

# MSWG Meeting #6, 1-June-2018

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**Present:** R. Alemany, F. Antoniou, F. Asvesta, M. Barnes, H. Bartosik, M. Carla, K. Cornelis, H. Damerau, M. Fraser, S. Hirlander, A. Huschauer, V. Kain, M. Kaitatzi, E. Koukovini-Platia, A. Lasheen, K. Li, E. Manosperti, B. Mikulec, E. Senes, F. Tecker

The minutes of the last meeting were approved.

## **Agenda:**

### [Link to the Indico Event:](#)

- Approval of minutes – Karel Cornelis
- Status of operational Beams – Machine supervisors
- Main presentations:
  - LEIR to PS extraction line optics – Enrico Manosperti
  - Proposal to re-cable SPS octupoles – Hannes Bartosik

## Status of operational Beams

### [PSB – Bettina Mikulec](#)

All OP beams OK with 97.7% availability. LHC MD beams are already prepared; however, an official list is needed to check parameters are as required. On-going reliability runs on phase noise and WR B-train (firmware bug identified and workaround found, to be solved). Only ISOLDE is running on the WR. A second power amplifier was connected to the TFB: needed for MD optics studies. A detailed list of on-going MD beams was presented.

### [PS – Heiko Damerau](#)

OP beams OK. Two new ion beams, EARLY single bunch Pb<sup>54+</sup> and Nominal Pb<sup>54+</sup> (3b with 75 ns spacing) are being brought into operation. Satellites on Nominal beam with 75 ns are evident: the impact of the satellites should be checked as a next step in the SPS. Two major problems experienced in PS complex over the last 2 weeks: SMH42 down due to broken strip-line for 17h downtime and PR.WFW down with 7h downtime. Preparation of an MTE beam with h = 1 synchronisation to track bunches from the PSB and know understand which bunch is which in the PS. Preparation of the LHC 100 ns cycle is being prepared for an LHC MD later in the year. A detailed list of on-going MD's was presented.

**H. Bartosik** suggested that the LHC 100 ns beam can be taken over the weekend if there is time. For the nominal ion beam, **H. Damerau** pointed out that the satellites develop and might require regular expert tuning to keep the satellites under control. **R. Alemany** asked how much time is needed to qualify this as operational: it is ready for tests in SPS and further investigations are needed. Higher intensity causes longitudinal instability through transition, more experience is needed to understand limits.

## SPS – Kevin Li

LHC beams at  $1.1E11$  ppb with a transverse normalised emittance of  $1.3 \text{ um rms}$ . Last night an instability at flat-top in the horizontal plane, caused by a strong coupled-bunch instability at 20 MHz (the BCMS beam becomes unstable after scraping and before extraction, was not caught by monitoring systems: instability monitoring may need to be considered in the future. This is a repeat event from another a few days ago.

SFTPRO beam up to about  $2.8E13$  ppp but the TT20 MBE2103 chain is down due to transformer power converter issue that tripped on Wednesday night. The trip was due to a low oil level but further diagnostics are needed. **K. Cornelis** explained that the transformer is complicated to open: one potential plan is to remove the transformer from the chain. At least 5 days of downtime for North Area expected.

MD results were discussed from crab cavities and high intensity (LHC 50ns) were summarised: up to  $2.8E11$  ppb was injected.

Ion set-up is on-going.

**K. Cornelis** would like to take the  $1.7E11$  ppb BCMS beam over the weekend for scrubbing.

## LEIR – Reyes Alemany

After analysis of ion beam intensities compared to last year and 2016, it was realised there 20% less is arriving after the spectrometer (29+ charge state) and confirmed with FC measurements: for the time being the source of issue is not known. The Pepper-pot recently installed in front of the BCT measuring this current will be removed to check if it is the cause. MD's and set-up on the nominal beam continues.

## Main presentations:

### [LEIR to PS extraction line optics – Enrico Manosperti](#)

During 2015-16 transfer to the PS was achieved by trail-and-error despite a clear mismatch to the PS ring optics of the reference files used by YASP. The optics for a re-matched transfer line optics, including the fringe field of the PS main unit, was presented along with details of the theoretical beam size, optical functions and aperture. In order to verify the new optics a measurement campaign has been launched based on kick response techniques and time is being invested to get the required tools for LEIR to PS up and running, including YASP, ALOHA, Accelerator Model and JMAD. Preliminary results were presented. The transmission is good at 98% for the present optics. Conclusions were made and follow-up tasks identified, including requesting magnetic measurements of the fringe fields needed to complete the optics model.

### *Discussion:*

**H. Bartosik** asked what the matching conditions in the PS were used in the plot from the LHC Design Report vol. 3. **R. Alemany** explained that over the years the knowledge of how the fringe field was implemented was lost and is not applied in the files on the optics repository: it is not clear exactly how

the optics were generated in the DR even though the magnet strengths are quoted. The assumptions made today are clearly different from the assumptions made in the past and are being followed up.

#### [Possible SPS octupole reconfiguration to minimize second-order chromaticity – Hannes Bartosik](#)

Until now LHC beams (Q20) could be stabilised in the SPS using no methods other than increasing the chromaticity and the transverse feedback. The 20 MHz coupled bunch instability could be cured with the damper and single-bunch instabilities cured with chromaticity. When looking to higher intensities, the use of Landau damping by introducing tune spread with octupoles can be an efficient way of curing the (unexpected) instabilities at LIU parameters. It is successfully used in the SPS for stabilization of the Fixed Target (Q26) beam. However, this is only the case if second-order ( $Q''$ , non-linear) chromaticity can be avoided: at present, with Q20 optics and due to location of the SPS octupoles in high dispersion regions, the  $Q''$  is relatively large compared to Q26. This is the motivating factor behind the proposal to reconfigure the octupoles and minimise  $Q''$ . The location of the present and modified octupole powering was presented for implementation in ITS2, before a proposal to physically move a few selected octupoles in LS2 was presented. The powering changes to the LOF and LOD circuits does not represent a major hardware change, just intervention on patch panels. The proposed solution will reduce the effective octupole strength (same amplitude detuning 1.5 times higher  $k$ ) but leaves sufficient margin for FT operation. Interestingly, the  $Q''$  remains relatively unchanged on the Q26 cycle with the proposed changes. The load should be OK for the power converters but is being verified by Gilles Le Godec. It is proposed to test the changes in a dedicated MD by intervention on the respective octupole patch panels in the tunnel during ITS2.

#### *Discussion:*

**K. Cornelis** pointed out that if we do this change a polarity check must be done in the machine and this will take time and must be properly planned during a short technical stop. **K. Cornelis** endorsed the very good proposal, however, it will be important to test the impact of the changes on the FT beam as it is the only beam that is really using the octupoles.