VSC contribution activity

WP5.2 Technical Meeting 4th October 2021

Gregory Cattenoz on behalf of VSC-BVO – EDMS 2640101

WP5.2 framework: Collimator to produce for LS3

LHC-TC-ER-0006

Type	Install	Spare	Prototype to produce	Series to produce
TCSPM	10	2		12
TCTPXH (new 2-in-1)	4	(1)	1	4
TCTPXV (new)	4	1		5
TCTPM	4	1		5
TCLPX (new 2-in-1)	4	(2)	1	5
TCLP	4	1		5
TCTP re-used	**8**			0
TCLM	12	3		15
TCPC YETS 21-22	2			2
TCPC YETS 22-23	2			2
TOTAL	42		**2**	**51**

Outline

- WP12 general contribution to WP5
  - VSC organization and contribution,
  - Budget and EVM,
  - Planning and monthly report
- WP12 technical contribution to WP5
  - Design, production, chemical cleaning, surface acceptance tests, procurements
- Interconnects production scheme for the proto TCLPX and TCTPXH
  - Remote tooling activities, procurement and planning

Most of the material here was presented to VB (WP12 Project Leader) during the dedicted meeting organised by GB (contributions to other WPs) on 5th of May 2021, EDMS 2479508

WP12 contribution to WP5

- Organised around 2 main document present in Contribution Document EDMS 1820624 – rev.2)
  1. Budget:
     - Global envelop calculated with LS1 and LS2 experience
     - Respond to project deliverables present under specification
     - Structured in Work Unit under EVM (declared to budget office)
  2. Planning:
     - Based on WP5 collimation master plan (update March 2021)
     - Defined in Work Units of activities: eg. collimator production or remote tooling.

→ Monthly reporting to HL project

Global Envelop for VSC activities

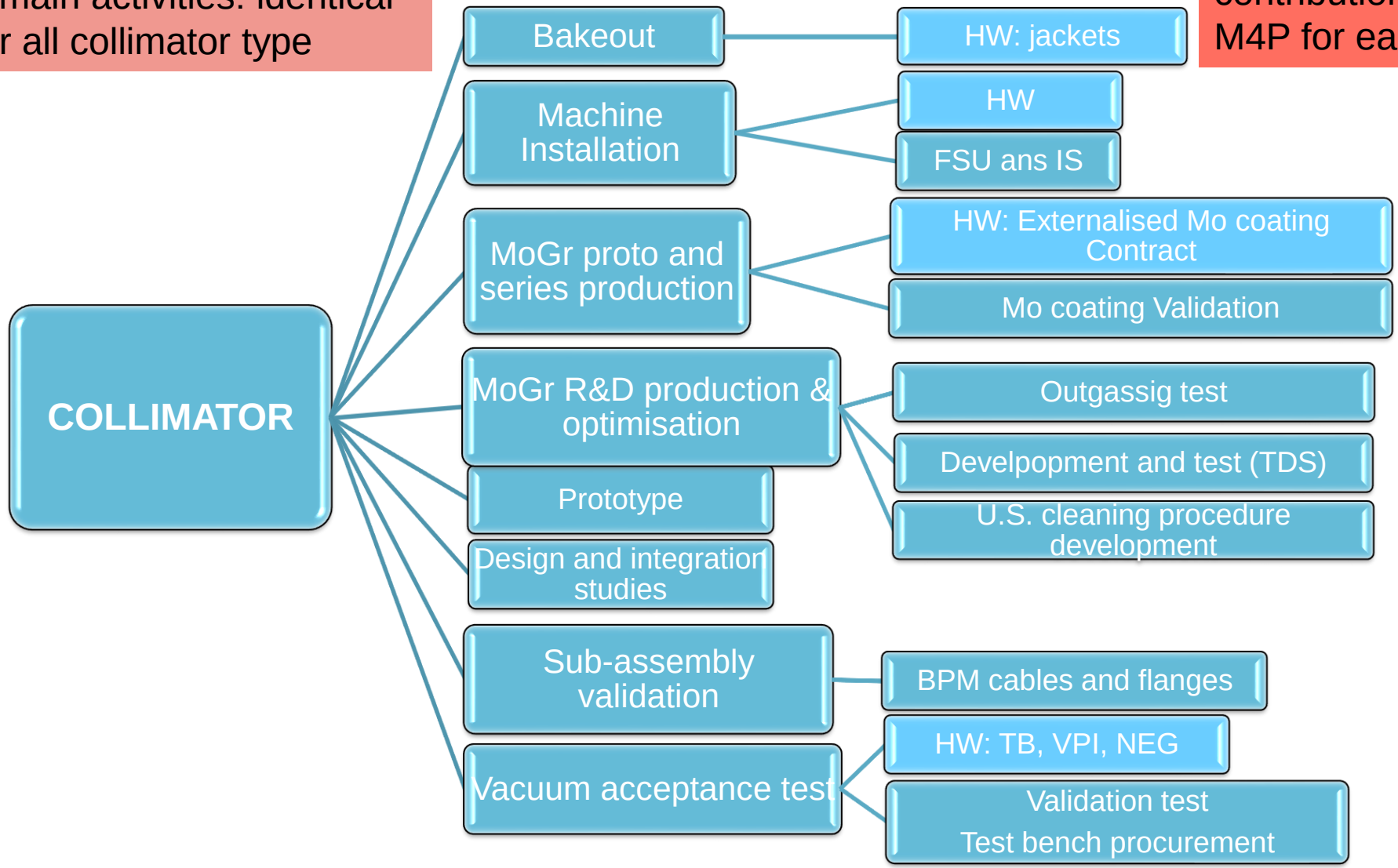
- Dedicated VSC budget codes within HL-LHC project (to end LS3)
- From past experience is estimated:
  - 1 unit (include proto) ≈ 50 kCHF
  - 1 spare unit ≈ 40 kCHF
  - TCLM ≈ 15 kCHF
  - TCPC (goniometer): free of charge, cost endorsed by VSC

