

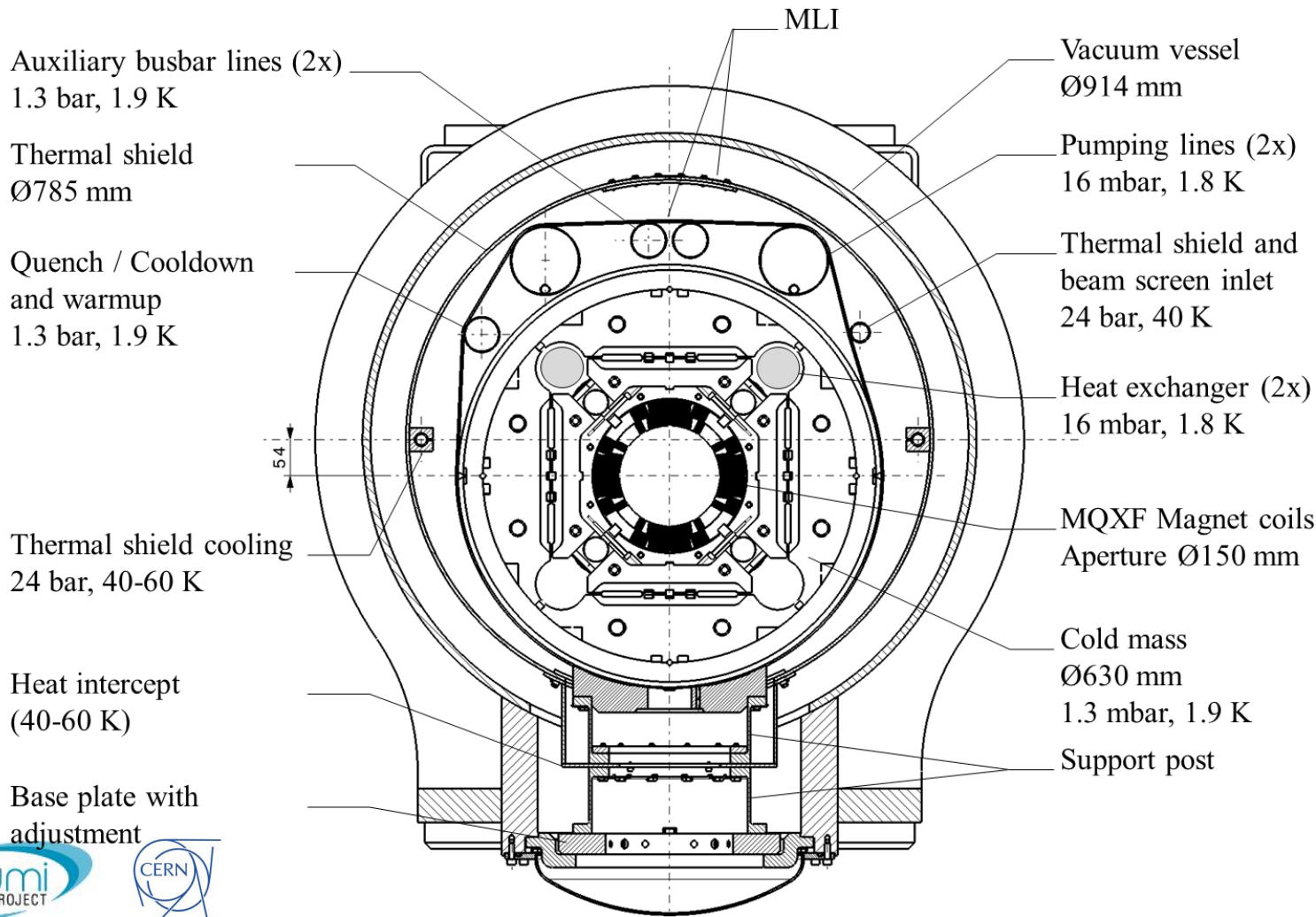


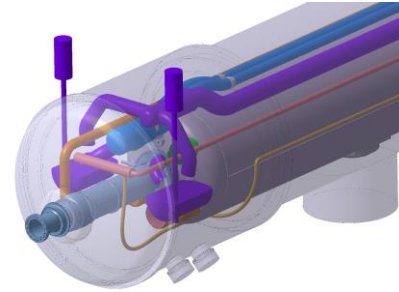
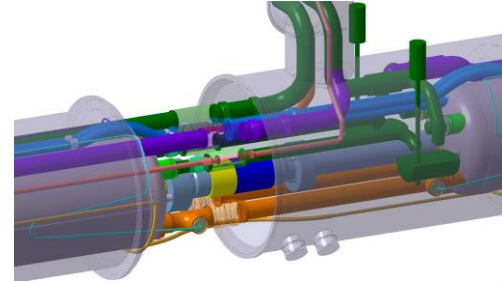
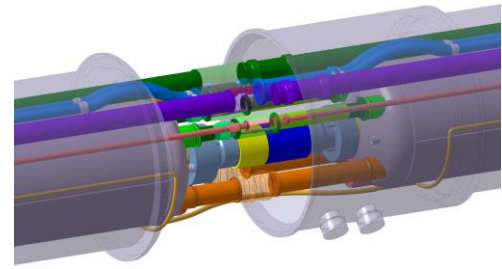
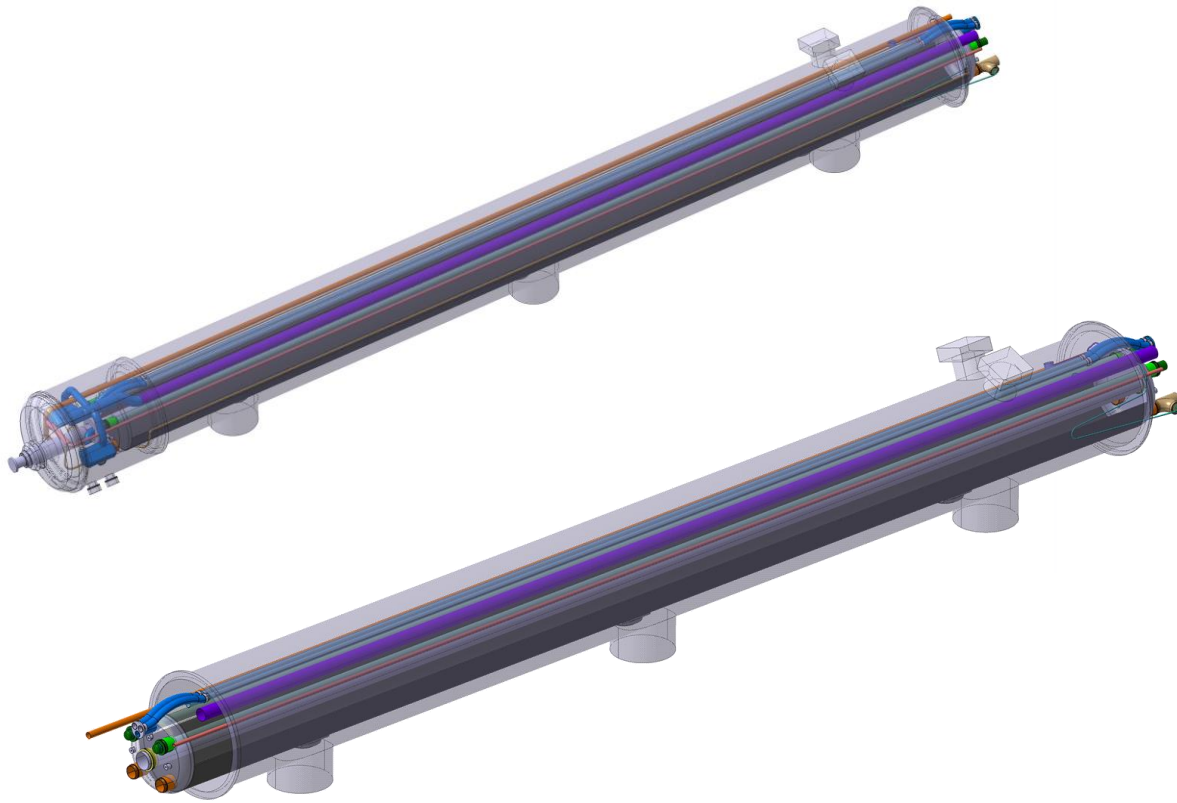
Roadmap for triplet cryostats

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Component	Who	Design	Procurement/Assembly
Cold mass	LMF	End covers depend on interconnect detailed design Interfaces for survey FSI	Delivered with N-lines Welded plates for cryo lines (tbd)
Vacuum vessel	CMI	First design by end of year <ul style="list-style-type: none"> Opening for support post Jack interfaces Deformations under load Urgent: baseline for instrumentation and CLIQ feedthroughs Minimise welded reinforcements for stability over time Interfaces for survey FSI 	Single contract for all WP3 vacuum vessels (excl. D1). Q10 as option. Cylinder + service module with adjuster diameter <ul style="list-style-type: none"> DR Jul 2017 (price estimation as C&SR) MS before end 2017 IT spring 2018 FC June 2018, Order Jul 2018 First units Q2 & Q1 Mar 2019 Delivery over 3 years (tbd)
Support posts	CMI	First design by end of year <ul style="list-style-type: none"> Review assembly procedure Increase diameter as much as possible for stiffness Thermalisation design Assembly tooling 	Single contract for all WP3 vacuum vessels incl. D1 (must be the same in a continuous cryostat) <ul style="list-style-type: none"> As critical as vacuum vessels Maybe below FC threshold DR Jul 2017 Order must be placed before July 2018, better earlier
