CMS ECAL Detector Control System Upgrade Plan
for the CERN Large Hadron Collider Long Shutdown II

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Introduction

The CMS Electromagnetic Calorimeter (ECAL) detector is composed of a scintillating crystal calorimeter and a lead/silicon preshower, partitioned as follows: Barrel (EB), Endcaps (EE) and Preshower (ES). The EB partition consists of 36 Supermodules (SM), the EE consists of two endcaps split in four semi-circles (Dees) and the ES consists of two circular structures. From the Detector Control System (DCS) point of view, partitions are compositions of multiple electronic equipment falling into one of the following categories: safety systems, powering systems, environmental monitoring systems and external interfaces. Powering systems are classified into two categories: Low Voltage (LV) and Bias Voltage (BV). The ECAL DCS supervisory layer runs the commercial Siemens SIMATIC WinCC OA platform [1] over three redundant computing servers and its software is built by a hierarchy of components, whose main functionality is organized into the following categories: System Configuration, Finite State Machine (FSM), Automatic Actions (AA) and User Interfaces (UIs).
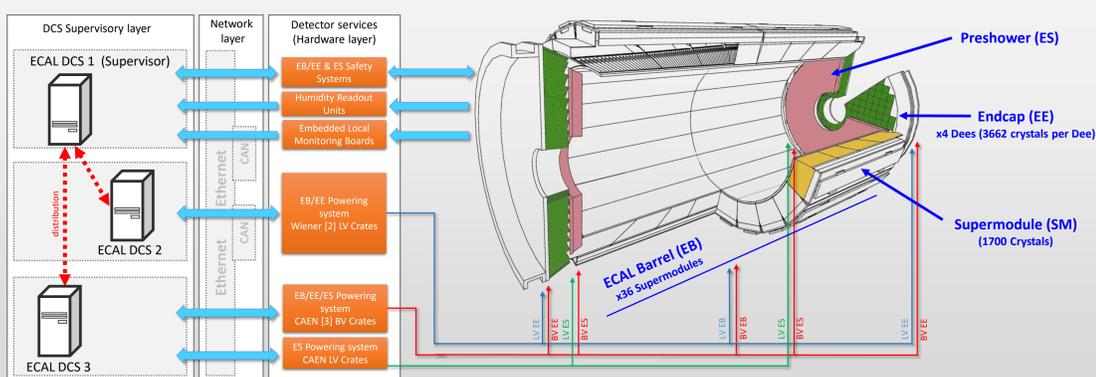

ECAL DCS upgrade plan for the LS2

During 2019 and 2020 the LHC will go through the second long shutdown (LS2) in order to perform maintenance and upgrades necessary to operate the collider at higher energy for the following three years. During the LS2, the ECAL DCS team will perform consolidation and upgrades of the ECAL DCS and its safety system, in order to improve its reliability and to simplify maintenance.
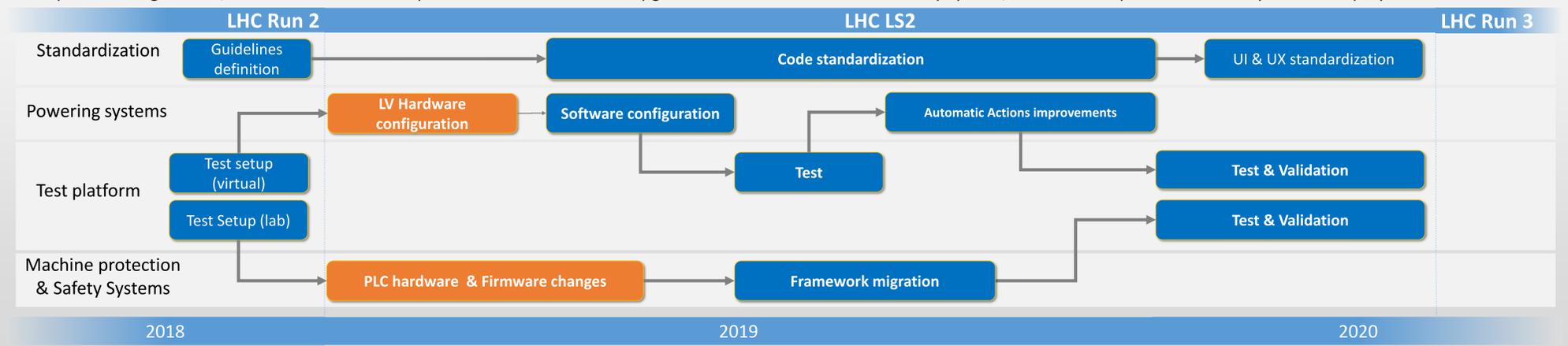

