IRFU : Institut de recherche sur les lois fondamentales de l'univers

Saclay

Etude de sensibilité des mesures de la masse du quark top par des méthodes innovantes dans l'expérience ATLAS au LHC

Spécialité Physique corpusculaire des accélérateurs

Niveau d'étude Bac+5

Formation Master 2

Unité d'accueil

Candidature avant le 28/04/2017

Durée 4 mois

Poursuite possible en thèse oui

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Résumé

Sujet détaillé

Le stage a pour but d'étudier la sensibilité des mesures de masse du quark top avec le détecteur ATLAS au LHC par des méthodes innovantes afin d'obtenir la meilleure précision possible de ce paramètre fondamental du modèle standard (voir description en anglais pour plus de détails).

Mots clés

Compétences

Logiciels

C++, Root

Sensitivity studies of measurements of the top-quark mass with innovative methods in the ATLAS experiment at the LHC

Summary

Full description

The top quark plays a particular role in the Standard Model (SM) of particle physics. Indeed even after the discovery of the Higgs boson, the top quark is still the heaviest known elementary particle. Due to its large mass, radiative corrections involving the top quark are often dominant in perturbative calculations. Using these computations, the top-quark and W-boson masses can constrain the Higgs-boson mass. This estimation can be compared with the direct Higgs-boson mass measurement to test the consistency of the SM. In addition the top-quark mass together with the Higgs-boson mass allows to compute the stability of the SM vacuum. The value of the top-quark mass is thus essential to state if our Universe is stable or not). For all these reasons, a precise determination of the top-quark mass is crucial in the SM.

The top-quark mass is now measured with a good precision, around 0.5%, using well-developed “standard” methods. Despite this precision, a lot of open questions remain. Indeed since the top quark is a coloured object, it is non trivial to know which mass is really measured using these standard methods. In all standard methods, a Monte Carlo (MC) simulation is used to calibrate the measurements. It is not obvious to relate the mass implemented in MC generators to the mass used in theory for the consistency checks of the SM. A way to overcome these limitations experimentally is to determine the top-quark mass using alternative methods. Such methods can use less inputs from MC or can have different sensitivity to systematic uncertainties than the standard analyses. In particular standard methods are usually limited by the uncertainty on jet energy calibration and b tagging.

As an example, a very promising alternative possibility is to measure the top-quark mass in events where one of the two top quarks decays in the leptonic channel with a J/

Keywords

LHC, ATLAS, top quark mass

Skills

Softwares

C++, Root