Minutes of RADWG meeting held on 18 June 2009

Present: Daniel Kramer EN/STI, This Wijnands EN/STI, Julian Palluel BE/CO, Rainer Denz TE/MPE, Roberto Losito EN/STI, Yves Thurel TE/EPC, Erik Van Der Bij EN/HDO, Pierre Dahlen TE/MPE, Marian Munoz EN-EL, Luca Bruno BE-ASR, Georges Burdet EN/EL, Sandrine le Naour TE/MSC, Philippe Ghyet EN/ICE, Ewald Effinger BE/BI, Markus Brugger EN/STI, Antonio Marin BE/ABP, Jorg Wenninger BE/OP.

Matters arising – Radioactive material Workshop (Luca Bruno):

Every department (including PH) has a responsible for the communication with the Radioactive workshop working group. In most departments it is the RSO.

The aim of the working group: rationalization and optimization of the radioactive material handling (storage, maintenance etc) within CERN with help of the directorate.

L.Bruno presented a form used for the survey of the material inventory that every equipment owner with electronics inside the ZDR (Zone Dechets Radioactifs – mostly the LHC tunnel locations) should fill in and send to the RSO of the department. **The forms are needed latest by mid-July.**

L.Bruno reminded that equipment removed from ZDR cannot be stored in the lab, but has to be placed in the temporary storage (zone tampon) and then in a dedicated storage. If an intervention has to be done on such equipment, it will be brought from the storage to the dedicated Rad-Workshop.

Destructive work will be allowed for devices with less than 5uSv/h on contact and nondestructive with less than 50uSv/h on contact.

It was pointed out that there is an unnecessary redundancy of information needed for the form as most of the data is already within the MTF and the Layout database. There could be eventually only several fields added to the Layout DB. L.Bruno replied that GS/AIS (including Ronny Billen) was contacted and are working on the possible update; the form just a temporary solution in order to have the data very soon.

T.Wijnands: The amount of spares has to be accounted as well, because they will become radioactive as well during the lifetime of LHC and storage has to be foreseen for them.

In case a group has some very expensive equipment which is unconceivable to be bought twice and is needed in the Rad-Workshop, it will have to be moved to the workshop and used also for the non-radioactive devices there.

Matters arising – TI2 injection test (T.Wijnands):

The next LHC injection test will be during the weekend of 11-12 July 2009. All the equipment in the UJ23 and UA23 should be powered during the test. The radiation levels behind the shielding should be small, but during the last TI8 tests, the RADMON in UJ87 had two SEUs.

Matters arising – R2E/RADWG mandate (R.Losito):

The R2E study group deals mainly with the Fluka simulations of the underground areas, proposes shielding options and reports to LMC, where the decisions have to be taken.

The RADWG deals with the rad-tol developments of electronics together with the corresponding radiation tests. It also

The R2E meetings are not closed, therefore everybody can come, but the actual electronics details are discussed very little. In case it is necessary, concerned people will be invited to the meeting (scheduled usually every 2nd Wednesday at 10:30). In case when clear measures for relocation were identified, the information has to be communicated within the RADWG.

Matters arising – Relocation issues (R.Losito):

During the last LMC meeting, R2E was asked to prepare a crash program for the electronics relocation/hardening and shielding issues. The effort should be centralized to the R2E, which should propose the shielding and relocation options.

For the moment, the contact person for the integration requests for the 1st year of operation is Anne Laure Perrot *(to be confirmed)*, who is in charge of the US85 relocations being actually in progress.

TI8 injection test – RadMon measurement results (D.Kramer)

D.Kramer presented the results from the transfer line injection test from 6 June 2009, when the beam was injected up to the TED dump in UJ88 with maximum intensity per extraction of $5x10^{11}p^+$. The Radmon hadron fluence measurements scale relatively well with the dumped intensity. There were 11 SEUs detected before the shielding and 2 SEUs behind the shielding in UJ87, where a power converter is *(to be confirmed)* installed. The device was set to high sensitivity (3V) and is therefore sensitive also to thermal neutrons, which are potentially as dangerous as hadrons>20MeV depending on equipment. The total extracted intensity was $5.6e13p^+$ and the total hadron fluence ~2m downstream the TED was measured as 7.0e9 cm^{-2}.

A disagreement between the respective dose measurements was shown, which could be caused by the dose rate dependence of the sensors. The effect will be further studied.

The next TI8 injection test is scheduled for the 20th of August 2009 and a single injection of $1e13p^+$ should be dumped on the TED, but the planning depends on the remaining LHC works downstream.

J. Wenninger mentioned that the TI8 line is normally very stable with no difference expected between high and low intensity, so high intensity dumps on the TED should be very rare during the operation. Also only little losses should occur on the collimators. Nevertheless, the jaw positions have to be set up and the procedure will produce a considerable amount of radiation. The operation regime of TI8 is not yet clear. Also the losses from the collimator right beside UJ87 should not be un issue, as the LHC magnet would quench in case of increased losses.

