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Integration and Installation of the CMS Electronics system

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The electronics systems used to control, trigger, and acquire data from the four experiments at LHC are, for the field of High Energy Physics, of unprecedented level of complexity and sophistication.
In the case of CMS, users are gaining access to the counting room (USC55) at a late stage with respect to the official LHC start-up date.
Measures taken to reduce the time required between when the access is granted for installation and the experiment is ready for physics are presented along with the current status and plans.

Summary

When it became obvious that the CMS cavern was going to be delivered to the collaboration at a very late stage, measures were taken to cope with the situation. An Electronics Integration Centre (EIC, in building 904, CERN), used by all electronics subsystems across CMS, was created in order to allow system integration to take place during the year before any electronics could be installed in the underground counting room. The electronics integration centre is currently being intensively used by practically all subsystems, including the Detector Security System (DSS). The DSS is responsible for the control and security in the racks where the electronics modules under test are located. The goal is to use, as far as practical, the same technology in the EIC as will be used in the underground control room.
As an additional test, most subsystems contribute to an integration test attached in time to the CMS magnet test with the goal to detect, trigger, and read out events originating from cosmic particles. The event goes under the name Magnet Test Cosmic Challenge (MTCC).
Fractions of the sub-detectors are mounted in the final positions inside and outside the large solenoid, contributing with the S in CMS. A complete slice of the electronics for the control, trigger, and readout systems is deployed, providing a last chance for verification before the experiment is lowered and the electronics system is finally installed for commissioning in the underground control room.
After a successful integration in the EIC, every subsystem has to go through an installation readiness review where every system having a direct interface has to agree that no visible problem exist. This review is estimated to be a useful preparation for installation, leaving only the new interconnects to verify during and after installation.

The plan for the electronics installation in USC55 has initially been developed together with TS-LEA, the CERN group responsible for the overall coordination at Point 5 in Cessy. The overall plan is vast and very complete, integrating the day to day work of external subcontractors performing a large variety of tasks, including installation of infrastructure and civil engineering.
As the site becomes ready, the actual electronics installation schedule becomes a detached planning.
The result is a day to day program detailed down to the hour. The installation of each subsystem has to follow the program with great precision, meaning finish on time. Failing to do so, the user might see the access to the underground refused the next morning due to some scheduled event.

After completion of the electronics system commissioning, the EIC facility will continue to serve as a centre for hardware, firmware, and software development. This development may be either for upgrades, or to achieve the design performance of the experiment.

The development task is likely to become major, since no guarantees can be given that the initial developers, who have the detailed knowledge about how and why the system actually works, are available even one year after the first physics run.

Author: HANSEN, Magnus (CERN)

Co-author: CMS ELECTRONICS COMMUNITY, The (Misc. institutes)

Presenter: HANSEN, Magnus (CERN)

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