T 32: QCD (Exp.) 1

Time: Tuesday 16:15–18:15   Location: T-H17

T 32.1   Tue 16:15   T-H17
Measurement and QCD analysis of inclusive jet production in deep inelastic scattering at ZEUS — ●Florian Lorkowski — DESY, Hamburg, Germany

The cross sections of deep inelastic scattering processes at the electron-proton collider HERA are a well established tool to test perturbative QCD predictions. Additionally, they can be used to determine the non-perturbative parton distribution functions of the proton. Measurements of jet production cross sections are particularly well suited to also constrain the strong coupling constant.

In this talk, a measurement of inclusive jet cross sections in neutral current deep inelastic scattering using the ZEUS detector at the HERA collider is presented. The data was taken in the years 2003 to 2007 at a center of mass energy of 318 GeV and corresponds to an integrated luminosity of $344\,\mathrm{pb}^{-1}$. Massless jets, reconstructed using the $k_\perp$-algorithm in the Breit reference frame, are measured as a function of the squared momentum transfer Q^2 and the transverse momentum of the jets in the Breit frame $p_{\perp,\mathrm{Breit}}$.

The measured cross sections are compared to previous measurements as well as NNLO theory predictions. The consistency of the measurement is demonstrated by a simultaneous determination of parton distribution functions and the strong coupling constant.

T 32.2   Tue 16:30   T-H17
QCD and SMEFT analysis of CMS 13 TeV inclusive jet cross section data — ●Toni Mäkelä and Katerina Lipka — DESY, Hamburg, Germany

The parton distributions of the proton, the strong coupling constant and the top quark mass are extracted simultaneously, using the cross sections of inclusive jet production and top quark-antiquark pair production at the LHC at a center of mass energy of 13 TeV. The standard model analysis is performed at NLO and NNLO. In an alternative analysis, the standard model cross section is extended with effective couplings for 4-quark contact interactions at NLO. In particular, left-handed vector-like or axial vector-like colour-singlet exchanges are considered. For the first time, the Wilson coefficients of contact interactions are extracted simultaneously with the standard model parameters using the LHC data.

T 32.3   Tue 16:45   T-H17
Triple-differential measurement of dijet production at $\sqrt{s} = 13$ TeV with the CMS detector — Günter Quast, Klaus Rabbertz, and ●Daniel Savoiu — Institute of Experimental Particle Physics (ETP), Karlsruhe Institute of Technology (KIT)

Jet measurements at high precision are an essential probe of quantum chromodynamics (QCD) and constitute valuable experimental inputs to determinations of fundamental QCD parameters and of the parton distribution functions (PDFs) describing the structure of protons.

In this talk, we present a recent measurement of the dijet production cross section using proton-proton collision data collected at a center-of-mass energy of 13 TeV by the CMS detector at the CERN LHC, amounting to an integrated luminosity of $36.3\,\mathrm{fb}^{-1}$. Jets are reconstructed using the anti-k_T algorithm for radius parameters of $R = 0.4$ and 0.8 and cross sections are measured triple-differentially as a function of the kinematic properties of the two jets with largest transverse momenta. After accounting for detector- and reconstruction-specific effects in a three-dimensional unfolding procedure, the data are compared to theoretical predictions derived at next-to-next-to-leading order in perturbative QCD and the impact of the data for determinations of the proton PDFs and the strong coupling constant α_s is studied.

T 32.4   Tue 17:00   T-H17
Electroweak corrections to high pT jets — ●Mikel Mendizabal and Hannes Jung — DESY, Hamburg, Germany

The production of electroweak (EW) bosons in association with jets has been extensively studied at particle colliders. The EW boson is considered the outcome of the hard process and the jets a product of parton evolution. These events are a great test of quantum chromodynamics and allow to study parton density functions and parton evolution equations. So far, light quarks and gluons are considered in the parton evolution. However, with increasing centre-of-mass energies the probability of radiating heavier particles increases.

In this analysis, the production of EW bosons in association with jets is studied specifically with the aim to investigate EW boson emitted in the parton shower. To this end, events with high transverse momentum jets are studied. Then, the contribution of EW boson emissions is measured.

Preliminary results are presented with data collected in 2016, corresponding to an integrated luminosituy of $36.3\,\mathrm{fb}^{-1}$. The contribution of the Z boson is studied in the leptonic decay channel.

