Flavour in the era of the LHC

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Impact of Recent Δm_s Results

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CKM fitter

ANNECY lapp

Δm_s: recent results

hep-ex/0603029

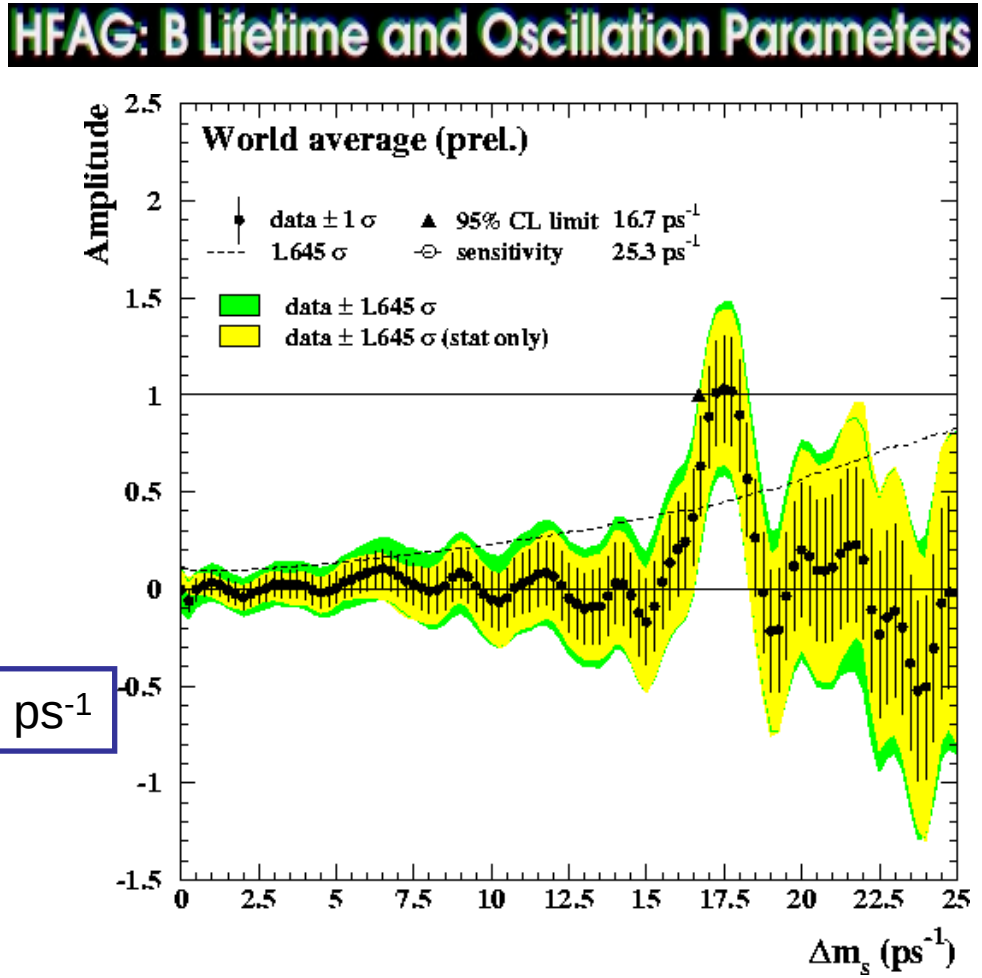
$17 < \Delta m_s < 21\ ps^{-1}$ @90 C.L.

