

**High
Luminosity
LHC**

Magnet cryostats test stations for HL-LHC

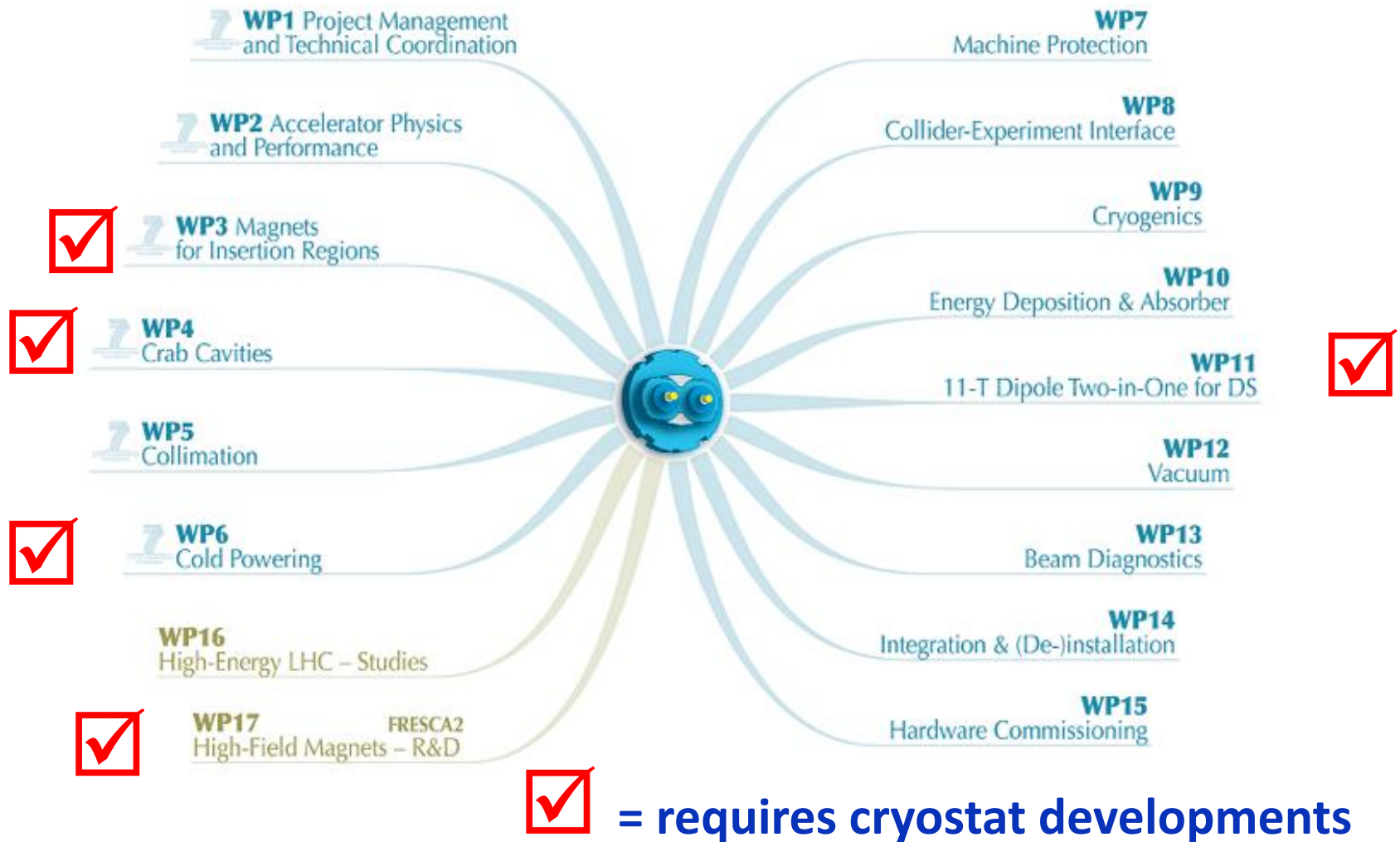
Overview May 2015



The HiLumi LHC Design Study is included in the High Luminosity LHC project and is partly funded by the European Commission within the Framework Programme 7 Capacities Specific Programme, Grant Agreement 284404.



HL-LHC structure

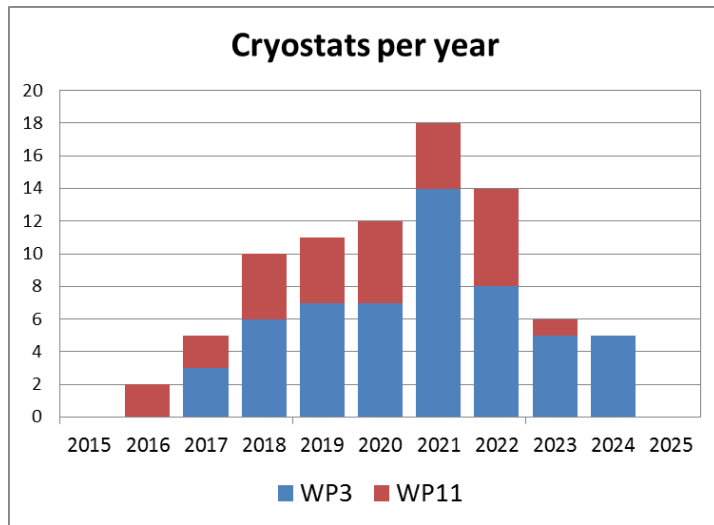


Outline

- Magnet cryostats
 - WP3 (insertion regions)
 - WP11 (11T dipoles and collimator)
- Cryostats for cold powering: WP6
- Cryostats for test stations
 - HFM
 - Cluster D
 - Fresca2

