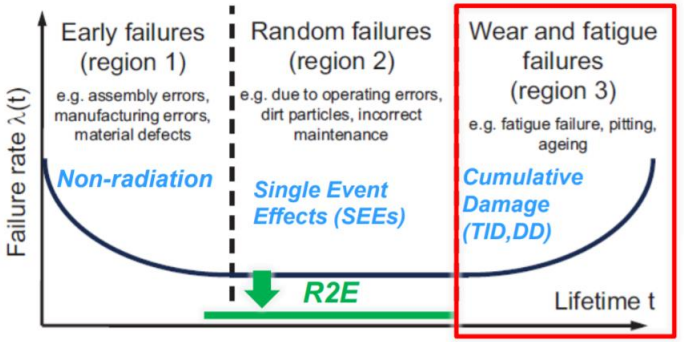
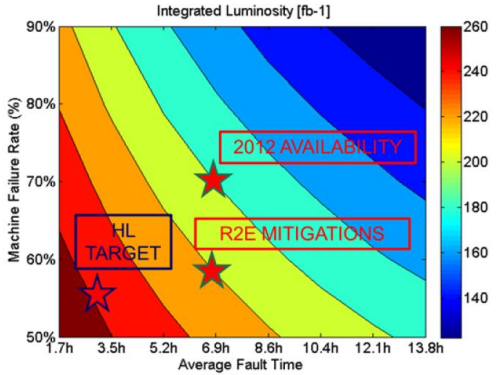
R2E Project Management status

Rubén García Alía, on behalf of the R2E Project

R2E Status and future challenges/risks

- Presently (Run 2), R2E failures in the LHC remain in the shadow for operation (i.e. relatively small impact on availability & performance)
- However [R2E Cost & Schedule Review 2017]:
  - **R2E Lifetime failures** are not constant in time (fluence) and could appear at a similar stage for many different distributed system units (e.g. nQPS, 60A converters…)
  - **R2E SEE failures** that are acceptable in terms of premature dumps (1-10 dumps/system/year) for present operation might not be acceptable for HL-LHC (tighter availability constraints, increased radiation levels)
  - The **injector availability** is critical for LHC operation; so far, no systematic R2E approach has been applied, and post-LIU operation will involve new equipment and different (typically more severe) radiation level distribution (e.g. SPS LSS5 dump area)





2017 Cost & Schedule review feedback

- Additional funding requests for 2020-2025 period
  - “co-funding” appears as way of funding large R2E driven productions
- Large scale **funding of hardware production** should not come (completely) from R2E budget
  - However, R2E still responsible for **harmonizing and reviewing developments**
  - All R&D activities integrated in R2E
- Need to revise project structure through **work package breakdown**
- CHARM facility operation of highest criticality during run 3 (possible East Area consolidation conflicts)
- Support for optical fibre distributed dosimetry deployment in LHC
- Endorsement of **radiation hardness assurance procedure**, to be implemented for all new development projects
- LS4 developments needed → to be requested for eventual incorporation in the MTP (e.g. possible LHCb high-luminosity upgrade is currently outside project scope)
- After LS2 startup and with return from experience: time for **planning post 2025 R2E needs and framework**

R2E WP structure

A. Operation

A-1: Project Management [S. Gilardoni/R. Garcia Alia]
A-2: RADWG Support [S. Danzeca]
A-3: MCWG Support [Y. Kadi]
A-4: Material Testing and External Facilities [M. Calviani]
A-5: Injector Chain [R. Garcia Alia]

B. Infrastructure

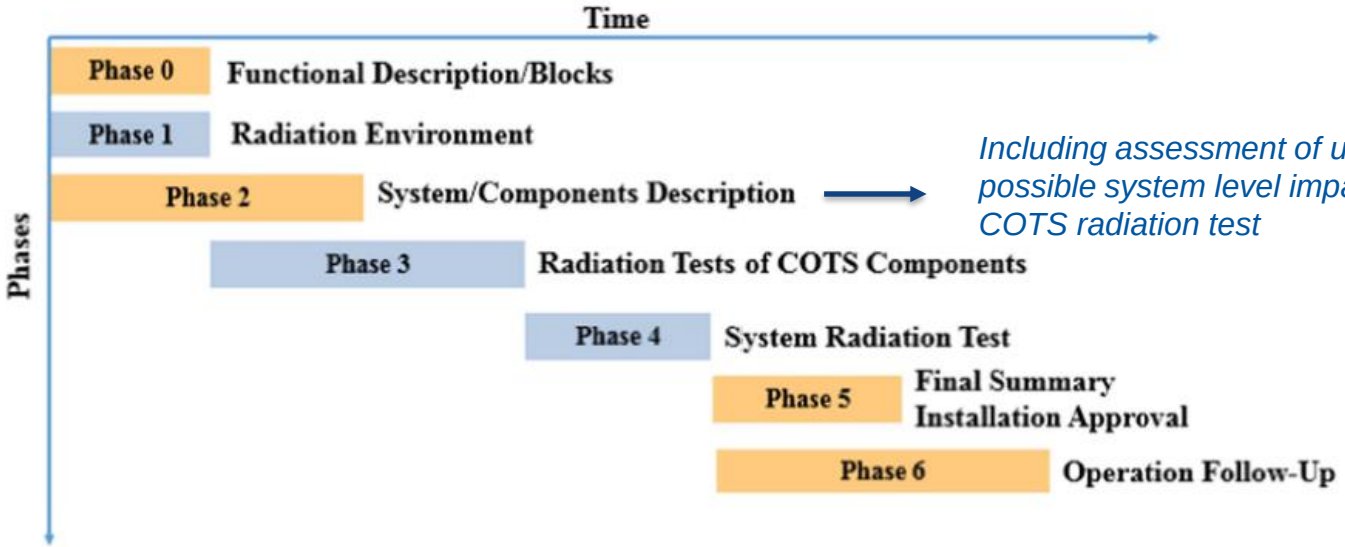
B-1: CERN Facilities [S. Danzeca]
B-2: RadMON Monitoring [S. Danzeca]
B-3: Optical Fibre Dosimetry [Y. Kadi]
B-4: Shielding & Relocation [M. Lazzaroni]

