

B[±]/B⁰ ADMIXTURE

B DECAY MODES

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

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 possibility 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 if only one D is allowed in the final state. Event 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 section.

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

Mode	Fraction (Γ_i/Γ)	Scale factor/ Confidence level
Semileptonic and leptonic modes		
Γ_1 $B \rightarrow e^+ \nu_e$ anything	[a] (10.74 ± 0.16) %	
Γ_2 $B \rightarrow \bar{p} e^+ \nu_e$ anything	< 5.9	× 10 ⁻⁴ CL=90%
Γ_3 $B \rightarrow \mu^+ \nu_\mu$ anything	[a] (10.74 ± 0.16) %	
Γ_4 $B \rightarrow \ell^+ \nu_\ell$ anything	[a,b] (10.74 ± 0.16) %	
Γ_5 $B \rightarrow D^- \ell^+ \nu_\ell$ anything	[b] (2.8 ± 0.9) %	
Γ_6 $B \rightarrow \bar{D}^0 \ell^+ \nu_\ell$ anything	[b] (7.2 ± 1.4) %	
Γ_7 $B \rightarrow D \tau^+ \nu_\tau$	(8.6 ± 2.7) × 10 ⁻³	
Γ_8 $B \rightarrow D^{*-} \ell^+ \nu_\ell$ anything	[c] (6.7 ± 1.3) × 10 ⁻³	
Γ_9 $B \rightarrow D^{*0} \ell^+ \nu_\ell$ anything		
Γ_{10} $B \rightarrow D^* \tau^+ \nu_\tau$	(1.62 ± 0.33) %	
Γ_{11} $B \rightarrow \bar{D}^{*0} \ell^+ \nu_\ell$	[b,d] (2.7 ± 0.7) %	
Γ_{12} $B \rightarrow \bar{D}_1(2420) \ell^+ \nu_\ell$ anything	(3.8 ± 1.3) × 10 ⁻³	S=2.4
Γ_{13} $B \rightarrow D \pi \ell^+ \nu_\ell$ anything + $D^* \pi \ell^+ \nu_\ell$ anything	(2.6 ± 0.5) %	S=1.5
Γ_{14} $B \rightarrow D \pi \ell^+ \nu_\ell$ anything	(1.5 ± 0.6) %	
Γ_{15} $B \rightarrow D^* \pi \ell^+ \nu_\ell$ anything	(1.9 ± 0.4) %	

Γ_{16}	$B \rightarrow \bar{D}_2^*(2460)l^+\nu_\ell$ anything	(4.4 \pm 1.6) $\times 10^{-3}$	
Γ_{17}	$B \rightarrow D^{*-}\pi^+l^+\nu_\ell$ anything	(1.00 \pm 0.34) %	
Γ_{18}	$B \rightarrow D_s^-l^+\nu_\ell$ anything	[b] < 7	$\times 10^{-3}$ CL=90%
Γ_{19}	$B \rightarrow D_s^-l^+\nu_\ell K^+$ anything	[b] < 5	$\times 10^{-3}$ CL=90%
Γ_{20}	$B \rightarrow D_s^-l^+\nu_\ell K^0$ anything	[b] < 7	$\times 10^{-3}$ CL=90%
Γ_{21}	$B \rightarrow l^+\nu_\ell$ charm	(10.57 \pm 0.15) %	
Γ_{22}	$B \rightarrow X_u l^+\nu_\ell$	(2.33 \pm 0.22) $\times 10^{-3}$	
Γ_{23}	$B \rightarrow \pi l \nu_\ell$	(1.35 \pm 0.10) $\times 10^{-4}$	
Γ_{24}	$B \rightarrow K^+l^+\nu_\ell$ anything	[b] (6.2 \pm 0.5) %	
Γ_{25}	$B \rightarrow K^-l^+\nu_\ell$ anything	[b] (10 \pm 4) $\times 10^{-3}$	
Γ_{26}	$B \rightarrow K^0/\bar{K}^0 l^+\nu_\ell$ anything	[b] (4.5 \pm 0.5) %	

D, D*, or D_s modes

Γ_{27}	$B \rightarrow D^\pm$ anything	(23.3 \pm 1.3) %	
Γ_{28}	$B \rightarrow D^0/\bar{D}^0$ anything	(62.2 \pm 2.9) %	S=1.3
Γ_{29}	$B \rightarrow D^*(2010)^\pm$ anything	(22.5 \pm 1.5) %	
Γ_{30}	$B \rightarrow D^*(2007)^0$ anything	(26.0 \pm 2.7) %	
Γ_{31}	$B \rightarrow D_s^\pm$ anything	[e] (8.4 \pm 0.8) %	
Γ_{32}	$B \rightarrow D_s^{*\pm}$ anything	(6.5 \pm 1.0) %	
Γ_{33}	$B \rightarrow D_s^{*\pm}\bar{D}^*$	(3.4 \pm 0.6) %	
Γ_{34}	$B \rightarrow \bar{D}D_{s0}(2317)$		
Γ_{35}	$B \rightarrow \bar{D}D_{sJ}(2457)$		
Γ_{36}	$B \rightarrow D^{(*)}\bar{D}^{(*)}K^0 + D^{(*)}\bar{D}^{(*)}K^\pm$	[e,f] (7.1 \pm 2.7 / -1.7) %	
Γ_{37}	$b \rightarrow c\bar{c}s$	(22 \pm 4) %	
Γ_{38}	$B \rightarrow D_s^{(*)}\bar{D}^{(*)}$	[e,f] (4.0 \pm 0.4) %	
Γ_{39}	$B \rightarrow D^*D^*(2010)^\pm$	[e] < 5.9	$\times 10^{-3}$ CL=90%
Γ_{40}	$B \rightarrow DD^*(2010)^\pm + D^*D^\pm$	[e] < 5.5	$\times 10^{-3}$ CL=90%
Γ_{41}	$B \rightarrow DD^\pm$	[e] < 3.1	$\times 10^{-3}$ CL=90%
Γ_{42}	$B \rightarrow D_s^{(*)}\pm\bar{D}^{(*)}X(n\pi^\pm)$	[e,f] (9 \pm 5 / -4) %	
Γ_{43}	$B \rightarrow D^*(2010)\gamma$	< 1.1	$\times 10^{-3}$ CL=90%
Γ_{44}	$B \rightarrow D_s^+\pi^-, D_s^{*+}\pi^-, D_s^+\rho^-, D_s^{*+}\rho^-, D_s^+\pi^0, D_s^{*+}\pi^0, D_s^+\eta, D_s^{*+}\eta, D_s^+\rho^0, D_s^{*+}\rho^0, D_s^+\omega, D_s^{*+}\omega$	[e] < 4	$\times 10^{-4}$ CL=90%
Γ_{45}	$B \rightarrow D_{s1}(2536)^+$ anything	< 9.5	$\times 10^{-3}$ CL=90%

Charmonium modes

Γ_{46}	$B \rightarrow J/\psi(1S)$ anything	(1.094 ± 0.032) %	S=1.1
Γ_{47}	$B \rightarrow J/\psi(1S)$ (direct) anything	(7.8 ± 0.4) × 10 ⁻⁵	S=1.1
Γ_{48}	$B \rightarrow \psi(2S)$ anything	(3.07 ± 0.21) × 10 ⁻³	
Γ_{49}	$B \rightarrow \chi_{c1}(1P)$ anything	(3.86 ± 0.27) × 10 ⁻³	
Γ_{50}	$B \rightarrow \chi_{c1}(1P)$ (direct) anything	(3.23 ± 0.25) × 10 ⁻³	
Γ_{51}	$B \rightarrow \chi_{c2}(1P)$ anything	(1.4 ± 0.4) × 10 ⁻³	S=1.9
Γ_{52}	$B \rightarrow \chi_{c2}(1P)$ (direct) anything	(1.65 ± 0.31) × 10 ⁻³	
Γ_{53}	$B \rightarrow \eta_c(1S)$ anything	< 9 × 10 ⁻³	CL=90%
Γ_{54}	$B^0 \rightarrow X(3872) K \times B(X \rightarrow D^0 \bar{D}^0 \pi^0)$	(1.2 ± 0.4) × 10 ⁻⁴	
Γ_{55}	$B \rightarrow KX(3945) \times B(X(3945) \rightarrow \omega J/\psi)$	[g] (7.1 ± 3.4) × 10 ⁻⁵	

K or K* modes

Γ_{56}	$B \rightarrow K^\pm$ anything	[e] (78.9 ± 2.5) %	
Γ_{57}	$B \rightarrow K^+$ anything	(66 ± 5) %	
Γ_{58}	$B \rightarrow K^-$ anything	(13 ± 4) %	
Γ_{59}	$B \rightarrow K^0/\bar{K}^0$ anything	[e] (64 ± 4) %	
Γ_{60}	$B \rightarrow K^*(892)^\pm$ anything	(18 ± 6) %	
Γ_{61}	$B \rightarrow K^*(892)^0/\bar{K}^*(892)^0$ anything	[e] (14.6 ± 2.6) %	
Γ_{62}	$B \rightarrow K^*(892)\gamma$	(4.2 ± 0.6) × 10 ⁻⁵	
Γ_{63}	$B \rightarrow \eta K \gamma$	(8.5 ^{+1.8} _{-1.6}) × 10 ⁻⁶	
Γ_{64}	$B \rightarrow K_1(1400)\gamma$	< 1.27 × 10 ⁻⁴	CL=90%
Γ_{65}	$B \rightarrow K_2^*(1430)\gamma$	(1.7 ^{+0.6} _{-0.5}) × 10 ⁻⁵	
Γ_{66}	$B \rightarrow K_2(1770)\gamma$	< 1.2 × 10 ⁻³	CL=90%
Γ_{67}	$B \rightarrow K_3^*(1780)\gamma$	< 3.7 × 10 ⁻⁵	CL=90%
Γ_{68}	$B \rightarrow K_4^*(2045)\gamma$	< 1.0 × 10 ⁻³	CL=90%
Γ_{69}	$B \rightarrow K\eta'(958)$	(8.3 ± 1.1) × 10 ⁻⁵	
Γ_{70}	$B \rightarrow K^*(892)\eta'(958)$	(4.1 ± 1.1) × 10 ⁻⁶	
Γ_{71}	$B \rightarrow K\eta$	< 5.2 × 10 ⁻⁶	CL=90%
Γ_{72}	$B \rightarrow K^*(892)\eta$	(1.8 ± 0.5) × 10 ⁻⁵	
Γ_{73}	$B \rightarrow K\phi\phi$	(2.3 ± 0.9) × 10 ⁻⁶	
Γ_{74}	$B \rightarrow \bar{b} \rightarrow \bar{s}\gamma$	(3.56 ± 0.25) × 10 ⁻⁴	
Γ_{75}	$B \rightarrow \bar{b} \rightarrow \bar{s}$ gluon	< 6.8 %	CL=90%
Γ_{76}	$B \rightarrow \eta$ anything	< 4.4 × 10 ⁻⁴	CL=90%
Γ_{77}	$B \rightarrow \eta'$ anything	(4.2 ± 0.9) × 10 ⁻⁴	

Light unflavored meson modes

Γ_{78}	$B \rightarrow \rho\gamma$		$(1.39 \pm 0.25) \times 10^{-6}$	S=1.2
Γ_{79}	$B \rightarrow \rho/\omega\gamma$		$(1.30 \pm 0.23) \times 10^{-6}$	S=1.2
Γ_{80}	$B \rightarrow \pi^\pm$ anything	[e,h]	$(358 \pm 7) \%$	
Γ_{81}	$B \rightarrow \pi^0$ anything		$(235 \pm 11) \%$	
Γ_{82}	$B \rightarrow \eta$ anything		$(17.6 \pm 1.6) \%$	
Γ_{83}	$B \rightarrow \rho^0$ anything		$(21 \pm 5) \%$	
Γ_{84}	$B \rightarrow \omega$ anything		< 81	% CL=90%
Γ_{85}	$B \rightarrow \phi$ anything		$(3.43 \pm 0.12) \%$	
Γ_{86}	$B \rightarrow \phi K^*(892)$		< 2.2	$\times 10^{-5}$ CL=90%

Baryon modes

Γ_{87}	$B \rightarrow \Lambda_c^+ / \bar{\Lambda}_c^-$ anything		$(4.5 \pm 1.2) \%$	
Γ_{88}	$B \rightarrow \Lambda_c^+$ anything			
Γ_{89}	$B \rightarrow \bar{\Lambda}_c^-$ anything			
Γ_{90}	$B \rightarrow \bar{\Lambda}_c^- e^+$ anything		< 2.3	$\times 10^{-3}$ CL=90%
Γ_{91}	$B \rightarrow \bar{\Lambda}_c^- p$ anything		$(2.6 \pm 0.8) \%$	
Γ_{92}	$B \rightarrow \bar{\Lambda}_c^- p e^+ \nu_e$		< 1.0	$\times 10^{-3}$ CL=90%
Γ_{93}	$B \rightarrow \bar{\Sigma}_c^{--}$ anything		$(4.2 \pm 2.4) \times 10^{-3}$	
Γ_{94}	$B \rightarrow \bar{\Sigma}_c^-$ anything		< 9.6	$\times 10^{-3}$ CL=90%
Γ_{95}	$B \rightarrow \bar{\Sigma}_c^0$ anything		$(4.6 \pm 2.4) \times 10^{-3}$	
Γ_{96}	$B \rightarrow \bar{\Sigma}_c^0 N (N = p \text{ or } n)$		< 1.5	$\times 10^{-3}$ CL=90%
Γ_{97}	$B \rightarrow \Xi_c^0$ anything $\times B(\Xi_c^0 \rightarrow \Xi^- \pi^+)$		$(1.93 \pm 0.30) \times 10^{-4}$	S=1.1
Γ_{98}	$B \rightarrow \Xi_c^+$ anything $\times B(\Xi_c^+ \rightarrow \Xi^- \pi^+ \pi^+)$		$(4.5 \begin{smallmatrix} + 1.3 \\ - 1.2 \end{smallmatrix}) \times 10^{-4}$	
Γ_{99}	$B \rightarrow p/\bar{p}$ anything	[e]	$(8.0 \pm 0.4) \%$	
Γ_{100}	$B \rightarrow p/\bar{p}$ (direct) anything	[e]	$(5.5 \pm 0.5) \%$	
Γ_{101}	$B \rightarrow \Lambda/\bar{\Lambda}$ anything	[e]	$(4.0 \pm 0.5) \%$	
Γ_{102}	$B \rightarrow \Lambda$ anything			
Γ_{103}	$B \rightarrow \bar{\Lambda}$ anything			
Γ_{104}	$B \rightarrow \Xi^- / \bar{\Xi}^+$ anything	[e]	$(2.7 \pm 0.6) \times 10^{-3}$	
Γ_{105}	$B \rightarrow$ baryons anything		$(6.8 \pm 0.6) \%$	
Γ_{106}	$B \rightarrow p\bar{p}$ anything		$(2.47 \pm 0.23) \%$	
Γ_{107}	$B \rightarrow \Lambda\bar{p}/\bar{\Lambda}p$ anything	[e]	$(2.5 \pm 0.4) \%$	
Γ_{108}	$B \rightarrow \Lambda\bar{\Lambda}$ anything		< 5	$\times 10^{-3}$ CL=90%

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

Γ_{109}	$B \rightarrow s e^+ e^-$	B1	$(4.7 \pm 1.3) \times 10^{-6}$	
Γ_{110}	$B \rightarrow s \mu^+ \mu^-$	B1	$(4.3 \pm 1.2) \times 10^{-6}$	
Γ_{111}	$B \rightarrow s \ell^+ \ell^-$	B1 [b]	$(4.5 \pm 1.0) \times 10^{-6}$	
Γ_{112}	$B \rightarrow \pi \ell^+ \ell^-$		< 6.2	$\times 10^{-8}$ CL=90%

Γ_{113}	$B \rightarrow K e^+ e^-$	$B1$	$(3.8 \pm_{-0.7}^{+0.8}) \times 10^{-7}$	
Γ_{114}	$B \rightarrow K^*(892) e^+ e^-$	$B1$	$(1.13 \pm 0.27) \times 10^{-6}$	
Γ_{115}	$B \rightarrow K \mu^+ \mu^-$	$B1$	$(4.2 \pm_{-0.8}^{+0.9}) \times 10^{-7}$	
Γ_{116}	$B \rightarrow K^*(892) \mu^+ \mu^-$	$B1$	$(1.03 \pm_{-0.23}^{+0.26}) \times 10^{-6}$	
Γ_{117}	$B \rightarrow K \ell^+ \ell^-$	$B1$	$(3.9 \pm 0.7) \times 10^{-7}$	S=1.2
Γ_{118}	$B \rightarrow K^*(892) \ell^+ \ell^-$	$B1$	$(9.4 \pm 1.8) \times 10^{-7}$	S=1.1
Γ_{119}	$B \rightarrow K^* \nu \bar{\nu}$		< 8	$\times 10^{-5}$ CL=90%
Γ_{120}	$B \rightarrow s e^\pm \mu^\mp$	LF	[e] < 2.2	$\times 10^{-5}$ CL=90%
Γ_{121}	$B \rightarrow \pi e^\pm \mu^\mp$	LF	< 9.2	$\times 10^{-8}$ CL=90%
Γ_{122}	$B \rightarrow \rho e^\pm \mu^\mp$	LF	< 3.2	$\times 10^{-6}$ CL=90%
Γ_{123}	$B \rightarrow K e^\pm \mu^\mp$	LF	< 3.8	$\times 10^{-8}$ CL=90%
Γ_{124}	$B \rightarrow K^*(892) e^\pm \mu^\mp$	LF	< 5.1	$\times 10^{-7}$ CL=90%

[a] These values are model dependent.

[b] An ℓ indicates an e or a μ mode, not a sum over these modes.

[c] Here “anything” means at least one particle observed.

[d] 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.

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

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

[g] $X(3945)$ denotes a near-threshold enhancement in the $\omega J/\psi$ mass spectrum.

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

B^\pm/B^0 ADMIXTURE BRANCHING RATIOS

$\Gamma(e^+ \nu_e \text{ anything})/\Gamma_{\text{total}}$ Γ_1/Γ

These branching fraction values are model dependent.

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<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
The data in this block is included in the average printed for a previous datablock.			

0.1074 ± 0.0016 OUR EVALUATION

0.1044 ± 0.0025 OUR AVERAGE Error includes scale factor of 1.5. See the ideogram below.

0.1028 ± 0.0018 ± 0.0024	¹ URQUIJO	07	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
0.0996 ± 0.0019 ± 0.0032	² AUBERT,B	06Y	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
0.1091 ± 0.0009 ± 0.0024	³ MAHMOOD	04	CLEO	$e^+ e^- \rightarrow \Upsilon(4S)$
0.097 ± 0.005 ± 0.004	⁴ ALBRECHT	93H	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.1085 ± 0.0021 ± 0.0036	⁵ OKABE	05	BELL	Repl. by URQUIJO 07
0.1083 ± 0.0016 ± 0.0006	⁶ AUBERT	04X	BABR	Repl. by AUBERT,B 06Y
0.1036 ± 0.0006 ± 0.0023	⁷ AUBERT,B	04A	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
0.1087 ± 0.0018 ± 0.0030	⁸ AUBERT	03	BABR	Repl. by AUBERT 04X
0.109 ± 0.0012 ± 0.0049	⁹ ABE	02Y	BELL	Repl. by OKABE 05
0.1049 ± 0.0017 ± 0.0043	¹⁰ BARISH	96B	CLE2	Repl. by MAHMOOD 04
0.100 ± 0.004 ± 0.003	¹¹ YANAGISAWA	91	CSB2	$e^+e^- \rightarrow \Upsilon(4S)$
0.103 ± 0.006 ± 0.002	¹² ALBRECHT	90H	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
0.117 ± 0.004 ± 0.010	¹³ WACHS	89	CBAL	Direct e at $\Upsilon(4S)$
0.120 ± 0.007 ± 0.005	CHEN	84	CLEO	Direct e at $\Upsilon(4S)$
0.132 ± 0.008 ± 0.014	¹⁴ KLOPFEN...	83B	CUSB	Direct e at $\Upsilon(4S)$

¹ URQUIJO 07 report a measurement of $(10.07 \pm 0.18 \pm 0.21)\%$ for the partial branching fraction of $B \rightarrow e\nu_e X_C$ decay with electron energy above 0.6 GeV. We converted the result to $B \rightarrow e\nu_e X$ branching fraction.

