SUMMARY OF SESSION 1B
"AVAILABILITY AND SYSTEM PERFORMANCE"

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INTRODUCTION

This session continued the topic of "Availability and Performance", with the focus on accelerator systems (see Fig. 1). The session is organized starting from "circuits" that combines power converters, magnets and protection mechanisms, through beam instrumentation systems, beam dump block and finishes with the radio frequency system. Results and conclusions were presented, in particular comparing performance in 2017 with those from 2016.

I. ROMERA: "CIRCUITS"

The performance of the LHC magnet circuits for the proton physics run in 2017 is evaluated. This contribution focuses on the availability of magnet powering (PC) and protection systems (QPS, EE, FMCM and Interlocks) and evaluates the impact of the new deployments, mainly the FGClite and RPADO power converters, on the overall performance of the machine. Finally, a comparison with 2016 availability is presented.

Discussion

During the ensuing discussion **J. Wenninger** observed that the 2% reduction in overall fault time is perhaps too general a statistic as this may hide important underlying trends. It is necessary to distinguish who are the largest contributors to downtime. **D. Nisbet** responded that the power converters in the RRs (and their controls) will be changed during LS2. This corresponds to systems responsible for ~30% of the power converter downtime in 2017. **D. Nisbet** also commented that the desire to replace the 600A power converter modules during LS3 is in the early stages of planning and no activities beyond LS2 are funded yet.

J. Wenninger also highlighted that the FMCM system is still dumping the beam during thunderstorms and asked if there any other dumps that could have been saved with different powering technology. **I. Romera** replied that 5 trips could have been prevented if the Q4 and Q5 in LR3 and LR7 were upgraded in addition to the RMSD in P6.

V. SCHRAMM: "BEAM INSTRUMENTATION"

The dependability of CERN's Beam Instrumentation (BI) in 2017 is presented. All faults which contributed to LHC downtime are analysed, categorised and compared to previous years to isolate recurrent failures and evaluate

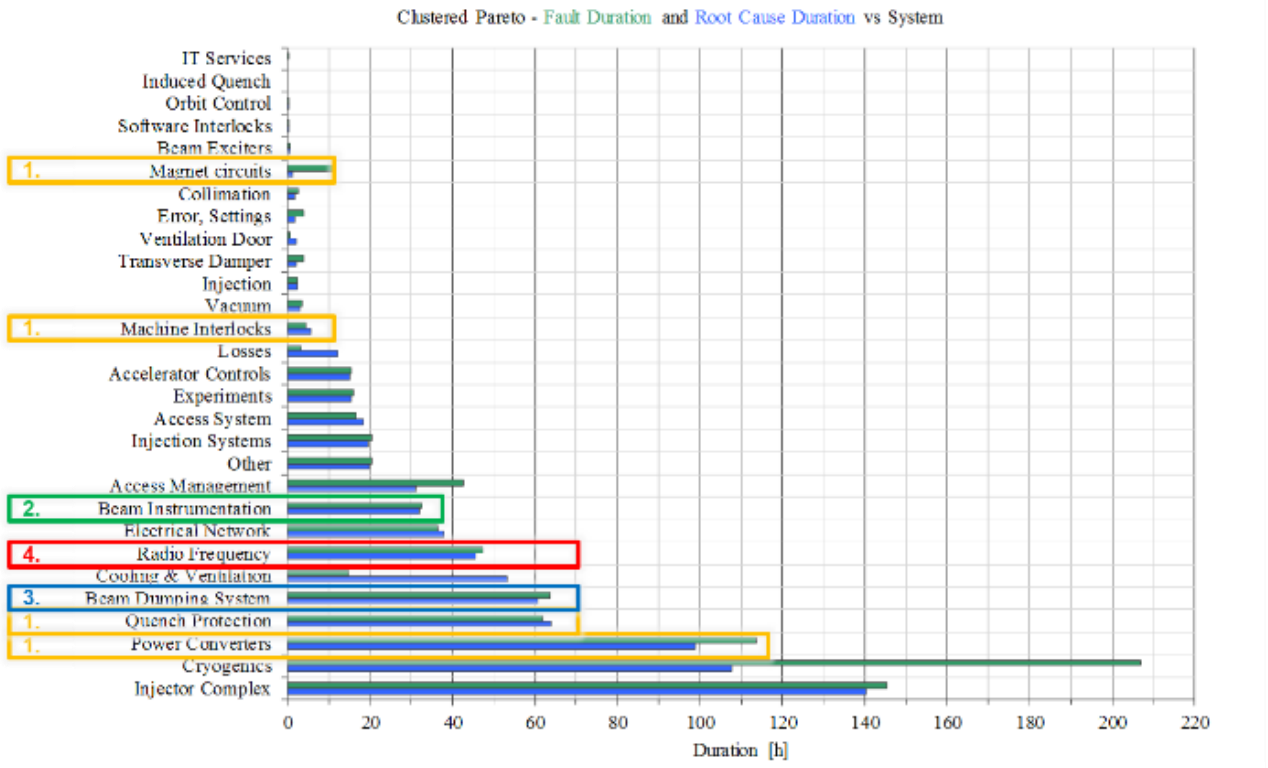

Figure 1 : Availability in 2017 highlighting systems covered in the session.

