LHC RF Meeting
20th August 2004

Present: Olivier Brunner, Edmond Ciapala, Trevor Linnecar, Pierre Maesen, Joachim Tückmantel, Daniel Valuch.

1. SM18 – Module 3 incident

- **Events:** Following the arcing which occurred when conditioning the coupler of Cavity A, together with heating of the waveguide system in the bunker, the waveguides were dismantled to reveal traces of arcing from the coupler, back towards the klystron. There were also signs of arcing visible on the ceramic and its upper copper sealing ring. This is a serious incident – it means that the coupler will have to be replaced. ('Fortunately' this has happened on Module 3, for which couplers were to be changed anyway, as the first series polarization ceramics fitted cannot take full bake-out.)

The operations with RF had been as follows:

- 12th August - First conditioning, reaching 240 kW after a few hours; thereafter power could only be taken to 100 kW, with klystron arc detector trips on. The klystron output waveguide was opened; some traces of arcing were visible. The waveguide short was put in, and full power was applied without problem.
- 13th August – Short taken out. Again only 100 kW could be reached. Arcs were heard in klystron area, but RF switching off only some seconds afterwards. Then it was found that the top E-bends on the waveguide system in the bunker were hot, indicating that the arcing must have been in that region and not originating near the klystron as previously thought..
- First part of week 34 - Inspection of bunker waveguides and coupler window – see above. It was decided not to risk applying power to cavity A again. Full power (>300 kW) could be applied to couplers B and C (cavities detuned) with no problems.

- **Analysis**: Two possible explanations for the arcing have been put forward:

- **1) Humidity on the coupler window.** Since humidity levels were high and blowers and window heaters had only been on for only ~ 2 hours before the first day's test, arcing may have occurred on the ceramic, limiting power to 240 kW. The reaching of only 100 kW the following day (blowers and windows on normally for many hours) would have to be explained by degradation of the window on the final powering of the day before.
- **2) Small metallic particle(s) in the coupler waveguide**. These would be moved randomly around by the coupler air flow, causing breakdown on contact with the ceramic with RF on. They could have been introduced during the last adjustments of the waveguides or the fitting of the transitions.

- **Actions:** At the moment we cannot be sure of either of the above explanations but improvements in procedures and interlocking will be followed up for to avoid both of these dangerous situations.

The following actions were agreed:

- **1) Inspection of coupler A:** When the module is removed from the bunker the waveguide will be removed, the coupler window will be inspected in greater detail and a search made for any dust or metal particles. **(Action: Eric)**
- **2) Arc detectors near cavity window:** From now on these must be fitted. The search for a reliable radiation tolerant arc detector is however still ongoing. The arc detector must be sufficiently sensitive to catch a small amount of light (~1 lux) and low noise electronics are needed to avoid false trips. They are also prone to microphonics and RF. A system with two detectors, both needing to trigger to cause a trip, was adopted in LEP. Use of a fibre, rather than mounting the diode directly on the waveguide, is a good solution but a large diameter fibre and special connectors are needed. New prototypes have been made and should be tested and fitted in SM18. **(Action: Olivier)**
- The fast interlock and PLC I/O should be expanded to allow all four MC arc detectors, alternatively a single one would have to be moved each time to the cavity being tested. **(Action: Luca)**

- Testing of arc detectors in H112, possibly using a specially developed dedicated waveguide setup, was suggested.

➨ **3) Review of interlocks:** Checking that window heater and blowers have been on for a sufficiently long time between cool-down and allowing RF switch on could be included in the PLC software.

- This would also be a good time to make a complete review of the specification of the interlock and protection systems, with the aim of finalizing it. It should then be documented.

(Action: Luca. Olivier, Pierre, Eric, Ed)

➨ **4. Review of installation procedures:** A written list, with the names of those responsible, will be made of all the procedures (re. vacuum, cryo, cavity, coupler, waveguides) to be followed during the installation in and the removal of a module from the bunker. The details of the individual procedures must be documented, where not already done.

(Action: Pierre, Ed, with those responsible)

➨ **5. Review of operational procedures.** Similarly a list, with the names of those responsible, will be made of all the operations to be done for the tests and conditioning of cavities and couplers in the bunker. The individual procedures, including details such as connection of cables and equipment, must be documented, where not already done. **(Action: Pierre, Eric, Roberto, Ed.)**

2. **SM18 - Module 1:** Module 1 coupler mechanics will be mounted next week; the module will go in the bunker the week after and be cooled down in the following week.

3. **Coupler conditioning in SA2:** Conditioning is now at 210 kW continuous, progress has been a little slower due to pressure from SM18 activities.

4. **ACS Power** (Olivier)

- **Klystrons, loads & circulators:** The last of the previous batch loads/circulators is to be tested in H112. The final batch will be delivered at the end of the month. Klystron 10 will arrive next week. Klystrons 9 and 1 are due for the end of September.
- **Klystron Ripple:** A solution for reducing 50 Hz on the klystron modulator can be put in place in SM18 by G. Pecheur.

5. **ADT Status** (Trevor)

- **Test of SPS Anode Converters:** Some preliminary tests were done on the behaviour of 6-pulse converters for the SPS damper systems in BA2. Some interference was seen.

6. **Cabling Lists**

- Sufficient information is now in the new Excel form cable lists for both ACS and ADT. The DiC information should be extracted and given to J_C. Guillaume. **(Action: Volker with J-C Perrier)**

7. **Planning and commissioning:** (Olivier)

- The revised commissioning note is presently with Andy for additions on software and requirements. It should then be forwarded to R. Saban. **(Action: Andy)**

8. **AoB:**

- **TS-CE Contact man:** With the departure of W. Van Baaren our contact man with TS-CE is newly arrived Dave Ryan.
- **RF Installation planning:** H. Gaillard (TS-IC) has apparently done a planning for RF installation. The scope and level of detail will be checked by Olivier.
- **EVM:** The update (re-baselining, removal of CERN staff and LS) has been done for some systems. We should aim to complete it for all systems by next week's meeting, so that the overall situation can be reviewed then.

Next Meeting: Friday 27th August at 08:45 in the JBA Room 864-2-B14

E. Ciapala, 24th August 2004