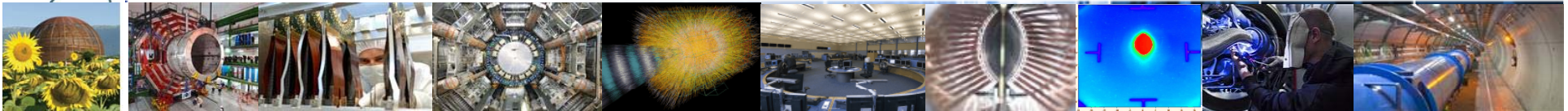




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HWC Workshop (19.03.2009)

# Consolidation and major changes that have impact on the powering circuits





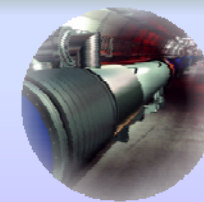
# I. Major changes

Type of work / Type of sector	E L Q A	C R Y O	Q P S IST	P C IST	P I C IST	P T	Systems/ PT Details
1 New overpressure relief valves installation (warm sectors) 	N	Y	N	N	N	N	Will be done during PT → impact on test schedule
2 New QPS 	Ya	N	Y	N	N	Y	Commissioning to be integrated in the PT procedures
3 Magnet exchanged	Y	N	N	N	N	Y	Re-commission all the circuits concerned
4 Bus Bar repair in connection cryostat (risk of shorts) → <b>S56 (&amp;S34 preventive t.b.c.)</b>	Y	N	N	N	N	Y	Adapt procedures (check circuits integrity)
5 S34 (ARC+LSS+IT) → <b>1+2+3</b> (special sector)	Y	Y	Y	Yb	N	Y	S34 is a new sector to be fully commissioned
6 S12 & S67 (ARC+LSS+IT) → <b>1+2+3</b>	Y	Y	Y	N	N	Y	Re-commission all the circuits concerned
7 S56 (ARC+LSS+IT) → <b>1+2+4</b>	Y	Y	Y	N	N	Y	Adapt procedures + re-comm. mains
8 S23 & S45 ( <b>ARCT &lt; 100 K</b> ) → <b>2</b>	Y	N	Y	N	N	Y	Re-commission main circuits
9 S81 & S78 ( <b>T &lt; 5 K</b> ) → <b>2</b>	Y	N	Y	N	N	Y	Re-commission main circuits 2

May go ~ 100 K

May go > 100 K


# Miscellaneous



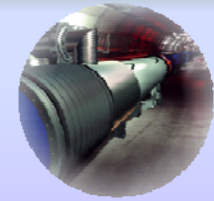
	Type of work / Type of sector	E L Q A	C R Y O	Q P S IST	P C IST	P I C IST	P T	Systems/PT Details
10	Relocation of UPS and electronics from UJ76 to the TZ76 (PIC, WIC, PC, UPS)	N	N	N	N	Y	Y	Normal procedures for PIC
11	AUG issues + non conformities → f(issue, non conformity)	N	N	Y	Y	Y	N	Adapt procedures to test that everything is conform (H. Thiesen talk)
12	S34 missing corrector in SSS, should be documented in the as-built database							Systems concerned: FIDEL (TF generation), QPS (inductance calculation), DB, drawings
13	Field quality of the newly installed magnets should be extracted using WISE to provide ABP with a up-to-date status of the machine							Systems concerned: FIDEL must be updated, ABP simulations

# PC



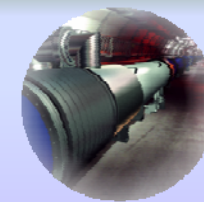
	Type of work / Type of sector	E L Q A	C R Y O	Q P S IST	P C IST	P I C IST	P T	Systems/PT Details
14	Short Circuit Test (Heat Run) in S34	N	N	Y	Y	N	N	
15	Installation of DC contactors for 8 RQS and for 8 RTQXI power converters to improve protection	N	N	N	Y	N	Y	Circuits concerned/Normal procedures ( <del>PIC, PCC, PNO</del> )
16	Water Cooled Cables repairs (UA63,UA43)	Y	N	N	Y	N	Y	Circuits concerned/Adapt procedures (cables IST + short circuit test on PCs)
17	Exchange of DC cables for circuits powered from UJ33 (RQT4/5.R3) 	Y	N	N	Y	W I C	Y	Circuits concerned/Normal procedures (+heat run)
18	Desintallation/reinstallation of ALICE correctors	Y	N	N	Y	W I C	Y	Circuits concerned/Full commissioning

