

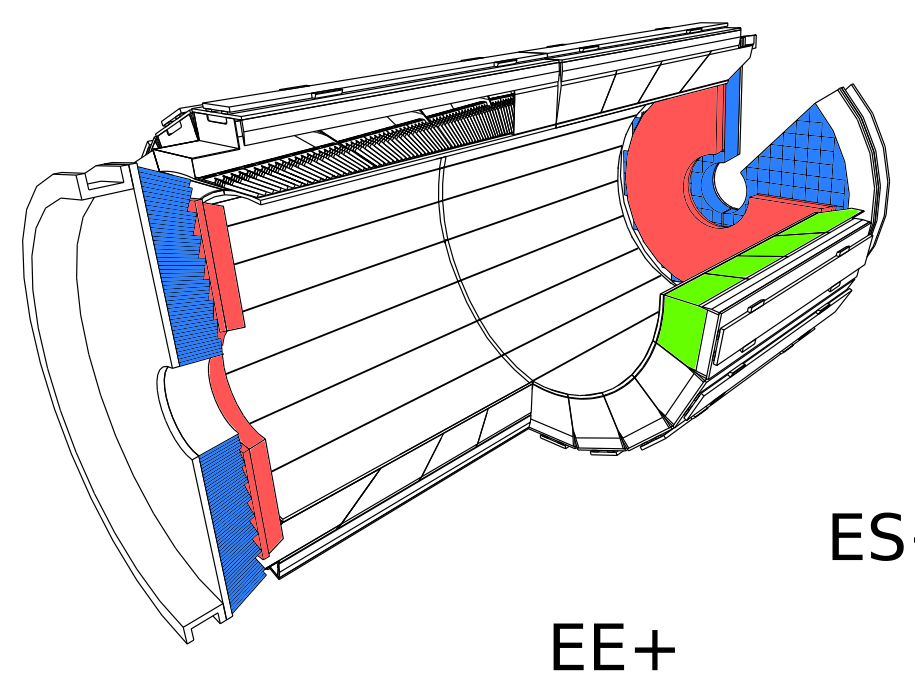
The CMS ECAL data acquisition system and its performance at the LHC Run 2

Dario Mapelli, *Università degli Studi di Milano-Bicocca*,
on behalf of the CMS collaboration

