LHC RF Meeting

9th July 2003

Present:
Philippe Baudrenghien, Andy Butterworth, Elena Chapochnikova, Edmond Ciapala, Wolfgang Höfle, Trevor Linnecar, Roberto Losito, Eric Montesinos, Volker Rödel, Joachim Tückmantel, Daniel Valuch.
Excused/Absent: Thomas Bohl, Luca Arnaudon, Olivier Brunner.

Correction to minutes of meeting 25th June: [Para 3) item iii) third point]
- The bake-out proposal from AT-VA is based on the use water at 150 ° and 8 bar, circulating in the normal cooling channels of the equipment – **not** on the use of air.

1) Follow-up from previous meeting on 18th June:

i) Power Couplers: (Eric)
- Conditioning of the first pair of couplers in SA2 is now progressing and 100 kW has been reached with 5 us pulsing. Conditioning will continue till 500 kW if possible. The second pair of couplers will be installed in week 30. Tests done with Serge Mathot EST/MS indicate that problems with the second ceramics may be related to the brazing.

ii) Radiation in UX45: (Andy)
- Preliminary results indicate that levels will be 100 times less than in the RRs, where power converters and electronics will be installed. The levels will be higher at the top of the racks. Simulations are done using the APWs as sources, taking a vacuum of 1.0E-7. The present estimate is 1.0E4neutrons/cm^2/year. The results are scalable with vacuum. The susceptibility of components needs to be studied.

iii) VME modules and crates (Philippe/Andy)
- Prototype crates are being wired. We still have to provide a brief spec to W. Heinze, on the use of crates from Wiener within the AB-CO contract.

iv) Ventilation in tunnel and UX45
- TIS prefer the overpressure solution. This has now to be agreed on by ourselves and the other parties **(Action:** Volker**)**

v) Earthing in tunnel
- Layout and connections in tunnel to be determined (**Action:** Volker)
- A draft summary of the meeting with J. Pedersen ST-EL is available for comments and corrections. He will be contacted next week. (**Action**: Ed)

vi) SM18 and ACS Modules (Roberto)
- After 6 rapid cycles on the second module, the tuning range of one cavity is still too asymmetric around the nominal frequency. A further long cool-down will be done. A third module will now be cycled. (H. Preis & Luca in the absence of Roberto)
- Power Converter DCCT cabling has to be done
- The waveguide switching system is in place

vii) Warm recovery line and safety valves. (Roberto)
- The overall proposal is being elaborated with L. Serio. As well as avoiding He gas discharge into the tunnel and subsequent problems with valves after any incident, it should also allow improved pressure regulation in the modules. The line should form part of the integration studies. (**Actions:** Roberto and Volker)

2) ADT news: (Wolfgang)

Thanks to Wolfgang for providing the following summary:

- **ADT driver amplifiers:** Following FC approval in June, a draft contract (F514/AB/LHC) had been sent to Thales Communications, Belgium, for comments. We expect feedback from Thales by Friday 11.07.03 and plan to visit them next week (17.07.03) together with SPL to clarify the outstanding issues: i.e. schedule, milestones, payments, mechanism of design approval and prototype acceptance. The contract has made a first circulation at CERN and is now in the 2nd approval loop (electronic signatures).

- **Market Survey MS3218:** This concerns the power converters for LHCADT (UA,Ug1,Ug2) and all power converters for the LEIR machine. It is conducted jointly with AB/PO (J. Lahaye). Power converters are grouped into three categories (A: High power, high voltage, B: medium power and voltage, C: low voltage, "high" current). ADT is only concerned with A and B. Details can be found in market survey document ms3218. The MS was sent to 59 firms. We will visit 6 firms which are interested in the requirements A, which are of custom design. The visits and the selection process needs to be finished by August 15 in order to respect the LEIR schedule. For ADT the planning foresees Adjudication in FC March 2004, which means that offers need to be received already by December 2003.

- **ADT HOM damping:** The ADT electrodes will be capacitively coupled to an HOM feedthrough for damping of HOMs. Feedthroughs from LEP cavities have been recuperated and checked by H. Preis. They can extract 500 W each. R/Q values were calculated with MAFIA (in 2002) and Q values measured on a prototype. This led to design modifications and the introduction of the HOM couplers in 2002. For nominal bunch spacing and intensity we can get more than 500 W per HOM coupler if an HOM falls accidentally on a 40 MHz line. With damping this can be reduced to less than 100 W in the most favourable case, and less than 500 W in the worst case. Further improvement is expected by the design changes introduced which will reduce the R/Q of the modes. HOMs need to be remeasured on the final device, and some tuning may be applied to move modes away from the bunch frequency lines. Calculations were also done with 50ns and 75ns bunch spacing with similar results. The lowest mode is at around 80 MHz and the spectrum extends up to 2 GHz. Due to the weakly coupled electrodes, longitudinal modes can be associated with a transverse mode very nearby in frequency.

