

1st Meeting of the Machine Availability and Reliability Panel (MARP)

Present: A. Apollonio [TE/MPE], O. Brüning [ATS/DO], J. Gutleber [ATS/DO], L. Ponce [BE/OP], R. Schmidt [TE/MPE], L. Serio [EN/ARP], B. Todd [TE/EPC], J. Uythoven [TE/MPE].

Excused: -.

Indico link: <https://indico.cern.ch/event/613248/>

Introduction (R. Schmidt)

R. Schmidt recalled the presentation given at the ATSMB, where the MARP was formally approved. He mentioned the ongoing activities in the field and the related resources at CERN. R. Schmidt will chair the meetings of the MARP in the beginning, then a new chairman will have to be found in summer.

ACTION 1: Identify MARP chairman.

An [indico website](#) was created for the meetings of the MARP.

O. Brüning asked if experimental test facilities are within the scope of the MARP. The example of the SPS crab cavity test was made. J. Uythoven commented that the test is interesting in view of HL-LHC, but it is also critical for protection of the SPS. Adequate diagnostics should be foreseen to study the behavior of the crab cavities and the related failure modes. J. Uythoven mentioned that the crab cavities will be connected to the Beam Interlock System, but a failure mode analysis should be carried out to clarify from what scenarios one should be protected.

ACTION 2 [MPP]: follow-up failure scenario definitions for SPS crab cavity tests.

O. Brüning mentioned that for example for Coldex the HL-LHC project recommended the installation of BLMs to monitor beam losses and UFO rates.

O. Brüning asked if the MARP should also foresee some outreaching activities, related to machines outside CERN (e.g. MYRTE/MYRRHA). R. Schmidt explained that CERN is involved in some external collaborations in the field of reliability. In particular for MYRRHA the collaboration regards the Linac4 modelling and the sharing of data from the reliability run (scheduled in summer 2017) captured with the fault tracker. R. Schmidt added that he recommended having an invited presentation at IPAC on reliability for particle accelerators, with no success so far. B. Todd mentioned a recent workshop/review organized to look at the availability of PETRA. J. Gutleber

commented that even without engaging in official collaborations one should work towards the formation of a community for reliability in the accelerator domain. J. Uythoven mentioned the ongoing collaboration with ESS, also regarding the development of modelling tools. B. Todd added that a forum already exists in the field of accelerator reliability, the Accelerator Reliability Workshop, co-organized by R. Giachino every two years and involving facilities from all over the world. The next workshop will be held in Paris in October 2017. He also mentioned the attempts to have a central storage of information (reliability data), which so far were not successful, due to difficulties related to the definition of a common metric across different facilities, and the legalities of sharing device specific reliability information. B. Todd mentioned that during the DESY review, Andreas Lüdeke (PSI) provided a draft paper which summarized a means of consolidating the approach to availability across different light-sources.

Availability Working Group and Accelerator Fault Tracker – Status and Plans (B. Todd)

B. Todd gave a presentation on the ongoing activities coordinated by the Availability Working Group. Starting in 2012, the working group has been working towards a consistent definition of availability, focusing on the LHC. From the first analyses, it was clear that a standardization of the fault data capture was needed to present meaningful fault and downtime statistics. The Accelerator Fault Tracking project was launched by BE/CO and the AFT is now widely used for the LHC data capturing. Going forward, the focus of the working group will still be on LHC data capture and the production of availability reports, with the idea of having a long-term monitoring of LHC performance during its life-cycle. The plan for 2017 is to address the metric of LHC turnaround time. The extension of the AFT to the injector complex requires the definition of small work teams dedicated to the fault review in the injectors.

ACTION 3: propose the formation of work teams in charge of injector fault review.

O. Brüning noted that the focus of the AWG is only on the LHC, but other facilities might be critical in term of 'delivery' (e.g. ELENA), these could be included as well.

