Second semester report

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Thesis title:

Precision electroweak measurements with the CMS detector at the LHC

Introduction

Direct searches for new phenomena are optimized for specific models featuring New Physics, such as the appearance of new heavy particles. They are thus very efficient in looking for known unknowns. On the other hand, precision measurements looking for small deviations in experimental observables due to the presence of some New Physics at a higher energy scale are more general and potentially are able to catch the unexpected. During my PhD I intend to test the Standard Model and look for signs of new phenomena with these complementary methods. I thus joined the Standard Model Physics Analysis Group this semester.

Description of research work carried out in current semester

My first task is coordinated by the Physics Performance and Dataset (PPD) Group at CMS. The role of PPD is to ensure the quality of data that are provided to the physics analysis groups. They are responsible both for the quality of data being recorded during collisions, as well as after (re)processing with improved calibration. In the CMS experiment, the Data Quality Monitoring (DQM) is critically important for detector and operation efficiency, and for the reliable certification of the data for physics analyses. The main goal is to discover and pin-point problems occurring in detector hardware or reconstruction software promptly and with sufficient accuracy and clarity to reach high efficiency and excellent performance.

I am part of the Physics Data and Monte Carlo Validation (PdmV) organization collaborative effort, at which I work on validating new software release that comprises changes from many developers in many packages. This should be done before using a release for official MC production or data reconstruction. A set of samples (CMS data, “fullsim” detailed Geant4 Monte Carlo (MC) simulation and “fastsim” parametric less CPU intensive MC) is produced for every release to be validated for each Physics Analysis Group (PAG). I perform validation tasks by verifying typical physics performance plots that are produced with standard physics analysis procedures. I compare target plots vs. reference plots, and then summarize the findings in validation reports. I am responsible for Forward, Small-x and QCD-Physics (FSQ) and Standard Model Physics (SMP) validation based on Minimum Bias and Z→ll physics samples.

In case of observed differences, I investigate if they are *expected* due to developments, such as improvements in calibration or reconstruction software or other known changes, or if they are *unexpected* (for example a result of mistakes introduced in the new version) and cause problems or decrease performance. In the reports, I describe the differences and their origin if found.

Studies in current semester

I followed 4 courses this semester:

- Strong Interactions at Low Energies (3 credits)
- Relativistic Quantum Electrodynamics (6 credits)
- Selected Chapters in High Energy Physics (6 Credits)
- Experimental Methods in Particle Physics I (2 Credits)

Attendance on regular seminars, meetings

ELTE Ortvay seminars, ELTE Particle Physics seminars, Hungarian CMS Group seminars, ELTE CMS meetings.