MSWG Meeting #11, 10-August-2018

Present: S. Albright, F. Antoniou, F. Asvesta, M. Barnes, H. Bartosik, N. Biancacci, M. Carla, N. Charitonidis, K. Cornelis, G. Franchetti, K. Hanke, A. Saa Hernandez, A. Huschauer, H. Rafique, M. Kaitatzi, E. Koukovini, E. Metral, T. Prebibaj, G. Rumolo;

The approval of the MSWG minutes of the last meeting was postponed to the next meeting.

Agenda:

Link to the Indico Event:

- Approval of minutes – K. Cornelis
- Main presentations:
    - Status of operational beams
    - PS loss maps and tune scans – M. Kaitatzi
    - Recent studies at LEIR – N. Biancacci

PSB – S. Albright for A. Findlay

There is an on-going issue with intermittent losses on R2 with higher intensity and the possible sources are being investigated. The high temperature outside is causing issues with cooling circuits, in particular for the MPS.

Several MDs are performed in the PSB. Among others, studies at 160 MeV such as capture of a coasting beam were performed in preparation of post LS2 operation. Also a cycle with ramp rate is being prepared to allow earlier injection into the PS for studies of post acceleration.

PS – K. Hanke

The new TOF cycle with higher intermediate energy plateau for the longitudinal blow-up, which was demonstrated to reduce losses in MDs, was successfully deployed operationally.

The operational LHC cycles were affected by the power cut last weekend and the consequences on the PS RF system. Now the PS is full recovered.

SPS – Hannes Bartosik

The delivery of the operational beams is going well for both LHC and fixed target users. The dedicated MD on Wednesday was devoted to studies of the slow extraction, in particular the measurement of the momentum distribution during slow extraction spill. As explained by Karel, at flat top the momentum distribution of the beam is translated into a tune spread due to the large chromaticity and by ramping the tune through the resonance the particles are extracted according to

momentum. This allows reconstructing the momentum distribution from the applied tune trim. With this method the momentum distribution can be measured without perturbing physics and furthermore will allow optimizing the RF gymnastics for providing a flat momentum distribution. In operational conditions, the momentum distribution reaches +/- 2 permill.

Main presentations:

Tune Diaragram Measurements in the PS – M. Kaitatzi

The aim of the study was to characterize resonance excitation in the PS and compare the results with previous measurements from 2012. The measurement technique is based on the observation of losses during a dynamic tune scan. The new measurements were performed with a high emittance beam at 1.4 GeV using the low energy quadrupoles for tune manipulation, while the measurements from 2018 were done at 2 GeV using the pole face windings. Some changes of the resonance excitation could come from alignment of the main magnets peen performed in the last years.
The new results clearly show that 3^{rd} and 4^{th} order resonances are excited. The impact of remnant fields from octupoles and sextupoles to these resonances was tested. Both 3^{rd} and 4^{th} order resonances are observed with reduced strength when degaussing the octupoles used for MTE, but no clear impact was observed when degaussing the sextupoles (also used for MTE).
An additional measurement was performed when using the newly installed sextpoles for chromaticity correction (2 individual sextupoles). These sextupoles have a very strong impact on the nonlinear dynamics and drive 4^{th} order and even 5^{th} order resonances in addition to the third order resonances, and can therefore not really be used for correcting chromaticity operationally.

Discussion:

E. Metral asked if additional resonances were excited when changing the tune with the pole face windings. **A. Huschauer** explained that this is the case and therefore the new measurements were performed with the low energy quadrpuoles, which have been upgraded during LS1.
G. Franchetti asked about the surprising result that the strength of 3^{rd} order resonances is reduced when octupoles are degaussed. **A. Huschauer** explained that there is also an impact on the 4^{th} order resonances as expected, but the strong impact on the 3^{rd} order resonances is not fully understood.
K. Cornelis asked if it is the closed orbit or the magnet misalignment responsible for the 3^{rd} order resonance excitiation. This is not yet clear and will be studied.
S. Albright asked if the drift of the tune along the flat bottom as shown in the slides is an issue for the measurement. **M. Kaitatzi** explained that this is not an issue because the measured tune is used in the analysis.

Recent studies at LEIR – N. Biancacci

Very good performance levels have been achieved in the last few weeks. Even slightly higher intensity was reached as compared to the record from 2016 despite the lower intensity from Linac3. This is mainly due to a very high efficiency of the injection process after optimization using new

optimizer applications developed recently. All other steps for achieving this performance were also outlined, in particular the optimization of the electron cooling for keeping the stacked beam below the momentum distribution of the injected beam, the closed orbit optimization and the steering of the transfer lines. Also the elimination of the tune ripple induced by the (not used) sextupole pole face windings on the main dipole magnets was a crucial ingredient as this was causing additional losses all along the cycle. A drift of the main magnetic field on the flat bottom was also discovered and is now accounted for by dragging the beam accordingly with the cooler. As in 2016, a closed orbit bump is needed in straight section 4 to avoid strong pressure rise and degraded beam lifetime due to losses at injection. Detailed studies are also ongoing to characterize the energy distribution of the incoming beam as a function of ramping cavity and debunching cavity at the exit of Linac3.
The remaining issues with reproducibility of the machine performance are under study. So far the following effects have been identified: 1) Drifts in the trajectory of the injected beam, which is correlated with the outside temperature for the first injection. 2) Drifts of the beam intensity from Linac3. 3) Resonances in the vicinity of the operational working point contribute to losses after RF capture. Recently the most important resonance at Qy=2.66 could be compensated using the harmonic skew sextupole correctors of LEIR. 4) Detailed characterization of the electron cooler is ongoing.

Discussion:

S. Albright asked if the reproducibility of the Linac3 current is now the main focus, since the LIU performance can be reached even with lower Linac3 current. K. Cornelis pointed out that the reason for the reduced Linac3 current it needs to be understood in any case. Then the reproducibility issues of the beam from the Linac should be attacked.