Minutes of the RADWG meeting held on 3 May 2010

Present: Helmut Jena, Markus Brugger, Antonio Marin, Roland Chery, Gonzalo Penacoba, Giovanni Spiezia, Pierre Dahlen, Alessandro Masi, Silvia Grau, Chiara Bracco, Ketil Roeed, Juan Casas, Erik Van der Bij, Eric Sallaz, Yves Thurel, Daniel Kramer

Follw-Ups as identified during the meeting:

All:
- provide the number of sensitive units per critical area, as well as their distribution in terms of failure consequence

M. Brugger:
- contact RadWG members to discuss about mid/long-term RadWG requirements and objectives

D. Kramer:
- distribute input table to equipment owners so that they can fill out the number of 'units' per critical area, as well as indicate the respective failure consequence (according to possible failure)

H. Jena:
- repetitive test of power reset to determine if destructive failure of power supply could be triggered by the reset

E. Sallaz:
- regular reset as soon as equipment shows failure -> aiming in collecting statistics before cumulative damage becomes a problem
- check for next access/stop: can the equipment (possibly new switches) be configured so that they're tested/monitored with traffic
- is a remote reset a possible (even temporary) mitigation action which could be envisaged for the critical areas

S. Grau:
- check for next access/stop: can the test-setup be modified so that the detectors (possibly new ones, even only one or two) can be tested while they 'detect' fire

Matters arising – (Markus Brugger):

- RadWG is a working group and in order to be functional needs to fulfill the requirements of its members. Individual members will be contacted by Markus Brugger during the coming weeks to discuss the requirements of the equipment groups in detail [**follow-up: M. Brugger**]. Current focus is put on the following activities:
    - Preparation for June R2E Workshop and Report
    - 2010 CNRAD Equipment Tests with focus on COTS
    - Detailed review of Equipment in Critical areas (e.g., H. Jena's talk last time)
    - Possible requirements for short 2010/11 shutdown
    - Power Converter Tests (LHC or North-Area)
    - 2010 Radiation Tests and Related Issues
- The upcoming WG meetings will be scheduled every 2 weeks and after the workshop in June, the frequency will be most likely every three weeks depending on the arising matters.
    - The best matching result of the doodle poll is the slot of Tuesday morning at 10:30

DRAFT

- The June R2E workshop and its outcome will be followed by S. Meyers.
- Following the talk of H. Jena during the last RadWG, it was possible to identify new potentially critical CV equipment in the tunnel. This confirms the requirement to have the equipment iterated by the equipment responsible and discussed during the RadWG. The overview presentations of the WG members will continue with M. Munoz (EN/EL) during the upcoming RadWG.
- It is clear that the operation will be very difficult beyond 2013 without significant mitigation actions being taken; therefore important actions will have to be taken during the long shutdown of 2012. The preparatory actions have to be launched in advance due to the important lead times.
- Examples of the points which need to be clarified:
    - Is a safe remote reset a satisfactory option for some of the equipments and could it be installed already in 2011 if the remote reset racks are relocated in advance?
        - When a reset is needed every 10 minutes even on a non critical equipment, it is perhaps not acceptable for the operation, the latter to be checked case-by-case
    - Can only the control parts of some systems be relocated in order to save space and money for the relocation? (*i.e.,* IP5 possibly not enough space for a full relocation)
    - …
- A draft table summarizing the expected fluences in the critical areas together with estimations of the number of equipment types and their SEE cross sections was presented (based on preliminary CNGS results and guessed number of equipments). The table has to be finalized before the workshop using the input of the CNRAD tests and detailed equipment counts from the concerned groups (number of sensitive units per critical area). It was suggested by several RadWG members (e.g., E.v.d. Bij, G. Penacoba) that several distinct tables have to be made to account separately for the respective criticality of the failure consequences. D. Kramer will distribute an 'input-table' allowing to collect the number of units per critical area, as well as their respective failure category [**follow-up: D. Kramer**]; i.e.
    - immediate dump and access required
    - immediate dump
    - scheduled access required
    - other
    - The final table aims for a first (rough) estimation of the Radiation Induced Failure Rates expected for 2011 and the nominal LHC operation
    - Where 'best estimates' (guessed) assumptions are considered (*e.g.*, failure cross sections) those are to be clearly distinguished from the tested ones.
- Due to the requirement of the power converter review to test the devices in radiation, a brain storming meeting was held on Wednesday and the minutes are available here (as well as the respective summary slides). The further investigated short-term possibilities are IR7 collimation area and North area (H4). For the long-term a dedicated facility (*e.g.*, East-Area) would be of clear advantage.

