LHC-Beam Commissioning Working Group

Notes from the meeting held on
7 July 2009

Present: Reyes Alemany, Roger Bailey, Helmut Burkhardt, Massimiliano Ferro-Luzzi, Kajetan Fuchsberger, Rossano Giachino, Massimo Giovannozzi, Brennan Goddard, Magali Gruwé, Lars Jensen, John Jowett, Verena Kain, Grzegorz Kruk, Mike Lamont (chair), Alick Macpherson, Malika Meddahi, Mario Pereira, Mirko Pojer, Laurette Ponce, Bruno Puccio, Stefano Redaelli, Frank Schmidt, Rüdiger Schmidt, Katarina Sigerud, Ralph Steinhagen, Marek Strzelczyk, Ezio Todesco, Walter Venturini Delsolaro, Helmut Vincke, Jörg Wenninger.

Excused: Oliver Brüning, Pierre Charrue, Eugenia Hatziangeli, Jan Uythoven, Stefan Roesler

1. Comments and actions from the last minutes

No comments on the previous minutes.

Follow-ups:

- Tolerance for the beam pipes: - Massimo Giovannozzi- got confirmation from Ray Veness that the radial tolerance of 15 mm (2.6 mm - alignment - 2.6 mm - mechanical - 9.8 mm - other) can be reduced to 11 mm. These 15 mm tolerances were already tight at injection and the 11 mm proposal is in line with what is needed to remove the aperture bottleneck at that location and, in addition, goes to the right direction for the high β^* optics. General aperture and tolerances review is being done.
- Convention on the use of the parameters "on_x" - Massimo Giovannozzi (slides)
  Three switches are used in the set-up of the optics settings: "on_x" for crossing angle, "on_sep" for parallel separation and "on_lhcb", "on_alice" for spectrometer magnets in IR2/8. **Agreed**: the value 1 of the switch provides the nominal value of the corresponding physical quantity.
  Remarks:
  - The physical parameters can be re-scaled by setting the switch to an appropriate value.
  - Scaling with energy can be applied: Parallel separation - the scaling can be applied to any insertions; Crossing angle - the scaling can be applied to IR1/5, only. In IR2/8 the presence of the spectrometer breaks the scaling.
  - During the squeeze:
    - An appropriate crossing scheme is provided (the parallel separation remains constant). The aim is to vary the crossing smoothly (to the nominal value, e.g. for IR1/5 142.5 μrad).
    - What to do in case the squeeze is stopped at an intermediate β^* value? **Proposal**: An appropriate crossing scheme is provided: this could be selected with a new flag "**on_coll"**.

  In general: cannot hope to cover all possible configurations. Knobs should be generated to change easily the crossing scheme in operation.
  Remarks:

Jörg Wenninger and Ralph Steinhagen: have to make sure that the adopted philosophy does not fight the orbit feedback. **Proposal**: from one β^* value to the next one, carry the optics changes with the previous corrector settings fixed and only update them when new

β* value is reached. Motivation: to keep it simple and safe and limit the number of changing parameter during ramp and individual squeeze steps until those are managed in a controlled fashion.

Provide the values of the corrector settings to Jörg Wenninger and Ralph Steinhagen: **Massimo Giovannozzi**

- Update table for pre-collision separation and collision crossing angle values - Massimo Giovannozzi (slides)
  - Standard value of 0.5 mm (half separation) re-scaled with energy
  - Crossing angles: values provided in Chamonix (Werner Herr) and in the table by M. Ferro-Luzzi seem ok. Possible refinement in discussion.

For IR8 (reviewed by Werner Herr): Crossing angle values compatible with both 5 TeV and 4 TeV were given for β* from 10m down to 2m.

- Updates in the LHC sequences - Massimo Giovannozzi (slides)
  - Two new elements defined:
    - TKICKER (transverse kicker): KICKER, but not used for c.o. correction.
    - PLACEHOLDER: same as INSTRUMENT, but generic.
  - Changes in some elements definitions will be performed (see list in Massimo's presentation) in order to avoid confusions.
  - Proposal for "as-built" LHC sequence:
    Two sequences: an "as-designed" sequence (frozen) and an "as-built" one (updated according to NCs). Three classes of NCs are relevant for MAD-X sequence: Non-working magnet (as PLACEHOLDER), magnet installed in wrong slot (e.g. repair sector 3-4, as PLACEHOLDER) and magnets with non-nominal performance (e.g. weak MQTLs in IR3/6/7, with Imax and Kmax changed in the sequence)
    Brennan Goddard: sequences contain alignement information? Massimo Giovannozzi: no, they are in a separate file.
    TI sequences: call Pascal Le roux or Samy Chemli to get the right definition of the BPMI (currently defined as instrument and not monitor). **Malika Meddahi**
- Mike Lamont: **The TL beam tests originally planned on 22 / 23 August are now scheduled on 29 / 30 August**. Some beam time will be dedicated to these TL tests, allowing LHC injection sequencing tests.
- **LHC injection test for beam 1 is now scheduled for week 39**.
- LHC injection test beam 2 only pencilled down for week 41.
- Preparation for the TI 2 tests of 11-12 July – Rossano Giachino: DSO tests performed Friday 3 July and went O.K. TI 2 power convertors pulsed during 4-5 July: problem on RBIV26407 which gave a magnet fault and internal fault on quadrupole RQID20300. A regulation card was changed on RQID20300 and a cooling valve repositioned on the magnet MBIVA26407 by Jérémie Bauche – was opened by a quarter of a turn, to be checked for all magnets of the line after the TI 2 tests. Patrol scheduled at noon on Friday. Alice will be closed by 18h-19h, allowing some early beam to TT60 TED on Friday late afternoon. DR: all equipment tested and O.K. PMI2 closure will be done on Thursday. Beam permit to be given by Ghislain Roy. Check the RF synchronisation for Alice. Beam test programme here.

