# Meeting of LIU SPS-BD WG on 21.04.2016

Present

H. Bartosik, T. Kaltenbacher, K. Li, G. Rumolo, M. Schenk, E. Shaposhnikova, C. Vollinger, J. Repond, T. Roggen, D. Quartullo, J. Esteban Müller, T. Bohl, A. Lasheen, J. Perez Espinos, B. Salvant

Agenda

1. Improved method for the measurements and simulations of the SPS nonlinear optics – H. Bartosik
2. Longitudinal instability thresholds on the SPS flat top – J. Repond
3. Update on  impedance of vacuum flanges – T. Kaltenbacher

Foreword

* The working group on vacuum flanges plans to short-circuit the vacuum flanges in June (36h technical stop), device design from C. Vollinger/T.Kaltenbacher, manpower with access to the tunnel is needed to install short-circuits.
* A working group exists for the TWC200 upgrade. Work has been currently done for the 200 MHz impedance study, to have a better estimation of the HOM and further damping ideas.

Previous actions

* Fritz will give an evaluation of the low frequency impedance between 20 MHz and 1 GHz for the isolated flanges at one of the next meetings. → Fritz absent, postponed.
* The installation of the second 1-section cavity TW200 in the lab to be checked with Eric → done?

**1 - Improved method for the measurements and simulations of the SPS nonlinear optics – H. Bartosik**

* **Motivation:** study incoherent effect, chromaticity, resonances etc.
* **Measurements:** tune as a function of the radial steering.
* Measurements and model changes from year to year, depends on the optics and the SPS supercycle.
* Measurements are corrected with the detuning due to impedances.
* Parametric model in MAD, each magnet depends on their type (symmetry) and remanent fields have multipolar errors (each type of magnet has one type of error). The parametric model is minimized with an SVD algorithm to fit the measurements.
* Combined fit using Q20 and Q26 results together with taking into account the errors from the remanent field in the sextupoles and the octupoles allow to fit very well the measurements with the MAD model.
* The remnant field value from the fit is at the 1% level.
* Tests are planned to go to negative current at the end of the cycles to minimize the remanent field and see the effects on the linear chromaticity, assess the effect of demagnetization of the sextupoles/octupoles at the end of the cycle and to optimize the operational cycles (small losses on the injection plateau…)

**2 - Longitudinal instability thresholds on the SPS flat top**

* Simulations for 72 bunches at the SPS flat top for the present impedance/ RF configuration and the future configuration (RF upgrade + impedance reduction).
* Good agreement for the current situation, HL-LHC goals achievable with impedance reduction but within very tight margin.
* Uncertainties in simulations
  + Due to the scan in emittance and intensity (coarse grid).
  + How the beam loading is taken into account as a function of intensity with feedback loops.
  + Bunch to bunch variations.
* According to synchrotron frequency shift studies, some reactive impedance is still missing in the SPS impedance model
  + Equivalent to ImZ/n ~ 1 Ohm or multiplying (all) kickers impedance by 1.5.
  + For multi-bunch instabilities, the simulations are more pessimistic with respect to measurements.
  + This impedance could come from loops around the insulated flanges.
* Possible gain in instability threshold for the HL-LHC can be obtained from
  + Shielding more vacuum flanges.
  + Acting on the 629 MHz HOM.
  + Acting on the MKP impedance.
  + Small improvement for each type.
* The influence of the 800 MHz parameters (voltage V800 and phase) has been studied. The ratio V800/V200 between the voltages is currently set in operation to 0.1 (bunch shortening mode). Increasing V800 (from 10% to 30%) increases substantially the stability threshold on the SPS flat top for V200 = 10 MV.
* Two 800 MHz cavities are now available in the tunnel, we can test this in MD (intensity is limited due to beam loading, idea is to try for smaller emittances).
* The effect of the 800MHz phase offset is asymmetric (adding up to +60° doesn’t change much the stability, while up to -60% the beam is much more unstable).
* Need to simulate the stability with 72 bunches through the ramp, currently difficult due to simulation time (> 2 weeks for 1 simulation).

**3 - Update on impedance of vacuum flanges – T. Kaltenbacher**

* Current shielding of QF-MBA flanges reduces the R/Q by a factor ~20 (with gap filling).
* Simulations done for the double tube design were compared with measurements of the prototype.
* Simulations run to study the effect of the gaps for the double tube design → the open gaps leave resonances that can be removed by closing the gaps with RF fingers.
* Benoit: the impedance reduction is also beneficial in the transverse plane.

Afterthought

* Elena : We have seen in simulations that the effect of the 42 remaining unshielded pumping port is important.

Actions

* Simulations for single bunch stability adding ImZ/n ~ 1 Ohm to assess how much the agreement would change → A. Lasheen.
* Schedule the MD sessions.
* Next meeting 19th or 26th of May 2016

Minutes written by A. Lasheen and J. Repond