# PIC / WIC



	Type of work / Type of sector	E L Q A	C R Y O	Q P S IST	P C IST	P I C IST	P T	Systems/PT Details
19	Modifications of the PIC (BIC interface modification - lab test)	N	N	N	N	N	Y	Circuits concerned/Normal procedures for PIC
20	Modification of the WIC (Fast Module activation)	N	N	N	N	W I C	Y	Circuits concerned/Normal procedures
21	Software interlock ACCESS-PIC	N	N	N	N	Y	N	PIC-SIS-ACCESS dedicated test

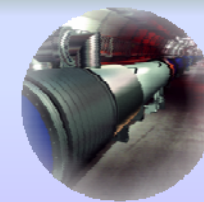
# CRYO



	Type of work / Type of sector	E L Q A	C R Y O	Q P S IST	P C IST	P I C IST	P T	Systems/PT Details
23	<b>Thermo switch<sup>a</sup></b> (thermo switches on top of leads to mitigate the risk associated with soft interlocks)	N	<b>N</b>	N	<b>Y</b>	<b>Y</b>	<b>N</b>	
24	Modification of the cryogenic link for 600A circuits powered from UJ33	<b>Y</b>	<b>Y</b>	N	N	N	<b>Y</b>	Circuits concerned/Normal procedures

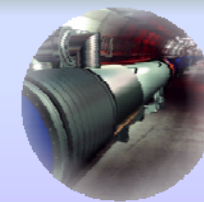
<sup>a</sup> Thermo switches will be installed everywhere but only connected for the high current circuits in s78 and sector 81 (other later, due to short time for cabling)

# CRYO



	Type of work / Type of sector	E L Q A	C R Y O	Q P S I S T	P C I S T	P I C I S T	P T	Systems/PT Details
25	Consolidations on Stand-alone, priority: MQY and MQM , the level gauges will be replaced to improve the control of the Helium level	N	Y	N	N	N	N	
26	Cryogenic cabling	N	Y	N	N	N	N	
27	Repair of Y Line, in sectors 12 and 34 (S78 & S81 if warms)	N	Y	N	N	N	N	
28	Installation of Cu strips + thermometers in ITL5 and IR (outside of the cold mass in the insulation vacuum)	N	Y	N	N	N	N	
29	Modification to DFBs	N	Y	N	N	N	N	<p>Install additional pressure switches for the dry air system</p> <p>Improve LHe level regulation for DFBAC LCM</p> <p>Improve the configuration of the safety valves discharge outlet</p> <p>Add heaters on top plates of DFBXs to avoid heavy condensation</p>

