

# Machine Protection WG

## Strategy for Hardware Commissioning: organization of the work

Félix Rodríguez Mateos, TS-HDO

# Outline

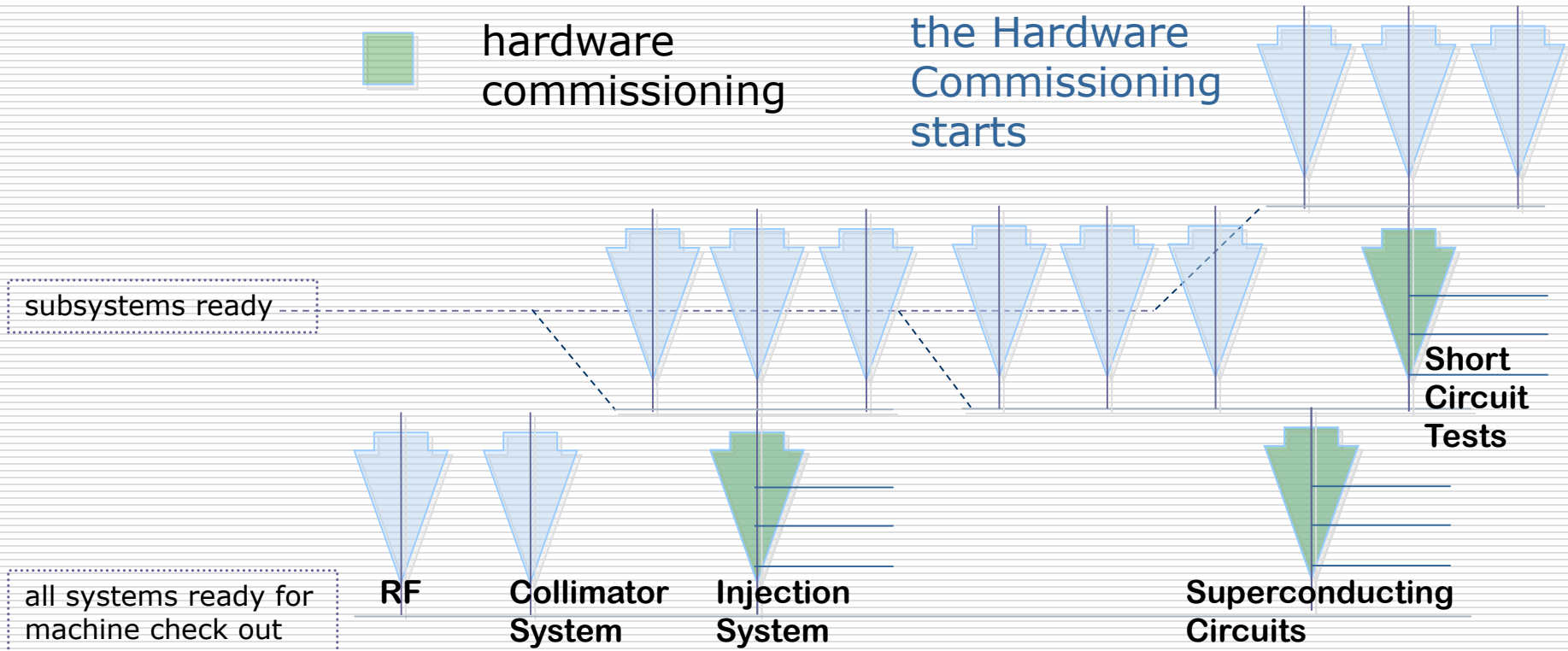
---

- HC: the organization of the work
- Document plan: EDMS and MTF as tools
- MTF for Hardware Commissioning
- E-logbook

# the logic

- individual system tests
- hardware commissioning

we assume everything is installed before the Hardware Commissioning starts




two types of documents :

***as designed***  
***as tested***

- impact on equipment safety
- impact on equipment/system performance
- impact on machine performance



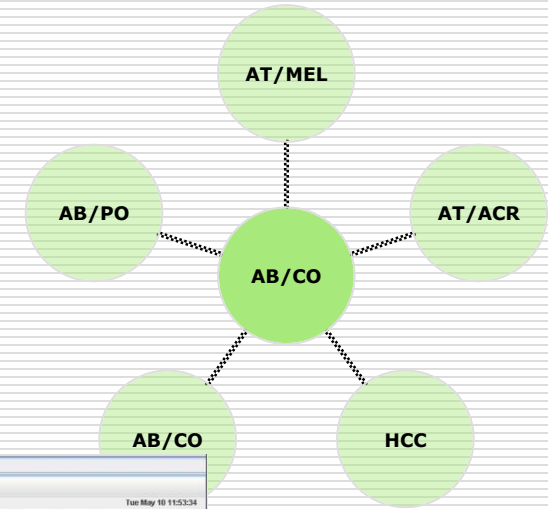
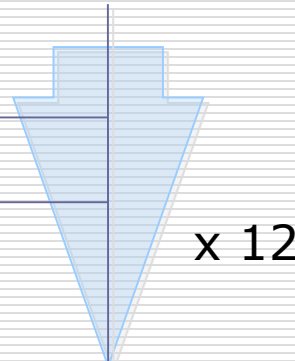
# preparation : software

 **sacec** : software applications for the commissioning of the electrical circuits


- QPS
- Power Converters
- Powering Interlock

procedures

commissioning scenario



CERN  
CH-1211 Geneva 23  
Switzerland

 the Large Hadron Collider project

LHC Project Document No.  
**LHC-D-HCP-0005 rev.03**

CERN File Naming Convention Document No.  
**AB/CO, AT/MEL, TS/HDD**

EDIP Document No.  
**571449**

Date: 2005-04-13

**Functional Specification**

**PROCEDURES FOR THE SHORT CIRCUIT TESTS OF POWER CONVERTERS AND AUTOMATED COMMISSIONING OF INTERLOCKS FOR ELECTRICAL CIRCUITS OF THE LHC**

**Abstract**  
This document describes the sequence of interactions between the application software and the equipment (QC, QPS, Power Converters, etc.) during the tests for the commissioning of power converters in short circuit and the tests of the interlock system for the superconducting electrical circuits as described in the engineering specifications LHC-R-HCP-0001 and LHC-D-HCP-0002. The general frame of the commissioning procedures is hereby given in the document LHC-D-HCP-0003.

