Contribution ID: **107** Type: **Poster**

Failure analysis and lessons learned on crate and power supply equipment

For nearly 20 years, the Power Supply and Crate Service at CERN has been responsible for the maintenance tracking of power supplies and crates used by the CERN experiments. With this experience, and with the imminent introduction of a new generation of power supplies for the HL-LHC, the timing is opportune to conduct a statistical analysis to draw lessons from the past and make recommendations for the future. This study aims to analyze failures, identify the most vulnerable components, expose the improvement solutions, and highlight the benefits of preventive maintenance campaigns to ensure reliable long-term operation.

Summary (500 words)

Significant quantities of both high and low DC voltage power supplies (PS) and crates are used to house and power sub-detector electronics within the CERN experiments. The EP-ESE Power Supply and Crate service plays a crucial role in supporting this equipment, managing a series of long-term contracts with five different manufacturers. This service oversees a total of over 15,000 objects valued at over 47 million euros, ensuring individual tracking since purchase, including all maintenance interventions such as repairs, calibrations, verifications, or preventive maintenance. On average each year, 460 maintenance interventions are carried out by the manufacturers, 450 tests are conducted by the service, and over the past 20 years, 23 preventive maintenance and/or upgrade campaigns have been jointly conducted by the CERN users and the relevant manufacturers involving about 2,300 items.

Centralized management of maintenance tasks is facilitated through a technical database, documenting a comprehensive maintenance history for each piece of equipment. Beyond mere tracking, the database enables detailed statistical analysis of failure rates, identification of potential weak equipment, and insights into the types of interventions performed on specific items. This statistical tool added to close collaboration with manufacturers who provide valuable insights into the root causes of failures has made it possible to identify vulnerabilities, provide appropriate solutions and launch preventive maintenance campaigns depending on the type of equipment and the planning of experiments.

With the transition from LHC to HL-LHC, some of the existing power supplies will be replaced with new-generation models. This presents an opportune moment to offer technical and operational recommendations aimed at optimizing the selection, integration, costs, reliability, and maintenance of future power supplies for the experiments. These recommendations draw upon over two decades of operational experience, the statistical analysis of failures outlined in this paper, and particularly the benefits observed from preventive maintenance campaigns.

Primary author: MICO, Sylvain (CERN)

Co-author: BOBILLIER, Vincent (CERN)

Presenter: MICO, Sylvain (CERN)

Track Classification: Power, Grounding and Shielding