# Meeting of LIU SPS-BD WG on 02.02.2017

Present

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Agenda

1. Outcome of Chamonix workshop – E. Shaposhnikova
2. Status of vacuum flange shielding – C. Vollinger
3. Transverse HOM damping in 200 MHz TWC – P. Kramer, J. Repond
4. Update on the SPS impedance model – T. Kaltenbacher
5. **– Outcome of Chamonix workshop – E. Shaposhnikova**

The LHC Performance Workshop (Chamonix 2017) took place from 23 to 26 January 2017. The outcome concerning the upgrade of the SPS are presented.

* Findings from the CMAC (CERN Machine Advisory Committee):
  + Losses after transfer to the SPS decreased significantly (30%) by adding cavities in the PS.
  + Losses are still present due to S-shape.
  + Regarding the ions beam, slip-stacking in the SPS must be studied.
* Recommendations:
  + Address the current limits in PS/SPS for protons and ions.
    - Actual limitations in the PS: a strong coupled bunch instability.
      * Mitigated by a 10 MHz RF system FB and a coupled bunch feedback for dipole motion based on the Finemet cavity.
      * Higher-order multipole instability observed.
      * Intensity threshold for the LHC proton beam with 0.35 eVs: 2 x 10^11 ppb.
      * Controlled emittance blow-up is necessary to obtain 2.6 x 10^11 (0.5 eVs). Larger bunch in the SPS gives more losses (0.35 eVs presently).
    - Actual limitations in the SPS:
      * Capture losses at injections.
      * Strong coupled bunch instability.
  + Study slip-stacking with intensity effects in the SPS (Danilo).
  + Evaluate the possibility of cooperating with other lab (CERN collaborations):
    - Slip-stacking requires a lot of work mainly in the LLRF.
    - Possible review in the middle of year, inviting experts (Fermilab).

**2 – Status of vacuum flange shielding – C. Vollinger**

A new shielded design of the RF flanges is presented.

* Two types of shielding:
  + Interpolated shield design (currently deployed during EYETS 16/17).
    - Uses sliding RF fingers 🡪 less reliable.
  + Double tube shield.
* Both suffer from the gasket gap (impedance with resonant frequency at 1.5 GHz).
  + With the gasket closed: impedance at 1.5 GHz significantly decreased.
* New design: braided RF shield (already used in Japan: the new design is vacuum compatible).
* **Action**: provide impedance measurement of the new design (braided RF shield).
* **Suggestion**: produce a prototype for measurements. Study the validity of the design from RF point of view.

**3 – Transverse HOM damping in 200 MHz TWC– P. Kramer, J. Repond**

The transverse couplers at 938 MHz in the SPS 200 MHz TW structure enhanced the 628 MHz longitudinal HOM. This HOM is critical for beam stability and possible modification of the transverse coupler is studied. The available holes in the cavity could be used for another type of coupler (coupling the magnetic field).

* Present configuration: 2x4sections + 2x5sections with:
  + 460 MHz transverse HOM couplers (4 per cavity).
  + 628 MHZ longitudinal HOM couplers (4 per section).
  + 938 MHZ transverse HOM couplers (0-3 per section).
* The 628 MHz longitudinal HOM is critical for beam stability and has to be damped.
  + Possible option: damping system which couples to the magnetic field at the position of the 938 MHz couplers.
* The actual 938 MHz transverse couplers enhance the longitudinal HOM at 628 MHz.
* What is the effect of the **938 MHz HOM** on transverse beam stability? **Acceptable value** regarding the **damping** of this HOM?
  + The couplers have been installed for the fixed target beam (lower intensity than LHC-beam).
* Possible test:
  + Replace one or two couplers during dedicated MD (too many to replace them all).
  + Observe if it affects transverse beam stability.
* **To keep in mind**: beam quality for the fixed target beam (possible higher intensity in future) should not be deteriorated.

**4 – Update on the SPS impedance model – T. Kaltenbacher**

Report on new improvements in the SPS impedance model.

* The functional specifications for the vacuum valves in the SPS (VVSA, VVSB) are ready to circulate.
* Beam dump (TIDVG 3 and 4):
  + Building of the proposed design (version 3) in progress.
  + ImZ/n reduced to 10.3 mOhm (previously 14.6 mOhm).
  + Details of version 4 under discussion.
* 11 MBB/DN159 pumping ports in the tunnel (100 kOhm):
  + No damping resistors mounted.
  + More of this type of pumping ports will be installed in future.
* Ongoing study of two different items with several resonant impedance in the range of 500 MHz to 1.5 GHz.
* Some connections between magnets with complex shape have been identified and their impedance will be studied in future.
* Question from simulations:
  + Some pumping ports contribute to low frequency impedance (below 500 MHz).
  + How is it possible that holes of the size of the beam pipe contribute in this frequency range? 🡪 Show next time results for discussion.

Actions

* Danilo: simulation of slip-stacking taking into account intensity effects, with realistic beam parameters (bunch-by-bunch variation).
* Provide measurements of the new RF shield design (braided RF shield), produce a prototype for measurements.
* Thomas K.: Provide results of pumping ports impedance acting below 500 MHz for discussion.

Minutes written by J. Repond