# LHC Beam Operation Committee

## Notes from the meeting held on 24th January 2012

List of Participants

Jorg Wenninger presented a comment on the minutes from the LBOC meeting on 16.01.2011: Lars Jensen remarked that it has to be verified if the temperature correlation was correctly applied for the BPMs at the TCDQs and that he will follow this up.

### 1. Vertical Crossing Angle at IP8 (Roderik Bruce)

Roderik Bruce explained that currently a strong external horizontal crossing angle bump of ±250µrad is needed to avoid parasitic encounters in LHCb. As a consequence, the net crossing angle is different for the two LHCb spectrometer polarities. The proposed solution is a vertical external crossing angle. For 25ns beams an **external vertical crossing angle of ±100µrad would be sufficient** to ensure a 10σ beam-beam separation for the first parasitic encounter.
R. Bruce reminded that the beam screen orientation is optimized for a horizontal crossing angle. **At flat top,** the aperture restriction is in the Q2, but with an expected aperture of 20σ (not considering tolerances for orbit, beta-beat and off-momentum or beam separation) **there is a lot of margin.** This has to be verified by local aperture measurements.
R. Bruce presented that **at injection energy an aperture of 13σ is expected** (not considering tolerances for orbit, beta-beat and off-momentum or beam separation). Taking into account that with the present settings, the TCT aperture is 13σ as well, **it seems very problematic to operate with the vertical crossing angle already at injection energy.**
Since luminosity leveling and beam separation must be established in a plane that is orthogonal to the plane of beam crossing, a combination of horizontal and vertical bumps is needed. R. Bruce presented different operational implementations (see slides).

***Discussion:***
Bernhard Holzer asked if the aperture calculations assume a centered orbit. Roderik Bruce replied that the displacements due to the external crossing angle are taken into account.
Jorg Wenninger pointed out that **the proposed operational procedures imply a new TCT setup when the LHCb spectrometer polarity is changed.**
Frank Zimmermann remarked that the proposed procedure implies that there are 4 possible combinations of the internal and external crossing angles and pointed out that LHCb might want to switch between all four combinations to exclude systematics. Richard Jacobsson replied that this will not be necessary in 2012. He pointed out that **it should be ensured that the luminosity does not**

**exceed the defined limits.** LHCb will presumably request a **change of the spectrometer polarity during and a few weeks after every technical stop.** Given the impact that this procedure will have on machine availability (i.e. TCT set-up and loss maps at every polarity change) **the committee asked the Physics Coordinator to make an official request (to the LMC)** provided that all the experiments agree.

## 2. Superconducting Circuits Recommissioning (Mirko Pojer)

Mirko Pojer presented the planning of the recommissioning of the superconducting circuits after the winter technical stop 2011/2012. **From 08.02.2012 onwards, there will be powering tests during nights and weekends. 24/7 recommissioning will begin on 22.02.2012.** It is planned to **finish the recommissioning on 07.03.2011,** regardless of a possible extension of the technical stop.
Mirko Pojer informed that internal splice resistance measurements will be done on a few inner triplet circuits. As R2E mitigation about 1200 temperature sensor cards on the current leads for cryogenics control will be replaced. Since they will be singularly tested, no particular electrical quality assurance (ElQA) tests are foreseen.
The main dipole circuits will be commissioned up to 6850A (6770A required for 4TeV operation). Mirko Pojer informed about a non-conformity in an electrical insulation on magnet B30.*R7 (already observed during the 2009 commissioning),* this will not be a limitation for 4TeV operation, though.
Mirko Pojer pointed out cooling problems on some 120A corrector magnets in the inner triplets. It is agreed to use them in MDs, but they are not needed for a squeeze to 1m beta*. A non-conformity was found on an electrical connection of a quench heater for the inner triplet R1. The limitation is mitigated by the exchange of a power converter. **The RQT circuits will be limited to 200A** (in 2011 they were commissioned to 400A, but were never used with currents above 100A, including precycles and MDs). **The octupole circuits will be commissioned to 550A** (400A in 2011). For the hardware commissioning, a new user interface will be used.
Mirko Pojer presented that **the quench heaters will be fired at 200V** (instead of 900V) which will limit the degradation of the heaters.
The F3/F4 circuit breakers were swapped in half of the machine. Mirko Pojer posed the question if this should be continued for the other half of the machine.

### *Discussion*

Rudiger Schmidt pointed out that Knud Dahlerup-Petersen and Reiner Denz propose to swap the F3/F4 circuit breakers for the whole machine. Jan Uythoven asked if this could lead to a loss in protection. Rudiger Schmidt stated that this is not the case and on the other hand it could reduce the number of spurious QPS trips due to accidental opening of the circuit breakers. **The LBOC agrees to swap the F3/F4 circuit breakers in the whole LHC.**
Rudiger Schmidt pointed out that with the new hardware commissioning tool, it is no longer possible to launch tests in an unsafe order.
Jorg Wenninger underlined that during operation 200A are not needed for the RQT circuits, but that this might be the case in MDs. Massimo Giovannozzi

pointed out that for high beta optics the main quadrupole circuits are used to change the tunes. **Action: Massimo Giovannozzi will verify whether currents higher than 200 A might be required during ATS optics MDs.**

## 3. IP position offset @ IP5 (Jorg Wenninger)

Jorg Wenninger presented that the **CMS pixel detector is most likely displaced by 4mm vertically and 2.5mm horizontally** with respect to the beam center. Since the pixel detector cannot be recentred before LS1, **CMS requests to shift the interaction point in CMS towards the center of the pixel detector.** Jorg Wenninger presented that since both beams need to be moved together, the non-common correctors in the long straight sections must be used. For a 1mm orbit bump at the IP, the orbit is displaced by 1.5mm in the Q2 and about 3mm in the Q4. Assuming no compromise in beta*, there is **basically no margin in the horizontal plane.** In the vertical plane (separation plane) some margin is available. Taking into account the COD limits, Jorg Wenninger assumes that an **IP position offset in the vertical plane of 2-2.5mm could be achievable.**
Jorg Wenninger suggested to bring up the bumps for the IP shift after collapsing the separation bump. A more detailed analysis of the aperture implications and the optimal bump implementation is needed. **Action: ABP.**

### *Discussion*

Nicola Bacchetta underlined that the positioning of the CMS pixel detector will be readjusted during LS1 and asked if the shift of the IP position would interfere with van-der-Meer scans. Jorg Wenninger replied that the van-der-Meer scans are fairly small compared to the proposed IP position shift and should not imply any limitations.
Frank Zimmermann pointed out that moving the inner triplets could be an alternative.
Stefano Redaelli asked if the bump needed for the IP position offset is in the same direction as the separation bump. Jorg Wenninger replied that this has still to be checked.
Roderik Bruce pointed out that **the TCT positions should respect the proposed orbit bumps.** Thus, it is favorable to have the position shift applied during the TCT setup.

## Upcoming meetings:

Tuesday, 31st January 2012 15:30 in 874-1-011: LBOC

---

Reported by Tobias Baer