R2E Review – November 2011

Dates: three days during week 47: 21.11. – 25.11.
(exact length to be defined once talks/sessions are scheduled on Indico)

Structure of this working document:

- each session contains a list of questions to be addressed/answered during the review
- based on this list a schedule was proposed per session
- timing of talks and sessions are iterated/optimized to fit into an overall planning
- for each session a chair and a secretary, as well as internal/external reviewers are defined based on the main aspects to be discussed
- the review aims to fit into 2-3days, with a possible wrap-up/discussion session in the end (day after)

Review Key-Questions:

- How good/bad are our predictions for radiation levels.
- How good/bad are our predictions for overall equipment failure rates.
- What failure rate do we expect after 2011/12 xMasBreak and LS1 mitigation actions
- What patch solutions are required to bring us to LS1 and what is the remaining risk
- Radiation tests on power-converters only partly confirm their high sensitivity -> can patch-solutions be sufficient for some of them -> with and without relocation/shielding measures taken for the RRs?
- Mitigation actions focusing mainly on commercial equipment in the shielded areas, what's the status of the tunnel equipment and what will happen when beam-gas kicks in (will it)?
- What's about the (long) story of safe-rooms and what part is related to R2E.
- What are our options with super-conducting links, their time-scale and impact on the R2E strategy
- What's the status of the shielding and relocation measures and where are we with their preparation?
- Are we able to implement all measures for the LS1 shutdown and what are the corresponding preparation and coordination requirements?
- How much will it finally cost and what's about man-power, co-activities and coordination?
- Can we exclude major civil-engineering actions and what CE related activities do remain and what is their possible synergy with LHC upgrade activities
- Do we need betatron collimation in P3 as a future backup solution?

Draft Program

Sessions:

Introduction: Aim of the review + Performed Actions

1. **Calculations & Monitoring**
   chair: M. Calviani
   confirmed reviewers:
   secretary: tbd
2. **Power-Converter Radiation Tolerant Development & Super-Conducting Links**
   chair: F. Formenti
   confirmed reviewers:
   secretary: Q. King
3. **Radiation Testing, Equipment Failures**
   chair: G. Spiezia
   confirmed reviewers:
   secretary: J. Mekki
4. **Integration, Implementations, Planning & Safety**
   chair: S. Baird
   confirmed reviewers:
   secretary: A.L. Perrot
5. **Resources & Strategy**
   chair: R. Losito
   confirmed reviewers:
   secretary: M. Brugger

Wrap-Up & Summary

Details:

Introduction: Aim of the review + Performed Actions

- expectations from operation and the management
- what general questions have to be answered for R2E
  - what happened during 2010/11
  - what improvements are already implemented in the LHC and how much did we gain (important for failure study)
  - xMasBreak 2011/12 what will we do/can we do and what's the expected impact on 2012 Operation
  - general strategy: next xMasBreak + Long-Shutdown 1
  - strategy beyond

Title	Speaker	Key Words	Length
Expectations from operation and the management	**M. Lamont, P. Collier or S. Myers**	Performance reach, acceptable downtime and SEE impact,	15'
Overview of R2E related events during 2010/2011	**G. Spiezia/M. Calviani**	General overview of R2E related beam-dumps (families, modes, respective mitigation options) -> no details, but general correlation (PM database, follow-up through weekly reports, R2E weekly shifts, etc…)	20'
Achieved R2E improvements (mitigation measures)	**A.L. Perrot**	Summary of implemented mitigation measures	20'
Key questions to be answered by this review	**M. Brugger**	Open issues, question-marks and decision criteria	15'
		Total:	1h 10'

Session – 1: Calculations & Monitoring

Chair: M. Calviani

Secretary: R. Garcia Alia

Internal Reviewers: A. Ferrari, S. Roesler

External Reviewers: ESA (G. Santin)?, A. Fasso, Montpellier (F. Wrobel)

- LHC Operation: past and future operation (luminosity, loss distribution).
- Beam losses and distribution in the LHC collimation regions
- Vacuum & Beam-Gas: measured densities and predictions for the coming years and how does it compare with calculated monitor predictions?
- Overview/results of additional FLUKA calculations.
- Calibration improvements and summary of calibration values (including references/reports).
- How do the monitored radiation levels compare to the predictions and extrapolations?
- Overview of LHC radiation levels and extrapolation.
- UX15/UL leakage: analysis and outlook
- How 'performing' is the installed shielding (measurements + calculations)

- Is the monitoring coverage sufficient and what long-term developments are required?
- How much are we affected by thermal neutrons?
- How big are our uncertainties in predicting radiation levels (tunnel, shielded areas)
- Radiation levels in the UA63/67 (kicker equipment)
- Are there additional weak-points coming up (e.g., P4, REs)

