HIE-ISOLDE Project Status Report

50th ISOLDE & nTOF Technical Committee meeting
July 1st 2015

Y. Kadi

OUTLINE

- HIE-ISOLDE Roadmap for 2015
- Status of the Technical Systems
  - ✓ REX+SC Linac+HEBT Commissioning
  - ✓ CM2 Assembly
- Phase 2
  - ✓Procurement of CM3 & CM4
- 3rd Beam Line + HELIOS integration
- Conclusions

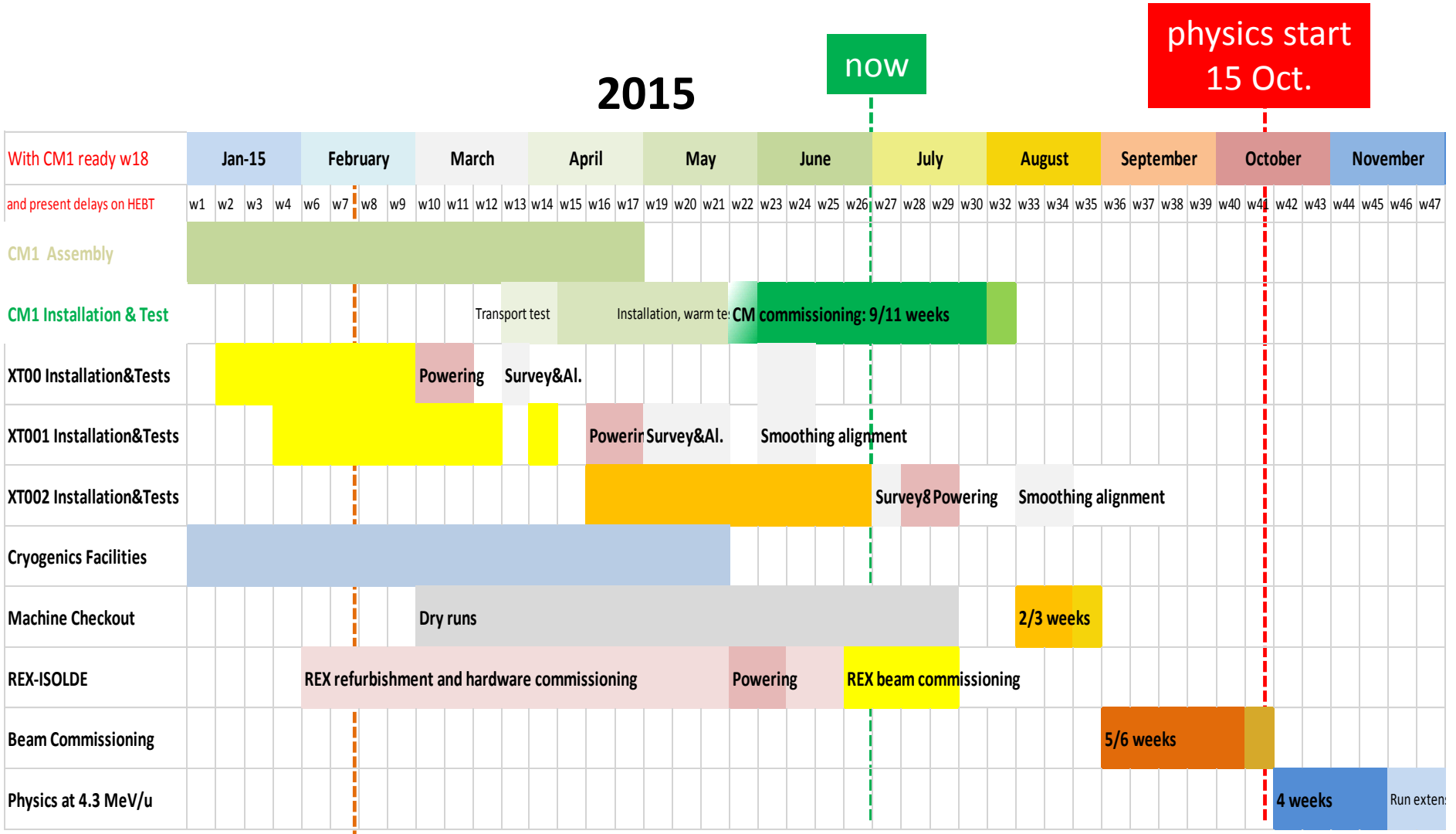
Visit of CERN DG 27/05/2015

Visit of CERN DG 27/05/2015

Many more !

\\cern.ch\dfs\Users\f\formenti\Public\Visit…

HIE ISOLDE roadmap in 2015

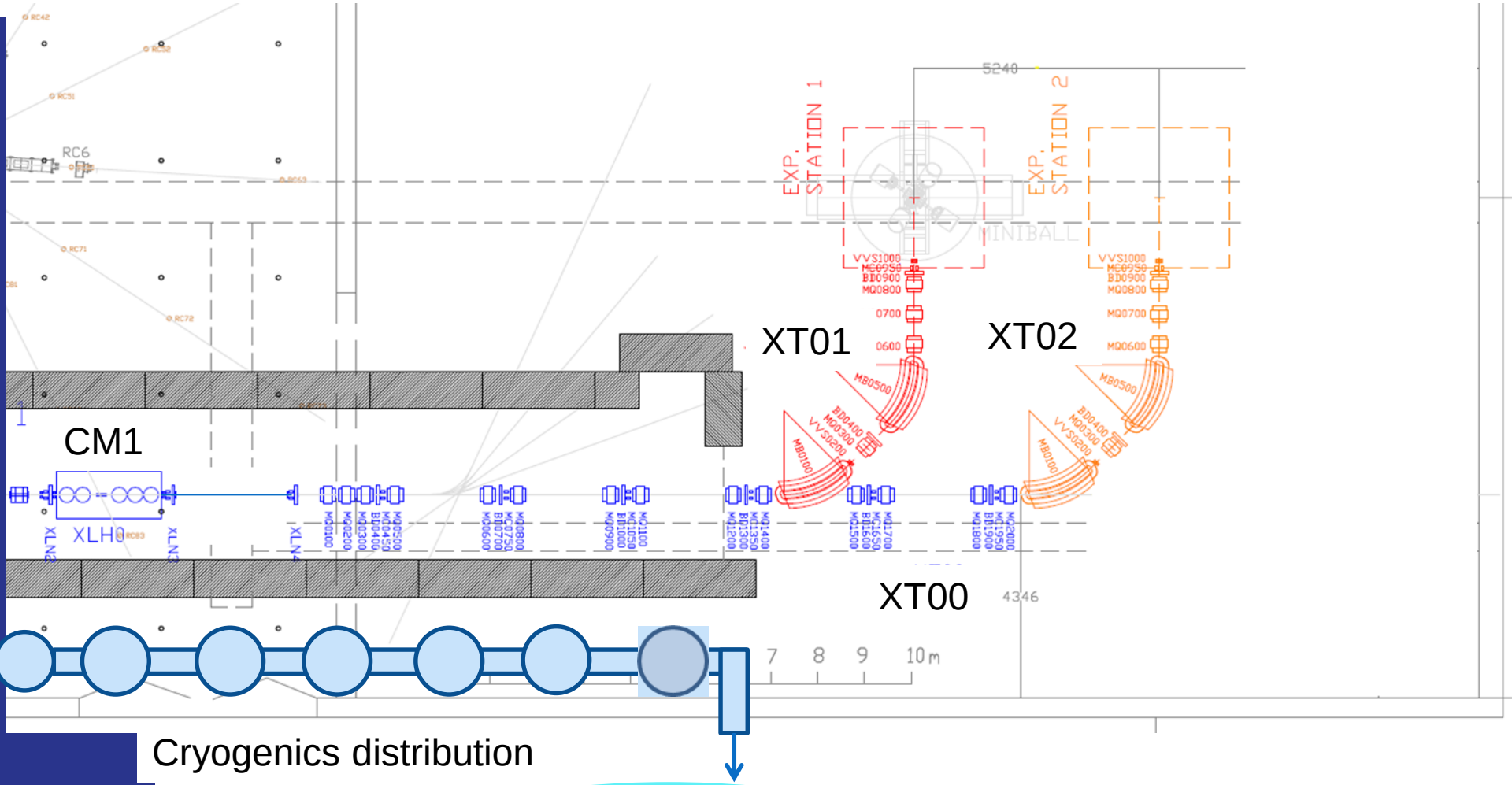


HW tests starting 19 Feb.

