Meeting of LIU SPS-BD WG on 17.03.2016

Present: Hannes Bartosik, Thomas Bohl, Mauro Migliorati, Fritz Caspers, Juan Esteban Muller, Thomas Kaltenberger, Alexandre Lasheen, Danilo Quartullo, Toon Roggen, Elena Shaposhnikova, Christine Vollinger, Joël Repond;

Excused: R. Calaga, V. Kain, G. Rumolo, B. Salvant

Agenda:

1. Beam simulations for situation after the RF upgrade – A. Lasheen
2. Measurements and EM simulations for vacuum flanges – T. Kaltenbacher
3. Update on studies of the 200 MHz TW RF system – T. Roggen

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1. **Alexander Lasheen – Beam simulations for situation after the RF upgrade**

- The impedance reduction scenario from the LIU baseline is not sufficient to achieve the required beam intensity with 72 bunches and 7 MV.
- We have to determine a realistic impedance reduction scenario. Do we miss an impedance in the model, dominant for 72 bunches and how the 200 MHz RF impedance will change after the RF upgrade?
- **Fritz Casper:** The contribution of the isolated vacuum flanges together with grounding loops in the range 1 MHz to 1 GHz are not yet included in the model which could be numerous and important.

  => Action: measurements of inductive impedance of vacuum flanges on experimental set-up by Fritz, Christine and Thomas K.
- The impedance of the main harmonic of the TWC differs between the estimation from G. Dôme and the CST simulations. Up to now the CST value was used in BLonD simulations.
- For the HOM the estimations and the CST simulations are comparable but still need to be refined.
- The assumptions for an impedance reduction used in simulations are:
    - The non-enamelled flanges can be short-circuited by shielding with design having almost zero impedance.
    - The complete change of impedance at the reduced by approximately factor 20 level was taken from the CST simulations for the enamelled flanges.

- The real RF power for acceleration available at intensity of 2.5E11/bunch after RF upgrade has to be evaluated.
- From the simulations on the SPS flat top at 10 MV :
    - Dividing the impedance of the MKP by 2 does not improve the situation significantly.
    - The gain from acting on the BPV-QD is not very large and in reality it is very difficult to do so.
    - Acting only on vacuum flanges gives us only small margin in beam stability above the HL-LHC value.
    - The remaining unshielded pumping ports (UPP), what can be done about them?
    - What can be achieved concerning the damping of the 630 MHz HOM?
    - With impedance reduction planed in the baseline, we are not so far from the LIU baseline but within small margin and a lot of assumption and uncertainties are to be taken into account.
- A complete redesign of the vacuum flanges would be the best (but too expensive) solution.
    - We do not know exactly how the impedance will be changed by the shielding
    - A complex design introduces mechanical problems and can change the impedance in an unexpected way.
    - Installation of many shields makes the machine less reliable.
- The impact of a more realistic beam distribution and the ramp should be studied. The updates of the impedance model will be gradually implemented.

2. **Thomas Kaltenbacher – Measurements and EM simulations for vacuum flanges**

- The strategy used for the EM simulations:
    - Import the model from CATIA whenever possible
    - Reduce the complexity.
    - Store them in a database.
- The MBA-QF and QF-QF flanges can be considered as identical from impedance point of view

- The Q in measurements is lower with respect to simulations (approximately by factor 3). The difference may come from material conductivity and contact resistance of the vacuum gasket. Work is ongoing to fully assess this effect.
- Other sources of the SPS impedance are investigated.

3. **Toon Roggen – Update on studies of the 200 MHz TW RF system**

- The measured and simulated S21 transmissions around the HOM 630 MHz were compared for the cavity in the workshop (1 section) and in the tunnel (4 sections):
    - For 1 section, there is a good agreement between measurements and CST simulations (within error margin, due to temperature, etc.). The 630 MHz HOM dampers work great.
    - For 4 sections, there is disagreement between measurements and simulations as well as between the two measured 4-section cavities (R. Calaga).
- The resonances that disagree may be transverse. Transverse HOM dampers will be included in the simulations to check this.
- We have to make sure that the model is representing the cavities in the tunnel.
- The simulations for 4 sections around 630 MHz compared with previous simulations (J. Varela) are in good agreement (small discrepancies at a few percent level, which may depend on meshing in simulations). The discrepancies and small resonances are in the uncertainty (mechanical tolerances …).
- It may be difficult to increase further HOM damping, as the dampers work already very well. In simulations 30% further reduction (Ya. Shashkov) was achieved by installation of the additional dampers on the bottom of cavity.
- From S21 measurements, it is difficult to say if a further damping is possible (spectrum is quite flat around 630 MHz). A comparison of the HOM with loads off is necessary and data exist.

4. **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.
- The installation of the second 1-section cavity in the lab to be checked with Eric => Elena
- The next meeting is planned for April 21st.

Minutes written by J. Repond