² The measurements are obtained for charged and neutral B mesons partial rates of semileptonic decay to electrons with momentum above 0.6 GeV/ c in the B rest frame. The best precision on the ratio is achieved for a momentum threshold of 1.0 GeV: $B(B^+ \rightarrow e^+\nu_e X) / B(B^0 \rightarrow e^+\nu_e X) = 1.074 \pm 0.041 \pm 0.026$.

³ Uses charge and angular correlations in $\Upsilon(4S)$ events with a high-momentum lepton and an additional electron.

⁴ ALBRECHT 93H analysis performed using tagged semileptonic decays of the B . This technique is almost model independent for the lepton branching ratio.

⁵ The measurements are obtained for charged and neutral B mesons partial rates of semileptonic decay to electrons with momentum above 0.6 GeV/ c in the B rest frame, and their ratio of $B(B^+ \rightarrow e^+\nu_e X)/B(B^0 \rightarrow e^+\nu_e X) = 1.08 \pm 0.05 \pm 0.02$.

⁶ The semileptonic branching ratio, $|V_{cb}|$ and other heavy-quark parameters are determined from a simultaneous fit to moments of the hadronic-mass and lepton-energy distribution.

⁷ Uses the high-momentum lepton tag method and requires the electron energy above 0.6 GeV.

⁸ Uses the high-momentum lepton tag method. They also report $|V_{cb}| = 0.0423 \pm 0.0007(\text{exp}) \pm 0.0020(\text{theo.})$.

⁹ Uses the high-momentum lepton tag method. ABE 02Y also reports $|V_{cb}| = 0.0408 \pm 0.0010(\text{exp}) \pm 0.0025(\text{theo.})$. The second error is due to uncertainties of theoretical inputs.

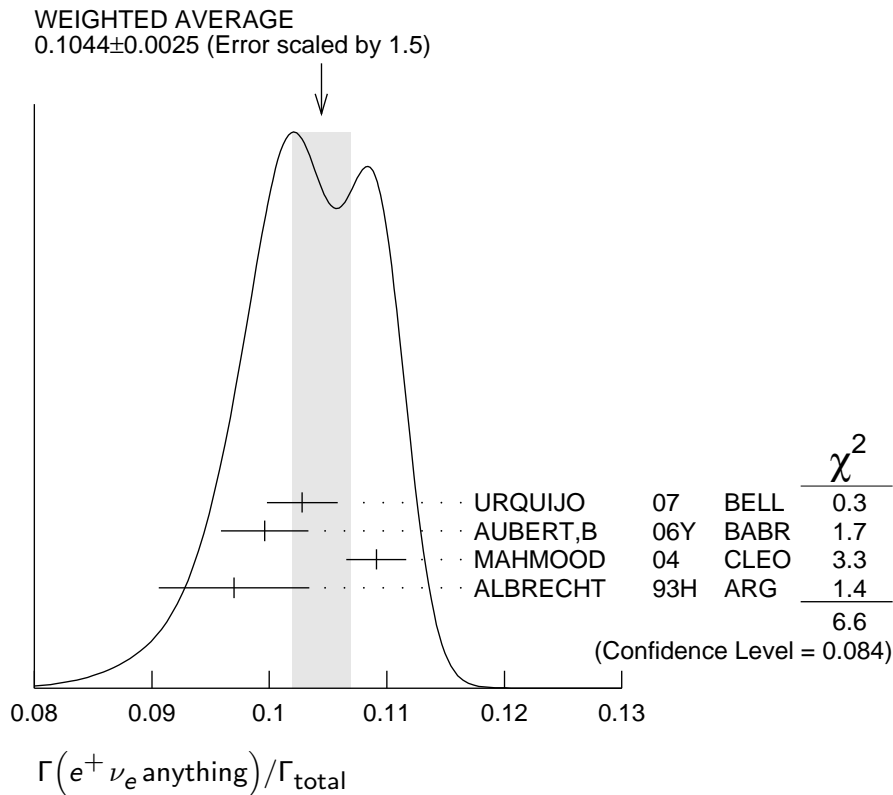
¹⁰ BARISH 96B analysis performed using tagged semileptonic decays of the B . This technique is almost model independent for the lepton branching ratio.

¹¹ 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.

¹² ALBRECHT 90H uses the model of ALTARELLI 82 to correct over all lepton momenta. 0.099 ± 0.006 is obtained using ISGUR 89B.

¹³ Using data above $p(e) = 2.4$ GeV, WACHS 89 determine $\sigma(B \rightarrow e\nu\text{up})/\sigma(B \rightarrow e\nu\text{charm}) < 0.065$ at 90% CL.

¹⁴ Ratio $\sigma(b \rightarrow e\nu\text{up})/\sigma(b \rightarrow e\nu\text{charm}) < 0.055$ at CL = 90%.



$\Gamma(\bar{p}e^+ \nu_e \text{ anything}) / \Gamma_{\text{total}}$ **Γ_2 / Γ**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.9 \times 10^{-4}$	90	¹ ADAM 03B	CLE2	$e^+e^- \rightarrow \gamma(4S)$

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< 0.0016	90	ALBRECHT 90H	ARG	$e^+e^- \rightarrow \gamma(4S)$
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¹ Based on V-A model.

$\Gamma(\mu^+ \nu_\mu \text{ anything}) / \Gamma_{\text{total}}$ **Γ_3 / Γ**

These branching fraction values are model dependent.

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VALUE	DOCUMENT ID	TECN	COMMENT
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The data in this block is included in the average printed for a previous datablock.

0.1074 ± 0.0016 OUR EVALUATION

• • • We do not use the following data for averages, fits, limits, etc. • • •

$0.100 \pm 0.006 \pm 0.002$	¹ ALBRECHT 90H	ARG	$e^+e^- \rightarrow \gamma(4S)$
$0.108 \pm 0.006 \pm 0.01$	CHEN 84	CLEO	Direct μ at $\gamma(4S)$
$0.112 \pm 0.009 \pm 0.01$	LEVMAN 84	CUSB	Direct μ at $\gamma(4S)$

¹ ALBRECHT 90H uses the model of ALTARELLI 82 to correct over all lepton momenta. 0.097 ± 0.006 is obtained using ISGUR 89B.

$\Gamma(\ell^+ \nu_\ell \text{ anything})/\Gamma_{\text{total}}$

Γ_4/Γ

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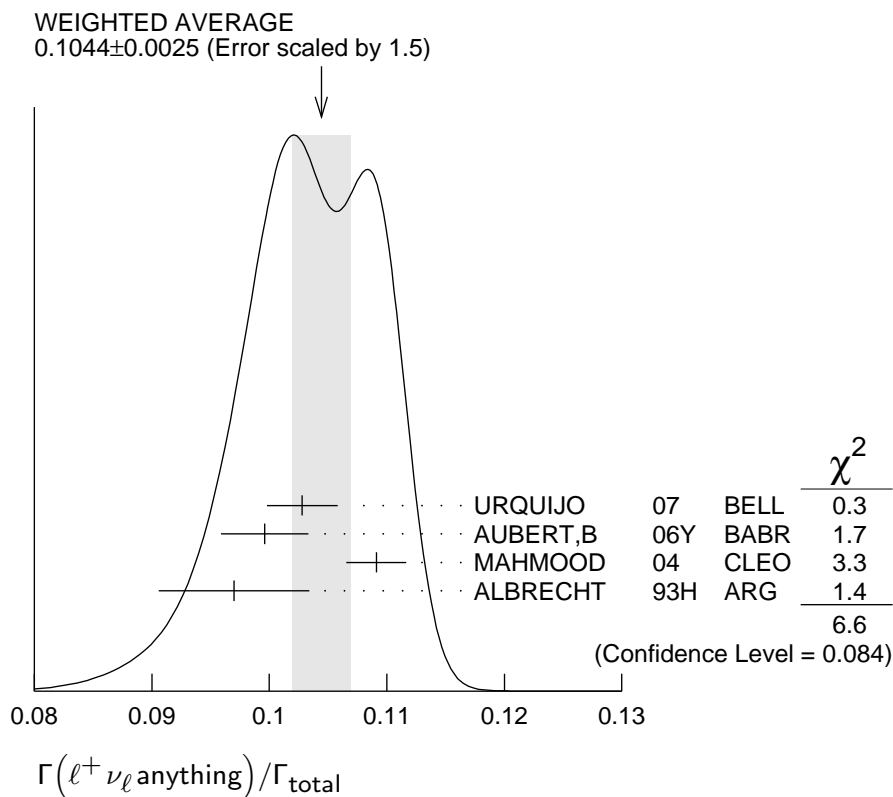
0.1074 ± 0.0016 OUR EVALUATION

0.1044 ± 0.0025 OUR AVERAGE Includes data from the 2 datablocks that follow this one. Error includes scale factor of 1.5. See the ideogram below.

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.108 ± 0.002 ± 0.0056 ¹ HENDERSON 92 CLEO $e^+ e^- \rightarrow \gamma(4S)$

¹ HENDERSON 92 measurement employs e and μ . 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.



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

Γ_5/Γ_4

$\ell = e \text{ or } \mu$.

VALUE DOCUMENT ID TECN COMMENT

0.26 ± 0.07 ± 0.04 ¹ FULTON 91 CLEO $e^+ e^- \rightarrow \gamma(4S)$

¹ FULTON 91 uses $B(D^+ \rightarrow K^- \pi^+ \pi^+) = (9.1 \pm 1.3 \pm 0.4)\%$ as measured by MARK III.

$\Gamma(\bar{D}^0 \ell^+ \nu_\ell \text{ anything}) / \Gamma(\ell^+ \nu_\ell \text{ anything})$ Γ_6 / Γ_4

$\ell = e \text{ or } \mu.$

VALUE	DOCUMENT ID	TECN	COMMENT
0.67 ± 0.09 ± 0.10	¹ FULTON 91	CLEO	$e^+ e^- \rightarrow \gamma(4S)$

¹ FULTON 91 uses $B(D^0 \rightarrow K^- \pi^+) = (4.2 \pm 0.4 \pm 0.4)\%$ as measured by MARK III.

$\Gamma(D \tau^+ \nu_\tau) / \Gamma_{\text{total}}$ Γ_7 / Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
0.86 ± 0.24 ± 0.12	¹ AUBERT 08N	BABR	$e^+ e^- \rightarrow \gamma(4S)$

¹ Uses a fully reconstructed B meson as a tag on the recoil side.

$\Gamma(D^{*-} \ell^+ \nu_\ell \text{ anything}) / \Gamma_{\text{total}}$ Γ_8 / Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
0.67 ± 0.08 ± 0.10	ABDALLAH 04D	DLPH	$e^+ e^- \rightarrow Z^0$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 ± 0.3 ± 0.1	¹ BARISH 95	CLE2	$e^+ e^- \rightarrow \gamma(4S)$
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¹ BARISH 95 use $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.08 \pm 0.17)\%$ and $B(D^{*+} \rightarrow D^0 \pi^+) = (68.1 \pm 1.0 \pm 1.3)\%$.

$\Gamma(D^{*0} \ell^+ \nu_\ell \text{ anything}) / \Gamma_{\text{total}}$ Γ_9 / Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.6 ± 0.6 ± 0.1	¹ BARISH 95	CLE2	$e^+ e^- \rightarrow \gamma(4S)$
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¹ BARISH 95 use $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.08 \pm 0.17)\%$, $B(D^{*+} \rightarrow D^0 \pi^+) = (68.1 \pm 1.0 \pm 1.3)\%$, $B(D^{*0} \rightarrow D^0 \pi^0) = (63.6 \pm 2.3 \pm 3.3)\%$.

$\Gamma(D^* \tau^+ \nu_\tau) / \Gamma_{\text{total}}$ Γ_{10} / Γ

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
1.62 ± 0.31 ± 0.11	¹ AUBERT 08N	BABR	$e^+ e^- \rightarrow \gamma(4S)$

¹ Uses a fully reconstructed B meson as a tag on the recoil side. The results are normalized to the B^+ decay rate.

$\Gamma(\bar{D}^{**} \ell^+ \nu_\ell) / \Gamma_{\text{total}}$ Γ_{11} / Γ

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. $\ell = e \text{ or } \mu$, not sum over e and μ modes.

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
0.027 ± 0.005 ± 0.005	63		¹ ALBRECHT 93	ARG	$e^+ e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.028	95		² BARISH 95	CLE2	$e^+ e^- \rightarrow \gamma(4S)$
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¹ ALBRECHT 93 assumes the GISW model to correct for unseen modes. Using the BHKT model, the result becomes $0.023 \pm 0.006 \pm 0.004$. 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 μ value.

² BARISH 95 use $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.08 \pm 0.17)\%$, assume all nonresonant channels are zero, and use GISW model for relative abundances of D^{**} states.

$\Gamma(\bar{D}_1(2420)\ell^+\nu_\ell\text{ anything})/\Gamma_{\text{total}}$ Γ_{12}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0038 ± 0.0013 OUR AVERAGE	Error includes scale factor of 2.4.		
0.0033 ± 0.0006	¹ ABAZOV	05O D0	$p\bar{p}$ at 1.96 TeV
0.0074 ± 0.0016	² BUSKULIC	97B ALEP	$e^+e^- \rightarrow Z$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
seen	³ BUSKULIC	95B ALEP	Repl. by BUSKULIC 97B

- ¹ Assumes $B(D_1 \rightarrow D^*\pi) = 1$, $B(D_1 \rightarrow D^*\pi^\pm) = 2/3$, and $B(b \rightarrow B) = 0.397$.
² BUSKULIC 97B assumes $B(D_1(2420) \rightarrow D^*\pi) = 1$, $B(D_1(2420) \rightarrow D^*\pi^\pm) = 2/3$, and $B(b \rightarrow B) = 0.378 \pm 0.022$.
³ BUSKULIC 95B reports $f_B \times B(B \rightarrow \bar{D}_1(2420)^0\ell^+\nu_\ell\text{ anything}) \times B(\bar{D}_1(2420)^0 \rightarrow \bar{D}^*(2010)^-\pi^+) = (2.04 \pm 0.58 \pm 0.34)10^{-3}$, where f_B is the production fraction for a single B charge state.

$[\Gamma(D\pi\ell^+\nu_\ell\text{ anything}) + \Gamma(D^*\pi\ell^+\nu_\ell\text{ anything})]/\Gamma_{\text{total}}$ Γ_{13}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.026 ± 0.005 OUR AVERAGE	Error includes scale factor of 1.5.		
0.0340 ± 0.0052 ± 0.0032	¹ ABREU	00R DLPH	$e^+e^- \rightarrow Z$
0.0226 ± 0.0029 ± 0.0033	² BUSKULIC	97B ALEP	$e^+e^- \rightarrow Z$

- ¹ Assumes no contribution from B_s and b baryons. Further assumes contributions from single pion ($D\pi$ and $D^*\pi$) states only, allowing isospin conservation to relate the relative π^0 and π^+ rates.
² BUSKULIC 97B assumes $B(b \rightarrow B) = 0.378 \pm 0.022$ 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 Λ_b^0 .

$\Gamma(D\pi\ell^+\nu_\ell\text{ anything})/\Gamma_{\text{total}}$ Γ_{14}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0154 ± 0.0061	ABREU	00R DLPH	$e^+e^- \rightarrow Z$

$\Gamma(D^*\pi\ell^+\nu_\ell\text{ anything})/\Gamma_{\text{total}}$ Γ_{15}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0186 ± 0.0038	ABREU	00R DLPH	$e^+e^- \rightarrow Z$

$\Gamma(\bar{D}_2^*(2460)\ell^+\nu_\ell\text{ anything})/\Gamma_{\text{total}}$ Γ_{16}/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0044 ± 0.0016		¹ ABAZOV	05O D0	$p\bar{p}$ at 1.96 TeV
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.0065	95	² BUSKULIC	97B ALEP	$e^+e^- \rightarrow Z$
not seen		³ BUSKULIC	95B ALEP	$e^+e^- \rightarrow Z$

- ¹ Assumes $B(D_2^* \rightarrow D^*\pi^\pm) = 0.30 \pm 0.06$ and $B(b \rightarrow B) = 0.397$.
² A revised number based on BUSKULIC 97B which assumes $B(D_2^*(2460) \rightarrow D^*\pi^\pm) = 0.20$ and $B(b \rightarrow B) = 0.378 \pm 0.022$.
³ BUSKULIC 95B reports $f_B \times B(B \rightarrow \bar{D}_2^*(2460)^0\ell^+\nu_\ell\text{ anything}) \times B(\bar{D}_2^*(2460)^0 \rightarrow \bar{D}^*(2010)^-\pi^+) \leq 0.81 \times 10^{-3}$ at CL=95%, where f_B is the production fraction for a single B charge state.

$$\frac{\Gamma(B \rightarrow \bar{D}_2^*(2460)\ell^+\nu_\ell \text{ anything}) \times B(D_2^*(2460) \rightarrow D^{*-}\pi^+)}{\Gamma(B \rightarrow \bar{D}_1(2420)\ell^+\nu_\ell \text{ anything}) \times B(\bar{D}_1(2420) \rightarrow D^{*-}\pi^+)}$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.39 ± 0.09 ± 0.12	ABAZOV	050 D0	$p\bar{p}$ at 1.96 TeV

$$\Gamma(D^{*-}\pi^+\ell^+\nu_\ell \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{17}/\Gamma$$

Includes resonant and nonresonant contributions.

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
10.0 ± 2.7 ± 2.1	¹ BUSKULIC	95B ALEP	$e^+e^- \rightarrow Z$

¹ BUSKULIC 95B reports $f_B \times B(B \rightarrow \bar{D}^*(2010)^-\pi^+\ell^+\nu_\ell \text{ anything}) = (3.7 \pm 1.0 \pm 0.7)10^{-3}$. Above value assumes $f_B = 0.37 \pm 0.03$.

$$\Gamma(D_s^-\ell^+\nu_\ell \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{18}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.007	90	¹ ALBRECHT	93E ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 93E reports < 0.012 from a measurement of $[\Gamma(B \rightarrow D_s^-\ell^+\nu_\ell \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)]$ assuming $B(D_s^+ \rightarrow \phi\pi^+) = 0.027$. We rescale to our best value $B(D_s^+ \rightarrow \phi\pi^+) = 4.39 \times 10^{-2}$.

$$\Gamma(D_s^-\ell^+\nu_\ell K^+ \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{19}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.005	90	¹ ALBRECHT	93E ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 93E reports < 0.008 from a measurement of $[\Gamma(B \rightarrow D_s^-\ell^+\nu_\ell K^+ \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)]$ assuming $B(D_s^+ \rightarrow \phi\pi^+) = 0.027$. We rescale to our best value $B(D_s^+ \rightarrow \phi\pi^+) = 4.39 \times 10^{-2}$.

$$\Gamma(D_s^-\ell^+\nu_\ell K^0 \text{ anything})/\Gamma_{\text{total}} \quad \Gamma_{20}/\Gamma$$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.007	90	¹ ALBRECHT	93E ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 93E reports < 0.012 from a measurement of $[\Gamma(B \rightarrow D_s^-\ell^+\nu_\ell K^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)]$ assuming $B(D_s^+ \rightarrow \phi\pi^+) = 0.027$. We rescale to our best value $B(D_s^+ \rightarrow \phi\pi^+) = 4.39 \times 10^{-2}$.

$$\Gamma(\ell^+\nu_\ell \text{ charm})/\Gamma_{\text{total}} \quad \Gamma_{21}/\Gamma$$

VALUE	DOCUMENT ID	TECN	COMMENT
0.1057 ± 0.0015 OUR AVERAGE			
0.1044 ± 0.0019 ± 0.0022	¹ URQUIJO	07 BELL	$e^+e^- \rightarrow \gamma(4S)$
0.1061 ± 0.0016 ± 0.0006	² AUBERT	04X BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ Measured the independent B^+ and B^0 partial branching fractions with electron energy above 0.4 GeV.