trends. Special attention is given to the Beam Loss Monitoring system and their Sanity Checks which was the highest contribution to the BI downtime in 2017. Finally, actions taken to remedy the situation as well as on-going reliability analysis and upgrade efforts to improve the overall performance in the future are discussed.

Discussion

B. Todd opened the discussion by commenting that metrics looking at a penalty time for beam dumps had been investigated in the past, but the measurement had been abandoned following user feedback. He asked if BE-BI would be willing to evaluate and propose a formula to provide a suitable metrics. **R. Jones** replied that the objective would be to help guide prioritisation of appropriate actions to improve overall availability. **B. Goddard** made the observation that beam dumps during stable beams will cause more lost physics than faults that block injections. **B. Todd** replied that he was willing to discuss further how to integrate a suitable metrics for lost physics time.

M. CALVIANI: "BEAM DUMP BLOCK"

This contribution presents a summary of the LHC TDE dump block observations during the 2017 operational run, eventual limitations and the plans for the YETS. Details are provided on the efforts made to reduce potential downtime of the machine, including the interferometer readings, the redesign of the downstream window and graphite oxidation studies. Long-term perspectives for LS2 and LS3 are provided as well in order to guarantee the long-term operability and availability of the dump block assembly.

Discussion

J. Uythoven began the discussion by observing that there would be no interlocking of operation based on the N_2 pressure, so how will we know if the dump leak is degrading. **M. Calviani** replied that this would be possible to determine based on the rate of consumption of N_2 required to maintain the operating pressure. He also emphasized that the dump will be run with a higher over-pressure, thus the diagnosis of a degrading leak will be easier.

J. Wenninger postulated that perhaps we can essentially forget the dump interlocks. **J. Uythoven** replied that MPP would wish to evaluate and asses such a change.

B. Goddard asked if the spare needs to be installed. **M. Calviani** replied that the current information indicates this would not be necessary, however information from inspections during the YETS might change this conclusion. **B. Goddard** also queried how long it would be permitted to run the dump block exposed to air. **M. Calviani** replied that this information would be available in about 2 months time, and agreed this time should be defined. **R. Steerenberg** enquired as to whether there remains a risk to damage of the downstream window. **M. Calviani** confirmed this risk was still present. **E. Bravin** asked if this was due to vibrations, and is there a mitigation for this. **M. Calviani** replied that EN-STI is still investigating this issue, but in any case a solution would not be available before the end of LS2.

H. TIMKO: "RF"

The availability of the LHC ADT and RF systems in 2017 is presented in details, including high- and low-power RF and RF controls. A comparison with 2016 availability is performed. The full-detuning scheme, commissioned early this year, has been operational throughout the year and the first experience with this scheme is summarised. New operational diagnostics, implemented this year, are shown as well. Finally, the latest findings from beam dynamics studies and measurements, which have implications for the operation today and in the near future, are highlighted.

Discussion

R. Steerenberg opened the discussion by querying how the data from the ObsBox could be stored. **H. Timko** replied that that this is already stored for the transverse measurements, and could be added for longitudinal measurements.

R. Steerenberg followed with a query about the full detuning scheme, which is stated to have no negative impact on the klystrons; could it in fact have a positive impact? **H. Timko** responded that within statistical errors there is no measureable impact on the klystrons.

M. Wendt was interested in clarification about the oscillations observed at injection. **H. Timko** indicated that the oscillations have a dependency on beam intensity. They are seen to be present already at injection and survive the entire ramp, sometimes increasing in frequency. At this time insufficient data exists to draw conclusions. **M Wendt** asked what actions are proposed, and **H. Timko** responded that sinusoidal RF modulation to counter the oscillation will be tested soon, however the source of the oscillations still needs to be understood.

Y. Papaphilippou asked whether the RF team are confident in the tools at their disposal. **H. Timko** said they were not. **G. Arduini** suggested additional transverse damper diagnostics such as the information sent to the RF kicker. **H. Timko** observed that this is a recurring request. **D. Valuch** responded that 120MSPS is a lot of data to manage for long term storage so this is not available at the moment. It is a recurring problem for just some seconds of recorded data.