

# Minutes of the 4<sup>th</sup> PAF working group meeting

15. August 2005

\*\*\*\*\* FINAL VERSION \*\*\*\*\*

Participants:

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M. Benedikt, A. Ceccucci, E. Shaposhnikova, R. Garoby (convener), R. Ostojic, KH. Mess, W. Kalbreier, D. Smekens, J. Wenninger, J. Ellis.

## 1a) Status of magnets in the proton injector chain (KH. Mess)

KH. Mess gave a presentation on the status of normal conducting magnets in the proton accelerators.

Amongst other tasks, the AT/MEL group is responsible for all normal-conducting magnets at CERN and 14 staff (AT-MEL-MI section) are dedicated to this activity. The total number of normal-conducting magnets in PS Complex, SPS complex and LHC is around 4000.

### **LINAC2:**

There are around 102 magnets in total, no problems anticipated.

### **PSB:**

128 magnets in total. Main problem over the last years was the ageing of the rubber water hoses and seals causing leaks. Routine maintenance is ongoing and there is a reasonable number of spare magnets and coils available. Therefore there is no major concern about the PSB magnets.

### **PS:**

There are 100 main magnets and around 80 auxiliary magnets installed in the PS ring. The main magnets are combined function and their design is complicated by the so called "pole face windings PFW" and the "figure of eight" loop.

The very high integrated dose seen by the main magnets (typically some 10 MGy) has caused serious degradation and during HV test before the run 2003 the coil insulation on two main magnets was destroyed. The two major concerns are:

- deteriorated main coil insulation that is no longer adhering to the Al-conductor,
- destroyed cable insulation of the pole face windings.

A two-phase PS magnet consolidation project was started in 2003.

Phase I is financed and foresees refurbishment (new coils & PFWs) on the 40 weakest units before 2006. Due to serious delays in PFW and in particular in coil production, 24 units will be refurbished at most. To complete the 40 units will take up to 2009 (8 units per year replaced from 2006 on, assuming standard few-months shut-downs).

Phase II is not yet approved and was initially planned to go from 2006 - 2013 (8 units refurbished per year). With the additional delay due to Phase I the total project will take until 2017. The only way to speed up the consolidation is the construction of

additional spare magnet units which is an important effort (only 4 spares, i.e. 1 unit per type, at present).

An additional problem with the main magnet laminations was discovered recently. The high dose also degraded the glue between the laminations and in the centre of the magnets, where no shims can be positioned to stop movements, loose laminations were found. These sheets will be glued in situ and bolted together.

In conclusion the PS main magnets can be kept alive provided consolidation Phase II is approved. However, unscheduled interruptions of operations may be unavoidable. In addition, there will be no functional spare units available at the first month(s) after each shut-down throughout the consolidation phase.

No serious risk is anticipated for the auxiliary PS magnets.

### **SPS:**

On the SPS there are two major concerns that were already anticipated 10 years ago (SL-Note-96-32-DI):

- Erosion of the copper pipes in the manifold of the main dipoles
- Breakdown of splitter magnets due to corrosion.

In 2004 seven water leaks on the copper tube manifold of 7 MBB main dipoles appeared. In situ repair is impossible, and it takes about 2,5 days to repair a unit incl. reinstallation.

This could become a serious problem since there are 744 main dipole units in total. Defining a consolidation strategy is difficult since there are no diagnostic tools to evaluate the erosion problem in situ and in a non-destructive way. Replacement of all magnets would take 8 years if it was done sequentially (1/2,5 days)!

Very high leakage currents (300 times nominal) were found on the coils of the seven MBB that were repaired in 2004. This is caused by water penetrating the insulation. It is planned to replace the coils which will reduce the number of MBB spare coils from 16 to 9 calling for new coil production. For MBA there are 14 spare coil sets.

There are several other (less dangerous) consolidation needs on the SPS over the next 5 years.

In conclusion the situation concerning SPS main dipoles is not very clear since the size of the problem cannot be evaluated. The progressing degradation is a major concern.

### 1b) Discussion

R. Garoby thanked KH. Mess and the AT-MEL people for the detailed presentation. In the discussion following KH's presentation, the question was raised whether an external review should be considered on the magnet status. The AT-MEL representatives felt that this was not appropriate today because:

- All magnet experts are fully busy with LHC installation and magnet consolidation so that the request for analysis by external reviewers will increase the manpower problems.

- The PS is being taken care of and the situation for 2006 is considered relatively safe.
- Degradation of the SPS main dipoles is very unclear and the statistics is very poor. Whatever happens in 2006 may give indications on the size of the problem.

The issue of external review was briefly discussed inside PAF afterwards and will be followed up in the next meetings in the presence of all committee members.

## 2) Subjects to be analysed by POFPA

A number of questions for POFPA have already come up following discussions between PAF members on the “dream” proton accelerator complex.

- Is there a need for multi-MW beam power at PS energies: 3 GeV - 10 GeV - 30 GeV and for which physics applications?
- Physics interest for a 1 TeV proton beam (other than for LHC upgrade).
- Need for slow-extracted beams in the future; which physics applications and which energies? 10 GeV – 100 GeV – 500 GeV – 1 TeV – 7 TeV?
- Physics potential of beta beams, super beams vs. neutrino factory (is the beta-beam a realistic alternative to a neutrino factory).
- Options and requirements for kaon physics.

Augusto will transmit these issues to POFPA.

## 3) Miscellaneous:

- J. Ellis announced the members of the POFPA: A. Blondel, L. Camilleri, A. Ceccucci, J. Ellis (convener), M. Lindroos, M. Mangano and G. Rolandi.
- J. Ellis will propose a date for a common meeting with POFPA beginning of September.
- The next meeting will take place on 22<sup>nd</sup> August in 864-1-002 (16:00).

Minutes by M. Benedikt, 17.08.2005