² The semileptonic branching ratio, $|V_{cb}|$ and other heavy-quark parameters are determined from a simultaneous fit to moments of the hadronic-mass and lepton-energy distribution.

$\Gamma(X_u \ell^+ \nu_\ell) / \Gamma_{\text{total}}$ Γ_{22} / Γ

VALUE (units 10^{-3}) DOCUMENT ID TECN COMMENT

2.33 ± 0.22 OUR AVERAGE

2.27 ± 0.26 ^{+0.37} _{-0.33}	1	AUBERT	06H	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
2.53 ± 0.24 ± 0.24	2	AUBERT,B	05X	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
2.80 ± 0.52 ± 0.41	3	LIMOSANI	05	BELL	$e^+ e^- \rightarrow \Upsilon(4S)$
1.77 ± 0.29 ± 0.38	4	BORNHEIM	02	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

2.24 ± 0.27 ± 0.47	5	AUBERT	08AS	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
	6,7	AUBERT	04I	BABR	Repl. by AUBERT,B 05X

¹ Obtained from the partial rate $\Delta B = (0.572 \pm 0.041 \pm 0.065) \times 10^{-3}$ for the electron momentum interval of 2.0–2.6 GeV/c based on BLNP method.

² Determined from the partial rate $\Delta B = (4.41 \pm 0.42 \pm 0.42) \times 10^{-4}$ measured for electron energy > 2 GeV and hadronic mass squared < 3.5 GeV², and calculated acceptance 0.174 in that region. The V_{ub} is measured as $(4.41 \pm 0.30 \pm 0.65 \pm 0.28) \times 10^{-3}$.

³ Uses electrons in the momentum interval 1.9–2.6 GeV/c in the center-of-mass frame. The V_{ub} is found to be $(5.08 \pm 0.47 \pm 0.49 \pm 0.48) \times 10^{-3}$.

⁴ BORNHEIM 02 uses the observed yield of leptons from semileptonic B decays in the end-point momentum interval 2.2–2.6 GeV/c with recent CLEO-2 data on $B \rightarrow X_S \gamma$. The V_{ub} is found to be $(4.08 \pm 0.34 \pm 0.53) \times 10^{-3}$.

⁵ Measures several partial branching fractions in different phase space regions. The most precise result is obtained in the region for hadronic mass $M_X < 1.55 \text{ GeV}/c^2$, and is $\Delta B = (1.18 \pm 0.09 \pm 0.07) \times 10^{-3}$. The corresponding $|V_{ub}|$ from the BLNP method is $(4.27 \pm 0.16 \pm 0.13 \pm 0.30) \times 10^{-3}$, where the last uncertainty comes from the theoretical prediction of the partial rate in the given phase-space region.

⁶ Used BaBar measurement of Semileptonic branching fraction $B(B \rightarrow X \ell \nu_\ell) = (10.87 \pm 0.18 \pm 0.30)\%$ to convert the ratio of rates to branching fraction.

⁷ The third error includes the systematics and theoretical errors summed in quadrature.

$\Gamma(X_u \ell^+ \nu_\ell) / \Gamma(\ell^+ \nu_\ell \text{ anything})$ Γ_{22} / Γ_4

ℓ denotes e or μ , not the sum. These experiments measure this ratio in very limited momentum intervals.

VALUE (units 10^{-2}) CL% EVTS DOCUMENT ID TECN COMMENT

2.06 ± 0.25 ± 0.42			1	AUBERT	04I	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

			2	ALBRECHT	94C	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$
		107	3	BARTELT	93B	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$
		77	4	ALBRECHT	91C	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$
		41	5	ALBRECHT	90	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$
		76	6	FULTON	90	CLEO	$e^+ e^- \rightarrow \Upsilon(4S)$
<4.0	90		7	BEHRENDIS	87	CLEO	$e^+ e^- \rightarrow \Upsilon(4S)$
<4.0	90			CHEN	84	CLEO	Direct e at $\Upsilon(4S)$
<5.5	90			KLOPFEN...	83B	CUSB	Direct e at $\Upsilon(4S)$

- ¹ The third error includes the systematics and theoretical errors summed in quadrature.
- ² ALBRECHT 94C find $\Gamma(b \rightarrow c)/\Gamma(b \rightarrow \text{all}) = 0.99 \pm 0.02 \pm 0.04$.
- ³ 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 $b \rightarrow u\ell\nu_\ell$. This corresponds to a model-dependent partial branching ratio ΔB_{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 ± 0.006 and 0.076 ± 0.008 , respectively.
- ⁴ ALBRECHT 91C result supersedes ALBRECHT 90. Two events are fully reconstructed providing evidence for the $b \rightarrow u$ 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.
- ⁵ ALBRECHT 90 observes 41 ± 10 excess e and μ (lepton) events in the momentum interval $p = 2.3\text{--}2.6$ GeV signaling the presence of the $b \rightarrow u$ transition. The events correspond to a model-dependent measurement of $|V_{ub}/V_{cb}| = 0.10 \pm 0.01$.
- ⁶ FULTON 90 observe 76 ± 20 excess e and μ (lepton) events in the momentum interval $p = 2.4\text{--}2.6$ GeV signaling the presence of the $b \rightarrow u$ 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 $B(b \rightarrow c\ell\nu) = 10.2 \pm 0.2 \pm 0.7\%$.
- ⁷ 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.

$\Gamma(\pi\ell\nu_\ell)/\Gamma_{\text{total}}$ Γ_{23}/Γ

"OUR EVALUATION" is an average using rescaled values of the data listed below. The average and rescaling were performed by the Heavy Flavor Averaging Group (HFAG) and are described at <http://www.slac.stanford.edu/xorg/hfag/>. The averaging/scaling procedure takes into account correlation between the measurements.

<u>VALUE (units 10^{-4})</u>	<u>DOCUMENT ID</u>
1.35 ± 0.07 ± 0.07 OUR EVALUATION	The result includes measurements of $B^0 \rightarrow \pi^- \ell^+ \ell_\nu$ and $B^+ \rightarrow \pi^0 \ell^+ \nu_\ell$ decay rates.

$\Gamma(K^+ \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ Γ_{24}/Γ_4

ℓ denotes e or μ , not the sum.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.58 ± 0.05 OUR AVERAGE			
0.594 ± 0.021 ± 0.056	ALBRECHT 94C	ARG	$e^+ e^- \rightarrow \gamma(4S)$
0.54 ± 0.07 ± 0.06	¹ ALAM 87B	CLEO	$e^+ e^- \rightarrow \gamma(4S)$

¹ ALAM 87B measurement relies on lepton-kaon correlations.

$\Gamma(K^- \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ Γ_{25}/Γ_4

ℓ denotes e or μ , not the sum.

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.092 ± 0.035 OUR AVERAGE			
0.086 ± 0.011 ± 0.044	ALBRECHT 94C	ARG	$e^+ e^- \rightarrow \gamma(4S)$
0.10 ± 0.05 ± 0.02	¹ ALAM 87B	CLEO	$e^+ e^- \rightarrow \gamma(4S)$

¹ ALAM 87B measurement relies on lepton-kaon correlations.

$\Gamma(K^0/\bar{K}^0 \ell^+ \nu_\ell \text{ anything})/\Gamma(\ell^+ \nu_\ell \text{ anything})$ Γ_{26}/Γ_4

ℓ denotes e or μ , not the sum. Sum over K^0 and \bar{K}^0 states.

VALUE	DOCUMENT ID	TECN	COMMENT
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0.42 ± 0.05 OUR AVERAGE

0.452 ± 0.038 ± 0.056	¹ ALBRECHT	94C	ARG	$e^+ e^- \rightarrow \gamma(4S)$
0.39 ± 0.06 ± 0.04	² ALAM	87B	CLEO	$e^+ e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 94C assume a K^0/\bar{K}^0 multiplicity twice that of K_S^0 .

² ALAM 87B measurement relies on lepton-kaon correlations.

$\langle n_c \rangle$

VALUE	DOCUMENT ID	TECN	COMMENT
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1.10 ± 0.05	¹ GIBBONS	97B	CLE2	$e^+ e^- \rightarrow \gamma(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

0.98 ± 0.16 ± 0.12	² ALAM	87B	CLEO	$e^+ e^- \rightarrow \gamma(4S)$
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¹ GIBBONS 97B from charm counting using $B(D_S^+ \rightarrow \phi\pi) = 0.036 \pm 0.009$ and $B(\Lambda_c^+ \rightarrow pK^- \pi^+) = 0.044 \pm 0.006$.

² From the difference between K^- and K^+ widths. ALAM 87B measurement relies on lepton-kaon correlations. It does not consider the possibility of $B\bar{B}$ mixing. We have thus removed it from the average.

$\Gamma(D^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{27}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
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0.233 ± 0.013 OUR AVERAGE

0.232 ± 0.012 ± 0.006	¹ GIBBONS	97B	CLE2	$e^+ e^- \rightarrow \gamma(4S)$
0.24 ± 0.04 ± 0.01	² BORTOLETTO92		CLEO	$e^+ e^- \rightarrow \gamma(4S)$
0.22 ± 0.05 ± 0.01	³ ALBRECHT	91H	ARG	$e^+ e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.20 ± 0.05 ± 0.01	20k	⁴ BORTOLETTO87	CLEO	Sup. by BORTOLETTO 92
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¹ GIBBONS 97B reports $[\Gamma(B \rightarrow D^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D^+ \rightarrow K^- 2\pi^+)] = 0.0216 \pm 0.0008 \pm 0.00082$. We divide by our best value $B(D^+ \rightarrow K^- 2\pi^+) = (9.29 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BORTOLETTO 92 reports $[\Gamma(B \rightarrow D^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D^+ \rightarrow K^- 2\pi^+)] = 0.0226 \pm 0.0030 \pm 0.0018$. We divide by our best value $B(D^+ \rightarrow K^- 2\pi^+) = (9.29 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ALBRECHT 91H reports $[\Gamma(B \rightarrow D^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D^+ \rightarrow K^- 2\pi^+)] = 0.0209 \pm 0.0027 \pm 0.0040$. We divide by our best value $B(D^+ \rightarrow K^- 2\pi^+) = (9.29 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ BORTOLETTO 87 reports $[\Gamma(B \rightarrow D^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D^+ \rightarrow K^- 2\pi^+)] = 0.019 \pm 0.004 \pm 0.002$. We divide by our best value $B(D^+ \rightarrow K^- 2\pi^+) = (9.29 \pm 0.25) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}$ Γ_{28}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.622±0.029 OUR AVERAGE		Error includes scale factor of 1.3. See the ideogram below.		

0.642±0.025 ^{+0.007} _{-0.008}		¹ GIBBONS	97B CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
0.60 ±0.05 ±0.01		² BORTOLETTO92	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
0.50 ±0.07 ±0.01		³ ALBRECHT	91H ARG	$e^+e^- \rightarrow \Upsilon(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
0.54 ±0.07 ±0.01	21k	⁴ BORTOLETTO87	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
0.61 ±0.18 ±0.01		⁵ GREEN	83 CLEO	Repl. by BORTOLETTO 87

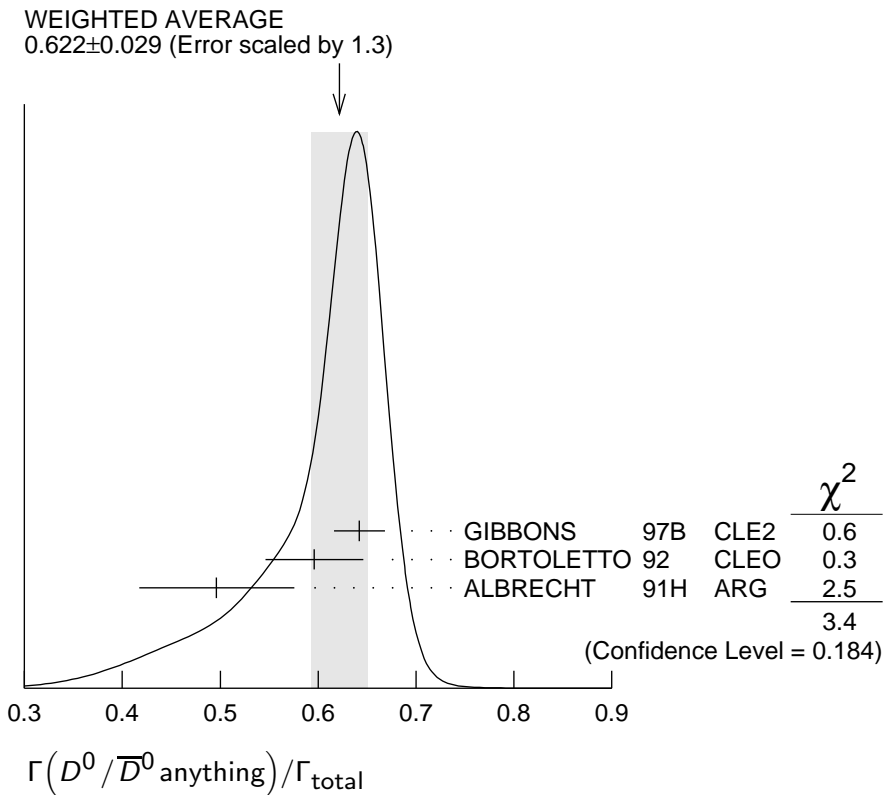
¹ GIBBONS 97B reports $[\Gamma(B \rightarrow D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D^0 \rightarrow K^- \pi^+)] = 0.0251 \pm 0.0006 \pm 0.00075$. We divide by our best value $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² BORTOLETTO 92 reports $[\Gamma(B \rightarrow D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D^0 \rightarrow K^- \pi^+)] = 0.0233 \pm 0.0012 \pm 0.0014$. We divide by our best value $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ALBRECHT 91H reports $[\Gamma(B \rightarrow D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D^0 \rightarrow K^- \pi^+)] = 0.0194 \pm 0.0015 \pm 0.0025$. We divide by our best value $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ BORTOLETTO 87 reports $[\Gamma(B \rightarrow D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D^0 \rightarrow K^- \pi^+)] = 0.0210 \pm 0.0015 \pm 0.0021$. We divide by our best value $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ GREEN 83 reports $[\Gamma(B \rightarrow D^0/\bar{D}^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(D^0 \rightarrow K^- \pi^+)] = 0.024 \pm 0.006 \pm 0.004$. We divide by our best value $B(D^0 \rightarrow K^- \pi^+) = (3.91 \pm 0.05) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.



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

Γ_{29}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.225 ± 0.015 OUR AVERAGE				
$0.247 \pm 0.019 \pm 0.01$		¹ GIBBONS 97B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
$0.205 \pm 0.019 \pm 0.007$		² ALBRECHT 96D	ARG	$e^+e^- \rightarrow \Upsilon(4S)$
$0.230 \pm 0.028 \pm 0.009$		³ BORTOLETTO92	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
$0.283 \pm 0.053 \pm 0.002$		⁴ ALBRECHT 91H	ARG	Sup. by ALBRECHT 96D
$0.22 \pm 0.04 \begin{smallmatrix} +0.07 \\ -0.04 \end{smallmatrix}$	5200	⁵ BORTOLETTO87	CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
$0.27 \pm 0.06 \begin{smallmatrix} +0.08 \\ -0.06 \end{smallmatrix}$	510	⁶ CSORNA 85	CLEO	Repl. by BORTOLETTO 87

¹ GIBBONS 97B reports $B(B \rightarrow D^*(2010)^+ \text{ anything}) = 0.239 \pm 0.015 \pm 0.014 \pm 0.009$ 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.

² ALBRECHT 96D reports $B(B \rightarrow D^*(2010)^+ \text{ anything}) = 0.196 \pm 0.019$ using CLEO measured $B(D^*(2010)^+ \rightarrow D^0 \pi^+) = 0.681 \pm 0.01 \pm 0.013$, $B(D^0 \rightarrow K^- \pi^+) = 0.0401 \pm 0.0014$, $B(D^0 \rightarrow K^- \pi^+ \pi^+ \pi^-) = 0.081 \pm 0.005$. 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.

³ BORTOLETTO 92 reports $B(B \rightarrow D^*(2010)^+ \text{ anything}) = 0.25 \pm 0.03 \pm 0.04$ using MARK II $B(D^*(2010)^+ \rightarrow D^0 \pi^+) = 0.57 \pm 0.06$ and $B(D^0 \rightarrow K^- \pi^+) = 0.042 \pm 0.008$. 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.

⁴ ALBRECHT 91H reports $0.348 \pm 0.060 \pm 0.035$ from a measurement of $[\Gamma(B \rightarrow D^*(2010)^\pm \text{anything})/\Gamma_{\text{total}}] \times [B(D^*(2010)^+ \rightarrow D^0 \pi^+)]$ assuming $B(D^*(2010)^+ \rightarrow D^0 \pi^+) = 0.55 \pm 0.04$. We rescale to our best value $B(D^*(2010)^+ \rightarrow D^0 \pi^+) = (67.7 \pm 0.5) \times 10^{-2}$. 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 $B(D^0 \rightarrow K^- \pi^+) = 0.0371 \pm 0.0025$.

⁵ BORTOLETTO 87 uses old MARK III (BALTRUSAITIS 86E) branching ratios $B(D^0 \rightarrow K^- \pi^+) = 0.056 \pm 0.004 \pm 0.003$ 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 $0.13 \pm 0.02 \pm 0.012$. Superseded by BORTOLETTO 92.

⁶ $V-A$ momentum spectrum used to extrapolate below $p = 1$ GeV. We correct the value assuming $B(D^0 \rightarrow K^- \pi^+) = 0.042 \pm 0.006$ and $B(D^{*+} \rightarrow D^0 \pi^+) = 0.6^{+0.08}_{-0.15}$. The product branching fraction is $B(B \rightarrow D^{*+} X) \cdot B(D^{*+} \rightarrow \pi^+ D^0) \cdot B(D^0 \rightarrow K^- \pi^+) = (68 \pm 15 \pm 9) \times 10^{-4}$.

$\Gamma(D^*(2007)^0 \text{anything})/\Gamma_{\text{total}}$ Γ_{30}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.260±0.023±0.015	1 GIBBONS	97B CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ GIBBONS 97B reports $B(B \rightarrow D^*(2007)^0 \text{anything}) = 0.247 \pm 0.012 \pm 0.018 \pm 0.018$ 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.

$\Gamma(D_s^\pm \text{anything})/\Gamma_{\text{total}}$ Γ_{31}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.084±0.008 OUR AVERAGE				
0.091±0.010±0.007		1 ARTUSO	05B CLE2	$e^+e^- \rightarrow \gamma(5S)$
0.089±0.005±0.007		2 AUBERT	02G BABR	$e^+e^- \rightarrow \gamma(4S)$
0.066±0.011±0.005		3 ALBRECHT	92G ARG	$e^+e^- \rightarrow \gamma(4S)$
0.070±0.011±0.005	257	4 BORTOLETTO90	CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.086±0.023±0.007		5 HAAS	86 CLEO	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.096±0.008±0.008		6 GIBAUT	96 CLE2	Repl. by ARTUSO 05B
0.096±0.025±0.007		7 ALBRECHT	87H ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ARTUSO 05B reports $0.0905 \pm 0.0025 \pm 0.0140$ from a measurement of $[\Gamma(B \rightarrow D_s^\pm \text{anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)]$ assuming $B(D_s^+ \rightarrow \phi \pi^+) = (4.4 \pm 0.5) \times 10^{-2}$. We rescale to our best value $B(D_s^+ \rightarrow \phi \pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² AUBERT 02G reports $[\Gamma(B \rightarrow D_s^\pm \text{anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)] = 0.00393 \pm 0.00007 \pm 0.00021$. We divide by our best value $B(D_s^+ \rightarrow \phi \pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ALBRECHT 92G reports $[\Gamma(B \rightarrow D_s^\pm \text{anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)] = 0.00292 \pm 0.00039 \pm 0.00031$. We divide by our best value $B(D_s^+ \rightarrow \phi \pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁴ BORTOLETTO 90 reports $[\Gamma(B \rightarrow D_s^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.00306 \pm 0.00047$. We divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ HAAS 86 reports $[\Gamma(B \rightarrow D_s^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.0038 \pm 0.0010$. We divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. 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.

