Minutes of the SPS Studies Working Group (SSWG)

6^{th} meeting 21^{st} August 2001

Present: G. Arduini, T. Bohl, H. Burkhardt, R. Cappi, K. Cornelis (chairman), M. Hayes, W. Höfle, L. Jensen, R. Jones, J. Klem, T. Linnecar, S. Myers, G. Rumolo, F. Schmidt, E. Shaposhnikova, R. Tomas, J. Tückmantel, L. Vos, J. Wenninger, F. Zimmermann (secretary)
Excused: D. Manglunki

---

1 Impedance Measurements (H. Burkhardt, J. Klem, R. Jones, E. Shaposhnikova)

H. Burkhardt reported on measurements of coherent tune shifts and head-tail growth rates, performed by himself, G. Rumolo, F. Zimmermann et al. on the MD cycle with the MESPS beam on August 6, 8 and 15. Two preceding days had been spent on the set up of the cycle. The detuning with amplitude and the optimum octupole strengths were also determined during these MDs (A. Faus-Golfe et al.). The last impedance measurement, on August 15, suffered from interference by the parallel MD on the main cycle.

Compared with the year 2000, the coherent tune shift is reduced by about 30% in the vertical plane. The horizonal tune shift with intensity is almost exactly zero. The head-tail growth rates as a function of chromaticity are not much smaller than those measured last year. The chromaticity was varied over a large range, corresponding to a chromatic frequency shift of about ± 0.8 GHz. Many synchrobetatron modes were observed. Decay times of individual modes are obtained from a filtered fit.

L. Vos recalled that an impedance reduction by about 50% had been expected. Space charge might affect some of the results. H. Burkhardt mentioned that a repetition of these measurements at different bunch lengths or energies would be desirable.

J. Klem presented data on the current dependent phase advance. The scatter over the BPMs is considerable, and no definite conclusion can be drawn. There seems to be less evidence for step changes (localized impedance) than in last year's results.

R. Jones showed a measurement with the head-tail monitor where the phase shift between head and tail strongly increases with intensity. This signal might provide a complementary

means of measuring the transverse impedance.

E. Shaposhnikova reported on longitudinal impedance measurements, performed by T. Bohl, T. Linnecar, and herself. The rf was on, and the bunches were short, with an FWHM length between 1.6 and 2.0 ns. Both the quadrupole frequency shift and the bunch length were measured as a function of intensity. At low current, the slope of the frequency shift with intensity is reduced by a factor 2.5–3.0 compared with 1999. The quadrupole frequency shift saturates above $N_b \approx 5 \times 10^{10}$, which is ascribed to the imaginary part of the impedance. This compares favorably with results from 1999, where at the same intensity the quadrupole frequencies sharply dropped reflecting the threshold of a longitudinal instability.

In 2001, also the bunch lengthening with current is much reduced compared with 1999. Fitting the slope of the bunch lengthening vs. intensity the reduction amounts to a factor 5–7. A striking observation is that bunch length oscillations with amplitudes of about 10% persist over several seconds. R. Cappi raised the question if these oscillations may be a feature of a double harmonic rf bucket.

No single-bunch instability was seen. Controlled blow up will now be required to stabilize the beam against coupled-bunch instabilities.

2 Matching in TT20 (G. Arduini)

In order to provide an even spill to the experiments, especially to NA48, zero dispersion is required at the splitter and at the target. In 2000, the measured vertical dispersion was found to be large at the last measurement point, but this result appeared to be inconsistent not only with the model but also with a fit to the upstream monitors. Afterwards it was discovered that the SEM grids had wrongly been assumed as uniform. Taking the correct grid spacing into account, the final dispersion, though still large, is now consistent with small deviations from the ideal model optics measured upstream. The dispersion can be corrected by dipole correctors, and the optics response was as expected. After correction, the spill quality greatly improved in T2, T4, T6, and in NA48. K. Cornelis emphasized that this study has solved a 20-year old problem in the SPS.

3 2002 MD Schedule (K. Cornelis)

G. Arduini presented a first draft MD schedule for 2002. He proposed to allocate time for 9 long MDs and 5 Wednesday MDs. This will maintain the same density of long MDs as this year throughout the 2002 run. The fraction of Wednesday MDs is reduced. Also evoked was the possibility to combine SPS and CPS MDs into longer blocks of 36 hours. R. Cappi mentioned that this might be inconvenient given limited manpower in the PS. He also indicated a preference for more MD time in the CPS. The schedule will be discussed with the physics coordinators. The allocation of MDs during the lead ion run was not completely clear.

K. Cornelis mentioned a request by F. Ruggiero for fewer and longer blocks of MD time. Several participants favored many 24-hours MDs, believing that these reduce the risk of losing MD time due to failures and allow for reflection between successive MDs.

H. Burkhardt expressed the wish to change the beam energy during the MD cycle, *e.g.*, for the impedance measurements.

4 Next long MD (G. Arduini)

The next long MD is scheduled for this week, August 22–23. The first and last 8 hours will be devoted to the rf, the intermediate 8 hours to transverse studies. Either 3 or 4 LHC batches will be stored and accelerated.

The availability of the luminiscence and ionization profile monitors (IPM) was discussed. C. Fischer may look at the latter for two hours on early Thursday morning.

5 Resonant Driving Terms (R. Tomas)

Data acquisition and analysis for the measurement of resonance driving terms have partly been integrated into J. Klem's programme. Last week, new data were taken by M. Hayes, F. Schmidt, and R. Tomas. Among other applications, this technique can be used for coupling correction by minimizing the ratio of horizontal and vertical tune lines in the vertical frequency spectrum, or vice versa, as a function of skew-quadrupole strength. The magnitudes of the slope on either side of the minimum were found to be more similar this year, though not exactly the same (-37 and 26). The optimum setting of the skew quadrupole was -0.115. This is about the same magnitude as last year, but opposite in sign. K. Cornelis suggested to localize the source of coupling by processing data for all BPMs.

6 Next Meeting

The next meeting of the SPS SWG is tentatively scheduled for Tuesday, 4th September, at 09:15, in Room 865-1D17. The agenda will be posted on the web page of the working group http://cern.ch/sl-mgt-sps-swg, and an announcement will be sent by email in due time.

F. Zimmermann, 21st August 2001