T 69: Strong Interaction / QCD

Time: Thursday 16:15–18:15 Location: VG 0.110

T 69.1 Thu 16:15 VG 0.110

Measurement of the Z boson production cross-section in association with c-jets at $\sqrt{s} = 13$ TeV with the ATLAS detector — •Stefanie Götz[1], Otmar Biebel[1], Valerio D'Amico[1], Bao Tai Le[1], Lars Linden[1], Tim Rexrodt[1], Celine Stauch[1], and Camilla Vittori[2] — [1]LMU München — [2]CERN

Z boson production cross-section measurements in association with heavy flavour jets are important tests for perturbative quantum chromodynamics (pQCD) and the proton internal structure. This talk intends to show preliminary studies on a new cross-section measurement of the Z boson production using the full proton-proton collision data of Run-2 ($\sqrt{s}$ = 13 TeV) taken by the ATLAS detector at the Large Hadron Collider (LHC). The focus will be on events containing at least one jet originating from a c quark, which may be sensitive to test the hypothesis of the intrinsic charm component of the proton, and a first glance at data-to-Monte Carlo comparison distributions will be provided.

T 69.2 Thu 16:30 VG 0.110

Non-perturbative effects in multidimensional dijet and Z+jet production at the LHC — Stefan Gieseke[1], Maximilian Horzela[2], Manjit Kaur[3], Dari Leonardi[1], Klaus Rabbertz[4], Aayushi Singla[3], and •Cedric Verstege[4] — [1]Institute of Theoretical Physics, Karlsruhe Institute of Technology — [2]II. Institute of Physics, Georg-August Universität Göttingen — [3]Department of Physics, Panjab University, Chandigarh, India — [4]Institute of Experimental Particle Physics, Karlsruhe Institute of Technology,

Comparison of precision LHC data at stable-particle level to the most accurate fixed-order calculations in perturbative QCD requires the latter to be corrected for non-perturbative effects. These effects are studied using Monte-Carlo simulation combining fixed-order predictions with parton showers and non-perturbative models for Underlying Event and hadronization.

The impact of the non-perturbative effects is studied for two well established processes, dijet and Z+jet production. Corresponding measurements may be used for precision determinations of parameters of the SM like the strong coupling constant or the proton structure. Surprising differences of the non-perturbative corrections for both processes in similar 3-dimensional phase spaces are observed. These differences also show a dependence on additional perturbative radiations, showcasing that the naive assumption of a clear differentiation between perturbative calculations and non-perturbative effects does not always hold.

T 69.3 Thu 16:45 VG 0.110

Elastic scattering with the ATLAS-ALFA detector at the LHC — •Per-Oleg Puhl, Hasko Stenzel, and Marko Milovanovic — II. Physikalisches Institut, Justus-Liebig Universität Gießen, D-35392 Gießen

The Absolute Luminosity For ATLAS (ALFA) detector is designed to detect elastic scattering protons under very small scattering angles. Elastic scattering in the very forward direction can be used for the measurement of the total pp cross section and a calibration of the luminosity.

The ALFA detector participated in several special runs of the LHC at high $\beta^\star$. In this talk the ALFA detector will be presented and results from Run 1 and Run 2 will be discussed. Special emphasis in this talk will be placed on the special runs from 2018 with $\beta^\star = 90$ m at $\sqrt{s}$ = 13 TeV, corresponding to an integrated luminosity of 500 nb^{-1}. In these runs the focus is on elastic scattering at large momentum transfer t and in particular on the dip-bump structure of the differential cross section. The precision of the measurement depends crucially on the alignment of the Roman Pot detectors, for which the preliminary results will be presented.

T 69.4 Thu 17:00 VG 0.110

QCD cross-section measurements for astroparticle physics with the LHCb experiment — Johannes Albrecht[1], Hans Dembinski[1], •Lars Kolk[1], Felix Riehn[1], and Michael Schmelling[2] — [1]TU Dortmund University, Dortmund, Germany — [2]Max Planck Institut Heidelberg, Heidelberg, Germany

A long-standing issue in the field of cosmic-ray research is the discrepancy between the observed and simulated numbers of muons in cosmic-ray-induced hadronic showers in the Earth's atmosphere, which are called air showers. This discrepancy is referred to as the Muon Puzzle, as the required changes to existing models in simulation would either violate data constraints or the consistency between air shower simulations and other air shower features.
One explanation for this inconsistency lies in universal strangeness enhancement, which measurements from the ALICE and LHCb experiments show first evidence off. To further study the impact on forward-produced hadrons and to test this universality, proton-ion data from the LHCb fixed target mode are analysed. Of particular interest are proton-oxygen collisions, as they are a good proxy for air showers. Since proton-oxygen data are not yet available, the first step is to bracket oxygen with helium and neon. The current status of this analysis is presented.