After a description and the specification of the primitives to access data and give commands to the hardware for each component, the document lists the sequence that must be executed by the software for each step of the tests to drive the hardware through the test procedures.

Prepared by :	Checked by :	Approved by :
SACEC Francis Chevrier Reiner Denz Herve Milcent Stephen Page Bruno Puccio Hugues Thiesen Markus Zorlaut	Franck Di Maio Eugenia Hatziangeli Quentin King Mike Lamont Kris Kostro Robin Lauckner Felix Rodriguez-Mateos	Frederick Bordry Bertrand Frammery Karl Hubert Hess Roberto Saban Rudiger Schmidt

PC Short Circuit  
Circuit Interlock

Test Monitoring

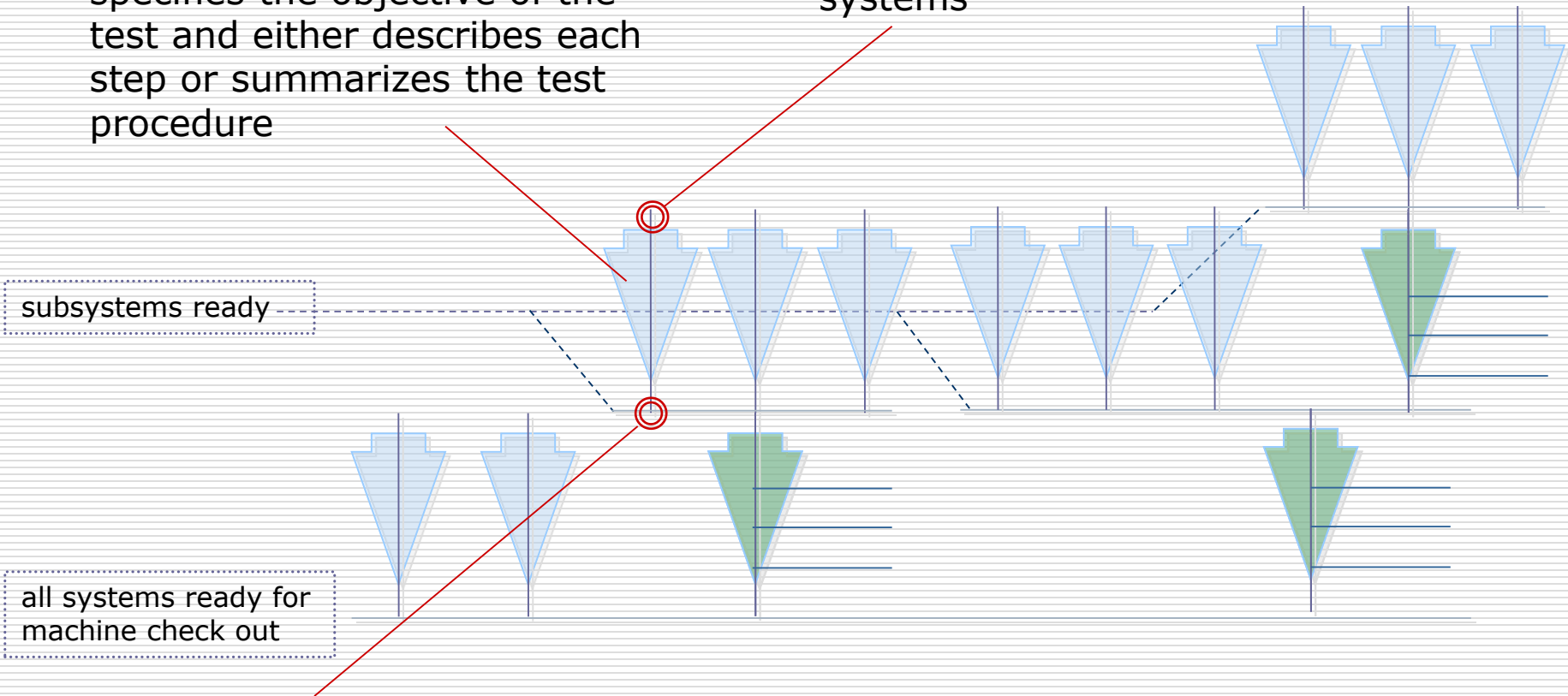
11:53:34 248kVdcTest starting  
11:53:38 setting State PC to OFF  
11:53:39 FQC\_FAULTS has not contain NO\_PC\_FPERMIT  
11:53:39 waiting for PC to go to OFF  
11:53:40 State PC OFF  
11:53:40 setting State PC to ON\_STANDBY  
11:53:40 FQC\_FAULTS has not contain NO\_PC\_FPERMIT  
11:53:40 waiting for PC to go to ON\_STANDBY  
11:53:40 State PC ON\_STANDBY  
11:53:45 setting State PC to IDLE  
11:53:45 FQC\_FAULTS has not contain NO\_PC\_FPERMIT  
11:53:45 waiting for PC to go to IDLE  
11:53:46 State PC IDLE  
11:53:47 ramping from 0 to 10 amp  
11:53:47 Message sent to console: 248kVdcTest FQC\_2 - Start sampling  
11:53:47 waiting for PC to go to IDLE  
11:54:23 State PC IDLE  
11:54:23 Message sent to console: 248kVdcTest FQC\_2 - Stop sampling  
11:55:03 setting State PC to ON\_STANDBY  
11:55:03 FQC\_FAULTS has not contain NO\_PC\_FPERMIT  
11:55:03 waiting for PC to go to ON\_STANDBY  
11:55:28 State PC ON\_STANDBY  
11:55:28 setting State PC to OFF  
11:55:28 FQC\_FAULTS has not contain NO\_PC\_FPERMIT  
11:55:28 waiting for PC to go to OFF  
11:55:34 State PC OFF  
11:55:34 248kVdcTest stopped

