

LHC-Beam Commissioning Working Group

Notes from the meeting held on 27 July 2010

Present: Carmen Alabau, Nicholas Aquilina, Gianluigi Arduini, Ralph Assmann, Tobias Baer, Roger Bailey, Chiara Bracco, Roderik Bruce, Andy Butterworth, Xavier Buffat, Helmut Burkhardt, Rama Calaga, Ed Ciapala, Bernd Dehning, Octavio Dominguez, Lene Drosdal, Lyn Evans, Kajetan Fuchsberger, Per Hagen, Werner Herr, Wolfgang Höfle, Eva Barbara Holzer, Lars Jensen, John Jowett, Emanuele Laface, Mike Lamont, Ewen Maclean, Aurelien Marsili, Malika Meddahi, Elias Metral, Ryoichi Miyamoto, Valerie Montabonnet, Gabriel Mueller, Eduardo Nebot, Giulia Papotti, Mario Pereira, Mirko Pojer, Bruno Puccio, Mariusz Sapinski, Elena Shaposhnikova, Andrzej Siemko, Katarina Sigerud, Matteo Solfaroli, Marek Strzelczyk, Ezio Todesco, Rogelio Tomas, Jan Uythoven, Walter Venturini Delsolaro, Louis Walckiers, Uli Wienands, Simon White, Markus Zerlauth.

Excused: Markus Albert, Reyes Alemany, Wolfgang Bartmann, Philippe Baudrenghien, Chandra Bhat, Oliver Brüning, Pierre Charrue, Guy Crockford, Riccardo De Maria, Laurent Deniau, Stephane Fartoukh, Massimilano Ferro-Luzzi, Marek Gasior, Rossano Giachino, Massimo Giovannozzi, Brennan Goddard, Delphine Jacquet, Verena Kain, Thibaut Lefevre, Yngue Levinsen, Alick Macpherson, Lasse Normann, Laurette Ponce, Stefano Redaelli, Stefan Roesler, Adriana Rossi, Frank Schmidt, Rüdiger Schmidt, Ralph Steinhagen, Daniel Valuch, Glenn Vanbavincckhove, Jörg Wenninger, Daniel Wollmann, Frank Zimmermann.

1- Comments and Follow-up from the the last minutes

- RF bucket problem: software fixed, deployed : All O.K. – Philippe Baudrenghien.
- Reference orbit at stable beams – In progress - **Jörg Wenninger**.
- BIC communication problem: fixed. Bruno Puccio and team.
- Un-bunched beam at injection: **Philippe Baudrenghien**. Elena Shaposhnikova: There will always be some small amount of uncaptured beam and the observed losses are indeed really small (in particular when compared to the SPS case -but not superconducting machine), and nothing better can do done about it. LHC will have to operate with this level of losses. However, the loss levels were high enough again on 27 July to cause a beam dump, after waiting about 30 minutes on the flat bottom with beam circulating.
- MKIs not firing at injection: Etienne Carlier. Before the technical stop in June there was about 1 missing injection per week. This was traced back to an off-set in the timing of the pre-pulse between the SPS and the LHC by 1 ms. This was fixed by CO in the technical stop beginning of June. Since then there has been one missing for each beam in 1.5 month. During the last technical stop a change in software has been made, having to do with the soft start, which could solve the remaining problem, but we will need time to get some statistics.
- BPMI87804: inversed polarity in H and V – fixed and reference trajectory updated. Lars Jensen + Jörg Wenninger.
- Head-tail monitor status to be checked: Lars Jensen - operational – **to be checked with Ralph Steinhagen**.
- Hump quest: Fixed display and temporal correlation with other parameters – Mario Pereira. ([slides](#)). Every minute: i) Retrieve data from measurement database – ii) Refresh charts. One sample is taken every 10 sec due to amount of data, up to one

hour. Older data is then discarded to give place to recent data. Flashback: Data taken from logging database. Only one sample per minute.

2- LHC beam commissioning: progress and issues – Roger Bailey – Jörg Wenninger

Nicholas Aquilina ([slides](#)): 10A/s pre-cycle: in operation since the end of the technical stop. Before: 2A/s was used. The decay amplitude is expected to increase by 50 to 75 % from 2 A/s to 10 A/s.

Roger Bailey: LHC commissioning progress: Difficult recovery from this 4 day technical stop

Achieved: ramp with pilot and ramp with nominal bunches. Beam dump qualification. Beta beat measurements at 450 GeV and 3.5 TeV with squeezed optic: very reproducible (beta beat measurements missing for beam 2 at 3.5 m).

Loss maps to be done.

