LHC-Beam Commissioning Working Group

Notes from the meeting held on
31 March 2009

Present: Reyes Alemany, Gianluigi Arduini, Roger Bailey, Darius Bocian, Oliver Brüning, Helmut Burkhardt, Bernd Dehning, Stephane Fartoukh, Rossano Giachino, Brennan Goddard, Jean-Jacques Gras, Eva Barbara Holzer, Hitomi Ikeda, Delphine Jacquet, Lars Jensen, Verena Kain, Christoph Kurfürst, Mike Lamont (chair), Alick Macpherson, Aurelien Marsili, Malika Meddahi, Lasse Norman, Bruno Puccio, Mirko Pojer, Laurette Ponce, Stefano Redaelli, Mariusz Sapinski, Matteo Solfaroli, Mareck Strzelczyk, Jan Uythoven, Walter Venturini Delsolaro, Antonio Vergara, Marco Zanetti.

1. Comments on the last minutes

To note: the dates of the beam tests will be discussed at the next LMC meeting. New schedule is to be expected.

2. Report from the LHC Machine Committee (M. Lamont)

M. Lamont highlighted some of the topics discussed at the last LHC MC (see minutes for details).
- CE problems in point 6 (floor damages during transport)
- Increasing the MCBX ramp rate: What has already been done, in which conditions and what are the results? Clarification needed. **To be followed-up.**
- Updates on UPS electronics
- Hardware commissioning days summarised by R. Schmidt
- Powering conditions and access during phase 1 and phase 2

3. Dry Run News (V. Kain, in collaboration with R. Alemany)

V. Kain summarized the dry run performed in week 13 (slides). All infrastructures were in place to perform the tests and the overall results are quite successful.
Concerning the BI equipment dry run (see details), the tests went very well, the remaining issues are: **To be followed-up**:
- RBAC policy in strict mode: not ready yet
- BTV proxies: no solution yet;
- More work on BCTs needed;
- Logging: provide logging requests for some equipment ;
- Fill data: more users-friendly structure;
- Request from BLMs: should not use OPERA account anymore.
- Simulated SMP intensity: could not change it;
- Fixed display: fewer windows.

MCS tests: All successfully tested except the on-line checks (see details). The list of still-to-be-done was summarised and remaining tests will be carried out.

Next dry runs:
- On-going are the FGC tests with operational settings.

- Dry run 1 for injection equipment is planned for week 14: MKI 8, TI 8 and TI 2, Injection BI.
- Dry run 2 is scheduled in week 17 (injection, LBDS software, timing &new telegram) and a detailed test plan will come.
- Week 17 was proposed as well to test the BCTs.

To follow-up:
- Fix a date for the tests with RBAC on strict mode
- TI 2 and TI 8 on LHC or SPS control system? MSI injection septa will be on SPS control system so as to have current interlocking - Brennan Goddard said that this functionality is also required for other LHC magnets, in particular MSD extraction septa, and that a discussion of how to achieve this with the FGCs should be launched with the power group.

4. BLM quench threshold estimates on the MB magnet (M. Sapinski and D. Bocian)

Mariusz Sapinski presented the results of Geant4 simulation of BLM Quench Level (QL) estimates on MB magnet for steady state losses (slides). It was clarified that energy depositions in case of vertical losses are about 4-8 times smaller than in the horizontal plane. Results are therefore concentrating on the horizontal plane. Simulated values could be compared with the two quenches experienced during operation, in MB magnets, one with 2e9 protons (at an angle of 750 µrad) and the second one with 4e9 protons (at an angle of 250 µrad), both with beam size of less than 1mm. The simulated signals are a factor 3 smaller than the measured ones. Therefore, the BLM thresholds are to be set to 3x the calculated ones.

Possible reasons for this discrepancy are investigated –could be due to the description of the cascade tail or from missing tunnel walls in the model which thermalise the neutrons.

S. Fartoukh pointed out that the sensitivity of the results to the beam size knowledge (taking into account the beta beat) is to be checked.

Concerning the longer losses, a very complete network model was made by Dariusz Bocian (slides). A full model of the magnet was implemented (to note that the He channel inside the cold bore is the most sensitive element in the model), together with the model for the superconducting cables. It was clarified that the beam screen is taken into account in the energy deposition model.

The temperature distribution in the MB magnet at QL are summarized for the cold bore, the He channel and coil (lambda point is when super fluidity is lost).

Simulation results gave the quench limits at different energies for the peak QL and the average QL and these results are very close to the ones presented in the LHC PR 44.

Dariusz added that the QL for the main quads is higher. Simulations have been as well performed for the MQM and MQY, only at 4.5 K, but for MQTL this would require making a new model.

Dariusz concluded that the QL at steady state for the real beam loss depends on the beam loss profiles. The model validation is complete. And the first quench level calculations for MB magnet with real beam loss profile have been presented (see summary table in Dariusz's talk).

Conclusions:
- Quench-protecting threshold for steady state loss on MB magnet is around 100 µGy/s for 7 TeV
- For transient losses the threshold is about 21 µGy at 7 TeV and 1200 µGy at 450 GeV (Tested and corrected with the quenches during operation)
- Safety factor of 3 is used.

- Simulations suggest that magnets quenched for enthalpy limit below the theoretical one.
- Additional quenches in horizontal plane would help to validate the model and understand the energy deposition in coil!
- Simulation improvement is investigated.

4. A.O.B

Information from S. Fartoukh: Possible aperture limitation from an objet (RF finger?) at one location in the LHC. **To be followed up**.

Next meeting

Tuesday 21 April 2009, 15:00, 874-1-011.

Malika Meddahi