  →Total allocated for VSC activities ≈ 2,294 kCHF
- Budget spread over 3 posts:
  - Halo and IR Cleaning collimators (TCSPM, TCLMs, TCTPs, TCLPs): 99150
  - Remote handling: 99152
  - M4P: 99151

Work Unit definition

8 main activities: identical for all collimator type

Definition of detailled contribution for HW and M4P for each sub activity



Detailled activity for budgeting

Eg TCSPM (Done for every colimator)

LS	WU	Type	WU ACTIVITY	Activity type	Detail
LS3	WU.01	TCSPM	Bake out	Procurement	Bake out jackets design and procurement
LS3	WU.01	TCSPM	Machine Installation	Logistics	Material storage and transport - SMA
LS3	WU.01	TCSPM	Machine Installation	Logistics	Material preparation and control
LS3	WU.01	TCSPM	Machine Installation	Procurement	Material for new sector: VPIAN, NEG and local cables
LS3	WU.01	TCSPM	Machine Installation	Procurement	Material for intervention: pinch off, HLD, pumping group, gas, connectics, furniture
LS3	WU.01	TCSPM	Machine Installation	Mechanics	Installation, connexion, leak test, pinch off
LS3	WU.01	TCSPM	Machine Installation	Bake out	Bake out logistic, preparation, installation and removal
LS3	WU.01	TCSPM	Machine Installation	NEG activation	Sector vacuum conditionning
LS3	WU.01	TCSPM	Machine Installation	Logistics	Organisation et procurement for installation (meca et bo)
LS3	WU.01	TCSPM	Machine Installation	Quality control	Quality checks and tour de machine
LS3	WU.01	TCSPM	MoGr prototype and series production	Coating	CERN cleaning and externalised coatings (SCC)
LS3	WU.01	TCSPM	MoGr prototype and series production	Mechanics	MoGr blocks validation proto et series
LS3	WU.01	TCSPM	MoGr prototype and series production	Test and validation	MoGrblocks proto et series
LS3	WU.01	TCSPM	MoGr R&D production & optimisation	Mechanics	MoGr R&D
LS3	WU.01	TCSPM	MoGr R&D production & optimisation	Test and validation	MoGr R&D
LS3	WU.01	TCSPM	MoGr R&D production & optimisation	Coating	MoGr+Mo coating R&D: CERN internal (BVO-SCC)
LS3	WU.01	TCSPM	Sub-assembly vacuum validation	Test and validation	x96 BPM cables and x24 lateral flanges
LS3	WU.01	TCSPM	Vacuum Acceptance test	Logistics	Logistics and stock management
LS3	WU.01	TCSPM	Vacuum Acceptance test	Procurement	Collimator test bench commissioning at external supplier site
LS3	WU.01	TCSPM	Vacuum Acceptance test	Procurement	Collimator test bench commissioning at external supplier site
LS3	WU.01	TCSPM	Vacuum Acceptance test	Procurement	TB spare instruments and parts, maintenance and small furniture
LS3	WU.01	TCSPM	Vacuum Acceptance test	Bake out	Bake out racks
LS3	WU.01	TCSPM	Vacuum Acceptance test	Mechanics	12x TCSPM collimator validation
LS3	WU.01	TCSPM	Vacuum Acceptance test	Test and validation	12x TCSPM collimator validation

