# $B^{\pm}/B^{0}$ ADMIXTURE

## $B$ DECAY MODES

The branching fraction measurements are for an admixture of $B$ mesons at the $\Upsilon(4S)$. The values quoted assume that B($\Upsilon(4S) \rightarrow B\overline{B}$) = 100%.

For inclusive branching fractions, *e.g.*, $B \rightarrow D^{\pm}$ anything, the treatment of multiple $D$'s in the final state must be defined. One possiblity would be to count the number of events with one-or-more $D$'s and divide by the total number of $B$'s. Another possibility would be to count the total number of $D$'s and divide by the total number of $B$'s, which is the definition of average multiplicity. The two definitions are identical when only one of the specified particles is allowed in the final state. Even though the "one-or-more" definition seems sensible, for practical reasons inclusive branching fractions are almost always measured using the multiplicity definition. For heavy final state particles, authors call their results inclusive branching fractions while for light particles some authors call their results multiplicities. In the $B$ sections, we list all results as inclusive branching fractions, adopting a multiplicity definition. This means that inclusive branching fractions can exceed 100% and that inclusive partial widths can exceed total widths, just as inclusive cross sections can exceed total cross sections.

$\overline{B}$ modes are charge conjugates of the modes below. Reactions indicate the weak decay vertex and do not include mixing.

| | Mode | | Fraction ($\Gamma_i/\Gamma$) | Scale factor/ Confidence level |
|---|---|---|---|---|
| | **Semileptonic and leptonic modes** | | | |
| $\Gamma_1$ | $B \rightarrow e^+ \nu_e$ anything | [a] | $(10.41 \pm 0.29)$ % | S=1.2 |
| $\Gamma_2$ | $B \rightarrow \overline{p} e^+ \nu_e$ anything | | $< 1.6 \times 10^{-3}$ | CL=90% |
| $\Gamma_3$ | $B \rightarrow \mu^+ \nu_\mu$ anything | [a] | $(10.3 \pm 0.5)$ % | |
| $\Gamma_4$ | $B \rightarrow \ell^+ \nu_\ell$ anything | [a,b] | $(10.45 \pm 0.21)$ % | |
| $\Gamma_5$ | $B \rightarrow D^- \ell^+ \nu_\ell$ anything | [b] | $(2.7 \pm 0.8)$ % | |
| $\Gamma_6$ | $B \rightarrow \overline{D}^0 \ell^+ \nu_\ell$ anything | [b] | $(7.0 \pm 1.4)$ % | |
| $\Gamma_7$ | $B \rightarrow D^{*-} \ell^+ \nu_\ell$ anything | | | |
| $\Gamma_8$ | $B \rightarrow D^{*0} \ell^+ \nu_\ell$ anything | | | |
| $\Gamma_9$ | $B \rightarrow \overline{D}^{**} \ell^+ \nu_\ell$ | [b,c] | $(2.7 \pm 0.7)$ % | |
| $\Gamma_{10}$ | $B \rightarrow \overline{D}_1(2420) \ell^+ \nu_\ell$ anything | | $(7.4 \pm 1.6) \times 10^{-3}$ | |
| $\Gamma_{11}$ | $B \rightarrow D \pi \ell^+ \nu_\ell$ anything + $D^* \pi \ell^+ \nu_\ell$ anything | | $(2.3 \pm 0.4)$ % | |
| $\Gamma_{12}$ | $B \rightarrow \overline{D}_2^*(2460) \ell^+ \nu_\ell$ anything | | $< 6.5 \times 10^{-3}$ | CL=95% |

| | | | | | | |
|---|---|---|---|---|---|---|
| $\Gamma_{13}$ | $B \to D^{*-} \pi^+ \ell^+ \nu_\ell$ anything | | ( 1.00 ± 0.34 ) % | | | |
| $\Gamma_{14}$ | $B \to D_s^- \ell^+ \nu_\ell$ anything | [b] | < 9 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{15}$ | $B \to D_s^- \ell^+ \nu_\ell K^+$ anything | [b] | < 6 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{16}$ | $B \to D_s^- \ell^+ \nu_\ell K^0$ anything | [b] | < 9 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{17}$ | $B \to \ell^+ \nu_\ell$ noncharmed | [b] | | | | |
| $\Gamma_{18}$ | $B \to K^+ \ell^+ \nu_\ell$ anything | [b] | ( 6.0 ± 0.5 ) % | | | |
| $\Gamma_{19}$ | $B \to K^- \ell^+ \nu_\ell$ anything | [b] | ( 10 ± 4 ) | $\times 10^{-3}$ | | |
| $\Gamma_{20}$ | $B \to K^0 / \overline{K}^0 \ell^+ \nu_\ell$ anything | [b] | ( 4.4 ± 0.5 ) % | | | |

## $D$, $D^*$, or $D_s$ modes

| | | | | | | |
|---|---|---|---|---|---|---|
| $\Gamma_{21}$ | $B \to D^\pm$ anything | | ( 24.1 ± 1.9 ) % | | | |
| $\Gamma_{22}$ | $B \to D^0 / \overline{D}^0$ anything | | ( 63.5 ± 2.9 ) % | | | S=1.1 |
| $\Gamma_{23}$ | $B \to D^*(2010)^\pm$ anything | | ( 22.7 ± 1.6 ) % | | | |
| $\Gamma_{24}$ | $B \to D^*(2007)^0$ anything | | ( 26.0 ± 2.7 ) % | | | |
| $\Gamma_{25}$ | $B \to D_s^\pm$ anything | [d] | ( 10.0 ± 2.5 ) % | | | |
| $\Gamma_{26}$ | $B \to D^{(*)} \overline{D}^{(*)} K^0 + D^{(*)} \overline{D}^{(*)} K^\pm$ | [d,e] | ( 7.1 $^{+2.7}_{-1.7}$ ) % | | | |
| $\Gamma_{27}$ | $b \to c \overline{c} s$ | | ( 22 ± 4 ) % | | | |
| $\Gamma_{28}$ | $B \to D_s^{(*)} \overline{D}^{(*)}$ | [d,e] | ( 4.9 ± 1.3 ) % | | | |
| $\Gamma_{29}$ | $B \to D^* D^*(2010)^\pm$ | [d] | < 5.9 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{30}$ | $B \to D D^*(2010)^\pm + D^* D^\pm$ | [d] | < 5.5 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{31}$ | $B \to D D^\pm$ | [d] | < 3.1 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{32}$ | $B \to D_s^{(*)\pm} \overline{D}^{(*)} X(n\pi^\pm)$ | [d,e] | ( 9 $^{+5}_{-4}$ ) % | | | |
| $\Gamma_{33}$ | $B \to D^*(2010) \gamma$ | | < 1.1 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{34}$ | $B \to D_s^+ \pi^-$, $D_s^{*+} \pi^-$, $D_s^+ \rho^-$, $D_s^{*+} \rho^-$, $D_s^+ \pi^0$, $D_s^{*+} \pi^0$, $D_s^+ \eta$, $D_s^{*+} \eta$, $D_s^+ \rho^0$, $D_s^{*+} \rho^0$, $D_s^+ \omega$, $D_s^{*+} \omega$ | [d] | < 5 | $\times 10^{-4}$ | CL=90% | |
| $\Gamma_{35}$ | $B \to D_{s1}(2536)^+$ anything | | < 9.5 | $\times 10^{-3}$ | CL=90% | |

## Charmonium modes

| | | | | | | |
|---|---|---|---|---|---|---|
| $\Gamma_{36}$ | $B \to J/\psi(1S)$ anything | | ( 1.15 ± 0.06 ) % | | | |
| $\Gamma_{37}$ | $B \to J/\psi(1S)$(direct) anything | | ( 8.0 ± 0.8 ) | $\times 10^{-3}$ | | |
| $\Gamma_{38}$ | $B \to \psi(2S)$ anything | | ( 3.5 ± 0.5 ) | $\times 10^{-3}$ | | |
| $\Gamma_{39}$ | $B \to \chi_{c1}(1P)$ anything | | ( 4.2 ± 0.7 ) | $\times 10^{-3}$ | | |
| $\Gamma_{40}$ | $B \to \chi_{c1}(1P)$(direct) anything | | ( 3.7 ± 0.7 ) | $\times 10^{-3}$ | | |
| $\Gamma_{41}$ | $B \to \chi_{c2}(1P)$ anything | | < 3.8 | $\times 10^{-3}$ | CL=90% | |
| $\Gamma_{42}$ | $B \to \eta_c(1S)$ anything | | < 9 | $\times 10^{-3}$ | CL=90% | |

## $K$ or $K^*$ modes

| | | | | |
|---|---|---|---|---|
| $\Gamma_{43}$ | $B \to K^{\pm}$ anything | [d] | $(78.9 \pm 2.5)$ % | |
| $\Gamma_{44}$ | $B \to K^{+}$ anything | | $(66 \pm 5)$ % | |
| $\Gamma_{45}$ | $B \to K^{-}$ anything | | $(13 \pm 4)$ % | |
| $\Gamma_{46}$ | $B \to K^0/\overline{K}^0$ anything | [d] | $(64 \pm 4)$ % | |
| $\Gamma_{47}$ | $B \to K^*(892)^{\pm}$ anything | | $(18 \pm 6)$ % | |
| $\Gamma_{48}$ | $B \to K^*(892)^0/\overline{K}^*(892)^0$ anything | [d] | $(14.6 \pm 2.6)$ % | |
| $\Gamma_{49}$ | $B \to K^*(892)\gamma$ | | | |
| $\Gamma_{50}$ | $B \to K_1(1400)\gamma$ | | $< 4.1 \times 10^{-4}$ | CL=90% |
| $\Gamma_{51}$ | $B \to K_2^*(1430)\gamma$ | | $< 8.3 \times 10^{-4}$ | CL=90% |
| $\Gamma_{52}$ | $B \to K_2(1770)\gamma$ | | $< 1.2 \times 10^{-3}$ | CL=90% |
| $\Gamma_{53}$ | $B \to K_3^*(1780)\gamma$ | | $< 3.0 \times 10^{-3}$ | CL=90% |
| $\Gamma_{54}$ | $B \to K_4^*(2045)\gamma$ | | $< 1.0 \times 10^{-3}$ | CL=90% |
| $\Gamma_{55}$ | $B \to \overline{b} \to \overline{s}\gamma$ | | $(2.3 \pm 0.7) \times 10^{-4}$ | |
| $\Gamma_{56}$ | $B \to \overline{b} \to \overline{s}$gluon | | $< 6.8$ % | CL=90% |
| $\Gamma_{57}$ | $B \to \eta$ anything | | $< 4.4 \times 10^{-4}$ | CL=90% |
| $\Gamma_{58}$ | $B \to \eta'$ anything | | $(6.2 {}^{+2.1}_{-2.6}) \times 10^{-4}$ | |

## Light unflavored meson modes

| | | | | |
|---|---|---|---|---|
| $\Gamma_{59}$ | $B \to \pi^{\pm}$ anything | [d,f] | $(359 \pm 7)$ % | |
| $\Gamma_{60}$ | $B \to \eta$ anything | | $(17.6 \pm 1.6)$ % | |
| $\Gamma_{61}$ | $B \to \rho^0$ anything | | $(21 \pm 5)$ % | |
| $\Gamma_{62}$ | $B \to \omega$ anything | | $< 81$ % | CL=90% |
| $\Gamma_{63}$ | $B \to \phi$ anything | | $(3.5 \pm 0.7)$ % | S=1.8 |
| $\Gamma_{64}$ | $B \to \phi K^*(892)$ | | $< 2.2 \times 10^{-5}$ | CL=90% |

