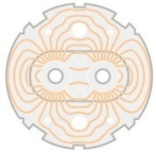


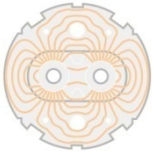
Safety Issues Related to Commissioning of the Powering System

Hugues Thiesen, TE-EPC

*Compilation of presentations given by
Anne Funken and **Valérie Montabonnet***



- Changes since the last powering tests in 2008
- Access in the tunnel during powering tests
- Electrical safety
- “*Chargé de travaux électriques*”
- UPS commissioning

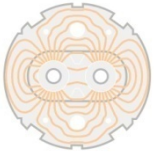


Changes since the last powering tests in 2008

- Access in the tunnel
 - Closed areas = no access
 - Restricted areas = access controlled by the CCC
 - General mode = access no controlled by the CCC

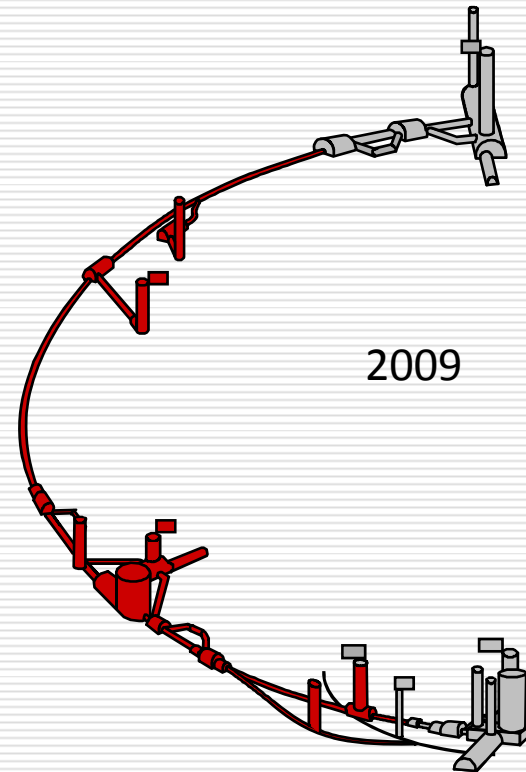
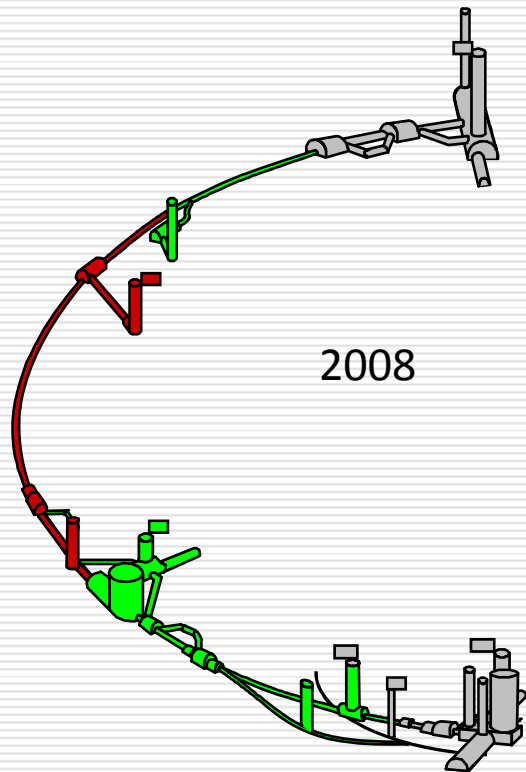
- Electrical safety
 - Electrical consignment before any work on or close electrical circuit
 - Electrical safety under the responsibility of the “*Chargé de travaux électriques*”

- Cryogenic safety
 - Cryogenic consignment before any work
 - Cryogenic safety under the responsibility of the “*Chargé de travaux cryo*”



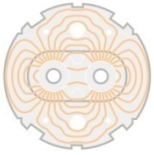
Changes since the last powering tests in 2008