TE-VSC Budget main table

Budget office new structure proposal implemented on 01/10/2021

All collimators type billed to 1 BC only with 8 sub-activities

As requested for HL-LHC: reduction of IS/FSU and replacement by **TTE**

WBS	Budget Code	Work Units	Main Component	ID	Description Tasks	2021	2022	2023	2024	2025	2026	Total Collimators Series	Total Remote tooling Series
WP5.2	99150 HL-LHC WP05 - TE-VSC	WU.01	Collimators	1	Bake out	CHF -	CHF 130,000	CHF 77,500	CHF -	CHF -	CHF -	CHF 202,831	
			Collimators	2	Machine Installation	CHF -	CHF -	CHF -	CHF 200,000	CHF 250,000	CHF 350,000	CHF 782,000	
			Collimators	3	Prototype	CHF 5,000	CHF 19,433	CHF 2,100	CHF -	CHF -	CHF -	CHF 25,936	
			Collimators	4	MoGr prototype and series production	CHF -	CHF 20,663	CHF 25,625	CHF -	CHF -	CHF -	CHF 45,246	
			Collimators	5	MoGr R&D production & optimisation	CHF 12,775	CHF -	CHF -	CHF -	CHF -	CHF -	CHF 12,488	
			Collimators	6	Sub-assembly vacuum validation	CHF 2,083	CHF 7,083	CHF 7,020	CHF -	CHF -	CHF -	CHF 15,823	
			Collimators	7	Vacuum Acceptance test	CHF 17,900	CHF 84,586	CHF 108,432	CHF 31,039	CHF 35,831	CHF 33,346	CHF 304,133	
			Collimators	8	BE integration, design	CHF 60,000	CHF 55,000	CHF -	CHF -	CHF -	CHF -	CHF 112,413	
			Collimators	9	FSU & IS	CHF 34,963	CHF 32,863	CHF 44,473	CHF 54,772	CHF 42,633	CHF 28,850	CHF 233,187	
HLLHC 5.4.1 - Remote Handling	99152 - HL-LHC WP05 Collimation - Remote Handling-TE/VSC	177284	VSC Remote Handling	10	VSC Remote Handling (Out of scope of WP5 as indicated in EDMS 1820624 - Chapter 8.6 Total of 100kCHF)	CHF -	CHF 100,000	CHF 10,000	CHF -	CHF -	CHF -		CHF 110,000
HL-LHC-WP5-M4P-Collimation	99151, SC 99151 - HL-LHC WP05 Collimation-TE/VSC (Personnel)	177275, 229077	MPA	11	MPA (TTE) to replace FSU& IS for vacuum acceptance teste & procurements	CHF -	CHF 70,000	CHF 70,000	CHF 70,000	CHF 70,000	CHF 70,000	CHF 350,000	
HL-LHC-WP5-M4P-Collimation	99151 SC 99151 - HL-LHC WP05 Collimation-TE/VSC (Personnel)	177275, 229077	MPA	12	MPA for remote handling (Activity is finishing in 2022) - Within the scope of EDMS 1820624 - Chapter 8.6 total of 500kCHF from 2019	CHF -	CHF 70,000	CHF -	CHF -	CHF -	CHF -		CHF 70,000
					TOTAL	CHF 132,722	CHF 589,627	CHF 345,150	CHF 355,812	CHF 398,464	CHF 482,196	CHF 2,084,055	CHF 180,000

2022: Dominated by bake out procurement and production of 4 interconnect tools

Started in 2019 and due to end in 2022

Total amount shall fall within the total allocated envelop from Collimation Project