## Baryon modes

| | | | | |
|---|---|---|---|---|
| $\Gamma_{65}$ | $B \to \Lambda_c^{\pm}$ anything | | $(6.4 \pm 1.1)$ % | |
| $\Gamma_{66}$ | $B \to \Lambda_c^{+}$ anything | | | |
| $\Gamma_{67}$ | $B \to \Lambda_c^{-}$ anything | | | |
| $\Gamma_{68}$ | $B \to \Lambda_c^{-} e^{+}$ anything | | $< 3.2 \times 10^{-3}$ | CL=90% |
| $\Gamma_{69}$ | $B \to \Lambda_c^{-} p$ anything | | $(3.6 \pm 0.7)$ % | |
| $\Gamma_{70}$ | $B \to \Lambda_c^{-} p e^{+} \nu_e$ | | $< 1.5 \times 10^{-3}$ | CL=90% |
| $\Gamma_{71}$ | $B \to \overline{\Sigma}_c^{--}$ anything | | $(4.2 \pm 2.4) \times 10^{-3}$ | |
| $\Gamma_{72}$ | $B \to \overline{\Sigma}_c^{-}$ anything | | $< 9.6 \times 10^{-3}$ | CL=90% |
| $\Gamma_{73}$ | $B \to \overline{\Sigma}_c^{0}$ anything | | $(4.6 \pm 2.4) \times 10^{-3}$ | |
| $\Gamma_{74}$ | $B \to \overline{\Sigma}_c^{0} N (N = p$ or $n)$ | | $< 1.5 \times 10^{-3}$ | CL=90% |
| $\Gamma_{75}$ | $B \to \Xi_c^{0}$ anything $\times$ B$(\Xi_c^{0} \to \Xi^{-}\pi^{+})$ | | $(1.4 \pm 0.5) \times 10^{-4}$ | |

| | | | | | |
|---|---|---|---|---|---|
| $\Gamma_{76}$ | $B \to \Xi_c^+$ anything $\times$ B($\Xi_c^+ \to \Xi^- \pi^+ \pi^+$) | | ( $4.5\ ^{+1.3}_{-1.2}$ ) $\times 10^{-4}$ | | |
| $\Gamma_{77}$ | $B \to p/\overline{p}$anything | [d] | ( 8.0 $\pm$0.4 ) % | | |
| $\Gamma_{78}$ | $B \to p/\overline{p}$(direct) anything | [d] | ( 5.5 $\pm$0.5 ) % | | |
| $\Gamma_{79}$ | $B \to \Lambda/\overline{\Lambda}$anything | [d] | ( 4.0 $\pm$0.5 ) % | | |
| $\Gamma_{80}$ | $B \to \Lambda$anything | | | | |
| $\Gamma_{81}$ | $B \to \overline{\Lambda}$anything | | | | |
| $\Gamma_{82}$ | $B \to \Xi^-/\overline{\Xi}^+$ anything | [d] | ( 2.7 $\pm$0.6 ) $\times 10^{-3}$ | | |
| $\Gamma_{83}$ | $B \to$ baryons anything | | ( 6.8 $\pm$0.6 ) % | | |
| $\Gamma_{84}$ | $B \to p\overline{p}$anything | | ( 2.47$\pm$0.23) % | | |
| $\Gamma_{85}$ | $B \to \Lambda\overline{p}/\overline{\Lambda}p$anything | [d] | ( 2.5 $\pm$0.4 ) % | | |
| $\Gamma_{86}$ | $B \to \Lambda\overline{\Lambda}$anything | | $<$ 5 $\times 10^{-3}$ | | CL=90% |

**Lepton Family number ($LF$) violating modes or $\Delta B = 1$ weak neutral current ($B1$) modes**

| | | | | | |
|---|---|---|---|---|---|
| $\Gamma_{87}$ | $B \to e^+ e^- s$ | $B1$ | $<$ 5.7 $\times 10^{-5}$ | | CL=90% |
| $\Gamma_{88}$ | $B \to \mu^+ \mu^- s$ | $B1$ | $<$ 5.8 $\times 10^{-5}$ | | CL=90% |
| $\Gamma_{89}$ | $B \to e^\pm \mu^\mp s$ | $LF$ | $<$ 2.2 $\times 10^{-5}$ | | CL=90% |

[a] These values are model dependent. See 'Note on Semileptonic Decays' in the $B^+$ Particle Listings.

[b] An $\ell$ indicates an $e$ or a $\mu$ mode, not a sum over these modes.

[c] $D^{**}$ stands for the sum of the $D(1\,^1P_1)$, $D(1\,^3P_0)$, $D(1\,^3P_1)$, $D(1\,^3P_2)$, $D(2\,^1S_0)$, and $D(2\,^1S_1)$ resonances.

[d] The value is for the sum of the charge states or particle/antiparticle states indicated.

[e] $D^{(*)}\overline{D}^{(*)}$ stands for the sum of $D^*\overline{D}^*$, $D^*\overline{D}$, $D\overline{D}^*$, and $D\overline{D}$.

[f] Inclusive branching fractions have a multiplicity definition and can be greater than 100%.

## $B^\pm/B^0$ ADMIXTURE BRANCHING RATIOS

### $\Gamma(\ell^+ \nu_\ell$ anything$)/\Gamma_{total}$ — $\Gamma_4/\Gamma$

These branching fraction values are model dependent. See the note on "Semileptonic Decays of $B$ Mesons at the beginning of the $B^+$ Particle Listings.

| VALUE | DOCUMENT ID | TECN | COMMENT |
|---|---|---|---|
| **0.1045$\pm$0.0021 OUR AVERAGE** | Includes data from the 2 datablocks that follow this one. | | |
| 0.108 $\pm$0.002 $\pm$0.0056 | [1] HENDERSON 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[1] HENDERSON 92 measurement employs $e$ and $\mu$. The systematic error contains 0.004 in quadrature from model dependence. The authors average a variation of the Isgur, Scora, Grinstein, and Wise model with that of the Altarelli-Cabibbo-Corbò-Maiani-Martinelli model for semileptonic decays to correct the acceptance.

## $\Gamma(e^+ \nu_e \text{anything})/\Gamma_{total}$ — $\Gamma_1/\Gamma$

These branching fraction values are model dependent. See the note on "Semileptonic Decays of $B$ Mesons at the beginning of the $B^+$ Particle Listings.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | |
| **0.1041±0.0029 OUR AVERAGE** | Error includes scale factor of 1.2. | | | |
| 0.1049±0.0017±0.0043 | [2] BARISH | 96B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| 0.097 ±0.005 ±0.004 | [3] ALBRECHT | 93H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.100 ±0.004 ±0.003 | [4] YANAGISAWA | 91 | CSB2 | $e^+e^- \to \Upsilon(4S)$ |
| 0.103 ±0.006 ±0.002 | [5] ALBRECHT | 90H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.117 ±0.004 ±0.010 | [6] WACHS | 89 | CBAL | Direct $e$ at $\Upsilon(4S)$ |
| 0.120 ±0.007 ±0.005 | CHEN | 84 | CLEO | Direct $e$ at $\Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.132 ±0.008 ±0.014 | [7] KLOPFEN... | 83B | CUSB | Direct $e$ at $\Upsilon(4S)$ |

[2] BARISH 96B analysis performed using tagged semileptonic decays of the $B$. This technique is almost model independent for the lepton branching ratio.

[3] ALBRECHT 93H analysis performed using tagged semileptonic decays of the $B$. This technique is almost model independent for the lepton branching ratio.

[4] YANAGISAWA 91 also measures an average semileptonic branching ratio at the $\Upsilon(5S)$ of 9.6–10.5% depending on assumptions about the relative production of different $B$ meson species.

[5] ALBRECHT 90H uses the model of ALTARELLI 82 to correct over all lepton momenta. 0.099 ± 0.006 is obtained using ISGUR 89B.

[6] Using data above $p(e) = 2.4$ GeV, WACHS 89 determine $\sigma(B \to e\nu\text{up})/\sigma(B \to e\nu\text{charm}) < 0.065$ at 90% CL.

[7] Ratio $\sigma(b \to e\nu\text{up})/\sigma(b \to e\nu\text{charm}) < 0.055$ at CL = 90%.

## $\Gamma(\mu^+ \nu_\mu \text{anything})/\Gamma_{total}$ — $\Gamma_3/\Gamma$

These branching fraction values are model dependent. See the note on "Semileptonic Decays of $B$ Mesons at the beginning of the $B^+$ Particle Listings.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| The data in this block is included in the average printed for a previous datablock. | | | | |
| **0.103±0.005 OUR AVERAGE** | | | | |
| 0.100±0.006±0.002 | [8] ALBRECHT | 90H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.108±0.006±0.01 | CHEN | 84 | CLEO | Direct $\mu$ at $\Upsilon(4S)$ |
| 0.112±0.009±0.01 | LEVMAN | 84 | CUSB | Direct $\mu$ at $\Upsilon(4S)$ |

[8] ALBRECHT 90H uses the model of ALTARELLI 82 to correct over all lepton momenta. 0.097 ± 0.006 is obtained using ISGUR 89B.

## $\Gamma(\bar{p} e^+ \nu_e \text{anything})/\Gamma_{total}$ — $\Gamma_2/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.0016** | 90 | ALBRECHT | 90H | ARG | $e^+e^- \to \Upsilon(4S)$ |

## $\Gamma(D^- \ell^+ \nu_\ell \text{anything})/\Gamma(\ell^+ \nu_\ell \text{anything})$ — $\Gamma_5/\Gamma_4$

$\ell = e$ or $\mu$.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.26±0.07±0.04** | [9] FULTON | 91 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[9] FULTON 91 uses B($D^+ \to K^- \pi^+ \pi^+$) = (9.1 ± 1.3 ± 0.4)% as measured by MARK III.

## $\Gamma(\overline{D}^0 \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ — $\Gamma_6/\Gamma_4$

$\ell = e$ or $\mu$.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.67±0.09±0.10** | [10] FULTON | 91 | CLEO | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[10] FULTON 91 uses B($D^0 \rightarrow K^- \pi^+$) = (4.2 ± 0.4 ± 0.4)% as measured by MARK III.

## $\Gamma(D^{*-} \ell^+ \nu_\ell \text{ anything})/\Gamma_{total}$ — $\Gamma_7/\Gamma$

| VALUE (units $10^{-2}$) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.6±0.3±0.1 | [11] BARISH | 95 | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[11] BARISH 95 use B($D^0 \rightarrow K^- \pi^+$) = (3.91 ± 0.08 ± 0.17)% and B($D^{*+} \rightarrow D^0 \pi^+$) = (68.1 ± 1.0 ± 1.3)%.

## $\Gamma(D^{*0} \ell^+ \nu_\ell \text{ anything})/\Gamma_{total}$ — $\Gamma_8/\Gamma$

| VALUE (units $10^{-2}$) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.6±0.6±0.1 | [12] BARISH | 95 | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[12] BARISH 95 use B($D^0 \rightarrow K^- \pi^+$) = (3.91 ± 0.08 ± 0.17)%, B($D^{*+} \rightarrow D^0 \pi^+$) = (68.1 ± 1.0 ± 1.3)%, B($D^{*0} \rightarrow D^0 \pi^0$) = (63.6 ± 2.3 ± 3.3)%.