J. Uythoven commented that the AFT increased the awareness of equipment groups of the problems related to the availability of their systems, additional work is required for the full exploitation of the tool, e.g. to prioritize consolidation tasks. J. Gutleber agreed and added that upon the identification of critical areas, working groups with a limited duration could be formed to work on suitable solutions.

L. Serio commented that the AFT is an interesting tool also for the TIOC, an investment should be made to make it useful also for the expert analyses. Discussions are for

example ongoing to synchronize the TI logbook with AFT. J. Gutleber commented that C. Roderick should clarify what are the needs for progressing with AFT developments and functionalities.

ACTION 4: invite C. Roderick to present plans and resources required for AFT.

L. Serio agreed and mentioned the current delays related to the simultaneous implementation of the AFT in the injectors. L. Ponce commented that the MARP should also clarify priorities for the AFT.

ACTION 5: L. Serio to present a TBS, and recording/review of faults in TOIC + AFT.

L. Serio added that in the AFT the data should be structured according to a system breakdown structure, as proposed for TI systems, to facilitate the analysis by experts. One should be able to treat different abstraction levels in the AFT, statistics should be weighted by the system complexity. L. Ponce commented that the entry point of the AFT is the OP logbook, so it not necessarily evident from the CCC what is the root cause of the problem. J. Gutleber suggested working on a standardized way of defining fault trees for the AFT, as initiated in the framework of the FCC studies.

J. Uythoven recalled the effort made for the LBDS by N. Magnin to capture the data in the AFT according to the failure models developed during the design phase, to have a systematic follow-up of the predictions.

Follow-up Meetings of the Availability Modelling Workshop (J. Uythoven)

J. Uythoven presented the ongoing activities organized following up the Availability Modelling Workshop held at CERN in July 2016. These meetings include discussions on the reliability/availability modelling of systems from different groups and provide a forum for sharing tools and methodologies. J. Gutleber commented that too many groups are involved and different levels are treated, it would be better to set-up ad-hoc working groups focusing on detailed studies. L. Serio commented that if the focus of the working group is on methods and software then this is fine.

J. Uythoven recalled the recent discussions on the risk definition for particle accelerators and the confusion deriving from the use of Safety Integrity Level (SIL) for systems not related to personnel protection. L. Ponce commented that at CERN the Complex Safety Advisory Panel (CSAP) is in fact already in charge of following up studies related to personnel protection. S. Hurst, a technical student from the University of Stuttgart, gave recently a presentation on the analysis of the radiation monitoring system for personnel protection (CROME). It was stressed that the working group cannot review such analysis, and cannot take any responsibility for the work

when it comes to personnel protection. The working group can only provide a forum for discussion and give some support on the methodology.

Collaborations and Training (J. Gutleber)

J. Gutleber gave an overview of the ongoing collaborations and projects with external institutes in the field of reliability at CERN.

L. Serio mentioned that he would be interested in collaborating on the component database definition. Data is already available on infrastructures for example for tokamaks. It is important to keep raw data for monitoring the evolution of the system behavior over time. J. Gutleber mentioned that a Ph. D. student working on this topic will collaborate with CERN in the future. R. Schmidt commented that this could be an example of a topic to be treated in a dedicated working group.

J. Gutleber added that also a collaboration with the University of Leuven is being defined on the use of Artificial Intelligence for failure prediction. The use case will be based on the injection kickers and in the future on the LBDS.

J. Gutleber proposed having once at CERN a presentation from a team providing the SIL certification, to have a better feeling of what this implies in terms of procedures, maintenance, etc. B. Todd explained that such a training session and presentation was already given at CERN, by Felix Redmill (University of Newcastle).

ACTION 6: Investigate potential for another session on IEC-61508

J. Gutleber stressed that collaborations to be successful require systematic follow-up, so a good plan should be defined from the beginning.

L. Serio commented that these collaborations might be of interest for many groups, so it is good to discuss them in the MARP.