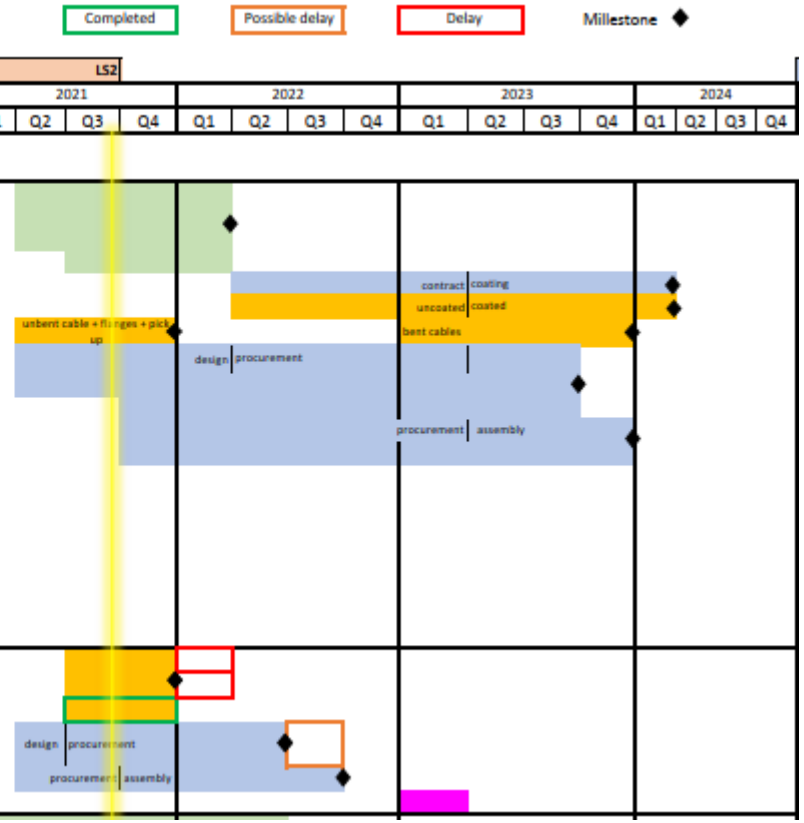
TE-VSC planning and millestones in detail

Planning and Milestones WP12 contr. to WP5.xlsx (cern.ch)

PLANNING of VSC contribution to HL-LHC WP5

Legend: HW, R&D, Inter. tests, Validation, Installation — Completed, Possible delay, Delay, Millestone

Type	Deliverable	TE-VSC DETAILLED CONTRIBUTION	Responsible
TCSPM	MoGr production optimisation	Outgassing test for optimised production parameters (IFAST)	BVO
		Coating development and tests (TDS)	BVO-SSC
		Outgassing tests for optimised Molybdenum coating technique	BVO-SSC
		New MoGr U.S. cleaning procedure (before and after Mo Coating)	BVO-SSC
	Mo coating and validation	Contract and follow up of Mo coating activity	SSC
		Vacuum validation of MoGr before and after coating series	BVO
	BPM vacuum validation	Validation of BPM cables, flanges and pick up	BVO
	Bake-out series	Bake out jacket design and procurement	BVO
	Final acceptance test (HW)	Test bench procurement and repair with spare parts	BVO
		External company collimator test bench comissioning and control visits	BVO
		Procurement and assembly of ion pumps and NEG pumps	BVO
		Procurement of bake out racks (x6)	BVO
	Final acceptance test (FSU and IS)	Acceptance test of 12 collimators (r: CERN reception date)	BVO
	TCSPM Tunnel Beam Vacuum Activities (IS & FSU)	Mechanical and bake out activities for vacuum conditioning of LHC sector	BVO
		NEG activation for vacuum conditionning of LHC sector	BVO
		Control racks, cables and controller installed (ICM)	ICM
		Quality checks and tour de machine	BVO
	TCSPM Tunnel vacuum Activities (HW)	Material VPI, NEG and Penning gauges for new sector	BVO
		Materials for machine intervention: Logistics and preparation	BVO
TCTPXH proto.	TCTPX prototype (IS & FSU)	Validation of CuCD blocks: 16 series + 2 pre-series	BVO
		Validation of 2 assembled jaws	BVO
		Validation of BPM lateral flanges and cables	BVO
	TCTPX Bake-out prototype (HW)	Bake out jacket design and procurement	BVO
	TCTPX prototype (HW)	Procurement and assembly of ion pumps and NEG pumps	BVO
	TCTPX prototype (IS & FSU)	One TCTPX prototype collimator (R: Reception CERN)	BVO



