HK 30: Hadron Structure and Spectroscopy V

Zeit: Mittwoch 14:00–16:00 Raum: HZO 50

Gruppenbericht HK 30.1 Mi 14:00 HZO 50

Feasibility studies for the measurement of time-like, electromagnetic form factors of the proton at PANDA-FAIR — Samer Ahmed[1], Luigi Capozza[1], Alaa Dbeyssi[1], Phillip Grasemann[1], Frank Maas[1,2], Oliver Noll[1], David Rodriguez Pineiro[1,2], Sahra Wolff[1], Manuel Zambrana[1,2], and •Iris Zimmermann[1] for the PANDA-Collaboration — [1]Helmholtz-Institut Mainz — [2]GSI Darmstadt

One of the main goals of the future PANDA experiment at FAIR (Darmstadt, Germany) is the investigation of the proton structure. Electromagnetic form factors (FF's) are fundamental quantities which parameterize the electric and magnetic structure of hadrons. In the time-like region, proton FF's can be accessed experimentally in $\bar{p}p \to l^+l^-$ (l = e, μ) annihilation processes, assuming that the interaction takes place through the exchange of one virtual photon. The expected statistical precision for the measurement of time-like electromagnetic proton form factors with PANDA was investigated in the framework of the PANDARoot software for detector simulation and event reconstruction for both muon and electron channels. These studies investigated the possibility to achieve an optimal signal-background separation and sufficient background suppression of the relevant background channels. Different methods have been used to generate and analyse the processes of interest. The results show, that time-like electromagnetic proton form factors can be measured at PANDA with high statistical accuracy over a large kinematical region.

HK 30.2 Mi 14:30 HZO 50

Monte Carlo Event Generation with Bremsstrahlung in Deep-Inelastic Scattering — •Nicolas Pierre for the COMPASS-Collaboration — Universität Mainz, Mainz, Deutschland

In order to apply QED corrections in the extraction of 1-photon cross-sections in deep-inelastic scattering, radiation of real photons has to be taken into account. In the COMPASS experiment, the production of hadrons is studied by scattering 160 GeV muons off nucleons. In the analysis, the event kinematics are calculated using the measurement of the incoming and scattered muons. Radiation of a real photons before or after the deep-inelastic scattering leads to different kinematics at the interaction vertex. Thus, this radiation has to be taken care of in the Monte Carlo simulation used to obtain the acceptance. The DJANGOH event generator is chosen as it describes well our data and was modified to be used in the Monte Carlo simulation of the COMPASS apparatus. The results for radiative corrections factors for both inclusive and semi-inclusive channels as well as comparison between Monte-Carlo and real data will be discussed.

HK 30.3 Mi 14:45 HZO 50

The axial-vector $a_1(1420)$ as a triangle singularity — •Mathias Wagner, Mikhail Mikhasenko, and Bernhard Ketzer for the COMPASS-Collaboration — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The $a_1(1420)$, a resonance-like signal, was recently observed by the COMPASS experiment in the $J^{PC} = 1^{++}$ partial wave decaying to $f_0(980)\pi$. Fitting a Breit-Wigner form to the spin-density matrix, a mass of 1414^{+15}_{-13} MeV and a width of 153^{+8}_{-23} MeV was extracted [Phys.Rev.Lett. 115 (2015) no.8, 082001].

This talk focuses on the results of applying a new fit model to the data, in which the $a_1(1420)$ is interpreted as a triangle singularity appearing in the rescattering of $K^*\bar{K} \to f_0\pi$. I will explain the fit model and discuss the fit results as well as its statistical uncertainties obtained by applying a bootstrap method. Also the results of systematic studies are presented. The quality of the triangle fit will be compared to the simple Breit-Wigner model.

Supported by BMBF.

HK 30.4 Mi 15:00 HZO 50

ComPWA - The Common Partial Wave Analysis Framework — •Peter Weidenkaff[1], Miriam Fritsch[2], Klaus Götzen[4], Wolfgang Gradl[1], Mathias Michel[3], Frank Nerling[4], Klaus Peters[4], and Stefan Pflüger[3] — [1]Johannes Gutenberg-Universität Mainz — [2]Ruhr-Universität Bochum — [3]Helmholtz-Institut Mainz — [4]GSI Helmholtzzentrum für Schwerionenforschung

One of the main challenges of hadron physics is the search for new hadronic states. Apart from conventional states also exotics, such as glueballs or hybrids, are realizable. In order to experimentally verify and classify hadronic states, an amplitude analysis is often mandatory. The analysis and comparison of data from multiple experiments is particularly interesting.

