Average Results of Babar Semileptonic $B->D^{(*)}l\nu$ Decay Measurements.

Babar Physics Workshop,
June 30, 2008

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Motivation

- Since last year 4 Babar measurements of $B->D^{(*)}l\nu$ decays have come out :
  - $B^0->D^{*-}l^+\nu$ FF, BF and $F(1)|V_{cb}|$ (Exclusive reconstruction) (Phys.Rev.D77,032002(2008))
  - $B^-->D^{*0}e^-\nu$ FF, BF and $F(1)|V_{cb}|$ (Exclusive reconstruction) (Phys.Rev.Lett.100,231803(2008))
  - $B->D^{(*)}l\nu$ BF (Hadronic tag) (Phys.Rev.Lett.100,151802(2008))
  - $B->D^{(*)}l\nu$ FF, BF and $F(1)|V_{cb}|$ (Global fit) (BAD1781)
- It is a good time to have Babar average results.
- These analysis use different and complementary methods.
  - One analysis is not an update of another analysis.
  - Average should be unbiased results.

Method

- Scale previous results by new numbers :
  - Charm decay branching fractions.
  - Y(4S) -> $B^+B^-/B^0\bar{B}^0$ ratio.
- Impose isospin symmetry.
- Construct covariance matrix :
  - Correlations between statistical uncertainties are assumed to be negligible.
  - Assume 100 % correlation between systematic errors (see next page for detail).
- Minimize χ^2 by assuming one real value.
- Since we take 100 % systematic correlation, we are on conservative side.

Systematic correlation

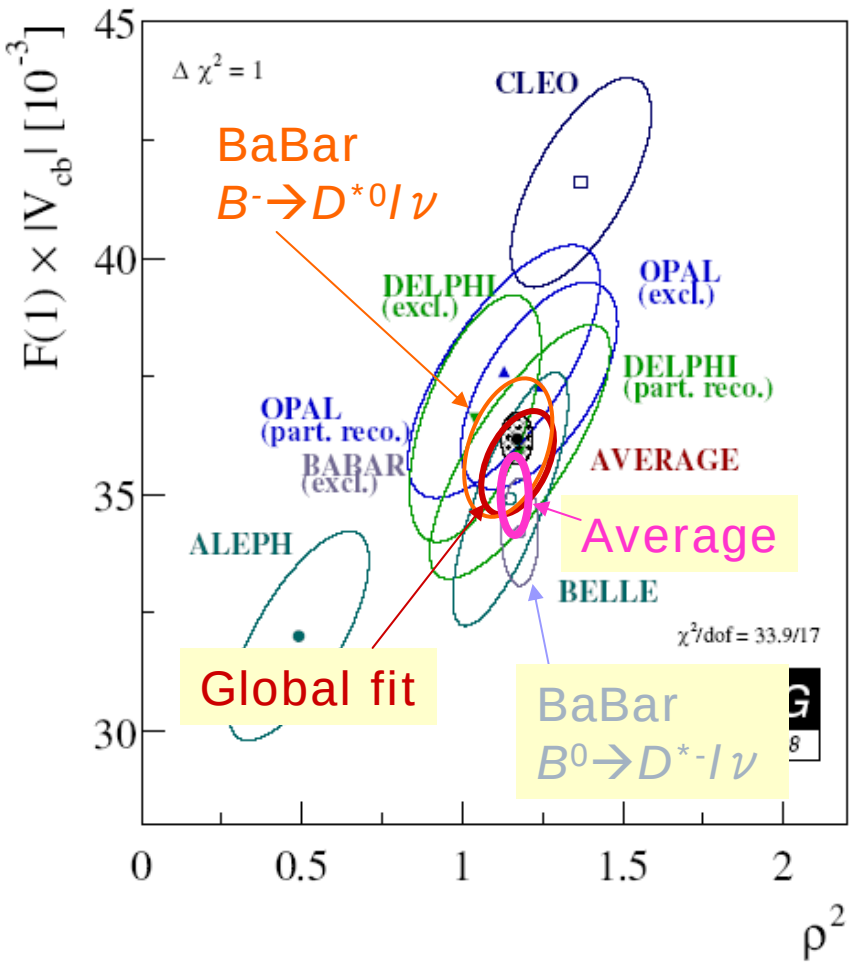
- Correlations between systematic errors :
  - Systematic errors are categorized into
    - Detector effect
    - Soft pion reconstruction
    - Backgrounds
    - R1 and R2
    - BF($D^{*0} \to D^0 \pi^0$)
    - BF($D^{*+} \to D^0 \pi^+$)
    - BF($D^+ \to K^- \pi^+ \pi^+$)
    - BF($D^0 \to K^- \pi^+$)
    - B lifetime ratio
    - Y(4S) -> $B^+B^-/B^0\bar{B}^0$ ratio.
    - B counting
    - Beam energy correction
    - Radiative corrections
    - B tagging
  - Take quadrature sum within each category.
  - Assume 100 % correlation between quadrature sums of different analysis.

Results.

- Global fit results :
  - D slope = 1.23 ± 0.04 ± 0.07
  - D^* slope = 1.21 ± 0.02 ± 0.07
  - BF($B^+ \to D l \nu$) = (2.38 ± 0.03 ± 0.13) %
  - BF($B^+ \to D^* l \nu$) = (5.32 ± 0.02 ± 0.21) %
  - $\mathcal{F}(1)|V_{cb}| = (35.6 \pm 0.2 \pm 1.2) \times 10^{-3}$
- Average results :
  - BF($B^+ \to D l \nu$) = (2.35 ± 0.10) % (χ^2 probab.=0.95)
  - D^* slope = 1.19 ± 0.05 (χ^2 probab.=0.87)
  - BF($B^+ \to D^* l \nu$) = (5.49 ± 0.20) % (χ^2 probab.=0.17)
  - $\mathcal{F}(1)|V_{cb}| = (35.0 \pm 1.0) \times 10^{-3}$ (χ^2 probab.=0.67)
- All χ^2 probab. are good => good agreements between different analysis.

Comparison with others

- Good agreement with world average.
- Correlation is unknown → No correlation is assumed to make the ellipse.



Other input

- $B^0 \to D^{*-} l^+ \nu$ (Phys.Rev.D77,032002(2008))
  - D^* slope = 1.191 ± 0.048 ± 0.028
  - BF($B^0 \to D^* l \nu$) = (4.96 ± 0.04 ± 0.34) %
  - $F(1)|V_{cb}|$ = (34.4 ± 0.3 ± 1.1)×10^{-3}
- $B^- \to D^{*0} e^- \nu$ (Phys.Rev.Lett.100,231803(2008))
  - D^* slope = 1.16 ± 0.06 ± 0.08
  - BF($B^+ \to D^* l \nu$) = (5.56 ± 0.08 ± 0.41) %
  - $F(1)|V_{cb}|$ = (35.9 ± 0.6 ± 1.4)×10^{-3}
- $B \to D^{(*)} l \nu$ (B_{reco}) (Phys.Rev.Lett.100,151802(2008))
  - BF($B^+ \to D l \nu$) = (2.33 ± 0.09 ± 0.09) %
  - BF($B^0 \to D l \nu$) = (2.21 ± 0.11 ± 0.12) %
  - BF($B^+ \to D^* l \nu$) = (5.83 ± 0.15 ± 0.30) %
  - BF($B^0 \to D^* l \nu$) = (5.49 ± 0.16 ± 0.25) %