Title	Speaker	Key Words	Length
Measurements & Benchmarks:			
Overview of RadMon calibration campaigns	**J. Mekki**	Radmon calibration, achieved accuracy, open issues/questions, limitations to be considered	20'
Review of RadMon installation in the LHC tunnel	**G. Spiezia**	RadMon locations (incl. types) around the machine, logic in location/voltage settings, additional requirements, possible changes in the future	15'
Are there any additional weak points (possibly linked to beam-gas pressure)	**M.Brugger**	P4 UX45/US45, Res, ARC in general – how will it behave with 25ns operation, Evolution of radiation levels in P4, available calculations, new monitoring and results	15'
ATLAS P1 measurement and UX/UL weak point	**M. Calviani**	UX15 cross-check and measurement, UX/UL junction weak point	10'
P1/5 benchmark and R-Factor Evaluation	**C. Adorisio**	RadMon results, FLUKA calculations, RAMSES results and evaluation, Check how material and equipment affect the R-factor in UJ14/16 in the real geometry	20'
Requirements & Evolution:			
Vacuum evolution over 2011 and perspectives for 2012 and beyond	**V. Baglin**	Vacuum, beam-gas, 25ns expectations, scrubbing requirements, pressure evolution in the DS/ARC as well as P4 LSS	20'
Beam-Gas Predictions & Radiation Levels	**R. Versaci**	FLUKA calculations, BLM detections thresholds, MD results	15'
Collimation losses in IR3/7, 2011/2012 evaluation and future expectations	**A. Nordt**	Loss distribution within the collimation area; annual number of protons for 2011/2012 and future, possible 'reminder' on P7 benchmark and conclusion for IR7 to be added in one/two slides (Markus)	15'
LHC operation perspectives	**M. Pojer**	Beam operation perspectives for 2012; 25ns operation? Target luminosities for the various exp.ts?	15'
IR1 & 5: RR advanced shielding options	**R. Kwee**	After LS1 shielding implementations, what how much can we gain in addition and where are the limitations	15'
Review of the LHC SEU-related radiation levels over 2011 and perspectives in 2012 as well as during nominal LHC conditions	**M. Calviani**	Monitoring results summary, calculation summary, deducted radiation levels, considering updates, already implemented, as well as future mitigation measures, what about UJ23/87 are we ok?	20'
		Total:	3h 00'

Session – 2: Power-Converter Radiation Tolerant Development & Super-Conducting Links
Chair: F. Formenti
Secretary: Q. King
Internal Reviewers: R. Schmidt, F. Faccio, J. Christiansen
External Reviewers: R. Gaillard, Montpellier (F. Saigne?) , ESA (A. Mohammadzadeh?)

- observed failures during operation, H4IRRAD test results and respective outlook for next years of LHC operation
- status of conceptual design study of radiation tolerant power-converters
- status of conceptual design study of new FGCs
- 60A anything to worry about?
- FGCs anything to worry about?
- component requirements and status with respect to ongoing/planned radiation tests
- strategy of component purchase, availabilities and storage
- is the development/testing/prototyping/procurement strategy feasible and in line with LHC operation
- short-term patch-solutions versus long-term development
- Status and outlook for new horizontal/vertical superconducting links.
- IR7: status of horizontal link tests, do we need the super-conducting links and when, what do we have to foresee for TZ76

Title	Speaker	Key Words	Length
Radiation sensitivity of LHC Power Converters and projections	**Q. King**	New H4IRRAD and CNRAD test results, and LHC events during operation processed. Projection to LHC operation, and patch solutions.: Test, events, failures, LHC, Operation, FGC, Power Converter, Voltage Source, LHC projection	20'
Radiation-tolerant components qualification process	**G. Spieza**	Choice, test and qualification criteria for components being considered for radiation-tolerant design: Trad, PSI test, structure, mode of operation, results, what to conclude on series test required, limitation vs LHC environment, test results, database, test facilities	20'
A proposed strategy for production, validation of radiation-tolerant Power Converters series	**A. Dinius**	Procurement, radiation qualification of series components, and final validation criteria for FGC and Voltage Source.: Components, test radiation tester, strategy, procurement, spares, management, requirements, test facilities, validation, classification, documentation, database	20'
R2E Power-Converter Projects: Status / Where are we?	**Y. Thurel**	Design, team, planning, FGC, Power Converter, Voltage Source, patch solution for operation, documentation	20'
Super-Conducting Links: Horizontal/Vertical – Status & Possibilities	**A. Ballarino**	Status of test bench, feasibility, possible integration (including issues), compatibility with long-term LHC requirements, update on planning/costs	20'
DISCUSSION			
Radiation Tolerant Power Converters & Super-	**All**	Pro & Cons of various mitigation options, limitations, compatibility with time-line, flexibility advantages	20'