C. Radiation Tolerant Developments

C-1: Common Building Blocks [S. Danzeca]
C-2: Vacuum [G. Pigny]
C-3: Beam Instrumentation [R. Jones/T. Lefevre]
C-4: Quench Protection System [R. Denz]
C-5: Power Converters [Y. Thurel]
C-6: Cryogenics [J. Casas-Cubillo]
C-7: Controls [J. Serrano]

Importance of RADWG and MCWG regular meetings for CERN "R2E Community"

RHA guidelines for COTS based systems

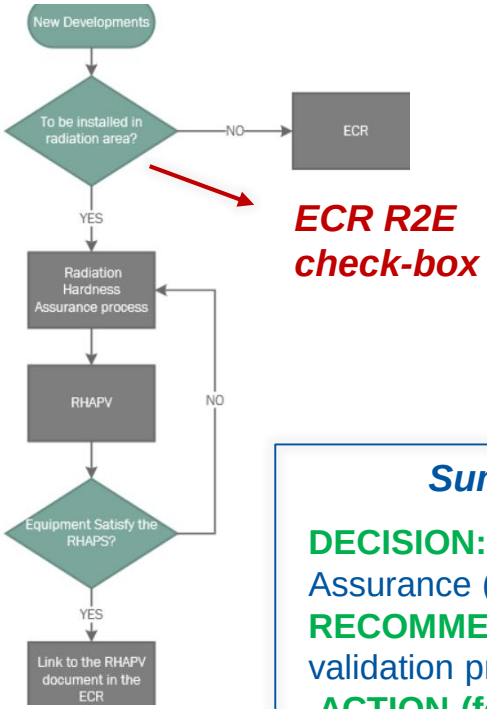


Including assessment of use in radiation and possible system level impact, to be considered in COTS radiation test

- *Considering radiation tolerance constraints at **very early (initial) stage of design***
- *Validation of **radiation tolerance at system level** before final production*

(CHARM validation can help identify and correct radiation effects at system level; difficult to predict from component level behavior)

RHA validation – process structure



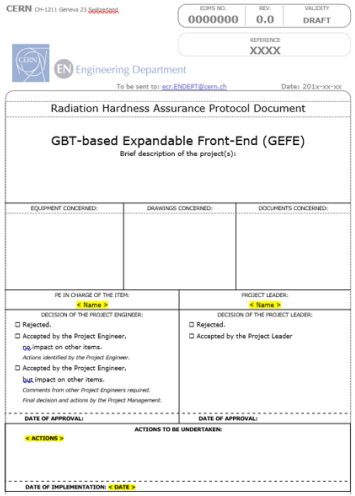
ECR R2E check-box

- Endorsed during 2017 R2E Cost & Schedule review
- Linked to LHC Engineering Change Request (ECR) as final validation
  - **Check-box in ECR template** for electronics installed in possible radiation areas
- Contains the RHA Project Validation document as cornerstone for equipment exposed to radiation
- RHAPV and ECR provide final validation, but **actual R2E work starts at very early stage of system design**

Summary of the 362nd LMC Meeting (Sept 2018)

DECISION: the LMC endorses the proposal to formalize the Radiation Hardness Assurance (RHA) validation in the LHC.
RECOMMENDATION (for IEFC): the LMC recommends to follow the same RHA validation practices and formalization process in the LHC injectors.
ACTION (for EN-ACE and equipment groups): review the ECR template to include the R2E checkbox and update all ECRs for LS2 in order to ensure a good traceability.

