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# Absolute calibration of jets and search for new physics with the ATLAS experiment

- Thèses, Stages, Formation et Enseignement - Propositions de thèses antérieures - Propositions de thèses 2019 -



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**Title:** Absolute calibration of jets and search for new physics with the ATLAS experiment

**Advisor:** [Mélissa Ridel](#)

**Co-advisor:** [Bogdan Malaescu](#)

**Team:** Masses et Interactions Fondamentales ; expérience : ATLAS

## Description:

The LHC, the Large Proton Collider, at CERN in Geneva will close the data taking period at 13 TeV in the centre of mass, the greatest energy for a collider up to now, by the end of the year 2018. Then, the machine will be stopped for 2 years, period called LS2 before a new data taking season, the Run III, which will coincide with the beginning of the third year of this PhD.

The ATLAS experiment is installed on the LHC beams and is able to explore the phenomena, which take place at very high energy using the huge amount of data delivered by the LHC. In particular, ATLAS with the other LHC experiment, CMS, discovered the Higgs boson in 2012. This particle is necessary to get, dynamically, masses to elementary particles of the Standard Model.

The ATLAS team from the LPNHE lab has known expertise on both jets reconstruction and calibration, as on electrons and photons. People from the team are involved in several publications in Run I and Run II like the Higgs discovery, precision measurement with jets in the final states or precision measurement of different standard model parameters. A complete understanding of the standard model processes is required to search for new physics due to similar final states. The measurement with the best possible precision of the energy of the different objects reconstructed in the detectors is of the most important matter both for precision measurement and to increase the sensitivity of new physics searches beyond the Standard model. The PhD subject proposed below is equilibrated between those two aspects through the study of jet events in the final state within the ATLAS detector. Parts of those events are used to improve the jet energy calibration, which is a main component for counting analyses or for those with a veto on jets. The Run II with its new and busier data taking condition imposes to redefine the jet energy calibration strategy to keep the knowledge of the jet energies with the % level. **The LS2 period is a unique opportunity to take the time to develop an absolute jet energy calibration, the best way of keeping the jet energy calibration at the same level of precision in the future data taking conditions.** All the improvements which will be in place for the Run III will have an impact on several ATLAS analysis and publications.

In addition, the differential cross section of multijet events production is measured as a function of several observables and compared to theoretical predictions. Those measurements are used to test QCD predictions and are also sensitive to a signal beyond the Standard Model like the presence of supersymmetric particles to possibly explain dark matter or the discovery of a new type of interaction.

A pre PhD internship with the team that proposes to welcome the student is recommended to learn about the project and the different necessary tools used in the ATLAS collaboration.

**Contacts :** [Mélissa Ridel](#), Tél: 33 (0)1 44 27 37 68, [Bogdan Malaescu](#)

**Possible trips:** CERN