**Meeting of LIU SPS-BD WG on 16/04/2015**

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**Agenda:**

1. Impedance measurements of the 200 MHz TWC – T. Roggen
2. Discussion on enamel flanges need – E. Shaposhnikova/J. E. Varela/BI
3. Report from the SPS scrubbing run – H. Bartosik
4. Update on BLonD development – A. Lasheen
5. **T. Roggen – First Measurements on the SPS 200 MHz Travelling Wave Cavity (ACTCA) towards an impedance model**

* Bead-pull measurements were performed on a one-section test module of the 200 MHz SPS cavity. This test module has no power couplers and no HOM couplers. The measurements were performed in standing wave configuration.
* Good agreement between measurements and numerical simulations for the R/Q values of the modes at the fundamental pass band and for the HOMs is achieved. However for some modes asymmetric field dependence along the cavity was observed in the measurements. This could be intrinsic to the test module.
* Calculating the Q value for a full cavity consisting of 4 or 5 sections is not straightforward. Further studies are needed.
* No significant longitudinal impedance was found at 1.4 GHz.
* Since the measurements cannot be performed in the travelling wave configuration, the impedance of the cavities in the normal operational mode needs to be extracted from numerical simulations.

1. **E. Shaposhnikova/J. E. Varela/BI – Discussion on enamel flanges need**

* When the SPS was built, each half-cell was grounded at the last dipole. In order to avoid eddy currents due to ground loops at the BPMs, which are also grounded, insulated flanges (Enamel coating) were used next to the BPMs. In general, all elements that are grounded were originally equipped with insulating flanges on either side.
* In the course of the pumping port shielding campaign, the pumping port shieldings have also been installed in about 2/3 of the bellows (64 in total) next to the horizontal BPMs and as a consequence, the adjacent insulated flanges have been short-circuited and these BPMs have insulated flanges only on one side. In case of interventions, the installation of these shieldings in the bellows next to the QFs is particularly inconvenient since the bellow needs to be fully compressed and this requires special tools. If the original situation of insulated flanges needs to be re-established, these shieldings would need to be removed. In this case a new stock of Enamel flanges needs to be built up, since there are not enough spares and the Enamel coating is damaged for several flanges installed in the machine.
* The functionality of the present MOPOS BPM system is not affected by ground loops. Also the new MOPOS electronics, which will be deployed as part of LIU, will not be affected by ground loops as the electric signal is going through a transformer and is then converted to an optical signal.
* An experimental check of the effect of ground loops on the new MOPOS electronics could be done with the BPMs used for the transverse damper, which are already equipped with the new electronics, by short-circuiting the adjacent Enamel flanges.
* A possible option for cost saving for the present shielding campaign could be to keep the Enamel coating only on one side of the BPMs. However, this could create a ground loop. The question would then be how many of these ground loops could be acceptable for machine operation or in other words, how many positions around the machine could be accepted to be only insulated on one side of the BPMs. An option could be to install the pumping port shield in the remaining 39 bellows next to the horizontal BPMs not yet shielded, even though this could create additional ground loops. Furthermore the vacuum group does not prefer this option due to the complicated installation procedure.
* The impact of eddy currents on the beam is clearly seen in terms of chromaticity variation along the ramp and chromaticity decay at the injection plateau. If further presently insulated flanges are short-circuited, e.g. by removing the Enamel coating, the dynamic effect of eddy currents on chromaticity is expected to be enhanced.
* The eddy currents in ground loops induced by the variation of the magnetic field and the resulting multipole components seen by the beam could be studied in simulations in order to understand how critical the insulation of vacuum flanges is. Alternatively an experimental test could be done by temporarily short-circuiting a large number of Enamel flanges.
* The status of the ground connections around the machine was checked during LS1 for the first time since a very long time. Many ion pumps are not grounded properly, some are not insulated (the Enamel coating is an integral part of the vacuum pumps). Some vacuum chambers in the machine are floating, i.e. have Enamel flanges on both sides but no ground connection. The problem is that there is no clear procedure and policy on where Enamel flanges are required in the SPS. In new drawings produced for ECRs there is usually no mentioning of Enamel flanges, even if the element that is being modified had Enamel flanges in the past. A clear procedure for the installation of vacuum flanges, similar to what is done in the PS (checking vacuum flange insulation of the modified element after installation), needs to be established for the SPS.
* The documentation of the vacuum flanges having Enamel coating presently in the machine needs to be improved, i.e. the machine layouts need to be updated, and clear installation procedures for all vacuum interventions need to be established 🡪 to be discussed in the LIU coordination meeting.

1. **H. Bartosik – Report from the SPS scrubbing run**

* The standard 25 ns LHC beam with 1.8e11 p/b was injected into the SPS. No blow-up along the batch was observed when beam is stabilized with octupoles in the horizontal plane. Otherwise the beam suffers most likely from coupled bunch instabilities. Simulations of this coupled bunch instability due to e-cloud are computationally very demanding and presently not feasible.
* The main limitation for the scrubbing dose comes from the MKP4 vacuum interlock, which is reached due to a combination of static pressure increase due to the kicker heating and due to dynamic pressure rise coming from e-cloud. The interlock level was raised in agreement with TE-ABT.
* The possibility of performing stable phase measurements in the SPS during the scrubbing run to identify e-cloud induced energy loss along the bunch train was discussed. The development of a dedicated measurement card would require significant development time on the order of months. Measuring only at flat bottom might be possible using existing hardware, but the measurement resolution could be an issue. It would be interesting to get a first estimation of the expected energy loss from pyECLOUD simulations.

1. **A. Lasheen – Update on BLonD development**

* The coordinate system for the longitudinal equations of motion was changed from using theta (longitudinal position around the machine in radians) to time.
* Multi-bunch beams can be generated including matching to the RF bucket with intensity effects.
* Multi-bunch simulation results agree with the results from the simulation code of Theodoros, but both simulation codes show a higher threshold for the onset of the multi-bunch longitudinal instabilities along the ramp compared to the measurements.
* Multi-turn wakes are not yet implemented in the code. They are essential for simulations for the PSB, but might also be needed for simulating properly high Q resonances in the SPS.

Minutes written by Hannes Bartosik