

<https://lfnheweb3.in2p3.fr/spip.php?article1562>

Jet calibration, cross-section measurements and alpha_S extraction at ATLAS and at the Future Circular Collider at CERN (FCC-ee)



Date de mise en ligne : Thursday 5 November 2020

- Thèses, Stages, Formation et Enseignement - Propositions de thèses 2021 -

Copyright © LPNHE - UMR 7585 - All rights reserved

Title: Jet calibration, cross-section measurements and alpha_S extraction at ATLAS and at the Future Circular Collider at CERN (FCC-ee)

Supervisor: [Luc Poggioli](#)

Co-supervisor: [Bogdan Malaescu](#)

Team: Masses and fundamental interactions; ATLAS et FCC groups

Description:

The evaluation of the strong coupling constant α_S and the test of its running as a function of the energy scale, as predicted by the renormalisation group equation in QCD (RGE), can be done using jet cross section measurements. We propose to perform such studies using data accumulated by ATLAS mainly during the Run 2 of the LHC, with a possible extension to also use data collected during Run 3 (foreseen to start in March 2022). With the increase in the accumulated luminosity, allowing for small statistical uncertainties even in the case of multi-dimensional cross-section measurements, it becomes more and more important to also reduce the systematic uncertainties as much as possible. This will be achieved by performing an absolute jet in-situ calibration, where physics and detector effects are well factorised. Such method will allow to rely less on the use of Monte Carlo simulation (MC), compared to the current relative jet in-situ calibration that uses extensive comparisons between data and MC. Indeed, while the current relative in-situ calibration method applied to the jets in data uses MC for describing both detector and physics effects in various event topologies, the absolute calibration method will use MC for describing the physics effects while the determination of the detector response will be fully data-driven. Methods for extracting α_S and testing its RGE will also be studied in the context of the design studies for the FCC-ee collider, with the corresponding detectors. For this purpose, event topologies with a hard photon emitted from the initial state particles (ISR) and several jets in the final state will be considered. Ratios of cross-sections with different jet multiplicities in the final state will allow to reduce the impact of systematic uncertainties. The use of the ISR method will be facilitated by the high luminosity foreseen at the FCC-ee. This will allow for a good understanding of the systematic uncertainties, when performing measurements on a broad range of the energy of the final state particles, with the same detector and collider conditions. Studies to optimise the detector design in view of such measurements will be performed.

Possible trips: CERN

Contacts:

- [Luc Poggioli](#), 33 (0)1 44 27 73 81
- [Bogdan Malaescu](#), 33 (0)1 44 27 91 30

Documentations:

- [ATLAS](#)
- [FCC](#)