HK 42: Hadron Structure and Spectroscopy VII

Time: Wednesday 14:00–15:30 Location: HK-H8

Group Report HK 42.1 Wed 14:00 HK-H8

Experimental Inputs to the Hadronic Vacuum Polarisation Contribution of the Anomalous Magnetic Moment of the Muon at the BESIII Experiment. — •Riccardo Aliberti for the BESIII-Collaboration — Johannes Gutenberg-Universität

The recent result from the Fermilab Muon $g-2$ Experiment has confirmed the tension between the standard model (SM) prediction of the anomalous magnetic moment of the muon (a_μ) and the experimental measurement at a 4.2 σ level. Currently, the uncertainties on experimental and predicted values are very similar (41×10^{-10} and 43×10^{-10}, respectively) and further improvement in both are to be expected in the next years.
The uncertainty on the SM prediction is dominated by hadronic contributions and particularly by the Hadronic Vacuum Polarisation (HVP) component, which is evaluated with a dispersive formalism from the measurement of hadron production cross sections in electron-positron annihilations.
The BESIII experiment, located at the BEPCII collider in Beijing, collects since 2008 data with center-of-mass energies between 2 and 5 GeV, resulting in the world's largest dataset in e^+e^--annihilations in the τ-charm energy region. In this talk the current status and perspective for the measurement of hadron production cross sections, entering the evaluation of the HVP contribution to a_μ, at BESIII are reviewed.

HK 42.2 Wed 14:30 HK-H8

Small Angle Initial State Radiation Analysis of the Pion Form Factor at BESIII — •Yasemin Schelhaas, Riccardo Aliberti, and Achim Denig for the BESIII-Collaboration — Institut für Kernphysik, Johannes Gutenberg-Universität Mainz, Deutschland

One of the most precisely measured quantities in modern physics is the anomalous magnetic moment of the muon. However, there is a discrepancy of 4.2 standard deviations between the Standard Model (SM) prediction and the average of the latest direct measurements at BNL and Fermilab. This fact is known as the Muon $(g-2)$-puzzle. For the SM prediction the main uncertainty arises from hadronic contributions and can be improved systematically using measurements of hadronic cross sections at e^+e^- colliders. One of the most important processes is $e^+e^- \to \pi^+\pi^-$. Using a data set of $3.2\,\mathrm{fb}^{-1}$ at a center of mass energy of 4.18 GeV, the $\pi^+\pi^-$ cross section is measured at the BESIII experiment located at the BEPCII collider in Beijing, exploiting the initial state radiation technique at small angles. The analysis aims to determine the pion form factor at masses above 0.8 GeV, which is also interesting for hadron spectroscopy. In this talk the current status of the analysis is presented.

Supported by DFG.

HK 42.3 Wed 14:45 HK-H8

A FAIR Phase-0 Project at MAMI — Luigi Capozza[1], Alaa Dbeyssi[1], Alexander Greiner[1], Samet Katilmis[1], Dong Liu[1], Frank Maas[1,2,3], Julian Moik[1], Oliver Noll[1,2], David Rodriguez Piñeiro[1], Christoph Rosner[1], and •Sahra Wolff[1] — [1]Helmholtz-Institut Mainz, Mainz, Germany — [2]Institute of Nuclear Physics, Mainz, Germany — [3]PRISMA Cluster of Excellence, Mainz, Germany

Within the FAIR phase-0 project, the use of FAIR equipment at other facilities before the completion of the civil construction is envisaged. The PANDA EMC is a good candidate for FAIR Phase-0, due to the advanced state of its development. In particular, the backward endcap (BWEC) of the PANDA EMC, which is developed and built at HIM in Mainz, could be ready by 2022, three years before its foreseen installation. Therefore, an experiment at the MAMI electron beam facility making use of the BWEC is envisaged.

The goal is to measure the π_0 electromagnetic transition form factor in virtual Primakoff-kinematics via the electroproduction of a π_0 in the Coulomb field of a heavy nucleus. To select this channel, the momentum distribution of the π_0 needs to be measured by detecting the decay γ particles and the scattered electron in the EMC.

This talk will address the current status of the FAIR Phase-0 experiment at MAMI.

HK 42.4 Wed 15:00 HK-H8

The new Forward Tracker System for the HADES and PANDA Phase-0 experiment — •Gabriela Perez-Andrade[1], James Ritman[2,1], and Peter Wintz[1] for the HADES-Collaboration — [1]Forschungszentrum Jülich — [2]Helmholtzzentrum für Schwerionenforschung

HADES is a fixed-target experiment where proton, pion, and heavy-ion induced reactions are used to study nuclear matter and the properties of baryonic resonances. HADES is in operation at the SIS18 in GSI, Darmstadt, and is part of the phase-0 program of the future FAIR facility. The new Straw Tracking Stations (STS1/2) installed at HADES were built in collaboration with the PANDA experiment. The STS1/2 enlarge the HADES acceptance for hyperon reconstruction in p+p reactions. Each station has four double layers of gas-filled straws. The straw design is based on the PANDA central and forward straw trackers (STT, FT). Four azimuthal orientations of the double layers are used for 3D track reconstruction, and to resolve ambiguities in multi-track events. From pre-commissioning tests, a spatial resolution of 0.13 mm for MIPs was determined. The system was installed at GSI at the end of 2020, and a dedicated commissioning beamtime in February 2021 with proton beams impinging on an LH2 target showed a stable STS operation. The collected data are used to develop the calibration and track reconstruction methods in the experiment analysis software HYDRA. A description of the STS system and a summary of the results from the beamtime will be presented.

HK 42.5 Wed 15:15 HK-H8

Performance Improvement of Deep Machine Learning for the PANDA Software Trigger — •Peiyong Jiang[1,2], Klaus Goetzen[1], Ralf Kliemt[1], Klaus Peters[1], and Frank Nerling[1] for the PANDA-Collaboration — [1]GSI Helmholtzzentrum fuer Schwerionenforschung GmbH, Darmstadt, Germany — [2]Institute of Modern Physics, Chinese Academy of Sciences, Lanzhou, China

Deep machine learning methods have been studied for the PANDA software trigger with data sets from full Monte Carlo simulation using PandaRoot. Following the first comparison of multiclass and binary classification, the binary classification has been selected because of higher signal efficiencies. In total seven neural network types have been compared and the residual convolutional neural network with 4 residual blocks has been chosen. The results of optimized neural networks and those of the conventional method have been compared, showing an efficiency gain of up to 140% for the deep machine learning method. The flatness quality parameters on Dalitz plots and theta-phi projections have been obtained.