**Meeting of LIU SPS-BD WG on 21/05/2015**

**Present:** Theodoros Argyropoulos, Hannes Bartosik, Thomas Bohl, Fritz Caspers, Juan Esteban Muller, Jose Ferreira Somoza, Alexej Grudiev, Wolfgang Höfle, Patrick Kramer, Kevin Li, Jaime Perez Espinos, Toon Roggen, Giovanni Rumolo, Benoit Salvant, Elena Shaposhnikova, Jose Varela Campelo, Christina Vollinger;

**Agenda:**

1. Overview of the 2015 scrubbing runs and MDs on transverse plane – K. Li/H. Bartosik
2. Multibunch measurements and simulations – T. Argyropoulos
3. Update on design of VF shielding – J. Varela
4. Summary of discussion on enamel flanges/isolation need – E. Shaposhnikova
5. **K. Li and H. Bartosik – Overview of the 2015 scrubbing runs and MDs on transverse plane**
* The scrubbing runs in Week16 and Week17 were mainly performed with the standard 25 ns beam with up to 2e11 p/b. The main limitation for the scrubbing efficiency comes from the MKP4 outgassing. Doublet beams were used during periods of MKP4 cool-down.
* Coherent horizontal instabilities observed above 1.6e11 p/b could be cured with LOF octupoles such that no emittance blow-up along the bunch train was observed for up to the maximum intensity injected, i.e. about 2e11 p/b.
* Bunch-by-bunch losses on the flat bottom extracted from the FBCT show significant electron cloud signature for high intensity 25 ns beams. Gradual improvement of the losses could be achieved over the two scrubbing periods (from up to 40% losses within 3.5s for individual bunches to less than 20% losses).
* Radial steering and closed orbit bumps over entire arcs were performed with several batches of the doublet beam for scrubbing outer parts of the dipole chambers.
* The transverse emittance at the end of the flat bottom was measured as function of intensity showing the expected linear dependence with good emittance preservation in the SPS. Further optimization in the PSB and PS is needed to reach the full brightness potential of the injectors.
* Higher intensity from the injectors would be desirable for the next scrubbing session in order to study the beam quality for a beam with 2e11 p/b after scrubbing with higher intensity.
* The test of accelerating high intensity beams will be also part of the next scrubbing run.
* MDs on non-linear single particle beam dynamics are presently ongoing in order to benchmark the SPS octupole knobs with the MADX model.
1. **T. Argyropoulos – Multibunch measurements and simulations**
* The beam energy threshold of the longitudinal instability of LHC type multi-bunch beams along the ramp in single RF was measured as function of intensity. Similar thresholds are observed for bunch trains with 24 or more bunches, while a slightly higher threshold is found for a train of 12 bunches. Even higher instability thresholds are found for single bunches.
* The characteristic of the driving impedance was studied as function of the gap in between two batches of 12 bunches. It seems that a gap of 275 ns might be sufficient to decouple the two batches, since in this case the threshold is similar to the 12 bunches case. For smaller gaps the threshold is similar to a train of 24 bunches. Further measurement will be needed to improve statistics.
* No clear coupled bunch modes are observed when the beam becomes unstable, but rather a mixture of all intra-bunch modes (microwave instability).
* A possible candidate for driving this instability is the vacuum flanges impedance. First calculations of the induced voltage indicate that a gap of 275 ns is sufficient to decouple bunch trains of 12 bunches, similar to the observations in the measurements.
1. **J. Varela – Update on design of VF shielding**
* An update on the studies for shielding flanges of group II was presented. The proposed solutions are compatible with insulated (Enamel coated) flanges.
* Using a finer mesh for a more realistic analysis of the convolutions leads to additional resonances results in a 25% higher total imaginary Z/n.
* A slight reduction of the total imaginary Z/n of the reference shield could be achieved by using a tube-like shield inside the bellow and RF fingers to ensure the electrical contact between shield and flange. This solution is mechanically more robust, but also more expensive.
* The remaining cavity like volume cannot be filled from the side of the bellow since the vacuum seal needs to be passed through. The gap can be filled from the other side. A small gap always needs to remain to avoid trapped volumes which take a long time to pump down.
* Compared to the complete redesign of the flanges, the proposed shielding has a higher imaginary Z/n (since the full impedance spectrum is taken into account).
* It was proposed to study the option of using an RF bypass with a 2-3 Ohm contact between insulated flanges.
1. **Summary of discussion on enamel flanges/isolation need – E. Shaposhnikova**
* Vacuum flanges of group I exhibit a larger cross-section change and thus a bigger contribution to the total SPS impedance is expected.
* Insulating flanges were installed in the SPS to avoid eddy currents in the loops formed by grounding cables (one at each last dipole in ½ cell). Short-circuiting these flanges could enhance the impact of eddy currents on the beam (chromaticity decay at flat bottom and variation along the ramp). About 1/6 of the enameled flanges around the BPMs were short-circuited by the installation of shieldings during the last impedance shielding campaign. It is not necessary to remove these shieldings in case the insulating flange is kept on the other side. It remains to be decided how the remaining 39 unshielded BPH-QF flanges can be shielded, since there are not enough spare shieldings of the same type available.
* In general insulated flanges should be preserved at the locations of the machine where they are presently installed. The type of shielding to be deployed could be decided after additional tests.
* The RF bypass of the PS vacuum flanges is needed to mitigate the beam-coupling impedance created by insulating flange in combination with ground loop. A similar RF bypass with a resistance of a few Ohm could be beneficial also for the SPS.
* The status of the insulation of the vacuum flanges of the pick-ups used for the transverse damper will be investigated during the upcoming technical stop.

Minutes written by Hannes Bartosik