Conducting Links: Options and Requirements			
		Total:	2h 00'

Session – 3: Radiation Testing, Equipment Failures

Chair: G. Spiezia

Secretary: J. Mekki

Internal Reviewers: P. Farthouat, F. Faccio, J. Christiansen

External Reviewers: R. Gaillard, Montpellier (F. Saigne?), ESA (A. Mohammadzadeh?)

- Summary of CNRAD test results and lessons learned – impact on LHC (test reports!)?
- Summary of PSI test results (including setups) and lessons learned – impact on LHC (test reports!?
- Overview and analysis of 2010/2011 equipment failures, including table on performed/envisaged mitigation measures
- LHC/OP impact of SEE induced failures – can we quantify the time?
- H4IRRAD the new test area
- How representative is our test strategy (PSI, CNRAD + H4IRRAD) for LHC conditions (shielded areas/tunnel)?
- Analysis of QPS failures, extrapolation with LHC operation (especially higher beam-gas densities) and review of applied mitigation plan.
- H4IRRAD radiation tests & consequences:
    - power-converters (see power-converter session)
    - safe-room equipment
    - GTO test results and consequences for UA63/67 installation
    - other tests
- 1st results and approach of outsourced radiation tests, including TRAD evaluation of test strategies (TRAD or similar)
- nanoFIP status and implementation in user systems
- What can we say about the observed uFIP failures, the expected failure cross-section and the need for mitigation actions?
- Other radiation tolerant developments/requirements for the LHC tunnel (present/upcoming)
- What about 'hidden failures': e.g., second stage problems caused from one equipment to the other (e.g., Ethernet switches)
- What about failures possibly attributed to SEE while being of other origin?
- PSIRRAD the next step for a long-term facility?
- Available test facilities, future options and respective requirements & availability (including long-term view).

Title	Speaker	Key Words	Length
H4IRRAD test area construction and operation. Perspectives for running in 2012 and beyond?	**M. Calviani**	H4Irrad new test area, commissioning, performance and possibilities, as well as limitations	15'
Test strategy for components and systems	**G. Spiezia**	Time constraints, facilities, test methods and requirements, feedback from TRAD analysis	20'
Radiation test results: PSI	**P. Perronard**	Summary of results and impact on mitigation actions	20'

Radiation test results: CNRAD	**J. Mekki**		20’
Radiation test results: H4IRRAD (other than PCs)	**Tbd**		20’
QPS observed failures and mitigation measures	**R. Denz**	QPS events observed, mitigation measures applied and in pipeline, LHC impact for 2012 and beyond	15’
Cryo observed failures and mitigation measures	**S. Claudet**	Cryo events observed, mitigation measures applied and in pipeline, expected (remaining) impact on LHC operation	15’
Cryo PLC strategy	**E. Blanco Vinuela**	Report on H4IRRAD radiation tests, LHC observations and proposed strategy (xMasBreak, 2012 operation and LS1)	15’
Summary of LHC Equipment failures (other than QPS)	**G. Spiezia**	Overview of SEE related events during 2011, applied/envisaged mitigation solutions and patches, uFIP cases and possibilities	20’
nanoFIP	**E. Gousiou**	nanoFIP development status, availability for users, implementation timeline, next steps, foreseen applications (short/mid/long-term)	15’
Test requirements (2012-2016)	**Tbd**	Estimate of radiation test requirements for 2012 and beyond (R2E Mitigation project and A&T Sector)	15’
		Total:	3h 10’

Session – 4: Integration, Implementations, Planning & Safety

Chair: S. Baird

Secretary: A.L. Perrot

Internal Reviewers: K. Foraz, F. Duval, J. Pedersen, S. Roesler

External Reviewers: none

Mitigation actions already implemented in the past year and their effectiveness -> covered in Session-1.

