**Meeting of LIU SPS-BD WG on 13/12/2012**

**Present:** Theodoros Argyropoulos, Hannes Bartosik, Chandra Bhat, Nicolo Biancacci, Fritz Caspers, Heiko Damerau, Juan Esteban Muller, Roland Garoby, Steve Hancock, Wolfgang Höfle, Elena Shaposhnikova, Mauro Taborelli, Helga Timkó;

**Presentations:**

**Theodoros: RF measurements during floating MD in week 46**

This MD was a continuation of the longitudinal studies with the high intensity (1.6-1.7x1011 ppb injected) 25 ns beam in the Q20 optics. This time the focus was put on the first batch only, which is typically the most critical with respect to instabilities at high energy. The importance of the uniformity of the bunch length along the batch was demonstrated: Taking the bunch length along the batch for all stable cases and all unstable cases during this MD shows very similar average bunch length in both cases, but a larger spread for the unstable cases. The controlled longitudinal emittance blow-up is difficult to optimize for a high intensity beam when the bunch length spread is big, due to the potential well distortion and the large variation of the synchrotron tune shifts. In particular in the center of the batch the synchrotron frequency distribution is monotonic with a big slope and thus the effect of a bunch length variation on the frequency shift is strong. For these bunches the controlled emittance blow-up is typically less effective and this could explain why typically bunches in the center of the batch become unstable at high energy. On the other hand, bunches at the end of the batch are blown up more efficiently due to the effect of beam loading and they typically remain stable.

*The large longitudinal emittance (high bunch length at injection) used during this MD helps for stability. More important than the average bunch length is however the spread of the bunch lengths/longitudinal emittances at injection, as it affects the efficiency of the controlled blow-up. Unfortunately it seems very difficult to significantly improve the bunch length spread at PS extraction beyond the presently achieved parameters.*

*The controlled blow-up is achieved by adding noise on the phase loop of the 200 MHz RF cavities. No significant difference was observed in previous studies when introducing the noise on the phase loop of the 800 MHz system instead.*

*The effect of bigger blow-up of the bunches at the edges of the batch is attributed to beam loading. The beam loading in the 800 MHz cavity will be compensated better after the upgrade of the 800 MHz low-level RF system during LS1. In any case, the beam suffers more from the beam loading in the 200 MHz cavities, which is already compensated by the existing one turn feedback.*

**Thomas: Illustration of longitudinal bunch profiles for the 25ns beam showing satellite bunches**

In recent MDs with the 25ns beam the voltage program had dips at the moment of each injection. This was observed to improve beam stability at high energy, but leads to a larger satellite population (since the dips create uncaptured beam). As a large satellite population is undesired in the LHC, the satellite population should be monitored and kept at reasonable values in future MDs.

*The SPS BQM setting for the satellite population in percent is just a knob: the BQM is looking at the entire longitudinal profile (including reflections and things like that); it has to be adjusted such that the LHC can accept it (and it does not correspond to a physical number);*

**General discussion: How about capturing in the 800 MHz system and then ramp up the 200 MHz voltage for merging the four bunches into one?**

*This question was raised, since the capture of long bunches into two 200 MHz buckets for testing the doublet beam (for scrubbing) had a comparably high efficiency and it could similarly help to better capture the longitudinal distribution after the bunch rotation in the PS. However, it is presently not possible to capture in 800 MHz, since then the 200 MHz component would be missing and thus the phase loop would not work in the present configuration. In addition the available voltage for the 800 MHz system is much too low.*

**MD priorities in 2013:**

A limited amount of parallel MD time will be available in the beginning of 2013 (until middle of February). This time should be used for reference impedance measurements in longitudinal and transverse planes before the machine modification / upgrade during LS1, and other measurements and studies for better understanding and modeling of the present machine limitations for LHC beams.

Minutes written by Hannes Bartosik