Several mitigation measures to catch up with earlier delays possible (first already adopted: no cold test of CM1 in SM18).

courtesy W. Venturini, 30.6.2015

Components to be commissioned



HW commissioning of XT00 and XT01

Magnet family	Slot name:	Power Converter name	PC IST	DC cable connection	Water check	ELQA OK/Not OK	WIC-magnet interlock test	WIC-PC interlock test	PC-circuit connection	PS setup 10% Inom	Polarity Test	Heat Run	Performance test	I min op	I nominal	Released for OP
Quadrupole	XT00.MQ.0100	XT00.RQ.0100												2	132	locked
Quadrupole	XT00.MQ.0200	XT00.RQ.0200												2	132	locked
Quadrupole	XT00.MQ.0300	XT00.RQ.0300												2	132	locked
Steerer	XT00.MC.0450	XT00.RCH.0450												0	45	locked
		XT00.RCV.0450												0	45	
Quadrupole	XT00.MQ.0500	XT00.RQ.0500												2	132	locked
Quadrupole	XT00.MQ.0600	XT00.RQ.0600												2	132	locked
Steerer	XT00.MC.0750	XT00.RCH.0750												0	45	locked
		XT00.RCV.0750												0	45	
Quadrupole	XT00.MQ.0800	XT00.RQ.0800												2	132	locked
Quadrupole	XT00.MQ.0900	XT00.RQ.0900												2	132	locked
Steerer	XT00.MC.1050	XT00.RCH.1050												0	45	locked
		XT00.RCV.1050												0	45	
Quadrupole	XT00.MQ.1100	XT00.RQ.1100												2	132	locked

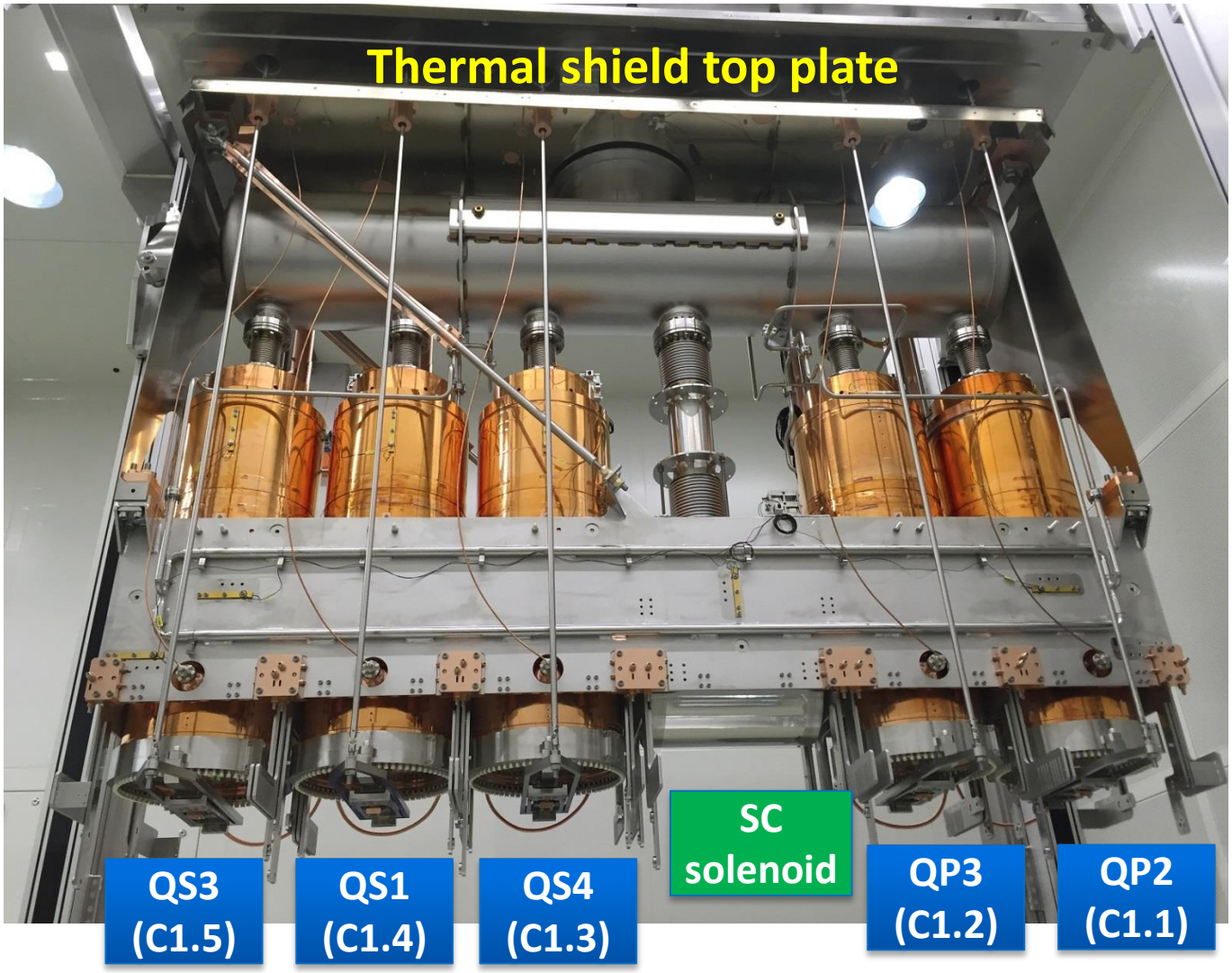
3 Steerers still to commission inside tunnel (will be done together with XT02)

XT02 campaign starting end of this week

Magnet family	Slot name:	Magnet cable id.	Power Converter name	PC cable id.	PC IST	DC cable connection	Water check	Measured R (Ω)	ELQA OK/Not OK	WIC-magnet interlock test	WIC-PC interlock test	PC-circuit connection	PS setup 10% Inom	Polarity Test	Heat Run	Performance test	I min op	I nominal	Released for OP
Dipole	XT01.MB.0100	2731762A	XT01.RB.0100	2731842A				103.56									0	425	locked
Quadrupole	XT01.MQ.0300	2731763A	XT01.RQ.0300	2731808A				123.6									2	132	locked
Dipole	XT01.MB.0500	2731764A	XT01.RB.0500	2731841A	SPARE PRODUCTO SPARE			105.13					OK for operation (minor diag issue)				0	425	locked
Quadrupole	XT01.MQ.0600	2731765A	XT01.RQ.0600	2731803A				125									2	132	locked
Quadrupole	XT01.MQ.0700	2731766A	XT01.RQ.0700	2731804A				123.6									2	132	locked
Quadrupole	XT01.MQ.0800	2731767A	XT01.RQ.0800	2731805A				122.2									2	132	locked
Steerer	XT01.MC.0950	2731768A	XT01.RCH.0950	2731870A				167											
			XT01.RCV.0950	2731871A				162											