LHCP2018 Bologna,
4-9 June



ECAL and ES subsystems



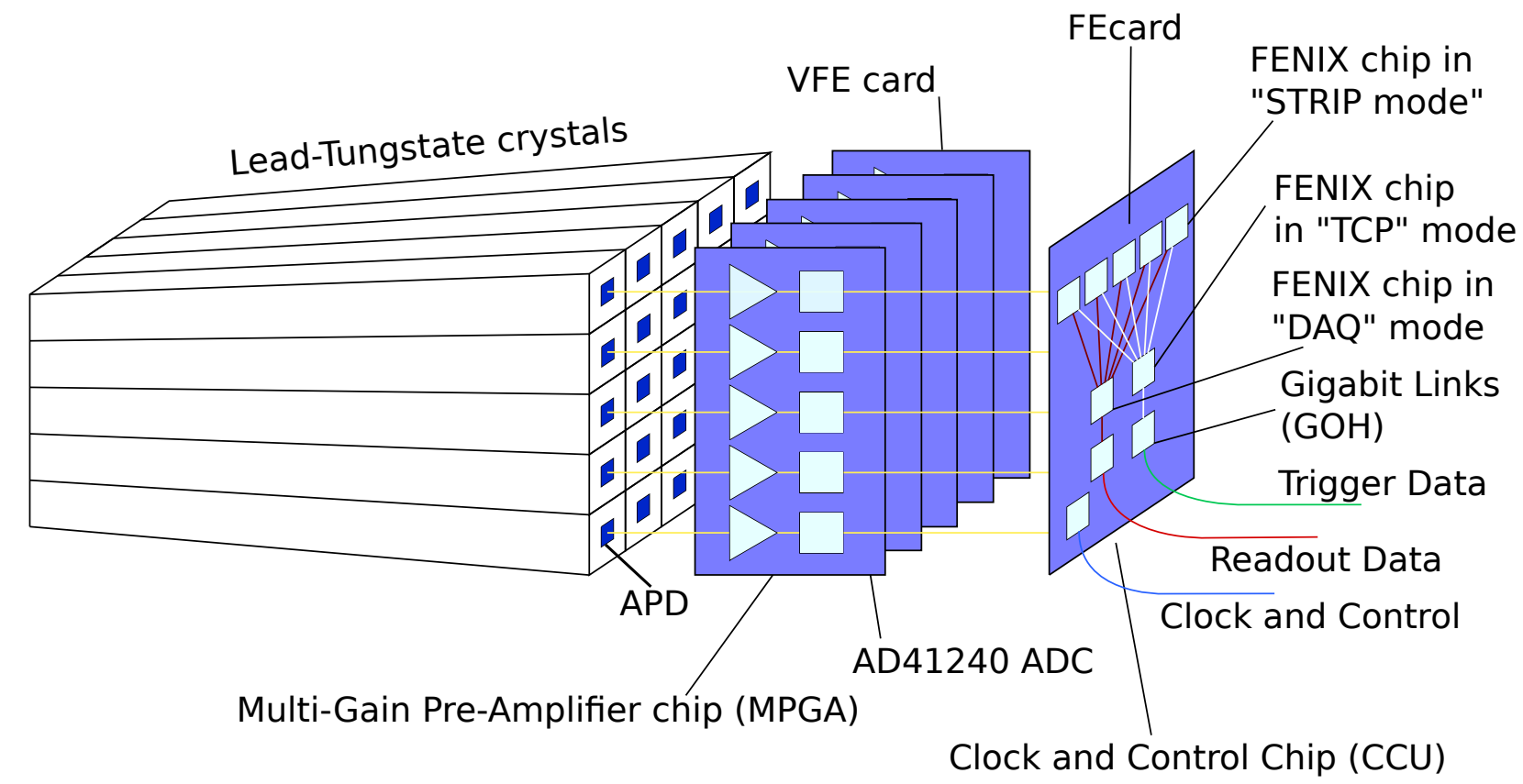
EE-
ES-
EB-
EB+
ES+
EE+

ECAL: Electromagnetic Calorimeter
ES: Endcap preShower
EE: ECAL Endcap
EB: ECAL Barrel

