

T 32: Flavour physics VI

Time: Tuesday 16:00–18:30

Location: Tg

T 32.1 Tue 16:00 Tg

Angular analysis of $B_s^0 \rightarrow \phi\mu^+\mu^-$ decays — ●MARCEL MATEROK, CHRISTOPH LANGENBRUCH, and ELUNED SMITH — I. Physikalisches Institut B, RWTH Aachen University

The LHCb experiment at the LHC is dedicated to the search for new phenomena beyond the Standard Model (SM) through precision measurements of heavy flavour decays. Rare semileptonic $b \rightarrow s\ell^+\ell^-$ decays are particularly interesting as they constitute flavour-changing neutral currents that are forbidden at tree-level in the SM and are only allowed at loop-level. These processes are thus rare and are sensitive to the effects of new, heavy particles beyond the SM.

The rare decay $B_s^0 \rightarrow \phi\mu^+\mu^-$ has been previously analysed by the LHCb collaboration using data taken in 2011 and 2012, during Run 1 of the LHC. Further studies of this mode are particularly motivated by recent tensions with SM predictions seen in other rare $b \rightarrow s\ell^+\ell^-$ processes.

This talk will give an overview of the measurement of the angular observables in the $B_s^0 \rightarrow \phi\mu^+\mu^-$ decay using LHCb data collected during Run 1 and 2.

T 32.2 Tue 16:15 Tg

Calibration of Belle II hadronic tagging on Belle data — FLORIAN BERNLOCHNER⁴, THOMAS KUHR^{1,2}, ●KILIAN LIERET^{1,2}, FELIX METZNER³, and MARKUS PRIM⁴ — ¹Ludwig Maximilian Universität — ²Excellence Cluster Origins — ³Karlsruhe Institute of Technology — ⁴Rheinische Friedrich-Wilhelms-Universität Bonn

The Belle II experiment at the SuperKEKB accelerator observes pairs of B mesons. As the center of mass energy is known, the kinematics of one B meson (the signal B) are determined if the other B meson (the tag B) is fully reconstructed.

The tag B meson can be reconstructed in different channels and using different techniques. This analysis considers hadronic B decays reconstructed with the FEI (Full Event Interpretation), an algorithm relying heavily on machine learning techniques.

Because imperfections in the MC simulation may result in a different tag B reconstruction efficiency than in real data, the FEI must be calibrated. By considering a well known decay mode on the signal side (here inclusive $B \rightarrow X\ell\nu$), calibration weights can be calculated.

The calibration is performed for the full Belle dataset of 710fb^{-1} , which has been converted in order to be analyzed with the Belle II software framework. The results of the calibration will be first used for an update of Belle results for $B \rightarrow D^{(*)}\ell\nu_\ell$ decays that profit from the improved Belle II reconstruction software.

T 32.3 Tue 16:30 Tg

Rare baryonic decays at LHCb — JOHANNES ALBRECHT, MAIK BECKER, ●VITALII LISOVSKIY, and JANINA NICOLINI — TU Dortmund
Flavour-changing neutral-current $b \rightarrow s\ell^+\ell^-$ transitions are forbidden at tree level in the Standard Model, and can only occur at loop level. Therefore, they are rare and sensitive to potential New Physics effects.

A number of tensions has been observed in the recent years in such rare decays of mesons containing a b quark ("beauty mesons"). Beauty baryons offer complementary probes owing to their non-zero spin. Baryonic decays often have orthogonal experimental and theoretical challenges, compared to mesonic transitions. LHCb has actively explored the rare decays of the Λ_b baryon, performing angular analyses and lepton universality tests. Decays of other beauty baryons, such as Ξ_b or Ω_b , may offer complementary observables, and are currently being explored. This talk presents an overview of the LHCb physics programme with rare baryonic decays, including recent results and future prospects.

