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A closer look at the extraction of $|V_{ub}|$ from $B \to \pi l \nu$..

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The Cabibbo-Kobayashi-Maskawa (CKM) element V_{ub} is an important input parameter for the theoretical predictions of many observables in the flavor sector as it is responsible for the CP violating phase within the Standard Model. There exists a long standing tension between the tree-level determinations using the inclusive $B \to X_u l \nu$ decays (where X_u refers to sum over all final state hadrons containing an up quark) and exclusive decays like $B \to \pi l \nu$, known as the inclusive-exclusive puzzle. We relook into the precision extraction of the CKM matrix element $|V_{ub}|$ from the tree level semileptonic $b \to u l \nu_l$ ($\ell = e, \mu$) decays, incorporating all the available inputs (data and theory) on the $B \to \pi l \nu$ ($\ell = e, \mu$) decays including the newly available inputs on the form-factors from light cone sum rule (LCSR) and Lattice QCD (LQCD) approach. We have reproduced and compared the results with the procedure taken up by the Heavy Flavor Averaging Group (HFLAV), while commenting on the effect of outliers on the fits. After removing the outliers and creating a comparable group of data-sets, we mention a few scenarios in the extraction of $|V_{ub}|$. Our best results for $|V_{ub}|^{exc.}$ are $(3.94 \pm 0.14) \times 10^{-3}$ and $(3.93^{+0.14}_{-0.15}) \times 10^{-3}$ in frequentist and Bayesian approaches, respectively, which are consistent with the most recent estimate for $|V_{ub}|^{inc.}$ from Belle-II within 1 σ confidence interval.

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