The new amplitude analysis framework ComPWA was specifically created to satisfy such demands and set new standards in the amplitude analysis frontier. Its modular design allows flexible amplitude analysis and framework extensions, most importantly the physics models and formalisms. Interfaces to the optimization libraries Minuit2 and Geneva are available. The ComPWA framework was already used for analysis of BESIII data. Since ComPWA is not specifically bound to any experiment, amplitude analysis of data from future experiments like PANDA are also awaited.

This talk presents the possibilities of the ComPWA framework, the current status and the ongoing development.

HK 30.5 Mi 15:15 HZO 50

Extended freed-isobar PWA at Compass — •Fabian Michael Krinner for the COMPASS-Collaboration — Technische Universität München

Compass is a multi-purpose two-stage spectrometer that constitutes the longest-running experiment at the CERN SPS at the moment. One of the primary goals of the experiment is to study the spectrum of light mesons. The flagship channel for this kind of analysis is the diffractive process $\pi^- p \to \pi^-\pi^+\pi^- p$, for which Compass has collected a sample of 46×10^6 events.

In order to extract 3π resonances from these data, a partial-wave analysis is performed. This analysis is based on the isobar model and relies on the complete knowledge of the dynamic amplitudes of the $\pi^+\pi^-$ resonances (isobars) that appear in the subsystems. In order to reduce the model-dependence that is introduced by the employed fixed parameterizations of the isobar amplitudes, we developed a novel method, the freed-isobar PWA, which allows to extract the dynamic isobar amplitudes directly from the data. We will discuss results obtained for waves with $J^{PC} = 3^{++}$ and 4^{++}.

This work was supported by BMBF, the DFG Cluster of Excellence "Origin and Structure of the Universe" (Exc 153), and the Maier-Leibnitz-Laboratorium der Universtiät und der Technischen Universität München

HK 30.6 Mi 15:30 HZO 50

Diffractively produced final states $\eta\pi$ and $\eta'\pi$ in the COMPASS experiment. — •Rocio Reyes Ramos, Mikhail Mikhasenko, and Bernhard Ketzer — Universität Bonn, Helmholtz-Institut für Strahlen- und Kernphysik, Bonn, Germany

The COMPASS experiment at CERN uses a 190 GeV/c π^- beam scattered off a hydrogen target to study the excitation spectrum of light isovector mesons. The final states $\eta\pi$ and $\eta'\pi$ are particularly interesting, because waves with odd angular momentum between the two pseudoscalar mesons must have spin-exotic quantum numbers. An earlier COMPASS analysis [1] exhibited clear structures in the P-waves of both final states, which could be signs of hybrid mesons with gluonic degrees of freedom.

In addition to resonance decay there is, however, a large non-resonant contribution to the signal, which becomes dominant for higher invariant masses of the final-state particles. The goal of this study is therefore to extend the previous analysis to higher invariant masses.

Compared to the previous analysis, we make use of an improved reconstruction of charged particles and especially an improved photon reconstruction in the calorimeters, which is expected to increase the data set. In this talk, we will present the status of the event selection and show the improvement with respect to the original analysis.

Supported by BMBF.

[1] The COMPASS Collaboration. Phys. Lett. B 740, (2015)

HK 30.7 Mi 15:45 HZO 50

Analysis of COMPASS data on DVCS — •Johannes Giarra — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Johann-Joachim-Becher-Weg 45, 55099 Mainz

In 2016 and 2017 a measurement of the Deeply Virtual Compton Scattering (DVCS) was performed at the M2 beamline of the CERN SPS by

using 160 GeV positive and negative charged muon beams scattering off a liquid hydrogen target. The scattered muons and the produced real photons were detected by the COMPASS spectrometer, which was supplemented by an additional electromagnetic calorimeter for the detection of large angle photons. The recoil protons were detected by the CAMERA detector, which consists of two barrels of scintillators surrounding the 2.5 m long target. The time of flight (TOF) measurement performed by the detector is used to identify the protons.
To select the DVCS events after track reconstruction a precise determination of the target position is necessary. Also for a precise determination of the muon flux, which is needed for the calculation of the cross section, the position of the target is crucial.
The talk will cover a method to precisely determine the target position and will show its influence on the muon flux.