Canadian Association of Physicists
Association canadienne des physiciens et physiciennes

Contribution ID: **2517** Type: **Oral Competition (Graduate Student) / Compétition orale (Étudiant(e) du 2e ou 3e cycle)**

Vector Boson Scale Factor Measurement with the ATLAS Detector

Monday 3 June 2019 11:30 (15 minutes)

Scale factors (SF) are powerful tools for any particle physics analysis. They provide a clean way of estimating particle identification uncertainty. A SF is defined as the ratio of particle identification efficiency in data to Monte Carlo (MC) simulation. From the SF definition, correlations between systematic uncertainties in data to MC may be cancelled, thereby reducing the systematic uncertainty on a measurement. Because the SF is applied directly to the measurement of a particle production cross-section, understanding the particle identification efficiencies and minimizing the systematic uncertainty are of primary importance. In this study, a W or Z vector boson is identified by its hadronic decay products using tagging techniques on jet substructure observables from the ATLAS detector. The observables implemented are mass and energy correlation fractions, which are functions based on transverse momenta and pair-wise angles between decay particles. After tagging a particle as a W or Z boson, fits with defined functional forms are done on the signal and background distributions in MC. The fits are then applied to data and the tagging efficiencies are extracted. SF measurements and results from the ATLAS detector at CERN using 2015-2018 data will be presented.

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Session Classification: M1-2 Exploring the energy frontier (PPD) | Explorer la frontière d'énergie (PPD)

Track Classification: Particle Physics / Physique des particules (PPD)