Reference Voltage: 0.0 V Current: 0.0015053554 A  
Measure Voltage: xxxxx V FQC\_FAULTS:  
PC Status: OFF PC Status:  
Water Temperature: xxx C QPS Status:

# the *as designed* documentation

specifies the objective of the test and either describes each step or summarizes the test procedure

defines the pre-requisites to start the tests in terms of conditions and availability of systems



subsystems ready

all systems ready for machine check out

describes in what conditions the system should be delivered to the next step

# Outline

---

- HC: the organization of the work
- Document plan: EDMS and MTF as tools
- MTF for Hardware Commissioning
- E-logbook

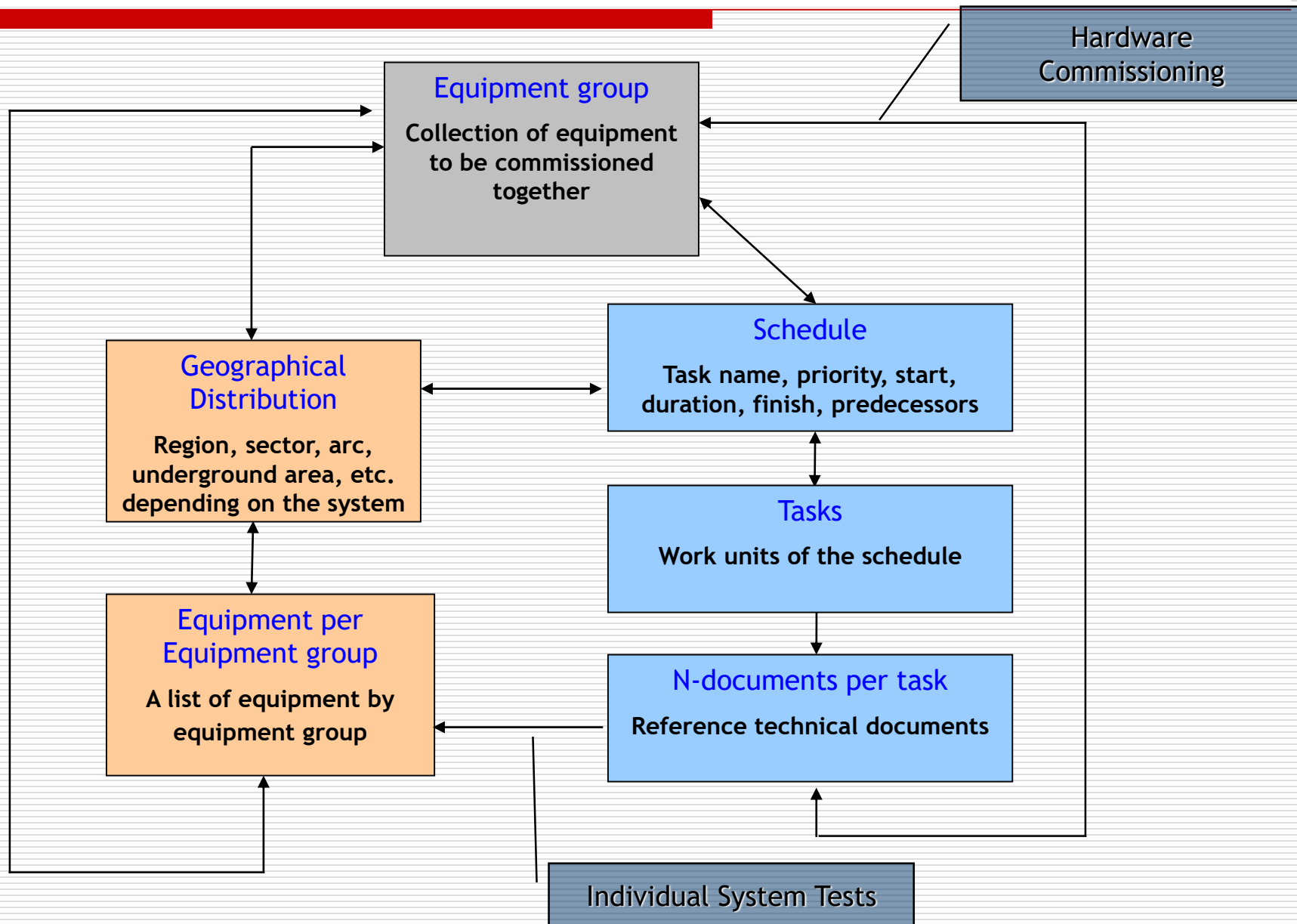
# Objectives

---

- ❑ Organize and have available the **logical distribution** of machine components
- ❑ Archive the technical **documents** (schedules, procedures, sequences, safety rules)
- ❑ Give **process tracking** capabilities
- ❑ Perform the surveillance of **quality assurance**
  
- ❑ The document plan will:
  - allow to follow up and evaluate the **timing** of the commissioning phases
  - be a key tool to **take decisions** during the commissioning