Consolidation of the test platform

A set of physical and virtual machines from the CMS computing infrastructure will be used to fragment and speed up the different software developments.
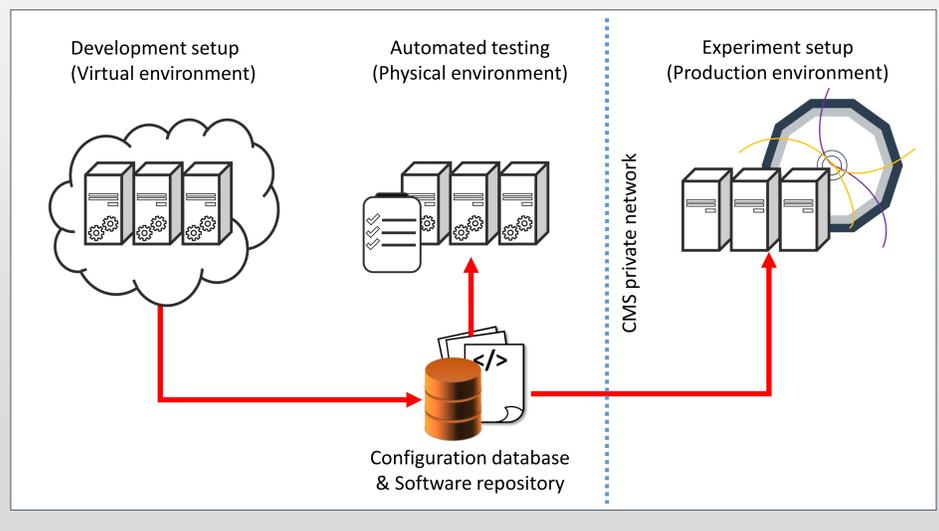

Reconfiguration of the low voltage powering system

The modifications in the CAN bus interface for the LV powering system will increase the overall performance of the system; requiring a crosswise software re-configuration.

* Distribution of power supplies per CAN bus indicated with white squares.
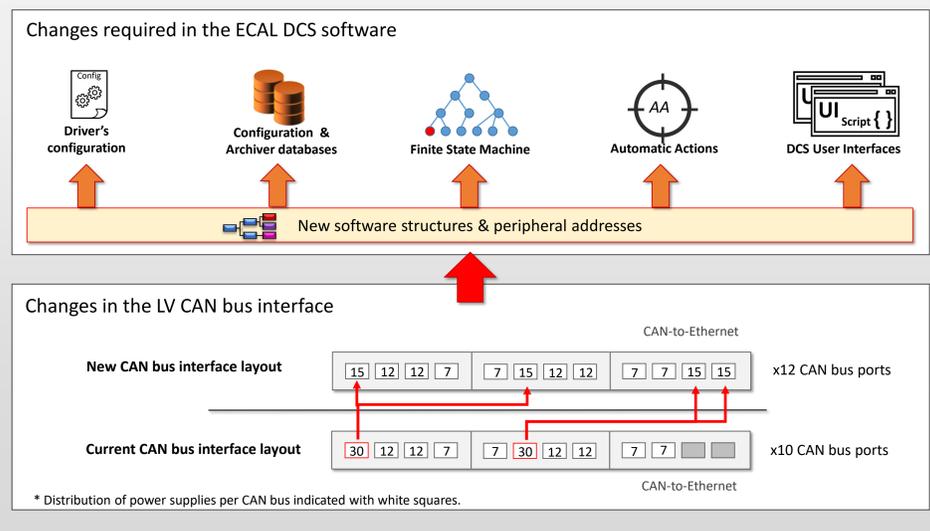
Modifications of the ECAL DCS software

Multiple software components will be modified and based on new development guidelines and software best practices. The adoption of common frameworks and tools will also help to reduce the maintenance efforts while improving critical parts of the system.
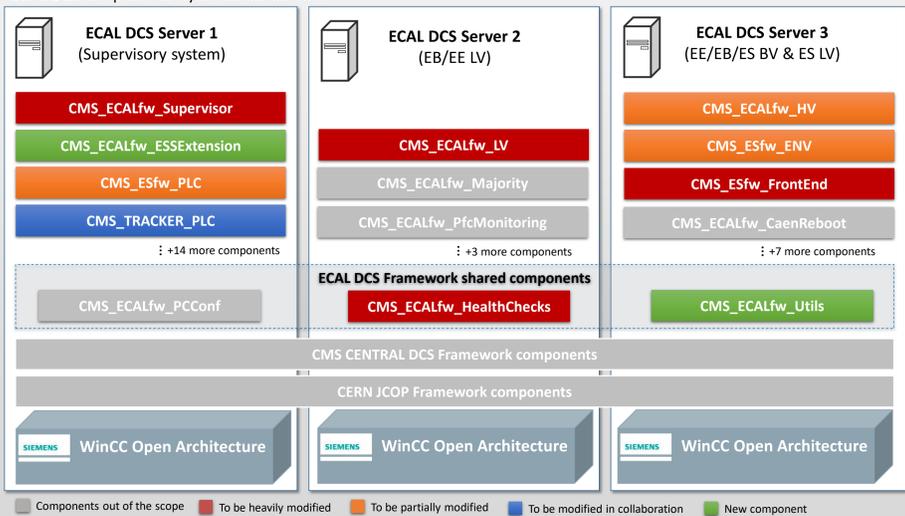
Machine protection & safety systems

The usage of the CMS Tracker PLC framework will permit a certain level of non-critical PLC parametrization from the DCS supervisory layer. This framework is already used by the Preshower PLCs. The migration to this framework is also foreseen for the EB/EE Safety PLC.

* Hardcode safety logic to prevent from operational mistakes.

The ECAL Safety Systems architecture overview