T 59: Elektroschwache Wechselwirkung I

Zeit: Mittwoch 16:30–18:20 Raum: Z6 - SR 1.005

Gruppenbericht T 59.1 Mi 16:30 Z6 - SR 1.005

Muonic X-ray measurements at the Paul Scherrer Institute — •Frederik Wauters — Johannes Gutenberg-Universität Mainz

Muonic X-ray measurements at the Paul Scherrer Institute

Negative muons at rest quickly get captured by nearby atoms in highly exited atomic states. These muonic atoms subsequently de-exite via radiative and Auger transitions until the muon ends up in the 1s orbital. At the lower orbits, there is substantial overlap between the muon wave function and the nucleus, making this system an excellent laboratory to study the interaction between the muon and atomic nucleus. MuX is a renewed effort at the Paul Scherrer to measure muonic X-rays in medium- and high-Z nuclei, fully exploiting the coverage and multiplicity of a germanium detector array and the high yield of negative muons available. The physics program focuses on atomic parity violation (APV). A measurement of the charge radius of 226Ra, derived from the 2s-1s transition energy, will serve as crucial input for an upcoming APV experiment with a single Ra ion. A second measurement program is exploring the possibility of measuring APV directly in muonic atoms. We focus on Z=30 nuclei, where a measurable branching ratio of the single photon 2s-1s transition is expected. APV arrises from the mixing of the opposite parity 2p and 2s atomic states. In the summer of 2017, we successfully commissioned a novel target for the 226Ra charge radius measurement, which is planned to run in 2018. In addition, 2 weeks of beam time were dedicated to observe the 2s-1s transition for the first time, and quantify the background.

T 59.2 Mi 16:50 Z6 - SR 1.005

Studien zum hadronischen Rückstoß für die Bestimmung der Masse des W-Bosons mit dem ATLAS Experiment — •Verena Herget und Raimund Ströhmer — Universität Würzburg

Die Messung der Masse des W-Bosons ist ein zentraler Bestandteil von Präzisionstests des Standardmodells. Mit der Analyse der Daten des ATLAS Experiments bei 7 TeV wurde bereits ein sehr präziser Wert von $m_W = 80.370 \pm 19$ MeV erreicht. Die Präzision kann nun verbessert werden, indem die weiteren Datennahmekampagnen des ATLAS Experiments mit unterschiedlichen Luminositäten und PileUp Profilen ausgenutzt werden, um die systematischen Unsicherheiten zu verbessern. Die Auflösung des hadronischen Rückstoßes, welcher eine Messung der Zerfallskinematik ermöglicht, hat einen großen Einfluss auf den Gesamtfehler. Deswegen ist ein sehr detailliertes Verständnis des hadronischen Rückstoßes essenziell. Durch Ereignisse mit Z-Bosonen kann der Einfluss des PileUps und des Underlying Events auf die verschiedenen Algorithmen zur Messung des hadronischen Rückstoßes untersucht werden. Die unterschiedliche Sensitivität der Algorithmen wird genutzt, um Effekte von PileUp und Underlying Event zu separieren. Außerdem kann eine Kalibrierung der Monte Carlo Simulationen durchgeführt werden, um das gleiche Verhalten, das die Daten zeigen, in der Simulation präzise zu modellieren.

In diesem Vortrag soll ein Einblick in den Zusammenhang zwischen PileUp, Underlying Event und hadronischem Rückstoß gegeben werden und diesbezügliche Unterschiede in Daten und Monte Carlo Simulationen vorgestellt werden.

T 59.3 Mi 17:05 Z6 - SR 1.005

Search for anomalous quartic gauge couplings in the all-jets final state at $\sqrt{s} = 13$ TeV with the CMS experiment — •Steffen Albrecht, Robin Aggleton, and Andreas Hinzmann — University of Hamburg

This talk presents a search for new physics analysing the scattering of weak bosons ($VV \to VV$, where V denotes a $W^\pm$ or a Z boson) produced in association with two jets in pp-collisions at $\sqrt{s} = 13$ TeV. The study of vector boson scattering can help to extend the understanding in the mechanism behind electroweak symmetry breaking and to find new physics by precisely measuring gauge boson couplings.

In this analysis we constrain the anomalous quartic gauge couplings in terms of a framework of dimension-eight effective field theory operators. The all-jets final state at di-boson invariant masses larger than 1 TeV is explored for the first time. The two bosons are highly boosted and each form a single jet, allowing for significant reduction of SM backgrounds.