# Document plan: the architecture (a diagram of relations)



# How we did it

---

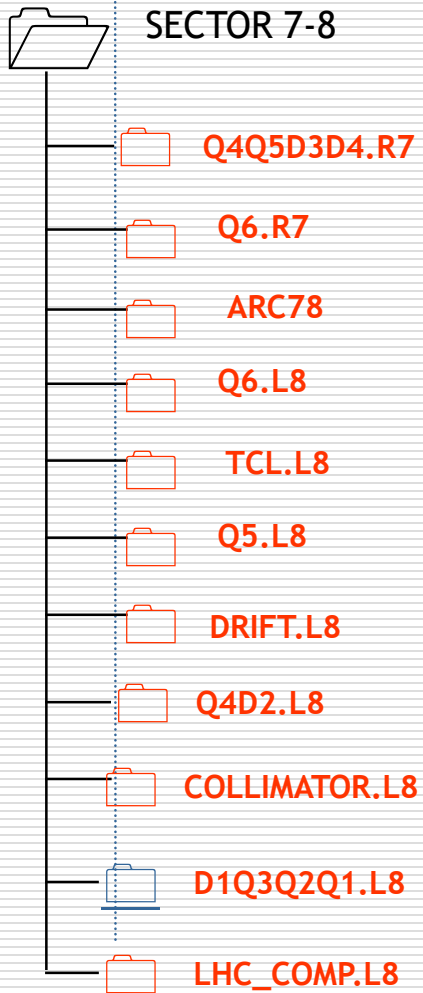
- Define the groups of equipment via the commissioning procedures → Equipment owners and HCWG
  
- Create a structure containing the machine equipment distributed both **geographically** and **functionally** → EDMS
  
- Structured Documentation → EDMS / MTF
  
- Quality Assurance Program per equipment (IST) and equipment group (HC) → Procedures, MTF
  
