**SPSU 14 April 2011**

**Present:** H. Bartosik,E. Benedetto,F. Caspers, K. Cornelis, P. Costa-Pinto, S. Hancock, W. Hofle, R. Garoby, S. Gilardoni, B. Goddard, N. Mounet, G. Rumolo, E. Shaposhnikova

**Excused**: G. Arduini, Y. Papaphillipou, H. Damerau, M. Taborelli, E. Métral

**Brennan Goddard**

Summary and discussions:

Brennan showed the slides presented by Roland at the IEFC workshop, in which the LIU baseline and stretched goal beam parameters were displayed. Detailed discussions took place to clarify the reason for the limitations of emittances as function of intensity (in particular the linear dependence of the emittance on intensity below a threshold intensity (vertical line), the latter being set by the maximal intensity that could be delivered to the SPS). In the present upgrade schemes, there is a clear push for high bunch intensity. However, Roland reminded that LHC50 and LHC75 are harder to produce with low longitudinal emittances in the PS as fewer splittings are performed. W. Hofle also pointed out the problem of large inhomogenety of the intensity of injected bunches in the SPS. It was proposed to study slip stacking to merge bunches in the SPS to overcome the intensity limitations from the PS. It will be necessary to perform simulations for various proposed schemes in the upgraded machine. The idea is also to consider all the limitations in the injector chain together, not only the limitations set by the SPS.

**Elena Shaposhnikova**

Summary

Elena reported on her studies on the opportunity to install a low frequency RF system in the SPS to enable increasing the longitudinal emittance. Elena reminded that the 80 MHz RF system in the SPS was already proposed and discarded in the 1990s, as it was concluded that bunch compression in the PS was a better solution. Elena listed the constraints for the injected bunch length, stability and voltage for the possible frequencies of this low frequency SPS RF system, i.e. 40, 80, 120 or 160 MHz.

Elena’s studies show that what is good for the bunch length in the PS is bad for the beam stability in the SPS. Actually only the 80 MHz RF with a low gammaT seems to be a viable solution from that point of view.

Elena then argued that the 200 MHz RF system should be kept in the SPS along in any case with the new low frequency RF system, which actually puts a constraint on the minimum low harmonic RF voltage that should be installed (to work as Landau cavity the 200 MHz voltage should be much lower than that from the accelerating cavity, but at the same time the 200 MHz should not be too low as it is very difficult to operate below 500 kV due to beam loading).

Elena stated that the requirements are difficult to obtain with a low harmonic SPS RF system, and came to the same conclusion as D. Boussard, probably not for exactly the same reasons.

Single particle tracking simulations by Heiko Damerau show that more 80 MHz voltage could enable to obtain 0.43 eVs within 4ns full bunch length, and that there would still be a need for bunch rotation in the PS, even with a low harmonic in SPS.

Steve Hancock showed a PS logbook entry (23 March 2011), in which he used all three 80 MHz PS RF cavities to increase the longitudinal emittance of LHC beams, and observed that LHC beams with a larger longitudinal emittance are still subject to coupled bunch instability, and pointed out the bunch length increase along the batch due to the impedance of the extra 80 MHz cavity.

Discussion:

* Injecting 8 ns long bunches would create satellite and lead to beam loading issues due to the 200 MHz system.
* Putting more cavities in the PS would not help for beam stability in the PS. More voltage would be interesting (as in SPS for extraction to the LHC). There is also a plan to add additional feedback in the PS. Fritz asked about the e-cloud in PS for shorter bunches and higher intensity.
* Elena asked if this study was convincing enough or more analysis is needed? Roland answered that all arguments are there. There is a fairly small interest in low harmonic in the SPS. These studies should be summarized in a paper and a presentation at the PSU WG is foreseen.

**Pedro Costa Pinto: report from PAC’11**

A lot of interest has been expressed from Argonne lab and BNL on aC coating, and on the link between SEY and roughness. In Cornell, it is possible to measure SEY in-situ, and conditioning can be seen very well on Al and TiN surfaces (with synchrotron radiation). No conditioning was observed on amorphous carbon samples, probably due to their low SEY. This is consistent with ecloud monitor readings in SPS. They also have no complete understanding of pressure behaviour.

**Hannes Bartosik for Giuliano Franchetti:**

For space charge studies in the SPS Giuliano performed harmonic analysis of the betatron oscillations around the ring and found a peak at 108 (periodicity of beta functions, 108 FODO cells) and also a peak at 52 (=2\*Qx). Since he also obtained an increase in vertical emittance above the integer tune and 2 islands in phase space, he concludes that the structure resonance of second order is excited.

In low gammaT optics, the peak at 2\*Qx=40 in harmonic analysis is smaller by a factor 10 than for nominal gammaT. Giuliano is planning now to perform self-consistent 2D simulations for low gammaT to compare the emittance growth. He also has ideas for future MDs and simulation campaigns and the SPSU-BD is planning to invite him again in a few months.

**W. Hofle**

The calculations and measurements of the resistive wall instability spectra and growth rates done for transverse damper upgrade in preparation of the SPS for LHC beam in 1998-1999 were reviewed.

The values of resistive wall impedance, 120 MOhm/m and 200 MOhm/m in H/V plane, quoted from L. Vos, seem to be higher than presently used, by approximately factor 3, most probably due to the different working points (different non-integer part of tunes). This impedance leads correspondingly to very high growth rates, also confirmed at that time by measurements with damper off for both 5 ns (full ring, no e-cloud) and 25 ns (1/11 and 3/11 of the ring) bunch spacings. The resistive wall growth rates should depend on total intensity. Growth rates at low frequencies were indeed determined by the total intensity while those at high frequencies - by local intensity. Another presentation at future meetings will be devoted to the simulations done for CNGS beam in collaboration with E. Vogel.

* check that the difference in H/V impedance can be explained by different WPs (below and above the half integer in particular).

Fritz was wondering about image currents in the frequency range 0-100 kHz.

**M. Holz**

First results obtained at the multipactoring test in 181 were presented.

It was possible to reproduce measurements carried out last September. Clear effect of multipactoring has been seen from pressure rise for all gas components together with cleaning at a few hours time scale. Thermal effect can be excluded due to the fast signal decay after switching power off. Pressure Increase with magnetic field has been observed together with the fact that Hydrogen component becomes dominant (instead of water). Dependence on resonant frequency has been studied; by changing the frequency different regions can be cleaned.

Next meeting on May 12.

Preliminary agenda:

* SPS MD W19 – first beam observations
* Impedance of ceramic slots in the SPS – B. Salvant (tbc)
* Update on resistive impedance – N. Mounet
* Space charge calculations – H. Bartosik

Minutes by B. Salvant