Minutes of the meeting of the SPS Upgrade Study Group on 21 January 2011

Present: G. Arduini, T. Argyropoulos, H. Bartosik, C. Bhat, F. Caspers, S. Federmann, W. Hofle, Y. Papaphilippou, B. Salvant, M. Taborelli, G. Rumolo, E. Shaposhnikova

Excused: R. Garoby, B. Goddard

• Transverse emittances now and after SPS upgrades (preparation for Chamonix) - E. Shaposhnikova

(1) Linear fit to the single bunch emittance measured in the intensity range from 1E11 to 3.5E11 (single bunch limit) doesn't go through the origin and most probably describes emittance blow-up due to the SPS transverse impedance. It is not clear why measurement points are on one line. In any case measurements should be used with caution since they were taken under different conditions (days). Nevertheless a lot of effort went into the machine settings optimisation for intensities up to 2E11.

→ We should try and reproduce in simulations this emittance blow-up below the TMCI threshold with the existing SPS impedance model.

(2) Transverse emittances of LHC beams with 75, 50 and 25 ns bunch spacings measured in 2010 at various intensities are very different, with maximum emittances for a 25 ns beam and 75 ns beam being close to the single bunch limit (see above). Note that injected emittances for 50 and 75 ns beams were higher than in the past (with double batch injection in the PS).

(3) The dependence of transverse emittances of 25 ns and 50 ns spaced LHC beams (with the same total and bunch intensities) on batch number is different. A 25 ns beam has blow-up, most probably due to the e-cloud effect.

(4) For the same bunch intensity transverse emittances measured during MDs with low transition energy are significantly smaller than those with nominal optics. This could be explained by the increase in beam stability and an absence of emittance blow-up related to the transverse impedance (below TMCI threshold). However the measured points should be scaled down in intensity due to longer bunches and 10% losses at the too low voltage of 1.8 MV (the same as with nominal optics). Note that in order to obtain the same longitudinal parameters the RF voltage should be increased $\sim \eta$. After scaling by 30% in intensity these emittances (together with low intensity point at nominal optics) give as a linear fit another line which goes through the origin and corresponds to a space charge limit of 0.13.

→ Accurate measurements with correct voltage should be done in 2011 to verify these expectations

In conclusion, studies done in 2010 allow to hope already now for a 3 μm emittance for the ultimate beam spaced at 50 and 75 ns, and with the 25 ns spacing after e-cloud mitigation. Even lower emittances, 2.5 μm, can probably be obtained now with the low gamma-t optics for 50 and 75 ns beams if RF voltage (at the beginning of cycle and at transfer to LHC) turn out to not be a problem.

• **MD planning for 2011 - G. Rumolo**

The overall MD time in the SPS in 2011 is very similar to 2010, but the proportion between dedicated and floating MDs has changed in favour of the latter. The first proposal for 2011 MD schedule has been modified: MDs at the end of the large MD blocks (LHC TSs) are displaced (to free July) to avoid an overlap with the LHC set-up.

A new MD web page has been created.

At the moment (deadline is on 31.01) the MD requests received cover 33% of 444 hours available (both dedicated - 132 h and floating - 312 h).

The list of MDs important to the SPS upgrade was presented. It was completed by an extensive list of MDs related to the low gamma-t optics.

→ The most important question for the SPSU studies is the stability of nominal and ultimate LHC beams in the low gamma-t optics and the required/available RF voltage.

- The next meeting will be on **14 February 2011** at 15:30.

Preliminary agenda:

- Structure of the SPSU project - B. Goddard
- Outcome of Chamonix workshop - E. Shaposhnikova
- Update on Headtail simulations for single bunch in the SPS - B. Salvant
- Observation of transverse instability in SPS with 50 ns bunch spacing - G. Rumolo

Elena Shaposhnikova, 1.02.2011