
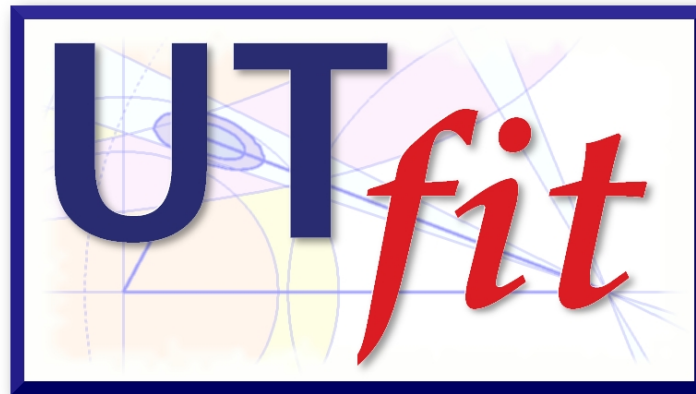


Unitarity Triangle analysis in the Standard Model and beyond from UTfit

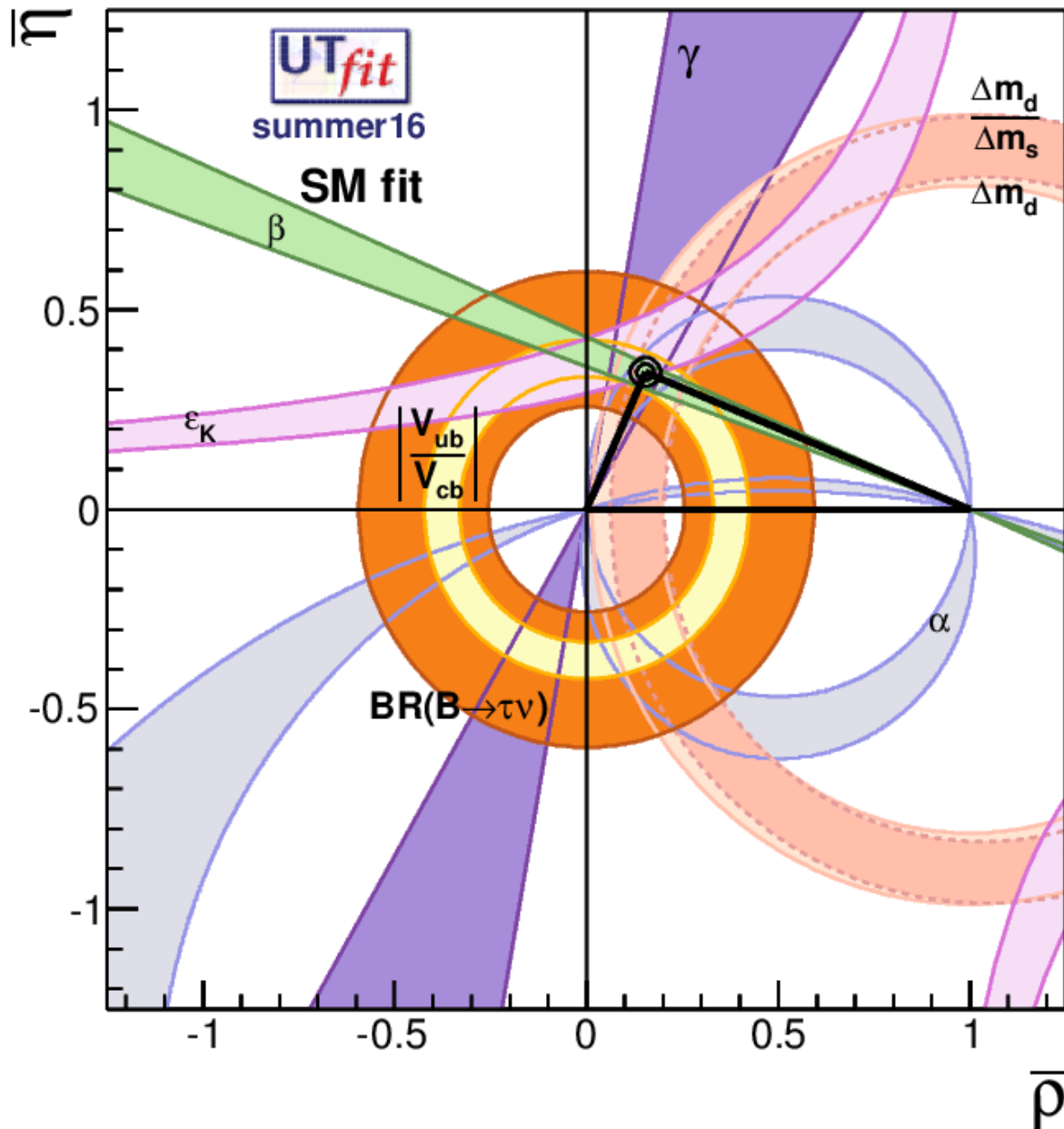
Marcella Bona (QMUL )



