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UNITARITY TRIANGLE FIT WITHIN AND BEYOND THE STANDARD MODEL*

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We present here the update of the Unitarity Triangle (UT) analysis in the Standard Model (SM). Combining the direct measurements on sides and angles of the UT, we determine the values of the CKM parameters $\bar{\rho}$ and $\bar{\eta}$. Then we generalize the analysis to include possible physics beyond the SM and, in Minimal Flavour Violation (MFV) scenarios, we translate the analysis results into lower limits on the NP scale.

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1. Introduction

We show the UT analysis using the latest determinations of the theoretical and experimental parameters. The basic (*sides*) constraints are $|V_{ub}/V_{cb}|$, Δm_d, Δm_s, and ε_K, while the *angles* ones are α, γ, $2\beta+\gamma$, $\cos 2\beta$ and $\sin 2\beta$ from $B^0 \to J/\psi K^0$ decays [1]. The results related to this analysis are continuously updated at the URL `http://www.utfit.org` which provides also the relevant input quantities, while Refs. [2, 3] describe the procedure followed to extract and combine the constraints.

2. Results of the SM and NP analyses

The determinations of $\bar{\rho}$ and $\bar{\eta}$ are shown in Figs. 1. The global UT fit is now strongly overconstrained, testing in a highly nontrivial way the CKM picture of flavour and CP violation (CPV). Since 2005 [4], comparing the results of the two sets of constraints (angles *versus* sides), there is a discrepancy at 2σ level deriving from a tension between the value of $\sin 2\beta$ and the one of $|V_{ub}|$ from inclusive decays.

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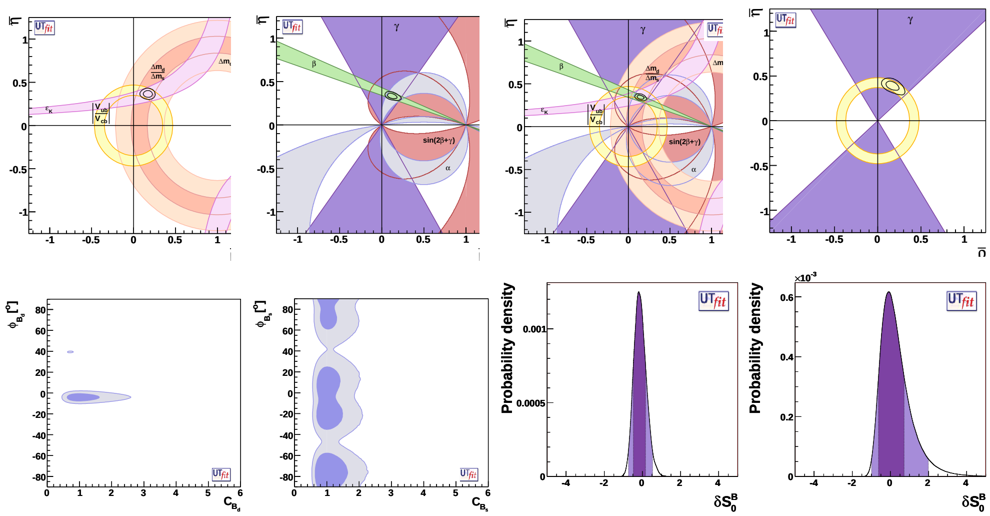

Fig. 1. Top row: the UT using side measurements (left), using angles (middle-left), using all information (middle-right), and including possible generic NP contributions (right). Bottom row: NP parameters C *versus* ϕ in the B_d system (left), and in the B_s one (middle-left), Inami-lim shifts for B systems in small $\tan\beta$ MFV scenarios (middle-right), and in large $\tan\beta$ ones (right). Picture description in [2].

The overconstraining allows to obtain predictions from the UT analysis on possible NP contributions. The mixing processes can be parameterized with two parameters quantifying the difference between the full amplitude and the SM one, so NP effects in $\Delta F = 2$ transitions are included as NP amplitudes $C_{B_{d,s},K}$ and phases $\phi_{B_{d,s}}$ [5]. As Figs. 1 show, the NP contribution in the $b \to d$ transitions prefers a phase close to the SM, pointing either towards MFV models, or towards new sources of flavour and CPV only in $b \to s$ transitions. In MFV, the only source of flavour and CPV is in the Yukawa couplings and all $|\Delta F| = 2$ NP effects are included as modification (Inami-lim shift) of the top (and bottom in case of large $\tan\beta$) quark contribution to box diagrams. We obtain the lower bounds on the NP scale of 5.5 TeV (5.1 TeV) at 95% prob. for small (large) $\tan\beta$ MFV models [6].

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