- Follow up of activity progress (monthly reporting)
- Identify peak activity, bottleneck and anticipate delay → Adjustment
- Ensure allocated budget spending

WP12 Technical contribution to WP5

- **Design**: Interconnect tool, bake out jacket, chambers
- **Production**: Procurement of materials, instrumentation/test, prototype interconnect tools
- **Surface treatment**: Cleaning, coating (+external),…etc.
- **Vacuum acceptance test:** CERN + externally
- **Cabling and connexion**: Pulling request, local connexion with controllers and tests
- **Tunnel activities**: Installation and connexion, leak testing, bake out and sector conditioning

Design contribution

- Johnathan Meignan: Design of interconnect tool
- Livia Coman: procurement and production follow up
- Frederic Rasmussen: QCF300 flange and chains test
- Szymon Wlodarczyk: Continue after F. Rasmussen on QCF connexions tests and study.

Design and integration studies

- Interconnect tool design (good) progress:
  - Flange contact study for leak tightness before and after bake out
  - Procurement of new material to strengthen the CF300 QCF chain
- Bake out jacket for double beam collimator
- Design changes on proto collimator due to unforeseen integration issue
- Connectic transition for UHV tests

Laboratory study and validation activities

- MoGr outgassing studies (TCSPM):
  - CH4 → Influence of Molybdenum on MoGr bulk and on MoGr+Mo coat
  - Au interlayer before Mo. Coat
  - Air exposed blocks: autumn 2021
  - TDS results on MoGr: results under analysis
- MoGr outgasing study with optimised production parameters (“IFAST”): on-going
- Validation of new MoGr cleaning procedure (EDMS 2570228) : on-going
- Prototypes sub-assembly validation:
  - 4 MoGr taper blocks for proto: validated OK
  - 2 CuCD prototype blocks delivery at b113 (NANOKER) expected W41
  - 16 CuCD series blocks delivery at b113 Jan 2022
  - 16 tungsten blocks expected W48
  - 4 complete jaws assembly → Feb. 2022.
- 2 CERN prototype final vacuum acceptance test→ End 2022 - begining 2023.
- BPM material validation:
  - All LS3 production needs of BPM flanges: cleaned+vacuum tested
  - All LS3 BPM cables needs (before bending): cleaned and vacuum tested.
  - BPM cables after bending for cleaning and outgassing tests ➔ 2022
  - Titanium orthogonal pick up CF25 for outgassing test to November 2021
- Two collimator vacuum test benches ready for external company use.
- Procurement of vacuum material (gauges, pump,..etc) ➔ Started in Sept. 21
- New TTE K.HENNELI due to start Nov. 2021 → all collimation related activities

Solid planning ahead!

- Unforeseen or «last minute» test→ delay not guaranteed

Production scheme for the prototype collimators

2 units (TCLPX and TCTPXH) produced at CERN for end 2022

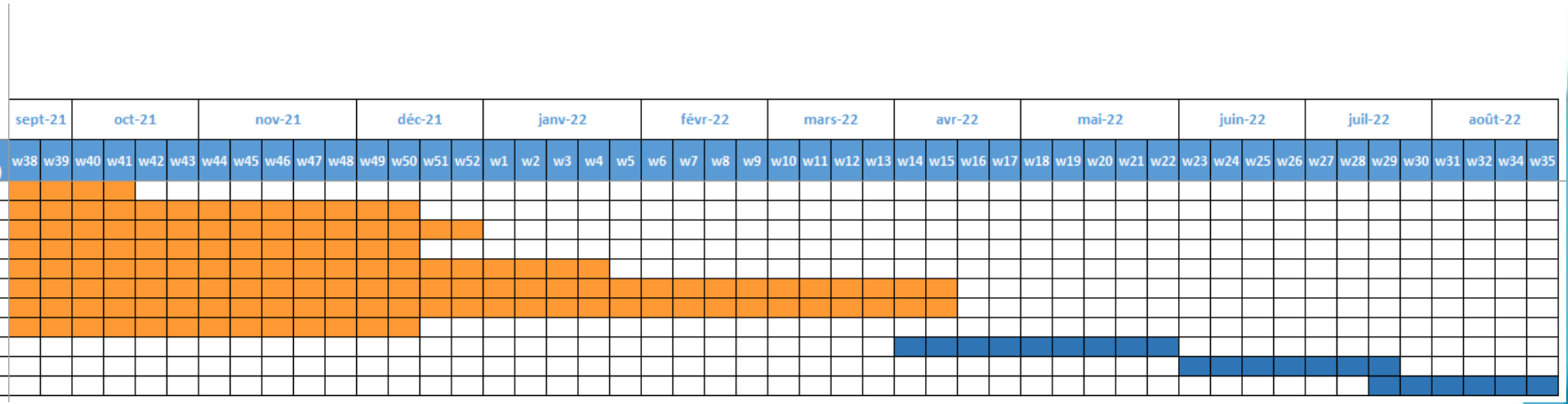
VSC shall provide for Aug. 2022:

