MPE activities within MP3

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The questions:

1. **Define the scope of work for your activity**
2. **Structure of the scope of work (flow charts are very helpful)**
3. **Was it properly planned, how much in advance?**
4. **Initial schedule and actual schedule (the realised one)**
5. **How many resources were used? How many resources would have been needed?**
6. **Give three examples of aspects which worked well**
7. **Give three examples of aspects which went wrong and gave difficulties**
8. **What needs to be improved?**
9. **What needs to be changed?**
10. **What will be done in the same way next time?**

Answers on the above questions are mainly based on the MP3 review that took place on 28 April 2015 (see Indico 384361 for the presentations and EDMS 1513925 for the executive summary).

1. Define the scope of work of the MP3

- **Identify, track and document all important issues and non-conformities related to the SC magnets system. Set-up of a database for the management of exceptions related to the magnet circuits.**
- Solve or mitigate all pending issues related to the magnet circuits.
- If needed, open and close non-conformities.
- **If needed, give recommendations for future operation, or for additional testing (in the machine and/or in SM18).**
- Report to TE-TM and LS1 Coordination Committee on electrical performance and all critical magnet circuit issues, in particular involving inter-group responsibilities.
- **Define and revise the procedures for the powering of all main ring magnet circuits.**
- **Set-up and run the CCC support team during the "hardware commissioning" campaign.**

2. “Structure” of the scope of work

- The MP3 was re-started beginning of 2013. Since then, we had almost weekly meetings.
- To assure our mandate, the MP3 is set up of almost 20 people (from MPE, MSC, EPC, and CRG). Most of the MP3 members had experience with previous HWC campaigns.
- Each task of the MP3 is usually done by a (small) subgroup, presented in a meeting, and then approved.
- We planned a CCC support team of 12 people for the powering tests during the HWC. These people were also doing the procedures, analysis manual, automation, 7 TeV campaign in Feb 2013.

3. Planning

- **Identify, track and document all important issues and non-conformities related to the SC magnets system. Set-up of a database for the management of exceptions related to the magnet circuits.**

The “database” containing issues, NC’s, and exceptions on the SC circuits was started in Aug 2013, and was then modified whenever needed (see https://twiki.cern.ch/twiki/bin/view/MP3/SummaryIssues)

Tracking of MP3 issues during operation was started immediately after LS1 (using an excel file). Since May 2015 we include the issues in Jira (which was used during Run-1 by COMS).

- **If needed, give recommendations for future operation, or for additional testing (in the machine and/or in SM18).**

16 recommendations have been issued between June 2013 and Aug 2014, see https://twiki.cern.ch/twiki/bin/view/MP3/MP3recommendations

3. Planning

- **Define and revise the procedures for the powering of all main ring magnet circuits.**

We started the revision of the procedures in Dec 2013. After approval in EDMS all procedures were released in Aug-Nov 2014 (except “Powering Group of Circuits”, because it was only needed in 2015).

- **Set-up and run the CCC support team during the “hardware commissioning” campaign.**

We started preparation for the HWC in the beginning of 2014.

Conclusion: Our planning for HWC was OK. The (old) NC’s/circuit issues were listed and the procedures were ready, and we had a rather large team (with sufficient contingency) to analyse the powering tests. We did not cause delays during LS1 and the HWC.

4. Initial schedule and actual schedule

- We always “followed” the official schedule. We were flexible enough to adjust to the frequently revised planning, because:
  - we were 12 people, working part-time for the MP3,
  - the planning usually got longer and never shorter.
- Initially we planned a CCC support team of 12 people for the powering tests from Aug 2014 to Jan 2015. The time span was changed several times, finally from end Sept 2014 to mid March 2015.
- The MP3 was never the reason for schedule revisions.
- The slow start of the HWC was very helpful to train all 12 MP3 members.

5. Resources

How many resources were planned/used?

- 9 weeks with 5 shifts of 8 hrs of 2 persons
- 3 weeks with 5 shifts of 8 hrs of 2 persons and 2 shifts of 1 person (weekend)
- 9 weeks with 10 shifts of 8 hrs of 2 persons and 4 shifts of 1 person (weekend)

Total: 314 person-days (pd)

We planned “large” in order to learn (in the beginning), to complete the analysis manual, and to have the possibility to easily disappear from the CCC for a few hours (for other work, meetings, etc). We could have planned for more (about 500 pd) if needed.

Many shifts were (partially) cancelled due to lack of analysis work.

On average, the MP3 work took about 30% of the time for the 12 involved persons.

How many resources would have been needed?

In the last 12 weeks we could have maybe reduced to 1 person per shift during the week, so reducing by 12x5x2=120 pd. So about 200 pd in total would have been OK.

6. Three examples of aspects which worked well

1. The powering procedures were much completer and clearer than before:
    - Uniform structure among the 10 procedures.
    - Better description of the circuit, the protection and the signals.
    - Tests were also visually explained.
    - The sequencer and procedure were carefully checked against each other.
    - Less important info was moved to the Annex.
2. We created an analysis manual, so that we all analysed the tests in the same way. This will also be the starting point for further automatic analysis of future HWC campaigns and powering events during operation. We also created a database covering all magnet/circuit quenches during reception tests, HWC tests, and operation.
3. We reduced the number of signatures, by having automatic analysis of all 60 A and 80-120 A circuits, and by taking over most of the analysis for the QPS and EE.

7. Three examples of aspects which gave difficulties

1. The data of the QPS post-mortem files still contain many timing errors, saturated points, spikes, which also make a dependable analysis and automation very difficult, if not impossible. Non-logical signal and crate naming, signal swaps, polarity issues, and incorrect documentation further complicated the analysis.

2. We expected to discuss issues related to the circuits such as long training, heater problems, internal shorts, insufficient bus cooling, DFB regulation etc. In stead, we got much more issues with the QPS, which continued to come back during the testing of the 8 sectors. The tracking and follow-up of these issues was insufficient and not efficient.

3. We did not receive a proper analysis manual from QPS and EE for analysis of the different tests before the start of the powering tests. This also resulted in some last-minute changes of the signature in AccTesting.

8/9. What needs to be improved / changed?

1. Proper tracking of issues during the powering tests in AccTesting with clear rules when a test can be repeated.

2. Before starting the powering tests, the Individual System Test (IST) of the QPS should be completely finished. An additional IST at very low current can be added, so that the QPS people can check proper signals, polarities, compensation factors, PM file contents.

3. There should be a QPS expert in the CCC at least as long as many QPS problems slip through the QPS-IST.

4. All circuits should have an updated circuit diagram, including signal names, polarities, measurement frequency, filtering, threshold(s), evaluation time, etc.

5. Control systems should be fully debugged and available several months before the start of the HWC.

8/9. What needs to be improved / changed?

6. The analysis manual for the PGC tests.

7. The analysis manual with clear acceptance and warning criteria for the QPS and EE part.

8. Review of the test requirements for the ‘End of the Year Technical Stop’.

9. Automatic analysis of more tests (also with more uniform approach).

10. Automatic analysis of powering events (with heater firing) during operation.

11. Continuous monitoring of protection-related signals.

12. Storage of analysis results in user friendly (easily accessible) database.

10. What will be done in the same way next time?

1. Preparation for the HWC about 6-12 months before the start of the powering tests.

2. Planning of the MP3 support during the powering tests.

3. Use of Twiki as communication means between MP3 members (and to the outside).

4. Carry on to automate and speed-up the analysis of the powering tests, while keeping the same level (or improving) the quality.

and of course much much more….