# Meeting of LIU SPS-BD WG on 04.08.2016

Present

K. Li, C. Vollinger, T. Kaltenbacher, J. Muller, A. Schaffer, K. Iliakis, D. Quartullo, P. Kramer, E. Shaposhnikova, J. Repond, V. Kain, G. Rumolo, H. Bartosik, A. Lasheen, W. Hofle, J. Mitchell, H. Timko, F. Caspers, H. Damerau.

Agenda

1. Results of recent MDs on HBWB damping system – K. Li
2. Missing impedance from synchrotron frequency shift – A. Lasheen
3. Latest results of ramp simulations for 72 bunches – J. Repond
4. Short summary of previous studies of PS/SPS transfer – H. Timko
5. Studies of LHC beam losses at PS/SPS transfer – H. Bartosik
6. **- Results of recent MDs on HBWB damping system – K. Li**

* **Goal** for the wideband feedback system.
  + To damp e-cloud instabilities (multi-bunch) using high bandwidth kickers (for intra-bunch motion).
* **MD:** stabilization of e-cloud instability, TMCI.
  + Future: excite and damp intra-bunch motion.
* **Achievements.**
  + Able to target and act individually on bunches in multi-bunch MDs.
  + Able to generate a reproducible head-tail instability, but rise time still too fast for the damper.
    - Closing/opening the loop still shows that the damper is able to damp the instability and lower the losses.
* This system would be more efficient with lower synchrotron frequency 🡪 interest in Q22?
* Having a transverse Schottky system in the SPS would be a good investment (especially for crab cavity tests). The hardware is already here, but no infrastructure (Fritz: all the hardware on the 4.8 GHz system is gone?).
  + Schottky spectrum can show the cause of the rapid growth in emittance (no intensity effect).

**2 – Missing impedance from synchrotron frequency shift – A. Lasheen**

* Last presentation 🡪 2 Ohm of ImZ/n missing (50% of the actual impedance).
* New measurements were done in the Q20 optics.
* Data for bunch length corrected taking into account the PU transfer function (can change bunch length up to 150ps).
* Now missing impedance **ImZ/n~ 0.3-0.5 Ohm**.
  + For larger bunch length it seems that we need more inductive impedance.
* Adding to the SPS impedance model a resonator at 350 MHz with R/Q = 3 kOhm gives a better agreement, many possible candidates are already envisioned.

**3 – Latest results of ramp simulations for 72 bunches – J. Repond**

* Controlled emittance blow-up is the main missing element to make simulations during the ramp.
* **Blow-up** from band-limited noise **implemented** and tested for 12 bunches. Simulations running for more bunches to test the blow-up.
* The simulations being very long, a way to reduce the simulation time is to lower the number of particles and reduce the resolution of the bunch profile (smaller frequency range for intensity effects calculations).
* The numerical noise without filtering is stabilizing the beam (+7-10% in intensity threshold). Adding a filter (Chebyshev) or cutting the impedance profile gives the same results.
  + Simulations with higher number of particles are running to check the convergence (already 1 million per bunch in usual simulations…).

**4 – Short summary of previous studies of PS/SPS transfer – H. Timko**

* The bucket length is much smaller in the SPS than in the PS 🡪 need PS bunch rotation to fit it in.
* Studies in 2012: RF voltage of the 40 MHz and 80 MHz for bunch rotation optimized to maximize the transmission (turning on the second 40 MHz cavity allows to have a better transmission) and have a smaller longitudinal emittance.
* Studies in 2015: simulations redone with BLonD, good agreement with old simulations using ESME.
  + In measurements, scans were redone using the two 40 MHz 🡪 better transmission.
* Present result: **5% losses are foreseen** by the present PS-SPS transfer scheme for 0.35 eVs.
* 2x 40MHz (600 kV) 🡪 better transmission and smaller bunch length.
  + Make the S-shape less pronounced.
  + But cannot erase losses completely (**gain only 1-2% in losses but can gain 40% in emittance**).
* Remaining question: how does it behave with intensity effects?

**5 – Studies of LHC beam losses at PS/SPS transfer – H. Bartosik**

* Incoherent losses at injection plateau in the LHC (total about 5%).
* What is the nature of the losses on FB and how will this behave with LIU intensity?
* Important to minimize those losses because the SPS tunnel become more and more radioactive (long lifetime isotopes) in high dispersive regions.
* Losses were studied in a special cycle with two small ramps and 2 constant energy portions (26 GeV and 28 GeV).
* Losses at flat bottom bigger with the 800 MHz cavity switched ON, but with the same total transmission (after the losses at the beginning of the ramp).
* Loss rate comes back to the same value as with 800MHz OFF after cleaning the uncaptured beam with the tune kicker.
* By cleaning the uncaptured beam with a kicker timed outside of the batch, the losses are still present with a small rate
* Still some losses in the second flat energy portion but lower, losses at both start and the end of the ramp.
* Losses are located in high dispersive region (energy loss?).
* The bunch by bunch fast BCT study shows that the last bunches loose more than the first (e-cloud? beam loading?) 🡪 answer from measurements with 72 bunches (if still increases in the batch: e-cloud).

**Discussion**

Possible orientations and MDs to study losses in PS/SPS transfer.

* Optimize bunch rotation in the PS or explore other means.
* Include intensity effects + feedbacks in the PS/SPS studies/simulations.
* Measure with half intensity and longitudinal emittance and study losses.
* Measure losses in the SPS and scan for intensities.
* Measure with different number of bunches to determine if losses comes from longitudinal impedance or e-cloud.

Minutes written by A. Lasheen and J. Repond