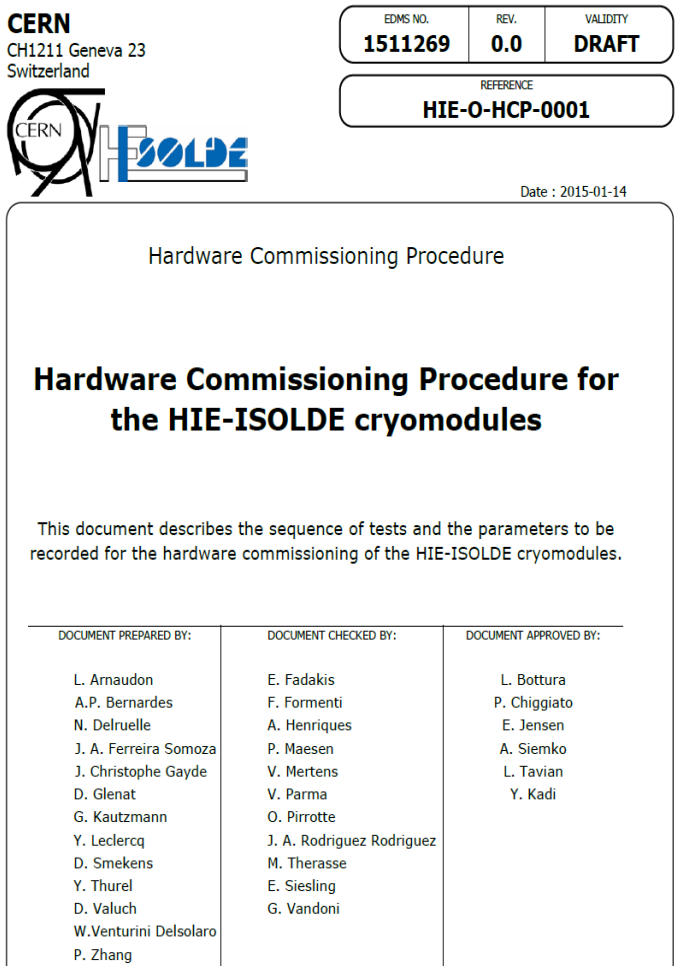
courtesy W. Venturini, 30.6.2015

HIE ISOLDE Cryomodule 1



courtesy W. Venturini, 30.6.2015

CM 1 main commissioning steps



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1511269	0.0	DRAFT

REFERENCE
HIE-O-HCP-0001

Date : 2015-01-14

Hardware Commissioning Procedure

Hardware Commissioning Procedure for the HIE-ISOLDE cryomodules

This document describes the sequence of tests and the parameters to be recorded for the hardware commissioning of the HIE-ISOLDE cryomodules.

DOCUMENT PREPARED BY:	DOCUMENT CHECKED BY:	DOCUMENT APPROVED BY:
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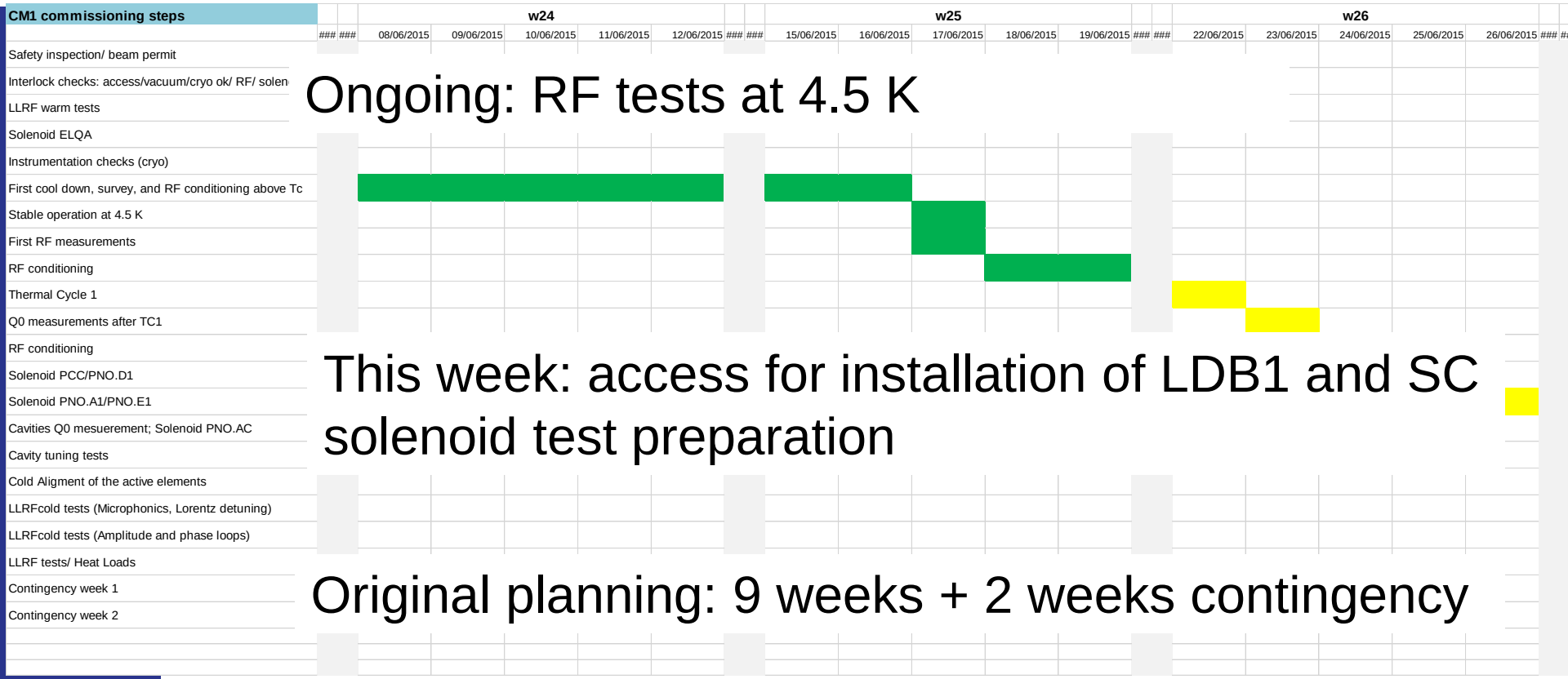
1. Interlock tests
2. Slow pump down
3. RF, Instrumentation, ELQA tests before cool down
4. Low Level RF tests
5. Cool down
6. RF conditioning above Tc
7. RF tests at 4.5 K
8. SC solenoid test
9. Survey and Alignment
10. Heat load measurements
11. Thermal cycles

courtesy W. Venturini, 30.6.2015

CM1 test planning



Ongoing: RF tests at 4.5 K

This week: access for installation of LDB1 and SC solenoid test preparation

Original planning: 9 weeks + 2 weeks contingency

~ 1 week behind schedule after 5 weeks from start

courtesy W. Venturini, 30.6.2015

In summary

- SCRF cavities: all multipacting levels are conditioned
- All cavities tuned close to Linac frequency: tuning range OK.
- CAV1-CAV4: no field emission up to 5 MV/m, CAV5 tbc
- Preliminary measurement of microphonics very encouraging
- Working out precise calibrations
- Issue with stability at large (10 Hz) BW: being addressed
- Delicate steps ahead: solenoid training, unison powering, cold alignment
- Beam commissioning planning and modus operandi to be worked out in details

courtesy W. Venturini, 30.6.2015

Commissioning of REX

- ✓ Maintenance and refurbishment of amplifiers for RFQ, buncher, IH structure and 7 gap structures completed
- ✓ Remote controls functional
- ✓ Connections to the new HIE-ISOLDE RF reference line completed

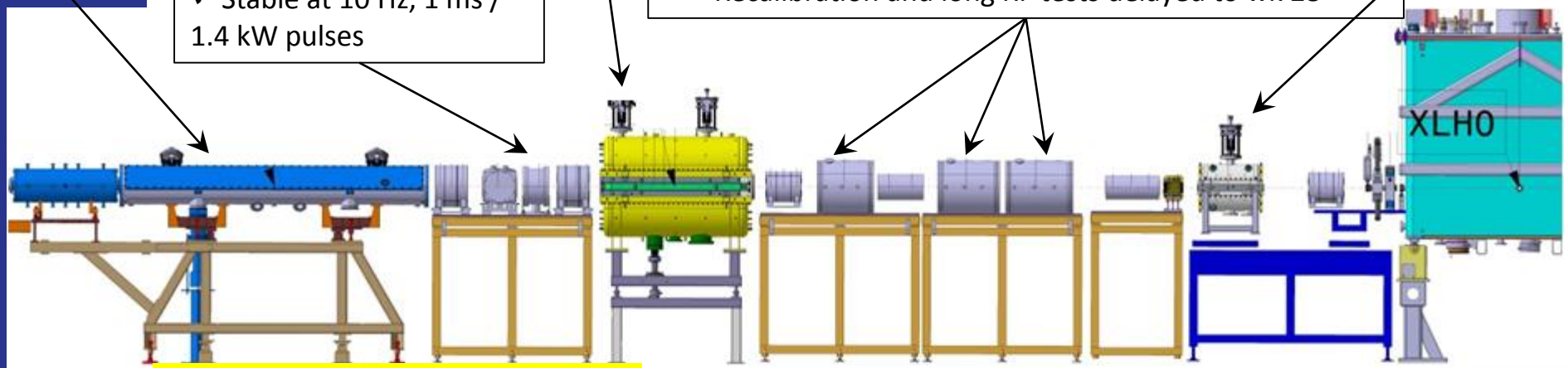
IH structure:
- First RF in the structure delayed to wk 27
- Recalibration and long RF tests delayed to wk 28

