Updates on Unitarity Triangle fits

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Unitarity Triangle analysis in the SM

- SM UT analysis:
  - All updated with Summer 2023 inputs
  - provide the best determination of CKM parameters
  - test the consistency of the SM ("*direct*" vs "*indirect*" determinations)
  - provide predictions (from data..) for SM observables

.. and beyond

- NP UT analysis:
  - Also all updated with Summer 2023 inputs
  - model-independent analysis
  - provides limit on the allowed deviations from the SM
  - obtain the NP scale

www.utfit.org

RELOADED

M.Bona, M. Ciuchini, D. Derkach, F. Ferrari,
E. Franco, V. Lubicz, G. Martinelli, D. Morgante,
M. Pierini, L. Silvestrini, S. Simula, A. Stocchi,
C. Tarantino, V. Vagnoni, M. Valli and L. Vittorio

Plots and numbers updated for Summer 2023:
new paper: Rendiconti Lincei. Scienze Fisiche e Naturali (2023) 34:37–57
https://doi.org/10.1007/s12210-023-01137-5

Usual method and inputs:

$$f(\bar\rho,\bar\eta,X|c_1,...,c_m) \sim \prod_{j=1,m} f_j(\mathcal{C}|\bar\rho,\bar\eta,X) * \prod_{i=1,N} f_i(x_i) f_0(\bar\rho,\bar\eta)$$

Bayes Theorem

$X \equiv x_1,...,x_n = m_t, B_K, F_B, ...$

$\mathcal{C} \equiv c_1,...,c_m = \epsilon, \Delta m_d/\Delta m_s, A_{CP}(J/\psi K_S), ...$

$(b\to u)/(b\to c)$	$\bar\rho^2+\bar\eta^2$	$\bar\Lambda, \lambda_1, F(1), ...$
ϵ_K	$\bar\eta[(1-\bar\rho)+P]$	B_K
Δm_d	$(1-\bar\rho)^2+\bar\eta^2$	$f_B^2 B_B$
$\Delta m_d/\Delta m_s$	$(1-\bar\rho)^2+\bar\eta^2$	ξ
$A_{CP}(J/\psi K_S)$	$\sin 2\beta$	$-$

, $\mathbf{m_t}$

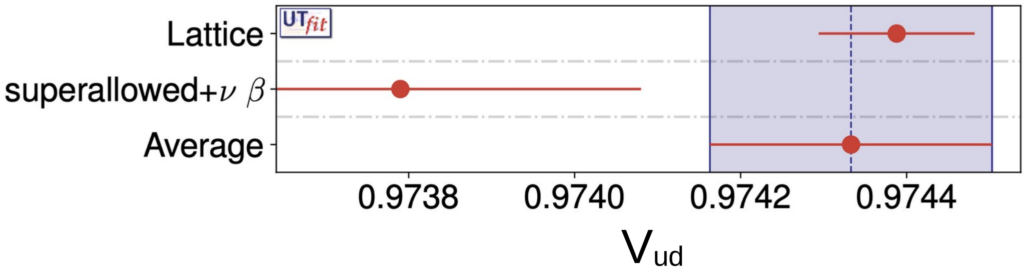
Standard Model + OPE/HQET/ Lattice QCD to go from quarks to hadrons

M. Bona *et al*. (UTfit Collaboration) JHEP 0507:028,2005 hep-ph/0501199
M. Bona *et al*. (UTfit Collaboration) JHEP 0603:080,2006 hep-ph/0509219

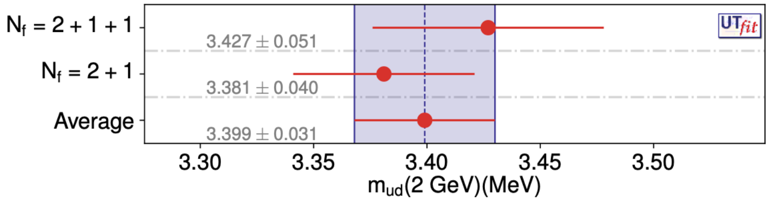
Novelties in Summer 2023:

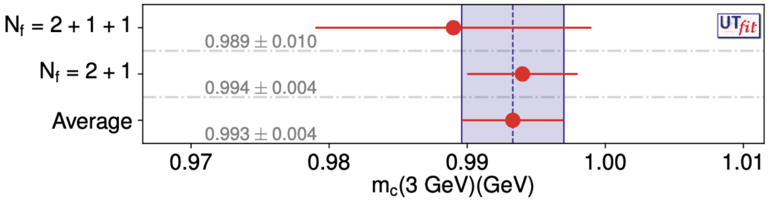
Main experiment updates:
New sin2β, α, γ
For α, γ new in-house averages

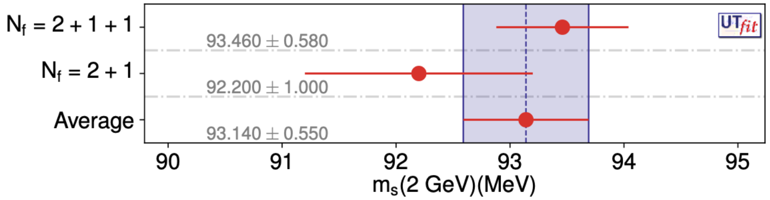
Main theory updates:
New V_{ud} extraction from neutron decays
[V.Cirigliano et al, arXiv:2306.03138]
New lattice values for masses
New lattice form factors for exclusive determinations

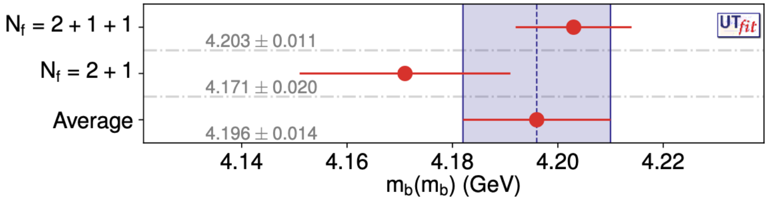


Averages with PDG scale factors









V_{cb} and V_{ub}

See Ludovico Vittorio's talk on Wednesday here

$|V_{cb}|$ *(excl)* = (40.55 ± 0.46) 10^{-3}

$|V_{cb}|$ *(incl)* = (42.16 ± 0.50) 10^{-3}

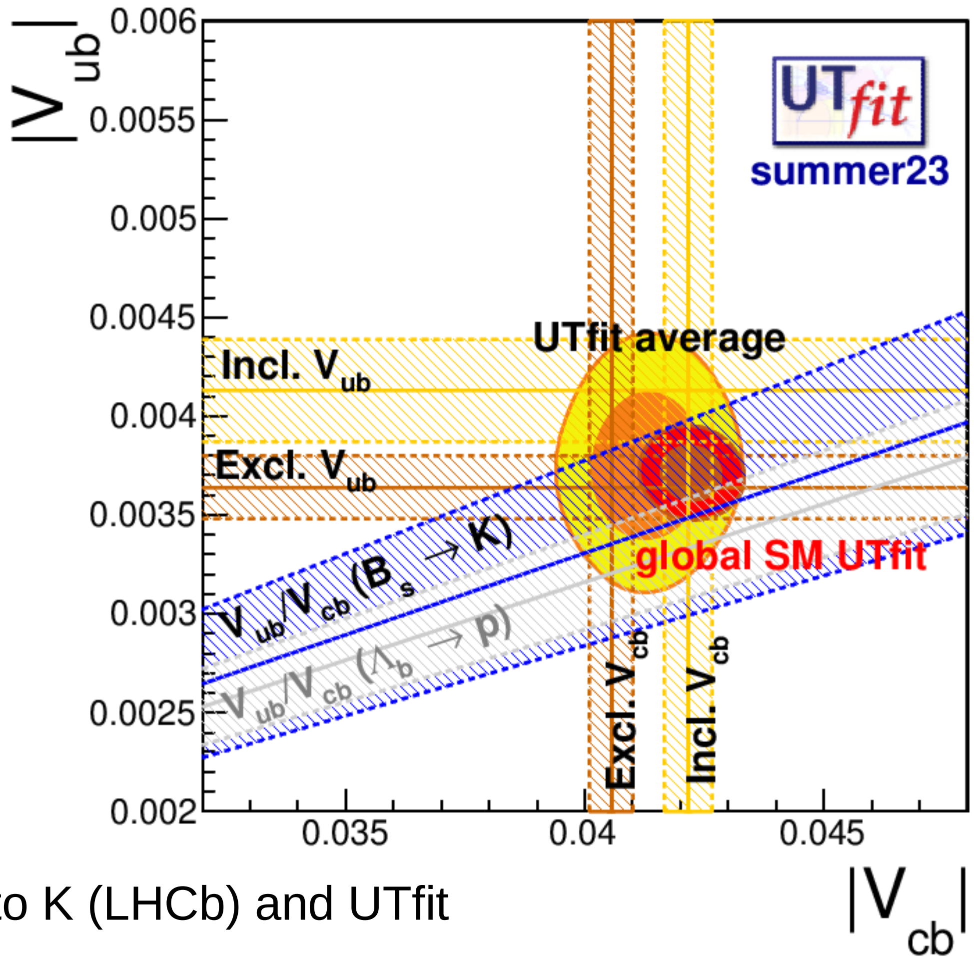
from Bordone et al. arXiv:2107.00604

FLAG 2023 online update

$|V_{ub}|$ *(excl)* = (3.64 ± 0.16) 10^{-3}

$|V_{ub}|$ *(incl)* = (4.13 ± 0.26) 10^{-3}

PDG 2022



$|V_{ub} / V_{cb}|$ = (8.27 ± 1.17) 10^{-2} From B_s to K (LHCb) and UTfit

$|V_{ub} / V_{cb}|$ *(LHCb)* = (7.9 ± 0.6) 10^{-2} From Λ_b, excluded following FLAG guidelines

V_{cb} and V_{ub}

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$|V_{cb}|$ *(excl)* = $(40.55 \pm 0.46)\ 10^{-3}$

$|V_{cb}|$ *(incl)* = $(42.16 \pm 0.50)\ 10^{-3}$

from Bordone et al. arXiv:2107.00604

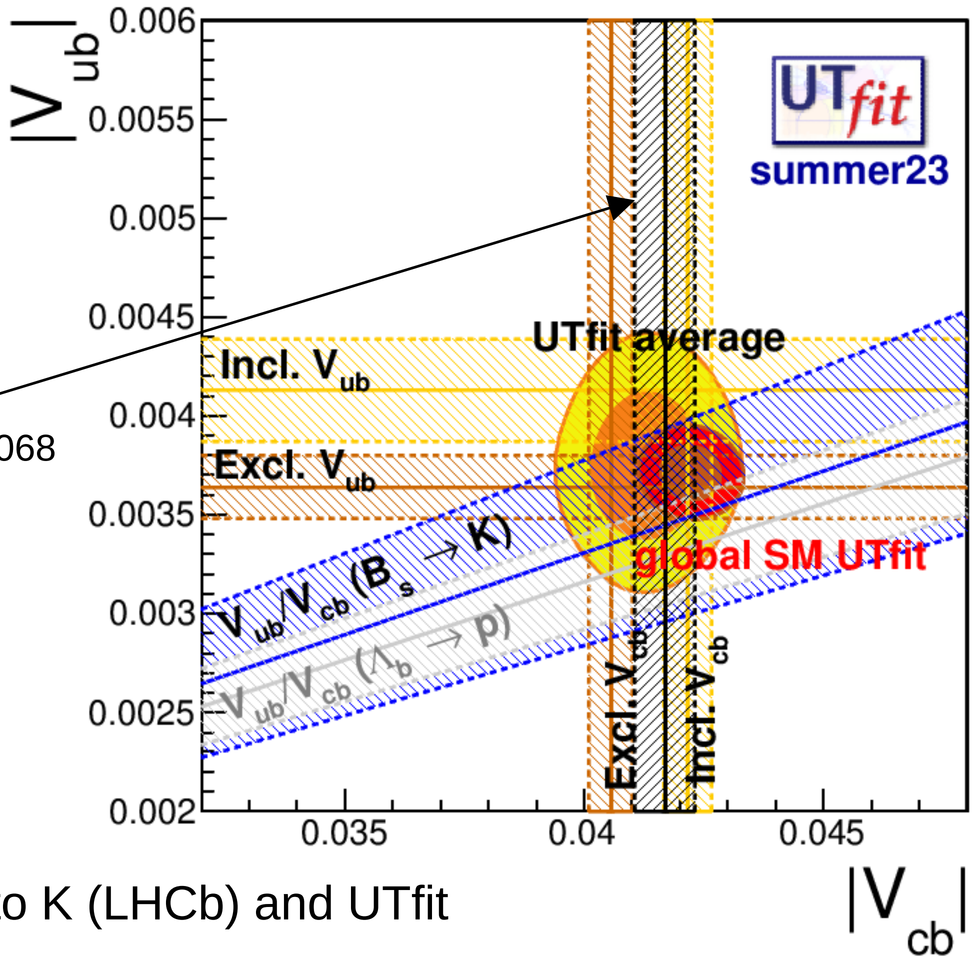
V_{cb} (incl.) = $(41.69\pm0.63)\ 10^{-3}$ in JHEP 10 (2022) 068
will be included in the next update