Each subsystem is divided in supermodules called Front End Drivers

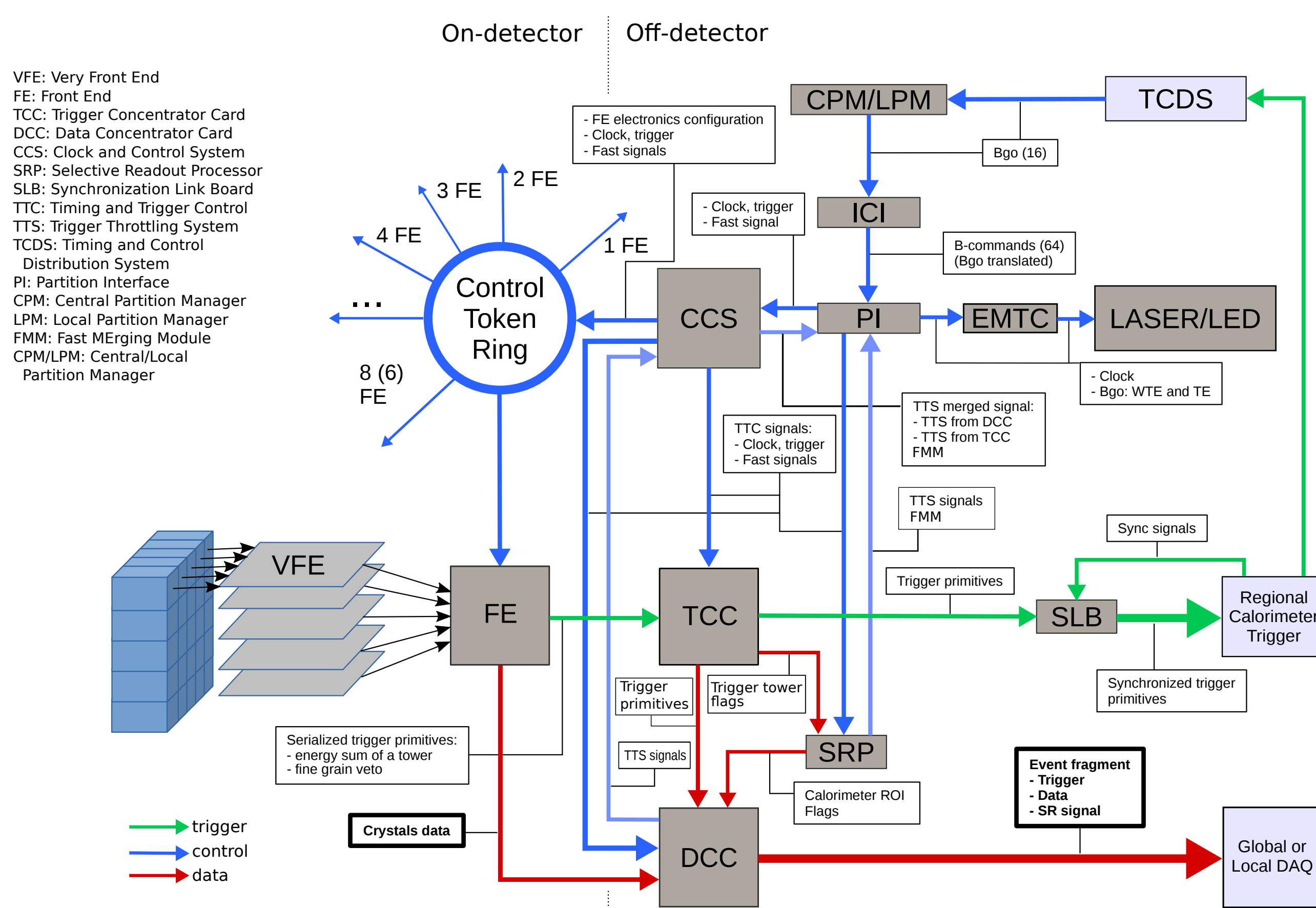
ECAL Front End

- * On-detector
- * Signal digitization and trigger primitives generation
- * Organised in Trigger Towers (TTs), each grouping 25 crystals