T 59.4 Mi 17:20 Z6 - SR 1.005

Study of the electroweak $W^\pm W^\pm jj$ process and its experimental challenges — •Giulia Gonella and Karsten Köneke — Albert-Ludwigs-Universität Freiburg

Measurements of the electroweak sector of the Standard Model are a way to probe the mechanism of electroweak symmetry breaking at LHC, and to detect small deviations from the theoretical predictions, through which the effect of new physics could manifest itself. In this context the scattering of vector bosons is a key process. In particular the production of W bosons pairs is a vital test of the mechanism, since its scattering amplitude would increase at high energies violating unitarity, without cancellations of divergences due to exchange involving Z or Higgs boson. The talk will give an overview of the measurements of the WW production of two W bosons with the same electric charge in the signature of two leptons, missing transverse energy and two jets with the ATLAS experiment at the LHC. The same-charge requirement leads to a better suppression of the QCD background, but is experimentally more challenging due to the contributions from opposite-charge di-lepton production processes, where the charge of one electron is wrongly reconstructed. The talk will finally focuse on the procedure and techinques applied to estimate this intrumental background using data, and will illustrate its challenges and its impact on the measurement of WW scattering.

T 59.5 Mi 17:35 Z6 - SR 1.005

Reconstruction of the $\tau\tau$ system for Higgs and Z boson property measurements — David Brunner, Jordy Degens, Peter Fackeldey, Olena Hlushchenko, Wolfgang Lohmann, •Johannes Merz, Thomas Müller, Alexander Nehrkorn, Claudia Pistone, Dennis Roy, Hale Sert, Achim Stahl, and Dominik Wolfschläger — III. Physikalisches Institut B, RWTH Aachen University

When reconstructing characteristics of particles decaying into a pair of two τ leptons, the four-momenta need to be accessed. These quantities need to be reconstructed, which poses challenges because of undetectable neutrinos. The currently used algorithm in CMS for the reconstruction of these quantities in $H \to \tau\tau$ and $Z \to \tau\tau$ events is updated with a new version, where improvements were implemented, e.g. a constraint on the boson mass, which will lead to an improvement in resolution. Comparison studies were performed to evaluate the performance gain and will be presented in this talk. A small outlook on further developments of the algorithm is presented additionally.
Polarisation of τ leptons is a particularly interesting measurement, as it allows to access the weak mixing angle $\sin\theta_W$. This requires access to the spin information of the τ leptons, which in turn depends on the ability to reconstruct angular quantities of the τ leptons, which will be provided by the algorithm described above and will make great use of the implemented improvements. The knowledge gained in such a polarisation measurement might also prove fruitfull in a $H \to \tau\tau$ CP analyses.

T 59.6 Mi 17:50 Z6 - SR 1.005

Search for the production of *WVZ* processes in leptonic final states at 13 TeV in ATLAS — Julien Caudron[1], Markus Cristinziani[1], Mazuza Ghneimat[1], Carlo A. Gottardo[1], Sebastian Heer[1], Vadim Kostyukhin[1], Ö. Oğul Öncel[1,2], Arshia Ruina[1], and •Andrea Sciandra[1] — [1]Physikalisches Institut, Universität Bonn — [2]Institut für Kernphysik, Universität zu Köln

The triboson production is one of the key processes for studying quartic gauge couplings. Next-to-leading order corrections are mandatory to reduce theoretical uncertainties: the QCD correction is about 100%.

I will discuss the development of a new ATLAS analysis aiming to measure on-shell *WWZ* and *WZZ* cross-sections, as the production of triboson processes is becoming accessible at LHC Run 2. The analysis selects events with three or four reconstructed light leptons. The main challenge is the reduction of main backgrounds, i.e. *WZ* in the three-lepton channel and *ZZ* in the four-lepton final state. Multivariate techniques are explored, as well as data-driven methods, to estimate the contribution of non-prompt and fake leptons.

T 59.7 Mi 18:05 Z6 - SR 1.005

Measurement of the scattering of electroweak gauge bosons in the like-charge WWjj final state with the ATLAS detector

at the LHC — •Stefanie Todt, Franziska Iltzsche, Joany Manjarres, Carsten Bittrich, Tim Herrmann, and Michael Kobel — IKTP, TU Dresden

Since the discovery of a SM-like Higgs boson, the scattering of massive weak vector bosons (VBS) has been a further yet missing piece in the Standard Model puzzle. Due to the best signal to background ratio, the $W^{\pm}W^{\pm}$jj channel is the most favourable final state for studying VBS at a hadron collider such as the LHC. VBS in this channel contains processes with triple and quartic electro-weak (EWK) couplings, as well as Higgs exchange processes. The Higgs contribution is crucial as it ensures unitarity of the scattering amplitude of VBS. Therefore it represents an optimal physics process to probe the non-abelian structure of the EWK Standard Model and at the same time serves as complementary approach to study the EWK symmetry breaking mechanism. We present the analysis of $W^{\pm}W^{\pm}$jj VBS conducted at the ATLAS experiment with data taken at $\sqrt{s} = 13\,\text{TeV}$ in Run-2 of the LHC. Major goals include the observation of the scattering process. A further aim is the measurement of the fiducial cross section of the EWK process which involves the development of a decent understanding of the theoretical predictions. A further critical analysis component constitutes the estimate of major backgrounds. These include instrumental mismeasurements which are insufficiently described by simulations and therefore need the employment of data-driven approaches.