FLAG 2023 online update

$|V_{ub}|$ *(excl)* = $(3.64 \pm 0.16)\ 10^{-3}$

$|V_{ub}|$ *(incl)* = $(4.13 \pm 0.26)\ 10^{-3}$

PDG 2022



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V_{cb} and V_{ub}

Inputs to the global fit
from 2D à la D'Agostini averages

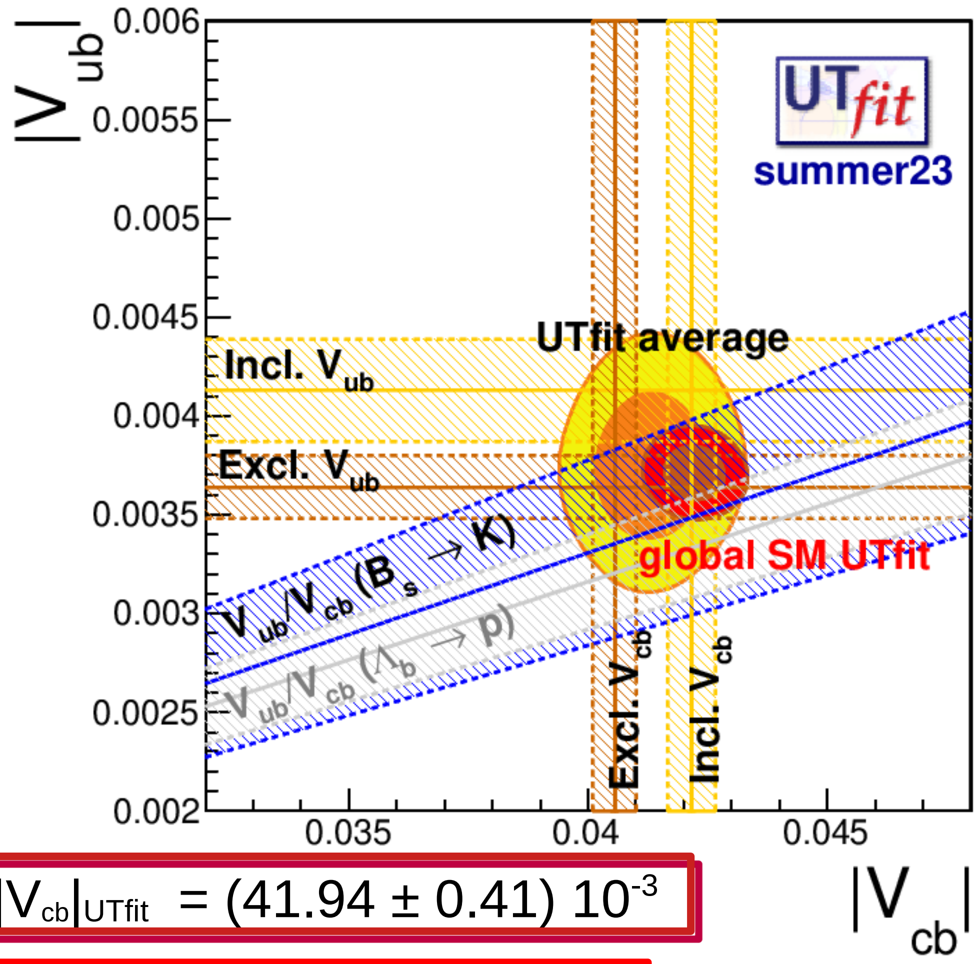
$|V_{cb}|_{UTfit} = (41.32 \pm 0.73)\ 10^{-3}$

$|V_{ub}|_{UTfit} = (3.75 \pm 0.26)\ 10^{-3}$

UTfit predictions:

$|V_{cb}|_{UTfit} = (42.21 \pm 0.51)\ 10^{-3}$

$|V_{ub}|_{UTfit} = (3.70 \pm 0.09)\ 10^{-3}$



UTfit full fit

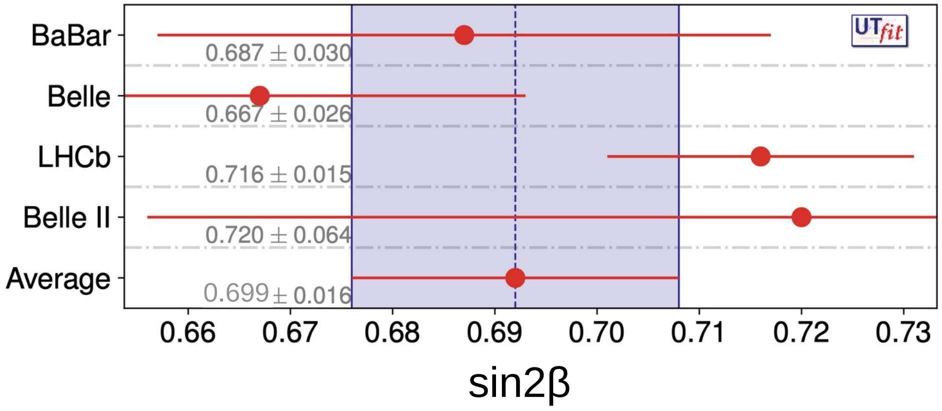
$|V_{cb}|_{UTfit} = (41.94 \pm 0.41)\ 10^{-3}$

$|V_{ub}|_{UTfit} = (3.70 \pm 0.08)\ 10^{-3}$

ϕ_1/β angle

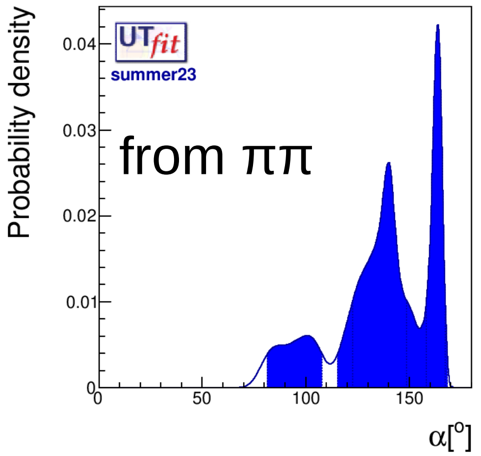
- Averaged charmonium values
  - New sin2β from LHCb
- Average including updated correction due to Cabibbo-suppressed penguin contributions
- Theoretical uncertainty comparable to experimental error
  - Correction of -0.01 ± 0.01

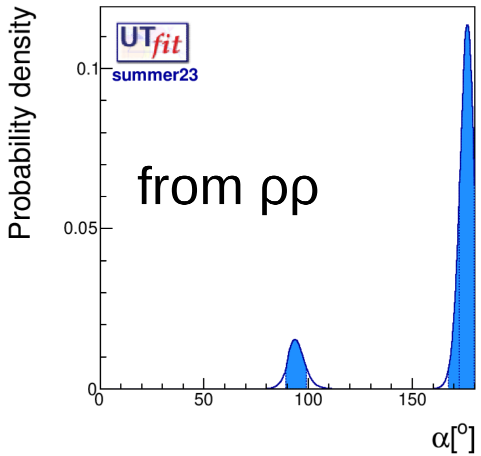
Ciuchini, Pierini, Silvestrini
https://arxiv.org/abs/hep-ph/0507290

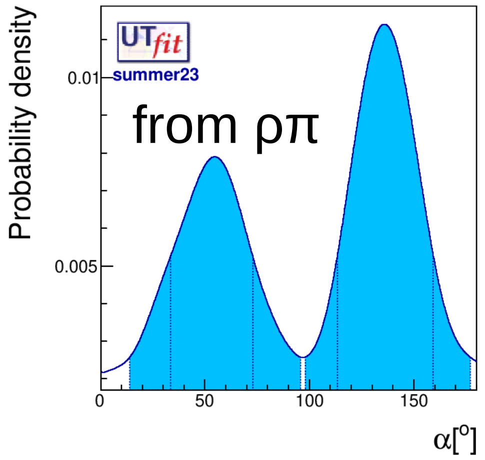


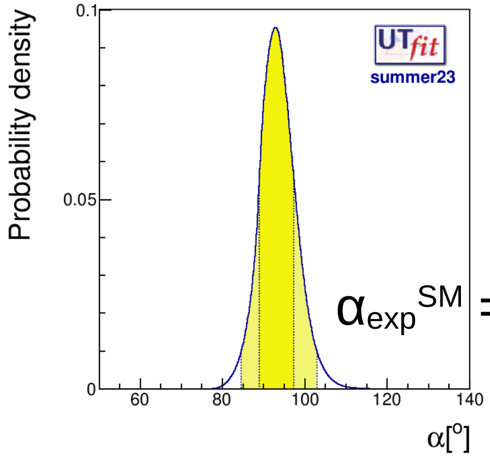
Basically from all charmonium
HFLAV: 0.698 ± 0.017
adding Belle II: 0.720 ± 0.064
getting average: 0.699 +/- 0.016
Corrected with -0.01 +- 0.01
final number is **0.689 +/- 0.019**

