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Control, monitoring and safety aspects of power distribution in the ATLAS experiment

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The Atlas infrastructure, including also power distribution, has been built from scratch for the purpose of the LHC experiment. This provided more freedom and helped to deploy modern solutions. It this document will be presented examples of different approaches to implement electrical distribution. Ways to achieve the expected level of control will be demonstrated, statistics presenting usage of the control system will be given. Applications developed to enrich monitoring of the electrical infrastructure including also quality of the powering network will be shown. Characteristics of applications focused on safety of the Atlas rack's supply will be demonstrated.

Summary 500 words

The electrical supply at Point 1 comes from two independent and coupled together 18 kV branches: one, dedicated to the Atlas experiment and the other one, dedicated to the LHC. The Atlas experiment requires more than 6 MW of electrical power to operate. Depending on the functionality of the supplied system, three different types of power are provided: the regular, Diesel and UPS ones.
In general, the UPS supply in Atlas is not seen as a buffer separating a global powering grid from the experiment and thus providing a clean environment but rather as a source of power available during a long power break. Atlas has started its operation having 2 UPS systems: one of 600 kVA located in the SDX1 surface building and one of 160 kVA located in the US15 underground counting room. Although both UPS units are backed-up by the Diesel supply providing thus practically unlimited autonomy, in case of the back-up's failure, a selective shutting down of some equipment is foreseen. How such UPS management concept has been implemented and how it evolved in course of the operation will be presented.

The Atlas electronic equipment is located in different areas, also in places inaccessible during a normal LHC operation. Systems are mutually dependent and very often the loss of one leads the Detector Safety System (DSS) to switch off power to the other ones. That is why the possibility to control the power cutting devices from distance was one of the key objectives when designing the supply of the experimental equipment. In total 450 racks hosting electronics have been installed in the USA15, US15, and SDX1 counting rooms and in the UX15 detector cavern. While a modular system composed of the Canalis bus-bar and supplying Twido boxes has been deployed in the USA15 counting room to bring power to the racks, a more traditional switchboard-cable-connection approach has been taken in other areas. Different ways of controlling ON/OFF operations including the staggered start-up of thousands of PC units in the TDAQ room will be shown. Some statistics of usage of the control system will be presented.

Although the implementation of the powering infrastructure differs in different counting rooms, the principles of monitoring are the same. Local controllers in the cabinets/powering boxes keep track of states of the powering devices while the supervising PLC provides an interface to the external environment. Examples of applications presenting state of the electrical installations important for the Atlas operation will be presented. Equally important as monitoring of electrical distribution is monitoring of quality of the electrical supply. Atlas has only partial coverage of its equipment by the UPS supply therefore some part of its electronics is exposed to all kinds of perturbations coming from the network. An example of known predictable perturbation on the powering network will be shown. How one can track down events happening on the powering network will be presented.

Everywhere where we have electricity there is a risk of fire. The supply of racks has been designed with safety aspects in mind. Apart from power, there is a cooling infrastructure provided to each rack to cool down a dissipated heat. In addition, a constant monitoring of temperature and smoke is provided. In racks delivering high power or hosting unique and difficult to replace equipment, a liquid CO2 based extinction system has been implemented. A comparison of the latter system with similar ones developed in other LHC experiments will be given.

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