MSWG Meeting #16, 2-November-2018

Present:

S. Albright, F. Antoniou, F. Asvesta, M. Barnes, H. Bartosik, M. Carla, I. Efthymiopoulos, V. Forte, M. Fraser, V. Kain, M. Kaitatzi, E. Koukovini Platia, T. Lefevre, B. Mikulec, M. Pari, T. Prebibaj, A. Santamaria Garcia, F. Tecker, F. Velotti

Agenda:

Link to the Indico Event:

- Approval of minutes – Hannes Bartosik
- Status of operational Beams – Machine supervisors
- Main presentations:
    - Tune scans for resonance identification in the PSB – Andrea Santamaria Garcia
    - Measurements of the second order chromaticity with the new SPS octupole scheme – Michele Carla'

The minutes from the last meeting were approved.

Status of operational Beams

PSB – Bettina Mikulec on behalf of G.P. Di Giovanni

Excellent availability for the PSB with only minor faults. Recent focus was on providing LHC and injector MD beams. Reference measurements are on-going. Last minute request by LHC for VdM scans (0.9 - 1.0E11 ppb at LHC injection Ex and Ey = 1.5 - 2.5 um) since the Linac3 issue caused an adjustment of the schedule. A detailed summary and progress of MDs carried out in the PSB over the last 2 weeks was presented. ISOLDE accelerated with more than 800e10 ppb on all rings with new TFB system.

PS – Ilias Efthymiopoulos

The PS had an availability of 89% with significant downtime for the North Area due to a fault on the bipolar power converter for PE.BSW14 which has no spare. The fault was explained in detailed; part of the converter was exposed to water due to a leak in the building. Modifications are foreseen during LS2 with upgraded converters and a normal spare policy. A list of on-going MD studies was presented at length. n-TOF reached the year's planned POT late on Monday October 29.

SPS – Hannes Bartosik

Recent MD highlights were briefly summarised including the BDF prototype test target MD on T6, extraction tests using a crystal to shadow the ZS, spill noise correction and high intensity LIU-type beams delivered to the LHC. Yesterday, in addition to using octupoles to reduce the extraction loss at

the ZS by a factor of almost 2, the crystal was applied in addition to achieve a loss reduction factor of 3 - 4 reduction at the ZS. An automated ZS alignment algorithm was successfully tested to speed up the alignment procedure.

Setting up of the ions in on-going. An LHC probe for Q26 optics is ready along with the EARLY cycle. The NOMINAL ion cycle is almost ready but setting up of the extraction is still required.

Main presentations:

Tune scans for resonance identification in the PSB – Andrea Santamaria Garcia

The studies were motivated by presenting the large incoherent space charge tune spread at injection (50 MeV) that currently limits the brightness of the beams in the PSB. As a result, many resonances are crossed leading to the degradation of the beam brightness. Although the injection energy will be boosted to 160 MeV after LS2, the space charge tune spread will still remain comparable to today due to the increase in intensity. In view of the LIU upgrade, measurements were carried out to identify the resonances currently present in the bare machine at 160 MeV. The parameters of the MD beam and measurements on a 160 MeV flat-top were outlined along with the method of static tune scans starting from a clean working point (4.15, 4.20). The tune was scanned over a wide range and resonances identified on tune diagrams presented with the lost intensity (from BCT) for different scenarios. The tune was measured after kicking the beam using the BBQ system. The difference between the measurements and the sampler was presented and discussed; it could arise from a coherent tune shift from impedance. The presentation then moved to dynamic tune scans which were presented in a similar way, where one tune is scanned whilst the other is held constant to scan all possible tunes. The observed resonances were summarised for each ring, and in particular, the 3Qx = 13 resonance observed in 2014 has disappeared on Ring 4. In the last part of the presentation resonance compensation was discussed. The multipole correctors in the PSB were introduced: (QNO, QSK) for the correction of normal and skew quadrupolar errors and (XNO, XSK) for the correction of normal and skew sextupolar errors. (ONO, OSK) for the correction of normal and skew octupolar errors are not connected to power converters in all rings. The powering values for resonance compensation using these elements were calculated by **F. Asvesta** and **H. Rafique** and tested using dynamic tune scans in the machine. Additional compensation of resonances proposed for 160 MeV could be used upon the restart of the machine.

Discussion:

S. Albright asked about the apparent difference in tune spreads for the different rings and if it is problematic. **A. Santamaria Garcia** stated that the tune spreads are anyway relatively small shouldn't play an important role in the measurements.

H. Bartosik pointed out that compensation of half-integer is most critical as after LS2 it will be attempted to move the working point close to the half-integer, which is critical to achieve higher brightness. For this reason, he suggested to take another look at the half-integer compensation with the remaining beam time. In addition, it should be understood why the compensation worked for some rings but not others.

H. Bartosik also recommended that the half-integer compensation is combined with other non-linear corrections in the remaining MD time.

Measurements of the second order chromaticity with the new SPS octupole scheme – Michele Carla'

In order to use the tune spread introduced by octupoles to suppress single-bunch instabilities at LIU intensities a new powering scheme was proposed and cabled for the SPS lattice to reduce the second-order chromaticity with Q20. Prior to the re-cabling incoherent losses were observed with high octupole strength due to the induced second-order chromaticity. The expected reduction of the second-order chromaticity for Q20 and Q26 was presented for the modifications that took place during the September Injector Technical Stop (ITS2). Measurement results of the non-linear chromaticity made before and after ITS2 were presented showing very good agreement with expectation for Q20 and Q26, as well as Q22 after the change. The measurement technique was explained in detail, with the tune measured using the BBQ and the momentum extracted from the RF frequency. To save time, the octupoles were turned on during the flat-bottom to make a reference with and without. A low intensity beam (1e10 p) was captured in multiple SPS buckets (PS bunch rotation off) with low momentum spread to aid stability at low or even negative chromaticity.

Discussion:

V. Kain suggested that the data is extracted and attached to the reference measurement eLogbook.

H. Bartosik explained that the very low intensity per bunch gave very precise measurements of the non-linear chromaticity. The low intensity is needed to avoid seeing other effects on the tune coming from collective behaviour when one only wants to measure the single particle behaviour in this case. For non-linear measurements the beam stays stable at large momentum offsets even as chromaticity changes wildly. Also, the small momentum spread was needed to avoid losses on the aperture when the beam is radially steered to large dp/p for the measurement.