ϕ_2/α angle

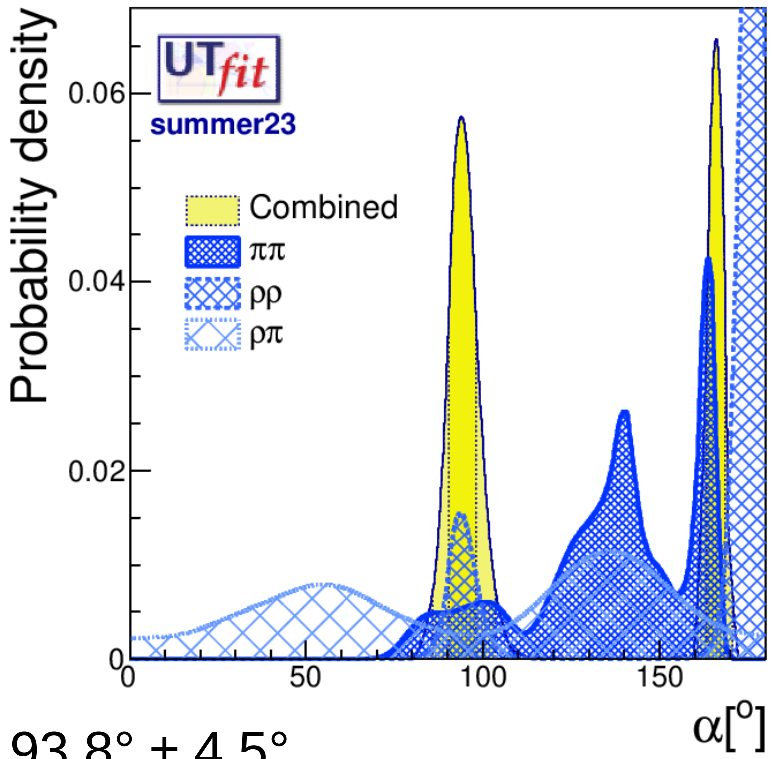




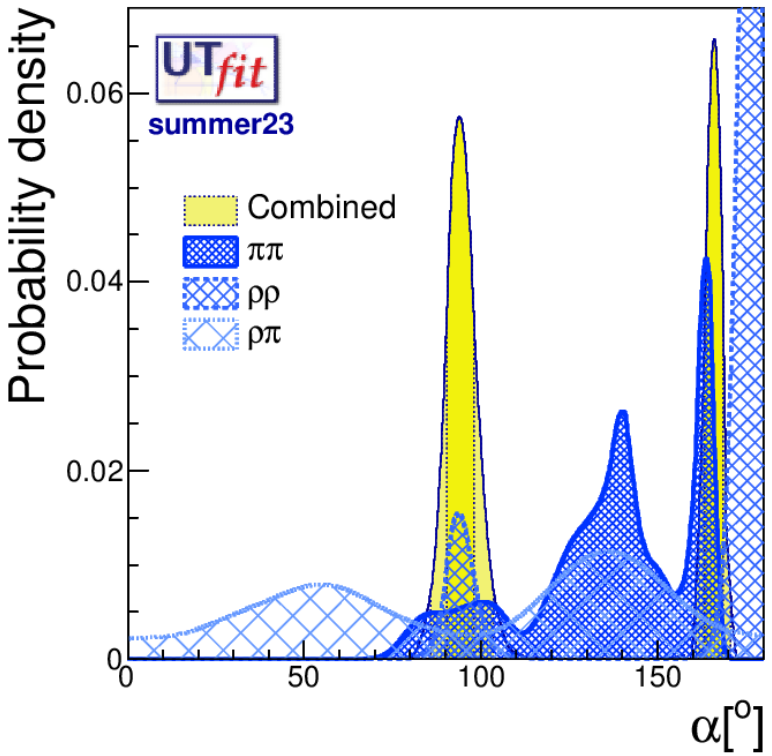


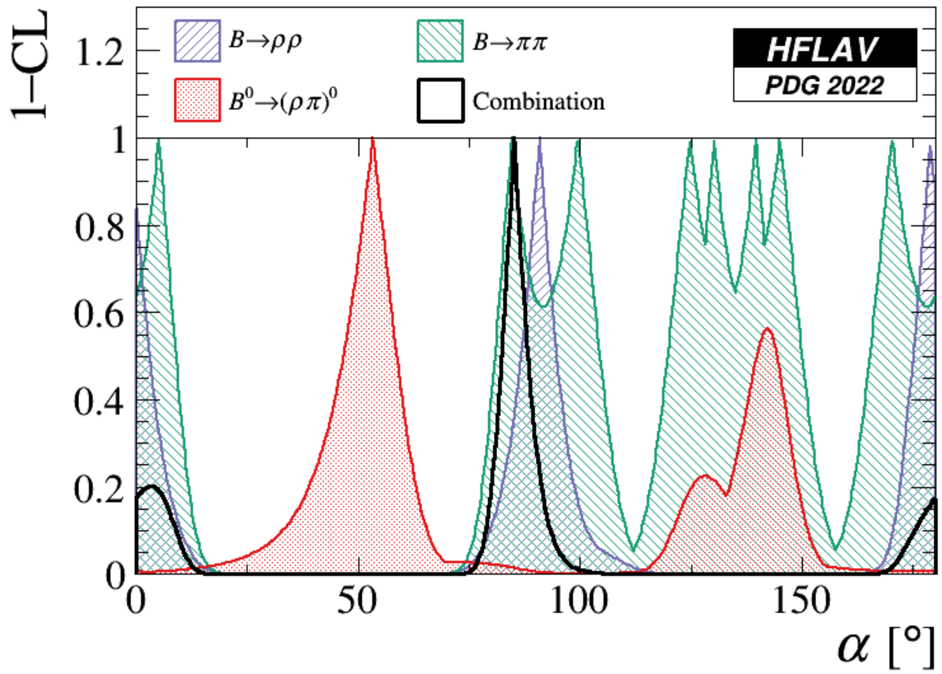


$\alpha_{exp}^{SM} = 93.8° \pm 4.5°$



ϕ_2/α angle



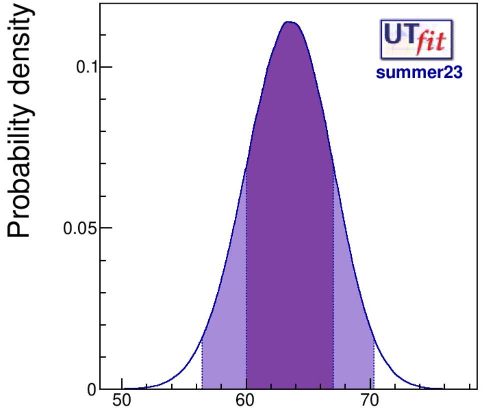


$\alpha^{exp} = 93.8° \pm 4.5°$

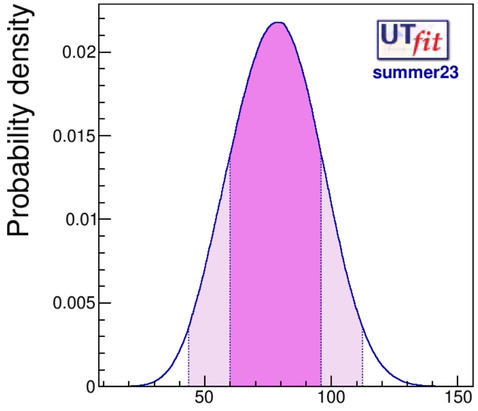
$\alpha_{HFLAV} = 85.5 \pm 4.6$

ϕ_3/γ angle

See new D mixing fit from Di Palma&Silvestrini at EPS23:
https://indico.desy.de/event/34916/contributions/146904/

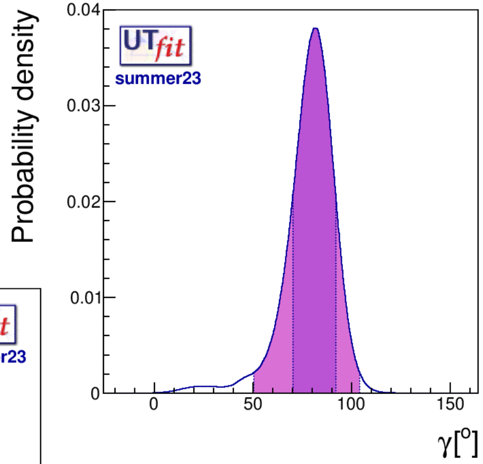


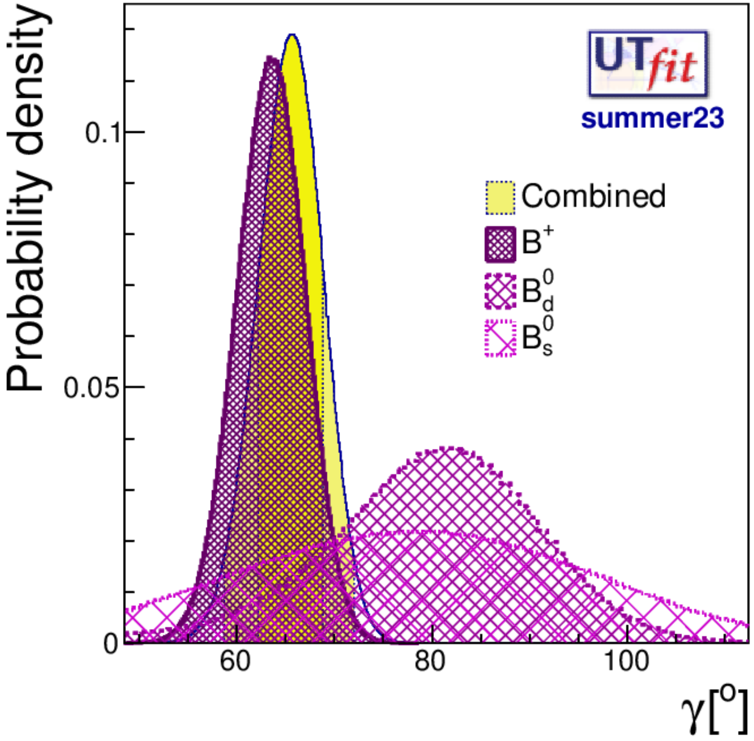
$\gamma^{B+} = 63.5° \pm 3.5°$



$\gamma^{Bs} = 78° \pm 18°$

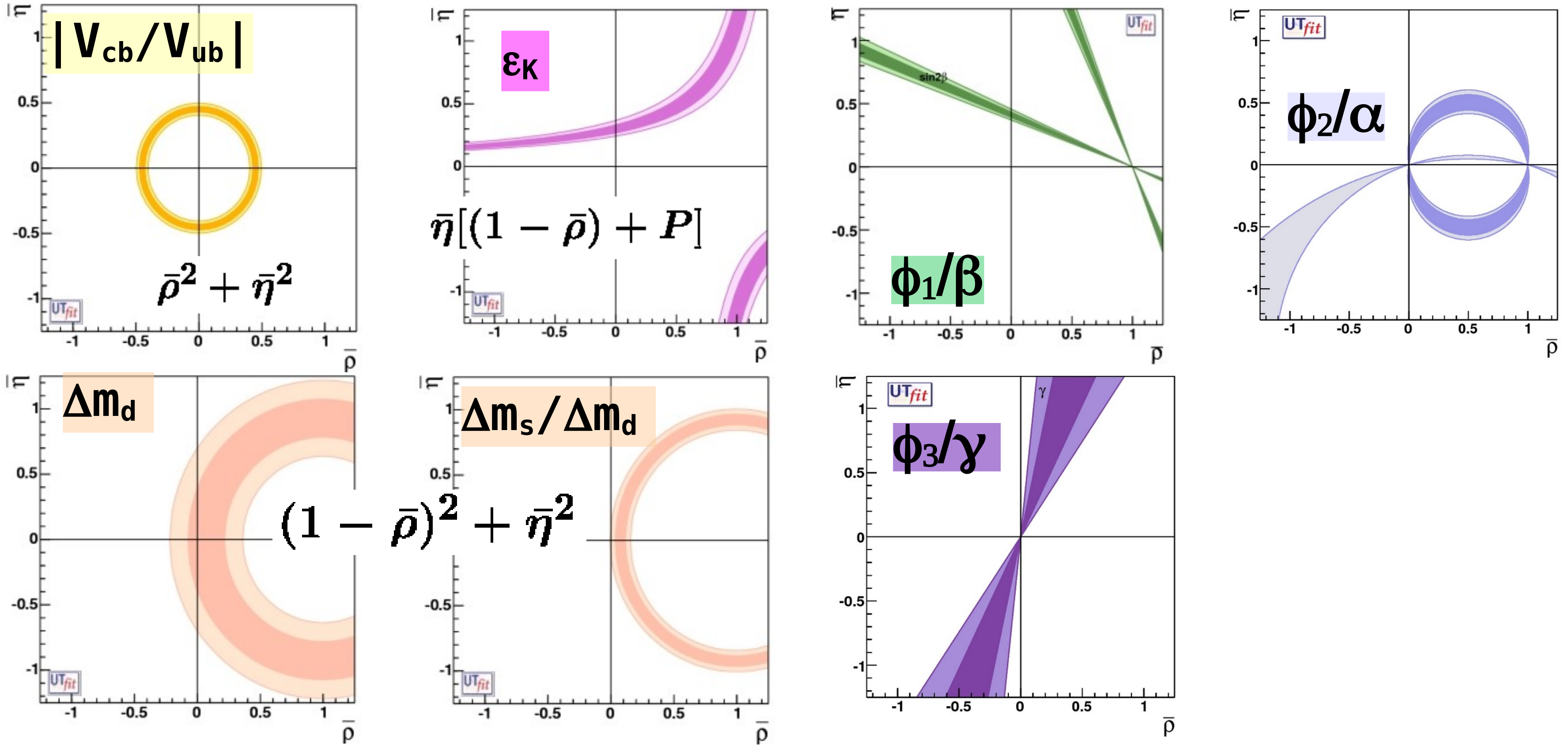
$\gamma^{Bd} = 81° \pm 11°$





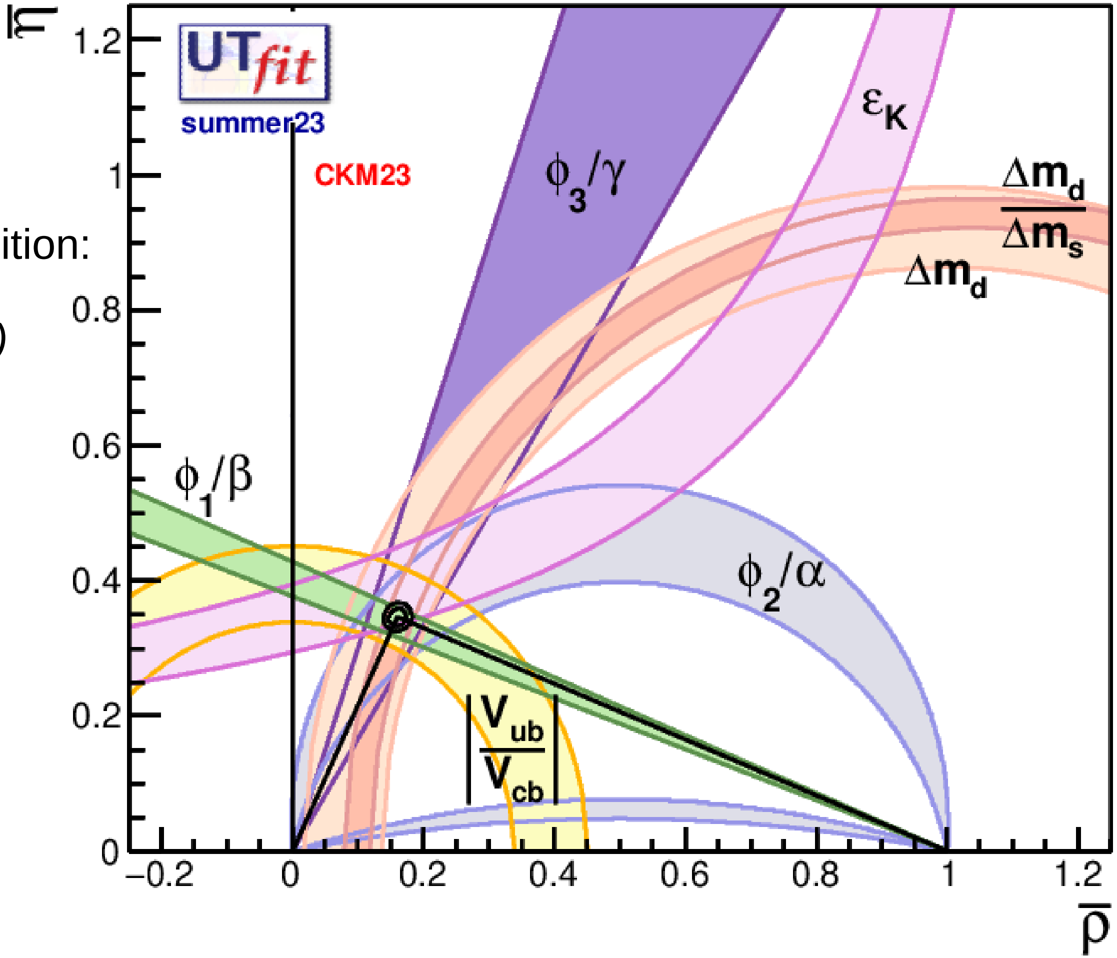
$\gamma^{exp} = 65.4° \pm 3.3°$

Unitarity Triangle analysis in the SM:



Unitarity Triangle analysis in the SM:

Special edition:
homage
to Belle (II)



levels @
95% Prob

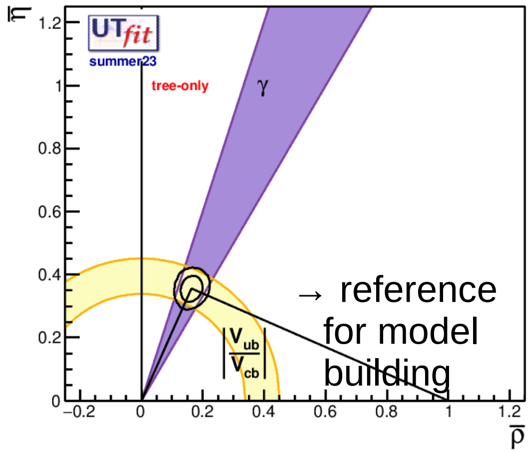
$\bar{\rho}$ = 0.160 ± 0.009
$\bar{\eta}$ = 0.346 ± 0.009

