LHC-Beam Commissioning Working Group

Notes from the meeting held on
3 November 2009

Present: Carmen Alabau, Ralph Assmann, Tobias Baer, Sophie Baron, Wolfgang Bartmann, Chiara Bracco, Lene Drosdal, Massimiliano Ferro-Luzzi, Kajetan Fuchsberger, Massimo Giovannozzi, Brennan Goddard, Eugenia Hatziangeli, Hitomi Ikeda, Lars Jensen, John Jowett, Verena Kain, Mike Lamont (chair), Yngve Levinsen, Alick Macpherson, Malika Meddahi, Gabriel Mueller, Mario Pereira, Bruno Puccio, Stefan Roesler, Adriana Rossi, Katarina Sigerud, Ezio Todesco, Rogelio Tomas, Marek Strzelczyk, Jan Uythoven, Walter Venturini Delsolaro, Glenn Vanbavinckhove, Simon White, Daniel Wollmann.

Excused: Oliver Brüning, Barbara Holzer, Ralph Steinhagen.

1. Follow-up from the last minutes

Centering of horizontal collimators in TI 8 and TCP, TCLA scans in IP7– Daniel Wollmann (slides). For all fits, the results from the TCDIH centering of jaws indicate a measured sigma larger than the expected nominal betatron sigma. Work in progress.
Brennan Goddard: should use the total sigma, including the dispersive term; Verena Kain: use as well the measured emittance, not the theoretical one.
Scans of the TCPs and TCLAs jaw positions have been performed with TCDI settings at 4.5 nominal sigma and with TCDI out.
More beam time is needed to improve the method of the measurements and to continue the data taking and setting up of these collimators.

2. News from LMC – Mike Lamont

Summary notes from previous LMC meetings, written by Brennan Goddard or Frank Zimmermann, are available here.
Last meeting was dedicated to the organisation of the Christmas shutdown. The first 2-3 weeks in January, following the laboratory closure, will be dedicated to HW commissioning in order to have the machine ready for 3.5 GeV.

3. Dry Run news – Verena Kain (slides)

Work still to be done:
- Injection: Logging for IQC
- Beam dump: tracking needed and XPOC
- BI: In general: Alarms and some logging not yet fully tested
  - DCBCT: calibration issues solved
  - FTBCT: acq capture to check.
  - BWS: application to be fixed
  - BSRA: undulator function/sequencer task needed. Undulator: injection phase at full current, at 1TeV should leave it on.
  - BSRT: undulator functions/sequencer task. Procedure with mirror in/out beam during aperture scan.
  - BRANs: Fixed display. Logging not working for BRANA.
- RF: in progress this week.
- Timing and injection sequencer: beam dump events auto. PM event auto.
- FiDel (Ezio Todesco): verification in progress. Main field of dipoles is fine. B3: still some discrepancy, being investigated. By the end of the week, all will be checked

and ready for ramping up to 1.1 TeV. Decay: scaling being understood. Snapback strongly reduced. Probably first ramp will be done without correction.
- Feedbacks: in progress
- Vacuum: close/open all valves command: decide what to do!
- Post Mortem: much remain to be done
- Power converters and settings managements: in progress. All the knobs are there, including coupling.

Details and progress of the dry run for this week at:
https://espace.cern.ch/mddb/Activity%20Tracking%20Tool/Activity%20Tracking%20Welcome.aspx?View={593B6E53-F6F9-4485-8646-E7E683D0F681}&SelectedID=55

Eugenia Hatziangeli: BLM and data subscription: major programming changes being done in order to be ready for the upcoming sector tests. Therefore some time will be dedicated to check this new release before the next beam tests.

4. LHC pre-cycles- Ezio Todesco (slides)

Why pre-cycle needed? 3 main reasons:
- In SC magnets, hysteresis implies that there is a different transfer function for going up or down with the current (same current, different field; independent of the speed on the path –dI/dt).
- In SC magnets there are as well dynamic effects. The DC magnetization component decays during the injection plateau, and then snaps back at the beginning of the ramp. A good pre-cycling allows having always the same decay, i.e. the previous setting will work well for the next run. The critical parameters that can be changed during operations are time on the flat top and pre-injection time
- For NC magnets, pre-cycle to stabilise the magnets and erase previous history.

Strategy for pre-cycling: Magnets are divided in 4 categories, and each of them will follow a designated strategy (details in slides).
- SC magnets with decay: MB, MQM, MQY;
- SC magnets with negligible decay: MBX, MBRS, MBRC, MBRB, MQ, MQXA, MQXB;
- SC without decay: all correctors;
- Resistive magnets;
For the special cases: MO –has to be degaussed to avoid residual field at injection when it has 0 current- and nested correctors – 3 cases, will only cycle the outer one.

