

# LHC Beam Operation Committee

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Notes from the meeting held on 13th March 2012

## List of Participants

### 1. Chromaticities, Octupoles' Currents and Bunch Length for the 2012 run (Elias Metral)

E. Metral proposed to use for the 2012 run **chromaticities of about +1** (2011:  $\approx 2$ ), **octupoles' currents of about 450A** (2011:  $\approx 200A$ ), and a **bunch length ( $4\sigma$ ) of about 1.35ns** (2011:  $\approx 1.2ns$ ) at flat top.

E. Metral explained that the chromaticity should be kept positive but as low as possible in order to minimize the needed octupoles' currents.

By using tight collimator settings, a **2.3 times larger tune shift** compared to 2011 settings is expected, which motivates the larger octupoles' currents. E. Metral pointed out that the values are obtained by scaling the 2011 settings. The predicted values by simulations are much smaller. The discrepancy remains to be understood.

E. Metral elaborated on the power loss in the MKIs and the ALFA detectors and showed that an **increased bunch length can help to reduce the power loss by a few 10%**. He also pointed out that the bunch distribution has a significant influence on the power loss. **E. Metral proposed to test different bunch lengths early on and fix it then**, also because the experiments are reluctant to bunch length changes.

E. Metral presented the results from simulations and tests related to the influence of the 2<sup>nd</sup> order chromaticity. He concluded that a large 2<sup>nd</sup> order chromaticity (due to larger octupoles' currents) is not expected to have a significant effect on the beam lifetime. Only a beneficial effect was observed so far.

#### *Discussion:*

R. Steinhagen pointed out that, due to the residual instantaneous tune noise and small modulation amplitude, the required chromaticity stability is difficult to measure at the desired reference of  $Q'=1$  and second-scale bandwidths. A better resolution around  $Q'=1$  implies longer integration which is incompatible with the fast snap-back time constant. He recommends to perform these type of measurements at an increased  $Q'=5$ . G. Arduini added that the chromaticity is very reproducible, though.

G. Arduini pointed out that the increased octupoles' currents will deteriorate the tune measurement.

P. Baudrenghien noted that an increase of the RF voltage to 14MV should not be a problem (normally 12MV). Operation at 16MV (nominal) could be tried, but is not favorable for normal operation since more trips are expected.

**Decision: We will start with the same bunch length as in 2011 and tests with longer bunches (1.35 ns) will be performed during the run to evaluate the impact on component heating and on luminosity and luminosity lifetime.**

## 2. Source of Orbit Perturbations during the Squeeze (Jorg Wenninger)

J. Wenninger elaborated on the orbit excursions during the squeeze, which were observed in 2011. Especially around the matched optics points, **reproducible orbit deviations of about 100 $\mu$ m rms amplitude were observed.** J. Wenninger presented that the deviations are even predicted by the MAD-X model. In 2011, the orbit perturbations were partly mitigated by using a larger orbit feedback bandwidth and feeding forward the real time corrections.

During the generation of the 2012 settings, a special look was taken at the LSA smoothing algorithm. Normally, a spline interpolation is used between discrete values of the generated magnet strengths. J. Wenninger presented that this **individual spline interpolation can lead to unmatched settings** (especially a dynamic non-closure of separation and crossing bumps). He showed that for the 2012 squeeze settings, this is expected to lead to 300 $\mu$ m rms orbit excursions.

J. Wenninger explained that alternatively a parabolic or parabolic-linear-parabolic (PLP) smoothing algorithm can be used. He showed that **by using the parabolic smoothing algorithm, the expected orbit excursions can be reduced by a factor 5-6**, because the temporal length of the parabolic round-off is fixed and hence also the power converter settings remain temporally synchronized.

J. Wenninger pointed out that by using the parabolic interpolation, the ability to trim the settings between the matched optics points is lost. Thus, for chromaticity, tune-trim and orbit knobs, a PLP interpolation will be used. For all other settings (in squeeze-type beam processes) the **parabolic smoothing algorithm will be used as baseline for 2012.**

### *Discussion:*

Mike Lamont asked if this will be used for the non-closure bumps of the experimental spectrometer bumps as well. J. Wenninger proposed to let the non-closure be corrected by the orbit feedback and to feed forward the real-time corrections.

### 3. Follow up of faster ramping (Mike Lamont)

Mike Lamont explained the b3 compensation model for the snapback. He showed that **for the proposed faster ramp the snap-back is expected to be about a factor 2 faster (duration of  $\approx 10$ s instead of 20s).**

#### *Discussion*

J. Wenninger added that it is planned to start with the 2011 ramp parameters (extrapolated to 4 TeV). A faster ramp will be studied early on. He pointed out that the ramp functions can be switched without much overhead.

### 4. Preliminary Planning for Initial Beam Commissioning (Gianluigi Arduini)

G. Arduini presented the planning for the first week of beam commissioning: First injections are foreseen for Wednesday 14.03.2012 morning (***Amendment: Circulating beams on 14.03.2012, 23:30; Ramp to 4TeV on 16.03.2012, 22:43***). The latest version of the planning is available on the [LHC latest-news homepage](#).

#### *Discussion*

P. Baudrenghien pointed out that the new longitudinal blow up system should be tested before ramping a single nominal bunch. Additionally, he proposed a test on longitudinal luminosity leveling by dephasing the beams. J. Wenninger pointed out that such an approach would couple the luminosity leveling for all experiments.

E. Todesco mentioned that for the decay measurements about 5 hours beam time at flat top are needed.

#### **Upcoming meetings:**

**Tuesday, 20<sup>st</sup> March 2012 15:30 in 874-1-011: LBOC**

**Tuesday, 27<sup>th</sup> March 2012 15:30 in 871-1-011: LBOC and LSWG (short)**