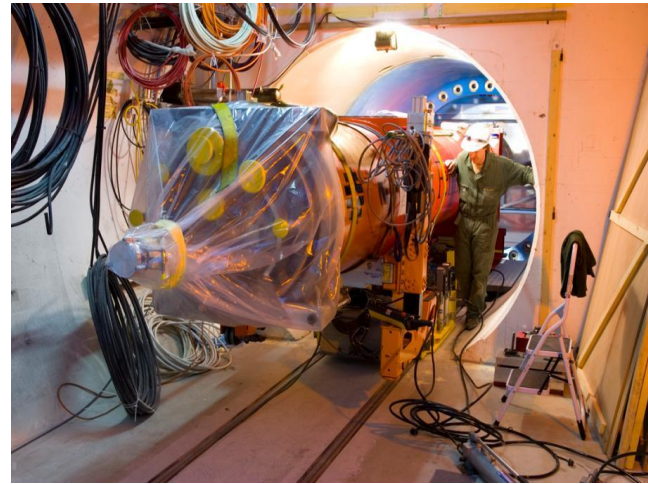
WP3 & WP11: Quantity of magnet cryostats to be assembled and provisional schedule

- 83 cryostat units
 - 55 units for WP3
 - 28 units for WP11



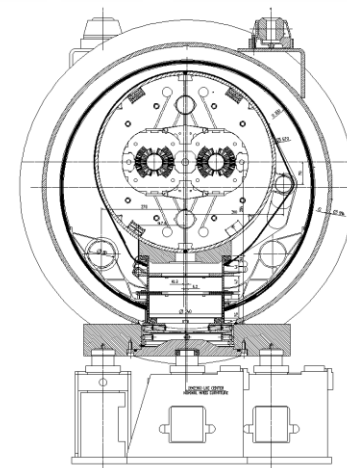
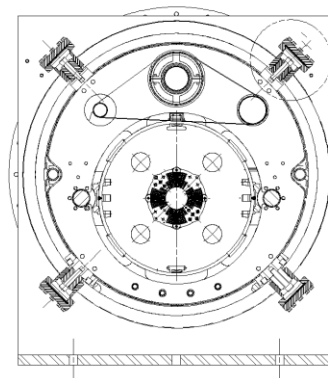
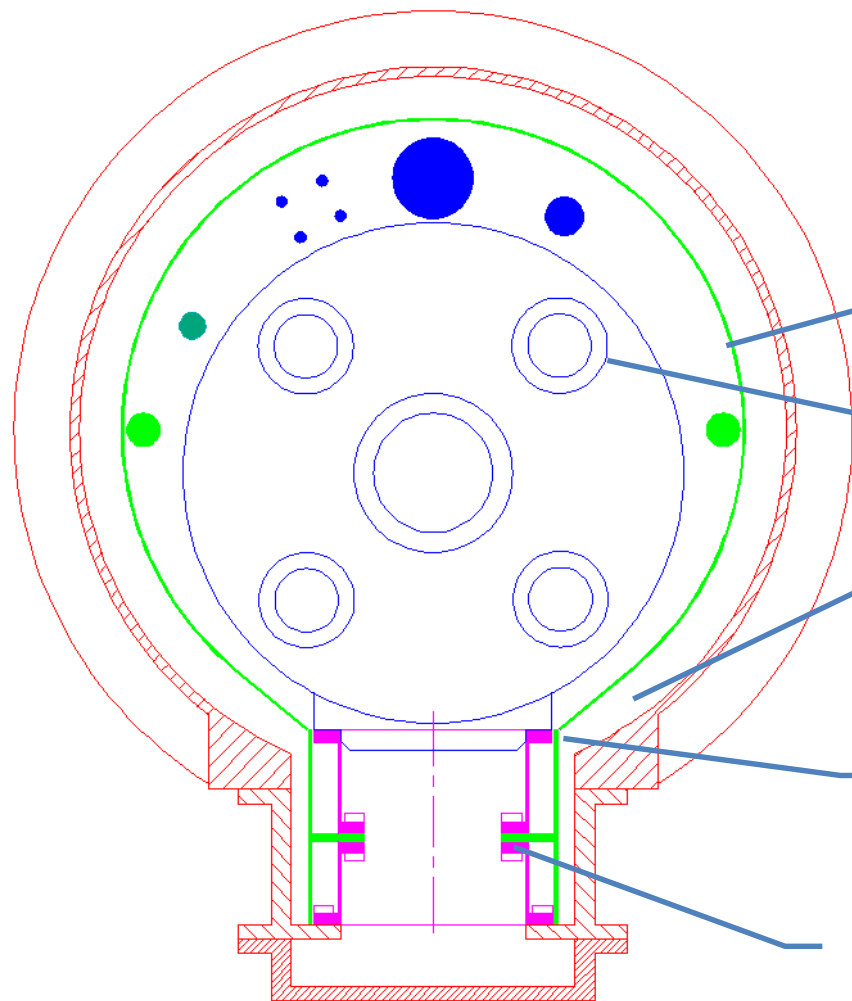
	WP3										WP11		WP3	WP11
	IR 1 and 5										IR7,1,5			
	Q1/Q3	Q2	CP	D1	D2	Q4	Q5	Q6	Q10	Q5	11T	Bypass		
2015-1														
2015-2														
2015-3														
2015-4														
2016-1													0	0
2016-2													0	0
2016-3											1		0	1
2016-4												1	0	1
2017-1													0	0
2017-2	1												1	0
2017-3										1		1	1	1
2017-4										1		1	1	1
2018-1											1		0	1
2018-2		1							1		1		2	1
2018-3		1							1		1		2	1
2018-4			1						1		1		2	1
2019-1									1		1		1	1
2019-2			1		1	1					1		3	1
2019-3			1										1	0
2019-4		1	1								1	1	2	2
2020-1			1								1	1	1	2
2020-2		1				1						1	2	1
2020-3	1	1										1	2	1
2020-4		1				1					1		2	1
2021-1	1	1			1	1					1		4	1
2021-2	1	1			1	1					1		4	1
2021-3	1				2	1					1		4	1
2021-4		1			1						1		2	1
2022-1	1	1			1						1		3	1
2022-2	1	1									2		2	2
2022-3	1	1									2		2	2
2022-4	1											1	1	1
2023-1	1											1	1	1
2023-2	1												1	0
2023-3							1	1					2	0
2023-4							1						1	0
2024-1							1	1					2	0
2024-2							1	1					2	0
2024-3								1					1	0
2024-4													0	0
2025-1														
2025-2														
2025-3														
2025-4														
	11	12	5	0	7	6	4	4	4	2	19	9	55	28
	55										19	9	83	

