CMS

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Abstract

This paper reviews

Contents

1 Introduction

In the beginning of this section use introduction from the AN, modify it to make appropriate for more general audience

1.1 Fundamental Particles and Interactions

Fundamental particles and interactions

1.2 Electroweak Interactions

Electroweak interactions

1.3 The Higgs Mechanism

The Higgs Mechanism

1.4 Quantum Chromodynamics

Quantum chromodynamics

1.5 Physcis of Proton-Proton Collisions

Physcis of Proton-Proton Collisions

1.6 Open Questions of the Standard Model

Open Questions

2 The Wγ Process

2.1 Standard Model Wγ Production

Explain Feynman diagrams Give a definitions of the total and differential cross section of the Standard Model processes Explain LO/NLO/NNLO thing Provide theoretical cross section and order

2.2 Anomalous Wγ Production

ATGC

2.3 Measurements in the Past

Wg 7 TeV at CMS Wg 7 TeV at ATLAS Wg 8 TeV at ATLAS (?)

3 Experimental Setup

3.1 Large Hadron Colllider

main ring injector collision points detectors (CMS, ATLAS, LHCb, ALICE) list and briefly main discoveries

Bunch crossing

3.2 Compact Muon Solenoid

3.2.1 Introduction

CMS detector configuration r-phi plane, r-z plane slice in r-phi plane subsystems a particle traveling through the detector: ele, pho, muon, hadron, neutrino Where to place particle reconstruction, particle flow algorithm and MET? Check other theses Acceptance: particles which are too collinear and go to pipe; particles which get curved too strongly

3.2.2 CMS Magnet

4T inside, 2T outside, needed for track curvatures to measure the momenta need stronger field inside to distinguish tracks better, the track density in the tracker is much higher than in the muon system explain how the magnetic field outside the detector is created the size, what's inside, what's outside material

3.2.3 CMS Tracking System

measures track geometry and momentum of charged particle needs to disturb particles as little as possible: just a few measurement points to reconstruct the track electric charge and amplification silicon pixels, barrel and forward silicon strips, barrel and forward tracker alignment (here ?) limitations

3.2.4 CMS ECal

measures energy of electrons and photons also determines the track, especially for photons match to tracker: if track, it's ele/pos, if not - it's a photon (Why muons and hadrons don't release their energy here?) electromagnetic shower lead tungstate crystals how scintillator works, what the scintillation light is photodetectors (photomultipliers?) ECAL preshower: to distinguish between two photons coming from pi0 decay limitations

3.2.5 CMS HCal

measures energy of charged and neutral hadrons also determines the track, especially for neutral hadrons match to tracker: if track, it's charged, if not - it's neutral (Why muons don't release their energy here? Would photons and electrons release the energy here?) hadronic shower HCal Sampling calorimeter (?) Lqyers: absorber+scintillator Hybrid Photodiodes

3.2.6 CMS Muon System

four layers of muon detectors (stations) iron return yoke between them (how it works? why do we need it?)

¿¿ (from cms.web.cern.ch) In total there are 1400 muon chambers: 250 drift tubes (DTs) and 540 cathode strip chambers (CSCs) track the particles positions and provide a trigger, while 610 resistive plate chambers (RPCs) form a redundant trigger system, which quickly decides to keep the acquired muon data or not.

drift tubes cathode strip chambers resistive plate chambers

3.2.7 Triggering and Data Aquisition

Level-I trigger High Level Trigger

3.2.8 Event Reconstruction

4 CMS Tracker Alignment

4.1 Introduction

(mostly along the lines of my presentation for the USCMS workshop because it was time when I was the most active)

4.2 Alignment Algorithm and Software

Millepede, HIP, validation, CMSSW, configuration files

4.3 Selected Results

CRUZET, CRAFT and first collisions of 2015

5 Wγ Cross Section Measurement

Place analysis outline here

5.1 Data and Simulation Samples

5.2 Object and Event Selection

5.3 Background Estimation and Subtraction

5.4 Detector Resolution Unfolding

5.5 Acceptance and Efficiency

5.6 Systematic Uncertainties

5.7 Cross Section

6 Summary and Conclusions