**Meeting of LIU SPSU-BD WG on 19/12/2011**

**Present:** Theodoros Argyropoulos, Hannes Bartosik, Thomas Bohl, Heiko Damerau, Roland Garoby, Simone Gilardoni, Steven Hancock, Wolfgang Hofle, Elias Métral, Juan Esteban Mueller, Giovanni Rumolo, Benoit Salvant, Elena Shaposhnikova, Mauro Taborelli, Helga Timkó.

**Excused:** Gianluigi Arduini, Fritz Caspers

1. **Heiko Damerau: Results of the last MD on LHC beams transfer from PS to SPS**
* *Summary:*

Heiko summarized the results of the two MDs performed in July and November 2011 to see if there is a benefit for beam transmission in the SPS in using all three 80 MHz PS cavities for the bunch rotation. The MD in July showed that transmission depends mainly on longitudinal emittance and less on bunch length. The MD in November confirmed this fact also for optimized conditions in the SPS (e.g. 3 MV capture voltage in the SPS). The bunch length is ~0.5 ns smaller with 3 cavities, but SPS transmission was not improved. Non-optimal first part of rotation with 40 MHz could be the cause of the 1-2% additional losses with 3 cavities for the same bunch length and larger emiitance. Indeed ~1% particles seem to be in the tails for bunch rotation with 900 kV.

**Action for PS-SPS MDs in 2012: measurements with varied rotation time in 40 MHz should be performed to check transmission in SPS at constant longitudinal emittance.**

* *Discussion*

Roland wondered if the larger emittance would not be an issue for the transfer line, but Heiko answered that the transfer line acceptance is very large.

Simone concluded that these MDs are a confirmation that optimization in the SPS did not help to the SPS transmission: particles are already outside of the SPS bucket whatever happens in the SPS.

**Helga Timkó: PS to SPS transfer studies, update on simulations**

* *Summary:*

Helga reminded the results presented at the last meeting. She showed that ~1% more particles are simulated (with ESME) to be in the tails with 900 kV rotation, in very good agreement with the bunch shape measurements of Heiko. She scanned a few values of the bunch shortening time and showed that simulated transmission can be optimized by 1 or 2% that way, but bunch length is then increased. There would be more margins with 3 of the 80 MHz cavities to increase the bunch length.

**Action for Helga: add PS impedance in simulations.**

* *Discussion:*

Steve Hancock said that old estimates of the longitudinal low frequency inductive impedance of the PS are in the 15-20 Ohm range.

Heiko could not see in measurements the effect of the transient beam loading during bunch rotation.

Is there also an effect of e-cloud in the PS (energy loss)? It is difficult to observe as the bunch is already asymmetric in the measurement. An idea would be to use a longer flat top and see what happens.

Are the remaining observed losses assumed to be also longitudinal? It is hard to tell and Elena said there is probably also a bit of transverse.

Simone proposed to use an intermediate voltage (750kV). However the effect is expected to be linear with voltage.

Heiko expects that the impact of impedance is bigger during acceleration than during bunch rotation.

**Steven Hancock: Non-adiabatic Bunch Rotation in the PS: Can the Spare 40MHz (80MHz) Cavity Help?**

* *Summary:*

Steven compared the potential beneficial impact of adding another 40 MHz cavity or another 80 MHz cavity. He said that both cases would not improve much the matching to the SPS bucket, but he added that the 40 MHz cavity would offer more bucket margin, leading to a more linear rotation. Using the third 80 MHz cavity to decrease losses requires optimization of the bunch rotation and also leads to an increase in bunch length.

**Action: generate loss maps as a function of different RF timings.**

* *Discussion:*

The following questions were raised: can impedance be added reliably in ESME? Can beam loading in mult- bunch be estimated? Which PS model should we use?

**Action: study high intensity effects.**

Heiko wondered how much there is really to gain, as measurements and simulations show gains of the order of 1-2% for nominal bunch intensities.

**Hannes Bartosik: space charge calculations**

* *Summary:*

Following discussions at the last meeting between Yannis Papaphilippou and Alexey Burov in particular, Hannes compared the space charge tune spread computed for Q20 and Q26 optics from the known formula (protons). Higher dispersion in arcs in Q20 would be expected to lead to a smaller space charge tune spread. Indeed Hannes found that the computed tune spread for Q20 is 10 to 20% smaller than for Q26 in similar beam conditions.

* *Discussion*

For ions, IBS seems to be the main limitation.

**Action: Hannes and Yannis will look more closely at IBS to see if new optics can be implemented.**

**Elena Shaposhnikova: Review of 2011 studies and priorities for 2012**

* *Summary:*

Elena pointed out the main results from 2011, as well as the discussion points for the next run, in particular the need to decide on coating or scrubbing at the end of 2012, the limits posed by MKE heating and ZS sparking, the need to optimize the Q20 optics without systematic comparisons with Q26 and to make beam in Q20 optics ready for injection into LHC. Finally she drew the priority list for studies in 2012 (test scrubbing, inject Q20 into LHC, push up 25 ns intensity, optimize double RF system, and impedance identification).

* *Discussion*

Elena mentioned that the lower emittances observed last year compared to previous years could be an effect of instrumentation (both multi bunch and single bunch). Elias reminded that 1.1e11p/b were already measured at 1.4micrometers with 50 ns in 2008 and asked which differences with previous years could explain the lower emittances. He said that it is the first year where we had 50ns beam high intensity sent in LHC, but Giovanni answered that he does not expect it could give a significant scrubbing.

Were there less capture losses?

Roland reminded that the decision to coat the SPS is to meet HL-LHC requirements in 2020.

With 25ns beam, Roland said that the official highest intensity in SPS was 1.1E11 in 3 micrometers. For the PS, Simone will check.

Roland also mentioned the checks of the scheme with 7e10p/b within 1micrometer in SPS and LHC.

Minutes taken by B. Salvant