What if:
- Any phase of commissioning not involving the ramp: needs a pre-cycling with zero flat top to go on the right branch
- Any phase involving the ramp: needs a complete pre-cycling with 1000 s flat top for MB, MQM and MQY
- If one of the circuits goes down during injection: should be individually recycled, and the other magnets left there at injection
- If one of the circuits goes down at the beginning or during or at the end of the ramp: should probably recycle everything. **To be analysed in details** for the case of beginning of the ramp.

Pre cycle results from the 2009 injection tests: The pre-cycle performed in 2-3 for the main dipoles and quads was shown. In 7-8 no pre-cycle was done due to hardware constraints – no effect observed as starting from 0 current situation.

Ezio Todesco, Walter Venturini Delsolaro: Main magnets are not supposed to be trimmed. Eventually have to incorporate the needed correction in the magnetic model.

5- CCC consoles and NFS disk space – Pierre Charrue (slides)

<u>CCC consoles</u>: 110 operational consoles are in operation in the CCC, all with 2Gb RAM. Concern: some consoles are too slow.
-   **Decided** to limit the possible number of applications launched on the same console (at the exception of the collimator application)
-   Good habit: make sure to use the colored CCM flag and, when orange or red, remove some unused applications or contexts, if possible.
-   **Decided** to upgrade 10 consoles from 2 to 4 Gb RAM (SPS and LHC consoles). If O.K. will be extended to the rest of the CCC.
-   If not enough, can upgrade the consoles themselves.

Brennan Goddard: No continuous programme of upgrade? Pierre Charrue: No, but can be envisaged.

<u>NFS disk space</u>: operational data structure was presented together with the backup strategy.

In 2009, the total amount of controls operational disk space is 4Tb. In the last 2 months, 2 Tb have already been filled by users and application data. All limits are being reached (warning limits and critical signal received, CCR physical limit, tape backup time....). Proposal was given in view of reducing the amount of data stored and therefore backed-up. A small WG will be organised with OP and equipment group members to address this issue and will report back towards the end of November with a proposition to host the demanded disk space. **Names needed for contributors**. Brennan Goddard: let's first identify the bigger memory space users, where all the data is mainly coming from?

6. <u>RF ramping tests</u> – Sophie Baron (<u>slides</u>)

A ramping test is a realistic sequence of beam modes simulating a basic LHC hypercycle, focusing on the RF frequency. In the RAMP mode, the RF frequency is slowly increased to simulate the beam acceleration from 450 GeV to 7 TeV. The RF frequency follows the 'frequency program' controlled by operation and integrated in the sequencer. Two separate frequency functions per particle type were tested (protons and ions) and the experiments received the Bunch Clock = RF/10.

This exercise was very useful for both RF and OP teams (test HW, firmware and SW, validate, adjustments…) and for the experiments -run the detectors with typical frequency cycles and adjust their strategy in term of clock switching, start of data taking, QPLLs re-settings procedures.

All the experiments were involved, at different levels (at the exception of CMS, recovering from a repair). At the end of the exercise, two full proton and ion ramps could finally be performed and many lessons learnt, e.g. a re-sync indeed lasts …9 sec., sudden events on the clocks are actually well handled by the experiments, all experiments reported a very smooth behaviour of their electronic during both p and ions ramps… In the future it is proposed to keep the RF at the high energy value until reaching back the new set up mode.

Next: a new RF ramping test will be performed again on Friday 13 November, with the participation of all the experiments.

7- LHC injection test 2 – Mike Lamont and round table.

Sector test planning was shown (<u>link</u>).

Note: To establish the procedure for the momentum aperture in sector 23. Alick Macpherson: vacuum system is ready for the sector test.

All comments –re-arrangement of work slots- no night shift…- to be sent to Mike Lamont.

Programme will be dynamically updated during the tests, as a function of the work progress: **Mike Lamont**.

Duration of the radiation survey on 9 November 2009 -Stefan Roesler (slide). Time estimate is based on a team of 2 persons. Survey could be finished in the afternoon of 9 November. The order in which the different locations should be surveyed must be confirmed by OP - **Mike Lamont**.

8- A.O.B. –

DAILY LHC pre-operation meeting at 17:00 CCC conference room.

Next meeting

Tuesday 10th November 2009, 15:30, 874-1-011. Agenda will be sent in due time.

<div align="right">Malika Meddahi.</div>