⁶ GIBAUT 96 reports $0.1211 \pm 0.0039 \pm 0.0088$ from a measurement of $[\Gamma(B \rightarrow D_s^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)]$ assuming $B(D_s^+ \rightarrow \phi\pi^+) = 0.035$. We rescale to our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁷ ALBRECHT 87H reports $[\Gamma(B \rightarrow D_s^\pm \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.0042 \pm 0.0009 \pm 0.0006$. We divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. 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.

$\Gamma(D_s^{*\pm} \text{ anything})/\Gamma_{\text{total}}$

Γ_{32}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.065 ± 0.009 ± 0.005	¹ AUBERT	02G BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ AUBERT 02G reports $[\Gamma(B \rightarrow D_s^{*\pm} \text{ anything})/\Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi\pi^+)] = 0.00284 \pm 0.00029 \pm 0.00025$. We divide by our best value $B(D_s^+ \rightarrow \phi\pi^+) = (4.39 \pm 0.34) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(D_s^{*\pm} \bar{D}^{(*)})/\Gamma(D_s^{*\pm} \text{ anything})$ Sum over modes

Γ_{33}/Γ_{32}

VALUE	DOCUMENT ID	TECN	COMMENT
0.533 ± 0.037 ± 0.037	AUBERT	02G BABR	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\bar{D} D_{s0}(2317))/\Gamma_{\text{total}}$

Γ_{34}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ KROKOVNY	03B BELL	$e^+e^- \rightarrow \gamma(4S)$

¹ The product branching ratio for $B(B \rightarrow \bar{D} D_{s0}(2317)^+) \times B(D_{s0}(2317)^+ \rightarrow D_s \pi^0)$ is measured to be $(8.5_{-1.9}^{+2.1} \pm 2.6) \times 10^{-4}$.

$\Gamma(\bar{D} D_{sJ}(2457))/\Gamma_{\text{total}}$

Γ_{35}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
seen	¹ KROKOVNY	03B BELL	$e^+e^- \rightarrow \gamma(4S)$

¹ The product branching ratio for $B(B \rightarrow \bar{D} D_{sJ}(2457)^+) \times B(D_{sJ}(2457)^+ \rightarrow D_s^{*+} \pi^0, D_s^+ \gamma)$ are measured to be $(17.8_{-3.9}^{+4.5} \pm 5.3) \times 10^{-4}$ and $(6.7_{-1.2}^{+1.3} \pm 2.0) \times 10^{-4}$, respectively.

$\Gamma(D^{(*)}\bar{D}^{(*)}K^0) + \Gamma(D^{(*)}\bar{D}^{(*)}K^\pm)/\Gamma_{\text{total}}$				Γ_{36}/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.071^{+0.025+0.010}_{-0.015-0.009}$	¹ BARATE	98Q	ALEP	$e^+e^- \rightarrow Z$

¹ The systematic error includes the uncertainties due to the charm branching ratios.

$\Gamma(c\bar{c}s)/\Gamma_{\text{total}}$				Γ_{37}/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
0.219 ± 0.037	¹ COAN	98	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ COAN 98 uses D - ℓ correlation.

$\Gamma(D_s^{(*)}\bar{D}^{(*)})/\Gamma(D_s^\pm \text{ anything})$				Γ_{38}/Γ_{31}
Sum over modes.				
VALUE	DOCUMENT ID	TECN	COMMENT	
0.469 ± 0.017 OUR AVERAGE				

0.464 ± 0.013 ± 0.015 AUBERT 02G BABR $e^+e^- \rightarrow \gamma(4S)$

0.56 $^{+0.21+0.09}_{-0.15-0.08}$ ¹ BARATE 98Q ALEP $e^+e^- \rightarrow Z$

0.457 ± 0.019 ± 0.037 GIBAUT 96 CLE2 $e^+e^- \rightarrow \gamma(4S)$

0.58 ± 0.07 ± 0.09 ALBRECHT 92G ARG $e^+e^- \rightarrow \gamma(4S)$

0.56 ± 0.10 BORTOLETTO90 CLEO $e^+e^- \rightarrow \gamma(4S)$

¹ BARATE 98Q measures $B(B \rightarrow D_s^{(*)}\bar{D}^{(*)}) = 0.056^{+0.021+0.009+0.019}_{-0.015-0.008-0.011}$, 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 $B(B \rightarrow D_s^{(*)}\bar{D}^{(*)})$ by our best value of $B(B \rightarrow D_s \text{ anything}) = 0.1 \pm 0.025$.

$\Gamma(D^*D^{*(2010)^\pm})/\Gamma_{\text{total}}$				Γ_{39}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.9 \times 10^{-3}$	90	BARATE	98Q	ALEP $e^+e^- \rightarrow Z$

$[\Gamma(DD^{*(2010)^\pm}) + \Gamma(D^*D^\pm)]/\Gamma_{\text{total}}$				Γ_{40}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 5.5 \times 10^{-3}$	90	BARATE	98Q	ALEP $e^+e^- \rightarrow Z$

$\Gamma(DD^\pm)/\Gamma_{\text{total}}$				Γ_{41}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 3.1 \times 10^{-3}$	90	BARATE	98Q	ALEP $e^+e^- \rightarrow Z$

$\Gamma(D_s^{(*)\pm}\bar{D}^{(*)})\chi(n\pi^\pm)/\Gamma_{\text{total}}$				Γ_{42}/Γ
VALUE	DOCUMENT ID	TECN	COMMENT	
$0.094^{+0.040+0.034}_{-0.031-0.024}$	¹ BARATE	98Q	ALEP	$e^+e^- \rightarrow Z$

¹ The systematic error includes the uncertainties due to the charm branching ratios.

$\Gamma(D^*(2010)\gamma)/\Gamma_{\text{total}}$				Γ_{43}/Γ
VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$< 1.1 \times 10^{-3}$	90	¹ LESIAK	92	CBAL $e^+e^- \rightarrow \gamma(4S)$

¹ LESIAK 92 set a limit on the inclusive process $B(b \rightarrow s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s -quark hadronization.

$$\Gamma(D_s^+ \pi^-, D_s^{*+} \pi^-, D_s^+ \rho^-, D_s^{*+} \rho^-, D_s^+ \pi^0, D_s^{*+} \pi^0, D_s^+ \eta, D_s^{*+} \eta, D_s^+ \rho^0, D_s^{*+} \rho^0, D_s^+ \omega, D_s^{*+} \omega) / \Gamma_{\text{total}} \quad \Gamma_{44} / \Gamma$$

Sum over modes.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0004	90	¹ ALEXANDER 93B	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$

¹ ALEXANDER 93B reports $< 4.8 \times 10^{-4}$ from a measurement of $[\Gamma(B \rightarrow D_s^+ \pi^-, D_s^{*+} \pi^-, D_s^+ \rho^-, D_s^{*+} \rho^-, D_s^+ \pi^0, D_s^{*+} \pi^0, D_s^+ \eta, D_s^{*+} \eta, D_s^+ \rho^0, D_s^{*+} \rho^0, D_s^+ \omega, D_s^{*+} \omega) / \Gamma_{\text{total}}] \times [B(D_s^+ \rightarrow \phi \pi^+)]$ assuming $B(D_s^+ \rightarrow \phi \pi^+) = 0.037$. We rescale to our best value $B(D_s^+ \rightarrow \phi \pi^+) = 4.39 \times 10^{-2}$. This branching ratio limit provides a model-dependent upper limit $|V_{ub}| / |V_{cb}| < 0.16$ at CL=90%.

$$\Gamma(D_{s1}(2536)^+ \text{ anything}) / \Gamma_{\text{total}} \quad \Gamma_{45} / \Gamma$$

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

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0095	90	¹ BISHAI 98	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$

¹ Assuming factorization, the decay constant $f_{D_{s1}^+}$ is at least a factor of 2.5 times smaller than $f_{D_s^+}$.

$$\Gamma(J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}} \quad \Gamma_{46} / \Gamma$$

VALUE (units 10^{-2})	EVTS	DOCUMENT ID	TECN	COMMENT
1.094 ± 0.032 OUR AVERAGE		Error includes scale factor of 1.1.		
1.057 ± 0.012 ± 0.040		¹ AUBERT 03F	BABR	$e^+ e^- \rightarrow \Upsilon(4S)$
1.121 ± 0.013 ± 0.042		ANDERSON 02	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$
1.30 ± 0.45 ± 0.01	27	² MASCHMANN 90	CBAL	$e^+ e^- \rightarrow \Upsilon(4S)$
1.24 ± 0.27 ± 0.01	120	³ ALBRECHT 87D	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$
1.36 ± 0.24 ± 0.01	52	⁴ ALAM 86	CLEO	$e^+ e^- \rightarrow \Upsilon(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
1.13 ± 0.06 ± 0.01	1489	⁵ BALEST 95B	CLE2	$e^+ e^- \rightarrow \Upsilon(4S)$
1.4 ^{+0.6} _{-0.5}	7	⁶ ALBRECHT 85H	ARG	$e^+ e^- \rightarrow \Upsilon(4S)$
1.1 ± 0.21 ± 0.23	46	⁷ HAAS 85	CLEO	Repl. by ALAM 86

¹ AUBERT 03F also reports the momentum distribution and helicity of $J/\psi \rightarrow \ell^+ \ell^-$ in the $\Upsilon(4S)$ center-of-mass frame.

² MASCHMANN 90 reports $(1.12 \pm 0.33 \pm 0.25) \times 10^{-2}$ from a measurement of $[\Gamma(B \rightarrow J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow e^+ e^-)]$ assuming $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.069 \pm 0.009$. We rescale to our best value $B(J/\psi(1S) \rightarrow e^+ e^-) = (5.94 \pm 0.06) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

³ ALBRECHT 87D reports $(1.07 \pm 0.16 \pm 0.22) \times 10^{-2}$ from a measurement of $[\Gamma(B \rightarrow J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow e^+ e^-)]$ assuming $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.069 \pm 0.009$. We rescale to our best value $B(J/\psi(1S) \rightarrow e^+ e^-) = (5.94 \pm 0.06) \times 10^{-2}$. 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/ψ not from $\psi(2S)$ to be 0.0081 ± 0.0023 .

⁴ ALAM 86 reports $(1.09 \pm 0.16 \pm 0.21) \times 10^{-2}$ from a measurement of $[\Gamma(B \rightarrow J/\psi(1S) \text{ anything}) / \Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow \mu^+ \mu^-)]$ assuming $B(J/\psi(1S) \rightarrow$

$\mu^+ \mu^-) = 0.074 \pm 0.012$. We rescale to our best value $B(J/\psi(1S) \rightarrow \mu^+ \mu^-) = (5.93 \pm 0.06) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

⁵ BALEST 95B reports $(1.12 \pm 0.04 \pm 0.06) \times 10^{-2}$ from a measurement of $[\Gamma(B \rightarrow J/\psi(1S)\text{anything})/\Gamma_{\text{total}}] \times [B(J/\psi(1S) \rightarrow e^+ e^-)]$ assuming $B(J/\psi(1S) \rightarrow e^+ e^-) = 0.0599 \pm 0.0025$. We rescale to our best value $B(J/\psi(1S) \rightarrow e^+ e^-) = (5.94 \pm 0.06) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. They measure $J/\psi(1S) \rightarrow e^+ e^-$ and $\mu^+ \mu^-$ and use PDG 1994 values for the branching fractions. The rescaling is the same for either mode so we use $e^+ e^-$.

⁶ 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.

⁷ Dimuon and dielectron events used.

$\Gamma(J/\psi(1S)(\text{direct}) \text{ anything})/\Gamma_{\text{total}}$ Γ_{47}/Γ

<u>VALUE (units 10^{-2})</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0078 ± 0.0004 OUR AVERAGE	Error includes scale factor of 1.1.		
0.00740 ± 0.00023 ± 0.00043	¹ AUBERT	03F	BABR $e^+ e^- \rightarrow \Upsilon(4S)$
0.00813 ± 0.00017 ± 0.00037	² ANDERSON	02	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.0080 ± 0.0008	³ BALEST	95B	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$

¹ AUBERT 03F also reports the helicity of $J/\psi \rightarrow \ell^+ \ell^-$ produced directly in B decay.

² Also reports the measurement of $J/\psi \rightarrow \ell^+ \ell^-$ polarization produced directly from B decay.

³ 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 $B \rightarrow J/\psi(1S)(\text{direct}) X$ branching ratio.

$\Gamma(\psi(2S)\text{anything})/\Gamma_{\text{total}}$ Γ_{48}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.00307 ± 0.00021 OUR AVERAGE				
0.00297 ± 0.00020 ± 0.00020		AUBERT	03F	BABR $e^+ e^- \rightarrow \Upsilon(4S)$
0.00316 ± 0.00014 ± 0.00028		¹ ANDERSON	02	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$
0.0046 ± 0.0017 ± 0.0011	8	ALBRECHT	87D	ARG $e^+ e^- \rightarrow \Upsilon(4S)$
• • • We do not use the following data for averages, fits, limits, etc. • • •				
0.0034 ± 0.0004 ± 0.0003	240	² BALEST	95B	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$

¹ Also reports the measurement of $\psi(2S) \rightarrow \ell^+ \ell^-$ polarization produced directly from B decay.

² 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 $B(B \rightarrow \psi(2S)X)$.

$\Gamma(\chi_{c1}(1P)\text{anything})/\Gamma_{\text{total}}$					Γ_{49}/Γ
<u>VALUE</u>	<u>EVTs</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.00386 ± 0.00027 OUR AVERAGE					
0.00367 ± 0.00035 ± 0.00044		AUBERT	03F BABR	$e^+e^- \rightarrow \Upsilon(4S)$	
0.00363 ± 0.00022 ± 0.00034		¹ ABE	02L BELL	$e^+e^- \rightarrow \Upsilon(4S)$	
0.00435 ± 0.00029 ± 0.00040		ANDERSON	02 CLE2	$e^+e^- \rightarrow \Upsilon(4S)$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.0033 ± 0.0004 ± 0.0001		² CHEN	01 CLE2	$e^+e^- \rightarrow \Upsilon(4S)$	
0.0040 ± 0.0006 ± 0.0004	112	³ BALEST	95B CLE2	Repl. by CHEN 01	
0.0105 ± 0.0035 ± 0.0025		⁴ ALBRECHT	92E ARG	$e^+e^- \rightarrow \Upsilon(4S)$	

¹ ABE 02L uses PDG 01 values for $B(J/\psi(1S) \rightarrow \ell^+\ell^-)$ and $B(\chi_{c1,c2} \rightarrow J/\psi(1S)\gamma)$.

² CHEN 01 reports $0.00414 \pm 0.00031 \pm 0.00040$ from a measurement of $[\Gamma(B \rightarrow \chi_{c1}(1P)\text{anything})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = 0.273 \pm 0.016$. We rescale to our best value $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (34.1 \pm 1.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

³ 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 ψ -photon invariant mass distribution allows for a $\chi_{c1}(1P)$ and a $\chi_{c2}(1P)$ component.

⁴ ALBRECHT 92E assumes no $\chi_{c2}(1P)$ production.

$\Gamma(\chi_{c1}(1P)\text{(direct) anything})/\Gamma_{\text{total}}$					Γ_{50}/Γ
<u>VALUE</u>		<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>	
0.00323 ± 0.00025 OUR AVERAGE					
0.00341 ± 0.00035 ± 0.00042		AUBERT	03F BABR	$e^+e^- \rightarrow \Upsilon(4S)$	
0.00332 ± 0.00022 ± 0.00034		¹ ABE	02L BELL	$e^+e^- \rightarrow \Upsilon(4S)$	
0.0031 ± 0.0004 ± 0.0001		² CHEN	01 CLE2	$e^+e^- \rightarrow \Upsilon(4S)$	
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●					
0.0037 ± 0.0007		³ BALEST	95B CLE2	Repl. by CHEN 01	

¹ ABE 02L uses PDG 01 values for $B(J/\psi(1S) \rightarrow \ell^+\ell^-)$ and $B(\chi_{c1,c2} \rightarrow J/\psi(1S)\gamma)$.

² CHEN 01 reports $0.00383 \pm 0.00031 \pm 0.00040$ from a measurement of $[\Gamma(B \rightarrow \chi_{c1}(1P)\text{(direct) anything})/\Gamma_{\text{total}}] \times [B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = 0.273 \pm 0.016$. We rescale to our best value $B(\chi_{c1}(1P) \rightarrow \gamma J/\psi(1S)) = (34.1 \pm 1.5) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

³ 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 $B \rightarrow \chi_{c1}(1P)\text{(direct) } X$ branching ratio.

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

Γ_{51}/Γ

VALUE (units 10^{-4})	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
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14 ± 4 OUR AVERAGE Error includes scale factor of 1.9. See the ideogram below.

21.0 ± 4.5 ± 3.1			AUBERT	03F BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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18.0 ^{+2.3} _{-2.8} ± 2.6		1	ABE	02L BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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6.8 ± 3.4 ± 0.3		2	CHEN	01 CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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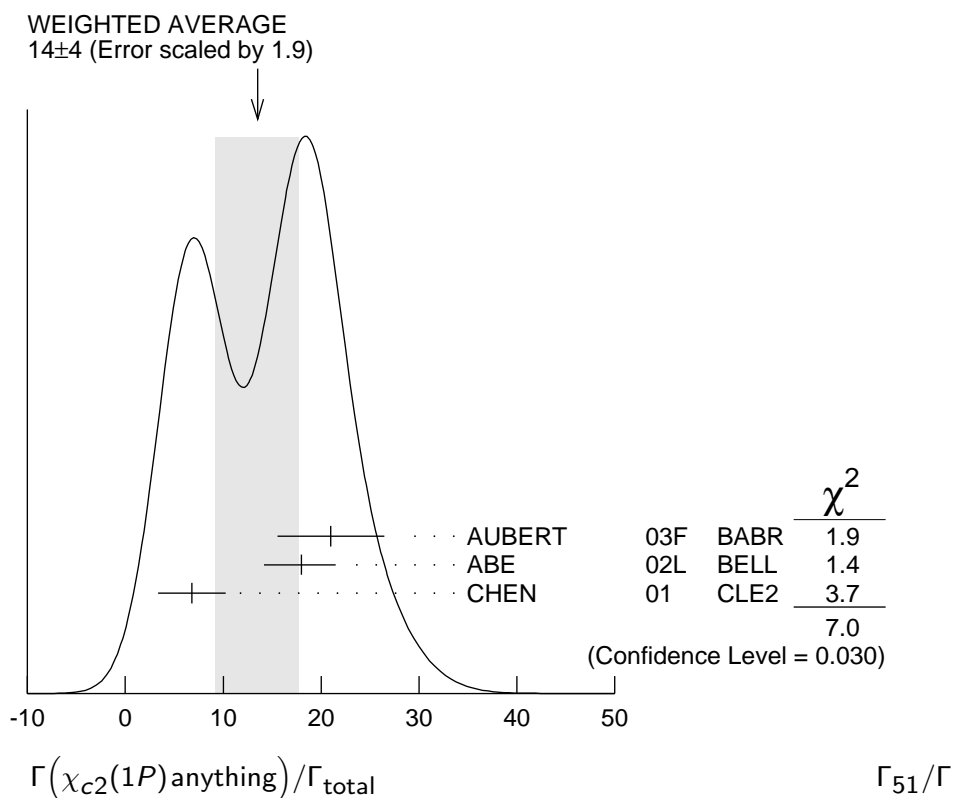
• • • We do not use the following data for averages, fits, limits, etc. • • •

<38	90	35	³ BALEST	95B CLE2	Repl. by CHEN 01
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¹ ABE 02L uses PDG 01 values for $B(J/\psi(1S) \rightarrow \ell^+\ell^-)$ and $B(\chi_{c1,c2} \rightarrow J/\psi(1S)\gamma)$.