- Shielding blocks: purchase status, storage and preparation, readiness for installation
- Relocation actions per point/area: overview/preparation/planning/documentation.
    - UJ14/16/56/76 and US85
- Shielding actions per point/area: overview/preparation/planning/documentation.
    - UJ14/16/56?, RR13/17/53/57 and US85
- Relocation actions: possible safety constraints and respective mitigation.
- Shielding actions: possible safety constraints and respective mitigation.
- Status of ECRs and safety documentation
- What can/will be anticipated in the xMasBreaks/technical stops?
- TZ76: how much of the wall is to be dismantled during LS1
- Safe-Room relocations: final strategy
- PAD/MAD: final mitigation approach/decision/impact.
- Civil engineering requirements (for mid- and long-term actions), what actions come next?
- UJ23/87: long-term requirements/options?
- Analysis of most critical mitigation actions with respect to timing/accuracy/safety
- Coordination requirements for xMasBreak and later LS1

- P4 and REs, first ideas in case it turns out to be a long-term issue
- Radiation protection and radiation safety constraints for both, proposed mitigation solutions, as well as final work implementation
- Planning of mitigation actions (xMasBreaks 11/12 + LS1)
- Foreseen worksite planning and coordination, organization of work-sites and safety responsibilities.

Title	Speaker	Key Words	Length
Shielding Actions: Integration status	**M. Lazzaroni**	preparation, installation plan, logistics, possible issues	20'
Relocation Actions: Integration status	**Y. Muttoni**	layouts, open issues (if any), critical points, required procedures	20'
Safe room relocations: status of studies	**F. Duval**	R2E impact and concerned equipment, coherence with general safe-room evaluation, respective planning, costs and resources, consequence of radiation tests	20'
Civil-Engineering Activities	**J.C. Bisquert**	xMas2011/12, LS1 and beyond, TZ76, including coherence with upgrade requirements	15'
Relocation & Shielding: implementation	**A.L. Perrot**	ECRs, status of contracts	20'
xMas2011/12 and LS1: General Schedule & Safety Remarks	**K. Foraz**	Overview of scheduling, critical main points, possible improvements (through resources); overview of safety concerns, what can be done during TSs	20'
R2E Activities: detailed schedule	**M. B. Marin**	anticipated work and impact on overall planning, criticality, etc., highlighting critical activities, delay constraints, timing, open questions/concerns	20'
Worksite organization: resource requirement, organization	**A.L. Perrot**	Proposed structure, follow-up of work, coordination strategy, organizational aspects and preparation, radiation protection, traceability, etc.	20'
What can go wrong?	**S. Weisz**	Bottle necks and problems as happened in the past; margins and measures to be taken	15'
		Total:	2h 50'

Session – 5: Resources & Strategy
Chair: R. Losito
Secretary: M. Brugger
Internal Reviewers: R. Saban, S. Prodon, S. Weisz, Finance?
External Reviewers: none

- Are our radiation test resources sufficient (and efficient)?
- What test activities could be reasonably outsourced?
- Do we have sufficient 'eyes', monitoring information of the LHC machine and what are possible additional long-term requirements
- How do we fit the mitigation actions best into the LHC operation planning and what are our flexibilities in case the planning changes; or delays/problems appear (plan-B)?
- Resource (budget & man-power) status per work-package, update of next year(s) planning

- Activities/Resources overlaps during xMasBreaks and Long-Shutdowns, what is/can be done? -> mainly covered in session-4, do we need a wrap-up/analysis
- Betatron cleaning in IR3: was considered as long-term possibility -> is it still needed (long-term) for IR7 -> original issue obsolete after coll-review, however long-term aspect to be addressed
- Putting it together: input from radiation tests, LHC observations, mitigation actions -> what is the proposed/updated strategy?
- New/Future equipment to be installed (not only at the LHC), how can we organize an effective policy/structure?
    - *Requirements for an efficient R2E policy -> possibly not needed for this review.*
    - *Strategy/Proposal to implement an LHC (later also for other accelerators) radiation policy.*

Title	Speaker	Key Words	Length
Radiation Tests: resources and strategy	**G. Spiezia**	TE/EPC requirements, LHC requirements, A&T sector requirements, possible outsourcing	15'
Monitoring Status/Requirements & Facilities	**M. Calviani**	Available monitoring: sufficient, additional requirements, needs of new developments, what facilities are available and what other options do we have	20'
Scheduling: key issues and possibilities	**K. Foraz**	Bottle necks in planning (e.g., P5), how to react on delays/problems, summary of options we have	20'
Radiation Tolerant Power Converters Super-Conducting Links & Betatron-Collimation: Options and Requirements	**R. Losito**	summary of discussion in session-2, analysis of available mitigation options and long-term requirements	15'
Budget & Resources: Relocation & Shielding	**A.L. Perrot**	Update/Summary of budget estimates, required resources (internal/external), possible bottlenecks	20'
R2E Strategy: Update	**M. Brugger**	Putting it together	20'
Final Discussion	**All**	Remarks, Suggestion, Feedback	20'
		Total:	2h 10'