

**RAT** Réunion Avancement Travaux

HARDWARE COMMISSIONING COORDINATION

November 13, 2006, 9:30 in point 5

Present: Knud Dahlerup-Petersen, Claude Dehavay, Jean-Pierre Malod-Dognin, David Nisbet, Rosario Principe, Rudiger Schmidt, Antonio Vergara, Markus Zerlauth.

**Friday November 3, 2006**  
**13kA switch opening event during the AUG simulation**

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**The event**

On Friday Nov 3, an electric cut has been generated in the UA63 in order to reproduce the situation of an AUG activation in the area and verify the behaviour of the equipment installed.

At the moment of the electric cut, 09H21M41S, nothing in particular has been observed and globally the machine infrastructure behaved as expected apart from the fact that no Post Mortem file for any of the three 13 kA EE systems (for the RB, RQF and RQD circuits) has been generated. On the other hand, the PIC had recorded the event.

About 1.5 hr later the switches of the EE system for the RQD circuits were found to be closed.

The missing Post Mortem recording was probably the consequence of the logging state not being armed inside the EE controllers before the test. This could not happen in the LHC machine because QPS\_PERMIT is not valid in such state hence the converters would not be powered. As the Post Mortem file is created by an opening of the DQS switches and as the two other systems RB and RQF were definitely found open, the missing Post Mortem files do not lead to the conclusion that the DQS switches did not open.

For the 16 systems of energy extraction at 600 A all Post Mortem files were created.

How did we detect that the switches were closed? Some time after the restoration of power (~1 hr), the EE team received the request from AB/PO to close the QPS switches in order to allow the PCs to operate correctly.

Before the EE operator gave the order to close the switches via the EE supervision system, he observed that the switch DQSQD was already closed. It should be noted here that this was only verified using the remote system.

No other system is capable of knowing the exact state of the switch, thus the remote information is the only information source for this incident.

An inquiry to understand the behaviour of the DQSQD switch was launched, but today the available information, coming from the different supervision systems operating in this area, does not provide a precise picture of event concerning the DQSQD switch and whether or not it opened at the moment of the power cut.

Actually the EE remote controller does not log the status of the switches (open/closed), which makes very difficult the analysis *a posteriori* of the facts.

### **The conclusion**

All direct tests of the FPA loop rupture performed both before and after the AUG test gave a 100% positive result with the consequent opening of the DQSQD. Same results for the series of tests performed by EE in collaboration with ABPO on Friday November 3 after the AUG simulation and on Tuesday November 7. But this activity could not involve the complete protection system (PIC, PC, etc.)

Therefore it has been decided to perform a new electric cut simulating an AUG in UA63. The test is scheduled on Friday November 17 from 8h30 to 10h00.

At that moment a reinforced EE team will guarantee a direct observation of the behaviour of the 13kA switches *in situ*.

In case of positive performance of the switch, the HC will consider the possibility to close the dossier. The event will be anyhow recorded in order to allow any possible analysis and comparison with similar problems which could appear in the future on this kind of switches.

During the meeting it became clear that the interfaces between power converters, powering interlock system and quench protection system (incl. the EE system) are complex and were defined some years ago. For the tests in UA63 the final interface to the EE system had not been available and a preliminary system was in place. This has been and will continue to be the case for all SCT ISTs, however the Dry Run tests will use the final implementations of the hardware.

The preliminary FPA current loops, provided by AT/MEL, have been used in all short-circuits tests up to now (UA83, UA47, UA87, UA63) on all three 13 kA EE facilities of each location. It has a common source for the three circuits. It has allowed the interlinking of the PC, the PIC and the EE system.

Slow monitoring of the switch status using the logging system was discussed; such system would simplify the diagnostics of non-understood events in such a delicate component of LHC.

A special meeting will be organised to:

- Recall the interfaces - do all teams have the same understanding, and is the realisation as specified? What is the difference between the final interface, and the preliminary interface to the EE system?
- Discuss possible improvements, in particular monitoring of the statuses of switches. The logging of commands to/from the switch should also be discussed.

Rosario