- Scheduling → Standard Tool  
Link from/to MTF

# Logical distribution of the machine equipment

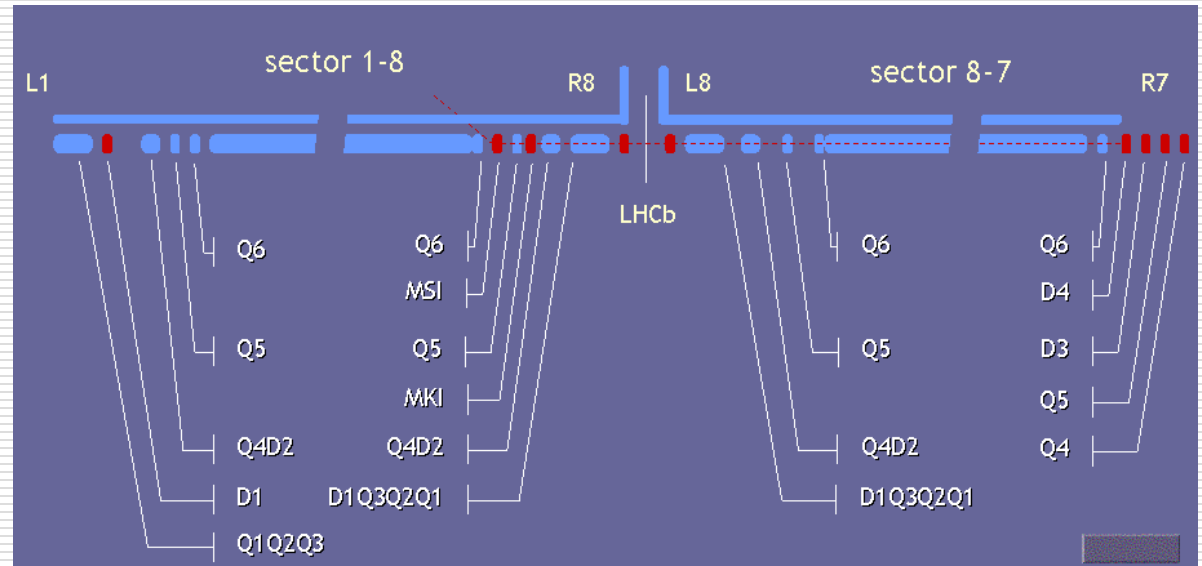
## Geographically

Sector

Region

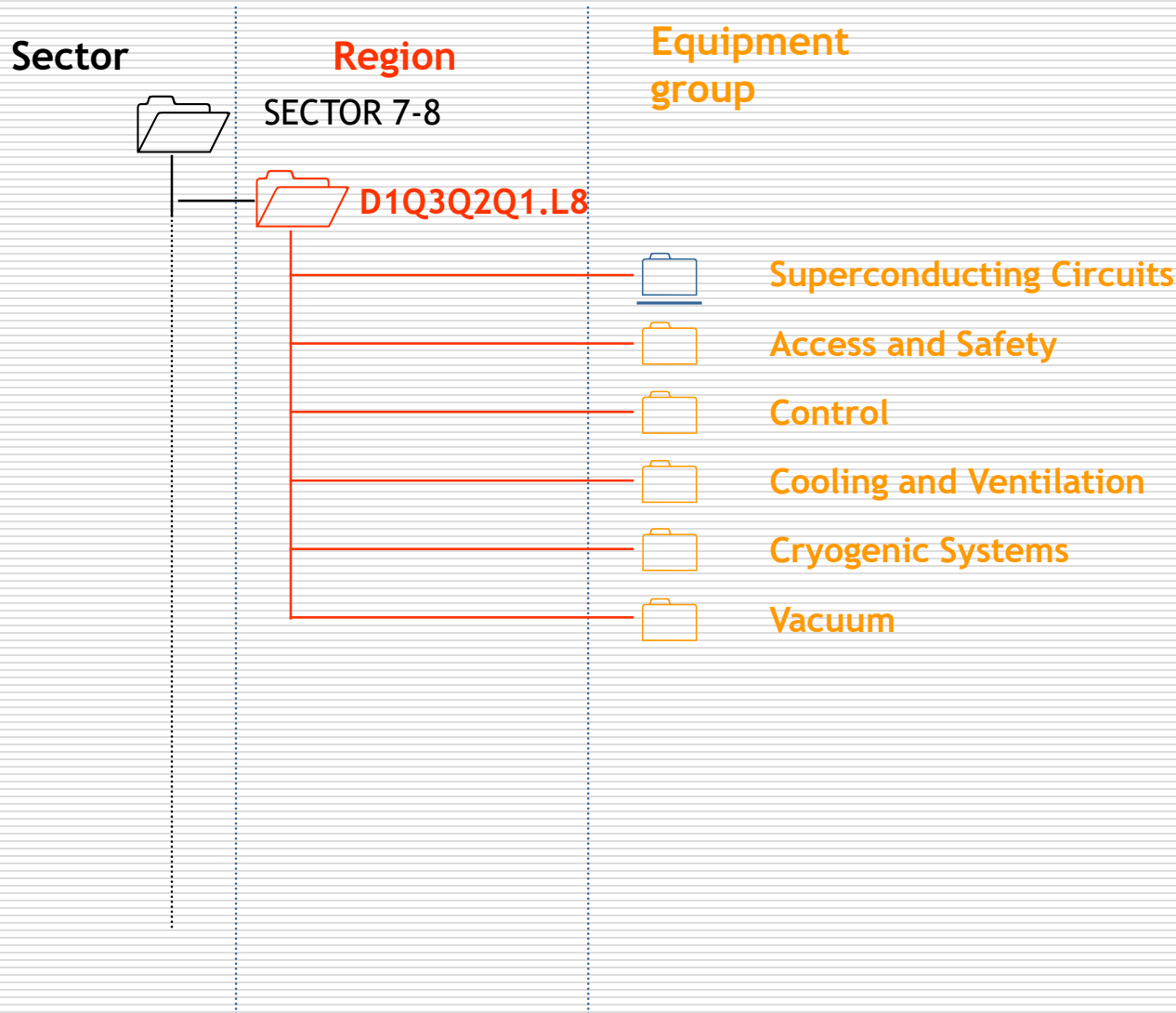


- The regions are delimited by the beam vacuum valves



# Logical distribution of the machine equipment

## Functionally

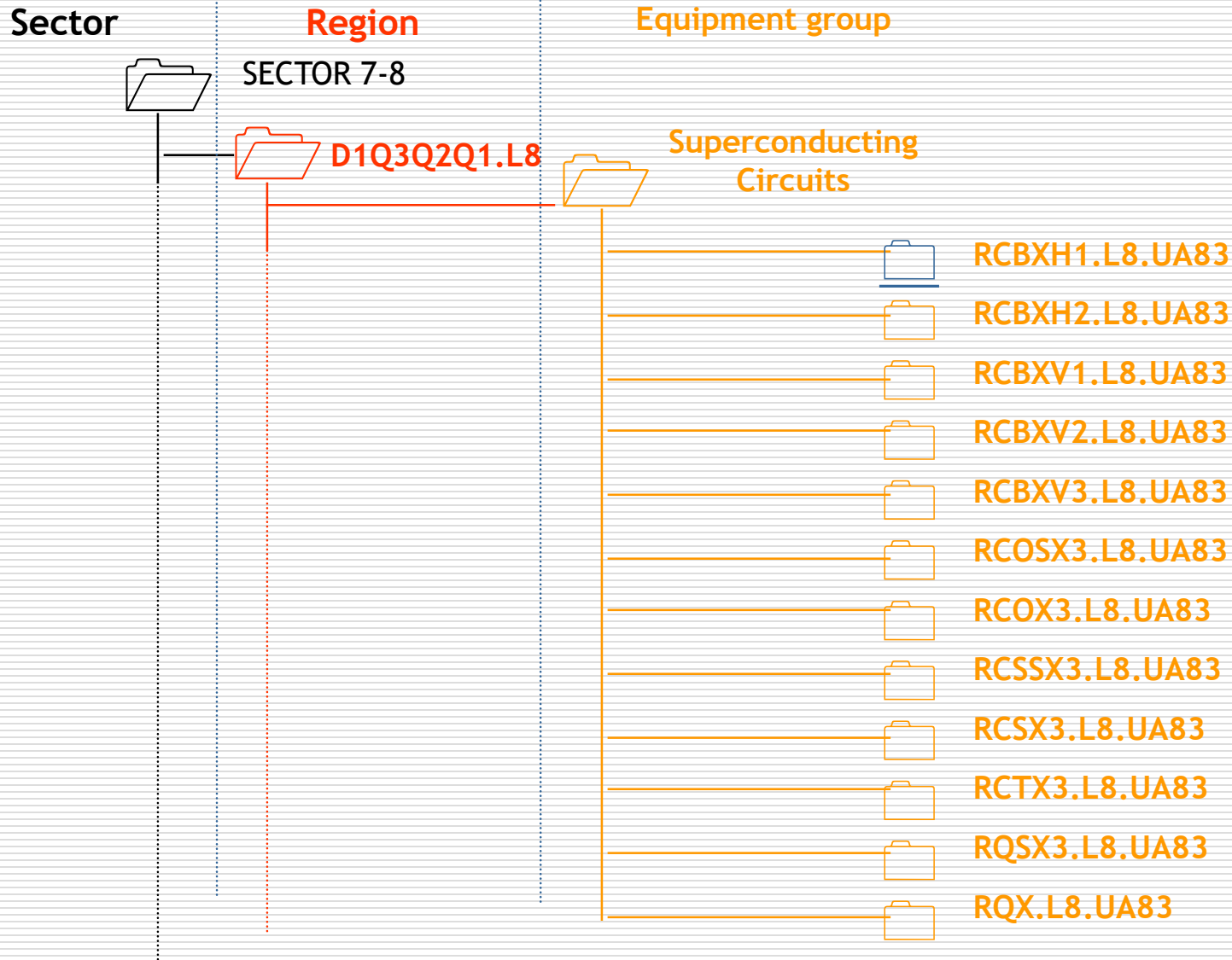


The commissioning of the equipment groups implies parallel commissioning of several “systems”

