T 104: Flavor VIII

Time: Thursday 15:50–17:20 · Location: HSZ/0304

T 104.1 Thu 15:50 HSZ/0304
b->c decays at NNLO — •MANUEL EGNER[1], MATTEO FAEL[2], KAY SCHOENWALD[3], and MATTHIAS STEINHAUSER[1] — [1]Karlsruhe Institute of Technology, TTP — [2]CERN, Department of Theoretical Physics — [3]University of Zurich, Physik-Institut

The decay of B mesons can be described in the heavy quark expansion as the decay of a free bottom quark plus corrections which are suppressed by powers of $1/m\_b$. In this talk I will present our NNLO calculations to the decay of free bottom quarks b->c with full charm mass dependence. For the semileptonic decay channel b->clv, we obtain analytic results which can be compared to previous known results obtained via expansions in the mass ratio m_c/m_b. I will also give an outlook on the ongoing calculation of the hadronic decay channels b->cud and b->ccs, where similar calculation techniques as in the semileptonic case are used.

T 104.2 Thu 16:05 HSZ/0304
Measurement of the branching fraction and q^2-spectrum of $B \to D^{**}\ell\nu$ decays at Belle II — •EYLÜL ÜNLÜ, THOMAS LÜCK, and THOMAS KUHR — Ludwig-Maximilians-Universität München

There is currently some tension between the measured value of $R(D^*) = \mathcal{B}(B \to D^*\tau\nu_\tau)/\mathcal{B}(B \to D^*\ell\nu_\ell)$ and the Standard Model prediction, hinting at lepton universality violation. Semileptonic B meson decays to D^{**} mesons are background to the $R(D^*)$ measurement, where D^{**} denotes the orbitally excited P-wave charm mesons: $D_1(2420)$, $D_2^*(2460)$, $D_0^*(2300)$, and $D_1'(2430)$. These decays are not well understood, and there have been discrepancies between past measurements of their yields made by BaBar and Belle. Hence, improved understanding of these decays would reduce an important systematic uncertainty of $R(D^*)$ measurements.

The aim of the present study is to use simulation and data from the Belle II experiment to study these decays, in particular to determine the distribution of $q^2 = (p_B - p_{D^{**}})^2$ which is key to understanding these decays and an important input for theory.

We reconstruct one of the B mesons from the $\Upsilon(4S) \to BB$ decay in the signal channel, $B \to D^{**}(D^*\pi)\ell\nu$. The other B meson is reconstructed in various hadronic modes using the Full Event Interpretation algorithm, which provides a high purity tag B sample with well known kinematics. We identify signal decays by a peak at zero in the $M^2_{missing}$ (missing mass squared) distribution, and do a fit to the mass difference $M(D^*\pi) - M(D^*)$ to extract the D^{**} signal yield.

The current status of the analysis will be presented.

T 104.3 Thu 16:20 HSZ/0304
Studies of $B \to D^{**}\ell\nu$ at Belle II — GERALD EIGEN[1,2], ARIANE FREY[2], and •NOREEN RAULS[2] — [1]Institutt for fysikk og teknologi, Bergen, Norway — [2]II. Physikalisches Institut, Georg-August-Universität Göttingen, Deutschland

To probe the Standard Model, various different measurements can be conducted. One test that can be performed is the determination of the ratio $R(D^{(*)}) = \frac{\mathcal{B}(B \to D^{(*)}\tau\bar{\nu})}{\mathcal{B}(B \to D^{(*)}\ell\bar{\nu})}$, where one limiting factor is the background arising from semileptonic $B \to D^{**}\ell\nu$ decays. Therefore, this analysis attempts to acquire a better understanding of the decay $B \to D^{**}\ell\nu$ as well as measure its branching ratio.
This measurement is based on data collected at the Belle II experiment, which is situated at the asymmetric e^+e^- collider SuperKEKB in Japan, which operates at the $\Upsilon(4S)$ resonance. Thus, the B mesons are always produced in pairs. One of these B mesons is reconstructed employing the hadronic Full Event Interpretation (FEI), which recon-

structs exclusive hadronic B decays. To reconstruct the other B meson, a charged, light lepton is combined with a D^{**}, where multiple hadronic decay modes are considered.
This talk will outline the selection procedure as well as explain a binned maximum likelihood fit to extract the branching ratio. Besides, a brief outlook on future plans will be given.

T 104.4 Thu 16:35 HSZ/0304
Untagged analysis of $B \to \pi\ell\bar{\nu}_\ell$ and $B \to \rho\ell\bar{\nu}_\ell$ and extraction of $|V_{ub}|$ at Belle II — FLORIAN BERNLOCHNER, JOCHEN DINGFELDER, •SVENJA GRANDERATH, and PETER LEWIS for the Belle II-Collaboration — Physikalisches Institut der Rheinischen Friedrich-Wilhelms-Universität Bonn

One of the puzzles of current research in flavor physics is the persisting discrepancy between the results of exclusive and inclusive measurements of the CKM matrix element $|V_{ub}|$. The charmless semileptonic decays $B \to \pi\ell\bar{\nu}_\ell$ and $B \to \rho\ell\bar{\nu}_\ell$ belong to the most accessible and powerful channels for determining $|V_{ub}|$ in exclusive modes. Using data from the Belle II experiment, new precision measurements of $|V_{ub}|$ can be performed. In preparation for this, an untagged measurement method for simultaneously extracting $B \to \pi\ell\bar{\nu}_\ell$ and $B \to \rho\ell\bar{\nu}_\ell$ events is developed. An untagged measurement allows for sufficiently large samples of these rare decays already with the current Belle II dataset. In order to increase the signal purity, boosted decision trees are employed to suppress continuum and $B\bar{B}$ backgrounds. Once the signal events are extracted, $|V_{ub}|$ is determined using the measured partial branching fractions in combination with theory predictions of hadronic form factors. This talk will present the current status of the analysis and $|V_{ub}|$ extraction.

T 104.5 Thu 16:50 HSZ/0304
$B \to \rho\ell\nu_\ell$ Decays with Hadronic Tagging in Belle II Data — •MORITZ BAUER, TORBEN FERBER, and PABLO GOLDENZWEIG — Karlsruhe Institute of Technology (KIT)

Over the last 10 years, a 3σ tension between inclusive and exclusive measurements of the magnitude of the CKM matrix element $|V_{ub}|$ has become apparent in multiple experiments. Semileptonic decays involving $b \to u$ quark transitions present a unique opportunity to measure $|V_{ub}|$ with the current Belle II dataset due to their comparatively high branching fraction.

We present analyses of $B \to \rho\ell\nu_\ell$ decays in Belle II data as steps towards the extraction of this matrix element from exclusive decays. These analyses are conducted with hadronic tagging, an approach in which the second B meson in $\Upsilon(4S)$ decays is reconstructed in a wide variety of hadronic decay chains to increase the selection purity and obtain the recoil of the B-meson decay of interest. This is achieved using a multivariate analysis method, the Full Event Interpretation.

T 104.6 Thu 17:05 HSZ/0304
Leptoquarks at high and low energies — •FELIX WÜST, MARCO FEDELE, and ULRICH NIERSTE — Institut für Theoretische Teilchenphysik (TTP), Karlsruher Institut für Technologie (KIT)

I consider the case that quarks and leptons are unified at some high scale. The so-called flavour anomalies, which have built up in the data of recent years, are usually interpreted in terms of leptoquarks (LQ) with masses in the multiple-TeV range. I present the renormalisation group equations which connect the LQ couplings at the fundamental high scale with those at the low scale probed in the flavour experiments and discuss phenomenological implications.