WP3: Q1 to D1 string to be replaced during LS3



RB14 01/09/2007

WP3: Q1-D1 Cryostat concept



Thermal shield supported on cold mass

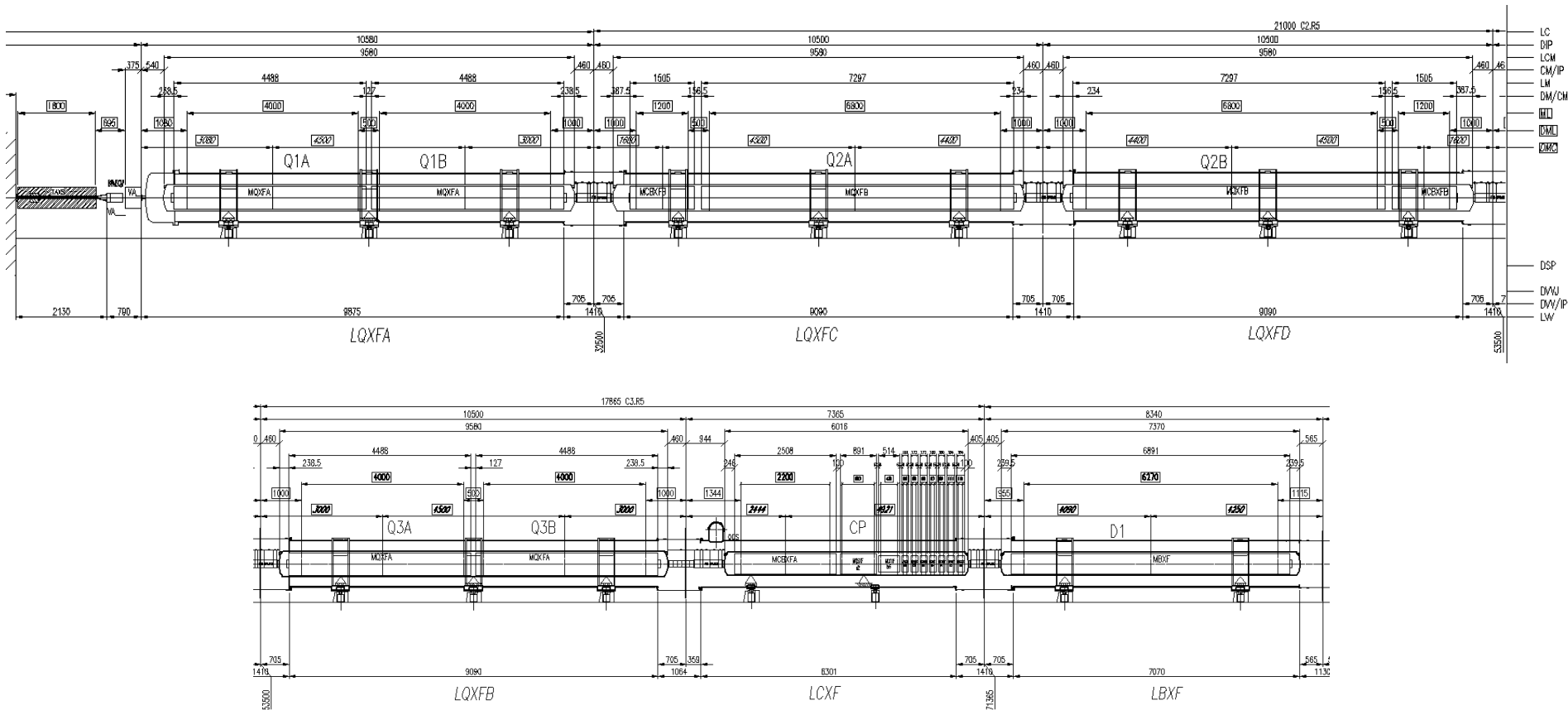
Heat exchangers must be placed on the two upper CM holes