(See G. Borissov's talk)

FPCP '06

$\Delta m_s = 17.33^{+0.42}_{-0.21}(stat) \pm 0.07\ (syst)\ ps^{-1}$

(See S. De Cecco's talk)



The signal has a significance of 3.8σ at 17.5 ps^{-1}

Δm_s : constraint in the ($\bar{\rho}$-$\bar{\eta}$) plane

$$\Delta m_s = \frac{G_F^2}{6\pi^2} m_{B_s} m_W^2 \eta_B S_0(x_t) f_{B_s}^2 B_s \left| V_{ts} V_{tb}^* \right|^2$$

Very weak dependence on $\bar{\rho}$ and $\bar{\eta}$

The point is:

$$f_{B_s}^2 B_s = \frac{f_{B_s}^2 B_s}{f_{B_d}^2 B_d} f_{B_d}^2 B_d = \xi^2 f_{B_d}^2 B_d$$

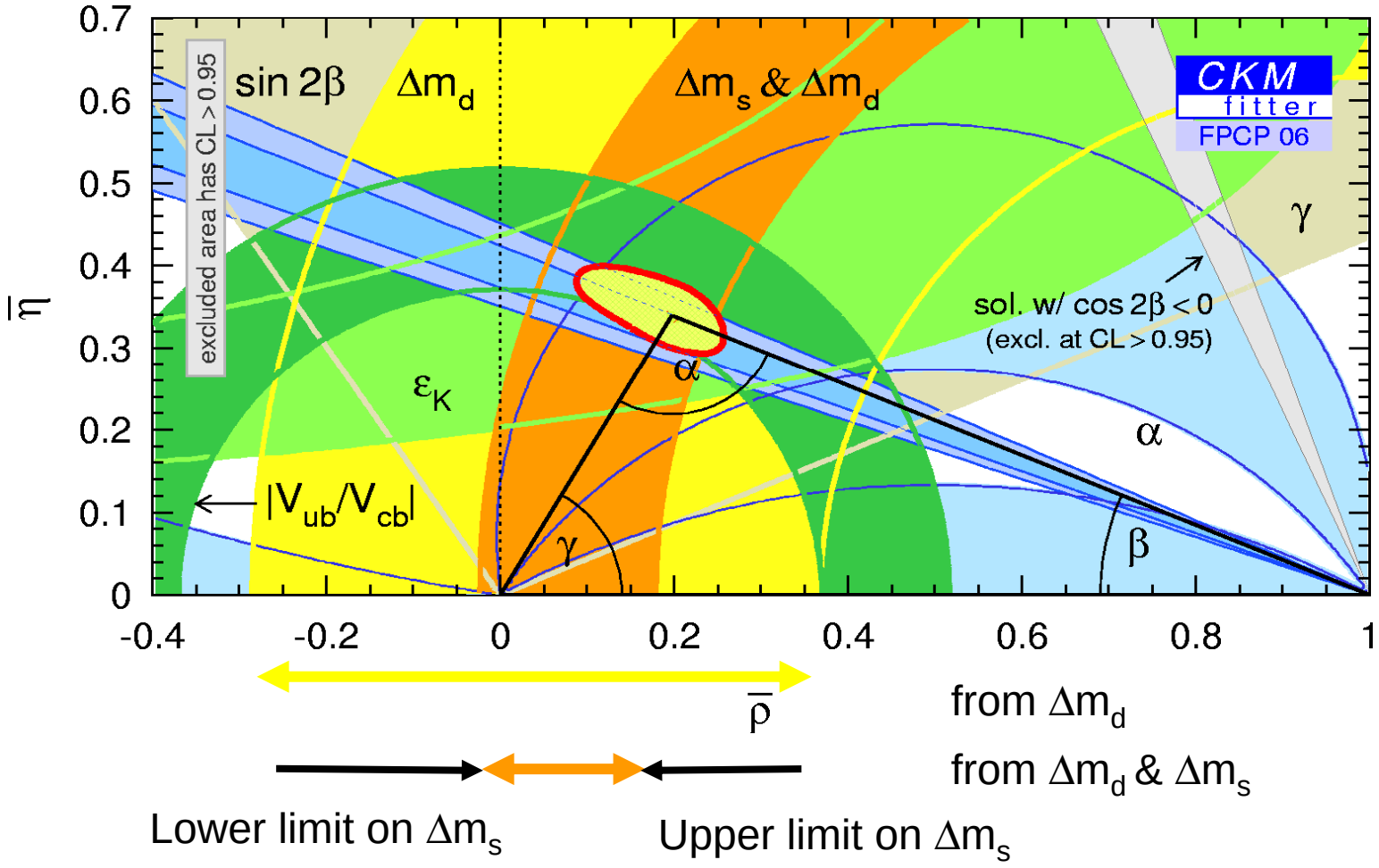
ξ: SU(3)-breaking corrections

Measurement of Δm_s reduces the uncertainties on $f^2_{B_d} B_d$ since ξ is better known from Lattice QCD