T 32.5   Tue 17:15   T-H17
Triple differential measurement of the inclusive Z+jet production — ●Cedric Verstege, Klaus Rabbertz, and Günter Quast — Institut für Experimentelle Teilchenphysik, Karlsruher Institut für Technologie (KIT)

The triple differential inclusive cross section for Z $(\to \mu\mu)$ + jet production is measured combining CMS Run II data from 2016-2018. The measurement uses the observables p_T^Z, the difference in rapidity between the Z-Boson and the jet y^* as well as the boost of the center of mass system y_b. Those variables allow for a suitable division of the phase space in order to obtain a better sensitivity to the partonic subprocesses.

Detector effects are corrected via a three-dimensional unfolding procedure. The resulting cross section is then compared to QCD theory predictions at next-to-next-to-leading order. The results can be used as constraints for fitting the PDFs.

T 32.6   Tue 17:30   T-H17
Measurement of jet mass distribution of hadronic W and Z bosons — ●Steffen Albrecht[1], Andreas Hinzmann[1], Dennis Schwarz[2], and Roman Kogler[3] — [1]Universität Hamburg — [2]Austrian Academy of Sciences — [3]DESY Hamburg

In this talk we introduce a new effort towards measuring the jet mass distribution of hadronically decaying W and Z bosons.
We study events in which the bosons have a large transverse momentum and thus produce strongly collimated decay products reconstructed as single fat jets. The substructure of such jets proves to be a useful handle in various procedures (e.g. jet calibration, jet tagging), but has room for improvement in its modelling. We aim to gain an in-depth understanding of the substructure by studying the unfolded jet mass distribution in dependence of the jet p_T and substructure tagger discriminants. While previous measurements of jet mass have been carried out for gluon, quark and top jets in dijet, $Z(\mathrm{ll})$+jet and $t\bar{t}$ samples, this is the first study of W and Z jet masses in the processes with $W(qq)$+jets, $Z(qq)$+jets as well as hadronic $t\bar{t}$ systems in the final states.
In addition the measurement of the difference $m_Z - m_W$ will be pursued, setting a first step towards a potential measurement of the W mass with jet substructure.

T 32.7   Tue 17:45   T-H17
Jet Energy Calibration for Ultra Legacy Data with Z+Jet Events at CMS — ●Robin Hofsaess, Daniel Savoiu, Florian von Cube, and Maximilian Horzela — KIT (ETP), Karlsruhe, Germany

High precision analyses in modern particle physics experiments rely on the measurement of jets coming from the particle interactions. Since jets comprise many different particles and the observation of such complex physics objects is affected by detector- and reconstruction-specific effects, sophisticated methods are necessary to get a reliable and accurate calibration of the jet energy.

At CMS, a factorized approach – collectively known as the jet energy calibration – is employed for correcting shifts in the jet energy. An important step in this process exploits events where a jet is balanced against a well-measured reference object such as the Z boson. By comparing the transverse momenta of the two objects, it is possible to determine the absolute jet energy scale, accounting for any residual differences between simulation and data.

In this talk, the methods for the determination of the jet energy scale will be described and the latest results for the legacy calibration of Run II will be presented.

T 32.8   Tue 18:00   T-H17

Differential cross section for $Z\gamma$+jets using the ATLAS detector — •Vincent Goumarre — Deutsches Elektronen-Synchrotron (DESY), Hamburg, Germany

Differential measurements of the production of $Z\gamma$ bosons in association with jet activity in pp collisions at $\sqrt{s} = 13$ TeV are presented in this work, using the full Run2 dataset of 139fb^{-1} collected by the ATLAS detector at the LHC.

Jet activity is a crucial point to study since differential distributions can help constrain important Standard Model (SM) parameters and calibrate models used in inputs in other observables, such as PDFs functions. Moreover, due to the possibility to fully reconstruct the final state, and a large cross section with a small background, $Z\gamma$ is a good candle to test beyond the SM physic, with models such as ALPs or anomalous gauge couplings.

Distributions are measured in a fiducial space with transverse momentum of the photon greater than 30 GeV and considering only events where the Z-boson decays leptonically. The sum of the dilepton invariant mass and the dilepton plus photons invariant mass has to be greater than 182 GeV to suppress final state radiation.