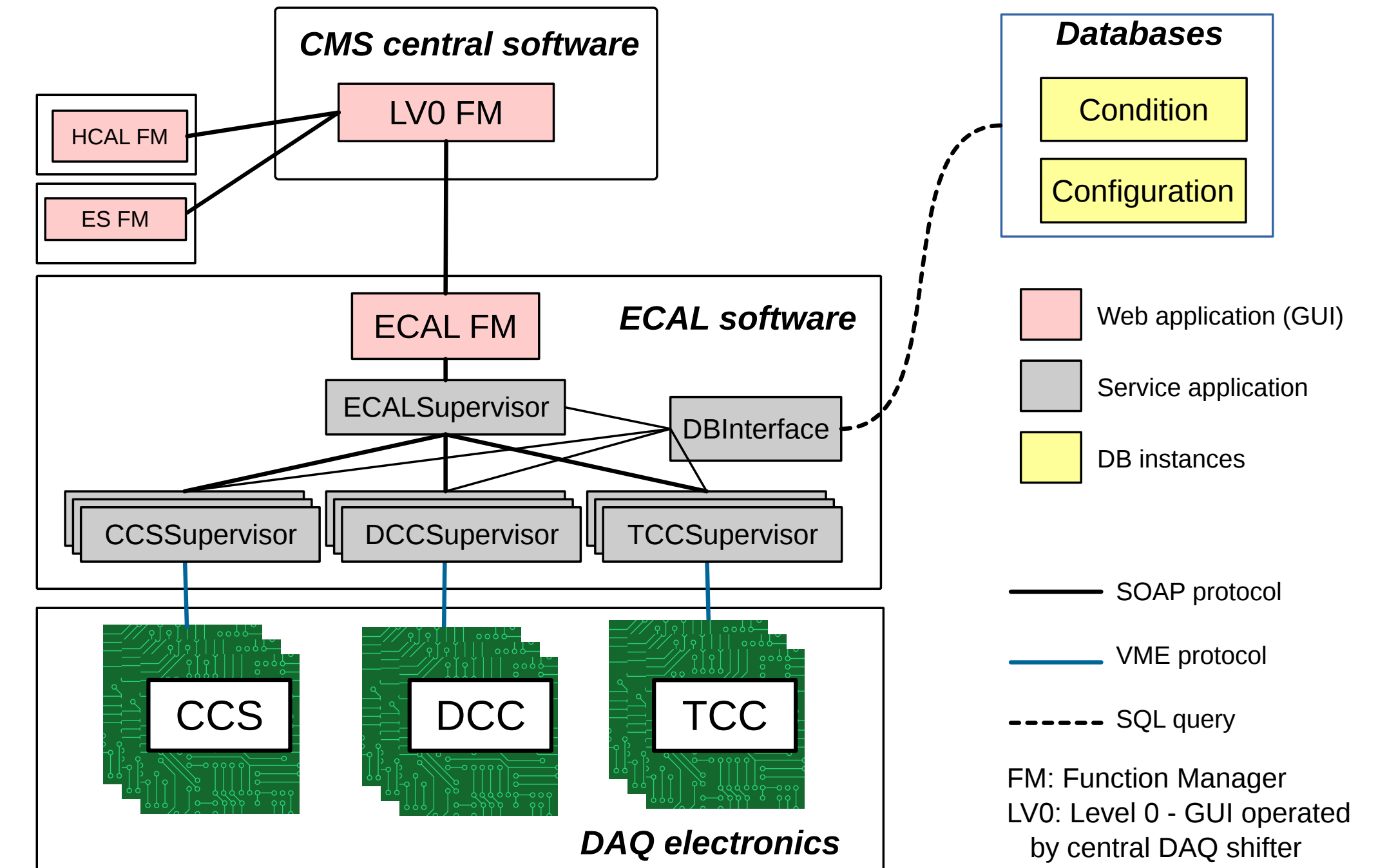
ECAL Trigger and DAQ hardware system

- * Off-detector, organised in 54 FEDs
- * Each FED manages from 48 to 68 TTs and is composed by:
 - * Clock and Control System (CCS)
 - * Trigger Concentrator Card (TCC)
 - * Data Concentrator Card (DCC)



