# Meeting of LIU SPS-BD WG on 04.08.2016

Present

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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