λ = 0.2251 ± 0.0008
A = 0.827 ± 0.010

Some interesting configurations

"Tree only"

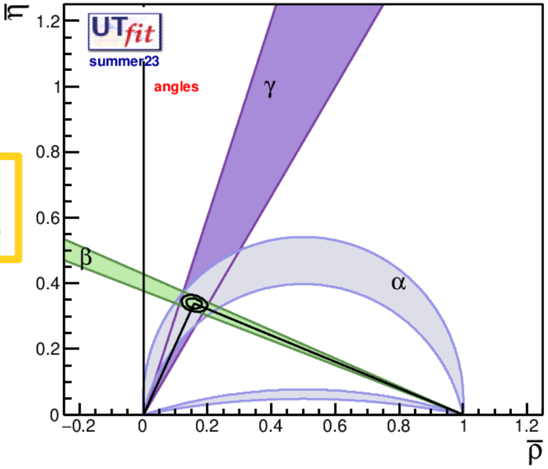
$\bar{\rho}$ = ±0.163 ± 0.024
$\bar{\eta}$ = ±0.356 ± 0.027



→ reference for model building

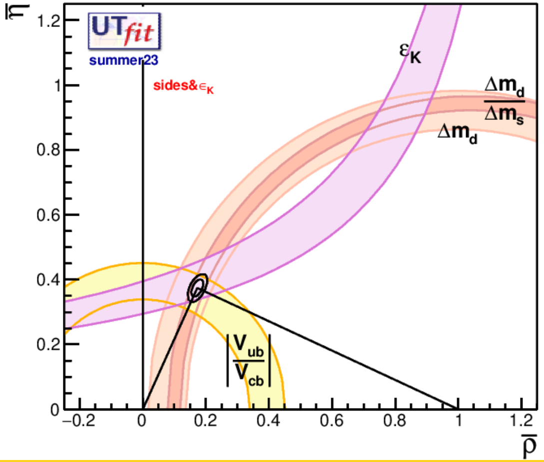
Angles only

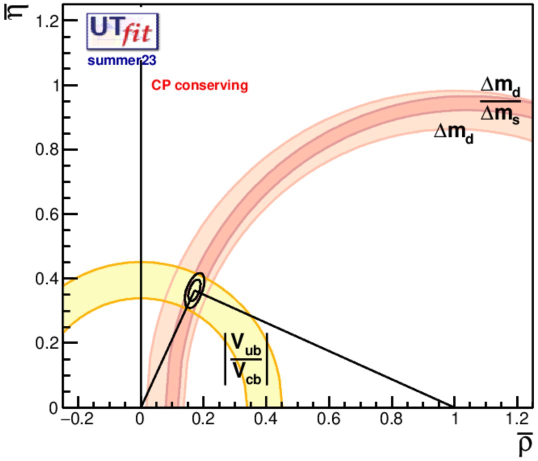
$\bar{\rho}$ = 0.159 ± 0.016
$\bar{\eta}$ = 0.339 ± 0.010



Sides and ε_K

$\bar{\rho}$ = 0.173 ± 0.012
$\bar{\eta}$ = 0.374 ± 0.018





CP conserving constraints

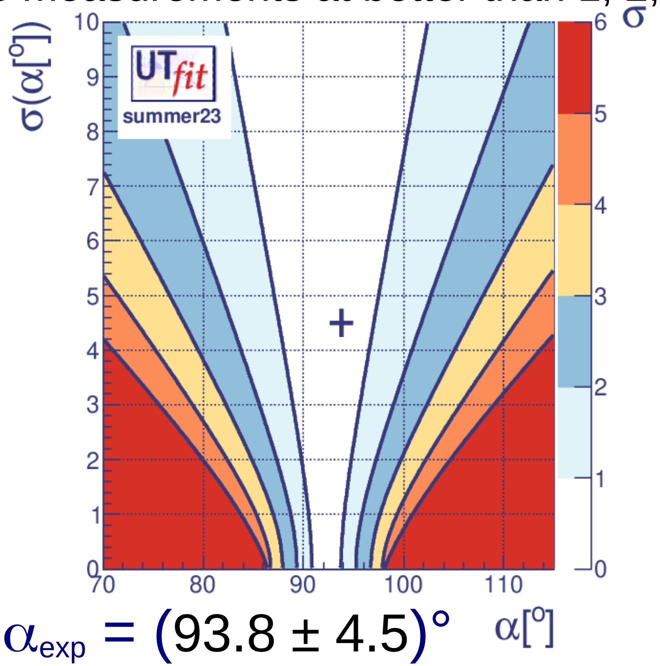
$\bar{\rho}$ = 0.171 ± 0.013
$\bar{\eta}$ = 0.363 ± 0.022

Compatibility plots

A way to “measure” the agreement of a single measurement with the indirect determination from the fit using all the other inputs: test for the SM description of the flavour physics

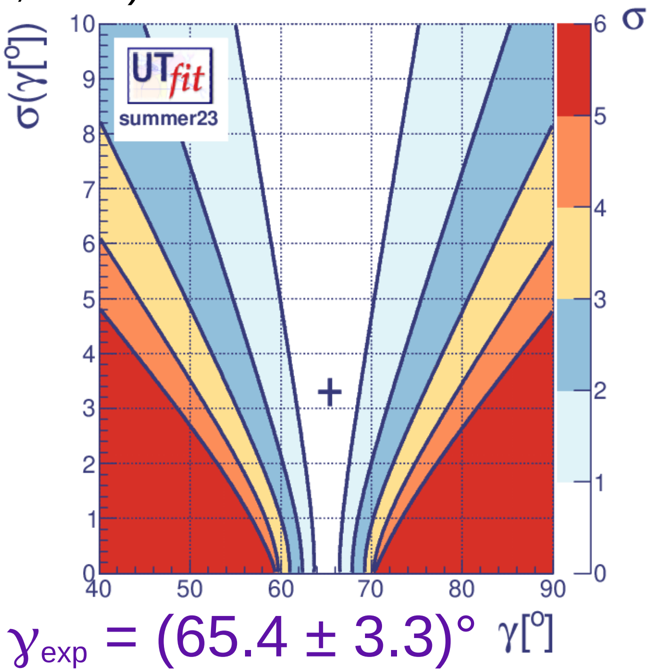
Colour code: agreement between the predicted values and the measurements at better than 1, 2, ...nσ

The cross has the coordinates (x,y)=(central value, error) of the direct measurement



$\alpha_{exp} = (93.8 \pm 4.5)°$

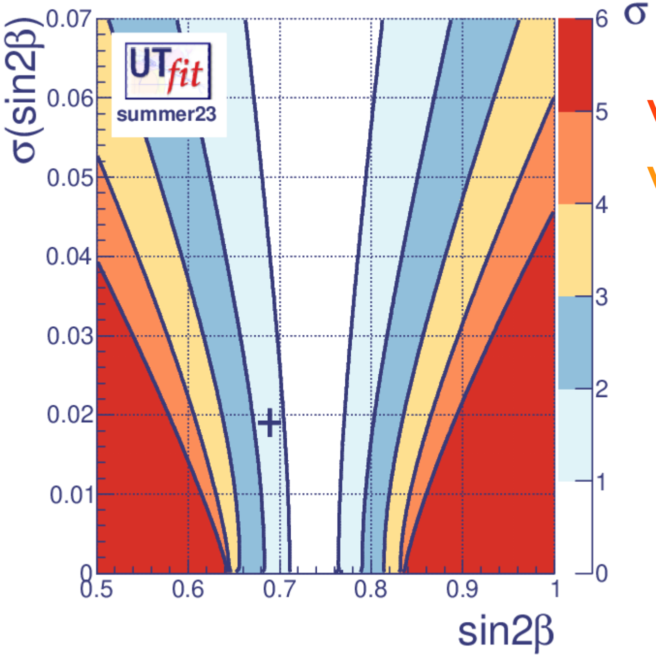
$\alpha_{UTfit} = (92.3 \pm 1.5)°$



$\gamma_{exp} = (65.4 \pm 3.3)°$

$\gamma_{UTfit} = (65.2 \pm 1.5)°$

Checking the usual *tensions*..

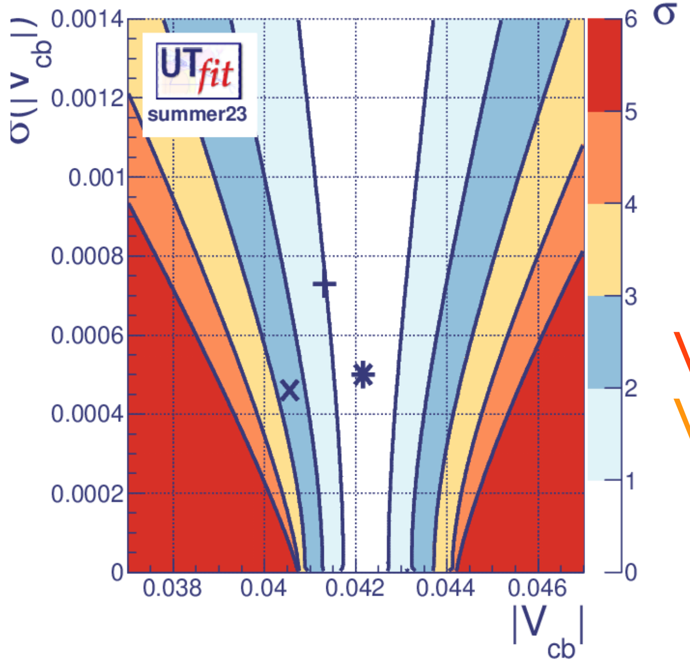


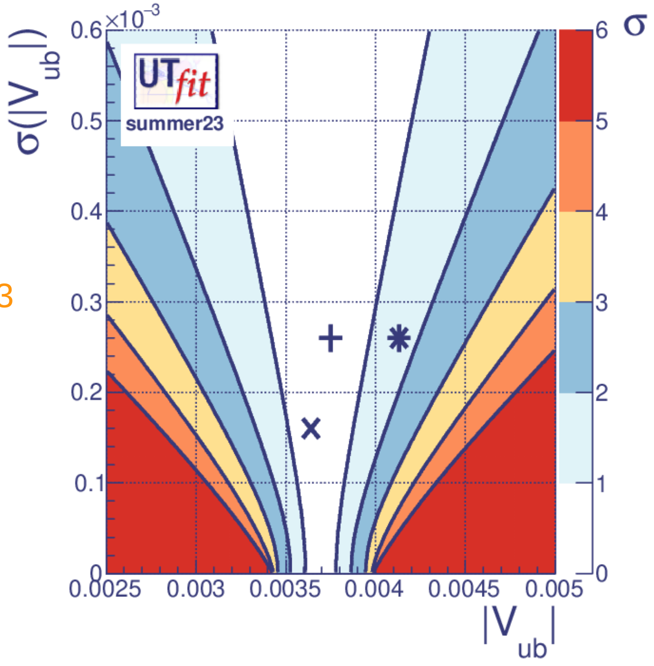
$\sin 2\beta_{exp} = 0.689 \pm 0.019$

$\sin 2\beta_{UTfit} = 0.739 \pm 0.027$

$Vcb_{exp} = (41.32 \pm 0.73) \cdot 10^{-3}$

$Vcb_{UTfit} = (42.21 \pm 0.51) \cdot 10^{-3}$





$Vub_{exp} = (3.75 \pm 0.26) \cdot 10^{-3}$

$Vub_{UTfit} = (3.70 \pm 0.09) \cdot 10^{-3}$

x = exclusive

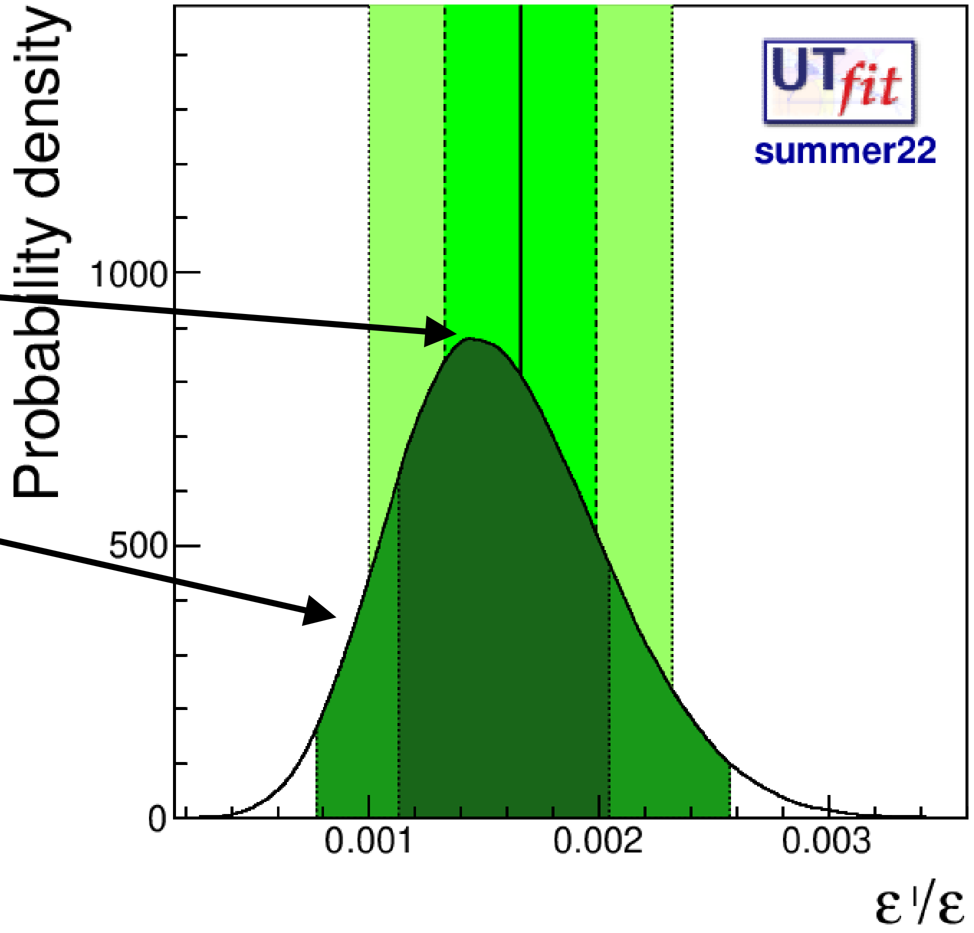
∗ = inclusive

New ε'/ε prediction from the Unitarity Triangle fit

Experimental value
$\varepsilon'/\varepsilon = (16.6 \pm 3.3) \cdot 10^{-4}$

UTfit prediction:
$\varepsilon'/\varepsilon = (15.2 \pm 4.7) \cdot 10^{-4}$

RBC/UKQCD obtains:
$\varepsilon'/\varepsilon = (21.7 \pm 6.7 \pm 5.0_{IB}) \cdot 10^{-4}$
IB = isospin-breaking uncertainty