➔Leads to improvement of the constraint from Δm_d measurement on $|V_{td}V^*_{tb}|^2$

$$\Delta m_d = \frac{G_F^2}{6\pi^2} m_{B_d} m_W^2 \eta_B S_0(x_t) f_{B_d}^2 B_d \left| V_{td} V_{tb}^* \right|^2 \propto A^2 \lambda^6 \left[(1-\bar{\rho})^2 + \bar{\eta}^2 \right]$$

Δm_s : constraint in the $(\bar{\rho}\text{-}\bar{\eta})$ plane



$\xi = 1.24 \pm 0.04 \pm 0.06$ chiral logs

$\xi = (1.06+0.122-0.047)$ [lattice value not in the fit]

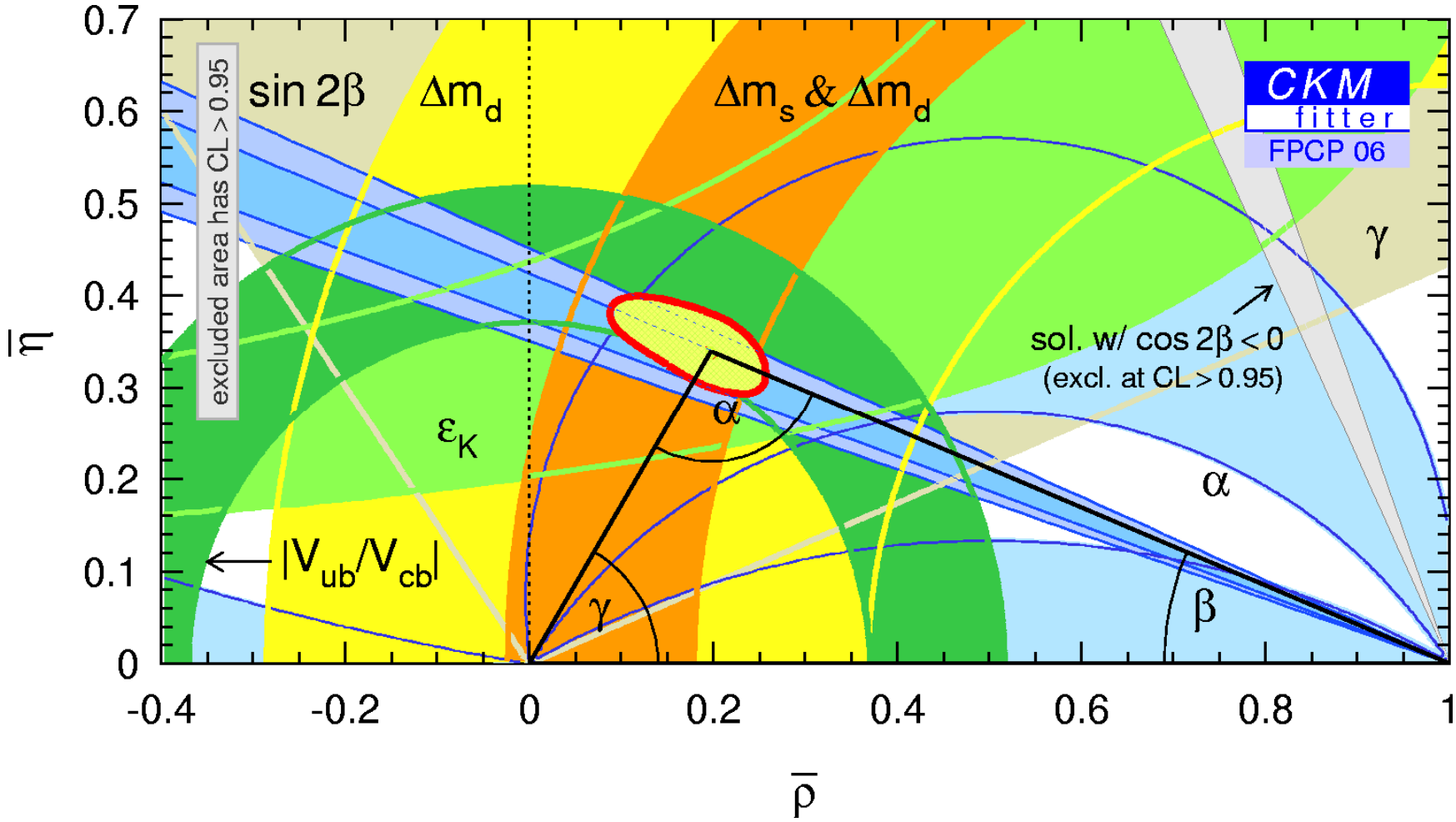
Not yet competitive with LQCD

Δm_s : constraint in the $(\bar{\rho}\text{-}\bar{\eta})$ plane

$\bar{\rho} = 0.219^{+0.076}_{-0.040}$ $\bar{\eta} = 0.327^{+0.024}_{-0.046}$ (Δm_s>14.4 ps^{-1})

(Summer '05)

