**Meeting of LIU SPS-BD WG on 29/01/2015**

**Present:** Theodoros Argyropoulos, Hannes Bartosik, Thomas Bohl, Juan Esteban Muller, Jose Ferreira Somoza, Verena Kain, Alexandre Lasheen, Giulia Papotti, Jaime Perez Espinos, Danilo Quartullo, Benoit Salvant, Elena Shaposhnikova, Mauro Taborelli, Jose Varela Campelo, Na Wang, Carlo Zannini;

**Agenda:**

1. Survey of the SPS vacuum flanges during x-mas stop – J. A. Ferreira Somoza
2. Update of the SPS impedance model – J. E. Varela Campelo
3. New features of the SPS BQM – G. Papotti
4. First results of instability simulations during ramp – T. Argyropoulos
5. Planning of the SPS MDs for 2015 – H. Bartosik
6. **J. A. Ferreira Somoza – Survey of the SPS vacuum flanges during x-mas stop**

A summary of the X-ray survey of the SPS vacuum flanges was presented.

* The presence of the damping resistors in vacuum flanges was checked with X-ray radiography for all positions specified by J. Varela (all positions apart from one position behind the beam dump which was not accessible).
* On average, the damping resistors are missing in about 14% of the cases. Almost 25% of the damping resistors are missing in BA4. In BA1 most of the damping resistors are in place (5% missing), most likely due to the fact that the area is quite hot and therefore not so many interventions have been done.
* Some example pictures were shown. Sometimes only the screws for holding the damping resistors in place were left in the flanges. There was also a flange in which 2 damping resistors were installed.
* The survey was important in order to clarify the situation of the damping resistors presently installed in the machine and to establish a consistent impedance model.

1. **J. E. Varela Campelo – Update of the SPS impedance model**

An update of the SPS longitudinal impedance model taking into account the findings from the X-ray survey of the damping resistors was presented.

* In the 2014 impedance model it was assumed that in total 7% of damping resistors are missing. The model was updated to account for the 12% missing damping resistors as identified in the X-ray survey.
* A comparison of R/Q between the 2014 model and the updated model shows very similar values. Some high Q resonances have been slightly enhanced since in some cases the percentage of missing damping resistors has been underestimated.
* The latest version of the impedance model includes the main impedance sources. Elements not included so far, such as the ZS and MSE/MST septa are expected to represent small contributions compared to the flanges.

1. **G. Papotti – New features of the SPS BQM**

An overview of the SPS BQM features and the underlying algorithms as well as the upgrades implemented during LS1 was presented.

* The BQM acquires one profile at the first turn after each injection, 25 profiles during the ramp for a detailed analysis of the beam pattern and the population of satellite bunches, and 8 profiles at flat top for measuring the final bunch parameters and beam stability.
* The number of turns between the profile acquisitions at flat top was adjusted to the faster synchrotron motion in Q20 cycles – now there are 26 turns between acquisitions (the synchrotron period at 450 GeV corresponds to 3.5 ms).
* Two attenuators are available to adjust the sensitivity of the wall current monitor to the beam intensity; one is non-PPM (adjusted by Thomas Bohl and Urs Wehrle), the other one is PPM and can be adjusted by the operators.
* A new feature is the possibility to set a number of bunches that are allowed to be outside the BQM limits. The idea is not to dump the beam if only one or two bunches do not meet the beam quality requirements.
* Another new feature is the possibility to set limits on the minimum and maximum tolerated bunch intensity (i.e. the sum of ADC counts in the bucket). For the doublet beam the minimum/maximum intensity includes a setting for the tolerated intensity unbalance. The limits of acceptable unbalance for LHC BPMs will be defined together with BI.
* Losses of individual bunches along the bunch train, e.g. from e-cloud, will be caught by the BQM though the RMS intensity check.
* A rough pattern check is done also for the doublet beams, but no check for satellites.
* For the moment the BQM does not deal with beams consisting of both standard and doublet bunches, however this will be needed for the LHC (normal bunches within a train of doublets will be needed for orbit measurements).
* The calculation of the 25% and 75% bunch length in addition to the FWHM proposed for the LHC would be very interesting also for the SPS in order to get some additional information on the longitudinal distribution.

1. **T. Argyropoulos – First results of instability simulations during ramp**

Preliminary results of the simulations of the longitudinal instability during the ramp were presented.

* Measurements of the longitudinal instability performed in the SPS using 12 bunches of the 25 ns beam with varying intensity in single RF are used to benchmark the macroparcticle simulation code of T. Argyropoulos written in MATLAB. The feed-forward and the longitudinal damper were off, but the feed-back was on during the measurements.
* The measurements show a sharp decrease of the momentum threshold as function of the beam intensity. There was no big difference observed between measurements with or without feed-back.
* Using the SPS longitudinal impedance model, the macroparticle simulations of the full ramp reproduce the intensity dependence of the momentum threshold quite well. The momentum thresholds found in the simulations are slightly lower compared to the measurements. Better agreement might be achieved by reducing the numerical noise in the simulations by using a larger number of macro-particles.
* Simulation studies on the dependence of the instability threshold on the RF voltage setting with multi-bunch beams are ongoing. It was observed with single bunches (both in measurements and in simulations) that during the ramp a lower RF voltage is better for beam stability, while at flat top a higher voltage is better.
* First multi-bunch simulations indicate higher thresholds when excluding the vacuum flanges. Detailed studies will be performed to assess the impact of the 1.4 GHz and 2.5 GHz resonances of the flanges on the beam stability. Also the importance of the different types of vacuum flanges on the instability threshold will be studied.
* It was mentioned that in one scenario for the implementation of the aC coating of the dipoles for e-cloud suppression the short straight sections need to be removed to access the dipoles and thus the adjacent vacuum flanges need to be dismounted anyhow. This work could be combined with the flange modification for impedance reduction.
* For the option of designing new vacuum flanges for impedance reduction it needs to be clarified if the Enamel coating is really needed (e.g. for the BPMs). At the moment about 66% of the enameled flanges presently installed in the machine are short-circuited due to scratches on the Enamel coating. If the Enamel coating is needed, it will be outsourced to external companies.

1. **H. Bartosik – Planning of the SPS MDs for 2015**

An overview of the MD planning for 2015 was presented.

* About 30 blocks of 10 hours dedicated MDs will be available in 2015. The main focus of the studies will be e-cloud (scrubbing vs. coating) and longitudinal beam dynamics (intensity limitations and beam instabilities). Parallel MDs can be done 4 days per week.
* A new web-tool for collecting and organizing the MD requests has been put in place <http://md-coord.web.cern.ch>. MD requests should be submitted directly there.

Minutes written by Hannes Bartosik