## $\Gamma(\overline{D}^{**} \ell^+ \nu_\ell)/\Gamma_{total}$ — $\Gamma_9/\Gamma$

$D^{**}$ stands for the sum of the $D(1\,^1P_1)$, $D(1\,^3P_0)$, $D(1\,^3P_1)$, $D(1\,^3P_2)$, $D(2\,^1S_0)$, and $D(2\,^1S_1)$ resonances. $\ell = e$ or $\mu$, not sum over $e$ and $\mu$ modes.

| VALUE | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.027±0.005±0.005** | | 63 | [13] ALBRECHT | 93 | ARG | $e^+ e^- \rightarrow \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| <0.028 | 95 | | [14] BARISH | 95 | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[13] ALBRECHT 93 assumes the GISW model to correct for unseen modes. Using the BHKT model, the result becomes 0.023 ± 0.006 ± 0.004. Assumes B($D^{*+} \rightarrow D^0 \pi^+$) = 68.1%, B($D^0 \rightarrow K^- \pi^+$) = 3.65%, B($D^0 \rightarrow K^- \pi^+ \pi^- \pi^+$) = 7.5%. We have taken their average $e$ and $\mu$ value.

[14] BARISH 95 use B($D^0 \rightarrow K^- \pi^+$) = (3.91 ± 0.08 ± 0.17)%, assume all nonresonant channels are zero, and use GISW model for relative abundances of $D^{**}$ states.

## $\Gamma(\overline{D}_1(2420) \ell^+ \nu_\ell \text{ anything})/\Gamma_{total}$ — $\Gamma_{10}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.0074±0.0016** | [15] BUSKULIC | 97B | ALEP | $e^+ e^- \rightarrow Z$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | [16] BUSKULIC | 95B | ALEP | Repl. by BUSKULIC 97B |

[15] BUSKULIC 97B assumes B($D_1(2420) \rightarrow D^* \pi$) = 1, B($D_1(2420) \rightarrow D^* \pi^\pm$) = 2/3, and B($b \rightarrow B$) = 0.378 ± 0.022.

[16] BUSKULIC 95B reports $f_B \times$ B($B \rightarrow \overline{D}_1(2420)^0 \ell^+ \nu_\ell$ anything) × B($\overline{D}_1(2420)^0 \rightarrow \overline{D}^*(2010)^- \pi^+$) = (2.04 ± 0.58 ± 0.34)$10^{-3}$, where $f_B$ is the production fraction for a single $B$ charge state.

### $[\Gamma(D\pi\ell^+\nu_\ell \text{anything}) + \Gamma(D^*\pi\ell^+\nu_\ell \text{anything})]/\Gamma_{total}$ — $\Gamma_{11}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.0226±0.0029±0.0033** | [17] BUSKULIC | 97B | ALEP | $e^+e^- \to Z$ |

[17] BUSKULIC 97B assumes B($b \to B$) = 0.378 ± 0.022 and uses isospin invariance by assuming that all observed $D^0\pi^+$, $D^{*0}\pi^+$, $D^+\pi^-$, and $D^{*+}\pi^-$ are from $D^{**}$ states. A correction has been applied to account for the production of $B_s^0$ and $\Lambda_b^0$.

### $\Gamma(\overline{D}_2^*(2460)\ell^+\nu_\ell \text{anything})/\Gamma_{total}$ — $\Gamma_{12}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.0065** | 95 | [18] BUSKULIC | 97B | ALEP | $e^+e^- \to Z$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| not seen | | [19] BUSKULIC | 95B | ALEP | $e^+e^- \to Z$ |

[18] A revised number based on BUSKULIC 97B which assumes B($D_2^*(2460) \to D^*\pi^\pm$) = 0.20 and B($b \to B$) = 0.378 ± 0.022.

[19] BUSKULIC 95B reports $f_B \times$ B($B \to \overline{D}_2^*(2460)^0\ell^+\nu_\ell$ anything) × B($\overline{D}_2^*(2460)^0 \to \overline{D}^*(2010)^-\pi^+$) $\leq 0.81 \times 10^{-3}$ at CL=95%, where $f_B$ is the production fraction for a single $B$ charge state.

### $\Gamma(D^{*-}\pi^+\ell^+\nu_\ell \text{anything})/\Gamma_{total}$ — $\Gamma_{13}/\Gamma$

Includes resonant and nonresonant contributions.

| VALUE (units $10^{-3}$) | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **10.0±2.7±2.1** | [20] BUSKULIC | 95B | ALEP | $e^+e^- \to Z$ |

[20] BUSKULIC 95B reports $f_B \times$ B($B \to \overline{D}^*(2010)^-\pi^+\ell^+\nu_\ell$ anything) = (3.7 ± 1.0 ± 0.7)$10^{-3}$. Above value assumes $f_B$ = 0.37 ± 0.03.

### $\Gamma(D_s^-\ell^+\nu_\ell \text{anything})/\Gamma_{total}$ — $\Gamma_{14}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.009** | 90 | [21] ALBRECHT | 93E | ARG | $e^+e^- \to \Upsilon(4S)$ |

[21] ALBRECHT 93E reports < 0.012 for B($D_s^+ \to \phi\pi^+$) = 0.027. We rescale to our best value B($D_s^+ \to \phi\pi^+$) = 0.036.

### $\Gamma(D_s^-\ell^+\nu_\ell K^+ \text{anything})/\Gamma_{total}$ — $\Gamma_{15}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.006** | 90 | [22] ALBRECHT | 93E | ARG | $e^+e^- \to \Upsilon(4S)$ |

[22] ALBRECHT 93E reports < 0.008 for B($D_s^+ \to \phi\pi^+$) = 0.027. We rescale to our best value B($D_s^+ \to \phi\pi^+$) = 0.036.

### $\Gamma(D_s^-\ell^+\nu_\ell K^0 \text{anything})/\Gamma_{total}$ — $\Gamma_{16}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.009** | 90 | [23] ALBRECHT | 93E | ARG | $e^+e^- \to \Upsilon(4S)$ |

[23] ALBRECHT 93E reports < 0.012 for B($D_s^+ \to \phi\pi^+$) = 0.027. We rescale to our best value B($D_s^+ \to \phi\pi^+$) = 0.036.

## $\Gamma(\ell^+ \nu_\ell \text{ noncharmed})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ — $\Gamma_{17}/\Gamma_4$

$\ell$ denotes $e$ or $\mu$, not the sum. These experiments measure this ratio in very limited momentum intervals.

| VALUE | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| | | | [24] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| | | 107 | [25] BARTELT | 93B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| | | 77 | [26] ALBRECHT | 91C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| | | 76 | [27] FULTON | 90 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| | | 41 | [28] ALBRECHT | 90 | ARG | $e^+e^- \to \Upsilon(4S)$ |
| <0.04 | 90 | | [29] BEHRENDS | 87 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| <0.04 | 90 | | CHEN | 84 | CLEO | Direct $e$ at $\Upsilon(4S)$ |
| <0.055 | 90 | | KLOPFEN... | 83B | CUSB | Direct $e$ at $\Upsilon(4S)$ |

[24] ALBRECHT 94C find $\Gamma(b \to c)/\Gamma(b \to \text{all}) = 0.99 \pm 0.02 \pm 0.04$.

[25] BARTELT 93B (CLEO II) measures an excess of $107 \pm 15 \pm 11$ leptons in the lepton momentum interval 2.3–2.6 GeV/$c$ which is attributed to $b \to u \ell \nu_\ell$. This corresponds to a model-dependent partial branching ratio $\Delta B_{ub}$ between $(1.15 \pm 0.16 \pm 0.15) \times 10^{-4}$, as evaluated using the KS model (KOERNER 88), and $(1.54 \pm 0.22 \pm 0.20) \times 10^{-4}$ using the ACCMM model (ARTUSO 93). The corresponding values of $|V_{ub}|/|V_{cb}|$ are $0.056 \pm 0.006$ and $0.076 \pm 0.008$, respectively.

[26] ALBRECHT 91C result supersedes ALBRECHT 90. Two events are fully reconstructed providing evidence for the $b \to u$ transition. Using the model of ALTARELLI 82, they obtain $|V_{ub}/V_{cb}| = 0.11 \pm 0.012$ from 77 leptons in the 2.3–2.6 GeV momentum range.

[27] FULTON 90 observe $76 \pm 20$ excess $e$ and $\mu$ (lepton) events in the momentum interval $p = 2.4$–2.6 GeV signaling the presence of the $b \to u$ transition. The average branching ratio, $(1.8 \pm 0.4 \pm 0.3) \times 10^{-4}$, corresponds to a model-dependent measurement of approximately $|V_{ub}/V_{cb}| = 0.1$ using $B(b \to c \ell \nu) = 10.2 \pm 0.2 \pm 0.7\%$.

[28] ALBRECHT 90 observes $41 \pm 10$ excess $e$ and $\mu$ (lepton) events in the momentum interval $p = 2.3$–2.6 GeV signaling the presence of the $b \to u$ transition. The events correspond to a model-dependent measurement of $|V_{ub}/V_{cb}| = 0.10 \pm 0.01$.

[29] The quoted possible limits range from 0.018 to 0.04 for the ratio, depending on which model or momentum range is chosen. We select the most conservative limit they have calculated. This corresponds to a limit on $|V_{ub}|/|V_{cb}| < 0.20$. While the endpoint technique employed is more robust than their previous results in CHEN 84, these results do not provide a numerical improvement in the limit.

## $\Gamma(K^+ \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ — $\Gamma_{18}/\Gamma_4$

$\ell$ denotes $e$ or $\mu$, not the sum.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.58 ±0.05 OUR AVERAGE** | | | | |
| 0.594±0.021±0.056 | ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.54 ±0.07 ±0.06 | [30] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[30] ALAM 87B measurement relies on lepton-kaon correlations.

## $\Gamma(K^- \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ — $\Gamma_{19}/\Gamma_4$

$\ell$ denotes $e$ or $\mu$, not the sum.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.092±0.035 OUR AVERAGE** | | | | |
| 0.086±0.011±0.044 | ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.10 ±0.05 ±0.02 | [31] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[31] ALAM 87B measurement relies on lepton-kaon correlations.

## $\Gamma(K^0/\overline{K}^0 \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ — $\Gamma_{20}/\Gamma_4$

$\ell$ denotes $e$ or $\mu$, not the sum. Sum over $K^0$ and $\overline{K}^0$ states.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.42 ±0.05 OUR AVERAGE** | | | | |
| 0.452±0.038±0.056 | [32] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.39 ±0.06 ±0.04 | [33] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[32] ALBRECHT 94C assume a $K^0/\overline{K}^0$ multiplicity twice that of $K^0_S$.

[33] ALAM 87B measurement relies on lepton-kaon correlations.

## $\langle n_c \rangle$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **1.10±0.05** | [34] GIBBONS | 97B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.98±0.16±0.12 | [35] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[34] GIBBONS 97B from charm counting using $B(D_s^+ \to \phi\pi) = 0.036 \pm 0.009$ and $B(\Lambda_c^+ \to pK^-\pi^+) = 0.044 \pm 0.006$.

[35] From the difference between $K^-$ and $K^+$ widths. ALAM 87B measurement relies on lepton-kaon correlations. It does not consider the possibility of $B\overline{B}$ mixing. We have thus removed it from the average.