$\bar{\rho} = 0.197^{+0.026}_{-0.030}$ $\bar{\eta} = 0.339^{+0.019}_{-0.018}$

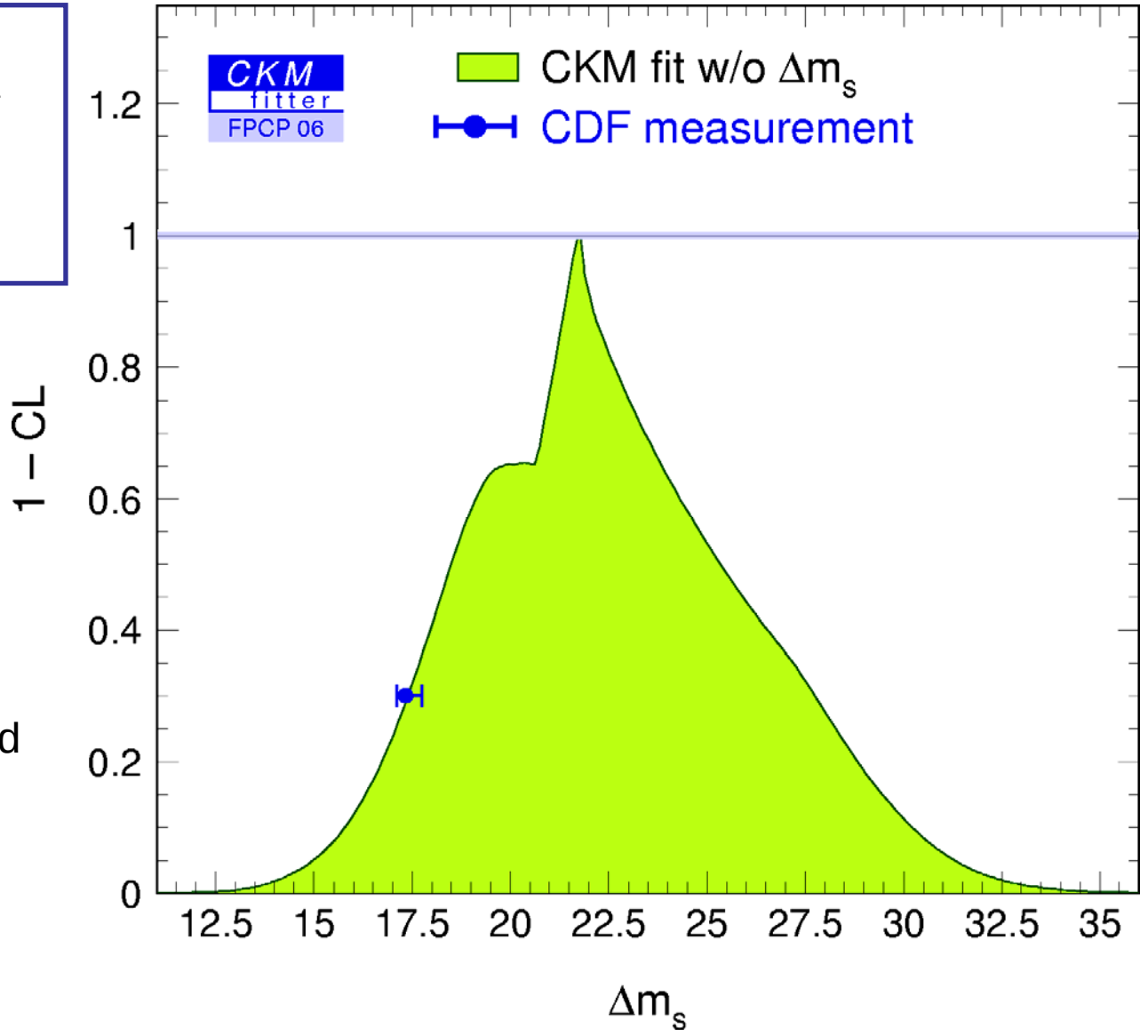


Global CKM Fit

Direct Measurement:
$\Delta m_s = 17.34^{+0.49}_{-0.20}\ ps^{-1}$