Thermalizations for support posts	CMI	Idem <ul style="list-style-type: none"> Must be very compact 	Difficult to source outside CERN Qualifying a vendor for 11T at the moment Schedule OK if design done end 2017
Thermal shields	CMI	First design by end of year <ul style="list-style-type: none"> Thermalization and accessibility during assembly Split vertically or horizontally (consider 2 prototypes) Temporary support during cryostating Cold mass alignment targets: approve heat loads 	Aluminium extrusions <ul style="list-style-type: none"> Tender before end of the year Aluminium to stainless steel transitions <ul style="list-style-type: none"> Tender before end of the year Plates and machining <ul style="list-style-type: none"> With support from MME (tbd) Thermalizations for supports Welding/assembly in SMI2 Bottom trays and transitions for Q4 and Q10: qty ins stock to be checked.
MLI		Blankets designed by contractor	Not much to gain with scale effect. Several orders according to needs
Cryo piping and phase separators	CMI	Cross check pressure drop with TE-CRG Detailed design of phase separator manifold Design of liquid boiling solution, active or passive (with TE-CRG)	Procurement strategy will depend on design Assembled after cold test: Will be not shipped to the US.

Component	Who's in charge	Design	Procurement/Assembly
Expansion joints and hoses	CMI (tbd)	Pre-design and functional specification Design by contractor LHC specifications on materials are not interesting to contractors: we must revise them	Better in a single contract or we risk not being attractive to industry Conceptual specification Design by the supplier Fatigue testing of pre-series Series production Heat exchanger bellows + N Line hoses shipped to US, others welded at CERN? (tbd)
CLIQ and instrumentation feedthroughs		Local feedthroughs: <ul style="list-style-type: none"> • Can be cold tested with the magnet • Simpler test bench • Less connections if magnet must be removed • Integration WP seems to prefer feedthroughs away from IP for radiation reasons (meeting in August) 	
Current leads <ul style="list-style-type: none"> • 2x30 A trim • 16x120 A correctors • 2x200 A correctors 		Location must be discussed urgently!	
Beam screens / BPM / Plug-in module / CWT	VSC	There is very little room for welding and cutting between beamscreen and cold mass lines: to be discussed at the level of HL-LHC integration BPM cables and feedthroughs to be routed	
Interconnects		Welding and cutting tools to be designed Mockups	Vacuum vessels sleeves ordered as single contract (needed for the string) Thermal shields and MLI to have shorted lead times Procurement of welding and cutting tools must be addressed as soon as the first design is done
Jacks		Will we need to design new jacks or can we use existing ones? Strategy to be discussed with SU	
Cryostating bench for SMI2		Will replace existing MS bench. Compatible with all WP3 cryostats + LHC MS SSS and long connection cryostats Design by contractor according to CERN functional spec.	MS under preparation Installation at CERN Aug 2018