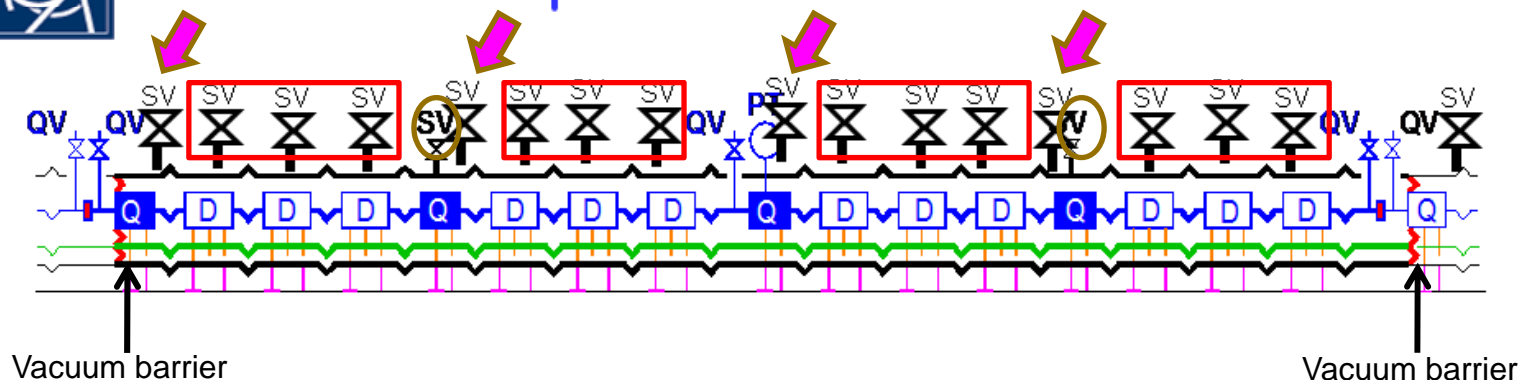




# New relief valve scheme



## New overpressure relief scheme



- Keep existing ② DN90 relief devices
- Mount relief springs on 4 DN100 blank flanges
- Add 12 DN200 new relief devices (1 per dipole)

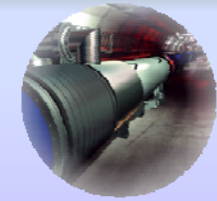
→ Cross section increase: **x 33**

Quench valves on cold mass circuit **QV** → **DN50**

Insulation vacuum pressure relief devices **SV** → **DN90**



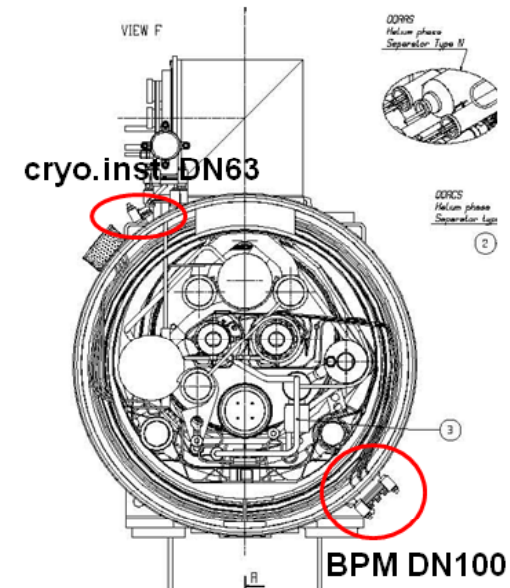
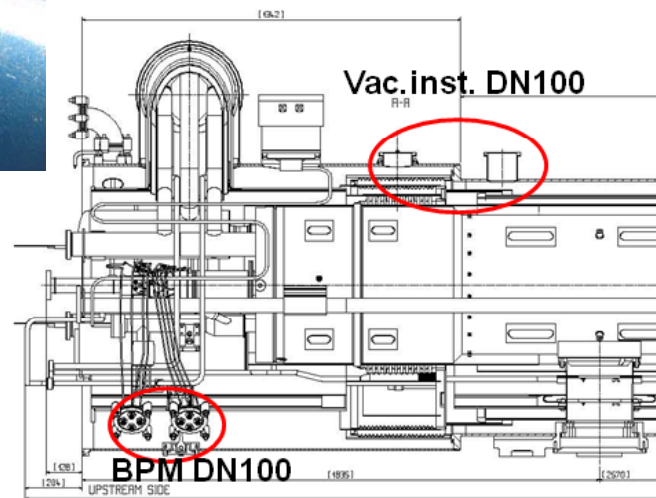
# Types of valves



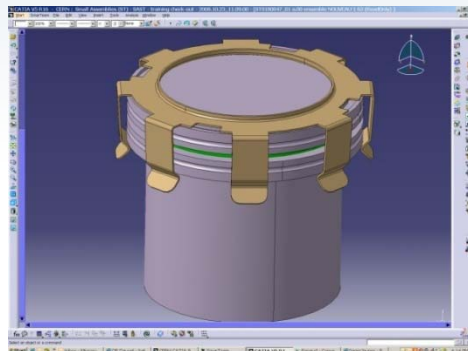
DN200



Existing ports: all on SSS



Replacing clamps with spring-loaded clamps



**Every SSS:** 5 ports

- 4 DN100 ports (2 for vac. equip., 2 for BPM cable feedthrough)
- 1 DN63 port (for cryogenic instrumentation feedthrough)