9 GAP structure:
- ✓ Temporary 9gap amplifier stable at 1Hz, 300 us, 45 kW
- Final 9gap amplifier scheduled to arrive in week 31. Commissioning will be completed by week 35

RFQ:
- ✓ RFQ recalibrated
- ✓ Stable at 10 Hz, 1 ms / 40 kW pulses

7 GAP structures:
- ✓ RF power in 7 gap structures for a short period of time
- Recalibration and long RF tests delayed to wk 28

Buncher:
- ✓ Stable at 10 Hz, 1 ms / 1.4 kW pulses



Courtesy J.A. Rodriguez, 30.6.2015

Hardware commissioning: Other systems

Power converters and magnets:

- ✓ New power converters for quads (19 units) fully functional
- ✓ New cooling water circuits for all the quads operational
- ✓ Electrical short in last triplet repaired and triplet refurbished
- ✓ Additional tests and measurements in other quadrupoles completed (thermal switches characterized, temperature rise measured…)

Diagnostics:

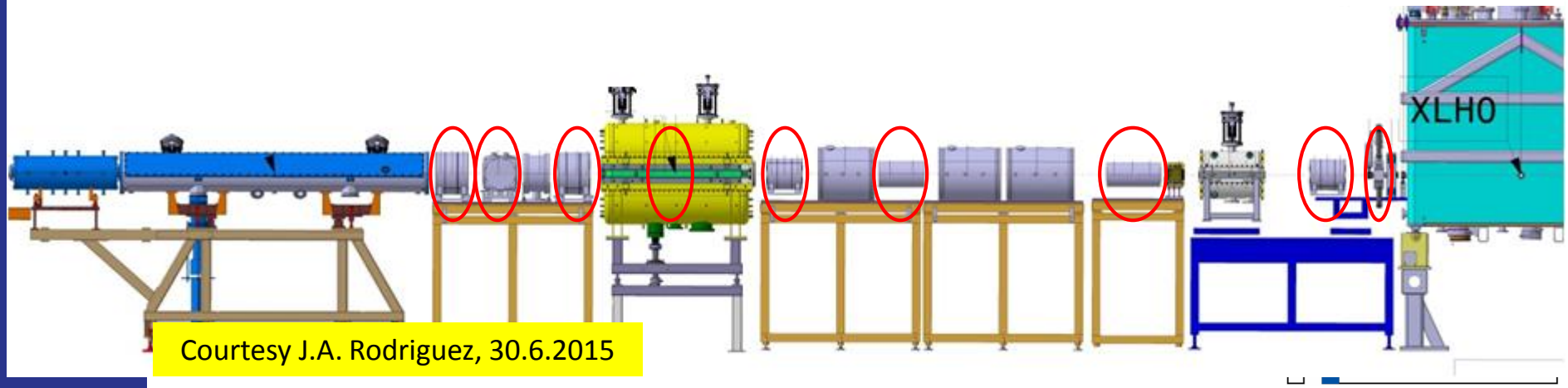
- ✓ FC, MCP and collimator wheel in REX diagnostics box commissioned
- ▪ FC and Si detector in first HIE-ISOLDE diagnostics box will be installed and commissioned this week

Vacuum:

- ✓ Scheduled maintenance completed. Faulty turbo pumps, controllers and gauges replaced
- ✓ Fast Penning gauges for fast acting valve to protect cryomodule installed
- ▪ Update/upgrade of the control software scheduled for the winter shutdown

Controls:

- ✓ New low level controls functional (new power converters, RF amplifiers…)
- ▪ High level applications currently being updated (working sets and equipment arrays ready)



Courtesy J.A. Rodriguez, 30.6.2015

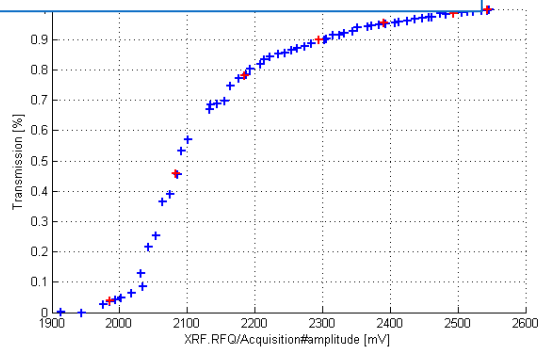
Commissioning with beam

- ✓ Commissioning with beam started on week 25
- ✓ Beam with an A/Q=4.0 has been accelerated to 0.3 MeV/u (RFQ output energy)
- ✓ We have reached the first diagnostic box and commissioned the FC, MCP and collimator wheel
- ✓ Beam transmission through RFQ for different power levels
- ✓ Evaluating the possibility of using quad scans to measure beam properties

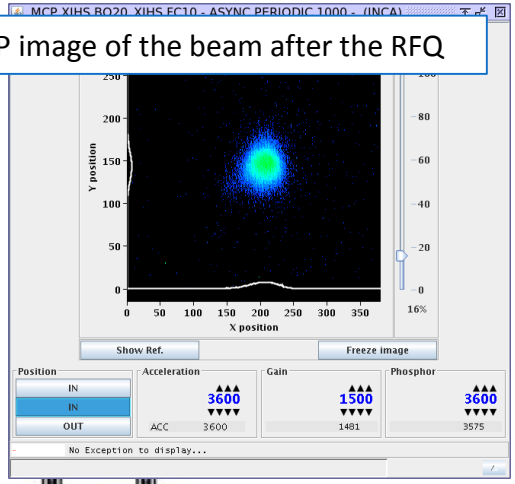
Next steps:

- Commissioning of first HIE-ISOLDE diagnostics box once installation is completed (week 27/28)
- Phasing of the NC cavities (weeks 28 to 31)

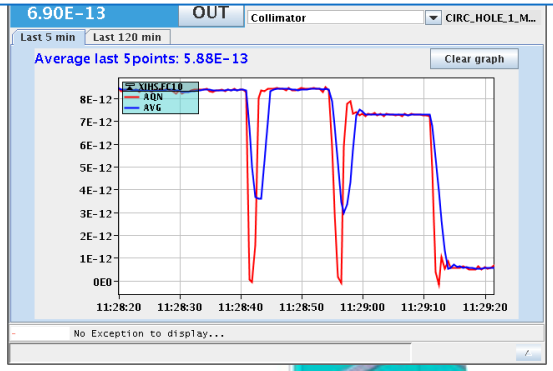
Beam transmission thru the RFQ vs RF power for A/Q=4.0

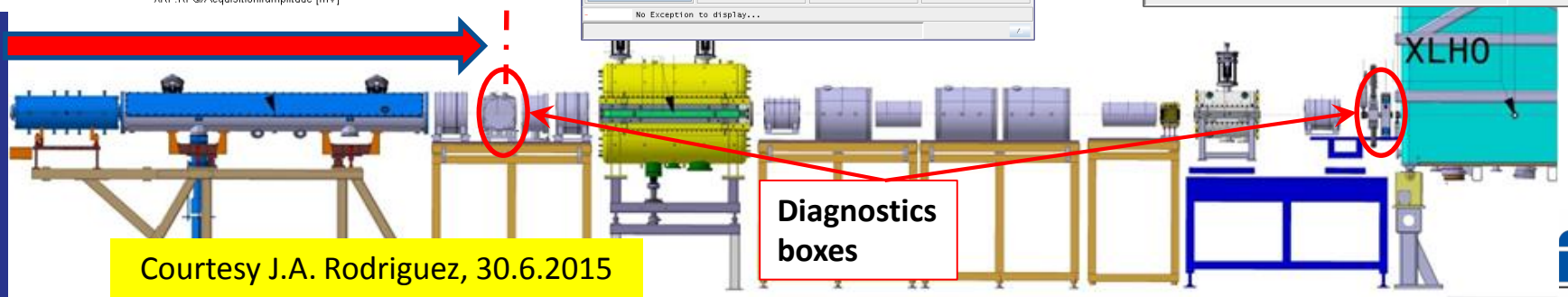


MCP image of the beam after the RFQ



Beam in FC after RFQ for different collimator aperture sizes (15, 5, 3 and 1 mm)



