Minutes of the SPS Studies Working Group (SSWG)

1th meeting 30th April 2002

Present: G. Arduini (chairman), V. Baglin, R. Bailey, P. Baudrenghien, T. Bohl, H. Burkhardt, R. Cappi, B. Dehning, J. Gareyte, M. Hauschild, N. Hilleret, W. Höfle, L. Jensen, T. Linnecar, D. Manglunki, F. Roncarolo, G. Rumolo, E. Shaposhnikova, R. Tomas, J. Tückmantel, L. Vos, J. Wenninger, F. Zimmermann (secretary)

Excused: M. Jimenez

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1 SPS Start-Up Schedule (G. Arduini)

The SPS schedule foresees 3 days of start-up from Friday 10 to Sunday 12 May, which will be followed by 7 days of beam scrubbing. G. Arduini raised the question whether the LHC beam could be available already on Wednesday from the PS, in case the cold check-out goes well. R. Cappi affirmed that a beam from the PS on Wednesday is *not impossible*. A beam on Wednesday could be useful for setting up at least the new diagnostics in the transfer line. This beam should have a reduced intensity. SPS damper tests by W. Hoefle could be done in parallel.

2 Electron-Cloud Studies in the SPS (N. Hilleret et al.)

A number of key parameters will be investigated using numerous upgraded and novel diagnostics, such as electron energy analyzers, strip pick ups, stripe detector, in situ measurements of the secondary emission yield, calorimeters, and COLDEX.

N. Hilleret explained that during the scrubbing period a decrease in the relative pressure rise $\Delta P/P$ will be a direct signature of the bombardment. This decrease is caused by two processes: (1) cleaning of the surface and (2) reduction of the electron-cloud activity (*i.e.*, the decrease in secondary emission yield). The objectives of the scrubbing run are twofold. The first is to determine the approximate scrubbing time required in the SPS before being able to inject into the LHC. This depends primarily on the pressure rise. The second objective is to validate the scrubbing scenario for the LHC, which is more directly related to the secondary emission.

N. Hilleret and V. Baglin proposed to to inject test beams of constant properties at three times during the scrubbing run, namely at the beginning, in the middle, and at the end. The duration of each test-beam period was estimated at 8 hours.

It is known that the pressure interlocks in the arcs are the first to respond. From past experience initially a single batch with $5 - 5.5 \times 10^{10}$ protons per bunch might be near the tolerable limit. In 2000 (or 2001?) the pressure decreased by 30% after 3 days of scrubbing. Therefore, N. Hilleret estimated that after 2–3 days the bunch intensity can be increased. If the pressure rise exceeds the tolerable limit, one can either reduce the duty cycle or dump the beam earlier. The pressure limit is about 5×10^{-7}–10^{-6} torr.

The recommended test beam consists of a single batch of 48 bunches with variable bunch intensity. The batch should be short enough to not cause problems in the arc, while at the same time the bunch intensity should be sufficiently high to induce multipacting in the straight sections, where most of the diagnostics is installed (WAMPAC, COLDEX, NEG tests).

Responding to a question by G. Arduini, R. Cappi remarked that the PS can vary the bunch intensity within a factor of 2 (or $\Delta N_b \approx 4 \times 10^{10}$) without major intervention. Only 30 minutes are needed to change the intensity within this range. Overnight the SPS should only be operated with scrubbing beams, but not with test beams.

G. Arduini proposed as an alternative approach to only operate with 72-bunch batches and slowly increase the intensity. This approach would maximize the scrubbing time, and not devote time to setting up different beams. F. Zimmermann asked why a special test beam for the straight sections is needed, if there will be no scrubbing in the straight sections. N. Hilleret answered that he expects scrubbing in the straight section during the second half of the week. V. Baglin mentioned that in his simulation the 48-bunch batch with 10^{11} protons per bunch will produce a signal in COLDEX and WAMPAC. T. Linnecar cautioned that the availability of a test beam with 10^{11} protons per bunch is not guaranteed for the scrubbing run. From the point of view of the rf there is no great difference between batches of 48 and 72 bunches.

It was decided to start the SPS set up with 72 bunches, and, if time permits, to start scrubbing during the weekend May 10–12 using 72 bunches. The first beam will consist of 72 bunches with about 3×10^{10} protons per bunch.

G. Arduini asked which parameters should be recorded during the scrubbing. He emphasized that presently no pressure readings are available in the control room, and that these are urgently needed prior to the run. It is planned to log the beam intensity at the start and end of each cycle, as well as the time of the beam dump. A discussion suggested that bunch length, bunch shape, and the transverse beam size should also be monitored, ideally from cycle to cycle.

The normal cycle time will be 16.8 s with 2 batches. The length of the cycle will not be changed. The SPS coordinator M. Hauschild agreed that 2 periods of 8 hours each will be available for the injection of up to 3 batches. The distance between batches will be the minimum which is still compatible with the kicker rise time (15–20 buckets).

The pressure increase will be controlled by changing the time of the beam dump. R. Bailey and G. Arduini discussed the operational scenario of dumping the beam in each cycle. This is the simplest scheme and does not require manual intervention. The latest possible dump time is about 16 s within the cycle. Thus, the duty factor for the scrubbing can be larger than 90%. P. Baudrenghien proposed to vary the rf voltage during the store in order to shorten (or lengthen) the bunches, which will affect the electron cloud build up. E. Shaposhnikova pointed out that the spacing between batches is another parameter affecting the multipacting.

During the scrubbing run a meeting for strategical discussions will be held once per day, presum-

ably at 8:30. This will be organized by P. Collier.

The earliest day when the new SPS cycle can be loaded is Tuesday 7th, due to ongoing tests of cooling, compensator etc., which require a pulsed machine.

It is planned to insert COLDEX during the weekend, May 10–12. This will take about one hour.

L. Jensen mentioned that the BI group would like to see the MD plan for 2002. G. Arduini replied that the MD plan will depend on the results of the scrubbing run.

3 Next Meeting

The next meeting of the SPS SWG is tentatively scheduled for Tuesday, 14th May, 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 invitation will be sent by email.

F. Zimmermann, 30th April 2002