T 125: Flavour physics 6

Time: Friday 9:00–10:30 Location: Geb. 30.41: HS 4

T 125.1 Fri 9:00 Geb. 30.41: HS 4

Search for $B \to \mu\nu$ at Belle and Belle II — Florian Bernlochner, Jochen Dingfelder, •Daniel Jacobi, and Markus Prim — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

The leptonic B meson decay of $B \to \mu\nu$ is highly CKM- and helicity-suppressed and represents a challenging signature to identify. Its decay rate is extremely sensitive to new physics contributions from leptoquarks or thus far unidentified charged scalar mediators. Within the context of the Standard Model, its discovery also allows for another avenue to determine the Cabibbo-Kobayashi-Matrix element V_{ub}. Due to the two-body nature of the leptonic decay, however, the muon momentum is fixed in the rest frame of the decaying B meson. By boosting muon candidates into this rest frame frame, a better signal resolution and improved sensitivity can be achieved. For this, however, the full $e^+e^- \to B\overline{B}$ event needs to be analyzed and the kinematic properties of the accompanying B meson need to be reconstructed. This can be achieved with high efficiency using an inclusive reconstruction approach. We present the current status of a search for $B \to \mu\nu$ using the full Belle and Run 1 Belle II data set of 1.07 ab^{-1}. Control studies, using $B^- \to D^0[\to K^-\pi^+]\pi^-$ decays illustrate the accuracy of the employed inclusive reconstruction technique of the accompanying B meson information. The signal extraction relies on a full likelihood combination of both data sets, resulting in improved sensitivity.

T 125.2 Fri 9:15 Geb. 30.41: HS 4

Branching fraction measurement of the rare decays $B^0_{(s)} \to \pi^+\pi^-\mu^+\mu^-$ at LHCb — Johannes Albrecht[1], Thomas Blake[2], •Jan Peter Herdieckerhoff[1], and Biljana Mitreska[1] — [1]TU Dortmund University, Dortmund, Germany — [2]University of Warwick, Coventry, United Kingdom

Rare flavour-changing neutral current decays with $b \to q\ell^+\ell^-$ quark transitions ($q = s, d$) are sensitive probes of the Standard Model and thus among the measurements of interest to the LHCb experiment. Due to smaller CKM factors the $b \to d\ell^+\ell^-$ transition is even more suppressed than the $b \to s\ell^+\ell^-$ transition and therefore, less frequently detected at LHCb. With Run 1 data LHCb measured the decay $B^0_s \to \pi^+\pi^-\mu^+\mu^-$ with a significance of $7.2\,\sigma$. The decay $B^0 \to \pi^+\pi^-\mu^+\mu^-$ was not yet observed, it was measured with a statistical significance of $4.8\,\sigma$. The main contributions to the studied channels are believed to proceed via the resonant decays $B^0_s \to f_0(980)(\to \pi^+\pi^-)\mu^+\mu^-$ and $B^0 \to \rho^0(770)(\to \pi^+\pi^-)\mu^+\mu^-$.

In this talk the current status of the branching fraction measurements of the $B^0_{(s)} \to \pi^+\pi^-\mu^+\mu^-$ decays using $8.9\,\text{fb}^{-1}$ of combined Run 1 and Run 2 data is presented. The possibility of performing a differential branching fraction measurement is explored.

T 125.3 Fri 9:30 Geb. 30.41: HS 4

Search for CP violation in hadronic charm decays — •Serena Maccolini — TU Dortmund University, Dortmund, Germany

A search for the violation of the *CP* symmetry $A_{CP}(h^-h^+)$ in the Cabibbo-suppressed $D^0 \to h^-h^+$ decays with $h = K, \pi$ is performed at the LHCb detector using proton-proton collisions recorded from 2015 to 2018 at the centre of mass energy of 13 TeV. The data used corresponds to an integrated luminosity of 5.7 fb^{-1}. The flavour of the charm mesons is defined from the charge of the pion in $D^{*+} \to D^0\pi^+$ and $D^{*-} \to D^0\pi^-$ decays. Instrumental effects are evaluated through the calibration of high-statistics control samples (with negligible *CP* violation) in order to emulate the detector response for the signal candidates.