□ Powering of sector 34



■ $I < 1\text{kA}$: Restricted mode
■ $I > 1\text{kA}$: Closed mode

■ $E < E_0$: Restricted mode
■ $E > E_0$: Closed mode

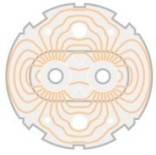


Access in the tunnel during HC period

- Access only in restricted mode
 - HC period = access in restricted mode or closed mode
 - Access only in restricted mode
 - Restricted mode # no current in the superconducting circuits and/or power converters “*consignés*”

- Intervention triggered by the CCC
 - ADI is not mandatory
 - Short duration intervention (1 or 2 hours max.)
 - Intervention realized by the HC team or Technical “*Piquet*” (CV, EL, etc...)

- Intervention triggered by the HC Coordination (planned)
 - ADI is mandatory
 - Intervention realized by team not directly involved in the HC activities



Access in the tunnel during HC period

□ ADI

What ?

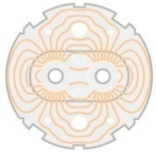
Who ?

Where ?

When ?

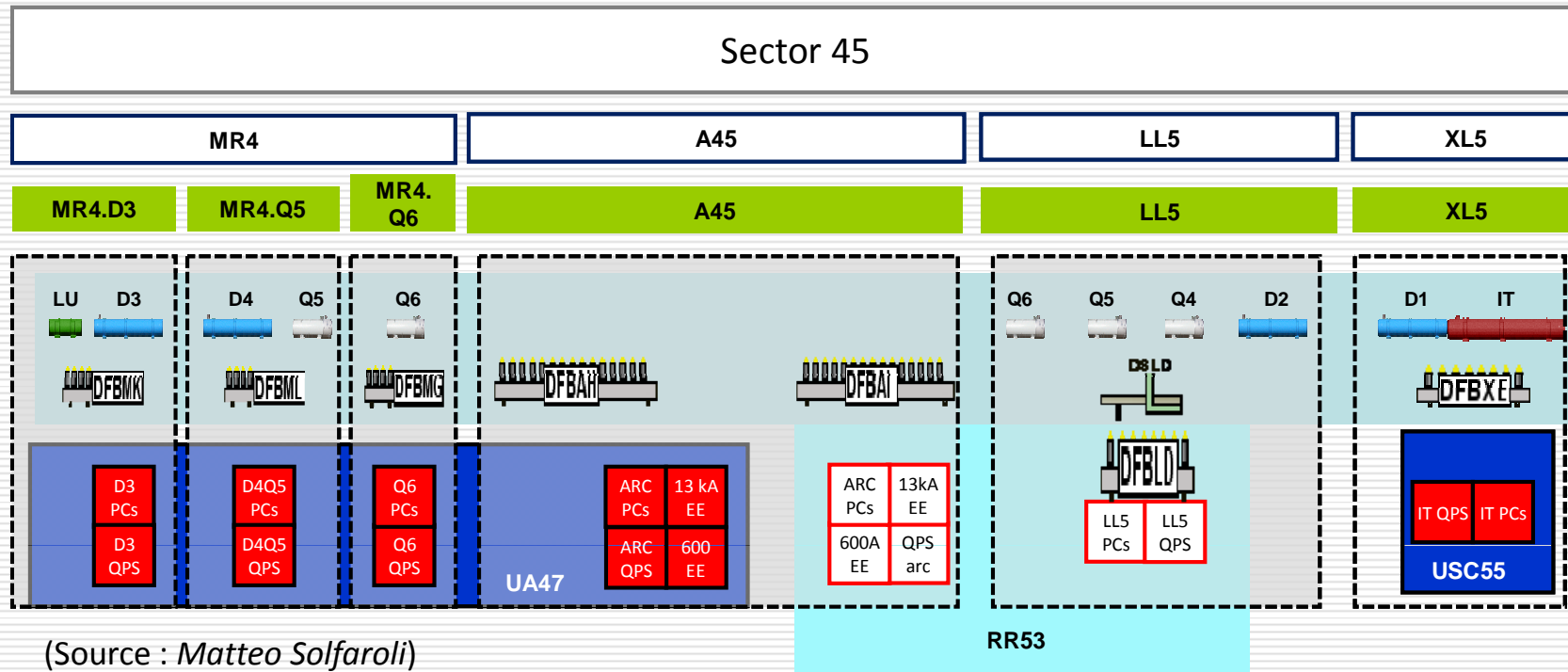
VIC ?