Radiation Simulations of TI8 (M.Brugger)

M.Brugger showed the simulations reproducing the layout situation of the WIC crate which failed during the TI8 test. The collimator was hit with 2e12 protons and the scoring box was placed 30m downstream at the location of the WIC crate. The high energy hadron flux was estimated to 6e8 cm^{-2}. The energy spectra show a thermal neutron peak at the level of ~2e8 cm^{-2}. This doesn't explain the WIC SEE, as its SEE cross section was measured in the order of 1e-11cm^2, but one event is not enough for statistical estimation and the previous integrated fluence is not known.

The UJ88/UJ87 simulation data was obtained by converting the prompt dose RP simulations. The very approximate and conservative results are in full agreement with the RadMon measurements if the latest are scaled to the low sensitivity setting (5V) i.e. 1e8 cm^{-2} (hadrons>20MeV) for $1.4e16p^+$ on TED. Also the ratio in front/behind concrete for the RadMon measurements is in agreement with a factor 5 attenuation expected for 80cm of concrete.

Report on the WIC crate error in TI8 (P.Dahlen)

The crash in TI8 was most likely due to a memory corruption of a register in the Siemens communication module ET200M (profibus interface). The interlock stopped also CNGS as it shares the same powering chain, but in a completely failsafe mode. The manual remote reset worked (power of the module is cycled with a relay). P.Dahlen also presented the results of previous TID tests, which showed a large dose margin. The PSI 60MeV p+ tests showed a SEFI cross section of up to 6e-11 cm^2. The complete WIC crates were tested previously in TT41 and showed no errors.

J.Wenninger mentioned that the TT41 line is very stable and therefore very little beam losses are present.

WIC installations in the transfer lines: 18 crates in TI2; 20 in TI8; 6 in CNGS. There is another WIC crate in the same situation (~30m downstream a collimator) located in TI2, all others should be OK, as no direct showers are expected in their respective locations.

The only realistic solution possible is the relocation of the 2 crates upstream of the collimators, which will minimize the risk of similar events.

J.Wenninger pointed out that it is not at all clear where this subject should be treated. Perhaps the best is the MPWG.

Partial report from ongoing BPM tests in CNGS (E.Calvo)

The optical signals from the WBTNs showed 3 or 4 spikes for a hadron fluence of about 1e10cm-2 and ~0.8Gy. The WorldFIP showed no errors so far. The complete analysis is pending as the data amount is very large.

The crate will be moved in front of the TSG45 duct during the next CNGS access in order to increase the integrated radiation levels (was done on 17/06/09).

Report from ongoing CRYO tests in CNGS (G.F.Penacoba)

So far, the tunnel cards showed no errors (1e11 cm^{-2} 1MeV n eq. and ~5e10 cm^{-2} "H>20MeV").

The non-tunnel cards containing the digital insulators (ISO150) are crashing very often. The insulated temperature channels have 0.34 SEU/channel/h. The errors are recovered by an automatic soft remote reset, which was added to the functionality of the cards. The insulators are used in a static mode (never refreshed), therefore every SEU will manifest as a SEFI.

A procedure was proposed to circumvent the problems: when detecting a gain change, the output is latched and the FPGA resets. The reset takes just one cycle.

The QRL heaters both failed during the same day (~8.5e10 cm^{-2} 1MeV n eq., 6.7 Gy). Most likely the solid state relays failed on the cards.

It was decided to stay in the same place and wait for the failures on the tunnel cards to occur and accumulate statistics on the non-tunnel cards, mainly the WorldFIP communication and the signal conditioners.

G.F.Penacoba replied to R.Losito that a report will be written from the test once they are complete.

Report from ongoing QPS tests in CNGS (R.Denz)

The microFIP chip running in the micro-controlled mode at 1Mbit/s got stuck twice. One day after installation (29.4 but

A 50uV voltage drift was observed so far on the high precision part of DQQBS (4.3e9 cm^{-2} 1MeV n eq.).

HTS current leads in CNGS (S.Le Naour)

S.Le Naour gave a summary description of the equipment installed in CNGS and results from the 2008 tests in CNGS. The controllers of the current lead heaters are installed mostly in RRs, UJs and UAs and contain a regulator controlling a solid state relay. The power part (transformer and breaker) are on the DFBs.

There is no direct feedback on the functionality, but the temperature measurement shows clearly if the heater is off.

In 2008, the regulators failed at 1.3e10 and 3.2e10 cm^{-2} (1MeV n eq.) respectively. The units received in total 6e10 cm^{-2} (1MeV n eq.). One unit recovered from the error and was placed back to CNGS. The regulator of the second unit was exchanged and put back as well. The solid state relays remained functional.

There are 252 controllers installed in UJ56 and UJ14/16. The RRs contain 324 controllers.

WorldFIP tests in CNGS (J.Palluel)

There were no errors observed so far (31Gy, 3.4e11 cm^{-2} (1MeV n eq.)). Only a current decrease from 140 to 132mA was observed. According to the experience of P.Dahlen it could be caused by the decreased consumption of the LEDs (bipolar). 1 more test slot is needed for the 1MHz card.

J.Palluel replied to T.Wijnands that several FIPdiag cards can be tested simultaneously (perhaps 3), but not the repeaters. So far the tests are being performed in the Standalone mode, but can be done in the micro-controlled mode (more sensitive to SEE).