- 2 fully functionnal and tested interconnect tool units + 2 reserve units
- 2 blank flanges CF300 (for test campaign)

Date 01/09/2021

Delay
Planned
In Progress
Done

No.	Task	Milestone Date	Status	Duration (months)	Delay (months)
1	Functional layout TAXN to D2	Oct-21	In Progress		
2	Approval of 3D models and 2D drawings	Dec-21	In Progress		
3	Robotic tests	Dec-21	In Progress		
4	Quotations	Mid Dec-21	In Progress		
5	Placed Orders	Mid Jan-22	In Progress		
6	Delivery of items made to drawings	Mid Apr-22	In Progress		
7	Delivery of standard components at CERN	Mid Apr-22	In Progress		
8	Assembly and test procedures	Mid Dec-22	In Progress		
9	Tests of delivered components	May-22	Planned		
10	Assembly of Components	Jul-22	Planned		
11	Validation tests of final assembly	Aug-22	Planned		



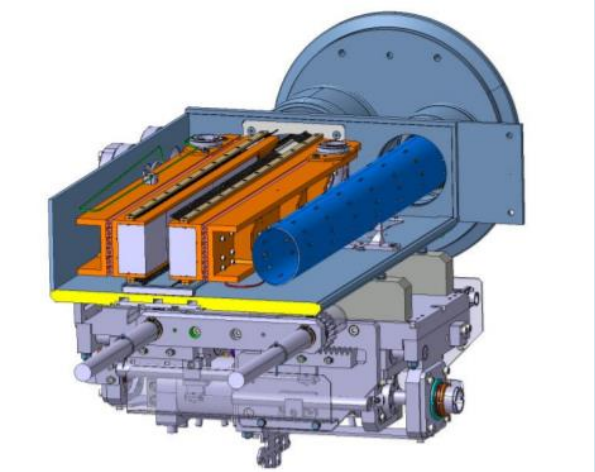
- Feedback from robotic team is needed to Jan to progress further with interconnect tool study and test