Global fit w/o Δm_s:
$\Delta m_s = 21.7^{+5.9}_{-4.2}\ ps^{-1}$

In agreement with the global CKM fit.
➔Consistent with Standard Model

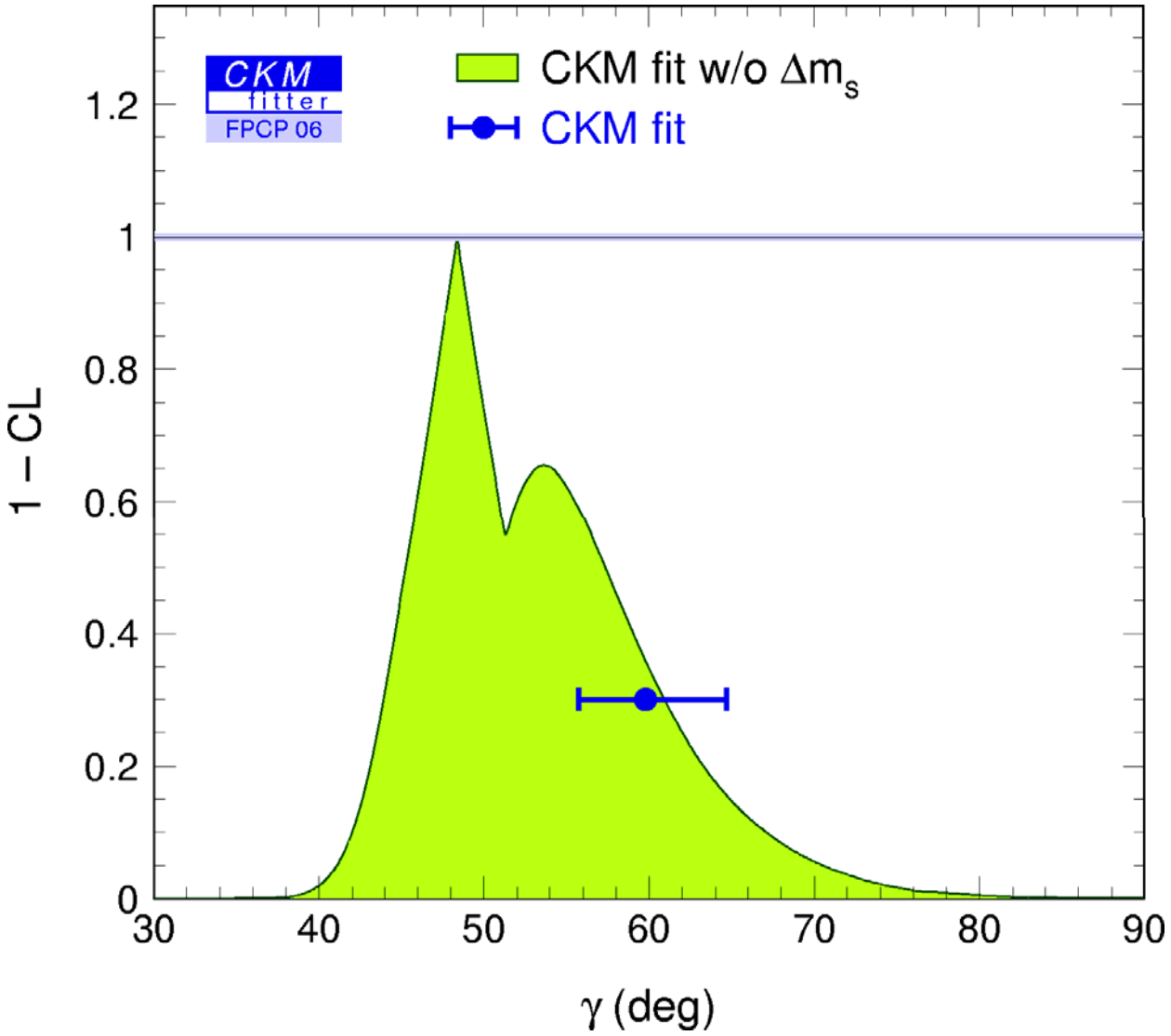


Constraint on γ

