T 3: Standard Model Physics I

Time: Monday 16:15–18:00 Location: KH 00.014

T 3.1 Mon 16:15 KH 00.014

Strategy for constraining multi-parton interactions at the LHC using Z boson events — •Ek-ong Atthaphan and Ynyr Harris — University of Bonn, Bonn, Germany

Multi-Parton Interactions (MPI) occur in every proton-proton collision at the CERN Large Hadron Collider and play a crucial role in the modelling of soft QCD processes and observables at low momentum transfer. In particular, an accurate description of Z-boson production at low transverse momentum requires a detailed understanding of MPI effects. In this talk, a novel method for directly measuring the number of MPI scatters in individual pp events is presented. The MPI multiplicity is extracted from a fit to the azimuthal two-particle correlation function. A comparison of this method applied to ATLAS data and Pythia Monte Carlo simulations demonstrates sensitivity to the MPI model parameters $p_{T,0}$ and $p_{T,min}$, providing new constraints on their values for LHC collisions.

T 3.2 Mon 16:30 KH 00.014

Phenomenology of heavy flavour jet angularities at hadron colliders — Andrea Ghira[1], Lorenzo Mai[2], Simone Marzani[2], Daniel Reichelt[3], Steffen Schumann[4], and •Leon Stöcker[4] — [1]Technical University of Munich, TUM School of Natural Sciences, Physics Department, Garching, Germany — [2]Dipartimento di Fisica, Universita di Genova and INFN, Sezione di Genova, Italy — [3]CERN, Theoretical Physics Department, Geneva, Switzerland — [4]Institut für Theoretische Physik, Georg-August-Universität Göttingen, Germany

We compute resummed and matched predictions for jet angularities in hadronic Z+jet events, where the jet is initiated by a b quark. The analysis is performed both with and without grooming the candidate jets using the SoftDrop algorithm. Mass effects are consistently included at both fixed-order and resummed levels. Our theoretical predictions also incorporate non-perturbative corrections from the underlying event and hadronisation, implemented through parton-to-hadron transfer matrices extracted from dedicated Sherpa Monte Carlo simulations. Finally, we compare our results with previous implementations in order to quantify the impact of mass effects.

T 3.3 Mon 16:45 KH 00.014

Triple differential Z+Jet cross section measurement — •Cedric Verstege and Klaus Rabbertz — Institute of Experimental Particle Physics, Karlsruhe Institute of Technology, Germany

We present a measurement of the triple-differential production cross section of Z($\to \mu\mu$)+jet events in proton-proton collisions at $\sqrt{s}$ = 13 TeV recorded with the CMS detector during Run 2, corresponding to 138 fb^{-1}. The cross section is measured simultaneously in three dimensions defined by the transverse momentum of the muon pair, half of the absolute rapidity separation between the muon pair and the leading jet, and the rapidity boost of their center-of-mass system. This choice of observables provides sensitivity to the scattering angle and to the fractional momenta of the initial-state partons. After unfolding for detector effects, the results at particle level are compared to NNLO QCD predictions supplemented with electroweak and non-perturbative corrections, as well as to predictions from state-of-the-art Monte Carlo event generators.

T 3.4 Mon 17:00 KH 00.014

Estimation of α_s from dijet/Z+jet CMS data — •Johannes Gässler — Schlossgartenstraße 52, 76327 Pfinztal, Germany

In a recent CMS analysis (Eur. Phys. J. C 85, 72 (2025)) the 2016 multidifferential dijet cross sections were published. This also included fits of the strong coupling constant and the proton structure to the data with results of $\alpha_s = 0.1179 \pm 0.0019$ for the double-differential binning and $\alpha_s = 0.1181 \pm 0.0022$ for the triple-differential binning respectively. I will present the results of a re-analysis of the data using complete NNLO predictions (taken from Phys.Rev.Lett. 135 (2025) 3, 031903) in comparison to the leading-color approximation employed previously. Moreover, I upgraded the xFitter package to the latest version, providing access to improved theory settings. I am extending the analysis to also include CMS Z+jet data with the ultimate goal of a combined fit using both datasets.

T 3.5 Mon 17:15 KH 00.014

Data-driven background estimation in EW VBF-Zjj ATLAS Analysis — •Simone Ruscelli — Technische Universität Dortmund (Germany)

Measurements exploiting weak vector-boson fusion (VBF) processes have become increasingly prominent at the Large Hadron Collider (LHC). Among these are studies of electroweak production of two jets in association with a weak boson (EW Vjj), a process highly sensitive to the VBF mechanism and to the gauge structure of the Standard Model, and potential anomalous weak-boson self-interactions. These measurements rely on precise theoretical predictions and Monte Carlo event generators, which are used to model electroweak processes, optimise event selections, and isolate the electroweak signal from dominant backgrounds. The results presented here employ the ABCD statistical method to estimate the strong-Zjj (QCD Zjj) background in signal-enriched regions, using fits to relevant kinematic distributions. The studies are based on $\sqrt{s}$ = 13 TeV pp collision data collected by the ATLAS detector between 2015 and 2018.

T 3.6 Mon 17:30 KH 00.014

Improvement of Parton Distribution Functions through the ATLAS W-boson Measurement at High Transverse Masses — •Luca Nicastro, Tim Frederik Beumker, Frank Ellinghaus, and Johanna Wanda Kraus — Bergische Universität Wuppertal

High-precision measurements of W bosons at large transverse masses offer sensitivity to the proton*s parton distribution functions (PDFs), particularly in the high Bjorken-x region. In this work, the impact of the recently published ATLAS Run-2 measurement of double-differential charged-current Drell-Yan cross sections at $\sqrt{s} = 13$ TeV is investigated. Using the `xFitter` framework, the study assesses how this dataset can refine existing PDF sets through profiling. Different analysis strategies, including the treatment of lepton channels, the choice between additive and multiplicative electroweak corrections, and the use of charge asymmetries, are systematically compared. The results demonstrate which configurations yield the strongest quantitative constraints on specific PDF components and illustrate these constraints.

T 3.7 Mon 17:45 KH 00.014

Production of hadronically-decaying boosted vector bosons reconstructed as large-radius jets at the ATLAS experiment — •Donna Maria Mattern and Chris Malena Delitzsch — TU Dortmund, Fakultät Physik

At the Large Hadron Collider (LHC), W and Z bosons are often produced with large Lorentz boosts due to the high energies of the proton-proton collisions. When such boosted vector bosons (BVBs) decay hadronically, they are reconstructed as large-radius jets ($R = 1.0$) at the ATLAS experiment. These large-radius jets pass through a chain of different calibration steps, including an in-situ jet energy scale correction to account for differences between data and Monte Carlo simulation, before they can be used in analyses. To separate BVB jets from the much more abundantly produced background jets from quantum-chromodynamic (QCD) processes at the LHC, their substructure is considered, which describes the energy flow within the large-radius jet. Using a neutral-network based tagger that relies on substructure information and is decorrelated with the input large-radius jet's mass, the background events can be suppressed. This talk discusses important aspects of the cross-section measurement of hadronically-decaying BVBs in association with jets.