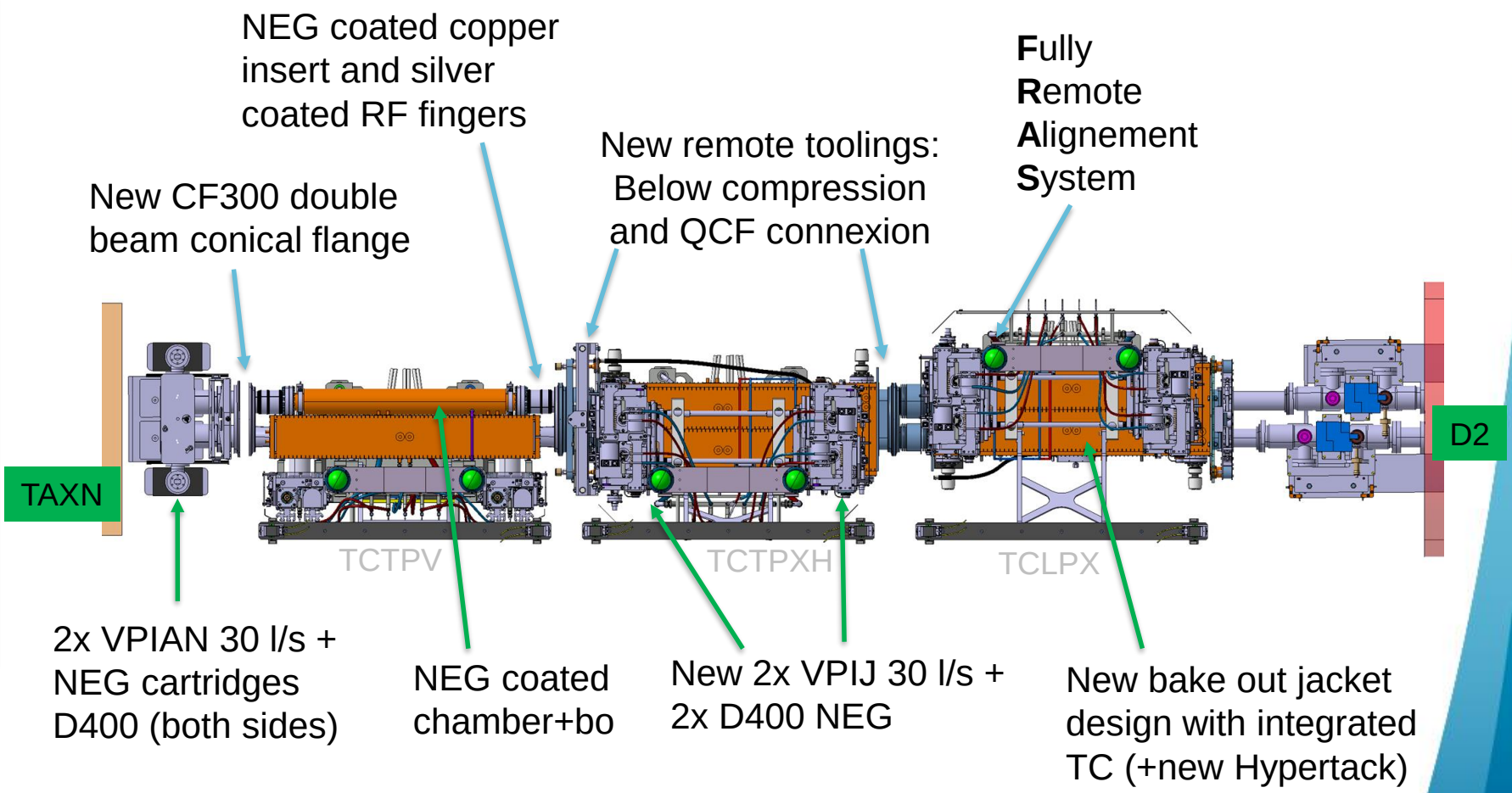
Thank you

Additionnal slides

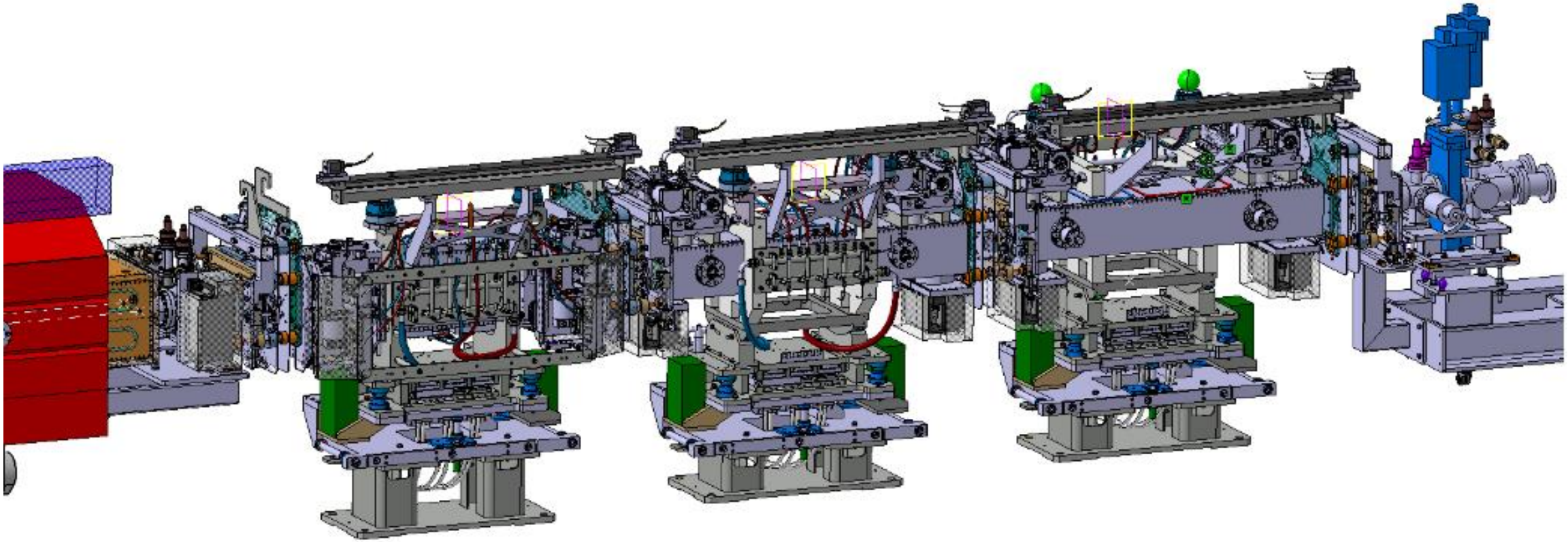
D2-TAXN collimation area close up

«2 in 1» design specificity: (X)
_Horizontal orientation