www.utfit.org

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Unitarity Triangle analysis in the SM @ ICHEP'16:



levels @
95% Prob

~10 %


$$\bar{\rho} = 0.154 \pm 0.015$$

$$\bar{\eta} = 0.344 \pm 0.013$$

~4%

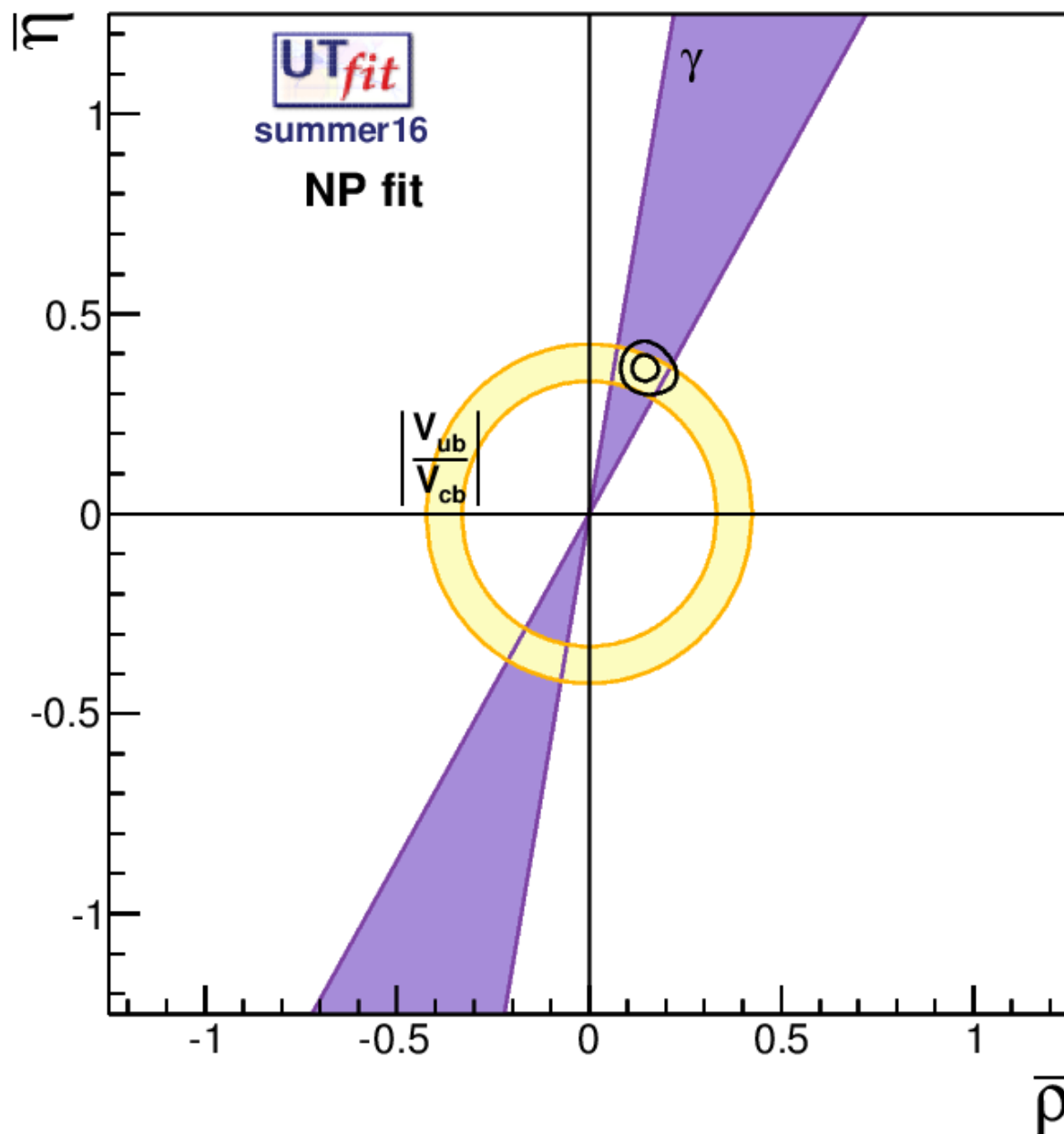
Unitarity Triangle analysis in the SM @ ICHEP'16:

obtained excluding
the given constraint
from the fit



Observables	Measurement	Prediction	Pull ($\# \sigma$)
$\sin 2\beta$	0.680 ± 0.023	0.725 ± 0.030	~ 1.2
γ	70.5 ± 5.7	65.4 ± 2.1	< 1
α	94.2 ± 4.5	90.9 ± 2.5	< 1
$ V_{ub} \cdot 10^3$	3.74 ± 0.21	3.66 ± 0.11	< 1
$ V_{ub} \cdot 10^3$ (incl)	4.41 ± 0.22	–	~ 2.9 ←
$ V_{ub} \cdot 10^3$ (excl)	3.62 ± 0.14	–	< 1
$ V_{cb} \cdot 10^3$	41.7 ± 1.0	42.6 ± 0.7	< 1
β_s	0.97 ± 0.94	1.05 ± 0.04	< 1
$\text{BR}(B \rightarrow \tau \nu)[10^{-4}]$	1.06 ± 0.20	0.81 ± 0.06	~ 1.2
$A_{\text{SL}}^d \cdot 10^3$	0.2 ± 2.0	-0.283 ± 0.024	< 1
$A_{\text{SL}}^s \cdot 10^3$	1.7 ± 3.0	0.013 ± 0.001	< 1

NP analysis results @ ICHEP'16:



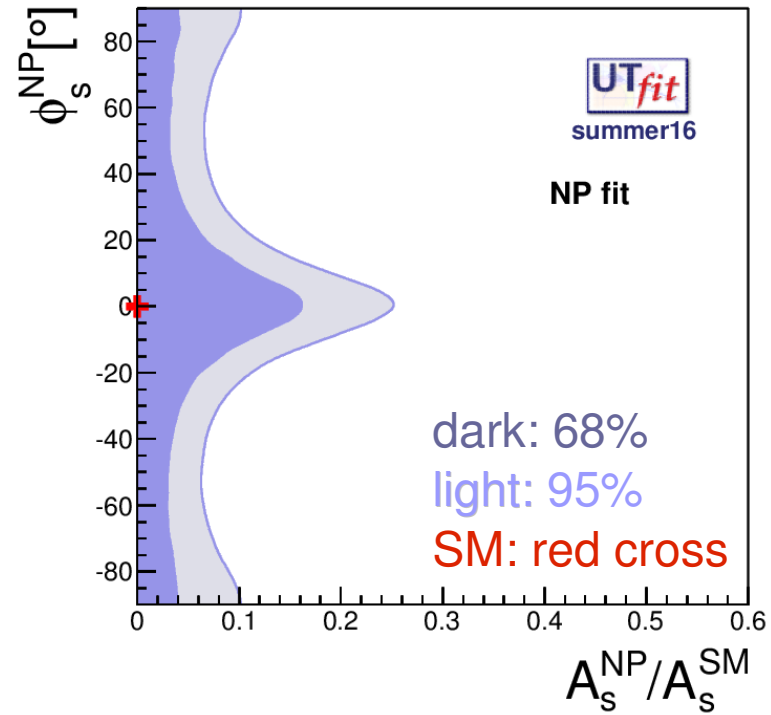
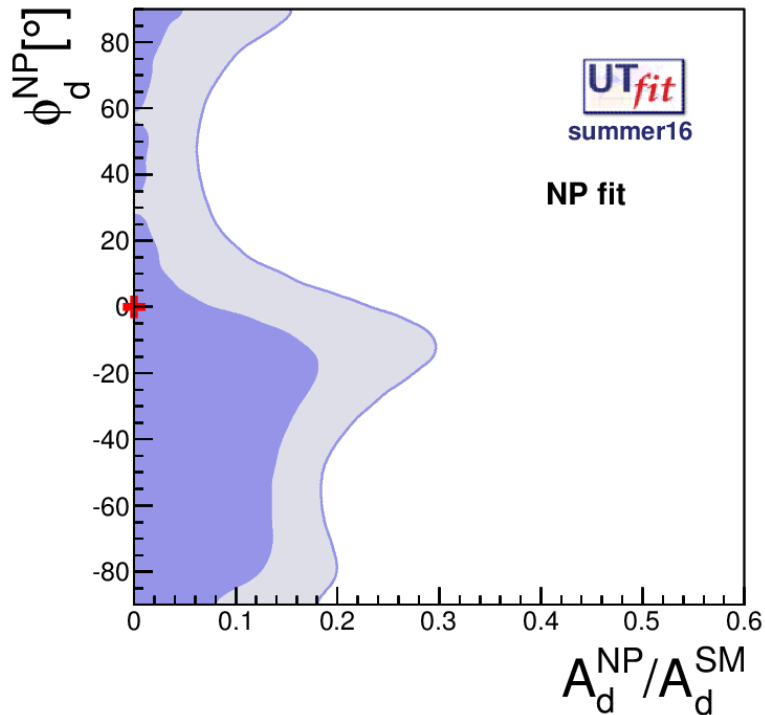
$$\bar{\rho} = 0.150 \pm 0.027$$
$$\bar{\eta} = 0.363 \pm 0.025$$