Result summary

Observables	Measurement	Prediction	Pull (#σ)
$\sin 2\beta$	0.689 ± 0.019	0.739 ± 0.027	~ 1.5
γ	65.4 ± 3.3	65.2 ± 1.5	< 1
α	93.8 ± 4.5	92.3 ± 1.5	< 1
$\varepsilon_K \cdot 10^3$	2.228 ± 0.001	2.01 ± 0.14	~ 1.6
$\lvert V_{cb}\rvert \cdot 10^3$	41.32 ± 0.73	42.21 ± 0.51	~ 1
$\lvert V_{cb}\rvert \cdot 10^3$ (excl)	40.55 ± 0.46		~ 2.5
$\lvert V_{cb}\rvert \cdot 10^3$ (incl)	42.16 ± 0.50		< 1
$\lvert V_{ub}\rvert \cdot 10^3$	3.75 ± 0.26	3.70 ± 0.09	< 1
$\lvert V_{ub}\rvert \cdot 10^3$ (excl)	3.64 ± 0.16	-	< 1
$\lvert V_{ub}\rvert \cdot 10^3$ (incl)	4.13 ± 0.26	-	~ 1.5
$BR(B \to \tau\nu)[10^4]$	1.06 ± 0.19	0.865 ± 0.041	~ 1
$BR(B \to \mu\mu)[10^9]$	3.41 ± 0.29	3.45 ± 0.13	< 1
$\lvert V_{ud}\rvert$	0.97433 ± 0.00017	0.9737 ± 0.0011	< 1

Lattice result summary

We obtain the predictions for the lattice parameters in different configurations in the fit:

- only lattice parameters ratios
  - (F_{Bs}/F_B, B_{Bs}/B_{Bd} used)
- only B parameters
  - (B_{Bs}^1, B_{Bs}/B_{Bd} used)
- only B_K parameter

Observables	Measurement	Prediction
B_K	**0.756 ± 0.016**	**0.840 ± 0.053**
Ratios only		
f_{Bs}	**0.2301 ± 0.0012**	**0.234 ± 0.010**
B_{Bs}	**1.284 ± 0.059**	**1.27 ± 0.10**
B pars only		
f_{Bs}/f_{Bd}	**1.208 ± 0.005**	**1.201 ± 0.027**
f_{Bs}	**0.2301 ± 0.0012**	**0.229 ± 0.006**
B_K only		
f_{Bs}	**0.2301 ± 0.0012**	**0.226 ± 0.011**
f_{Bs}/f_{Bd}	**1.208 ± 0.005**	**1.07 ± 0.12**
B_{Bs}	**1.284 ± 0.059**	**1.32 ± 0.12**
B_{Bs}/B_{Bd}	**1.015 ± 0.021**	**1.29 ± 0.29**

UT analysis including new physics

fit simultaneously for the CKM and the NP parameters (generalized UT fit)

- add most general loop NP to all sectors
- use all available experimental info
- find out NP contributions to ΔF=2 transitions

B_d and B_s mixing amplitudes (2+2 real parameters):

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

$\Delta m_{q/K} = C_{B_q/\Delta m_K} (\Delta m_{q/K})^{SM}$	$\varepsilon_K = C_\varepsilon \varepsilon_K^{SM}$
$A_{CP}^{B_d \to J/\psi K_s} = \sin 2(\beta + \phi_{B_d})$	$A_{CP}^{B_s \to J/\psi\phi} \sim \sin 2(-\beta_s + \phi_{B_s})$
$A_{SL}^q = \mathrm{Im}(\Gamma_{12}^q / A_q)$	$\Delta\Gamma^q / \Delta m_q = \mathrm{Re}(\Gamma_{12}^q / A_q)$

new-physics-specific constraints

semileptonic asymmetries in B^0 and B_s:
sensitive to NP effects in both size and phase.

$$A^s_{SL} \equiv \frac{\Gamma(\bar{B}_s \to \ell^+ X) - \Gamma(B_s \to \ell^- X)}{\Gamma(\bar{B}_s \to \ell^+ X) + \Gamma(B_s \to \ell^- X)} = \mathrm{Im}\left(\frac{\Gamma^s_{12}}{A^{\mathrm{full}}_s}\right)$$

HFLAV from Cleo, BaBar, Belle, D0 and LHCb

same-side dilepton charge asymmetry:
admixture of B_s and B_d so sensitive to NP effects in both.

D0 arXiv:1106.6308

$$A^{\mu\mu}_{SL} \times 10^3 = -7.9 \pm 2.0$$

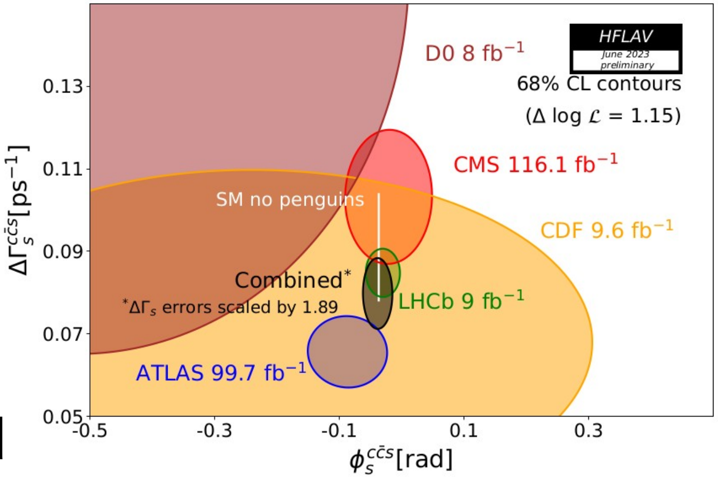
$$A^{\mu\mu}_{SL} = \frac{f_d \chi_{d0} A^d_{SL} + f_s \chi_{s0} A^s_{SL}}{f_d \chi_{d0} + f_s \chi_{s0}}$$

lifetime τ^{FS} in flavour-specific final states:
average lifetime is a function to the width and the width difference

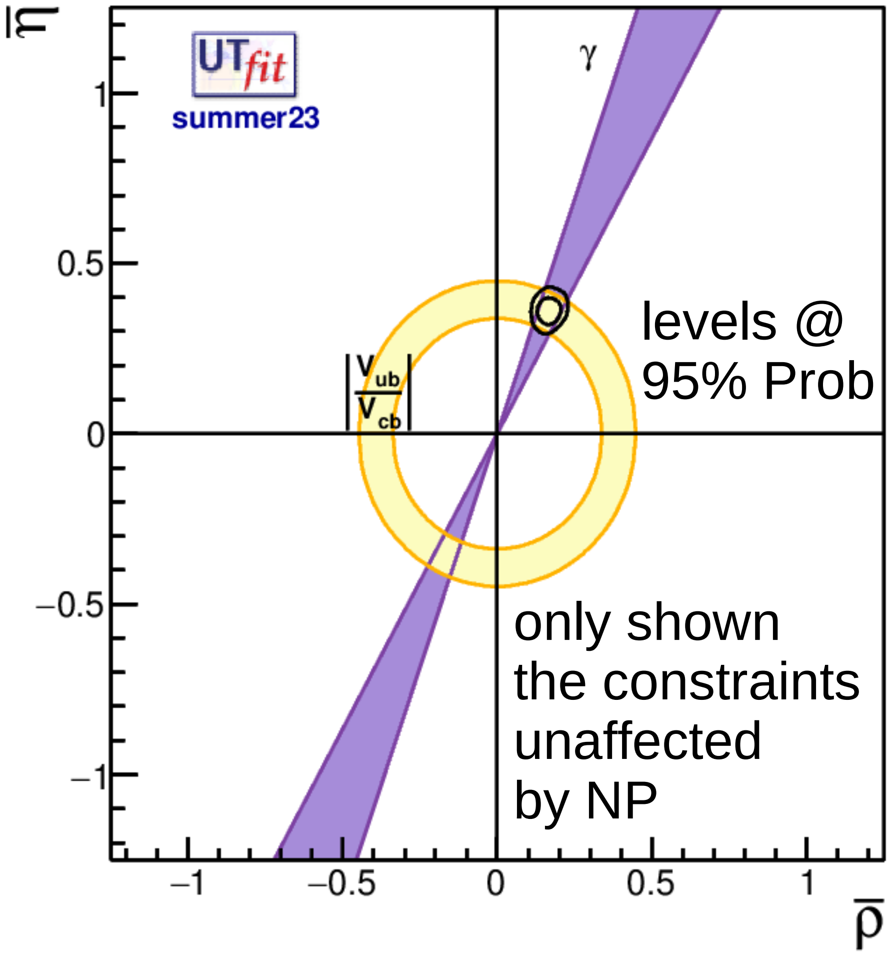
$\tau^{FS}(B_s) = 1.527 \pm 0.011$ ps HFLAV

$\phi_s = 2\beta_s$ vs $\Delta\Gamma_s$ from $B_s \to J/\psi\phi$
angular analysis as a function of proper time and b-tagging

$\phi_s = -0.039 \pm 0.016$ rad



NP analysis results



$\bar{\rho} = 0.167 \pm 0.025$
$\bar{\eta} = 0.361 \pm 0.027$

SM is

$\bar{\rho} = 0.160 \pm 0.009$
$\bar{\eta} = 0.346 \pm 0.009$

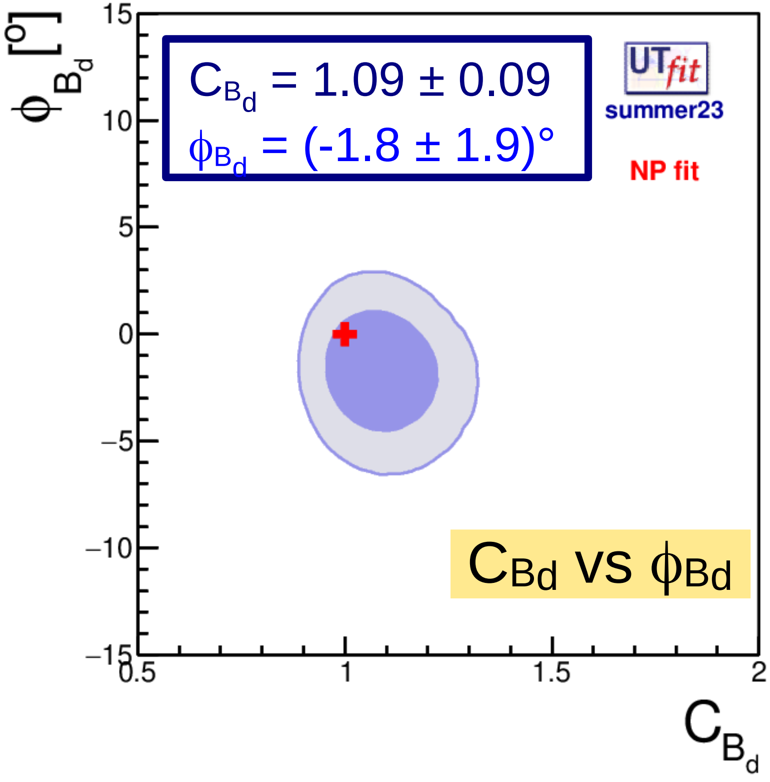
NP parameter results

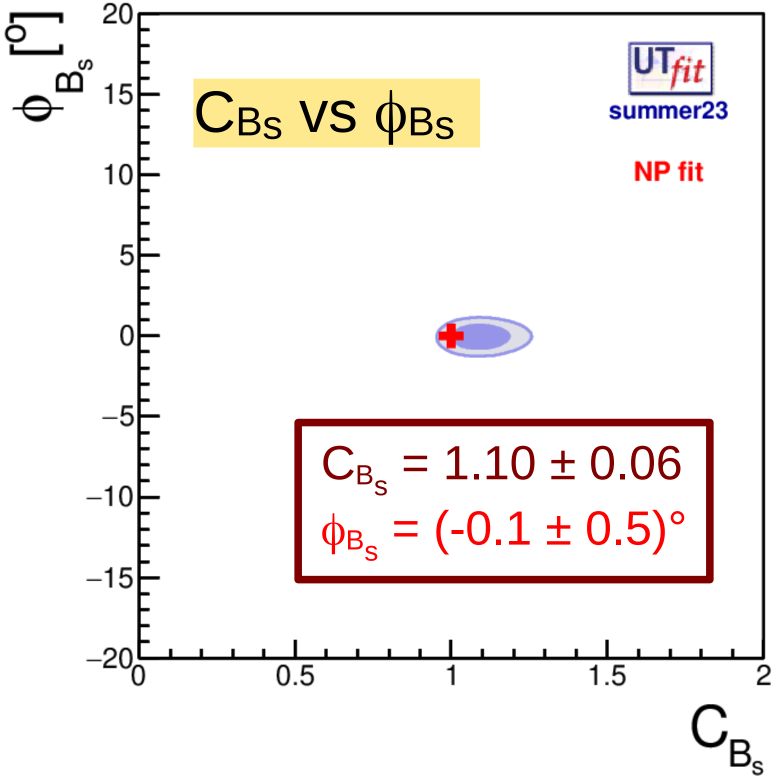
$$A_q = C_{B_q} e^{2i\phi_{B_q}} A_q^{SM} e^{2i\phi_q^{SM}}$$