**Every standard vacuum sub-sector:** 4 SSS, i.e. 20 ports:

- 16 DN 100 ports
- 4 DN63 ports

# nQPS

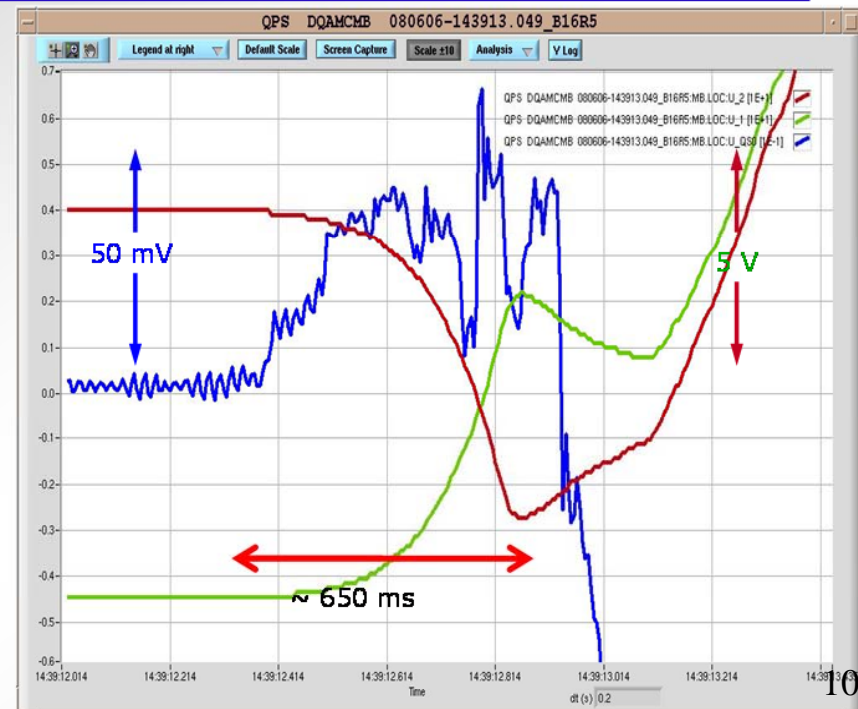


- Suspicious splice detection (UTH = 300  $\mu\text{V}$ , 10 s)
- Detection of symmetric quenches
- Voltage to earth detection



## Symmetric Heat-Induced Quench in B16.R5 at ~7.4 kA

> 50 MA<sup>2</sup> \* s



# Exchange of DC cables for circuits powered from UJ33 (RQT4/5.R3)



## Re-cabling of RQT4.R3 - RQT5.R3



The commissioning of the two magnets showed the impossibility to keep the nominal current in the circuits due to the increase of T of DC cables and magnets. This effect produces a significant variation of the resistance of the circuits with the consequence that the PC is not longer able to provide the nominal current

**Engineering Change Order  
EDMS n.938480**



$$R = \rho \frac{l}{A}$$

# Exchange of DC cables for circuits powered from UJ33 (RQT4/5.R3)



## Re-cabling of RQT4.R3 -RQT5.R3



**The solution proposed is to pull additional DC cables from the PC to the magnets in order to reduce the resistance of the circuits and limit the DC cables temperature**



**The present modification is not mandatory for the 5TeV LHC operation**

# Exchange of DC cables for circuits powered from UJ33 (RQT4/5.R3)



## Re-commissioning of RQT4 - RQT5



### Electrical Quality Assurance

to verify the integrity of the circuits

### Polarity Check

to verify the correct DC cabling

### 24h heat run

to validate the electrical circuits  
(ventilation and equipments have been  
already validated in the previous campaign)

