ID de Contribution: **18** Type: **Non spécifié**

Multivariate analysis of the EW gauge bosons' polarisation at the LHC with the ATLAS experiment

lundi 1 décembre 2025 14:20 (25 minutes)

My thesis subject is the study of the polarisation of electroweak gauge bosons. The longitudinally polarised state is highly correlated to the Goldstone boson, so before the electroweak symmetry breaking, thus allows us to test the limit of the Standard Model prediction. The challenge of this observation of simultaneously produced bosons, called Vector Boson Scattering, is the very low cross-section.

During my PhD, I focused on the development of deep neural network (DNN) optimisation for signal vs background discrimination and polarisation state determination for EW-WZjj. I proved that we can outperform the previous machine learning based method that was present in our framework. I set up the fit with a subset of systematic, and we can compute the significance for the observation of the joint polarisation EW-W0Z0jj as well as the single polarisation state.

This will result in a fit of Run-2 and partial Run-,3, making it the first study on this channel of VBS. The limited statistic is a key concern regarding this analysis and therefore only serves as a first step toward a full measurement using the data of the High-Luminosity LHC, increasing greatly the number of collisions per bunch crossing (pile-up, μ). This new era will bring several upgrades to the ATLAS detector as the replacement of the current Inner Detector by the Inner Tracker, enhancing the coverage in pseudorapidity η up to 4.0 (instead of 2.5).

In this context, I work on my qualification task in order to be a qualified author on the identification of these new forward electrons with a machine learning based technique using the p_T uncorrelation technique, making the output less p_T-dependent. This also comprises a calibration.

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Classification de Session: Standard Model

Classification de thématique: Standard Model