This is the part which refers to **Hardware Commissioning** activities

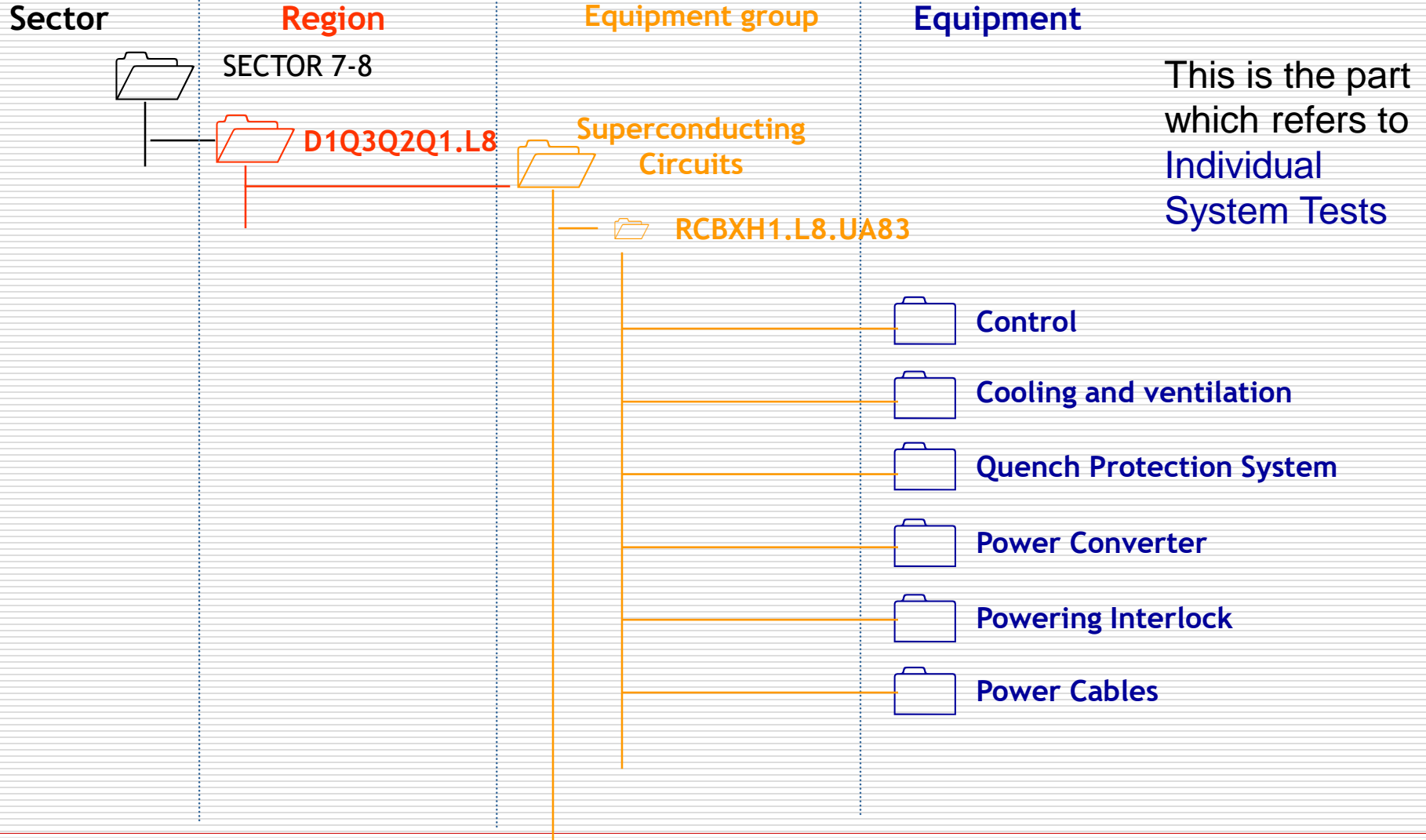
# Logical distribution of the machine equipment

