EXPERIMENTAL TECHNIQUES

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Abstract

Detectors for particle physics are designed to study features of the smallest components of our universe. They are build out of several sub-detectors, each contributing its own signature to the overall picture of a particle collision. The purpose of these two lectures is, in a very concentrated form, to present some of the ideas going into the design and construction of modern high energy physics experiments. Most of the examples will be taken from the two general purpose experiments ATLAS and CMS, presently under preparation for LHC. The lectures cover the LHC experimental environment and a discussion of the signal signatures for some of the important physics processes. A walk through the generic detector for collider physics introduces the individual sub-detectors. Starting from the interaction point the inner tracking and vertex detector are followed by the calorimeters and finally the muon spectrometer system. The functionality of the sub-detectors are illustrated by new developments for the LHC experiments. The lectures cover the drift chamber and solid state detectors, electromagnetic and hadron calorimetry, muon chamber systems and some aspects of triggering and data acquisition.

Finally the standard model Higgs signal is used to demonstrate the capability of ATLAS and CMS to observe low cross-section physics in a complicated environment.

The form and contents of the lectures were very similar to those given by Daniel Fournier in Dubna, at the 1995 European School of High-Energy Physics. The write up of those lectures (CERN 96–04), produced by Daniel Fournier and Lautent Selin, is of an outstanding quality, with an enormous richness of details and an extensive list of references. I strongly recommend those for further reading.