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Isospin extrapolation as a method to measure inclusive b->sll decays (live)

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Over the last few years, several discrepancies with respect to SM predictions have arisen in studies of exclusive $b \to s\ell^+\ell^-$ decays, where a b-hadron decays into a specific final state. The interpretation for a significant fraction of these discrepancies is clouded by hadronic uncertainties. Inclusive $b \to s\ell^+\ell^-$ decays are regarded to be under better theoretical control, but are less precise experimentally.

Previous measurements of inclusive decays rely on a sum-of-exclusives approach, whereby several specific final states are combined and the result is extrapolated to the full inclusive rate using a hadronisation model. This approach suffers from the systematic uncertainty associated with this extrapolation and is difficult to control. This can be avoided with measurements of fully inclusive decays, whereby only the two leptons are reconstructed. However this approach suffers from large backgrounds.

Here we discuss a new approach to reconstruct inclusive decays involving isospin extrapolation. The idea is to reconstruct a charged kaon and require that it forms a common vertex with the two leptons, resulting in a semi-inclusive $b \to K^+\ell^+\ell^- X$ signature. The presence of the additional kaon allows for greater rejection of background and a well-defined sideband region which can be used to control it.

Measurements of the $b \to K^+\ell^+\ell^- X$ signature require an extrapolation to the fully inclusive rate to account for final states with a K^0 meson. This can be done by assuming using isospin rules for the inclusive decay, which is well established in exclusive B^+ and B^0 $b \to s\ell^+\ell^-$ decays. The extrapolation is expected to provide a complimentary extrapolation to fully inclusive decay rate compared to traditional methods.

The inclusive $b \to s\ell^+\ell^-$ decay rate is approximately one order of magnitude larger than exclusive decays and exists for all b-hadron species. This results in a very large signal yield compared to exclusive measurements which offers potential for very precise measurements in theoretically clean observables, in addition to those affected by hadronic uncertainties. Lepton flavour violation searches and lepton universality tests can be performed on the inclusive decay, where background can be reduced without fear of spoiling the theoretical interpretation. The reconstruction of the kaon also allows for a perfect tagging of the flavour of the b-hadron at decay. This allows for forward-backward asymmetry and CP asymmetry measurements to be performed with similar statistical advantages as for the lepton symmetry tests.

A paper on this would have the following aspects: First by defining the problem and method approach. Then it would detail the main aspects in which background is better controlled with the additional charged kaon. For the theoretically clean observables, discussion on further reducing background and the expected signal yields for the various observables would be estimated. Finally, a discussion on the isospin extrapolation itself will be made. This includes specific issues related to the presence of the diverse admixture of different b-hadron hadron species in the LHC production.

Primary authors: AMHIS, Yasmine Sara (IJCLab (Orsay)); OWEN, Patrick Haworth (Universitaet Zuerich (CH))

Presenter: OWEN, Patrick Haworth (Universitaet Zuerich (CH))

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