The precision of the measurements is limited by the size of the control samples after the calibration procedure. An overview on alternative techinques and future measurements is also reported.

T 125.4 Fri 9:45 Geb. 30.41: HS 4

Charm-Quark Mass in the Heavy Quark Expansion — •Anastasia Boushmelev[1], Thomas Mannel[1], and K. Keri Vos[2] — [1]Theoretical Particle Physics, Center for Particle Physics Siegen, University of Siegen — [2]Gravitational Waves and Fundamental Physics (GWFP), Maastricht University, Duboisdomein 30, NL-6229 GT Maastricht, the Netherlands and Nikhef, Science Park 105, NL-1098 XG Amsterdam, the Netherlands

The Heavy Quark Expansion is a powerful framework for making predictions for inclusive heavy hadron decays. It is well established for b-decays and for increasing precision several short-distance mass schemes have been invented in the case of the b quark. Though, considering the charm sector, the treatment of the quark mass has to be further investigated as these mass schemes are not suitable in this case. Here we suggest to replace the charm mass, as well as further non-perturbative quantities, directly by q^2 moments based on a similar strategy applied on b-decays using e^+e^- inverse moments [1]. Following this strategy we study the impact on the perturbative series.

[1] A. Boushmelev, T. Mannel and K. K. Vos, JHEP 07 (2023), 175 doi:10.1007/JHEP07(2023)175 [arXiv:2301.05607 [hep-ph]]

T 125.5 Fri 10:00 Geb. 30.41: HS 4

Revisiting $D \to \pi\ell^+\ell^-$ in the Standard Model using LCSR — •Anshika Bansal, Alexander Khodjamirian, and Thomas Mannel — Theoretical Particle Physics, Center for Particle Physics Siegen, University of Siegen

Recently, LHCb has significantly updated the upper bound on the flavour changing neutral current (FCNC) semi-leptonic charm decay ($D^+ \to \pi^+\mu^+\mu^-$). With these updates, it is important to re-analyse the theoretical predictions for this mode as, unlike for the down quark sector, the FCNC for the up-sector are very challenging due to strong GIM suppression of short distance contributions. This leads the branching fraction to be dominated by the long distance effects. In this talk, I will discuss $D \to \pi\ell^+\ell^-$ decays in the U-spin symmetry limit. I will further discuss the use of the method of Light Cone Sum Rules to compute these long distance contributions and the associated challenges. Lastly, I will provide some estimates for the branching ratio.

T 125.6 Fri 10:15 Geb. 30.41: HS 4

Statistical Methods in the Search for Electric Dipole Moments at COSY — •Valentin Tempel for the JEDI-Collaboration — Institute for Nuclear Physics II, FZ Jülich, Germany — III. Physikalisches Institut B, RWTH Aachen University, Germany — GSI Helmholtzzentrum für Schwerionenforschung GmbH, Darmstadt, Germany

The observed matter-antimatter asymmetry in the Universe, which the Standard Model cannot explain, points to the necessity of additional CP-violating phenomena (Sakarov conditions). Particles with Electric Dipole Moments (EDMs) violate both T-symmetry and P-symmetry, implicating CP-violation as well, provided the CPT theorem holds true.

Charged particle EDMs can be measured in storage rings by observing the spin precession of a polarized particle beam. The Cooler Synchrotron (COSY) at Forschungszentrum Jülich provides polarized protons and deuterons up to a momentum of 3.7 GeV/c and offers the possibility to manipulate and measure the beam polarization. The JEDI-Collaboration (Jülich Electric Dipole moment Investigations) is working on the first measurement of the deuteron EDM by observing its influence on spin motion. This presentation will delve into the details of the statistical analysis and fitting methods used to obtain observables, such as the amplitude of the polarization, its corresponding confidence intervals and the spin coherence time.