## $\Gamma(D^\pm \text{ anything})/\Gamma_{\text{total}}$ — $\Gamma_{21}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.241±0.019 OUR AVERAGE** | | | | | |
| $0.240 \pm 0.013^{+0.015}_{-0.016}$ | | [36] GIBBONS | 97B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| 0.25 ±0.04 ±0.02 | | [37] BORTOLETTO | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| $0.23 \pm 0.05 \; ^{+0.01}_{-0.02}$ | | [38] ALBRECHT | 91H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.21 ±0.05 ±0.01 | 20k | [39] BORTOLETTO | 87 | CLEO | Sup. by BORTOLETTO 92 |

[36] GIBBONS 97B reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0216 \pm 0.0008 \pm 0.00082$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (9.0 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[37] BORTOLETTO 92 reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0226 \pm 0.0030 \pm 0.0018$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (9.0 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[38] ALBRECHT 91H reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.0209 \pm 0.0027 \pm 0.0040$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (9.0 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[39] BORTOLETTO 87 reports $[B(B \to D^\pm \text{anything}) \times B(D^+ \to K^-\pi^+\pi^+)] = 0.019 \pm 0.004 \pm 0.002$. We divide by our best value $B(D^+ \to K^-\pi^+\pi^+) = (9.0 \pm 0.6) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

## $\Gamma(D^0/\overline{D}^0 \text{ anything})/\Gamma_{total}$ — $\Gamma_{22}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.635±0.029 OUR AVERAGE** | | Error includes scale factor of 1.1. | | | |
| 0.656±0.025±0.015 | | [40] GIBBONS | 97B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| 0.61 ±0.05 ±0.01 | | [41] BORTOLETTO | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| 0.51 ±0.08 ±0.01 | | [42] ALBRECHT | 91H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.55 ±0.07 ±0.01 | 21k | [43] BORTOLETTO | 87 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| 0.63 ±0.19 ±0.01 | | [44] GREEN | 83 | CLEO | Repl. by BORTOLETTO 87 |

[40] GIBBONS 97B reports [B($B \to D^0/\overline{D}^0$ anything) × B($D^0 \to K^-\pi^+$)] = 0.0251 ± 0.0006±0.00075. We divide by our best value B($D^0 \to K^-\pi^+$) = (3.83±0.09)×$10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[41] BORTOLETTO 92 reports [B($B \to D^0/\overline{D}^0$ anything) × B($D^0 \to K^-\pi^+$)] = 0.0233± 0.0012±0.0014. We divide by our best value B($D^0 \to K^-\pi^+$) = (3.83±0.09)×$10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[42] ALBRECHT 91H reports [B($B \to D^0/\overline{D}^0$ anything) × B($D^0 \to K^-\pi^+$)] = 0.0194 ± 0.0015±0.0025. We divide by our best value B($D^0 \to K^-\pi^+$) = (3.83±0.09)×$10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[43] BORTOLETTO 87 reports [B($B \to D^0/\overline{D}^0$ anything) × B($D^0 \to K^-\pi^+$)] = 0.0210± 0.0015±0.0021. We divide by our best value B($D^0 \to K^-\pi^+$) = (3.83±0.09)×$10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[44] GREEN 83 reports [B($B \to D^0/\overline{D}^0$ anything) × B($D^0 \to K^-\pi^+$)] = 0.024±0.006± 0.004. We divide by our best value B($D^0 \to K^-\pi^+$) = (3.83 ± 0.09) × $10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

## $\Gamma(D^*(2010)^\pm \text{ anything})/\Gamma_{total}$ — $\Gamma_{23}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.227±0.016 OUR AVERAGE** | | | | | |
| 0.247±0.019±0.01 | | [45] GIBBONS | 97B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| 0.205±0.019±0.007 | | [46] ALBRECHT | 96D | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.230±0.028±0.009 | | [47] BORTOLETTO | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.283±0.053±0.002 | | [48] ALBRECHT | 91H | ARG | Sup. by ALBRECHT 96D |
| 0.22 ±0.04 $^{+0.07}_{-0.04}$ | 5200 | [49] BORTOLETTO | 87 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| 0.27 ±0.06 $^{+0.08}_{-0.06}$ | 510 | [50] CSORNA | 85 | CLEO | Repl. by BORTOLETTO 87 |

[45] GIBBONS 97B reports B($B \to D^*(2010)^+$ anything) = 0.239 ± 0.015 ± 0.014 ± 0.009 using CLEO measured $D$ and $D^*$ branching fractions. We rescale to our PDG 96 values of $D$ and $D^*$ branching ratios. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[46] ALBRECHT 96D reports B($B \to D^*(2010)^+$ anything) 0.196 ± 0.019 using CLEO measured B($D^*(2010)^+ \to D^0\pi^+$) = 0.681 ± 0.01 ± 0.013, B($D^0 \to K^-\pi^+$) = 0.0401±0.0014, B($D^0 \to K^-\pi^+\pi^+\pi^-$) = 0.081±0.005., We rescale to our PDG 96

values of $D$ and $D^*$ branching ratios. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[47] BORTOLETTO 92 reports B($B \rightarrow D^*(2010)^+$ anything) = 0.25 ± 0.03 ± 0.04 using MARK II B($D^*(2010)^+ \rightarrow D^0\pi^+$) = 0.57 ± 0.06 and B($D^0 \rightarrow K^-\pi^+$) = 0.042 ± 0.008. We rescale to our PDG 96 values of $D$ and $D^*$ branching ratios. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[48] ALBRECHT 91H reports 0.348 ± 0.060 ± 0.035 for B($D^*(2010)^+ \rightarrow D^0\pi^+$) = 0.55 ± 0.04. We rescale to our best value B($D^*(2010)^+ \rightarrow D^0\pi^+$) = (67.7 ± 0.5) × $10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Uses the PDG 90 B($D^0 \rightarrow K^-\pi^+$) =0.0371 ± 0.0025.

[49] BORTOLETTO 87 uses old MARK III (BALTRUSAITIS 86E) branching ratios B($D^0 \rightarrow K^-\pi^+$) = 0.056 ± 0.004 ± 0.003 and also assumes B($D^*(2010)^+ \rightarrow D^0\pi^+$) = $0.60^{+0.08}_{-0.15}$. The product branching ratio for B($B \rightarrow D^*(2010)^+$) B($D^*(2010)^+ \rightarrow D^0\pi^+$) is 0.13 ± 0.02 ± 0.012. Superseded by BORTOLETTO 92.

[50] $V-A$ momentum spectrum used to extrapolate below $p$ = 1 GeV. We correct the value assuming B($D^0 \rightarrow K^-\pi^+$) = 0.042 ± 0.006 and B($D^{*+} \rightarrow D^0\pi^+$) = $0.6^{+0.08}_{-0.15}$. The product branching fraction is B($B \rightarrow D^{*+}$ X)·B($D^{*+} \rightarrow \pi^+ D^0$)·B($D^0 \rightarrow K^-\pi^+$) = (68 ± 15 ± 9) × $10^{-4}$.

## $\Gamma(D^*(2007)^0$ anything$)/\Gamma_{total}$ — $\Gamma_{24}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.260±0.023±0.015** | [51] GIBBONS | 97B | CLE2 | $e^+e^- \rightarrow \Upsilon(4S)$ |

[51] GIBBONS 97B reports B($B \rightarrow D^*(2007)^0$ anything) 0.247 ± 0.012 ± 0.018 ± 0.018 using CLEO measured $D$ and $D^*$ branching fractions. We rescale to our PDG 96 values of $D$ and $D^*$ branching ratios. Our first error is their experiment's error and our second error is the systematic error from using our best value.

## $\Gamma(D_s^\pm$ anything$)/\Gamma_{total}$ — $\Gamma_{25}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.100±0.025 OUR AVERAGE** | | | | | |
| $0.117 \pm 0.009^{+0.028}_{-0.029}$ | | [52] GIBAUT | 96 | CLE2 | $e^+e^- \rightarrow \Upsilon(4S)$ |
| $0.081 \pm 0.014^{+0.019}_{-0.020}$ | | [53] ALBRECHT | 92G | ARG | $e^+e^- \rightarrow \Upsilon(4S)$ |
| $0.085 \pm 0.013^{+0.020}_{-0.021}$ | 257 | [54] BORTOLETTO | 90 | CLEO | $e^+e^- \rightarrow \Upsilon(4S)$ |
| $0.105 \pm 0.028^{+0.025}_{-0.026}$ | | [55] HAAS | 86 | CLEO | $e^+e^- \rightarrow \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.116±0.030±0.028 | | [56] ALBRECHT | 87H | ARG | $e^+e^- \rightarrow \Upsilon(4S)$ |

[52] GIBAUT 96 reports 0.1211 ± 0.0039 ± 0.0088 for B($D_s^+ \rightarrow \phi\pi^+$) = 0.035. We rescale to our best value B($D_s^+ \rightarrow \phi\pi^+$) = (3.6 ± 0.9) × $10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[53] ALBRECHT 92G reports [B($B \rightarrow D_s^\pm$ anything) × B($D_s^+ \rightarrow \phi\pi^+$)] = 0.00292 ± 0.00039 ± 0.00031. We divide by our best value B($D_s^+ \rightarrow \phi\pi^+$) = (3.6 ± 0.9) × $10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[54] BORTOLETTO 90 reports [B($B \rightarrow D_s^\pm$ anything) × B($D_s^+ \rightarrow \phi\pi^+$)] = 0.00306 ± 0.00047. We divide by our best value B($D_s^+ \rightarrow \phi\pi^+$) = (3.6 ± 0.9) × $10^{-2}$. Our first

error is their experiment's error and our second error is the systematic error from using our best value.

[55] HAAS 86 reports [B($B \rightarrow D_s^{\pm}$ anything) $\times$ B($D_s^+ \rightarrow \phi\pi^+$)] = 0.0038 $\pm$ 0.0010. We divide by our best value B($D_s^+ \rightarrow \phi\pi^+$) = (3.6 $\pm$ 0.9) $\times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. 64 $\pm$ 22% decays are 2-body.

[56] ALBRECHT 87H reports [B($B \rightarrow D_s^{\pm}$ anything) $\times$ B($D_s^+ \rightarrow \phi\pi^+$)] = 0.0042 $\pm$ 0.0009 $\pm$ 0.0006. We divide by our best value B($D_s^+ \rightarrow \phi\pi^+$) = (3.6 $\pm$ 0.9) $\times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. 46 $\pm$ 16% of $B \rightarrow D_s$X decays are 2-body. Superseded by ALBRECHT 92G.

## $[\Gamma(D^{(*)}\overline{D}^{(*)}K^0) + \Gamma(D^{(*)}\overline{D}^{(*)}K^{\pm})]/\Gamma_{total}$ — $\Gamma_{26}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **$0.071^{+0.025}_{-0.015}{}^{+0.010}_{-0.009}$** | [57] BARATE | 98Q | ALEP | $e^+e^- \rightarrow Z$ |

[57] The systematic error includes the uncertainties due to the charm branching ratios.

## $\Gamma(c\overline{c}s)/\Gamma_{total}$ — $\Gamma_{27}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.219$\pm$0.037** | [58] COAN | 98 | CLE2 | $e^+e^- \rightarrow \Upsilon(4S)$ |

[58] COAN 98 uses $D$-$\ell$ correlation.

