Minutes of the 28th meeting of the SPS Upgrade Study Team on 4 August 2009

Present: O. Aberle, G. Arduini, S. Calatroni, P. Chiggiato, P. Costa Pinto, S. Federmann, R. Garoby, R. Losito, G. Rumolo, D. Seebacher, E. Shaposhnikova, A. Stadler, M. Taborelli, C. Yin Vallgren

Excused: K. Cornelis, E. Metral

• Studies of the SPS internal dump (TIDVG) for current and future proton beams - A. Stadler

Research of production history and possible causes of outgassing of the SPS beam dumps were presented at the SPSU meeting one year ago by Y. Kadi.

The TIDVG installed in LSS1 is used to dump beam with energy from 105 to 450 GeV. Dump #1 with damaged Titanium foil was replaced by Dump #2 (without foil) two years ago. Since that time outgassing during dumps is very high. For this beam dump the initial bake-out was done at 1000 deg (1 h) and the final bake-out was done at 150 deg (after assembly and installation). Tests in the lab were carried out on Dump #3 (with foil) which was opened to air for this purpose for several months. Bake-out at 150-250 deg during 25 days was not sufficient to avoid significant outgassing for temperatures above 150 deg bearing in mind that during operation the peak T could reach 500-600 deg. The largest peak in the RGA spectrum measured at different temperatures belongs to Hydrogen. The presence of hydrocarbons is also confirmed. Increasing the bake-out time, both at 1000 deg and at 150 deg as well as minimising air exposure should improve Dump #3, the spare. It was also proposed to consider buying new graphite with improved quality (e.g. as for LHC beam dump and collimators).

The limits of TIDGV for dumping current and future LHC and CNGS-type beams in the SPS were explored using ANSYS and FLUKA simulations. The main limitation is the Antico (aluminum) temperature which should not exceed 450 deg. The proposed slight design modification should increase the number of allowed consecutive dumps up to 50%. Currently the dump absorbs at 450 GeV only 155 GeV/p.

New design and materials can significantly increase performance and should be used for long-term solution.

The transverse sizes of the CNGS and LHC beam are very different (LHC beam is smaller) - was this taken into account in simulations?

• Results of e-cloud measurements BA5 MD week 29 - F. Caspers, S. Federmann, D. Seebacher

The microwave transmission method was used to compare coated and uncoated dipole magnets from the difference in phase modulation of the transmitted wave. The expected phase difference is very small (0.13 deg). In comparison with the previous MD the experimental set-up had several modifications (DC power supply in tunnel, high-pass filters at the end of the coaxial cables on the surface), but they still could not reduced sufficiently, at least for uncoated magnets, the Inter

Modulation Distortion (IMD) caused by the signal at the revolution frequency 43.4 KHz and higher beam harmonics. The latter are much more difficult to deal with. A few further improvements were suggested. The measured signal was indeed contaminated by IMD with AM directly related to beam intensity. However for the first time cases of transmission in the coated magnet were obtained where PM was higher than AM and two signals were not correlated. Some correlation between the amplitude of this PM signal and the signal in the e-cloud monitor with the StSt liner was observed during different tests (such as beam displacement). The receiver part for measurements in the uncoated and coated magnets is not completely identical due to different types of pick-ups used (loops for coated and buttons for uncoated). Simultaneous acquisitions during the same cycle were also not possible due to only one spectrum analyser being available. For the uncoated magnet the useful signal was dominated by IMD in all measurements. To obtain any reliable information the AM should be smaller than the PM.

More tests will be performed during the next SPS MD in W.33 (12 August).

• **MD run, week 29 - M. Taborelli**

During this MD, pressure between two coated and uncoated magnets was recorded together with the e-cloud signal in the ECM to study effects of beam bumps, the RF voltage, batches with holes (missing 12 bunches) and magnetic field in liners.

For horizontally displaced beam, pressure increase was observed both in coated and uncoated magnets. With orbit bumps an increase in e-cloud signal was observed in the liners together with a pressure rise in this region. Pressure rise was also observed with zero B-field (more precisely - zero current, exact B-field needs to be calibrated). Pressure variation in coated and uncoated magnets was similar and correlated with total beam intensity (1-2 batches and holes) and RF voltage changes on the flat bottom. For batches with holes (less e-cloud) pressure became slightly higher in the coated magnets.

Double peaks in pressure rise were observed during acceleration, however synchronisation of acquisition should be improved to get reliable results.

Very small e-cloud signal was measured in Carbon liners (1/300).

• The next meeting will be on **8th September 2009** at 15:30 in the JBA room (bld. 864-2B14).

Preliminary agenda:

Results from the SPS long MD week 33 - M. Taborelli, F. Caspers
Traces of e-cloud in SPS magnets and pumping ports - K. Cornelis
e-cloud activities in Cornell - S. Calatroni

Elena Shaposhnikova, 10.08.2009