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Contribution ID: **4404** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

(G*) Establishing evidence for the Higgs boson dimuon decay using the ATLAS detector

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The Large Hadron Collider (LHC) at CERN, is the largest and most powerful particle collider in the world, and the only machine capable of producing Higgs bosons. Interactions with the Higgs field gives particles mass, and a particle's coupling with the Higgs boson is proportional to its mass. The Standard Model particles that make up matter can be grouped into different generations, and previous measurements of Higgs' couplings have focused on the third generation of particles, which are the most massive. The best opportunity to measure the Higgs coupling to a second-generation particle at a lower, untested mass scale is by measuring the Higgs boson decay into two muons.

The Higgs to dimuon decay is a very rare process, and there are many other processes that can mimic this signature, making it very difficult to measure. Advanced methods are required to identify this small signal from a large continuous background in the data collected by the ATLAS detector at the LHC. An important technique to increase the signal-to-background ratio is splitting the data into distinct categories, based on the properties and kinematics of the events. The Higgs signal can then be extracted separately from several datasets with different signal-to-background ratios, resulting in a large increase in overall statistical significance of the measurement. Using the latest advancements in machine learning, I will use a deep neural network (NN) to optimize these categories. Various observables measured by the ATLAS detector will be provided to this NN, and it will determine the optimal way to separate the data into categories to maximize the statistical significance.

After the data has been split into optimal categories, the Higgs boson resonance peak can be extracted from the background. With improvements in analysis techniques and data currently being taken during Run-3 of the LHC, we hope to measure the Higgs to dimuon production with at least 3 sigma significance at the ATLAS detector, which would establish evidence for this process.

Keyword-1

Collider Physics

Keyword-2

Higgs Boson

Keyword-3

Machine Learning

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