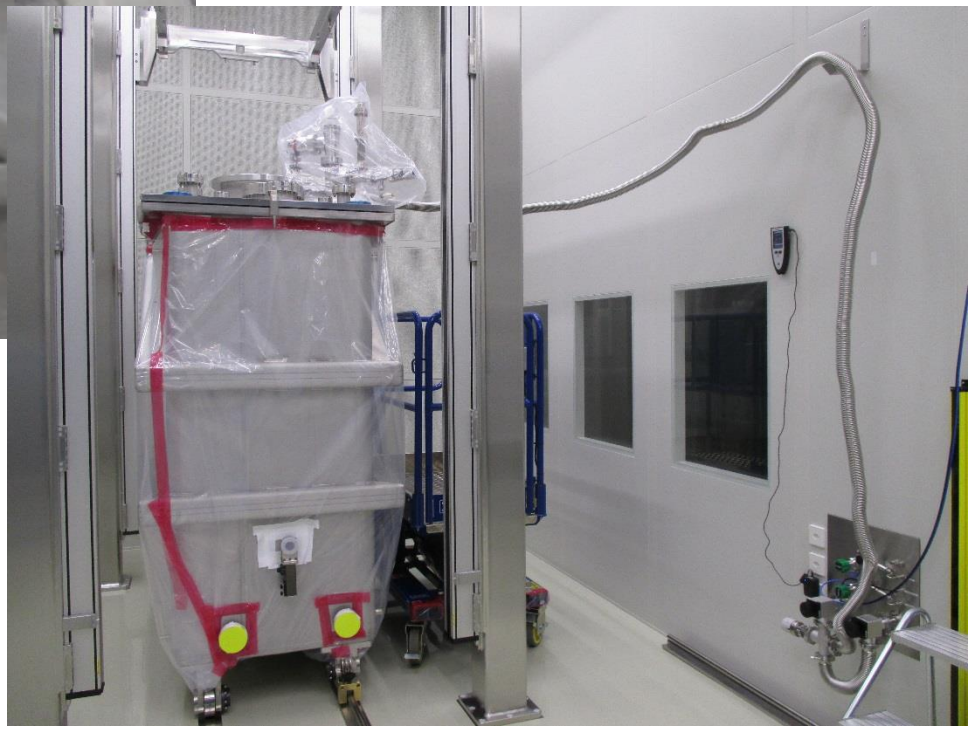


Diagnostics boxes

Courtesy J.A. Rodriguez, 30.6.2015

CM2

Insertion test and vacuum leak test



Next thermal shield assembly

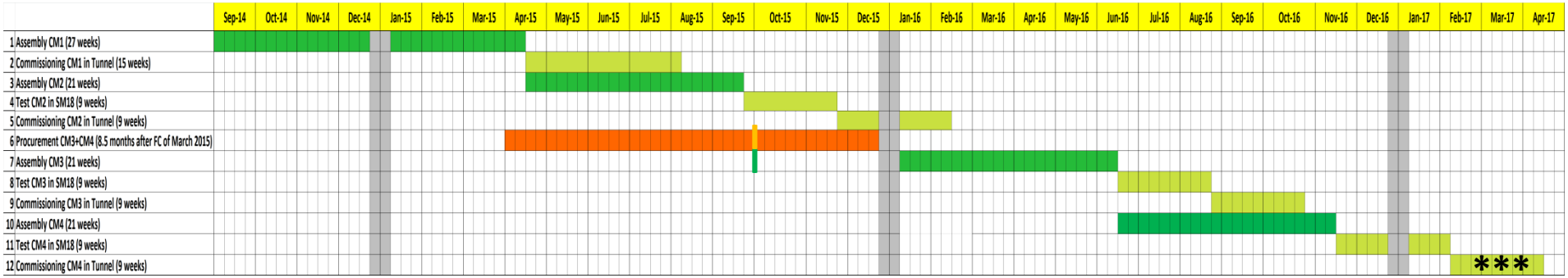
Phase 2 - Procurement

	Phase 1					Phase 2		
Items	**CM1**	**CM2**	**Order/Job #**	**Supplier/In charge**	**Remarks**		**CM3**	**CM4**
	Actual costs (CHF)					**Status of the Negotiations**	**Actualised costs (CHF)***	
Cavity/solenoid Frame	33,121	33,121	CA 5636186	Kinkele (DE)/TE-MSC	Option for CM3	**Ordered: DAI#6048199 => 13% decrease. Delivery in week 38**	28,895	28,895
Frame suspension system	29,103	29,103	J3017658	Rodofil (IT)/EN-MME		**new offer request week 22**		
Omega alignment plates								
Frame adjustment mechanisms	101,826	44,126	NA	Kirkolm (DK)/TE-MSC	Purchased for 3 CM through CATE – KE2021	**offer of June 15 => no cost increase**	25,109	50,218
Solenoid adjustment system	0	0	NA	NA	Optional, to purchase for 4 CM, retrofit on CM1, CM2	**pending CM1 tests**		
Helium vessel	36,950	36,950	CA 5469217	Cadinox (ES)/TE-MSC	Option for CM3	**Ordered: DAI#5990486 => 14% increase. Delivery in weeks 41 & 44**	45,598	45,598
Vacuum vessel	48,543	48,543	CA 5468803, CA 5593295	Cadinox (ES)/TE-MSC	Option for CM3	**Ordered: DAI#5990486 => 33.5% increase, Delivery in weeks 43 & 46**	66,792	66,792
Vacuum vessel raw material	71,500	71,500		TE-MSC	Supplied to Cadinox for 2 units	**Ordered EDH 5976927 + EDH 5995196 (use for CM3 unused material from Phase1)**	45,977	74,977
Vacuum vessel windows	4,824	4,824	CA 1557656	VAQTEC(IT)/TE-VSC	Purchased for 3 CM	**in progress**	0	
Thermal Shield	138,722	138,722	J3016196, +…	Various/EN-MME		**in progress, new drgs being finalised by TE/MSC (raw material ordered 10 kCHF each). Delivery in week 44**	12,200	12,200
Thermal shield ancillaries	7,443	7,443		EN-MME		**in progress**	5,151	5,151
Vacuum instrumentation cabling/feedthroughs	38,874	38,874	CA 5719701	Allectra (GB)/TE-MSC		**in progress, design changes being implemented. Request for new offer in week 24**		
Cryogenic and insulation vacuum sensors	40,691	40,691	CA 5508927, CA 5514341	AMI, TECO (US)/TE-CRG		**Ordered (DAI#6015770) => missing LHe gauges**	35,968	35,968
Flexible elements (bellows+flexibles)	11,686	11,686	CA 5630244	Witzenmann (FR)/TE-MSC		**ordered (CA6058125)**	6,191	6,191
Rigid cryogenic piping	35,663	35,663	various	EN-MME		**in progress**		
Cryogenic bayonets	5,813	5,813	F636/TE/HIE	Criotec (IT)/TE-CRG	purchased for 6 CM	–	0	0
Top plate chimney	12,500	12,500	various	EN-MME		**in progress**		
Current leads	1,013	1,013	CA 5638405	TECO(USA)/TE-MSC	includes assembly spares	**in progress**		
Vacuum burst disks	4,249	4,249	CA 5754382, CA 5752741	Witzenmann (FR)/TE-VSC	purchased for 6 CM, includes 4 spares	–	0	0
Cryogenic safety devices	1,576	1,576	CA5757967	CONTEL CONTROL EQUIPMENT (CH)/TE-CRG	Purchased for 3 CM, 2 spares to be added	**in progress**		
Helicoflex seals	19,429	19,429	CA5438714	TE-MSC	supplied for 2 CM, add spares	**Ordered (DAI#6069558)**	4,681	4,681
Chimney sub-assembly	14,146	14,146	various	EN-MME		**in progress**		
Jacks	10,610	10,610		EN-MME	supplied for 6 CM	–	0	0
CM Supporting Table	4,610	4,610		EN-MME	supplied for 2 CM	**in progress**		
Miscellaneous (EN-MME produced components, flanges, screws&rivets, Kolsterizing, thermalisation straps, etc.)	91,086	91,086	various jobs and orders	EN-MME, TE-MSC		**in progress**	25,369	25,369
TOTALS	763,975	706,275				**Totals**	301,930	356,039
						Procurement level	**40%**	**49%**