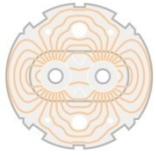
Etc...



□ Electrical safety subsector:

An Electrical Safety Subsector is a cryogenic section electrically isolated from the rest of the machine.

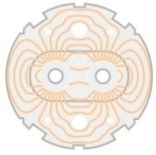




□ Electrical safety subsector

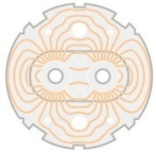
| | IT | Q4D2 or D3 | Q5* | Q6 | Q7-Q11 Arc | Q6 | Q5* | Q4D2 or D3 | IT |
|-------------------|-----|------------------|--------|--------|---------------|--------|--------|------------------|-----|
| Sector 1-2 | XR1 | LR1 | | | A12 | | ML2.Q5 | ML2.Q4 | XL2 |
| Sector 2-3 | XR2 | MR2.Q4 | MR2.Q5 | A23 | | A23.Q6 | - | - | - |
| Sector 3-4 | - | - | - | A34.Q6 | A34 | ML4.Q6 | ML4.Q5 | ML4.D3 | - |
| Sector 4-5 | - | MR4.D3 | MR4.Q5 | MR4.Q6 | A45 | LL5 | | | XL5 |
| Sector 5-6 | XR5 | LR5 | | | A56 | - | ML6.Q5 | ML6.Q4 | - |
| Sector 6-7 | - | MR6.Q4 | MR6.Q5 | - | A67 | A67.Q6 | - | - | - |
| Sector 7-8 | - | - | - | A78.Q6 | A78 | | ML8.Q5 | ML8.Q4 | XL8 |
| Sector 8-1 | XR8 | MR8.Q4 | MR8.Q5 | A81.Q6 | A81 | LL1 | | | XL1 |

* Q5D4 for the electrical safety subsectors ML4.Q5 and MR4.Q5

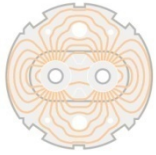


□ “*Consignation Electrique*”

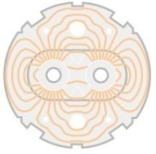
- The “*Consignation*” is mandatory before any work on or close to electrical circuit
- The list of the devices which must be “*consignés*” depends of the intervention (defined by the “*Chargé de travaux*”).
 - Intervention on main dipole IFS box
 - *RB circuit*
 - *RCO, RCS and RCD circuits*
 - *QHPS*
- “*Consignation*” in two steps
 - “*Chargé de consignation*” = Separation and Locked
 - “*Chargé de travaux*” = Identification, VAT and MALT-CC



- “*Vérification d’Absence de Courant*” (VAC)
 - For superconducting circuits, the risks are linked with the current in the circuit not only with the voltage across the circuit
 - Before any intervention on or close to superconducting circuit VAC must be done
 - The VAC must be requested at the same time that the “*Consignation*” of the power converter and the VAC is realized by TE-EPC team under the responsibility of the “*Chargé de travaux*”



