

1 Detector Operations

By the end of this quarter, Long Shutdown 1 of the LHC had come to an end. CMS completed its shutdown activities, closed up the detector, and took cosmic ray data to commission the experiment. In March this included running with the detector solenoid at 4 Tesla. At this time the experiment is ready to continue commissioning with beams to prepare for physics running.

1.1 Milestones and Metrics

US CMS has developed a set of milestones and metrics for 2015 to measure performance. At the present time the detector is still being commissioned and so we do not report metrics. Milestone progress is reported for each subsystem individually below.

1.2 BRIL

The main emphasis of the US-CMS effort as part of the BRIL sub-detector group is the pixel luminosity telescope (PLT). The detector is now completely installed inside the CMS detector and its functionality has been tested. It is ready to take “splash” events that are planned during the first/second week of April. Monitoring and online error diagnostics tools are prepared and deployed to enable regular shift operations. The relative luminosity measurements during VdM scans are in preparation and on track for the first scans.

Table 1: BRIL Milestones

Subsystem	Description	Scheduled	Achieved
BRIL	Hardware installed	Jan	Jan
BRIL	Ready to deliver Lum	March	March
BRIL	Ready to deliver bkg nums	May	

1.3 Tracker

Since closing of CMS the tracker (Strips and Pixel) have operated well at the lower temperatures (see Milestone table). Unlike the conditions during Run 1, the lower humidity conditions have been maintained even during full magnetic field. This is a good success for the tracker humidity campaign. Detailed, post insertion, calibrations were performed for both the Barrel (BPiX) and Forward (FPiX) Pixel detectors, and the whole CMS tracker was able to profit from cosmic ray running with magnetic field on and off. With the field on, it was found that a sector, about 3%, of the BPiX will trip if all the modules in that sector are turned on. Debugging of the BPiX sector, and optimizing the number of powered modules in sector will continue when the CMS magnetic field is turned back on.

Table 2: Tracker Milestones

Subsystem	Description	Scheduled	Achieved
Tracker	Installation and checkout		Achieved
Tracker	Tracker operate -15C		Achieved
Tracker	Pixel operate -10C		Achieved
Tracker	Ready for proton beams	March	March

1.4 ECAL

A two-day detailed review of ECAL online and offline readiness for Run II was held on 2nd/3rd February 2015. This covered the current commissioning status, the near-term goals and the plans for commissioning and calibration with the first LHC beams. Significant progress was observed in all areas and the detector is in good shape for Run II. All parts of ECAL (EB/EE/ES) are participating in global runs, following the migration to the new central DAQ and TCDS systems. The immediate goals involve the recommissioning of the electron/photon trigger path and the validation of the ECAL links to the legacy and upgrade calorimeter trigger systems (with new components installed during LS1). The timing synchronization of the ECAL trigger and readout is being validated and will be further tested during the beam commissioning period (including the use of beam splash events). Laser calibration

data is being recorded at 3.8T to monitor the recovery of crystal transparency during LS1. A successful test of the cold operation of the ECAL preshower, which will operate at -8°C during Run II, has been performed.

Table 3: ECAL Milestones

Subsystem	Description	Scheduled	Achieved
ECAL	Finish HV Install	Feb	delayed
ECAL	Baseline levels zero suppression	March	March
ECAL	Complete install HV calib system	April	
ECAL	Selective readout	June	
ECAL	Trigger thresholds	June	
ECAL	Zero suppression thresholds	June	

Regarding the delayed milestone, 3 of the 6 CAEN HV mainframes have been installed. Final one is scheduled to be installed on May 12th. This is behind the original schedule but it is not a problem because the existing mainframes are fully operational so we are swapping them out progressively. The delay was caused by when we received them from CAEN.

1.5 HCAL

Since the previous report, the HCAL has completed its Long Shutdown 1 (LS1) activities and is currently finalizing its Run 2 preparations, which include the completion of the first milestone of the Phase-1 upgrade of installing the HF μTCA back-end electronics. Significant effort was invested into the development of the HCAL local reconstruction code for LHC operation with 25ns bunch spacing, including proper out-of-time pile up subtraction. The code was provided for Offline while its faster version for use in the High-Level Trigger (HLT) is presently undergoing tests.

1.6 EMU

The CSC system participated in cosmic global runs throughout this period, including extended runs in the closed configuration at zero magnetic field (CRUZET) and runs with the solenoid ramped up to full field of 3.8 T (CRAFT). The operation of the CSC were generally smooth, with a few

Table 4: HCAL Milestones

Subsystem	Description	Scheduled	Achieved
HCAL	Fully functional HCAL in CRAFT runs	March	March
HCAL	prepared to do HF Phase scan and ϕ symmetry calibration analysis	May	
HCAL	New HBHE backend operating in parallel with legacy system	July	

remaining firmware/software issues being worked on. The CSCValidation program was revived to present prompt diagnostic information from the CRUZET and CRAFT runs. The web interface was updated and features were added to compare data from different runs in real time. The spatial resolution for each chamber type was evaluated from the 2015 CRAFT cosmic ray data. It was found to be essentially unchanged with respect to the November 2014 data, when the magnet was last powered.

Table 5: EMU Milestones

Subsystem	Description	Scheduled	Achieved
EMU	CSC ready for collisions	May	
EMU	Calibration for HLT and Offline included in DB	July	
EMU	Fine timing adjustments with collision data completed	July	

1.7 DAQ

The DAQ2 system, including new Storage Manager Disk system and the new Trigger Control and Distribution System (TCDS) that was read out through the SLinkExpress fiber link of the FEROL module system was successfully used in global data taking through out the first quarter of FY 2015 in its basic functionality. The focus during this quarter was on commissioning the DAQ2

system to handle edge cases, improving it's the monitoring and performance.

Table 6: DAQ Milestones

Subsystem	Description	Scheduled	Achieved
DAQ	Hardware Installation of DAQ2 with new HLT nodes complete	April	
DAQ	Complete DAQ2 is operational for collisions	July	
DAQ	μ TCA DAQ link commissioned for new trigger and HCAL FEDs	July	
DAQ	DAQ2 with Run I design performance	September	

1.8 Trigger

During this quarter the US groups continued their work on the regional calorimeter (RCT) and the endcap muon triggers. In both significant progress was made timing in the various elements of the triggers. This work will continue with the arrival of beams which, being synchronous, simplify the task. During the cosmic ray running the system was successfully used to trigger the events.

Table 7: Trigger Milestones

Subsystem	Description	Scheduled	Achieved
TRIG	Legacy RCT ready for physics	June	
TRIG	MPC ready for physics	June	
TRIG	CSCTF Ready for physics	June	
TRIG	Stage-1 Layer-1 calorimeter trigger ready for physics	September	