T 32.4 Tue 16:45 Tg

Search for the rare decay $\Omega_b^- \rightarrow \Omega^- \mu^- \mu^+$ at the LHCb experiment — JOHANNES ALBRECHT, VITALII LISOVSKIY, and ●JANINA NICOLINI — Technische Universität Dortmund

At the LHCb experiment several $b \rightarrow s\ell\ell$ transitions, such as $B \rightarrow K\ell\ell$ or $B \rightarrow K^*\ell\ell$, have been studied. They show tensions towards the Standard Model predictions in several observables, such as lepton universality ratios (R_K , R_{K^*}) or angular observables. While the differential branching fractions for mesonic and baryonic decays differ, most of the measurements have been focused on mesons and the Λ_b baryon.

To clarify the nature of the tensions seen for the Λ_b decays, it is important to study $b \rightarrow s\ell\ell$ transitions for other weakly decaying baryons as well.

Therefore the primary aim of this analysis is to observe the decay $\Omega_b^- \rightarrow \Omega^- \mu^- \mu^+$. If successful, the branching ratio relative to the decay $\Omega_b^- \rightarrow \Omega^- J/\Psi (\rightarrow \mu^- \mu^+)$ will be measured.

The used data set corresponds to an integrated luminosity of 6fb^{-1} , which has been taken with the LHCb experiment from 2015 to 2018. In this talk the current status of the analysis is presented.

T 32.5 Tue 17:00 Tg

Search for the rare decay $B^+ \rightarrow \ell^+ \nu_\ell \gamma$ with the Full Event Interpretation at the Belle II experiment — ●LAURA FRANK and PABLO GOLDENZWEIG — Karlsruher Institut für Technologie

Since challenging questions in flavour physics still remain open and indicate possible unrevealed New Physics, the experimental determination of CKM matrix elements and related parameters are of great importance. The e^+e^- collider experiment Belle II at the SuperKEKB accelerator in Japan produces charged and neutral B-meson pairs whose decays offer a great variety of analyses including the rare decay $B^+ \rightarrow \ell^+ \nu_\ell \gamma$. Although no B-factory has yet to observe this decay, the existing measurements provide an important limit on the first inverse momentum λ_B of the light-cone distribution amplitude (LCDA) of the B-meson.

We present preliminary studies of the first search for $B^+ \rightarrow \ell^+ \nu_\ell \gamma$ decays at Belle II, where the signal decay is combined with the exclusively reconstructed tag side provided by the Full Event Interpretation tagging algorithm.

T 32.6 Tue 17:15 Tg

Search for the lepton flavour violating decays $B^+ \rightarrow K^+ e^\pm \mu^\mp$ with the full dataset of the LHCb experiment — JOHANNES ALBRECHT, ●ALEXANDER BATTIG, and ELENA DALL'OCCHO — Technische Universität Dortmund

The conservation of lepton flavour in interactions of charged leptons is an important prediction of the Standard Model of particle physics, making searches for lepton flavour violating decays of B mesons an interesting probe for New Physics. In addition, hints of lepton non-universality in $b \rightarrow s\ell\ell$ transitions (R_{K^+} , R_{K^*0}) imply the violation of lepton flavour conservation. Due to the abundance of produced B-mesons and ability to precisely study them, the LHCb experiment provides an ideal environment for searches for lepton flavour violating decays of B-mesons.

In this talk, the search for the lepton flavour violating decays $B^+ \rightarrow K^+ e^\pm \mu^\mp$ with the LHCb experiment is presented. The analysed data set has been recorded during Run 1 and Run 2 of the LHC and corresponds to an integrated luminosity of 9.1fb^{-1} .

T 32.7 Tue 17:30 Tg

Search for new physics in $B \rightarrow D^{(*)}\tau\nu$ decays — THOMAS KUHR, THOMAS LÜCK, and ●LIANG QIAO — Ludwig-Maximilians-Universität, München

The decays $B \rightarrow D^{(*)}\tau\nu$ are one of the few cases where a significant deviation from the standard model prediction was observed in the experiment. Therefore it is essential to study these decays in as much detail as possible. The expected huge dataset and the sophisticated analysis tools at Belle II will open new analysis techniques to investigate possible violations of lepton universality using Monte Carlo simulations as well as the reconstruction of B mesons. Ideas of an inclusive reconstruction of the second B meson in $Y(4S) \rightarrow B\bar{B}$ events will be presented.

