

## LHC-Beam Commissioning Working Group

### Notes from the meeting held on 06 October 2009

Present: Carmen Alabau, Ralph Assmann, Tobias Bär, Helmut Burkhardt, Andy Butterworth, Rama Calaga, Bernd Dehning, Lene Drosdal, Rossano Giachino, Massimo Giovannozzi, Brennan Goddard, Eugenia Hatziangeli, Eva Barbara Holzer, Hitomi Ikeda, Lars Jensen, John Jowett, Verena Kain, Mike Lamont (chair), Aurélien Marsili, Malika Meddahi, Lasse Norman, Mario Pereira, Laurette Ponce, Bruno Puccio, Stefan Roesler, Marek Strzelczyk, Ezio Todesco, Rogelio Tomas, Jan Uythoven, Jörg Wenninger, Simon White, Frank Zimmermann.

Excused: Gianluigi Arduini, Reyes Alemany, Oliver Brüning, Kajetan Fuchsberger, Alick Macpherson, Mirko Pojer.

#### 1. Comments and actions from the last minutes

None.

#### 2. News from LMC – Mike Lamont (slides)

Summary notes from previous LMC meetings, written by Brennan Goddard or Frank Zimmermann, are available [here](#).

Out of the items presented at the LMC30, the simulation results of LHC interconnects (Arjan Verweij) were highlighted. The simulation code is now validated. There is a good agreement between measurements and calculations for the voltage signals, the temperatures and the thermal runaway times (for 1.9 K and 4.3 K and currents from 2-12 kA). The quench currents of more than 50 test cases could be simulated with accuracy better than a few hundred Amperes. It indicates that operating at 3.5 TeV is safe but operation at 5 TeV seems risky, especially because at this energy a magnet quench could propagate quickly to the interconnect by means of normal zone propagation in the bus.

The status of the LHC magnetic model was presented by Ezio Todesco at the LMC30. Injection and circulating beam in 2008 showed a very good knowledge and reproducibility of the machine. The next critical steps include beam ramping –with decay and snapback– and beam squeezing – with large beta functions in the triplet and very sensitive optics. SM18 should remain active (no shutdown before March 2010). Mid-term activities: identify luminosity limitations wrt field model knowledge and work on reducing precycles time as much as possible.

Latest on the LHC schedule (Katy Foraz) was given with detailed progress report for each sector ([slides](#)). The start date of the LHC beam commissioning tends to move towards the end of week 47 (~November 20<sup>th</sup>),

The date of the sector test -23/26 October- seems still to hold, at least for one beam if not for the two beams.

#### 3. Dry Run news – Verena Kain (slides)

##### W40:

- BCTs: Operational. A couple of things like ergonomics and missing info on applications and fixed displays as well as some logging details still need sorting out. Publishing data process to be looked at.

- The injection quality check (IQC) is now connected to the injection sequencer and the SIS. Thorough testing will only be done next week with an LHC cycle in the SPS.
- The whole chain for virtual critical settings is now fully operational. Can now configure all the virtual thresholds for SIS, XPOC and IQC.
- Abort gap monitor application: everything implemented (also trim for critical settings). Some small display features will be improved.
- AC Dipole/tune kicker/ aperture kicker: fully operational. (For the AC dipole current limit check only implemented so far for beam 1...will come for beam 2 in the next days.) OASIS provides envelope display of waveform and also a sufficiently high sampling rate to acquire the whole waveform for the AC dipole. Hole in the waveform to be understood.

#### Program for W41:

- Prep for PGCs: PGC beam processes, operational settings (at least squeeze for point 1), knobs for tune, chromaticity, coupling
- LHC BPM concentrator stress test on Monday
- Testing of IQC with SIS and injection sequencer. Timing in of the injection kickers if possible
- Totem dry run on Wednesday
- Feedbacks on Monday
- Tune and headtail monitor on Friday
- First vacuum valves machine protection test towards end of the week
- BTV machine protection tests on Monday
- TCDQ system dry run: simulated energy function

#### 4. Draft schedule of the LHC Beam Commissioning – Malika Meddahi

LHC beam commissioning: Draft schedule ([link](#)). Comments are welcome.