- **ADT main feedthrough:**

A call for tenders will be launched this week and sent to a number of firms. This follows tests on prototype feedthroughs last year received from two companies, which although electrically OK and leak tight were rejected by LHC-VAC due to bad welds. LHC-VAC demanded a proper specification be written and approved. This has been done (Jean-Francois Malo has done a very good job with this) and the tenders will be sent out next week.

- **LHC damper, collimators and MKI/MKE**

The LHC damper has been designed to be adapted to the machine resistive wall impedance which rolls-off with frequency and to expected injection kicker ripples and static errors which where thought to be contained in a bandwidth of 1 MHz. At higher frequency our gain and kick strength drops off. Two issues are currently under investigation which push us to consider modifications towards a larger (power)-bandwidth:

1) The MKI LHC injection kicker (vertical) has a ripple extending to frequencies higher than 1 MHz
2) The resistive wall impedance contribution from the collimators (decision for graphite was recently taken) is basically flat with frequency.

Together with our Russian collaborators we are presently investigating possible modifications to the power system. There will be a meeting on Friday 11 July with the BT group to discuss

these issues. BT group will also present the characteristics of the SPS MKE extraction kicker which introduces some ripple in the horizontal plane.

- **Russian collaboration:**

The progress on the hardware is not as fast as it should be. Two kicker tanks are still blocked at the customs in Russia and JINR cannot do anything about it. There are some technological problems with the electrode fabrication in the Dubna workshop. A ceramic support ring with metal coating is awaiting testing in LHC-VAC and series production in Dubna is on stand-by until LHC-VAC gives its OK. Due to the holiday period progress is slow as items are queued by LHC-VAC for tests.
Reinier is currently working with Vladimir and Eugene (who are here for three weeks) on the purchasing of power amplifier parts with the usual restrictions imposed by CERN purchasing procedures.
V. Zhabitsky from JINR will start to lead the JINR team and will visit us next week. Due to the reorganization at JINR and his previous involvement in damper work we expect a positive push for the project.

- **Test area 867:**

No new work was done. Coordination should be discussed at a future meeting.

3)LLRF and Beam Control - Planning: (Philippe)

- Work is progressing on the realization of prototype RF electronics: Clock generator & distribution, analog demodulator, RF IQ&A demodulation. The tuner module analog and digital layouts are being finalized by John Molendijk and Tony Rohlev. Daniel is making good progress on various components: directional couplers, coax switch and RF circulator. This work will be presented at the next meeting.
- Philippe presented the planning. Some 40 plus electronics modules have now to be realized, one peak being for cavity controller electronics, lasting till 2004, followed by another even larger peak for BC and synchro electronics. Manpower concerns were raised.
- Design office support is also a concern. Presentation of planning to the responsible persons allows them to better manage their resources. For layouts we need close collaboration with the designer. For board fabrication can we look at the use of other outside firms?

4) Cryo lines to ACS modules in UX45

At the last Integration Working Group (ICL) meeting of 2nd July, AT-ACR presented a rigid supply line supplying the ACS cavities. Our understanding, from discussions with QRL and cryo specialists in 2001, that flexible lines would be used. We have since learned, in a meeting with G. Riddone (QRL responsible) and L. Tavian, that this rigid line is now part of the QRL contract. Reasons given are losses in flexible lines of 3 W/m. Routing of this line now has to be decided (**Action:** Volker et al. via MIWG-ICL)

5) EVM and CtoC (Volker)

Present EVM PV estimates indicate higher costs than CtoC for some systems, notably LLRF&Beam Control, Controls and RF power. Project Management will impose the CtoC figures and we have to see if reductions can be made, especially in the above items.
(**Action:** Trevor et al.)

6) P4 Integration

- Integration meetings are continuing every Wednesday morning till mid-August when P4 tunnel integration is expected to be complete. **Some outstanding issues:**
    - Cryo rigid line routing
    - Warm recovery line and routing
    - Vacuum (APW pumping, sector valves as radiation stoppers, ADT pumping requirements, cabling)
    - Cooling water circuits and connections for ADT

    - Earthing
- The document The LHC Access Control System is out for approval.

7) Work on RF components (Daniel)
- This will be presented in the next meeting

8) Other round table matters:
- No other urgent items

Next Meeting:
To be announced

E. Ciapala, 17th July 2003