² CHEN 01 reports $(9.8 \pm 4.8 \pm 1.5) \times 10^{-4}$ from a measurement of $[\Gamma(B \rightarrow \chi_{c2}(1P)\text{anything})/\Gamma_{\text{total}}] \times [B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S))]$ assuming $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = 0.135 \pm 0.011$. We rescale to our best value $B(\chi_{c2}(1P) \rightarrow \gamma J/\psi(1S)) = (19.4 \pm 0.8) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value. Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

³ BALEST 95B assume $B(\chi_{c2}(1P) \rightarrow J/\psi(1S)\gamma) = (13.5 \pm 1.1) \times 10^{-2}$, 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 ± 13 events correspond to $B(B \rightarrow \chi_{c2}(1P)X) = (0.25 \pm 0.10 \pm 0.03) \times 10^{-2}$.



$\Gamma(\chi_{c2}(1P)(\text{direct anything})/\Gamma_{\text{total}}$ Γ_{52}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.00165 ± 0.00031 OUR AVERAGE			
0.00190 ± 0.00045 ± 0.00029	AUBERT	03F	BABR $e^+e^- \rightarrow \Upsilon(4S)$
0.00153 ^{+0.00023} _{-0.00028} ± 0.00027	¹ ABE	02L	BELL $e^+e^- \rightarrow \Upsilon(4S)$

¹ ABE 02L uses PDG 01 values for $B(J/\psi(1S) \rightarrow \ell^+\ell^-)$ and $B(\chi_{c1,c2} \rightarrow J/\psi(1S)\gamma)$.

$\Gamma(\eta_c(1S)\text{anything})/\Gamma_{\text{total}}$ Γ_{53}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.009	90	¹ BALEST	95B	CLE2 $e^+e^- \rightarrow \Upsilon(4S)$

¹ 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 $J/\psi(1S) \rightarrow \mu^+\mu^-$. Search region $2960 < m_{\eta_c(1S)} < 3010 \text{ MeV}/c^2$.

$\Gamma(X(3872)K \times B(X \rightarrow D^0\bar{D}^0\pi^0))/\Gamma_{\text{total}}$ Γ_{54}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
1.22 ± 0.31^{+0.23}_{-0.30}	¹ GOKHROO	06	BELL $e^+e^- \rightarrow \Upsilon(4S)$

¹ Measure the near-threshold enhancements in the $(D^0\bar{D}^0\pi^0)$ system at a mass $3875.2 \pm 0.7^{+0.3}_{-1.6} \pm 0.8 \text{ MeV}/c^2$.

$\Gamma(KX(3945) \times B(X(3945) \rightarrow \omega J/\psi))/\Gamma_{\text{total}}$ Γ_{55}/Γ

VALUE (units 10^{-5})	DOCUMENT ID	TECN	COMMENT
7.1 ± 1.3 ± 3.1	¹ CHOI	05	BELL $e^+e^- \rightarrow \Upsilon(4S)$

¹ CHOI 05 reports the observation of a near-threshold enhancement in the $\omega J/\psi$ mass spectrum in exclusive $B \rightarrow K\omega J/\psi$. The new state, denoted as $X(3945)$, has a mass of $3943 \pm 11 \pm 13 \text{ GeV}/c^2$ and a width $\Gamma = 87 \pm 22 \pm 26 \text{ MeV}$.

$\Gamma(K^\pm \text{anything})/\Gamma_{\text{total}}$ Γ_{56}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
0.789 ± 0.025 OUR AVERAGE			
0.82 ± 0.01 ± 0.05	ALBRECHT	94C	ARG $e^+e^- \rightarrow \Upsilon(4S)$
0.775 ± 0.015 ± 0.025	¹ ALBRECHT	93I	ARG $e^+e^- \rightarrow \Upsilon(4S)$
0.85 ± 0.07 ± 0.09	ALAM	87B	CLEO $e^+e^- \rightarrow \Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

seen	² BRODY	82	CLEO $e^+e^- \rightarrow \Upsilon(4S)$
seen	³ GIANNINI	82	CUSB $e^+e^- \rightarrow \Upsilon(4S)$

¹ ALBRECHT 93I value is not independent of the sum of $B \rightarrow K^+$ anything and $B \rightarrow K^-$ anything ALBRECHT 94C values.

² Assuming $\Upsilon(4S) \rightarrow B\bar{B}$, 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 $(b\text{-quark} \rightarrow c\text{-quark})/(b\text{-quark} \rightarrow \text{all})$ of $1.09 \pm 0.33 \pm 0.13$.

³ GIANNINI 82 at CESR-CUSB observed $1.58 \pm 0.35 K^0$ per hadronic event much higher than 0.82 ± 0.10 below threshold. Consistent with predominant $b \rightarrow cX$ decay.

$\Gamma(K^+ \text{ anything})/\Gamma_{\text{total}}$ **Γ_{57}/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.66 ± 0.05	¹ ALBRECHT 94C	ARG	$e^+e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.620 ± 0.013 ± 0.038	² ALBRECHT 94C	ARG	$e^+e^- \rightarrow \gamma(4S)$
0.66 ± 0.05 ± 0.07	² ALAM 87B	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ 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 $(18.1 \pm 4.3)\%$.

² Measurement relies on lepton-kaon correlations. It includes production through mixing of the neutral B meson.

$\Gamma(K^- \text{ anything})/\Gamma_{\text{total}}$ **Γ_{58}/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.13 ± 0.04	¹ ALBRECHT 94C	ARG	$e^+e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
0.165 ± 0.011 ± 0.036	² ALBRECHT 94C	ARG	$e^+e^- \rightarrow \gamma(4S)$
0.19 ± 0.05 ± 0.02	² ALAM 87B	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ 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 $(18.1 \pm 4.3)\%$.

² Measurement relies on lepton-kaon correlations. It includes production through mixing of the neutral B meson.

$\Gamma(K^0/\bar{K}^0 \text{ anything})/\Gamma_{\text{total}}$ **Γ_{59}/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.64 ± 0.04 OUR AVERAGE			
0.642 ± 0.010 ± 0.042	¹ ALBRECHT 94C	ARG	$e^+e^- \rightarrow \gamma(4S)$
0.63 ± 0.06 ± 0.06	ALAM 87B	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 94C assume a K^0/\bar{K}^0 multiplicity twice that of K_S^0 .

$\Gamma(K^*(892)^\pm \text{ anything})/\Gamma_{\text{total}}$ **Γ_{60}/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.182 ± 0.054 ± 0.024	ALBRECHT 94J	ARG	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(K^*(892)^0/\bar{K}^*(892)^0 \text{ anything})/\Gamma_{\text{total}}$ **Γ_{61}/Γ**

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.146 ± 0.016 ± 0.020	ALBRECHT 94J	ARG	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(K^*(892)\gamma)/\Gamma_{\text{total}}$ **Γ_{62}/Γ**

<u>VALUE (units 10^{-5})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
4.24 ± 0.54 ± 0.32		¹ COAN 00	CLE2	$e^+e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
< 150	90	² LESIAK 92	CBAL	$e^+e^- \rightarrow \gamma(4S)$
< 24	90	ALBRECHT 88H	ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ An average of $B(B^+ \rightarrow K^*(892)^+\gamma)$ and $B(B^0 \rightarrow K^*(892)^0\gamma)$ measurements reported in COAN 00 by assuming full correlated systematic errors.

² LESIAK 92 set a limit on the inclusive process $B(b \rightarrow s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s -quark hadronization.

$\Gamma(\eta K \gamma)/\Gamma_{\text{total}}$ Γ_{63}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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$8.5 \pm 1.3^{+1.2}_{-0.9}$	¹ NISHIDA	05	BELL $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ $m_{\eta K} < 2.4 \text{ GeV}/c^2$

$\Delta_{0+}(B \rightarrow K^*(892)\gamma)$

Δ_{0+} describes the isospin asymmetry between $\Gamma(B^0 \rightarrow K^*(892)^0 \gamma)$ and $\Gamma(B^+ \rightarrow K^*(892)^+ \gamma)$.

VALUE	DOCUMENT ID	TECN	COMMENT
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$0.050 \pm 0.045 \pm 0.037$	¹ AUBERT, BE	04A	BABR $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ Uses the production ratio of charged and neutral B from $\Upsilon(4S)$ decays $R^{+}/0 = 1.006 \pm 0.048$ and the lifetime ratio of $\tau_{B^+} / \tau_{B^0} = 1.083 \pm 0.017$. The 90% CL interval is $-0.046 < \Delta_{0+} < 0.146$.

$\Gamma(K_1(1400)\gamma)/\Gamma_{\text{total}}$ Γ_{64}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 12.7 \times 10^{-5}$	90	¹ COAN	00	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 1.6 \times 10^{-3}$	90	² LESIAK	92	CBAL $e^+ e^- \rightarrow \Upsilon(4S)$
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$< 4.1 \times 10^{-4}$	90	ALBRECHT	88H	ARG $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² LESIAK 92 set a limit on the inclusive process $B(b \rightarrow s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s-quark hadronization.

$\Gamma(K_2^*(1430)\gamma)/\Gamma_{\text{total}}$ Γ_{65}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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$1.66^{+0.59}_{-0.53} \pm 0.13$		¹ COAN	00	CLE2 $e^+ e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

< 83	90	ALBRECHT	88H	ARG $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ COAN 00 obtains a fitted signal yield of $15.9^{+5.7}_{-5.2}$ events. A search for contamination by $K^*(1410)$ yielded a rate consistent with 0; the central value assumes no contamination.

$\Gamma(K_2(1770)\gamma)/\Gamma_{\text{total}}$ Γ_{66}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 1.2 \times 10^{-3}$	90	¹ LESIAK	92	CBAL $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ LESIAK 92 set a limit on the inclusive process $B(b \rightarrow s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s-quark hadronization.

$\Gamma(K_3^*(1780)\gamma)/\Gamma_{\text{total}}$ Γ_{67}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$< 3.7 \times 10^{-5}$	90	¹ NISHIDA	05	BELL $e^+ e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$< 3.0 \times 10^{-3}$	90	ALBRECHT	88H	ARG $e^+ e^- \rightarrow \Upsilon(4S)$
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¹ Uses $B(K_3^*(1780) \rightarrow \eta K) = 0.11^{+0.05}_{-0.04}$.

$\Gamma(K_4^*(2045)\gamma)/\Gamma_{\text{total}}$ Γ_{68}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<1.0 \times 10^{-3}$	90	¹ LESIAK	92 CBAL	$e^+e^- \rightarrow \gamma(4S)$

¹ LESIAK 92 set a limit on the inclusive process $B(b \rightarrow s\gamma) < 2.8 \times 10^{-3}$ at 90% CL for the range of masses of 892–2045 MeV, independent of assumptions about s-quark hadronization.

$\Gamma(K\eta'(958))/\Gamma_{\text{total}}$ Γ_{69}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$(8.3^{+0.9}_{-0.8} \pm 0.7) \times 10^{-5}$	¹ RICHICHI	00 CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

$\Gamma(K^*(892)\eta'(958))/\Gamma_{\text{total}}$ Γ_{70}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
$4.1^{+1.0}_{-0.9} \pm 0.5$		¹ AUBERT	07E BABR	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<22	90	¹ RICHICHI	00 CLE2	$e^+e^- \rightarrow \gamma(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

$\Gamma(K\eta)/\Gamma_{\text{total}}$ Γ_{71}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$<5.2 \times 10^{-6}$	90	¹ RICHICHI	00 CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

$\Gamma(K^*(892)\eta)/\Gamma_{\text{total}}$ Γ_{72}/Γ

VALUE	DOCUMENT ID	TECN	COMMENT
$(1.80^{+0.49}_{-0.43} \pm 0.18) \times 10^{-5}$	¹ RICHICHI	00 CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

$\Gamma(K\phi\phi)/\Gamma_{\text{total}}$ Γ_{73}/Γ

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
$2.3^{+0.9}_{-0.8} \pm 0.3$	¹ HUANG	03 BELL	$e^+e^- \rightarrow \gamma(4S)$

¹ Assumes equal production of charged and neutral B meson pairs and isospin symmetry.

$\Gamma(\bar{b} \rightarrow \bar{s}\gamma)/\Gamma_{\text{total}}$ Γ_{74}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
3.56 ± 0.25 OUR AVERAGE			

3.91 ± 0.91 ± 0.64 ^{1,2} AUBERT 08O BABR $e^+e^- \rightarrow \gamma(4S)$

3.92 ± 0.31 ± 0.47 ^{1,3} AUBERT,BE 06B BABR $e^+e^- \rightarrow \gamma(4S)$

3.49 ± 0.20 ^{+0.59}_{-0.46} ^{1,4} AUBERT,B 05R BABR $e^+e^- \rightarrow \gamma(4S)$

3.50 ± 0.32 ± 0.31 ^{1,5} KOPPENBURG04 BELL $e^+e^- \rightarrow \gamma(4S)$

3.29 ± 0.44 ± 0.29 ^{1,6} CHEN 01C CLE2 $e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

3.36 ± 0.53 ^{+0.65}_{-0.68} ⁷ ABE 01F BELL Repl. by KOPPENBURG 04

2.32 ± 0.57 ± 0.35 ALAM 95 CLE2 Repl. by CHEN 01C

¹ We correct it to $E_\gamma > 1.6$ GeV using the method of hep-ph/0507253 (average of three theoretical models).

² Uses a fully reconstructed B meson as a tag on the recoil side. The measurement reported is $(3.66 \pm 0.85 \pm 0.60) \times 10^{-4}$ for $E_\gamma > 1.9$ GeV.

³ The measurement reported is $(3.67 \pm 0.29 \pm 0.45) \times 10^{-4}$ for $E_\gamma > 1.9$ GeV.

⁴ The measurement reported is $(3.27 \pm 0.18^{+0.55}_{-0.42}) \times 10^{-4}$ for $E_\gamma > 1.9$ GeV.

⁵ The measurement reported is $(3.55 \pm 0.32 \pm 0.32) \times 10^{-4}$ for $E_\gamma > 1.8$ GeV.

⁶ The measurement reported is $(3.21 \pm 0.43^{+0.32}_{-0.29}) \times 10^{-4}$ for $E_\gamma > 2.0$ GeV.

⁷ ABE 01F reports their systematic errors $(\pm 0.42^{+0.50}_{-0.54}) \times 10^{-4}$, where the second error is due to the theoretical uncertainty. We combine them in quadrature.

$\Gamma(\bar{b} \rightarrow \bar{s} \text{gluon})/\Gamma_{\text{total}}$ Γ_{75}/Γ

VALUE	CL%	EVTS	DOCUMENT ID	TECN	COMMENT
<0.068	90		¹ COAN	98	CLE2 $e^+e^- \rightarrow \Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.08		2	² ALBRECHT	95D	ARG $e^+e^- \rightarrow \Upsilon(4S)$
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¹ COAN 98 uses D - ℓ correlation.

² ALBRECHT 95D use full reconstruction of one B decay as tag. Two candidate events for charmless B decay can be interpreted as either $b \rightarrow s \text{gluon}$ or $b \rightarrow u$ transition. If interpreted as $b \rightarrow s \text{gluon}$ they find a branching ratio of ~ 0.026 or the upper limit quoted above. Result is highly model dependent.

$\Gamma(\eta \text{ anything})/\Gamma_{\text{total}}$ Γ_{76}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<4.4 $\times 10^{-4}$	90	¹ BROWDER	98	CLE2 $e^+e^- \rightarrow \Upsilon(4S)$

¹ BROWDER 98 search for high momentum $B \rightarrow \eta X_S$ between 2.1 and 2.7 GeV/ c .

$\Gamma(\eta' \text{ anything})/\Gamma_{\text{total}}$ Γ_{77}/Γ

VALUE (units 10^{-4})	DOCUMENT ID	TECN	COMMENT
4.2 \pm 0.9 OUR AVERAGE			

3.9 \pm 0.8 \pm 0.9 ¹ AUBERT, B 04F BABR $e^+e^- \rightarrow \Upsilon(4S)$

4.6 \pm 1.1 \pm 0.6 ² BONVICINI 03 CLE2 $e^+e^- \rightarrow \Upsilon(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

6.2 \pm 1.6 $^{+1.3}_{-2.0}$ ³ BROWDER 98 CLE2 $e^+e^- \rightarrow \Upsilon(4S)$

¹ The reported branching ratio is for high momentum η between 2.0 and 2.7 GeV in the $\Upsilon(4S)$ center-of-mass frame. X_s represents a recoil system consisting of a kaon and zero to four pions.

² BONVICINI 03 observed a signal of 61.2 ± 13.9 events in $B \rightarrow \eta' X_{nc}$ production for high momentum η' between 2.0 and 2.7 GeV/ c in the $\Upsilon(4S)$ center-of-mass frame. The X_{nc} denotes "charmless" hadronic states recoiling against η' . The second error combines systematic and background subtraction uncertainties in quadrature.

³ BROWDER 98 observed a signal of 39.0 ± 11.6 events in high momentum $B \rightarrow \eta' X_S$ production between 2.0 and 2.7 GeV/ c . The branching fraction is based on the interpretation of $b \rightarrow sg$, where the last error includes additional uncertainties due to the color-suppressed $b \rightarrow$ backgrounds.

$\Gamma(\rho\gamma)/\Gamma_{\text{total}}$ Γ_{78}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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1.39 ± 0.25 OUR AVERAGE Error includes scale factor of 1.2.

1.73 ^{+0.34} _{-0.32} ± 0.17		1,2 AUBERT	08BH BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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1.21 ^{+0.24} _{-0.22} ± 0.12		1,2 TANIGUCHI	08 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.36 ^{+0.29} _{-0.27} ± 0.10		1,3 AUBERT	07L BABR	Repl. by AUBERT 08BH
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< 1.9	90	1,3 AUBERT	04C BABR	Repl. by AUBERT 07L
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< 14	90	1,4 COAN	00 CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² Assumes $\Gamma(B \rightarrow \rho\gamma) = \Gamma(B^+ \rightarrow \rho^+\gamma) = 2 \Gamma(B^0 \rightarrow \rho^0\gamma)$ and uses lifetime ratio of $\tau_{B^+}/\tau_{B^0} = 1.071 \pm 0.009$.

³ Assumes $\Gamma(B \rightarrow \rho\gamma) = \Gamma(B^+ \rightarrow \rho^+\gamma) = 2 \Gamma(B^0 \rightarrow \rho^0\gamma)$ and uses lifetime ratio of $\tau_{B^+}/\tau_{B^0} = 1.083 \pm 0.017$.

⁴ COAN 00 reports $B(B \rightarrow \rho\gamma)/B(B \rightarrow K^*(892)\gamma) < 0.32$ at 90%CL and scaled by the central value of $B(B \rightarrow K^*(892)\gamma) = (4.24 \pm 0.54 \pm 0.32) \times 10^{-5}$.

$\Gamma(\rho\gamma)/\Gamma(K^*(892)\gamma)$ Γ_{78}/Γ_{62}

VALUE (units 10^{-2})	DOCUMENT ID	TECN	COMMENT
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3.02^{+0.60+0.26}_{-0.55-0.28}	TANIGUCHI	08 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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$\Gamma(\rho/\omega\gamma)/\Gamma_{\text{total}}$ Γ_{79}/Γ

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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1.30 ± 0.23 OUR AVERAGE Error includes scale factor of 1.2.

1.63 ^{+0.30} _{-0.28} ± 0.16		1,2,3 AUBERT	08BH BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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1.14 ± 0.20 ^{+0.10} _{-0.12}		1,3 TANIGUCHI	08 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

1.25 ^{+0.25} _{-0.24} ± 0.09		4 AUBERT	07L BABR	Repl. by AUBERT 08BH
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1.32 ^{+0.34+0.10} _{-0.31-0.09}		4 MOHAPATRA	06 BELL	Repl. by TANIGUCHI 08
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0.6 ± 0.3 ± 0.1		4 AUBERT	05 BABR	Repl. by AUBERT 07L
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< 1.4	90	4 MOHAPATRA	05 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes $\Gamma(B \rightarrow \rho\gamma) = \Gamma(B^+ \rightarrow \rho^+\gamma) = 2 \Gamma(B^0 \rightarrow \rho^0\gamma)$ and uses lifetime ratio of $\tau_{B^+}/\tau_{B^0} = 1.071 \pm 0.009$.