#### Discussion:

Ralph Assmann: will prepare collimator settings for test ramps. Commissioning of betatron and momentum cleaning needed -as soon as more intensity is in. Analysis of the vacuum pressure and beam lifetime behavior monitoring to be done.

Brennan Goddard: collimator settings for injection will be implemented and can then be left through the ramp, if this poses no problems.

Brennan Goddard: one overnight shift to be allocated for commissioning the orbit (and tune) feedback once the preliminary optics checks are done and before the ramp attempts.

Mike Lamont: beam dump timing events will be inserted during the ramp. Ramp trial will be done with LHCprobe intensity, nominal emittance. Programme presented was done with no feedback systems switched on.

Bernd Dehning: Dedicated BLM commissioning needed.

Rogelio Tomas: If beta-beating measurements and corrections are required to value better than 30-50%, AC dipole is needed. Otherwise would easily be achievable with kick measurements. Massimo Giovannozzi: At top energy the optics measurements require the AC dipole as the excitation of the MKQA kicker is not enough (and there are no injection oscillations to exploit). Hence, any measurement/correction at top energy would require the AC dipole.

To add in the SF list: coupling, polarity measurements, time for AC dipole commissioning (if bb better than 30-50% or top energy measurements required), emittance measurements, commissioning of feedback systems, MPS&BLM checks.

## 5. Readiness of the systems and tools for the sector tests and full LHC beam commissioning - round table

### Injection test dates:

DSO tests: Tuesday 20 October

Full patrol on Friday 23 October

Beam tests: from Friday 23 October to Monday 26 October, 07:00.

Next tentative date for the second sector tests: 7-8 November

### [Link to Programme.](#)

Note: The actual beam which will be injected can be either beam 1, beam 2 or both, depending on the sectors' readiness.

Lars Jensen: Readiness of all systems is under way as planned. To note: BST triggered acquisition and post mortem to be tried during injection test.

Bernd Dehning: BLM work progressing nicely, system will be ready as scheduled.

Ezio Todesco: Pre-cycles are ready, very few changes done w.r.t. last year. Consistency checks are now going on.

Jorg Wenninger: MPS: will include BLM tests and the generation of post mortem events with BPMs and BLMs.

Bruno Puccio: BIS: no issues; currently performing the electrical quality insurance of the connections with the User systems. SMP: in good preparation progress.

Massimo Giovannozzi: knobs generations –needed for the LHC beam commissioning - are in progress with Stefano Redaelli. For the injection tests: concatenated optics being prepared. New version of the LHC sequence being extracted, some issues found – consistency between the 'as-designed' and 'as-built' data base - so checks are manually being done. Aperture model being updated to take into account the interconnection cryostats. The separation bumps in IR2/8 are now closed at Q5s. So the separation scheme is not any more linked to injection (injection is done on c.o.) Injection optics and ramp optics are frozen. Squeeze and pre-squeeze will be done at the same time for IR2 and IR8 up to 3/5 TeV as agreed in a previous meeting.

Helmut Burkhardt: Experiments would like to test various systems without beam and with beam. List being compiled.

Marek Strzelczyk: Regeneration of all Transfer Function and harmonics to be done. Ezio Todesco: Final FiDel set of data will be ready by the end of this week.

Brennan Goddard: list of injection system checks compiled, work progresses as scheduled.

### A.O.B.

Rossano Giachino: Extra TI 8 beam test for LHCb: Monday 12 October, by 18:00, beam down to TED-TI 8 line for 16 to 18 hours. RP survey will follow as usual.

### Next meeting

**Tuesday 13<sup>th</sup> October 2009**, 15:30, 874-1-011. Agenda will be sent in due time.

Malika Meddahi.