

Minutes of the SPS Studies Working Group (SSWG)

6th meeting -23th May 2000

Present: G. Arduini, T. Bohl, H. Burkhardt, K. Cornelis (chairman), Y.C. Chao, W. Hofle, M. Jimenez, J. Klem, T. Linnecar, D. Manglunki, G. Rumolo, E. Shaposhnikova, R. Tomas, J. Tuckmantel, L. Vos, K. Weiss, F. Zimmermann, M.P. Zorzano (secretary)

1 MD results on the LHC cycle

1.1 Acceleration studies (T. Linnecar)

Acceleration studies with a single batch (80 bunches) on the LHC cycle show beam blow up and losses on the ramp due to noise in the coarse frequency program which is injected into the loops. These loop gains were adjusted in the past to minimise the parameter changes during extraction, this was needed for the experiments. But the frequency program has a limited number of bits and this creates steps in the function. As a temporal solution the blow up can be avoided by suppressing the loop, but for the future this problem needs to be solved.

In the following MDs the bunch length should be monitored. This is interesting also for the head-tail device (R. Jones), as well as for the ferrite kickers studies (L. Vos).

1.2 Chromaticity settings (G. Arduini)

Normally at high energy the chromaticity is put to negative values during extraction (in order to have less sextupolar component in the machine). With these settings, due to the intensity on each bunch, the system was unstable. The chromaticity has been corrected to be positive at high energy without perturbing the extraction.

2 Relocation of the SPS transverse damper (W. Hofle)

Until now the kickers are installed in the dispersion suppressor (“missing magnet section”) of sextant 2 (left), between QF214 and QD215. All the equipment is in BA2. The horizontal

kickers that have an aperture of 142 mm would work fine up to a $\beta_H = 88\text{m}$. The two horizontal systems are presently at a location with $\beta_H = 72\text{ m}$ (average). The vertical kickers have an aperture of 38 mm and are presently at a location with $\beta_V = 42\text{ m}$ (average), already close to the aperture limit ($\beta_V = 49\text{ m}$). Presently SPS tunes are $Q_{x,y} = (26.62, 26.58)$ and it is under consideration to change the tune (raise Q_x to reduce the dispersion, specially for the high intensity beams with big $\Delta p/p$, or reduce Q_x for gamma transition).

It has been observed in the past that when the machine tune is set very close to a fractional tune of $Q = 0.5$ the beam becomes unstable. For the case of a transverse instability in a circular accelerator, controlled by a feedback system working in resistive mode using a single kicker, the gain margin vanishes as the tune approaches multiples of 0.5. Since the needed gain increases with the intensity of the beam this will be an important issue for the high current beams. The problem disappears in simulations when the two kickers are located 90 degrees apart in betatron phase space. A phase advance smaller than 90 degrees also helps. The minimum phase advance required in practice is about 60 degrees. In an MD it was confirmed that the gain margin is drastically reduced when the machine tune is changed from 26.58 to 26.53 in the vertical plane.

To solve the instability problem it has been proposed and agreed to displace one of the vertical systems from the left dispersion suppressor (sextant 2-) to the right (sextant 2+) dispersion suppressor. The phase advance between the two positions is 300 degrees which is equivalent to 60 degrees. This solution works fine for integer tunes from 21 to 27.

3 Vacuum studies during the scrubbing MDs (M. Jimenez)

A number of measurements have been performed during the scrubbing test MD for increasing intensity per bunch and increasing number of bunches in the batch. The current threshold beyond which the vacuum rises linearly is typically 4×10^{12} protons for the gauges located between two dipoles, whereas for the gauges without magnetic field the threshold is higher and equal to 5×10^{12} protons. The vacuum improves as the scrubbing acts.

As for the chamber that were treated by a N_2 discharge (installed in BA5) the behaviour with and without treatment seems to be similar. But the Nitrogen treatment increases the efficiency of the commissioning (after 94 h there is no threshold).

(G. Arduini, K. Cornelis) For comparison it is advisable to repeat these studies with a treated chamber located in a dipole (candidate: MB6). For the treatment procedure we need to install a wire to discharge, we should remove the magnet for this. The location can be vented but only for a short time. One should also monitor simultaneously the electron cloud presence with the help of pick-ups.

During these MDs the intensity was never higher than 6×10^{12} , and we can not check if any saturation process exists beyond a certain current as it is expected from F. Zimmermann simulations.

4 AOB

CPS single bunch has not been tested. It is foreseen that either this afternoon or on Thursday morning the beam should be available. Therefore the Friday MD, will probably be dedicated to commissioning of this beam on the SPS site.

5 Next meeting

The next meeting is scheduled for Tuesday 6th June, at 09:15, Room 865-1D17. A reminder will be sent by email in due time and the agenda will be announced on the web page of the working group

<http://cern.ch/sl-mgt-sps-swg>

M.P. Zorzano 23th May 2000