SM is

$$\bar{\rho} = 0.154 \pm 0.015$$
$$\bar{\eta} = 0.344 \pm 0.013$$

NP parameter results @ ICHEP'16

$$A_q = \left(1 + \frac{A_q^{NP}}{A_q^{SM}} e^{2i(\varphi_q^{NP} - \varphi_q^{SM})} \right) A_q^{SM} e^{2i\varphi_q^{SM}}$$



The ratio of NP/SM amplitudes is:

< 15% @68% prob. (30% @95%) in B_d mixing

< 15% @68% prob. (25% @95%) in B_s mixing

Unitarity Triangle analysis in the SM for Belle II:

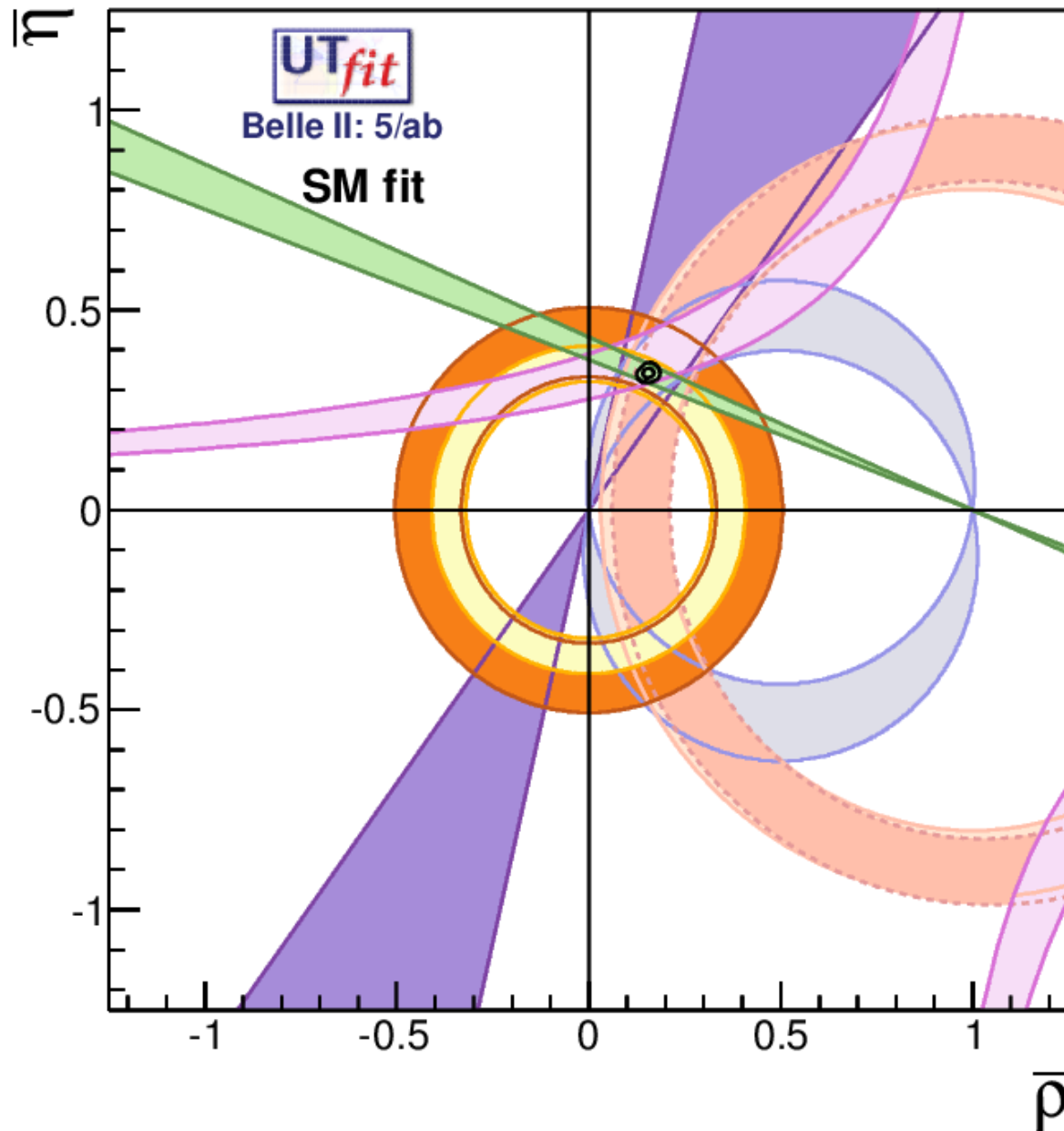
central values obtained from the tuning
errors from the Belle II at 5/ab