_Movable jaws + uncolimated beam
_Double beam conical CF300 flange

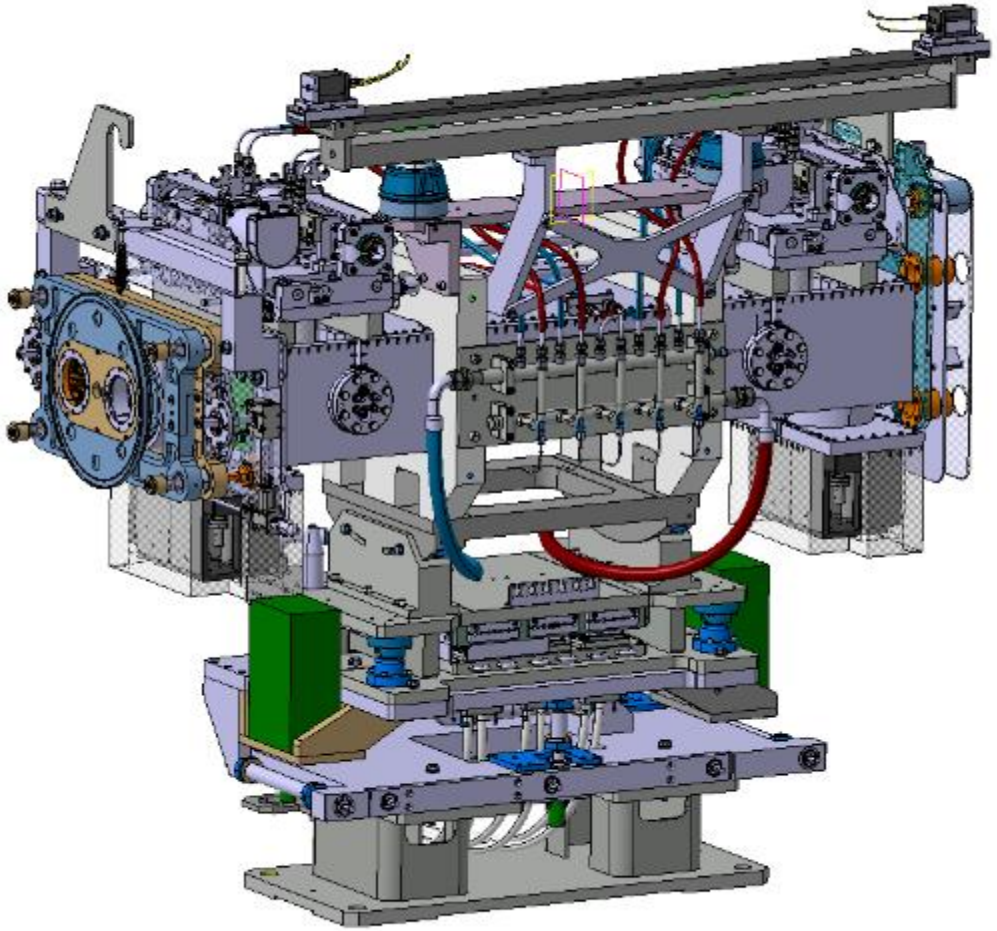




IR1/5 3D



«2-in-1» new collmator for IR1/5



WP5 framework: Planning

Updated March 2021