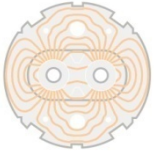
- Electrical Intervention under the responsibility of a “*Chargé de travaux*”
 - The “*Chargé de travaux*” has in charge the safety of the intervention
 - He must be “*habilité*” B2 or H2
 - He realized with the help of the “*Chargé de Consignation*” the “*Consignations*” of the circuits
 - He give an “*Autorisation de Travail*” to the workers
 - After the intervention, he realized the “*Déconsignation*” of the circuits with the help of the “*Chargé de Consignation*”



"Chargé de travaux"

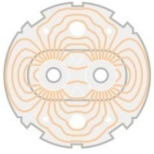
- First case: Electrical Intervention
 - For all electrical interventions, the *"Chargé de Travaux"* is a member of the team in charge of the intervention

- Example of electrical Intervention
 - Intervention inside 13kA-EE cabinet



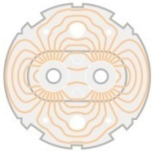
- Second case: Non electrical intervention on or close superconducting circuits
 - For all non electrical interventions on or close to superconducting circuit, the *"Chargé de Travaux"* is a member of the HCC team
 - Non electrical intervention = mainly intervention on the DC cables

- Example of non electrical Intervention
 - Connexions of the DC cables to the current leads



□ *“Chargé de travaux HCC”*

- Available only during the working hours and only the morning or the afternoon (Intervention must be planned).
- Available only during the powering tests (not during or after cold check out)
- The *“Chargé de travaux HCC”* is only responsible of the electrical safety



Safety Documentation

Hardware Commissioning - Windows Internet Explorer provided by CERN

http://hcc.web.cern.ch/hcc/

Hardware Commissioning

hardware commissioning coordination

- INTRO
- NONCONFORMITIES
- SAFETY**
- LHC BEAM
- ACCESS
- TEAM
- MEETINGS & SCHEDULES
- CONTACTS
- THE FIELD

- MAIN PAGE
- ARCHIVE
- WORKSHOPS**
- MEETINGS
- MTF
- DOCUMENTS
- ELOGBOOK
- WORKING GROUPS
- POWERING PROCEDURES
- CERN
- LHC
- TIMBER
- METER
- EDMS
- CDD
- LAYOUT DATABASE
- ELECTRICAL CIRCUITS

SUBSECTORS

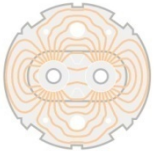
- DOCUMENTATION**
- PRESENTATIONS
- CONSIGNATION

"Following the incident in Sector 34; when these are complete, the commissioning of the remaining few circuits has been interrupted. Investigations are ongoing to better understand the incident in Sector 34; when these are complete, the sector will be brought into shut down mode. Maintenance work of the infrastructure systems is planned with the consolidation of LHC systems, the installation of remaining collimators and, their work needed in Sector 34."

LHC re-start scheduled for 2009

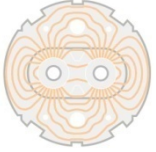
Geneva, 23 September 2008. Investigations at CERN following a large helium leak into sector 3-4 of the Large Hadron Collider (LHC) tunnel have indicated that the most likely cause of the incident was a faulty electrical connection between two of the accelerator's magnets. Before a full understanding of the incident can be established, however, the sector has to be brought to room temperature and the magnets involved opened up for inspection. This will take three to four weeks. Full details of this investigation will be made available once it is complete.

Documentation concerning the safety during powering tests
<http://hcc.web.cern.ch/hcc/>



- UPS system commissioning (UPS + Load)
 - Several NC have been found during the shut down with the AUG tests (e.g. MQ QD in cell 15R5 not on UPS)
 - Important modifications of the UPS systems during the shut down
 - Split the “Double UPS” in two “Single UPS”
 - New F4 network
 - Serialization of the PIC signals
 - UPS have never been tested in operation configuration

- “AUG tests” before powering
 - AUG tests before powering are the best tests to identify the potential issues, but important constraints to cryogenic systems.
 - How to realize “AUG tests” without disturb cryogenic systems ?



END