

DFX instrumentation requirements_DRY RUN

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Conceptual design review of the DFX 31 Jan 2019

Outline

- Functional requirements:
 - Cryogenic
 - Vacuum
 - Protection of circuits
- List of instrumentation
 - Vtaps
 - Cryo sensors
 - Vaccum



Functional requirements

- The DFX will host the MgB2/Nb-Ti splices and the Nb-Ti bus bars of the cold powering system of triplets:
 - 2x 18 kA
 - 2 x 13 kA
 - 3x 7 kA
 - 12 X 2 kA

Three types of functional requirements (others not part of this presentation)

- Cryogenic
- Vacuum
- Protection



Cryogenic requirement

- Immersion of Nb-Ti/MgB₂ splices and Nb-Ti bus bars in LHe bath => regulation of level.
- Generate from the LHe bath, a He boil off mass flow (of up to 10 g/s) sufficient to:
 - Maintain the MgB2 cable of the Sc Link below 25 K
 - Maintain the MgB2 HTS splices below 25 K
 - Thermalize to 50 K the bottom of the HeX of the leads





Cryogenic instrumentation of DFX

- 6 Thermal transducers (TT)
 - Two in the He tank
 - 4 in the splice box
- Two heaters
 - I Ghe/LHe Heat exchanger
 - 1 resistive Heater
- 1 He pressure gage
- Two LHe level transducers



Elaborated in collaboration with S. Claudet

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Additional instrumentation for transients not listed (CV, EH and TT)

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Cryogenic instrumentation of Sc Link



Protection requirements

- Each of the circuit of the Sc Link shall be protected by a dedicated QPS system that:
 - Detect any quench or detached Vtaps
 - Triggers the removal of energy from the circuit (strategy depends on the circuit): fast abort, EE system, quench heater
- Each circuit equipped with Vtaps to monitor voltage along Sc cables and across splices.



List of VTaps

- Each VTap has a spare
- Vtaps on the 1.9 K side required to monitor the plug
- Local pairing (outside the DFX) of taps of the plug required