² Also reports $|V_{td}/V_{ts}| = 0.233^{+0.025+0.022}_{-0.024-0.021}$.

³ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

⁴ Assumes $\Gamma(B \rightarrow \rho\gamma) = \Gamma(B^+ \rightarrow \rho^+\gamma) = 2 \Gamma(B^0 \rightarrow \rho^0\gamma)$ and uses lifetime ratio of $\tau_{B^+}/\tau_{B^0} = 1.083 \pm 0.017$.

$\Gamma(\rho/\omega\gamma)/\Gamma(K^*(892)\gamma)$ Γ_{79}/Γ_{62}

<u>VALUE (units 10^{-2})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$2.84 \pm 0.50^{+0.27}_{-0.29}$		¹ TANIGUCHI	08 BELL	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<3.5 90 MOHAPATRA 05 BELL Repl. by TANIGUCHI 08

¹ Also reports $|V_{td}/V_{ts}| = 0.195^{+0.020}_{-0.019} \pm 0.015$.

$\Gamma(\pi^\pm \text{ anything})/\Gamma_{\text{total}}$ Γ_{80}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$3.585 \pm 0.025 \pm 0.070$	¹ ALBRECHT	93I ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 93 excludes π^\pm from K_S^0 and Λ decays. If included, they find $4.105 \pm 0.025 \pm 0.080$.

$\Gamma(\pi^0 \text{ anything})/\Gamma_{\text{total}}$ Γ_{81}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$2.35 \pm 0.02 \pm 0.11$	¹ ABE	01J BELL	$e^+e^- \rightarrow \gamma(4S)$

¹ From fully inclusive π^0 yield with no corrections from decays of K_S^0 or other particles.

$\Gamma(\eta \text{ anything})/\Gamma_{\text{total}}$ Γ_{82}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.176 \pm 0.011 \pm 0.012$	KUBOTA	96 CLE2	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\rho^0 \text{ anything})/\Gamma_{\text{total}}$ Γ_{83}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
$0.208 \pm 0.042 \pm 0.032$	ALBRECHT	94J ARG	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\omega \text{ anything})/\Gamma_{\text{total}}$ Γ_{84}/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
<0.81	90	ALBRECHT	94J ARG	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\phi \text{ anything})/\Gamma_{\text{total}}$ Γ_{85}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0343 ± 0.0012 OUR AVERAGE			
0.0353 ± 0.0005 ± 0.0030	HUANG	07 CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.0341 ± 0.0006 ± 0.0012	AUBERT	04S BABR	$e^+e^- \rightarrow \gamma(4S)$
0.0390 ± 0.0030 ± 0.0035	ALBRECHT	94J ARG	$e^+e^- \rightarrow \gamma(4S)$
0.023 ± 0.006 ± 0.005	BORTOLETTO	086 CLEO	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\phi K^*(892))/\Gamma_{\text{total}}$ Γ_{86}/Γ

<u>VALUE</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>
<2.2 × 10 ⁻⁵	90	¹ BERGFELD	98 CLE2

¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

$\Gamma(\Lambda_c^+ / \bar{\Lambda}_c^- \text{ anything}) / \Gamma_{\text{total}}$ Γ_{87} / Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
0.045 ± 0.004 ± 0.012		¹ AUBERT	07C BABR	$e^+ e^- \rightarrow \gamma(4S)$
0.064 ± 0.008 ± 0.008		² CRAWFORD	92 CLEO	$e^+ e^- \rightarrow \gamma(4S)$
0.14 ± 0.09		³ ALBRECHT	88E ARG	$e^+ e^- \rightarrow \gamma(4S)$
<0.112	90	⁴ ALAM	87 CLEO	$e^+ e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ AUBERT 07C reports $0.045 \pm 0.003 \pm 0.012$ from a measurement of $[\Gamma(B \rightarrow \Lambda_c^+ / \bar{\Lambda}_c^- \text{ anything}) / \Gamma_{\text{total}}] \times [B(\Lambda_c^+ \rightarrow p K^- \pi^+)]$ assuming $B(\Lambda_c^+ \rightarrow p K^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. We rescale to our best value $B(\Lambda_c^+ \rightarrow p K^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

² CRAWFORD 92 result derived from lepton baryon correlations. Assumes all charmed baryons in B^0 and B^\pm decay are Λ_c .

³ ALBRECHT 88E measured $B(B \rightarrow \Lambda_c^+ X) \cdot B(\Lambda_c^+ \rightarrow p K^- \pi^+) = (0.30 \pm 0.12 \pm 0.06)\%$ and used $B(\Lambda_c^+ \rightarrow p K^- \pi^+) = (2.2 \pm 1.0)\%$ from ABRAMS 80 to obtain above number.

⁴ Assuming all baryons result from charmed baryons, ALAM 86 conclude the branching fraction is $7.4 \pm 2.9\%$. The limit given above is model independent.

$\Gamma(\Lambda_c^+ \text{ anything}) / \Gamma(\bar{\Lambda}_c^- \text{ anything})$ $\Gamma_{88} / \Gamma_{89}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.19 ± 0.13 ± 0.04	¹ AMMAR	97 CLE2	$e^+ e^- \rightarrow \gamma(4S)$

¹ AMMAR 97 uses a high-momentum lepton tag ($P_\ell > 1.4 \text{ GeV}/c^2$).

$\Gamma(\bar{\Lambda}_c^- e^+ \text{ anything}) / \Gamma(\Lambda_c^+ / \bar{\Lambda}_c^- \text{ anything})$ $\Gamma_{90} / \Gamma_{87}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.05	90	¹ BONVICINI	98 CLE2	$e^+ e^- \rightarrow \gamma(4S)$

¹ BONVICINI 98 uses the electron with momentum above 0.6 GeV/c.

$\Gamma(\bar{\Lambda}_c^- p \text{ anything}) / \Gamma(\Lambda_c^+ / \bar{\Lambda}_c^- \text{ anything})$ $\Gamma_{91} / \Gamma_{87}$

VALUE	DOCUMENT ID	TECN	COMMENT
0.57 ± 0.05 ± 0.05	BONVICINI	98 CLE2	$e^+ e^- \rightarrow \gamma(4S)$

$\Gamma(\bar{\Lambda}_c^- p e^+ \nu_e) / \Gamma(\bar{\Lambda}_c^- p \text{ anything})$ $\Gamma_{92} / \Gamma_{91}$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.04	90	¹ BONVICINI	98 CLE2	$e^+ e^- \rightarrow \gamma(4S)$

¹ BONVICINI 98 uses the electron with momentum above 0.6 GeV/c.

$\Gamma(\bar{\Sigma}_c^{--} \text{ anything}) / \Gamma_{\text{total}}$ Γ_{93} / Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0042 ± 0.0021 ± 0.0011	77	¹ PROCARIO	94 CLE2	$e^+ e^- \rightarrow \gamma(4S)$

¹ PROCARIO 94 reports $[\Gamma(B \rightarrow \bar{\Sigma}_c^{--} \text{ anything}) / \Gamma_{\text{total}}] \times [B(\Lambda_c^+ \rightarrow p K^- \pi^+)] = 0.00021 \pm 0.00008 \pm 0.00007$. We divide by our best value $B(\Lambda_c^+ \rightarrow p K^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{\Sigma}_c^- \text{ anything})/\Gamma_{\text{total}}$ Γ_{94}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.010	90	¹ PROCARIO 94	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ PROCARIO 94 reports $[\Gamma(B \rightarrow \overline{\Sigma}_c^- \text{ anything})/\Gamma_{\text{total}}] \times [B(\Lambda_c^+ \rightarrow pK^- \pi^+)] < 0.00048$. We divide by our best value $B(\Lambda_c^+ \rightarrow pK^- \pi^+) = 5.0 \times 10^{-2}$.

$\Gamma(\overline{\Sigma}_c^0 \text{ anything})/\Gamma_{\text{total}}$ Γ_{95}/Γ

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.0046 ± 0.0021 ± 0.0012	76	¹ PROCARIO 94	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ PROCARIO 94 reports $[\Gamma(B \rightarrow \overline{\Sigma}_c^0 \text{ anything})/\Gamma_{\text{total}}] \times [B(\Lambda_c^+ \rightarrow pK^- \pi^+)] = 0.00023 \pm 0.00008 \pm 0.00007$. We divide by our best value $B(\Lambda_c^+ \rightarrow pK^- \pi^+) = (5.0 \pm 1.3) \times 10^{-2}$. Our first error is their experiment's error and our second error is the systematic error from using our best value.

$\Gamma(\overline{\Sigma}_c^0 N(N = p \text{ or } n))/\Gamma_{\text{total}}$ Γ_{96}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
<0.0015	90	¹ PROCARIO 94	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ PROCARIO 94 reports < 0.0017 from a measurement of $[\Gamma(B \rightarrow \overline{\Sigma}_c^0 N(N = p \text{ or } n))/\Gamma_{\text{total}}] \times [B(\Lambda_c^+ \rightarrow pK^- \pi^+)]$ assuming $B(\Lambda_c^+ \rightarrow pK^- \pi^+) = 0.043$. We rescale to our best value $B(\Lambda_c^+ \rightarrow pK^- \pi^+) = 5.0 \times 10^{-2}$.

$\Gamma(\Xi_c^0 \text{ anything} \times B(\Xi_c^0 \rightarrow \Xi^- \pi^+))/\Gamma_{\text{total}}$ Γ_{97}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.193 ± 0.030 OUR AVERAGE	Error includes scale factor of 1.1.		
0.211 ± 0.019 ± 0.025	¹ AUBERT,B 05M	BABR	$e^+e^- \rightarrow \gamma(4S)$
0.144 ± 0.048 ± 0.021	² BARISH 97	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ The yield is obtained by requiring the momentum $P < 2.15 \text{ GeV}/c$.
² BARISH 97 find $79 \pm 27 \Xi_c^0$ events.

$\Gamma(\Xi_c^+ \text{ anything} \times B(\Xi_c^+ \rightarrow \Xi^- \pi^+ \pi^+))/\Gamma_{\text{total}}$ Γ_{98}/Γ

VALUE (units 10^{-3})	DOCUMENT ID	TECN	COMMENT
0.453 ± 0.096 ^{+0.085}_{-0.065}	¹ BARISH 97	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ BARISH 97 find $125 \pm 28 \Xi_c^+$ events.

$\Gamma(p/\bar{p} \text{ anything})/\Gamma_{\text{total}}$ Γ_{99}/Γ

Includes p and \bar{p} from Λ and $\bar{\Lambda}$ decay.

VALUE	EVTS	DOCUMENT ID	TECN	COMMENT
0.080 ± 0.004 OUR AVERAGE				
0.080 ± 0.005 ± 0.005		ALBRECHT 93I	ARG	$e^+e^- \rightarrow \gamma(4S)$
0.080 ± 0.005 ± 0.003		CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.082 ± 0.005 ^{+0.013} _{-0.010}	2163	¹ ALBRECHT 89K	ARG	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •
 >0.021 ² ALAM 83B CLEO $e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 89K include direct and nondirect protons.

² ALAM 83B reported their result as $> 0.036 \pm 0.006 \pm 0.009$. Data are consistent with equal yields of p and \bar{p} . Using assumed yields below cut, $B(B \rightarrow p + X) = 0.03$ not including protons from Λ decays.

$\Gamma(p/\bar{p}(\text{direct}) \text{ anything})/\Gamma_{\text{total}}$ Γ_{100}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.055±0.005 OUR AVERAGE				
0.055±0.005±0.0035		ALBRECHT 93I	ARG	$e^+e^- \rightarrow \gamma(4S)$
0.056±0.006±0.005		CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.055±0.016	1220	¹ ALBRECHT 89K	ARG	$e^+e^- \rightarrow \gamma(4S)$

¹ ALBRECHT 89K subtract contribution of Λ decay from the inclusive proton yield.

$\Gamma(\Lambda/\bar{\Lambda} \text{ anything})/\Gamma_{\text{total}}$ Γ_{101}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.040±0.005 OUR AVERAGE				
0.038±0.004±0.006	2998	CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.042±0.005±0.006	943	ALBRECHT 89K	ARG	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.022±0.003±0.0022		¹ ACKERSTAFF 97N	OPAL	$e^+e^- \rightarrow Z$
>0.011		² ALAM 83B	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ ACKERSTAFF 97N assumes $B(b \rightarrow B) = 0.868 \pm 0.041$, *i.e.*, an admixture of B^0 , B^\pm , and B_s .

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

$\Gamma(\Lambda \text{ anything})/\Gamma(\bar{\Lambda} \text{ anything})$ $\Gamma_{102}/\Gamma_{103}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.43±0.09±0.07	¹ AMMAR 97	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ AMMAR 97 uses a high-momentum lepton tag ($P_\ell > 1.4 \text{ GeV}/c^2$).

$\Gamma(\Xi^-/\bar{\Xi}^+ \text{ anything})/\Gamma_{\text{total}}$ Γ_{104}/Γ

<u>VALUE</u>	<u>EVTS</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.0027±0.0006 OUR AVERAGE				
0.0027±0.0005±0.0004	147	CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
0.0028±0.0014	54	ALBRECHT 89K	ARG	$e^+e^- \rightarrow \gamma(4S)$

$\Gamma(\text{baryons anything})/\Gamma_{\text{total}}$ Γ_{105}/Γ

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.068±0.005±0.003	¹ ALBRECHT 920	ARG	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

0.076±0.014	² ALBRECHT 89K	ARG	$e^+e^- \rightarrow \gamma(4S)$
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¹ ALBRECHT 920 result is from simultaneous analysis of p and Λ yields, $p\bar{p}$ and $\Lambda\bar{\Lambda}$ correlations, and various lepton-baryon and lepton-baryon-antibaryon correlations. Supersedes ALBRECHT 89K.

² ALBRECHT 89K obtain this result by adding their their measurements (5.5 ± 1.6)% for direct protons and ($4.2 \pm 0.5 \pm 0.6$)% for inclusive Λ 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)%.

$\Gamma(p\bar{p}\text{anything})/\Gamma_{\text{total}}$ **Γ_{106}/Γ**

Includes p and \bar{p} from Λ and $\bar{\Lambda}$ decay.

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

$\Gamma(p\bar{p}\text{anything})/\Gamma(p/\bar{p}\text{anything})$ **Γ_{106}/Γ_{99}**

Includes p and \bar{p} from Λ and $\bar{\Lambda}$ decay.

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.30 ± 0.02 ± 0.05	¹ CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
¹ CRAWFORD 92 value is not independent of their $\Gamma(p\bar{p}\text{anything})/\Gamma_{\text{total}}$ value.			

$\Gamma(\Lambda\bar{\Lambda}\text{anything})/\Gamma_{\text{total}}$ **Γ_{107}/Γ**

Includes p and \bar{p} from Λ and $\bar{\Lambda}$ decay.

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

$\Gamma(\Lambda\bar{\Lambda}\text{anything})/\Gamma(\Lambda/\bar{\Lambda}\text{anything})$ **$\Gamma_{107}/\Gamma_{101}$**

Includes p and \bar{p} from Λ and $\bar{\Lambda}$ decay.

VALUE	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •			
0.76 ± 0.11 ± 0.08	¹ CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
¹ CRAWFORD 92 value is not independent of their $[\Gamma(\Lambda\bar{p}\text{anything}) + \Gamma(\bar{\Lambda}p\text{anything})]/\Gamma_{\text{total}}$ value.			

$\Gamma(\Lambda\bar{\Lambda}\text{anything})/\Gamma_{\text{total}}$ **Γ_{108}/Γ**

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

$\Gamma(\Lambda\bar{\Lambda}\text{anything})/\Gamma(\Lambda/\bar{\Lambda}\text{anything})$ **$\Gamma_{108}/\Gamma_{101}$**

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
• • • We do not use the following data for averages, fits, limits, etc. • • •				
<0.13	90	¹ CRAWFORD 92	CLEO	$e^+e^- \rightarrow \gamma(4S)$
¹ CRAWFORD 92 value is not independent of their $\Gamma(\Lambda\bar{\Lambda}\text{anything})/\Gamma_{\text{total}}$ value.				

$\Gamma(se^+e^-)/\Gamma_{\text{total}}$ **Γ_{109}/Γ**

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
4.7 ± 1.3 OUR AVERAGE				
4.04 ± 1.30 ^{+0.87} _{-0.83}		¹ IWASAKI 05	BELL	$e^+e^- \rightarrow \gamma(4S)$
6.0 ± 1.7 ± 1.3		² AUBERT,B 04I	BABR	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

	$5.0 \pm 2.3 \begin{smallmatrix} +1.3 \\ -1.1 \end{smallmatrix}$	² KANEKO	03	BELL	Repl. by IWASAKI 05
< 57	90	GLENN	98	CLEO	$e^+e^- \rightarrow \gamma(4S)$
<50000	90	BEBEK	81	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ Requires $M_{\ell^+\ell^-} > 0.2 \text{ GeV}/c^2$.

² Requires $M_{e^+e^-} > 0.2 \text{ GeV}/c^2$.

$\Gamma(s\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{110}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-6})	CL%	DOCUMENT ID	TECN	COMMENT
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4.3 ± 1.2 OUR AVERAGE

$4.13 \pm 1.05 \begin{smallmatrix} +0.85 \\ -0.81 \end{smallmatrix}$ ¹ IWASAKI 05 BELL $e^+e^- \rightarrow \gamma(4S)$

$5.0 \pm 2.8 \pm 1.2$ AUBERT,B 04i BABR $e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

	$7.9 \pm 2.1 \begin{smallmatrix} +2.1 \\ -1.5 \end{smallmatrix}$	KANEKO	03	BELL	Repl. by IWASAKI 05
< 58	90	GLENN	98	CLEO	$e^+e^- \rightarrow \gamma(4S)$
<17000	90	CHADWICK	81	CLEO	$e^+e^- \rightarrow \gamma(4S)$

¹ Requires $M_{\ell^+\ell^-} > 0.2 \text{ GeV}/c^2$.

$[\Gamma(se^+e^-) + \Gamma(s\mu^+\mu^-)]/\Gamma_{\text{total}}$ $(\Gamma_{109} + \Gamma_{110})/\Gamma$

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<4.2 × 10⁻⁵ 90 GLENN 98 CLEO $e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

<0.0024	90	¹ BEAN	87	CLEO	Repl. by GLENN 98
<0.0062	90	² AVERY	84	CLEO	Repl. by BEAN 87

¹ BEAN 87 reports $[(\mu^+\mu^-) + (e^+e^-)]/2$ and we converted it.

² Determine ratio of B^+ to B^0 semileptonic decays to be in the range 0.25–2.9.

$\Gamma(s\ell^+\ell^-)/\Gamma_{\text{total}}$ Γ_{111}/Γ

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

VALUE (units 10^{-6})	DOCUMENT ID	TECN	COMMENT
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4.5 ± 1.0 OUR AVERAGE

$4.11 \pm 0.83 \begin{smallmatrix} +0.85 \\ -0.81 \end{smallmatrix}$ ¹ IWASAKI 05 BELL $e^+e^- \rightarrow \gamma(4S)$

$5.6 \pm 1.5 \pm 1.3$ ² AUBERT,B 04i BABR $e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

$6.1 \pm 1.4 \begin{smallmatrix} +1.4 \\ -1.1 \end{smallmatrix}$	² KANEKO	03	BELL	Repl. by IWASAKI 05
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¹ Requires $M_{\ell^+\ell^-} > 0.2 \text{ GeV}/c^2$.

² Requires $M_{e^+e^-} > 0.2 \text{ GeV}/c^2$.

$\Gamma(\pi\ell^+\ell^-)/\Gamma_{\text{total}}$ Γ_{112}/Γ

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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$<6.2 \times 10^{-8}$	90	¹ WEI	08A BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$<9.1 \times 10^{-8}$	90	¹ AUBERT	07AG BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

$\Gamma(Ke^+e^-)/\Gamma_{\text{total}}$ Γ_{113}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
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$3.8^{+0.8}_{-0.7}$ OUR AVERAGE

$3.3^{+0.9}_{-0.8} \pm 0.2$		¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$4.8^{+1.5}_{-1.3} \pm 0.3$		^{1,2} ISHIKAWA	03 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$7.4^{+1.8}_{-1.6} \pm 0.5$		¹ AUBERT	03U BABR	Repl. by AUBERT,B 06J
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<13	90	ABE	02 BELL	Repl. by ISHIKAWA 03
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² The second error is a total of systematic uncertainties including model dependence.