## Functionally

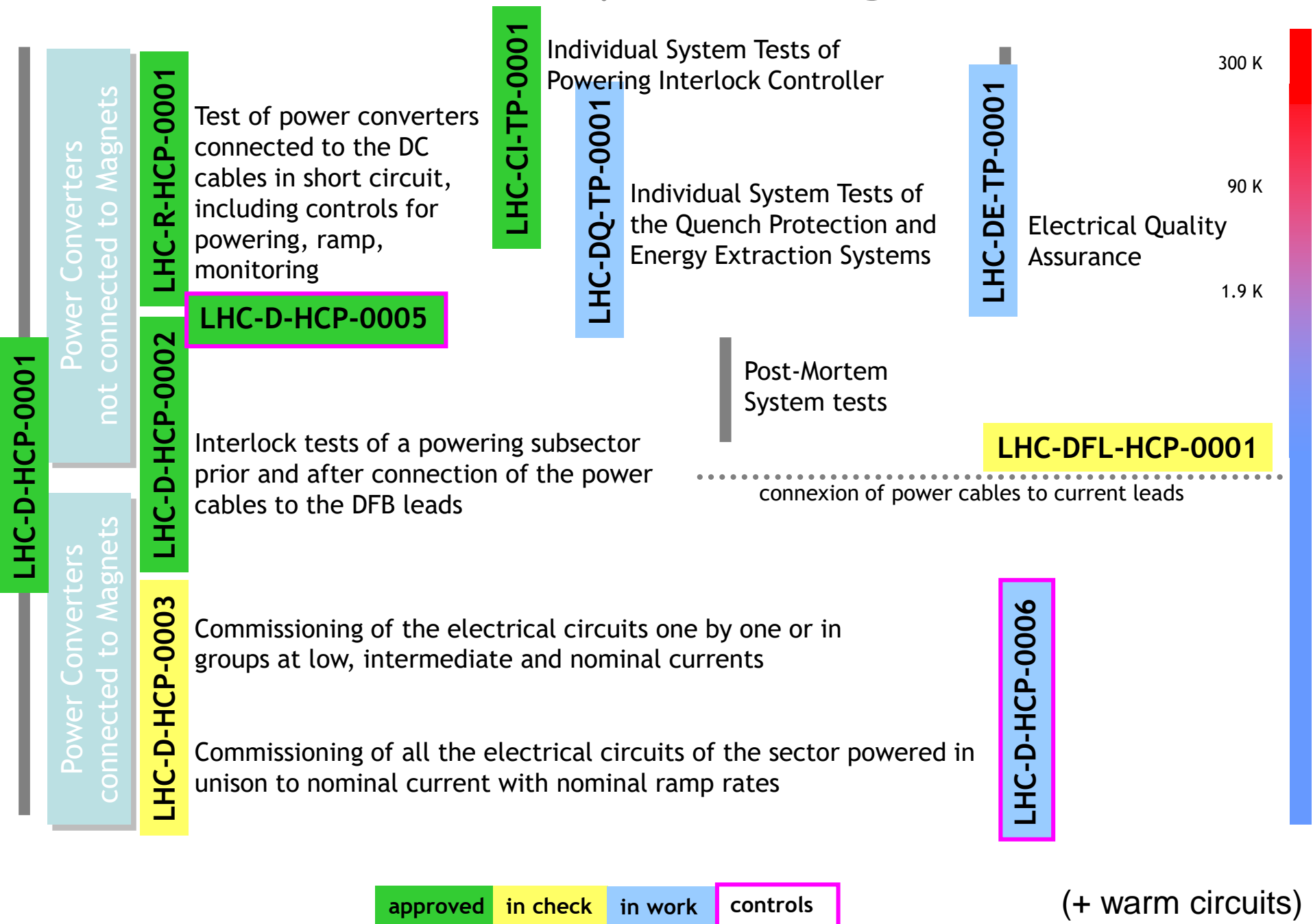


# Logical distribution of the machine equipment

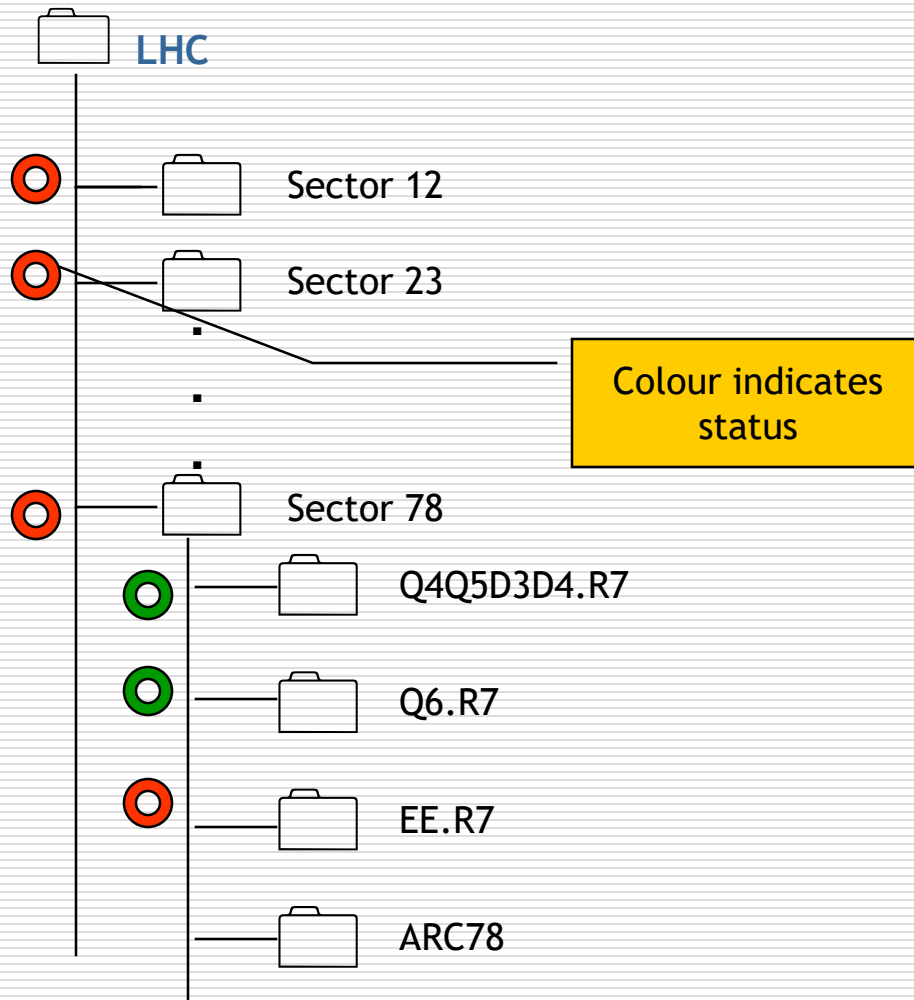
## Functionally



# documentation: superconducting electrical circuits



# Process tracking capabilities



- The commissioning of one equipment group cannot start if all the IST of the corresponding equipment have not finished
- The commissioning of one region will not finish till all the equipment groups have been commissioned
- The commissioning of a sector will not be considered as finished until all the regions have been commissioned



