

# Session 4 Powering Tests

MP3 Review

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# Outline

- Perception & Topical discussions
  - Communication
  - Documentation
  - Organization
  - Post Mortem/Analysis

# “Disclaimer”

The Powering Tests after LS1 (and the role of MP3 within) have to be regarded as a **great success**, as despite very tight time constraints, additional test campaigns etc., the task has been completed timely and without damage to the superconducting circuits (this is not trivial and a major achievement by all involved ...)

WHAT FOLLOWS IS THE “**BUT**” . . .

## Organization

Defined who does what  
and when

## PM/Analysis

Should be clear and  
consistent

## Optimal Powering tests

## Communication

Efficient information flow  
between OP/HCC, MP3 &  
equipment owners

## Documentation

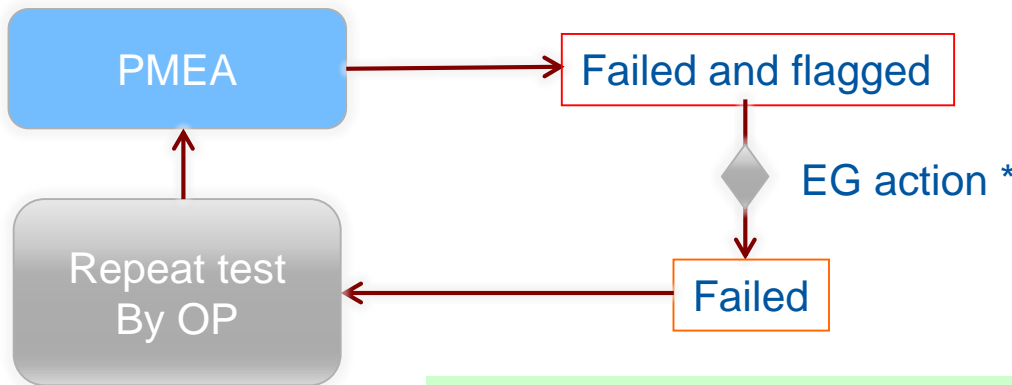
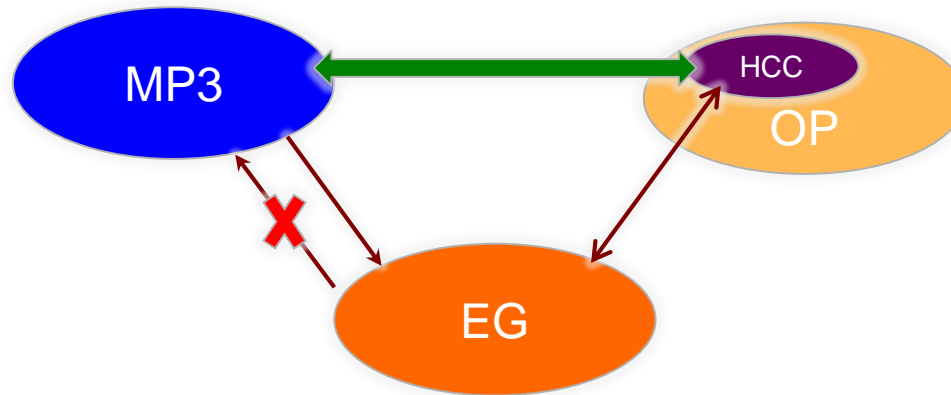
Should be available, clear  
and intuitive

# Communication

- MP3 presence in CCC has been considered positive and facilitates communication (op)
- Information from MP3 meetings did not pass easily through to HCC unless the latter were attending (op)
- The double communication between MP3 – Equipment Groups and MP3 – OP should be better balanced (op)
- The way problems have been brought up and discussed in the 8h30 meetings was not always very useful (qps)
- Issues should be tracked by an issue tracker (e.g.. JIRA) to avoid unnecessary and complex communication (qps)
  - JIRA was used successfully by MPE-COMS for several years in run 1
- When both EE and MP3 teams were present in the CCC no problem but especially the non-conformity information flow should improve, probably with help of a software platform (JIRA, ACCTEST..) (ee)
- Communication with Equipment experts was often difficult and inefficient (mp3)

# Communication (op)

- Members of EG belonging to MP3 should not do coordination within MP3 but together with OP (op)



M&M propose to improve PMEAs to manage open issues and repeat tests once cleared the flags by the EG engineers

\* N.B. OP should not intervene at the level of "failed & flagged" lists, only experts from EG

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# Documentation/Procedures

- Recommendations by MP3 should be more “formal” to OP/HCC (op)
- Procedures give scope envelopes. Any aspect that changes and goes outside of the envelope or implies major changes to planning should go to LMC (op)
- QD thresholds must be recorded in a reference file (op)
  - Any change to them should be subject to ECR and then approved by LMC
- Coherence with respect to repeated test steps after repairs, TS, YETS , LS, etc. is not yet there, efforts required (op)
- Towards the end of HWC analysis handbooks, firmware, controls and test strategies had been adapted to system specifics (qps)
- Converter performance and circuit performance ? (epc)
  - Only protection issues are verified from low to high current
- Prepare the procedures well in advance (epc)
- Tracking of non-conformities ? (epc)
- Update of layout database before powering tests start (epc)
- EE Procedures and test criteria were not clear and not ready so could not be communicated to MP3 (ee)
- QPS documentation with details was sometimes missing (mp3)
- In some cases, equipment owners had problems to clearly define their criteria for passing/failing tests (mp3)
- A lot of tests had to be repeated causing unnecessary heater firing (mp3)