First report on WIC tests in CNRAD 2010 (P.Dahlen)

- The same equipment as the one tested is installed in US85
- List of the observed errors:
    - PLC S7-300 error - OK after reset
    - Boolean processor failure after the reset
    - PLC S7-300 catastrophic failure – no trace of it in PVSS but fail safe (beam would be dumped)
    - **Preliminary** SEE cross section estimation **around 1e-7cm2** high energy hadrons

DRAFT

    - Boolean processor still working and setup kept in place. The power of the processor was kept ON and the rest of the system shut down. It can be later used for the remote IO tests via the Profibus cable. A new PLC will be placed in the control room of ECA4 and the ET200M module will be used to interface the I/Os to be tested.
    -
- Following a question by M. Brugger, P. Dahlen confirmed that the Boolean processor failure could have been 'hidden' due to the S7-300 error, thus only became visible once the reset was performed.

First report on CV tests in CNRAD 2010 (H.Jena)

- Schneider premium tested together with the Siemens PLCs. The Schneider is *e.g.*, installed in UW85 on critical cooling circuits (10s interlock)
- 3 temperature sensors were installed within the test setup
- Slow control application programmed in WinCC
- Several failures happened at low fluences (most likely Profibus communication or S7-200 ?)
- The Schneider PLC was lost after the power cycle, the rest recovered. In situ tests revealed a likely damage of the power supply (fresh PLC immediately damaged as well)
    - Power supply is the "standard rack one" 10A at 5V
- P. Dahlen mentioned that he tested several standard PLC power supplies and most of them are very sensitive. Y.Thurel asked if he ever investigated which components actually failed. This was not done. Cycled resets in the lab should be performed to exclude the possibility of non radiation induced failure of the Schneider after power cycle [**follow-up: H. Jena**]
- When the beam restarted on Friday, the reset was needed every 1 to 2 hours.
- The observed failures shall be collected and analyzed to determine a respective failure cross-section

First report on Remote Reset/ Timing tests in CNRAD 2010 (R.Chery)

- Schneider TWIDO is used in the remote reset test setup
- The system catastrophically failed on Saturday 15:00. Reset impossible.
    - Power supply or Ethernet module are the primary suspects
    - The question was raised if no failures observed before. R. Chery confirmed that the device was working without errors beforehand.

First report on Ethernet Switch tests in CNRAD 2010 (E.Sallaz)

- During Slot 1, one switch lost SNMP connection but PING OK and 35min later the same was reproduced
- No communication possible since 1:20 23/4
- Second device self rebooted (it takes ~20s)
- 2 switches stopped responding during slot 2, reset to be done
- For the coming measurement period it was pointed out that regular resets should be performed (as soon as possible after the observation of a failure) [**follow-up: E. Sallaz**].
- The proper functionality should be tested by using equipment connected to it. Option to be studied by E.Sallaz [**follow-up: E. Sallaz**]
- According to the discussion the mitigation for the switches could be done with a remote reset which should not be automatic due to the equipment connected to it. The possibility of such an approach shall be tentatively analyzed until the June R2E workshop [**follow-up: E. Sallaz**].

DRAFT

First report on Fire Detectors test in CNRAD 2010 (S.Grau)

- No problem during Slot 1 and functionality verified during access by real smoke
- One detector failed on 2/5 at 1:52 (about 9e7cm-2 high energy hadrons). All detectors recovered after power cycle
- It should be investigated if the real operation of the detectors can be verified during irradiation (i.e. mechanical blocking of the light path; preferably periodical) – [**follow-up: S. Grau**]

First report on PXI collimation rack test in CNRAD 2010 (A.Masi)

- One of the 2 main PRS power supplies had a catastrophic failure after ~1.6e6cm-2 HE hadrons (preliminary calibration!) and was replaced during the access. The circuit breaker was down so the cabling was separated (3 individual breakers now)
- Several errors were observed during the start of Slot 2 and are summarized in the following together with their impact on LHC operation:
    - FPGA stuck in armed state -> remote reset of FPGA OK
    - Self REBOOT of PRS -> would cause IMMEDIATE DUMP
    - Loss of communication with MDC -> remote hard reset of MDC OK
    - Loss of resolver steps -> reset FPGA OK
    - MDC driver reading timeout -> reset drivers NOT OK – access required
    - MDC FPGA stuck at the same time -> reset FPGA OK
- The low level control is still working

Next meeting:

- Date: Tuesday May 18th, 10:30h
- Preliminary Agenda:
    - EN/EL Equipment in Critical Areas (M. Codoceo)
    - Update of Failure Rate Table (M. Brugger)
    - Feedback from Equipment Report Approvals (G. Spiezia)
    - Remaining Radiation Test Campaigns 2010 (D. Kramer)
    - Calculations vs. Measurements a first ‘glance’ (M. Brugger)

    a.o.b.,

DRAFT