Requires space for sleds and rails

Conduction cooled support thermalization

Single stage heat extraction

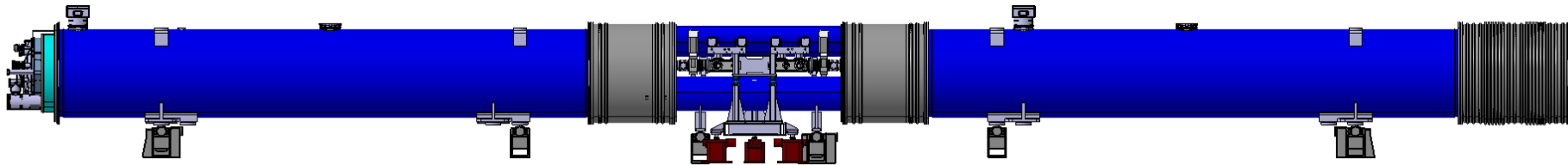
WP3: Layout Q1 to D1, IR1 and IR5



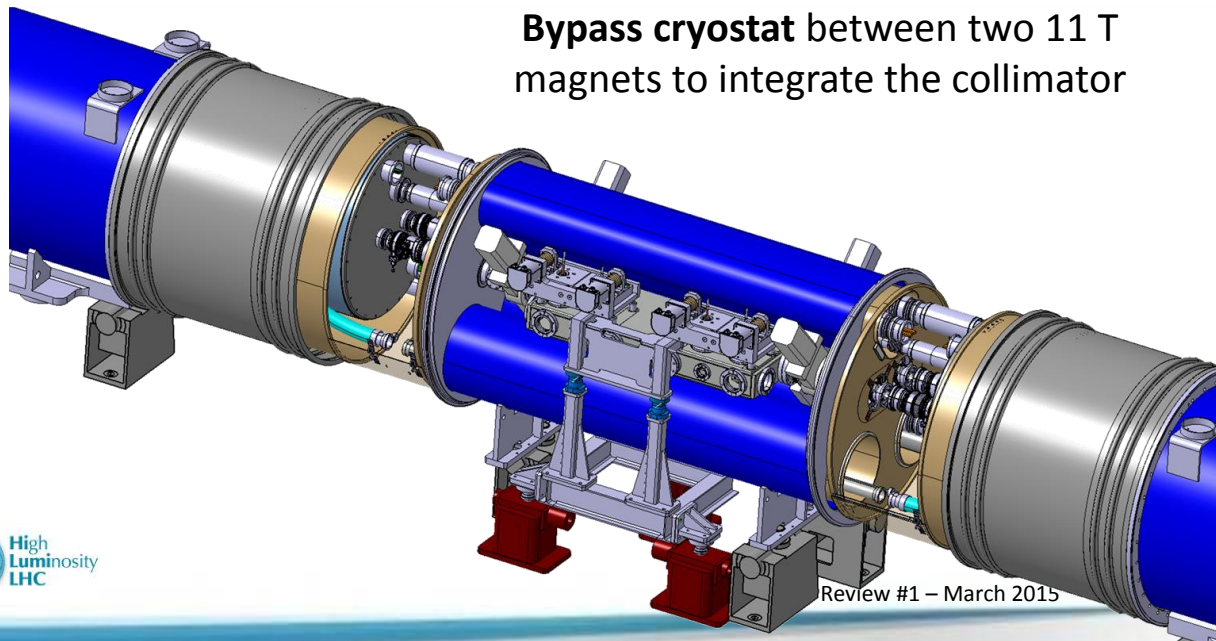
Installation during LS3

WP11: Cryostats for 11T dipoles and collimator integration

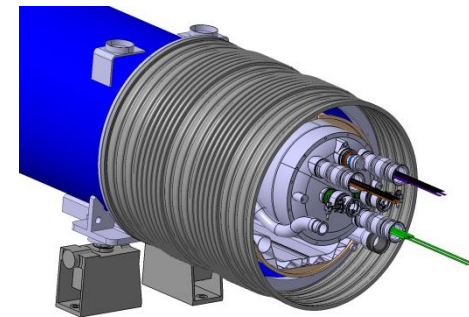
LHC MB replaced by **3 cryostats + collimator**, all independently supported and aligned:



