

LHC RF Meeting

30th July 2004

Present: Luca Arnaudon, Philippe Baudrenghien, Olivier Brunner, Andy Butterworth, Edmond Ciapala, Wolfgang Höfle, Daniel Valuch.

1) Klystrons, Circulators and Loads (Olivier)

- Tests on loads/circulators are in progress in Hall 112. A total of 12 circulator/loads have now been accepted. Load number 13 has a blocked cooling channel. Three sets remain to be delivered. Klystrons 9 (repaired after cooling problem) and 11 are expected in August. Work on construction of HV equipment in A5 is progressing well.

2) ACS Modules and Couplers

- **Couplers:** Conditioning of couplers 111 and 112 has started in SA2 and is progressing normally (15 kW). The next two couplers are now being assembled.

3) SM18 – Modules & Planning

- **Module 1:** Has had couplers fitted and bake-out is nearly finished. The module will be leak tested next week.
- **Module 3:** Remains in the bunker. Cool down, test of instrumentation (LHe level), start of conditioning and bunker radiation tests are planned for the coming week.
- **LLRF tests** are planned for weeks 33 and 34. A possible extension of one week could be allowed if needed, but it may be better to use the full 3 week test period planned in September with Module 1 in the bunker.
- **Second bunker:** Time for LLRF tests is severely limited by the tests on the modules. The need for equipping the second bunker will be re-evaluated after experience with Module 1.

4) SM18 RF tests – Klystrons & LLRF set-up

- During the present period without cryo the opportunity was taken to do some tests on the SM18 power supply and klystron with a short in the waveguide. (Philippe, Olivier, Daniel, Ed.)

- **Power supply ripple:** The total amplitude ripple on the supply at 8 A and 57 kV is 400 V pp. (0.7 %) This is mainly 50 Hz and 300 Hz and harmonics of these as expected but there is also a strong 100 Hz component.

- **Resulting klystron RF amplitude disturbance:** The amplitude ‘noise’ level is roughly proportional to the RF power (less so near saturation). The measured level is much larger than expected, over 10 kW total pp at 200 kW. Based on the figure of $2 \times 1.2\%$ per % for relative variation in RF power with respect to relative variation in cathode voltage (See [Review of LHC Klystrons](#) presented at the HRF meeting of 25th March 2002) less than 4 kW would be expected. The measurement will be checked again. **(Action: Philippe, Ed.)**

- **Resulting phase disturbance:** The phase ‘noise’ level is independent of RF amplitude at 6 degrees RF total pp. This fits exactly with the 8.4 degrees per percent relative change in voltage quoted in klystron review presentation and the measured 0.7% voltage ripple.

- **Pulsed performance:** No modulation could be seen on the cathode voltage or mod. anode voltage dividers when pulsing at frequencies near the LHC revolution frequency. The klystron output followed the pulsed input cleanly and no trips occurred.

Note: Pulsed performance for LEP klystrons is described in a paper by Daniel presented to the 2003 PAC: [Operation of the LEP CW Klystrons in Pulsed Mode](#) .

- **Klystron sidebands:** Sidebands 65 dB down were seen around the RF frequency, the distance varying depending on the RF power, from 250 kHz at 200 kW to 135 kHz at 45 kW. This should be checked in Hall 112. **(Action: Olivier)**

5) ADT Status (Wolfgang) *(With some corrections 06/04/04)*

- **Kickers:** Two short test chambers, each with different steel, have been successfully welded at Dubna and are awaiting customs clearance for shipment to CERN.
- **Power amplifiers:** One is now being made at Dubna. The series (20 in total, including 4 spares) will be pre-assembled and completed later here at CERN. Completion dates are not yet defined.
- **Anode power converters:** It has been established that running all 8 converters from the same 18 kV transformer in SR4 is unsatisfactory, both for disturbance of the network and for power converter performance. This is being followed up, proposals for transformer and switchgear modifications and 12 pulse connection are being studied by TS-EL and the supplier. There will be a full assessment of the situation on 11th August.
- **Feedthroughs:** These are basically satisfactory but tests are still ongoing.

6) DiC & Cabling lists (Luca et al.)

- **ACS:** All equipment and patch panels for ACS have now been defined and named, including HV bunkers and their equipment. The cable list has been reorganized such that compilation and modification of the basic list can be easily done by the equipment specialist. Some additional information has been added. The DiC itself and other information (cable trays, cable types etc.) can be easily extracted without modification of the basic list. The ACS list is now nearing completion; details remain to be completed for SR4 equipment and exact destinations of some cables to other systems have to be identified. There are also some questions on the assignment of RF cables for diagnostics. Some additional cable trays may be needed for coaxial cables. It was agreed to follow this up as soon as possible.

(Action: Ed, Andy, Philippe, Luca)

- **ADT:** Naming for ADT is being completed (Wolfgang and J-C Perrier) and a cable list using the same format as for the ACS will then be compiled. (Wolfgang and Frode) The SR4 rack naming should also be put on the SR4 equipment and layout drawing, as has now been done for UX45.

(Action Jean-Claude with Sylvain)

! Diagnostics cabling and equipment also needs to be finalized for ADT.

(Action Frode, Wolfgang, Andy, Ed.)

- **Note:** J-C Guillaume requires the DiC by the end of August, in order to start procurement of cable and connectors.

7) Integration of UX45

- This will now be handled by The EST/ME team (R. Valbuena). Drawings and details have now been now been put on the [ICL](#) website of the [MIWG](#)

8) Planning and commissioning: (Olivier)

- Details of the latest planning are expected next week. Starting CE work (e.g. platforms) in UX45 (e.g. platforms) before completion of the QRL is being considered. No adverse comments have appeared in EDMS on the RF commissioning note. RF (software & controls requirements and planning status) will be discussed at the next commissioning committee meeting on 5th August.

Next Meeting: Friday 6th August at 08:45 in the JBA Room 864-2B-15

E. Ciapala, 5th August 2004
(Corrected 6th August 2004 ec)