

## LHC RF Meeting 30<sup>th</sup> July 2003

**Present:** Luca Arnaudon, Olivier Brunner, Edmond Ciapala, Wolfgang Höfle, Trevor Linnecar, Volker Rödel, Daniel Valuch.

**Excused/Absent:** Thomas Bohl, Philippe Baudrenghien, Andy Butterworth, Elena Chapochnikova, Roberto Losito, Eric Montesinos, Joachim Tückmantel.

### **Agenda:**

- 1) Points arising and follow-up from previous meeting of 9th July
- 2) News on P4 integration
- 3) Work on RF components (Daniel)
- 4) Round table

### **1) Follow-up** from previous meeting on 9<sup>th</sup> July:

#### **i) Power Couplers:** (Ed on input from Eric)

- Conditioning of the first pair of ACS couplers in SA2 successfully reached the goal of 450 kW. The second pair has been fitted and reached 150 kW after 40 hrs effective conditioning time. The results are encouraging and if all continues to go well the set of four couplers can be fitted to the module by the end of August. An improved brazing technique for future second ceramics is being studied with EST/MS.

#### **ii) Radiation in UX45:**

- No news during Andy's absence.

#### **iii) VME modules and crates** (Ed)

- We still have to provide a brief spec to W. Heinze, on possible use of crates from Wiener within the AB-CO contract. First prototype crates are being built in the Lab.

#### **vi) ACS Modules** (Ed on info from M. Prax)

- Module 4 (the third) is presently being cycled. Six cycles are planned before mid-August, when Roberto will do the measurements.

#### **vii) Warm recovery line and safety valves.**

- The proposal should be presented on Roberto's return.

#### **viii) ADT news:** (Wolfgang) (*The following is based on a summary supplied by Wolfgang*)

- **ADT driver amplifiers** - Contract F514: We expect Thales Belgium to sign the contract officially soon. Technical work has started and the contract will enter into force retroactively from July 1st, 2003.

- **Market Survey MS3218 for Power Converters:** One company was visited last week and two more will be visited next week. A number of companies out of the total list of over 60 qualify, based on the information supplied. The supplies are in 3 categories: A, B and C. A specification committee must be held in week 34 to maintain the AB/PO LEIR schedule. The drafting of a single generic specification for the B and C requirements is presently being discussed, to limit the number of different contracts. The supply for LEIR e-cooling, A3, will be separate and dealt with exclusively by AB/PO. The 15 kV converters for LHC dampers, A1, are planned for adjudication in the March 2004 FC. The LEIR RF supply, A2, has to be dealt with urgently by RF and PO groups. The draft specification for B and C converters for will be circulated to persons concerned with the ADT project. Controls requirements for these converters also need to be defined urgently - by mid August.

- **Russian collaboration:** Two kicker tanks have arrived and are now in B867. They will be tested by LHC-VAC (bake out at 300 °C was confirmed OK by Dubna). The tanks are manufactured by the Raduga enterprise. Some welds have been worked over by Dubna. We

expect follow-up during the testing from LHC-VAC. Tests are the responsibility of W. Hofle, J-F. Malo, H. Preis, M. Jimenez and the Air Liquide team. The waiting list is approximately one week and we will know next week when tests are scheduled. These tests will also allow us to check our estimates of time and resources needed for future tests.

The Russian team is now on holiday for some weeks but can be contacted by email.

- **ADT main feedthrough:** The call for tender (price enquiry DO-21437) was sent out to eight firms, the closing date is 22.08.2003. 50 feedthroughs will be ordered. The specification LHCADTKV-CI-0001, EDMS 378073 has been carefully elaborated in collaboration with LHC-VAC and by consulting BT group. Some companies expressed concern about the required corrosion tests with 10% nitric acid for 100 hours. There is a potential incompatibility with the plating and brazing and the fact that we will have a copper pin and not a stainless steel pin as for feedthroughs used in previous projects. Jean-Francois is following up this call for tenders.

- **Collimators and impedance:** Studies are ongoing. Indications are that carbon will have to be used for (certain) collimators and the resulting impedance increase accepted. At some stage feedback needs to be given to the LTC.

- **MKI/MKE:** A meeting was held with B. Goddard on injection kicker 'spikes'

- **Water Cooling for ADT:** see integration below.

