SPS Studies Working Group
Third Meeting – 1 June 1999

Present: G. Arduini, E. Chapochnikova, P. Collier, K. Cornelis (chairman), B. Goddard, K. Hanke, W. Höfle, T. Linnecar, G. Schröder, J. Uythoven, G. Roy (secretary)

Excused: R. Cappi, D. Manglunki

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1 Follow-Up of Previous Meeting

- MD news: G. Arduini reports on a parasitic MD coordination meeting with PS. PS will use the parasitic MD cycle (p2) for their studies on Tuesdays and Thursdays; SPS will use it on Mondays and Fridays. Its use on Wednesdays will be discussed on a weekly basis. This scheme, which remains flexible and open for discussion depending upon circumstances, will allow the best use of this cycle for both CPS and SPS. The SPS MD web pages have been updated and can be found at:
  `http://nicewww.cern.ch/~arduini/spsmd/1999/mdpage.html`

- CPS: G. Arduini reports on the use of spare cavities to get shorter bunches (4 ns) and investigation of the possibility of smoothly varying the intensity in the range (3×10^{10}–1.1×10^{11} ppp). If this cannot be done over the whole range, CPS will first concentrate their efforts on the lower half.
  The 25 ns bunch should be available by the end of the week.

- SPS: the 14 GeV cycle has been commissioned last week. A problem with a transient on the main power supplies has been unveiled and solved. Also the synchro settings files for the RF have been corrupted; this affects all files created after 25 May. Settings will have to be regenerated by hand.

  Action: T. Linnecar

- Transfer Lines: K. Cornelis mentions that the momentum/emittance aperture of the LHC transfer lines is being calculated by M. Meddahi. A report should be available in two weeks.

2 Measurements at 14 GeV

W. Höfle presented the transverse coupled mode instability in the SPS viewed from the damper. He first recalled some work already presented in January 1999 at the Chamonix Workshop on SPS and LEP Performance, including a comparison of the time domain analysis and the frequency domain analysis.

An estimate – numerical solution of the eigenvalue problem involving a large matrix – of the growth rates as a function of the frequency is made using different filling patterns for the SPS: 11/11, 5/11, 3/11 and 1/11 of the ring filled. For the same total intensity the growth rates at high frequencies increase as the ring is more and more sparsely filled. At lower frequencies the increase in growth rates increase dramatically when the single bunch intensities become significant.

The relevance of these studies for the SPS are:

- in feedback mode for the LHC beam: no relevance; after upgrade the damper should have enough bandwidth; turn up the gain if growth rates are higher than expected.
- in feedback mode for the NGS beam: a problem could arise if instabilities are present above 20 MHz. The questions are then: can we see and characterise these instabilities and can we cure them with octupoles and/or a different working point.
- Injection damping: this is a transient phase problem which needs separate investigation.

The MD program proposed by W. Höfle is as follows:

- investigate at 14 GeV/c with a 5 ns bunch spacing: can we cure the instabilities at higher frequencies with octupoles? Do we see coupled bunch instabilities above 20 MHz which are covered neither by the damper upgrade nor the octupoles settings?
- investigate at 26 GeV/c on the LHC with a 25 ns bunch spacing: study the injection transients and stability.

3 Heating of kicker ferrites

G. Schröder presented the problem by recalling that the LHC kickers include a ferrite assembly which heat-up in presence of the LHC bunch structure since ferrite is essentially transparent to these frequencies (large skin depth). Estimates of the loss factors have been made and found to increase with increasing frequencies.

A model by F. Caspers has been confirmed by wire-based measurements and an estimate of about 15 W given in the case of MKE in the SPS for 1.6×10^{13} ppp. One MKE has been fitted with temperature probes and measurements carried out in the SPS tunnel. The temperature of the tunnel was steady at 25°C and the beam current (BCT) and probe temperatures were simultaneously recorded.

The time structure of the SPS super-cycle is clearly seen and is well explained. After a beam interruption the decay of the temperature exhibits a long term exponential decay explained by the heating of the ferrite itself with a time constant of about 20 hours. This long term behaviour fits well with the model of F. Caspers.

However a short term rapid decay is also observed which is being investigated: it could be that the temperature probes themselves are directly heated-up by the high frequency modes for which the ferrite is essentially transparent and the observed decay could correspond to the temperature decay f the probes themselves. This behaviour is observed on all probes installed.

In the case of the LHC, where a power load of 3.5 kW per tank is estimated, the solution envisaged is to install an internal shielding to the ferrite assembly consisting of a ceramic chamber internally coated with metallised stripes. Measurements on a mockup LHC injection kicker (MKI) show that this solution would be sufficient in the case of LHC.

K. Cornelis recalled the question of whether the SPS is capable of accelerating $7. \times 10^{13}$ protons per pulse with a fast extraction on a six second cycle for the NGS project. This problem of beam induced kicker heating seems worrying and the solution adopted for LHC can not be applied to the case of the SPS where the aperture of the kickers is already at a minimum. Estimates need to be made in this context.

Action: G. Schröder, J. Uythoven

4 Next Meeting

The next meeting is scheduled for Tuesday 15th June 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
1 June 1999