dark: 68%
light: 95%
SM: red cross

K system

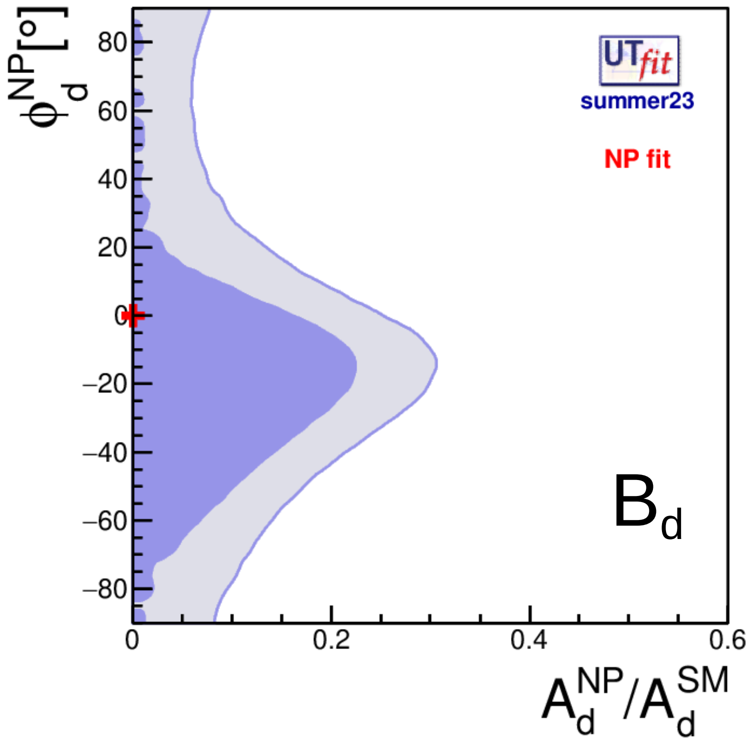
$C_{\epsilon_K} = 1.09 \pm 0.10$

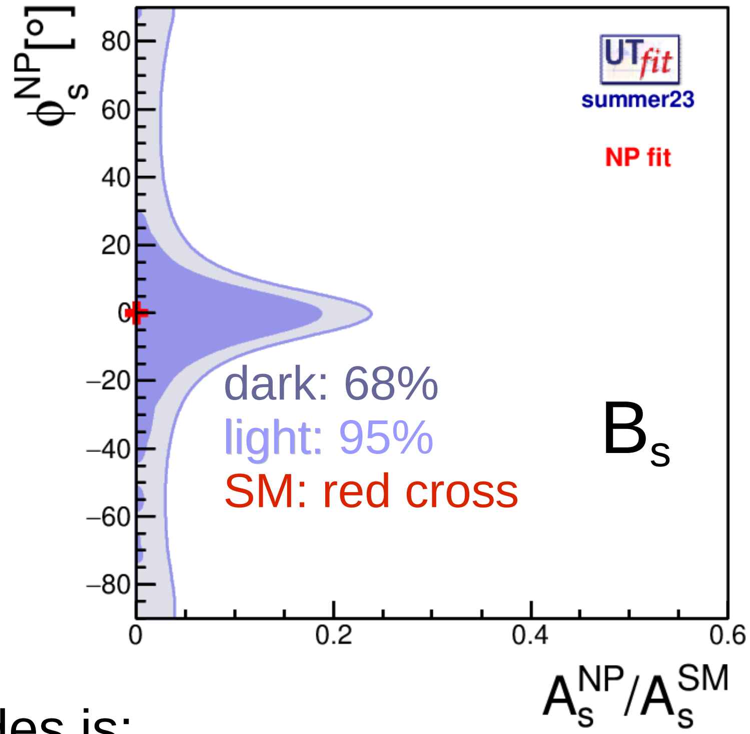




NP parameter results

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





The ratio of NP/SM amplitudes is:

< 20% @68% prob. (30% @95%) in B_d mixing

< 20% @68% prob. (25% @95%) in B_s mixing

Testing the new-physics scale

M. Bona *et al.* (UTfit)
JHEP 0803:049,2008
arXiv:0707.0636

R G E

At the high scale
new physics enters according to its specific features

At the low scale
use OPE to write the most general effective Hamiltonian.
the operators have different chiralities than the SM
NP effects are in the Wilson Coefficients C

$$\mathcal{H}_{\rm eff}^{\Delta B=2} = \sum_{i=1}^{5} C_i Q_i^{bq} + \sum_{i=1}^{3} \tilde{C}_i \tilde{Q}_i^{bq}$$

$$\begin{aligned} Q_1^{q_iq_j} &= \bar{q}_{jL}^{\alpha}\gamma_\mu q_{iL}^{\alpha}\bar{q}_{jL}^{\beta}\gamma^\mu q_{iL}^{\beta} ,\\ Q_2^{q_iq_j} &= \bar{q}_{jR}^{\alpha} q_{iL}^{\alpha}\bar{q}_{jR}^{\beta} q_{iL}^{\beta} ,\\ Q_3^{q_iq_j} &= \bar{q}_{jR}^{\alpha} q_{iL}^{\beta}\bar{q}_{jR}^{\beta} q_{iL}^{\alpha} ,\\ Q_4^{q_iq_j} &= \bar{q}_{jR}^{\alpha} q_{iL}^{\alpha}\bar{q}_{jL}^{\beta} q_{iR}^{\beta} ,\\ Q_5^{q_iq_j} &= \bar{q}_{jR}^{\alpha} q_{iL}^{\beta}\bar{q}_{jL}^{\beta} q_{iR}^{\alpha} . \end{aligned}$$

$$C_i(\Lambda) = F_i \frac{L_i}{\Lambda^2}$$

F_i: function of the NP flavour couplings
L_i: loop factor (in NP models with no tree-level FCNC)
Λ: NP scale (typical mass of new particles mediating ΔF=2 processes)

Testing the new-physics scale

$$C_i(\Lambda) = F_i \frac{L_i}{\Lambda^2}$$

The dependence of C on Λ changes depending on the flavour structure.
We can consider different flavour scenarios:

- Generic: $C(\Lambda) = \alpha/\Lambda^2$ — $F_i \sim 1$, arbitrary phase
- NMFV: $C(\Lambda) = \alpha \times |F_{SM}|/\Lambda^2$ — $F_i \sim |F_{SM}|$, arbitrary phase
- MFV: $C(\Lambda) = \alpha \times |F_{SM}|/\Lambda^2$ — $F_1 \sim |F_{SM}|$, $F_{i\neq1} \sim 0$, SM phase

α (L_i) is the coupling among NP and SM
- $\alpha \sim 1$ for strongly coupled NP
- $\alpha \sim \alpha_W$ (α_S) in case of loop coupling through weak (strong) interactions

If no NP effect is seen lower bound on NP scale Λ

F is the flavour coupling and so
F_{SM} is the combination of CKM factors for the considered process

Results from the Wilson coefficients

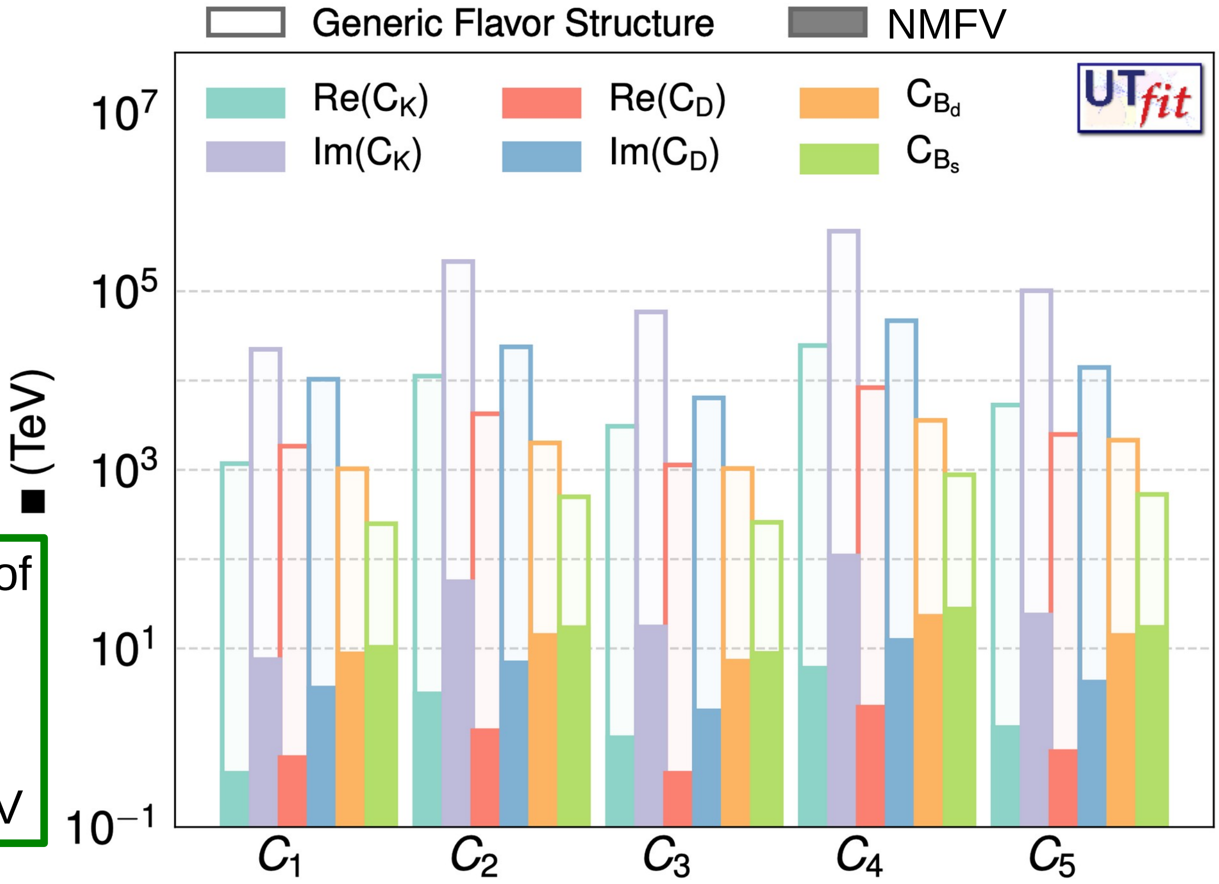
Generic:
$C(\Lambda) = \alpha/\Lambda^2$,
$F_i \sim 1$, arbitrary phase

$\alpha \sim 1$ for strongly coupled NP

$\Lambda > 4.7\ 10^5$ TeV

$\alpha \sim \alpha_W$ in case of loop coupling through weak interactions

$\Lambda > 1.4\ 10^4$ TeV



NMFV:
$C(\Lambda) = \alpha \times |F_{SM}|/\Lambda^2$,
$F_i \sim |F_{SM}|$, arbitrary phase

$\alpha \sim 1$ for strongly coupled NP

$\Lambda > 108$ TeV

$\alpha \sim \alpha_W$ in case of loop coupling through weak interactions

$\Lambda > 3.2$ TeV

for lower bound for loop-mediated contributions, simply multiply by α_s (~ 0.1) or by α_W (~ 0.03).

conclusions

- SM analysis displays very good (improved) overall consistency
  - We will be trying to keep the webpage updated. It’s quite the challenge but you are welcome to put pressure on us asking for updated plots :)
- Still open discussion on semileptonic inclusive vs exclusive
- UTA provides determination of NP contributions to $\Delta F=2$ amplitudes. It currently leaves space for NP at the level of ~25%
- So the scale analysis points to high scales for the generic scenario and at the limit of LHC reach for weak coupling. Indirect searches are not only complementary to direct searches, but they might be the main way to glimpse at new physics.