Same **15660 mm length** between interconnect planes as an LHC MB

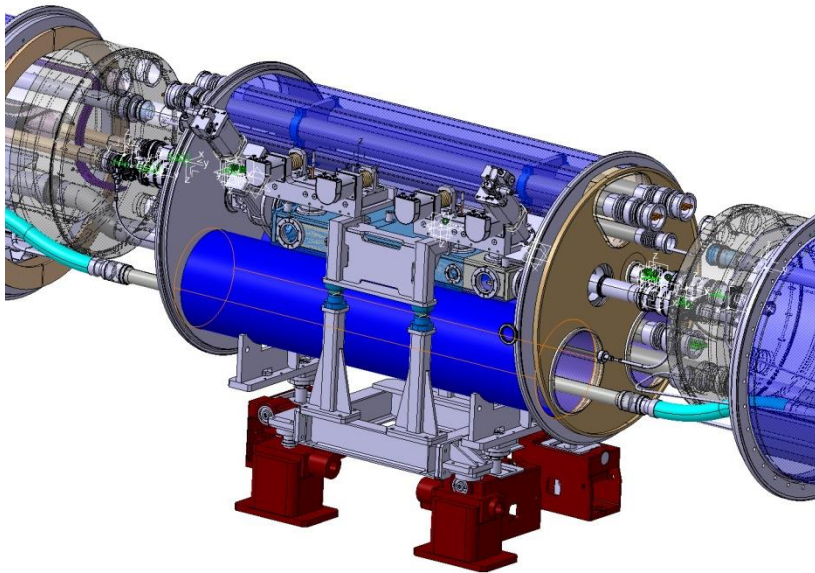


Bypass cryostat between two 11 T magnets to integrate the collimator



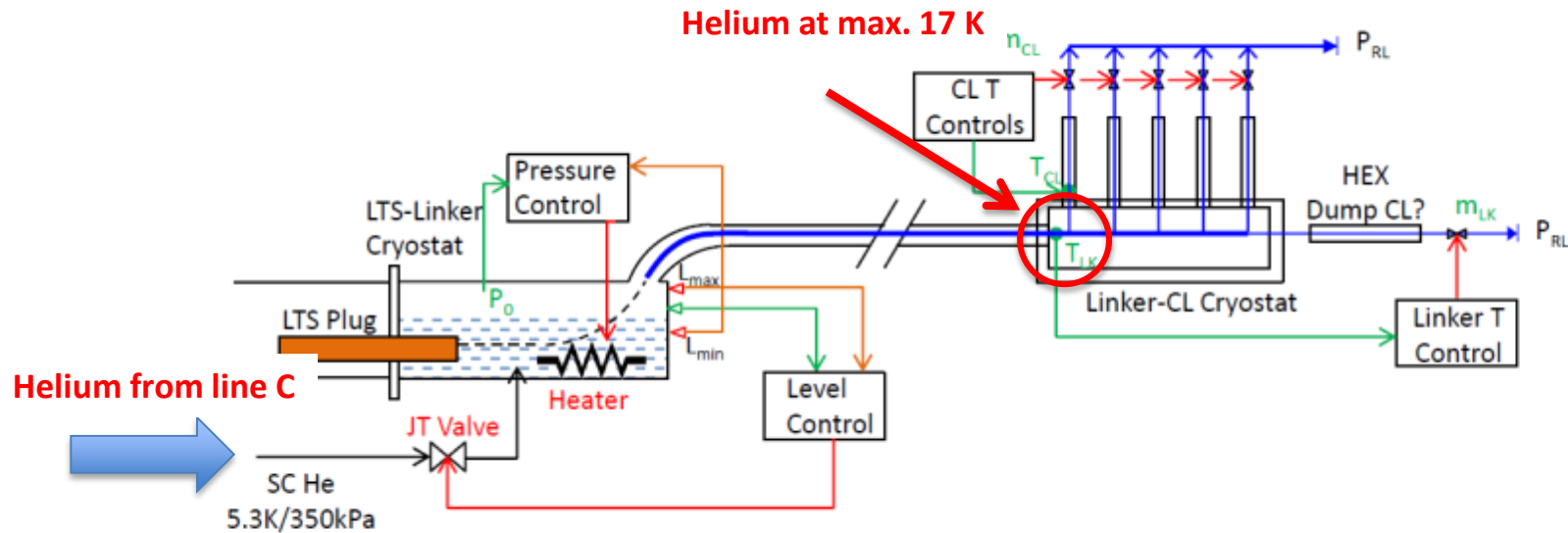
Same interfaces at the extremities: **no changes to nearby magnets**, standard interconnection procedures & tooling

