SPS Studies Working Group
Ninth Meeting – 28 September 1999

Present: G. Arduini, T. Bohl, H. Burkhardt, R. Cappi, E. Chapochnikova, K. Cornelis (chairman), W. Höfle, T. Linnecar, I. Papaphilippou, F. Ruggiero, F. Schmidt, J. Tückmantel, H. Tsutsui, L. Vos, M.P. Zorzano, G. Roy (secretary)

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1 Status of Beams

R. Cappi mentioned that the fast shavers are now operational and that the scraped beams should be available for the MD in 10 days.

2 Power Limits in TW RF system

T. Linnecar reported on the power limitations in the 200 MHz TW RF system. The limitations are due to beam loading.

The TWC in LSS3 will have their couplers redesigned during the shutdown for broadband untuned models with a power rating of 750 kW per cavity and a total voltage of 8 MV.

The power amplifiers, one per cavity, now stand a maximum power of 1 MW. The average that can be safely delivered is about 750 kW. The couplers after the upgrade will sustain this average power of 750 kW and will tolerate a maximum power of 1.5 MW. In conclusion: realistic values are: 1 MW for two to three seconds and 750 kW on average.

A further gain can be obtained by modulating the power at the revolution frequency. Note that broadband tuning implies a short filling time and the local density of beam current is the parameter of interest.

T. Linnecar then reviewed the scaling laws leading to the optimization of the cavity lengths and number of cavities as a function on intensity. One can then calculate the voltage required, hence the power, along the SPS supercycle for different conditions of longitudinal emittances...

T. Linnecar concluded that the local intensity is the important parameter. Tuning the magnetic cycle can help a bit with tight emittance budgets; in any case careful calculations must be done for each beam/cycle combination. Other problems of high intensity operations, loops, feedbacks, stability... have not been considered.

The question of the limit in $\delta p/p$ at the end of the cycle was raised. K. Cornelis answered that this is still an open question but the designs of the transfer lines TI2 and TI8 were done

assuming $\delta p/p = 0.15\%$. This is a large value calculated for a slow extracted beam which leaves some margin for a fast extracted beam like the LHC beam.

3 MD Results

3.1 Damper Studies

W. Höfle first reminded that a temporary solution of adding solenoids to the four installed pick-ups of the damper required additional fans and temperature interlocks to be installed because of the induced heating. More permanent solutions are sought with the use of permanent magnets to create a field geometry which, albeit not solenoidal, could clear the electron avalanche from the electrodes. A prototype using white-board magnets and tapes was displayed but it seems that the fields that can be attained are not very high and limited to around 100 Gauss. Investigation is ongoing.

L. Voss asked whether the 3.5 GeV leptons would be affected by this solution, and more specifically the situation with regards to coupling.

3.2 Impedance

H. Burkhardt reported on an experiment with a single bunch on the MD cycle where coherent detuning with intensity was measured. The RF voltage was properly matched to the intensity at injection, typically 0.5 MV, followed by a voltage ramp to a fixed value of 3 MV, ensuring reproducible conditions for the measurements. A good set of machine parameters (tunes...) could be found in these conditions. The variations of intensities were performed on the PS side by vertically scraping the beam.

I. Papaphilippou reported on a numerical method to increase the precision of the determination of the tune from the measured spectra. The method is based on Frequency Analysis and consists in approximating the signal by truncated Fourier series after windowing with a Hanning filter. I. Papaphilippou showed that the precision reached is clearly better than for a simple FFT method. It is also possible to perform a harmonic decomposition of the signal and determine other tunes (synchrotron...). It might also be possible to obtain growth rates and damping rates.

M.P. Zorzano reported on bunch length measurements as a function of the bunch current with a fixed voltage of 2.5 MV. Bunch lengths between 0.5 and 0.55 ns were measured from the scope in the Faraday cage. Warnings were given of an instrumental error on this scope whereby the later part of the signal shows an exaggerated tail. The data obtained from D. Manglunki in PS during this experiment is consistent. Some discrepancies were systematically seen in the past and the agreement observed this time could arise from using vertical scraping for intensity modulation.

In the same conditions (2.5 MV) vertical emittance measurements using wire-scanners show,

as expected, a strong dependence of the vertical emittance with current. It was noted that the absence of correlation between horizontal emittance and current in this experiment is a sign of a well decoupled optics in TT10.

4 Next Meeting

The next meeting is scheduled for Tuesday 12th October 1999, at 09:15, Room 865 1-D17. 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://wwwinfo.cern.ch/~ghislain/sswg/sswg.html`

G. Roy
15 October 1999