T 26: Flavor III

Time: Tuesday 17:00–18:30 Location: HSZ/0401

T 26.1 Tue 17:00 HSZ/0401

Multi-lepton B decays within the Standard Model and their impact on LHCb analysis — Johannes Albrecht, Emmanuel Stamou, Vitalii Lisovskyi, and •Jan Peter Herdieckerhoff — TU Dortmund University, Dortmund, Germany

Rare flavour-changing neutral current decays of hadrons to multi-lepton final states are sensitive probes of the Standard Model and thus among the target measurements at LHCb. A reliable Standard Model prediction of their rates is an essential input for the realistic simulation within the LHCb analyses and even more so when analysing decays with non-trivial angular and q^2 dependence.
One such analysis is the most recent search of $B^0_{(s)} \to \mu^+\mu^-\mu^+\mu^-$ performed by the LHCb experiment and published in 2022. The main systematic uncertainty in this search comes from the missing Standard Model prediction. So far, only a simplified phase-space approach was used to simulate signal candidates in the LHCb analysis.
In this talk, we present the computation and results of the Standard Model prediction of the decay $B^0_s \to \mu^+\mu^-\mu^+\mu^-$, and its implementation in the simulation framework `EvtGen`. The impact of this calculation on the LHCb analysis is also evaluated.

T 26.2 Tue 17:15 HSZ/0401

Tests of muon-electron universality at the LHCb experiment — •Alex Seuthe and Johannes Albrecht — TU Dortmund University, Dortmund, Germany

The LHCb experiment at the Large Hadron Collider (LHC) specialised in high-precision measurements of flavour physics with hadrons containing b and c quarks. Tests of lepton flavour universality are a sensitive and clean way to probe the Standard Model of particle physics. Any deviations from this universality would be a clear sign of new physics. In this talk, I will present the first simultaneous test of muon-electron universality using the full LHCb Run 1 and Run 2 dataset with the observables R_{K^*} and R_K. These observables are defined as ratios of the branching fractions of the decays $B^0 \to K^{*0}\mu^+\mu^-$ and $B^0 \to K^{*0}e^+e^-$, and $B^+ \to K^+\mu^+\mu^-$ and $B^+ \to K^+e^+e^-$, respectively. This result is the most sensitive test of lepton flavour universality with rare b decays to date.

T 26.3 Tue 17:30 HSZ/0401

Angular analysis of the decay $B^0 \to K^{*0}\mu^+\mu^-$ with LHCb — •Leon Carus[1], Thomas Oeser[1], Eluned Smith[2], and Christoph Langenbruch[1] — [1]I Physikalisches Institut B RWTH Aachen — [2]Massachusetts Institute of Technology

Flavor Changing Neutral Currents, such as $b \to s\ell^+\ell^-$ transitions, are forbidden in the Standard Model of Particle Physics (SM) at tree-level and may only occur at the loop-level. Angular analyses of $b \to s\ell^+\ell^-$ decays are thus very sensitive to New Physics contributions. A previous measurement of angular observables of $B^0 \to K^{*0}(\to K^+\pi^-)\mu^+\mu^-$ decays, performed by the LHCb collaboration using data collected during Run 1 and 2016, found tensions with SM predictions at the level of 3 standard deviations.

The analysis of the full Run 2 data sample of LHCb, along with improvements of the analysis strategy, is expected to increase the precision of this measurement significantly. This talk will present the status of an update of this analysis, including LHCb data collected in 2017 and 2018.

T 26.4 Tue 17:45 HSZ/0401

Isospin asymmetry in $B \to K\mu^+\mu^-$ decays — Johannes Albrecht, •Fabio De Vellis, Vitalii Lisovskyi, and Biljana Mitreska — TU Dortmund University, Dortmund, Germany

Isospin symmetry is a fundamental property of the Standard Model. It predicts a branching fraction that is almost the same for decays which differ only by one spectator quark, like $B^0 \to K^0\mu^+\mu^-$ and $B^+ \to K^+\mu^+\mu^-$. For these decays a quantity which describes differences in branching fraction, namely the asymmetry, can be defined. This is particularly convenient since it is theoretically clean and it allows to cancel some experimental uncertainties.

Previous measurements on these decays from LHCb and Belle, despite being compatible with expectations, suggested coherent deviations that could be interpreted as statistical fluctuations, or unaccounted theoretical uncertainties, or as a sign of New Physics. In this talk an update of the asymmetry measurement with the full LHCb dataset is presented. This means that data corresponding to an integrated luminosity of 6 fb^{-1} are added to the dataset used in the previous Run 1 analysis. Particular attention is given to the new strategy adopted to calibrate simulation samples to data.

T 26.5 Tue 18:00 HSZ/0401

Neutrino Cross-Section Measurements with the T2K Near Detector — •Liam O'Sullivan for the DUNE-Collaboration — Johannes-Gutenberg Universität Mainz

T2K is a long baseline neutrino oscillation experiment in Japan, measuring electron (anti-)neutrino appearance in a muon (anti-)neutrino beam. As a good understanding of neutrino-nucleus interactions is essential to enable precise oscillation measurements, the T2K near detector complex has been designed to measure neutrino interactions on a variety of nuclear targets for the T2K neutrino beam at a distance of 280m from the beam target. This talk presents an overview of the T2K cross-section measurement strategy in the context of both present and future neutrino oscillation measurements, together with select recent cross-section results.

T 26.6 Tue 18:15 HSZ/0401

Čerenkov ring counting using ensembles of CNNs in ANNIE — •Daniel Tobias Schmid, David Maksimović, Michael Nieslony, and Michael Wurm for the ANNIE-Collaboration — Johannes Gutenberg-Universität Mainz, Germany

The Accelerator Neutrino Neutron Interaction Experiment (ANNIE) is a 26-ton Gadolinium-doped water Čerenkov detector located at the Booster Neutrino Beam (BNB) at Fermilab. The scientific aim of ANNIE is the study of the cross-section and the neutron multiplicity of GeV neutrinos in the BNB.

These measurements will benefit next generation neutrino experiments through the reduction of systematics and understanding the underlying interactions.

This talk focuses on using ensembles of Convolutional Neural Networks (CNNs) to perform Čerenkov ring counting to discriminate single- and multi-ring events. The identification of single-ring events will be used in the ANNIE neutron multiplicity analysis to select an exclusive sample of CC-0π events which are predominantly composed of CC-quasielastic interactions, while simultaneously rejecting more inelastic pion-producing interaction types.