PUBLISHED BY INSTITUTE OF PHYSICS PUBLISHING AND SISSA

RECEIVED: *January 9, 2008*
ACCEPTED: *May 18, 2008*
PUBLISHED: *August 14, 2008*

THE CERN LARGE HADRON COLLIDER: ACCELERATOR AND EXPERIMENTS

The CMS experiment at the CERN LHC

CMS Collaboration

ABSTRACT: The Compact Muon Solenoid (CMS) detector is described. The detector operates at the Large Hadron Collider (LHC) at CERN. It was conceived to study proton-proton (and lead-lead) collisions at a centre-of-mass energy of 14 TeV (5.5 TeV nucleon-nucleon) and at luminosities up to $10^{34}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$ ($10^{27}\,\mathrm{cm}^{-2}\mathrm{s}^{-1}$). At the core of the CMS detector sits a high-magnetic-field and large-bore superconducting solenoid surrounding an all-silicon pixel and strip tracker, a lead-tungstate scintillating-crystals electromagnetic calorimeter, and a brass-scintillator sampling hadron calorimeter. The iron yoke of the flux-return is instrumented with four stations of muon detectors covering most of the 4π solid angle. Forward sampling calorimeters extend the pseudo-rapidity coverage to high values ($|\eta| \leq 5$) assuring very good hermeticity. The overall dimensions of the CMS detector are a length of 21.6 m, a diameter of 14.6 m and a total weight of 12500 t.

KEYWORDS: Instrumentation for particle accelerators and storage rings - high energy; Gaseous detectors; Scintillators, scintillation and light emission processes; Solid state detectors; Calorimeters; Gamma detectors; Large detector systems for particle and astroparticle physics; Particle identification methods; Particle tracking detectors; Spectrometers; Analogue electronic circuits; Control and monitor systems online; Data acquisition circuits; Data acquisition concepts; Detector control systems; Digital electronic circuits; Digital signal processing; Electronic detector readout concepts; Front-end electronics for detector readout; Modular electronics; Online farms and online filtering; Optical detector readout concepts; Trigger concepts and systems; VLSI circuits; Analysis and statistical methods; Computing; Data processing methods; Data reduction methods; Pattern recognition, cluster finding, calibration and fitting methods; Software architectures; Detector alignment and calibration methods; Detector cooling and thermo-stabilization; Detector design and construction technologies and materials; Detector grounding; Manufacturing; Overall mechanics design; Special cables; Voltage distributions.

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