The CMS ECAL Control and Safety Systems Updates during the CERN LHC Long Shutdown 2

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The CMS ECAL Detector Control System

Safety System
Temperature Readout System

1. Safety System
   Temperature Readout System
   - Motivation: Original system presented several hardware and software issues
   - Replacement of Custom Made (CM) by Commercial-Off-The-Shelf (COTS) hardware
   - 352 NTC sensors B57211V2471J060 read out by 44 SIEMENS 6ES7331-1FK02-0AB0
   - Sensors’ redundancy preserved with distribution among different readout modules
   - Recovery of four sensors – monitoring coverage at 100%
   - Improved reliability, availability and robustness

2. Safety System
   24VDC Distribution with UPS
   - Motivation: Load increase due to the installation of new hardware
   - Fully redundant UPS-based 24VDC/20A distribution
   - Based on the latest generation of SIEMENS hardware
   - LiFePO batteries to be replaced every 15 years
   - Batteries can support the complete system for approx. 60 min
   - Improved availability and reduced maintenance efforts

3. Safety System
   PLC Code
   - Motivation: Standardization across CMS sub-detectors safety systems
   - Based on the CMS Tracker PLC code architecture, adapted for the CMS ECAL specifications
   - CPU and PROFIBUS redundancies properly implemented and validated
   - Redundancy issues are logged and propagated to the detector control system for alerts
   - Improved long-term support and maintenance

Control System
Software

4. Control System
   Software
   - Motivation: Hardware/specifications changes and evolution of software platforms
   - Adapted to support all hardware changes and new functionalities
   - Computing hardware to be replaced by new and more powerful servers
   - Migration to Windows Server 2016 and WinCC OA 3.16
   - Deployment of latest versions of the CMS DCS and JCOP frameworks
   - Certification of source codes compatibility with UTF-8 (ISO-8859-1 encoding no longer supported)
   - Migration from Subversion (SVN) to GitLab
   - Migration to OPC Unified Architecture (UA)
   - New and enhanced user interfaces
   - Improved operation and long-term support

Low Voltage System
Re-distribution of data buses

5. Low Voltage System
   Re-distribution of data buses
   - Motivation: Fix communication issues on buses running at the limit of their specifications
   - Handling of additional latency introduced by CAN-Ethernet adapters
   - Two buses containing 30 nodes each were split in four buses with 15 nodes
   - Optimal set of parameters introduced in the data server configuration
   - General performance improvement by a factor of up to 2
   - Initial tests successful and long-term validation ongoing
   - Improved reliability, availability and performance

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