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T 69.5 Thu 17:15 VG 0.110

Angular analysis of J/ψ pair central exclusive production with the LHCb experiment — •Ilya Segal and Mikhail Mikhasenko — Ruhr University Bochum, Bochum, Germany

The analysis of the central exclusive production (CEP) provides possibilities to study quantum chromodynamics (QCD). Since the CEP of the double J/ψ system is dominantly carried out through the double pomeron exchange (DPE) mechanism, it can provide an understanding of the role of the pomeron in QCD. The comparison of inclusive and exclusive double J/ψ production mass spectra offers a probe into double parton scattering (DPS) effects, which are absent in exclusive processes. Previously, several intermediate states were observed in the double J/ψ spectrum, such as $T_{cc\bar{c}\bar{c}}$ tetraquark. The angular analysis can shed light on their quantum numbers. In this talk, the first results of the angular analysis based on the data sample of pp collisions collected by the LHCb experiment during Run 1 and Run 2 data-taking periods are presented.

In addition to this, work is done to improve the performance of the general-purpose Monte-Carlo generators such as Pythia, Herwig, etc. for the cases of the DPS and DPE. This can be done using the tuning procedures that involve the Rivet analysis preservation tool. The Rivet plugin is developed for the inclusive double J/ψ production previously measured by LHCb. The performance of this plugin for the test data is also presented in the talk.

T 69.6 Thu 17:30 VG 0.110

$\bar{\Lambda}^0/K^0_S$ production cross-section ratio at LHCb in Run 3 — Johannes Albrecht[1], •Noah Behling[1], Lukas Calefice[2], Biljana Mitreska[1], and Titus Mombächer[3] — [1]TU Dortmund University, Dortmund, Germany — [2]Universitat de Barcelona, Barcelona, Spain — [3]CERN

Hadron production ratios are a useful probe to test and improve hadronisation models. In this work, the production ratio of K^0_S and $\bar{\Lambda}^0$ is studied with Run 3 proton-proton collision data from the upgraded LHCb experiment. These studies are also essential to calibrate and validate the performance of the upgraded detector. The proper operation of all subsystems must be ensured step-by-step to carry out precise measurements with data recorded recently and in the future. The performance of the tracking system can be evaluated with the measured ratio.

Meson-to-baryon ratios and strangeness production also contribute to the understanding of hadronic processes in cosmic-ray-induced extensive air showers, which are dominated by soft-QCD effects in the forward region. In air-shower data, an excess of muons produced with respect to Monte Carlo event generators has been observed, which could originate from mismodelling of the hadronisation process. The LHCb experiment offers a unique environment to test hadronic models in the forward region.

The current status of the analysis and recent studies on detector performance will be presented. Additionally, the connection of collider experiments to air-shower measurements will be discussed.

T 69.7 Thu 17:45 VG 0.110

Partial-Wave Analysis of $\tau^- \to \pi^-\pi^-\pi^+\nu_\tau$ at Belle II — •Claudia Perez-Orive[1], Stefan Wallner[1], Hans-Günther

Moser[1], Stephan Paul[1,2], Daniel Greenwald[2], and Andrei Rabusov[2] — [1]Max Planck Institute for Physics — [2]Technical University of Munich

$\tau^- \to \pi^-\pi^-\pi^+\nu_\tau$ decays measured at the Belle II experiment at the SuperKEKB e^+e^- collider offer a clean environment to investigate light mesons. We perform a detailed partial-wave analysis to precisely study the meson resonances appearing in the 3π system, including the $a_1(1260)$ and the $a_1(1420)$ signal observed by COMPASS.

We will present input-output studies using simulated data where we investigate resolution effects and effects caused by the unmeasured direction of the τ lepton on the partial-wave analysis. Additionally, we study how the fit depends on its initialization.

T 69.8 Thu 18:00 VG 0.110

Lattice determination of the higher-order hadronic vacuum polarization contributions to the muon g-2. — •Arnau Beltran Martínez[1] and Hartmut Wittig[1,2] — [1]PRISMA+ Cluster of Excellence and Institut für Kernphysik, Johannes Gutenberg-Universität, Mainz, Germany — [2]Helmholtz-Institut Mainz, Johannes Gutenberg-Universität, Mainz, Germany

We present initial results from a lattice QCD computation for the next-to-leading order (NLO) contribution to the hadronic vacuum polarization (HVP) of the muon $g-2$. Our approach is based on the time-momentum representation (TMR) involving three kernels needed to compute the different NLO HVP diagrams, following the framework developed by Balzani, Laporta and Passera.

For the NLO corrections involving extra photon or lepton lines, we present analytical series expansions for small values of the Euclidean time and numerical series expansions for the large time values. The NLO diagram with two QCD insertions is solved analytically and expanded across different regions of the two-dimensional Euclidean time plane.

These results are then combined with lattice QCD calculations of the vector correlator performed on more than 30 gauge ensembles using $O(a)$-improved Wilson quarks. To control the continuum limit, we implement two improvement schemes, each combining two discretizations. After correcting for finite-volume effects, we perform a combined chiral and continuum extrapolation to the physical point, yielding a final estimate for a_μ^{hvp}[NLO].