Phase 2 - Schedule

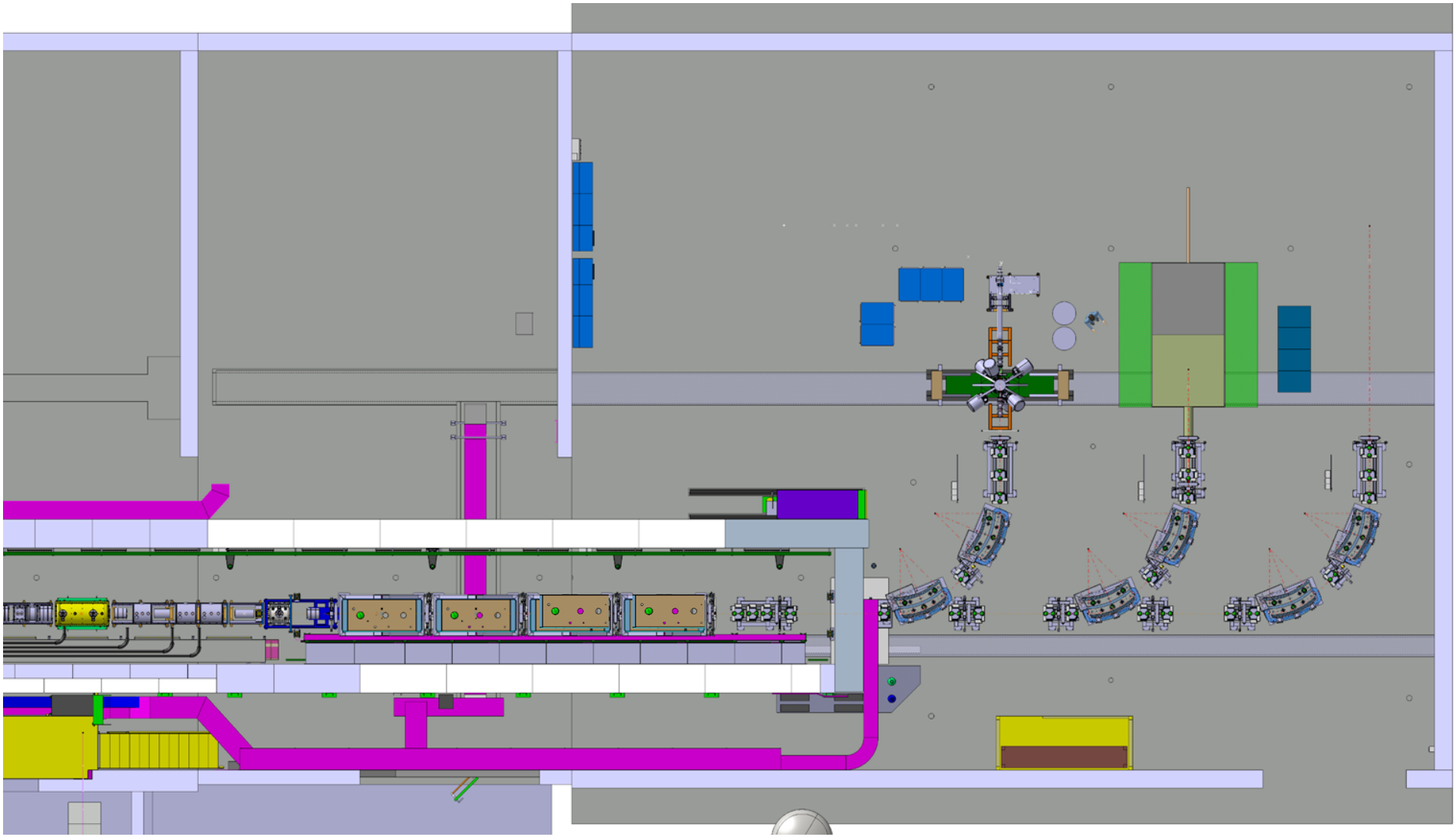
Planning:

CM3 assembly in principle starting right after CM2 (provided parts have arrived by then).
CM3 + CM4 to be finished towards end 2016 and installed in SD 2016/2017 (Ext. SD).



*** If delayed start of CM3 assembly CM4 commissioning will last until mid-April 2017
(just in time for beam to HIE-ISOLDE, with zero margin)

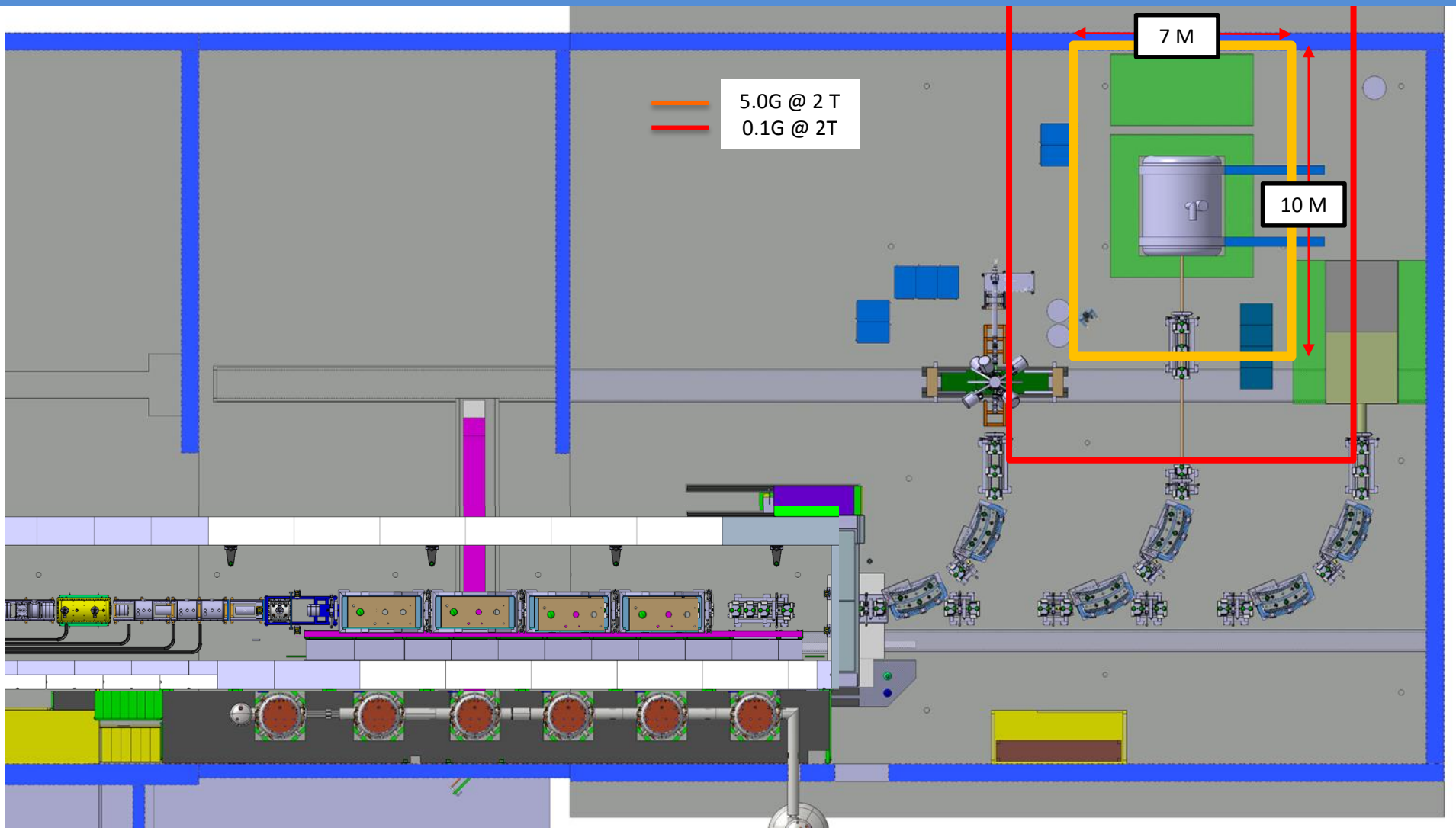
Phases 1 & 2 + XT03



HEBT:

- XT01: Miniball
- XT02: Movable setup + Tilted Foil setup
- XT03: could be installed by Apr. 2017 together with CM3 and CM4