WP11: Design and mockup work on-going



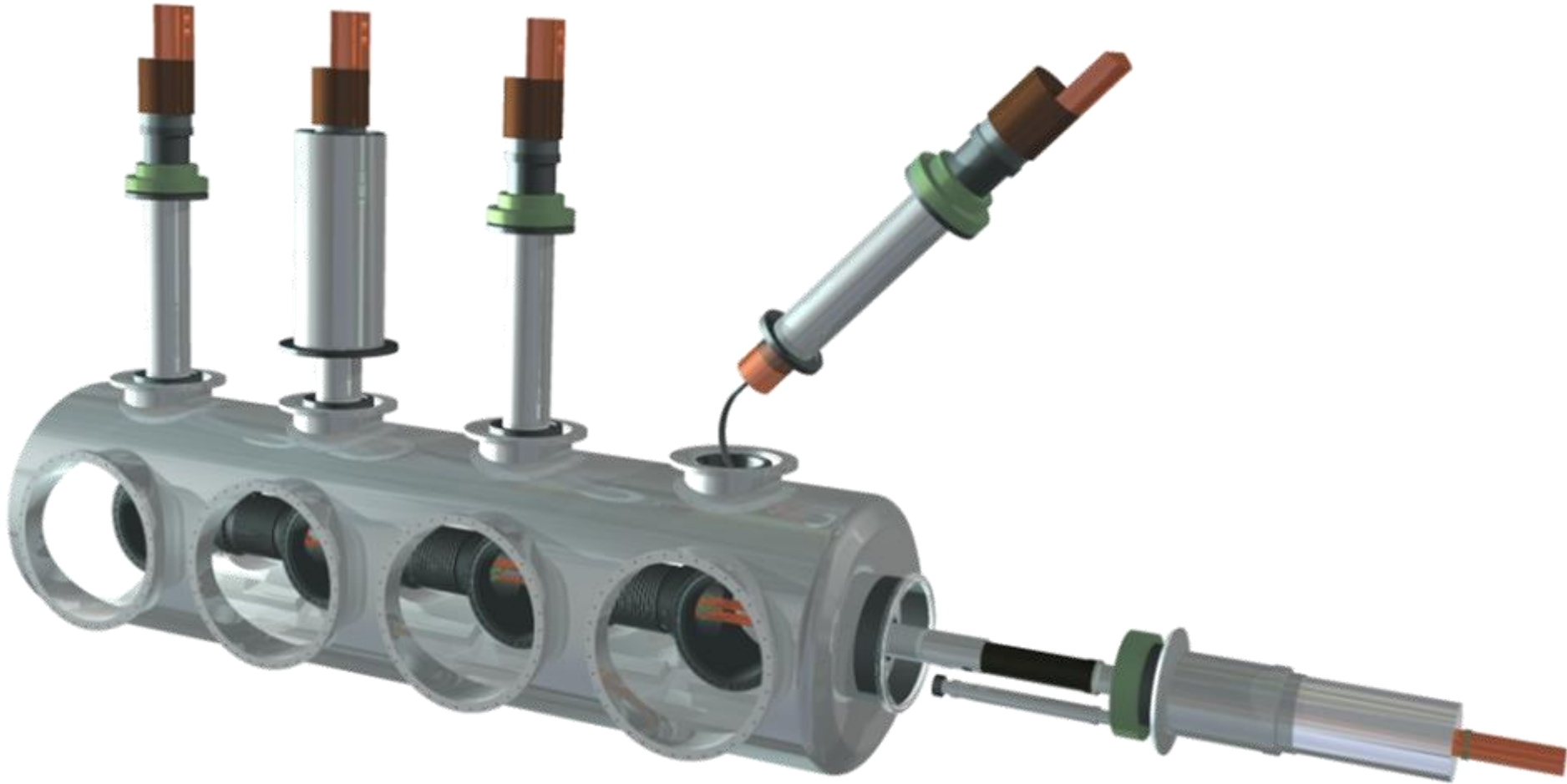
Price enquiry for 11T dipole vacuum vessel prototype in July 2015

WP6: Current cryogenics feeding concept (all sites)

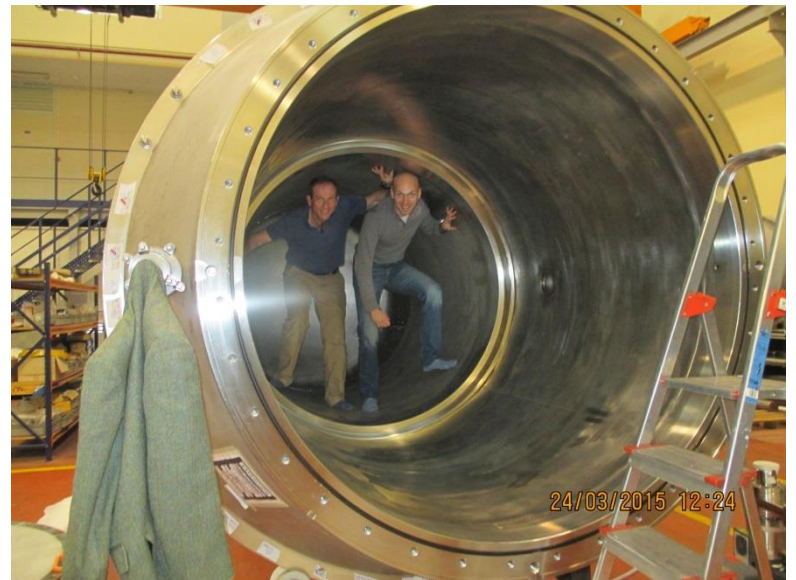
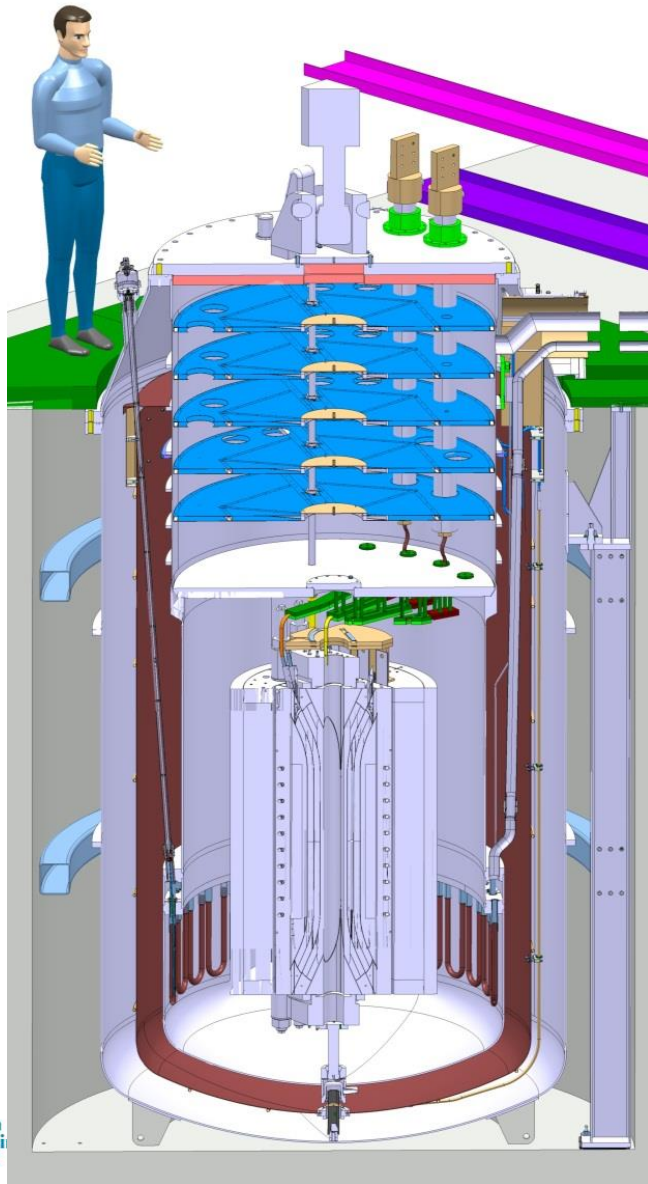


