Physics of the B-Factories Book

CKM sides: V_{td} and V_{ts}

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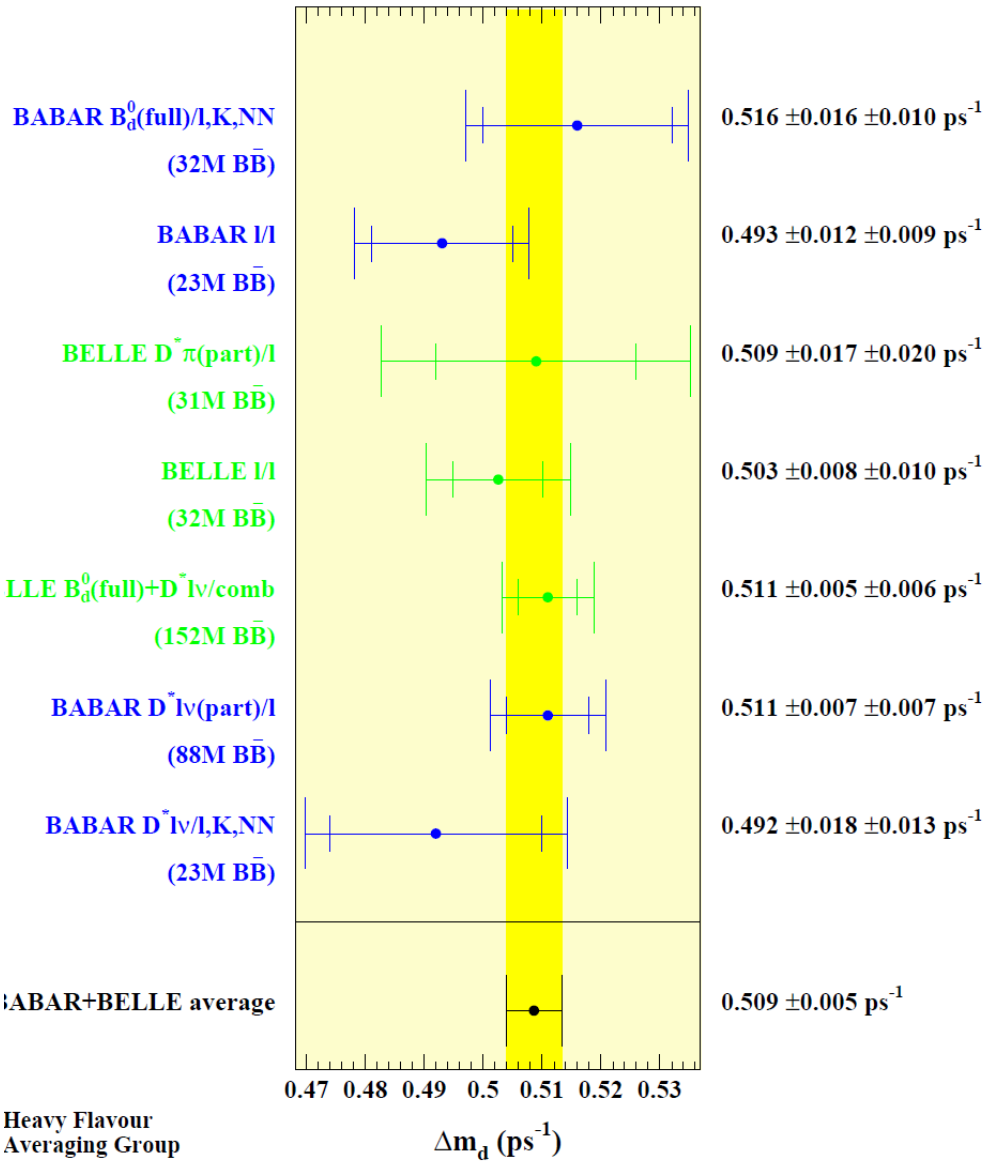
Chapter Outline

- Basic plan of the chapter is to describe extraction of |Vtd/Vts| from two sets of experimental results:
  - Δm_d and Δm_s
    - Forward reference(s) to mixing chapter
    - Discussion of Tevatron results and lattice inputs
      - Lattice inputs common with global fits and ?
  - $B \to X_{s,d} \gamma$ branching fractions
    - Forward reference(s) to radiative penguins chapter
    - Babar has done two sets of complementary analyses
      - Exclusive $B \to K^* \gamma$ and $B \to \rho/\omega \gamma$
      - Semi-inclusive $B \to X_s \gamma$ and $B \to X_d \gamma$
    - Similar from Belle ?

External Dependencies: Mixing

- Will mixing chapter discussion of Δm_d culminate in HFAG average?
- One current Babar analysis possibly to be added, but unclear if final total uncertainty will be better than previous msmts
- Anything new (and improved) expected from Belle?



External Dependencies: RadPen

- Final Babar exclusive and semi-inclusive analyses of B->Xdgamma include |Vtd/Vts| as part of the final results
  - Similar Belle analyses?

- RadPen will presumably discuss these experimental results without interpretation in the context of |Vtd/Vts|

- These results would be forward referenced in the Vtd, Vts chapter

Shared Inputs with Global Fits

- Lattice inputs are required to derive |Vtd/Vts| from the experimental observable $\Delta m_{d,s}$

$$\Delta m_B = 2|M_{12}| = \frac{G_F^2}{6\pi^2}\eta_B m_B \boxed{\hat{B}_B f_B^2} M_W^2 S\left(\frac{m_t^2}{M_W^2}\right)|V_{tb}V_{td}^*|^2$$

Lattice QCD dependence

- Precision of lattice inputs are substantially better for the ratio |Vtd/Vts| than for the individual CKM elements

	$f_B\sqrt{\hat{B}_{B_d}}$(MeV)	$f_{B_s}\sqrt{\hat{B}_{B_s}}$(MeV)
Average	216 ± 15	275 ± 13

	ξ	$(\delta\xi)_{\text{stat}}$	$(\delta\xi)_{\text{syst}}$
FNAL/MILC '08 [32]	1.205	0.036	0.037
HPQCD '09 [29]	1.258	0.025	0.021
Average	1.243 ± 0.028		

Averages taken from Laiho, Van de Water, Lunghi, "Lattice QCD inputs to the CKM unitarity triangle analysis", PRD 81,034503 (2010)

Some Final Details

- Belle co-editor still needed
  - Lacking this, at least Belle review of relevant material
- Expect to need 4-6 pages, 1-2 figures, 2-4 tables
- **Debbie Bard** has agreed to contribute Vtd/Vts discussion
  - Lead analyst for Babar semi-inclusive B->Xdgamma
- The selection of material here has been discussed in general terms with **Tobias Hurth** (theory ed.), but the details presented here still need to be reviewed and agreed upon
- Will be useful to see initial draft of Radiative Penguin and Mixing sections in order to guide the writing here