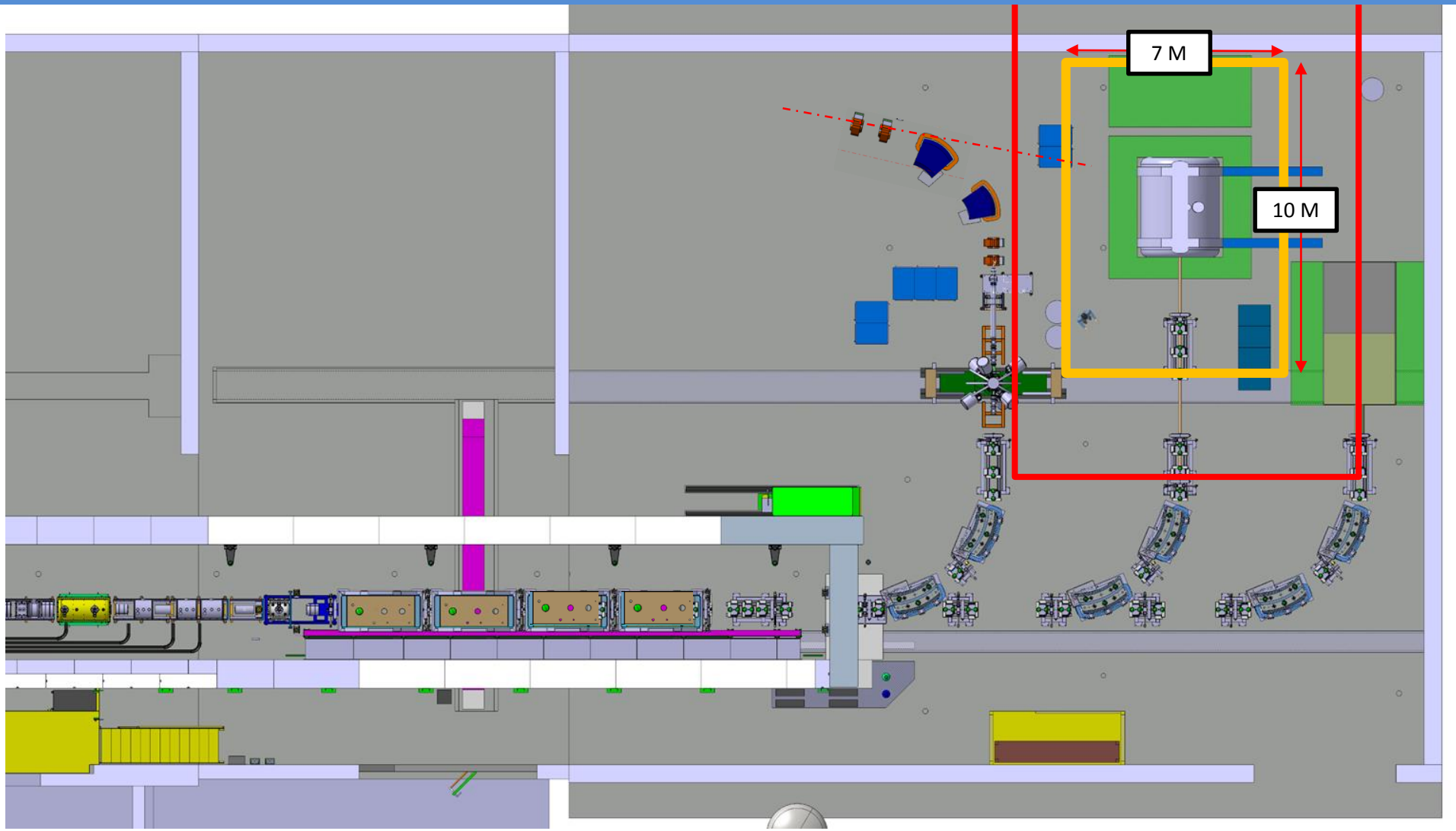
Phase 2 with HELIOS on XT02 (2017/2018)



Proposal#1: HELIOS on XT02 => cost optimised solution

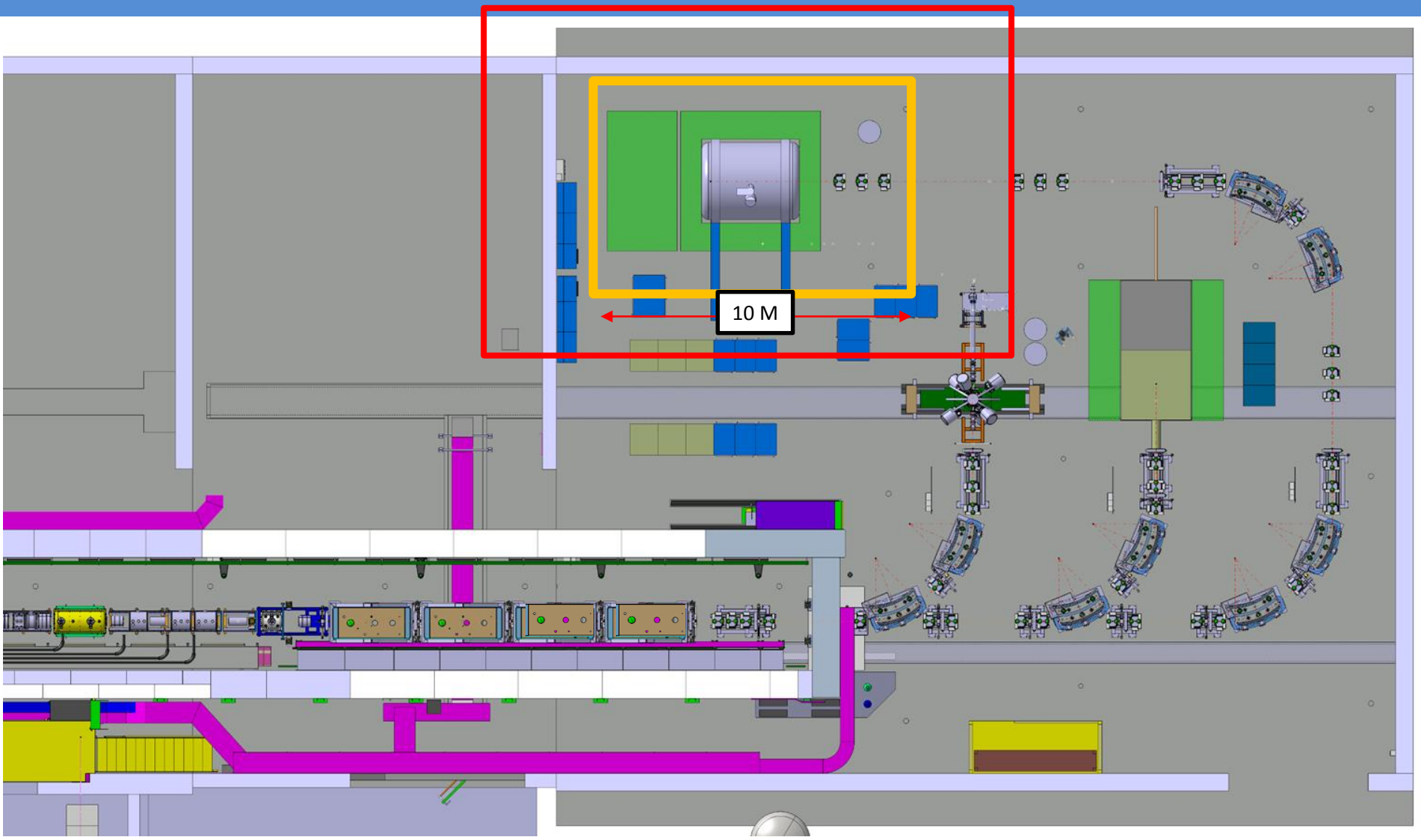
- Beam parameters unchanged
- HELIOS footprint includes magnetic shielding + access to the rear
- Layout remains TSR compatible