@ 5/ab

Observables	Measurement	
β	22.0 ± 0.7	
γ	65.5 ± 6.0	
α	92.5 ± 2.0	
$ V_{ub} \cdot 10^3$	3.67 ± 0.21	5.6% (4.4% \oplus 3.4%)
$ V_{cb} \cdot 10^3$	42.3 ± 0.9	2% (1.6% \oplus 1.3%)
β_s	0.97 ± 0.94	untouched
$\text{BR}(B \rightarrow \tau\nu)[10^{-4}]$	1.06 ± 0.10	10%
$A_{\text{SL}}^d \cdot 10^3$	0.2 ± 2.0	not used
$A_{\text{SL}}^s \cdot 10^3$	1.7 ± 3.0	not used

first run just as test: ICHEP values for lattice parameters

Unitarity Triangle analysis in the SM for Belle II:



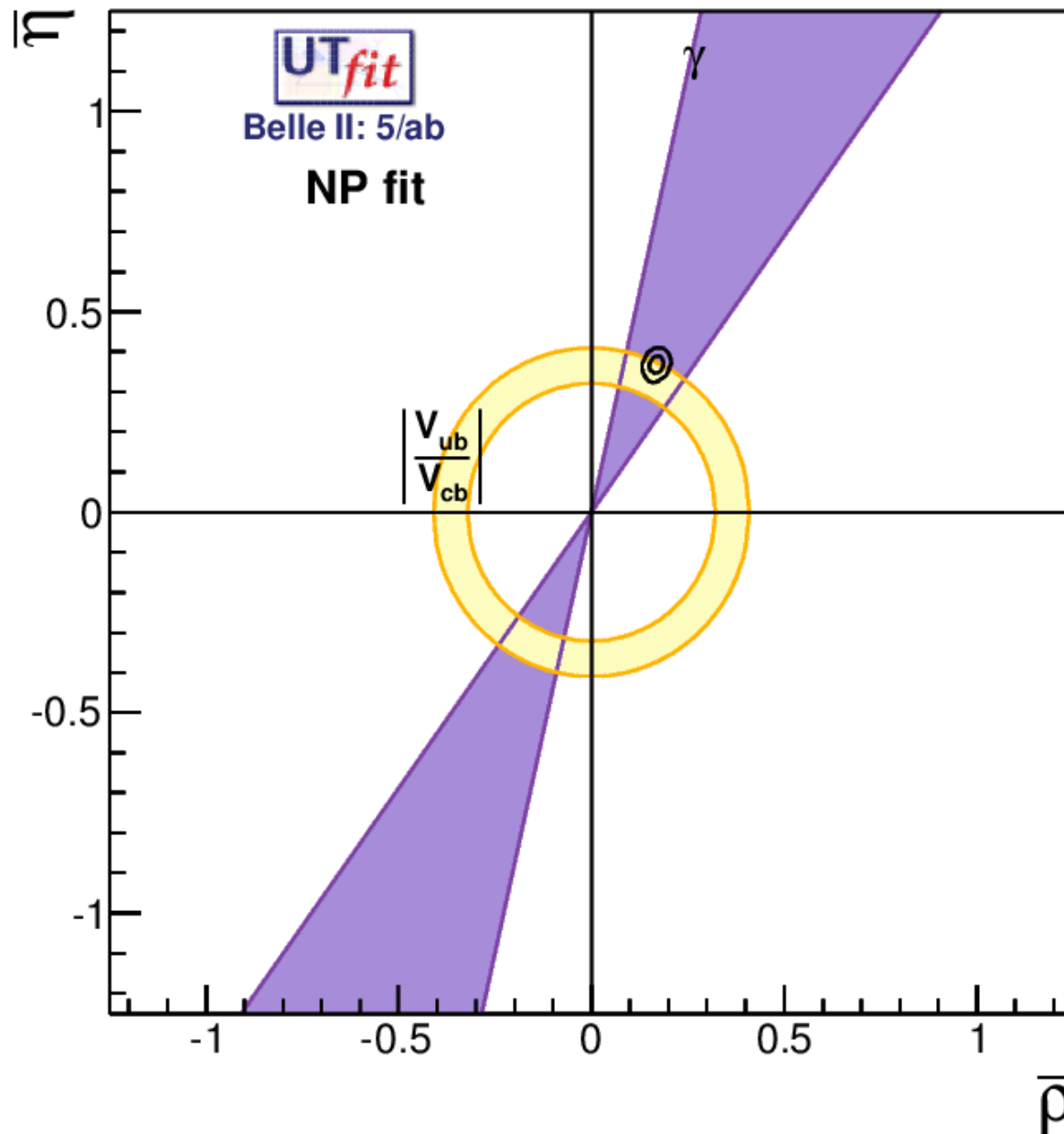
levels @
95% Prob

~8%

$$\begin{aligned} \bar{\rho} &= \pm 0.012 \\ \bar{\eta} &= \pm 0.011 \end{aligned}$$

~3%

Unitarity Triangle analysis beyond SM for Belle II:



levels @
95% Prob

~10 %

$$\begin{aligned} \bar{\rho} &= \pm 0.015 \\ \bar{\eta} &= \pm 0.018 \end{aligned}$$

~5%

Unitarity Triangle analysis beyond SM for Belle II:

$$A_q = C_{B_q} e^{2i\varphi_{B_q}} A_q^{SM} e^{2i\varphi_q^{SM}}$$

@ ICHEP'16

C_{B_d} VS ϕ_{B_d}

$$C_{B_d} = 1.04 \pm 0.12$$

$$\phi_{B_d} = (-1.8 \pm 1.7)^\circ$$

@ Belle II 5/ab

C_{B_d} VS ϕ_{B_d}

$$C_{B_d} = \pm 0.10$$

$$\phi_{B_d} = \pm 1.2^\circ$$

need a longer run for the results in the other parameterisation

Back up slides

V_{cb} and V_{ub}

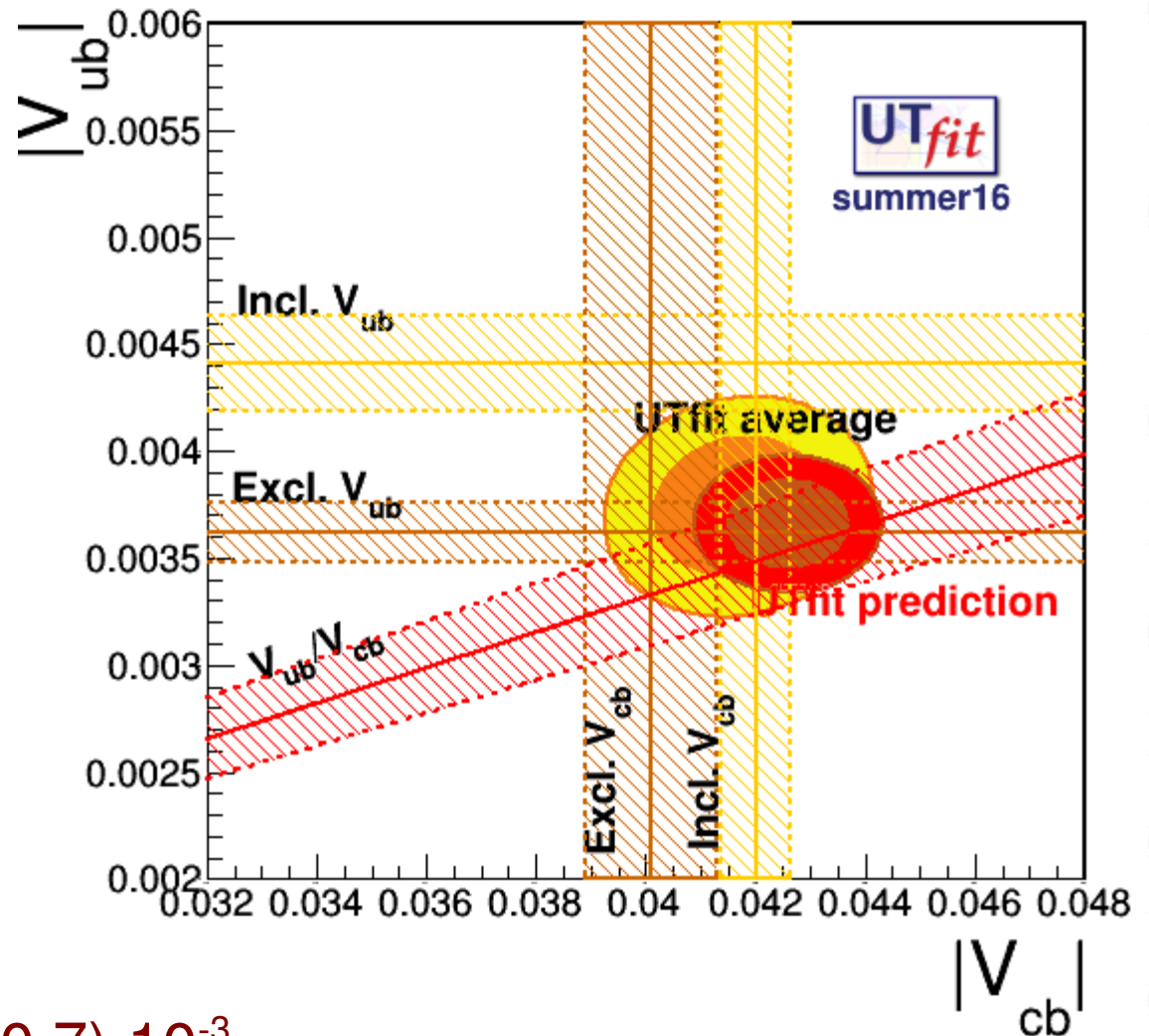
2D average inspired by D'Agostini skeptical procedure (hep-ex/9910036) with $\sigma=1$. Very similar results obtained from a 2D a la PDG procedure.

$$|V_{cb}| = (41.7 \pm 1.0) 10^{-3}$$

uncertainty $\sim 2.4\%$

$$|V_{ub}| = (3.74 \pm 0.21) 10^{-3}$$

uncertainty $\sim 5.6\%$



$$|V_{cb}| = (42.6 \pm 0.7) 10^{-3}$$

$$|V_{ub}| = (3.66 \pm 0.13) 10^{-3}$$

UTfit predictions

Unitarity Triangle analysis in the SM:

obtained excluding
the given constraint
from the fit

Observables	Measurement	Prediction	Pull ($\# \sigma$)
B_K	0.740 ± 0.029	0.81 ± 0.07	< 1
f_{B_s}	0.226 ± 0.005	0.220 ± 0.007	< 1
f_{B_s}/f_{B_d}	1.203 ± 0.013	1.210 ± 0.030	< 1
B_{B_s}/B_{B_d}	1.032 ± 0.036	1.07 ± 0.05	< 1
B_{B_s}	1.35 ± 0.08	1.30 ± 0.07	< 1

in general: average the Nf=2+1+1 and Nf=2+1 FLAG averages,
through eq.(28) in arXiv:1403.4504

for B_K , f_{B_s} , f_{B_s}/f_{B_d} :

FLAG Nf=2+1+1 (single result) and Nf=2+1 average

for B_{B_s} , B_{B_s}/B_{B_d} :

update w.r.t. the Nf=2+1 FLAG average (no Nf=2+1+1 results yet)

updating the FNAL/MILC result to FNAL/MILC 2016 (1602.13560)