RHA validation – related document



CERN CH-1211 Geneva 23

EDMS NO.	REV.	VALIDITY
0000000	0.0	DRAFT

REFERENCE: XXXX

EN Engineering Department

To be sent to: ecr.ENDEPT@cern.ch Date: 201x-xx-xx

Radiation Hardness Assurance Protocol Document

GBT-based Expandable Front-End (GEFE)

Brief description of the project(s):

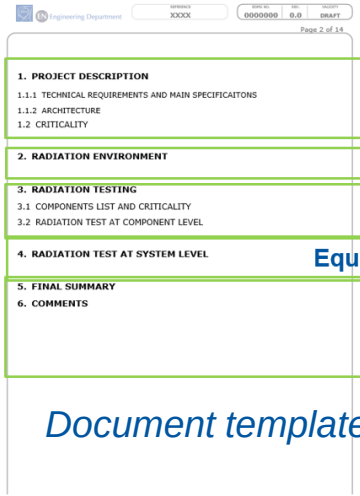
EQUIPMENT CONCERNED:	DRAWINGS CONCERNED:	DOCUMENTS CONCERNED:

PE IN CHARGE OF THE ITEM:	PROJECT LEADER:
< Name >	< Name >
DECISION OF THE PROJECT ENGINEER:	DECISION OF THE PROJECT LEADER:
☐ Rejected. ☐ Accepted by the Project Engineer, no impact on other items. Actions identified by the Project Engineer. ☐ Accepted by the Project Engineer, but impact on other items. Comments from other Project Engineers required. Final decision and actions by the Project Management.	☐ Rejected. ☐ Accepted by the Project Leader
DATE OF APPROVAL:	DATE OF APPROVAL:

ACTIONS TO BE UNDERTAKEN:

< ACTIONS >

DATE OF IMPLEMENTATION: < DATE >



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1. PROJECT DESCRIPTION 1.1.1 TECHNICAL REQUIREMENTS AND MAIN SPECIFICAITONS 1.1.2 ARCHITECTURE 1.2 CRITICALITY	Equipment group
2. RADIATION ENVIRONMENT	MCWG chair
3. RADIATION TESTING 3.1 COMPONENTS LIST AND CRITICALITY 3.2 RADIATION TEST AT COMPONENT LEVEL	Radiation test service
4. RADIATION TEST AT SYSTEM LEVEL	Equipment group + Radiation test service
5. FINAL SUMMARY 6. COMMENTS	R2E project leader

Document template available on EDMS (2028777)

Proposal for implementation at ECR level (+ R2E section in "Engineering Specification" document)

5.3 IMPACT ON PERFORMANCE

R2E impact on performance and availability	[To be competed with the R2E team for systems with active electronic components to operate in radiation areas. Linked to R2E Radiation Hardness Assurance validation document for concerned equipment (template: EDMS 2028777)]

Application to LS2 ECRs (examples)

released	LHC-RF-EC-0002 v.1.0	FGClite Deployment - Phase 2 (RRs)
released	LHC-RPH-EC-0003 v.1.0	Change of LHC4-6-8kA power converters in the LHC RR13/17/53/57 areas
released	LHC-RPMBD-EC-0001 v.1.0	Change of RPMB Power Converters in the LHC RR13/17/53/57/73 and 77 areas

1282651 v.2.0 **Implemented** **Restricted access**

BYBPM racks under the SPS dipole magnets as part of the Upgrade of Beam Position Monitors electronics (MOPOS) *by Joel Albertone; Frederic Galleazzi*

(+ vacuum racks in DS, 11T QPS systems in IP7 RRs…)

- *These LS2 ECRs will "retrospectively" be linked to their associated RHA documents (important for quality control, traceability, etc.)*

WP description document

[WP name] WORK-PACKAGE

[WP name] R2E WP description document

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R2E management meetings

- **Project Steering Meetings:** to be held with the different WP leaders twice per year, focusing on:
  - Technical milestones and deliverables
  - Budget and personnel
  - Review of future “R2E operation needs” (radiation level specification, testing, design & qualification review…)
- **Technical coordination committee:**
  - Composed by R2E WP leaders, meeting every 2-3 months to cover technical aspects/decisions with broad project repercussion

Possible 2019 review

- **Radiation environment: monitoring and specification**
  - Part I: present R2E radiation monitor performance evaluation, future requirements and upgrades (RadMON, optical fiber, passive dosimetry, others)
  - Part II: radiation environment definition for equipment groups, focusing on (i) HL-LHC and (ii) injectors.

Possible 2019 review (II)

- **EEE part procurement strategy in view of LS3**
  - Evaluation/definition of part procurement strategies, with a focus on possible common procurement, screening and storage
  - Definition of coherent and practical batch/lot radiation acceptance test criteria, according to equipment group needs
- To lead to a more general review on “guidelines for accelerator, COTS based, radiation tolerant design & qualification” (2020, synergy with RADSAGA handbook)
- 2020+: reviews of radiation-tolerant systems for LS3

Thanks for your attention!!