Back up slides

Lattice inputs summary

Observables	**Measurement**
B_K	**0.756 ± 0.016**
f_{Bs}	**0.2301 ± 0.0012**
f_{Bs}/f_{Bd}	**1.208 ± 0.005**
B_{Bs}/B_{Bd}	**1.015 ± 0.021**
B_{Bs}	**1.284 ± 0.059**

We quote the weighted average of the N_f=2+1+1 and N_f=2+1 results with the error rescaled when chi2/dof > 1, as done by FLAG for the N_f=2+1+1 and N_f=2+1 averages separately

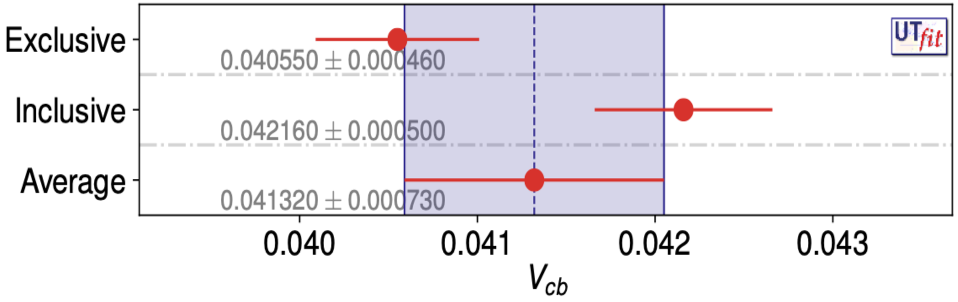
Observables	**Measurement**
V_{ud}	**0.97432 ± 0.00013**
V_{us}	**0.2249 (± 0.0004)**

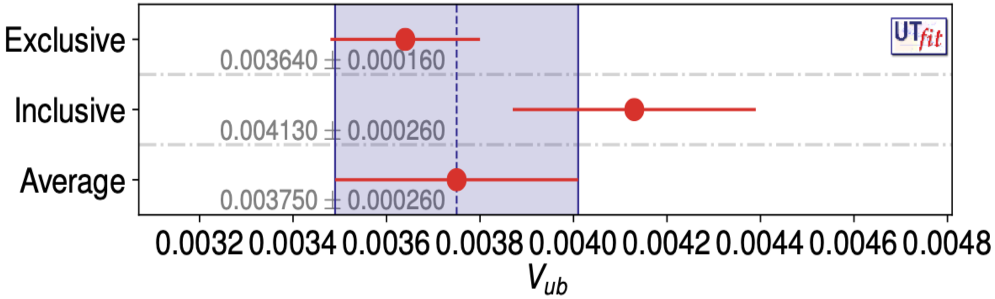
V_{ud} is taken from the PDG average of V_{ud} FLAG numbers (for 2+1+1 and 2+1) and superallowed beta decays value.

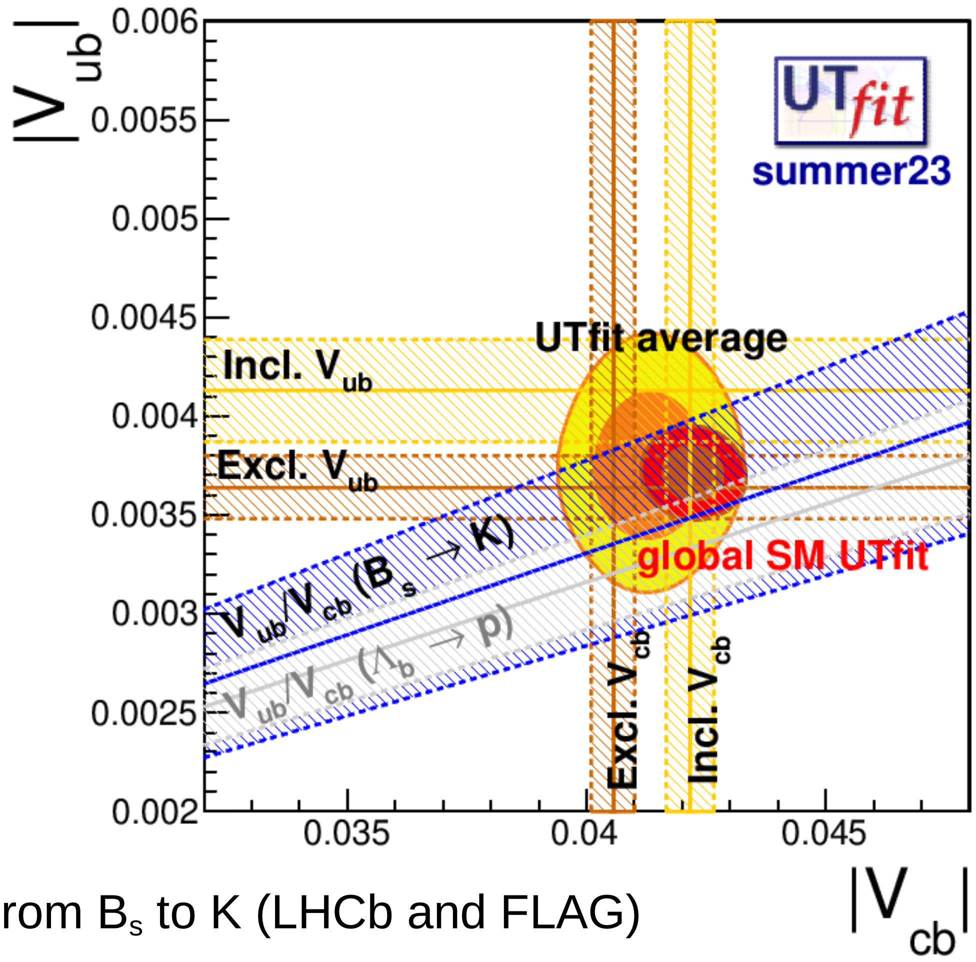
V_{us} is not used in the fit

V_{cb} and V_{ub}

See Ludovico Vittorio's talk on Wednesday here





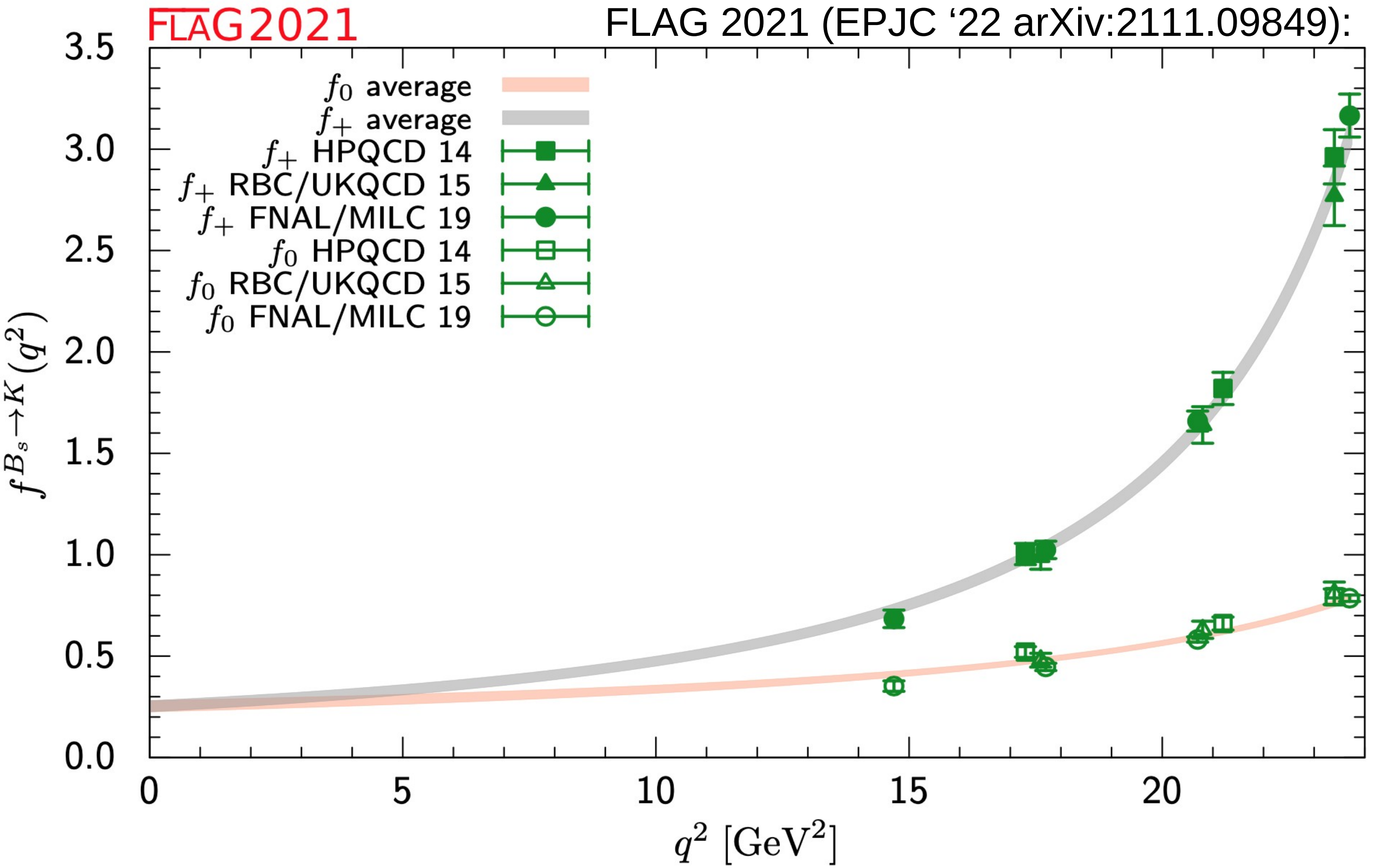


$|V_{ub} / V_{cb}|$ *(LHCb)* = $(8.27 \pm 1.17)\ 10^{-2}$ From B_s to K (LHCb and FLAG)

$|V_{ub} / V_{cb}|$ *(LHCb)* = $(7.9 \pm 0.6)\ 10^{-2}$ From Λ_b, excluded following FLAG guidelines

V_{cb} and V_{ub}

FLAG 2021 (EPJC '22 arXiv:2111.09849):



V_{cb} and V_{ub}

G.Martinelli et al.: Updates on the determination of $|V_{cb}|$, $R(D^*)$ and $|V_{ub}|/|V_{cb}|$

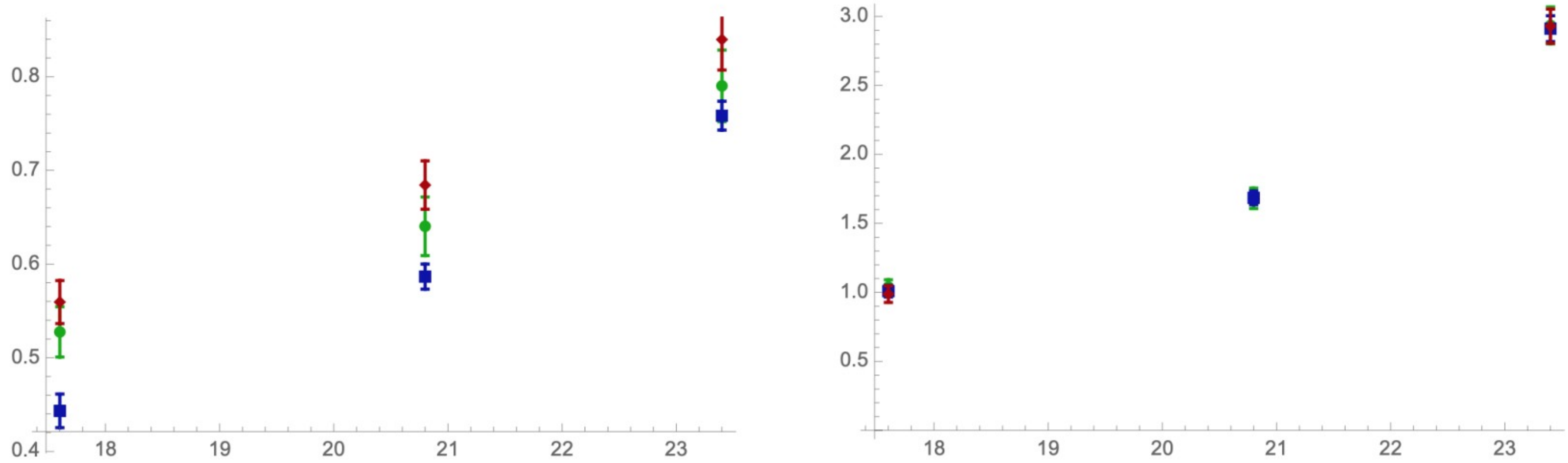
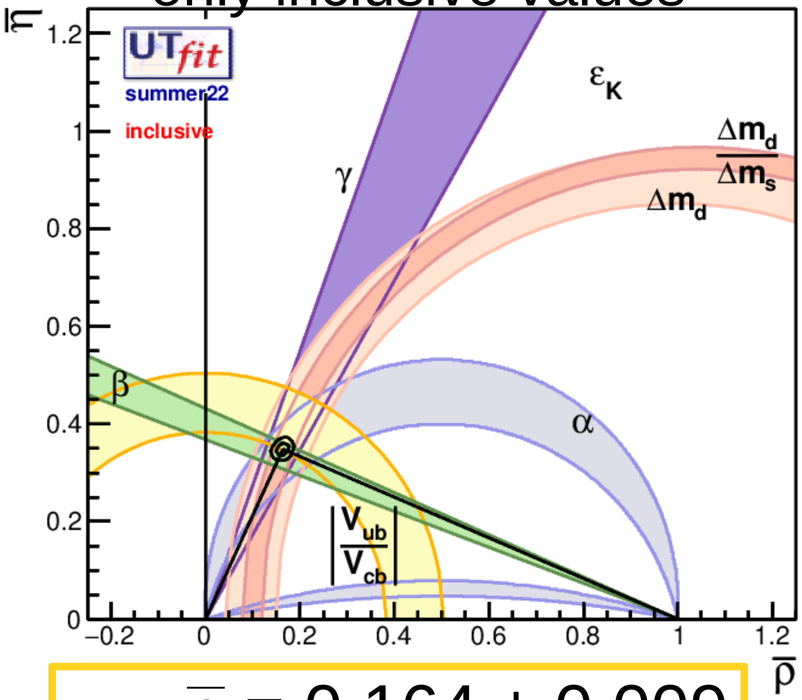


