

Connecting Great Minds

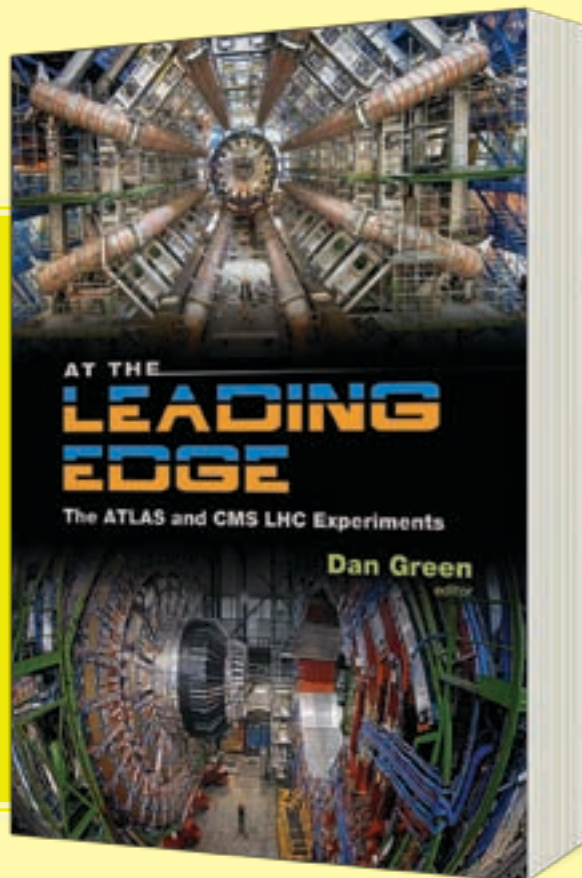
AT THE LEADING EDGE

The ATLAS and CMS LHC Experiments

edited by **Dan Green**

Fermi National Accelerator Laboratory, USA

- Highest energy proton collider
- 1 billion interactions per second
- First silicon pixels in a proton collider
- First all silicon tracker
- 100 million channels of radiation hard electronics
- Calorimeter with 60,000 PbWO₄ crystals
- First use of accordion liquid argon calorimeter
- Largest magnetic toroids
- Largest magnetic solenoid
- Selection of one in 10 million interactions at a 40 MHz speed.
- Enormous data logging rate – 1 million CD per year
- Worldwide grid computing analysis



Too often descriptions of detectors focus on the “what” and not the “why”. This volume aims to elucidate how the requirements of the physics at the Large Hadron Collider (LHC) define the detector environment. In turn, the detector choices are made to adopt to that environment. The goal of LHC physics is to explore the mechanism for electroweak symmetry breaking. Because of the minuscule cross-sections which need to be explored, 0.1 fb, the LHC needs to provide 100 fb⁻¹/yr, or an instantaneous luminosity of 10³⁴ / (cm² sec). With a bunch crossing interval of 25 nsec, well matched to detector speeds, there will be 25 events occupying each bunch crossing.

Thus the physics requires fast, finely segmented, low noise and radiation resistant detectors which provide redundant measurements of the rarely produced electrons and muons. To achieve those goals, new ground was broken in constructing the A Toroidal LHC Apparatus (ATLAS) and Compact Muon Solenoid (CMS) detectors in the vertex detectors, tracking systems, calorimetry, strong magnets, muon systems, front end electronics, trigger systems, and in the data acquisition methods used.

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