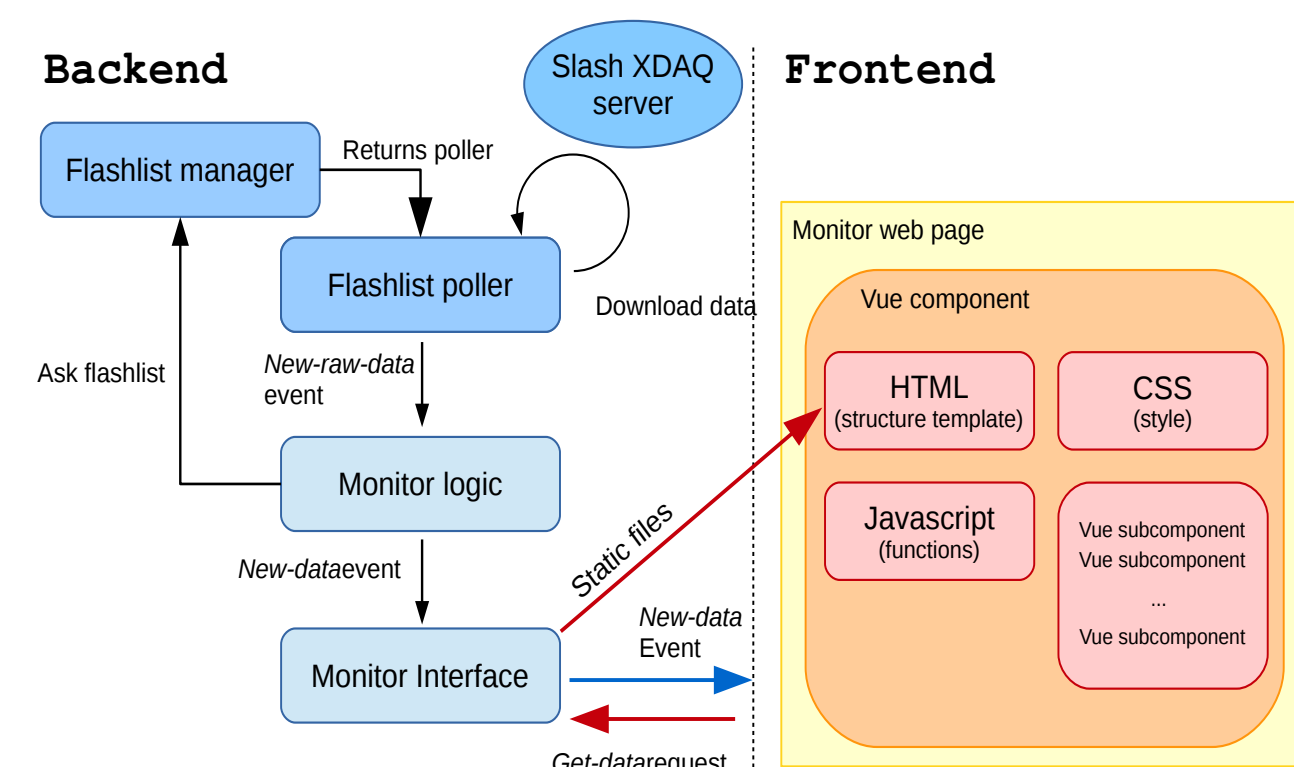