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# Organization (1)

- Commissioning strategy changed from permanent internal expert presence in CCC to analysis by MP3 (external) (qps)
  - Took a while to adapt all involved persons to the new scheme (qps)
- There seems to be a certain lack of awareness that the resources of the equipment teams are very tight, especially during the final phase of hardware commissioning and not all issues can be fixed immediately (qps)
- There is also a meanwhile “traditional” conflict concerning the implication of the QPS project engineer(s) into MP3, which should be resolved for future campaigns (qps)
- Converters are also interlocking other parts of the circuit as current leads (thermal interlocks), water-cooled cables, earth current ...
  - Responsibilities for tests of these parts not identified and not documented: are they under BE-OP / MP3? (epc)
- Tests for the warm part: who is responsible? (epc)
- Tests for the **warm magnets** under MP3 responsibility or MSC responsibility? (epc)
- Safety organization: is it under BE-OP responsibility ? (epc)
- Electrical Safety : who is doing the yellow paper ? and the second step of “consignation” ? (epc)

# Organization (2)

- **Clarify the responsibility between BE-OP and MP3** on Powering Tests (epc)
- Automatic Analysis tool to be developed. Who is in charge of this ? (epc)
- Sequencer software to be developed. Who is in charge of this ? (epc)
- Organization of the Powering Tests should also be reviewed (e.g. condemnation of PC) (epc)
- Responsibility share between EE and MP3 were not so clear in the beginning, gradually improved during the HWC period (ee)
- It would be useful to have an EE specialist (Bozhidar, Alexandre, Knud, Gert) in the MP3 Team (ee)
- The special PLI3 and PNO test are performed within a reduced time window and with limited number of specialists. Next time it would be useful to upgrade the measurement system so it can be run from the sequencer and create a post mortem file. This will limit the need for specialists to NCs (ee)
- There should be a clear definition about the tasks during LSs and these should be frozen, at least, 1 year before the start of the LS in order to prepare properly all tasks, including Powering. (ee)

# Organization (3)

- QPS IST was not fully complete (some steps required powering) (mp3)
- QPS debugging took place during powering tests (mp3)
- Responsibilities had been sometimes unclear e.g.. EP vs EE section (mp3)
- EE signatures not clear in the beginning (mp3)
- Are we sure everyone was following the same schedule? Were priorities the same for everyone? Two examples: (mpe-c)
  - 600A EE testing: as late as possible for the Team responsible, different in schedules
  - QPS Team wanted to work per circuit type, the schedule was done per sector
  - Activities were often driven by availability of circuits/experts and not planning

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# Post Mortem/analysis (1)

- Relevance of proper PM was underestimated (qps)
- PM files were corrupted (various reasons) (mp3)
- Analysis Handbook was not ready before start of the tests. (mp3)
- PM files lacked timing integrity (e.g.. Quench detector vs. heater discharge) (mp3)
- Polarities of QPS signals opposite to power converters (mp3)
- 60-120A are difficult to analyse if automatic analysis fails (mp3)
- Automatic analysis for EE failed too often due to strict limits and timing issues. (mp3)

# Post Mortem/analysis (2)

- Toggling board A and B should be replaced by two different signals. PM names with 1 ms difference is not logical (mp3)
- Timing issues (wrong timing / misalignment of simultaneous signals) (mp3)
- Incoherence of signal naming w.r.t. databases (mp3)
- Many signals have saturated spikes (mp3)
- nQPS signals and crate names are not clear (mp3)
- A lot of tests failed and had to be repeated 14000 mp3 signatures on 10000 test steps (40% failed) (op)

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# Technical aspects (1)

- Post Mortem data
  - Pre-processor (filter/conversion) for QPS data before sending to PM?  
Processing capabilities in the tunnel are very low (8-bit uC)
  - Parallel quenching of circuits (standard for coupled circuits such as RCBXH/V and RCD-RCO) in the same crate only give one PM file (treated by the same controller)
  - QPS parameters should be read back and checked
- Lost commands and other Field bus issues
  - E.g. reset for 600A QD systems
  - Erratic behavior of controls system (lost commands, reversed order etc.)
- Firmware upgrades
  - Data blocks missing in 600A
  - Heater firing during QPS settings
  - IPQs (sampling frequency, compensation, inversion B1 and B2)
  - nQPS

# Technical aspects (2)

- Inductance compensation on IPQ and 600A – MP3 was called to help
- Cabling issues (all circuits)
- QPS Expert applications, and macro capabilities
- Controls middle layer CMW
- Software tools for effective commissioning inexistent in the beginning
- PM browser incompatible with new PM files
- Lost signatures between PMEA and ACC testing
- Limitations given by crate controllers/field bus (e.g.. 1 controller for several circuits)
- 600A EE measurement campaigns imposed big logistics effort