## $\Gamma(D_s^{(*)}\overline{D}^{(*)})/\Gamma(D_s^{\pm}$ anything$)$ — $\Gamma_{28}/\Gamma_{25}$

Sum over modes.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.49 $\pm$0.04 OUR AVERAGE** | | | | |
| $0.56^{+0.21}_{-0.15}{}^{+0.09}_{-0.08}$ | [59] BARATE | 98Q | ALEP | $e^+e^- \rightarrow Z$ |
| 0.457$\pm$0.019$\pm$0.037 | GIBAUT | 96 | CLE2 | $e^+e^- \rightarrow \Upsilon(4S)$ |
| 0.58 $\pm$0.07 $\pm$0.09 | ALBRECHT | 92G | ARG | $e^+e^- \rightarrow \Upsilon(4S)$ |
| 0.56 $\pm$0.10 | BORTOLETTO | 90 | CLEO | $e^+e^- \rightarrow \Upsilon(4S)$ |

[59] BARATE 98Q measures B($B \rightarrow D_s^{(*)}\overline{D}^{(*)}$) = $0.056^{+0.021}_{-0.015}{}^{+0.009}_{-0.008}{}^{+0.019}_{-0.011}$, where the third error results from the uncertainty on the different $D$ branching ratios and is dominated by the uncertainty on B($D_s^+ \rightarrow \phi\pi^+$). We divide B($B \rightarrow D_s^{(*)}\overline{D}^{(*)}$) by our best value of B($B \rightarrow D_s$ anything)= 0.1 $\pm$ 0.025.

## $\Gamma(D^* D^*(2010)^{\pm})/\Gamma_{total}$ — $\Gamma_{29}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<5.9 \times 10^{-3}$** | 90 | BARATE | 98Q | ALEP | $e^+e^- \rightarrow Z$ |

## $[\Gamma(D D^*(2010)^{\pm}) + \Gamma(D^* D^{\pm})]/\Gamma_{total}$ — $\Gamma_{30}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<5.5 \times 10^{-3}$** | 90 | BARATE | 98Q | ALEP | $e^+e^- \rightarrow Z$ |

## $\Gamma(D D^{\pm})/\Gamma_{total}$ — $\Gamma_{31}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<3.1 \times 10^{-3}$** | 90 | BARATE | 98Q | ALEP | $e^+e^- \rightarrow Z$ |

## $\Gamma(D_s^{(*)\pm}\overline{D}^{(*)}X(n\pi^\pm))/\Gamma_{total}$ — $\Gamma_{32}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| $0.094^{+0.040}_{-0.031}{}^{+0.034}_{-0.024}$ | [60] BARATE | 98Q | ALEP | $e^+e^- \to Z$ |

[60] The systematic error includes the uncertainties due to the charm branching ratios.

## $\Gamma(D^*(2010)\gamma)/\Gamma_{total}$ — $\Gamma_{33}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<1.1\times10^{-3}$ | 90 | [61] LESIAK | 92 | CBAL | $e^+e^- \to \Upsilon(4S)$ |

[61] LESIAK 92 set a limit on the inclusive process $B(b \to s\gamma) < 2.8\times10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about $s$-quark hadronization.

## $\Gamma(D_s^+\pi^-, D_s^{*+}\pi^-, D_s^+\rho^-, D_s^{*+}\rho^-, D_s^+\pi^0, D_s^{*+}\pi^0, D_s^+\eta, D_s^{*+}\eta, D_s^+\rho^0, D_s^{*+}\rho^0, D_s^+\omega, D_s^{*+}\omega)/\Gamma_{total}$ — $\Gamma_{34}/\Gamma$

Sum over modes.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<0.0005$ | 90 | [62] ALEXANDER | 93B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[62] ALEXANDER 93B reports $< 4.8\times10^{-4}$ for $B(D_s^+ \to \phi\pi^+) = 0.037$. We rescale to our best value $B(D_s^+ \to \phi\pi^+) = 0.036$. This branching ratio limit provides a model-dependent upper limit $|V_{ub}|/|V_{cb}| < 0.16$ at CL=90%.

## $\Gamma(D_{s1}(2536)^+\text{anything})/\Gamma_{total}$ — $\Gamma_{35}/\Gamma$

$D_{s1}(2536)^+$ is the narrow $P$-wave $D_s^+$ meson with $J^P = 1^+$.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<0.0095$ | 90 | [63] BISHAI | 98 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[63] Assuming factorization, the decay constant $f_{D_{s1}^+}$ is at least a factor of 2.5 times smaller than $f_{D_s^+}$.

## $\Gamma(J/\psi(1S)\text{anything})/\Gamma_{total}$ — $\Gamma_{36}/\Gamma$

| VALUE (units $10^{-2}$) | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **1.15±0.06 OUR AVERAGE** | | | | | |
| 1.13±0.06±0.02 | 1489 | [64] BALEST | 95B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| 1.30±0.45±0.02 | 27 | [65] MASCHMANN | 90 | CBAL | $e^+e^- \to \Upsilon(4S)$ |
| 1.24±0.27±0.02 | 120 | [66] ALBRECHT | 87D | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 1.37±0.25±0.02 | 52 | [67] ALAM | 86 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $1.4\ ^{+0.6}_{-0.5}$ | 7 | [68] ALBRECHT | 85H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 1.1 ±0.21±0.23 | 46 | [69] HAAS | 85 | CLEO | Repl. by ALAM 86 |

[64] BALEST 95B reports $1.12 \pm 0.04 \pm 0.06$ for $B(J/\psi(1S) \to e^+e^-) = 0.0599 \pm 0.0025$. We rescale to our best value $B(J/\psi(1S) \to e^+e^-) = (5.93 \pm 0.10)\times10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.. They measure $J/\psi(1S) \to e^+e^-$ and $\mu^+\mu^-$ and use PDG 1994 values for the branching fractions. The rescaling is the same for either mode so we use $e^+e^-$.

[65] MASCHMANN 90 reports $1.12 \pm 0.33 \pm 0.25$ for $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.069 \pm 0.009$. We rescale to our best value $B(J/\psi(1S) \rightarrow e^+ e^-) = (5.93 \pm 0.10) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[66] ALBRECHT 87D reports $1.07 \pm 0.16 \pm 0.22$ for $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.069 \pm 0.009$. We rescale to our best value $B(J/\psi(1S) \rightarrow e^+ e^-) = (5.93 \pm 0.10) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. ALBRECHT 87D find the branching ratio for $J/\psi$ not from $\psi(2S)$ to be $0.0081 \pm 0.0023$.

[67] ALAM 86 reports $1.09 \pm 0.16 \pm 0.21$ for $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = 0.074 \pm 0.012$. We rescale to our best value $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.88 \pm 0.10) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

[68] Statistical and systematic errors were added in quadrature. ALBRECHT 85H also report a CL = 90% limit of 0.007 for $B \rightarrow J/\psi(1S) + X$ where $m_X$ <1 GeV.

[69] Dimuon and dielectron events used.

## $\Gamma(J/\psi(1S)(\text{direct})\text{ anything})/\Gamma_{\text{total}}$ — $\Gamma_{37}/\Gamma$

| VALUE | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0080±0.0008** | [70] | BALEST | 95B | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[70] BALEST 95B assume PDG 1994 values for sub mode branching ratios. $J/\psi(1S)$ mesons are reconstructed in $J/\psi(1S) \rightarrow e^+ e^-$ and $J/\psi(1S) \rightarrow \mu^+ \mu^-$. The $B \rightarrow J/\psi(1S)X$ branching ratio contains $J/\psi(1S)$ mesons directly from $B$ decays and also from feeddown through $\psi(2S) \rightarrow J/\psi(1S)$, $\chi_{c1}(1P) \rightarrow J/\psi(1S)$, or $\chi_{c2}(1P) \rightarrow J/\psi(1S)$. Using the measured inclusive rates, BALEST 95B corrects for the feeddown and finds the $B \rightarrow J/\psi(1S)$(direct) X branching ratio.

## $\Gamma(\psi(2S)\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{38}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0035±0.0005 OUR AVERAGE** | | | | | |
| 0.0034±0.0004±0.0003 | 240 | [71] BALEST | 95B | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |
| 0.0046±0.0017±0.0011 | 8 | ALBRECHT | 87D | ARG | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[71] BALEST 95B assume PDG 1994 values for sub mode branching ratios. They find $B(B \rightarrow \psi(2S)X,\ \psi(2S) \rightarrow \ell^+ \ell^-) = 0.30 \pm 0.05 \pm 0.04$ and $B(B \rightarrow \psi(2S)X,\ \psi(2S) \rightarrow J/\psi(1S)\pi^+\pi^-) = 0.37 \pm 0.05 \pm 0.05$. Weighted average is quoted for $B(B \rightarrow \psi(2S)X)$.

## $\Gamma(\chi_{c1}(1P)\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{39}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0042±0.0007 OUR AVERAGE** | | | | | |
| 0.0040±0.0006±0.0004 | 112 | [72] BALEST | 95B | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |
| 0.0105±0.0035±0.0025 | | [73] ALBRECHT | 92E | ARG | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[72] BALEST 95B assume $B(\chi_{c1}(1P) \rightarrow J/\psi(1S)\gamma) = (27.3 \pm 1.6) \times 10^{-2}$, the PDG 1994 value. Fit to $\psi$-photon invariant mass distribution allows for a $\chi_{c1}(1P)$ and a $\chi_{c2}(1P)$ component.

[73] ALBRECHT 92E assumes no $\chi_{c2}(1P)$ production.

## $\Gamma(\chi_{c1}(1P)(\text{direct})\text{ anything})/\Gamma_{\text{total}}$ — $\Gamma_{40}/\Gamma$

| VALUE | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0037±0.0007** | [74] | BALEST | 95B | CLE2 | $e^+ e^- \rightarrow \Upsilon(4S)$ |

[74] BALEST 95B assume PDG 1994 values. $J/\psi(1S)$ mesons are reconstructed in the $e^+ e^-$ and $\mu^+ \mu^-$ modes. The $B \rightarrow \chi_{c1}(1P)X$ branching ratio contains $\chi_{c1}(1P)$ mesons directly from $B$ decays and also from feeddown through $\psi(2S) \rightarrow \chi_{c1}(1P)\gamma$. Using the measured inclusive rates, BALEST 95B corrects for the feeddown and finds the $B \rightarrow \chi_{c1}(1P)$(direct) X branching ratio.

## $\Gamma(\chi_{c2}(1P)\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{41}/\Gamma$

| VALUE | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.0038** | 90 | 35 | [75] BALEST | 95B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[75] BALEST 95B assume $B(\chi_{c2}(1P) \to J/\psi(1S)\gamma) = (13.5 \pm 1.1) \times 10^{-2}$, the PDG 1994 value. $J/\psi(1S)$ mesons are reconstructed in the $e^+e^-$ and $\mu^+\mu^-$ modes, and PDG 1994 branching fractions are used. If interpreted as signal, the $35 \pm 13$ events correspond to $B(B \to \chi_{c2}(1P)X) = (0.25 \pm 0.10 \pm 0.03) \times 10^{-2}$.

## $\Gamma(\eta_c(1S)\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{42}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.009** | 90 | [76] BALEST | 95B | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[76] BALEST 95B assume PDG 1994 values for sub mode branching ratios. $J/\psi(1S)$ mesons are reconstructed in $J/\psi(1S) \to e^+e^-$ and $J/\psi(1S) \to \mu^+\mu^-$. Search region 2960 $< m_{\eta_c(1S)} <$3010 MeV/$c^2$.

