

A Proposal for Availability & Reliability:

Machine Availability and Reliability Panel (MARP)

J. Gutleber, R. Schmidt

Input from: A. Apollonio, J.M. Jimenez, A. Siemko, L. Ponce, C. Roderick, B. Todd, J. Uythoven, M. Zerlauth

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- What is required?
- What is currently being done?
- Who are the players?

- Proposal for an organised approach

- **Cost effective operation:** Rudiger puts some keyword
- **Protection:** Machine protection systems need to be designed with **high reliability in mind** – this must be demonstrated
 - LHC machine protection systems (LBDS, Interlocks, BLM system, magnet protection system – extensive studies on their reliability since >15 years)
 - Other CERN accelerators: in particular beam dumping systems
- **Availability:** Accelerators need to operate with acceptable availability (requires reliable subsystems and efficient operation, **turnaround time is key**)
 - LHC as flagship operating machine
 - Pre-accelerators (**circular and linear, e.g. Linac4**)
 - Challenge for future accelerators

- **Can the cost-effectiveness of operation be improved?**
- Can we operate safely the accelerators (machine protection) ?
- How can we keep the LHC availability observed this year ?
- Is reliability of HL-LHC technical designs/realization adequate to achieve the nominal Integrated Luminosity (availability) ?
- Is Linac4 going to be as reliable as Linac2 ?
- Can post-LHC accelerator infrastructures be realized with adequate availability?
- How to balance maintenance and repair costs with high availability?
- How to propagate high-level availability requirements to technical systems?

- Model and simulate the LHC + Injector chain operation with high confidence to quantify expected performance for different accelerators under different operation scenarios
- Training + creation of durable network across CERN teams
- Coherent guidelines and methods (“Book of Knowledge”)
- Common services and infrastructures (hardware, test stands, software, analytics, ...)
- Implementation of the outcome of studies - ensuring continuity
- Studies
 - For future machines
 - For efficiency improvement of operation
- Collaborations
 - What collaborations exist?
 - How to efficiently work together?

- Machine and magnet protection (electronics, SW, HW) – 2.5 FTE (HL-LHC)
- FCC (model, simulation, analytics) – 3 FTE
- FCC RAMS training (2/year, 4 years, USTUTT, TUTT, Ramentor)
- CLIC / Linac4 (modelling, simulation) – 1.5 FTE
- Accelerator Fault Tracking – 2 FTE (in several groups)
- Power converters – 1.2 FTE
- Beam Instrumentation – 1.2 FTE
- Beam Transfer – 1 FTE (until recently)
- Technical infrastructure (EN) – 1.2 FTE
- Operation – task force driven (e.g. AFT for injectors)

Mostly fellows, PhD students and Technical students

FCC collaborations (engaged resources)

- University Stuttgart (KE 3046/ATS)
- Technical University Tampere (EDMS 1390679 & KE 3331)
- Ramentor (Finnish company, KE 3357/ATS)
- TU Delft (KN2914/BE)
- Heidelberg Ion Therapy facility (ARIES H2020 Grant Agreement)
- University of Vienna (data integration)
- Myrte (H2020 Grant Agreement)

Existing contacts

- Empresarios Agrupados (Spanish company)
- ESS Lund
- TU Munich (Robotics and Embedded Systems/CPS)

- **Goals:**

- **Develop and maintain a consistent and coherent approach** to reliability and availability activities across department and group boundaries and across different systems
- Core team analyses, develops and proposes strategies that can be implemented in dedicated teams according to priority and needs

- **Scope:**

- Existing accelerators and infrastructures, projects and studies **at CERN**

- **Working mode:**

- **Consensus based** conclusions
- Creation of limited-duration activity groups
- Provide forums for information exchange
- Meets regularly with agenda + minutes (**monthly**)
- Reports to appropriate committees / projects

- Andrea Apollonio
- O. Bruening
- Johannes Gutleber
- Laurette Ponce
- Rudiger Schmidt (scientific advisor)
- Ben Todd
- Jan Uythoven

....up to the core team to further detail the work and the composition

To ensure continuity, membership reviewed on yearly basis to adapt to scope and evolving environment

- If ATSMB endorses the proposed approach
 - MB proposes an interim chair and organiser (secretary)
 - Interim chair calls for a constituting panel meeting
 - Panel repeats scope, tasks, composition in minutes

- Availability tracking WG, chaired by Ben, Laurette and Andrea
- Studies on availability in work-packages (e.g. WP 7 for HL-LHC and WP for FCC)
- **Accelerator Fault Tracker tool (BE/CO)**
- FCC Reliability, Availability, Maintainability studies
 - Model LHC accelerator complex + injectors + tech. infrastructures
 - Integration of continuous monitoring of the accelerator operation to derive good quality information for MC simulation
 - Sector wide training and Book of Knowledge creation
- ~~• Training (twice per year, for members of all technical groups + operation) – should allow to raise awareness and improve understanding of terms etc.~~
 - ~~• Organised with IMA Stuttgart, assistance by University Tampere~~