$\Gamma(K^*(892)e^+e^-)/\Gamma_{\text{total}}$ Γ_{114}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
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11.3 ± 2.7 OUR AVERAGE

$9.7^{+3.0}_{-2.7} \pm 1.4$		¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$14.9^{+5.2+1.2}_{-4.6-1.3}$		² ISHIKAWA	03 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$9.8^{+5.0}_{-4.2} \pm 1.1$		¹ AUBERT	03U BABR	Repl. by AUBERT,B 06J
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<56	90	ABE	02 BELL	Repl. by ISHIKAWA 03
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² Assumes equal production of B^0 and B^+ at $\Upsilon(4S)$. The second error is a total of systematic uncertainties including model dependence.

$\Gamma(K\mu^+\mu^-)/\Gamma_{\text{total}}$ Γ_{115}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-7})	DOCUMENT ID	TECN	COMMENT
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$4.2^{+0.9}_{-0.8}$ OUR AVERAGE

$3.5^{+1.3}_{-1.1} \pm 0.3$		¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$4.8^{+1.2}_{-1.1} \pm 0.4$		^{1,2} ISHIKAWA	03 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$4.5^{+2.3}_{-1.9} \pm 0.4$	¹ AUBERT	03U	BABR	Repl. by AUBERT,B 06J
$9.9^{+4.0+1.3}_{-3.2-1.0}$	ABE	02	BELL	Repl. by ISHIKAWA 03

¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² The second error is a total of systematic uncertainties including model dependence.

$\Gamma(K\mu^+\mu^-)/\Gamma(Ke^+e^-)$ $\Gamma_{115}/\Gamma_{113}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
1.06 ± 0.48 ± 0.08	AUBERT,B	06J	BABR $e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K^*(892)\mu^+\mu^-)/\Gamma_{total}$ Γ_{116}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

<u>VALUE (units 10^{-7})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
10.3^{+2.6}_{-2.3} OUR AVERAGE				

$8.8^{+3.5}_{-3.0} \pm 1.2$	¹ AUBERT,B	06J	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$11.7^{+3.6}_{-3.1} \pm 1.0$	² ISHIKAWA	03	BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$12.7^{+7.6}_{-6.1} \pm 1.6$	¹ AUBERT	03U	BABR	Repl. by AUBERT,B 06J
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<31	90	ABE	02	BELL	Repl. by ISHIKAWA 03
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² Assumes equal production of B^0 and B^+ at $\Upsilon(4S)$. The second error is a total of systematic uncertainties including model dependence.

$\Gamma(K^*(892)\mu^+\mu^-)/\Gamma(K^*(892)e^+e^-)$ $\Gamma_{116}/\Gamma_{114}$

<u>VALUE</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
0.91 ± 0.45 ± 0.06	AUBERT,B	06J	BABR $e^+e^- \rightarrow \Upsilon(4S)$

$\Gamma(K\ell^+\ell^-)/\Gamma_{total}$ Γ_{117}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

<u>VALUE (units 10^{-7})</u>	<u>CL%</u>	<u>DOCUMENT ID</u>	<u>TECN</u>	<u>COMMENT</u>
3.9 ± 0.7 OUR AVERAGE				Error includes scale factor of 1.2.

$3.4 \pm 0.7 \pm 0.2$	¹ AUBERT,B	06J	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$4.8^{+1.0}_{-0.9} \pm 0.3$	² ISHIKAWA	03	BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$6.5^{+1.4}_{-1.3} \pm 0.4$	³ AUBERT	03U	BABR	Repl. by AUBERT,B 06J
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$7.5^{+2.5}_{-2.1} \pm 0.6$	⁴ ABE	02	BELL	Repl. by ISHIKAWA 03
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< 5.1	90	¹ AUBERT	02L	BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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<17	90	⁵ ANDERSON	01B	CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² Assumes equal production rate for charge and neutral B meson pairs, isospin invariance, lepton universality for $B \rightarrow K\ell^+\ell^-$, and $B(B \rightarrow K^*(892)\mu^+\mu^-) = 1.33$. The second error is total systematic uncertainties including model dependence.

³ Assumes all four $B \rightarrow K\ell^+\ell^-$ modes having equal partial widths in the fit.

⁴ Assumes lepton universality.

⁵ The result is for di-lepton masses above 0.5 GeV.

$\Gamma(K^*(892)\ell^+\ell^-)/\Gamma_{\text{total}}$ Γ_{118}/Γ

Test for $\Delta B = 1$ weak neutral current. Allowed by higher-order electroweak interactions.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
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9.4 ± 1.8 OUR AVERAGE Error includes scale factor of 1.1.

$7.8^{+1.9}_{-1.7} \pm 1.1$		¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$11.5^{+2.6}_{-2.4} \pm 0.8$		² ISHIKAWA	03 BELL	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

$8.8^{+3.3}_{-2.9} \pm 1.0$		³ AUBERT	03U BABR	Repl. by AUBERT,B 06J
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<31	90	^{1,4} AUBERT	02L BABR	Repl. by AUBERT 03U
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<33	90	⁵ ANDERSON	01B CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

² Assumes equal production rate for charge and neutral B meson pairs, isospin invariance, lepton universality for $B \rightarrow K\ell^+\ell^-$, and $B(B \rightarrow K^*(892)\mu^+\mu^-) = 1.33$. The second error is total systematic uncertainties including model dependence.

³ Assumes the partial width ratio of electron and muon modes to be $\Gamma(B \rightarrow K^*(892)e^+e^-)/\Gamma(B \rightarrow K^*(892)\mu^+\mu^-) = 1.33$.

⁴ For averaging $K^*(892)\mu^+\mu^-$ and $K^*(892)e^+e^-$ modes, AUBERT 02L assumed $B(B \rightarrow K^*(892)e^+e^-)/B(B \rightarrow K^*(892)\mu^+\mu^-) = 1.2$.

⁵ The result is for di-lepton masses above 0.5 GeV.

$\Gamma(K^*\nu\bar{\nu})/\Gamma_{\text{total}}$ Γ_{119}/Γ

VALUE (units 10^{-5})	CL%	DOCUMENT ID	TECN	COMMENT
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<8	90	AUBERT	08BC BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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$\Gamma(se^\pm\mu^\mp)/\Gamma_{\text{total}}$ Γ_{120}/Γ

Test for lepton family number conservation. Allowed by higher-order electroweak interactions.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<2.2 × 10 ⁻⁵	90	GLENN	98 CLEO	$e^+e^- \rightarrow \Upsilon(4S)$
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$\Gamma(\pi e^\pm\mu^\mp)/\Gamma_{\text{total}}$ Γ_{121}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<9.2 × 10 ⁻⁸	90	¹ AUBERT	07AG BABR	$e^+e^- \rightarrow \Upsilon(4S)$
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• • • We do not use the following data for averages, fits, limits, etc. • • •

<1.6 × 10 ⁻⁶	90	¹ EDWARDS	02B CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

$\Gamma(\rho e^\pm\mu^\mp)/\Gamma_{\text{total}}$ Γ_{122}/Γ

Test of lepton family number conservation.

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
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<3.2 × 10 ⁻⁶	90	¹ EDWARDS	02B CLE2	$e^+e^- \rightarrow \Upsilon(4S)$
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¹ Assumes equal production of B^+ and B^0 at the $\Upsilon(4S)$.

$\Gamma(K e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{123}/Γ

Test of lepton family number conservation.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 0.38	90	¹ AUBERT,B	06J BABR	$e^+ e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<16	90	¹ EDWARDS	02B CLE2	$e^+ e^- \rightarrow \gamma(4S)$
¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.				

$\Gamma(K^*(892) e^\pm \mu^\mp)/\Gamma_{\text{total}}$ Γ_{124}/Γ

Test of lepton family number conservation.

VALUE (units 10^{-7})	CL%	DOCUMENT ID	TECN	COMMENT
< 5.1	90	¹ AUBERT,B	06J BABR	$e^+ e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●				
<62	90	¹ EDWARDS	02B CLE2	$e^+ e^- \rightarrow \gamma(4S)$
¹ Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.				

CP VIOLATION

A_{CP} is defined as

$$\frac{B(\bar{B} \rightarrow \bar{f}) - B(B \rightarrow f)}{B(\bar{B} \rightarrow \bar{f}) + B(B \rightarrow f)},$$

the CP -violation charge asymmetry of inclusive B^\pm and B^0 decay.

$A_{CP}(B \rightarrow K^*(892)\gamma)$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.010 ± 0.028 OUR AVERAGE			
$-0.013 \pm 0.036 \pm 0.010$	¹ AUBERT,BE	04A BABR	$e^+ e^- \rightarrow \gamma(4S)$
$-0.015 \pm 0.044 \pm 0.012$	² NAKAO	04 BELL	$e^+ e^- \rightarrow \gamma(4S)$
$+0.08 \pm 0.13 \pm 0.03$	² COAN	00 CLE2	$e^+ e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$-0.044 \pm 0.076 \pm 0.012$	³ AUBERT	02C BABR	Repl. by AUBERT,BE 04A

¹ Corresponds to a 90% CL allowed region, $-0.074 < A_{CP} < 0.049$.

² Assumes equal production of B^+ and B^0 at the $\gamma(4S)$.

³ A 90% CL range is $-0.170 < A_{CP} < 0.082$.

$A_{CP}(B \rightarrow s\gamma)$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.014 ± 0.028 OUR AVERAGE			
$-0.011 \pm 0.030 \pm 0.014$	¹ AUBERT	08BJ BABR	$e^+ e^- \rightarrow \gamma(4S)$
$-0.10 \pm 0.18 \pm 0.05$	^{2,3} AUBERT	08O BABR	$e^+ e^- \rightarrow \gamma(4S)$
$+0.002 \pm 0.050 \pm 0.030$	⁴ NISHIDA	04 BELL	$e^+ e^- \rightarrow \gamma(4S)$
$-0.079 \pm 0.108 \pm 0.022$	⁵ COAN	01 CLE2	$e^+ e^- \rightarrow \gamma(4S)$
● ● ● We do not use the following data for averages, fits, limits, etc. ● ● ●			
$+0.025 \pm 0.050 \pm 0.015$	⁶ AUBERT,B	04E BABR	Repl. by AUBERT 08BJ

¹ Uses a sum of exclusively reconstructed $B \rightarrow X_S$ decay modes, with X_S mass between 0.6 and 2.8 GeV/ c^2 .

² The result is for $E_\gamma > 2.2$ GeV.

³ Uses a fully reconstructed B meson as a tag on the recoil side.

⁴ This measurement is performed inclusively for recoil mass X_s less than 2.1 GeV, which corresponds to $-0.093 < A_{CP} < 0.096$ at 90% CL.

⁵ Corresponds to $-0.27 < A_{CP} < 0.10$ at 90% CL.

⁶ Corresponds to $-0.06 < A_{CP} < +0.11$ at 90% CL.

$A_{CP}(b \rightarrow (s+d)\gamma)$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.110 \pm 0.115 \pm 0.017$	AUBERT,BE 06B	BABR	$e^+e^- \rightarrow \gamma(4S)$

$A_{CP}(b \rightarrow X_S \ell^+ \ell^-)$

VALUE	DOCUMENT ID	TECN	COMMENT
$-0.22 \pm 0.26 \pm 0.02$	¹ AUBERT,B 04i	BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ The final state flavor is determined by the kaon and pion charges where modes with $X_S = K_S^0, K_S^0 \pi^0$ or $K_S^0 \pi^+ \pi^-$ are not used.

LEPTON FORWARD-BACKWARD ASYMMETRY IN $B \rightarrow K^{(*)} \ell^+ \ell^-$ DECAY

The forward-backward angular asymmetry of the lepton pair in $B \rightarrow K^{(*)} \ell^+ \ell^-$ decay is defined as

$$A_{FB}(s) = \frac{N(\cos\theta > 0) - N(\cos\theta < 0)}{N(\cos\theta > 0) + N(\cos\theta < 0)},$$

where $s = q^2/m_B^2$, and θ is the angle of the lepton with respect to the flight direction of the B meson, measured in the dilepton rest frame. In addition, the fraction of longitudinal polarization F_L of the K^* and F_S , the relative contribution from scalar and pseudoscalar penguin amplitudes in $B \rightarrow K \ell^+ \ell^-$, can be measured from the angular distribution of its decay products.

$A_{FB}(B \rightarrow K^* \ell^+ \ell^-) (q^2 > 0.1 \text{ GeV}^2/c^4)$

VALUE	CL%	DOCUMENT ID	TECN	COMMENT
$0.50 \pm 0.15 \pm 0.02$		¹ ISHIKAWA 06	BELL	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

>0.55 95 ² AUBERT,B 06J BABR $e^+e^- \rightarrow \gamma(4S)$

¹ Using an unbinned max. likelihood fits to the M_{bc} distribution in five q^2 bins for $\cos\theta > 0$ and $\cos\theta < 0$.

² Results with different q^2 cuts are also reported.

$F_L(B \rightarrow K^* \ell^+ \ell^-) (q^2 > 0.1 \text{ GeV}^2/c^4)$

VALUE	DOCUMENT ID	TECN	COMMENT
$0.63^{+0.18}_{-0.19} \pm 0.05$	¹ AUBERT,B 06J	BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ Results with different q^2 cuts are also reported.

$A_{FB}(B \rightarrow K\ell^+\ell^-) (q^2 > 0.1 \text{ GeV}^2/c^4)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.11 ± 0.12 OUR AVERAGE			
$0.15^{+0.21}_{-0.23} \pm 0.08$	¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \gamma(4S)$
$0.10 \pm 0.14 \pm 0.01$	² ISHIKAWA	06 BELL	$e^+e^- \rightarrow \gamma(4S)$

¹ Results with different q^2 cuts are also reported.

² Using an unbinned max. likelihood fits to the M_{bc} distribution in five q^2 bins for $\cos\theta > 0$ and $\cos\theta < 0$.

$F_S(B \rightarrow K\ell^+\ell^-) (q^2 > 0.1 \text{ GeV}^2/c^4)$

VALUE	DOCUMENT ID	TECN	COMMENT
0.81^{+0.58}_{-0.61} ± 0.46	¹ AUBERT,B	06J BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ Results with different q^2 cuts are also reported.

ISOSPIN ASYMMETRY

Δ_{0-} is defined as

$$\frac{\Gamma(B^0 \rightarrow f_d) - \Gamma(B^+ \rightarrow f_u)}{\Gamma(B^0 \rightarrow f) + \Gamma(B^+ \rightarrow f)}$$

the isospin asymmetry of inclusive neutral and charged B decay.

$\Delta_{0-}(B(B \rightarrow X_s\gamma))$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.01 ± 0.06 OUR AVERAGE			
$-0.06 \pm 0.15 \pm 0.07$	^{1,2} AUBERT	08O BABR	$e^+e^- \rightarrow \gamma(4S)$
$-0.006 \pm 0.058 \pm 0.026$	AUBERT,B	05R BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ The result is for $E_\gamma > 2.2 \text{ GeV}$.

² Uses a fully reconstructed B meson as a tag on the recoil side.

$\Delta_{\rho\gamma} = \Gamma(B^+ \rightarrow \rho^+\gamma) / (2 \cdot \Gamma(B^0 \rightarrow \rho^0\gamma)) - 1$

VALUE	DOCUMENT ID	TECN	COMMENT
-0.46 ± 0.17 OUR AVERAGE			
$-0.43^{+0.25}_{-0.22} \pm 0.10$	AUBERT	08BH BABR	$e^+e^- \rightarrow \gamma(4S)$
$-0.48^{+0.21+0.08}_{-0.19-0.09}$	TANIGUCHI	08 BELL	$e^+e^- \rightarrow \gamma(4S)$

$B \rightarrow X_c\ell\nu$ HADRONIC MASS MOMENTS

$\langle M_X^2 - \overline{M_D^2} \rangle$ (First Moments)

VALUE (GeV ²)	DOCUMENT ID	TECN	COMMENT
0.36 ± 0.08 OUR AVERAGE	Error includes scale factor of 1.8.		
$0.467 \pm 0.038 \pm 0.068$	¹ ACOSTA	05F CDF	$p\bar{p}$ at 1.96 TeV
$0.293 \pm 0.012 \pm 0.058$	² CSORNA	04 CLE2	$e^+e^- \rightarrow \gamma(4S)$
$0.251 \pm 0.023 \pm 0.062$	³ CRONIN-HEN..01B	CLE2	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

¹ Moments are measured with a minimum lepton momentum of 0.7 GeV/c in the B rest frame;

² Uses minimum lepton energy of 1.5 GeV and also reports moments with $E_\ell > 1.0 \text{ GeV}$.

³ The leptons are required to have $P_\ell > 1.5 \text{ GeV}/c$.

$\langle M_X^2 \rangle$ (First Moments)

VALUE (GeV ²)	DOCUMENT ID	TECN	COMMENT
4.156 ± 0.029 OUR AVERAGE			
4.144 ± 0.028 ± 0.022	¹ SCHWANDA 07	BELL	$e^+e^- \rightarrow \gamma(4S)$
4.18 ± 0.04 ± 0.03	¹ AUBERT,B 04	BABR	$e^+e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_\ell > 1.5$ GeV/c.

$\langle (M_X^2 - \overline{M}_X^2)^2 \rangle$ (Second Moments)

VALUE (GeV ⁴)	DOCUMENT ID	TECN	COMMENT
0.55 ± 0.08 OUR AVERAGE			
0.515 ± 0.061 ± 0.064	¹ SCHWANDA 07	BELL	$e^+e^- \rightarrow \gamma(4S)$
0.629 ± 0.031 ± 0.143	² CSORNA 04	CLE2	$e^+e^- \rightarrow \gamma(4S)$

• • • We do not use the following data for averages, fits, limits, etc. • • •

1.05 ± 0.26 ± 0.13	³ ACOSTA 05F	CDF	$p\bar{p}$ at 1.96 TeV
0.576 ± 0.048 ± 0.168	¹ CRONIN-HEN..01B	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_\ell > 1.5$ GeV/c.

² Uses minimum lepton energy of 1.5 GeV and also reports moments with $E_\ell > 1.0$ GeV.

³ Moments are measured with a minimum lepton momentum of 0.7 GeV/c in the B rest frame;

$\langle (M_X^2 - \overline{M}_D^2)^2 \rangle$ (Second Moments)

VALUE (GeV ⁴)	DOCUMENT ID	TECN	COMMENT
0.639 ± 0.056 ± 0.178	¹ CRONIN-HEN..01B	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_\ell > 1.5$ GeV/c.

$B \rightarrow X_c \ell \nu$ LEPTON MOMENTUM MOMENTS

$R_0 (\Gamma_{E_l > 1.7 \text{ GeV}} / \Gamma_{E_l > 1.5 \text{ GeV}})$

VALUE	DOCUMENT ID	TECN	COMMENT
0.6187 ± 0.0014 ± 0.0016	¹ MAHMOOD 03	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_l > 1.5$ GeV in the B rest frame.