## $\Gamma(K^{\pm}\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{43}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.789±0.025 OUR AVERAGE** | | | | |
| 0.82 ±0.01 ±0.05 | ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.775±0.015±0.025 | [77] ALBRECHT | 93I | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.85 ±0.07 ±0.09 | ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| seen | [78] BRODY | 82 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| seen | [79] GIANNINI | 82 | CUSB | $e^+e^- \to \Upsilon(4S)$ |

[77] ALBRECHT 93I value is not independent of the sum of $B \to K^+$anything and $B \to K^-$anything ALBRECHT 94C values.

[78] Assuming $\Upsilon(4S) \to B\overline{B}$, a total of $3.38 \pm 0.34 \pm 0.68$ kaons per $\Upsilon(4S)$ decay is found (the second error is systematic). In the context of the standard $B$-decay model, this leads to a value for ($b$-quark $\to$ $c$-quark)/($b$-quark $\to$ all) of $1.09 \pm 0.33 \pm 0.13$.

[79] GIANNINI 82 at CESR-CUSB observed $1.58 \pm 0.35$ $K^0$ per hadronic event much higher than $0.82 \pm 0.10$ below threshold. Consistent with predominant $b \to cX$ decay.

## $\Gamma(K^{+}\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{44}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.66 ±0.05** | [80] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.620±0.013±0.038 | [81] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.66 ±0.05 ±0.07 | [81] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[80] Measurement relies on lepton-kaon correlations. It is for the weak decay vertex and does not include mixing of the neutral $B$ meson. Mixing effects were corrected for by assuming a mixing parameter $r$ of $(18.1 \pm 4.3)$%.

[81] Measurement relies on lepton-kaon correlations. It includes production through mixing of the neutral $B$ meson.

## $\Gamma(K^- \text{anything})/\Gamma_{total}$ — $\Gamma_{45}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.13 ±0.04** | [82] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.165±0.011±0.036 | [83] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.19 ±0.05 ±0.02 | [83] ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[82] Measurement relies on lepton-kaon correlations. It is for the weak decay vertex and does not include mixing of the neutral $B$ meson. Mixing effects were corrected for by assuming a mixing parameter $r$ of (18.1 ± 4.3)%.

[83] Measurement relies on lepton-kaon correlations. It includes production through mixing of the neutral $B$ meson.

## $\Gamma(K^0/\overline{K}^0 \text{anything})/\Gamma_{total}$ — $\Gamma_{46}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.64 ±0.04 OUR AVERAGE** | | | | |
| 0.642±0.010±0.042 | [84] ALBRECHT | 94C | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.63 ±0.06 ±0.06 | ALAM | 87B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[84] ALBRECHT 94C assume a $K^0/\overline{K}^0$ multiplicity twice that of $K^0_S$.

## $\Gamma(K^*(892)^\pm \text{anything})/\Gamma_{total}$ — $\Gamma_{47}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.182±0.054±0.024** | ALBRECHT | 94J | ARG | $e^+e^- \to \Upsilon(4S)$ |

## $\Gamma(K^*(892)^0/\overline{K}^*(892)^0 \text{anything})/\Gamma_{total}$ — $\Gamma_{48}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.146±0.016±0.020** | ALBRECHT | 94J | ARG | $e^+e^- \to \Upsilon(4S)$ |

## $\Gamma(K^*(892)\gamma)/\Gamma_{total}$ — $\Gamma_{49}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $<1.5 \times 10^{-3}$ | 90 | [85] LESIAK | 92 | CBAL | $e^+e^- \to \Upsilon(4S)$ |
| $<2.4 \times 10^{-4}$ | 90 | ALBRECHT | 88H | ARG | $e^+e^- \to \Upsilon(4S)$ |

[85] LESIAK 92 set a limit on the inclusive process $B(b \to s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about $s$-quark hadronization.

## $\Gamma(K_1(1400)\gamma)/\Gamma_{total}$ — $\Gamma_{50}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<4.1 \times 10^{-4}$** | 90 | ALBRECHT | 88H | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| $<1.6 \times 10^{-3}$ | 90 | [86] LESIAK | 92 | CBAL | $e^+e^- \to \Upsilon(4S)$ |

[86] LESIAK 92 set a limit on the inclusive process $B(b \to s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about $s$-quark hadronization.

## $\Gamma(K^*_2(1430)\gamma)/\Gamma_{total}$ — $\Gamma_{51}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **$<8.3 \times 10^{-4}$** | 90 | ALBRECHT | 88H | ARG | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(K_2(1770)\gamma)/\Gamma_{total}$ — $\Gamma_{52}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<1.2 \times 10^{-3}$ | 90 | [87] LESIAK | 92 | CBAL | $e^+e^- \to \Upsilon(4S)$ |

[87] LESIAK 92 set a limit on the inclusive process $B(b \to s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about $s$-quark hadronization.

### $\Gamma(K_3^*(1780)\gamma)/\Gamma_{total}$ — $\Gamma_{53}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<3.0 \times 10^{-3}$ | 90 | ALBRECHT | 88H | ARG | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(K_4^*(2045)\gamma)/\Gamma_{total}$ — $\Gamma_{54}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<1.0 \times 10^{-3}$ | 90 | [88] LESIAK | 92 | CBAL | $e^+e^- \to \Upsilon(4S)$ |

[88] LESIAK 92 set a limit on the inclusive process $B(b \to s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about $s$-quark hadronization.

### $\Gamma(\overline{b} \to \overline{s}\gamma)/\Gamma_{total}$ — $\Gamma_{55}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| $(2.32 \pm 0.57 \pm 0.35) \times 10^{-4}$ | ALAM | 95 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\overline{b} \to \overline{s}\,\text{gluon})/\Gamma_{total}$ — $\Gamma_{56}/\Gamma$

| VALUE | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| $<0.068$ | 90 | | [89] COAN | 98 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| $<0.08$ | | 2 | [90] ALBRECHT | 95D | ARG | $e^+e^- \to \Upsilon(4S)$ |

[89] COAN 98 uses $D$-$\ell$ correlation.

[90] ALBRECHT 95D use full reconstruction of one $B$ decay as tag. Two candidate events for charmless $B$ decay can be interpreted as either $b \to s$ gluon or $b \to u$ transition. If interpreted as $b \to s$ gluon they find a branching ratio of $\sim 0.026$ or the upper limit quoted above. Result is highly model dependent.

### $\Gamma(\eta\,\text{anything})/\Gamma_{total}$ — $\Gamma_{57}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $<4.4 \times 10^{-4}$ | 90 | [91] BROWDER | 98 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[91] BROWDER 98 search for high momentum $B \to \eta X_s$ between 2.1 and 2.7 GeV/$c$.

### $\Gamma(\eta'\,\text{anything})/\Gamma_{total}$ — $\Gamma_{58}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| $(6.2 \pm 1.6 {}^{+1.3}_{-2.0}) \times 10^{-4}$ | [92] BROWDER | 98 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[92] BROWDER 98 observed a signal of $39.0 \pm 11.6$ events in high momentum $B \to \eta' X_s$ production between 2.0 and 2.7 GeV/$c$. The branching fraction is based on the interpretation of $b \to sg$, where the last error includes additional uncertainties due to the color-suppressed $b \to$ backgrounds.

### $\Gamma(\pi^{\pm}$ anything$)/\Gamma_{total}$ — $\Gamma_{59}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **3.585±0.025±0.070** | [93] ALBRECHT | 93I | ARG | $e^+e^- \to \Upsilon(4S)$ |

[93] ALBRECHT 93 excludes $\pi^{\pm}$ from $K^0_S$ and $\Lambda$ decays. If included, they find 4.105 ± 0.025 ± 0.080.

### $\Gamma(\eta$ anything$)/\Gamma_{total}$ — $\Gamma_{60}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.176±0.011±0.012** | KUBOTA | 96 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\rho^0$ anything$)/\Gamma_{total}$ — $\Gamma_{61}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.208±0.042±0.032** | ALBRECHT | 94J | ARG | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\omega$ anything$)/\Gamma_{total}$ — $\Gamma_{62}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<0.81** | 90 | ALBRECHT | 94J | ARG | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\phi$ anything$)/\Gamma_{total}$ — $\Gamma_{63}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.035 ±0.007 OUR AVERAGE** | Error includes scale factor of 1.8. | | | |
| 0.0390±0.0030±0.0035 | ALBRECHT | 94J | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.023 ±0.006 ±0.005 | BORTOLETTO | 86 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\phi K^*(892))/\Gamma_{total}$ — $\Gamma_{64}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN |
|---|---|---|---|---|
| **$<2.2 \times 10^{-5}$** | 90 | [94] BERGFELD | 98 | CLE2 |

[94] Assumes equal production of $B^+$ and $B^0$ at the $\Upsilon(4S)$.

### $\Gamma(\Lambda_c^{\pm}$ anything$)/\Gamma_{total}$ — $\Gamma_{65}/\Gamma$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.064±0.008±0.008** | | [95] CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| 0.14 ±0.09 | | [96] ALBRECHT | 88E | ARG | $e^+e^- \to \Upsilon(4S)$ |
| <0.112 | 90 | [97] ALAM | 87 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[95] CRAWFORD 92 result derived from lepton baryon correlations. Assumes all charmed baryons in $B^0$ and $B^{\pm}$ decay are $\Lambda_c$.

[96] ALBRECHT 88E measured $B(B \to \Lambda_c^+ X) \cdot B(\Lambda_c^+ \to p K^- \pi^+) = (0.30 \pm 0.12 \pm 0.06)\%$ and used $B(\Lambda_c^+ \to p K^- \pi^+) = (2.2 \pm 1.0)\%$ from ABRAMS 80 to obtain above number.

[97] Assuming all baryons result from charmed baryons, ALAM 86 conclude the branching fraction is 7.4 ± 2.9%. The limit given above is model independent.

### $\Gamma(\Lambda_c^+$ anything$)/\Gamma(\Lambda_c^-$ anything$)$ — $\Gamma_{66}/\Gamma_{67}$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.19±0.13±0.04** | [98] AMMAR | 97 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[98] AMMAR 97 uses a high-momentum lepton tag ($P_\ell > 1.4$ GeV/$c^2$).

### $\Gamma(\Lambda_c^- e^+ \text{anything})/\Gamma(\Lambda_c^\pm \text{anything})$ — $\Gamma_{68}/\Gamma_{65}$

| VALUE | CL% | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.05** | 90 | [99] | BONVICINI | 98 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[99] BONVICINI 98 uses the electron with momentum above 0.6 GeV/c.

### $\Gamma(\Lambda_c^- p \text{anything})/\Gamma(\Lambda_c^\pm \text{anything})$ — $\Gamma_{69}/\Gamma_{65}$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.57±0.05±0.05** | BONVICINI | 98 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

### $\Gamma(\Lambda_c^- p e^+ \nu_e)/\Gamma(\Lambda_c^- p \text{anything})$ — $\Gamma_{70}/\Gamma_{69}$

| VALUE | CL% | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.04** | 90 | [100] | BONVICINI | 98 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[100] BONVICINI 98 uses the electron with momentum above 0.6 GeV/c.

