

SPS Studies Working Group

Eighth Meeting – 14 September 1999

Present: G. Arduini, H. Burkhardt E. Chapochnikova, K. Cornelis (chairman), J. Gareyte, W. Höfle, J. Klemm, T. Linnecar, F. Schmidt, J. Tückmantel, L. Voss, F. Zimmermann, G. Roy (secretary)

Excused: T. Bohl, R. Cappi

1 Follow-Up of Previous Meeting

G. Roy reports that no significant movement due to the LHC Civil Engineering has been observed on the orbits yet.

2 MD Results

2.1 LHC Beams

T. Linnecar reported that the problems with the $2 \mu\text{s}$ batch was not unforeseen: the intensity on the LHC beam is limited to $5 - 6 \times 10^{12}$ protons in 80 bunches at injection and 4×10^{12} protons in 80 bunches at high energy. The limitation comes from beam loading in the travelling wave cavities and is linked to the transient response of the feedback system at 1.4 MHz. The RF feedback system will be rebuilt for next year.

K. Cornelis asked whether the limitation could also come from the filling time of the cavities. T. Linnecar answered positively but also said that a feed-forward system will be tested in the next few weeks. Ultimately both the feedback and feed-forward will be needed.

E. Chapochnikova also reported that increasing the RF capture voltage helped but triggered more losses albeit slow ones. This is not understood.

T. Linnecar insisted that this effect and the current problems with the SC cavities and the electron cloud effect strengthened the interest in getting a multi-batch LHC beam.

2.2 Barrier Bucket

T. Linnecar reported on the feasibility of the barrier bucket. Using the travelling wave cavities pulsed for $1.5 \mu\text{s}$ it was possible to contain the beam both at injection and high energy. Many

uses can be envisaged for this technique but there are restrictions at low energy: for an intensity above 2×10^{12} one observes a slippage of particles through the barrier; this technique is more likely to be useful to preserve a hole for the kicker at high energy.

2.3 Impedance

H. Burkhardt reports that no measurements have been done lately on the transverse impedance. For longitudinal impedance measurements E. Chapochnikova reports that they have had problems of stability of the beam delivered by CPS. However the first measurements using the technique of vertical scraping for intensity modulation look very promising.

2.4 Electron Cloud

F. Zimmermann reports that the last measurements confirm the results obtained during the long MD. They observe a rise of vacuum pressure as a function of the beam intensity. The threshold is at 4×10^{12} protons per batch of 80 bunches with 25 ns spacing. The idea of using “ghost bunches” to clear the electrons might prove to be difficult: the scheme is not easy to implement and tolerances on bunch current are very tight.

More studies should take place during the next Wednesday MD (15 September) when an LHC-type beam will be put in coast (100% duty cycle)

From the measured vacuum rise, O. Gröbner was able to estimate that 2×10^9 electrons per meter are generated. The source of the electrons leading to this avalanche is not yet clear.

The question of the saturation of the pressure rise was asked; the answer is that there will probably be no saturation. Also the systematic cleaning of the vacuum chamber, although not very practical, was mentioned. As a side note it was recalled that the shielding of the pumping ports to reduce the impedance of the SPS will also reduce the pumping speed; the effect on the electron cloud problem is not expected to be important though.

Ideas and solutions are actively sought for this problem.

2.5 Damper Studies

W. Höfle reported on the ongoing studies of what is now believed to be an electron effect on the damper pickups.

It was recalled that the bias voltage solution did not work satisfactorily: the bias needed is small and changes with time and beam conditions.

Using a solenoidal field (up to 100 Gauss) around the pickups the limit of the current beyond which the damper does not work correctly could be raised from 2.5×10^{12} to $5. \times 10^{12}$ protons

on the LHC beam (25 ns bunch spacing). Also this phenomenon is not visible in the 200 MHz band and only affects the low frequency domain.

During the shutdown it is proposed to modify the damper to use the 200 MHz signal or a multipole of 40 MHz (120 MHz?) and install solenoids around all eight damper pickups (208 to 215). The remaining beam time available in 1999 will be used to do systematic studies of this effect.

The question of the surface treatment of the electrodes was also raised. It is an open possibility which might be used in the future. Grounding the frame of the pickup structure was tried but did not help. Finally the impact of this problem on the LHC BOM system – based on phase processing in baseband – was raised.

3 Next Meeting

The next meeting is scheduled for Tuesday 28th September 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
19 September 1999