- The (assumed) 17 K limit for the MgB2 link allows only the 5 K, 3.5 bar helium from line C as coolant.
- The link will be cooled by helium gas created by evaporating the liquid helium in the spice box.
- Thermal shield solution not shown.

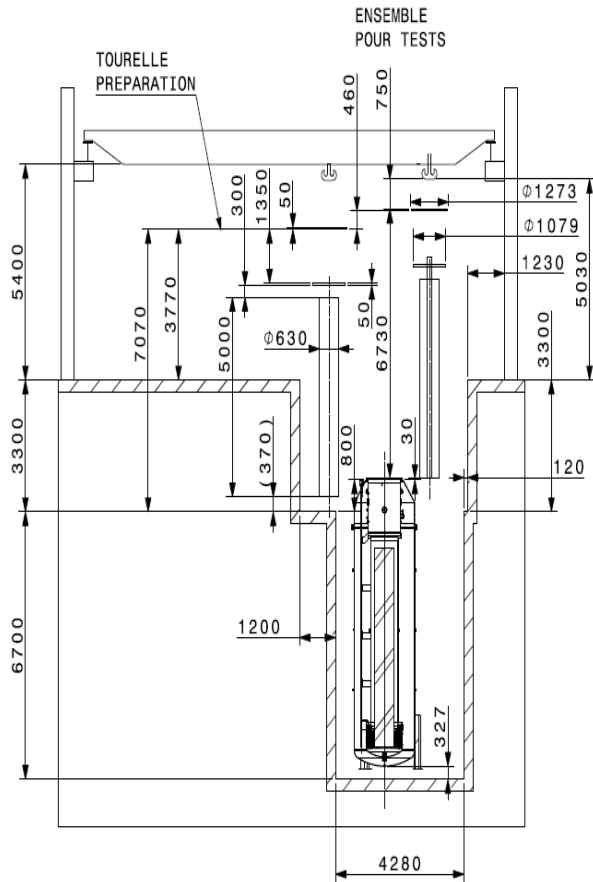
WP6: Current Leads Module concept (Y.Yang et al., Univ.of Southampton)



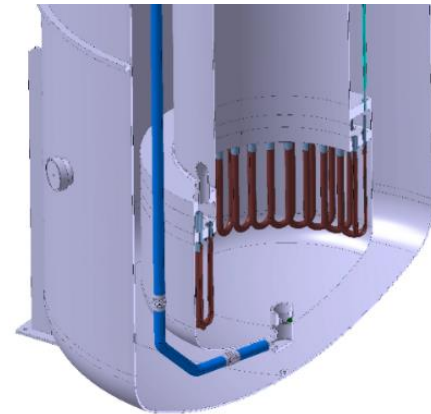
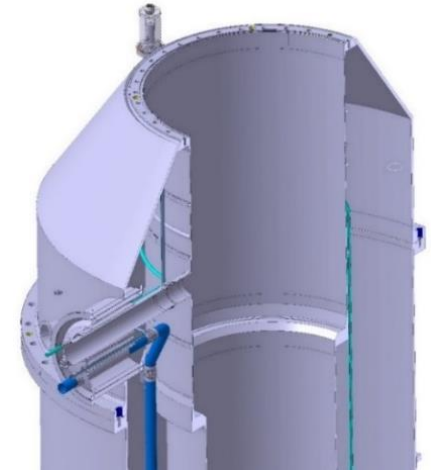
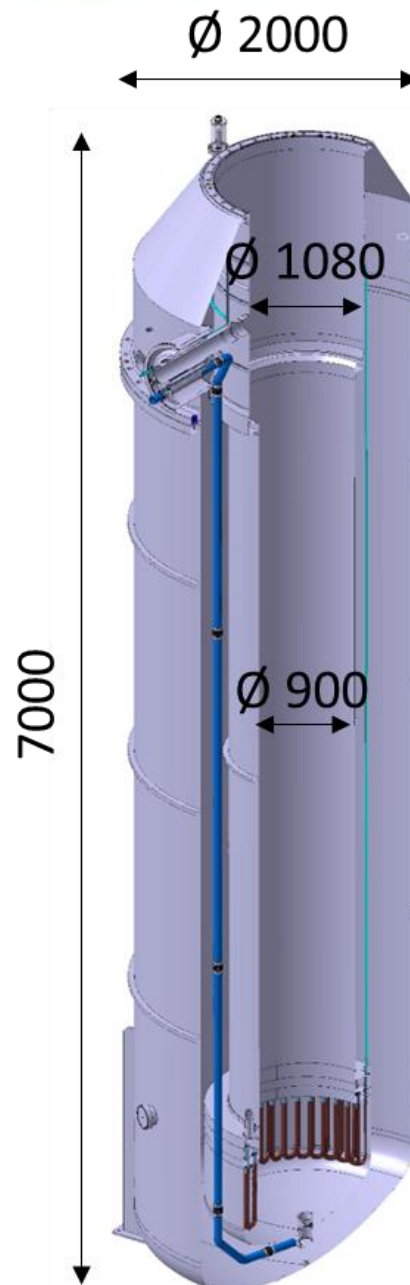
The HFM test cryostat