### $\Gamma(\overline{\Sigma}_c^{--} \text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{71}/\Gamma$

| VALUE | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.0042±0.0021±0.0011** | 77 | [101] | PROCARIO | 94 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[101] PROCARIO 94 reports $[B(B \to \overline{\Sigma}_c^{--} \text{anything}) \times B(\Lambda_c^+ \to p K^- \pi^+)] = 0.00021 \pm 0.00008 \pm 0.00007$. We divide by our best value $B(\Lambda_c^+ \to p K^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(\overline{\Sigma}_c^{-} \text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{72}/\Gamma$

| VALUE | CL% | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.010** | 90 | [102] | PROCARIO | 94 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[102] PROCARIO 94 reports $[B(B \to \overline{\Sigma}_c^{-} \text{anything}) \times B(\Lambda_c^+ \to p K^- \pi^+)] = < 0.00048$. We divide by our best value $B(\Lambda_c^+ \to p K^- \pi^+) = 0.050$.

### $\Gamma(\overline{\Sigma}_c^{0} \text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{73}/\Gamma$

| VALUE | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.0046±0.0021±0.0012** | 76 | [103] | PROCARIO | 94 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[103] PROCARIO 94 reports $[B(B \to \overline{\Sigma}_c^{0} \text{anything}) \times B(\Lambda_c^+ \to p K^- \pi^+)] = 0.00023 \pm 0.00008 \pm 0.00007$. We divide by our best value $B(\Lambda_c^+ \to p K^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

### $\Gamma(\overline{\Sigma}_c^{0} N (N = p \text{ or } n))/\Gamma_{\text{total}}$ — $\Gamma_{74}/\Gamma$

| VALUE | CL% | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.0015** | 90 | [104] | PROCARIO | 94 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[104] PROCARIO 94 reports $< 0.0017$ for $B(\Lambda_c^+ \to p K^- \pi^+) = 0.043$. We rescale to our best value $B(\Lambda_c^+ \to p K^- \pi^+) = 0.050$.

### $\Gamma(\Xi_c^0 \text{anything} \times B(\Xi_c^0 \to \Xi^- \pi^+))/\Gamma_{\text{total}}$ — $\Gamma_{75}/\Gamma$

| VALUE (units $10^{-3}$) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.144±0.048±0.021** | [105] | BARISH | 97 | CLE2 | $e^+ e^- \to \Upsilon(4S)$ |

[105] BARISH 97 find 79 ± 27 $\Xi_c^0$ events.

## $\Gamma(\Xi_c^+ \text{anything} \times B(\Xi_c^+ \to \Xi^- \pi^+ \pi^+))/\Gamma_{total}$ — $\Gamma_{76}/\Gamma$

| VALUE (units $10^{-3}$) | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| $0.453 \pm 0.096^{+0.085}_{-0.065}$ | [106] | BARISH | 97 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[106] BARISH 97 find 125 ± 28 $\Xi_c^+$ events.

## $\Gamma(p/\overline{p}\text{anything})/\Gamma_{total}$ — $\Gamma_{77}/\Gamma$

Includes $p$ and $\overline{p}$ from $\Lambda$ and $\overline{\Lambda}$ decay.

| VALUE | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.080±0.004 OUR AVERAGE** | | | | | | |
| 0.080±0.005±0.005 | | | ALBRECHT | 93I | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.080±0.005±0.003 | | | CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| $0.082 \pm 0.005^{+0.013}_{-0.010}$ | 2163 | [107] | ALBRECHT | 89K | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| >0.021 | | [108] | ALAM | 83B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[107] ALBRECHT 89K include direct and nondirect protons.

[108] ALAM 83B reported their result as > 0.036 ± 0.006 ± 0.009. Data are consistent with equal yields of $p$ and $\overline{p}$. Using assumed yields below cut, B($B \to p+$ X) = 0.03 not including protons from $\Lambda$ decays.

## $\Gamma(p/\overline{p}(\text{direct})\text{anything})/\Gamma_{total}$ — $\Gamma_{78}/\Gamma$

| VALUE | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.055±0.005 OUR AVERAGE** | | | | | | |
| 0.055±0.005±0.0035 | | | ALBRECHT | 93I | ARG | $e^+e^- \to \Upsilon(4S)$ |
| 0.056±0.006±0.005 | | | CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| 0.055±0.016 | 1220 | [109] | ALBRECHT | 89K | ARG | $e^+e^- \to \Upsilon(4S)$ |

[109] ALBRECHT 89K subtract contribution of $\Lambda$ decay from the inclusive proton yield.

## $\Gamma(\Lambda/\overline{\Lambda}\text{anything})/\Gamma_{total}$ — $\Gamma_{79}/\Gamma$

| VALUE | EVTS | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **0.040±0.005 OUR AVERAGE** | | | | | | |
| 0.038±0.004±0.006 | 2998 | | CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| 0.042±0.005±0.006 | 943 | | ALBRECHT | 89K | ARG | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| 0.022±0.003±0.0022 | | [110] | ACKERSTAFF | 97N | OPAL | $e^+e^- \to Z$ |
| >0.011 | | [111] | ALAM | 83B | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[110] ACKERSTAFF 97N assues B($b \to B$) = 0.868 ± 0.041, *i.e.*, an admixture of $B^0$, $B^\pm$, and $B_s$.

[111] ALAM 83B reported their result as > 0.022 ± 0.007 ± 0.004. Values are for (B($\Lambda$X)+B($\overline{\Lambda}$X))/2. Data are consistent with equal yields of $p$ and $\overline{p}$. Using assumed yields below cut, B($B \to \Lambda$X) = 0.03.

## $\Gamma(\Lambda\text{anything})/\Gamma(\overline{\Lambda}\text{anything})$ — $\Gamma_{80}/\Gamma_{81}$

| VALUE | | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.43±0.09±0.07** | [112] | AMMAR | 97 | CLE2 | $e^+e^- \to \Upsilon(4S)$ |

[112] AMMAR 97 uses a high-momentum lepton tag ($P_\ell > 1.4$ GeV/$c^2$).

## $\Gamma(\Xi^- / \overline{\Xi}^+ \text{ anything})/\Gamma_{total}$ — $\Gamma_{82}/\Gamma$

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0027±0.0006 OUR AVERAGE** | | | | | |
| 0.0027±0.0005±0.0004 | 147 | CRAWFORD | 92 | CLEO | $e^+ e^- \to \Upsilon(4S)$ |
| 0.0028±0.0014 | 54 | ALBRECHT | 89K | ARG | $e^+ e^- \to \Upsilon(4S)$ |

## $\Gamma(\text{baryons anything})/\Gamma_{total}$ — $\Gamma_{83}/\Gamma$

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| **0.068±0.005±0.003** | [113] ALBRECHT | 92O | ARG | $e^+ e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.076±0.014 | [114] ALBRECHT | 89K | ARG | $e^+ e^- \to \Upsilon(4S)$ |

[113] ALBRECHT 92O result is from simultaneous analysis of $p$ and $\Lambda$ yields, $p\overline{p}$ and $\Lambda\overline{p}$ correlations, and various lepton-baryon and lepton-baryon-antibaryon correlations. Supersedes ALBRECHT 89K.

[114] ALBRECHT 89K obtain this result by adding their their measurements (5.5 ± 1.6)% for direct protons and (4.2 ± 0.5 ± 0.6)% for inclusive $\Lambda$ production. They then assume (5.5 ± 1.6)% for neutron production and add it in also. Since each $B$ decay has two baryons, they divide by 2 to obtain (7.6 ± 1.4)%.

## $\Gamma(p\overline{p}\text{anything})/\Gamma_{total}$ — $\Gamma_{84}/\Gamma$

Includes $p$ and $\overline{p}$ from $\Lambda$ and $\overline{\Lambda}$ decay.

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.0247±0.0023 OUR AVERAGE** | | | | | |
| 0.024 ±0.001 ±0.004 | | CRAWFORD | 92 | CLEO | $e^+ e^- \to \Upsilon(4S)$ |
| 0.025 ±0.002 ±0.002 | 918 | ALBRECHT | 89K | ARG | $e^+ e^- \to \Upsilon(4S)$ |

## $\Gamma(p\overline{p}\text{anything})/\Gamma(p/\overline{p}\text{anything})$ — $\Gamma_{84}/\Gamma_{77}$

Includes $p$ and $\overline{p}$ from $\Lambda$ and $\overline{\Lambda}$ decay.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.30±0.02±0.05 | [115] CRAWFORD | 92 | CLEO | $e^+ e^- \to \Upsilon(4S)$ |

[115] CRAWFORD 92 value is not independent of their $\Gamma(p\overline{p}\text{anything})/\Gamma_{total}$ value.

## $\Gamma(\Lambda\overline{p}/\overline{\Lambda}p\text{anything})/\Gamma_{total}$ — $\Gamma_{85}/\Gamma$

Includes $p$ and $\overline{p}$ from $\Lambda$ and $\overline{\Lambda}$ decay.

| VALUE | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **0.025±0.004 OUR AVERAGE** | | | | | |
| 0.029±0.005±0.005 | | CRAWFORD | 92 | CLEO | $e^+ e^- \to \Upsilon(4S)$ |
| 0.023±0.004±0.003 | 165 | ALBRECHT | 89K | ARG | $e^+ e^- \to \Upsilon(4S)$ |

## $\Gamma(\Lambda\overline{p}/\overline{\Lambda}p\text{anything})/\Gamma(\Lambda/\overline{\Lambda}\text{anything})$ — $\Gamma_{85}/\Gamma_{79}$

Includes $p$ and $\overline{p}$ from $\Lambda$ and $\overline{\Lambda}$ decay.

| VALUE | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | |
| 0.76±0.11±0.08 | [116] CRAWFORD | 92 | CLEO | $e^+ e^- \to \Upsilon(4S)$ |

[116] CRAWFORD 92 value is not independent of their $[\Gamma(\Lambda\overline{p}\text{anything})+\Gamma(\overline{\Lambda}p\text{anything})]/\Gamma_{total}$ value.

### $\Gamma(\Lambda\overline{\Lambda}\text{anything})/\Gamma_{\text{total}}$ — $\Gamma_{86}/\Gamma$

| VALUE | CL% | EVTS | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|---|
| **<0.005** | 90 | | CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | | |
| <0.0088 | 90 | 12 | ALBRECHT | 89K | ARG | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\Lambda\overline{\Lambda}\text{anything})/\Gamma(\Lambda/\overline{\Lambda}\text{anything})$ — $\Gamma_{86}/\Gamma_{79}$

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.13 | 90 | [117] CRAWFORD | 92 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

[117] CRAWFORD 92 value is not independent of their $\Gamma(\Lambda\overline{\Lambda}\text{anything})/\Gamma_{\text{total}}$ value.

### $\Gamma(e^+e^-s)/\Gamma_{\text{total}}$ — $\Gamma_{87}/\Gamma$

Test for $\Delta B = 1$ weak neutral current.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<5.7 $\times 10^{-5}$** | 90 | GLENN | 98 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.05 | 90 | BEBEK | 81 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

### $\Gamma(\mu^+\mu^-s)/\Gamma_{\text{total}}$ — $\Gamma_{88}/\Gamma$

Test for $\Delta B = 1$ weak neutral current.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<5.8 $\times 10^{-5}$** | 90 | GLENN | 98 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.017 | 90 | CHADWICK | 81 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

### $[\Gamma(e^+e^-s) + \Gamma(\mu^+\mu^-s)]/\Gamma_{\text{total}}$ — $(\Gamma_{87}+\Gamma_{88})/\Gamma$

Test for $\Delta B = 1$ weak neutral current.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<4.2 $\times 10^{-5}$** | 90 | GLENN | 98 | CLEO | $e^+e^- \to \Upsilon(4S)$ |
| • • • We do not use the following data for averages, fits, limits, etc. • • • | | | | | |
| <0.0024 | 90 | [118] BEAN | 87 | CLEO | Repl. by GLENN 98 |
| <0.0062 | 90 | [119] AVERY | 84 | CLEO | Repl. by BEAN 87 |

[118] BEAN 87 reports $[(\mu^+\mu^-)+(e^+e^-)]/2$ and we converted it.

