Study of high mass dimuon production in *pp* collisions at $\sqrt{s}$ = 7 TeV with the ATLAS detector
（ATLAS検出器を用いた、重心系エネルギー７TeVでの陽子・陽子衝突における
高い質量を持ったミューオン対生成の研究）

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The Large Hadron Collider (LHC) is a proton-proton collider constructed at CERN. It was operated with the center of mass energy of 7 TeV in 2011. In this thesis, high mass resonances which decay into a muon-antimuon pair is studied, using the collision data taken with the ATLAS detector at the LHC in 2011, corresponding to an integrated luminosity of 5 fb^{-1}. Dimuon invariant mass distribution obtained from data is first compared to known physics process in the Standard Model (SM) expectation which is generated with Monte Carlo simulation. Then searches for new physics predicted.

The mass spectrum comparison between data and simulation is shown in figure 1. In the figure, the dot histogram is obtained from data, and color filled histograms are obtained from simulated samples. The *Z* boson mass peak is clearly seen at 91 GeV in the spectrum. The simulated samples are well representing the data. It can be seen the main source for these dimuon events comes from Drell-Yan process (light blue in the figure) which produces dimuon via *Z* boson or photon from quark-antiquark pair, and subsequently diboson, $t\bar{t}$, *W*+jet and QCD.

Searches for the new particle have been done on this mass spectrum using Sequential Standard model *Z'* as a bench mark. The example of the mass peaks of *Z'* is shown as solid line histograms in the figure. Narrow
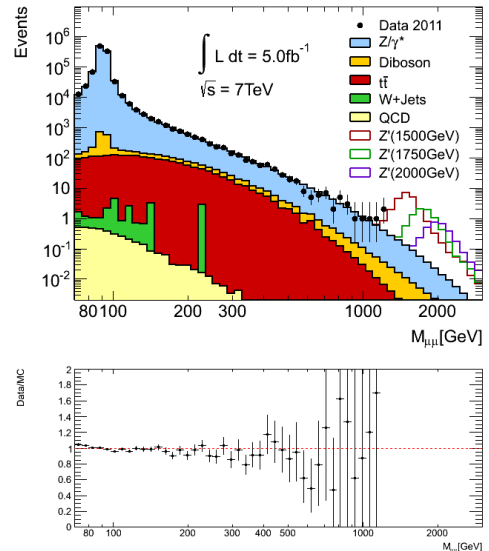

Figure 1: Top plot shows the mass comparison between obtained data and simulation. Bottom plot shows the ratio between data and simulation.

resonance searches are first attempted on this mass spectrum with "p-value" which is used as reference of signal existence. There is no significant deviation from the expectation and hence upper limit on the production cross section is set. As the result *Z'* is excluded at 95 % confidence level for mass below 2.00 TeV.