

# LHC Availability Studies and Improvements

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An Availability Working Group (AWG) at CERN is charged with studying the availability of the LHC machine. The main aim of the group is to identify where availability limitations are, and potential means to overcome these. The first part of this paper outlines the various availability definitions and methodologies that are specific to the LHC machine, and gives examples of how they are calculated, using the 2010-2012 physics run as a basis. The results of these analyses are shown and the key issues related to LHC machine availability are identified, with the evolution over the last two years of LHC operation being given, and the key lessons learned identified.

The second part of this paper outlines the data collection methods that have been in place in LHC Run 1, and explains a so-called Accelerator Fault Tracker (AFT), and cardiogram concept that is being put in place for LHC Run 2. This paper concludes with extrapolation of this work into the HL-LHC era, showing how availability is likely to become a limiting factor in achieving the HL-LHC goal of  $3000\text{fb}^{-1}$ .

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