[119] Determine ratio of $B^+$ to $B^0$ semileptonic decays to be in the range 0.25–2.9.

### $\Gamma(e^\pm\mu^\mp s)/\Gamma_{\text{total}}$ — $\Gamma_{89}/\Gamma$

Test for lepton family number conservation.

| VALUE | CL% | DOCUMENT ID | | TECN | COMMENT |
|---|---|---|---|---|---|
| **<2.2 $\times 10^{-5}$** | 90 | GLENN | 98 | CLEO | $e^+e^- \to \Upsilon(4S)$ |

# $B^{\pm}/B^{0}$ ADMIXTURE REFERENCES


| | | | | |
|---|---|---|---|---|
| BARATE | 98Q | EPJ C4 387 | R. Barate+ | (ALEPH Collab.) |
| BERGFELD | 98 | PRL 81 272 | T. Bergfeld+ | (CLEO Collab.) |
| BISHAI | 98 | PR D57 3847 | M. Bishai+ | (CLEO Collab.) |
| BONVICINI | 98 | PR D57 6604 | G. Bonvicini+ | (CLEO Collab.) |
| BROWDER | 98 | PRL 81 1786 | T.E. Browder+ | (CLEO Collab.) |
| COAN | 98 | PRL 80 1150 | T.E. Coan+ | (CLEO Collab.) |
| GLENN | 98 | PRL 80 2289 | S. Glenn+ | (CLEO Collab.) |
| ACKERSTAFF | 97N | ZPHY C74 423 | K. Ackerstaff+ | (OPAL Collab.) |
| AMMAR | 97 | PR D55 13 | R. Ammar+ | (CLEO Collab.) |
| BARISH | 97 | PRL 79 3599 | B. Barish+ | (CLEO Collab.) |
| BUSKULIC | 97B | ZPHY C73 601 | D. Buskulic+ | (ALEPH Collab.) |
| GIBBONS | 97B | PR D56 3783 | L. Gibbons+ | (CLEO Collab.) |
| ALBRECHT | 96D | PL B374 256 | +Hamacher, Hofmann, Kirchhoff+ | (ARGUS Collab.) |
| BARISH | 96B | PRL 76 1570 | +Chadha, Chan, Eigen+ | (CLEO Collab.) |
| GIBAUT | 96 | PR D53 4734 | +Kinoshita, Pomianowski, Barish+ | (CLEO Collab.) |
| KUBOTA | 96 | PR D53 6033 | +Lattery, Momayezi, Nelson+ | (CLEO Collab.) |
| PDG | 96 | PR D54 1 | | |
| ALAM | 95 | PRL 74 2885 | +Kim, Ling, Mahmood+ | (CLEO Collab.) |
| ALBRECHT | 95D | PL B353 554 | +Hamacher, Hofmann, Kirchoff+ | (ARGUS Collab.) |
| BALEST | 95B | PR D52 2661 | +Cho, Ford, Johnson+ | (CLEO Collab.) |
| BARISH | 95 | PR D51 1014 | +Chadha, Chan, Cowen+ | (CLEO Collab.) |
| BUSKULIC | 95B | PL B345 103 | +Casper, De Bonis, Decamp+ | (ALEPH Collab.) |
| ALBRECHT | 94C | ZPHY C62 371 | +Ehrlichmann, Hamacher, Hofmann+ | (ARGUS Collab.) |
| ALBRECHT | 94J | ZPHY C61 1 | +Ehrlichmann, Hamacher, Hofmann+ | (ARGUS Collab.) |
| PROCARIO | 94 | PRL 73 1306 | +Balest, Cho, Daoudi, Ford+ | (CLEO Collab.) |
| ALBRECHT | 93 | ZPHY C57 533 | +Ehrlichmann, Hamacher, Hofmann+ | (ARGUS Collab.) |
| ALBRECHT | 93E | ZPHY C60 11 | +Ehrlichmann, Hamacher, Hofmann+ | (ARGUS Collab.) |
| ALBRECHT | 93H | PL B318 397 | +Ehrlichmann, Hamacher, Hofmann+ | (ARGUS Collab.) |
| ALBRECHT | 93I | ZPHY C58 191 | +Cronstroem, Ehrlichmann, Hamacher+ | (ARGUS Collab.) |
| ALEXANDER | 93B | PL B319 365 | +Bebek, Berkelman, Bloom, Browder+ | (CLEO Collab.) |
| ARTUSO | 93 | PL B311 307 | | (SYRA) |
| BARTELT | 93B | PRL 71 4111 | +Csorna, Egyed, Jain, Akerib+ | (CLEO Collab.) |
| ALBRECHT | 92E | PL B277 209 | +Ehrlichmann, Hamacher, Krueger, Nau+ | (ARGUS Collab.) |
| ALBRECHT | 92G | ZPHY C54 1 | +Ehrlichmann, Hamacher, Krueger, Nau+ | (ARGUS Collab.) |
| ALBRECHT | 92O | ZPHY C56 1 | +Cronstroem, Ehrlichmann+ | (ARGUS Collab.) |
| BORTOLETTO | 92 | PR D45 21 | +Brown, Dominick, McIlwain+ | (CLEO Collab.) |
| CRAWFORD | 92 | PR D45 752 | +Fulton, Jensen, Johnson+ | (CLEO Collab.) |
| HENDERSON | 92 | PR D45 2212 | +Kinoshita, Pipkin, Procario+ | (CLEO Collab.) |
| LESIAK | 92 | ZPHY C55 33 | +Antreasyan, Bartels, Besset, Bieler+ | (Crystal Ball Collab.) |
| ALBRECHT | 91C | PL B255 297 | +Ehrlichmann, Glaeser, Harder, Krueger+ | (ARGUS Collab.) |
| ALBRECHT | 91H | ZPHY C52 353 | +Ehrlichmann, Hamacher, Harder+ | (ARGUS Collab.) |
| FULTON | 91 | PR D43 651 | +Jensen, Johnson, Kagan, Kass+ | (CLEO Collab.) |
| YANAGISAWA | 91 | PRL 66 2436 | +Heintz, Lee-Franzini, Lovelock, Narain+ | (CUSB II Collab.) |
| ALBRECHT | 90 | PL B234 409 | +Glaeser, Harder, Krueger+ | (ARGUS Collab.) |
| ALBRECHT | 90H | PL B249 359 | +Ehrlichmann, Glaeser, Harder, Krueger+ | (ARGUS Collab.) |
| BORTOLETTO | 90 | PRL 64 2117 | +Goldberg, Horwitz, Jain, Mestayer+ | (CLEO Collab.) |
| Also | 92 | PR D45 21 | Bortoletto, Brown, Dominick, McIlwain+ | (CLEO Collab.) |
| FULTON | 90 | PRL 64 16 | +Hempstead, Jensen, Johnson+ | (CLEO Collab.) |
| MASCHMANN | 90 | ZPHY C46 555 | +Antreasyan, Bartels, Besset+ | (Crystal Ball Collab.) |
| PDG | 90 | PL B239 | Hernandez, Stone, Porter+ | (IFIC, BOST, CIT+) |
| ALBRECHT | 89K | ZPHY C42 519 | +Boeckmann, Glaeser, Harder+ | (ARGUS Collab.) |
| ISGUR | 89B | PR D39 799 | +Scora, Grinstein, Wise | (TNTO, CIT) |
| WACHS | 89 | ZPHY C42 33 | +Antreasyan, Bartels, Bieler+ | (Crystal Ball Collab.) |
| ALBRECHT | 88E | PL B210 263 | +Boeckmann, Glaeser+ | (ARGUS Collab.) |
| ALBRECHT | 88H | PL B210 258 | +Boeckmann, Glaeser+ | (ARGUS Collab.) |
| KOERNER | 88 | ZPHY C38 511 | +Schuler | (MANZ, DESY) |
| ALAM | 87 | PRL 59 22 | +Kitukama, Kim, Li+ | (CLEO Collab.) |
| ALAM | 87B | PRL 58 1814 | +Katayama, Kim, Sun+ | (CLEO Collab.) |
| ALBRECHT | 87D | PL B199 451 | +Andam, Binder, Boeckmann+ | (ARGUS Collab.) |
| ALBRECHT | 87H | PL B187 425 | +Binder, Boeckmann, Glaser+ | (ARGUS Collab.) |
| BEAN | 87 | PR D35 3533 | +Bobbink, Brock, Engler+ | (CLEO Collab.) |
| BEHRENDS | 87 | PRL 59 407 | +Morrow, Guida, Guida+ | (CLEO Collab.) |
| BORTOLETTO | 87 | PR D35 19 | +Chen, Garren, Goldberg+ | (CLEO Collab.) |
| ALAM | 86 | PR D34 3279 | +Katayama, Kim, Sun+ | (CLEO Collab.) |
| BALTRUSAIT... | 86E | PRL 56 2140 | Baltrusaitis, Becker, Blaylock, Brown+ | (Mark III Collab.) |

| | | | | |
|---|---|---|---|---|
| BORTOLETTO | 86 | PRL 56 800 | +Chen, Garren, Goldberg+ | (CLEO Collab.) |
| HAAS | 86 | PRL 56 2781 | +Hempstead, Jensen, Kagan+ | (CLEO Collab.) |
| ALBRECHT | 85H | PL 162B 395 | +Binder, Harder+ | (ARGUS Collab.) |
| CSORNA | 85 | PRL 54 1894 | +Garren, Mestayer, Panvini+ | (CLEO Collab.) |
| HAAS | 85 | PRL 55 1248 | +Hempstead, Jensen, Kagan+ | (CLEO Collab.) |
| AVERY | 84 | PRL 53 1309 | +Bebek, Berkelman, Cassel+ | (CLEO Collab.) |
| CHEN | 84 | PRL 52 1084 | +Goldberg, Horwitz, Jawahery+ | (CLEO Collab.) |
| LEVMAN | 84 | PL 141B 271 | +Sreedhar, Han, Imlay+ | (CUSB Collab.) |
| ALAM | 83B | PRL 51 1143 | +Csorna, Garren, Mestayer+ | (CLEO Collab.) |
| GREEN | 83 | PRL 51 347 | +Hicks, Sannes, Skubic+ | (CLEO Collab.) |
| KLOPFEN... | 83B | PL 130B 444 | Klopfenstein, Horstkotte+ | (CUSB Collab.) |
| ALTARELLI | 82 | NP B208 365 | +Cabibbo, Corbo, Maini, Martinelli | (ROMA, INFN, FRAS) |
| BRODY | 82 | PRL 48 1070 | +Chen, Goldberg, Horwitz+ | (CLEO Collab.) |
| GIANNINI | 82 | NP B206 1 | +Finocchiaro, Franzini+ | (CUSB Collab.) |
| BEBEK | 81 | PRL 46 84 | +Haggerty, izen, Longuemare+ | (CLEO Collab.) |
| CHADWICK | 81 | PRL 46 88 | +Ganci, Kagar, Kass+ | (CLEO Collab.) |
| ABRAMS | 80 | PRL 44 10 | +Alam, Blocker, Boyarski+ | (SLAC, LBL) |