Fig. 8. *Available lattice results for the FFs $f_0(q^2)$ (left panel) and $f_+(q^2)$ (right panel) relevant for $B_s \to K\ell\nu_\ell$ decays. The RBC/UKQCD [6] (diamond), FNAL/MILC [31] (squares) and HPQCD [32, 33] (circles).*

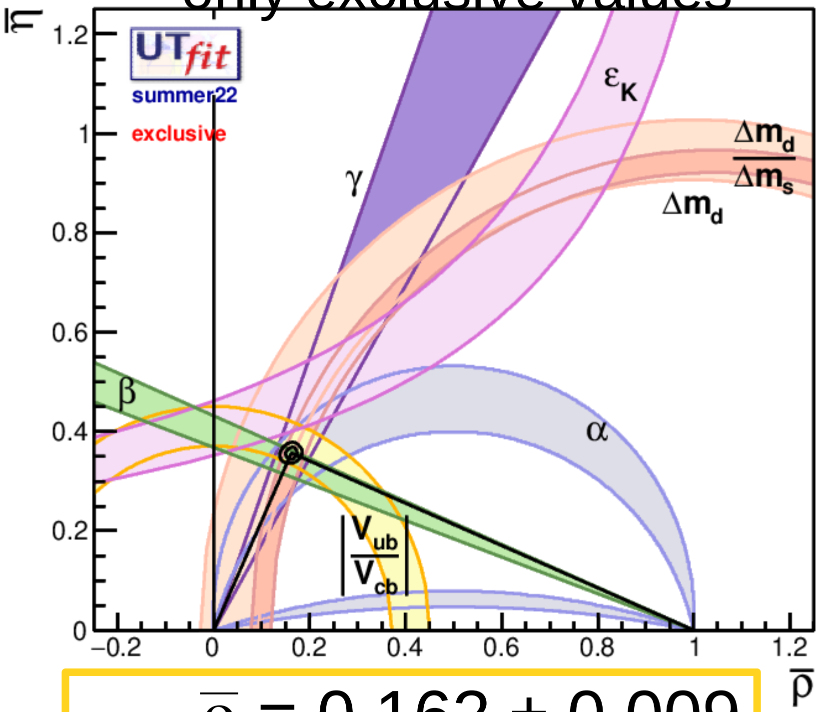
Inclusive vs Exclusive

only inclusive values



$$\bar{\rho} = 0.164 \pm 0.009$$
$$\bar{\eta} = 0.348 \pm 0.009$$
$$\sin 2\beta = 0.753 \pm 0.028$$

only exclusive values

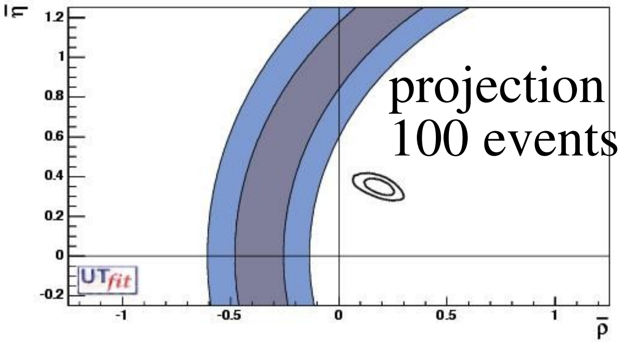


$$\bar{\rho} = 0.162 \pm 0.009$$
$$\bar{\eta} = 0.356 \pm 0.009$$
$$\sin 2\beta = 0.755 \pm 0.020$$

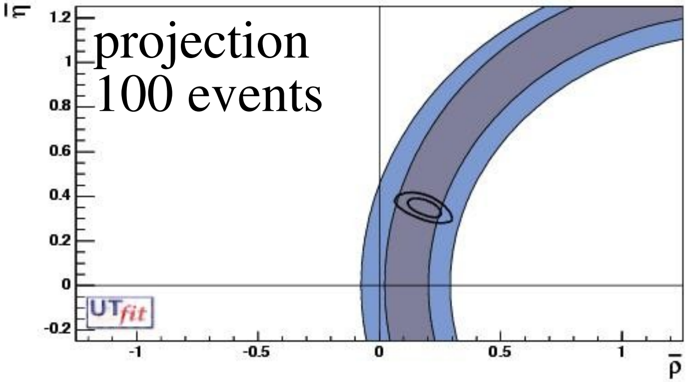
To be updated soon

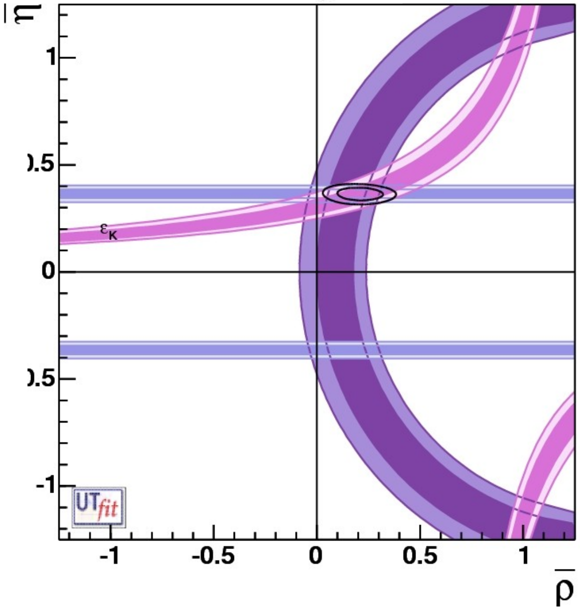
BR($K^+ \rightarrow \pi^+ \nu\bar{\nu}$)

E949 central value

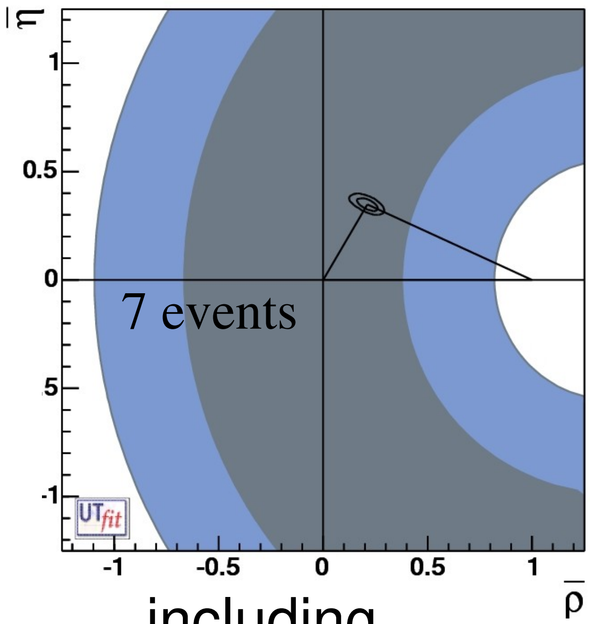


SM central value



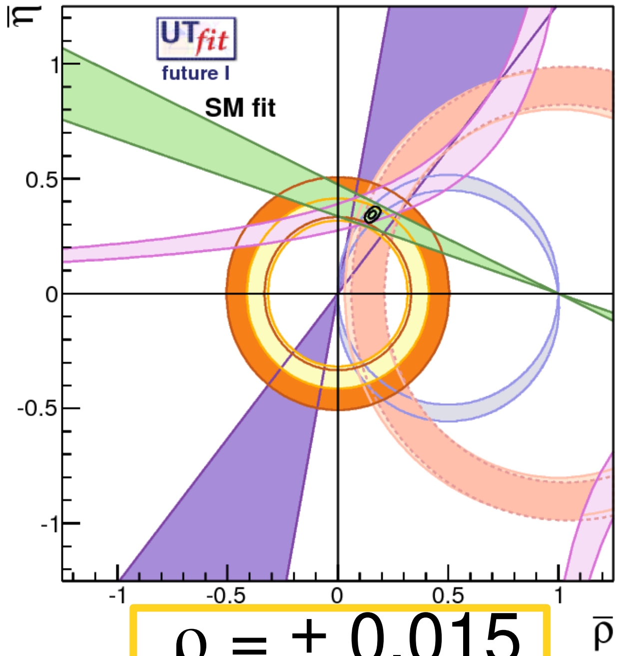


2007 global fit area



including
BR($K^0 \rightarrow \pi^0 \nu\bar{\nu}$)
SM central value

Old future predictions..



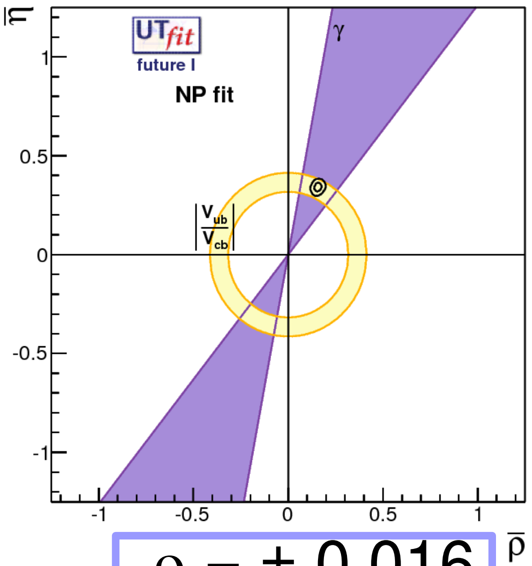
$\rho = \pm\ 0.015$
$\eta = \pm\ 0.015$

$\bar{\rho} = 0.160 \pm 0.009$
$\bar{\eta} = 0.346 \pm 0.009$

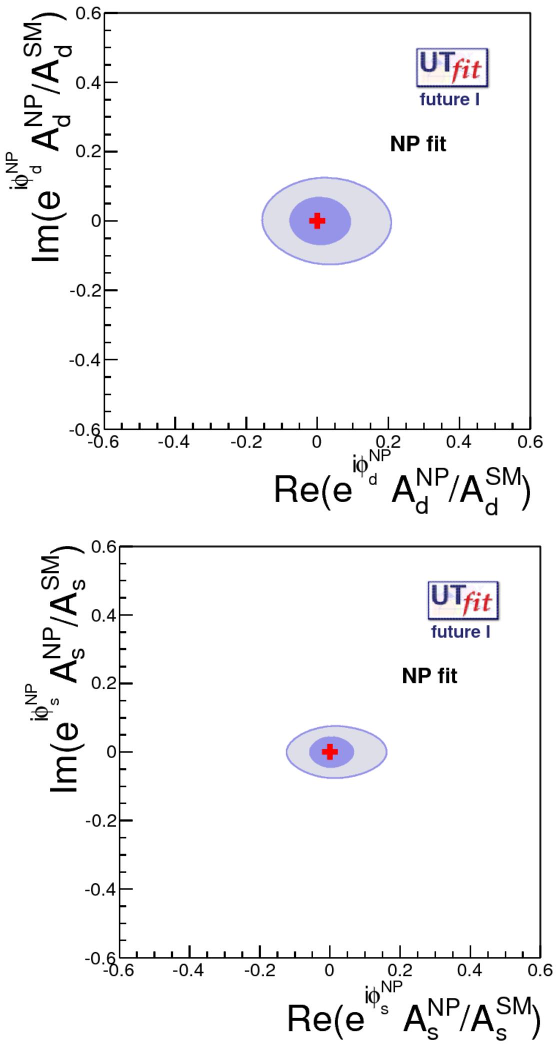
current sensitivity

$\bar{\rho} = 0.167 \pm 0.025$
$\bar{\eta} = 0.361 \pm 0.027$

future I scenario:
errors from
Belle II at 5/ab
+ LHCb at 10/fb



$\rho = \pm\ 0.016$
$\eta = \pm\ 0.019$



Lattice result summary (summer22)

We obtain the predictions for the lattice parameters in different configurations in the fit:

- only lattice parameters ratios
  - (F_{Bs}/F_B, B_{Bs}/B_{Bd} used)
- only B parameters
  - ($B_{Bs}{}^1$, B_{Bs}/B_{Bd} used)
- only decay constants f
  - (f_{Bs}, f_{Bs}/f_B included)

Observables	Measurement	Prediction
B_K	**0.756 ± 0.016**	**0.840 ± 0.053**
No B lattice		
$f_B \sqrt{B_{Bd}}$	**(0.2142 ± 0.0056)**	**0.212 ± 0.010**
$f_{Bs} \sqrt{B_{Bs}}$	**(0.2607 ± 0.0061)**	**0.259 ± 0.010**
ξ	**(1.217 ± 0.014)**	**1.225 ± 0.033**
Ratios only		
f_{Bs}	**0.2301 ± 0.0012**	**0.227 ± 0.009**
B_{Bs}	**1.284 ± 0.059**	**1.30 ± 0.10**
B pars only		
f_{Bs}/f_{Bd}	**1.208 ± 0.005**	**1.215 ± 0.028**
f_{Bs}	**0.2301 ± 0.0012**	**0.228 ± 0.008**
f pars only		
B_{Bs}/B_{Bd}	**1.015 ± 0.021**	**1.017 ± 0.028**
B_{Bs}	**1.284 ± 0.059**	**1.290 ± 0.065**