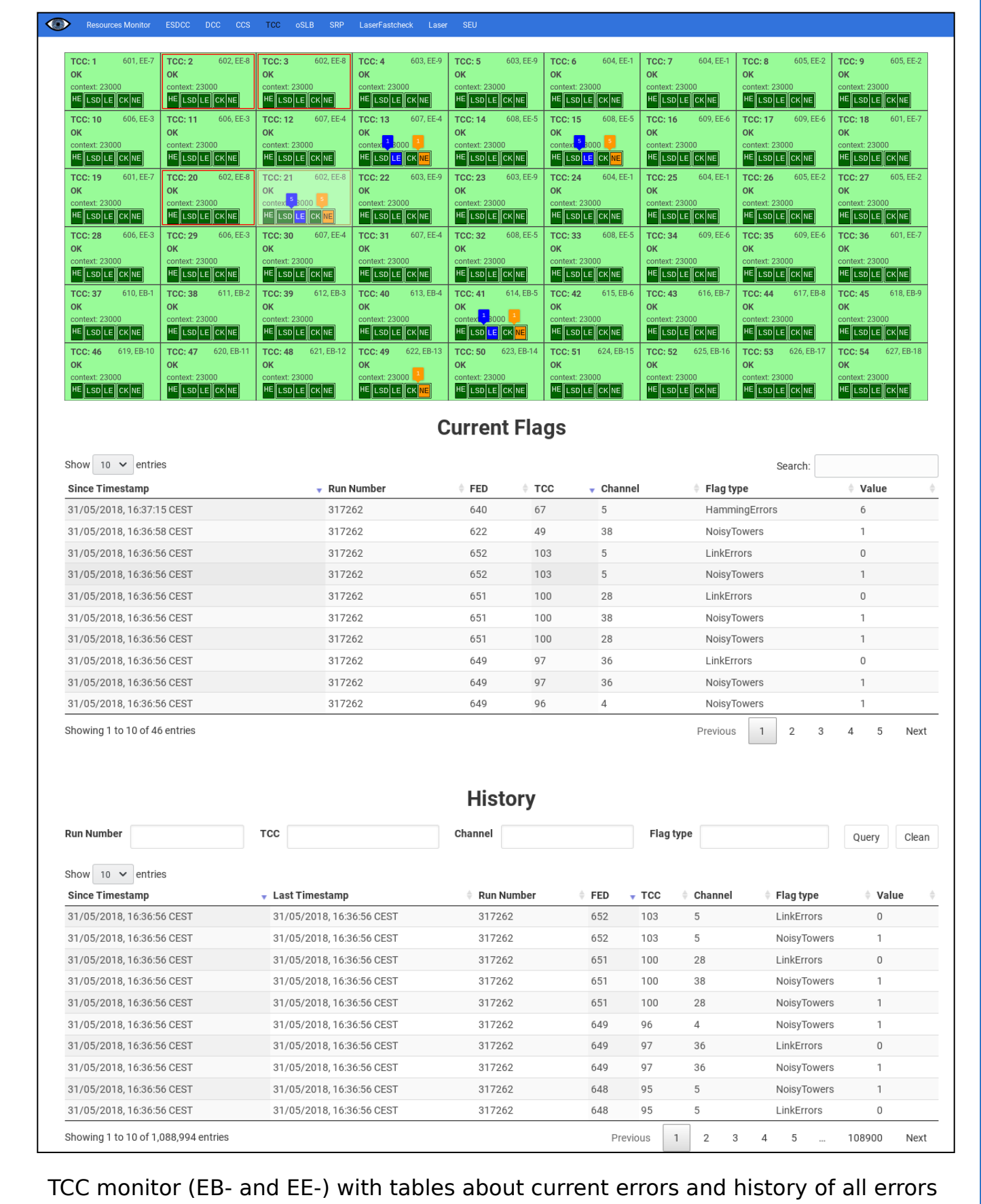
ECAL and ES Online Software

