Giuseppe BREGIOZZI

	Non-critical		Critical
	1 or 2	3	4 or 5
ifications	L. Dassa		O. Capatina
g and Tuner	K. Artoos		O. Capatina
RF compliance	N. Valverde		R. Calaga
& calculations	T. Capelli		O. Capatina
Welding & Logistics	J. Debeux / S. Barriere	M. Garlasche	
	C. Santos Maldonado	I. Aviles	S. Scobba
	V. Rude	M. Sosin	H. Mainaud
ance	G. Bregiozzi		
pliance	L. Delprat/K. Brodzinski		
y compliance	N. Valverde		R. Calaga
	K. Turaj		R. Calaga
RF	G. Haggmann		R. Calaga
is	A. Butterworth		R. Calaga
pliance	E. Montesinos		
pliance	N. Mounet		R. Tomas
f	G. Prica		H. Garcia Goveia
allation	G. Cipolla		P. Fessia/M. Modena
	C. Gaigant		T. Otto
ing on site	M. Perez Ornela		C. Bertone
mity	D. Tshilumba/L. Dassa		S. Marsh
Configuration	M. Zerlauth		

- Bob Laxdal – project lead
- Devon Lang – fabrication, assembly, alignment
- Ben Matheson – Design
- James Keir – fabrication, assembly, vacuum
- Oliver Law – Engineering
- Bhalwinder Waraich – clean assembly
- Zhongyuan Yao – cavity and cryomodule testing

Corresponding TRIUMF Engineering & Project Structure is known by CERN
But a more explicit version would be useful, in terms of specialized technicians/operators reference :

- Alignment, and metrology
- Instrumentation assy (Mech & Cryo)
- Vacuum and its procedures (leak checks, cleaning)
- Qualified welder
- CM assy

General Comments

Compliance of final products to CERN Specifications

Special attention to:

- compliancy with CERN **Safety Rules and Normative**. Implicit within CERN Tech Spec.
- mismatch between **CERN Spec requirements & Drawings VS. translations by collabs** (read ISO vs. ASME).

Collaboration is responsible to abide to these (→ DevReqs, PMAs, ...)

CAUTION: We don't have same ability to derogate, between preSeries <> LHC series.

Further complexity, due to TRIUMF strategy of TCM0+series for many products

Hardware

- Part Exchange Items are well agreed and production in schedule. It is time to focus on details (part "flow")
- First invoice in the pipeline
- CERN WP4 is fully ready to support TRIUMF with any further procurement and production which is deemed critical (normative, technologies,...)

Passage of Information & Coaching by CERN

- 2 days visit to CERN
- **Specific planning defined**

Cern Feedback/Expectations

On Planning

- Masterplan was agreed
- New proposal incompatible even with delayed LS3 installation
- **A lower-level CM detailed planning is needed**, to avoid lag time for components and info (first steps in this direction are done).
- Extremely important for setting CERN hold points and interventions

On QA

- Good interaction with TRIUMF
- (see presentations of Luca and Julien for technical points) → some missing points
 - Inhouse welding & corresponding QA
 - Processes : greenlight of Degreasing samples, assembled PIMs by CERN

On TRIUMF project structure

Manpower & ref. persons on specific activities to be officialised:

- Welding engineer : (Oliver)
- Alignment, and metrology
- Instrumentation assy (Mech & Cryo)
- Vacuum and its procedures (leak checks, cleaning)
- Qualified welder + CM assy

On Partial delivery of equipment form CERN

- Most ready
- Highest priority given to TRIUMF production
- Discussion for specific equipment unavailable for Apr 2025 : needs to be agreed asap
- Further part Exchange for Tuner?