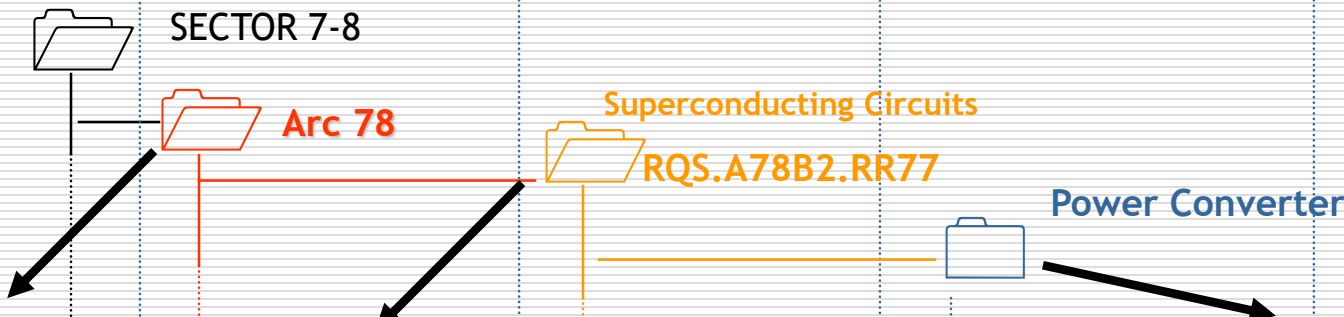
# Outline

---

- HC: the organization of the work
- Document plan: EDMS and MTF as tools
- MTF for Hardware Commissioning
- E-logbook

# HC MTF: 3 levels of stored information

Sector      Region      Equipment group      Equipment      Components



The screenshot displays the MTF Equipment Management Folder interface. The top navigation bar includes 'Home', 'Help', 'EDMS site', 'News', and 'Logi'. The user is identified as 'User: EBARBERO'. The main content area is titled 'Slot Folder: Main Info' and displays the following information:

- Slot Identifier: RQS.A78B2.R
- Description: Power Converter R for Hardware Commissioning

The interface also shows a navigation tree on the left side, with the following structure:

- Sector 78
  - Q4Q5D3D4.R7
  - Q6.R7
  - EE.R7
  - A78.LB
    - Orbit Correctors
    - Superconducting Circuits
      - DFBAN.7R7
      - RQS.A78B2.RR77 (highlighted)
      - RSS.A78B1.RR77
      - RSS.A78B2.RR77
      - RQTL9.R7B2.RR77
      - RQTL9.R7B1.RR77
      - RQT13.R7B1.RR77
      - RQT12.R7B1.RR77
      - RQT12.R7B2.RR77
      - RQT13.R7B2.RR77
      - RQTL10.R7B2.RR77
      - RQTL8.R7B2.RR77
      - RQTL8.R7B1.RR77
      - RQTL7.R7B2.RR77
      - RQTL7.R7B1.RR77
      - RQTL11.R7B2.RR77
  - TCL.7LB
  - Q6.LB
  - TCL.6LB
  - Q5.LB
  - DRIFT.LB
  - Q4D2.LB
  - TC.4LB
  - D1Q3Q2Q1.LB
  - LHC\_COMP.LB

The main information panel also includes a table of slot main data:

Slot main data	
Type	RR00
Status	Manufacturing
Other Identifier	
Parent slot	
Location	

Below the table, there are sections for 'Installation data' (Item, Equipment) and 'Comments'.

# Definition of the parameters to be stored in the HC MTF at the equipment level (IST)

- Main Parameters

Parameters that are useful to the owner of the equipment or to other users (extraction from existing data)

The owner of the equipment has the responsibility to provide this information (file, link...)

- IST :

Individual System Tests	Status	Not started
		In Progress
		Done OK
	Non conformities	Boolean
	Operator	Name
	Date	Date

Information is provided by the owner of the equipment by sector, subsector, circuit,...

- Documents:

Documents to be used as references for tests

# Definition of the parameters to be stored in the HC MTF at the level of equipment group (HC)

---

- Main Parameters :

Parameters useful during commissioning of the equipment or further during machine operation

Schedule

To be provided by the equipment owners and the HC team

- HC Steps:

Detailed steps with parameters associated to each step including results, date, responsible, status...

- Documents:

Documents to be used as references for tests and definitions

**HC team has the responsibility to introduce data into the HC MTFs**

# Definition of the parameters to be stored in the HC MTF

## □ Equipment groups

- Superconducting circuits
- Warm magnet circuits



**Already started ...**

- Vacuum
- Cryogenics
- RF
- Dump/Injection
- Control
- Access and Safety
- AC Distribution
- Cooling and ventilation
- BIS



**Have to start very soon**

# Outline

---

- HC: the organization of the work
- Document plan: EDMS and MTF as tools
- MTF for Hardware Commissioning
- E-logbook

# Objectives

---

- ❑ Keep track of the HC activities
- ❑ Collect comments on these activities
- ❑ Ensure confidentiality
- ❑ Define grants on Logbook Operations
- ❑ Easy to organize
- ❑ Friendly “natural” interface
- ❑ Easy to search
  - By any field and by using keywords
- ❑ Improved layout for printing
- ❑ Reach a logbook entry or a comment from an URL
- ❑ Keep people notified about the changes: mailing

The technical specification of the requirements  
system code discussion