Global fit w/o Δm_s:
$\gamma = 48.4^{+12.2}_{-4.4}$ (deg)

Global fit :
$\gamma = 59.8^{+4.9}_{-4.1}$(deg)

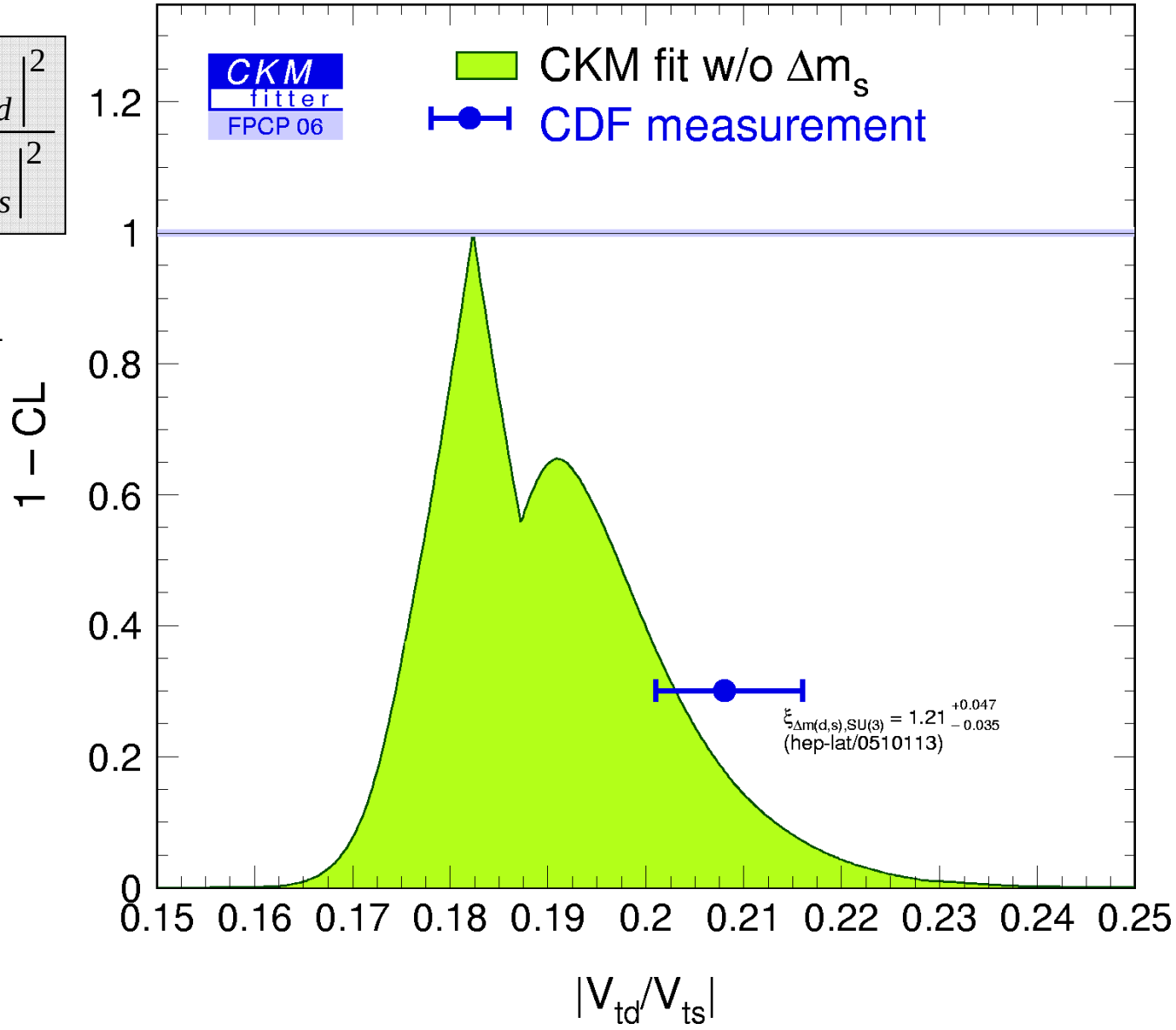
➔ New bounds on Δm_s impose stringent constraints on γ values