- * Configuration, control and monitoring of ECAL and ES Trigger and DAQ system.
- * Hierarchical structure of applications based on XDAQ libraries [2].



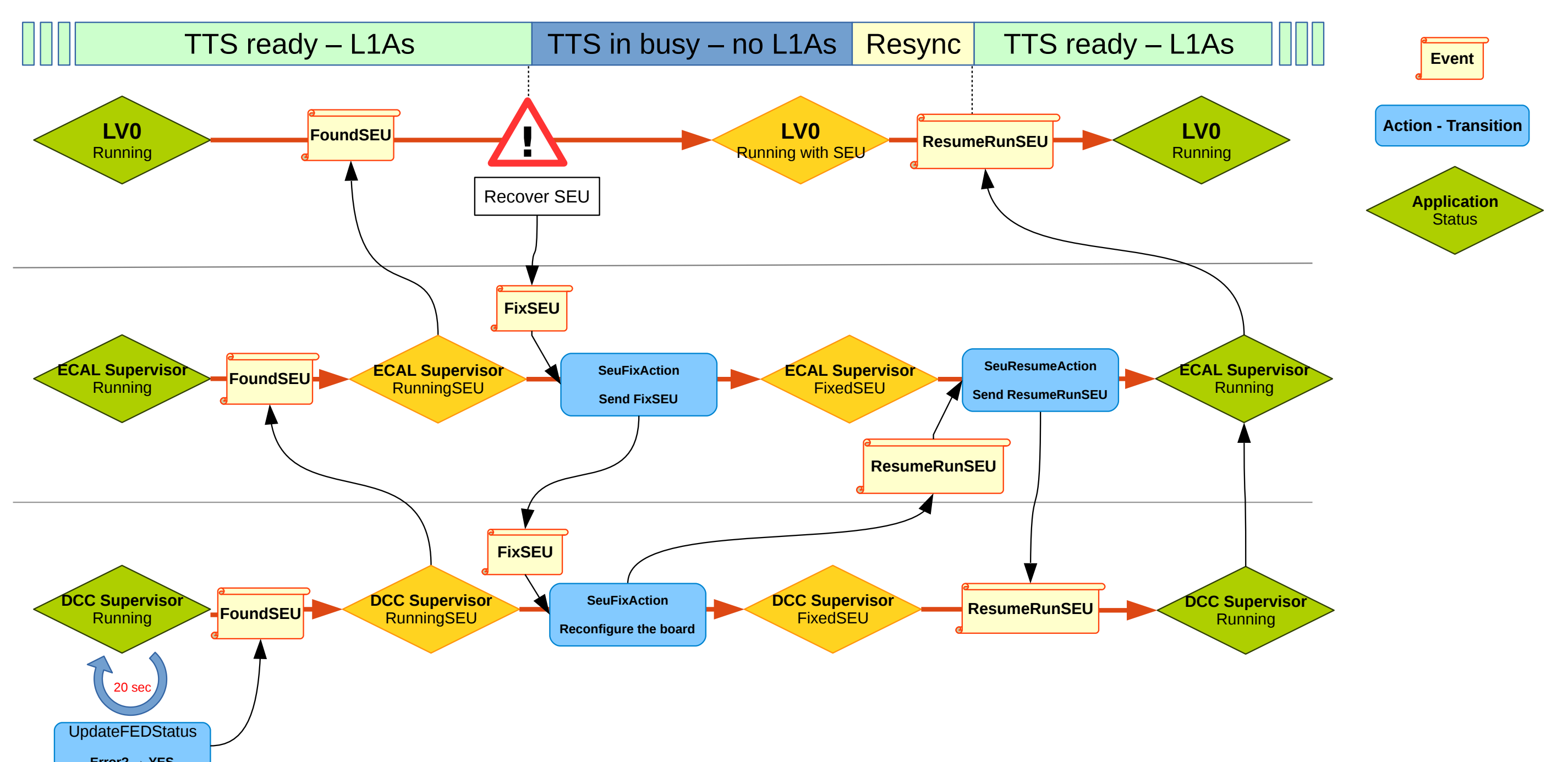
Monitoring software

- Web application monitoring ECAL and ES Trigger and DAQ systems.
- * Based on information published by online software applications
- * Backend: nodejs + express
- * Frontend: Vuejs components and Bulma libraries.



Auto-recovery of Single Event Upsets (SEUs) in ECAL

- * When a DCC board detects a SEU, It goes in error
- * Its supervisor reacts by changing state in "Running with SEU"
- * The ECAL Supervisor handles the SEU fix action



Performance: Recorded luminosity

Year	LHC delivered (fb ⁻¹)	CMS recorded (fb ⁻¹)	ECAL DAQ - induced losses ECAL + ES (pb ⁻¹ (% of LHC delivered))
2016	41.07	37.82	237.12 + 189.23 (0.6% + 0.5%)
2017	50.25	45.39	151.57 + 45.12 (0.3% + 0.09%)

Considering pp collisions at 13TeV, data from [1]

[1] CMS Lumi: <https://twiki.cern.ch/twiki/bin/view/CMSPublic/LumiPublicResults>

[2] XDAQ: <https://svnweb.cern.ch/trac/cmsos>