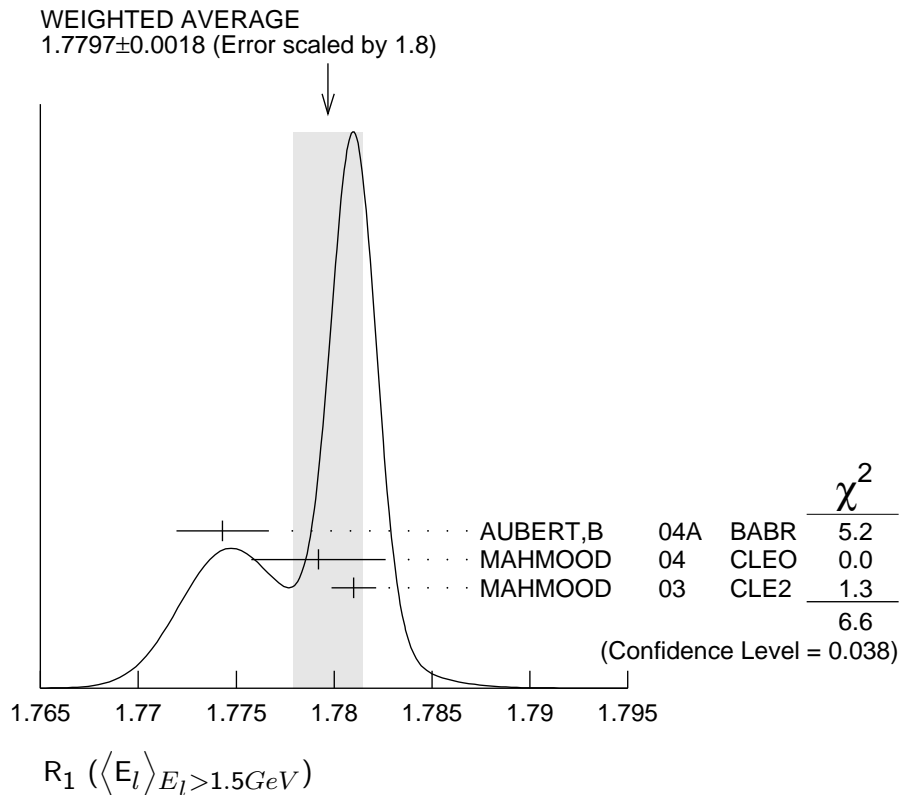
$R_1 (\langle E_l \rangle_{E_l > 1.5 \text{ GeV}})$

VALUE	DOCUMENT ID	TECN	COMMENT
1.7797 ± 0.0018 OUR AVERAGE	Error includes scale factor of 1.8. See the ideogram below.		
1.7743 ± 0.0019 ± 0.0014	¹ AUBERT,B 04A	BABR	$e^+e^- \rightarrow \gamma(4S)$
1.7792 ± 0.0021 ± 0.0027	² MAHMOOD 04	CLEO	$e^+e^- \rightarrow \gamma(4S)$
1.7810 ± 0.0007 ± 0.0009	³ MAHMOOD 03	CLE2	$e^+e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_l > 1.5$ GeV in the B rest frame. The result with $E_l > 0.6$ GeV is also given.

² Uses $E_e > 1.5$ GeV and also reports moments with other minimum minimum E_e conditions, as low as $E_e > 0.6$ GeV.

³ The leptons are required to have $E_l > 1.5$ GeV in the B rest frame.



$R_2 (\langle E_l^2 - \bar{E}_l^2 \rangle_{E_l > 1.5 GeV})$

VALUE (10^{-3} GeV^2)	DOCUMENT ID	TECN	COMMENT
30.8 ± 0.8 OUR AVERAGE			
$30.3 \pm 0.9 \pm 0.5$	¹ AUBERT,B	04A	BABR $e^+ e^- \rightarrow \gamma(4S)$
$31.6 \pm 0.8 \pm 1.0$	² MAHMOOD	04	CLEO $e^+ e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_l > 1.5 \text{ GeV}$ in the B rest frame. The result with $E_l > 0.6 \text{ GeV}$ is also given.

² Uses $E_e > 1.5 \text{ GeV}$ and also reports moments with other minimum minimum E_e conditions, as low as $E_e > 0.6 \text{ GeV}$.

$R_3 (\langle E_l^3 - \bar{E}_l^3 \rangle_{E_l > 1.5 GeV})$

VALUE (10^{-3} GeV^3)	DOCUMENT ID	TECN	COMMENT
$2.12 \pm 0.47 \pm 0.20$	¹ AUBERT,B	04A	BABR $e^+ e^- \rightarrow \gamma(4S)$

¹ The leptons are required to have $E_l > 1.5 \text{ GeV}$ in the B rest frame. The result with $E_l > 0.6 \text{ GeV}$ is also given.

$B \rightarrow X_s \gamma$ PHOTON ENERGY MOMENTS

$\langle E_\gamma \rangle$

VALUE (GeV)	DOCUMENT ID	TECN	COMMENT
2.298 ± 0.022 OUR AVERAGE			
$2.289 \pm 0.058 \pm 0.027$	^{1,2} AUBERT	080	BABR $e^+ e^- \rightarrow \gamma(4S)$
$2.309 \pm 0.023 \pm 0.023$	^{1,3} SCHWANDA	08	BELL $e^+ e^- \rightarrow \gamma(4S)$
$2.288 \pm 0.025 \pm 0.023$	¹ AUBERT,BE	06B	BABR $e^+ e^- \rightarrow \gamma(4S)$

¹ The result is for $E_\gamma > 1.9$ GeV.

² Uses a fully reconstructed B meson as a tag on the recoil side.

³ Results for different E_γ threshold values are also measured.

$$\langle E_\gamma^2 \rangle - \langle E_\gamma \rangle^2$$

VALUE (10^{-2} GeV ²)	DOCUMENT ID	TECN	COMMENT
2.9 ± 0.5 OUR AVERAGE			
3.34 ± 1.24 ± 0.62	1,2 AUBERT	08O BABR	$e^+e^- \rightarrow \Upsilon(4S)$
2.17 ± 0.60 ± 0.55	1,3 SCHWANDA	08 BELLE	$e^+e^- \rightarrow \Upsilon(4S)$
3.28 ± 0.40 ± 0.43	¹ AUBERT,BE	06B BABR	$e^+e^- \rightarrow \Upsilon(4S)$

¹ The result is for $E_\gamma > 1.9$ GeV.

² Uses a fully reconstructed B meson as a tag on the recoil side.

³ Results for different E_γ threshold values are also measured.

B^\pm/B^0 ADMIXTURE REFERENCES

AUBERT	08AS	PRL 100 171802	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08BC	PR D78 072007	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08BH	PR D78 112001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08BJ	PRL 101 171804	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08N	PRL 100 021801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	08O	PR D77 051103	B. Aubert <i>et al.</i>	(BABAR Collab.)
SCHWANDA	08	PR D78 032016	C. Schwanda <i>et al.</i>	(BELLE Collab.)
TANIGUCHI	08	PRL 101 111801	N. Taniguchi <i>et al.</i>	(BELLE Collab.)
WEI	08A	PR D78 011101R	J.-T. Wei <i>et al.</i>	(BELLE Collab.)
AUBERT	07AG	PRL 99 051801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07C	PR D75 012003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07E	PRL 98 051802	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	07L	PRL 98 151802	B. Aubert <i>et al.</i>	(BABAR Collab.)
HUANG	07	PR D75 012002	G.S. Huang <i>et al.</i>	(CLEO Collab.)
SCHWANDA	07	PR D75 032005	C. Schwanda <i>et al.</i>	(BELLE Collab.)
URQUIJO	07	PR D75 032001	P. Urquijo <i>et al.</i>	(BELLE Collab.)
AUBERT	06H	PR D73 012006	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	06J	PR D73 092001	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	06Y	PR D74 091105R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	06B	PRL 97 171803	B. Aubert <i>et al.</i>	(BABAR Collab.)
GOKHROO	06	PRL 97 162002	G. Gokhroo <i>et al.</i>	(BELLE Collab.)
ISHIKAWA	06	PRL 96 251801	A. Ishikawa <i>et al.</i>	(BELLE Collab.)
MOHAPATRA	06	PRL 96 221601	D. Mohapatra <i>et al.</i>	(BELLE Collab.)
ABAZOV	05O	PRL 95 171803	V.M. Abazov <i>et al.</i>	(D0 Collab.)
ACOSTA	05F	PR D71 051103R	D. Acosta <i>et al.</i>	(CDF Collab.)
ARTUSO	05B	PRL 95 261801	M. Artuso <i>et al.</i>	(CLEO Collab.)
AUBERT	05	PRL 94 011801	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	05M	PRL 95 142003	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	05R	PR D72 052004	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	05X	PRL 95 111801	B. Aubert <i>et al.</i>	(BABAR Collab.)
Also		PRL 97 019903 (errat.)	B. Aubert <i>et al.</i>	(BABAR Collab.)
CHOI	05	PRL 94 182002	S.-K. Choi <i>et al.</i>	(BELLE Collab.)
IWASAKI	05	PR D72 092005	M. Iwasaki <i>et al.</i>	(BELLE Collab.)
LIMOSANI	05	PL B621 28	A. Limosani <i>et al.</i>	(BELLE Collab.)
MOHAPATRA	05	PR D72 011101R	D. Mohapatra <i>et al.</i>	(BELLE Collab.)
NISHIDA	05	PL B610 23	S. Nishida <i>et al.</i>	(BELLE Collab.)
OKABE	05	PL B614 27	T. Okabe <i>et al.</i>	(BELLE Collab.)
ABDALLAH	04D	EPJ C33 213	J. Abdallah <i>et al.</i>	(DELPHI Collab.)
AUBERT	04C	PRL 92 111801	B. Aubert <i>et al.</i>	(BaBar Collab.)
AUBERT	04I	PRL 92 071802	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04S	PR D69 052005	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT	04X	PRL 93 011803	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04	PR D69 111103R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04A	PR D69 111104R	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04E	PRL 93 021804	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,B	04F	PRL 93 061801	B. Aubert <i>et al.</i>	(BABAR Collab.)

AUBERT,B	04I	PRL 93 081802	B. Aubert <i>et al.</i>	(BABAR Collab.)
AUBERT,BE	04A	PR D70 112006	B. Aubert <i>et al.</i>	(BABAR Collab.)
CSORNA	04	PR D70 032002	S.E. Csorna <i>et al.</i>	(CLEO Collab.)
KOPPENBURG	04	PRL 93 061803	P. Koppenburg <i>et al.</i>	(BELLE Collab.)
MAHMOOD	04	PR D70 032003	A.H. Mahmodd <i>et al.</i>	(CLEO Collab.)
NAKAO	04	PR D69 112001	M. Nakao <i>et al.</i>	(BELLE Collab.)
NISHIDA	04	PRL 93 031803	S. Nishida <i>et al.</i>	(BELLE Collab.)
ADAM	03B	PR D68 012004	N.E. Adam <i>et al.</i>	(CLEO Collab.)
AUBERT	03	PR D67 031101R	B. Aubert <i>et al.</i>	(BaBar Collab.)
AUBERT	03F	PR D67 032002	B. Aubert <i>et al.</i>	(BaBar Collab.)
AUBERT	03U	PRL 91 221802	B. Aubert <i>et al.</i>	(BaBar Collab.)
BONVICINI	03	PR D68 011101R	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
HUANG	03	PRL 91 241802	H.-C. Huang <i>et al.</i>	(BELLE Collab.)
ISHIKAWA	03	PRL 91 261601	A. Ishikawa <i>et al.</i>	(BELLE Collab.)
KANEKO	03	PRL 90 021801	J. Kaneko <i>et al.</i>	(BELLE Collab.)
KROKOVNY	03B	PRL 91 262002	P. Krokovny <i>et al.</i>	(BELLE Collab.)
MAHMOOD	03	PR D67 072001	A.H. Mahmood <i>et al.</i>	(CLEO Collab.)
ABE	02	PRL 88 021801	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	02L	PRL 89 011803	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	02Y	PL B547 181	K. Abe <i>et al.</i>	(BELLE Collab.)
ANDERSON	02	PRL 89 282001	S. Anderson <i>et al.</i>	(CLEO Collab.)
AUBERT	02C	PRL 88 101805	B. Aubert <i>et al.</i>	(BaBar Collab.)
AUBERT	02G	PR D65 091104R	B. Aubert <i>et al.</i>	(BaBar Collab.)
AUBERT	02L	PRL 88 241801	B. Aubert <i>et al.</i>	(BaBar Collab.)
BORNHEIM	02	PRL 88 231803	A. Bornheim <i>et al.</i>	(CLEO Collab.)
EDWARDS	02B	PR D65 111102R	K.W. Edwards <i>et al.</i>	(CLEO Collab.)
ABE	01F	PL B511 151	K. Abe <i>et al.</i>	(BELLE Collab.)
ABE	01J	PR D64 072001	K. Abe <i>et al.</i>	(BELLE Collab.)
ANDERSON	01B	PRL 87 181803	S. Anderson <i>et al.</i>	(CLEO Collab.)
CHEN	01	PR D63 031102	S. Chen <i>et al.</i>	(CLEO Collab.)
CHEN	01C	PRL 87 251807	S. Chen <i>et al.</i>	(CLEO Collab.)
COAN	01	PRL 86 5661	T.E. Coan <i>et al.</i>	(CLEO Collab.)
CRONIN-HENNESSY	01B	PRL 87 251808	D. Cronin-Hennessy <i>et al.</i>	(CLEO Collab.)
PDG	01	Unofficial 2001 WWW edition		
ABREU	00R	PL B475 407	P. Abreu <i>et al.</i>	(DELPHI Collab.)
COAN	00	PRL 84 5283	T.E. Coan <i>et al.</i>	(CLEO Collab.)
RICHICHI	00	PRL 85 520	S.J. Richichi <i>et al.</i>	(CLEO Collab.)
BARATE	98Q	EPJ C4 387	R. Barate <i>et al.</i>	(ALEPH Collab.)
BERGFELD	98	PRL 81 272	T. Bergfeld <i>et al.</i>	(CLEO Collab.)
BISHAI	98	PR D57 3847	M. Bishai <i>et al.</i>	(CLEO Collab.)
BONVICINI	98	PR D57 6604	G. Bonvicini <i>et al.</i>	(CLEO Collab.)
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COAN	98	PRL 80 1150	T.E. Coan <i>et al.</i>	(CLEO Collab.)
GLENN	98	PRL 80 2289	S. Glenn <i>et al.</i>	(CLEO Collab.)
ACKERSTAFF	97N	ZPHY C74 423	K. Akerstaff <i>et al.</i>	(OPAL Collab.)
AMMAR	97	PR D55 13	R. Ammar <i>et al.</i>	(CLEO Collab.)
BARISH	97	PRL 79 3599	B. Barish <i>et al.</i>	(CLEO Collab.)
BUSKULIC	97B	ZPHY C73 601	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
GIBBONS	97B	PR D56 3783	L. Gibbons <i>et al.</i>	(CLEO Collab.)
ALBRECHT	96D	PL B374 256	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BARISH	96B	PRL 76 1570	B.C. Barish <i>et al.</i>	(CLEO Collab.)
GIBAUT	96	PR D53 4734	D. Gibaut <i>et al.</i>	(CLEO Collab.)
KUBOTA	96	PR D53 6033	Y. Kubota <i>et al.</i>	(CLEO Collab.)
PDG	96	PR D54 1	R. M. Barnett <i>et al.</i>	
ALAM	95	PRL 74 2885	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT	95D	PL B353 554	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BALEST	95B	PR D52 2661	R. Balest <i>et al.</i>	(CLEO Collab.)
BARISH	95	PR D51 1014	B.C. Barish <i>et al.</i>	(CLEO Collab.)
BUSKULIC	95B	PL B345 103	D. Buskulic <i>et al.</i>	(ALEPH Collab.)
ALBRECHT	94C	ZPHY C62 371	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	94J	ZPHY C61 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
PROCARIO	94	PRL 73 1472	M. Procaro <i>et al.</i>	(CLEO Collab.)
ALBRECHT	93	ZPHY C57 533	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	93E	ZPHY C60 11	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	93H	PL B318 397	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	93I	ZPHY C58 191	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALEXANDER	93B	PL B319 365	J. Alexander <i>et al.</i>	(CLEO Collab.)
ARTUSO	93	PL B311 307	M. Artuso	(SYRA)
BARTELT	93B	PRL 71 4111	J.E. Bartelt <i>et al.</i>	(CLEO Collab.)
ALBRECHT	92E	PL B277 209	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	92G	ZPHY C54 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)

ALBRECHT	92O	ZPHY C56 1	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BORTOLETTO	92	PR D45 21	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
CRAWFORD	92	PR D45 752	G. Crawford <i>et al.</i>	(CLEO Collab.)
HENDERSON	92	PR D45 2212	S. Henderson <i>et al.</i>	(CLEO Collab.)
LESIAK	92	ZPHY C55 33	T. Lesiak <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	91C	PL B255 297	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	91H	ZPHY C52 353	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
FULTON	91	PR D43 651	R. Fulton <i>et al.</i>	(CLEO Collab.)
YANAGISAWA	91	PRL 66 2436	C. Yanagisawa <i>et al.</i>	(CUSB II Collab.)
ALBRECHT	90	PL B234 409	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	90H	PL B249 359	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BORTOLETTO	90	PRL 64 2117	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
	Also	PR D45 21	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
FULTON	90	PRL 64 16	R. Fulton <i>et al.</i>	(CLEO Collab.)
MASCHMANN	90	ZPHY C46 555	W.S. Maschmann <i>et al.</i>	(Crystal Ball Collab.)
PDG	90	PL B239 1	J.J. Hernandez <i>et al.</i>	(IFIC, BOST, CIT+)
ALBRECHT	89K	ZPHY C42 519	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ISGUR	89B	PR D39 799	N. Isgur <i>et al.</i>	(TNT0, CIT)
WACHS	89	ZPHY C42 33	K. Wachs <i>et al.</i>	(Crystal Ball Collab.)
ALBRECHT	88E	PL B210 263	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	88H	PL B210 258	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
KOERNER	88	ZPHY C38 511	J.G. Korner, G.A. Schuler	(MANZ, DESY)
ALAM	87	PRL 59 22	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALAM	87B	PRL 58 1814	M.S. Alam <i>et al.</i>	(CLEO Collab.)
ALBRECHT	87D	PL B199 451	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
ALBRECHT	87H	PL B187 425	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
BEAN	87	PR D35 3533	A. Bean <i>et al.</i>	(CLEO Collab.)
BEHREND	87	PRL 59 407	S. Behrends <i>et al.</i>	(CLEO Collab.)
BORTOLETTO	87	PR D35 19	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
ALAM	86	PR D34 3279	M.S. Alam <i>et al.</i>	(CLEO Collab.)
BALTRUSAIT...	86E	PRL 56 2140	R.M. Baltrusaitis <i>et al.</i>	(Mark III Collab.)
BORTOLETTO	86	PRL 56 800	D. Bortoletto <i>et al.</i>	(CLEO Collab.)
HAAS	86	PRL 56 2781	J. Haas <i>et al.</i>	(CLEO Collab.)
ALBRECHT	85H	PL 162B 395	H. Albrecht <i>et al.</i>	(ARGUS Collab.)
CSORNA	85	PRL 54 1894	S.E. Csorna <i>et al.</i>	(CLEO Collab.)
HAAS	85	PRL 55 1248	J. Haas <i>et al.</i>	(CLEO Collab.)
AVERY	84	PRL 53 1309	P. Avery <i>et al.</i>	(CLEO Collab.)
CHEN	84	PRL 52 1084	A. Chen <i>et al.</i>	(CLEO Collab.)
LEVMAN	84	PL 141B 271	G.M. Levman <i>et al.</i>	(CUSB Collab.)
ALAM	83B	PRL 51 1143	M.S. Alam <i>et al.</i>	(CLEO Collab.)
GREEN	83	PRL 51 347	J. Green <i>et al.</i>	(CLEO Collab.)
KLOPFEN...	83B	PL 130B 444	C. Klopfenstein <i>et al.</i>	(CUSB Collab.)
ALTARELLI	82	NP B208 365	G. Altarelli <i>et al.</i>	(ROMA, INFN, FRAS)
BRODY	82	PRL 48 1070	A.D. Brody <i>et al.</i>	(CLEO Collab.)
GIANNINI	82	NP B206 1	G. Giannini <i>et al.</i>	(CUSB Collab.)
BEBEK	81	PRL 46 84	C. Bebek <i>et al.</i>	(CLEO Collab.)
CHADWICK	81	PRL 46 88	K. Chadwick <i>et al.</i>	(CLEO Collab.)
ABRAMS	80	PRL 44 10	G.S. Abrams <i>et al.</i>	(SLAC, LBL)