**Meeting of LIU SPSU-BD WG on 31/05/2012**

**Present:** Theodoros Argyropoulos, Hannes Bartosik, Chandra Bhat, Fritz Caspers, Alexander Molodozhentsev, Juan Esteban Muller, Giovanni Rumolo, Elena Shaposhnikova, Brennan Goddard, Sasha, Giovanni Iadarola, Mauro Taborelli, Helga Timkó

**Presentations:**

**Helga: Recent PS-to-SPS transfer MD**

The ESME simulations showed that the efficiency of the PS-to-SPS transfer can be optimized by adjusting the timings of the 40 MHz and 80 MHz cavities for the bunch rotation in the PS. The goal of the MDs was to measure the transmission as a function of these timings.

*It is interesting to note that in some cases better transmission is obtained for longer bunches at extraction from the PS. While previously the optimization of transmission was usually based on minimizing the bunch length at extraction, this study shows that transmission depends more on the longitudinal emittance. It is crucial to obtain a good understanding of which parameter needs to be optimized for maximizing the transmission between the PS and SPS. It is important to note that these optimization studies aim at improving the transmission by up to (2 – 3)%, or equivalently, reducing the losses by up to 50% for nominal beams while the reproducibility* (standard deviation) of the transmission measurement is around (0.5–1)%.  
  
*. Good statistics are therefore needed for drawing conclusions. Furthermore, also transverse effects contribute to the losses.*

*In the presently ongoing MD studies high intensity 50 ns LHC beams are used. It may be better to use lower intensity beams in order to reduce intensity effects such as beam loading.*

**Hannes: SPS Space charge studies – preliminary MD results**

Space charge studies in 2012 were concentrated up to now on the identification and quantification of space charge effects, such as the estimation of the tune spread for given beam parameters, emittance blow-up close to the integer resonances, and emittance evolution along the flat bottom. An important observation is that the losses on the flat bottom and at the beginning of the ramp (long flat bottom for up to 4 injections and LHC type ramp) were higher compared to 2011.

*The higher losses on the flat bottom during these MDs compared to the last year need to be addressed in further studies. They might be related to interventions in the PS during or before the MD in the SPS (change of the extraction conditions due to a modification of the extraction bump). Another possible reason for higher losses could be insufficient orbit correction on the SPS flat bottom.*

**Theodoros: RF measurements during long MDs in week 17**

Single bunch longitudinal instability thresholds were studied in both the nominal Q26 and the low-gamma transition Q20 optics using only the 200 MHz main RF system. The results are not conclusive yet, as the measurements for the different optics were taken on different days and are thus not directly comparable. Furthermore, only a few valid data points could be acquired in limited time due to different issues during the MDs. Nevertheless, the threshold intensity for longitudinal single bunch instability is higher in the Q20 optics.

*The aim of the study is to find the threshold for this instability and not so much to compare the two optics. It seems important for future studies to establish stable beam conditions for the highest intensity to be studied (adjusting chromaticity, longitudinal emittance blow-up, the parameters of the 800 MHz system) before attempting to study instability effects.*

**Yannis: LHC ion beam in the SPS with Q20 optics**

The motivation for studying the Q20 optics for the LHC ion beam in the SPS comes from the observed strong losses and intensity effects on the long flat bottom, which result in a big spread of beam parameters at the SPS extraction: the IBS and space charge effects are expected to be mitigated in the Q20 optics due to larger (transverse) beam sizes.

*The growth rates of the transverse and longitudinal emittances due to IBS were calculated using the Piwinski formalism. For both optics this formalism predicts that below transition the transverse emittances will increase and at the same time the longitudinal emittance will decrease. It was discussed if these predictions are compatible with experimental observations in the machine. In particular, the observed bunch shortening might be related rather to losses than to the IBS effect, since the transverse emittances are practically conserved along the flat bottom and damping of the longitudinal emittance should not cause losses.*

*The Q20 optics was tested with ion beams in 2 parallel MD sessions (with only 6 injections, since all 4 injection kickers were needed). The observed losses, bunch shortening and conservation of transverse emittance are very similar to the nominal optics when using the same fractional tunes. Further studies are needed, in particular trying to better disentangle the effects of space charge, IBS and the impact of RF noise on the particle losses. In addition, other IBS theories should be compared with the results obtained so far and the simulations should be refined using multi-particle Monte-Carlo codes. It is also important to note that in general not many studies of IBS effects were performed for machines below transition (such as the SPS with ions at injection energy).*

**Elena: Uncontrolled emittance blow-up - Bunch length on FT**

An uncontrolled longitudinal emittance blow-up at the SPS extraction was observed in the Q26 optics with high intensity single bunches (>2e11p/b), setting a lower limit on the longitudinal emittance at around 0.5 eVs.

*High intensity single bunches were injected into the SPS and intensity was adjusted by transverse scraping at high energy. Without (or small) controlled longitudinal emittance blow-up, the bunch length at extraction was increasing with intensity. This could be explained by a longitudinal instability at high energy. The BQM measurements at flat top indicated long bunches which did not exhibit strong signs of instability. The measurements should be repeated acquiring bunch profiles during the ramp and at flat top, in order to see if the uncontrolled emittance blow-up is caused by instability.*

Minutes written by Hannes Bartosik