## 2) P4 Integration (Volker)

### i) An [integration meeting](#) took place on 30<sup>th</sup> July; the following items were discussed:

- **Tunnel Roof:** The opening will be 8.4 m by 1.85 m. This corresponds to 4 roof blocks and is sufficient for cavity removal.

- **Ventilation in UX45 tunnel:** An acceptable solution has now been found and we have agreed. Two ventilation units will be mounted on the tunnel roof, one for each side of the tunnel in UX45. On each side, air will be forced into a duct that passes along the outside of the tunnel then round the chicanes at the edge of the platform on the cryo side of UX45. These will feed ventilation ducts inside the tunnel. Air will be recuperated through an opening in the RF side of the tunnel wall into a duct that passes between the tunnel wall and shielding wall. These single openings on each side should have little influence on radiation levels. There will be no need to seal spaces between waveguides and the shielding wall, as the pressure in the cavern will be higher than that in the tunnel.

- **Cryo lines to ACS modules in UX45:** The rigid line will be moved away from the couplers and placed just at the edge of the transport zone.

- **Connectors for ADT amplifiers:** At present these reach into the transport zone. A solution is being studied by Wolfgang and J-F. Malo.

- **APW:** An 'envelope' of 1055 mm will be taken for the integration studies.

- **Crash barriers:** These will be mounted beside the ACN cavities but not the ACS modules, due to lack of space.

- **Compressed Air:** We have to specify the type of pipes/connections. (DN50?)

### ii) Other items still to follow up for present P4 integration:

- **Cooling water circuits and connections for ADT:** This is presently being worked on by Wolfgang and J-F. Malo. Olivier suggested the use of existing (ex-LEP) flow meters together with connecting pipes. Guy Yvon (MK) would be available to help with the design of the water-cooling system.

- **Earthing:** layout and connections in tunnel to be determined (**Action:** Volker/Ed)

- **Use of P6 for removing cavities:** The additional option of using the roof opening at P6 for eventual removal/installation of cavities is being investigated (**Action:** Volker)

- **Warm recovery line** and routing (**Action:** L. Serio, R. Losito)

- **Vacuum** (APW pumping, sector valves as radiation stoppers, ADT pumping requirements, cabling). Discussions needed with M. Jimenez (**Action:** Ed)

### 3) Work on RF components (Daniel)

- Daniel presented his work on [RF devices for the ACS low level RF system](#). Directional couplers have been designed in -10, -20 and -30 dB versions. Splitters have been designed in 2, 4 and 8-way versions. HOM filters for measurement of both fundamental and total power have been designed. An attenuator has been made that can handle high power. A variable delay has been developed and tested. The present designs are done in microstrip and need to be housed in RF leak-tight boxes. Future designs of some of these devices will use strip line. More expensive connectors would be needed but it was agreed that performance of the device is by far the main consideration.

- *Daniel has also developed electronics for the klystrons: an RF power meter (already in use in SM18), electronics for the DCCTs and optical interfaces for transmission of analog signals to and from the HV cage. (See above link)*

### 4) EVM and CtoC (Volker)

- EVM PV estimates had indicated higher costs than CtoC for some systems, notably LLRF+Beam Control, Controls and RF power. These systems have now been looked at with a serious view to reducing costs. The results are summarized in an Excel file. A further important reduction is obtained if He costs in SM18 are paid by AT-ACR. It was agreed that all the items listed in the Excel file be modified in EVM. (**Action:** Equipment responsables concerned)

### 5) Round table:

- **LHC Design Report** (Trevor)

Individual contributions to this have to be sent to Trevor who will make a first draft, which will then be circulated.

- **SM18 Power** (Olivier)

The DCCT and controls modifications will be made this week. Power tests will follow.

- **Klystron delivery.** (Olivier)

Klystrons 5 and 6 have been tested. Klystron 4 will be retuned to shift its resonance with the aid of specialists from Thales.

- **Circulators and loads**

We are still waiting for news from AFT

- **ISR stored equipment and removals** (Olivier)

Vacuum equipment will be recuperated for LHC from 10 LEP SC modules. The moving equipment out of ISR remains to be organized properly.

### Next Meeting:

To be announced

E. Ciapala, 4th August 2003