Phase 2 with HELIOS + TRIuP



- compatible with TRImuP@KVI-CAR on XT01 and Miniball in open position

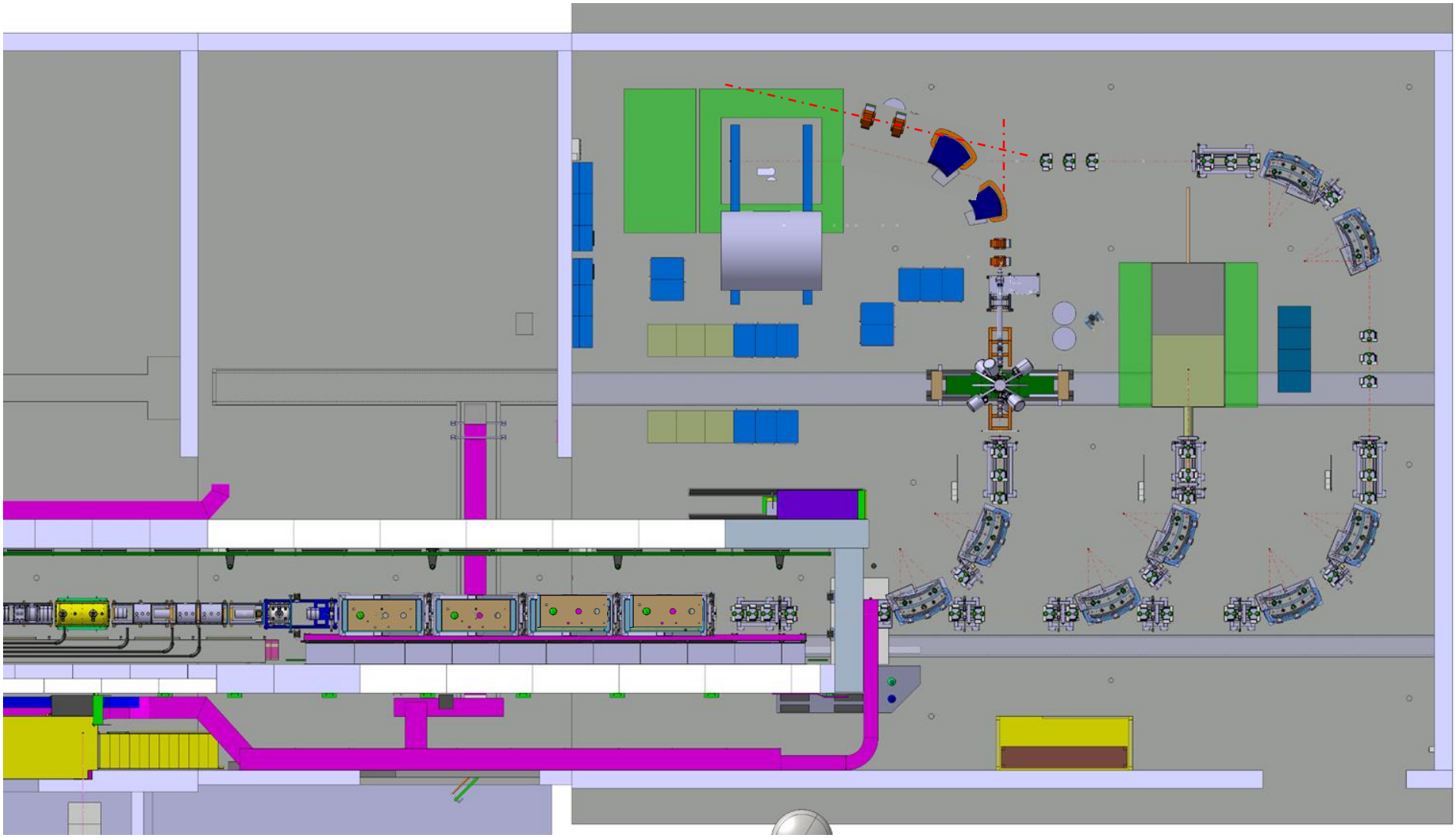
Phase 2 with HELIOS on U-Bend



Proposal#2: HELIOS on U-Bend

- Beam parameters unchanged
- HELIOS footprint includes magnetic shielding + access to the rear => too close to EPC racks
- Layout remains TSR compatible

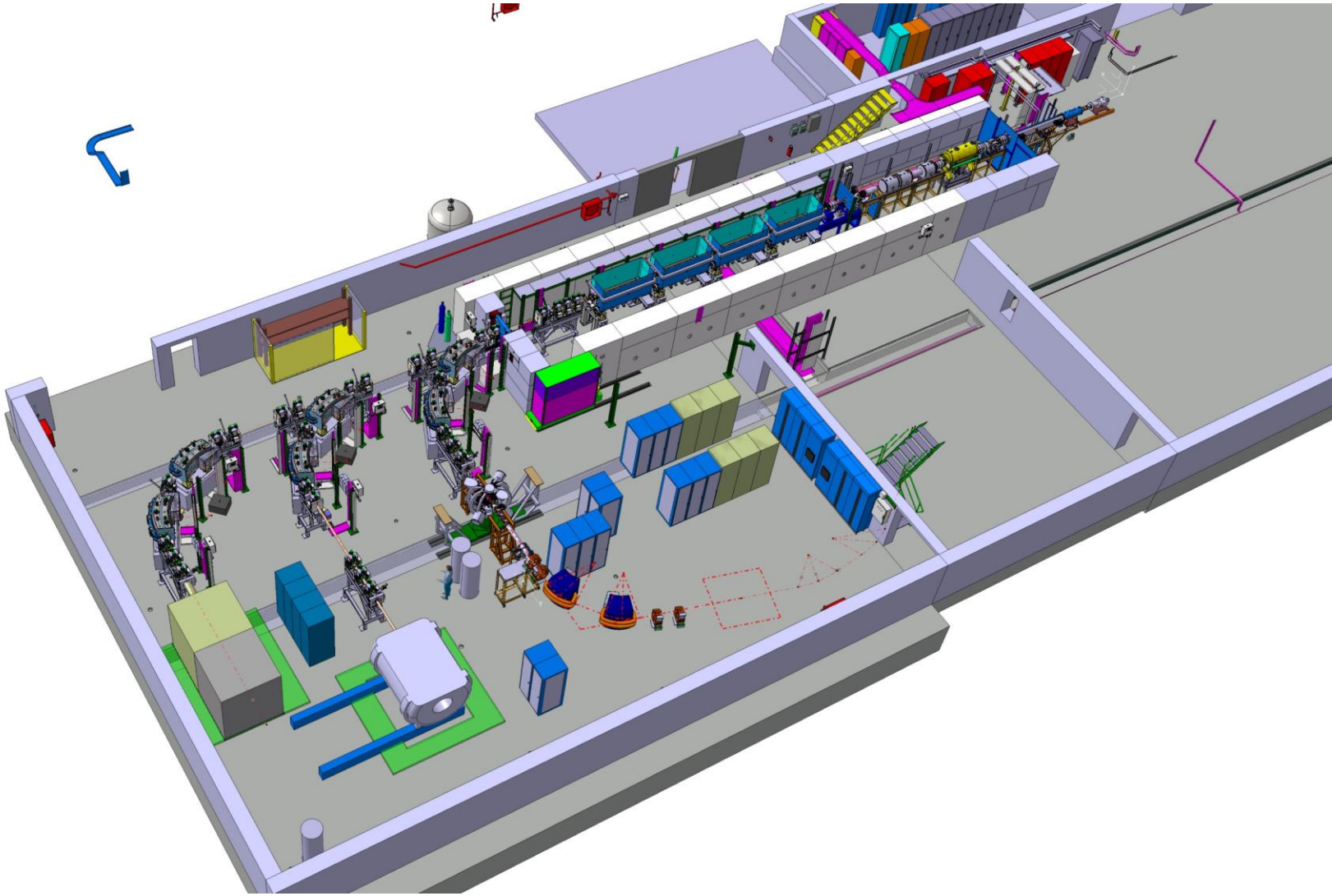
Phase 2 with HELIOS on U-Bend + TRImuP



Proposal#2: HELIOS on U-Bend

- Difficult to fit TRIuP@KVI-CAR on XT01 with Miniball in open position and HELIOS in parking position

3D view of HELIOS on XT02



Overall Summary

- All the project members have been commended by the CERN-DG, ATS Management, HIE-IAP and HIE-SC for the progress achieved so far
- **Machine commissioning** is well on track
- **Proposal for 3rd beam line with HELIOS on XT02 has been endorsed by ISCC.**
- Budget for **phase II** (CM3 + 4) has been consolidated in MTP 2016-2020
    - FSU for cryomodule assembly;
    - cost increase of components;
- Included as well in **MTP 2016-2020**:
    - machine spare parts;
    - consolidation of cryogenic system;
    - Spares for Phase 2
    - 3rd beam line
- **New EVM Baseline** to be launched very soon in order to keep track of Phase 1 + Phase 2
- **Risk Assessment for Phase 2** has been re-evaluated

Thank you for your attention