Next 1: 13bx13b physics fill

Next 2: 25b x 25b physics fill

Ralph Assmann: Collimator checks: to be done in full physics conditions, incl. the Roman pots, with orbit well corrected against reference.

Ralph Assmann: Record physics fill analysis looking at luminosity information ([slides](#)). Excellent agreement between the measured and calculated luminosity at the start of the stable beams. Then observed emittance growth, which makes the luminosity curve deviating (0.13 um/hour). Lyn Evans: What is expected from IBS? John Jowett: 0.48 (Nb/10¹¹) um/hour.

The beam-beam parameter is very close to design.

3- Updates on beam observations during stable beams – Werner Herr ([slides](#))

Only 5 fills performed since the last meeting. Only one fill (#1232) with some observed losses, with the exact same pattern as usual, this time following the collapse of the separation bumps and the correction of the orbit against the reference orbit. It was clarified by Joerg Wenninger that this fill 1232 did not have a 'wrong reference orbit'. It was corrected back to the usual reference, but the orbit cleanup at injection did induce significant changes for collisions. In fact looking at a few references in collisions shows that from fill to fill there are pretty different. It highlights the trickiness of the LHC with the combined regions and the problem of having to steer at the level of 10 ums in the triplet region with monitors that have clearly much larger errors. So the fill 1232 was in fact the same than fill 1233 from the point of view of the orbit and the collisions.

Also clear losses when trying to put the beams into collisions for ALICE, especially during that fill, with collisions very hard to find!

Suspicious Schottky spectra in the log-book, to be understood what exactly is plotted, but potentials useful information....

Luminosity with and without transverse damper: some observed lifetime degradation, but, very small so not significant.

Conclusions: same as last time (continue gentle luminosity scans). Also should manage to provoke/reproduce losses, although it seems not easy for weaker beams.

Wolfgang Höfle: Could switch on the ADT at the end of the squeeze, after the change of tunes. Agreed on.

Lyn Evans: Readiness of bunch-by-bunch orbit measurements? Lars Jensen commented that it should be possible to select which bunch-slots are used (now all) within the next 2-3 weeks. Further tests are required and a decision about how to deal with the bunch selection (YASP or ?) needs clarification

4- Multi-bunch injection – Brennan Goddard -in absentia

At the time of the meeting: 24 bunches of beam 2 had just been injected in the machine, with no problems. Beam 1 requires still more work, which is currently being done in the CCC with Brennan Goddard and team. *Added after the meeting: Beam 1 trajectory and injection oscillations were corrected. TCDIH.29050 re-aligned. Injection of 25 bunches was successfully done, for both beam 1 and beam 2.* Conclusions: **Some operational polishing to do, but multibunch injection now OK for 4 bunches per beam for 13 (12+1) or 25 (24+1) bunches total. Should be used in operation from now on, to gain experience.**

5- OP review in light of higher intensity – update – Mike Lamont et all. ([slide](#))

The question asked was: “are operations’ really ready to deal with the real destructive potential of 0.5 – 1 MJ?”. And the various actions needed to arrive to a positive answer have been reviewed. Mike Lamont went through the different sequences and summarise the status and the pending actions. See slides for all details.

To note: top 3:

- OFB and TFB: being worked on. Must be fully reliable, especially with more intensity in the machine
- Orbit correction strategy and procedures
- Sequencer

Squeeze factor for collimator: to be discussed at the end of the year.

Comments:

Mirko Pojer: Concerning crossing angles, for the best and longer fill achieved, they were put-in in small steps. Should be trimmed in and should not be done by hand! Could set-up a zero orbit with only crossing angles (which you get from MADX).

Reference orbit and collapse of the bumps: Jörg Wenninger:

At the end of June, there was a clear and clean squeeze orbit, and a well defined reference for stable beams. But there seem to be some confusion in taking the defined reference, despite the fact that it was clearly marked in the catalog and the reference still stands. What makes it worse is the way we collapse the bumps makes it basically impossible to do a proper incorporation of the stable beams settings because we jump back to the end of squeeze settings after the collisions procedure. This means every EIC has to start again from scratch, opening the field. A naive incorporation would also incorporate the collapsing of the separation and the Xing angle bumps. At the moment if you want to incorporate you have to: switch on Xing, collapse separation, fine tune collisions, then put back the separation, remove the Xing (also the non-closures !), incorporate, the switch Xing back on, separation off again !! For the 24 bunches this must be cleaned, and proper settings defined for the TEST_COLLISIONS BP for all orbit correctors, tune, chromaticity, octupoles etc... Follow-up: Jörg Wenninger

Daily 8:30 HWC meeting in the CCC conference room (09:00 at weekends).

Next meeting: 3 August 2010, 15:30, 874-1-01.

Malika Meddahi