Constraint on $|V_{td}/V_{ts}|$

$$\frac{\Delta m_d}{\Delta m_s} = \frac{m_{Bd}}{m_{Bs}} \xi_{\Delta m}^{-2} \frac{|V_{td}|^2}{|V_{ts}|^2}$$

$\Delta m_d = 0.508 \pm 0.004\ ps^{-1}$

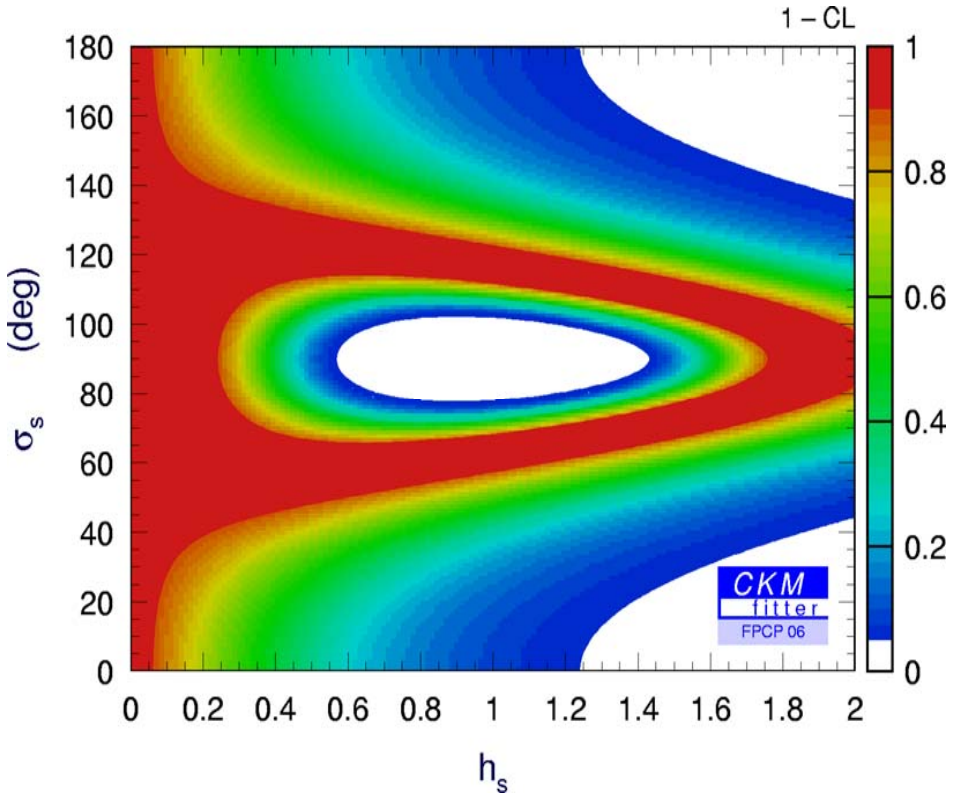


Constraint on New Physics

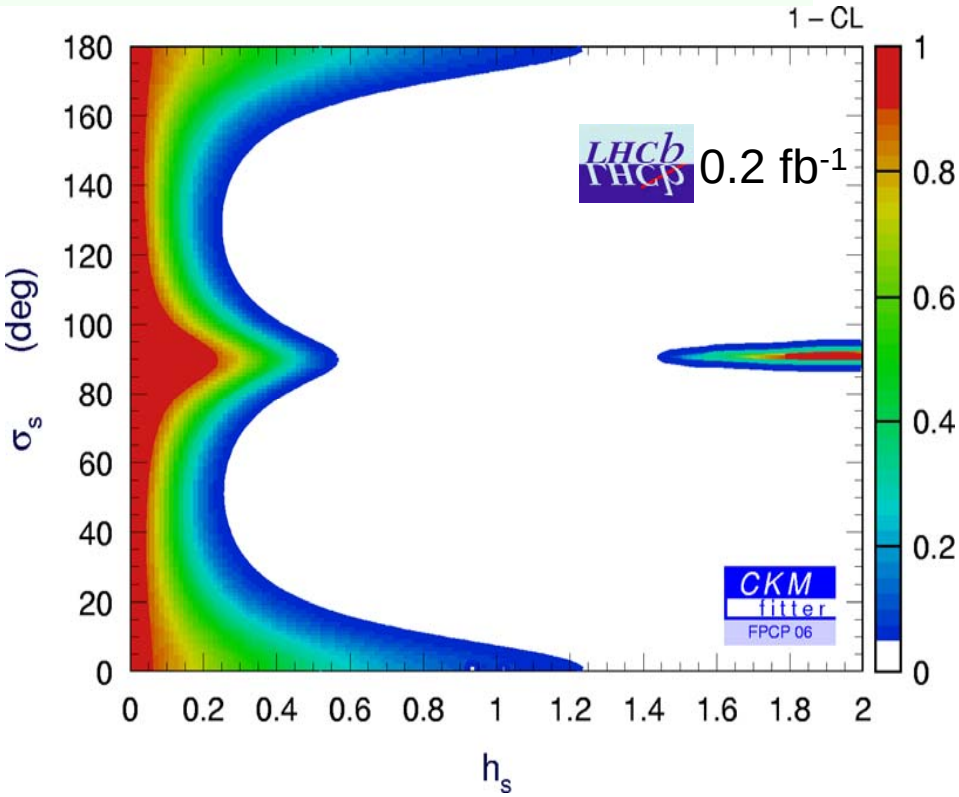
(See P. Ball's talk)

model-independent parametrization

$$\langle B_q | \mathcal{H}^{SM+NP}_{\Delta B=2} | \bar{B}_q \rangle \equiv \langle B_q | \mathcal{H}^{SM}_{\Delta B=2} | \bar{B}_q \rangle \times (1 + h_q e^{2i\sigma_q})$$



Still plenty of room for NP



$\sigma(\Delta m_s)$= 0.035, $\sigma(\sin(2\beta_s)$= 0.1

➔ $\sin(2\beta_s)$ =0.0365 ± 0.002 (global CKM fit)

➔ Measurement at the LHC will be a very sensitive probe to NP