2. News from LMC – Mike Lamont

The minutes, written by Frank Zimmermann, will be available here.
Out of the items covered, two subjects were highlighted:
- Measurements at warm in sector 4-5 and establishment of a warm-cold measurement correlation; the correlation of 80 K and 300 K data for the bends was satisfactory and useful; for the quadrupoles this is not yet the case.

- Strategy for LHC start-up: 3 weeks delay wrt original baseline;
Pending further measurement results and repair strategy, final top energy to be decided, together with the duration of the run.
Rüdiger Schmidt: 2-3 simulation programs have been developed and if used with identical initial conditions, give reasonable agreement between each other. Looking at different method to better qualify the splices. It is still questioned if running at 5 TeV is still possible for this year.

3. Dry Run news – Reyes Alemany (slides)

Week 26: AC Dipole and MKQA:

All working, pulsing, logged and interlocked (incl. alarms). Follow-up:

- RBAC needs to be defined for the AC-Dipole and tested for the MKQA;
- The AC dipole "switching on" needs to be improved and more separate from the MKQA;
- The AC dipole waveform signal should be added to OASIS;
- The horizontal tune kicker for B1 never pulsed - never saw OASIS triggering;
- The user-friendliness of the multiturn application to control the different exciters will also be improved –e.g. automatic refresh.

More details:
https://espace.cern.ch/mddb/Activity%20Tracking%20Tool/Activity%20Tracking%20Welcome.aspx?View={593B6E53-F6F9-4485-8646-E7E683D0F681}&SelectedID=37

Week 27: RF beam control tests (continuation of the May DR):

Overall RF beam control is essentially ready for beam.

- Sequence for "RF prepare filling" is fully debugged and working very well.
- Logging: logging of the frequencies and VCXO control input is still missing. Logging for the loop errors and status is working very well
- Loading of settings will be tested again with the new version of the FGCs in two weeks, with the possibility of the FGC output monitoring. Sequences are ready.
- In two weeks, repeat the real-time modulation of the frequency and look into how to monitor this.
- LHC-SPS rephasing worked initially. However, when the reference is manually changed, it never re-phased again. To be investigated.

For more details:
https://espace.cern.ch/mddb/Activity%20Tracking%20Tool/Activity%20Tracking%20Welcome.aspx?View={593B6E53-F6F9-4485-8646-E7E683D0F681}&SelectedID=38

Upcoming dry runs:

- W28 controls tests –TI 2 DR and beam tests
- W29 Post Mortem
- W30 RF, VMCS, LBDS
- W31 RBAC preparation for strict mode
- W35 transverse damper and abort gap cleaning.

4. 2009 commissioning planning - Mike Lamont/round table (slides)

Full machine protection commissioning will need a well adjusted and understood machine, so can't be done with the very first circulating beam.
Proposal: Steps for beam commissioning:
Global machine checkout -> Essential 450 GeV commissioning -> 450 GeV collisions -> Ramp commissioning at 1 TeV -> System / beam commissioning & MP comm. -> 4 TeV beam collision -> full machine protection commissioning -> system / beam commissioning & pilot physics.

To be added:
Jörg Wenninger: Preliminary MP commissioning to be added during the 450 GeV steps.
Brennan Goddard: Collimators setting up.
Massimiliano Ferro-Luzzi: Spectrometer commissioning.
Remarks:

- Stopping at 1 TeV for checks is important before ramping further towards 5 TeV.
- Safe intensity vs energy was shown, e.g. at 450 GeV, safe beam is 1e12, at 1 TeV safe is 2.5e11.
- Jörg Wenninger: Once the general plan is agreed, can go to detailed and rigorous plans.

LHC operation over the Christmas break:
Appropriate manpower coverage was shown, together with the corresponding questions:
- Can we do it effectively (lack of experts)
- Can we do it safely?
- Depends on what stage we will be in the commissioning process.

Maintenance needs:
All injector maintenance can be done in the shadow of the LHC technical stops. A monthly technical stop is scheduled for 3 days.
Commissioning schedule:
- 2 weeks to get beam to 1 TeV
- 1 week to get it to 4 TeV
- First collisions after 3 weeks, unsqueezed
- MPS commissioning, beam commissioning and pilot physics: 4 weeks

Brennan Goddard: Daily goal oriented commissioning steps are needed with such challenging and aggressive schedule
Roger bailey: MD time to be added in 2010 planning.

5. Updates on LHC physics targets for 2009 / 2010 run - Massimiliano Ferro-Luzzi

Overview table has been produced and presented on 23 June (slides). Note to be written. Target energy is to be defined and when energy picture clearer, the table will be updated.
John Jowett: if final top energy is low and the p-p run shorter than presently foreseen, would there be interest in colliding lead ions at the corresponding energy sooner?
Massimiliano Ferro-Luzzi: this will be part of the discussion.

Next meeting

Tuesday 21 July 2009 (tbc), 15:30, 874-1-011. Agenda will be sent in due time.

Malika Meddahi.