T 32.8 Tue 17:45 Tg

Search for a long-lived particle in b to s transitions at Belle II — ●SASCHA DREYER — DESY Belle II

The Belle II experiment at the asymmetric e^+e^- SuperKEKB collider in Tsukuba, Japan allows to perform studies in the B-physics sector as well searches for dark sectors.

A hypothetical new long-lived particle, e.g. a scalar particle that mixes with the Standard Model Higgs boson, could serve as a portal to dark sectors. This particle could be produced in B meson decays

via b to s quark transitions and decay to pairs of charged Standard Model particles. In the scalar portal case, small mixing angles result in a long lifetime on detector scales. The displaced vertex signature can be reconstructed within the tracking detectors.

This talk gives an overview of the search for a new long-lived particle at Belle II, including the reconstruction and selection of signal candidates.

T 32.9 Tue 18:00 Tg

Search for the lepton flavour violating decay $B^0 \rightarrow \tau^\pm \ell^\mp$ — THOMAS KUHR, THOMAS LÜCK, and •NATHALIE EBERLEIN — Ludwig-Maximilians-Universität, München

Lepton flavour is conserved in the Standard Model, but violated in many new physics models. An observation of the $B^0 \rightarrow \tau^\pm \ell^\mp$ decay, where $\ell = e/\mu$, would be a clear sign for new physics.

At B factories one can determine the kinematics of the signal B meson by fully reconstructing the accompanying B meson in $e^+e^- \rightarrow \Upsilon(4S) \rightarrow BB$ events. In the rest frame of the signal B meson the mono-energetic lepton provides a clean signature to identify the signal $B^0 \rightarrow \tau^\pm \ell^\mp$ decays.

This talk presents the current status of the search for $B^0 \rightarrow \tau^\pm \ell^\mp$ decays with Belle data using the Full Event Interpretation algorithm for the reconstruction of the accompanying B meson.

T 32.10 Tue 18:15 Tg

Search for the lepton flavour violating decays

$B^0 \rightarrow K^*(892)^0 \mu^\pm e^\mp$ and $B_s^0 \rightarrow \phi(1020) \mu^\pm e^\mp$

— •JAN-MARC BASELS, ANDREAS GÜTH, CHRISTOPH LANGENBRUCH, and STEFAN SCHAEEL for the LHCb-Collaboration — I. Physikalisches Institut B, RWTH Aachen University, Aachen, Germany

The conservation of lepton flavour in interactions involving charged leptons is a central property of the Standard Model (SM). Thus, every discovery of lepton flavour violation (LFV) would simultaneously be a discovery of new physics.

Designed to study the decays of heavy flavour hadrons, the LHCb detector at the Large Hadron Collider (LHC) at CERN allows for the search for LFV in $b \rightarrow s \ell^+ \ell'^-$ transitions of B -mesons with unprecedented sensitivity. An additional motivation for such searches arises by recent tests of lepton flavour universality (LFU) in rare $b \rightarrow s \ell^+ \ell^-$ decays, which have shown tensions with the SM prediction. Any discovery of lepton flavour non-universality would generally imply the existence of LFV.

This talk presents the status of a search for the LFV decays $B^0 \rightarrow K^*(892)^0 \mu^\pm e^\mp$ and $B_s^0 \rightarrow \phi(1020) \mu^\pm e^\mp$, based on a dataset taken with the LHCb detector during Run 1 and Run 2 of the LHC that corresponds to an integrated luminosity of 9.1 fb^{-1} . Particular focus is placed on the study and control of backgrounds and the determination of expected upper limits on the signal branching fraction.