Cluster D test station



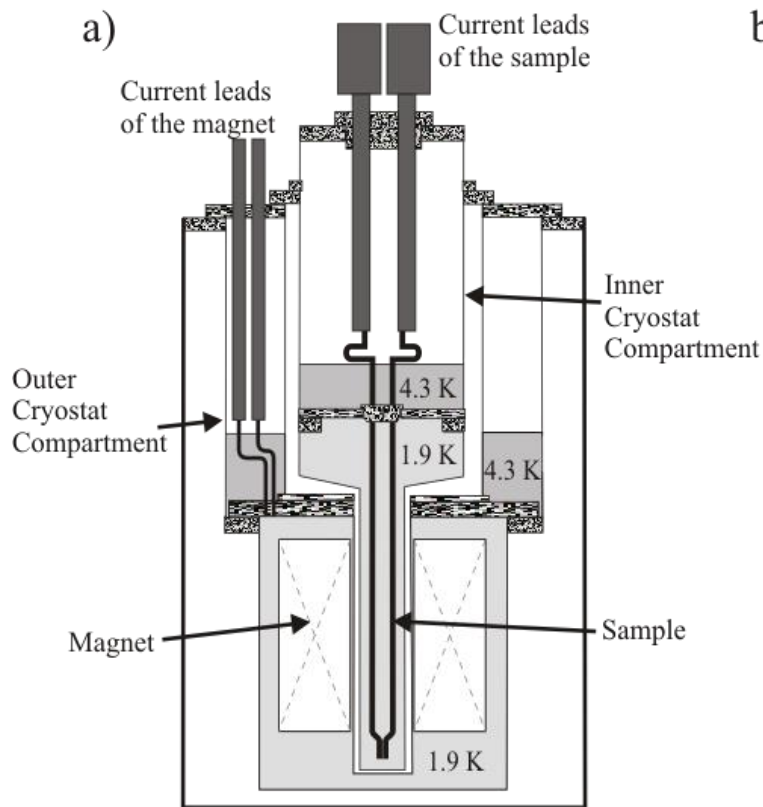
Invitation to tender in the coming weeks



New cryostat for FReSCa 2

(Facility for the Reception of Superconducting Cables)

a re-scaling from HFM cryostat?



• Key objective: FReSCa2

• **Nb₃Sn** dipole magnet

• **13 T**

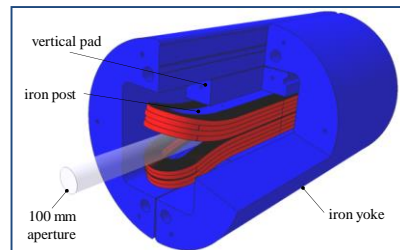
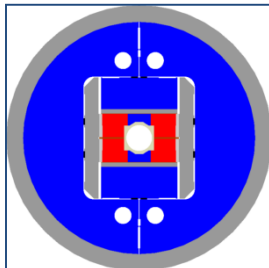
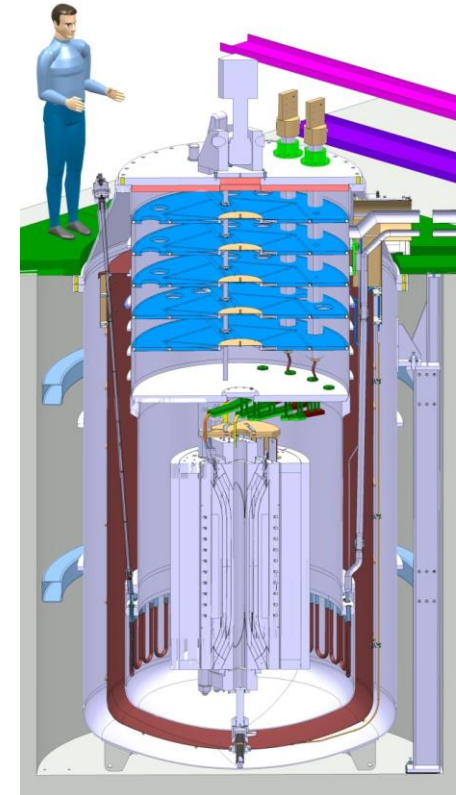
• **100 mm** clear bore

• **1.2 m** magnetic length

• **Plans**

• Fabrication and test of 2 Nb₃Sn coils in 2015

• FReSCa2 test in 2016



- Vertical double cryostat, height about 4 meter
 - Outer cryostat holds the dipole magnet (about 7 tonnes), always kept at LHe temperature
 - Inner cryostat (100 mm inner diameter) holds the sample.
- Warm-up 15 hours, cool-down 5 hours.