

Introduction

This monograph is a D.Sc. thesis and presents author's work in the CMS experiment [1] and, in particular, in the muon trigger groups. The long and very active work in the muon trigger group, participation in system design, operation and upgrade works, motivated author to emphasize that in the title of the presented monograph. The presented monograph also overviews main CMS physics results, including those to which the author was contributing and which use the reconstruction tools developed by the author.

The author has been a member of the collaboration since the beginning [2] of CMS. The author's work is mainly focused on the Level-1 muon trigger based on signals from RPC detectors (see for example [3–8]). However it also extends to general trigger activities, detector studies, event reconstruction and physics.

The results of author's work on physics, trigger and reconstruction were included in several major CMS design documents, including Letter of Intent [2], Technical Proposal [9] and Technical Design Reports (TDR): Level-1 TDR [10], HLT TDR [11] (also [12]) and Physics TDR, Vol.1 [13].

The monograph is organized in chapters. In the first chapter the CMS detector is presented. Its operation and early performance results are discussed. In the second chapter, the CMS Level-1 trigger system is presented with the emphasis on the muon part. The trigger performance results are also shown. The High-Level trigger is discussed in third chapter. The muon and track reconstruction methods are presented. The performance is analyzed. The next chapter is dedicated to CMS physics results. It includes Higgs boson discovery and selection of other measurements. The CMS upgrade perspectives are discussed in the summary.

There are three appendices to the monograph to present aspects of event reconstruction in which author's contribution was particularly prominent, and a glossary of acronyms. In the first appendix the performance of the RPC trigger is presented. A review of simplified reconstruction with the Pixel Detector, used also for seeding and relevant to Chapter 3, is given in the second appendix. The muon isolation studies are included in the third appendix.

This monograph is based on the revised conference reports given by the author on behalf of the CMS collaboration [14–19], author's contribution to CMS TDRs [10, 11, 13] and on the CMS notes [20, 21] to which the author gave leading contributions. Each chapter is preceded by a short information about author's contribution to the subject discussed in a given chapter.