	Plug \	LHCDFX				LHCDSH	LHCDFHX		LHCDFLHA LHCDFLHA LHCDFLHA	
		NbTi/NbTi MgB2/NbTi Splices Splices				MgB2/I Splice	HTS			
	VT 18L1_100 (101)	VT 18L1_102 (103)		VT 18L1_104 (105)	VT 18L1_106 (107	, I I	VT 18L1_108 (109)	VT 18L1_110 (111)	VT 18L1_112 (113)	VT 18L1_114 (115)
+18 KA	VT 18L1_200 (201)	VT 18L1_202 (203)		VT 18L1_204 (205)	VT 18L1_206 (207		VT 18L1_208 (209)	VT 18L1_210 (211)	VT 18L1_212 (213)	VT 18L1_214 (215)
-18 KA —	VT 13L1_100 (101)	VT 13L1_102 (103)		VT 13L1_104 (105)	VT 13L1_106 (107)	VT 13L1_108 (109)	VT 13L1_110 (111)	VT 13L1_112 (113)	VT 13L1_114 (115)
+13 KA	VT 13L1_200 (201)	VT 13L1_202 (203)		VT 13L1_204 (205)	VT 13L1_206 (207)	VT 13L1_208 (209)	VT 13L1_210 (211)	VT 13L1_212 (213)	NT 13L1_214 (215)
-13 KA	VT 7L1_100 (101)	VT 7L1_102 (103)		VT 7L1_104 (105)	VT 7L1_106 (107)		VT 7L1_108 (109)	VT 7L1_110 (111)	VT 7L1_112 (113)	VT 7L1_114 (115)
-7 kA	VT 7L1_200 (201)	VT 7L1_202 (203)		VT 7L1_204 (205)	VT 7L1_206 (207)		VT 7L1_208 (209)	VT 7L1_210 (211)	VT 7L1_212 (213)	VT 7L1_214 (215)
+7 kA	VT 7L1_300 (301)	VT 7L1_302 (303)		VT 7L1_304 (305)	VT 7L1_306 (307)		VT 7L1_308 (309)	VT 7L1_310 (311)	VT 7L1_312 (313)	VT 7L1_314 (315)
+2 kA C1	VT 2L1_1/100 (101)	VT 2L1_1/102 (103)		VT 2L1_1/104 (105)	VT 2L1_1/106 (10	17)	VT 2L1_1/108 (109)	VT 2L1_1/110 (111)	VT 2L1_1/112 (113)	NT 2L1_1/114 (115)
-2 kA C1	VT 2L1_1/200 (201)	VT 2L1_1/202 (203)		VT 2L1_1/204 (205)	VT 2L1_1/206 (20	17)	VT 2L1_1/208 (209)	VT 2L1_1/210 (211)	VT 2L1_1/212 (213)	VT 2L1_1/214 (215)
+2 kA C2	VT 2L1_2/100 (101)	VT 2L1_2/102 (103)		VT 2L1_2/104 (105)	VT 2L1_2/106 (10	17)	VT 2L1_2/108 (109)	VT 2L1_2/110 (111)	VT 2L1_2/112 (113)	NT 2L1_2/114 (115)
-2 kA C2	VT 2L1_2/200 (201)	VT 2L1_2/202 (203)		VT 2L1_2/204 (205)	VT 2L1_2/206 (20	17)	VT 2L1_2/208 (209)	VT 2L1_2/210 (211)	VT 2L1_2/212 (213)	VT 2L1_2/214 (215)
+2 kA C3	VT 2L1_3/100 (101)	VT 2L1_3/102 (103)		VT 2L1_3/104 (105)	VT 2L1_3/106 (10	17)	VT 2L1_3/108 (109)	VT 2L1_3/110 (111)	VT 2L1_3/112 (113)	VT 2L1_3/114 (115)
-2 kA C3	VT 2L1_3/200 (201)	VT 2L1_3/202 (203)		VT 2L1_3/204 (205)	VT 2L1_3/206 (20	7)	VT 2L1_3/208 (209)	VT 2L1_3/210 (211)	VT 2L1_3/212 (213)	VT 2L1_3/214 (215)
+2 kA C4	VT 2L1_4/100 (101)	VT 2L1_4/102 (103)		VT 2L1_4/104 (105)	VT 2L1_4/106 (10	7)	VT 2L1_4/108 (109)	VT 2L1_4/110 (111)	VT 2L1_4/112 (113)	VT 2L1_4/114 (115)
-2 kA CA	VT 2L1_4/200 (201)	VT 2L1_4/202 (203)		VT 2L1_4/204 (205)	VT 2L1_4/206 (20	7)	VT 2L1_4/208 (209)	VT 2L1_4/210 (211)	VT 2L1_4/212 (213)	VT 2L1_4/214 (215)
+2 kA C5	VT 2L1_5/100 (101)	VT 2L1_5/102 (103)		VT 2L1_5/104 (105)	VT 2L1_5/106 (10	7)	VT 2L1_5/108 (109)	VT 2L1_5/110 (111)	VT 2L1_5/112 (113)	VT 2L1_5/114 (115)
-2 kA C5	VT 2L1_5/200 (201)	VT 2L1_5/202 (203)		VT 2L1_5/204 (205)	VT 2L1_5/206 (20	7)	VT 2L1_5/208 (209)	VT 2L1_5/210 (211)	VT 2L1_5/212 (213)	VT 2L1_5/214 (215)
+2 kA, C5	VT 2L1_6/100 (101)	VT 2L1_6/102 (103)		VT 2L1_6/104 (105)	VT 2L1_6/106 (10	7)	VT 2L1_6/108 (109)	VT 2L1_6/110 (111)	VT 2L1_6/112 (113)	VT 2L1_6/114 (115)
-2 kA, C6	VT 2L1_6/200 (201)	VT 2L1_6/202 (203)		VT 2L1_6/204 (205)	VT 2L1_6/206 (20	7)	VT 2L1_6/208 (209)	VT 2L1_6/210 (211)	VT 2L1_6/212 (213)	VT 2L1_6/214 (215)
-2 KA, CO	~20 cm				0 cm					
	CERN						-			



Vacuum requirements

- The cold powering chain made of three vacuum volumes
- Each of the volume equipped with pumps and instrumentation (under definition with Germana, more advanced next week).....

