

## LHC-Beam Commissioning Working Group

Notes from the meeting held on  
**23 June 2009**

Present: Helmut Burkhardt, Andy Butterworth, Alejandro Castañeda, Massimiliano Ferro-Luzzi, Rossano Giachino, Massimo Giovannozzi, Brennan Goddard (scientific secretary), Lars Jensen, Verena Kain, Malika Meddahi (chair), Mario Pereira, Ralph Steinhagen, Marek Strzelczyk, Jan Uythoven, Walter Venturini Delsolaro, Jörg Wenninger, Simon White.

Excused: Mike Lamont, Bruno Puccio.

### 1. Comments from the last minutes

No comments on the previous minutes.

### 2. News from LMC – Brennan Goddard (slide)

Brennan Goddard briefly summarised the past two LMC meetings. The minutes, written by Frank Zimmermann, will be available [here](#).

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

Dry runs planned:

- W26 are MKQA and AC dipole for 1 day. Looking at all applications, logging, alarms, triggering etc.
- W27 RF beam control tests, including loops, voltages, frequency, rephrasing, gains, logging, FDs etc. Need LHC fast cycle.
- W28 controls tests – RBAC preparation for strict mode, BLMs critical settings, and MCS tests. Also TI 2 DR on Tuesday 7 July.
- W30 LBDS beam – needs RF, BIS and access strap.
- W35 for transverse damper and abort gap cleaning.

Brennan Goddard – Dry runs carry on while HWC ramps up? Verena Kain – from mid August on powering shift, from September on full 24h / 7d shifts until beam, and dry runs and machine checkout for this period have lower priority.

### 4. MD results on the LHC injection sequencing – Jörg Wenninger (slides)

Aims of the MD were to execute complete / nominal LHC injection sequences to ring 1/2 under LHC mastership, and bring all previously tested aspects together.

- Started with batches of 12 bunches of  $1e10$ .
- Had to adjust MKE4 waveform to improve waveform and also adjust timing in MKE6 to extract correctly (now understood by ABT). Need to define the settings and store these!
- Some small problems which prevented full sequence as timing bug stopped first injection to the SPS if there is no beam in the SPS...only problem found. Also IQC result came too late for the next cycle – could not be studied as lost the LHC mastership when trying to do this. Apparently both issues have been fixed.
- Prepulse diagnostics can be seen in the BIS monitor – settings critical and need to see about MCS with kicker delays.

- Observed beam losses on TPSGs due to uncaptured beam – need to calibrate this – need some more MD time which can be combined with the setup of the TPSG and MST/E protection which needs to be done
- Also seen spurious triggers on TL BPMs due to spurious bunches
- Extracted onto TED with cooling water off – about 60 degrees expected for full intensity batch.
- Beam quality monitor in SPS will be critical.

Malika Meddahi – when can we recheck? Jörg Wenninger – need similar conditions – needs long MD conditions. Need to check that the plan for August interleaved TI 2 / TI 8 has the correct conditions – e.g. 12 hours dedicated without CNGS... **Action: Mike Lamont / Elias Metral.**

Lars Jensen – could also check in detail the gains of the TL BPMs – suspect factor 1.12 too high. For TI 2 should make sure ready to cross-check. Malika Meddahi – should also apply the polynomial correction to the readings. **Action: BI**

Massimiliano Ferro-Luzzi – how is LHC simulated, e.g. BCTs? Verena Kain – TEDs in so masked out...cannot fully test IQC until injecting into the LHC.

## 5. Commissioning for forward experiments – Helmut Burkhardt ([slides](#))

Rehearsal for conference next week on elastic and diffractive scattering, with talk on commissioning of forward physics.

- TOTEM, ALFA, LHCf, FP420.
- Operational assumptions for year 1 – in steps 5 and 6 some months without crossing angle and 90 m  $\beta^*$  - would get  $5e29 - 2e30$ , which is fine for TOTEM. Could think doing this at the end of some fills?
- For later years pushing optics to limits – no crossing angle – 156 bunches, 1 mm emittance and  $3e10$  p+/bunch, gets about  $1e28 \text{ cm}^{-2}\text{s}^{-1}$ .
- Also important for absolute luminosity calibration.
- For 90 m optics need large tune compensation of 0.2 in Qx and 0.045 in Qy – can do some of this locally by giving up the right-left symmetry – but does not work due to quadrupole cabling – needs tuning and suggestions of where to do this – assuming so far that this is possible in IR4 – Ralph Steinhagen concerned about the damper and pick-up phase advances... Brennan Goddard – commissioning effort between the different optics to be considered – Massimo Giovannozzi in fact is in some senses more complicated than the squeeze, as there is a tune change to compensate non-locally – need to also consider collimation and protection setting up which adds time – can gain experience from the squeeze.
- Commissioning of unsqueeze to 90 m  $\beta^*$  foreseen during MD with minimum intensity. Brennan Goddard – when foreseen? Massimiliano Ferro-Luzzi – no formal approval from LTC yet – encouraged doing this... Ralph Steinhagen – optics possible at injection? Massimo Giovannozzi – could discuss – aperture would probably be an issue.
- For high  $\beta^*$  optics have some solutions which either involve quad polarity changes or extra cables – many things at the limit – closest aperture in IR5 is CMS beam pipe – Massimo Giovannozzi – tolerances are quite generous and can be revised. Jörg Wenninger / Brennan Goddard - should look at machine protection for this, since TCTs are at wrong phase advance. In P1 have optics for 2625 m  $\beta^*$ . Massimiliano Ferro-Luzzi – simultaneous 1 and 5? Would be an integer tune change...still lots of issues to investigate here, associated with optics, machine protection, collimation, emittance preservation, precision of parameters.

Massimiliano Ferro-Luzzi – note that LHCf want low luminosity and crossing angle, which again needs specific conditions.

#### 6. Plan for TI 2 beam tests for 11/12 July – Malika Meddahi – Rossano Giachino ([slides](#))

- Dry run in the week before, then similar to TI 8 programme with a lot of emphasis on the details of the optics, especially in comparison to TI 8. Should stay with safe beam.
- Alice requirements for TI 2 beam test – Massimiliano Ferro-Luzzi – are low intensity ( $2e9$ ) and synchro is essential with LHC clock 1, prepulse is preferred. On 2<sup>nd</sup> night they would like to switch on their dipole if possible. Need to know if above  $1e10$  per bunch.

#### 7. AOB

- MKQ kick strength limit (Jan Uythoven, [slides](#)) – concern about SEUs with 3.75 kV cf 2.8 kV ‘recommended’ by HW experts, which would break switches. Run at 2.8 kV which limits kick at 5 TeV to 0.35 sigma, which is fine for the Q measurements. Should fix this for 2011.

#### Next meeting

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

Brennan Goddard